AAM 58 R PROFINET INSTALLATION MANUAL

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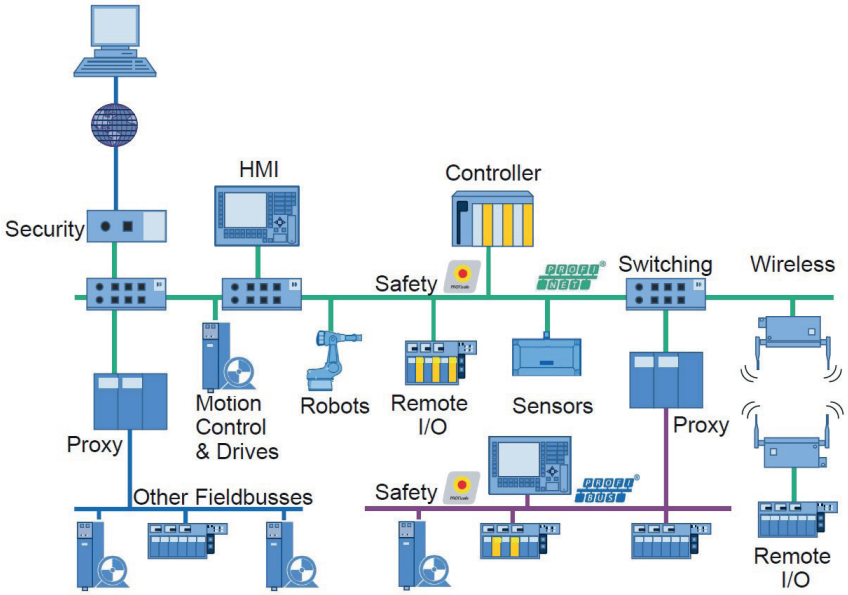
1. ENCODER TECHNICAL DETAILS

PROFINET TECHNOLOGY

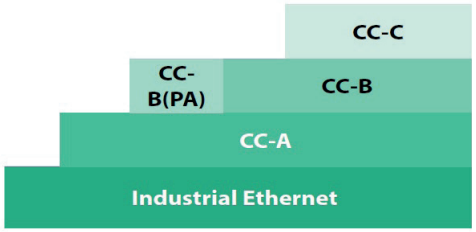
The ever-shorter innovation cycles for new products makes the continuous evolution of automation technology necessary. The use of fieldbus technology has been a significant development in the past few years. It has made possible to migrate from centralized automation systems to decentralized ones. PROFIBUS, as the global market leader, has set the benchmark here for 25 years.
In today's automation technology, Ethernet and information technology (IT) are increasingly calling the shots with established standards like TCP/IP and XML. Integrating information technology into automation opens up significantly better communication options among automation systems, extensive configuration and diagnostic possibilities, and network-wide service functionality.
These functions have been integral components of PROFINET from the outset. PROFINET is the innovative open standard for Industrial Ethernet.
PROFINET satisfies all requirements of automation technology; whether the application involves production automation, process automation, or drives (with or without functional safety), PROFINET is the first choice across the board. As a technology that is standard in the automotive industry, widely disseminated in machine building, and well-proven in the food and packaging and logistics industries, PROFINET has found its way into all application areas.
New application areas are constantly emerging, such as marine and rail applications or even day-to-day operations, for example, in a beverage shop. And now: the new PROFIenergy technology profile will improve the energy balance in production processes.
PROFINET is standardized in IEC 61158 and IEC 61784.
The ongoing further development of PROFINET offers users a long-term view for the implementation of their automation tasks.
For plant and machine manufacturers, the use of PROFINET minimizes the costs for installation, engineering, and commissioning.
For plant owners, PROFINET offers ease of plant expansion and high plant availability due to autonomously running plant units and low maintenance requirements. The mandatory certification for PROFINET devices also ensures a high quality standard.



Example of plant network

The scope of functions supported by PROFINET IO is clearly divided into conformance classes ("CC").
These provide a practical summary of the various minimum properties.
There are three conformance classes that build upon one another and are oriented to typical applications (see figure).

CC-A provides basic functions for PROFINET IO with RT communication. All IT services can be used without restriction. Typical applications are found, for example, in business automation. Wireless communication is specified for this class.
CC-B extends the concept to include network diagnostics via IT mechanisms as well as topology information. The system redundancy function important for process automation is contained in an extended version of CC-B named CC-B(PA).
CC-C describes the basic functions for devices with hardware-supported bandwidth reservation and synchronization (IRT communication) and is thus the basis for isochronous applications.



Structure of conformance classes

The conformance classes also serve as the basis for the certification and the cabling guidelines.
A detailed description of the CCs can be found in the document "The PROFINET IO Conformance Classes" [7.042].

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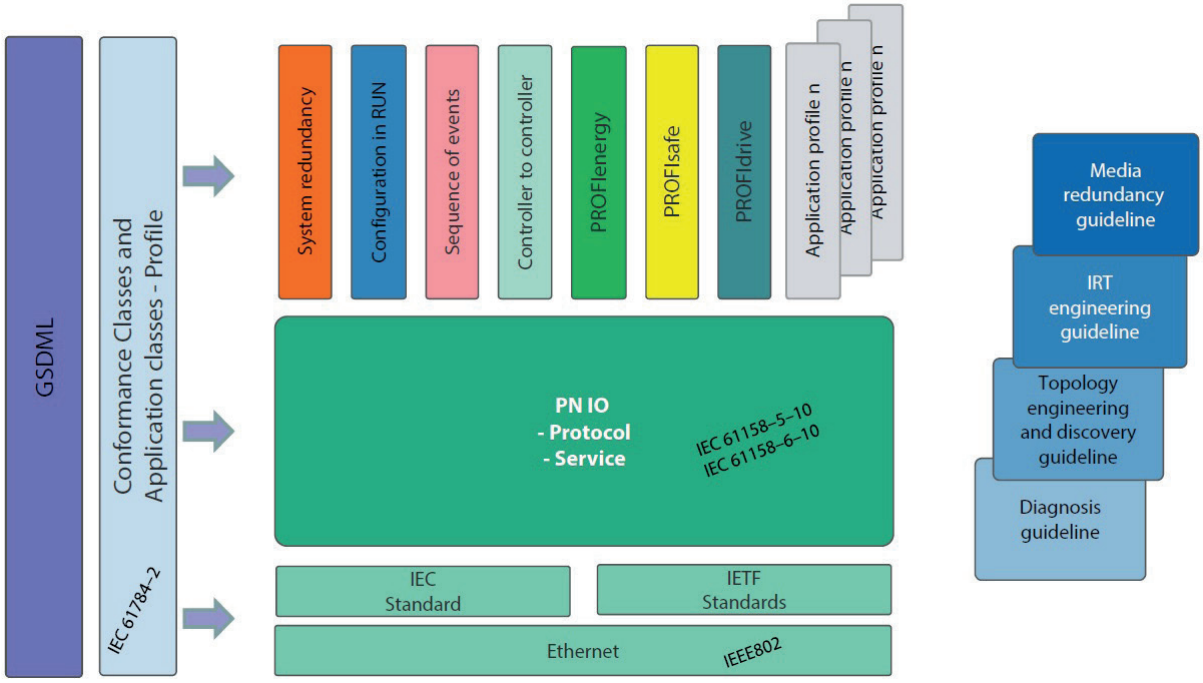
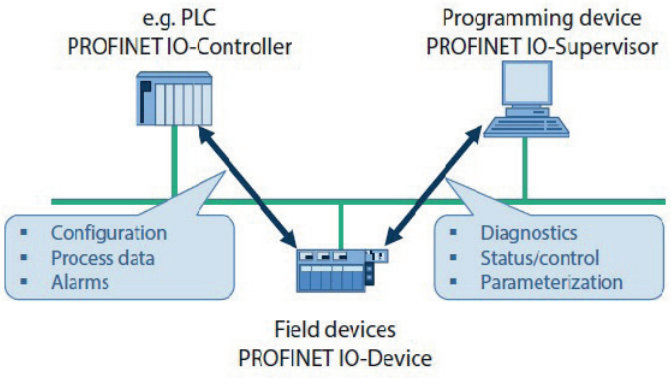


