R67069.0002 - 06

Manual

Encoders with
PROFINET interface

pulses for automation

Table of Contents

1 Document

This is the English translation of the original manual in German language.

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Text sources
PROFINET System DescriptionTechnology and Application 10.2014
Encoder Profile Technical Specification for PROFIBUS and PROFINET Version 4.2
PROFIdrive Profile Technical Specification for PROFIBUS and PROFINET Version 4.2

Image sources
Screenshots - Siemens TIA Portal
ARC Advisory Group - ARC WHITE PAPER NOVEMBER 2015 -
How Profinet and Industrie 4.0 Enable Information-Driven Industries
Encoder Profile Technical Specification for PROFIBUS and PROFINET Version 4.2
PROFIdrive Profile Technical Specification for PROFIBUS and PROFINET Version 4.2

Code sources
- none -

Legal Notices

2 General Information

Please read this document carefully before working with the product, mounting it or starting it up.

2.1 Target Group

The device may only be planned, mounted, commissioned and serviced by persons having the following qualifications and fulfilling the following conditions:

- Technical training.
- Briefing in the relevant safety guidelines.
- Constant access to this documentation.

2.2 Symbols used / Classification of the Warnings and Safety instructions

⚠ DANGER	**Classification:** This symbol, together with the signal word **DANGER**, warns against immediately imminent threat to life and health of persons. The non-compliance with this safety instruction will lead to death or severe adverse health effects.
⚠ WARNING	**Classification:** This symbol, together with the signal word **WARNING**, warns against a potential danger to life and health of persons. The non-compliance with this safety instruction may lead to death or severe adverse health effects.
⚠ CAUTION	**Classification:** This symbol, together with the signal word **CAUTION**, warns against a potential danger for the health of persons. The non-compliance with this safety instruction may lead to slight or minor adverse health effects.
ATTENTION	**Classification:** The non-compliance with the **ATTENTION** note may lead to material damage.

NOTICE	**Classification:**
	Additional information relating to the operation of the product, and hints and recommendations for efficient and trouble-free operation.

2.3 Transport / Storage

Check the delivery immediately upon receipt for possible transport damages. If you do not mount the device immediately, store it preferably in its transport package.

The device must be stored at a dry and dust-free location, in compliance with the technical data, see chapter Technical Data.

3 Product Description

3.1 Technical Data Sendix 58xx

Singleturn Technologie	Optisch
Multiturn Technologie	Optical, mechanical gear
Singleturn resolution (MUR)	Max. 16 bits (default 13 bits)
Multiturn resolution (NDR)	Max. 12 bits
Multiturn resolution (TMR)	Max. 28 bits (default 25 bits)
Accuracy	± 0.0117° (over the whole temperature range)
Data up-to-dateness	5 ms

Mechanical characteristics for the Sendix 58xx encoders

Maximum rotary speed	
IP65 up to 70 °C	9000 min^{-1}, 7000 min^{-1} (continuous operation)
IP65 up to T_{max}	7000 min^{-1}, 4000 min^{-1} (continuous operation)
IP67 up to 70 °C	8000 min^{-1}, 6000 min^{-1} (continuous operation)
IP67 up to T_{max}	6000 min^{-1}, 3000 min^{-1} (continuous operation)
Starting torque (at 20 °C)	
IP65	< 0.01 Nm
IP67	< 0.05 Nm
Mass moment of inertia	
Shaft version	3,0 x 10^{-6} kg/m^2
Hollow shaft version	7,5 x 10^{-6} kg/m^2 (MT) 6 x 10^{-6} kg/m^2 (ST)
Permissible shaft load	
radial	80 N
axial	40 N
Protection level acc. to EN 60529	
Housing side	IP67
Shaft side	IP65, optional IP67
Working temperature range	-40 °C ... +80 °C
Materials	
Shaft/hollow shaft	Stainless steel
Flange	Aluminum
Housing	Die-cast zinc
Shock resistance according to EN 60068-2-27	2500 m/s^2, 6 ms
Vibration resistance according to EN 60068-2-6	100 m/s^2, 55 ... 2000 Hz

Electrical data for the Sendix 58xx encoders

Supply voltage	10 … 30 V DC
Current consumption (no load) 10 … 30 V DC	max. 110 mA
Supply voltage reverse polarity protection	Yes

Output	PROFINET Ethernet 100Base-TX acc. to IEEE 802.x
Type of connection	Cable or connector
Interface	PROFINET IO
Implemented profile versions	Encoder Profile Version 4.1
Vendor ID	0x0198
Device ID	0x0001
Parameters memory	EEPROM
Implemented features	DCP RTA LLDP SNMP MIB-II LLDP-MIB PTCP MRP FSU I&M0 readable
Implemented telegrams	Std. telegram 81 Man. telegram 860 SPEED ST_POS MT_POS G1_STW G1_ZSW Universal module
Classifications	RT CLASS 1 RT CLASS 2 (RT) RT CLASS 3 (IRT) Conformance Class C Application Class 3 Encoder Class 3 Net load class III
Min. cycle time	Min. device interval = 1 ms

3.2 Technical Data Sendix F58xx

Singleturn technology	Optical
Multiturn technology	Battery-buffered, electronic counter, flash technology
Singleturn resolution (MUR)	
Maximum	19 bit
default	18 bit
Multiturn resolution (NDR)	
Maximum	24 bit
default	12 bit
Total resolution (TMR)	
Maximum	30 bit
default	30 bit
Scaling	Supports USF Supports gear factor
Accuracy	± 0,0137° (over the whole temperature range)

Mechanical Characteristics for the Sendix F58xx Encoders

Maximum rotational speed	
IP67 (for short periods– 10 min)	9000 min^{-1}
IP67 (continuous operation)	6000 min^{-1}
Starting torque (at 20 °C)	
IP67	< 0,01 Nm
Mass moment of inertia	
Shaft version	3,0 x 10^{-6} kg·m²
Hollow shaft version	6,0 x 10^{-6} kg·m²
Permissible shaft load	
radial	80 N
axial	40 N
Protection level (acc. to EN 60529)	
Housing side	IP67
Shaft side	IP65 (optional IP67)
Working temperature range	-40°C ... +80°C [-40°F ... +176°F]
Materials	
Shaft/hollow shaft	Stainless steel
Flange	Aluminum
Housing	Aluminum
Shock resistance (acc. to EN 60068-2-27)	2500 m/s², 6 ms
Vibration resistance (acc. to EN 60068-2-6)	100 m/s², 55 ... 2000 Hz

Electrical characteristics for the Sendix F58xx encoders

Supply voltage	10 ... 30 V DC
Maximum current consumption	110 mA
Supply voltage reverse polarity protection	Yes

Output	PROFINET Ethernet 100Base-TX nach IEEE 802.x
Type of connection	Cable or connector
Interface	PROFINET IO
Vendor ID	0x0198
Device ID	0x0001
Parameters memory	FRAM
Implemented profile versions	Encoder Profile Version 4.2 PROFIdrive Version V4.2
Implemented features	DCP RTA LLDP SNMP MIB-II LLDP-MIB PTCP MRP FSU I&M 0…3 Isochronous mode Basic web server - Firmware updates
Implemented telegrams	Std. telegrams 81, 82, 83, 84, 86, 88
Classifications	RT CLASS 1 RT CLASS 2 (RT) RT CLASS 3 (IRT) Conformance Class C Application Class 6 Encoder Class 4 Net load class III
Min. cycle time	Min. Device Interval = 250 µs

3.3 PROFINET IO Interface Description

PROFINET is a mechanism for exchanging data between controllers and devices. Controller may be a PLC, a DCS or a PAC (Programmable Logic Controller, Distributed Control System, or Programmable Automation Controller). Devices may be any I/O block, vision system, measuring sensor, RFID reader, drive, process instrument, proxy or even other controllers.

PROFINET exchanges data quickly and in a deterministic manner. The required speeds vary according to the application. Update can take place in hundreds of milliseconds, a few milliseconds or even < 1 millisecond. Determinism means that the messages arrive at a defined point of time, when they have to.

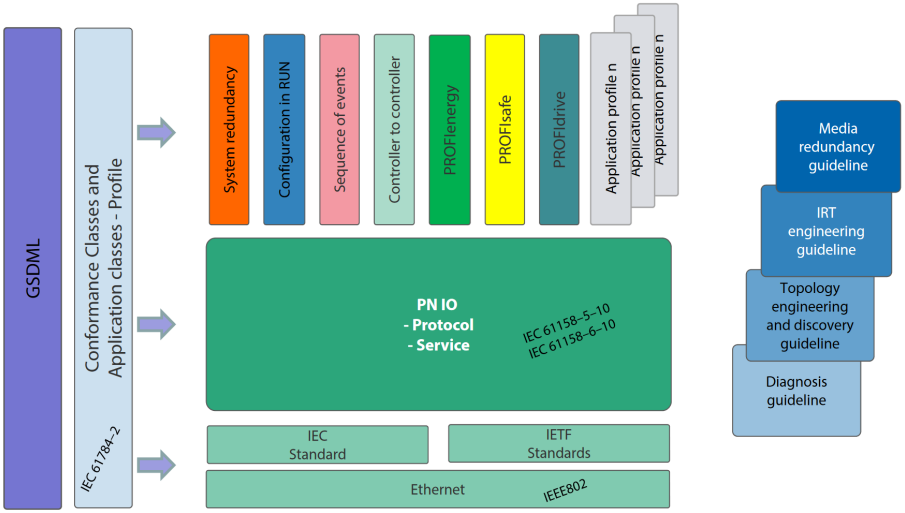
Other protocols are not as deterministic. For example Modbus TCP uses TCP, which implies that a virtual connection is established between both devices and that all messages must pass through the TCP/IP stack. EtherNet/IP uses UDP, so that messages must pass through the UDP/IP stack. The time to pass the stack is variable and reduces the determinism, in addition to the speed loss. EtherCAT is deterministic, but it is a closed network.

PROFINET exchanges data, including quality and asset management information. The protocol is standardized in IEC 61158 and IEC 61784.

Conformance Classes

PROFINET defines three conformity classes that build up on one another, which are oriented at typical applications (Figure below):

- CC-A provides basic functions for PROFINET IO with RT communication. All IT services can be used without restrictions. Typical applications can be found e. g. in the enterprise automation systems. For this class, wireless communication is specified.
- CC-B extends the concept with the network diagnostics through IT mechanisms and topology information. The system redundancy function, which is important for process automation, is included in an extended version of CC-B called CC-B(PA).
- CC-C describes the basic functions for devices with hardware-based band width reservation and synchronization (IRT communication) and is thus the basis for isochronous applications. The conformity classes also serve as the basis for certification and for the wiring guidelines.



IMG-ID: 108020747

Parameterizing

Parameterizing requires the GSD (General Station Description) files of the field devices to be configured. The XML-based GSDML describes the features and functions of the PROFINET IO field devices. It contains all data relevant for engineering and data exchange with the field device. The field device manufacturer must provide the XML-based GSD in compliance with the GSDML specification.

Addressing

In a PROFINET IO system, every field device is given a symbolic name, which clearly identifies the field device within this IO system. This name is used to correlate the IP address and the MAC address of the field device. The DCP (Discovery and basic Configuration Protocol) is used for this purpose.

Every PROFINET device is addressed by means of its worldwide unique MAC address. This MAC address includes a company code (bit 24 .... 47) as the OUI (Organizationally Unique Identifier) and a consecutive number (bit 0 .... 23). An OUI allows identifying up to 16,777,214 products of a single manufacturer.

Optionally, the name can also be assigned automatically to the IO device by the IO controller by means of a specified topology, based on neighborhood detection. Here the IP address is assigned on the basis of the device name via the DCP protocol. Since DHCP (Dynamic Host Configuration Protocol) is internationally widespread, PROFINET has provided an optional address setting via DHCP or via manufacturer-specific mechanisms. The addressing options supported by a field device are defined in the GSDML field for the concerned field device.

Source: PROFINET System Description Technology and Application 10.2014

3.4 Supported Standards and Protocols

The PROFINET standards and features implemented in the device are listed below:

3.4.1 58x8 Standards & Features

- RT_CLASS_1
- RT_CLASS_2 (RT)
- RT_CLASS_3 (IRT)
- DCP
- RTA
- LLDP
- SNMP
- MIB-II
- LLDP-MIB
- PTCP
- MRP
- FSU
- Conformance Class C
- Application Class 3
- Encoder Class 3

- NetloadClass III
- IM0 readable
- Min. DeviceInterval = 1000 µs
- Encoder profile V4.1

3.4.2 F58x8 Standards & Features

- RT_CLASS_1
- RT_CLASS_2 (RT)
- RT_CLASS_3 (IRT)
- DCP
- RTA
- LLDP
- SNMP
- MIB-II
- LLDP-MIB
- PTCP
- MRP
- FSU
- Conformance Class C
- Application Class 6
- Encoder Class 4
- NetloadClass III
- I&M 0…3
- Min. DeviceInterval = 250 µs
- Isochrounus Mode
- Encoder profile V4.2
- PROFIdrive profile V4.2
- Basic web server - Firmware update

3.4.3 Optional Features

PROFINET defines features that must not be mandatorily implemented (optional features).

NOTICE	**Observe the specific implementation**
	The overview provides information about whether the feature is implemented in the device. This however does not mean that the feature is implemented in the same way in every device The specific implementation can be found in the description in the following pages.

Optional PROFINET features	Description	Sendix 58x8 (Encoder profile 4.1)	Sendix F58x8 (Encoder profile 4.2)
Network Redundancy with Media Redundancy Protocol (MRP)	The Media Redundancy Protocol provides network ring redundancy for PROFINET IO real-time networks	Implemented	Implemented
System Redundancy	Allows a primary and backup controller for redundant applications with PROFINET	Implemented	Implemented
Device Redundancy	Allows a device to have several interfaces, including PROFINET redundancy	Not implemented	Not implemented
Shared Device	Distribution of the device functions over different controllers	Implemented	Not Implemented
Shared Inputs	Multiple access to inputs by different controllers	Not implemented	Not implemented
Device Access	Allows reading or writing parameters by means of a configuration tool	Implemented	Not Implemented
Supervisor Access	Allows an IO supervisor to take in charge an IO device to check inputs, outputs and device functions	Implemented	Implemented
Extended Device Information (Identification & Maintenance Records 1-3)	Extended device information (site description, mounting date, etc.)	Not implemented	Implemented
Direct data exchange / Multicast Communication Relation (MCR)	A multicast communication relation allows several devices to communicate by direct data exchange	Not implemented	Not implemented
Simple Network Management Protocol (SNMP)	Allows reading simple network management protocols and topology information	Implemented	Implemented
Simple device replacement	In the event of device failure and replacement, allows a controller to name automatically a replaced IO device	Implemented	Implemented
Configuration in Run (CiR)	Allows configuring and setting a device even while the controller / the PLC is in "Run" mode	Not implemented	Not implemented
Time Stamping	Allows using time stamps based on a real-time clock	Not implemented	Not implemented
Fiber Optic Cable diagnostics	The fiber optic cable diagnostics offer improved diagnostics for the maintenance in the event that the cable looses signal strength over time	Not implemented	Not implemented

Optional PROFINET features	Description	Sendix 58x8 (Encoder profile 4.1)	Sendix F58x8 (Encoder profile 4.2)
Fast Startup (FSU)	Fast device start-up after the power cycle for specific applications (e. g. tool changers)	Implemented	Implemented
Isochronous Real Time (IRT)	The isochronous real time allows synchronous communication with bandwidth reservation and scheduling up to 250 µs with < 1 µs jitter for motion control applications	Not implemented	Implemented
Dynamic Frame Packing (DFP)	Dynamic frame packing with IRT is optimized for line structures and allows 31.25 µs update times for high-speed motion control applications	Not available yet	Not available yet
IRT with Media Redundancy for Planned Duplication (MRPD)	Network media redundancy for planned duplication for IRT systems – Constant two-way transmission	Not implemented	Not implemented
Tool Calling Interface (TCI)	Tool calling interface used for calling a device-specific engineering tool	Not implemented	Not implemented
Individual Parameter Server (iPar)	Individual parameter server (iPar) for automatic parameter assignment of devices (e. g. for safety)	Not implemented	Not implemented
Application and Device Profiles	Special application/device profiles for specific applications (e. g. safety, energy, drives) or device data sets for specific device types (e. g. encoders)	Implemented	Implemented
Manufacturer Specific Alarms	Manufacturer-specific PROFINET diagnosis alarms (e.g. redundant power supply error, manufacturer-specific error code)	Not implemented	Implemented

4 Installation

NOTICE	**Observe the operation manual** Installation instructions can be found in the relevant operation manual.

4.1 Electrical Installation

4.1.1 General Information for the Connection

ATTENTION	**Destruction of the device** Before connecting or disconnecting the signal cable, always disconnect the power supply and secure it against switching on again.

NOTICE	**General safety instructions** Make sure that the entire system is in a de-energized state during electrical installation.

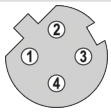
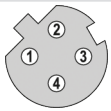
NOTICE	**No open cable wires** Connect all required cable wires / connectors before commissioning. Insulate individually all unused ends of the output signals to avoid short-circuits. • Electrostatic discharges at the contacts of the connector or at the cable ends could damage or destroy the device. Take appropriate precautionary measures.

NOTICE	**Traction relief** Always mount all cables with traction relief.

NOTICE	**Use shielded data lines** Use exclusively shielded data lines to comply with the EMC interference immunity requirements in force for interference emissions and external interference.

4.1.2 Terminal Assignment 58xx

PROFINET connection M12 connector

Inter-face	Type of connect ion	M12 connector, D-coded, 5-pin M12 connector, A-coded, 4-pin					Connector
C	2	**Connector**					
		LINK 1					
		Signal	TxD+	RxD0	TxD-	RxD-	
		Pin	1	2	3	4	
		Supply voltage					
		Signal	+V	-	0 V	-	
		Pin	1	2	3	4	
		LINK 2					
		Signal	TxD+	RxD0	TxD-	RxD-	
		Pin	1	2	3	4	

The two external encoder connectors "PORT 1" and "PORT 2" serve for the PROFINET communication (the encoder is here a PROFINET device). One of the two ports is sufficient for a star structure. Both ports are required for a line or ring structure. In principle, the data ports are equivalent and can be chosen freely. When a determined topology has been defined for the hardware configuration (e.g. for LLDP, IRT, MRP), they shall not be interchanged any more.

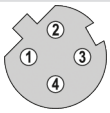
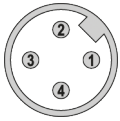
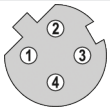
4.1.3 Terminal Assignment F58x8 / S58x8FS3

4.1.3.1 Terminal Assignment

The encoder has three connectors, two of them are the two Ethernet ports.

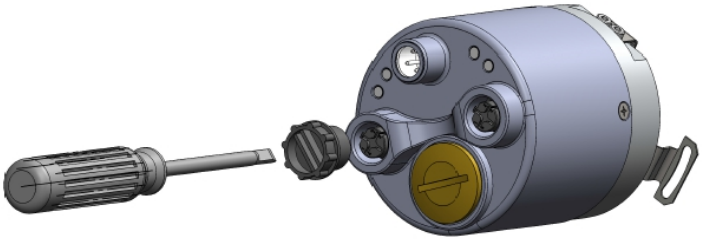
The central connector is the power supply of the encoder. The power supply connector is an A-coded M12 plug.

Both Ethernet connectors are D-coded M12 sockets. The assignment of the signals to the pins is described in the table below.

3x M12, 4-pole					Connector
	Link 1 - Ethernet Port IN / OUT				 Socket, D-coded
Signal	TxD+	RxD+	TxD-	RxD-	
Pin	1	2	3	4	
	Voltage supply				 Plug, A-coded
Signal	+ V	-	0 V	-	
Pin	1	2	3	4	
	Link 2 - Ethernet Port IN / OUT				 Socket, D-coded
Signal	TxD+	RxD+	TxD-	RxD-	
Pin	1	2	3	4	

The two external encoder connectors “PORT 1” and “PORT 2” are used for the Ethernet communication. One of the two ports is sufficient for a star structure. Both ports are required for a line or ring structure. In principle, the data ports are equivalent and can be chosen freely.

When a determined topology has been defined in the hardware configuration, the connectors may not be interchanged any more.



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NOTICE	**M12 connector cover**
	Both Ethernet ports are provided with a plastic cap. If only one of both ports is to be used, the cap of the other port must be tightened at a torque of 1 Nm [0.74 ft-lb] to ensure the IP protection level.

Signal assignment of an M12 to RJ45 cable

M12 to RJ45 direct

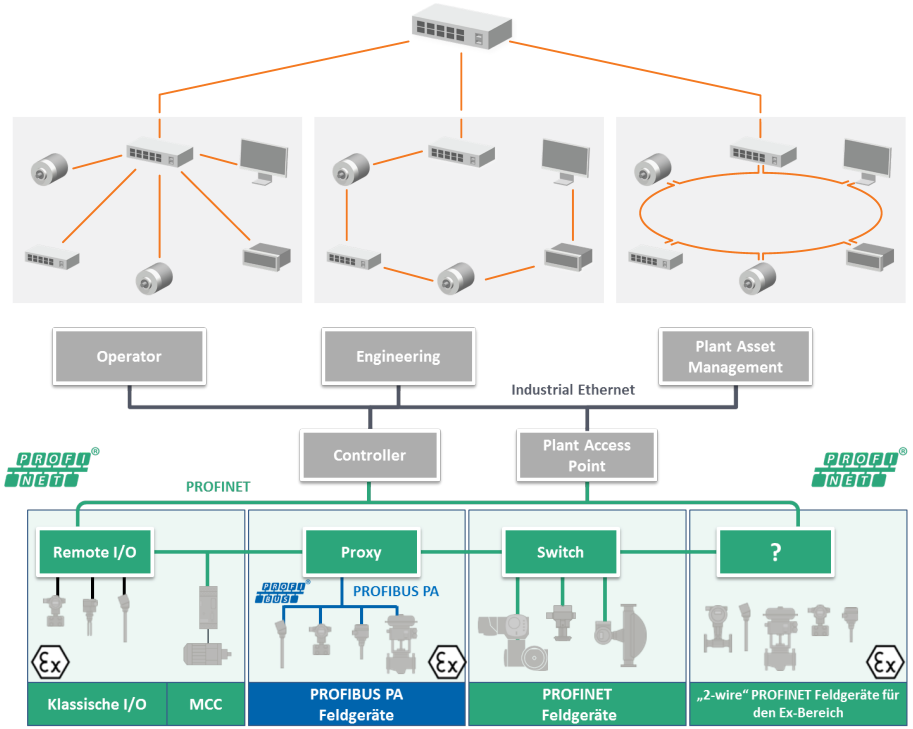
Signal	M12 Pin	RJ45 Pin
TxD+	1	1
TxD-	3	2
RxD+	2	3
RxD-	4	6

4.1.4 Network Topology

Network topologies result from the functional requirements imposed on the respective network. However, network planners must also consider aspects such as management, performance, spatial environment, safety, maintenance and savings potential. Thus, the network topology is in practice always a compromise resulting from very different considerations.

