Intesis®
BY HMS NETWORKS

Application note
EtherNet/IP - BACnet IP & MS/TP Server Gateway

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HMS

Solution Overview

The integration of valuable data from Factory to Building automation it's always a challenge since both locations, even being installed in the same building, could not use the exact protocol to control their associated devices. Due to environmental restrictions, safety in buildings and comfort for those inside the building, a BMS (Building Management System) is typically installed to operate and maintain those variables in place. This BMS typically uses BACnet to communicate with the systems installed: HVAC, lighting, sensors, access control, etc.

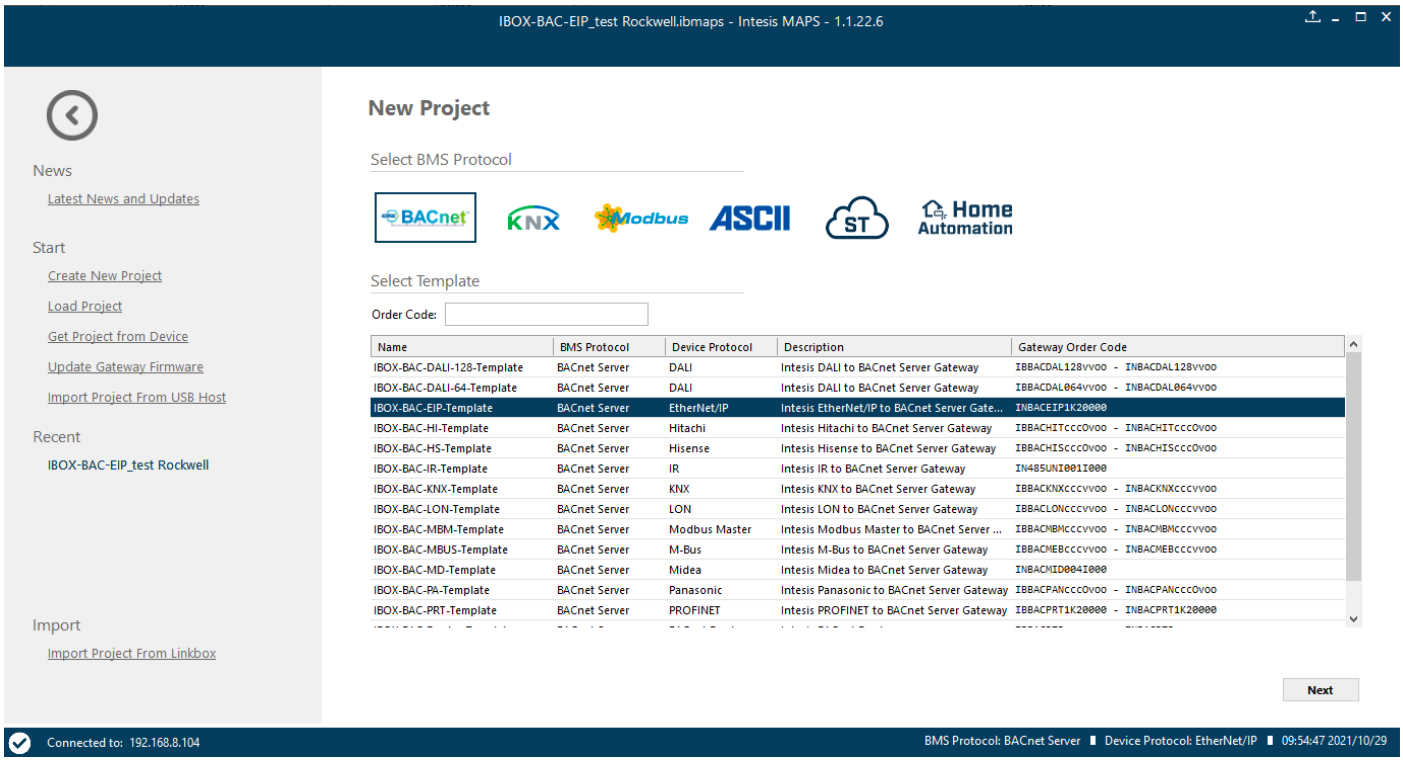
Therefore, if we can provide access to this BMS variables from a Rockwell controller, we will enable applications where both systems communicate with each other like:

- A chemical factory communicating with the BACnet BMS to shut down the HVAC system in the building due to an emergency.
- A working shift finishes and notifies to the BMS, so the HVAC, lighting and other systems must be switched off to reduce energy usage.
- A BACnet HMI or SCADA located in building, showing important KPIs from the industrial process happening in factory level.

This application note describes the relevant configuration options and files to achieve the applications described above.

Configuration tool: MAPS

Intesis MAPS supports all possible protocol combinations available for Intesis gateways providing a simple and consistent way to program all your devices, regardless of the protocol they use. Just launch MAPS, select the template for your gateway and you are ready to go.



Intesis MAPS provides device templates to import data automatically, without complex Excel configuration files or not-so-user-friendly interfaces that only increase the configuration time. It supports conversions such as scaling and offset to transform the data to your needs, and it enables advanced diagnostics and troubleshooting as well.

