

# User's guide

# EXM58 PT EXO58 PT





- EXM58 up to 30-bit multiturn encoder for standard purposes
- EXO58 up to 30-bit multiturn encoder for high end applications
- Encoder Profile Specifications V4.1 version 3.162
- RT real-time transmission & IRT isochronous real-time mode
- With Energy Harvesting Technology
- Multiple mechanical and electrical options

| Suitable for the following models:    | General Contents        |     |
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# Typographic and iconographic conventions

In this guide, to make it easier to understand and read the text the following typographic and iconographic conventions are used:

- parameters and objects of both Lika device and interface are coloured in GREEN;
- alarms are coloured in **RED**;
- states are coloured in FUCSIA.

When scrolling through the text some icons can be found on the side of the page: they are expressly designed to highlight the parts of the text which are of great interest and significance for the user. Sometimes they are used to warn against dangers or potential sources of danger arising from the use of the device. You are advised to follow strictly the instructions given in this guide in order to guarantee the safety of the user and ensure the performance of the device. In this guide the following symbols are used:

| Â | This icon, followed by the word <b>WARNING</b> , is meant to highlight the parts of the text where information of great significance for the user can be found: user must pay the greatest attention to them! Instructions must be followed strictly in order to guarantee the safety of the user and a correct use of the device. Failure to heed a warning or comply with instructions could lead to personal injury and/or damage to the unit or other equipment. |
|---|--|
| j | This icon, followed by the word <b>NOTE</b> , is meant to highlight the parts of the text where important notes needful for a correct and reliable use of the device can be found. User must pay attention to them! Failure to comply with instructions could cause the equipment to be set wrongly: hence a faulty and improper working of the device could be the consequence.   |
| ì | This icon is meant to highlight the parts of the text where suggestions useful for making it easier to set the device and optimize performance and reliability can be found. Sometimes this symbol is followed by the word <b>EXAMPLE</b> when instructions for setting parameters are accompanied by examples to clarify the explanation.   |

# **Preliminary information**

This guide is designed to provide the most complete information the operator needs to correctly and safely install and operate the following encoders **equipped with Profinet interface**:

| EXMxxx-13-14-PT4 | (DAP 1 : multiturn encoder 13 +14 bits) |
|------------------|---|
| EXMxxx-18-12-PT4 | (DAP 2 : multiturn encoder 18 +12 bits) |
| EXOxxx-18-00-PT4 | (DAP 3 : singleturn encoder 18 bits)    |
| EXOxxx-16-14-PT4 | (DAP 4 : multiturn encoder 16 +14 bits) |

For technical specifications refer to the technical catalogue.

To make it easier to read the text, this guide can be divided into some main sections.

In the first section (from chapter 1 to chapter 4) general information concerning the safety, the mechanical installation and the electrical connection.

In the second section (chapter 5) information on how to install and configure the encoder in TIA Portal development environment as well as tips for setting up and running properly and efficiently the unit are provided.

In the third section (from chapter 6 to chapter 11) both general and specific information is given on the Profinet interface. In this section the interface features and the parameters implemented in the unit are fully described.

In the fourth section (from chapter 12 to chapter 15) some examples of programming and advanced maintenance information are explained.

In the last section (chapter 16) the integrated web server is described.



Lika Electronic Profinet encoder documentation is complete with some **example projects** provided free of charge. These programs are designed to make your own project planning, programming, communication and diagnostics with the TIA V16 development environment user-friendly and reliable. You can find them in the Lika TIA V16 CPU1500 Profinet example project.zip compressed file contained in the SW EXM58 EXO58 PT.zip file.



#### WARNING

If the encoder is used as a **TO Technology Object**, please refer to the "5.7 TO Technology Objects" section on page 78.

# **Glossary of Profinet terms**

PROFINET IO, like many other networking systems, has a set of unique terminology. Table below contains a few of the technical terms used in this guide to describe the PROFINET IO interface. Sometimes they also refer more specifically to the S7 programming environment. They are listed in alphabetical order.

| Acyclic Communications | Unscheduled, on demand communications. Diagnostic messages from an IO Supervisor to an IO Device are Acyclic. Refer to page 109.  |
|------------------------|---|
| AP                     | Application Process - The application process running in the device. PROFINET supports a default Application Processes and additional profile specific application processes.   |
| API                    | The value of the API (Application Process Identifier) parameter specifies the application that is processing the IO data. PROFINET standard IEC 61158 assigns profiles to certain APIs (PROFIdrive, PROFIslave) which are defined by the PROFINET User Organization. The standard API is 0. |
| Application class      | An application class specifies a number of mandatory functions and addition optional functions to be supported by an IO device. The Profinet encoders can be configured as CLASS 3 and CLASS 4 PROFINET IO devices according to the encoder profile. Refer to page 92.                      |
| AR                     | Application Relation - The relationship between a PROFINET IO<br>Controller and an IO device. A PROFINET IO device can support<br>more than one Application Relationship.   |
| Automation system      | Programmable logic controller for the open-loop and closed-<br>loop control of process chains in process and production<br>engineering. The automation system consists of different<br>components and integrated system functions depending on<br>the automation task.                      |
| Bus                    | A bus is a communication medium connecting several nodes.<br>Data can be transferred via serial or parallel circuits, that is,<br>via electrical conductors or fiber optic.   |
| Channel                | A single IO point. A Channel can be discrete or analog.   |
| Consumer Status        | The Status an IO device provides to an IO Controller for the data it consumes from IO Controller.   |
| СРU                    | Central Processing Unit – Central module of an automation system with a control and arithmetic unit, memory, operating system and interface for programming device.   |
| CR                     | Communication Relationship - A virtual communication channel within an AR.  |
| Cyclic Communications  | Scheduled, repetitive communications. IO data and alarm transfers are cyclic.   |

| Data block      | In contrast to code blocks, data blocks (DB) do not contain<br>Step 7 statements. They are used to save data, i.e. variable<br>data which are processed by the user program. Global data<br>blocks serve to accommodate user data which can be used by<br>all other blocks.   |
|-----------------|---|
| DCP             | Discovery Control Protocol - A communications protocol with<br>PROFINET IO that allows an IO Controller or Supervisor to find<br>every PROFINET IO device on a subnet.  |
| Determinism     | Determinism means that a system responds in a predictable (deterministic) manner.   |
| Device name     | Before an IO device can be addressed by an IO controller, it<br>must have a device name. In PROFINET, this method was<br>selected because it is simpler to work with names than with<br>complex IP addresses. Refer to page 34.   |
| Encoder Profile | The PROFINET profile for Encoders is intended to define a standard application interface for encoders. The profile is a supplement to the PROFIdrive profile, so it is mandatory to read the PROFIdrive profile before implementing the encoder profile.  |
| Function        | Functions (FC) are code blocks which can be programmed by<br>the user. A FC does not have a "memory". Temporary variables<br>as well as parameters transferred to the function when the<br>latter is called are saved in a L stack. They are lost following<br>processing of the FC.  |
| Function block  | Function blocks (FB) are code blocks with a "memory" which<br>are programmed by the user. They have an assigned instance<br>data block (instance DB) as memory. Parameters transferred to<br>a FB as well as the static variables are saved in this data block.<br>An FB contains a program which is always executed when the<br>FB is called by another code block. Function blocks facilitate<br>the programming of frequently repeated, complex functions. |
| Frame ID        | The two-byte field in the Ethernet frame which defines the type of PROFINET IO message.   |
| GSD             | The properties of a PROFINET device are described in a GSD file<br>(General Station Description) that contains all the information<br>required for configuration. In PROFINET IO, the GSD file is in<br>XML format. The structure of the GSD file conforms to ISO<br>15734, which is the world-wide standard for device<br>descriptions. Refer to page 54.  |
| GSDML           | General Station Description Markup Language – The file containing the XML description of the PROFINET IO device. Refer to page 54.  |
| IO Controller   | Device used to address the connected IO devices. This means<br>that the IO controller exchanges input and output signals with<br>assigned field devices. The IO controller is often the controller<br>on which the automation program runs. Refer to page 90.   |
|                 | on which the automation program rans. Herer to page 56.   |

|                     | controllers (e.g. remote IO, encoders, valve terminals, frequency converters, switches, etc.). Refer to page 90.   |
|---------------------|--|
| IO Parameter Server | An IO Parameter Server is a server station, usually a PC, for<br>loading and saving the configuration data (records) of IO<br>Devices.   |
| IO Supervisor       | Programming device, PC or HMI device used for commissioning and diagnostics of IO Controllers and IO Devices. Refer to page 90.  |
| IP address          | The IP address is the name of the unit in a network using the Internet protocol. Refer to page 34.   |
| IRT                 | Synchronized transmission procedure for the cyclic exchange<br>of IRT data between PROFINET devices. A reserved bandwidth<br>within the send clock is available for the IRT IO data. The<br>reserved bandwidth ensures that the IRT data can be<br>transmitted at reserved, synchronized intervals whilst<br>remaining uninfluenced even by other greater network loads<br>(e.g. TCP/IP communication or additional real time<br>communication). The "high flexibility" enables simple planning<br>and expansion of the system. A topological configuration is<br>not required. Refer to page 140.   |
| MAC address         | The MAC address is an identifier unique worldwide consisting<br>of two parts: the first 3 bytes are the manufacturer ID and are<br>provided by IEE standard authority; the last three bytes<br>represent a consecutive number of the manufacturer. Refer to<br>page 34.  |
| Module              | Modules are user defined components that plug into slots.<br>Modules can be real or virtual.   |
| NRT                 | Non Real Time - The non Real Time PROFINET IO Channel.<br>Configuration and diagnostic messages are transferred over<br>the NRT Channel.   |
| Organization block  | A range of organization blocks (OB) are designed to execute<br>the user program. OBs are the interface between the user<br>program and the operating system of a CPU. They permit<br>event-controlled processing of special program components<br>within the user program. The order in which the user program<br>is executed is defined in the organization blocks.   |
| Profile             | Profiles define application-specific functionality to ensure the<br>openness of PROFIBUS and PROFINET is utilized consistently.<br>PI Profiles can cover simple devices such as encoders by<br>defining how signals are used and how they are physically<br>connected. However, profiles are increasingly covered more<br>complex systems or requirements. Profiles such as PROFIdrive<br>and PROFIsafe deliver active functionality as well. An<br>advanced profile covering active power management for end<br>devices like lasers and robots is now under development with<br>the aim of bringing significant reductions in energy<br>consumption for the automotive industry. Profiles guarantee |

|                       | quicker system design and they support faster device<br>interchange, promoting competition amongst vendors,<br>increased choice for users and full interoperability.  |
|-----------------------|---|
| Provider Status       | The Status an IO device provides to an IO Controller with the data transferred to the Controller.   |
| Proxy                 | A device which maps non PROFINET IO data to PROFInet.   |
| Real-time             | Real-time means that a system processes external events<br>within a defined time. If the reaction of a system is<br>predictable, one speaks of a deterministic system. The general<br>requirements for real-time are therefore: deterministic<br>response and defined response time. Refer to page 140.   |
| RT                    | Real Time - The Real Time PROFINET IO Channel. I/O and Alarm Data are transferred over the RT Channel. Refer to page 140.   |
| Slot                  | A group of one or more Subslots. Slots can be real or virtual.  |
| Standard signal       | The encoder profile defines a series of standard signals which are used to configure the IO data. Refer to page 97.   |
| Submodule             | A component of a module that is plugged into a subslot. A submodule is real or virtual.   |
| Subslot               | A group of one or more channels. Subslots can be real or virtual.   |
| Sync Domain           | All PROFINET devices that are to be synchronized via PROFINET<br>IO with IRT must belong to a Sync Domain. The Sync Domain<br>consists of precisely one Sync Master and at least one Sync<br>Slave. IO controllers and switches can hold the role of a Sync<br>Master or Sync Slave. Other IO devices support only the role as<br>Sync Slave.   |
| System function       | System functions (SFC) are integral functions in the operating<br>system of a S7 CPU. In addition, SFCs are frequently called<br>implicitly by SFBs. SFCs can be called by the user program like<br>normal functions. SFCs are used to implement a number of<br>important system functions for Profinet IO.   |
| System function block | System function blocks (SFB) are integral functions in the operating system of a S7 CPU. SFBs can be called by the user program like normal function blocks. SFBs are used to implement a number of important system functions for Profinet IO.   |
| TCP/IP                | <ul> <li>The Ethernet system is designed solely to carry data. It is comparable to a highway as a system for transporting goods and passengers. The data is actually transported by protocols. This is comparable to cars and commercial vehicles transporting passengers and goods on the highway.</li> <li>Tasks handled by the basic Transmission Control Protocol (TCP) and Internet Protocol (IP) (abbreviated to TCP/IP): <ol> <li>The sender splits the data into a sequence of packets.</li> <li>The packets are transported over the Ethernet to the correct recipient.</li> </ol> </li> </ul> |

|                   | <ol> <li>The recipient reassembles the data packets in the correct order.</li> <li>Faulty packets are sent again until the recipient acknowledges that they have been transferred successfully.</li> </ol>   |
|-------------------|--|
| Telegram          | A telegram is a rigidly defined bit stream carrying data. A telegram specifies the data length and the type of data which is sent to and from the IO controller. The encoder profile can support the Standard Telegrams 81, 82, 83 and 84. Refer to page 95. |
| Тороlоду          | <ul> <li>Network structure. Commonly used structures:</li> <li>Line topology;</li> <li>Ring topology;</li> <li>Star topology;</li> <li>Tree topology.</li> </ul>   |
| Transmission rate | Data transfer rate (in bps).   |
| User program      | The user program contains all instructions, declarations and<br>data for signal processing required to control a plant or a<br>process. It is assigned to a programmable module (for example<br>CPU) and can be structured in smaller units (blocks).        |

# List of abbreviations

Table below contains a list of abbreviations (in alphabetical order) which may be used in this guide to describe the PROFINET IO interface. Sometimes they also refer more specifically to the S7 programming environment.

| AR       | Application Relation                        |
|----------|---|
| API      | Application Process Identifier              |
| C-LS     | Controller's Sign-Of-Life                   |
| CR       | Communication Relation                      |
| DB       | Data block                                  |
| DO       | Drive Object                                |
| DO-LS    | Driver Object Sign-Of-Life                  |
| DU       | Drive Unit                                  |
| EO       | Encoder Object                              |
| EU       | Encoder Unit                                |
| FB       | Function block                              |
| FC       | Function                                    |
| I&M      | Identification & Maintenance                |
| IRT      | Isochronous Real Time Ethernet              |
| IRT Flex | IRT "High Flexibility"                      |
| IRT Top  | IRT "High Performance"                      |
| GSDML    | General Station Description Markup Language |
| 10       | Input/Output                                |
| IP       | Internet Protocol                           |
| LLDP     | Link Layer Discovery Protocol               |
| LS       | Sign-Of-Life                                |
| MAC      | Media Access Control                        |
| МАР      | Module Access Point                         |
| MLS      | Master Sign-Of-Life                         |
| ОВ       | Organization block                          |
| РАР      | Parameter Access Point                      |
| РІ       | PROFIBUS and PROFINET International         |
| RT       | Real Time Ethernet                          |

| SFB               | System function block         |
|-------------------|-------------------------------|
| SFC               | System function               |
| ТСР               | Transmission Control Protocol |
| Т <sub>МАРС</sub> | Master Application Cycle Time |

# References

1– <u>Profile Drive Technology. Encoder Profile. Technical Specification for PROFIBUS and PROFINET</u> Version 4.2 March 2017 Order No: 3.162

2- <u>Profile encoder. Technical Specification for PROFIBUS and PROFINET related to PROFIdrive</u> Version 4.1 December 2008 Order No: 3.162

3- <u>Profile Drive Technology. PROFIdrive Profile. Technical Specification for PROFIBUS and PROFINET</u> Version 4.2 October 2015 Order No: 3.172

4- <u>Profile Drive Technology PROFIdrive. Technical Specification for PROFIBUS and PROFINET</u> Version 4.1 May 2006 Order No: 3.172

5- <u>Profile Guidelines Part 1: Identification & Maintenance Functions. Guideline for PROFIBUS and</u> <u>PROFINET</u> Version 1.2 October 2009 Order No: 3.502

6- <u>Profile Guidelines Part 3: Diagnosis, Alarms and Time Stamping. Guideline for PROFIBUS and PROFINET</u> Version 1.0 July 2004 Order No: 3.522

7- Profibus Guidelines: Profibus Interconnection Technology Version V1.4 Order No: 2.142

8- Profinet Guidelines: Profinet Cabling and Interconnection Version V1.8 Order No: 2.252

# 1 Safety summary

### 1.1 Safety



- Always adhere to the professional safety and accident prevention regulations applicable to your country during device installation and operation;
- installation and maintenance operations have to be carried out by qualified personnel only, with power supply disconnected and stationary mechanical parts;
- device must be used only for the purpose appropriate to its design: use for purposes other than those for which it has been designed could result in serious personal and/or the environment damage;
- high current, voltage and moving mechanical parts can cause serious or fatal injury;
- warning ! Do not use in explosive or flammable areas;
- failure to comply with these precautions or with specific warnings elsewhere in this manual violates safety standards of design, manufacture, and intended use of the equipment;
- Lika Electronic assumes no liability for the customer's failure to comply with these requirements.