Basically, any network topology can be achieved with Industrial Ethernet. There are essentially three patterns used to arrange devices in a network: the star, the line and the ring. Each of these three basic physical topologies in turn includes the smallest topology possible: the point-to-point topology between two participants.

- The star topology includes point-to-point connections between a central network participant and all others, which are arranged in star with respect to it. The transmission medium runs point-to-point between them, resulting in a star structure.
- In the line topology, all participants are interconnected by means of a common transmission medium. This medium is called bus, so this topology is also called bus topology.
- For the ring topology, all network participants are connected via two points. This means that every participant maintains two point-to-point connections with other participants, resulting in a circular structure.



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The basic logical topologies can be assigned to these three basic patterns.

- In the star topology, every connection between the central network participant and another participant consists in two lines - one to send, one to receive. The sent signal of a network participant is sent via the central network participant to all others.

- In the line topology, the data sent by a network participant is broadcast over the whole transmission medium. Thus, when a network participant is sending, no other participant can send without leading to data collision.
- In the ring topology, a network participant is only allowed to send when he receives the transmission authorization (token) circulating in the ring. Data prepared for sending is added to the token and transmitted in the ring from participant to participant until the target participant receives it.

NOTICE	**Topology and line length** Independently of the chosen topology, the length of the line between the single devices shall in no case exceed 100 m. In the event of line lengths exceeding 100 m, the single devices must be coupled through suitable switches.

5 Commissioning and Operation

DANGER	**Risk of injury due to rotating shafts**
	Hair and loose clothing can be caught by rotating shafts. • Prepare all work as follows: ⇨ Switch the operating voltage off and stop the drive shaft. ⇨ Cover the drive shaft if the operating voltage cannot be switched off.

5.1 Function and Status LED

5.2 Quick Start Guide

5.2.1 Configuration

5.2.1.1 Configuring the Network

NOTICE	**Consider the project design software** The steps below refer to project design in SIMATIC TIA Portal. Deviations in the description may occur, depending on the software.

NOTICE	**Installation of the device description file** During installation, the corresponding .bmp file must be in the same folder as the GSDML /.xml file.

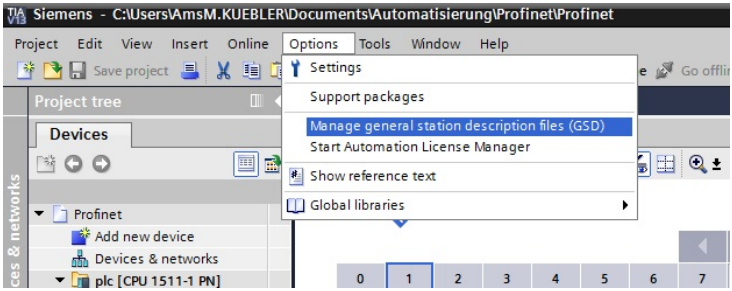
PROFINET integration

✓ Make sure that a static IP address has been assigned to the computer used for project design.

✓ The .xml file corresponding to the device must previously be downloaded from the website and decompressed in a folder.

a) Start SIMATIC TIA Portal and open the project (with the CPU or PN controller connected). Select "Project view".

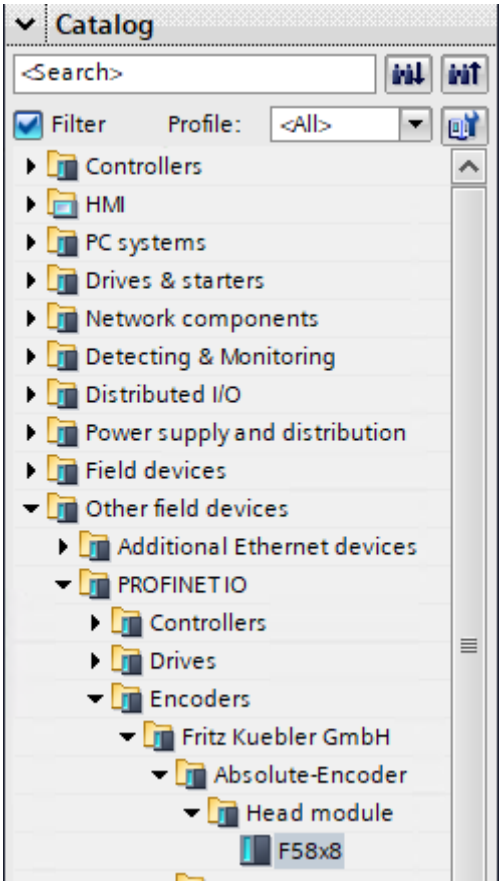
b) Install the current GSD file.



IMG-ID: 108551563

c) Double-click on "Project tree/Project…/Devices & Networks" to call up the "Network view".

d) In the "Hardware catalog", click on "Other field devices"and follow the path "/PROFINET IO/Encoders/Fritz Kuebler GmbH/Absolute encoder/Head module/F58x8“.



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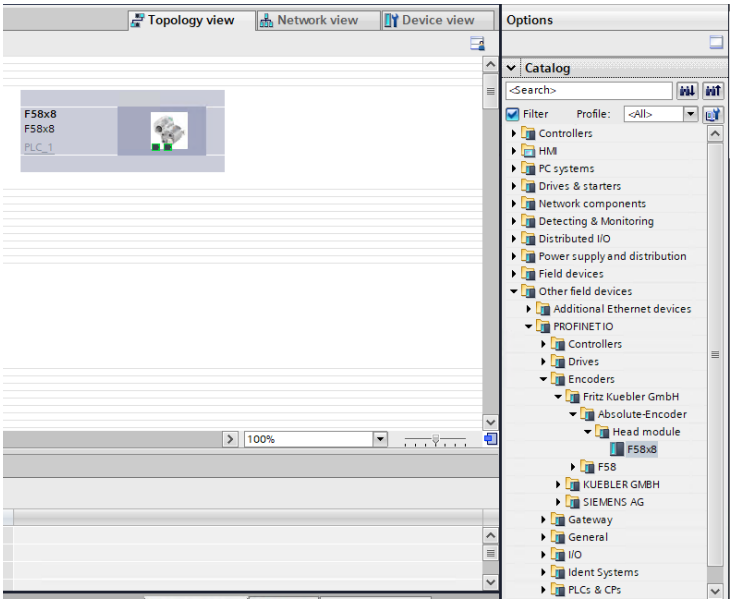
e) Use the mouse cursor to drag the module in the "Network view".

⇨ This creates an object, which represents the encoder.



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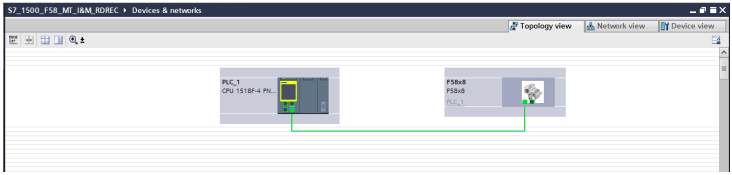
f) Connect graphically the encoder to your PLC (using "…PROFINET IO.System…").



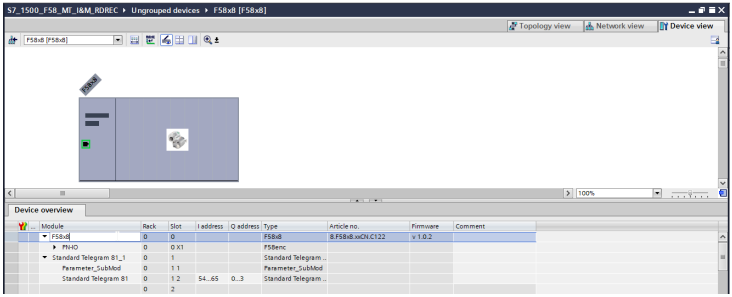
IMG-ID: 185298315

5.2.1.2 Configuring the Encoder

✓ Make sure that the encoder has been properly added to the network view.

a) Mark the added encoder.

b) Click on tab "Device overview". There, input a meaningful device name



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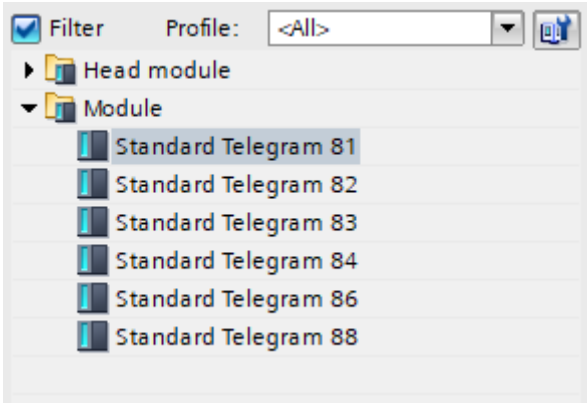
c) According to the required "Input/output data format", drag one of the modules from the hardware catalog in the "Device overview" to "Slot 1" of the encoder.



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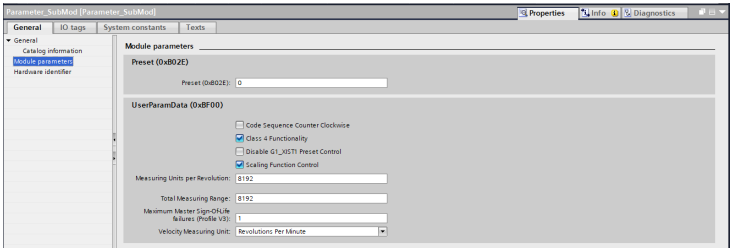
d) Click on "SUBslot 1" 1 = PARAMETER_SUBMOD.

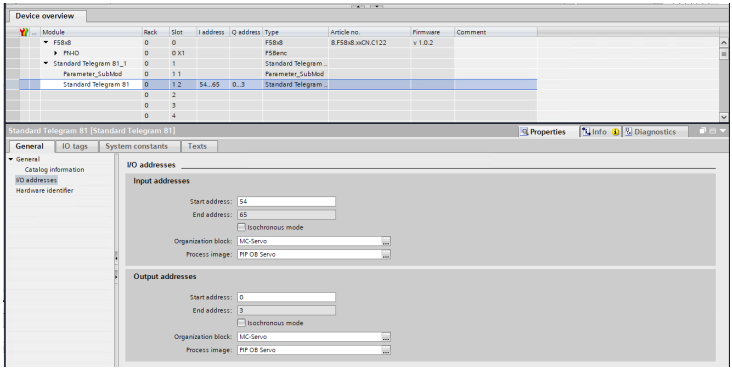
e) Select item "Module parameters" in tab "Properties" and set the encoder parameters as required.



IMG-ID: 185303051

NOTICE	**Observe factory settings** For multiturn encoders, the factory setting of the TMR value is 8192, which corresponds, with MUR 8192, to a singleturn encoder. This is due to the fact that both encoders are integrated using the same GSDML file. Therefore, for a MT encoder, this value must be modified by the user in any case. Submodule StdTel81 is set in the factory.

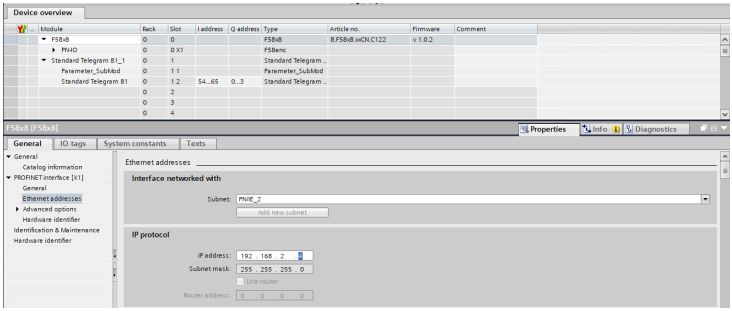
f) Select the respective telegram used and, if necessary, adapt the I/O addresses for the cyclic data exchange as required.



IMG-ID: 185304715

g) As an option, you can carry out settings under Slot "0" ("X1= Interface", "X1 P1 = Port 1" and "X1 P2 = Port 2").

h) Check the IP address and the used subnetwork. The latter can be adapted if necessary.



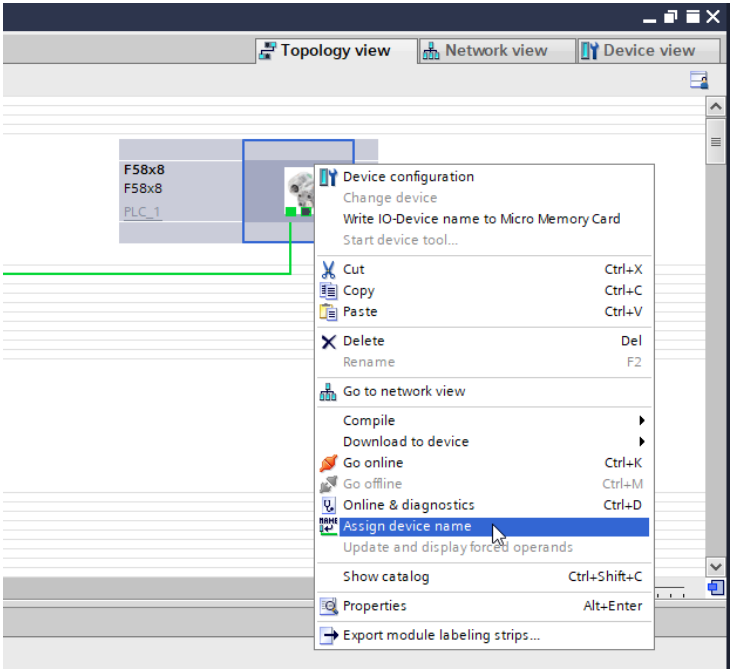
IMG-ID: 185306379

Assigning PROFINET device name

✓ Open the Topology view.

a) With the right mouse button, click on the integrated encoder.

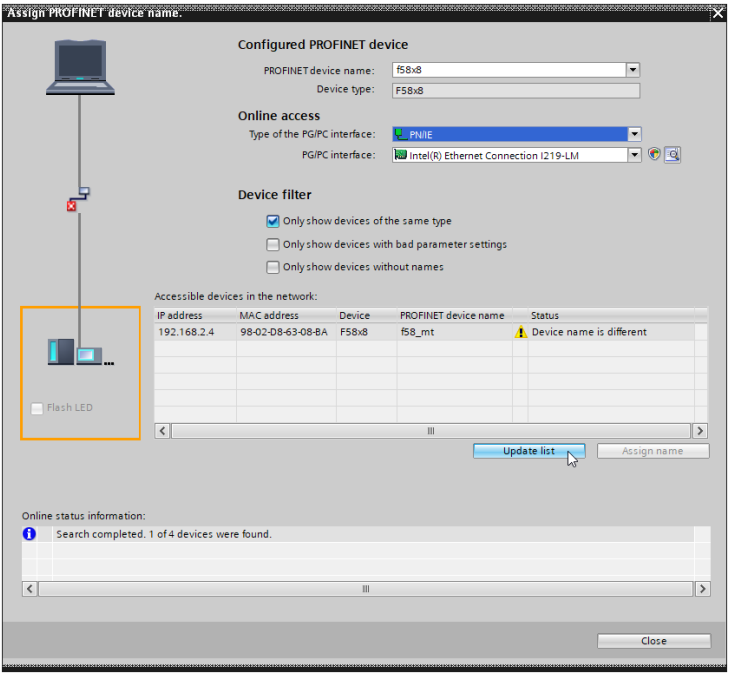
b) Select "Assign device name".



IMG-ID: 185325963

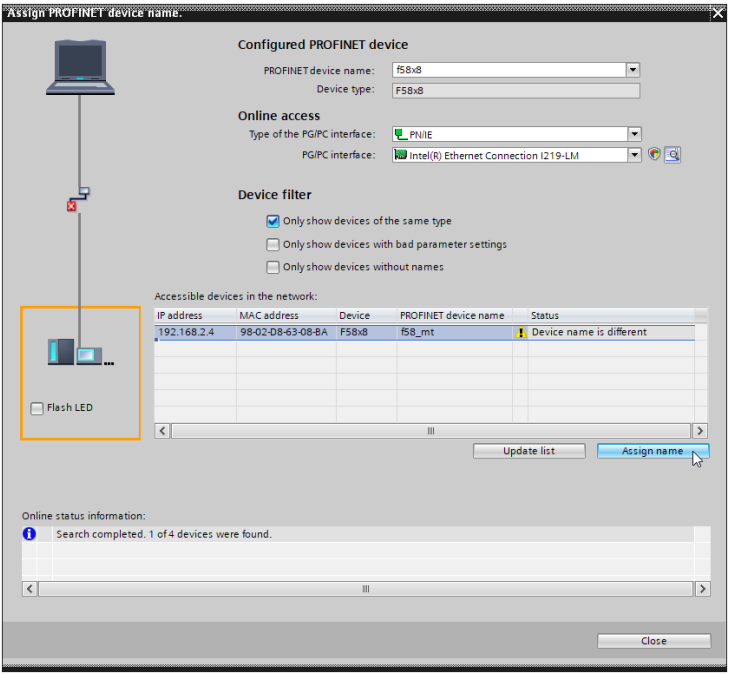
⇨ The window "Assign PROFINET device name" opens.

c) Set the proper interface and click on "Update list".



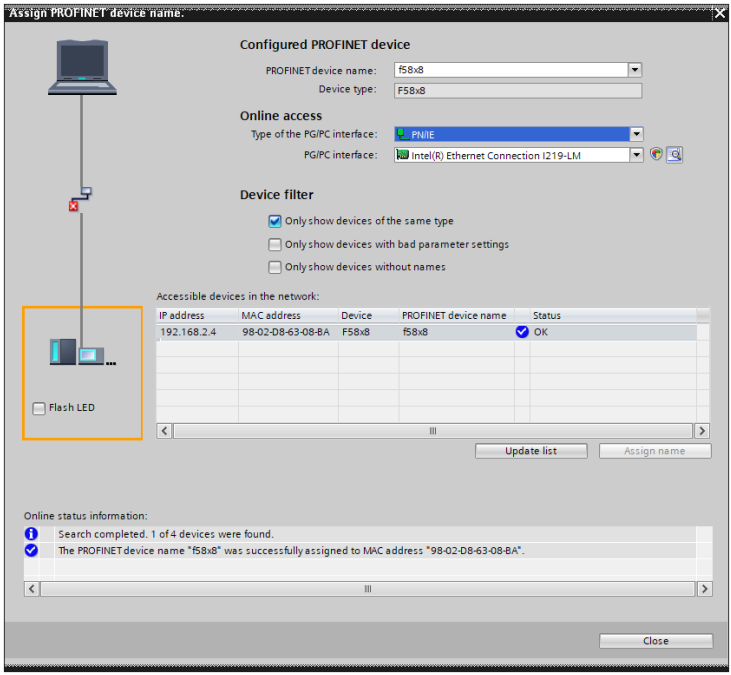
IMG-ID: 185327627

d) Now select the device and click on "Assign name".



IMG-ID: 185329291

⇨ If all settings are OK, the status OK is displayed and the device is successfully renamed. The control can communicate with the device.



IMG-ID: 185330955

5.2.2 Commissioning

NOTICE	**Identifying the IP address** The IP address of the device can be found with "Project tree/Online accesses/Network board/Update accessible nodes".

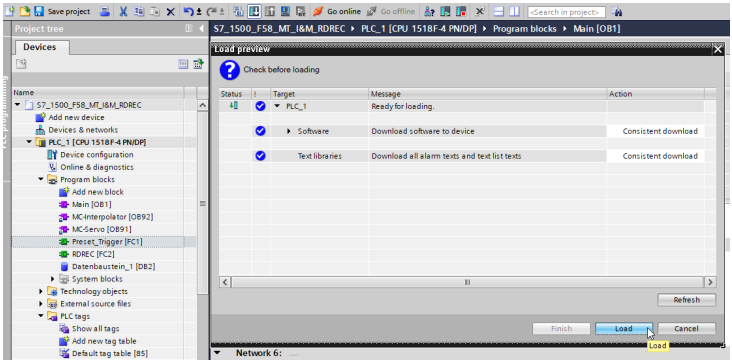
NOTICE	**Parking sensor is active in the initial state** For the standard telegrams 81, 82, 83 and 84 according to Encoder Profile v4.2, the parking sensor is active in the initial state, in which the encoder does not output data or the position is frozen. To set the encoder in the operating state, the parking sensor can be deactivated with bit 14 in G1_STW.

✓ Make sure that all required configuration parameters have been set properly.

✓ Make sure that the CPU IP address set in the device configuration corresponds to the actual IP address.

a) Click on your CPU (e.g. under "Project tree/Devices" and then on symbol "Load in device".

⇨ The window "Load preview" opens.



IMG-ID: 185349259

b) Click on "Load" and subsequently on "Finish".

⇨ This loads the hardware configuration in the PLC.

The configuration can then be started.

c) To do so, click on "Go online".

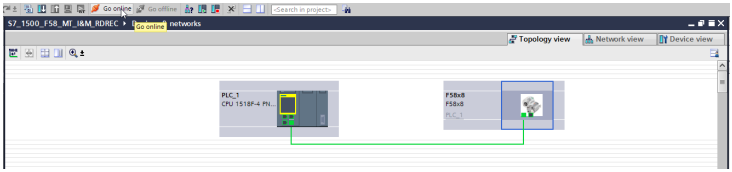


Fig. 1:

IMG-ID: 185350923

⇨ The encoder is now ready for operation and online. In order to allow the output of measured values, the parking sensor must be deactivated.

d) Activate the control through the PLC and deactivate the parking sensor by setting in STW2_ENC bit 10=1 and in G1_STW bit 14=0. Telegram data [▸ 72]

⇨ As soon as the configuration is started and the parking sensor deactivated, the values output by the encoder can be read.

Also refer to

Telegram data [▸ 72]

5.2.3 Resetting to Factory Settings

The PROFINET interface of the encoder can be reset to the "factory settings". This erases among others the device name and the IP address.

NOTICE	**Preset position**
	"Resetting to factory settings" only relates to the PN interface. The preset position of the encoder is not affected.