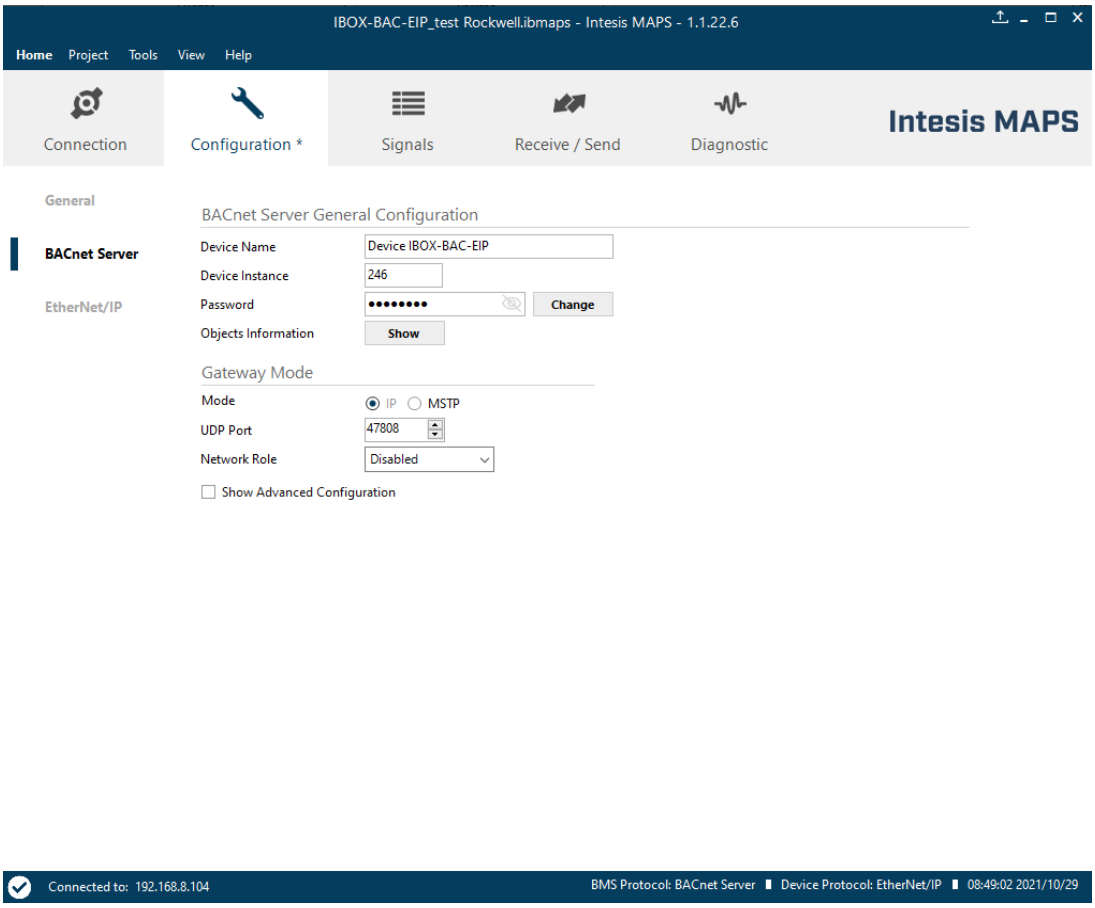
MAPS software is a Windows application and can be freely downloaded from Intesis website: www.intesis.com

BACnet features and EtherNet/IP Class types supported

BACnet side

On the BACnet side, the gateway acts as BACnet/IP Server or BACnet MSTP device, allowing other BACnet devices to perform subscription (COV) requests and reads/writes to its internal points.

This BACnet gateway supports both serial (MSTP) and IP communication. Using Intesis MAPS configuration software, the user can modify the settings of the gateway to adapt each side of the automation network, defining for example, the BACnet operation mode (IP or MSTP), the UDP port for its BACnet identification from a BACnet Client or the required Baud rate settings for its MSTP working mode.



This Intesis gateway supports several object types to perform the most common applications in a BACnet installation: Analog (Input, Output), Binary (Input, Output) and Multistate (Input, Output)
A complete list of supported types can be found on the user manual of the gateway.
https://www.intesis.com/docs/user-manual-inbaceip1k2000

EtherNet/IP side

On the EtherNet/IP side, the gateway acts as an Adaptor device and its interface supports the following CIP connection:

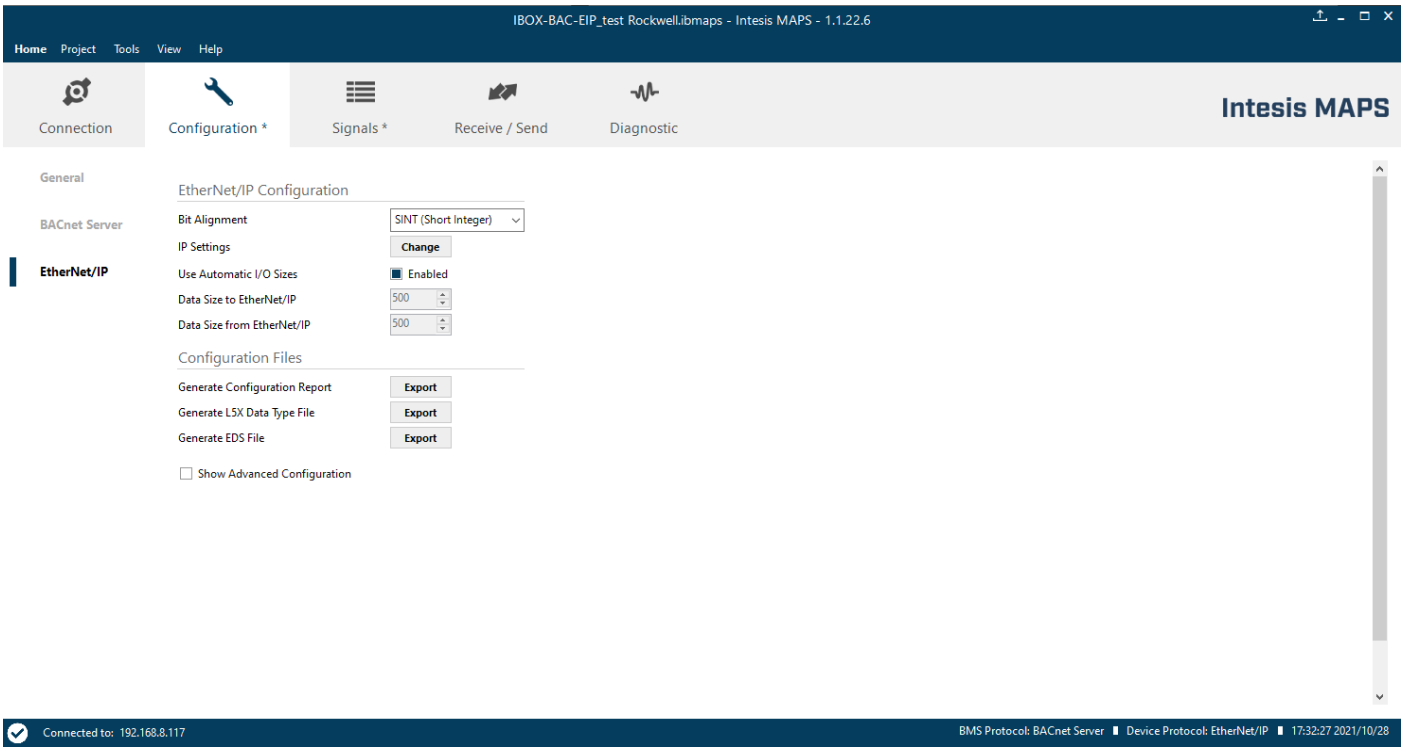
- Class-1 Connection. Also called 'Implicit messaging' is a method of communication between EtherNet/IP controllers and devices using Ethernet UDP messages. All data points configured as 'cycle' are exchanged between the controllers and devices at regular time intervals.

