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# TBF-PN PROFINET IO OUTPUT USER MANUAL



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## 1. INTRODUCTION

TBF-PN magnetostrictive transducer implements Profinet IO communication.

Profinet is a digital communication standard developed and maintained by PI (Profibus and Profinet International).

The digital communication allows the transfer of data between the device (the TBF-PN transducer) and the Master (PLC) through a network.

These data are:

Process data, such as position, speed, and status of the device

Acyclic data, such as parameterization, statistic, and diagnostic data

The ProfiNet standard provides a descriptor file called GSDML (General Station Description based on XML format).

This file allows clear identification of the device and comprehension of data provided and exchanged.

Please refer to TBF website for the download of GSDML files.

This manual is not designed to describe the “PROFINET” Fieldbus, as it is presumed the user is familiar with the same and will refer to any updates are required to the above-mentioned standard or the official PROFIBUS CONSORTIUM and PROFINET International website (PI),

<http://www.profibus.com/>.

## 2. INSTALLATION AND ELECTRICAL CONNECTIONS

### 2.1. General precautions

The system must be used only in accordance with the required protection level.

The sensor must be protected against accidental knocks and used in accordance with the instrument's ambient characteristics.

The sensors must be powered by non-distributed networks.



### 2.2. Electrical installation

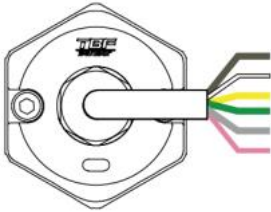
The transducer must be grounded (normally through the machine body or equipment it is installed on).

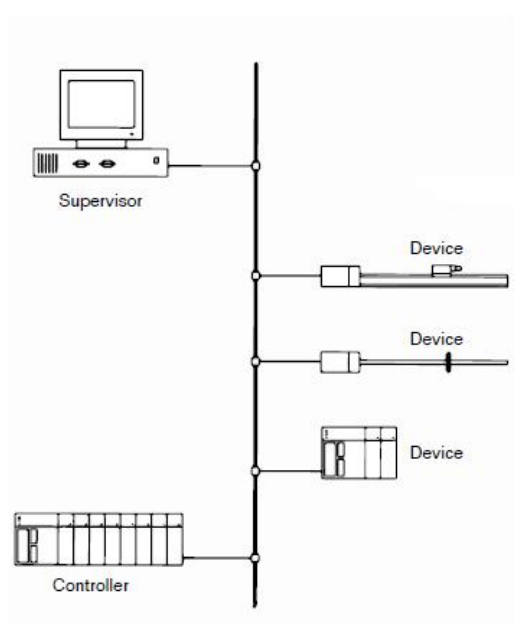
Connect cables shielding to ground at the cabinet side (control equipment or PLC).

To prevent interference, separate the power cables from signal cables.

<b>Aviation plug</b>					
Two 5-pin M12 ( female) + One 4-pin M12 (male)					
Two 5-pin M12 ( female) + One 4-pin M8 (male)					
<p>5 pin M12 female connector(D-coded)</p> <p>4 pin M12 male connector D58</p> <p>4 pin M8 male connector D56</p>	5-pin M12		PIN	Color	Function
			1	Yellow	TX+
			2	White	RX+
3			Orange	TX-	
4			Blue	RX-	
5			-	-	
	4 pin M12	5 pin M12	PIN	Color	Function
			1	Brown	+24VDC(-15/+20%)
3			Black	GND	

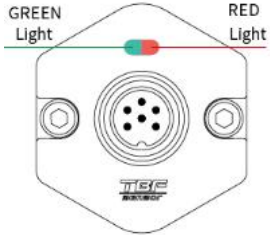
Aviation plug				
6-pin M12				
		PIN	Color	Function
		1	Pink	TX+
		2	Yellow	RX+
		3	Gray	TX-
		4	Green	RX-
		5	Brown	+24VDC(-15/+20%)
		6	White	GND

Straight out cable		
	Color	Function
	Brown	+24VDC(-15/+20%)
	White	GND
	Yellow	RX+
	Green	RX-
	Gray	TX-
	Pink	TX+



### 2.3. Status LEDs

The built-in LED indicator light provides basic fault feedback and fault alarm of the sensor.