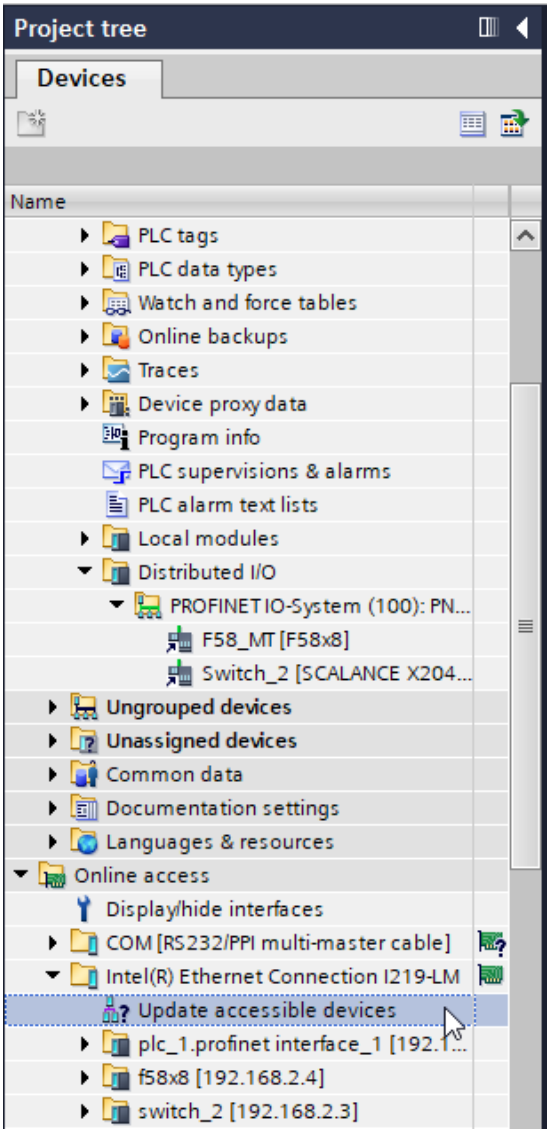
NOTICE	Output data behavior
	The output data bytes processed internally by the encoder are set to 0x00 and therefore erased in the following situations: • when powering (applying the supply voltage). • at every PN link interruption (e.g. disconnecting the PN data line). • when the PN controller sets "IOPS=BAD"(e.g. when the PLC switches to "STOP“).

NOTICE	Device name
	If the PN controller (PLC) is currently in operation and contains a LLDP configuration corresponding to the current topology, the configured name is automatically assigned to the device just reset to "factory settings" (and if necessary the PN link is set up again) after some seconds.

If a defective device is to be replaced in a PROFINET network, it is recommended to mount a new replacement device or a device reset to factory settings. It will then automatically be assigned the correct PROFINET device name if LLDP is enabled - see LLDP - Link Layer Discovery Protocol [▶ 85].

Proceed as follows to "reset to factory settings":

a) Open path "Project tree/Devices/Online access/{Your PN network card}".

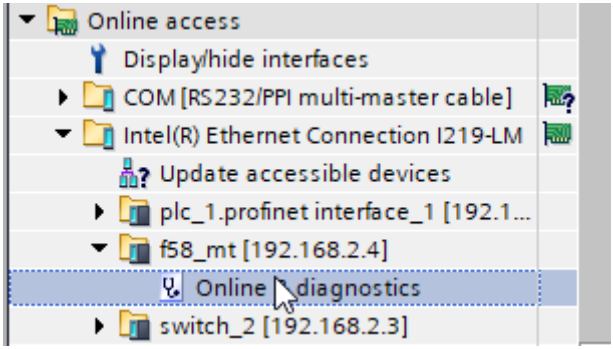


IMG-ID: 185356939

b) Double-click on "Update accessible devices"

c) Wait some seconds until the search process is completed and the list of the accessible PN devices is displayed.

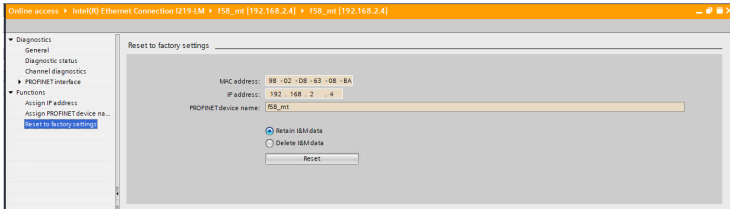
d) Double-click on "Online & Diagnostics" of the encoder to be reset.



IMG-ID: 185358603

e) Select "Functions/Reset to factory settings".

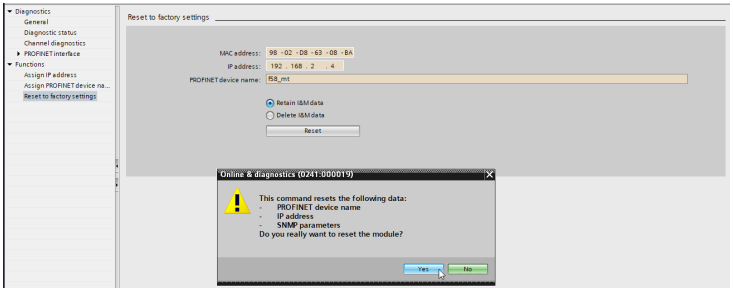
f) Click on "Reset".



IMG-ID: 185360267

g) Select whether also the I&M data is to be reset.

⇨ A warning message is displayed.



IMG-ID: 185361931

h) Confirm the warning message with "Yes".

⇨ The encoder is now reset to the factory settings.

5.3 Protocol Features

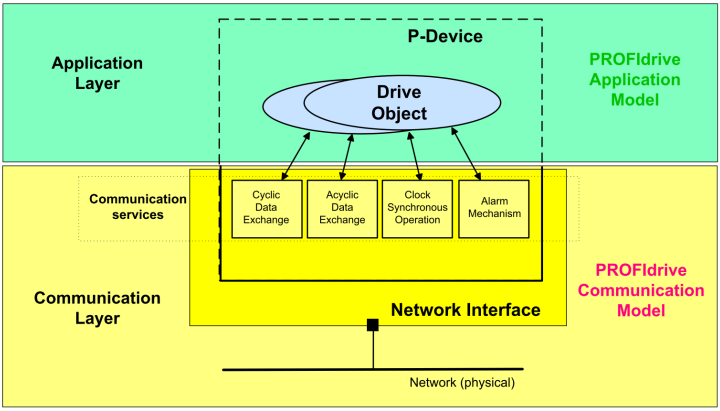
5.3.1 PROFIdrive

5.3.1.1 PROFIdrive Base Model

PROFIdrive describes the basic structure in which the PROFINET encoder model integrates itself. Every P device (PROFINET device, in the specific case the encoder) consists of an APPLICATION LAYER and a COMMUNICATION LAYER.

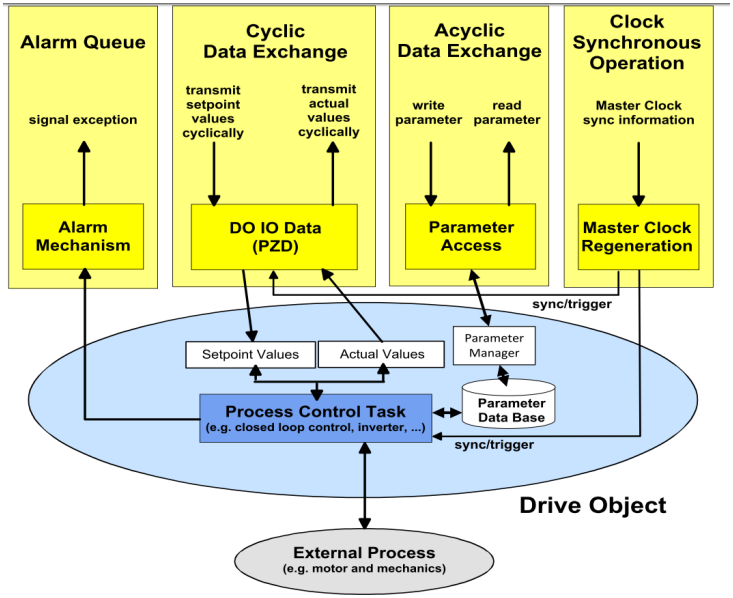
The DRIVE OBJECT can be subdivided in various communication services:

- ALARM MECHANISM: Output of alarms and warnings
- CYCLIC DATA EXCHANGE (RT)
- ACYCLIC DATA EXCHANGE (configuration parameters)
- CLOCK SYNCHRONOUS OPERATION: synchronous data exchange (IRT)



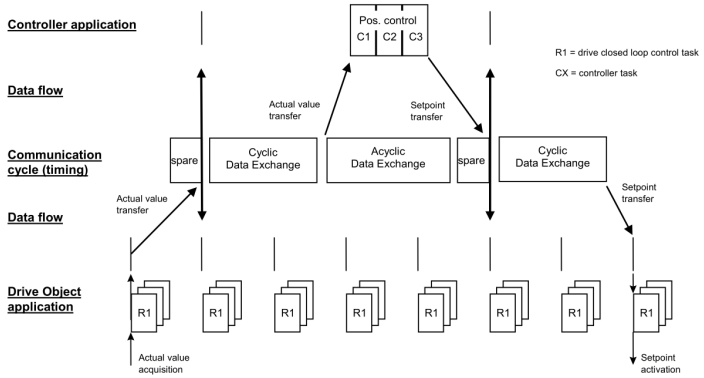
IMG-ID: 179289995

The DRIVE OBJECT communication predefined this way determines the base according to which the Encoder Model [▷ 36] is oriented.



IMG-ID: 179293835

PROFIdrive in particular describes the way to ensure clock synchronous process data, which is of crucial importance in closed drive system control loops. It allows achieving, for clock synchronous process data transmission, cycle times of less than 1 ms: the control issues a transmit clock cycle used by all PROFIdrive network participants for synchronization.



IMG-ID: 179333899

A part of the cyclic communication is reserved for the acyclic communication. It is generally used only if required. It includes e. g. status information of network participants or commands, as well as parameterizing data.

The PROFIdrive profile operates in accordance wit the so-called client-server model, in which the communication generally takes place via request and response. Special PLC blocks are available for this purpose, allowing addressing such commands to the network participant.

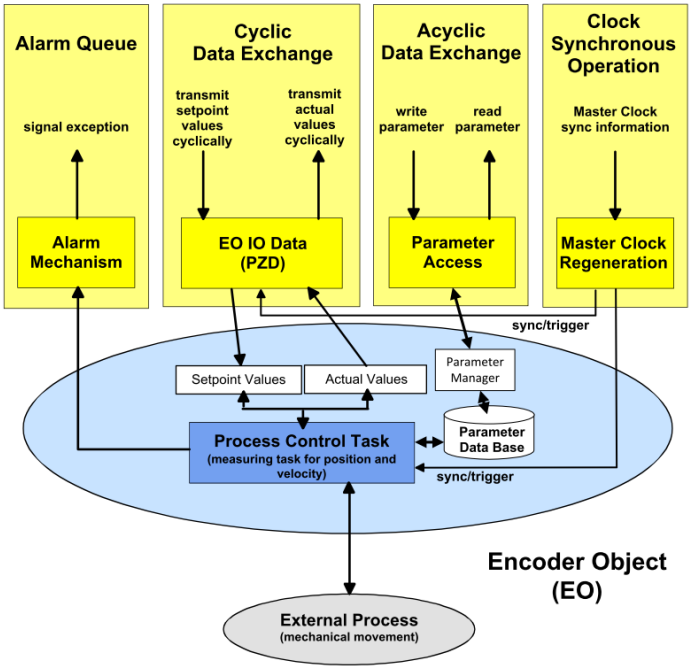
5.3.2 PROFINET

5.3.2.1 Encoder Model

PROFINET is represented on the encoder in accordance with the encoder model described in Encoder Profile V4.2. The main component of this model is the PROCESS CONTROL TASK. It ensures that the measured values are acquired and transmitted. The acquired and calculated values are also controlled by the configuration parameters.

Data communication can be subdivided into 4 main areas, which are all supported by the encoder.

- ALARM QUEUE: Output of warnings and alarms.
- CYCLIC DATA EXCHANGE (RT).
- ACYCLIC DATA EXCHANGE (configuration parameters)
- CLOCK SYNCHRONOUS OPERATION: synchronous data exchange (IRT).



IMG-ID: 177715851

5.4 Configuration Parameters Description

5.4.1 General Module Parameters

The encoder has various parameters, which can be set likewise in the respective header module, module (slot), subslot and telegram. While the device type-independent general parameters are located at header module level, the device/telegram-specific parameters are located at module, respectively telegram level. Basically, all parameters can be classified as follows:

1. Standard / general parameters

   These parameters are present for all devices. They include e.g. the transmission cycle, MRP settings, the startup mode, etc.

2. iParameters

   These parameters are individual for every device type and cannot be predetermined only by the GSDML file. For encoders, they include mainly the parameters TMR , MUR, direction of rotation, etc

3. F-parameters

   The F-parameters relate exclusively to failsafe devices, i.e. devices that support PROFIsafe. They include e.g. the F-destination address, the F-watchdog time and the F-parameters CRC.

The parameters supported by the device are listed below.

5.4.1.1 iParameters

Non-safe telegrams 81, 82, 83, 84, 86, 88

CODE SEQUENCE COUNTER CLOCKWISE

Influences the counting behavior depending on the direction of rotation. Looking at the shaft side of the encoder:

- CW: The encoder position increases for clockwise shaft rotation.
- CCW: The encoder position increases for counter-clockwise shaft rotation.

CLASS 4 FUNCTIONALITY

Influences the consideration of scaling, preset and direction of rotation setting in all telegrams and in position data G1_XIST1, 2 and 3:

- Disabled: Application class 3 - Scaling, preset and direction of rotation setting disabled.
- Enabled: Application class 4 - Scaling, preset and direction of rotation setting enabled.

DISABLE G1_XIST1 PRESET CONTROL

Influences the consideration of the preset (0xB02E):

NOTICE	**Effect of G1_XIST1 Preset Control**
	This parameter only controls the consideration of the preset for G1_XIST1. If the option is active, the preset will thus not be considered. The execution of a preset on G1_XIST2 and G1_XIST3 is always considered.

- Disabled: G1_XIST1 displays the current position, taking into consideration the preset (G1_XIST1 = G1_XIST2, but without possible error code).
- Enabled: G1_XIST1 displays the current position without taking into consideration the preset.

NOTICE	**Position value G1_XIST1**
	If G1_XIST1 is disabled and if the position value increases above the maximum value or falls below 0, the device outputs the maximum position value within the scaled total range as position value G1_XIST2. Position value G1-XIST1 is not limited to the scaled total range. For position value G1-XIST1, the device goes on issuing a scaled position value within the total measuring range, e. g. max. 33554432 position for 25 bits.

SCALING FUNCTION CONTROL

Influences the consideration of the scaling:

- Disabled: The position is represented in the maximum possible total resolution (ST+MT = TMR) of the respective used telegram.
- Enabled: The encoder position is represented scaled (according to MUR and TMR).

MUR – MEASURING UNITS PER REVOLUTION

Sets the number of different positions per revolution. This depends on the resolution of the used device and on the maximum permitted number of bits of the used telegram.

Std.Tel.	MUR max. [bits]	TMR max. [bits]	Max. permitted bits acc. to telegram
81, 82, 83, 84, 86	16	32	32
88	19	43	64

TMR – TOTAL MEASURING RANGE

Total number different from the positions to be issued, over all revolutions to be differentiated. Here:

- TMR / MUR = 1 → Singleturn
- MUR > TMR also possible

Without scaling via. USF

- TMR / MUR = power of 2 (e.g. ¼, ½, 1, 2, 4, 8, …, 4096)

With scaling via. USF

- TMR / MUR = decimal or power of 2

Example

✓ MUR = 8192

a) TMR = 65536

⇨ TMR is reached after 8 revolutions, so the positions 0 to 65535 are repeated every 8 revolutions.

Max. MASTER SIGN OF LIFE failures

Maximum number of master sign-of-life failures that can be tolerated.

Values range: 0 … 255

VELOCITY VALUE NORMALIZATION

This setting affects the unit of the calculated velocity. As a general rule, calculation takes place once per second.

Velocity unit	Value
Steps/s	0
Steps/100ms	1
Steps/10ms	2
RPM	3
N2/N4 normalized	4

N2/N4 normalized

Here

N2/N4 normalized [%]

100 % = Velocity reference value (parameter 60,000)

Example

✓ P60,000 = 4,000 RPM

a) Current velocity = 2,000 RPM, corresponding to 50 % of 4,000 RPM

⇨ NIST_A is 50,0 %

b) Current velocity = -6,000 RPM, corresponding to -150 % of 4,000 RPM

⇨ NIST_A is -150 %

PRESET value

Determines an absolute or relative position that can be used when performing a preset, e. g. by standard telegram 81.

Permissible values range:

- Absolute preset: 0…("TMR"-1)
- Relative preset: 0…+/-("TMR"-1)

N2/N4 VELOCITY REFERENCE VALUE

This parameter defines the unit of the actual velocity values. The unit relates to the values NIST_A and NIST_B

Permissible range:

-9000..-1, 1..9000

Parameter Control

Parameter initialization control (P65 005)

Encoder Parameters Parameter 65005 description

Parameter write protect (P65 005)

Encoder Parameters Parameter 65005 description

Parameter 65 005 and 971 write protect (P65 005)

Encoder Parameters Parameter 65005 description

Reset control write protect (P65 005)

Encoder Parameters Parameter 65005 description

Safe telegrams 36, 37

CODE SEQUENCE COUNTER CLOCKWISE

Influences the counting behavior depending on the direction of rotation. Looking at the shaft side of the encoder:

- CW: The encoder position increases for clockwise shaft rotation.
- CCW: The encoder position increases for counter-clockwise shaft rotation.

S_XIST32 PRESET CONTROL

Influences the consideration of the preset:

- Enabled: S_XIST32 considers a preset operation.
- Disabled: S_XIST32 displays the current position without taking into consideration the preset operation.

SCALING FUNCTION CONTROL

Influences the consideration of the scaling:

- Disabled: The position is represented in the maximum possible total resolution (ST+MT = TMR) of the respective used telegram.
- Enabled: The encoder position is represented scaled (according to the individual settings of MUR and TMR).

NOTICE	**Effect of the disabling of the Scaling Function Control**
	As soon as Scaling Function Control is disabled, the maximum values must be input in fields TMR and MUR.

NOTICE	**Scaling and velocity**
	Unlike the non-safe velocity value, the safe velocity value always relates to the unscaled singleturn position, also if an active scaling has been set for the positionnvalue.

MUR – MEASURING UNITS PER REVOLUTION

Sets the number of different positions per revolution. This depends on the resolution of the used device and of the maximum permitted number of bits of the used telegram.

Std.Tel.	MUR max. [bits]	TMR max. [bits]	Max. permitted bits acc. to telegram
36, 37	15	27	32

TMR – TOTAL MEASURING RANGE

Total number different from the positions to be issued, over all revolutions to be differentiated. Here:

- TMR / MUR = 1 → Singleturn
- MUR > TMR also possible

With scaling via. USF

- TMR / MUR = decimal or power of 2

Example

✓ MUR = 8192

a) TMR = 65536

⇨ TMR is reached after 8 revolutions, so the positions 0 to 65535 are repeated every 8 revolutions.

VELOCITY MEASURING UNIT

This setting affects the unit of the calculated velocity. As a general rule, calculation takes place once per second.

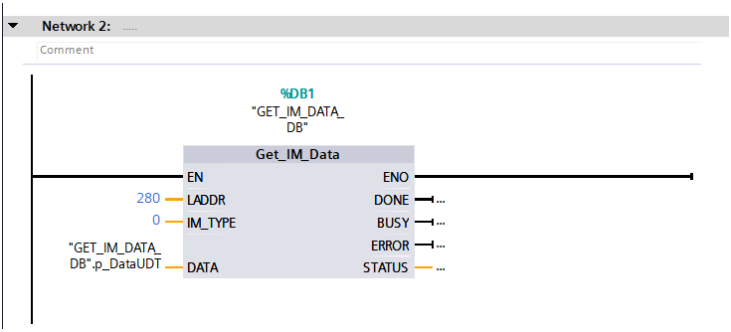
- 0 = Steps (positions) / second or
- 1 = Steps (positions) / 0.1 second or
- 2 = Steps (positions) / 0.01 second or
- 3 = Revolutions / minute

Also refer to

Configuration Parameters Description [▶ 37]

5.4.2 I&M Data

The encoder supports I&M. 0...3 , according to Encoder Profile V4.2 and IEC 61158-6-10 (PROFINET). Access takes place via a record read with index 0xAFF0 or TIA module GET_IM_DATA Reading the I&M data [▶ 98].



IMG-ID: 184227467

These include the basic device parameters relating to PROFINET and to the manufacturer identification.

The standard I&M 0 data is defined in the data block below.

I&M 0 Data Block

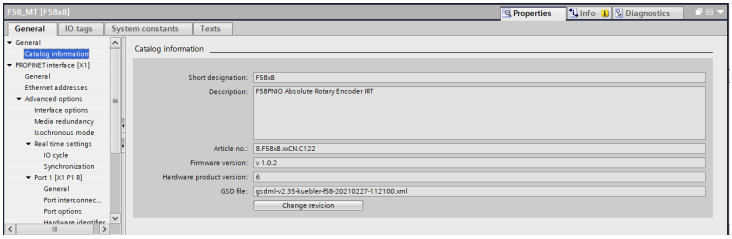
Data block	Data	Data type	Contents
Block Header	Block Type	UINT16	0x0020
	Block Length	UINT16	0x0038
	Block Version High	UINT8	0x01
	Block Version Low	UINT8	0x00
I&M Block	Manufacturer-ID	UINT16	0x0198 (Kübler)
	Order_ID	STRING	„08.x58x8xxx.xxCN.Cxxx“
	Serial Number	STING	„12345678“
	Hardware Revision	STRING	„6“
	Software Revision	STRING	„V1.0.0“
	Revision Counter	UINT16	0x0000
	Profile-ID	UINT16	0x3D00
	Profile Specific Type	UINT16	0x0001
	I&M Version (major)	UINT8	0x01
	I&M Version (minor)	UINT8	0x01
	I&M Supported	UINT16	0x000E

Further I&M data can be saved in addition to the standard I&M 0 data.