When the Scanner device writes an EtherNet/IP register in the gateway, the new value is updated on the BACnet side to be read by BACnet clients using pooling method and, if this BACnet object has active subscriptions the new value will be sent to the subscripted BACnet device(s).

The maximum number of simultaneous connections supported by on the EtherNet/IP side, depends on the Class connection, for instance, when working with Class 1, a maximum of 4 connections (1 as an exclusive owner) are supported.

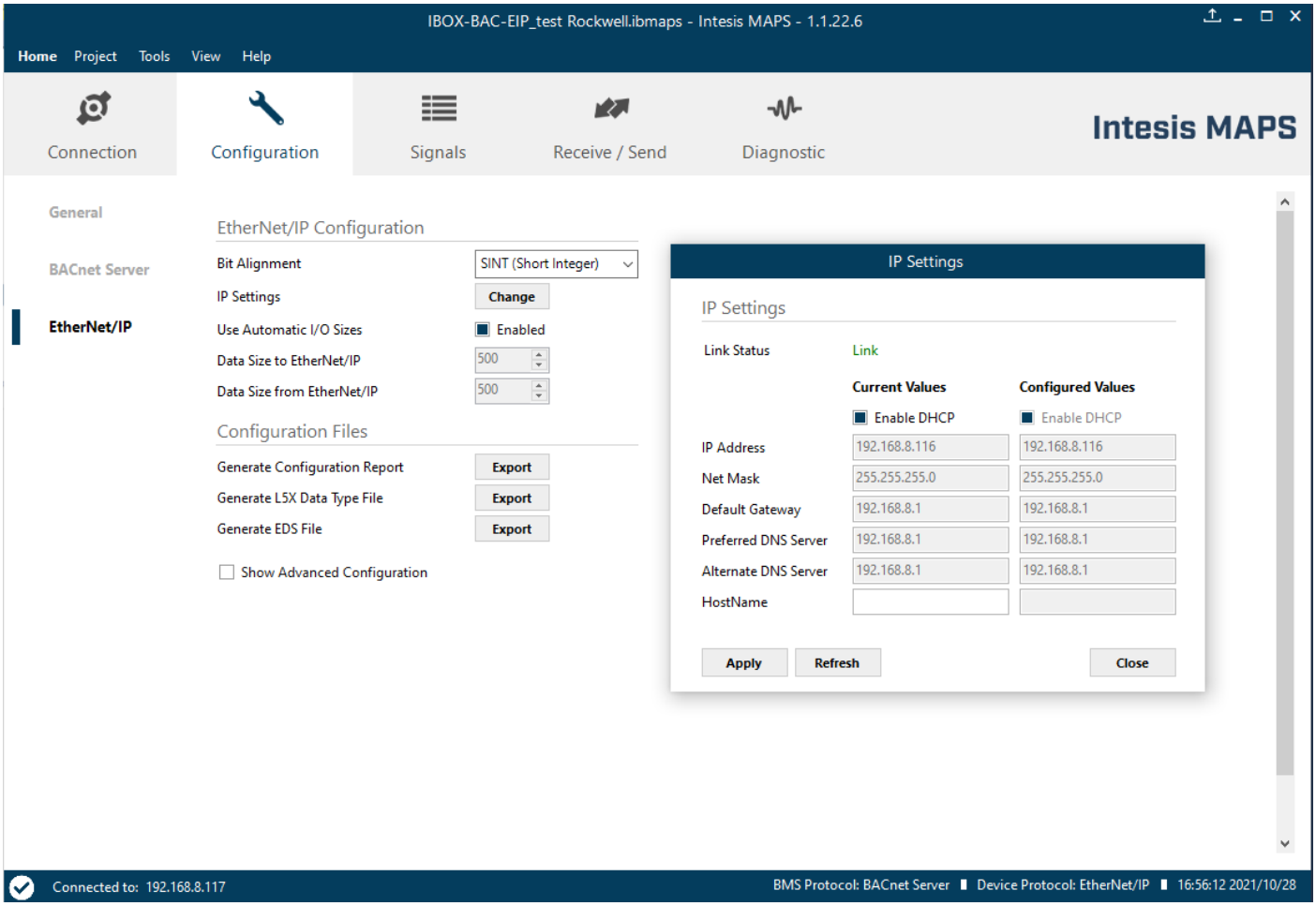
In terms of the data capacity, the amount of Input data supported is max 500 bytes and another 500 bytes for the Output data. This is the amount of memory available for mapping on EtherNet/IP network and will have effect on the amount of data that can be transferred to and from the gateway.

This capacity can be modified on the configuration toom MAPS, on the EtherNet/IP configuration setting.



Keep in mind that if Use Automatic I/O Sizes is active, it will enable the maximum capacity of the data package (500 bytes I/O), which will enable more forgiving communication between the scanner and the adaptor and avoid I/O configuration mismatches. However, MAPS allows to reduce this data size on the EtherNet/IP adaptor in its programming.

Another important feature is the possibility to modify the IP settings from the EtherNet/IP adaptor. This is the IP address that the EtherNet/IP side of the gateway will have to identify itself in the Rockwell´s Controller network.