### 1.2 Electrical safety

- Turn OFF the power supply before connecting the device;
- connect according to the explanation in the "Electrical connections" section on page 31;
- connect +Vdc and 0Vdc and check the power supply is correct first before connecting the communication ports;
- in compliance with 2014/30/EU norm on electromagnetic compatibility, the following precautions must be taken:



- before handling and installing the equipment, discharge electrical charge from your body and tools which may come in touch with the device;
- power supply must be stabilized without noise; install EMC filters on device power supply if needed;
- always use shielded cables (twisted pair cables whenever possible);
- avoid cables runs longer than necessary;
- avoid running the signal cable near high voltage power cables;
- mount the device as far as possible from any capacitive or inductive noise source; shield the device from noise source if needed;
- to guarantee a correct working of the device, avoid using strong magnets on or near by the unit;

- minimize noise by connecting the shield and/or the connector housing and/or the frame to ground. Make sure that ground is not affected by noise. The connection point to ground can be situated both on the device side and on user's side. The best solution to minimize the interference must be carried out by the user. Provide the ground connection as close as possible to the encoder. We suggest using the ground point provided in the housing, use one TCEI UNI M3 x 6 cylindrical head screw with two tooth lock washers.



### 1.3 Mechanical safety

- Install the device following strictly the information in the "Mechanical installation" section on page 26;
- mechanical installation has to be carried out with stationary mechanical parts;
- do not disassemble the unit;
- do not tool the unit or its shaft;
- delicate electronic equipment: handle with care; do not subject the device and the shaft to knocks or shocks;
- respect the environmental characteristics of the product;
- unit with solid shaft: in order to guarantee maximum reliability over time of mechanical parts, we recommend a flexible coupling to be installed to connect the encoder and user's shaft; make sure the misalignment tolerances of the flexible coupling are met;
- unit with hollow shaft: the encoder can be mounted directly on a shaft whose diameter has to respect the technical characteristics specified in the purchase order and clamped by means of the collar and, when requested, the anti-rotation pin.

# 2 Identification

Device can be identified through the **order code**, the **serial number** and the **MAC address** printed on the label applied to its body. Information is listed in the delivery document too. Please always quote the order code, the serial number and the MAC address when reaching Lika Electronic for purchasing spare parts or needing assistance. For any information on the technical characteristics of the product <u>refer to the technical catalogue</u>.



**Warning**: encoders having order code ending with "/Sxxx" may have mechanical and electrical characteristics different from standard and be supplied with additional documentation for special connections (Technical info).



# 3 Mechanical installation



#### WARNING

Installation and maintenance operations have to be carried out by qualified personnel only, with power supply disconnected. Shaft and mechanical components must be in stop.

For any information on the mechanical data and the electrical characteristics of the encoder please <u>refer to the technical catalogue</u>.

Values are expressed in millimetres (mm).

#### 3.1 Solid shaft encoders

- Mount the flexible coupling 1 on the encoder shaft;
- fix the encoder to the flange **2** (or to the mounting bell) by means of the M4 screws **3**;
- mount the flexible coupling 1 on the motor shaft;
- secure the flange **2** to the support (or the mounting bell to the motor);
- make sure the misalignment tolerances of the flexible coupling 1 are met.

#### 3.1.1 Customary installation



|                | a [mm] | b [mm] | c [mm] | d [mm] |
|----------------|--------|--------|--------|--------|
| EXM58, EXO58   | -      | 42     | 50 F7  | 4      |
| EXM58S, EXO58S | 36 H7  | 48     | -      | _      |

### 3.1.2 Installation using fixing clamps (code LKM386)

lika



|                | a [mm] | b [mm] | c [mm] | d [mm] |
|----------------|--------|--------|--------|--------|
| EXM58, EXO58   | -      | 50 F7  | 67     | 4      |
| EXM58S, EXO58S | 36 H7  | -      | 67     | -      |

### 3.1.3 Installation using a mounting bell (code PF4256)

EXM58S, EXO58S encoders only





### NOTE

In order to guarantee reliability over time of the encoder mechanical parts, we recommend a flexible coupling to be installed between the encoder and the motor shaft. Make sure the misalignment tolerances of the flexible coupling are met.

### 3.2 Hollow shaft encoders

### 3.2.1 EXM58C, EXO58C

- Fasten the M4 anti-rotation pin 1 to the rear of the motor (secure it using a locknut);
- mount the encoder on the motor shaft using the reducing sleeve **6** (if supplied). Avoid forcing the encoder shaft;
- insert the M4 anti-rotation pin **1** into the slot on the flange of the encoder; this secures it in place by grub screw **2**, preset at Lika;
- fix the collar to the encoder shaft (apply threadlocker to M2.5 screw **3**).







#### 3.2.2 EXM59C, EXO59C

- Mount the encoder on the motor shaft using the reducing sleeve **6** (if supplied). Avoid forcing the encoder shaft;
- fasten the fixing plate **4** to the rear of the motor using two M3 cylindrical head screws **5**;
- fix the collar to the encoder shaft (apply threadlocker to M2.5 screw **3**).





A = min. 8 mm, max. 18 mm



### NOTE

You are strongly advised not to carry out any mechanical operations (drilling, milling, etc.) on the encoder shaft. This could cause serious damages to the internal parts and an immediate warranty loss. Please contact our technical personnel for the complete availability of "custom made" shafts.



# 4 Electrical connections



### WARNING

Power supply must be turned off before performing any electrical connection! Installation, electrical connection, and maintenance operations must be carried out by qualified personnel only, with power supply disconnected. Mechanical components must be in stop.

Do not remove the plug on the rear of the encoder. Damage may be caused to internal components.



No user serviceable parts inside the encoder!



### Figure 1 - Connectors and diagnostic LEDs

Pin

### 4.1 PWR Power supply connector (Figure 1)

M12 4-pin male connector with A coding is used for power supply.



| +5Vdc +30Vdc | 1 |
|--------------|---|
| n.c.         | 2 |
| 0Vdc         | 3 |
| n.c.         | 4 |
|              |   |

n.c. = not connected



### WARNING

Connect +Vdc and OVdc and check the power supply is correct first before connecting the communication ports.

### 4.2 P1 Port 1 and P2 Port 2 connectors (Figure 1)

Two M12 4-pin female connectors with D coding are used for Ethernet connection through port 1 and port 2.



| Description | Pin |
|-------------|-----|
| Tx Data +   | 1   |
| Rx Data +   | 2   |
| Tx Data -   | 3   |
| Rx Data -   | 4   |

The ports are equal and interchangeable - if only one connection is required, either port can be used. The Ethernet interface supports 100 Mbit/s, full-duplex operation.



### WARNING

Connect +Vdc and OVdc and check the power supply is correct first before connecting the communication ports.

### 4.3 Network configuration: cables, hubs, switches - Recommendations

PROFINET is based on a 100 Mbps, full-duplex Ethernet network. Faster communication is also possible on all transmission sections (e.g., between switches, PC systems, or camera systems).

Using Ethernet several topologies of connection are supported by Profinet networks: line, tree, daisy-chain, star, ... . Furthermore Profinet networks can be configured in almost any topology in the same structure.

The connection of PROFINET IO field devices occurs exclusively with switches as network components. Switches typically integrated in the field device are used for this (with 2 ports assigned). PROFINET-suitable switches must support "autonegotiation" (negotiating of transmission parameters) and "autocrossover" (autonomous crossing of send and receive lines).

Cables and connectors comply with the Profinet specifications. The cabling guide defines for all Conformance Classes a 2-pair cable according to IEC 61784-5-3.

Standard Profinet cables commercially available can be used.

The maximum segment length for electrical data transmission with copper cables between two nodes (field devices or switches) is 100 m / 328.084 ft. The copper cables are designed uniformly in AWG 22. The installation guide defines different cable types, whose range has been optimally adapted to general requirements for industry. Sufficient system reserves allow industry-compatible installation with no limitation on transmission distance.

The PROFINET cables conform to the cable types used in industry:

- PROFINET Type A: Standard permanently routed cable, no movement after installation
- PROFINET Type B: Standard flexible cable, occasional movement or vibration
- PROFINET Type C: Special applications: for example, highly-flexible, constant movement (trailing cable or torsion)

For complete information please refer to IEC 61918, IEC 61784-5-13, and IEC 61076-2-101.

To increase noise immunity only S/FTP or SF/FTP cables must be used (CAT-5).

The maximum cable length (<u>100 meters / 328.084 ft</u>) predefined by Ethernet 100Base-TX must be compulsorily fulfilled.

Regarding wiring and EMC measures, the IEC 61918 and IEC 61784-5-13 must be considered.

For a complete list of the available cordsets and connection kits please refer to the product datasheet ("Accessories" list).

### 4.4 Line termination

Profinet network needs no line termination because the line is terminated automatically; in fact every Slave is able to detect the presence of the downstream Slaves.

### 4.5 MAC address and IP address

The unit can be identified in the network through the **MAC address** and the **IP address**. MAC address has to be intended as a permanent and globally unique identifier assigned to the unit for communication on the physical layer; while the IP address is the name of the unit in a network using the Internet protocol. MAC address is 6-byte long and cannot be modified. It consists of two parts, numbers are expressed in hexadecimal notation: the first three bytes are used to identify the manufacturer (OUI, namely Organizationally Unique Identifier), while the last three bytes are the specific identifier of the unit. The MAC address can be found on the label applied to the encoder. The IP address (and the subnet mask) must be assigned by the user to each interface of the unit to be connected in the network. For additional information on the MAC address refer to the "5.4 Mac address" section on page 53. For additional information on the IP address in the project" section on page 64.

### 4.6 Ground connection (Figure 1)

To minimize noise connect properly the shield and/or the connector housing and/or the frame to ground. Connect properly the cable shield to ground on user's side. Lika's EC- pre-assembled cables are fitted with shield connection to the connector ring nut in order to allow grounding through the body of the device. Lika's E- connectors have a plastic gland, thus grounding is not possible. If metal connectors are used, connect the cable shield properly as recommended by the manufacturer. Anyway make sure that ground is not affected by noise. It is recommended to provide the ground connection as close as possible to the device. We suggest using the ground point provided in the housing (see Figure 1, use one TCEI UNI M3 x 6 cylindrical head screw with two tooth lock washers).

### 4.7 Diagnostic LEDs (Figure 1)

Five LEDs located in the rear of the encoder (see Figure 1) are meant to show visually the operating or fault status of the encoder and the Profinet interface. The meaning of each LED is explained in the following tables.

#### MS Module Status LED (red)

It shows the state of the Profinet device. It is also referred to as SF (System Failure) LED.

| MS LED                                 | Description           | Meaning  |
|--|-----------------------|--|
| OFF                                    | No error              | No system error is active.   |
| ON red                                 | System error active   | A system error has occurred.<br>A watchdog timeout has occurred.<br>Channel, generic, or extended diagnosis<br>present.  |
| FLASHING<br><mark>red</mark> (1Hz, 3s) | DCP service initiated | DCP signal service is initiated via the<br>bus. The PROFINET specification defines the<br>Discovery and basic Configuration Protocol<br>(DCP) to change/set PROFINET device<br>parameters over the network (set station<br>name, set IP address, reset to factory,). |

#### NS Network Status LED (red)

It shows the current state of the network. It is also referred to as BF (Bus Failure) LED.

| NS LED                 | Description  | Meaning   |
|------------------------|--|---|
| OFF                    | No error   | No bus error is active.   |
| ON red                 | Bus error active<br>No connection to<br>another device<br>No data exchange | A bus error has occurred. The bus is<br>disconnected.<br>No configuration is present.<br>Controller / Master is not available or<br>switched off.<br>There is no physical link or it is a low<br>speed physical link. |
| FLASHING<br>red (2 Hz) | Parameterization<br>fault<br>Connection to                                 | No data exchange is occurring.<br>Device / Slave not configured yet or<br>wrong configuration.  |

| data exchange mode configuration. |  | However, the<br>device / Slave did<br>not switch to the | Wrong station address assigned (but not<br>outside the permitted range).<br>Actual configuration of the device /<br>Slave differs from the nominal |
|-----------------------------------|--|---|--|
|-----------------------------------|--|---|--|

### PWR Power LED (green / red)

It shows the power supply and system state. It is also referred to as SYS (System) LED.

| PWR LED                      | Description  | Meaning   |
|------------------------------|--|---|
| OFF                          | Power OFF  | The encoder power supply is switched OFF. No supply voltage for the device or hardware fault.   |
| ON green                     | Power ON   | The encoder power supply is switched<br>ON.<br>The firmware is running.   |
| BLINKING<br><mark>red</mark> | No firmware<br>program installed,<br>firmware update<br>mode | At power ON the LED blinks red at 1 Hz.<br>The firmware program is not installed,<br>the encoder enters the firmware update<br>mode and waits for the firmware file to<br>be installed. |

### L/A Link/Activity LED for port 2 P2 (green / yellow)

It shows the state and the activity of the physical link (port 2 P2).

| L/A LED              | Description                | Meaning  |
|----------------------|----------------------------|--|
| OFF                  | No link<br>No activity     | The device has no link to the Ethernet,<br>the link through port 2 P2 is not active.<br>There is no activity on port 2 P2, the<br>device does not send/receive Ethernet<br>frames through port 2 P2. |
| ON green             | Link active<br>No activity | Port 2 P2 link active, the device is linked to the Ethernet, there is no activity on port 2 P2.  |
| FLICKERING<br>yellow | Activity                   | Port 2 P2 link is active, there is activity<br>on port 2 P2, the device sends/receives   |
| Ethernet frames through port 2 P2. |
|------------------------------------|
|------------------------------------|

# L/A Link/Activity LED for port 1 P1 (green / yellow)

It shows the state and the activity of the physical link (port 1 P1).

| LED                  | Description                | Meaning  |
|----------------------|----------------------------|--|
| OFF                  | No link<br>No activity     | The device has no link to the Ethernet,<br>the link through port 1 P1 is not active.<br>There is no activity on port 1 P1, the<br>device does not send/receive Ethernet<br>frames through port 1 P1. |
| ON green             | Link active<br>No activity | Port 1 P1 link active, the device is linked to the Ethernet, there is no activity on port 1 P1.  |
| FLICKERING<br>yellow | Activity                   | Port 1 P1 link is active, there is activity<br>on port 1 P1, the device sends/receives<br>Ethernet frames through port 1 P1.   |

### 4.8 LED state definition

| LED state  | Frequency      | Description  |
|------------|----------------|--|
| Flashing   | 1 Hz, 3 s      | The LED turns ON and OFF for 3 seconds with a frequency of 1 Hz: "ON" for 500 ms, followed by "OFF" for 500 ms.  |
| Flashing   | 2 Hz           | The LED turns ON and OFF with a frequency of 2 Hz: "ON" for 250 ms, followed by "OFF" for 250 ms.  |
| Blinking   | 1 Hz, 4 Hz     | <ul> <li>The LED turns ON in phase with a frequency of approx.:</li> <li>1 Hz: ON color 1 for 500 ms and ON color 2 for 500 ms;</li> <li>4 Hz: ON color 1 for 125 ms and ON color 2 for 125 ms.</li> </ul> |
| Flickering | Load dependent | The LED turns ON and OFF with a frequency of approximately 10 Hz to indicate high Ethernet activity: "ON" for approximately 50 ms,   |

|  |  | followed by "OFF" for 50 ms. The LED turns ON<br>and OFF in irregular intervals to indicate low<br>Ethernet activity. |
|--|--|---|
|--|--|---|

### 4.9 States

Here follows the list of the Profinet states.