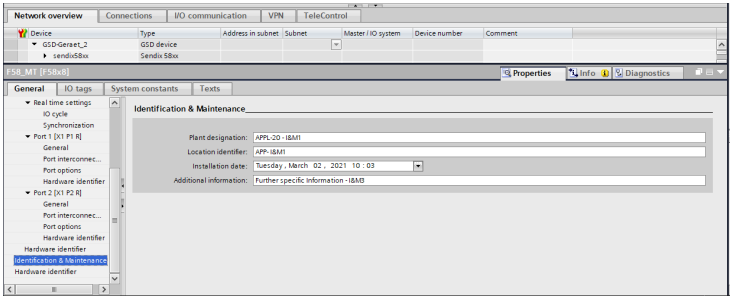
These are:

1. I&M 1 = Plant identification and location definition
2. I&M 2 = Installation date
3. I&M 3 = Additional manufacturer-specific information in the device

The I&M data can also be found in TIA Portal, directly in the device. They can be read and adapted in the respective device in the Inspector window, under Properties/General/Catalog information or under Properties/General/Identification & Maintenance.



IMG-ID: 184229131

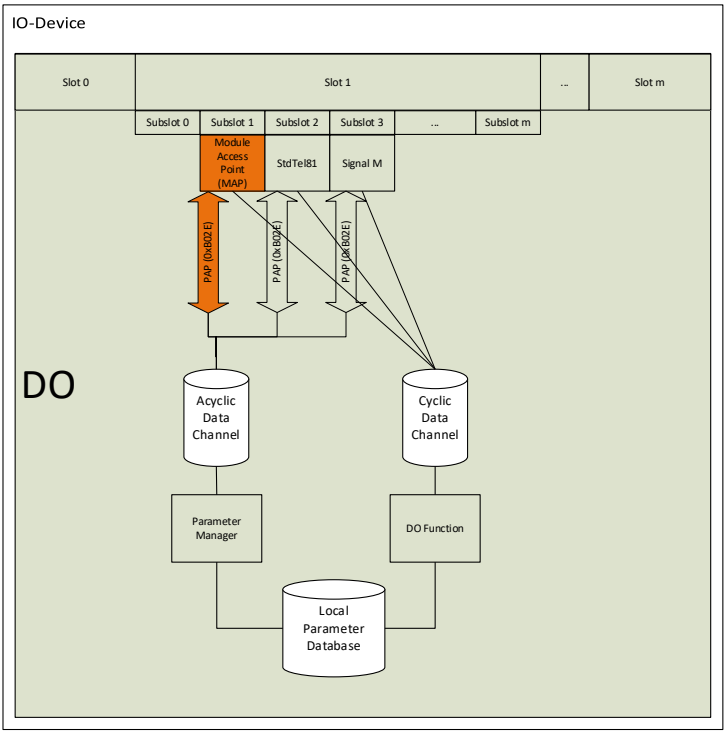


IMG-ID: 184230795

5.4.3 Acyclic Data Transmission

The acyclic data transmission allows reading information from the encoder and writing parameter data in the encoder.
All encoder parameters are referenced by reference numbers, the so-called PARAMETER NUMBERS - PNU.
They can be accessed via RECORD DATA OBJECTS, which communicate via PAP with the Parameter Manager.

The encoder profile is always located on slot 1.
Acyclic parameters (base mode parameters) are transmitted via subslot 1 (MAP).
Non-safe iParameters are transmitted via subslot 2.
Safe iParameters and F-parameters are transmitted via subslot 3.



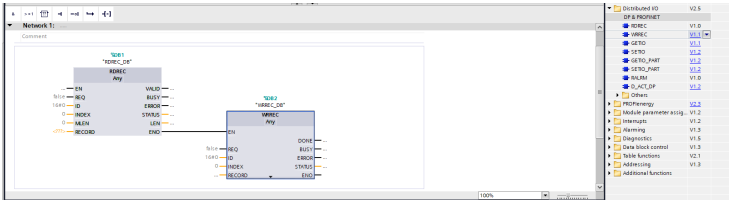
IMG-ID: 179485195

According to the area, PROFINET provides different access possibilities.

RECORD DATA OBJECT	Parameter access service	Slot	Subslot
0xAFF0	I&M 0 parameters	0x01	0x01
0xAFF1	I&M 1 parameters		
0xAFF2	I&M 2 parameters		
0xAFF3	I&M 3 parameters		
0xAFF4	I&M 4 parameters		
0xB02E	Base Mode Parameter Access	0x01	0x01
0xBF00	Start-up Configuration	0x01	0x01

With Siemens PLCs (S7), the "standard blocks" can be used for acyclic communication.

- SFB52=RDREC (READ RECORD)
- SFB53=WRREC (WRITE RECORD)

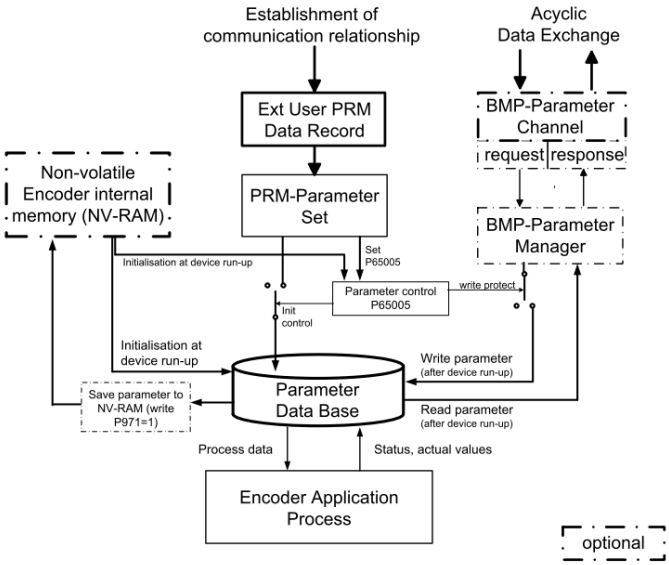


IMG-ID: 180363659

The function blocks implement the BASE MODE PARAMETER ACCESS 0xB02E.
The readable parameters are listed in the relevant chapter. See Encoder Parameters [▶ 53], PROFIdrive Parameters [▶ 49].

5.4.4 Base Mode Parameter

The following picture shows the encoder parameters database linked with the encoder application process and its associated mechanisms for the access to and the initialization of the parameter data. Also the optional mechanisms are implemented.



IMG-ID: 284210571

The use of the BMP parameters channel allows reading all implemented parameters. The write access to parameters through the BMP parameters channel is based on the setting of parameter “Parameter control” P65 005.

The initialization of the parameters data base during encoder start-up depends on the setting of parameter “Parameter control” in the PRM parameters set.

During encoder start-up (switching on), the content of the parameters data base is loaded from the NV-RAM of the encoder.

When establishing a communication relation with a parameterizing controller, the controller transmits the User Parameter Data Block (PRM data block) to the device. According to the setting of parameter “Parameter control” P65 005, the PRM data block is rejected or initialized. The parameters in the parameters data base correspond to the content of the PRM data block.

To save parameters in the NV-RAM, the parameters are in a first phase set in the parameters data base (via BMP parameters channel or PRM data block), and then the parameters are saved via. p971=1 (BMP parameters).

NOTICE	**Saving the configuration**
	It is strongly recommended to save the new permanent configuration in the NV-RAM (P971=1), as the position may deviate after a restart.
	Determined runtime parameters are always saved in the NV-RAM for every configuration, and they are reset in the event of a new configuration. If a set configuration is not saved, it will deviate from the current configuration in the NV-RAM. After a restart, the encoder loads the configuration from the NV-RAM and the runtime parameters are reset. This may lead to position deviations.

Access to the encoder parameters takes place through submodule “MAP Parameter Access” with “Record Data Object 0xB02E”, in compliance with Encoder Profile V4.2.

The base mode parameters, for which “Effective” is marked with “Reset”, are written in the parameters data base while parameterizing, but they are not saved in the device.
Only parameter “Transfer to non volatile memory” (P971=1) will write the data in the non-volatile memory to allow taking them over upon an encoder reset.

Write Access

- "Write request" by the IO controller with parameter number and the user data to be written.

Slot			BYTE	0x01
Subslot			BYTE	0x01
Index			WORD	0xB02E
Data Length			BYTE	individual
Data	Request Header	Request Reference	BYTE	
		Request ID	BYTE	0x01 = "Read" / 0x02 = "Write"
		Drive Object ID	BYTE	0x00
		Number of Parameters	BYTE	0x01
	Parameter Address	Attribute	BYTE	
		No. of Elements/ Values	BYTE	
		Parameter Number	WORD	
		Subindex	WORD	
	Parameter Value	Format / Data Type	BYTE	for "Write request"
		Number of values	BYTE	for "Write request"
		Values to write (if any)	BYTE	for "Write request"

- A "Write response" from the IO device.

Slot	BYTE	0x01
Subslot	BYTE	0x01
Index	WORD	0xB02E
Data Length	BYTE	individual

Read access

- "Write request" by the IO controller. Transmits which parameters are to be read.
- "Write response" from the IO device
- "Read request" from the IO controller

Slot	BYTE	always 0x01
Subslot	BYTE	always 0x01
Index	WORD	always 0xB02E
Data Length	BYTE	as from here (excl.)

- "Read response" from the IO device with the requested user data.

Slot			BYTE
Subslot			BYTE
Index			WORD
Data Length			BYTE
Data	Response Header	Response Reference	BYTE
		Response ID	BYTE
		Drive Object ID	BYTE
		Number of Parameters	BYTE
	Parameter Value	Format / Data Type	BYTE
		Number of values	BYTE
		Values	see format

5.4.4.1 PROFIdrive Parameters

Parameter number	Meaning	Data type	Permission	Effective
922	Telegram selection	UINT8	R	
925	Number of Controller Sign-Of-Life failures which may be tolerated	UINT8	R/W	Immediately
964	Drive unit identification	Array UINT16	R	-
965	Profile identification number	Array Octet string 2	R	-
971	Transfer to non volatile memory	UINT16	R/W	Immediately
972	Reset Encoder device	UINT16	R/W	Immediately
974	Base Mode Parameter Access service identification	UINT8	R	
975	DO identification	Byte Array [16]	R	
979	Sensor format	UINT32	R	
980	Number list of defined parameter	Array UINT16	R	

Parameter 922: Telegram selection

This parameter allows reading the parameterized telegram type.

Parameter value	Telegram
81	PROFIdrive telegram 81
82	PROFIdrive telegram 82
83	PROFIdrive telegram 83
84	PROFIdrive telegram 84
86	Telegram 86 with 32 bits for position + 32 bits for velocity
88	Telegram 88 with 64 bits for position + 32 bits for velocity

Parameter 925: Number of controller sign-of-life failures which may be tolerated

This parameter reads or writes the number of errors of the controller "sign-of-life" to be tolerated.

Valid values range: 1 ... 255

NOTICE	
	Writing the parameter is only possible when the Master lifesign is disabled.

Parameter 964: Drive unit identification

This parameter allows reading a data set for encoder identification.

Parameter	Meaning
964[0]	Manufacturer ID
964[1]	Drive Unit Type (manufacturer-specific)
964[2]	Firmware version e. g. 0x0064 = 100 corresponds to V1.00
964[3]	Firmware year e. g. 0x07E4 = 2020
964[4]	Firmware day and month e. g. 0x0067 = 103 corresponds to 1.03
964[5]	Number of Drive Objects

Parameter 965: Profile identification number

This parameter reads the PROFILE ID of the encoder profile and its parameterized version.

Parameter	Meaning
965[0]	Profile ID: 0x3D abbreviated
965[1]	0x1F = 31 = V3.1 0x2A = 42 = V4.2

Parameter 971: Transfer to non-volatile memory

This parameter allows storing the current parameters set (configuration) in the non-volatile memory.

Parameter value	Meaning
0	Default, no effect
1	Storing the current parameters set n the non-volatile memory

Parameter 972: Reset Encoder device

This parameter allows restarting the non-safe application.

Parameter value	Meaning
0	Default, no effect
1	Restart of the non-safe application

Parameter 974: Base mode parameter access service identification

This parameter reads three features of the parameter channel:

- Max. data length
- Multi-parameter access ability.
- Max. processing time for an access as an indication for a customer-side timeout.

Parameter	Meaning
974[0]	Max. data length (240 bytes = 0x00F0)
974[1]	Max. number of parameter requests per multi-parameter request
974[2]	Max. access processing time

Parameter 975: DO identification

This parameter reads the following information in the encoder:

Parameter	Meaning
975[0]	Manufacturer ID
975[1]	Drive Unit type (manufacturer-specific - F58 = 0x2190)
975[2]	Firmware version e. g. 0x0064 = 100 corresponds to V1.00
975[3]	Firmware year e. g. 0x07E4 = 2020
975[4]	Firmware day and month e. g. 0x0067 = 103 corresponds to 1.03
975[5]	PROFIdrive Type Class
975[6]	PROFIdrive DO Subclass 1
975[7]	Drive Object ID

Parameter 979: Sensor format

This parameter reads the set user parameters of the encoder.

Parameter	Meaning
979[0]	Header Info
979[1]	1st Sensor (G1) Type (**)
979[2]	Sensor Resolution
979[3]	Shift Factor for G1_XIST1
979[4]	Shift factor for absolute value in G1_XIST2
979[5]	Determinable Revolutions
979[6]	reserved
979[7]	reserved
979[8]	reserved
979[9]	reserved
979[10]	reserved

Parameter 980: Number list of defined parameter

This parameter reads all supported parameter numbers.

Parameter	Meaning
980[0]	922
980[1]	925
980[2]	964
980[3]	965
980[4]	971
980[5]	972
980[6]	974
980[7]	975
980[8]	979
980[9]	1002
980[10]	1003
980[11]	60000
980[12]	60001
980[13]	60022
980[14]	60023
980[15]	60024
980[16]	60025
980[17]	65000
980[18]	65001
980[19]	65002
980[20]	65004
980[21]	65005
980[22]	65006
980[23]	65007
980[24]	65008
980[25]	65009
980[26]	65100
980[27]	0 = End Mark

5.4.4.2 Encoder Parameters

The encoder features the following setting options/parameters:

Parameter number	Meaning	Data type	Effective	Permission
1002	Upload Counter	UINT32	-	R
1003	F_Dest_Add	UINT16	-	R
60000	N2/N4 velocity reference value	Float32	Reset	R/W
60001	Velocity value normalization	UINT16	Reset	R/W
60 022	Safety Telegram Number	UINT16	-	R
60023	Safe Speed Value Normalisation	UINT16	-	R
60024	Safety Setpoint Telegram	Array[n] UINT8	-	R
60025	Safety Actual Value Telegram	Array[n] UINT8	-	R
65000	Preset value	INT32	Immediately	R/W
65001	Operating status	Array[n] UINT32	-	R
65002	Preset value 64 bits	INT64	Immediately	R/W
65003	Reserved			
65004	Function control	UINT32	Reset	R/W
65005	Parameter control	UINT16	Reset	R/W
65006	Measuring units per revolution (MUR)	UINT32	Reset	R/W
65007	Total measuring range in measuring units (TMR)	UINT32	Reset	R/W
65008	Measuring units per revolution (MUR) 64 bit	UINT64	Reset	R/W
65009	Total measuring range in measuring units (TMR) 64 bit	UINT64	Reset	R/W
65100	Operating status	Array[n] UINT32	-	R

Parameter 1002: Upload Counter

Is incremented at every configuration. Read-only parameter.

Parameter 1003: F_Dest_Addr

Returns the biunique F_Dest_Addr set. Only for request.

Parameter 60000: N2/N4 velocity reference value

The velocity reference value returns the 100% value of the N2/N4 ratio and is to be understood as a percentage. N2/N4 thus indicates the ratio of NIST to NSOLL. It is always displayed with relation to the values NIST_A and NIST_B. NIST_A is the velocity in 16 bits length, NIST_B is the velocity in 32 bits.

Parameter 60001: Velocity value normalization

This parameter defines the unit of the actual velocity values. The unit relates to the values NIST_A and NIST_B

Velocity unit	Value
Steps/s	0
Steps/100ms	1
Steps/10ms	2
RPM	3
N2/N4 normalized	4

Parameter 60 022: Telegram selection

This parameter allows reading the parameterized telegram type for Safety.

Parameter value	Telegram
36	PROFIdrive telegram 36 (BP)
65572	PROFIdrive telegram 36 (XP)
37	PROFIdrive telegram 37 (BP)
65573	PROFIdrive telegram 37 (XP)

Parameter 60 023: Safe Speed Value Normalisation

This parameter returns the unit configured for the safe velocity values currently transmitted in signal S_NIST16.

Parameter 60 024: Safety Setpoint Telegram

Represents the content of the safety telegram received in the last PROFIsafe cycle.

Parameter 60 025: Safety Actual Value Telegram

Represents the content of the safety telegram sent in the last PROFIsafe cycle.

Parameter 65001 [2]: Error

As a principle, errors are displayed in parameter 65001. They are in connection with the error codes displayed in G1_XIST2:

- 0x0001 Sensor/device error - Bits:

Bit	Definition	0	1
0	Position error (hardware and signal quality)	Position OK	Position error
5	Position error (frequency / speed exceeded)	Position OK	Position error
6	Invalid scaling	Scaling parameter OK	Error scaling parameter
12	Overspeed	Always set to 0	-
14	Preset failed (preset value outside of range)	Always set to 0	-
22	Memory error	No memory error	Memory error
24	Battery voltage	No battery error	Battery error

Parameter 65001 [4]: Warnings

Warnings are also displayed in parameter 65001 - but in subindex 4.

Bit	Definition	0	1
0	Position warning (hardware and signal quality)	Position OK	Position warning
5	Position warning (frequency / speed exceeded)	Position OK	Position warning
6	Invalid scaling	Scaling parameter OK	Warning scaling parameter
12	Overspeed	Always set to 0	-
14	Preset failed (preset value outside of range)	Always set to 0	-
22	Memory warning	No memory warning	Memory warning
24	Battery voltage	No battery warning	Battery warning

Parameter 65004: Function control

The setting of the Function control parameter enables or disables the functionality of the encoder according to the list below.

Bit	Definition	0	1
0	Code sequence	CW	CCW
1	Class 4 functionality	Disabled	Enabled
2	G1_XIST1 Preset control	Enabled	Disabled
3	Scaling function control	Disabled	Enabled
4	Alarm channel control	Disabled	Enabled
5	V3.1 compatibility mode	Unused	Unused
6	Encoder type	Rotary encoder	Linear encoder
7	Reserved		
28 … 31	Reserved		

Parameter 65005: Parameter control

The setting of the Parameter control parameter enables or disables the access to parameters and special device-related functions according to the list below.

Bit	Definition	0 (default)	1
0 … 1	Parameter initialization control	Parameter initialization from the PRM data set	Parameter initialization from the internal NV-RAM
2 … 4	Parameter write protection	Write all: All parameters of the BMP parameter channel can be read and written	Read only: Parameters of the BMP parameter channel can only be read
5	Parameter 65005 Write protection	Write all: Read and write access to P65005 and P971 via the BMP parameter channel	Read only: Only read access to P65005 and P971 via the BMP parameter channel
6	Protection Device reset control	Write all: Read and write access to P972 via the BMP parameter channel	Read only: Only read access to P972 via the BMP parameter channel

Parameter 65006: MUR

Defines the measuring steps per revolution for up to 32-bit values. The max. singleturn resolution of the device must be taken into consideration. Technical Data Sendix S58x8FS3

Parameter 65007: TMR

Defines the total resolution for up to 32-bit values. The max. resolution of the device must be taken into consideration. Technical Data Sendix S58x8FS3

Parameter 65008: MUR

Defines the measuring steps per revolution for up to 64-bit values. The max. singleturn resolution of the device must be taken into consideration. Technical Data Sendix S58x8FS3

Parameter 65009: TMR

Defines the measuring steps per revolution for up to 64-bit values. The max. resolution of the device must be taken into consideration. Technical Data Sendix S58x8FS3

Parameter 65100 [2]: Error

Bit	Definition	0	1
3	Safety Exception	Safety Functions OK	Safety Functions fault
4	Safety Parametrisation	Safety Functions OK	Safety Functions fault
9	PROFIsafe	No PROFIsafe fault	PROFIsafe fault
16	Undervoltage	No Undervoltage fault	Undervoltage fault

Parameter 65100 [4]: Warnings

Bit	Definition	0	1
12	Overspeed	No overspeed	Overspeed warning

5.5 Telegrams Description

5.5.1 Available Submodules / Telegrams

Depending on the encoder, different submodules are available to the user.

Submodule / Telegram	Sendix 58XX (Encoder Profile V4.1)	Sendix F58XX (Encoder Profile V4.2)	Number of input data words	Number of output data words
ManTel860	X		4	2
Speed	X		1	0
ST_POS	X		2	0
MT_POS	X		2	0
G1_STW	X		0	1
G1_ZSW	X		1	0
Universal module	X		16	8
StdTel81	X	X	6	2
StdTel82		X	7	2
StdTel83		X	8	2
StdTel84		X	10	2
StdTel86		X	4	2
StdTel88		X	6	4

NOTICE	**Respect the input and output data convention**
	The description of the input and output data is always based on the viewpoint of the controller (PLC). Input data is sent from the encoder to the controller. Output data is sent from the controller to the encoder.

NOTICE	**ManTel860** The content of ManTel860 of encoder 58XX corresponds to Std.Tel86 of encoder F58XX. See Submodule - ManTel860 (Encoder Profile V4.1) [▶ 61].

Depending on the module, input and output data is defined for the module, which is either transmitted or received and processed by the encoder. The overview describes the composition of the single telegrams with their content - indicated in data words.

Input data words

Submodule / Telegram	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
ManTel860 [▶ 61]	G1_XIST1		NIST_B													
Speed [▶ 63]	Speed															
ST_POS [▶ 63]	Singleturn position															
MT_POS [▶ 64]	Multiturn position															
G1_ZSW [▶ 65]	G1_ZSW															
Universal module [▶ 66]	ZSW2_ENC	G1_ZSW	G1_XIST1		G1_XIST2		ST_POS		MT_POS		Speed	G1_ZSW	G1_XIST1		NIST_B	
StdTel81 [▶ 68]	ZSW2_ENC	G1_ZSW	G1_XIST1		G1_XIST2											
StdTel82 [▶ 68]	ZSW2_ENC	G1_ZSW	G1_XIST1		G1_XIST2		NIST_A									
StdTel83 [▶ 69]	ZSW2_ENC	G1_ZSW	G1_XIST1		G1_XIST2		NIST_B									

StdTel84 [▶ 70]	ZSW2_ ENC	G1_Z SW	G1_XIST3				G1_XIST2		NIST_B							
StdTel86 [▶ 70]	G1_XIST1			NIST_B												
StdTel88 [▶ 71]	G1_XIST3					NIST_B										

Output data words

Submodule / Telegram	0	1	2	3	4
ManTel860	G1_XIST_PRESET_B				
G1_STW	G1_STW				
Universal module	STW2_ENC	G1_STW	G1_STW	G1_XIST_PRESET_B	
StdTel81	STW2_ENC	G1_STW			
StdTel82	STW2_ENC	G1_STW			
StdTel83	STW2_ENC	G1_STW			
StdTel84	STW2_ENC	G1_STW			
StdTel86	G1_XIST_PRESET_B				
StdTel88	G1_XIST_PRESET_C				

The exact structure of the telegrams can be found in the respective descriptions. See Telegrams Description [▶ 57].