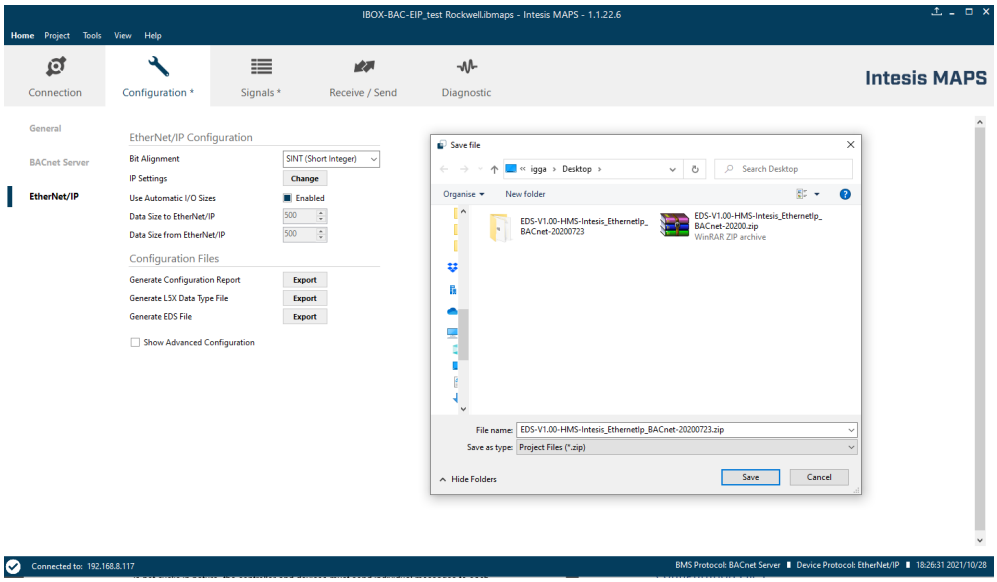


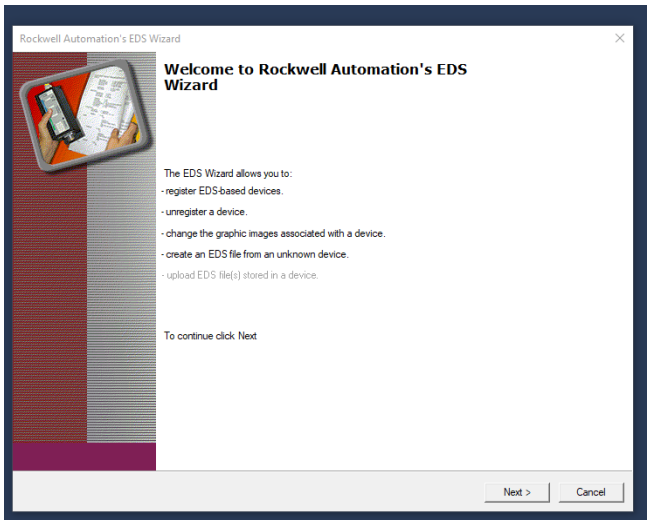
Configuration Files

EDS file

One of the main features of the Intesis gateway is it capability to create and generate Configuration files for easy integration on Rockwell controllers.

The EDS file generated from the gateway, simplifies the configuration process for the system integrator when integrating in the controller´s software. This EDS file contains all the relevant data from the Adaptor device, in this case, the BACnet EtherNet/IP gateway and can be generated from the EtherNet/IP configuration tab in MAPS.

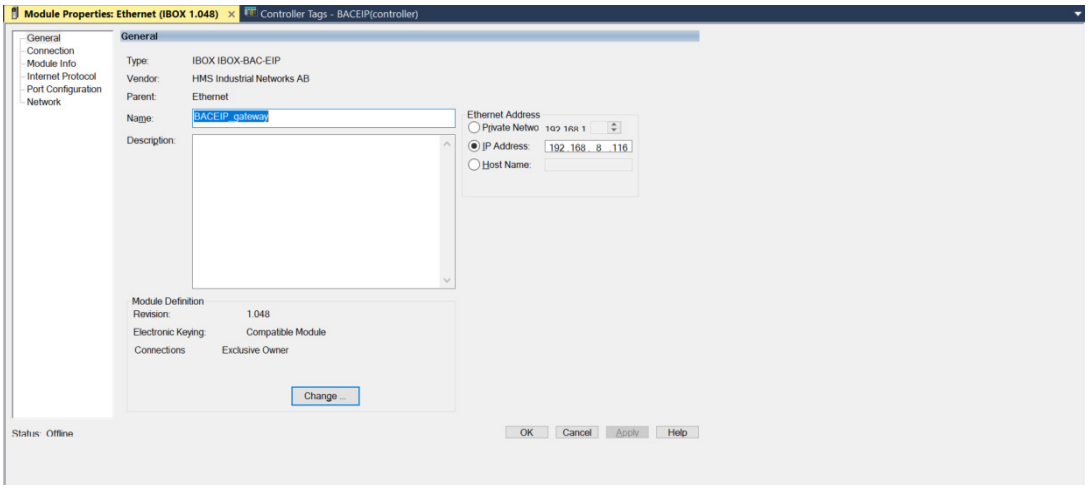




Once this file is stored, it can be opened from Studio 5000 Logix Designer software, following the EDS Wizard in the application:

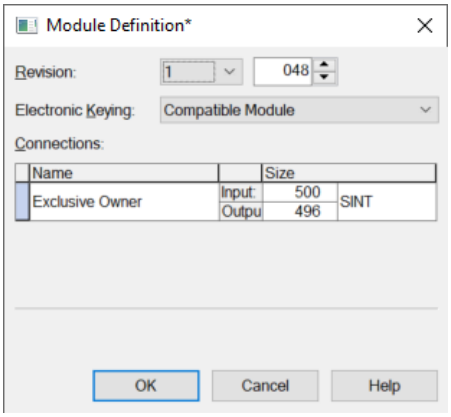
Once the EDS file has been successful imported, the module properties will automatically show the details of the communication set up by MAPS.

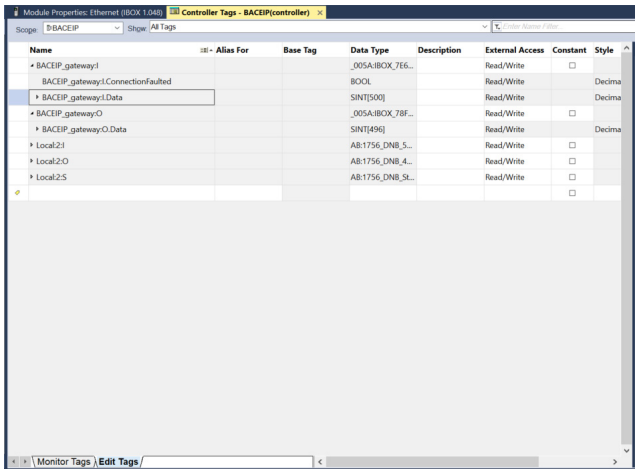
You can change some of the settings like the IP address to enable communication with the gateway. The IP address should be in the same range as the IP address for the PLC system.



Or modify the Module definition to change the I/O data size, however, keep in mind that these settings are already defined on the Adaptor/ gateway, and would need to be changed on the configuration of the gateway via MAPS.

In this example we use an Exclusive Owner connection and set the data type to INT, which represents the data as 16-bit values. The size of the input and output connections must correspond to the size configured for the Intesis EtherNet/IP gateway.





