Carlo Gavazzi IO-Link Master - Rockwell AOI

Instruction manual

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EN

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1. Introduction

This document describes how to integrate a Carlo Gavazzi IO-Link Master (IOLM) with a PLC from Rockwell Automation using our Add-on instruction (AOI). This integration is done by downloading various software from the Carlo Gavazzi Automation webpage, using the embedded webserver in the IOLM and then performing the integration in the Rockwell Logix studio.
In this example the hardware integration between the IOLM and the Rockwell PLC is using an EtherNet/IP network connection.

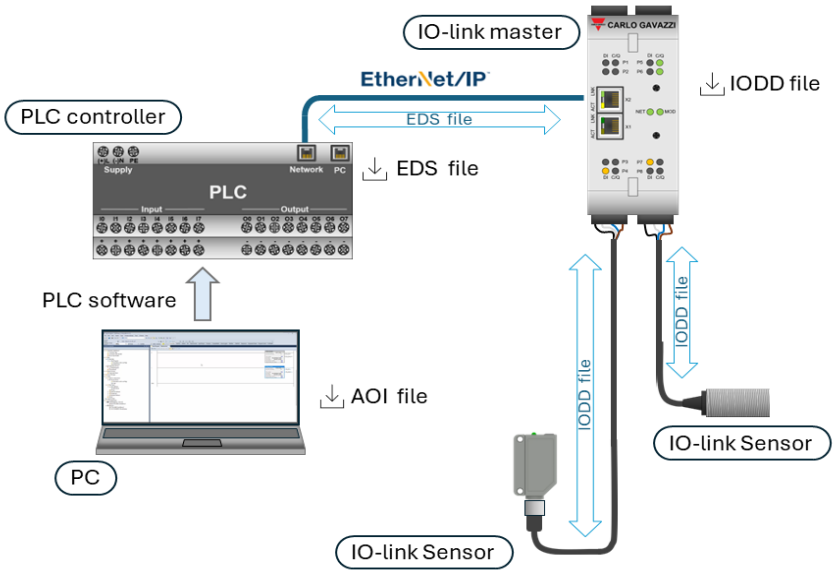
This document does not include all details for the IOLM. If further detailed information is needed, please refer to the IO-Link masters EtherNet/IP YL212 and YN115 Instruction manuals, which are also available on our web page www.gavazziautomation.com.

The software and configuration is not different between the YL212, IP67 field installation version and the YN115 IP20 Cabinet installation version.

A video guide showing this process flow is available on the Carlo Gavazzi automation webpage if you look under the IOLM you are using and find the available instructions.

1.1. Files

First element in the workflow is to download the needed files from the webpage www.gavazziautomation.com. Below is an illustration of the various elements used in the workflow described in this document.



The files are needed:

- IODD files are the driver files that allow communication between the IOLM and the IO-link Sensor. The IODD files is made to match each variation of sensor, therefore you will need to download different IODD files for inductive sensors, capacitive sensors, or photoelectric sensors. In each sensor type for example Capacitive sensor, you will need to download different files for a CA12 (12 mm sensor diameter), a CA18 (18 mm sensor diameter), and a CA30 (30mm sensor diameter). IODD files needs to be installed into the IO-Link Master.

- EDS files are the driver files that allow communication between the IOLM and the PLC using Ethernet/ IP network communication. Should the IOLM use another form of communication, then it will need another

file, for example PROFINET IO, IOLM variant (different item number) will need a GSD file. The EDS file will need to be installed in the PLC using the PLC programming software like RS Logix.

- AOI files are a small software block to be installed in the RS Logix project and uploaded with the PLC program to the controller.

1.2. Workflow

The Workflow contains main 4 steps:

- Download files from https://www.gavazziautomation.com
- Configure IO-link master
- Configure PLC to IO-link master
- Implement the AOI

1.3. Download files

To make the workflow as fast as possible we recommend downloading all relevant files from Carlo Gavazzi webpage before you start working on IOLM and PLC configurations. You will need to know exactly which sensors you will be connecting to the IOLM ports to ensure that all IODD files are available. EDS file and AOI do not have variations.

1.4. Configure IO-link master

When you are configuring the IOLM, you will need to make a network connection between your PC and the IOLM. This means you will need to set your PC to a static IP-address for the first connection. You can choose to configure the IP-address to match the network and then upload the IODD files later, this will depend on your workflow.

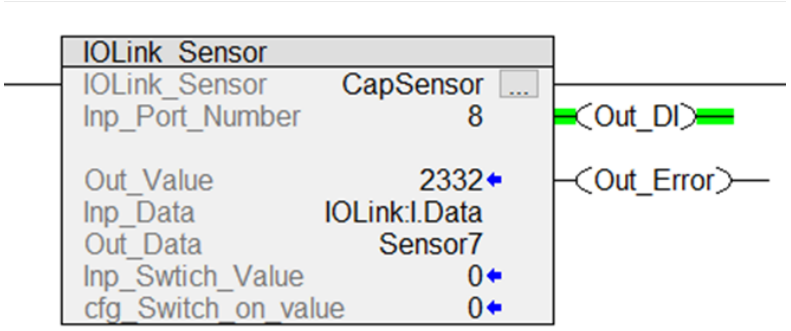
1.5. Configure PLC to IO-link master

To allow the PLC to communicate with the IOLM, you will need to install the EDS file in the RS Logix project and upload the project to the PLC.

1.6. Implement the AOI

The data structure of the AOI is described later in this document. The AOI provides the option of reading the cyclic process data in real time. Acyclic data will need the use of a message instruction (MSG) and this will not be described in this document.

The EDS files and AOI will work with several different Rockwell Logix software tools. These different tools will not be described individually in this document.



This Illustration shows the AOI when applied in a RS logix designer program.

2. IO-Link master setup

First step to get this integration working is to ensure that the parts are configured to communicate and to connect the parts physically. When configuring the IOLM the first time you will contact its default IP-address. If several IOLM is connected to the same network with default IP-addresses, you will have an IP-address conflict, and this will prevent you from connecting to the individual IOLM.
Always make a basic configuration to an IOLM before you install it in a network, this will ensure the communication works before the cables are connected.

2.1. Download of files

The following steps are related to collecting the relevant files for integration of an IO-link master to a PLC. Files can be collected on the webpage https://www.gavazziautomation.com.

