



AAM58 PROFINET INSTALLATION MANUAL



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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.

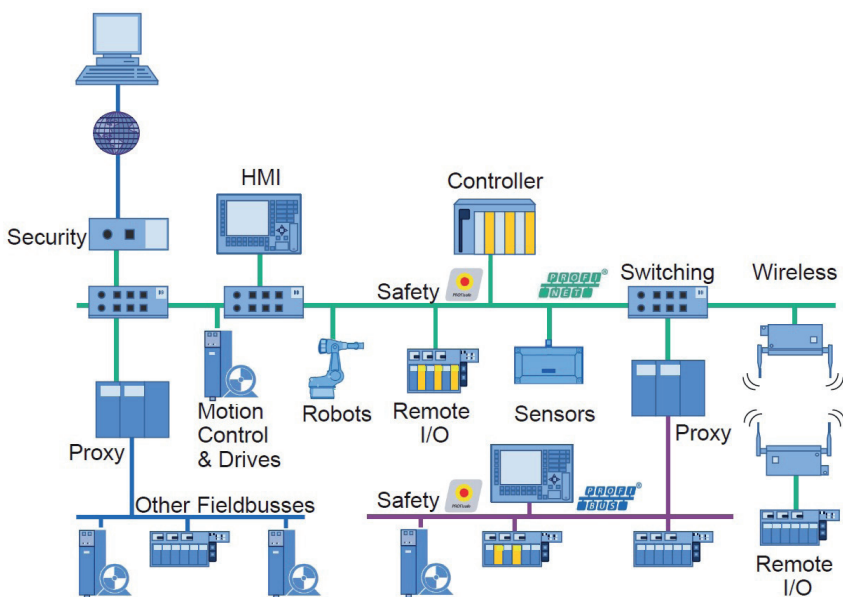
New application areas are constantly emerging, such as marine and rail applications or even day-to-day operations, for example, in a beverage shop. And now: the new PROFIenergy technology profile will improve the energy balance in production processes.

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").

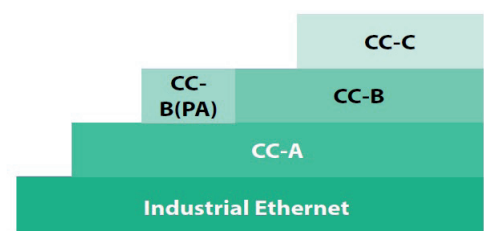
These provide a practical summary of the various minimum properties.

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).

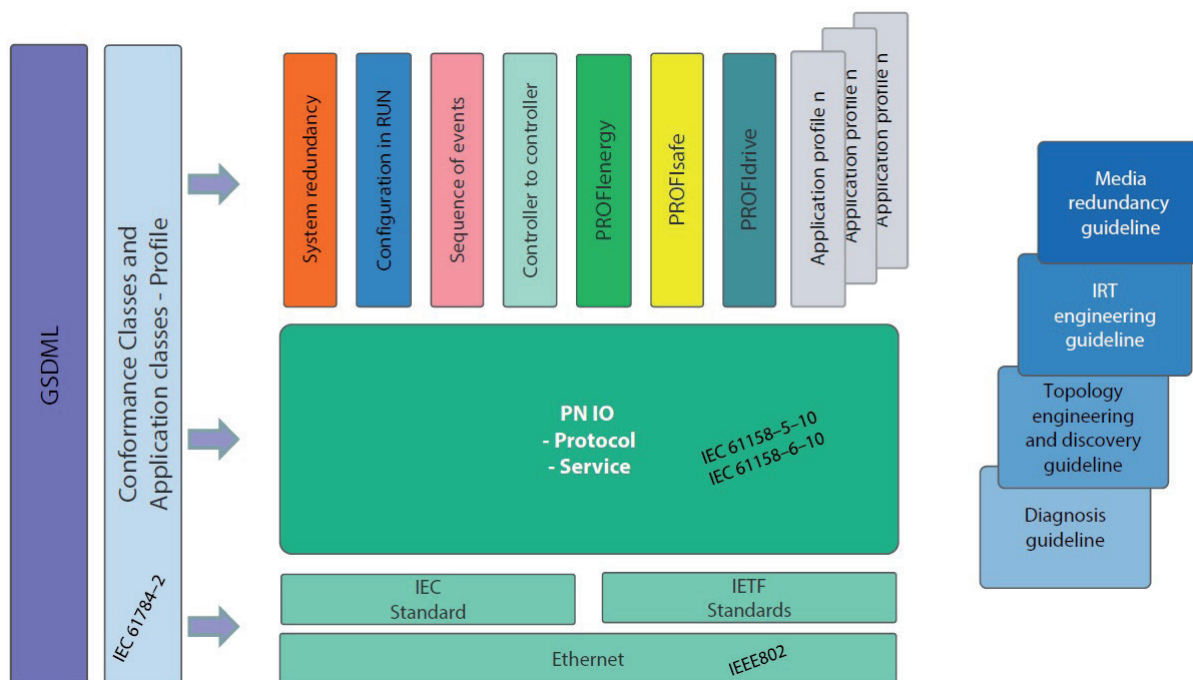
CC-C describes the basic functions for devices with hardware-supported bandwidth reservation and synchronization (IRT communication) and is thus the basis for isochronous applications.



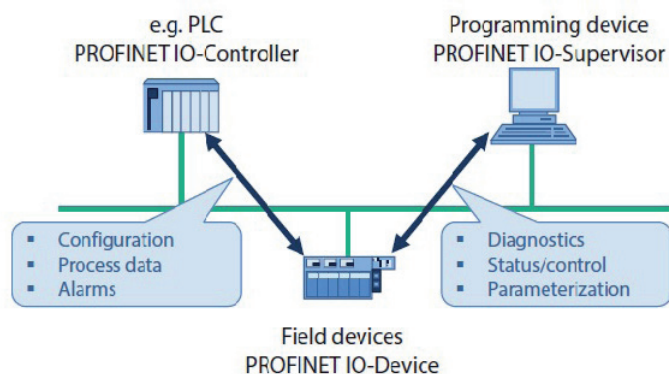
Structure of conformance classes

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].



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.

AAM58 DESCRIPTION

AAM58 is an absolute multiturn PROFINET encoder certified for Conformance Class B.