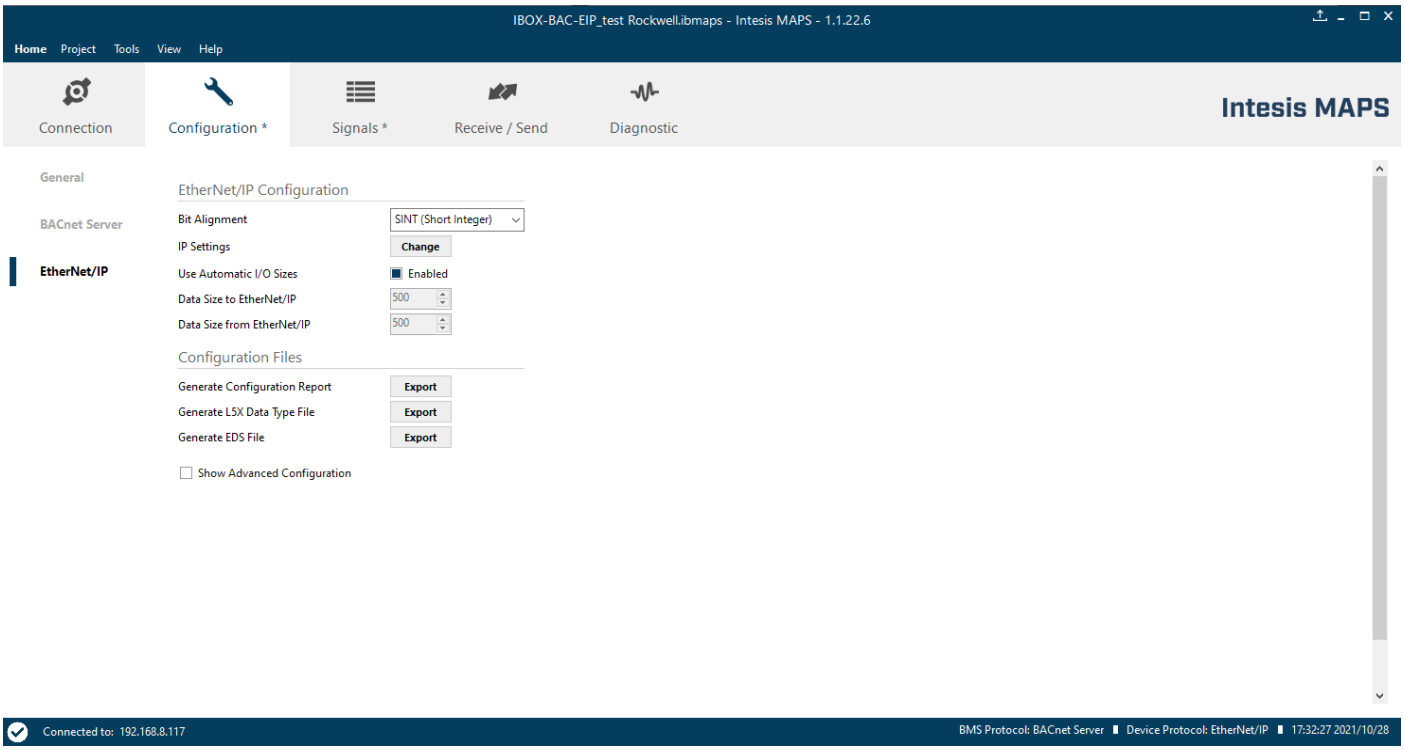
In the controller tags for the PLC, the configured I/O data values for the implemented Intesis EtherNet/IP gateway can be seen.

Configuration Report

The Configuration Report represents the existing data structure on the BACnet – EtherNet/IP HMS gateway. It is a very helpful document for System Integrators that are working directly on the programming of the PLC and would like to simplify the data structure generated by the EDS file generated by MAPS.

Following the information contained in the document about the data generated by the EtherNet/IP gateway, they can configure the tag names, look for the bit definition to understand the tags' function or its size on the PLC programming.

This report can be generated by MAPS on the EtherNet/IP configuration tab:



By clicking on Generate Configuration Report, an Excel file will be created containing all this information. However, it´s important to remark that this is not a configuration file. Modifying settings there to later import them in the gateway is not possible, thus this document is simply informative.

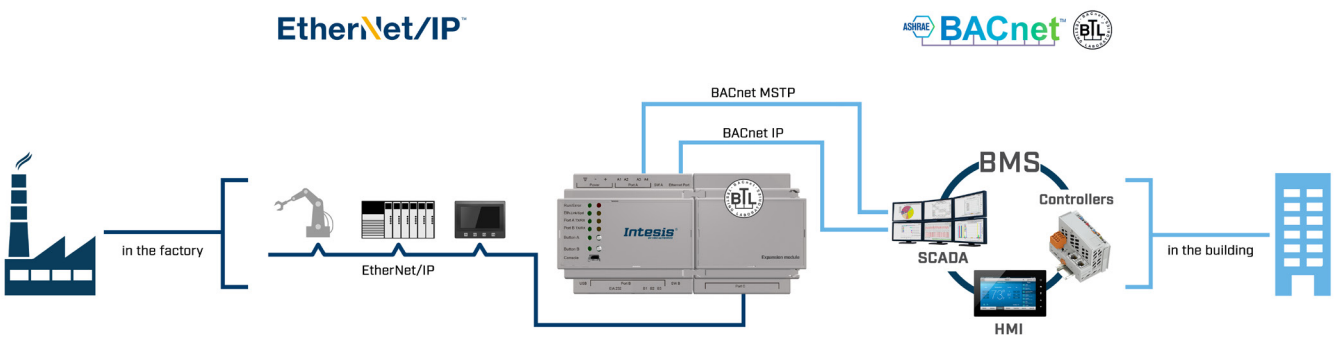
All the necessary configurations can be easily done with MAPS configuration software.

In the following application example, we will see how this Configuration report looks like.

Application Examples

We will take one of the application examples mentioned in the introduction:

- A chemical factory communicating with the BACnet BMS to shut down the HVAC system in the building due to an emergency.