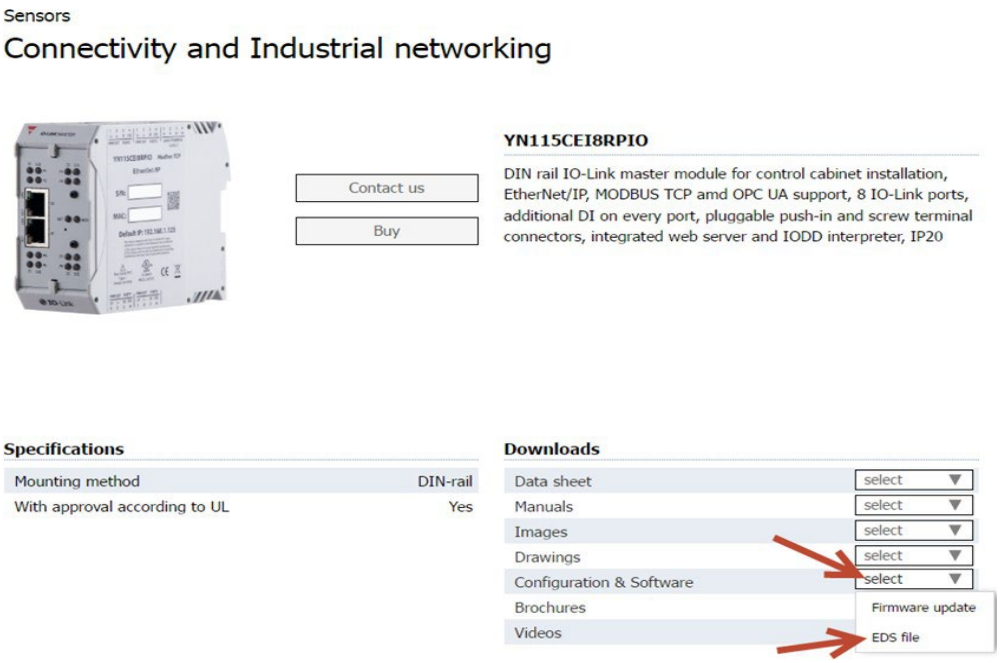
2.1.1. Download IODD files

IODD files are used for communication between the IO-link sensor and the IO-link master. The IODD files are selected from the sensor variant. Files are available on our company webpage https://www.gavazziautomation.com or on the https://ioddfinder.io-link.com/, where IODD files are available from the IODD Consortium.

1) Navigate to https://www.gavazziautomation.com.
2) Search for the **"sensor type number"** e.g. CA18CAF08BPM1IO or just start with CA18 and browse from there.
3) Select the dropdown menu for "**Configuration & Software**".
4) Click on "**IODD file**" and the file will be downloaded to your download folder.
5) Or you can move the IODD file to a project folder location for relevant files.
6) Follow the guide for uploading the IODD file to the IOLM.
   See guide in chapter 2.2.5 IODD File installation

2.1.2. Download EDS file

1) Navigate to https://www.gavazziautomation.com.
2) Search for the "Product type number". YN115
3) Select the dropdown menu for **"Configuration & Software**"
4) Click on **"EDS file"** and the file will be downloaded to your download folder.
5) Or you can move the EDS file to a project folder location for relevant files.
6) When you need to install the file in the PLC Extract the .zip file.
7) Open **"EDS Hardware installation Tool"** in Logix designer software.
8) Follow the wizard and finish with the EDS file for the IO-Link master (same for YN115 or YL212)

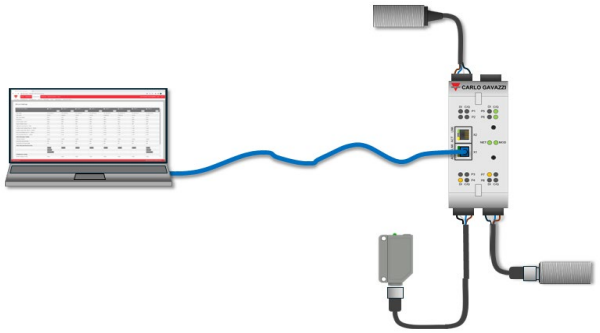


2.2. IO-Link master connection

The following steps are related to configuration of the IO-link master these steps are equally relevant for both YL212 and YN115.

2.2.1. Connecting to the IO-link master – Peer to peer

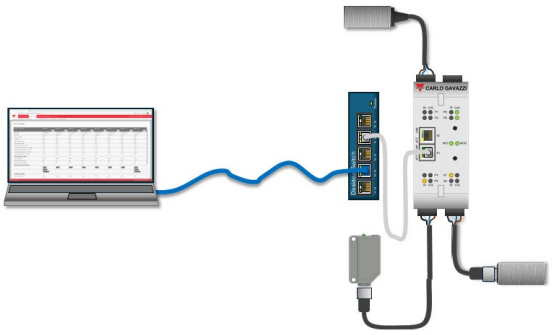
For the first initial configuration we recommend using a Peer-to-Peer connection between the PC and IOLM to configure the IOLM.
When the IOLM is unboxed from the factory or it is factory reset, the default IP address will be 192.168.1.125. Your PC will have to have a matching Static IP-address for example 192.168.1.120. If you are to configure several IOLMs before setting them up in a combined network, you will save time not having to adapt a static address at every IOLM.



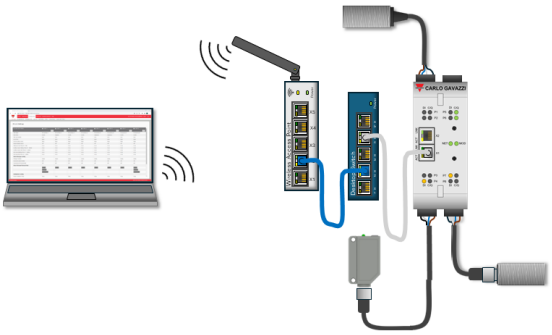
The YN115xxxx IO-link master has two Ethernet ports, this allows you can connect your PC in a Peer-to-Peer connection, even if the IOLM already is connected to a network switch. Ethernet ports will however have the same configured IP-address.

2.2.2. Connecting to the IO-link master – Network connection

Many switches have a default IP-address called 192.168.1.1. Therefore, a default network between a switch, one IOLM and a PC would work assuming the PC has a static IP-address matching the network for example 192.168.1.120. To increase the mobility a wireless access point could also be connected to avoid cable

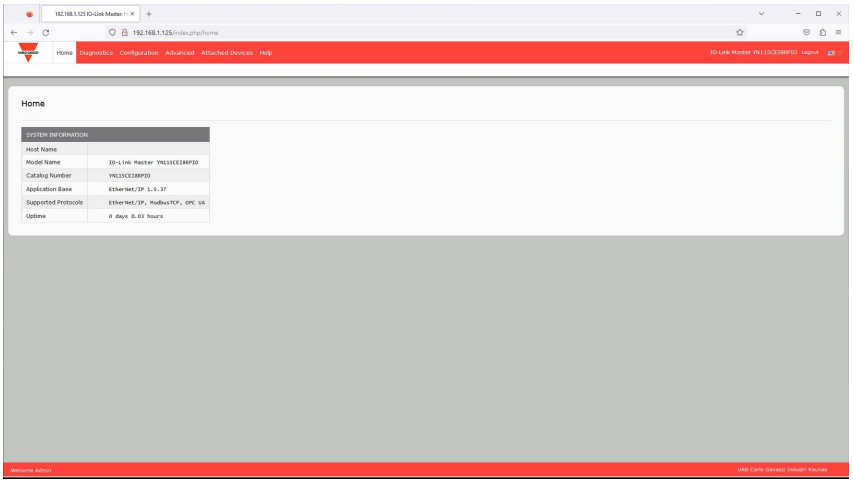


connection, for example on mobile units.