Solid shaft model and hollow shaft model are available, with a singleturn resolution of 13 bits, so 8192 different positions per turn while the resolution of the multiturn counter is 12 bits, so encoder can count up to 4096 rotations. Total available resolution is 25 bits ($8192 \times 4096 = 33'554'432$ positions).

AAM58 is programmable and according to the parameterization there are several parameters that can be set such as counting direction, resolution and speed. A preset function is also present, so that a reference position can be used for counting.

AAM58 implements standard telegrams (81,82,83,84) and a manufacturer custom telegram (100).

The encoder has two network interfaces, so the network topology can be either a star structure, linear or ring structure, without additional switches.

Configuration tools require a GSDML file to integrate device into the network.

This manual is for **Z1.0 firmware** version, with GSD file **GSDML-V2.31-ELTRA-ENCODER-20141012.xml**.

Supported standards & protocols:

RT_CLASS_1

DCP

UDP

LLDP

SNMP

MIB-II and LLDP-MIB

Supported telegrams:

Telegram 81

Telegram 82

Telegram 83

Telegram 84

Telegram 100 (custom)

AAM58 SPECIFICATIONS

ELECTRICAL SPECIFICATIONS	
Multiturn resolution	1 ... 12 bit programmable during commissioning
Singleturn resolution	1 ... 13 bit programmable during commissioning
Power supply¹	10 ... 30 V DC (reverse polarity protection)
Current consumption without load	< 200 mA
Electrical interface²	PROFINET IO RT Class 1 / Conformance Class B
Hardware features	Ertec 200 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
Electromagnetic compatibility	according to 2014/30/EU directive
RoHS	according to 2015/863/EU directive

¹ as measured at the transducer without cable influences

² for further details refer to OUTPUT LEVELS on TECHNICAL BASICS section

³ maximum load for static usage

⁴ measured on the transducer flange

⁵ condensation not allowed

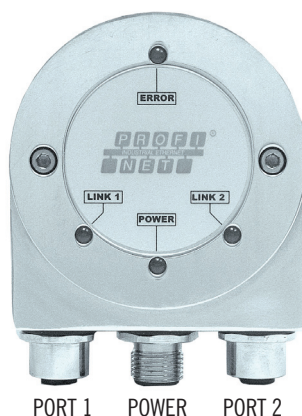
MECHANICAL SPECIFICATIONS	
Shaft diameter	solid ø 6 mm (mod. 58B) solid ø 10 mm (mod. 58C) blind hollow ø 15 / 12* / 10* mm (mod. 58F)
Enclosure rating	IP 65 (IEC 60529)
Max rotation speed	6000 rpm
Max shaft load³	80 N (17,98 lbs) radial / 40 N (9 lbs) axial
Starting torque (at +20°C / 68°F)	< 0,05 Nm (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	1.4305 / AISI 303 stainless steel
Body / cover material	EN-AW 2011 aluminium
Housing material	painted aluminium
Flange material	EN-AW 2011 aluminium
Operating temperature^{4,5}	-40° ... +80°C (-40° ... +176°F)
Storage temperature⁵	-40° ... +85°C (-40° ... +185°F)
Fixing torque for collar clamping	1,5 Nm recommended (mod. 58F)
Weight	600 g (21 oz)

* with optional adapter shaft, see Accessories

INSTALLATION

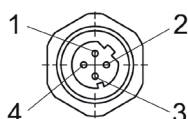
ELECTRICAL CONNECTIONS

On the AAM58 there are 3 x M12 4 pin connectors installed on the encoder cover: one is for the power supply (POWER) and the others two are D-Coded M12 connectors for Ethernet connection (LINK1 and LINK2).



Two ports can be used for PROFINET bus connection, "PORT1" and "PORT2". Either can be used and in a star network structure only one should be used.

M12 NETWORK CONNECTOR (D-CODED)



Signal	Function	Pin
TD+	Tx D+	1
TD-	Tx D-	2
RD+	Rx D+	3
RD-	Rx D-	4

M12 TO RJ45 (STRAIGHT)

Signal	M12	RJ45
TD+	1	1
TD-	3	2
RD+	2	3
RD-	4	6

M12 TO RJ45 (CROSSOVER)

Signal	M12	RJ45
TD+	1	3
TD-	3	6
RD+	2	1
RD-	4	2

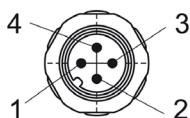
Recommended cable for PROFINET wiring:

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

Make sure that every single network segment do not exceed 100 m. If a segment exceeds 100 m, split the segment into shorter sub-segments less than 100 m, and use switches to connect sub-segments.

M12 POWER CONNECTOR (A-CODED)

Function	Pin
Power supply	1
/	2
0V	3
/	4

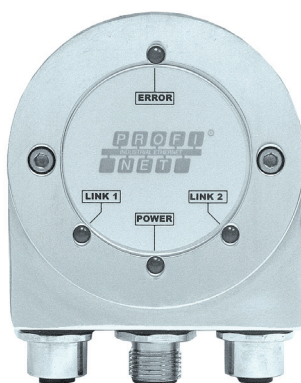
Specification can be downloaded from PNO site, as non-members
<http://www.profibus.com/download>

PROFINET Cabling and Interconnection Technology - PN-Cabling -Guide_2252_V400_May17.pdf

PROFINET Installation Guideline for Cabling and Assembly - PROFINET_Guideline_Assembly_8072_V10_Jan09.pdf

DIAGNOSTIC LEDS

On AAM58 there are four diagnostic leds labelled LINK1 - LINK2 - POWER - ERROR: led behaviour is explained on 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, slave and operation ok	
On	On	No connection to another device Criteria: no data exchange	- Bus disconnected - Master not available / switched off
Blinking (1)	On	Parameterisation fault, no Data exchange Criteria: Data exchange correct. However, the slave did not switch to the data exchange mode	- Slave not configured yet (or wrong configuration) - Wrong station address assigned (but not outside the permitted range) - Actual configuration of the slave differs from the nominal configuration

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

PROJECT EXAMPLES

TIA PORTAL PROJECT CONFIGURATION

This chapter explains how to integrate into the PROFINET network the encoder Eltra AAM58.