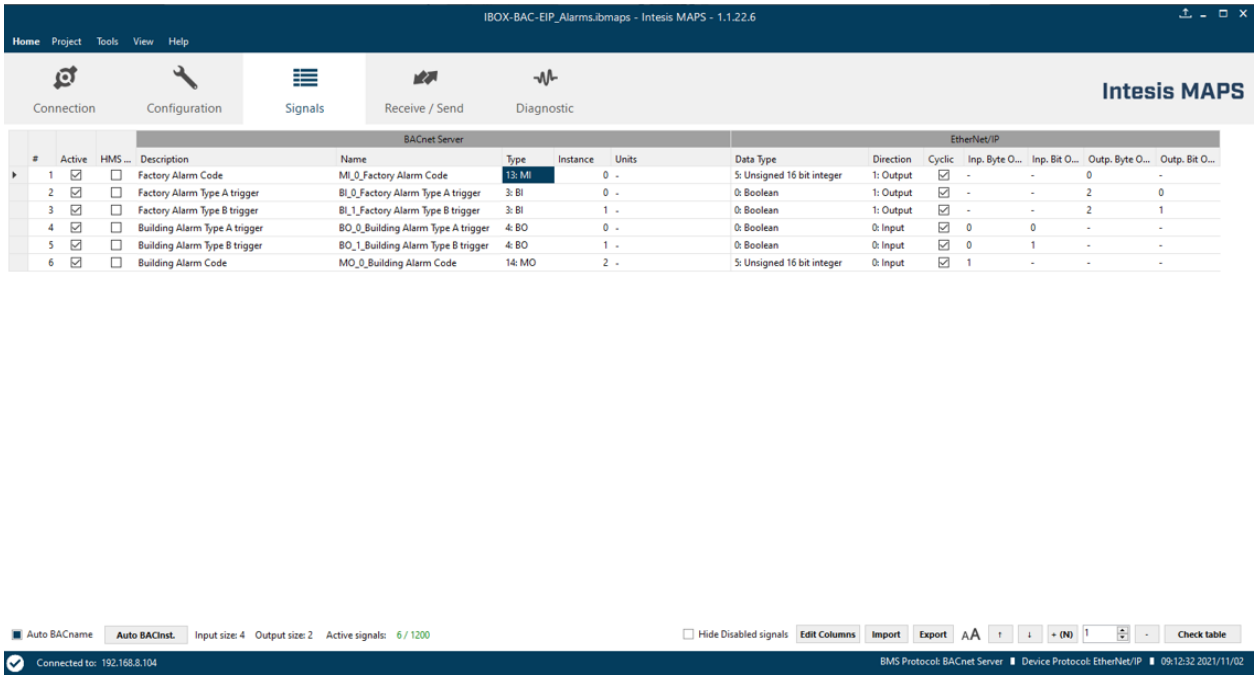


On Factory floor, there has been defined 2 types of alarms that can be triggered depending on the severity level. The Allen-Bradley PLC installed at factory level, is monitoring all the production processes, while keeping an eye on possible events that could cause an alarm.

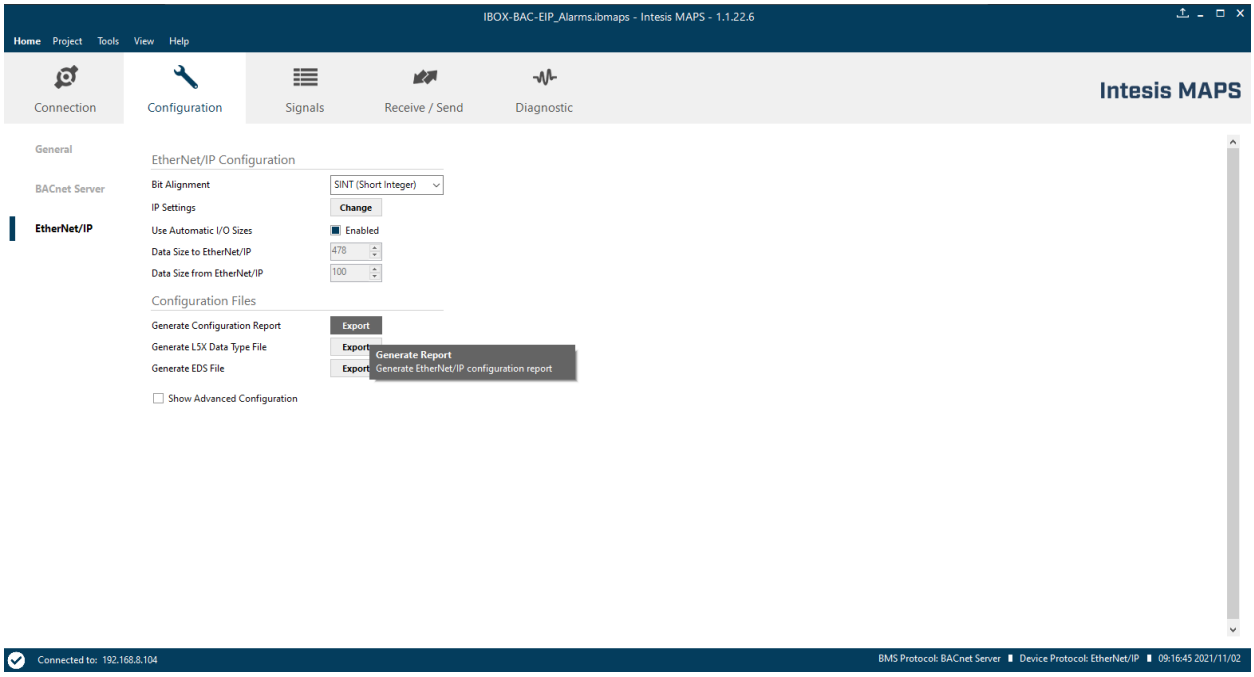
Inside of the Building, there is a BACnet BMS installed which is controlling all the general facilities of the building: HVAC, alarms, lighting, and energy management. It has also defined 2 types of alarms to communicate to the factory floor.

When there is an alarm on Factory floor, the PLC should communicate to the BMS in the Building to control the HVAC, lighting, and energy generation to make sure the systems will operate accordingly to the emergency type. And the other way around, when there is an alarm in the Building, the Factory floor should be notified to trigger its respective safety actions.

The system integrator can easily create these alarm types using MAPS on the Signals view and store them in the gateway by clicking on Send.



Once the signals have been created, the user can generate the required files for the integration and operation with the Allen-Bradley PLC.