### **ERROR** state

There is at least one serious network error. The Read Process Data shall be regarded as not valid. Write Process Data could still be forwarded to the Master, so the application must keep this data updated.

### **EXCEPTION** state

The module has ceased all network participation due to an error. This state is unrecoverable, i.e. the system must be restarted in order to be able to exchange network data.

### **IDLE** state

The network interface is idle; the communication establishment is in progress. The Read Process Data may be either updated or static (unchanged).

### NW\_INIT state

The device is currently performing network-related initialization tasks. Telegrams now contains Process Data (if such data is mapped), however the network Process Data channel is not active yet. If the process is successful, the module will shift to the WAIT\_PROCESS state; or, in case of failure or if a serious error occurs (i.e. any error which prevents the system from proceeding), it will shift to the EXCEPTION state.

### **OFFLINE** state

The IO Device has no valid configuration.

### **OPERATE** state

The I/O connection is established and valid I/O data is exchanged between the Controller and the Device.

### PROCESS\_ACTIVE state

The network Process Data channel is active and error free. Perform normal data handling.

#### **SETUP** state

The setup of the device is in progress. The encoder may not send commands to the application in this state. If setup is successful, the module will shift to the NW\_INIT state; or, in case of failure, it will shift to the EXCEPTION state.

#### **STOP** state

The IO Device has no communication to the IO Controller. Connection establishment is not in progress. The bus state of the IO Device may be set to ON or OFF.

### WAIT\_PROCESS state

The network Process Data channel is temporarily inactive. The system will consider the Read Process Data as not valid.

# 5 Getting started

# 5.1 Quick start information

The following instructions allow the operator to quickly and safely set up the device in a standard operational mode.

For complete and detailed information please read the mentioned pages thoroughly.

- Mechanically install the device, see on page 26 ff;
- execute the electrical connection and switch on the +5Vdc +30Vdc power supply, see on page 31 ff; check the soundness of the connection;
- switch off the power supply and execute the network connection, then switch on again the power supply, see on page 31 ff; check the soundness of the connection;
- install the GSDML file, see on page 56 ff;
- insert the Lika module and the type of telegram in the PROFINET-IO system, see on page 59 ff;
- set the device name, see on page 64 ff; at delivery the device name is set to a **blank string**;
- set the IP address and the subnet mask to the node, see on page 64 ff; the default address set by Lika is **0.0.0.0**;
- to set the encoder parameters, enter the **Module parameters** page, see on page 69; on this page you can, for example, set the singleturn resolution or the total resolution, enable the scaling function, or change the counting direction; after entering new values, you must download the parameters to the device; the complete list of the default parameters is available on page 179. <u>Please note that all the</u> <u>parameters listed in the Module parameters page are sent at each</u> <u>switching on.</u>
- to enable the scaling function, change the counting direction, and execute the preset, the Class 4 functionality parameter must be enabled (="1"), see on page 122.

# 5.1.1 Setting the resolution and the scaling function

 If you want to use the physical resolution of the encoder, please check that the Scaling function control parameter is disabled (="0"), see on page 123; this parameter is active only if the Class 4 functionality parameter is enabled (="1"), see on page 122;

- on the contrary, if you need a custom resolution, you must enable the scaling function by setting the **Scaling function control** parameter to ="1" first and then set the required resolution values:
  - open the **Module parameters** page and set the singleturn resolution next to the **Measuring units / Revolution** parameter, see on page 69 and on page 126;
  - open the **Module parameters** page and set the total resolution next to the **Total measuring range** parameter, see on page 69 and on page 127.

# 5.1.2 Reading the position

To read the value of the absolute position use the variable tables (for instance, if the Standard Telegram 83 is installed, use the Telegram 0x53 table available in the project example provided by Lika, see on page 96; see also the G1\_XIST1 parameter on page 99, the G1\_XIST2 parameter on page 101, and the G1\_XIST3 parameter on page 102).



# NOTE

It is possible to read the current position of the encoder also by entering the web server via browser (see the "14 Integrated web server" section on page 167): in the **Encoder position and speed** page (see on page 169), the current position of the encoder is displayed. For example, it is "350253" in Figure 77.

# 5.1.3 Setting and executing the preset

- To set and execute the preset proceed as follows:
  - check that the Control by PLC bit 10 of the STW2\_ENC control word is ="1", see on page 102;
  - check that the Class 4 functionality parameter is enabled (="1"), see on page 122;
  - check that the G1\_XIST1 Preset control parameter is enabled (="0"), see on page 122;
  - set the preset value by means of an acyclic data exchange: it is possible to use the P65000-Preset variable table available in the project example provided by Lika (see on page 159 and the P65000 Preset value parameter on page 118);
  - execute the preset by forcing high the **Request set/shift of home position** bit 12 in the **G1\_STW** control word, see on page 104;

- the encoder replies by forcing high the **Set/shift of home position executed** bit 12 in the **G1\_ZSW** status word, see on page 107;
- the Master must set back to 0 the **Request set/shift of home position** bit 12 in the **G1\_STW** control word, see on page 104;
- the **Set/shift of home position executed** bit 12 in the **G1\_ZSW** status word is set back to 0, see on page 107; see the diagram on page 163.

### Setting and activating the preset via TIA PORTAL and the example project



Documentation is complete with some example projects provided free of charge. The projects are designed to help you set and execute the preset with the TIA PORTAL V16 development environment easily. You can find them in the Lika TIA V16 CPU1500 Profinet

example project.zip compressed file contained in the SW EXM58\_EXO58 PT.zip file.

To set and activate the preset, please refer also to the "9.2 Record Data Objects" section on page 110.

Refer also to the **Preset EXM58 Profinet encoder Lika.mp4** video.

To set and activate the preset via TIA PORTAL development environment we suggest getting the followings:

- EXM5XX-13-14\_RT example project (see Lika TIA V16 CPU1500 Profinet example project);
- Preset EXM58 Profinet encoder Lika.mp4 explanation video.

You need to <u>set</u> the preset value through an acyclic request first. To do this proceed as follows:

- check that the Control by PLC bit 10 of the STW2\_ENC control word is ="1", see on page 102;
- check that the Class 4 functionality parameter is enabled (="1"), see on page 122;
- check that the G1\_XIST1 Preset control parameter is enabled (="0"), see on page 122;

 check the hardware identifier of the installed encoder module; to do this go to the Device view and select the Parameter Access Point. Then enter the System constants tab in the Inspector window: in the Hardware identifier column you will find the address of the installed encoder module ("264" in the example);

| EXM5XX-13-14 → Ungrouped devices → EXM13 [L     | IKA EXM5XX-13-14] |                    |                             |                     |         |        | ĩ≡×   |
|---|-------------------|--------------------|-----------------------------|---------------------|---------|--------|-------|
|   |                   | <b>2</b> 1         | Fopology view               | Network view        | 11      | Device | view  |
| 👉 🛛 EXM13 [LIKA EXM5XX-13-14] 💌 🗮 🔛             | 🔟 🔍 ±             |                    | Device overview             |                     |         |        |       |
|   |                   | ^                  | 1 Module                    |                     | Rack    | Slot   | I add |
|   |                   |                    | <ul> <li>EXM13</li> </ul>   |                     | 0       | 0      |       |
| 3   |                   |                    | Inte                        | rface               | 0       | 0 X1   |       |
| 53913   |                   |                    | <ul> <li>Multitu</li> </ul> | rn 27 Bit Module 1  | 0       | 1      |       |
| V   |                   |                    | Para                        | ameter Access Point | 0       | 11     |       |
|   |                   | 1                  | Star                        | ndard Telegram 83   | 0       | 12     | 015   |
| •   |                   |                    |                             |                     |         |        |       |
| < III > 100%                                    | · · ·             |                    | <                           |                     |         |        | >     |
| Parameter Access Point [Parameter Access Point] |                   |                    | Properties                  | 🗓 Info 追 📱 Diag     | gnostic | s      | 7 8 ▼ |
| General IO tags System constants                | Texts             |                    |                             |                     |         |        |       |
| Show hardware system constant 💌                 |                   | -                  |                             |                     |         |        |       |
| Name  | Туре              | Hardware identifie | er Used by                  | Comment             |         |        |       |
| EXM13-Multiturn_27_Bit_Module_1                 | Hw_SubModule      | 264                | PLC_1                       |                     |         |        |       |

• in the Project tree on the left select **Acyclic Request** under **Watch** and force tables;

|                           | □ < EX | KM5XX-13-14 	▶ Devices & networks  |           |                 |                | _ # # ×     | Hardware catalog    | 11         |
|---------------------------|--------|------------------------------------|-----------|-----------------|----------------|-------------|---------------------|------------|
| Devices                   |        |                                    |           | 📑 Topology view | A Network view | Device view | Options             | _          |
|                           | 1 🖻 🖬  | Network Connections HMI connection | - 2 4 1 1 | 1               | Network over   | /iew I + >  |                     | ) (44)<br> |
|                           |        | tot -                              |           |                 |                |             | ✓ Catalog           | _          |
| T EXM5XX-13-14            |        |                                    |           |                 | - Y Device     |             |                     |            |
| Add new device            |        | ✓                                  |           | <b>~</b>        | ET 2005        |             | <search></search>   | 644        |
| Devices & networks        |        | PLC_1                              |           | EXM13           | = PLC          |             | Filter <al></al>    |            |
|                           | •      | CPU 1512SP-1 PN                    |           | LIKA EXM5XX-1   | GSD de         |             | Controllers         |            |
| Device configuration      | -      |                                    |           | PLC_1           | EXAV           | 13          | ▶ 📻 HM              |            |
| Conline & diagnostics     |        |                                    |           |                 |                |             | PC systems          |            |
| Software units            |        |                                    |           |                 |                |             | Drives & starter    |            |
| Program blocks            | •      |                                    | PN/IE_1   |                 |                |             | • Im Network compo  | nents      |
| Technology objects        | -      |                                    |           |                 |                |             | > Detecting & Mor   | nitoring   |
| External source files     |        |                                    |           |                 |                |             | Distributed I/O     |            |
| PLC tags                  | •      |                                    |           |                 |                |             | Power supply an     | d distri.  |
| PLC data types            |        |                                    |           |                 |                |             | Field devices       |            |
| Watch and force tables    |        |                                    |           |                 |                |             | • Dther field devis | tes        |
| Add new watch table       |        |                                    |           |                 | Ĩ.             |             |                     |            |
| Acyclic request           |        |                                    |           |                 | -              |             |                     |            |
| Fill Force table          |        |                                    |           |                 |                |             |                     |            |
| Lelegram 0x53             |        |                                    |           |                 |                |             |                     |            |
| Online backups            |        |                                    |           |                 |                |             |                     |            |
| Traces                    |        |                                    |           |                 |                |             |                     |            |
| OPC UA communication      |        |                                    |           |                 |                |             |                     |            |
| Bevice proxy data         |        |                                    |           |                 |                |             |                     |            |
| Program info              |        |                                    |           |                 |                |             |                     |            |
| PLC supervisions & alarm: | ~      |                                    |           |                 |                |             |                     |            |
| Details view              |        |                                    |           |                 |                |             |                     |            |
|                           |        |                                    |           |                 |                |             |                     |            |
|                           |        |                                    |           |                 |                |             |                     |            |
|                           |        |                                    |           |                 |                |             |                     |            |
| Name                      |        |                                    |           |                 |                |             |                     |            |
|                           |        |                                    |           |                 |                |             |                     |            |
|                           |        |                                    |           |                 | ✓              |             |                     |            |
|                           |        |                                    |           |                 |                |             |                     |            |



• the Acyclic request watch table will be displayed;