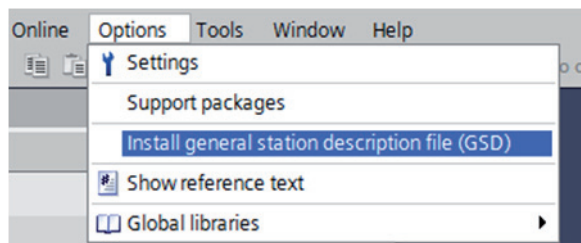
The following example were generated with

- Siemens Automation Totally Integrated Automation (TIA) portal V13
- S7-1200+KTP400 BASIC STARTER KIT 6AV6651-7KA01-3AA4

It may be necessary to disable Firewall in order to configure PROFINET devices.

Install the device description file (GSDML) GSD file

Before using a PROFINET encoder a device description file needs to be imported into the configuration software.



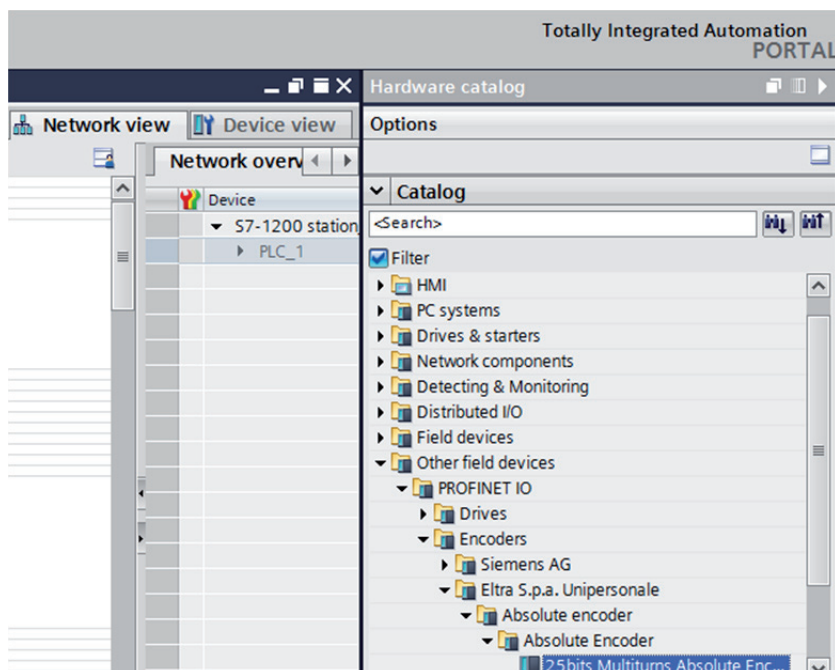
Main menu

Options -> Install general station description file (GSD)

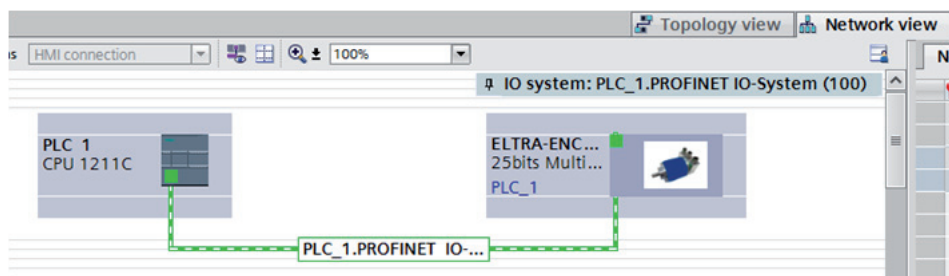
Set the source path to GSD file then select the GSD file and click on "Install"

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 Download Area -> Installation Manual / GSD

Select the device from "Hardware catalog" and drag it to "Network view" (Other field devices/PROFINET IO/Encoders/Eltra S.p.a. Unipersonale/Absolute encoder/Absolute encoder/25 bits Multiturn Absolute Encoder):



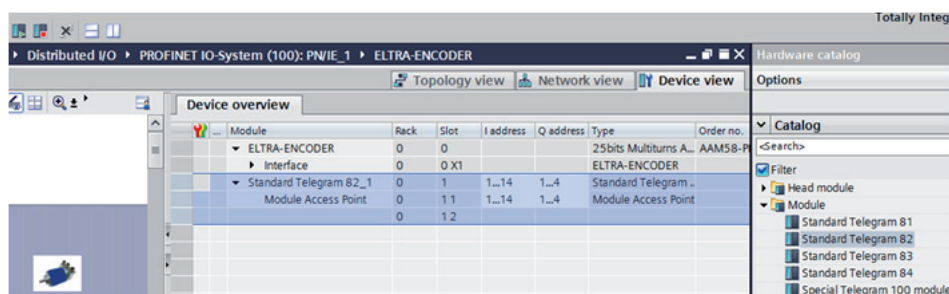
Drag a network connection from the encoder to the controller:



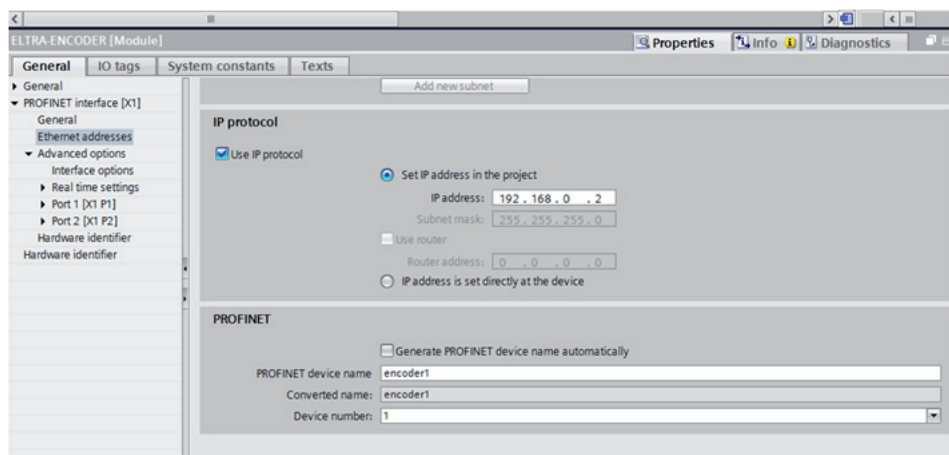
The encoder's PROFINET-interface is now installed with its default values.