5.5.2 Submodule - ManTel860 (Encoder Profile V4.1)

The Manufacturer Telegram 860 is a very simple manufacturer-defined data format that can be used for many applications. It allows direct setting of the preset value via the cyclic output data.

NOTICE	**Compatibility with StdTel86**
	The content of ManTel860 corresponds 1:1 to that of StdTel86. Thus position = G1_XIST1 and speed = NIST_B. Likewise, PRESET = G1_XIST_PRESET_B.

Structure

Index (byte)	0…3	4…7
Input	Position Actual position	Velocity Actual speed or Actual rotational speed
Output	Preset value Preset position and trigger bit	

Input data

	Position UINT 32				Speed SINT 32			
IO data (word)	0		1		2		3	
IO data (byte)	0	1	2	3	4	5	6	7
Sequence	MSB			LSB	MSB			LSB

Example

00 00 12 34 00 00 05 CD

→ Position = 0x1234 = 4660dec

→ Speed = 0x05CDh = +1485dec (position increases)

00 00 12 34 FF FF FA 33

→ Position = 0x1234h = 4660dec

→ Speed = 0xFFFFFA33 = -1485dec (position decreases)

Output data

	Preset UINT 32	
IO data (word)	0	1
IO data (byte)	Bit 31	Bit 30 … Bit 0
Sequence	MSB	LSB

Example

80 00 12 34

→ Preset to position = 1234h = 4660dec

5.5.3 Submodule - StdTel81 (Encoder Profile V4.1)

Standard data format according to Encoder Profile V4.1.

Structure

Index (byte)	0…1	2…3	4…7	8…11
Input	ZSW2_ENC Encoder status word	G1_ZSW Sensor status word	G1_XIST1 Actual position 1	G1_XIST2 Actual position 2
Output	STW2_ENC Encoder control word	G1_STW Sensor control word		

Input data

	ZSW2_ENC		G1_ZSW		G1_XIST1				G1_XIST2			
IO data (word)	0		1		2		3		4		5	
IO data (byte)	0	1	2	3	4	5	6	7	8	9	10	11
Sequence	MSB	LSB	MSB	LSB	MSB			LSB	MSB			LSB

Examples

F2 00 20 00 00 00 12 34 00 00 12 34

→ Position (valid) = 1234hex = 4660dec

F2 00 30 00 00 00 12 34 00 00 12 34

→ Position (valid) = 1234hex = 4660dec

→ Preset performed

F2 08 80 00 00 00 12 34 00 00 00 20

→ Position (invalid) = 1234hex = 4660dec

→ Error = 0020hex (memory error)

Output data

	STW2_ENC		G1_STW	
IO data (word)	0		1	
IO data (byte)	0	1	2	3
Sequence	MSB	LSB	MSB	LSB

NOTICE	**Preset Value**
	Unlike ManTel860, the preset value is transmitted cyclically with StdTel81. For the value itself, this means that it is not transmitted in the submodule, but that it uses a variable. This variable has the designation 0xB02E and it can be defined in the general settings of the submodule. See Telegram - Base Mode Parameter Access.

Examples

F4 00 20 00 → Normal case (request only position data).

F4 00 30 00 → Trigger absolute preset (to the parameterized preset position).

5.5.4 Submodule - Speed (Encoder Profile V4.1)

Structure

Index (byte)	0…1
Input	Velocity

Input data

	Velocity	
IO data (word)	0	
IO data (byte)	0	1
Sequence	MSB	LSB

5.5.5 Submodule - ST_POS (Encoder Profile V4.1)

Structure

Index (byte)	0…3
Input	Singleturn position

Input data

Singleturn position				
IO data (word)	0		1	
IO data (byte)	0	1	2	3
Sequence	MSB			LSB

Example

Position = 3456hex, MUR = 1000hex, TMR = 4000hex

→ Singleturn position (hex): 00 00 04 56

5.5.6 Submodule - MT_POS (Encoder Profile V4.1)

Structure

Index (byte)	0…3
Input	Multiturn position

Input data

Multiturn position				
IO data (word)	0		1	
IO data (byte)	0	1	2	3
Sequence	MSB			LSB

Example

Position = 3456hex, MUR=1000hex, TMR=4000hex

→ Multiturn position (hex): 00 00 00 03

5.5.7 Submodule - G1_STW (Encoder Profile V4.1)

Structure

Index (byte)	0…1
Output	Encoder control word

Output data

	G1_STW	
IO data (word)	0	
IO data (byte)	0	1
Sequence	MSB	LSB
Meaning	The control word determines the functionality of important encoder functions. Is not used. → Set both bytes to 0	

5.5.8 Submodule - G1_ZSW (Encoder Profile V4.1)

Structure

Index (byte)	0…1
Input	Encoder status word

Input data

	G1_ZSW	
IO data (word)	0	
IO data (byte)	0	1
Sequence	MSB	LSB
Meaning	The status word determines encoder statuses, confirmations and error messages of important encoder functions. Bit 15…12: "Encoder sign-of-life" = 1…15, 1…15, "Sign of life" of the encoder. Changes with every PN send clock signal (1 ms) Bit 9: "Control Requested" = 1 Switches permanently to 1 after PN link setup. Bit 3: "Fault Present" = 0/1 Switches to 1 if a hardware error is detected	

5.5.9 Submodule - Universal module

Structure

The "universal module "contains all defined submodules for encoder 58X8.

IO Data (word)	**0**	**1**	**2…3**	**4…5**	**6…7**	**8…9**	**10**	**11**	**12…13**	**14...15**
IO Data (byte)	**0…1**	**2…3**	**4…7**	**8…11**	**12…15**	**16…19**	**20…21**	**22…23**	**24…27**	**28…31**
Input	ZSW2_ENC Encoder status word	G1_ZSW Sensor status word	G1_XIST1 Actual position 1	G1_XIST2 Actual position 2	ST-position	MT-position	Speed	G1_ZSW	Position Actual position	Velocity Actual speed or Actual rotational speed

IO Data (word)	**0**	**1**	**2**	**3…4**
IO Data (byte)	**0…1**	**2…3**	**4…5**	**6…9**
Output	STW2_ENC Encoder control word	G1_STW Sensor control word	G1_STW Sensor control word	Preset value Preset position and trigger bit

This way, the various data formats of the single submodules can be used in parallel. Using the "Universal module" also allows combining "ManTel860" and "StdTel81".

IMG-ID: 184764299

NOTICE	**Preset operation**
	The preset operation cannot be triggered simultaneously with "ManTel860" and "StdTel81".
	With "ManTel860“, the preset position is transferred directly in the cyclic output data, while with "StdTel81“, the parameterized or acyclically transferred preset position is used.

5.5.10 Submodule - StdTel81 (Encoder Profile V4.2)

Standard data format according to Encoder Profile V4.2

Structure

Index (byte)	0…1	2…3	4…7	8…11
Input	ZSW2_ENC Encoder status word	G1_ZSW Sensor status word	G1_XIST1 Actual position 1	G1_XIST2 Actual position 2
Output	STW2_ENC Encoder control word	G1_STW Sensor control word		

Input data

IO Data (word)	0		1		2		3		4		5	
IO Data (byte)	0	1	2	3	4	5	6	7	8	9	10	11
Setpoint	ZSW2_ENC		G1_ZSW		G1_XIST1				G1_XIST2			

Output data

IO Data (word)	0		1	
IO Data (byte)	0	1	2	3
Setpoint	STW2_ENC		G1_STW	

NOTICE	**Preset value**
	Unlike StdTel86, the preset value is transmitted cyclically with StdTel81. For the value itself, this means that it is not transmitted in the submodule or in the telegram, but that it uses a variable. This variable has the designation 0xB02E and it can be defined in the general settings of the submodule. See Telegram - Base Mode Parameter Access.

5.5.11 Submodule - StdTel82 (Encoder Profile V4.2)

Standard data format according to Encoder Profile V4.2.

Structure

Index (byte)	0…1	2…3	4…7	8…11	12…13
Input	ZSW2_ENC Encoder status word	G1_ZSW Sensor status word	G1_XIST1 Actual position 1	G1_XIST2 Actual position 2	NIST_A Speed
Output	STW2_ENC Encoder control word	G1_STW Sensor control word			

Input data

IO data (word)	0		1		2		3		4		5		6	
IO data (byte)	0	1	2	3	4	5	6	7	8	9	10	11	12	13
Set point	ZSW2_ENC		G1_ZSW		G1_XIST1				G1_XIST2				NIST_A	

Output data

IO data (word)	0		1	
IO data (byte)	0	1	2	3
Set point	STW2_ENC		G1_STW	

5.5.12 Submodule - StdTel83 (Encoder Profile V4.2)

Standard data format according to Encoder Profile V4.2.

Structure

Index (byte)	0…1	2…3	4…7	8…11	12…15
Input	ZSW2_ENC Encoder status word	G1_ZSW Sensor status word	G1_XIST1 Actual position 1	G1_XIST2 Actual position 2	NIST_B Speed
Output	STW2_ENC Encoder control word	G1_STW Sensor control word			

Input data

IO data (word)	0		1		2		3		4		5		6		7	
IO data (byte)	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Set point	ZSW2_ENC		G1_ZSW		G1_XIST1				G1_XIST2				NIST_B			

Output data

IO data (word)	0		1	
IO data (byte)	0	1	2	3
Set point	STW2_ENC		G1_STW	

5.5.13 Submodule - StdTel84 (Encoder Profile V4.2)

Standard data format according to Encoder Profile V4.2.

Structure

Index (byte)	0…1	2…3	4…11	12…15	16…19
Input	ZSW2_ENC Encoder status word	G1_ZSW Sensor status word	G1_XIST3 Actual position 1	G1_XIST2 Actual position 2	NIST_B Speed
Output	STW2_ENC Encoder control word	G1_STW Sensor control word			

Input data

IO data (word)	0		1		2		3		4		5		6		7		8		9	
IO data (byte)	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Set point	ZSW2_ENC		G1_ZSW		G1_XIST3								G1_XIST2				NIST_B			

Output data

IO data (word)	0		1	
IO data (byte)	0	1	2	3
Set point	STW2_ENC		G1_STW	

5.5.14 Submodule - StdTel86 (Encoder Profile V4.2)

Standard data format according to Encoder Profile V4.2.

Structure

Index (byte)	0…3	4…7
Input	G1_XIST1 Actual position 1	NIST_B Speed
Output	G1_XIST_PRESET_B	

Input data

IO data (word)	0		1		2		3	
IO data (byte)	0	1	2	3	4	5	6	7
Set point	G1_XIST1				NIST_B			

Output data

IO data (word)	0		1	
IO data (byte)	0	1	2	3
Set point	G1_XIST_PRESET_B			

5.5.15 Submodule - StdTel88 (Encoder Profile V4.2)

Standard data format according to Encoder Profile V4.2.

Structure

Index (byte)	**0…7**	**8…11**
Input	G1_XIST3 Actual position 1	NIST_B Speed
Output	G1_XIST_PRESET_C	

Input data

IO data (word)	0		1		2		3		4		5	
IO data (byte)	0	1	2	3	4	5	6	7	8	9	10	11
Set point	G1_XIST3								NIST_B			

Output data

IO data (word)	0		1		2		3	
IO data (byte)	0	1	2	3	4	5	6	7
Set point	G1_XIST_PRESET_C							

5.5.16 Telegram data

Input data

All devices with Encoder Profile V4.1 – Sendix 58xx use the following input data:

Data	Data type	Description	Bit	Value	Meaning	Explanation
POSITION UINT 32	UINT32	Current encoder position	0 … 31			(unsigned) Value range = 0…("TMR"-1) "MUR" positions per revolution
Speed SINT 32	SINT 32	Current encoder speed	0 … 31			signed Unit according to parameter "Velocity Measuring Unit"
ZSW2_ENC	UINT64	Status word 2 Encoder	0 … 2	0		
			3		Fault Present	0/1 Switches to 1 if a hardware error is detected
			4 … 8	0		
			9	0		
				1	Control Requested	Switches permanently to 1 after PN link set-up
			10 … 11	0		
			12 … 15		Encoder Sign-Of-Life	Bit 15 … 12: „= 1…15, 1…15, … "Sign of life" of the encoder. Changes with every PN send clock signal (1 ms)
G1_ZSW	UINT 16	Sensor 1 status word	0 … 10	0		

Data	Data type	Description	Bit	Value	Meaning	Explanation
			11		Requirement Of Error Ack. Detected	Is set to 1 when an error is present and an attempt is made to reset it with bit 15 of G1_STW (there are no resettable errors at the moment)
			12		Set/Shift Of Home Position Executed	Is set to 1 after completion of a preset operation until the corresponding bit in G1_STW is erased again.
			13		Transmit Absolute Value Cyclically	Set to 1 when a valid position is present in G1_XIST2 (→ bit 15 = 0)
			14		Parking Sensor Active	Switches to 1 when the corresponding bit in G1_STW is set. In this case, the reported position is fixed.
			15		Sensor Error	Switches to 1 is a hardware error is detected. G1_XIST2 then contains the error code (→ bit 13 = 0).
G1_XIST1	UINT 32	Current encoder position	0 … 31			Value range = 0…("TMR"-1) "MUR" positions per revolution Possibly without considering the last preset operation (according to parameter "G1_XIST1 Preset Control")
G1_XIST2	UINT 32	Current encoder position	0 … 31			Current encoder position (as G1_XIST1, but always considering the last preset operation) or error code (if G1_ZSW, Bit 15 = 1): 0001_h = position error (e. g. sensor IC defective) 0020_h = memory error (FLASH or RAM defective)

Data	Data type	Description	Bit	Value	Meaning	Explanation
						1002_h = parameterizing error (BF00 tel. missing or invalid)
Speed	SINT 16	Current encoder speed	0 … 15		Current encoder speed	Signed - Limitation to +32767 and -32768 - Unit according to parameter "Velocity Measuring Unit"
ST_POS	UINT 16	Singleturn position	0 … 16		Current singleturn position:	Position within a revolution Values range = 0…(MUR-1)
MT_POS	UINT 32	Multiturn position	0 … 32		Current multiturn position	Revolution counter Values range = 0…((TMR/MUR)-1)

All devices as from Encoder Profile V4.2 – Sendix F58xx use the following input data:

Data	Data type	Description	Bit	Value	Meaning	Explanation
G1_XIST1	UINT32	Sensor 1 Position value 1	0 … 31		Position value 32 bits	Current absolute position value with max. 32 bits. Is affected by scaling and preset. The use of the preset can be disabled by "Disable G1_XIST1 Preset Control". By default, only G1_XIST1 is active and displays the scaled position which is set by TMR+MUR.
G1_XIST2	UINT32	Sensor 1 Position value 2	0 … 31		Position value 32 bits	Current absolute position value with max. 32 bits. Is affected by scaling and preset. G1_XIST2 can be enabled by bit 13 of STW2_ENC. G1_XIST2 then displays the same position as G1_XIST1. In the event of an error, the following error codes are output: 0x0001 Sensor/device error

Data	Data type	Description	Bit	Value	Meaning	Explanation
						0x0F01 Syntax error 0x0F02 Master Sign of Life error 0x0F04 Sync error For the exact description of the errors, see Encoder Parameters [▶ 53].
G1_XIST3	UINT64	Sensor 1 Position value 3	0 … 63		Position value 64 bits	Current absolute position value with max. 64 bits.
NIST_A	UINT16	Current speed 16 bits	0 … 14		Speed	Current speed value max. ± 15 bits
			15		Sign	0 = + / 1 = -
NIST_B	UINT16	Current speed 32 bits	0 … 30		Speed	Current speed value max. ± 31 bits
			31		Sign	0 = + / 1 = -
G1_ZSW	UINT64	Sensor 1 status word	0 … 10	0		
			11		Requirement Of Error Acknowledgment Detected	Is set to 1 if an error occurs. Other causes Controller sets or erases Sensor Error Acknowledge with bit 15 of G1_STW. Sensor error G1_ZSW bit 15 present and error code in G1_XIST2. Controller erases G1_ZSW Bit 15. G1_XIST2 contains again a position value.
			12		Set/Shift Of Home Position Executed	The encoder sets this bit to 1 after completion of a preset operation until the corresponding bit in G1_STW is erased again by the controller.

Data	Data type	Description	Bit	Value	Meaning	Explanation
			13		Transmit Absolute Value Cyclically	Set to 1 when a valid position is present in G1_XIST2. Is 0 when G1_ZSW bit 14 / bit 15 = 1
			14		Parking Sensor Active	Switches to 1 as soon as G1_STW bit 14 is set. In this case, the reported position is fixed.
			15		Sensor Error	Switches to 1 is a hardware error is detected. G1_XIST2 then contains the error code G1_ZSW bit 13 is set to 0. This error bit must be acknowledged via G1_STW bit 15 in order to set G1_ZSW bit 15 to 0. Condition: the error has been corrected.
ZSW2_ENC	UINT16	Status word 2 Encoder	0	0	Idle	The offset value of the latest preset operation is saved. The encoder is ready for a new preset operation.
				1	Preset confirmation	The previously defined preset value has been set as the new actual position value. This is confirmed with the change of the bit from 0 → 1. The value has been saved internally.
			1	0	G1_XISTx invalid	The position value in G1_XIST x is invalid
				1	G1_XISTx valid	The position value in G1_XIST x is valid
			2	0	G1_NISTx invalid	The speed value in G1_NIST x is invalid
				1	G1_NISTx valid	The speed value in G1_NIST x is valid
			3	0	No error present	The encoder detected no error.
				1	Error present	The encoder detected one or several errors.
			4 … 6			Reserved
			7	0	No warnings present	The encoder issued no warning message.

Data	Data type	Description	Bit	Value	Meaning	Explanation
				1	Warnings present	Warning messages are present in the encoder.
			8	0		Reserved
			9	0		No connection with the PLC.
				1		Connection has been established with the PLC.
			10.11			Reserved
			12 … 15	0 … 15	Encoder Sign-of-Life	Sign-of-life of the encoder As soon as the controller sends the master sign-of-life (M-LS), the encoder starts to send its own sign-of-life. This is a signal incremented bit by bit with the values 0 … 15 The start value is 0.

Output data

All devices with Encoder Profile V4.1 – Sendix 58xx use the following output data:

Data	Data type	Description	Bit	Value	Meaning	Explanation
PRESET UINT 32	UINT32	Preset ManTel860	0 … 27		Preset position (unsigned)	Position after conclusion of the preset operation carried out during standstill. Values range = 0…("TMR"-1) Limited to ("TMR-1") if range is exceeded.
			28 … 30	0		
			31		Preset control / Trigger bit:	Switching from 0 to 1 triggers a preset operation (duration up to 40 ms). Position is not updated during this period of time **(→ to be carried only during standstill)**.

Data	Data type	Description	Bit	Value	Meaning	Explanation
						The new calculated offset value is saved in a non-volatile memory. The trigger bit must then immediately be reset to 0 (in order to prevent any accidental triggering in the case a PROFINET link interruption occurs in the meantime). **Caution: Only to be activated if necessary ("wear" of the non-volatile memory).**
G1_STW	UINT16	Sensor 1 control word	0 … 10	0		
			11	0	Home Position Mode	Absolute preset (new position = preset value)
				1		Relative preset (new position = old position + preset value)
			12		Request Set/Shift Of Home Position	Switching from 0 to 1 triggers a preset operation (duration up to 40 ms). Position is not updated during this period of time (→ to be carried only during standstill!) The new calculated offset value is saved in a non-volatile memory. This bit must then immediately be reset to 0 (in order to prevent any accidental triggering in the case a PROFINET link interruption occurs in the meantime). **Caution: Only to be activated if necessary ("wear" of the non-volatile memory).**
			13		Request Absolute value Cyclically	Is currently ignored, but should be set to 1 (for future compatibility).
			14	0	Activate Parking Sensor	

Data	Data type	Description	Bit	Value	Meaning	Explanation
				1		Fixes the reported position
			15	0	Acknowledge Sensor Error	There are no resettable errors at the moment.
STW2_ENC	UINT16	Control word 2 Encoder	0 … 9	0		
			10			Bit 10: "Control By PLC" = 1 Must be set permanently to 1 after set-up of the link (otherwise G1_STW will not be evaluated).
			11	0		
			12 … 15		Controller Sign-of-Life	1…15 Is currently ignored, but should change constantly (e.g. incrementing from 1 ... 15) (for future compatibility).

All devices as from Encoder Profile V4.2 – Sendix F58 use the following output data:

Data	Data type	Description	Bit	Value	Meaning	Explanation
G1_STW	UINT32	Sensor 1 control word	0 … 7		Reserved	
			8 … 10		Reserved	
			11	0	Home Position Mode	Absolute preset (new position = preset value)
				1		Relative preset (new position = old position + preset value)
			12	0	Request Set/Shift Of Home Position	Initial state.
				1		Switching from 0 to 1 triggers a preset operation

Data	Data type	Description	Bit	Value	Meaning	Explanation
			13	0	Request Absolute value Cyclically	Disabled. G1_XIST2 is not transmitted.
				1		Enabled. G1_XIST2 is transmitted.
			14	0	Activate Parking Sensor	Disabled
				1		The control sets the encoder inactive ("park"). In this case, bit 14 in G1-ZSW is set to value 1. The current position data is frozen. No new errors are issued.
			15	0	Acknowledge Sensor Error	Sensor error transmission disabled.
				1		Sensor error transmission enabled.
STW2_ENC	UINT16	Control word 2 Encoder	0	0	Idle	Before this bit is set, it must have been set to "0" by the PLC.
				1	Trigger preset	Changing this bit from 0 → 1 sets the preset value of G1_XIST_PRESET_x as new actual position value. The actual position value is corrected by a calculated offset value. The offset is saved internally, with confirmation by ZSW2_ENC.bit0.
			1 … 6			Reserved
			7	0	No meaning	
				1	Error confirmation	Current errors in the error memory are confirmed with a change of the bit from 0 → 1.
			8, 9			Reserved

Data	Data type	Description	Bit	Value	Meaning	Explanation
			10	0	No control by the PLC.	Data is not valid, excepted the sign-of-life. G1_XIST2 is disabled.
				1	Control by the PLC.	Control via the interface, I/O data is valid.
			11			Reserved
			12 … 15	0 … 15	Master Sign-of-Life	Is only required if the isochronous mode is enabled. The encoder expects a bit by bit incrementation of bits 12 … 15. As soon as the M-LS contains a value different from 0, the encoder starts issuing the encoder LS. As soon as a deviation is detected in the M-LS with respect to the expected count sequence, the errors counter is incremented and, if necessary, error 0x0F02 is issued in G1_XIST2.
G1-XIST_PRESET_B	UINT32	Encoder control word 31 bits with trigger bit	0 … 30		Preset value	Preset value (31 bits) to which G1_XIST1 is to be set.
			31		Perform preset	Perform the preset operation as soon as bit 31 increases from 0 to 1.
G1-XIST_PRESET_C	UINT64	Encoder control word 63 bits with trigger bit	0 … 62		Preset value	Preset value (63 bits) to which G1_XIST3 is to be set.
			63		Perform preset	Perform the preset operation as soon as bit 63 increases from 0 to 1.