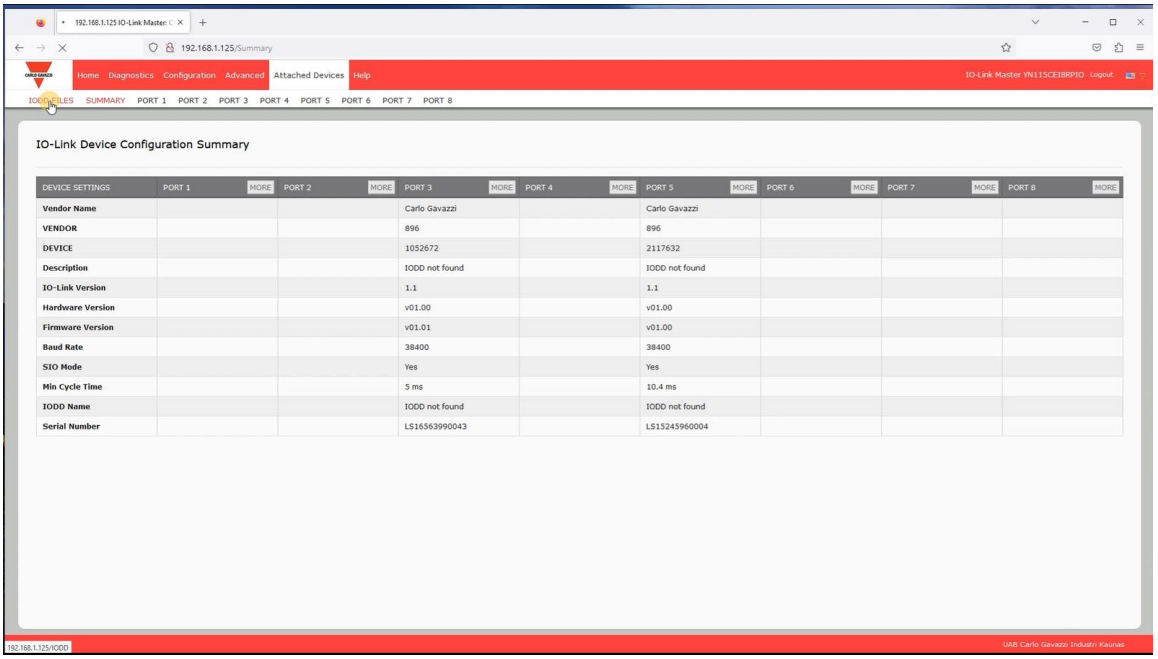
2.3. Embedded Webserver in IO-link master

To access the internal Webserver in the IOLM open a Browser window on your PC. Enter the default IP address (192.168.1.125.) in the browser address bar. Remember your PC must have a matching, static IP address. Below You can see the main page of the Webserver, when you see this page, you are connected to the IOLM

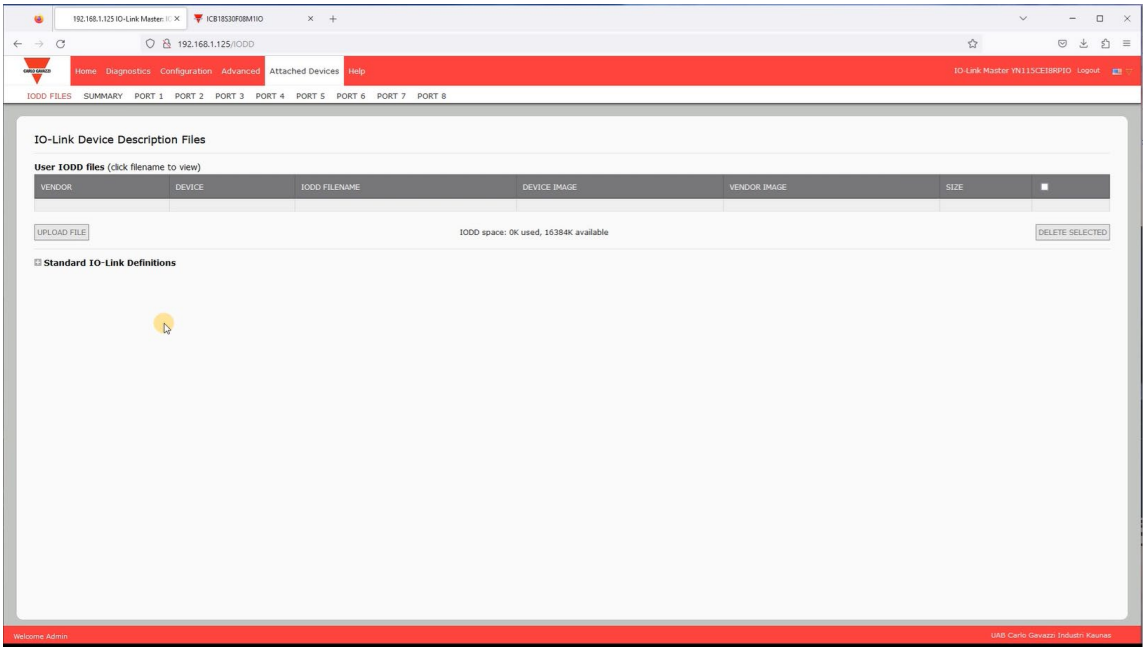


2.3.1. IODD File installation

The webserver allows you to see what components are connected to the IOLM. Going to the Tab “attached devices” and “Summary”. You will be able to see what sensors the IOLM detects is connected to at present time. You can also read the status of the IODD files. If you get the message “IODD not found”, it means that the needed IODD file is not uploaded to the IOLM.