Creating the Configuration Report, it will export and Excel format file that will contain the information programmed in the gateway, divided between:

- Input Cyclic Data
- Output Cyclic Data
- Acyclic Data

	A	B	C	D	E	F
1	Transaction Name	Element Size (bytes)	Absolute Range [Byte].[Bit]	Description	BACnet Type	BACnet Units
2	BO_0__Building Alarm Type A trigger	2	0.0	Building Alarm Type A trigger	4: BO	-
3	BO_1__Building Alarm Type B trigger	1 bit	0.1	Building Alarm Type B trigger	4: BO	-
4	MO_2__Building Alarm Code	1 bit	1	Building Alarm description	14: MO	-
5						
6						
7						
8						
9						

Input Cyclic data | Output Cyclic data | Acyclic data

	A	B	C	D	E	F
1	Transaction Name	Element Size (bytes)	Absolute Range [Byte].[Bit]	Description	BACnet Type	BACnet Units
2	MI_0__Factory Alarm Code	2	0	Factory Alarm description	13: MI	-
3	BI_0__Factory Alarm Type A trigger	1 bit	2.0	Factory Alarm Type A trigger	3: BI	-
4	BI_1__Factory Alarm Type B trigger	1 bit	2.1	Factory Alarm Type B trigger	3: BI	-
5						
6						
7						
8						
9						

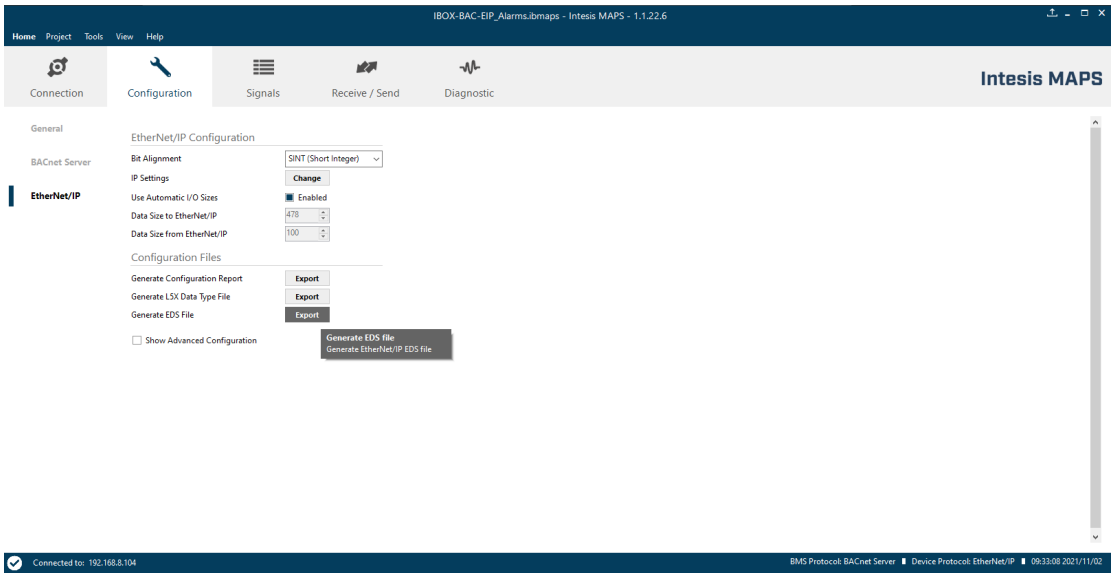
Input Cyclic data | Output Cyclic data | Acyclic data

	A	B	C	D	E	F	G
1	Name	Element Size (bytes)	EtherNet/IP Index	Access	Description	BACnet Type	BACnet Units
2	MI_0__Factory Alarm Code	2	1	RW	Factory Alarm description	13: MI	-
3	BI_0__Factory Alarm Type A trigger	1 bit	2	RW	Factory Alarm Type A trigger	3: BI	-
4	BI_1__Factory Alarm Type B trigger	1 bit	3	RW	Factory Alarm Type B trigger	3: BI	-
5	BO_0__Building Alarm Type A trigger	1 bit	4	R	Building Alarm Type A trigger	4: BO	-
6	BO_1__Building Alarm Type B trigger	1 bit	5	R	Building Alarm Type B trigger	4: BO	-
7	MO_2__Building Alarm Code	2	6	R	Building Alarm description	14: MO	-
8							
9							

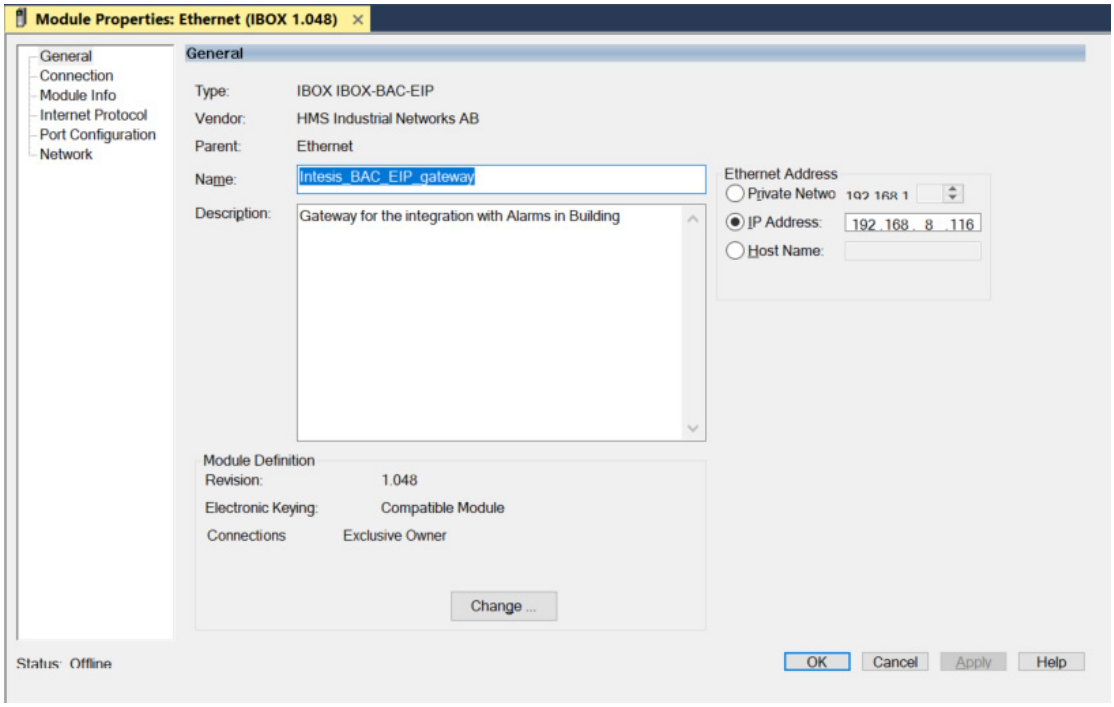
Input Cyclic data | Output Cyclic data | Acyclic data

The information generated in this Configuration File includes relevant information about the Tags required for the integration. The Elements size or the byte/bit range can be later used in the PLC programming to identify the specific Tags for each of the controller´s I/O.