PROFINET IO follows the Provider/Consumer model for data exchange.
Configuring a PROFINET IO system has the same look and feel as in PROFIBUS.
The following device classes are defined for PROFINET IO (figure below):



IO Controller: this is typically the programmable logic controller (PLC) on which the automation program runs. This is comparable to a class 1 master in PROFIBUS. The IO controller provides output data to the configured IO devices in its role as provider and is the consumer of input data of IO devices.

IO Device: an IO device is a distributed I/O field device that is connected to one or more IO controllers via PROFINET IO. It is comparable to the function of a slave in PROFIBUS. The IO device is the provider of input data and the consumer of output data.

IO Supervisor: this can be a Programming Device (PD), personal computer (PC), or human machine interface (HMI) device for commissioning or diagnostic purposes and corresponds to a class 2 master in PROFIBUS.

A plant unit contains at least one IO controller and one or more IO devices. IO supervisors are usually integrated only temporarily for commissioning or troubleshooting purposes.

AAM 58 R DESCRIPTION

The AAM58R is an absolute multiturn PROFINET encoder certified for Conformance Class B.
It is available with solid shaft or blind hollow shaft, with a singleturn resolution of 13 bits (allowing 8,192 different positions per turn) and a multi-turn counter of 12 bits (allowing up to 4,096 rotations). The total available resolution is 25 bits (8,192 x 4,096 = 33,554,432 positions).

The encoder is programmable, and the parameterisation allows for the setting of several parameters, including counting direction, resolution and speed. A preset function is also available, enabling the use of a reference position for counting.

The AAM58R implements standard telegrams (81,82,83,84) and a manufacturer custom telegram (100). The encoder is equipped with two network interfaces, allowing for network topologies such as a star, linear or ring structure, without the need for additional switches.

In order to integrate the device into the network, it is necessary to use a GSDML file with the configuration tools.
This manual is intended for the V5.1 firmware version, with the GSD file GSDML-V2.43-ELTRA-ENCODER-20241223.xml.

Supported standards & protocols:
RT_CLASS_1
DCP
UDP
LLDP

Supported telegrams:
Telegram 81
Telegram 82
Telegram 83
Telegram 84
Telegram 100 (custom)

AAM 58 R SPECIFICATIONS

ELECTRICAL SPECIFICATIONS

Multiturn resolution	1 ... 12 bit programmabile during commissioning
Singleturn resolution	1 ... 13 bit programmabile during commissioning
Power supply[1]	10 ... 30 V DC (reverse polarity protection)
Current consumption without load	< 200 mA
Electrical interface[2]	PROFINET IO RT Class 1 / Conformance Class B
Hardware features	Ertec 200P auto-negotiation auto-polarity auto-crossover diagnostic LEDs
Code type	binary
Max bus frequency	100 Mbit/s
Cycle time	≤ 1 ms
Accuracy	± 0.04°
Start-up time	500 ms
Mean time to dangerous failure ($MTTF_d$)[3] according to EN ISO 13849-1	121 years
Mission time (Tm)[3]	20 years
Diagnostic coverage (DC)[3]	0%
Electromagnetic compatibility	according to 2014/30/EU directive
RoHs	according to 2011/65/EU directive

MECHANICAL SPECIFICATIONS

Shaft diameter	ø 6 mm solid shaft (mod. 58B) ø 10 mm solid shaft (mod. 58C) ø 15 mm blind hollow shaft (mod. 58F) ø 12 mm blind hollow shaft (mod. 58F)* ø 10 mm blind hollow shaft (mod. 58F)* * with optional shaft adapter, please refer to Accessories
Enclousure rating	IP 65 (IEC 60529)
Max rotation speed	6,000 rpm
Max shaft load[4]	80 N (17,98 lbs) radial / 40 N (9 lbs) axial
Starting torque (at +20°C / +68°F)	< 0.05 Nm (7 Ozin)
Moment of inertia	approx 1.8 x 10^{-6} kgm^2
Shock	50 G, 11 ms (IEC 60068-2-27)
Vibrations	10 G, 10 ... 2000 Hz (IEC 60068-2-6)
Bearings life	10^9 revolutions
Bearings	n.2 ball bearings
Shaft material	stainless steel
Bearing stage / cover material	aluminium
Housing material	anodized aluminium
Operating temperature[5, 6]	-40° ... +80°C (-40° ... +176°F)
Storage temperature[6]	-40° ... +85°C (-40° ... +185°F)
Weight	600 g (21 oz)

[1] as measured at the transducer without cable influences
[2] for further details refer to OUTPUT LEVELS on TECHNICAL BASICS section
[3] this product is not a safety component, for further details refer to TECHNICAL BASICS section
[4] maximum load for static usage
[5] measured on the transducer flange
[6] condensation not allowed

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2. INSTALLATION

ELECTRICAL CONNECTIONS

The AAM 58 R is equipped with three M12 4-pin connectors on the encoder cover. One of these is for the power supply (POWER) and the other two are for Ethernet connections (PORT1 and PORT2).

PORT 1 POWER PORT 2

Two ports are available for PROFINET IO bus connection: “PORT1” and “PORT2”. Both options are viable, but in a star network structure, it is recommended that only one is used.