	Green light	Red light	Function
	ON	OFF	View on sensor
	ON	ON	Magnet cannot be measured, nor magnet number is correct.
	OFF		Communication exception

### 3. MAIN COMMUNICATION FEATURES

Ethernet Baud Rate	Max 100 Mbit/s
Data Transport Layer	Ethernet II, IEEE 802.3
PNIO version	2.3
Real-time Communication	RT
Profile	General (Manufacturer) Profile or Encoder Profile v 4.2 Class 4
Min Device Interval	1 ms (RT)
Address	Discovery and Configuration Protocol (DCP)
Default IP	192.168.1.100
Default Name	Tbfgmbh

#### 4. GENERAL AND ENCODER PROFILE

##### Standard Telegram 81

This telegram foresees 4 bytes of output (Master to Device) and 12 bytes of input (Device to Master)

##### OUTPUT DATA

Word Data	1		2	
Byte Data	0	1	2	3
Output value	STW2_ENC		G1_STW	
Meaning	Encoder control word 2		Sensor control word	

##### INPUT DATA

Word Data	1		2		3	4	5	6				
Byte Data	0	1	2	3	4	5	6	7	8	9	10	11
Output value	ZSW2_ENC		G1_ZTW		G1_XIST1		G1_XIST2					
Meaning	Status word 2		Status word		Position value		Position value 2					

We have expanded the standard 81 telegram format to enable the transmission of multiple position values. Currently, up to three position value inputs are supported. The actual number of position value inputs depends on the sensor order.

##### OUTPUT DATA

Word Data	1		2	
Byte Data	0	1	2	3
Output value	STW2_ENC		G1_STW	
Meaning	Encoder control word 2		Sensor control word	

## INPUT DATA

Word Data	1		2		3		4		5		6		2N+5		2N+6	
Byte Data	0	1	2	3	4	5	6	7	8	9	10	11	2N+10	2N+11	2N+12	2N+13
Output value	ZSW2_ENC		G1_ZTW		G1_XIST1		G1_XIST2		Position N							
Meaning	Status word 2		Status word		Position value		Position value 2		Position N							

If the user wishes to input velocity values, the corresponding telegram format can be configured during configuration. This format is also similar to the standard 81 telegram format.

## OUTPUT DATA

Word Data	1				2			
Byte Data	0		1		2		3	
Output value	STW2_ENC				G1_STW			
Meaning	Encoder control word 2				Sensor control word			

## INPUT DATA

Word Data	1		2		3		4		5		6		4N+3		4N+4		4N+5		4N+6	
Byte Data	0	1	2	3	4	5	6	7	8	9	10	11	4N+8	4N+9	4N+10	4N+11	4N+12	4N+13	4N+14	4N+15
Output value	ZSW2_ENC		G1_ZTW		G1_XIST1		G1_XIST2		Position N				Speed N							
Meaning	Status word 2		Status word		Position value		Position value 2		Position N				Speed N							

## STW2\_ENC=Encoder control word 2

Bit	Function	Notes
0	XIST_PRESET_CONTROL	
1...6	Reserved for profile	
7	Fault Acknowledgement	
8...9	Reserved for vendor-specific extensions	Not used
10	Control by PLC	
11	Reserved for vendor-specific extensions	Not used
12...15	Controller Sign-Of-Life	

## G1\_STW=Sensor control word

Bit	Function	Notes
0...7	Function requests: Reference mark search, measurement on the fly	
8...10	Reserved	
11	Home position mode	
12	Request set/shift of home position	
13	Request absolute value cyclically	
14	Activate parking sensor	
15	Acknowledging a sensor error	

BIT13 This bit requests that the additional transmitted magnetic ring's actual position value be displayed in the G1\_XIST2 position. If this bit is set to zero, G1\_XIST2 will transmit an invalid value, which in our sensor is 0x7FFFFFFF. If there is an error in the sensor, the error code will always be displayed in G1\_XIST2, regardless of whether this bit is set.

## ZSW2\_ENC=Status word 2

Bit	Function	Notes
0	XIST_PRESET_ACK	
1	XIST_VALID	
2	NIST_VALID	
3	Fault Present / No Fault	
4...6	Reserved for profile	
7	Warning Present / No Warning	
8	Reserved for vendor-specific extensions	
9	Control requested	
10,11	Reserved for vendor-specific extensions	
12...15	Encoder Sign-Of-Life	

### Bit10 PLC control

PLC control indicates that the sensor can be controlled via the G1\_STW control word. This bit must be set to 1. If this bit is set to 0, all controls in G1\_STW will be ignored.

If "compatibility mode V3.1" is activated, this function is invalid, meaning the input of G1\_STW is always effective.

## G1\_ZSW=Sensor status word

Bit	Function	Notes
0...7	Function status: Reference mark search, measurement on the fly	
8	Probe 1 deflected	
9	Probe 2 deflected	
10	Reserved, set to zero	
11	Requirement of acknowledgement detected	
12	Set / shift of home position executed	
13	Transmit absolute value cyclically (absolute encoder only)	
14	Parking sensor active	
15	Sensor error	

BIT13 Transmit the absolute value of cyclically

This bit depends on BIT13 in the G1\_STW control word and indicates that the sensor transmits the absolute displacement value of magnetic ring 1 in G1\_XIST2. This bit cannot be set simultaneously with BIT15.