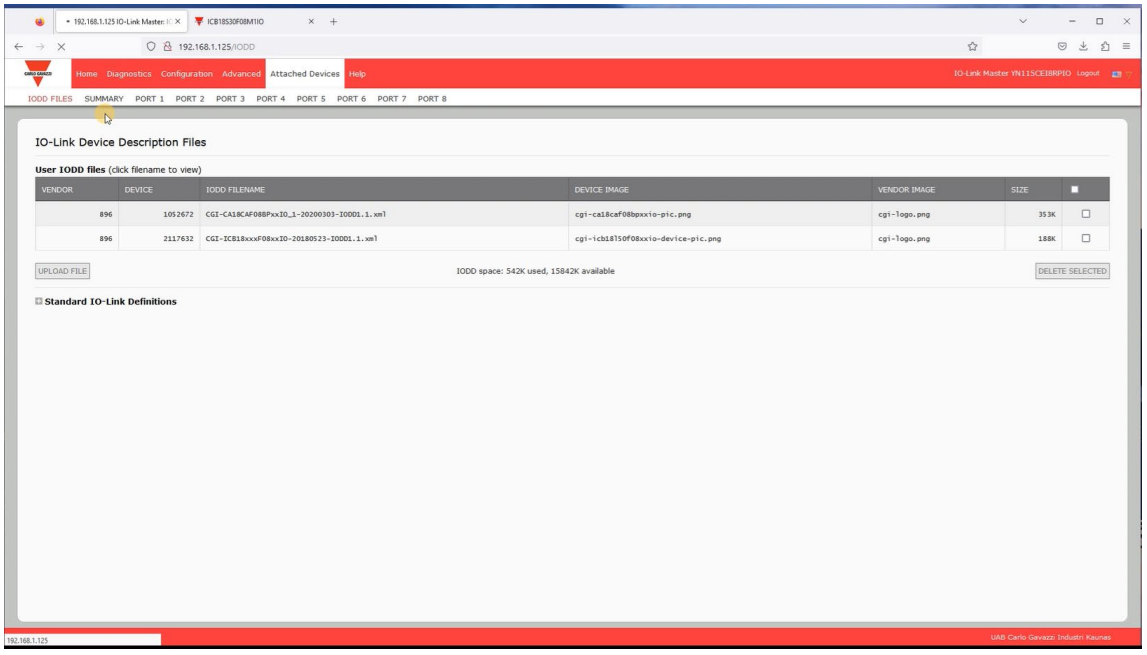


To upload IODD files, go to the “IODD FILES” tab. Click on the “UPLOAD FILE” button.

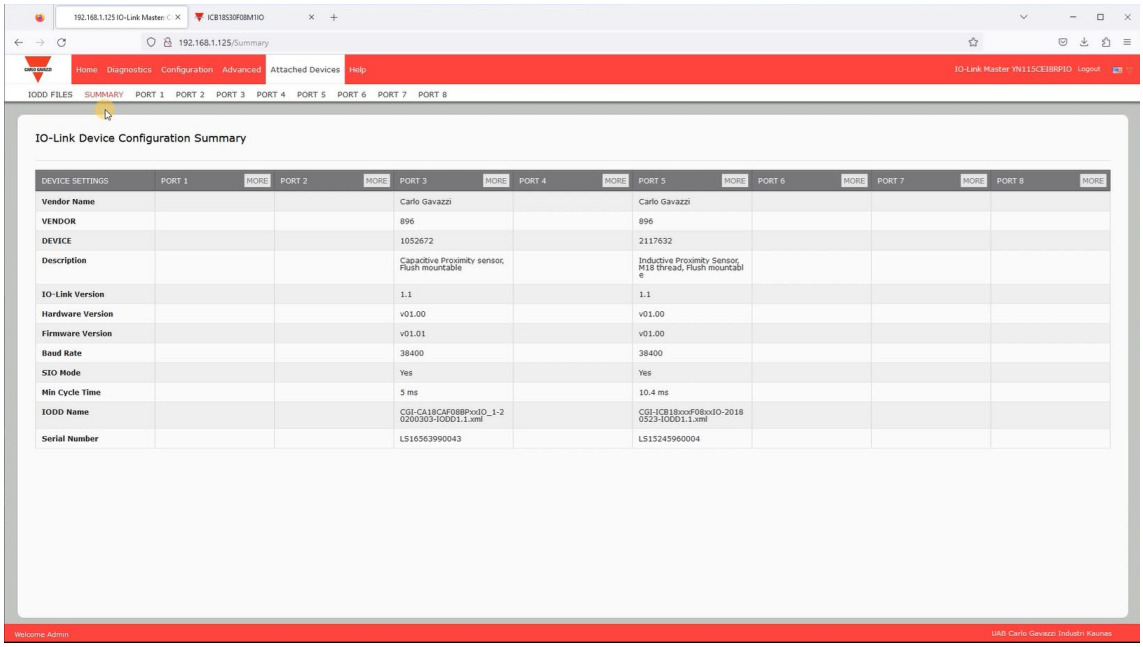


Browse to the location where you saved the files you downloaded from Carlo Gavazzi Automation webpage. Select the files and click Open.

If The IOLM already has the IODD files uploaded, then the files will be shown when you enter the “IODD FILES” tab.



When the correct IODD files are uploaded you will see the file names in the “ATTACHED DEVICE” -> “SUMMARY” Tab.