5.6 Features Description

5.6.1 Firmware update and reset

The device can be updated and reset by means of a web server. To this purpose, a browser is used to access to the respective IP address of the device.

The exact performance of the FW update can take place on request: Contact [▶ 113].

NOTICE	Web access possibilities The PROFINET communication must be disabled to allow access to the web server of the device, since this communication only takes place via TCP/IP. The condition is that the device has a valid IP address.

There are mainly two ways to establish a web access to the device.

1. Direct connection of the IO supervisor / PC to the encoder
2. Deactivate PROFINET participants in the existing network

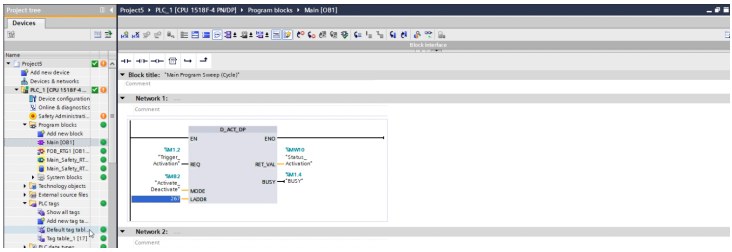
If you select the second option, e.g. because the direct connection of the device to the PC is not possible, the device must first be deactivated.

Deactivate the device in the active network

✓ Make sure that the PROFINET communication to the device operates without errors.

a) Implement the standard block “D_ACT_DP” in your process routine

b) Assign the required input and output parameters to the block. Details can be found in the block description.



IMG-ID: 306133259

c) Switch the status of the communication to “RUN”

d) Send the command that triggers the block and deactivates the device.

⇨ The device is deactivated. This is shown by a gray status symbol. The firmware update can now be carried out.

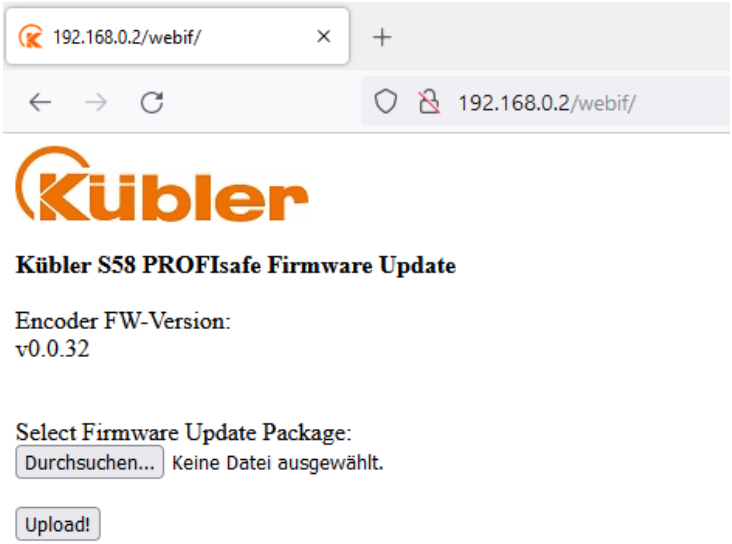
Call the web server and update the firmware

✓ Make sure that the device is connected (through the network) to the PC used for the project.

✓ Store the current firmware file in any folder chosen by you.

a) Input the IP address of the concerned device in your browser and confirm with Enter.

⇨ The FW versions currently installed on the device can be found in the representation of the web server.



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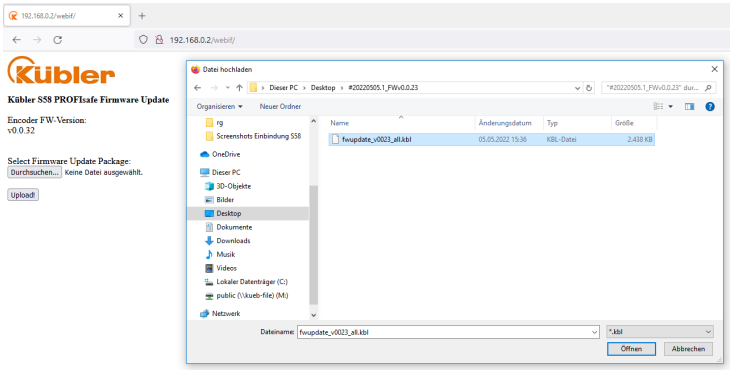
b) Click on “Upload” to upload the .kbl file.

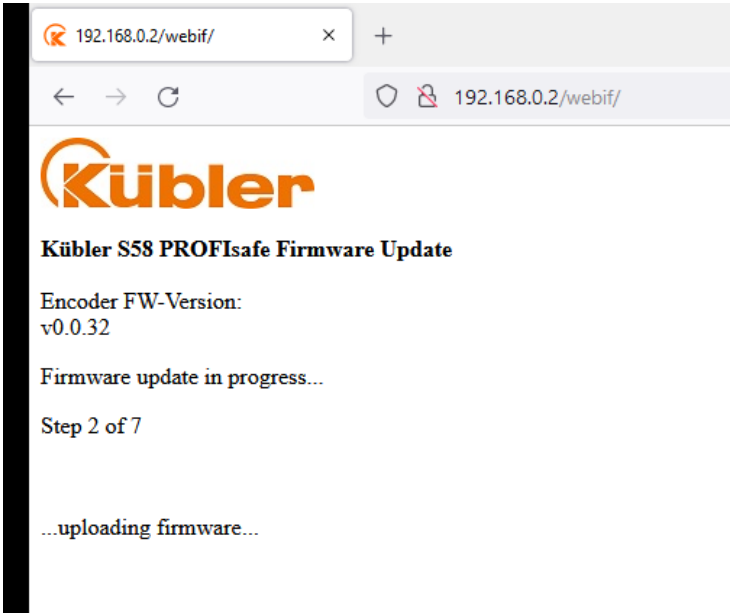


IMG-ID: 250032651

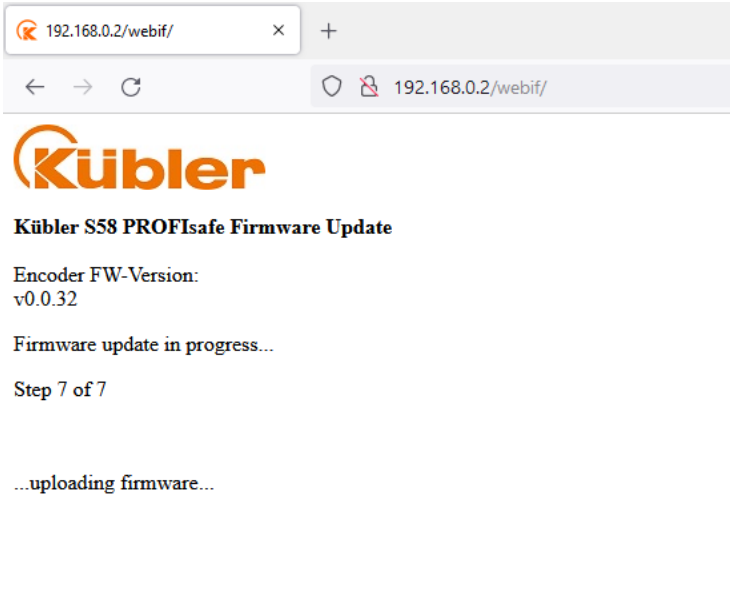
c) Now click on “Load” to transfer the firmware to the device. This operation can require some minutes.

⇨ The current update steps are displayed in the log line.

⇨ The log line indicates the completion of the FW transfer.



IMG-ID: 250050315



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Also refer to

Contact [▷ 113]

5.6.2 FSU - Fast Startup

NOTICE	Use of the feature
	The use of this feature is the same for the S58 and F58 series.

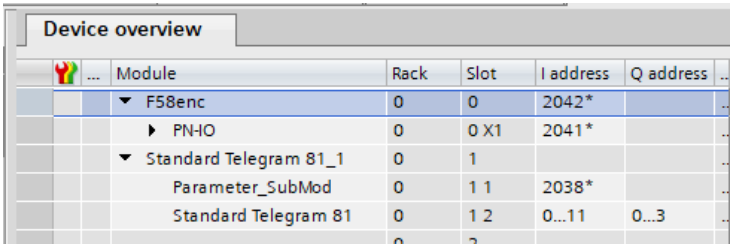
Using FSU allows achieving fast encoder startup. Usually, startup requires 6-7 seconds after applying the operating voltage. When FSU is enabled, the encoder is ready for operation already in approximately 2.5 seconds. This is indicated by the flashing LINK LED of the used port.

Proceed as follows to activate the FSU functionality:

✓ Make sure that you added the encoder to the topology.

a) Switch to Device overview.

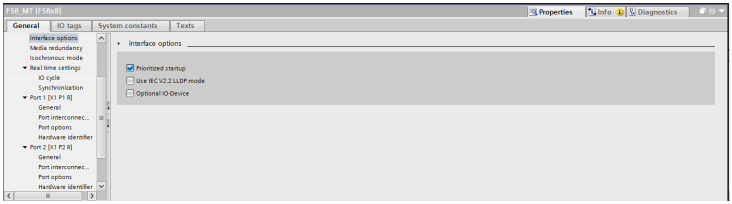
b) Click on the entry for Slot 0.



IMG-ID: 180407691

c) Switch to "Properties / General / Interface options".

d) Select "Prioritized startup" to be able to use the FSU functionality.



IMG-ID: 184432523

⇨ The encoder will start in FSU mode at the next startup.

5.6.3 LLDP - Link Layer Discovery Protocol

NOTICE	Use of the feature
	The use of this feature is the same for the S58 and F58 series.

LLDP is an initially manufacturer-independent layer 2 protocol. A device using LLDP sends in a cycle of a few seconds a message to its neighboring devices to identify itself and transmit network-related information.
This information relates to the device and its integration type in the respective topology (port description, IP address, device name, etc.).

As a standard, the LLDP function is always active, but it can be disabled. During startup in the network, all devices exchange this information. This allows recognizing/reconstructing directly the topology in an engineering tool. The main advantage is the simplified replacement of defective devices. A LLDP ALIAS name is automatically assigned to the new device. It can this way log on the network automatically, without using software.

NOTICE	**Conditions for device replacement without exchangeable medium – Plug&Play** To allow Plug&Play device replacement, it must be made sure that the new PROFINET device has no device name. This is the ex-factory delivery status. In addition, current controllers also allow overwriting existing device names. This must then be set by the controller. Likewise, smooth device replacement without additional parameterizing can only be guaranteed if the old PROFINET device has been projected with telegrams that are also supported in the new device. In the case of 58x8 – StdTel81 /86 or ManTel860. See Available Submodules / Telegrams [▶ 58].

Proceed as follows to allow easy device replacement without exchangeable medium:

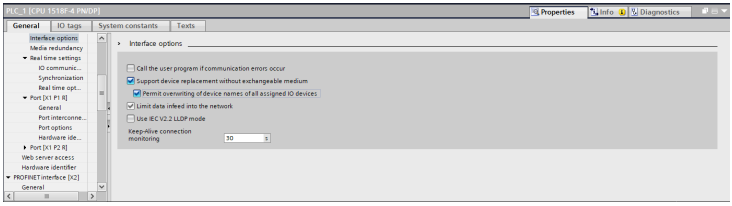
✓ Make sure that the old device was properly integrated and that the new device is accessible.

a) Select the control in the topology view.

b) Switch to "Properties / General / Interface options".

c) Make sure that item "Support device replacement without exchangeable medium" is checked.

⇨ As soon as a device is replaced in the topology with a device without device name, the latter is overwritten with the existing device name and is then ready for operation.



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✓ If the device already has a PROFINET device name, it can still be overwritten provided the controller supports this function.

d) For this purpose, select the option "Overwrite the device names of all assigned IO devices".

⇨ If devices are to be replaced in the existing topology, the device names are automatically overwritten.

5.6.4 MRP - Media Redundancy Protocol

NOTICE	Use of the feature
	The use of this feature is the same for the S58 and F58 series.

PROFINET offers the possibility of setting up a ring topology. The MRP allows conveying data to the controller using both directions of the logical ring. However, this only takes place in case of need (typically in the event of a cable break) – i. e. as soon as a transmission path stops operating, the second is opened. The changeover generally requires some milliseconds. The MRP is mostly used in connection with RT, but it can also be used with IRT.

Proceed as follows to activate the MRP functionality in the encoder:

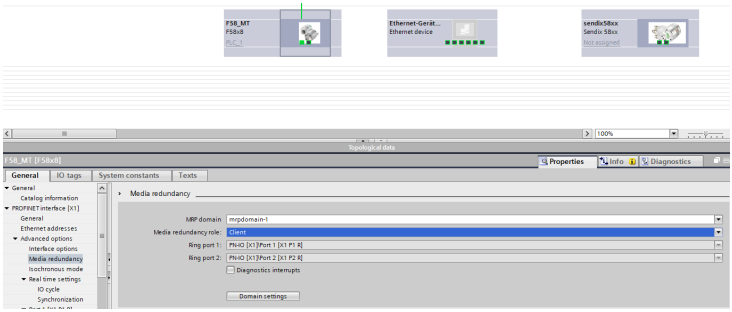
✓ Make sure that you added the encoder to the topology.

a) Switch to Device overview.

b) Switch to "Device settings / Properties / General".

c) Under Media redundancy, select the "Client" role to be able to use the MRP functionality.

⇨ The encoder now uses the MRP functionality.



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Proceed as follows to activate the MRP functionality in the controller:

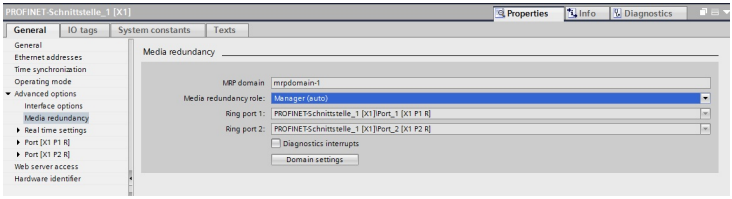
✓ Make sure that you added all participants to the topology.

d) Switch to the device overview of the controller.

e) Switch to "Device settings / Properties / General".

f) Under Media redundancy, select the "Master (auto)" role to be able to use the MRP functionality.

⇨ The whole network now uses the MRP functionality.



IMG-ID: 179750923

NOTICE	**Creation of a logical ring** To create a logical ring, all devices must be in the same subnet, i. e. the 3 first octets of the IP address must be identical everywhere. Since this also concerns the PC used to parameterize the controller, and since the controller generally has only 2 ring ports, the use of a switch is recommended.

5.6.5 Isochronous Mode IRT

NOTICE	**Use of the feature** The use of this feature is the same for the S58 and F58 series.

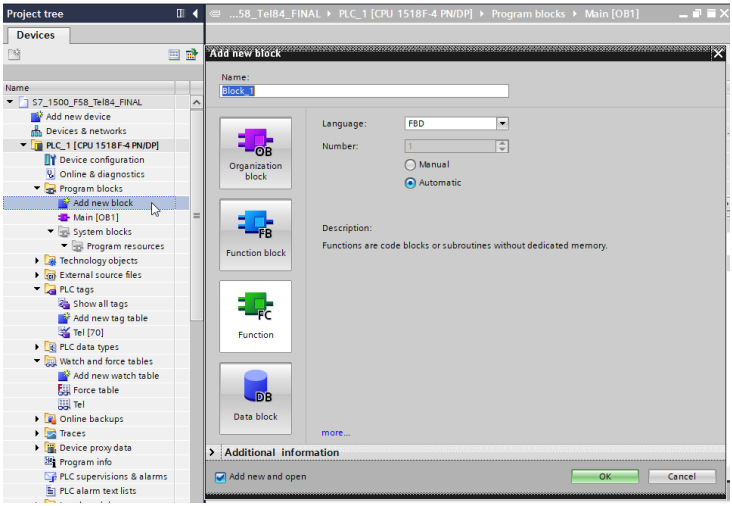
If the smallest IRT cycle times of the concerned application are not sufficient, such as e. g. in a Motion Control control loop, the isochronous mode can be enabled in addition. This mode ensures that data is deterministic at any time. This means that data is strictly sequenced and follows a specified clock cycle imposed by the controller. The minimum clock cycle is 250 µs (PROFINET device) or 500 µs (PROFisafe device – non-safe value). The cycle time can be any multiple of the minimum cycle time. All transmission times for all network participants are calculated in advance. Collisions and latencies due to jitter are excluded by network-side prioritization mechanisms. This allows e.g. assigning the position value obtained by the sensor to an exact moment (+/- 1 µs) at which it was measured.

Proceed as follows to activate the Isochronous Mode of the controller:

✓ Make sure that the controller has been integrated in the topology and parameterized properly.

a) Navigate to the Project tree and select "Add new block".

⇨ The "Add new block" window opens.



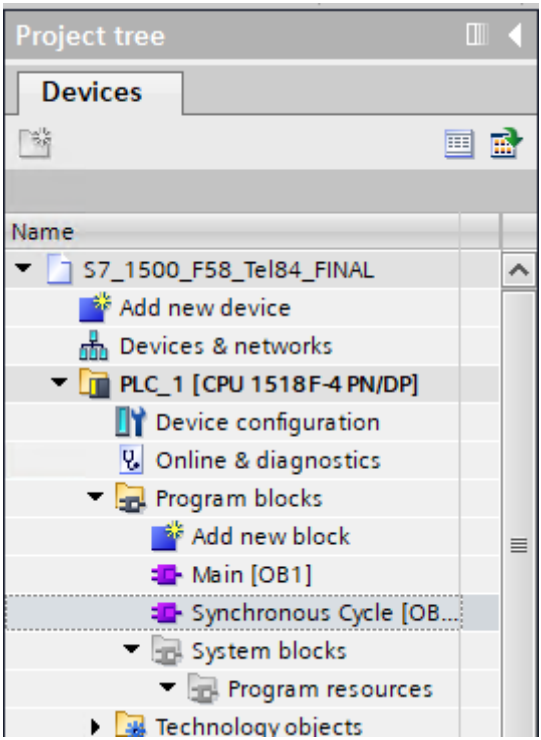
IMG-ID: 185405323

b) Click on "Organization block" and select the "Synchronous Cycle" block.

c) Confirm with "OK".

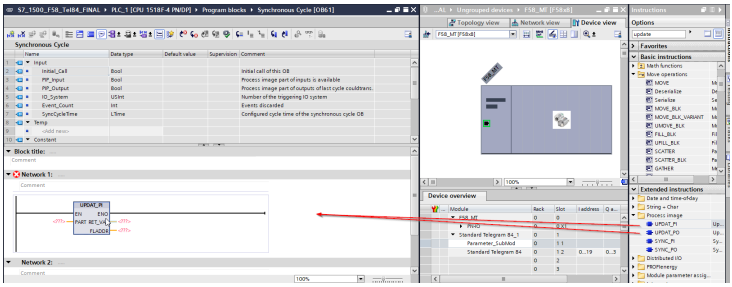
⇨ The block is added to the topology.

d) Open the newly added "Synchronous Cycle" block.



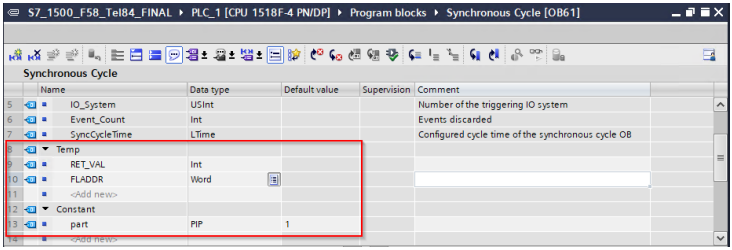
IMG-ID: 185406987

e) Now the functions UPDATE_PI and UPDATE_PO must be added. Drag them on the instructions topology into the block.



IMG-ID: 185408651

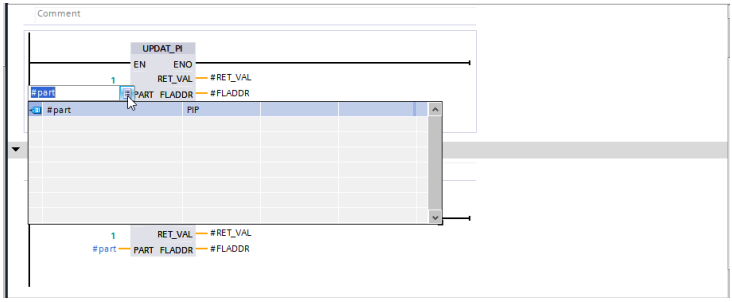
f) The functions consist of one input and two output parameters. Create them according to your data types in the data of the organization block.



IMG-ID: 185426187

g) Make sure that the default value of variable part is = 1. This determines the partition of the process image that is to be updated.

h) Assign these variables to the two functions.



IMG-ID: 185428619

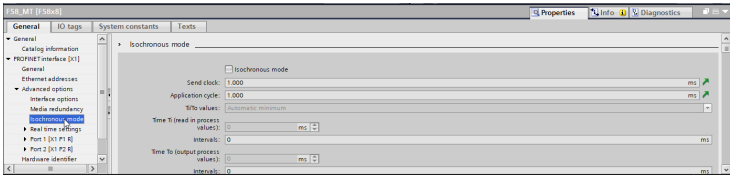
Proceed as follows to activate the IRT functionality of the encoder:

✓ Make sure that you added the encoder to the topology.