BIT15 Sensor error

Indicates a sensor error and outputs the error code in G1\_XIST2. BIT13 and BIT15 cannot be set simultaneously. BIT13 indicates that a valid displacement value is transmitted in G1\_XIST2, while BIT15 indicates that an error code is transmitted in G1\_XIST2.

### Standard Parameterization

Index (dec)	DataFormat	Name	Access	Values: meaning
65004.0	Bit	Code Sequence	RW	0: CW(forward) 1: CCW(reverse)
65004.1	Bit	Encoder Class 4 functionality	RW	1: Enable 0: Disable
65004.2	Bit	Preset affects G1_XIST1	RW	0: Enable 1: Disable
65004.3	Bit	Scaling function control	RW	1: Enable 0: Disable
65004.4	Bit	Alarm channel control	RW	1: Enable 0: Disable
65004.5	Bit	Compatibility mode V3.1	RW	0: Enable 1: Disable
65006	Unsigned32	Scaling: Measurement step [nm]	RW	1000: 1 micron
65007	Unsigned32	Scaling: Total measuring range	RW	
925	Unsigned8	Master Sign-of-Life faults	RW	
60001	Unsigned8	Velocity measuring unit	RW	- 0: steps/1000 ms - 1: steps/100 ms - 2: steps/10 ms

**Explanation:**

**Code Sequence:** it defines the increasing direction of position and velocity data; values allowed are:

- 0: Clockwise: it means that values increase positively from the sensor head to the end of stroke
- 1: Counterclockwise: it means that values increase positively from the sensor end of the stroke toward the head

**Encoder Class 4 functionality:** this parameter enables/disables the use of parameters “Code sequence”, “G1\_XIST1 preset control”, “Scaling function”, “measuring step”, “measuring range”, “velocity unit”. If this parameter is disabled the above-mentioned parameters are not taken into account, and the device by default measures with:

- Clockwise
- 1  $\mu$  m resolution
- No preset set

If “G1\_XIST1 preset control” is activated, this will affect G1\_XIST1, G1\_XIST2

**Preset affects G1\_XIST1:** this parameter defines whether the preset for G1\_XIST1 is active or not

**Scaling function control:** this parameter defines whether the resolution of the device can be changed or not

**Alarm channel control:** this parameter defines whether the alarm channel is active or not; it’s available only in compatibility mode and can be activated only in compatibility mode

**Compatibility mode V3.1:** this parameter defines whether the sensor works as a 3.1-compatible encoder or not; if this parameter is enabled, the following parameters are affected:

Functions	V3.1 Compatibility mode enabled	V3.1 Compatibility mode disabled
STW2_ENC	Ignored	Supported
User parameter alarm channel control	Supported	Not supported
P965 Profile Version	31 (V3.1)	42 (V4.2)

**Scaling: Measurement step [nm]:** It defines the resolution for the position data; values allowed are: 500, 1000, 2000, 5000, 10000, 50000, 100000 nm

**Scaling: Total measuring range:** it defines the limit of the measuring range in measuring steps; if the “Scaling function” is activated

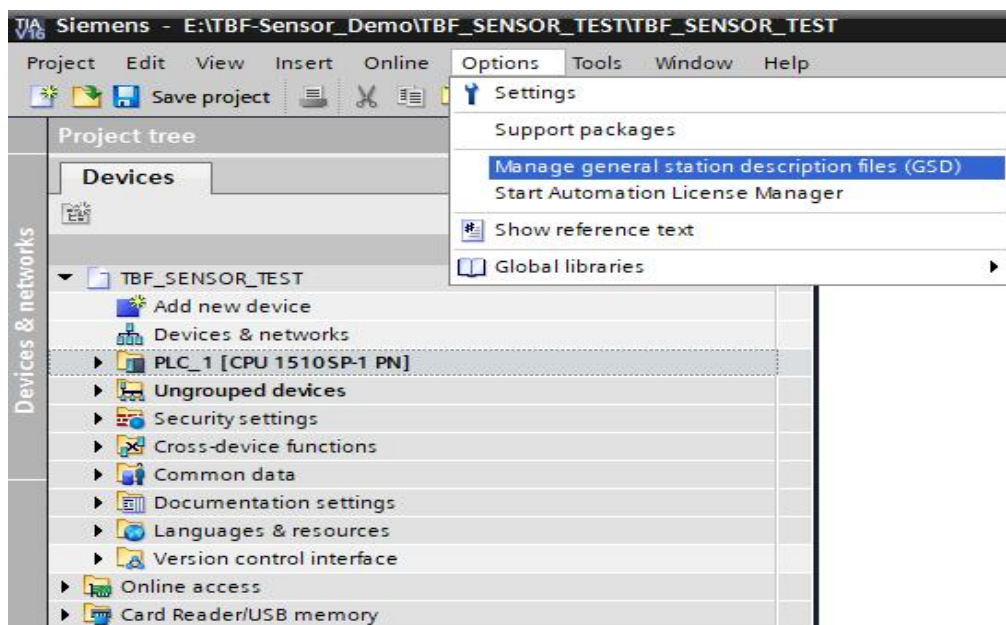
**Master Sign-of-Life faults:** it defines the number of allowed failures of the master sign-of-life; it can be used only in compatibility mode