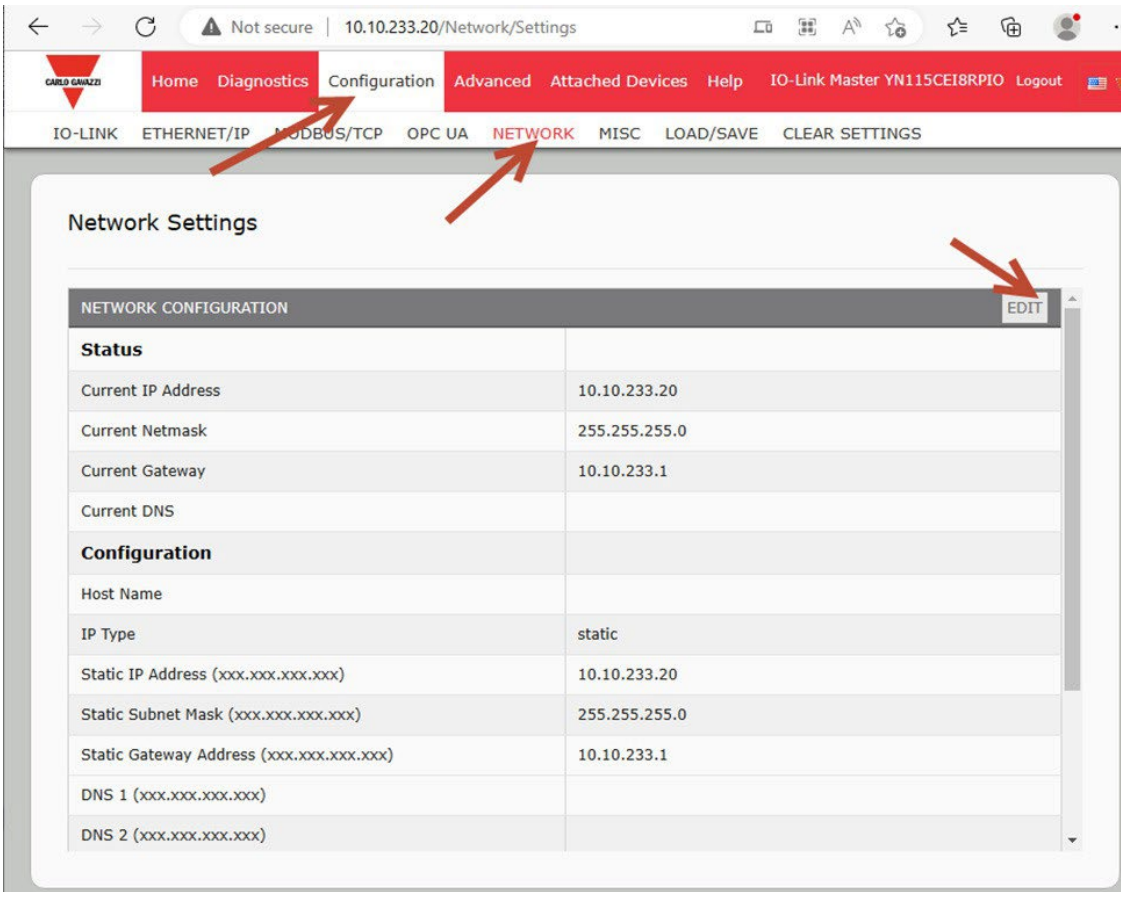


When the IODD file is shown in the “ATTACHED DEVICE” -> “SUMMARY” Tab, the sensor can be projected from the IOLM to the PLC. Assuming the PLC is setup to communicate with the IOLM and the IOLM and PLC are connected.

2.3.2. Configuring IOLM IP-address

To allow the IOLM to connect to the PLC using the EtherNet/IP connection you must ensure that the IOLM has the correct IP-configuration.

1) Navigate to “Configuration -> NETWORK” and select “Edit” to change default IP.
2) Set IP type to “static”.
3) Define the Static IP-address to be used in the connection with the IOLM.
4) Define the “Static Subnet Mask”.
5) Define the “Static Gateway address”
6) Click “SAVE” button.



When you click the "SAVE" button you will receive the notification box shown below. The message pops up because your PC will lose connection when you change the IP address, until you changed its IP-address to match this new IP-address saved in the IOLM.

The IOLM is now ready to communicate with the PLC and you can close the Webserver on the IOLM. This is done by closing the Web browser

2.3.3. Ethernet/IP settings

To make sure the Add-On Instruction works as expected:

Select “Ethernet/IP” in the “Configuration” tab and check the settings for each port, according to the below screenshot.

EtherNet/IP Settings

ETHERNET/IP PORT CONFIG	PORT 1
	EDIT
ISDU Data Settings:	
ISDU Response Timeout (1 - 10000)	20 sec
Process Data Settings:	
PDI Data Block Size (To PLC)	36 bytes
PDI Data Block Format (To PLC)	word (16 bit)
PDI Data Byte-Swap Method	word (16 bit) byte-swap
PDO Data Block Size (From PLC)	32-bytes
PDO Data Block Format (From PLC)	word (16 bit)
PDO Data Byte-Swap Method	word (16 bit) byte-swap
Clear Event Code In PDO Block	false
Clear Event Code After Hold Time	true
Active Event Hold Time (1 - 65535)	1000
Event Hold Time Units	ms
Clear Event Hold Time (1 - 65535)	500
Event Clear Time Units	ms
Transfer Mode Settings:	
PDI Receive Mode(s) (To PLC)	Polling Class1
PDO Transmit Mode (From PLC)	Class1
Read/Write Tag/File Settings:	
PLC IP Address (xxx.xxx.xxx.xxx)	0.0.0.0
PLC Controller Slot Number (0 - 64)	0
PLC Type	ControlLogix
Write PDI to Tag/File Settings:	
PDI Tag/File Name	
Append PDO to PDI Data	false
Maximum PLC Update Rate (10 - 65535)	40 ms
Heartbeat Update Enable	false
Heartbeat Update Rate (50 - 65535)	1000 ms

3. PLC configuration

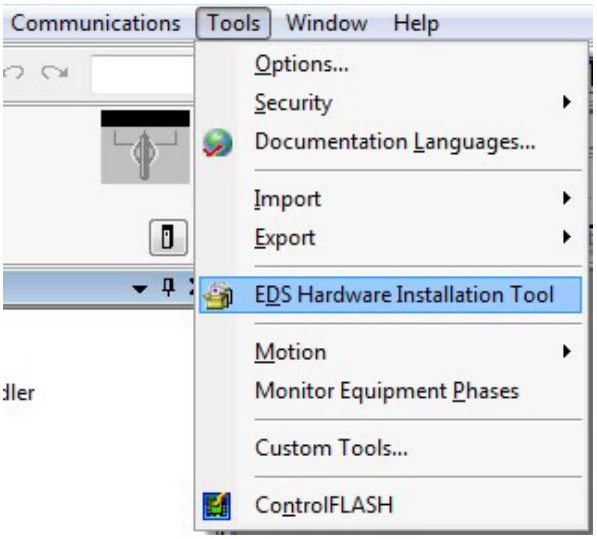
First step to have this integration working is to ensure that the parts are configured to communicate before the part are connect physically connected.

3.1. Logix designer PLC programming software

In the Logix designer software tool, first install the EDS file to allow the PLC to be able to communicate with the PLC. When the EDS file is installed, create the IOLM(s) in the Ethernet network tree.

3.1.1. Install EDS file.

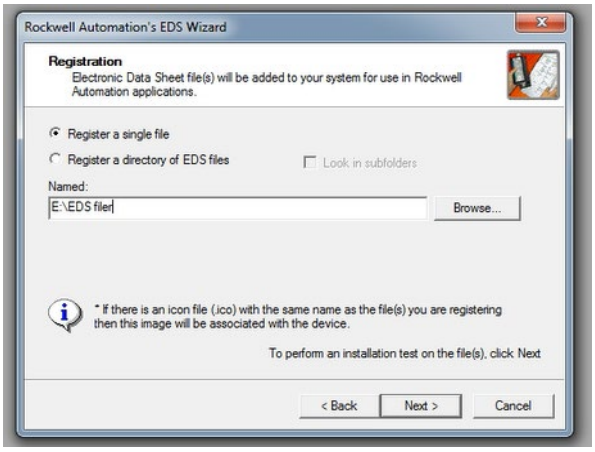
1) In the Logix designer click on "Tools pane" and select "EDS Hardware Installation Tool"



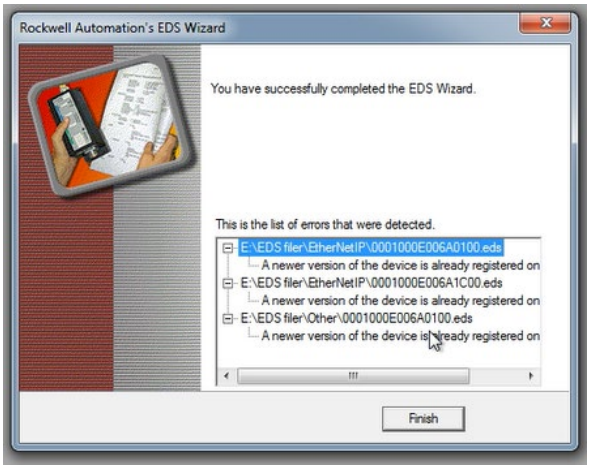
2) Follow the instructions in the "Rockwell Automation's EDS Wizard"

3) Select register an EDS file(s)

4) Select Register a single file and browse to the location where you saved the EDS file.