✓ The organization block OB61 Synchronous Cycle must have been added to the controller.

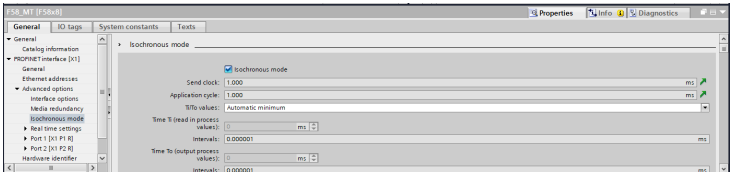
i) Switch to Device overview.

j) In the navigation tree, under "Settings / General", click on "Isochronous mode".



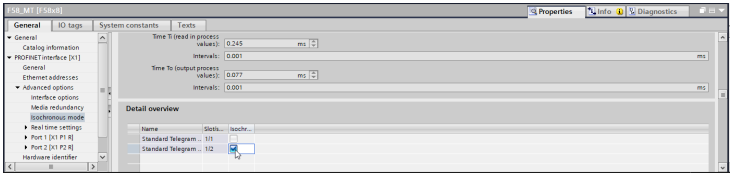
IMG-ID: 185431051

k) Check "Isochronous mode".



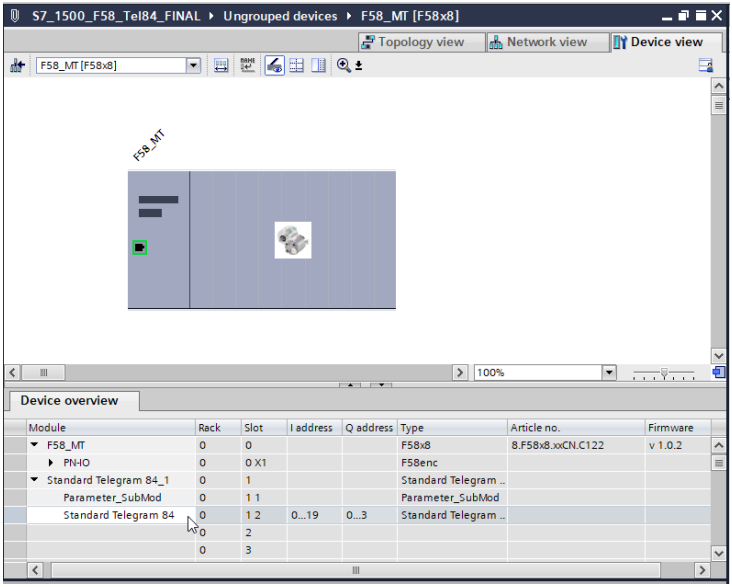
IMG-ID: 185432715

l) Select the desired telegram in the "Detail overview".



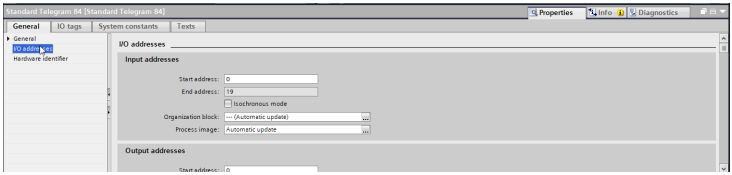
IMG-ID: 185434379

m) The encoder must be activated for the clock rate specification of the controller. for this, navigate to the detail overview of the concerned telegram.



IMG-ID: 185436043

n) Select Settings / General and click on I/O addresses

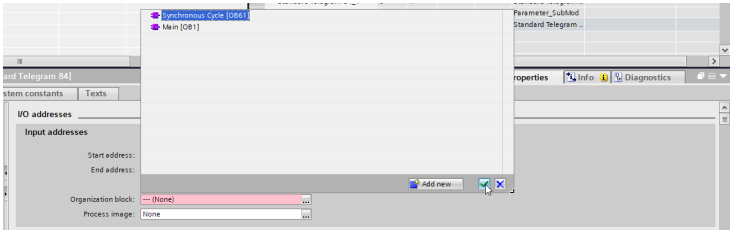


IMG-ID: 185437707

o) Check "Isochronous mode".

IMG-ID: 185439371

p) Assign the created organization block OB61 to the clock.

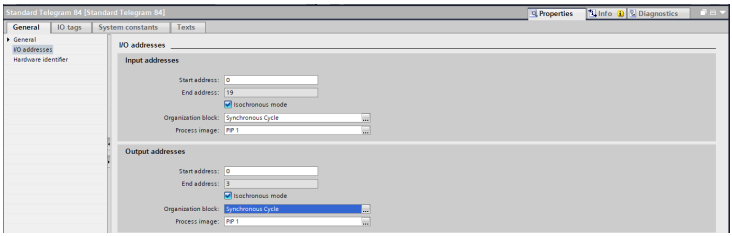


IMG-ID: 185441035

q) Proceed the same way for the output addresses

r) Download the configuration and start the communication.

⇨ The device now operates in IRT mode.



IMG-ID: 185442699

NOTICE	**IRT in conjunction with MRP.**
	MRP cannot be used associated with IRT. To achieve this, the devices must support MRPD in the ring.

5.6.6 Integrating an Encoder as a Technology Object

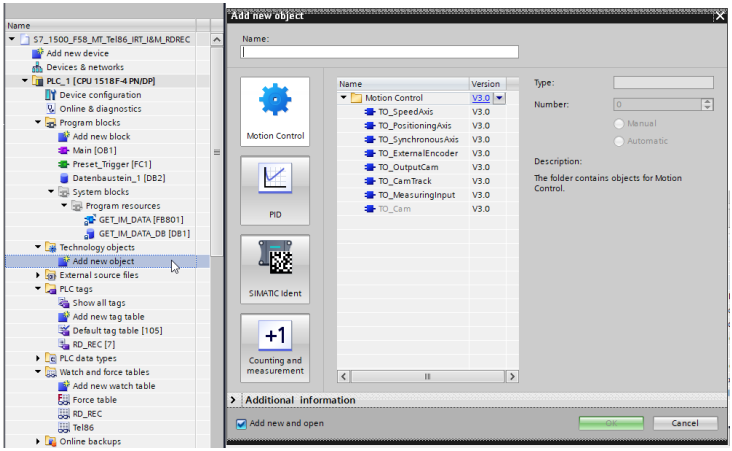
NOTICE	**Use of the feature**
	The use of this feature is the same for the S58 and F58 series.

The encoder can be integrated as a technology object in the project design:

✓ Make sure that the encoder is already present in the project.

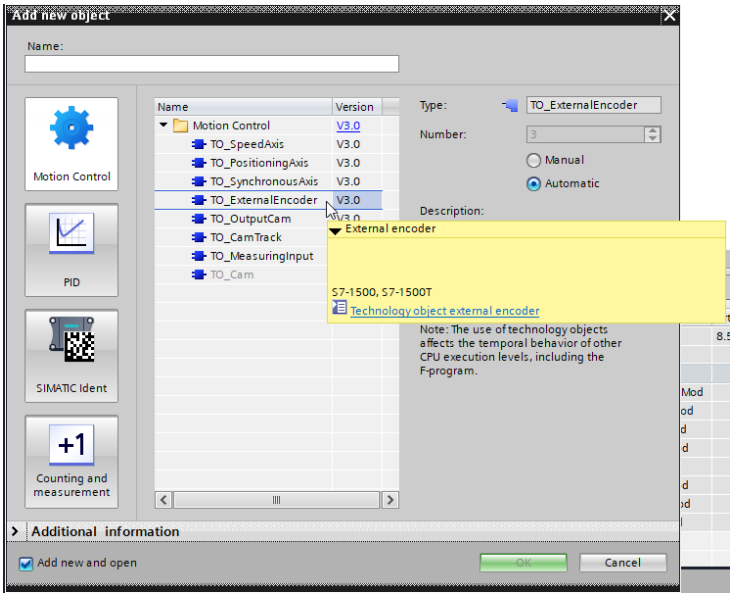
a) In the navigation, under "Technology objects", select "Add new object".

⇨ The window "Add new object" opens.



IMG-ID: 184787979

b) In the MOTION CONTROL folder, select object "TO_ExternalEncoder".

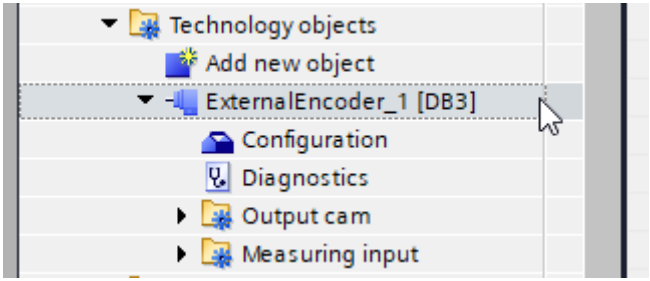


IMG-ID: 184789643

c) Assign a type designation for the encoder in the "Type" field.

d) Confirm with "OK".

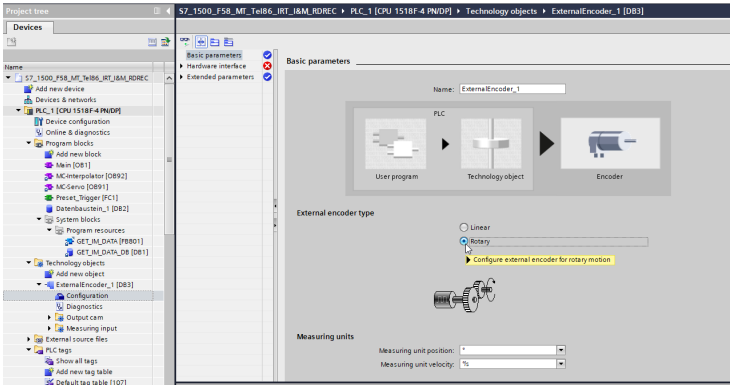
⇨ The technology object is displayed in the navigation.



IMG-ID: 184791307

e) Extend the new created object.

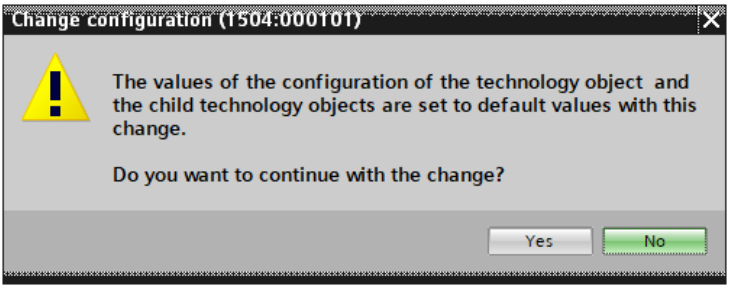
f) Select "Configuration".



IMG-ID: 184792971

g) Under "Basic parameters", set the option "Rotary".

⇨ A warning message is displayed. The configured values will be reset to default values.

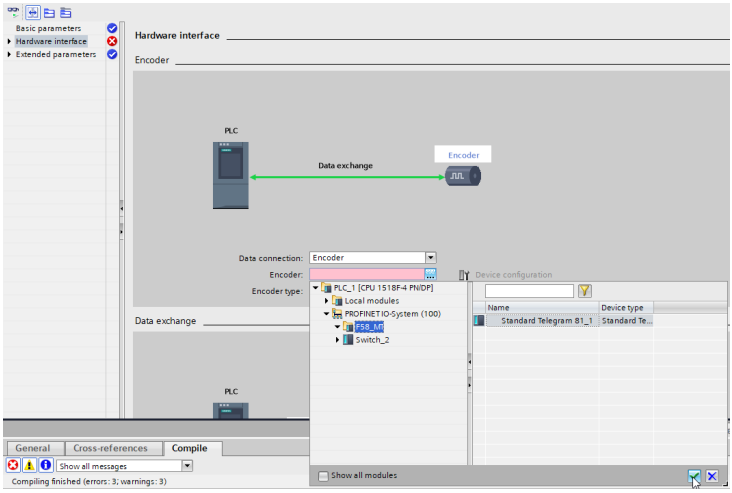


IMG-ID: 184794635

h) Confirm this message with "Yes".

i) Select "Hardware interface" and the option "PROFIdrive encoder to PROFINET/ PROFIBUS".

j) Under the selection field, add the encoder known from the GSDML file.

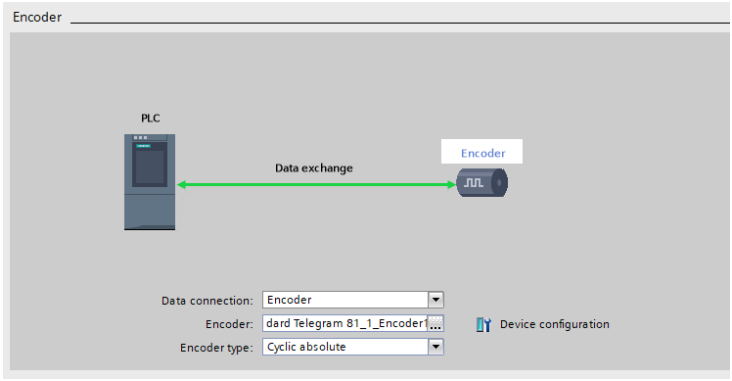


IMG-ID: 184801931

k) Confirm with the green check.

l) The encoder can be parameterized. To do so, select "Data exchange".

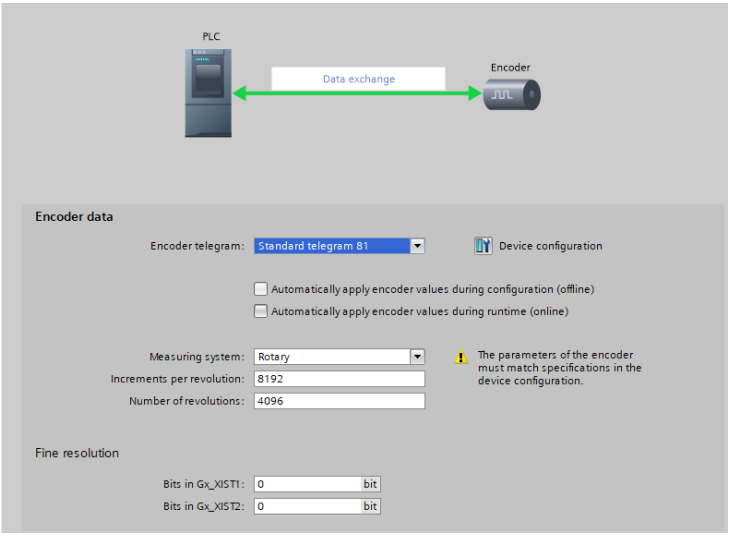
m) Under "Telegram", select the same telegram as the one selected when integrating the encoder. Only telegrams 81 and 83 are supported.



IMG-ID: 194718475

n) Under "Encoder type", select option "Rotary absolute".

o) In "Increments per revolution", input your MUR value (e. g. 524,288) and in field "Numbers of revolutions" the NDR value: 4096 → 19 bits ST / 31 bits TMR.



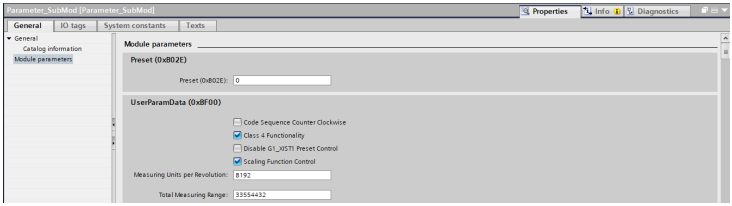
IMG-ID: 253505547

p) For complete encoder parameterization, click on Device configuration.

⇨ The device view opens.

q) Under the used submodule "Properties", "Module parameters", set the desired parameters.

⇨ The encoder is now entirely integrated as a technology object.

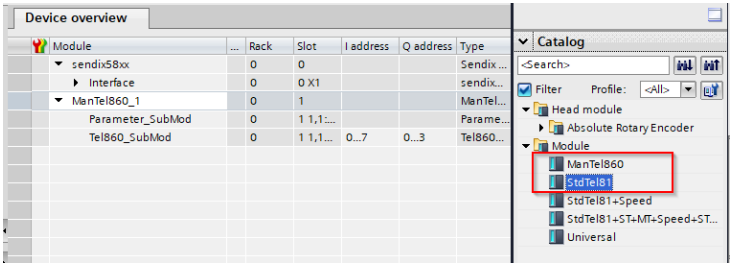


IMG-ID: 253507211

5.6.7 Backward compatibility

The Sendix F58xx encoder is backwards compatible with the Sendix 58xx encoder. This means that it can replace the latter directly and with little changes in the project design software.

Smooth replacement is only possible if telegram ManTel860 or StdTel81 has been used until now. All other telegrams of the Sendix 58xx encoder do not comply with the profile defined in Encoder Profile V4.2. If other telegrams have been used, it may be necessary to adapt the input / output addresses of the variables. In particular cases, the replacement may be carried out in consultation with the Support, see Contact [▶ 113].



IMG-ID: 185516811

The direct device replacement procedure can be found in the corresponding chapter. See Replacement of a PROFINET encoder in the network [▶ 99].

5.7 Examples

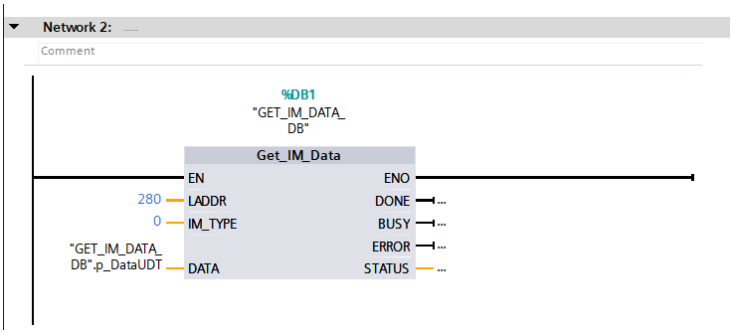
5.7.1 Reading the I&M data

Proceed as follows to read the I&M data:

✓ Make sure that the encoder has been created in the project design tool and is accessible (the example refers to TIA Portal).

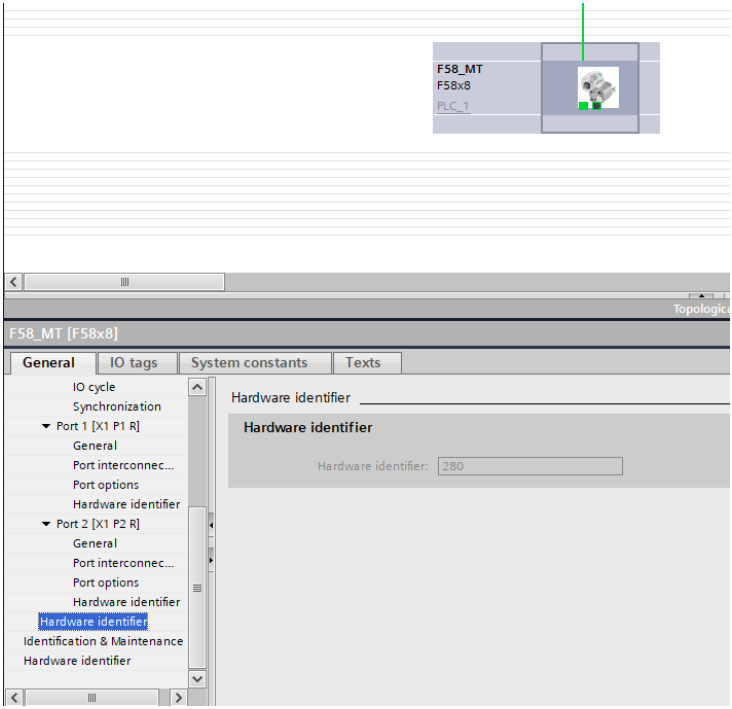
a) Navigate to the main routine of the controller.

b) Here, create block Get_IM_Data.



IMG-ID: 184253707

c) Save the proper hardware identifier in parameter LADDR. It can be found in the relevant device under Properties / General / Hardware identifier.

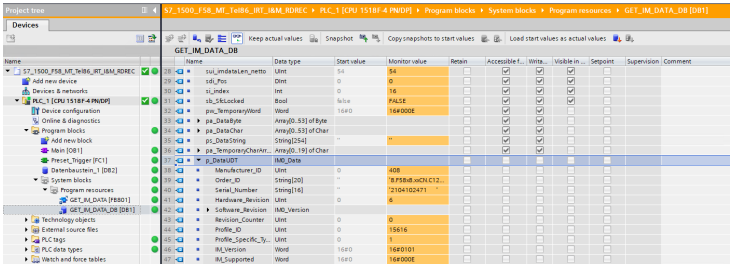


IMG-ID: 184250123

d) For IM_TYPE, save the desired I&M type (I&M 0...3). In this example, the I&M 0 data is to be read.

e) Finally, select the output range. This is a structure that is created automatically with the block. It contains the single variables assigned to the respective I&M 0 parameters. See I&M Data [▶ 42].

⇨ The I&M 0 data is now read and can be found in the data set of the block.



IMG-ID: 184255371

5.7.2 Replacement of a PROFINET encoder in the network

Proceed as follows to replace a PROFINET encoder during operation:

✓ Make sure that the supply voltage of the encoder is disconnected.

✓ To allow device replacement without parameterizing, the options "Support device replacement without exchangeable medium" and "Permit overwriting of device names of all assigned IO devices" must be activated in the controller.
See LLDP - Link Layer Discovery Protocol [▶ 85].

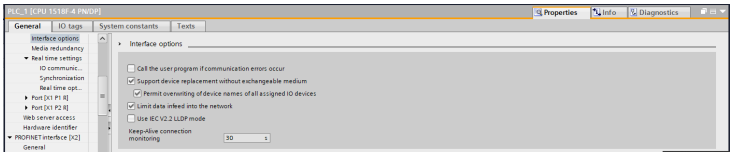


Fig. 2:

IMG-ID: 194693003

a) Disconnect the Ethernet line(s) from the old encoder.

b) Connect the Ethernet line(s) to the new encoder. Take care to connect the ports as they were with the old device.

c) Connect the supply voltage to the encoder.