Module and device configuration

To install the encoder module go to Device view and select eg: "Standard Telegram 82" from modules list and drag it to the encoder slot.



Set encoder name under Properties tab. 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.

I/O address configuration

Set the PLC addresses for the input data and for the output data under I/O addresses. Go to Properties -> General -> I/O addresses.

The screenshot shows the 'Module Access Point [Module]' configuration window with the 'General' tab selected. The 'I/O addresses' section is expanded, showing 'Input addresses' and 'Output addresses' configurations.

Input addresses:

- Start address: 1
- End address: 14
- Organization block: --- (Automatic update)
- Process image: Automatic update

Output addresses:

- Start address: 1
- End address: 4
- Organization block: --- (Automatic update)
- Process image: Automatic update

Encoder parameters

Set the encoder parameters (module parameters). Go to Device overview, select Module Access Point -> Module parameters then change the values.

The screenshot shows the 'Module Access Point [Module]' configuration window with the 'General' tab selected. The 'Module parameters' section is expanded, showing 'Preset value parameter' and 'Encoder parameters' configurations.

Preset value parameter:

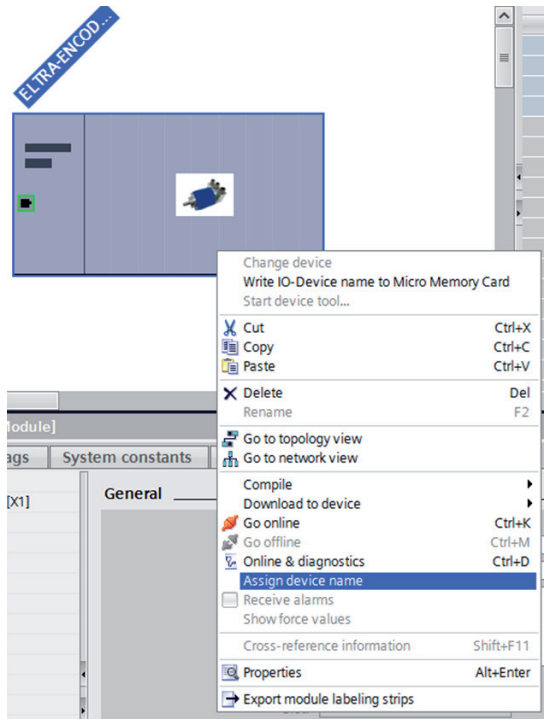
- Preset value: 0

Encoder parameters:

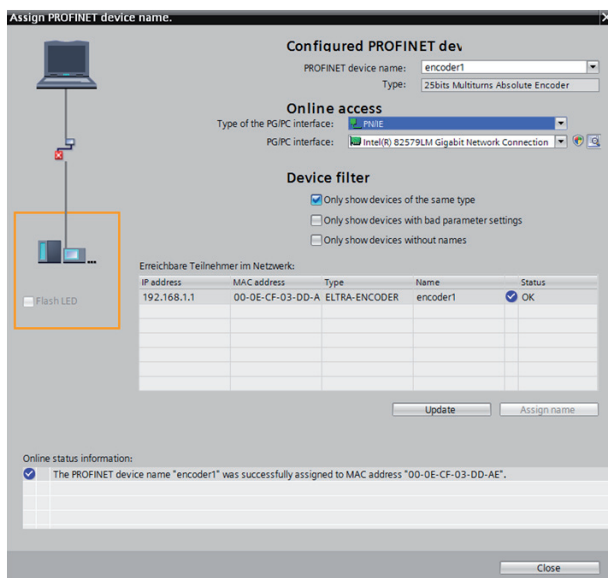
- Code sequence: CW
- Class 4 functionality: enable
- G1_XIST1 Preset control: disable
- Scaling function control: disable
- Alarm channel control: disable
- Compatibility Mode: enable
- Measuring units / Revolution: 8192
- Total measuring range: 33554432
- Maximum tolerated failures of Master Sign-Of-Life: 1
- Velocity measuring unit: Steps/s

Set the encoder name

With the encoder AAM58 and the programming device connected, a device name must be assigned. Right-click on the encoder and select “Assign device name”:



Then select the device to be renamed and then click on “Assign name”.



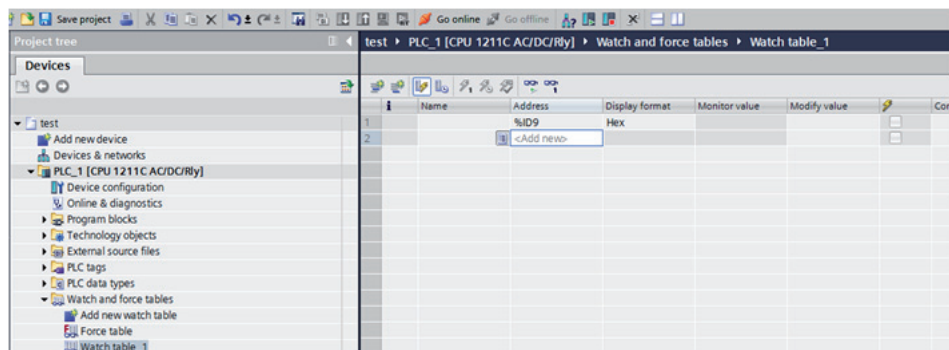
Download to the PLC

Load the hardware configuration into the PLC: .