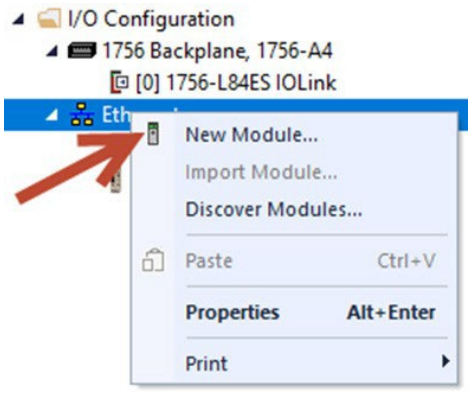


5) Follow the guidance of the Wizard and step on by clicking “Next” and when you reach final step click “Finish”

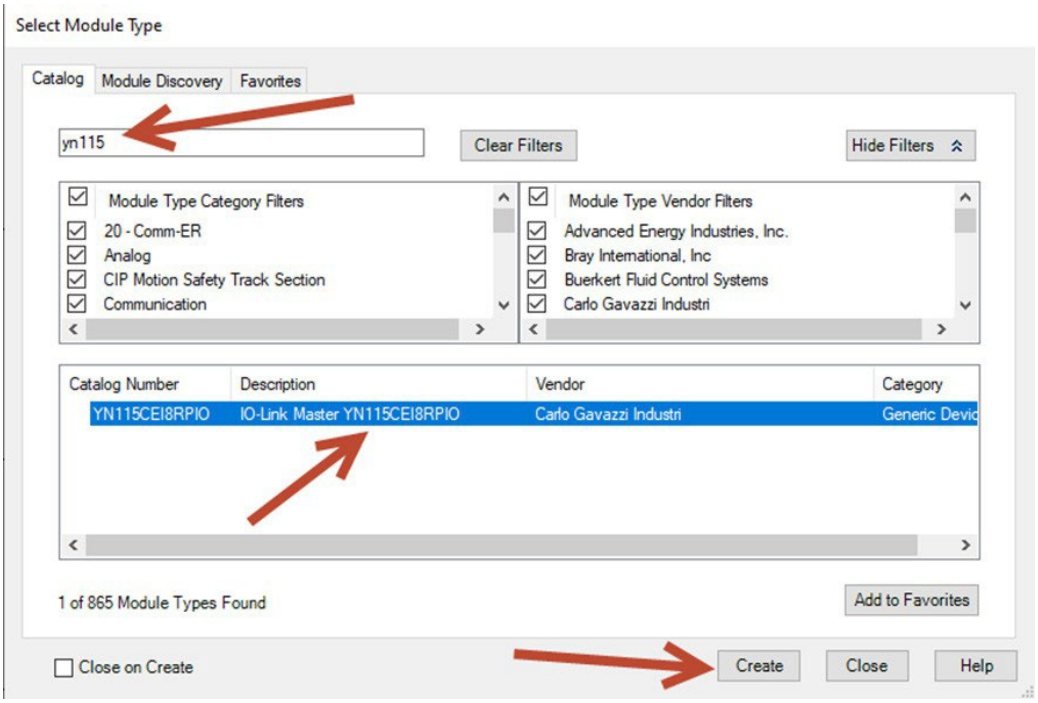


3.1.2. Add device, IOLM

1) In the Logix three window, Right click on ethernet card and select "New Module"



2) Search for the IO Link master (YN115 or YL212) and press "Create"