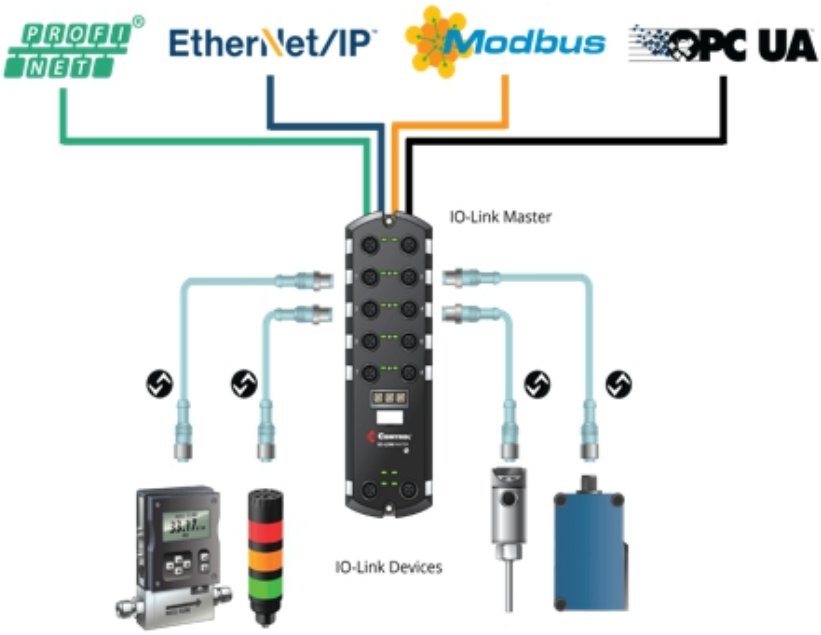
⇨ An IP address and a name are assigned to the new encoder via LLDP. It is ready for operation after a few seconds.

d) Deactivate bit 14 in G1_STW and activate bit 10 in STW2_ENC to disable the parking sensor.

⇨ The new encoder is now ready for operation and issues position values.

5.7.3 IO-Link device integration via PROFINET

An IO-Link Master is necessary to have IO-Link devices communicate with each other or with external participants. The IO-Link Master is connected point-to-point to the single devices and serves in the same time as a gateway in a superordinate communication system.



IMG-ID: 233006219

The section below describes how to integrate a Kübler IO-Link encoder via a Turck IO-Link master module (TBEN-S2-4IOL) in a Siemens PROFINET control (1518F-4 PN/DP).

✓ Make sure that the GSDML file of the IO-Link master is included in TIA Portal

a) Integrate the IO-Link master in the PROFINET network

Fig. 3:

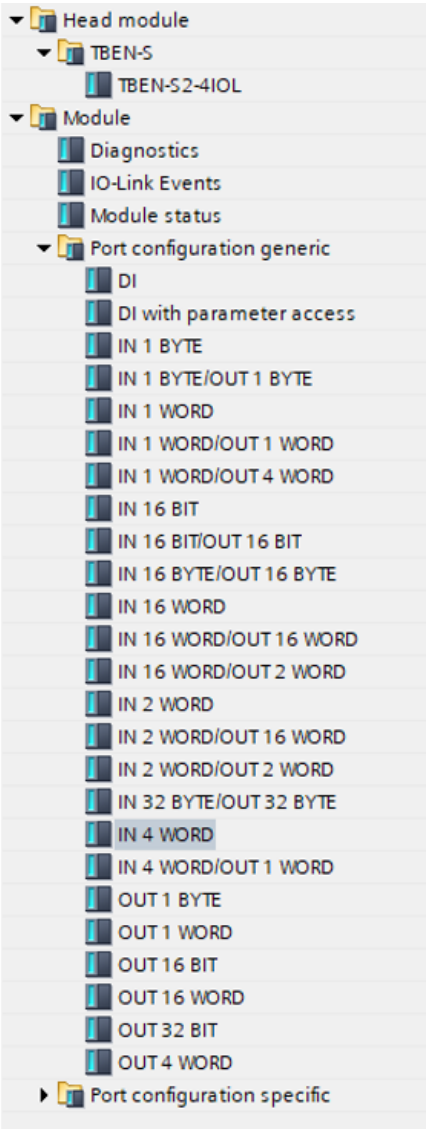
IMG-ID: 233008139

b) Configure the IO-Link master In this step, the single ports of the IO-Link master are configured based on the process data structure of the individual devices.

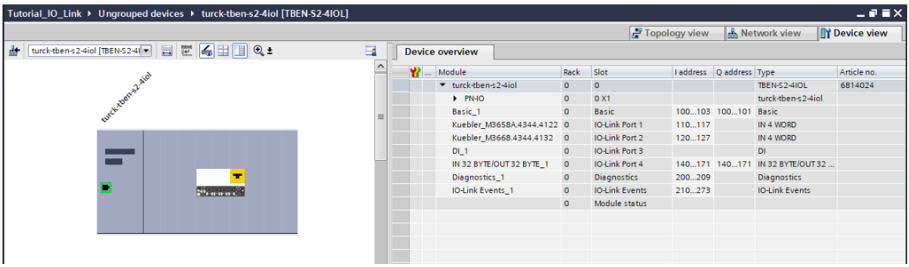
The example shows a M3658A.4344.4122 (ST IO-Link encoder with standard profile) on port 1 and a M3668.4344.4132 (MT IO-Link encoder with Smart-Sensor profile) on port 2.

The Kübler standard profile provides 8 bytes and the Smart-Sensor profile 6 bytes cyclic input data (seen from the master).

c) Now assign respectively 4 word (=8 bytes) input data and 0 byte output data to port 1.



IMG-ID: 233010059



IMG-ID: 233024779

d) Proceed exactly the same way for port 2. Since the selection does not provide for 6 bytes input data, also port 2 can be configured with 4 word (= 8 bytes) input data.

⇨ The IO-Link master is now configured with the ports

NOTICE	**Assignment of the address ranges**
	The address range of the input, respectively output data can be defined individually. In this example, the input data of the encoder on port 1 is assigned to address range 100...117 and the input data on port 2 to address range 120...127. In addition, a digital input is represented on port 3 and a display device on port 4.

5.7.3.1 Process data processing via standard Kübler profile

First, two independent variables are created to allow processing and separating the speed and position information provided by the encoder with standard Kübler profile to port 1.

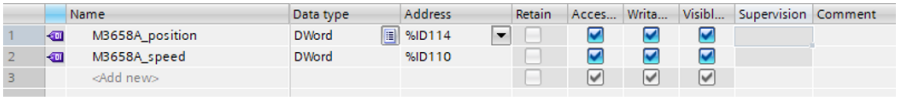
✓ In the menu tree, navigate to item Variable tables

a) Create a new variable table and name it according to the used profile.

b) Create the variables for position and speed.

⇨ The variables are now created in the table. The current input data is now written permanently in these variables, which thus can be integrated arbitrarily in the later user program.

Speed	ID110	(input byte 110…113)
Position	ID114	(input byte 114…117)



IMG-ID: 233037579

5.7.3.2 Process data processing via Smart-Sensor profile

Two further variables are created for the encoder with Smart-Sensor profile on port 2.

✓ In the menu tree, navigate to item Variable tables

a) Create a new variable table and name it according to the used profile.

b) Create the variables for position and speed.

⇨ The variables are now created in the table. The current input data is now written permanently in these variables, which thus can be integrated arbitrarily in the later user program.

Measured value	ID120	(input byte 120…123)
Scaling	IB124	(input byte 124)

	Name	Data type	Address	Retain	Acces...	Writa...	Visibl...	Supervision	Comment
1	M3668_measurement_value	DWord	%ID120	☐	☑	☑	☑		
2	M3668_scaling	Byte	%IB124	☐	☑	☑	☑		
3				☐	☑	☑	☑		

IMG-ID: 233063691

With the Smart Sensor profile, the encoder provides the unscaled measured value and the scaling factor. However, as a general rule, the later user program only needs the scaled value. Therefore, the values must first be factored in together.

For the processing of cyclic process data, Siemens provides in the TIA Portal a suitable function block for every Smart-Sensor profile class.

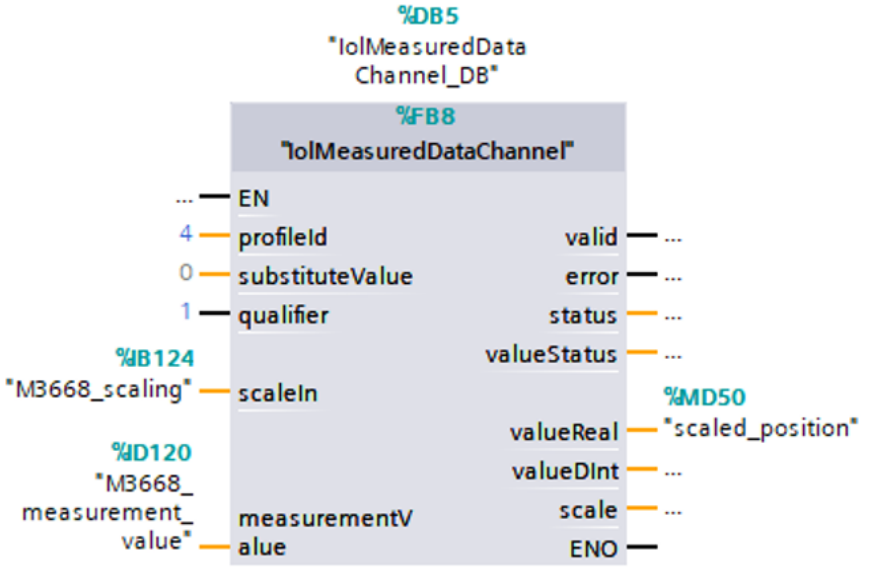
These function blocks can be found in the “Common- and Smart-Sensor profiles“ library and are available for download under the following link:

https://support.industry.siemens.com/cs/document/109766016/common-and-smart-sensor-profiles-for-io-link?dti=0&lc=en-WW

✓ Make sure that you have created the function block in the TIA library.

c) Select the function block “IoIMeasuredDataChannel” for profile class “Digitally measuring sensors“, which includes the encoders

d) Drag the function block “IoIMeasuredDataChannel” into the process routine. The block processes the raw values provided by the sensor and generates a usable process parameter for the user program.



IMG-ID: 233065611

e) Link the raw values, the measured value (ID120) and the scaling (IB124) of the encoder with the block.

⇨ The block now outputs a scaled position value as REAL and DINT.

The following tables describe the different operators of the “IolMeasuredDataChannel” block.

Parameter	Datentyp	Beschreibung
EN	BOOL	Freigabeeingang (enable)
profileId	WORD	ausgewählte Profil-ID bzw. Prozessdatenstruktur 1 = SSP 3.1 2 = SSP 3.2 3 = SSP 3.3 4 = SSP 3.4 (SSP = Smart Sensor Profil)
substituteValue	DINT	Der angegebene Erstzwert wird auf den "valueReal" und "valueDINT" angewendet, wenn "valueStatus" ungleich 0 ist.
qualifier	BOOL	Dieses Signal entspricht der Port Qualifier-Information des Sensors. FALSE = Prozessdaten sind ungültig TRUE = Prozessdaten sind gültig Das Port Qualifier-Bit kann im PCT-Tool aktiviert werden. Es wird für jeden IO-Link Port ein Bit reserviert.
scaleIn	SINT	An diesen Eingang wird die Skalierinformation des Sensors aus den Prozessdaten angelegt. HINWEIS: Die Breite der Prozessdateneingabe hängt vom Profil des Sensors ab (entweder INT16 oder INT32).
measurementValue	Variant	An diesen Eingang wird die Messwertinformationen des Sensors aus den Prozessdaten angelegt. Dieser Eingang unterstützt sowohl 16 Bit als auch 32 Bit Werte.

IMG-ID: 233076107

Parameter	Datentyp	Beschreibung
ENO	BOOL	Freigabeeingang (enable)
valid	BOOL	Wenn der Wert TRUE ist, sind die angegebenen Werte gültig und können für weitere Berechnungen verwendet werden.
error	BOOL	Wenn der Wert TRUE ist, tritt ein interner Fehler auf und weitere Informationen werden am Funktionsbaustein über den Ausgang "status" bereitgestellt.
status	WORD	Bietet interne Fehlercodes (siehe Tabelle 4-8)
valueStatus	INT	Status der Prozessdateneingabe 0 = ok 1 = Prozessdaten ungültig 2 = Keine Daten 3 = Außerhalb des Bereichs (+) 4 = Außerhalb des Bereichs (-) 5 = nicht definiert
valueReal	REAL	Prozessdaten im Realformat zur Auswertung innerhalb der SPS
valueDINT	DINT	Prozessdaten im Double-Integer-Format
scale	INT	Prozessdaten-Skalierungsfaktor (abhängig vom Eingang "scaleIn" und vom angeschlossenen Sensor)

IMG-ID: 233078027

Profil-Typ	Profil-ID	Name des Profilmerkmals	Funktionsklasse		Prozessdaten-struktur
			Messung	Deaktivierung Wandler	
SSP 3.1	0x000A	Messsensor	0x800A	-	PDI32.INT16_INT8
SSP 3.2	0x000B	Messsensor, hochauflösend	0x800B		PDI48.INT32_INT8
SSP 3.3	0x000C	Messsensor, Sperrfunktion	0x800A	0x800C	PDI32.INT16_INT8 PDO8.BOOL1
SSP 3.4	0x000D	Messsensor, hochauflösend, Sperrfunktion	0x800B		PDI48.INT32_INT8 PDO8.BOOL1

IMG-ID: 233079947

6 Annex

6.1 Scaling

The usability of the measured values output by the measuring system essentially depends on their scaling. Scaling the measured values presupposes that mathematical operations must be carried out, which, depending on the device type, are integrally or only partly supported. There are basically 3 different scaling types:

1. Binary scaling = Scaling function
2. Non-binary scaling = Universal Scaling function
3. Scaling by means of the gear factor = Gear Factor

6.2 Subnet mask in conjunction with the IP address

Each IP address can be subdivided into a network address and a host address. The subnet mask determines at which place this separation takes place. This basically determines the maximum possible number of host addresses and network addresses. The host addresses can be compared with the participants in an Ethernet network.

There are basically 3 address classes A, B and C.

Class A:

16,777,214 hosts per network

Subnet mask: 255.0.0.0

Maximum address range network address: 127,255,255,255

IP address 1st octet	IP address 2nd octet	IP address 3rd octet	IP address 3rd octet
1.	0.	0.	0.

Class B:

65,534 hosts per network

Subnet mask: 255.255.0.0

Maximum address range network address: 191,255,255,255

IP address 1st octet	IP address 2nd octet	IP address 3rd octet	IP address 4th octet
128.	**1.**	0.	0.

Class C:

254 hosts per network

Subnet mask: 255.255.255.0

Maximum address range network address: 223.255.255.255

IP address 1st octet	IP address 2nd octet	IP address 3rd octet	IP address 4th octet
192.	**0.**	**1.**	0.

The standard subnet mask is 255.255.255.0, thus allowing 254 network participants.

6.3 Decimal / Hexadecimal conversion table

Dec	Hex	Dec	Hex	Dec	Hex	Dec	Hex	Dec	Hex
0	*0x0*	51	*0x33*	102	*0x66*	153	*0x99*	204	*0xCC*
1	*0x1*	52	*0x34*	103	*0x67*	154	*0x9A*	205	*0xCD*
2	*0x2*	53	*0x35*	104	*0x68*	155	*0x9B*	206	*0xCE*
3	*0x3*	54	*0x36*	105	*0x69*	156	*0x9C*	207	*0xCF*
4	*0x4*	55	*0x37*	106	*0x6A*	157	*0x9D*	208	*0xD0*
5	*0x5*	56	*0x38*	107	*0x6B*	158	*0x9E*	209	*0xD1*
6	*0x6*	57	*0x39*	108	*0x6C*	159	*0x9F*	210	*0xD2*
7	*0x7*	58	*0x3A*	109	*0x6D*	160	*0xA0*	211	*0xD3*
8	*0x8*	59	*0x3B*	110	*0x6E*	161	*0xA1*	212	*0xD4*
9	*0x9*	60	*0x3C*	111	*0x6F*	162	*0xA2*	213	*0xD5*
10	*0xA*	61	*0x3D*	112	*0x70*	163	*0xA3*	214	*0xD6*
11	*0xB*	62	*0x3E*	113	*0x71*	164	*0xA4*	215	*0xD7*
12	*0xC*	63	*0x3F*	114	*0x72*	165	*0xA5*	216	*0xD8*
13	*0xD*	64	*0x40*	115	*0x73*	166	*0xA6*	217	*0xD9*
14	*0xE*	65	*0x41*	116	*0x74*	167	*0xA7*	218	*0xDA*
15	*0xF*	66	*0x42*	117	*0x75*	168	*0xA8*	219	*0xDB*
16	*0x10*	67	*0x43*	118	*0x76*	169	*0xA9*	220	*0xDC*
17	*0x11*	68	*0x44*	119	*0x77*	170	*0xAA*	221	*0xDD*
18	*0x12*	69	*0x45*	120	*0x78*	171	*0xAB*	222	*0xDE*
19	*0x13*	70	*0x46*	121	*0x79*	172	*0xAC*	223	*0xDF*
20	*0x14*	71	*0x47*	122	*0x7A*	173	*0xAD*	224	*0xE0*
21	*0x15*	72	*0x48*	123	*0x7B*	174	*0xAE*	225	*0xE1*
22	*0x16*	73	*0x49*	124	*0x7C*	175	*0xAF*	226	*0xE2*
23	*0x17*	74	*0x4A*	125	*0x7D*	176	*0xB0*	227	*0xE3*
24	*0x18*	75	*0x4B*	126	*0x7E*	177	*0xB1*	228	*0xE4*
25	*0x19*	76	*0x4C*	127	*0x7F*	178	*0xB2*	229	*0xE5*
26	*0x1A*	77	*0x4D*	128	*0x80*	179	*0xB3*	230	*0xE6*
27	*0x1B*	78	*0x4E*	129	*0x81*	180	*0xB4*	231	*0xE7*
28	*0x1C*	79	*0x4F*	130	*0x82*	181	*0xB5*	232	*0xE8*
29	*0x1D*	80	*0x50*	131	*0x83*	182	*0xB6*	233	*0xE9*
30	*0x1E*	81	*0x51*	132	*0x84*	183	*0xB7*	234	*0xEA*

Dec	Hex	Dec	Hex	Dec	Hex	Dec	Hex	Dec	Hex
31	*0x1F*	82	*0x52*	133	*0x85*	184	*0xB8*	235	*0xEB*
32	*0x20*	83	*0x53*	134	*0x86*	185	*0xB9*	236	*0xEC*
33	*0x21*	84	*0x54*	135	*0x87*	186	*0xBA*	237	*0xED*
34	*0x22*	85	*0x55*	136	*0x88*	187	*0xBB*	238	*0xEE*
35	*0x23*	86	*0x56*	137	*0x89*	188	*0xBC*	239	*0xEF*
36	*0x24*	87	*0x57*	138	*0x8A*	189	*0xBD*	240	*0xF0*
37	*0x25*	88	*0x58*	139	*0x8B*	190	*0xBE*	241	*0xF1*
38	*0x26*	89	*0x59*	140	*0x8C*	191	*0xBF*	242	*0xF2*
39	*0x27*	90	*0x5A*	141	*0x8D*	192	*0xC0*	243	*0xF3*
40	*0x28*	91	*0x5B*	142	*0x8E*	193	*0xC1*	244	*0xF4*
41	*0x29*	92	*0x5C*	143	*0x8F*	194	*0xC2*	245	*0xF5*
42	*0x2A*	93	*0x5D*	144	*0x90*	195	*0xC3*	246	*0xF6*
43	*0x2B*	94	*0x5E*	145	*0x91*	196	*0xC4*	247	*0xF7*
44	*0x2C*	95	*0x5F*	146	*0x92*	197	*0xC5*	248	*0xF8*
45	*0x2D*	96	*0x60*	147	*0x93*	198	*0xC6*	249	*0xF9*
46	*0x2E*	97	*0x61*	148	*0x94*	199	*0xC7*	250	*0xFA*
47	*0x2F*	98	*0x62*	149	*0x95*	200	*0xC8*	251	*0xFB*
48	*0x30*	99	*0x63*	150	*0x96*	201	*0xC9*	252	*0xFC*
49	*0x31*	100	*0x64*	151	*0x97*	202	*0xCA*	253	*0xFD*
50	*0x32*	101	*0x65*	152	*0x98*	203	*0xCB*	254	*0xFE*
								255	*0xFF*

6.4 Conversion table Data types

Data type	Figure type	Length in bits	Length in bytes
BOOL	Binary	1	-
BYTE	Binary	8	1
WORD	Binary	16	2
DWORD	Binary	32	4
LWORD	Binary	64	8
SINT	Integer	8	1
INT	Integer	16	2
DINT	Integer	32	4
UINT	Integer	32	4
LINT	Integer	64	8
REAL	Floating point number	32	4
LREAL	Floating point number	64	8

7 Contact

You want to get in touch with us:

Technical advice

For technical advice, analysis or support during installation, Kübler is directly on site with its globally active application team.

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Repair service / RMA-Form

For returns, please pack the product adequately and enclose the completed "Returns Form".

www.kuebler.com/rma

Send your return, specifying the RMA-reference, to the following address.

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Glossary

BOOL

Data type. A BOOL (or Boolean) represents a truth value that may be either true or false.

CRC

Cyclic Redundancy Check

Default

English for standard, generally used as default value. Factory-preset value of a changeable configuration value.

DINT

Data type. An operand of the data type DINT (double integer) has a length of 32 bits and is made of two components: a sign and a numerical value in two's complement.

DWORD

Data type. A DWORD consists of two WORDs, each consisting of 2 bytes, each of them consisting of 8 bits.

EMC

Electromagnetic compatibility

F-parameters

Failsafe related Parameters

INT

Data type. Integer. An integer is generally made of 16 bits.

iParameters

Individual / dynamic Parameters

IRT

Isochronous Real Time

LWORD

Data type. Long WORD consisting of two DWORDs.

MRP

Media Redundancy Protocoll - For ring-shaped topologies

MRPD

Media Redundancy for Planned Duplication - Allows the seamless switching of the communication paths in the event of a failure of a communication branch such as e. g. a cable break.

MUR

Measuring Units per Revolution

PAP

Parameter Access Point

PNU

Parameter Number - Number of the respective PROFINET encoder parameter

RMA

Return Material Authorization, authorization to return material, e.g. in the case of complaints.

RT

Real Time - includes cycle times of up to 1 ms

SINT

Data type. Short integer. An operand of the data type SINT (short INT) has a length of 8 bits and is made of two components: a sign and a numerical value.

TMR

Total Measuring Range

UINT

Data type. An operand of the data type UINT (Unsigned INT) has a length of 16 bits and contains numerical values without sign.

USF

Universal Scaling Function, a non-binary scaling function (without overflow error)

WORD

Data type. A WORD includes 2 bytes, each of them including 8 bits.

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