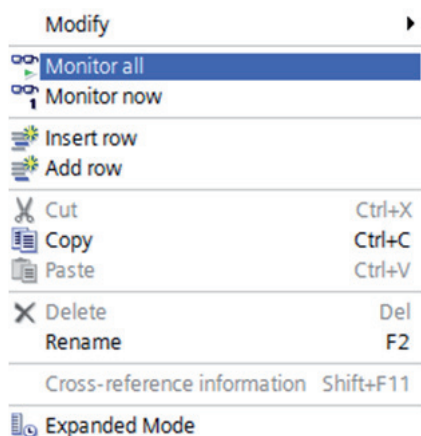


Position view (optional)

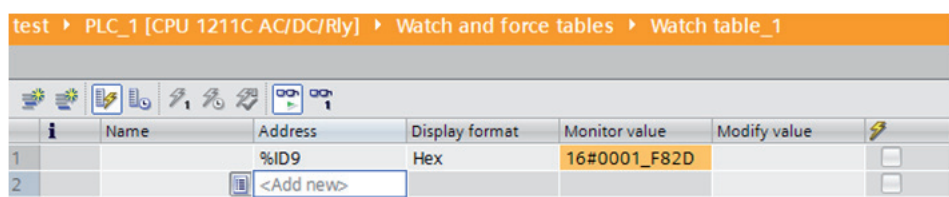
For testing purpose the encoder position can be view by adding a watch table. Select the PLC -> Watch and force table -> Add new watch table. Under Address insert %ID9 to add encoder position view (G1_XIST2).



Then right-click on the name (G1_XIST2) and select Monitor all.



The position will change in watch table when the shaft is rotated:



STEP7 PROJECT CONFIGURATION

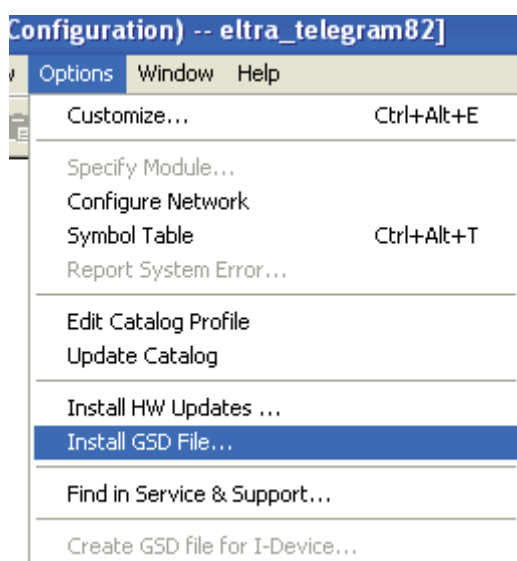
This chapter explains how to integrate into the PROFINET network the encoder Eltra AAM58.
The following example were generated with

- Siemens STEP 7 5.5 + SP3
- CPU 314C-2 PN/DP 6ES7 314-6EH04-0AB0 3.3

It may be necessary to disable Firewall in order to configure PROFINET devices.

Install the device description file (GSDML) GSD file

Before using a PROFINET encoder a device description file needs to be imported into the configuration software.

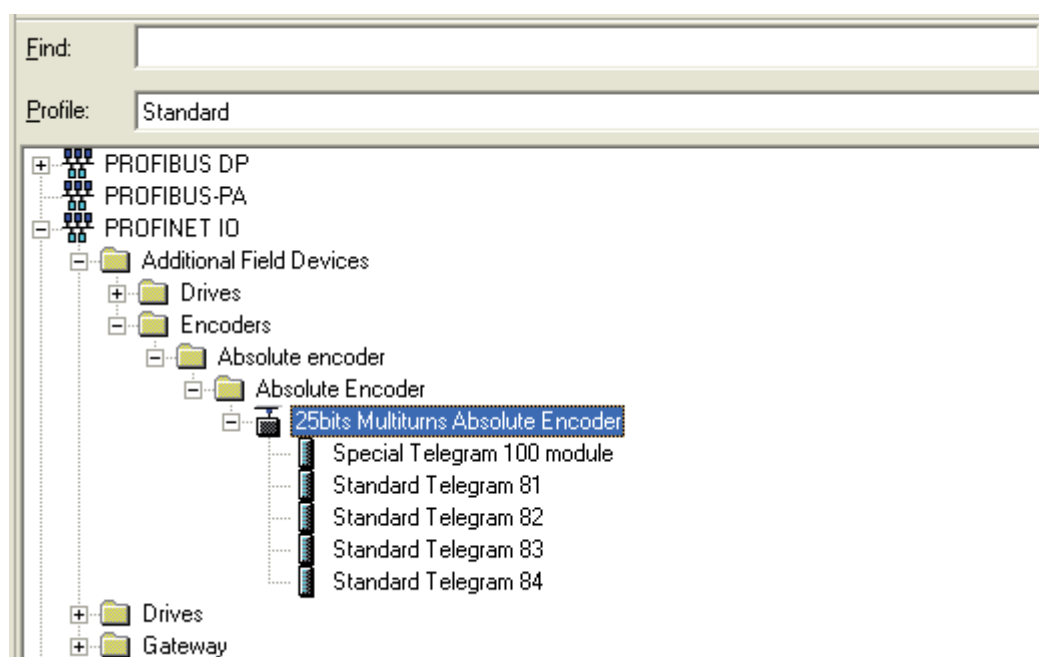


Main menu
Options -> Install GSD File

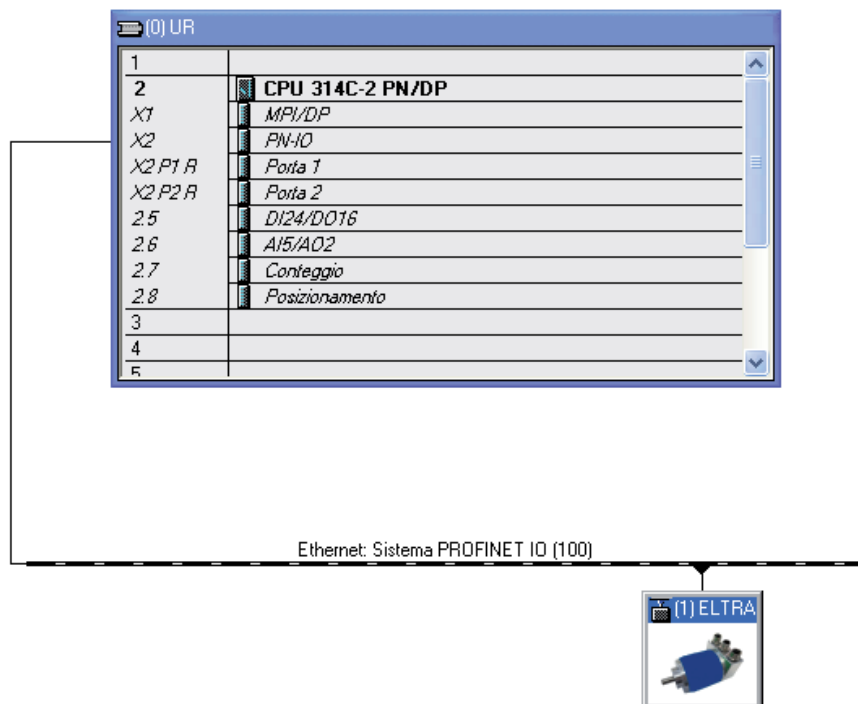
Set the source path to GSD file then select the GSD file and click on "Install"