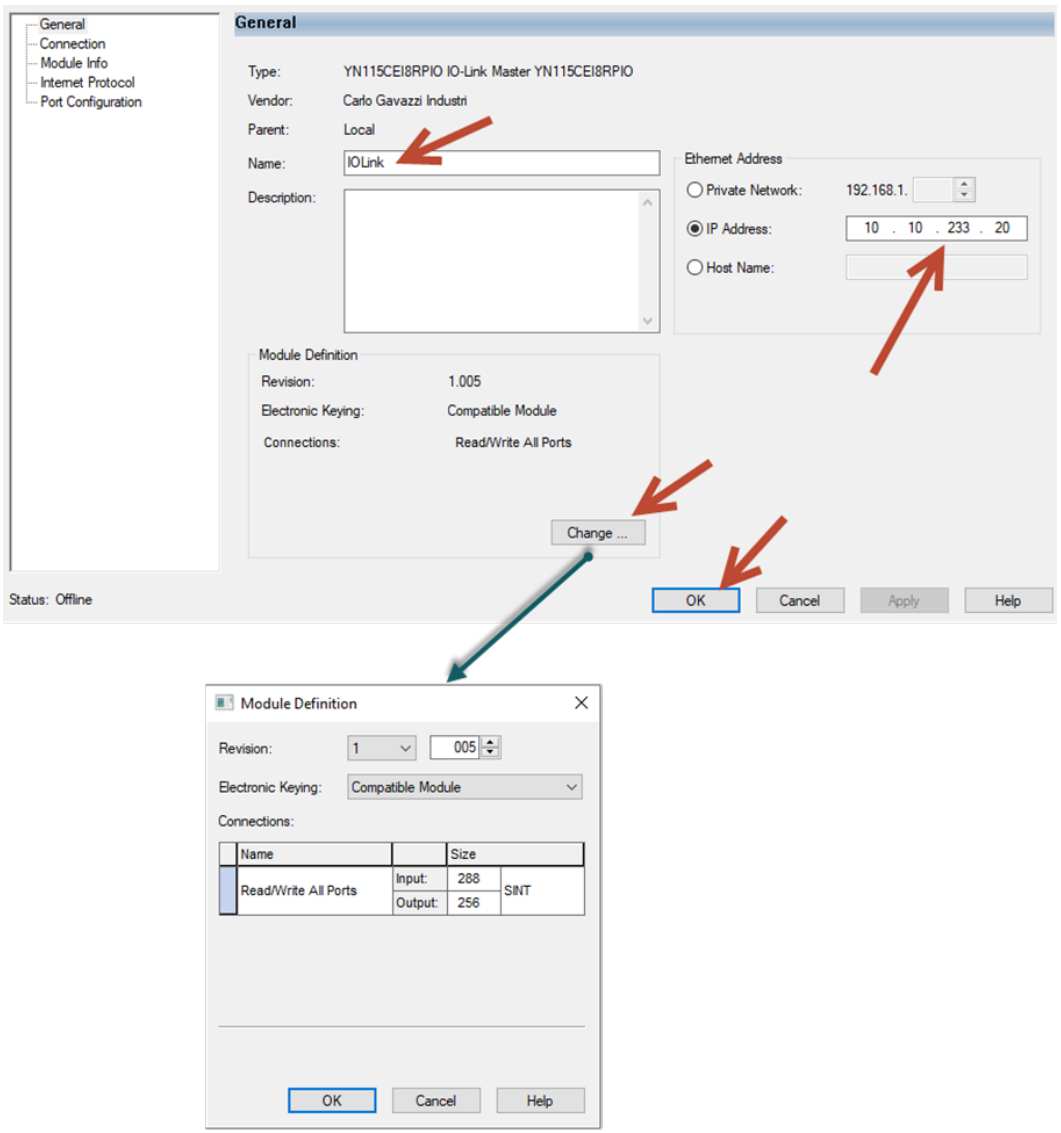


3) Select the correct IOLM part number

4) Click "Create"

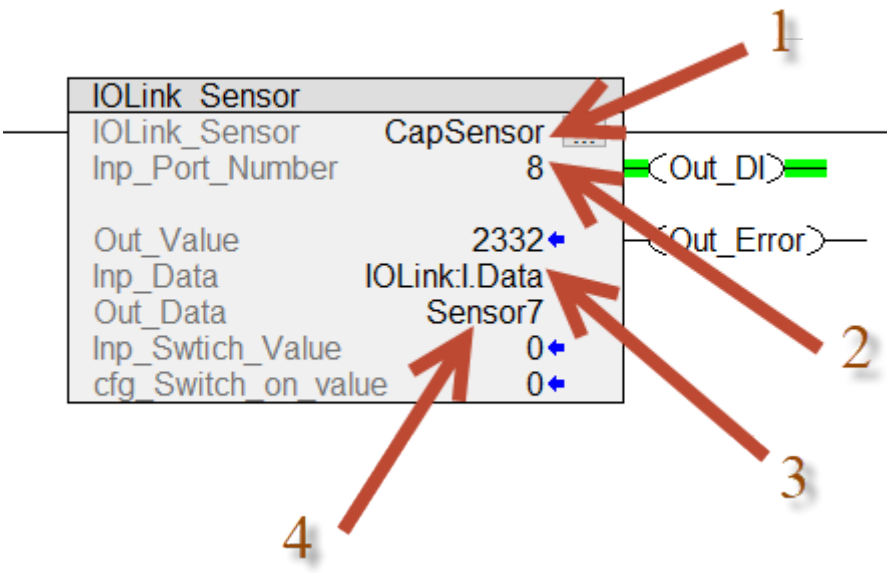
5) Fill in “Name” & “IP address” and press “Change” and check settings. Remember to use the IP-address you configured in the Webserver.

6) Click “OK” to create the IOLM in the Ethernet tree.



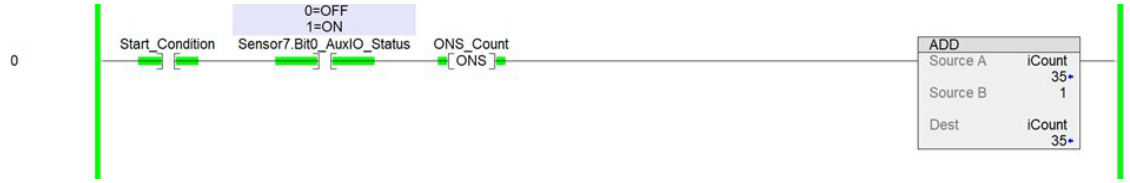
3.2. Program example Add-On Instruction

1) Insert and add Tag name for AOI.
2) Insert port number of the IO-Link masters port number, where the sensor is connected.
3) Insert the path to the input data array of the IO Link master.
4) Insert and add Sensor Tag name. This tag is used in the program.

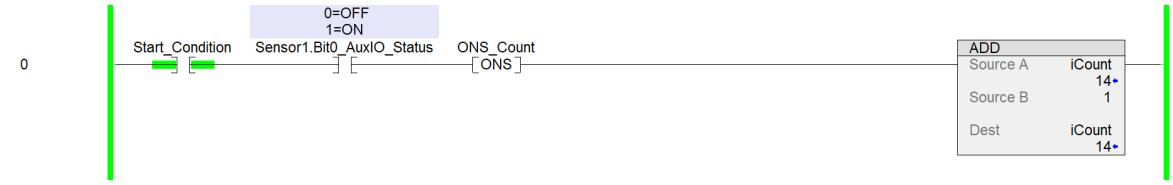


5) In the following example, sensor1.Bit0_AuxIO_Status is used for sensor status.

ON state



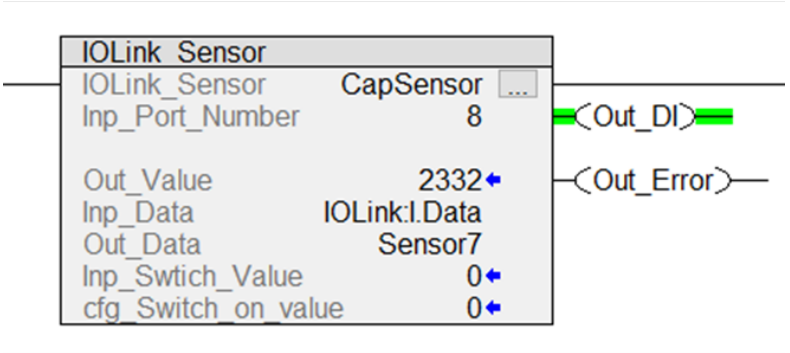
OFF state



6) It is also possible to use the status of the AOI directly.