| Devices     Options  | roject tree                                | ▲ EXM5 | XX-13-14 + PLC_1 [CPU 1512SP-1 PN] +     | Watch and fo       | rce tables + Acy | clic request  |              |   |         | _ • • × | Testing          |         |
|--|--|--------|--|--------------------|------------------|---------------|--------------|---|---------|---------|------------------|---------|
| Details:         Name         Addres         Dipply fermat         Modify value         Comment         Comment           Details:         Addres device         2         ************************************  | Devices                                    |        |  |                    |                  |               |              |   |         |         | Options          |         |
| Details:         Name         Addres         Dipply fermat         Modify value         Comment         Comment           Details:         Addres device         2         ************************************  | 8  |        | 2 10 10 10 10 00 00 00 00 00 00 00 00 00 |                    |                  |               |              |   |         |         |                  |         |
| DBLOKON 13-14         C         A         F<   |  | 1      |  | Address            | Display format   | Monitor value | Modify value | 9 | Comment | -       | × CPIL operator  |         |
| Discrete statution         Discret  | ExM5xx-13-14                               | A 1 // |  |                    |                  |               |              |   |         |         |                  |         |
| Image: Construction     Image: Construct   | Add new device                             | 2      | "Request R/W param single"               | %M0.0              | Bool             | FALSE         | TRUE         |   | 4       |         | PLC_1 [CPU 15125 | P-1 PN] |
| Minute configuration         S         Prodect (period)         PDC         Set         P24         Minute         PDC         PDC         Set         P24         Minute         PDC  | A Devices & networks                       | 3 //   |  |                    |                  |               |              |   |         |         | RUN / STOP       | RUN     |
| Image: Province on Signation     9 <sup>1</sup> | • 📑 PLC_1 [CPU 15125P-1 PN]                | 4      | "WRREC_Data".REQ                         |                    | Bool             | FALSE         |              |   |         |         | 50000            | C TOP   |
| Model as approted     Model Links     Mark  | TY Device configuration                    | 5      | "WRREC_Data".ID                          |                    | DEC              | 264           | 264          |   | 4       |         | _                |         |
| • Control of Market units           7 degrees LDD* Request L defenses           • Model DBBD            • Model DBBD            • Model DBBD   | Online & diagnostics                       | 6      | "WRREC_Data".INDEX                       |                    | Hex              | 16#0000_B02E  | 16#0000_B02E |   | 4       |         | MAINT            | MRES    |
| in the set of the s   |  | 7 11   |  |                    |                  |               |              |   |         |         |                  |         |
| • Bitchmall Score Res     10   | Program blocks                             | 8      | "Request_DB".Request_reference           | %D81.D880          | Hex              | 16#01         | 16#01        |   | 4       |         | Mode selector: 1 | RUN     |
| • Car Car Gags           • The quest, CD* Tho, Car Janmeters           • Nol D. DB3           • Heal           • Fail Car Car Gags           • Fail Car  |  | 9      | "Request_DB".Request_ID                  | %D81.D881          | Hex              | 16#02         | 16#02        |   | Ā       |         |                  |         |
| • • • • • • • • • • • • • • • • • • •  | External source files                      | 10     | "Request_DB" Axis_No_DO_ID               | %D81.D882          | Hex              | 16#00         | 16#00        |   | 4       |         |                  |         |
| ■     ■     13     1 Trajest (DP 1%) of classes()     NoBI DBS     Here     16401     ▲       ■     Arging regist     15     1 Trajest (DP 1%) of classes()     NoBI DBS     Here     16600     ♥     ▲       ■     Arging regist     15     1 Trajest (DP 1%) of classes()     NoBI DBS     Here     16600     ♥     ▲       ■     Arging regist     15     1 Trajest (DP 1%) of classes     NoBI DB10     Here     16643     16433     ♥       ■     Arging regist     15     1 Trajest (DP 1%) of classes     NoBI DB10     Here     16643     ♥     ▲       ■     Arging regist     15     1 Trajest (DP 1%) of classes     NoBI DB10     Here     16643     ♥     ▲       ■     Order Schape     18     1 Trajest (DP 1%) of classes     NoBI DB10     Here     16643     ♥     ▲       ■     Order Schape     18     1 Trajest (DP 1%) of classes     NoBI DB10     Here     16640     ♥     ▲       ■     Order Schape     18     1 Trajest (DP 1%) of classes     NoBI DB10     Here     16640     ♥     ▲       ■     1 Trajest (DP 1%) of classes     NoBI DB10     Here     16640     ♥     ▲       ■     1 Trajest (DP 1%) of classes<   | PLC tags                                   | 11     | "Request_DB".No_of_parameters            | %DB1.DB83          | Hex              | 16#01         | 16#01        |   | 4       |         |                  |         |
| Image: Constraint         He         He         He         Store         Store         Store         A           A regime regime         He         Tecports (D)* Subdet         NOB DBMS         He         Store         Store         A           B regime         HS         Tecports (D)* Subdet         NOB DBMS         He         Store         A           B regime         HS         Tecports (D)* Subdet         NOB DBMS         He         Store         A           B regime         HS         Tecports (D)* Subdet         NOB DBMS         He         Store         A           B regime         HS         Tecports (D)* Subdet         NOB DBMS         He         Store         A           B regime         HS         Tecports (D)* Nob(ts)         NOB DBMS         He         Store         A           B regime         HS         Tecports (D)* Nob(ts)         NOB DBMS         He         Store         A           B regime         HS         Tecports (D)* Nob(ts)         NOB DBMS         He         Store         A           B regime         HS         Tecports (D)* Nob(ts)         NOB DBMS         He         Store         He         Store           B regime         HS         <  | PLC data types                             | 12     | "Request_DB" Attribute_parameter_01      | %DB1.DB84          | Hex              | 16#10         | 16#10        |   | 4       |         |                  |         |
| Bit         Spige reguest         15         Trapport CD* Subindex         NOBI DBMB         Her         66430         1640000         C#         A           Circle Strates         Sin         Trapport CD* Subindex         NOBI DBMB         Her         66433         164030         C#         A           Circle Strates         Sin         Trapport CD* Subindex         NOBI DBMB         Her         16643         16403         C#         A           Circle Strates         Sin         Trapport CD* Nobic Loft Nobic DBMB         Her         166700         C#         A           Circle Strates         Sin         Trapport CD* Nobic Loft Nobic DBMB         Her         166700         C#         A           Circle Strates         Sin         Trapport CD* Nobic Loft Nobic DBMB         Her         166700         C#         A           Circle Strates         Sin         Trapport CD* Nobic DD* Nobic DBMB         Her         166700         C         C         A           Tartes         Sin         Trapport CD* Nobic DD* Nobic DBMB         Her         166700         C         C         C         C         C         C         C         C         C         C         C         C         C         C         C   | <ul> <li>Watch and force tables</li> </ul> | 13     | "Request_DB".No_of_elements_01           | %DB1.DB85          | Hex              | 16#01         | 16#01        |   | 4       |         |                  |         |
| Bit         The point (DP 1 mode)         Not DD 100         Hex         1643         Clinitian           1 % point point do 3         1 % point poin   | Add new watch table                        | 14     | "Request_DB".Parameter_number_01         | %DB1.DBW6          | DEC              | 65000         | 65000        |   | 4       |         |                  |         |
| Bit         Telepoints_ODF //oncut         NoDI D0010         Hex         16433         C         A           1         Goldne backups         16         Telepoints_ODF //oncut         NoDI D0010         Hex         16433         C         A           1         Goldne backups         18         Telepoints_ODF //oncut         NoDI D0010         Hex         16493         C         A           2         Telepoints_ODF //oncut         NoDI D0010         Hex         16490         C         A           3         Telepoints_ODF //oncut         NoDI D0012         Hex         164900         C         A           3         Telepoints_ODF //oncut         NoDI D0010         Hex         164901         C         A           4         Telepoints_ODF //oncut         NoDI D0010         Hex         164901         C         A           5         Telepoints_ODF //oncut         NoDI D0010         Hex         16491         C         C         A           5         Telepoints_ODF //oncut         NoDI D0010         Hex         16491         C         C         C         C         C         C         C         C         C         C         C         C         C         C   | Acyclic request                            | 15     | "Request_DB".SubIndex                    | %DB1.DBW8          | Hex              | 16#0000       | 16#0000      |   | 4       |         |                  |         |
| Image: Source backups     Image: Source backups <t< td=""><td>Force table</td><td>16</td><td>"Request_DB".Format</td><td>%D81.D8810</td><td>Hex</td><td>16#43</td><td>16#43</td><td></td><td>4</td><td></td><td></td><td></td></t<>  | Force table                                | 16     | "Request_DB".Format                      | %D81.D8810         | Hex              | 16#43         | 16#43        |   | 4       |         |                  |         |
| 10     Traces     19       20     OFL Mcommunication     10       120     OFL Mcommunication     10       131     OFL Mcommunication     10       132     OFL Mcommunication     10       133     OFL Mcommunication     10       134     OFL Mcommunication     10       135     OFL Mcommunication     10       134     OFL Mcommunication     10       134     Mcommunication     10       135     Mcommunication     10       136     Mcommunication     10       137     Mcommunication     10       138     Mcommunication     100       139     Mcommunication     100       141     Mcommunication     100       142   | Telegram 0x53                              | 17     | "Request_DB".No_of_value                 | %DB1.DBB11         | Hex              | 16#01         | 16#01        |   | 4       |         |                  |         |
| Op/CU UX Communication         D0         Transport up/feeduce_minume         NOSD.2000         Hex         6602           View Diversity of the State of the  | Online backups                             | 18     | "Request_DB".Value                       | %DB1.DBD12         | Hex              | 16#0000_1000  | 16#0000_1000 |   | 4       |         |                  |         |
| 1 @ Orker parsy data     21     1 % Exponse_D0* Aray bego Org.     NoB 2.DB1     Hex     16620       21     7 Mappane, D* Aray, beg Org.     NoB 2.DB1     Hex     16620       21     7 Mappane, D* Aray, beg Org.     NoB 2.DB2     Hex     16620       22     7 Mappane, D* Aray, beg Org.     NoB 2.DB2     Hex     16620       23     7 Mappane, D* Aray, beg Org.     NoB 2.DB2     Hex     16620       24     7 Mappane, D* Aray, beg Org.     NoB 2.DB2     Hex     16643       25     7 Mappane, D* Aray, beg Org.     NoB 2.DB2     Hex     16643       26     7 Mappane, D* Map, dual with NoB 2.DB3     Hex     16643       30     7 Mappane, D* Map, dual with NoB 2.DB5     Hex     16643       31     NoB 2.DB4     NoB 2.DB5     Hex     16643       32     7 Mappane, D* Vaule     NoB 2.DB5     Hex     166400       NoB     27     NoB 2.DB4     NoB 2.DB5     Hex     1664000       Name     27     NoB     NoB 2.DB4     Hex     1664000   | Traces                                     | 19 //  |  |                    |                  |               |              |   |         |         |                  |         |
| Name         23         Tesponse, DPI Aug, Dp. OD_, Drimered         NOSZ.DB22         Hex         6600           Details view         23         Tesponse, DPI Aug, Dramate         NOSZ.DB23         Hex         6601           Details view         24         Tesponse, DPI Aug, Dramate         NOSZ.DB24         Hex         16601           Details view         24         Tesponse, DPI Aug, Dramate         NOSZ.DB25         Hex         16601           26         Tesponse, DPI Aug, Dramate         NOSZ.DB25         Hex         16601         Image: DPI Aug, Dramate           26         Tesponse, DPI Aug, Dramate         NOSZ.DB25         Hex         16601         Image: DPI Aug, Dramate         NOSZ.DB26           1000000000000000000000000000000000000  | OPC UA communication                       | 20     | "Response_DB".Request_reference_mirror   | %D82.D880          | Hex              | 16#01         |              |   |         |         |                  |         |
| Car Supervisions & Aleman         V 23         Versponse, DP / Jug, dy avaneters         NOB 2.083         Hex         5661           Details view         23         Versponse, DP / Jug, dy luke         NOB 2.085         Hex         5663           25         Versponse, DP / Jug, dy luke         NOB 2.085         Hex         56691           26         Versponse, DP / Vuke         NOB 2.085         Hex         56691           27         Versponse, DP / Vuke         NOB 2.085         Hex         56690           Name         27         vidd mmo         1640000, 1000         164000, 1000  | Device proxy data                          | 21     | "Response_DB".Response_ID                | %D82.D881          | Hex              | 16#02         |              |   |         |         |                  |         |
| Details view         24         "response_DD1"semat         ND2.DB4         Hex         1643           25         "response_DD1"sed_view         ND2.DB5         Hex         16401           26         "feeponse_DD1"sed_view         ND2.DB5         Hex         16401           27  | 2 Program info                             | 22     | "Response_DB" Axis_No_DO_ID_mirrored     | %D82.D882          | Hex              | 16#00         |              |   |         |         |                  |         |
| 25         "Response_DB" Ass_d/value         NOZ DBS         Hex         16601           27         "Response_DB" Value         NOZ DBS         Hex         1660000_1000           27         vidd nexo         vidd nexo         I         I  | PLC supervisions & alarm:                  | ₩ 23   | "Response_DB".No_of_parameters           | %D82.D883          | Hex              | 16#01         |              |   |         |         |                  |         |
| 26         **asponse_DB*/value         NOE2.0005         Hex         1660000_1000           27         vhdd nexo   | Details view                               |        |  | %DB2.DB84          | Hex              |               |              |   |         |         |                  |         |
| Name add new a   |  |        |  |                    | Hex              |               |              |   |         |         |                  |         |
| Hane   |  | 26     | "Response_DB".Value                      | %D82.D8D6          | Hex              | 16#0000_1000  |              |   |         |         |                  |         |
|  |  | 27     |  | <add new=""></add> |                  |               |              |   |         |         |                  |         |
|  | Name                                       |        |  |                    |                  |               |              |   |         |         |                  |         |
|  |  |        |  |                    |                  |               |              |   |         |         |                  |         |
|  |  |        |  |                    |                  |               |              |   |         |         |                  |         |
|  |  | <      |  |                    |                  |               |              |   |         | >       |                  |         |

- in the **Acyclic request** table check and set -if required- the following items:
  - WRREC\_Data.ID: it is the hardware identifier of the encoder's hardware module; please check it matches the one of your encoder ("264" in the example);
  - **WRREC\_Data.INDEX**: it is the index of the PROFIdrive profile: "16#0000\_B02E"; it cannot be modified;
  - **Request\_DB.Request\_ID**: it sets whether the parameter is to be read (value 1) or to be written (value 2); enter "2" to set the preset;

|  | ▲ EXM5       | XX-13-14 → PLC_1 [CPU 1512SP-1 PN] →      |                    |                |               |              |  | _ # #   | X Testing    |             |
|--|--------------|---|--------------------|----------------|---------------|--------------|--|---------|--------------|-------------|
| Devices                                    |              |   |                    |                |               |              |  |         | Options      |             |
| 8  | 3 9 8        | P # ₩ 16 9. % % <sup>®</sup> <sup>®</sup> |                    |                |               |              |  |         |              | 0           |
|  | i            | Name                                      | Address            | Display format | Monitor value | Modify value | 9  | Comment | ✓ CPU oper   |             |
| EXM5XX-13-14                               | ∧ 1 <i>Ⅱ</i> |   |                    |                |               |              |  |         |              |             |
| Add new device                             | 2            | "Request R/W param single"                | %M0.0              | Bool           | FALSE         | TRUE         |  |         | PLC_1 [CPU 1 | 5125P-1 PN] |
| A Devices & networks                       | 3 //         |   |                    |                |               |              |  |         | RUN / STO    | DP RUN      |
| - D PLC 1 [CPU 15125P-1 PN]                | 4            | "WRREC_Data".REQ                          |                    | Bool           | FALSE         |              |  |         | ERROR        | STOP        |
| Device configuration                       | 5            | *WRREC_Data*.ID                           |                    | DEC            | 264           | 264          | M /  |         |              |             |
| Q Online & diagnostics                     | 6            | "WRREC_Data".INDEX                        |                    | Hex            | 16#0000_B02E  | 16#0000_B02E |  |         | MAINT        | MRES        |
| Software units                             | 7 //         |   |                    |                |               |              |  |         |              |             |
| Program blocks                             | 8            | "Request_DB".Request_reference            | %DB1.DB80          | Hex            | 16#01         | 16#01        | Image: A state of the state | L.      | Mode select  | or: RUN     |
| Technology objects                         | 9            | *Request_DB*.Request_ID                   | %DB1.DBB1          | Hex            | 16#02         | 16#02        | M /  |         |              |             |
| External source files                      | 10           | "Request_DB".Axis_No_DO_ID                | %D81.D882          | Hex            | 16#00         | 16#00        | M /  |         |              |             |
| PLC tags                                   | 11           | "Request_DB".No_of_parameters             | %DB1.DB83          | Hex            | 16#01         | 16#01        | Image: A state of the state | L       |              |             |
| PLC data types                             | 12           | "Request_DB" Attribute_parameter_01       | %DB1.DBB4          | Hex            | 16#10         | 16#10        | M /  | L       |              |             |
| <ul> <li>Watch and force tables</li> </ul> | 13           | "Request_DB".No_of_elements_01            | %DB1.DB85          | Hex            | 16#01         | 16#01        | Image: A state of the state | L.      |              |             |
| Add new watch table                        | 1.           | "Request_DB".Parameter_number_01          | %DB1.DBW6          | DEC            | 65000         | 65000        | Image: A state of the state | L.      |              |             |
| Acyclic request                            | 15           | "Request_DB".SubIndex                     | %D81.D8W8          | Hex            | 16#0000       | 16#0000      | Image: A state of the state | L.      |              |             |
| Ed. Force table                            | 16           | "Request_DB".Format                       | %D81.D8810         | Hex            | 16#43         | 16#43        | Image: A state of the state | L       |              |             |
| Telegram 0x53                              | 17           | "Request_DB".No_of_value                  | %DB1.DBB11         | Hex            | 16#01         | 16#01        | <b>I</b>   |         |              |             |
| Online backups                             | 18           | "Request_DB".Value                        | %DB1.DBD12         | Hex            | 16#0000_1000  | 16#0000_1000 |  | L       |              |             |
| Traces                                     | 19 //        |   |                    |                |               |              |  |         |              |             |
| OPC UA communication                       | 20           | "Response_DB".Request_reference_mirror    |                    | Hex            | 16#01         |              |  |         |              |             |
| Device proxy data                          | 21           | "Response_DB".Response_ID                 | %D82.D881          | Hex            | 16#02         |              |  |         |              |             |
| Program info                               | 22           | "Response_DB".Axis_No_DO_ID_mirrored      | %D82.D882          | Hex            | 16#00         |              |  |         |              |             |
| PLC supervisions & alarm:                  | ✓ 23         | "Response_DB".No_of_parameters            | %D82.D883          | Hex            | 16#01         |              |  |         |              |             |
| Details view                               | 24           | "Response_DB".Format                      | %DB2.DB84          | Hex            | 16#43         |              |  |         |              |             |
|  | 25           | "Response_DB".No_of_value                 | %DB2.DB85          | Hex            | 16#01         |              |  |         |              |             |
|  | 26           | "Response_DB".Value                       | %DB2.DBD6          | Hex            | 16#0000_1000  |              |  |         |              |             |
| la l   | 27           |   | <add new=""></add> |                |               |              |  |         |              |             |
| Name                                       |              |   |                    |                |               |              |  |         |              |             |
|  |              |   |                    |                |               |              |  |         |              |             |
|  |              |   |                    |                |               |              |  |         |              |             |
|  | <            |   |                    |                |               |              |  |         | >            |             |