**Velocity measuring unit:** it defines the resolution of velocity data; values allowed are:

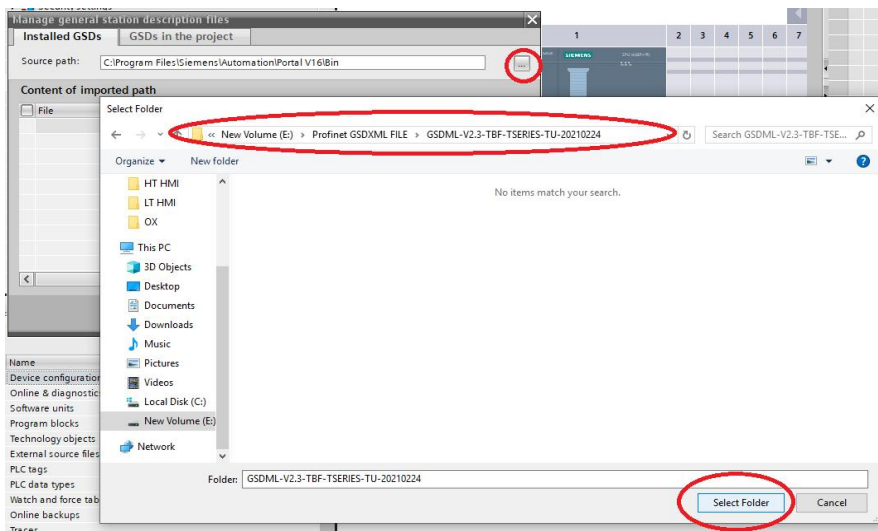
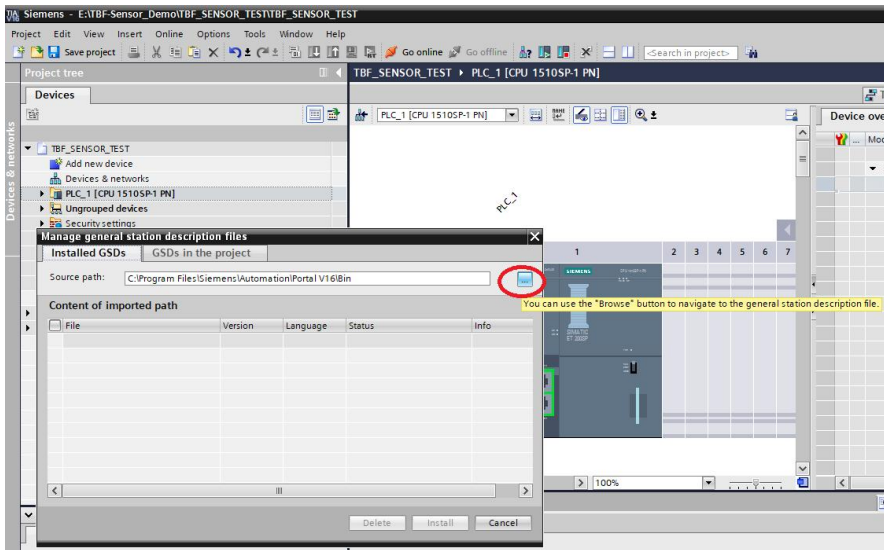
- 0: steps/1000 ms
- 1: steps/100 ms
- 2: steps/10 ms

## 5. EXAMPLE OF PLC CONFIGURATION

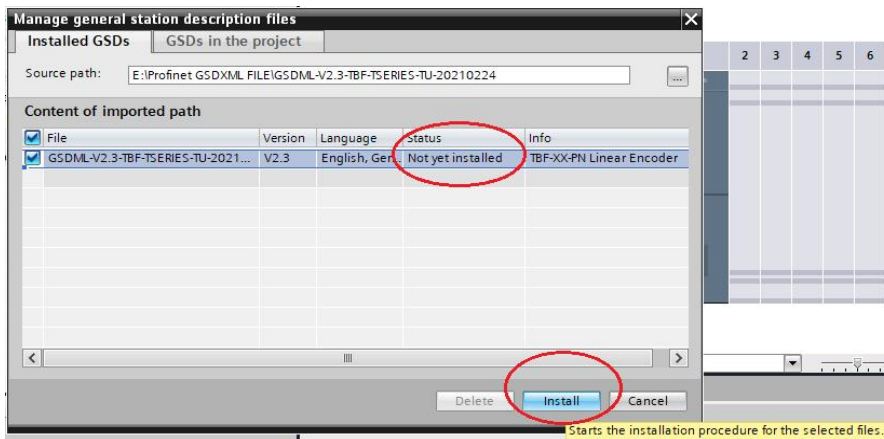
5.1 Open TIA Portal software, Options -> Manager general station description files (GSD).