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 Download Area -> Installation Manual / GSD

Select the device from "Profinet IO -> Additional Field Devices/Encoders/Absolute encoder/Absolute encoder/25 bits Multiturn Absolute Encoder):



Drag & drop the encoder into PROFINET IO System:



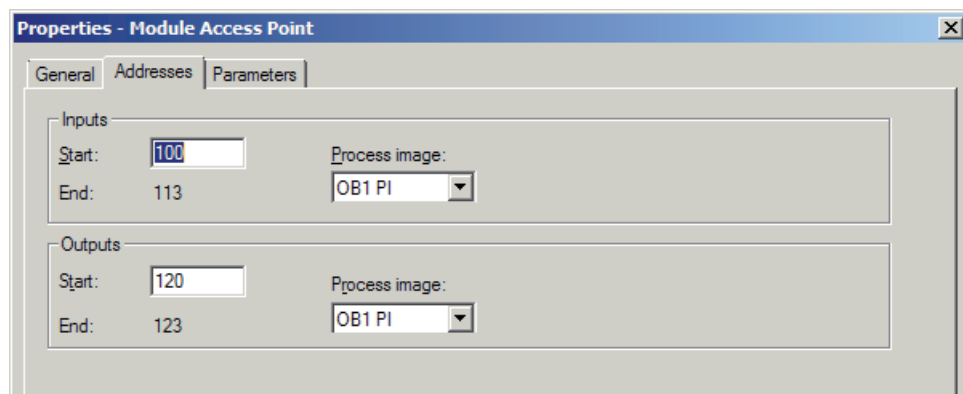
Module and device configuration

To install the encoder module select eg: “Standard Telegram 82” from telegram list and drag it to the module slot.

Slot	Module	Order number	I address	Q address	Diagnostic address:	Comment
0	ELTRA-ENCODER	AAM58-PFN			2042*	
X1	Interface				2041*	
X1.1	Port 1				2040*	
X1.2	Port 2				2039*	
1	Standard Telegram 82				100*	
1.1	Module Access Point		100...113	120...123		
1.2						

I/O address configuration

Set the PLC addresses for the input data and for the output data under I/O addresses. Right-click on Module Access Point then select Addresses.



Encoder parameters

Set the encoder parameters (module parameters). Right-click on Module Access Point then select Object Properties. Select Parameters tab and then change the values.

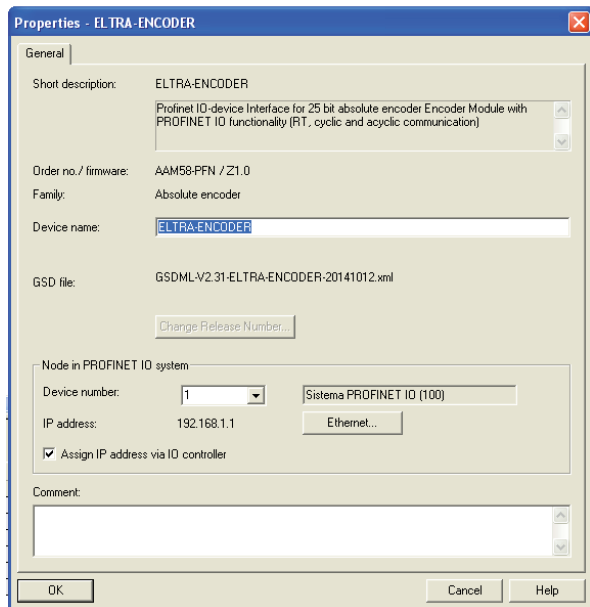
Diagram showing the connection between the CPU 314C-2 PN/DP and the ELTRA-ENCODER via Ethernet. The CPU is connected to the ELTRA-ENCODER through the 'Ethernet: Sistema PROFINET IO (100)' interface.

Module	Order number	I address	Q address	Diagnostic address	Comment
ELTRA-ENCODER	AAM58-PFN			2042*	
Interface				2041*	
Port 1				2040*	
Port 2				2039*	
Standard Telegram 82				100*	
Module Access Point		100... 113	120... 123		