M12 NETWORK CONNECTOR		
Signal	**Function**	**Pin**
Transmit data+	Tx D+	1
Transmit data-	Tx D-	3
Receive data+	Rx D+	2
Receive data-	Rx D-	4

PORT 1 / 2 connector (4 pin)
M12 D coded
front view

socket connectors not included, please refer to Accessories

M12 TO RJ45 (STRAIGHT)		
Signal	**M12**	**RJ45**
Transmit data+	1	1
Transmit data-	3	2
Receive data+	2	3
Receive data-	4	6

M12 TO RJ45 (CROSSOVER)		
Signal	**M12**	**RJ45**
Transmit data+	1	3
Transmit data-	3	6
Receive data+	2	1
Receive data-	4	2

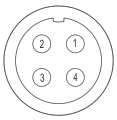
Recommended cable for PROFINET wiring:
Simatic NET Siemens Industrial Ethernet FC TP flexible Cable, GP 2x2 (PROFINET Type B), Twisted Pair installation, 4 wires, Shielded
P/N: 6XV1870-2B

Recommended RJ45 connector:
Siemens IE FC RJ45 with rugged metal housing
P/N: 6GK1901-1BB10-2AA0

Please ensure that each network segment does not exceed 100 metres. In the event that a segment exceeds 100 metres, it should be divided into shorter sub-segments of less than 100 metres. Switches should then be used to connect the sub-segments.

M12 POWER CONNECTOR	
Function	**Pin**
+V DC	1
/	2
0V	3
/	4

POWER connector (4 pin)
M12 A coded
front view



socket connector not included, please refer to Accessories

Specification can be downloaded from PNO site, as non-members
http://www.profibus.com/download

- PROFINET Cabling and Interconnection Technology - Version 5.3 - July 2023 - Order 2.252
- PROFINET Installation Guidelines - Version 1.0 - January 2009 - Order 8.072

3. DIAGNOSTIC LEDS

The product is equipped with diagnostic LEDs, labelled LINK1, LINK2, POWER and ERROR. The behaviour of each LED is explained in the tables below.

BUS STATUS LED (LINK1 - LINK2)		
Led label	**Colour**	**Functionality description**
LINK 1	orange and green (blinking)	Link to bus active - incoming and outgoing activity on PORT 1
LINK 2	orange and green (blinking)	Link to bus active - incoming and outgoing activity on PORT 2

LED INDICATION			
Error (red led)	**Power (green led)**	**Meaning**	**Cause**
Off	Off	No power	
Off	On	Data exchange, encoder and operation ok	
On	On	No connection to another device Criteria: no data exchange	Bus disconnected IO controller not available / switched off
Blinking (1)	On	Parameterisation fault, no Data exchange Criteria: Data exchange correct. However, the encode did not switch to the data exchange mode	Encoder not configured yet (or wrong configuration) Wrong station address assigned (but not outside the permitted range) Actual configuration of the encoder differs from the nominal configuration

(1) Blinking frequency 0,5 Hz, minimal indication time is 3 s

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4. PROJECT EXAMPLES

TIA PORTAL PROJECT CONFIGURATION

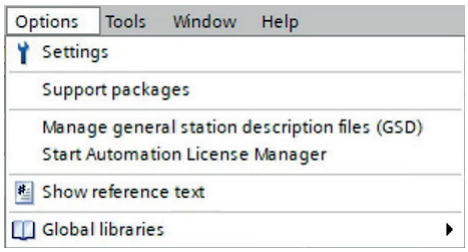
This chapter provides guidance on integrating the encoder Eltra AAM 58 R into the PROFINET network.
The following example has been created using

- Siemens Automation Totally Integrated Automation (TIA) portal V19
- SIMATIC S7-1200, CPU 1212C P/N: 6ES7212-1AE40-0XB0
- SIMATIC HMI MTP400 P/N: 6AV2123-3DB32-0AW0

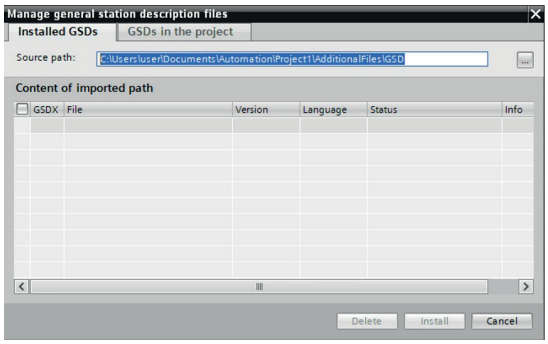
In order to configure PROFINET IO devices, it may be necessary to disable the firewall.

Device description file (GSDML) intallation

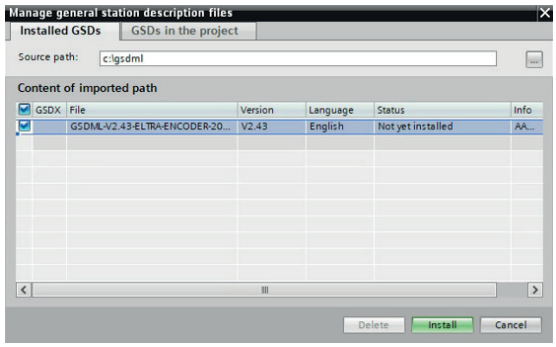
In order to integrate the device in a PROFINET IO network, it is necessary to import a device description file into the configuration software (TIA).
The device description file is a **G**eneric **S**tation **D**escription **M**arkup **L**anguage file (GSDML).



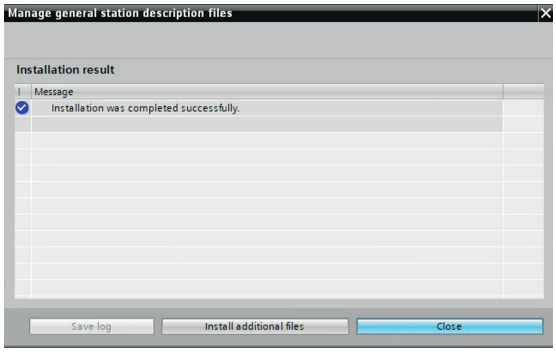
Main menu
Select “Options” ➜ “Manage general station description files (GSD)”.



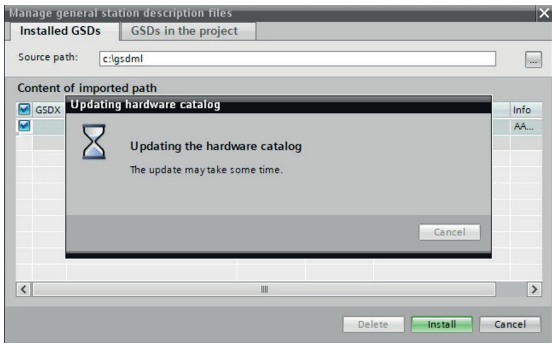
Set the source path.



Select the GSDML file anche click on “Install”.



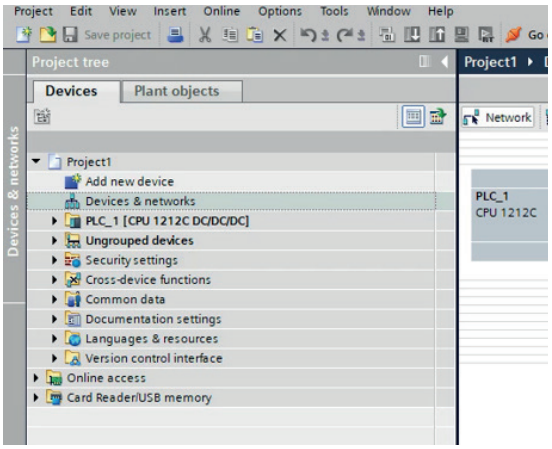
The GSDML file will be imported.