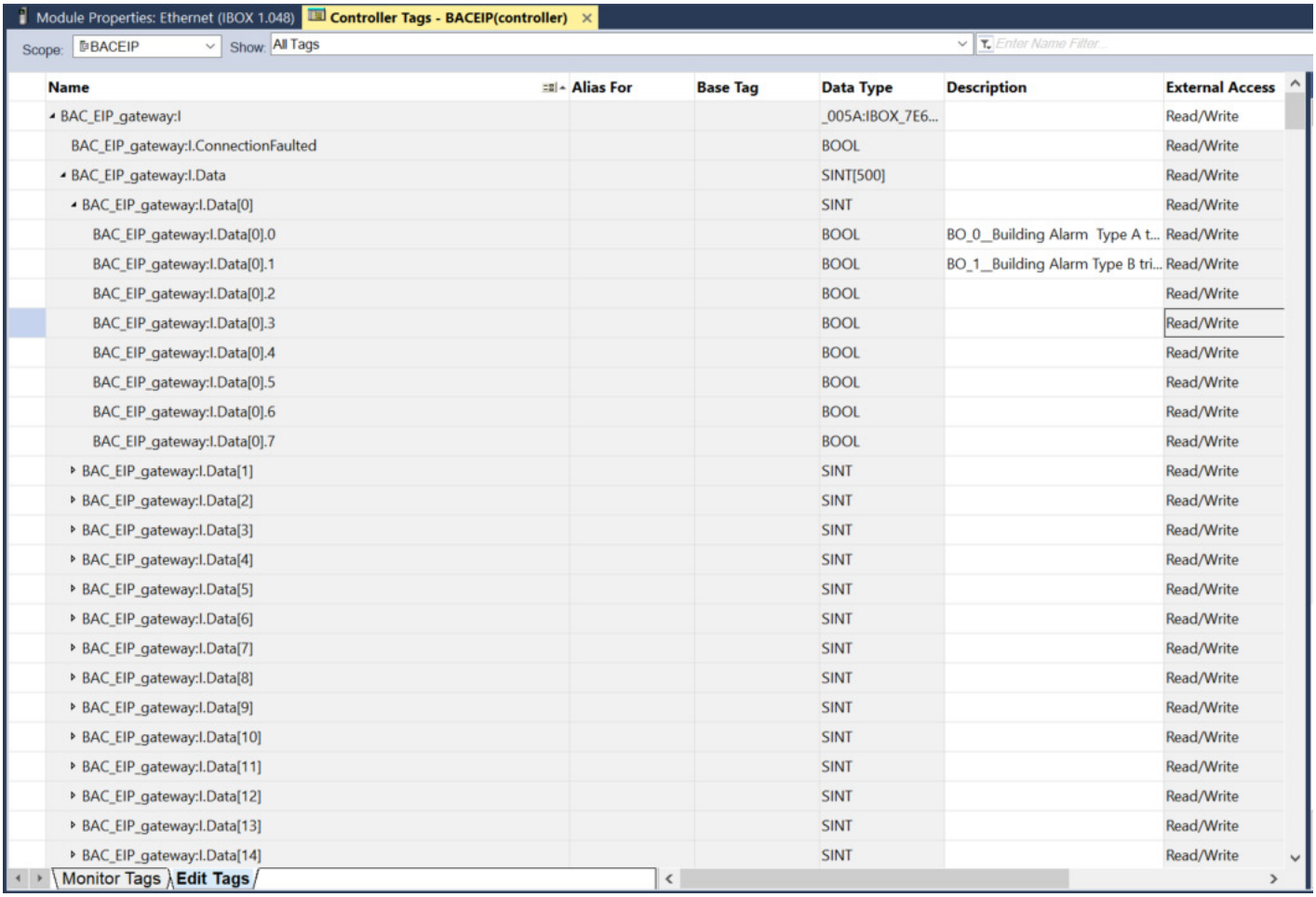
But before going to the Logix Designer project, the user can generate the EDS file that contains all the configuration information of the I/O adaptor (the gateway).



Now on the Studio 5000 Logix Controller software, the user can import the EDS file of the gateway and start the configuration of the module.



And finally, in the Controller tags for the PLC, the configured I/O data values for the implemented Intesis gateway can be seen and adapted to the project requirements, making use of the Configuration file generated from MAPS.



Name	Alias For	Base Tag	Data Type	Description	External Access
BAC_EIP_gateway:I			_005A:IBOX_7E6...		Read/Write
BAC_EIP_gateway:I.ConnectionFaulted			BOOL		Read/Write
BAC_EIP_gateway:I.Data			SINT[500]		Read/Write
BAC_EIP_gateway:I.Data[0]			SINT		Read/Write
BAC_EIP_gateway:I.Data[0].0			BOOL	BO_0_Building Alarm Type A t...	Read/Write
BAC_EIP_gateway:I.Data[0].1			BOOL	BO_1_Building Alarm Type B tri...	Read/Write
BAC_EIP_gateway:I.Data[0].2			BOOL		Read/Write
BAC_EIP_gateway:I.Data[0].3			BOOL		Read/Write
BAC_EIP_gateway:I.Data[0].4			BOOL		Read/Write
BAC_EIP_gateway:I.Data[0].5			BOOL		Read/Write
BAC_EIP_gateway:I.Data[0].6			BOOL		Read/Write
BAC_EIP_gateway:I.Data[0].7			BOOL		Read/Write
BAC_EIP_gateway:I.Data[1]			SINT		Read/Write
BAC_EIP_gateway:I.Data[2]			SINT		Read/Write
BAC_EIP_gateway:I.Data[3]			SINT		Read/Write
BAC_EIP_gateway:I.Data[4]			SINT		Read/Write
BAC_EIP_gateway:I.Data[5]			SINT		Read/Write
BAC_EIP_gateway:I.Data[6]			SINT		Read/Write
BAC_EIP_gateway:I.Data[7]			SINT		Read/Write
BAC_EIP_gateway:I.Data[8]			SINT		Read/Write
BAC_EIP_gateway:I.Data[9]			SINT		Read/Write
BAC_EIP_gateway:I.Data[10]			SINT		Read/Write
BAC_EIP_gateway:I.Data[11]			SINT		Read/Write
BAC_EIP_gateway:I.Data[12]			SINT		Read/Write
BAC_EIP_gateway:I.Data[13]			SINT		Read/Write
BAC_EIP_gateway:I.Data[14]			SINT		Read/Write