- Request\_DB.Parameter\_number\_01: it is the number of the parameter to access; it is "65000" for the preset value, see the P65000 – Preset value parameter on page 118;
- Request\_DB.Value: enter here the preset value you want to set;
- in the Request\_DB.Value set the new preset value under the Modify value column: e.g. "1234" (it is set to "1000" currently, see the Monitor value column as well as the Response\_DB.Value item);

|  | EXM5X  | X-13-14 → PLC_1 [CPU 1512SP-1 PN] →     |                    |                |               |                     |               | _ # = X  | Testing          |          |
|--|--------|---|--------------------|----------------|---------------|---------------------|---------------|----------|------------------|----------|
| Devices                                    |        |   |                    |                |               |                     |               |          | Options          |          |
|  |        | £ 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 |                    |                |               |                     |               |          |                  | 1        |
|  | i      | Name                                    | Address            | Display format | Monitor value | Modify value        | 5 Comment     |          | ✓ CPU operator   | panel    |
| 📄 EXM5XX-13-14 🛛 🖉 🔵                       | ∧ 1 // |   |                    |                |               |                     |               |          |                  |          |
| Add new device                             | 2      | "Request R/W param single"              | %M0.0              | Bool           | FALSE         | TRUE                | 🗹 🧘           |          | PLC_1 [CPU 1512: | SP-1 PN] |
| A Devices & networks                       | 3 //   |   |                    |                |               |                     |               |          | RUN / STOP       | RUN      |
| • 📑 PLC_1 (CPU 15125P-1 PN) 🗹 🔵            | 4      | "WRREC_Data".REQ                        |                    | Bool           | FALSE         |                     |               |          | ERROR            | STOP     |
| Device configuration                       | 5      | "WRREC_Data".ID                         |                    | DEC            | 264           | 264                 |               |          |                  | _        |
| 9 Online & diagnostics                     | 6      | "WRREC_Data".INDEX                      |                    | Hex            | 16#0000_B02E  | 16#0000_802E        |               |          | MAINT            | MRES     |
| Software units                             | 7 11   |   |                    |                |               |                     |               |          |                  |          |
| Program blocks                             | 8      | "Request_DB".Request_reference          | %DB1.DB80          | Hex            | 16#01         | 16#01               | A 1           |          | Mode selector:   | RUN      |
| Technology objects                         | 9      | "Request_DB".Request_ID                 | %D81.D881          | Hex            | 16#02         | 16#02               |               |          |                  |          |
| External source files                      | 10     | "Request_DB" Axis_No_DO_ID              | %D81.D882          | Hex            | 16#00         | 16#00               |               |          |                  |          |
| PLC tags                                   | 11     | "Request_DB".No_of_parameters           | %DB1.DB83          | Hex            | 16#01         | 16#01               |               |          |                  |          |
| Co PLC data types                          | 12     | "Request_DB" Attribute_parameter_01     | %DB1.DB84          | Hex            | 16#10         | 16#10               |               |          |                  |          |
| <ul> <li>Watch and force tables</li> </ul> | 13     | "Request_DB".No_of_elements_01          | %DB1.DB85          | Hex            | 16#01         | 16#01               | M 1           |          |                  |          |
| Add new watch table                        | 14     | "Request_DB".Parameter_number_01        | %DB1.DBW6          | DEC            | 65000         | 65000               |               |          |                  |          |
| Acyclic request                            | 15     | "Request_DB".SubIndex                   | %D81.D8W8          | Hex            | 16#0000       | 16#0000             |               |          |                  |          |
| Force table                                | 16     | "Request_DB".Format                     | %D81.D8810         | Hex            | 10443         | 16#43               |               |          |                  |          |
| Telegram 0x53                              | 17     | "Request_DB".No_of_value                | %D81.D8811         | Hex            | 16#01         | 16#01               |               |          |                  |          |
| Online backups                             | 18     | "Request_DB".Value                      | %DB1.DBD12         | Hex            | 16#0000_1000  | 16#0000_1234        |               |          |                  |          |
| Final Traces                               | 19 //  |   |                    |                |               |                     | 1             |          |                  |          |
| OPC UA communication                       | 20     | "Response_DB".Request_reference_mirror  | %D82.D880          | Hex            | 10891         |                     |               |          |                  |          |
| Device proxy data                          | 21     | "Response_DB".Response_ID               | %D82.D881          | Hex            | 16#02         |                     |               |          |                  |          |
| Program info                               | 22     | "Response_DB" Avis_No_DO_ID_mirrored    | %D82.D882          | Hex            | 16#00         |                     |               |          |                  |          |
| PLC supervisions & alarm:                  | 23     | "Response_DB".No_of_parameters          | %DB2.DB83          | Hex            | 16#01         |                     |               |          |                  |          |
| Details view                               | 24     | "Response_DB".Format                    | %DB2.DBB4          | Hex            | 16#42         |                     |               |          |                  |          |
|  | 25     | "Response_DB".No_of_value               | %DB2.DB85          | Hex            | 16#01         |                     |               |          |                  |          |
|  | 26     | "Response_DB".Value                     | %D82.D8D6          | Hex            | 16#0000_1000  |                     |               |          |                  |          |
|  | 27     |   | <add new=""></add> |                |               |                     |               |          |                  |          |
| Name                                       |        |   |                    |                | $\sim$        |                     |               |          |                  |          |
|  |        |   |                    |                |               |                     |               |          |                  |          |
|  |        |   |                    |                |               |                     |               |          |                  |          |
|  | <      |   |                    |                |               |                     |               |          |                  |          |
|  |        |   |                    |                |               | <b>Q</b> Properties | Ni Info 🚯 Dia | anostics |                  | _        |

after setting the new value press the MODIFY ALL SELECTED VALUES
 ONCE AND NOW button in the toolbar to confirm the set value; also the Response\_DB.Value field will be updated;

| roject tree                                | ▲ EXM5        | XX-13-14 > PLC_1 [CPU 1512SP-1 PN] >   | Watch and for      | ce tables + Acy | lic request   |              |          | _ *         | X Testing   |              |
|--|---------------|--|--------------------|-----------------|---------------|--------------|----------|-------------|-------------|--------------|
| Devices                                    |               |  |                    |                 |               |              |          |             | Options     |              |
| 8  | e 🖉           |  |                    |                 |               |              |          |             | options     |              |
|  |               |  |                    |                 |               |              | 4        | 1           |             |              |
|  | 1             | Name Modify all selected value         | ies once and now.  | Display format  | Monitor value | Modify value | 7        | Comment     | ✓ CPU ope   | rator panel  |
|  | <u>^ 1 //</u> |  |                    |                 | -             |              |          |             | PLC 1 (CPL) | 1512SP-1 PN] |
| Add new device                             | 2             | "Request R/W param single"             | %M0.0              | Bool            | FALSE         | TRUE         | 1        |             | RUN / ST    |              |
| Devices & networks                         | 3 //          |  |                    |                 | -             |              |          |             |             | OP RUN       |
| • 📑 PLC_1 [CPU 15125P-1 PN]                |               | "WRREC_Data".REQ                       |                    | Bool            | FALSE         |              |          |             | ERROR       | STOP         |
| Device configuration                       | 5 0           | "WRREC_Data".ID                        |                    | DEC             | 264           | 264          |          |             | MAINT       | MRES         |
| Q Online & diagnostics                     | 6 0           | "WRREC_Data".INDEX                     |                    | Hex             | 16#0000_802E  | 16#0000_802E | 1        |             | - mouri     | MAL 3        |
| Software units                             | 7 //          |  |                    |                 |               |              |          |             | Mode select | Di Mi        |
| <ul> <li>Program blocks</li> </ul>         | 8 =9          |  | %D81.D880          | Hex             | 16#01         | 16#01        | State    |             | Mode selec  | with more    |
| Technology objects                         | 9 = 9         |  | %DB1.DB81          | Hex             | 16#02         | 16#02        | <b>S</b> |             |             |              |
| External source files                      | 10 -          | "Request_DB".Axis_No_DO_ID             | %DB1.DB82          | Hex             | 16#00         | 16#00        | <b>V</b> |             |             |              |
| PLC tags                                   |               |  | %DB1.DB83          | Hex             | 16#01         | 16#01        | 1        |             |             |              |
| PLC data types                             | 12 -          |  | %DB1.DB84          | Hex             | 16#10         | 16#10        | 1        |             |             |              |
| <ul> <li>Watch and force tables</li> </ul> | 13 =9         |  | %DB1.DB85          | Hex             | 16#01         | 16#01        | 1        |             |             |              |
| Add new watch table                        | 14 =          |  | %DB1.DBW6          | DEC             | 65000         | 65000        | 1        |             |             |              |
| Acyclic request                            | 15 =          |  | %DB1.DBW8          | Hex             | 16#0000       | 16#0000      | 1        |             |             |              |
| EU Force table                             | 16 0          |  | %DB1.DBB10         | Hex             | 16#43         | 16#43        | 1        |             |             |              |
| Telegram 0x53                              | 17 =          |  | %DB1.DB811         | Hex             | 16#01         | 16#01        |          |             |             |              |
| Online backups                             | 18 = 9        | "Request_DB".Value                     | %DB1.DBD12         | Hex             | 16#0000_1234  | 16#0000_1234 |          |             |             |              |
| 🕨 🔄 Traces                                 | 19 //         |  |                    |                 | -             | -            | /        |             |             |              |
| OPC UA communication                       | 20            | "Response_DB".Request_reference_mirror | %DB2.DB80          | Hex             | 16#01         |              |          |             |             |              |
| Device proxy data                          | 21            | "Response_DB".Response_ID              | %DB2.DB81          | Hex             | 16#02         |              |          |             |             |              |
| Program info                               | 22            | "Response_DB".Axis_No_DO_ID_mirrored   | %D82.D882          | Hex             | 16#00         |              |          |             |             |              |
| PLC supervisions & alarm:                  | ✓ 23          | "Response_DB".No_of_parameters         | %D82.D883          | Hex             | 16#01         |              |          |             |             |              |
| Details view                               | 24            | "Response_DB".Format                   | %D82.D884          | Hex             | 16#43         |              |          |             |             |              |
|  | 25            | "Response_DB".No_of_value              | %DB2.DB85          | Hex             | 10401         |              |          |             |             |              |
|  | 26            | "Response_DB".Value                    | %DB2.DBD6          | Hex             | 16#0000_1234  |              |          |             |             |              |
|  | 27            |  | <add new=""></add> |                 | $\smile$      |              |          |             |             |              |
| Name                                       |               |  |                    |                 |               |              |          |             |             |              |
|  |               |  |                    |                 |               |              |          |             |             |              |
|  |               |  |                    |                 |               |              |          |             |             |              |
|  | <             |  |                    |                 |               |              |          |             | N           |              |
|  | <             | 1                                      |                    |                 |               |              | 1 Info   | Diagnostics | /           |              |

You need to <u>activate</u> the preset value through the set telegram now. To do this proceed as follows:

 in the Project tree on the left select the Telegram 0x53 item under Watch and force tables; the Telegram 0x53 watch table will be displayed;

|  | EXM5 |               |                    |                | force table > T | elegram 0x53 | ) |         | _ # = ×     | Testing             |      |
|--|------|---------------|--------------------|----------------|-----------------|--------------|---|---------|-------------|---------------------|------|
| Devices                                    |      |               |                    |                |                 | $\sim$       |   |         |             | Options             |      |
| i 📃 🖬                                      | 98   | · 12 10 10 91 | R 2 00 00          |                |                 |              |   |         |             |                     |      |
|  | 1    | Name          | Address            | Display format | Monitor value   | Modify value | 9 | Comment | Tag comment | ✓ CPU operator par  |      |
| 🖹 EXM5XX-13-14 🗹 🔵                         | A 1  | "STW2_ENC"    | %QW0               | Hex            | 16#0400         |              |   |         |             |                     |      |
| Add new device                             | 2    | "STW2_ENC.10" | %Q0.2              | Bool           | TRUE            | TRUE         |   |         |             | PLC_1 [CPU 15125P-1 | PN]  |
| A Devices & networks                       | 3 8  | "G1_STW"      | %QW2               | Hex            | 16#2000         |              |   |         |             | RUN / STOP          | RUN  |
| • 🚰 PLC_1 [CPU 15125P-1 PN]                | 4    | "G1_STW.11"   | %Q2.3              | Bool           | FALSE           | FALSE        |   |         |             | ERROR               | STOP |
| Device configuration                       | 5    | "G1_STW.12"   | 1 %Q2.4            | Bool           | FALSE           | FALSE        |   | L.      |             | _                   |      |
| 😵 Online & diagnostics                     | 6    | "G1_STW.13"   | %Q2.5              | Bool           | TRUE            | TRUE         |   | L.      |             | MAINT               | MRES |
| Software units                             | 7 .  | "G1_STW.14"   | %Q2.6              | Bool           | FALSE           | FALSE        |   |         |             |                     |      |
| Program blocks                             | 8    | "G1_STW.15"   | %Q2.7              | Bool           | FALSE           | FALSE        |   |         |             | Mode selector: RUN  |      |
| Technology objects                         | 9    | "ZSW2_ENC"    | %IWO               | Hex            | 16#0200         |              |   |         |             |                     |      |
| External source files                      | 10   | "G1_ZSW"      | %IW2               | Hex            | 16#2000         |              |   |         |             |                     |      |
| PLC tags                                   | 11   | "G1_ZSW.11"   | %12.3              | Bool           | FALSE           | FALSE        |   |         |             |                     |      |
| PLC data types                             | 12   | "G1_ZSW.12"   | %12.4              | Bool           | FALSE           | FALSE        |   |         |             |                     |      |
| <ul> <li>Watch and force tables</li> </ul> | 13   | "G1_ZSW.13"   | %12.5              | Bool           | TRUE            | FALSE        |   |         |             |                     |      |
| Add new watch table                        | 14   | *G1_ZSW.14*   | %12.6              | Bool           | FALSE           | FALSE        |   |         |             |                     |      |
| Acyclic request                            | 15   | *G1_ZSW.15*   | %12.7              | Bool           | FALSE           | FALSE        |   |         |             |                     |      |
| 55 Force table                             | 16   | "G1_XIST1"    | %ID4               | Hex            | 16#0000_1001    |              |   |         |             |                     |      |
| Telf gram 0x53                             | 17   | "G1_XIST2"    | %ID8               | DEC            | 4097            |              |   |         |             |                     |      |
| Online Backups                             | 18   | "NIST_B"      | %ID12              | DEC+/-         | 0               |              |   |         |             |                     |      |
| Traces                                     | 19   |               | <add new=""></add> |                |                 |              |   |         |             |                     |      |
| OPC UA communication                       |      |               |                    |                |                 |              |   |         |             |                     |      |
| Device proxy data                          |      |               |                    |                |                 |              |   |         |             |                     |      |
| Program info                               | 2    |               |                    |                |                 |              |   |         |             |                     |      |
| PLC supervisions & alarm:                  | ~    |               |                    |                |                 |              |   |         |             |                     |      |
| Details view                               |      |               |                    |                |                 |              |   |         |             |                     |      |
|  |      |               |                    |                |                 |              |   |         |             |                     |      |
|  | 2    |               |                    |                |                 |              |   |         |             |                     |      |
|  |      |               |                    |                |                 |              |   |         |             |                     |      |
| Name                                       |      |               |                    |                |                 |              |   |         |             |                     |      |
|  |      |               |                    |                |                 |              |   |         |             |                     |      |
|  |      |               |                    |                |                 |              |   |         |             |                     |      |
|  | <    |               |                    |                |                 |              |   |         |             |                     |      |