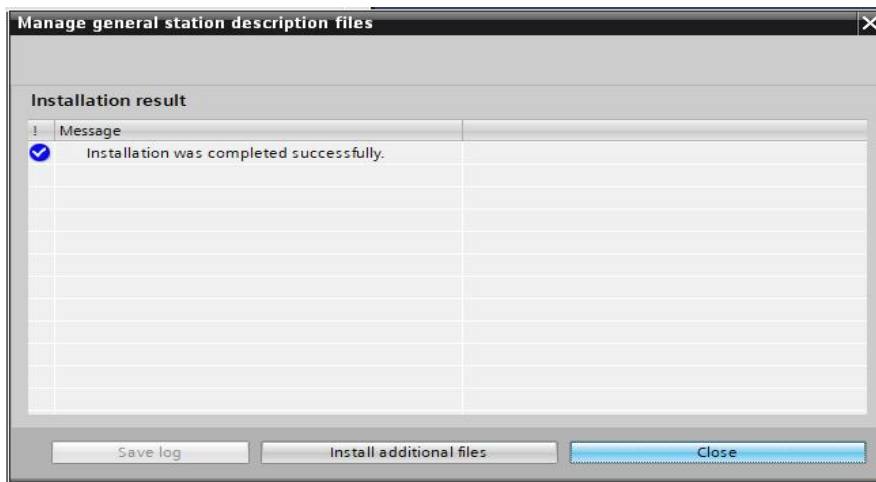


### 5.2 Open the path where the GSD file is located, select this folder

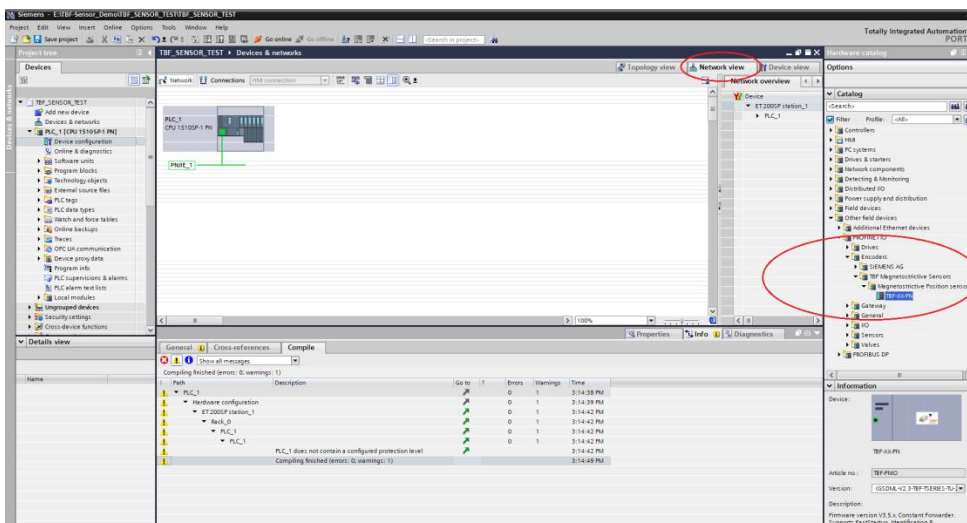


### 5.3 Select Install, wait for Install finished and close.

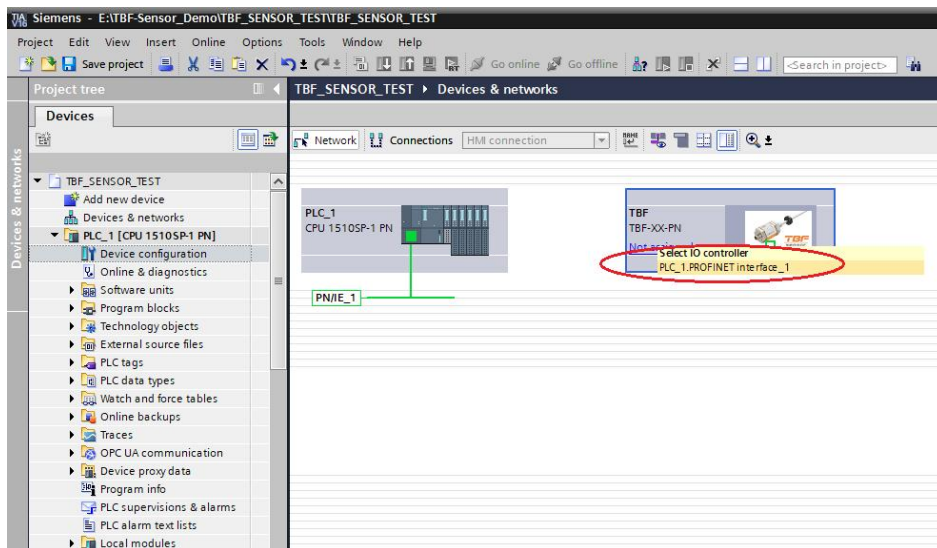




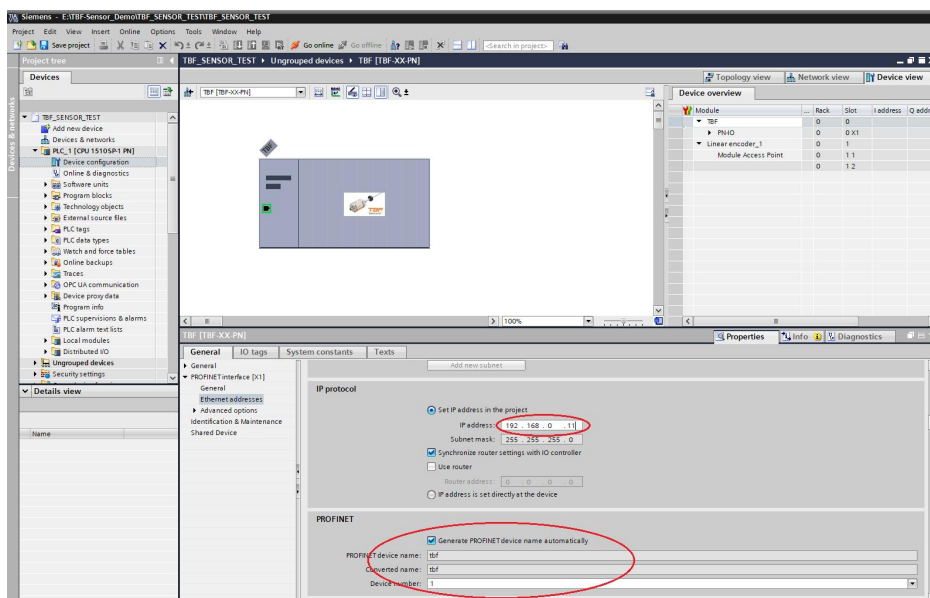
5.4 After creating a new project, open the network view, Hardware catalog->Other