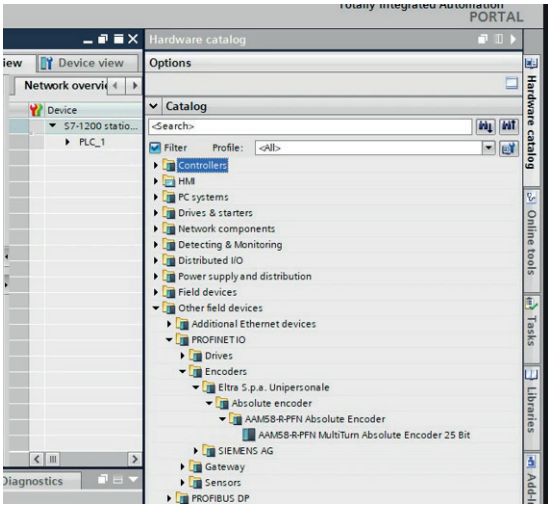
The hardware catalog will be updated with the imported GSDML.

The encoder bitmap picture will be imported automatically if present in the same folder. Please note that GSDML file and encoder bitmap can be downloaded from Eltra website (www.eltra.it) under product page.

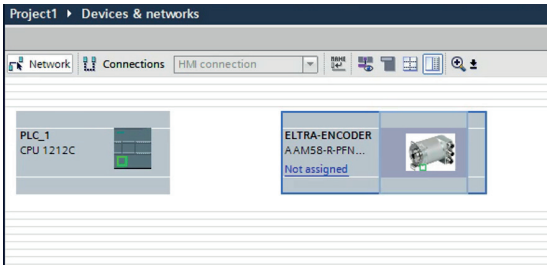
Device selection



Under the Project tree ➜ Devices click on “Devices & networks”.



Select the device from “Hardware catalog”.
Click “Other field devices” ➜ “PROFINET IO” ➜ “Encoders” ➜ “Eltra S.p.a. Unipersonale” ➜ “Absolute encoder” ➜ “AAM58-R PFN Absolute Encoder”.



Drag “AAM58-R PFN MultiTurn Absolute Encoder 25 Bit” into “Network view”.

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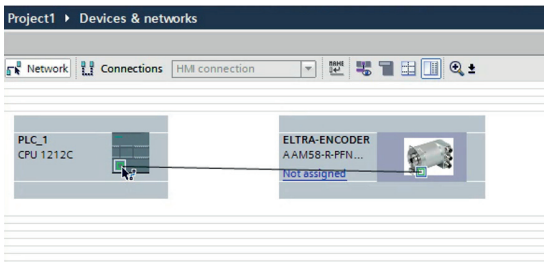
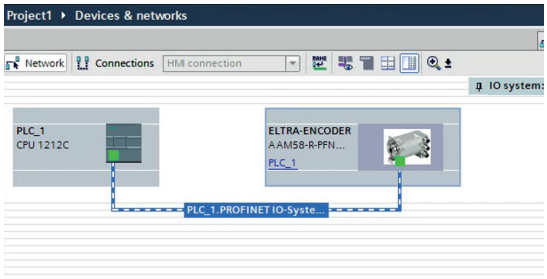


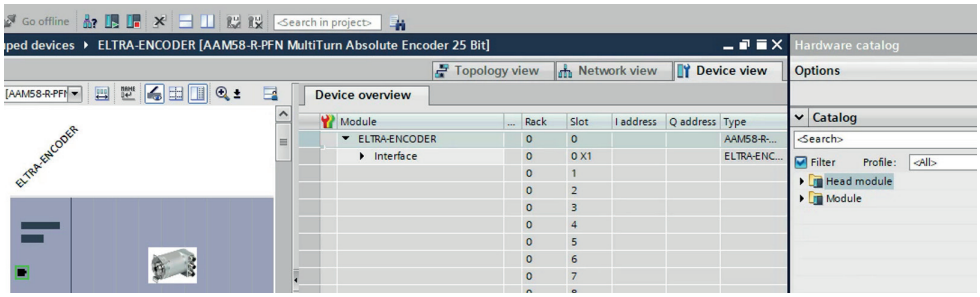
Drag a network connection from the encoder to the controller.



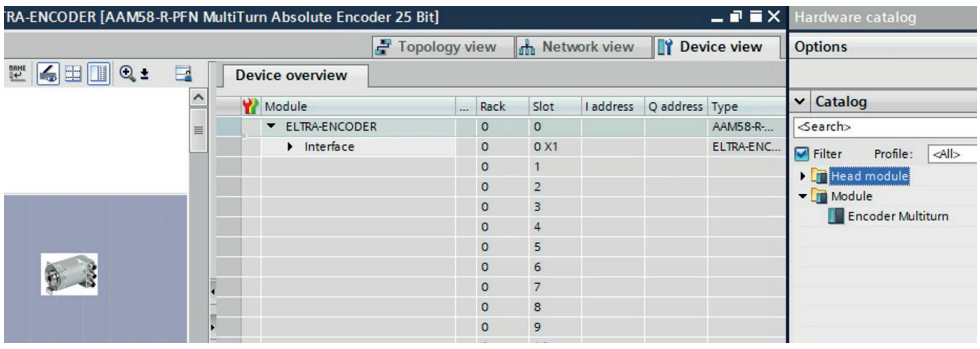
The encoder's PROFINET interface is now installed with its default values.

Module and device configuration

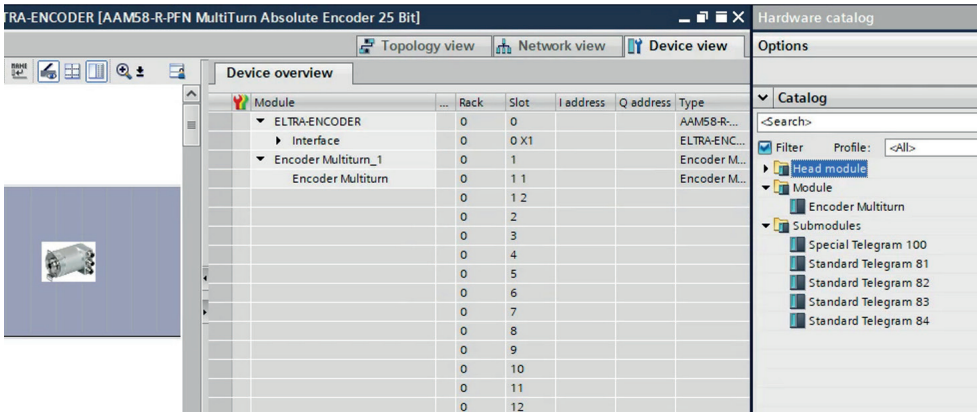
To install the encoder module and configure the device (the data length and the type of data to be sent to and from the I/O controller) first click on "Device view".