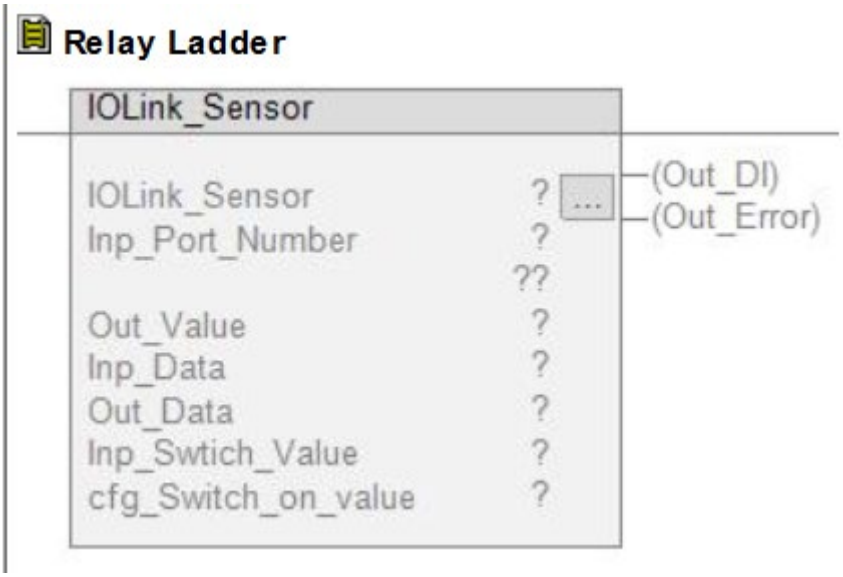
4. AOI – description of array

Parameters			
Name	**Data Type**	**Usage**	**Description**
IOLink_Sensor	IOLink_Sensor	InOut	Sensor reference description
EnableIn	BOOL	Input	
EnableOut	BOOL	Output	
Inp_Port_Number	DINT	Input	Port number where the IO link sensor is connected.
Out_DI	BOOL	Output	Digital Output, when sensor is activated = 1
Out_Value	INT	Output	Analog Value from Sensor (Not available in all sensors)
Inp_Data	SINT [288]	InOut	Reference to the Input Data Structure (Array of SINT, 288 long
Out_Data	UDT_IOLink	InOut	UDT with data for selected Port
Out_Error	BOOL	Output	Digital output indicating an error or lost connection Sensor Error detected = 1, No sensor error detected = 0
Inp_Switch_Value	DINT	Input	If the analogue value is greater than this, the digital output will go high. If value is 0 the Output is controlled by the sensor status (sensor adjustment)
Cfg_Switch_on_Value	BOOL	Input	If ON, the digital output will go high based on the "Inp_Switch_Value"



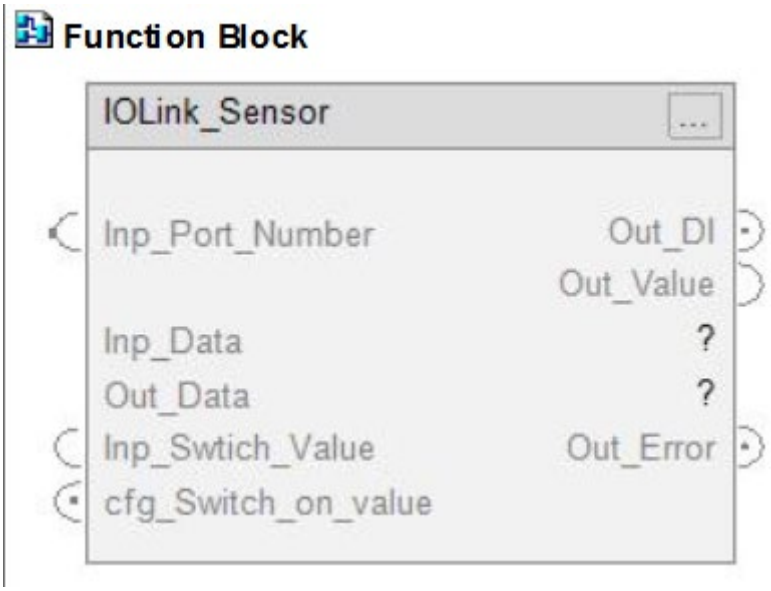
4.1. Ladder

This is a visualisation of the AOI software block in Ladder programming format.



4.2. Function Block

This is a visualisation of the AOI software block in Block programming format.



4.3. Structured Text

```
Structured Text
IOLink_Sensor(IOLink_Sensor,Inp_Port_Number,Inp_Data,Out_Data);
```

5. Data Structure

The data structure for the read write channel is:
Input: SINT[288]
Output: SINT[256]
Each port is indexed by 36 bytes these data arranged in a UDT according to the manual.

Sensor1	Local	{...}	{...}		UDT_IOL...	Standard	
Sensor1.Bit0_AuxIO_Status		0		Decimal	BOOL	Standard	0=OFF 1=ON
Sensor1.Bit1_AuxIO_Reserved		0		Decimal	BOOL	Standard	Reserved
Sensor1.Bit2_AuxIO_Reserved		0		Decimal	BOOL	Standard	Reserved
Sensor1.Bit3_AuxIO_Reserved		0		Decimal	BOOL	Standard	Reserved
Sensor1.Bit4_AuxIO_Reserved		0		Decimal	BOOL	Standard	Reserved
Sensor1.Bit5_AuxIO_Reserved		0		Decimal	BOOL	Standard	Reserved
Sensor1.Bit6_AuxIO_Reserved		0		Decimal	BOOL	Standard	Reserved
Sensor1.Bit7_AuxIO_Reserved		0		Decimal	BOOL	Standard	Reserved
Sensor1.Bit0_PortStatus_IOLink_Com_init		0		Decimal	BOOL	Standard	IO-Link Port communication initialization process. 1= Active 0 = Inactive
Sensor1.Bit1_PortStatus_IOLink_Com_Operation		1		Decimal	BOOL	Standard	IO-Link Port communication Operation 1= Operational 0 = Not Operational
Sensor1.Bit2_PortStatus_IOLink_Input_ProcessData		1		Decimal	BOOL	Standard	IO-Link input process data 1= Valid 0 = Not Valid
Sensor1.Bit3_PortStatus_Fault_Detected		0		Decimal	BOOL	Standard	Fault 1= Fault Detected 0=No Fault Detected
Sensor1.Bit4_PortStatus_Reserved		0		Decimal	BOOL	Standard	Reserved
Sensor1.Bit5_PortStatus_Reserved		0		Decimal	BOOL	Standard	Reserved
Sensor1.Bit6_PortStatus_Reserved		0		Decimal	BOOL	Standard	Reserved
Sensor1.Bit7_PortStatus_Reserved		0		Decimal	BOOL	Standard	Reserved
Sensor1.EventCode		0		Decimal	INT	Standard	
Sensor1.AnalogValue		749		Decimal	INT	Standard	

When a sensor is connected, **Bit0_PortStatus_IOLink_Com_init** goes high while sensor is initialized.

When the sensor is initialized **Bit1_PortStatus_IOLink_Com_Operation** and **Bit2_PortStatus_ IOLink_Input_ProcessData** will go high, which means that sensor is operational, and input is valid.

CARLO GAVAZZI

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Certified in accordance with ISO 9001