field devices->PROFINET IO->Encoders->TBF Magnetostrictive Sensors->TBF-XX-PN , double-click the left mouse button or drag .



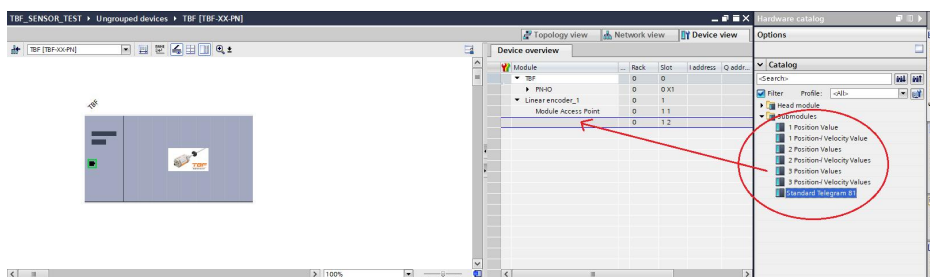
### 5.5 Select the IO controller, for example, the PLC\_1. PROFINET interface\_1.



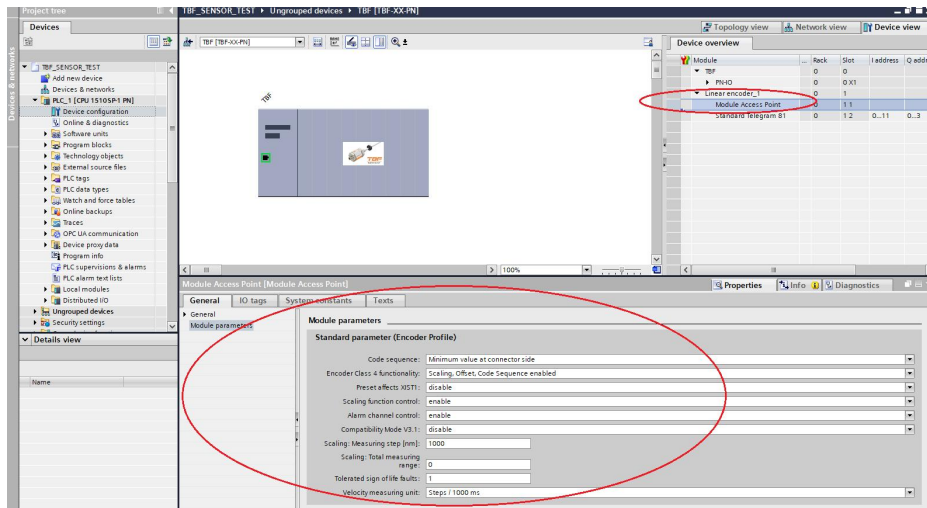
### 5.6 Set the IP address and device name according to the customer configuration.