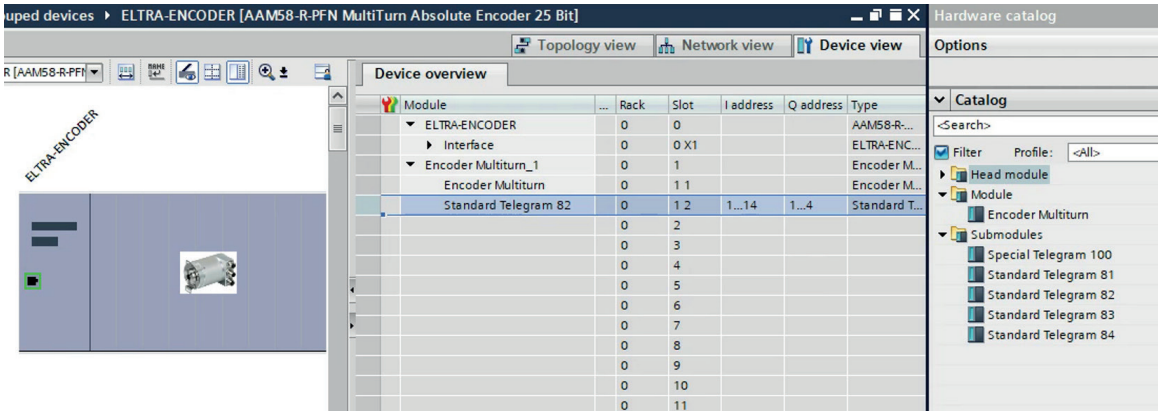
Then click on "Module" and drag the "Encoder Multiturn" into the "Device overview" area.



Click on "Module" and select a telegram from the the module list (eg: "Standard Telegram 82").

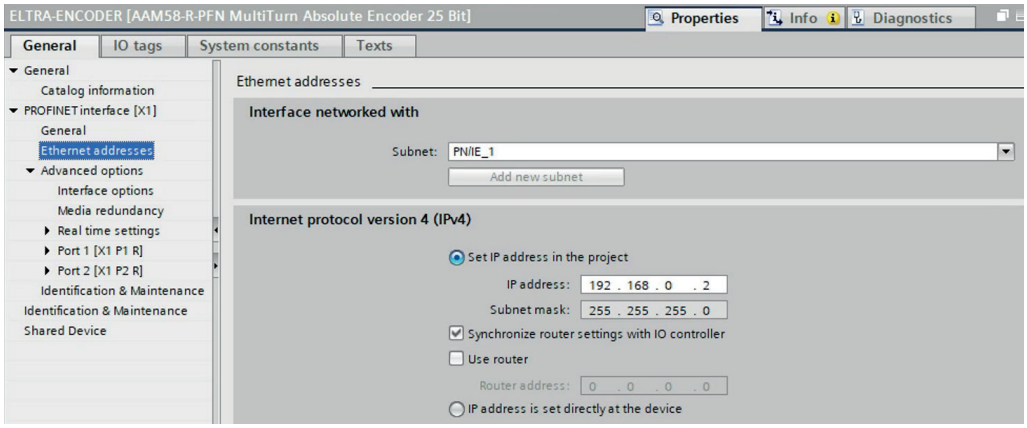


Drag the selected telegram into the “Device overview” window under the “Encoder Multiturn” slot.

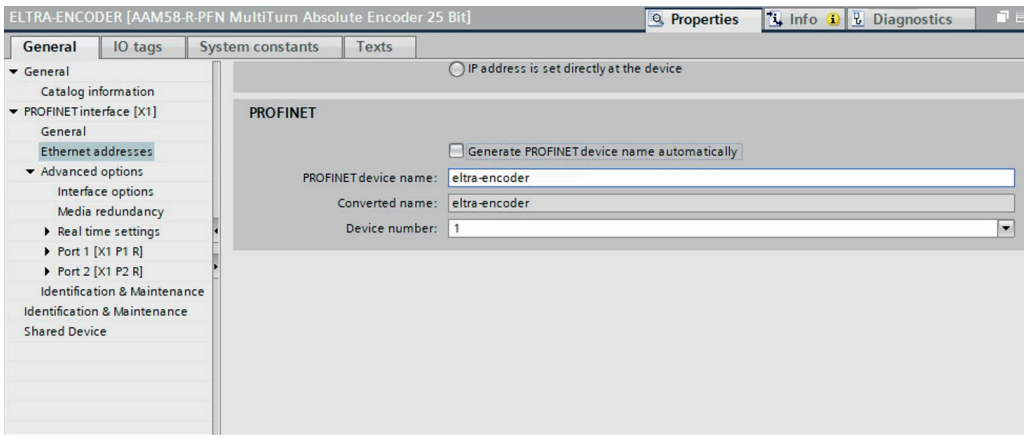


Set the encoder name

To set the encoder name go to “Properties” ➔ “General” ➔ “Ethernet addresses”.



In a PROFINET network every device name must be unique to identify the device.
The name could be assigned manually or automatically; with default configuration a device name is generated automatically, to manually assign a device name remove the tick from “Generate PROFINET device name automatically” and set the name.