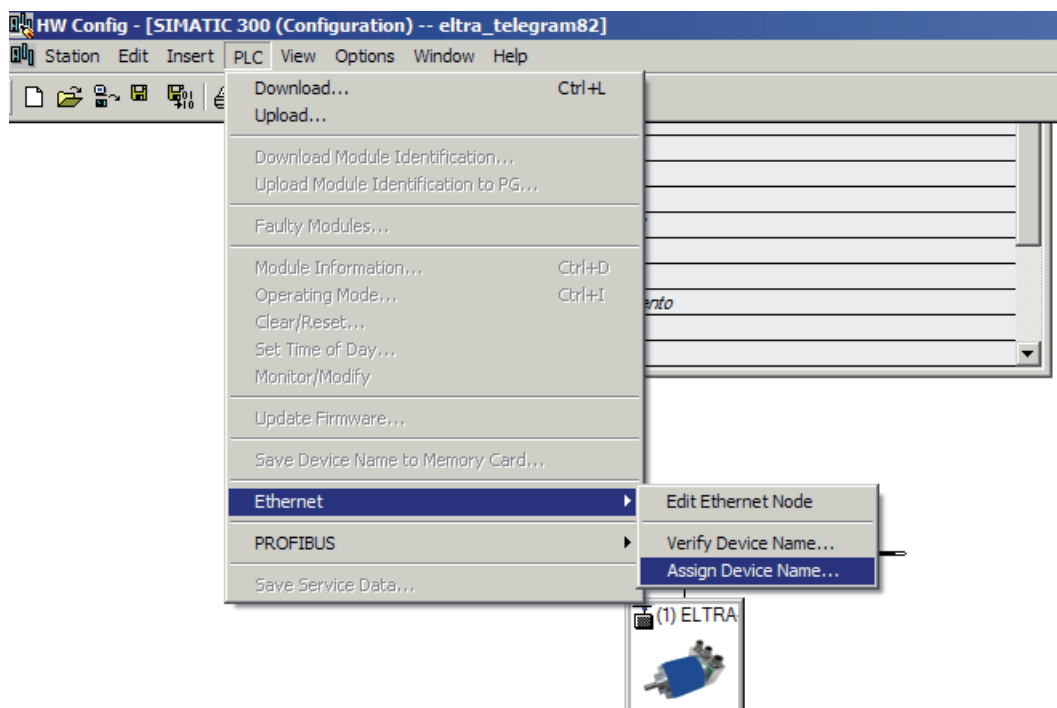
Set the encoder name

In a PROFINET network every device name **MUST** be unique to identify the device.

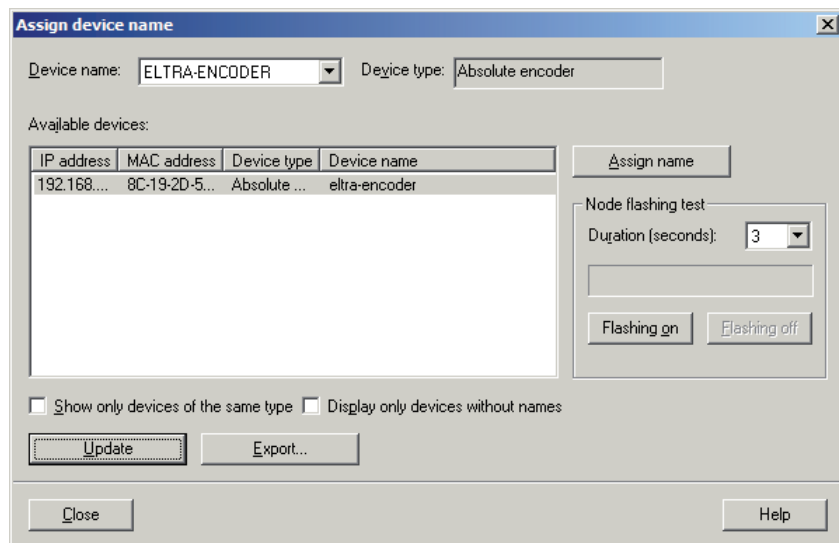
The name could be assigned manually or automatically; with default configuration a device name is generated automatically, to manually assign a device name right-click on the encoder the select Object Properties. Enter the device name and the click on OK to save.



With the encoder AAM58 and the programming device connected, a device name must be assigned. From main-menu go to PLC -> Ethernet and select Assign device name :

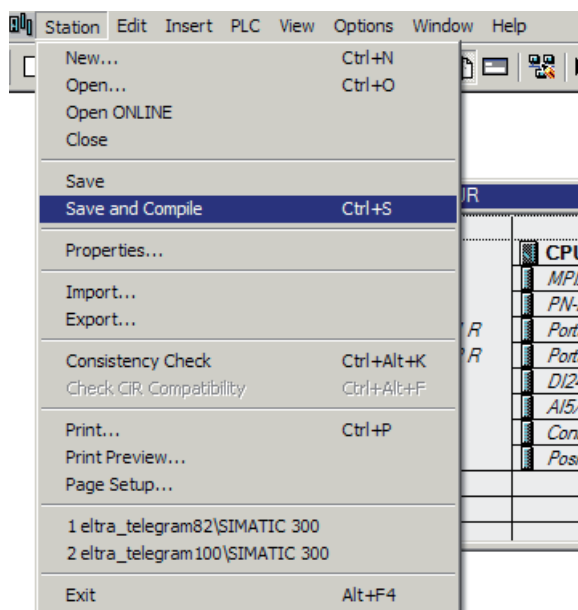


Then select the device to be renamed, change the name and then click on “Assign name”.



Compile & download

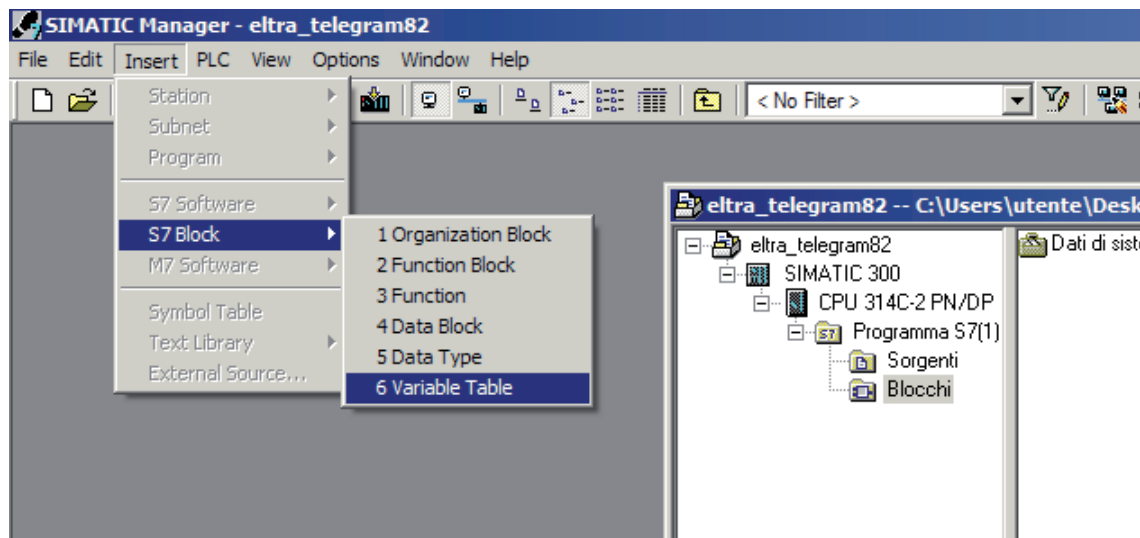
Save and compile the project by clicking on Station -> Save and Compile or click on the icon .