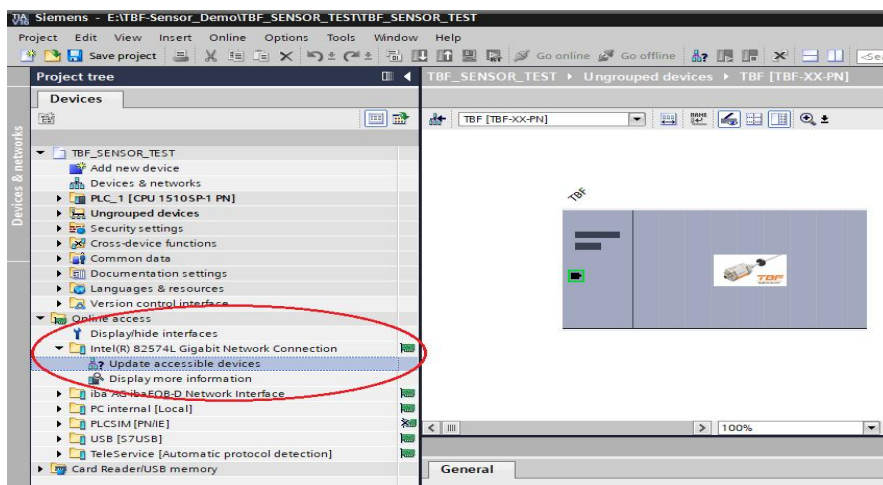
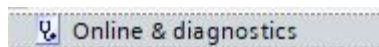
### 5.7 Select the Sun modules, for example, the Standard Telegram 81.



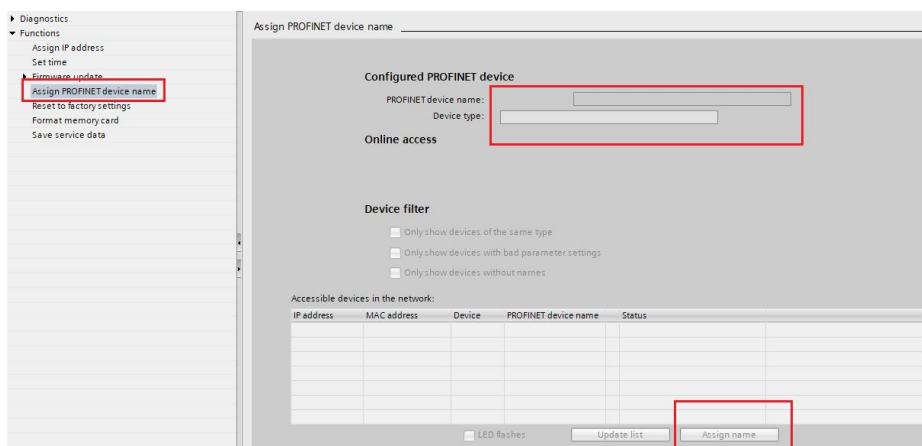
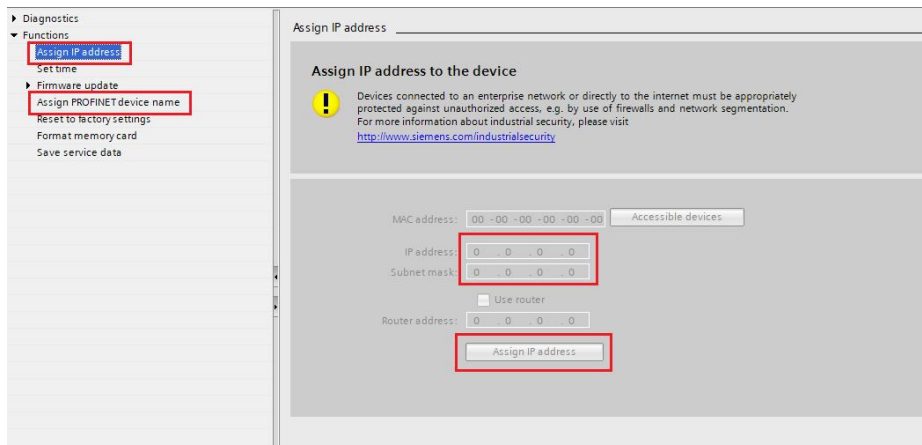
## 5.8 Select Module Access Point, set the Module parameters