 now you need to force high the Request set/shift of home position bit 12 in the G1\_STW control word, see on page 104; right click the field under the Modify value column next to the G1\_STW.12 item and press the Modify and Modify to 1 commands in the drop-down menus that appear;

|          |   |  |   |  |  |   |  |  | X Te  |  |  |
|----------|---|--|---|--|--|---|--|--|---|--|--|
|          |   |  |   |  |  |   |  |  | Op  | tions  |  |
| 1 9 8    | 2 19 16 9.  | % # <b>₽</b> ₽   |   |  |  |   |  |  |   |  |  |
|          |   |  |   |  |  |   |  | 1-   |   |  |  |
| 1        |   |  |   |  | Modity vali  | ye 🏏  | Comment  | Tag comm   | ent 🗸   | CPU operator   | panel  |
| ^ 1      |   |  |   |  |  |   |  |  | P   | 1 C 1 (CPU 15125   | P-1 PN   |
| 2        |   |  |   |  | TRUE   | M 🔺   |  |  |   |  | BUN  |
| 3        |   |  |   |  |  |   |  |  |   |  |  |
| 4        |   |  |   |  |  |   |  |  |   | ERROR  | STOP   |
| = 5      |   |  |   |  |  | Modify  | •  | Modify to 0  | Ctrl+F3   | MAINT  | MRES   |
| 0        |   |  |   |  |  | POI Monitor all   | Codu T   | Modify to 1  | Ctrl+F2   |  |  |
| /        |   |  |   |  |  |   | 1  |  |   | ode selector: F  | UN   |
| 0        |   |  |   |  | PALSE  |   |  |  |   |  |  |
| 9        |   |  |   |  |  |   |  | Enable peripheral output:  |   |  |  |
|          |   |  |   |  | FAIRE  | -   |  |  |   |  |  |
|          |   |  |   |  |  | 1 Insert comment  | t line   |  |   |  |  |
|          |   |  |   |  |  | X Cut   | Ctrl+X   |  |   |  |  |
|          |   |  |   |  |  | Copy  | Ctrl+C   |  |   |  |  |
|          |   |  |   |  |  | Paste   | Ctrl+V   |  |   |  |  |
|          |   |  |   |  | TALSE  | Y Delete  | Del  |  |   |  |  |
|          |   |  |   |  |  | Bename  | F2   |  |   |  |  |
|          |   |  |   |  |  |   |  |  |   |  |  |
|          | Mol_o   |  | DECTI   | •  |  |   |  |  |   |  |  |
| 10       |   | Cour news  |   |  |  |   |  |  |   |  |  |
|          |   |  |   |  |  | a.  |  |  |   |  |  |
|          |   |  |   |  |  | Expanded Mode   |  |  |   |  |  |
| ~        |   |  |   |  |  |   |  |  |   |  |  |
| <u> </u> |   |  |   |  |  |   |  |  |   |  |  |
|          | <ul> <li>I</li> <li>I</li></ul> | Iteme         Iteme           1         'STMQ_HC(')'           3         'G1_STMQ_HC(')'           4         'G1_STM_12''           5         'G1_STM_12''           6         'G1_STM_12''           7         'G1_STM_12''           8         'G1_STM_12''           9         'G1_STM_12''           10         'G1_STM_12''           11         'G1_STM_12''           12         'G1_STM_12''           13         'G1_STM_12''           14         'G1_STM_12''           15         'G1_STM_12''           16         'G1_STM_12''           17         'G1_STM_12''           18         'G1_STM_12'' | Hame         Address           1         "5700_EVC"         9000           2         "61_5_15.W"         9002           3         "61_5_15.W"         9002           6         "61_5_70.W"         9024           6         "61_5_70.W"         9024           6         "61_5_70.W1"         9024           7         "61_5_70.W1"         9024           8         "61_5_70.W1"         9024           9         "61_5_70.W1"         9024           9         "61_5_70.W1"         9024           9         "61_5_70.W1"         9024           10         "61_5_70.W1"         9024           11         "61_5_70.W1"         9024           12         "61_5_70.W1"         9024           13         "61_5_70.W1"         9024           13         "61_5_70.W1"         9024           13         "61_5_70.W1"         9024           13         "61_5_70.W1"         9024           14         "61_5_70.W1"         9024           15         "61_5_70.W1"         9024           16         "61_5_70.W1"         9024           16         "61_5_70.W1"         9024 | Hame         Address         Dipply format.           1         1         "5700_EVC"         9400         Hex           3         "61_5710"         NQ0.2         Bool         Bool           4         "5100_EVC.10"         NQ0.2         Bool         Bool           5         "61_5710"         NQ0.2         Bool         Bool <td>Image         Name         Address         Disply forms         Monitor value           1         57502_01K**         WOD         Hex         465430           3         1         57502_01K**         WOD         Hex         465430           3         1*5702_01K**         WOD         Hex         165430           4         5*5702_01K**         WOD         Hex         165200           5         1*5702_01K**         WOD         Hex         165200           6         1*01_571K**         WOD         Hex         165200           7         1*01_571K**         WOD         Bool         174545           7         1*01_571K**         WOD         Bool         174545           7         1*01_571K**         WOD         Hex         164200           9         1*210_02K**         MOD         Hex         164200           9         1*210_02K**         MOD         Hex         164200           10         1*01_570K**         MOD         Bool         17454           10         1*01_570K**         MOD         Bool         17454           10         1*01_570K**         MOD         Bool         17454      &lt;</td> <td>Image         Name         Address         Display format         Montor value         M</td> <td>Inter-         Address         Dipley formet         Monitor value         Monitor value</td> <td>Inter         Nations         Display format         Montor value         Modify value         P         Comment           1         1         57502_ERC (10*         VQO         Hes         1664600         Tube         Tube         Image: Tube         Tube         Image: Tube</td> <td>Inter         Notes         Displays format         Model y use         Comment         Tog commet           1         15% (3,1,1,1)*         Wood         Hes         Model y use         P         Comment         Tog commet           3         10         5% (3,1,1,1)*         Wood         Hes         Tog         Tog         Tog         Tog commet         &lt;</td> <td>Inter-         Nations         Display format         Montor value         Modely value         Comment         Tog comment           1         1         57500_ERLC (***)         VOID         Hes.         Tog comment         Tog comment</td> <td>Inter-         National Methods         Display format         Month value         Occument         Tog comment           1         1         55700, EUC 1000         Hes         666400         Image: Section 100, Sec</td> | Image         Name         Address         Disply forms         Monitor value           1         57502_01K**         WOD         Hex         465430           3         1         57502_01K**         WOD         Hex         465430           3         1*5702_01K**         WOD         Hex         165430           4         5*5702_01K**         WOD         Hex         165200           5         1*5702_01K**         WOD         Hex         165200           6         1*01_571K**         WOD         Hex         165200           7         1*01_571K**         WOD         Bool         174545           7         1*01_571K**         WOD         Bool         174545           7         1*01_571K**         WOD         Hex         164200           9         1*210_02K**         MOD         Hex         164200           9         1*210_02K**         MOD         Hex         164200           10         1*01_570K**         MOD         Bool         17454           10         1*01_570K**         MOD         Bool         17454           10         1*01_570K**         MOD         Bool         17454      < | Image         Name         Address         Display format         Montor value         M | Inter-         Address         Dipley formet         Monitor value         Monitor value | Inter         Nations         Display format         Montor value         Modify value         P         Comment           1         1         57502_ERC (10*         VQO         Hes         1664600         Tube         Tube         Image: Tube         Tube         Image: Tube | Inter         Notes         Displays format         Model y use         Comment         Tog commet           1         15% (3,1,1,1)*         Wood         Hes         Model y use         P         Comment         Tog commet           3         10         5% (3,1,1,1)*         Wood         Hes         Tog         Tog         Tog         Tog commet         < | Inter-         Nations         Display format         Montor value         Modely value         Comment         Tog comment           1         1         57500_ERLC (***)         VOID         Hes.         Tog comment         Tog comment | Inter-         National Methods         Display format         Month value         Occument         Tog comment           1         1         55700, EUC 1000         Hes         666400         Image: Section 100, Sec |



 the encoder replies by forcing high the Set/shift of home position executed bit 12 in the G1\_ZSW status word, see on page 107; see the G1\_ZSW.12 item as well as the G1\_XIST1 and G1\_XIST2 items;

| Image         Image         Image         Address         Display from its Address         Montor value         Comment         Top comment           EX66Xx1314         1 Strong, Ex6  |  | EXMEX | (-13-14 ) PLC_1 [ |                    |        |               |              |     |         |    | _ # # ×     | Testing        |          |
|---|--|-------|-------------------|--------------------|--------|---------------|--------------|-----|---------|----|-------------|----------------|----------|
| Inner         Addrs         Displement         Motor value         Comment         Tig comment         Cell operator panel           Moderability         Image         Moderability         Image         Moderability         Image   | Devices                                    |       |                   |                    |        |               |              |     |         |    |             | Options        |          |
| Inner         Addrs         Displement         Motor value         Comment         Tig comment         Cell operator panel           Moderability         Image         Moderability         Image         Moderability         Image   |  | 99    | 2 1 lo 9, 1       | 1 2 00 00          |        |               |              |     |         |    |             |                |          |
| DEMOSCR3314         Image: Second                            |  | i     |                   |                    |        | Monitor value | Modify value | 9   | Comment |    | Tag comment | Y CPI operato  | r nanel  |
| Decision Statements         5         761.37hr         No.0         No.4         Anti-         Anti-         Balance         Building         Fauilding         Building         Fauil   | EXM5XX-13-14                               | 1     | "STW2_ENC"        | %QW0               | Hex    | 16#0400       |              |     |         |    |             |                |          |
| Image: Construction   | Add new device                             | 2     | "STW2_ENC.10"     | %Q0.2              | Bool   | TRUE          | TRUE         | M 4 |         |    |             |                | SP-1 PN] |
| Import excerning watching     S = 101,27W12*     Import 24     Bool     Import 24,25     Bool     Import 24,25     Bool     Import 24,25     Import 24,25<   | A Devices & networks                       | 3     | "G1_STW"          | %QW2               | Hex    | 16#3000       |              |     |         |    |             | RUN / STOP     | RUN      |
| If Drive configuration     9     1     0     1     <  | - 🚰 PLC_1 [CPU 1512SP-1 PN]                | 4     | "G1_STW.11"       | %Q2.3              | Bool   | - muss        | FALSE        |     |         |    |             | FREDR          | STOP     |
| Operation         <   | Device configuration                       | 5     | "G1_STW.12"       | %Q2.4              | Bool   | TRUE          | TRUE         |     |         |    |             | -              | _        |
| Image: Provide a set of the set                    | S Online & diagnostics                     | 6     |                   | %Q2.5              | Bool   |               | TRUE         | I   |         |    |             | MAINT          | MRES     |
| • Triangland points this       • Triangland points this       • Triangland points this       • Triangland points this         • Triangland points this       • Triangland points       • Triangland points       • Triangland points       • Triangland points         • Triangland points       • Triangland points       • Triangland points       • Triangland points       • Triangland points       • Triangland points         • Triangland points       • Triangland points       • Triangland points       • Triangland points       • Triangland points       • Triangland points         • Triangland points       • Triangland points       • Triangland points       • Triangland points       • Triangland points       • Triangland points       • Triangland points         • Triangland points       • Triangland points       • Triangland points       • Triangland points       • Triangland points       • Triangland points         • Triangland points       • Triangland points       • Triangland points       • Triangland points       • Triangland points       • Triangland points         • Triangland points       • Triangland points       • Triangland points       • Triangland points       • Triangland points       • Triangland points         • Triangland points       • Triangland points       • Triangland points       • Triangland points       • Triangland points       • Triangland points <td< td=""><td>Software units</td><td>7</td><td>"G1_STW.14"</td><td>%Q2.6</td><td>Bool</td><td></td><td>FALSE</td><td></td><td></td><td>L2</td><td></td><td></td><td></td></td<>   | Software units                             | 7     | "G1_STW.14"       | %Q2.6              | Bool   |               | FALSE        |     |         | L2 |             |                |          |
| Image: Second             | 🕨 😓 Program blocks 🛛 🔵                     | 8     | "G1_STW.15"       | %Q2.7              | Bool   | FALSE         | FALSE        |     |         |    |             | Mode selector: | RUN      |
| Image: Construction Statem     11     10.2 XW 11*     W2.3     Book     Image: Construction Statem     FALSE       Image: Construction Statem     10     10.2 XW 12*     N2.4     Book     Image: Construction Statem       Image: Construction Statem     10     10.2 XW 12*     N2.4     Book     Image: Construction Statem       Image: Construction Statem     10     10.2 XW 12*     Book     Image: Construction Statem     FALSE       Image: Construction Statem     10     10.2 XW 12*     Book     Image: Construction Statem     FALSE       Image: Construction Statem     10     10.2 XW 12*     Book     Image: Construction Statem     FALSE       Image: Construction Statem     10     10.2 XW 12*     Book     Image: Construction Statem     FALSE  | Technology objects                         | 9     | "ZSW2_ENC"        | %IW0               | Hex    | 16#0200       |              |     |         |    |             |                |          |
| Image: Section Statement     Image: Section   | External source files                      | 10    | "G1_ZSW"          | %/W2               | Hex    | 16#3000       |              |     |         |    |             |                |          |
| Compare note base:         10 Tot _2001 11 Work: With a Book _ FALE         Add nerve workshale         Add nerve         Add nerve workshale         Add nerve         Add ner | PLC tags                                   | 11    | "G1_ZSW.11"       | %12.3              | Bool   | Bress         | FALSE        |     |         |    |             |                |          |
| Window Rev watch table         H         YG (1,50%) 4*         W2.6         Book         PALE           Anyoin reversal         Si (1,50%) 4*         W2.7         Book         PALE         Image: Control of Contro   | PLC data types                             | 12    | G1_ZSW.12*        | %12.4              | Bool   | TRUE          | FALSE        |     |         |    |             |                |          |
| Bit Might Regions 1         15         "C1_25W13"         %U.2         Boold         TAULE         FMLE           Control table         T0_25W13"         NUD4         Hex         156000_123.4         Image: Control table         Image: Contable         Image: Control table   | <ul> <li>Watch and force tables</li> </ul> | 13    | "G1_ZSW.13"       | %12.5              | Bool   | 3-14          | FALSE        |     |         |    |             |                |          |
| Bit Provide Saluty         View         Here         Difference 1234           Saluty         Saluty         Nucle         Here         Difference 1234           Saluty         Saluty         Saluty         Difference 12344         Difference 1234  | Add new watch table                        | 14    | *G1_ZSW.14*       | %12.6              | Bool   | FALSE         | FALSE        |     |         |    |             |                |          |
| Image: Section 2013         1         10         10         10         1600           Image: Section 2014         18         10012         DEC+1         0         0           Image: Section 2014         19         -04d memo         0         0         0           Image: Section 2014         19         -04d memo         0         0         0           Image: Section 2014         -04d memo         0         0         0         0           Image: Section 2014         -04d memo         0         0         0         0           Image: Section 2014         -04d memo         0         0         0         0         0           Image: Section 2014         -04d memo         0  |  | 15    | "G1_ZSW.15"       | %12.7              | Bool   | THE FALCE     | FALSE        |     |         |    |             |                |          |
| Image: Second                    | Force table                                | 16    | "G1_XIST1"        | %ID4               | Hex    | 16#0000_1234  |              |     |         |    |             |                |          |
| Contraction   | Telegram 0x53                              | 17    | "G1_XIST2"        | %ID8               | DEC    | 4660          |              |     |         |    |             |                |          |
| SQ DCM Accommunication       SQ Dreck proya data       SQ Dreck proya in rhb       SQ Dreck proya in rhb       SQ Dreck proya in rhb  | Online backups                             | 18    | "NIST_B"          | %ID12              | DEC+/- | 0             |              |     |         |    |             |                |          |
| S Droke providata<br>S2 Provegan info<br>G=RCsperioritions & alarmi ✓   | Traces                                     | 19    |                   | <add new=""></add> |        |               |              |     |         |    |             |                |          |
| 28 Program info<br>S₽ PC supervisions & alarm: ✓  | OPC UA communication                       |       |                   |                    |        |               |              |     |         |    |             |                |          |
| 🕞 PLC supervisions & alarm: 🔍   | Device proxy data                          |       |                   |                    |        |               |              |     |         |    |             |                |          |
|   | Program info                               |       |                   |                    |        |               |              |     |         |    |             |                |          |
| etalis view etalis  | PLC supervisions & alarm:                  |       |                   |                    |        |               |              |     |         |    |             |                |          |
|   | Details view                               |       |                   |                    |        |               |              |     |         |    |             |                |          |
|   | PLC supervisions & alarm:                  |       |                   |                    |        |               |              |     |         |    |             |                |          |
|   |  |       |                   |                    |        |               |              |     |         |    |             |                |          |