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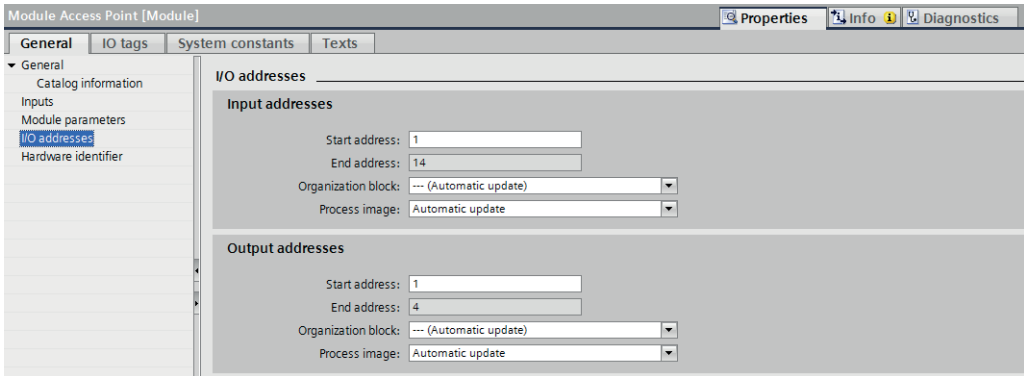
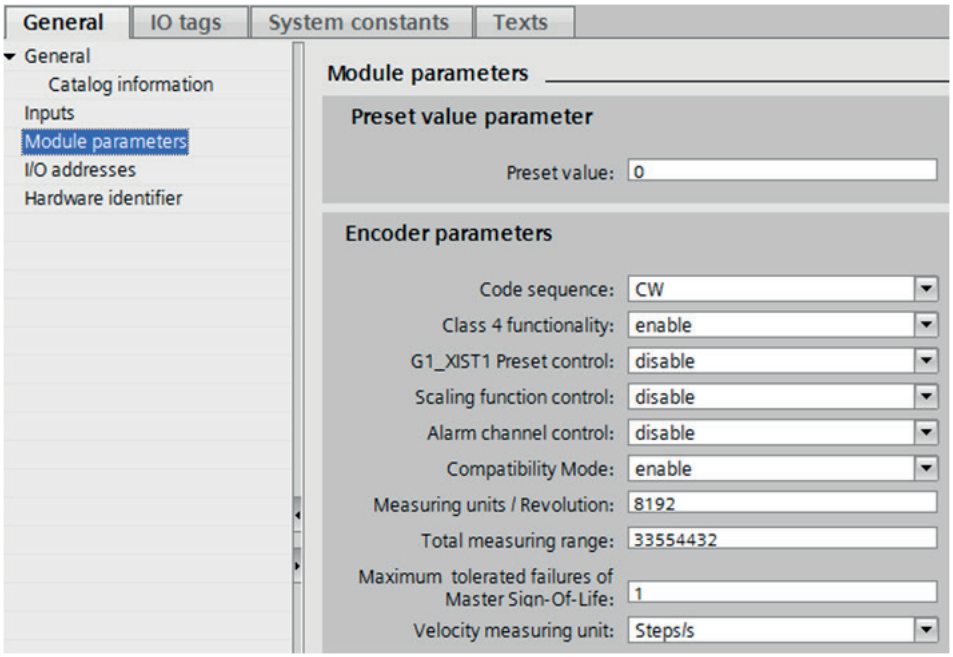
I/O address configuration

Configure the PLC addresses for both the input and output data under the I/O addresses section.
Go to “Properties” ➔ “General” ➔ “I/O addresses” window.



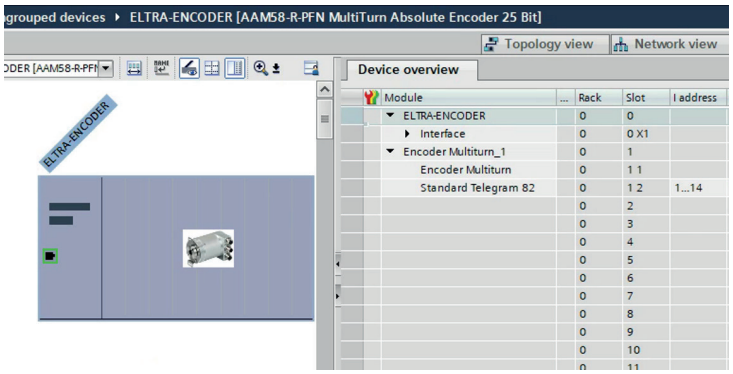
Encoder parameters

Set the encoder parameters by configuring the module settings.
Go to “Device Overview”, select “Module Access Point” ➔ “Module Parameters”and then change the values.

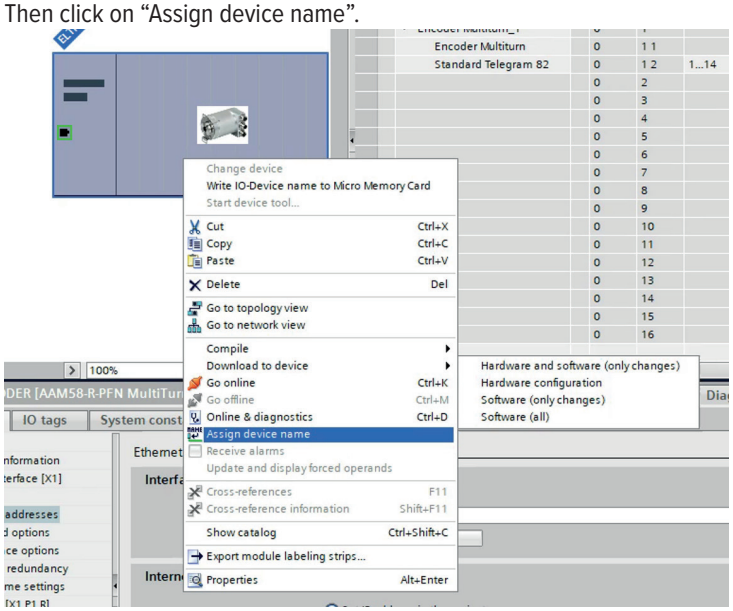


Assign the encoder name

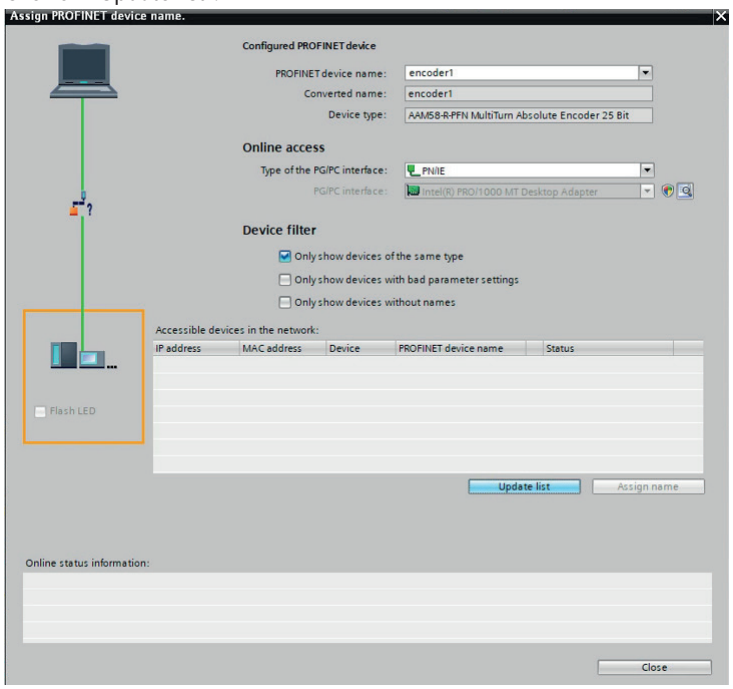
With the encoder AAM 58R and the programming device connected, a device name must be assigned. Right-click on the encoder.



Then click on “Assign device name”.



Click on “Update list”.