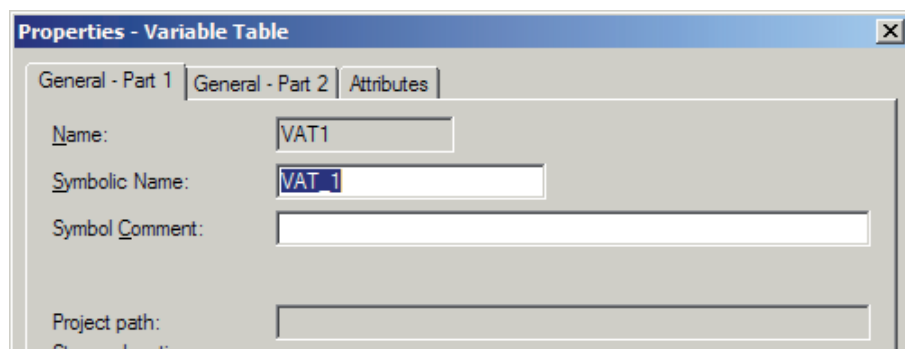
Download to the module by clicking on the icon .

Position view (optional)

For testing purpose the encoder position can be view by adding a watch table. Select the PLC, the select S7 Program -> Blocks Go to Insert -> S7 Block -> Variable Table



Set the Variable Table name.

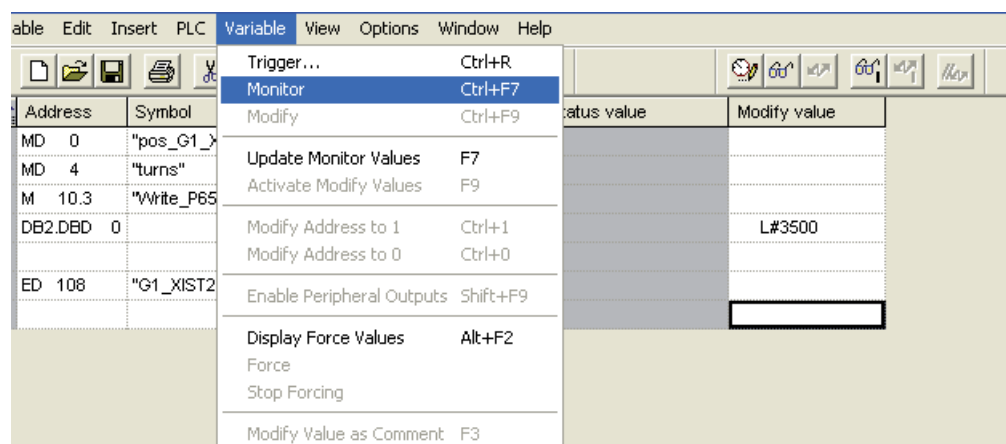


Double - click on created variable block then add the addresses (eg ED 108).

Address	Symbol	Display format	Status value	Modify value
MD 0	"pos_G1_XIST2"	DEC		
MD 4	"turns"	DEC		
M 10.3	"Write_P65000"	BOOL		
DB2.DBD 0		DEC		L#3500
ED 108	"G1_XIST2"	HEX		

Then go Online by clicking on the icon 

To monitor the variables go to Variable -> Monitor or click on the icon 



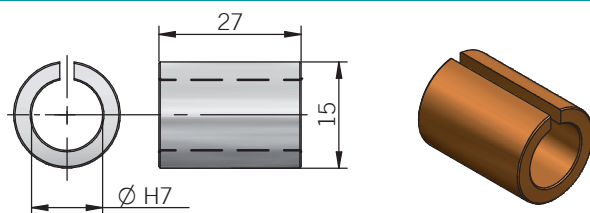
The position will change in the Status value when the shaft is rotated.

REFERENCES

- PROFINET Cabling and Interconnection Technology - Version 4.00 - May 2017 - Order 2.252
- PROFINET Installation Guideline for Cabling and Assembly - 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

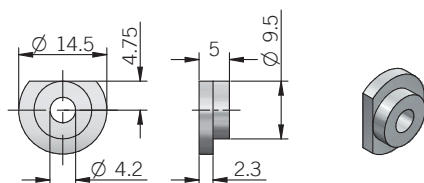
AAM58 ACCESSORIES

SHAFT ADAPTERS



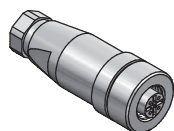
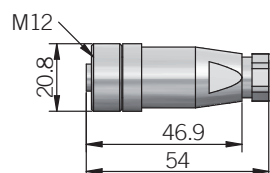
Description	P/N	Material	Scope of delivery	Applicable to model
Shaft adapter 15/12 mm	94990077	Bronze CuSn12 / CC483K	n.1 shaft adapter	AAM 58F
Shaft adapter 15/10 mm	94990078			

FIXING CLAMPS

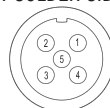


Description	P/N	Material	Scope of delivery	Applicable to model
kit n.3 fixing clamps	94080001	EN-AW 2011 aluminum	n.3 fixing clamps	58B

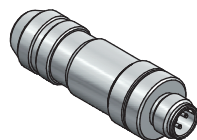
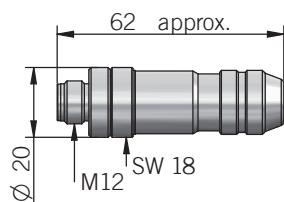
CONNECTORS



PINOUT SOLDER SIDE VIEW



Description	P/N	Material	Specifications	Scope of delivery	Applicable to model
CONN. M12FV 5P PLASTIC Field-attachable M12 straight 5 pin A-coded socket - IP67	94990114	Plastic	Screw max 0,75 mm ² / AWG 18 Cable gland range ø 3,5 ... 6 mm -40° ... +90°C (-40° ... +194°F)	n.1 connector	PFN POWER connector



PINOUT SOLDER SIDE VIEW



Description	P/N	Material	Specifications	Scope of delivery	Applicable to model
CONN. M12MV ETHERNET Field-attachable M12 straight 4 pin D-coded plug - IP67	94990115	Metal	Screw max 0,75 mm ² / AWG 18 Cable gland range ø 6 ... 8 mm -40° ... +85°C (-40° ... +185°F)	n.1 connector	PFN I/O connector



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