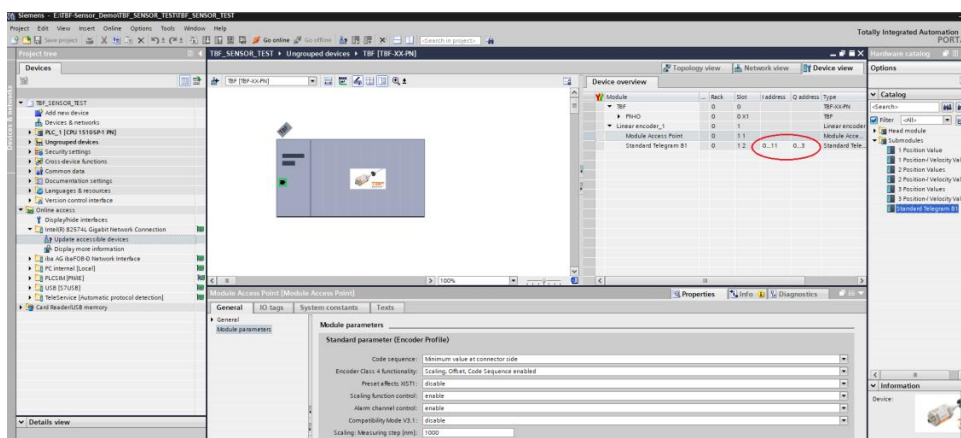
## 5.9 Select Online access, find the network card being used

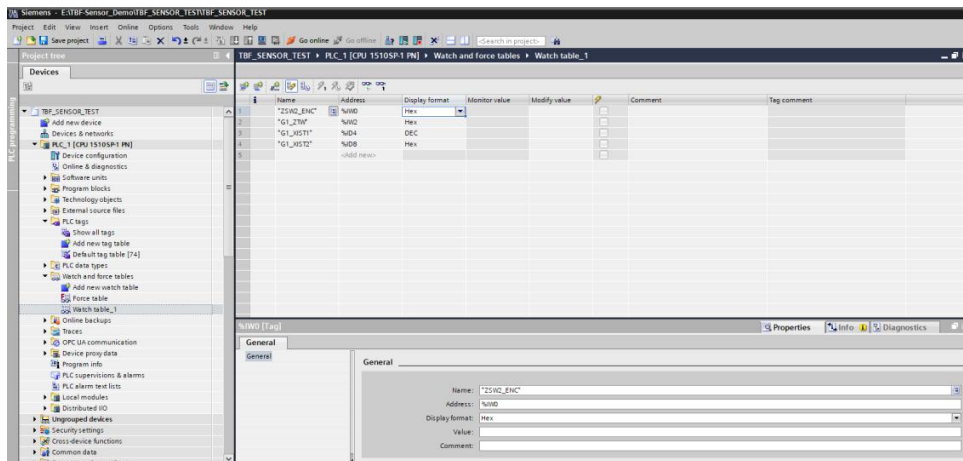


## 5.10 Assign IP address and assign PROFINET device names according to the project configuration

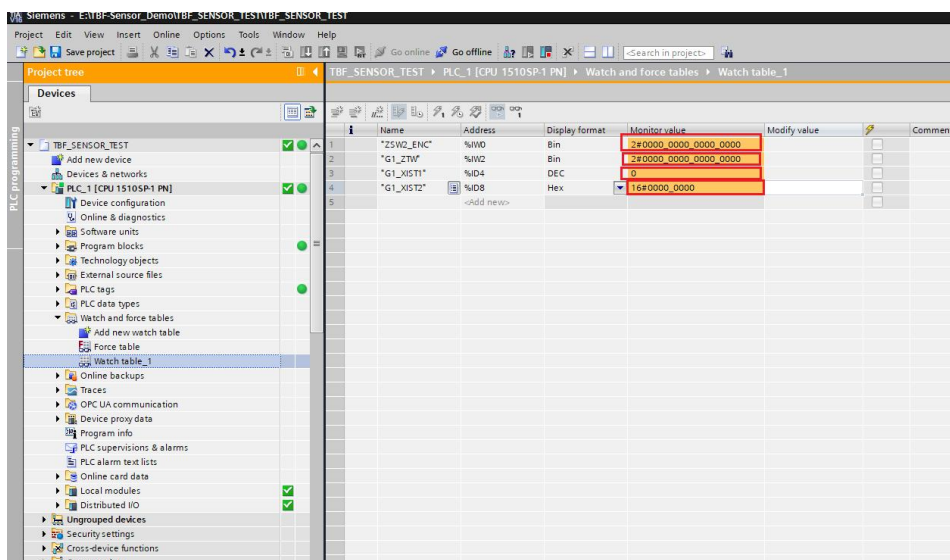


## 5.11 For example, the device hardware I/O address is 12 bytes INPUT and 4 bytes OUTPUT





### 5.12 Create a new Watch table\_1 table to monitor variables.



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