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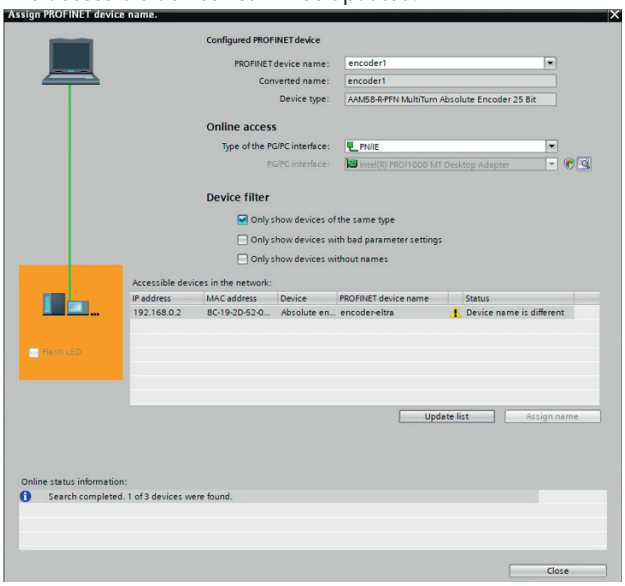
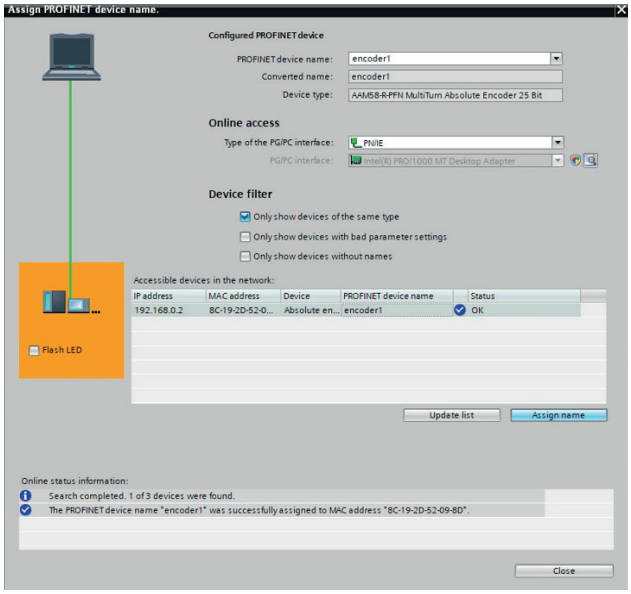
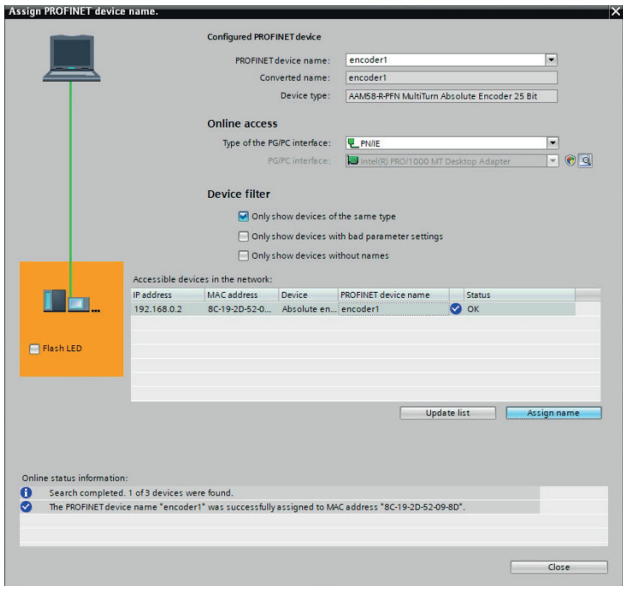
The accessible device list will be updated.



Then click on “Assign name”.

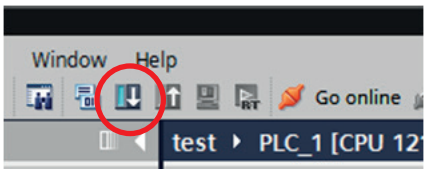


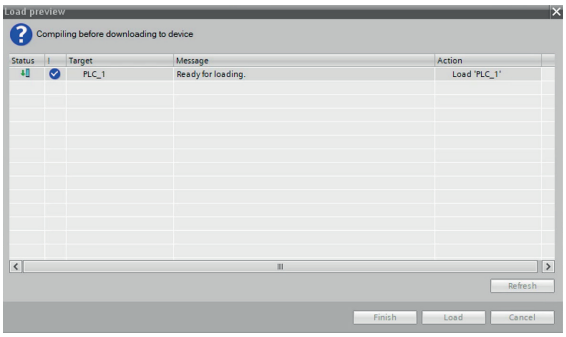
The name has been correctly assigned.



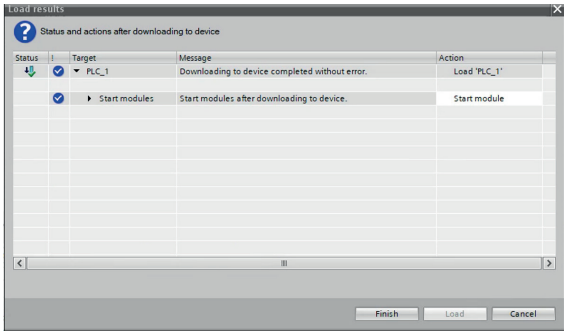
Load hardware configuration

After the device has been set up, it is necessary to compile and transfer the project into the device (PLC).
Click on the “Download to device” button in the toolbar.





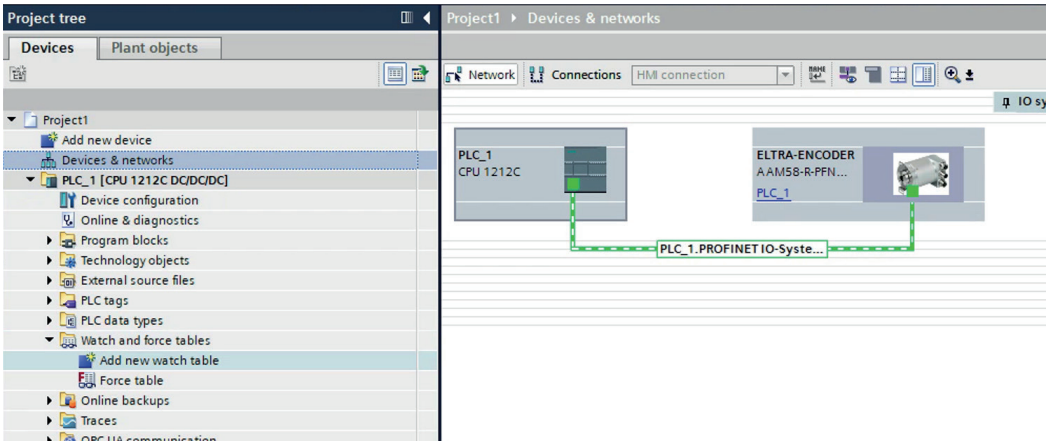
Once the process has been completed, click on the “Load” button.



The load has been successfully completed.

Create a new watch table

Should you require to test the functionality of the encoder, it is possible to view the position by adding a ‘watch table’.
Select the PLC ➜ “Watch and force table” ➜ “Add new watch table”.