 now you must set back to 0 the Request set/shift of home position bit 12 in the G1\_STW control word, see on page 104; right click the field under the Modify value column next to the G1\_STW.12 item and press the Modify and Modify to 0 commands in the drop-down menus that appear;

| EXASSOCIE314     Construction     Evaluation     Evaluation   | %QW2<br>%Q2.3<br>%Q2.4<br>%Q2.5<br>%Q2.6<br>%Q2.7<br>%W0<br>%W0<br>%W2<br>%U2.3<br>%U2.4<br>%U2.5   | Display format<br>Hex<br>Bool<br>Hex<br>Bool   | Monitor value<br>1680400<br>@ TRUE<br>0 FALSE<br>0 FALSE<br>0 FALSE<br>0 FALSE<br>1680200<br>1683000<br>0 FALSE | Modify val<br>TRUE<br>FALSE<br>TRUE<br>FALSE<br>FALSE<br>FALSE | Monitor all<br>Monitor now                         | Ctrl+T<br>Ctrl+Enter | Mod fy to 0<br>Modify to 1<br>Modify now<br>Modify with tr<br>2 Enable 2   | Tag comment<br>Ctri-<br>Ctri-<br>Shift | F2  |                                  |
|---|---|--|---|--|--|----------------------|--|--|---|----------------------------------|
| DADSX41214     DADSX4121     DADSX41214     DADSX4121     DADSX412     DADSX  | Address<br>%QW0<br>%Q0.2<br>%QV2<br>%Q2.3<br>%Q2.4<br>%Q2.5<br>%Q2.6<br>%Q2.7<br>%W0<br>%W02<br>%W02<br>%U2.5                                   | Display format<br>Hex<br>Bool<br>Hex<br>Bool<br>Bool<br>Bool<br>Bool<br>Hex<br>Hex<br>Bool | 16#0400<br># TRUE<br>16#3000<br># FALSE<br># FALSE<br># FALSE<br># FALSE<br>16#0200<br>16#3000<br># FALSE       | TRUE<br>FALSE<br>TRUE<br>TRUE<br>FALSE<br>FALSE                | Modify<br>Monitor all<br>Monitor now               | Ctrl+T<br>Ctrl+Enter | Modify to 1  | Ctri-<br>Ctri-<br>Shift-               | CPU operator     PLC_1 [CPU 1512:     RUN / STOP     ERROR     ERROR     MAINT     P2 | panel<br>(P-1 PN)<br>RUN<br>STOP |
| EX450x1214     Ex450x121     Ex450x12     | Address<br>%QW0<br>%Q0.2<br>%QV2<br>%Q2.3<br>%Q2.4<br>%Q2.5<br>%Q2.6<br>%Q2.7<br>%W0<br>%W02<br>%W02<br>%U2.5                                   | Display format<br>Hex<br>Bool<br>Hex<br>Bool<br>Bool<br>Bool<br>Bool<br>Hex<br>Hex<br>Bool | 16#0400<br># TRUE<br>16#3000<br># FALSE<br># FALSE<br># FALSE<br># FALSE<br>16#0200<br>16#3000<br># FALSE       | TRUE<br>FALSE<br>TRUE<br>TRUE<br>FALSE<br>FALSE                | Modify<br>Monitor all<br>Monitor now               | Ctrl+T<br>Ctrl+Enter | Modify to 1  | Ctri-<br>Ctri-<br>Shift-               | PLC_1 [CPU 1512:<br>RUN / STOP<br>ERROR<br>MAINT                                      | panel<br>(P-1 PN)<br>RUN<br>STOP |
| DABOX051-14         Image: Constraint of the second se                            | %QW0<br>0* %Q0.2<br>%QW2<br>%Q2.3<br>%Q2.4<br>%Q2.5<br>%Q2.6<br>%Q2.6<br>%Q2.7<br>%W0<br>%W2<br>%U2.3<br>%U2.3                                  | Hex<br>Bool<br>Hex<br>Bool<br>Bool<br>Bool<br>Bool<br>Hex<br>Hex<br>Bool                   | 16#0400<br># TRUE<br>16#3000<br># FALSE<br># FALSE<br># FALSE<br># FALSE<br>16#0200<br>16#3000<br># FALSE       | TRUE<br>FALSE<br>TRUE<br>TRUE<br>FALSE<br>FALSE                | Modify<br>Monitor all<br>Monitor now               | Ctrl+T<br>Ctrl+Enter | Modify to 1  | Ctri-<br>Ctri-<br>Shift-               | PLC_1 [CPU 1512:<br>RUN / STOP<br>ERROR<br>MAINT                                      | P-1 PN]<br>RUN<br>STOP           |
| 2 SYNC_EAC.     2 SYNC_EAC.     2 SYNC_EAC.     3 SYNC_EAC.     3 SYNC_EAC.     3 SYNC_EAC.     4 SYNC_EAC.     4 SYNC_EAC.     4 SYNC_EAC.     4 SYNC_EAC.     5 SYNC_E  | 0" %Q0.2<br>%QW2<br>%Q2.4<br>%Q2.4<br>%Q2.5<br>%Q2.6<br>%Q2.6<br>%Q2.7<br>%W0<br>%W2<br>%U2.3<br>%U2.5  | Bool<br>Hex<br>Bool<br>Bool<br>Bool<br>Bool<br>Hex<br>Hex<br>Bool                          | TRUE     16#3000     FALSE     FALSE     FALSE     FALSE     FALSE     FALSE     16#0200     I6#3000     FALSE  | FALSE<br>TRUE<br>TRUE<br>FALSE<br>FALSE                        | Modify<br>Monitor all<br>Monitor now               | Ctrl+Enter           | Modify to 1  | Ctrl+<br>Shift+                        | RUN / STOP<br>ERROR<br>F2   | RUN                              |
| Image: Solution of the                    | %QW2<br>%Q2.3<br>%Q2.4<br>%Q2.5<br>%Q2.6<br>%Q2.7<br>%W0<br>%W0<br>%W2<br>%U2.3<br>%U2.4<br>%U2.5   | Hex<br>Bool<br>Bool<br>Bool<br>Bool<br>Hex<br>Hex<br>Bool                                  | 16#3000<br># FALSE<br># TRUE<br># TRUE<br># FALSE<br># FALSE<br>16#2000<br>16#3000<br># FALSE                   | FALSE<br>TRUE<br>TRUE<br>FALSE<br>FALSE                        | Modify<br>Monitor all<br>Monitor now               | Ctrl+Enter           | Modify to 1  | Ctrl+<br>Shift+                        | ERROR<br>MAINT  | STO                              |
| ■ ACLICAU 153254 FMU         ■         ●         ●         ○         0.5.7.112           ■ Oriele ad supportion         ■         ○         0.5.7.112         ■         ○         0.5.7.112         ■         ○         0.5.7.112         ■         ○         0.5.7.112         ■         ○         0.5.7.112         ■         ○         0.5.7.112         ■         ○         0.5.7.112         ■         ○         0.5.7.112         ■         ○         0.5.7.112         ■         ○         0.5.7.112         ■         ○         0.5.7.112         ■         ○         0.5.7.112         ■         ○         0.5.7.112         ■         ○         0.5.7.112         ■         ○         0.5.7.112         ■         ○         0.5.7.112         ■         ○         0.5.7.112         ■         0.5.7.112         ■         0.5.7.112         ■         0.5.7.112         ■         0.5.7.112         ■         0.5.7.112         ■         0.5.7.112         ■         0.5.7.112         ■         0.5.7.112         ■         0.5.7.112         ■         0.5.7.112         ■         0.5.7.112         ■         0.5.7.112         ■         0.5.7.112         ■         0.5.7.112         ■         0.5.7.112         ■         0.5.7.11  | %Q2.3<br>%Q2.4<br>%Q2.5<br>%Q2.6<br>%Q2.7<br>%I/W0<br>%I/W2<br>%I/2.3<br>%I/2.4<br>%I/2.5   | Bool<br>Bool<br>Bool<br>Bool<br>Hex<br>Hex<br>Bool   | FALSE     TRUE     TRUE     FALSE     FALSE     FALSE     16#0200     16#3000     FALSE                         | TRUE<br>TRUE<br>FALSE<br>FALSE                                 | Modify<br>Monitor all<br>Monitor now<br>Insert row | Ctrl+Enter           | Modify to 1  | Ctrl+<br>Shift+                        | ERROR<br>MAINT  | STO                              |
| Image: Service configuration         5         01_57.01           Volumite & disponsions         6         01_57.01           Volumite & disponsions         7         01_57.01           Volumite & disponsions         8         01_57.01           Volumite & disponsions         7         01_57.01           Volumite & disponsions         8         01_57.01           Volumite & disponsions         9         72.02,000           Volumite & disponsions         9         72.02,000           Volumite & disponsions         12         01_57.01           Volumite & disponsions         12         01_57.000           Volumite & disponsions         13         01_57.000           Volumite & disponsions         14         01_57.000           Volumite & disponsions         15         01_57.000           Volumite & disponsions         16         01_57.000  | <ul> <li>NQ2.4</li> <li>NQ2.5</li> <li>NQ2.6</li> <li>NQ2.7</li> <li>NIV0</li> <li>NIV2</li> <li>NI2.3</li> <li>NI2.4</li> <li>NI2.5</li> </ul> | Bool<br>Bool<br>Bool<br>Hex<br>Hex<br>Bool   | TRUE     TRUE     FALSE     FALSE     FALSE     16#0200     16#3000     FALSE                                   | TRUE<br>TRUE<br>FALSE<br>FALSE                                 | Modify<br>Monitor all<br>Monitor now<br>Insert row | Ctrl+Enter           | Modify to 1  | Ctrl+<br>Shift+                        | MAINT   | _                                |
| U         Online & dispositos         6         C 0TNU 4'           Software works         7         C 0TNU 4'           Software Works         8         C 0_TNU 4'           Software Works         9         720x0_ENC'           Software Works         9         720x0_ENC'           Software Works         10         C 0_TXU 4'           Add new works hable         14         C 0_TXU 4'           Software Works         15         C 0_TXU 4'  | %Q2.5<br>%Q2.6<br>%Q2.7<br>%W0<br>%W2<br>%W2<br>%U2.3<br>%U2.4<br>%U2.5   | Bool<br>Bool<br>Bool<br>Hex<br>Hex<br>Bool   | TRUE     FALSE     FALSE     FALSE     16#0200     16#3000     FALSE  | TRUE<br>FALSE<br>FALSE   | Modify<br>Monitor all<br>Monitor now               | Ctrl+Enter           | Modify to 1  | Ctrl+<br>Shift+                        | +F2   | MRE                              |
| iiii Schwarz unic         7         Col_STW.15'           iii Technology object:         8         Col_STW.15'           iii Technology object:         9         Col_STW.15'           iii Technology object:         9         Col_STW.15'           iii Technology object:         9         Col_STW.15'           iii Technology object:         10         Col_STW.15'           iii Add erev such ababe:         16         Col_STW.15'   | %Q2.6<br>%Q2.7<br>%UV0<br>%UV2<br>%U2.3<br>%U2.4<br>%U2.5   | Bool<br>Bool<br>Hex<br>Hex<br>Bool   | FALSE<br>FALSE<br>16#0200<br>16#3000<br>FALSE   | FALSE  | Monitor now  | Ctrl+Enter           | A Modify now the first state of the second sta | Shift                                  |   |                                  |
| • Grogen blocks         8         70_5W157           • Britholdsychjett         9         722W2_EHC*           • Gatenal source files         10         70_52W157           • Gate Steps         11         70_52W157           • Mach data types         12         70_52W157           • Mach and force tables         13         70_125W157           • Add new watch table         14         70_125W157           • Add new watch table         15         70_125W157   | %Q2.7<br>%IW0<br>%IW2<br>%I2.3<br>%I2.4<br>%I2.5  | Bool<br>Hex<br>Hex<br>Bool   | FALSE<br>16#0200<br>16#3000<br>FALSE  | FALSE  | Monitor now  | Ctrl+Enter           | % Modify with tr   |  | F9 Inde selector  |                                  |
| image: Technology objects         9         7250/2_BCC           image: Technology objects         9         7250/2_BCC           image: Technology objects         10         °G1_2250/1           image: Technology objects         11         °G1_2250/1           image: Technology objects         11         °G1_2250/1           image: Technology objects         12         °G1_2250/1           image: Technology objects         13         °G1_2250/1           image: Technology objects         14         °G1_2250/1           image: Technology objects         15         °G1_2250/1   | %/W0<br>%/W2<br>%/2.3<br>%/2.4<br>%/2.5   | Hex<br>Bool  | 16#0200<br>16#3000<br>FALSE   |  | Pinsert row  | Ctrl+Enter           |  |  |   | RUN                              |
| General source files     10     'G1_ZSW     'G1_Z | %/W2<br>%i2.3<br>%i2.4<br>%i2.5   | Hex<br>Bool  | 16#3000<br>FALSE  |  |  |                      |  |  | 159   |                                  |
| Image: Processing of the second se                    | %12.4<br>%12.5  |  | FALSE   |  | Add row  | Alt+Ins              | Trable perip   | heral outputs                          |   |                                  |
| ▶ []         PLC data types         12         "G1_ZSW.12"           ▼  | %12.4<br>%12.5  |  |   | FALSE  | -  | Alt+Ins              |  |  |   |                                  |
| Watch and force tables         13         "G1_ZSW.13"           Add new watch table         14         "G1_ZSW.14"           Acyclic request         15         "G1_ZSW.15"   | %12.5   |  | TRUE  | FALSE  | nsert comment line                                 |                      |  |  |   |                                  |
| Add new watch table     14 "G1_ZSW.14"     J2SW.14"     15 "G1_ZSW.15"  |   | Bool   | TRUE  | FALSE  | X Cut  | Ctrl+X               |  |  |   |                                  |
| Acyclic request 15 "G1_ZSW.15"  | %12.6   | Bool   | FALSE   | FALSE  | Сору   | Ctrl+C               |  |  |   |                                  |
|   |   | Bool   | FALSE   | FALSE  | 📦 Paste  | Ctrl+V               |  |  |   |                                  |
| Force table 16 "G1_XIST1"   | %ID4  | Hex  | 16#0000_1234  |  | × Delete   | Del                  |  |  |   |                                  |
| Telegram 0x53 17 "G1_XIST2"   | %ID8  | DEC  | 4660  |  | Rename   | F2                   |  |  |   |                                  |
| Online backups     I8 "NIST_B"  | %ID12   | DEC+/-   | 0   |  | Go to definition                                   | Ctrl_shift_D         |  |  |   |                                  |
| Traces 19   | <add new=""></add>  |  |   |  | Cross-references                                   | Ctn+Shift+D<br>F11   |  |  |   |                                  |
| OPC UA communication  |   |  |   |  | X Cross-reference inform                           |                      |  |  |   |                                  |
| Device proxy data   |   |  |   |  | a.   |                      |  |  |   |                                  |
| 28 Program info   |   |  |   |  | Expanded Mode                                      |                      |  |  |   |                                  |
| PLC supervisions & alarm:   |   |  |   |  |  |                      |  |  |   |                                  |
| Details view  |   |  |   |  |  |                      |  |  |   |                                  |
|   |   |  |   |  |  |                      |  |  |   |                                  |
|   |   |  |   |  |  |                      |  |  |   |                                  |
|   |   |  |   |  |  |                      |  |  |   |                                  |
| Name  |   |  |   |  |  |                      |  |  |   |                                  |
|   |   |  |   |  |  |                      |  |  |   |                                  |
|   |   |  |   |  |  |                      |  |  |   |                                  |