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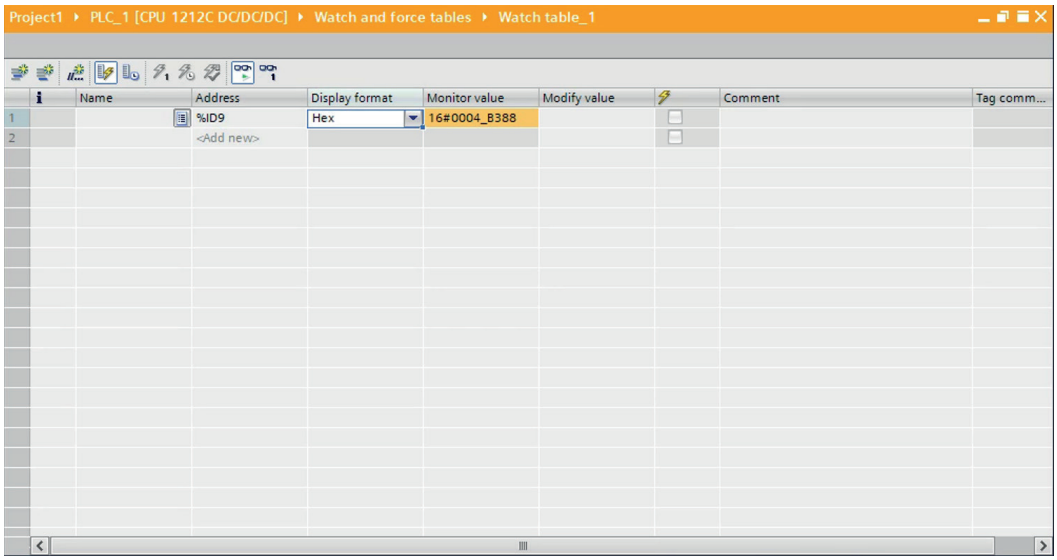
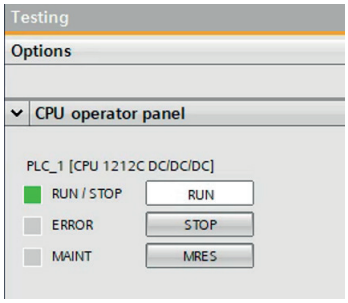
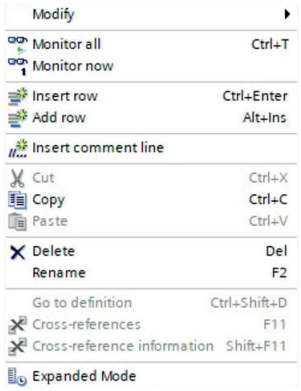
Under “Address” insert %ID9 to add encoder position view (G1_XIST2).



Please ensure that the CPU is in the “RUN” state.



Then right-click on the first raw (eg. %ID9) and select “Monitor all”.



The position will be displayed on the watch table according to the shaft’s rotation.

REFERENCES

- PROFINET Cabling and Interconnection Technology - Version 5.3 - July 2023 - Order 2.252
- PROFINET Installation Guidelines - Version 1.0 - January 2009 - Order 8.072
- Profile Encoder, Technical Specification for PROFIBUS and PROFINET related to PROFIdrive - Version 4.1 - December 2008 - Order3.162

INSTALLATION AND PRECAUTIONS

The transducer must be used in accordance with its specifications. It is a precision measuring instrument and not a safety device.

Personnel responsible for mounting and commissioning the device must be qualified and carefully follow installation instructions. For safety reasons, it is strongly recommended to avoid any mechanical or electrical modifications.
Please note that any modifications made to the product will invalidate the warranty.

To ensure proper functioning, avoid subjecting the device to stress or impact.

Please ensure that the mechanical coupling of the transducer is designed as specified in the technical datasheet and that the product is installed according to the instructions provided.

Additionally, ensure that the operating environment is free from corrosive substances, such as acids, and materials that are incompatible with the device and its IP rating.

It is also recommended that the device is properly grounded. If necessary, please make an additional external connection.

Products with variant codes (a number or combination of numbers after the full stop) may have different mechanical, electrical, or connection requirements than standard products. Please refer to the additional documentation for further information.

Installation and wiring should only be carried out by trained personnel in a POWER-OFF condition.

In order to prevent short circuits, it is essential to insulate any unused wires at varying lengths.
Please note that it is not recommended to connect unused pins on the connector.

Prior to switching on, please verify the voltage range applicable to the device.

Please ensure that power and signal cables are positioned in a way that avoids capacitive or inductive interferences, which may otherwise cause device malfunction. Furthermore, please ensure that the transducer cable is kept at a safe distance from power lines and any other cables with high noise levels.

Users who integrate the transducer into their appliances must comply with CE/UKCA regulations and are responsible for marking the end machine/device.

Failure to observe these usage and installation precautions may invalidate the warranty.

Eltra disclaims any liability for damages or injuries resulting from non-compliance with these directives.

The products should be stored in their original packaging in a dust-free, dry and temperature-regulated location that is free from chemical influences or mechanical shock/vibrations.

For storage periods exceeding 12 months, rotate the encoder shaft every 12 months at low speed (e.g. by hand) to allow the bearing lubricant to distribute.

Please refer to www.eltra.it for sales conditions.

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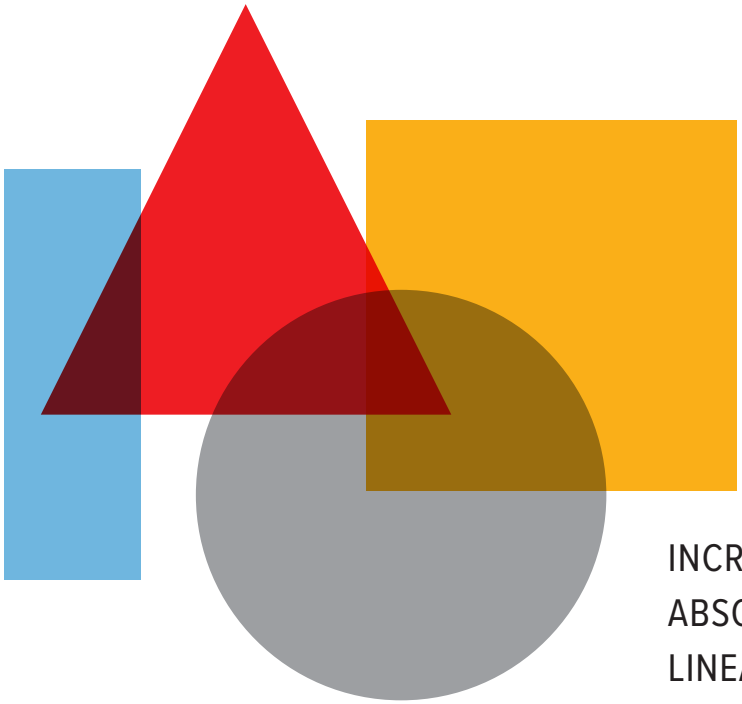

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