• the **Set/shift of home position executed** bit 12 in the **G1\_ZSW** status word is set back to 0, see on page 107; see the **G1\_ZSW.12** item.

| withing         Type://withing         No.2         Boold         INVE         Within         Mail         PLC.10(11):15120-1911         No.2         PLC.10(11):15120-1911         PLC.10(11):15120-1911         PLC.10(11):15120-1911         PLC  |                        |     | EXM5) |               |            |                |               |              |       |         | _ 🖬 🖬 🗙     | Testing         |          |
|--|------------------------|-----|-------|---------------|------------|----------------|---------------|--------------|-------|---------|-------------|-----------------|----------|
| Item         Address         Dipaly format         Montor value         Comment         Tag comment           924         ************************************   | evices                 |     |       |               |            |                |               |              |       |         |             | Options         |          |
| Interd         Address         Dipaty format         Montor value         Comment         Tig comment         Tig comment           0:4:0         0:1:0         1:00:0  |                        | m 🔹 | 9 -0  | P 😼 🕪 🔗 :     | 2 00 00 B  |                |               |              |       |         |             |                 |          |
| 23:4     Image: State                            |                        |     |       |               |            | Display format | Monitor value | Modify value | 9     | Comment | Tao comment | V CPIL operato  | r nanol  |
| w device         PLC_1[00] 13123F1R]         PLC_1[00] 1312F1R]         PLC_1[00] 1312F1R] <td>1 EXM5XX-13-14</td> <td></td> <td>1</td> <td>"STW2_ENC"</td> <td>%QW0</td> <td></td> <td>16#0400</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>  | 1 EXM5XX-13-14         |     | 1     | "STW2_ENC"    | %QW0       |                | 16#0400       |              |       |         |             |                 |          |
| 8 a Priority Start     1     "C1_5TW     VQ/2     Her.     168200     Image: Mark Start     Ma   | Add new device         |     | 2     | "STW2 ENC.10" | %00.2      | Bool           | TRUE          | TRUE         |       |         |             | PLC_1 [CPU 1512 | SP-1 PN] |
| C(00.157.26.26.17.11         V0.2.3         Bool         FALSE         FALSE </td <td>A Devices &amp; networks</td> <td></td> <td>3</td> <td>"G1 STW</td> <td>%OW2</td> <td>Hex</td> <td>16#2000</td> <td></td> <td></td> <td></td> <td></td> <td>RUN / STOP</td> <td>RUN</td>   | A Devices & networks   |     | 3     | "G1 STW       | %OW2       | Hex            | 16#2000       |              |       |         |             | RUN / STOP      | RUN      |
| See configuration         See 1         Col_12/M12         No.24         Boold         PLASE   |                        |     | 4     |               | %02.3      | Bool           | FALSE         | FALSE        |       |         |             |                 | 6700     |
| Inter designer     Image: State St                           | Device configuration   |     | 5     | "G1_STW.12"   | %Q2.4      | Bool           | FALSE         | FALSE        |       |         |             |                 |          |
| Note with Source Work         I         10         10.1.5V11         V0.2.6         Boold         FALSE         FALSE <td>S Online &amp; diagnostics</td> <td></td> <td>6</td> <td></td> <td></td> <td></td> <td></td> <td>TRUE</td> <td>· 🗹 🗼</td> <td></td> <td></td> <td>MAINT</td> <td>MRES</td>   | S Online & diagnostics |     | 6     |               |            |                |               | TRUE         | · 🗹 🗼 |         |             | MAINT           | MRES     |
| gram black         o         a         "G1_37N13"         %Q.27         Bool         #ALE         FALE         FALE         Mode selector: R.M           1         1         10         150_12.501_11V         WNO         Here         1682000         Image: Selector: R.M           transi source files         1         10         151_250_12.1VC         WNO         Here         1682000         Image: Selector: R.M           data spect         11         10         151_250_11VC         WLO         Here         1682000         Image: Selector: R.M           data spect         12         161_25011V         WLO         Here         1682000         FALE         FALE         Image: Selector: R.M           data spect         13         151_10VC         Selector: R.M         Selector: R.M         FALE         FALE         Image: Selector: R.M           data spect         13         15_10VVC         NLO         Selector: R.M         FALE         FALE         Image: Selector: R.M           data selector: R.M         10         FALE         FALE         FALE         Image: Selector: R.M         FALE         Image: Selector: R.M           ins backsplant         16         15_12VVLO         NLO         Image: FALE         FALE   | Software units         |     | 7     |               |            | Bool           |               | FALSE        |       |         |             |                 |          |
| binology dept     *  | Program blocks         |     | 8     |               | %02.7      | Bool           | FALSE         | FALSE        |       |         |             | Mode selector:  | RUN      |
| spag     0     "G1_250"     W/Q     Hex     182000       spag     0     "G1_250"     W/Q     Hex     182000       data types     11     "G1_250"     W/Q     Hex     182000       data types     12     "G1_250"     W/Q     Hex     184200       data types     13     "G1_250"     W/Q     Hex     Hex       Add new works table     14     "G1_250"     W/Q     Hex     Hex       Add new works table     16     "G1_250"     W/Q     Hex     Hex       Add new works table     16     "G1_250"     W/Q     Hex     Hex       fore table     16     "G1_250"     W/Q     Hex     Hex       fore table     16     "G1_250"     W/Q     E       fore table     18     "ND12"     ND     E       fore table     18     "ND12"     W/Q     E       fore table     19     W/D     E     E       fore table     19     W/D12"     E     E  | Technology objects     | -   | 9     | "ZSW2 ENC"    | %IWO       | Hex            | 16#0200       |              |       |         |             |                 |          |
| tags         •   | External source files  | -   | 10    |               | %/W2       | Hex            | 16#2000       |              |       |         |             |                 |          |
| data bges         12         "0 L_2VX12"         NL2 A         Bool         FALSE         FALSE           Add new works hable         13         "0 L_2VX12"         NL2 A         Bool         FALSE         FALSE         FALSE           Add new works hable         14         "0 L_2VX12"         NL2 A         Bool         FALSE         FALSE         FALSE           Add new works hable         14         "0 L_2VX12"         NL2 A         Bool         FALSE         FALSE         FALSE           Add new works hable         14         "0 L_2VX11"         NL2 A         Bool         FALSE  | PLC tags               |     | 11    |               | %12.3      | Bool           |               | FALSE        |       |         |             |                 |          |
| bh. and force subles         13         "G1_27813"         NL2         Bool         Canada         PALE           Addree watch balles         14         "G1_27813"         NL2         Bool         CANADA         PALE         Canada           Adjoit encode         14         "G1_27813"         NL2         Bool         CANADA         PALE         Canada           Adjoit encode         16         "G1_27813"         NL2         Bool         CANADA         PALE         Canada           Difference         16         "G1_27813"         NL2         Bool         CANADA         Canada         Canada           Bidegram GAS         16         "G1_2812"         NL04         Ref Model         Canada         Canada         Canada           Bidegram GAS         16         "G1_2812"         NL04         Ref Model         Canada         Canada         Canada           Bidegram GAS         18         "G1_2812"         NL04         Ref Model         Canada  | C PLC data types       |     | 12    | "G1 ZSW.12"   | %12.4      | Bool           | FALSE         | FALSE        |       |         |             |                 |          |
| Add nervo works hable         I         "O1_270:14"         NL2.6         Bool         PASE         PASE           Add nervo works hable         15         "O1_270:14"         NL2.6         Bool         PASE         PASE           Tore table         15         "O1_270:14"         NL2.6         Bool         PASE         PASE           Tore table         16         "O1_270:14"         NL2.0         IO_01         PASE         PASE           Tore table         16         "O1_270:14"         NL2.0         IO_01         PASE         PASE           Tore table         16         "O1_270:14"         NL9         IO_01         PASE         PASE         PASE           Tore table         16         "O1_170:11"         NL9         IO_01         PASE         PASE         PASE           Tore table         17         "O1_170:11"         NL9         IO_01         PASE         PASE         PASE           State         18         "ND1_2"         NL912         IOC_04         PASE         PASE         PASE         PASE           UA communication         V         Void I nevo         Void I nevo         PASE         PASE         PASE         PASE         PASE   | Watch and force tables |     |       |               | %12.5      |                |               |              |       |         |             |                 |          |
| Applic regist         16         10,1,270.19         VL2         Bool         PASE         PASE           Triegram 06.3         16         10,201.19         VL2         Bool         PASE         PASE           Triegram 06.3         16         10,1011*         VL2         Bool         PASE         PASE           Triegram 06.3         17         10,1011*         VL2         Bool         PASE         PASE           Triegram 06.3         18         VR51,8*         VL2         Bool         PASE         PASE         PASE           Triegram 06.3         18         VR51,8*         ND12         DECAF         D         PASE         PASE         PASE           Cast Applic   | Add new watch table    |     | 14    |               | %12.6      | Bool           |               | FALSE        |       |         |             |                 |          |
| Varies         16         "G1_JUST"         NuDi         Her         Meed000_1234           Integram 0.63         17         "G1_JUST"         NuDi         DECA         460           Inte backups         18         "NDT_S"         NuDi 2         DECA+         D           Status         18         "NDT_S"         NuDi 2         DECA+         D           UA communication         Interview         Interview         Interview         Interview           spravide         Interview         Interview         Interview         Interview   | Acyclic request        |     | 15    |               | %12.7      | Bool           | FALSE         | FALSE        | Ä     |         |             |                 |          |
| Titlegam         OFC         4660         Communication           ine backupp         18         "NUST_8"         NUB         DEC.4         0           ine backupp         18         "NUST_8"         NUB         DEC.4         0           Luccommunication         Image: Second Se  | Ful Force table        |     |       |               | %ID4       | Hex            |               |              |       |         |             |                 |          |
| Inter Saturding         Int         "MRTL8"         NUD 2         DECL*         D           Cat         19   | Telegram 0x53          |     |       |               | %ID8       | DEC            |               |              |       |         |             |                 |          |
| teri la la odda nexo.<br>LUk communication i<br>gran mb<br>y provindo s Alama<br>V   | Online backups         |     |       |               |            |                |               |              |       |         |             |                 |          |
| Uu communication le  | Traces                 |     |       |               | coadd news |                |               |              |       |         |             |                 |          |
| ice proy data gran indo  | OPC UA communication   |     |       |               |            |                |               |              |       |         |             |                 |          |
| gram inib<br>supervicions & alarmi V   | Bevice proxy data      |     |       |               |            |                |               |              |       |         |             |                 |          |
| supervisions & alarm 🛛 🗡   | Program info           |     |       |               |            |                |               |              |       |         |             |                 |          |
|  |                        | ~   |       |               |            |                |               |              |       |         |             |                 |          |
| ware and the second sec |                        |     | -     |               |            |                |               |              |       |         |             |                 |          |
|  | Program info           | ~   |       |               |            |                |               |              |       |         |             |                 |          |
|  |                        |     |       |               |            |                |               |              |       |         |             |                 |          |



# WARNING

It is mandatory to set the  $\ensuremath{\textbf{G1\_STW.12}}$  item back to 0 to avoid the preset value to be entered endlessly.



# NOTE

You are not required to save the preset value, it is saved automatically.

# 5.2 Configuring the encoder with Siemens TIA PORTAL V16

In this manual some screenshots are shown to explain how to install and configure the encoder in a supervisor. In the specific example the development environment is TIA PORTAL V16 with SIEMENS PLC CPU 1500. Therefore, the installation of the GSDML file, the assignment of the IP address and the device name, the configuration of the encoder in the network, topology, diagnostics, etc. will always refer to the aforementioned development tools. If you need to install the encoder using a different configuration tool, please follow carefully the instructions given in the documentation provided by the manufacturer.



Documentation is complete with some example projects provided free of charge. The projects are designed to help you set and execute the preset with the TIA PORTAL V16 development environment easily. You can find them in the Lika TIA V16 CPU1500 Profinet

example project.zip compressed file contained in the SW EXM58\_EXO58 PT.zip file.



# WARNING

lika

If the encoder is used as a **TO Technology Object**, please refer to the "5.7 TO Technology Objects" section on page 78. Please see the **example projects** available in the **Lika TIA V16 CPU1500 Profinet example project.zip** compressed file.

# 5.2.1 About TIA Portal

TIA Portal stands for Totally Integrated Automation Portal. It is an integrated engineering framework for controllers, HMI, and drives. It integrates several SIMATIC products into a single software in order to increase productivity and efficiency.

TIA portal can be used to configure both the PLC and the visualization in an homogeneous system. Data is saved in a single project. Tools for programming (STEP 7) and displaying (WinCC) are not distinct programs, but editors of a system that has access to and uses a common database. One single user interface is used to enter all functions used for displaying and programming.

### 5.2.2 Project overview



- 1. Title bar: the name of the project is displayed in the title bar.
- 2. **Menu bar**: the menu bar contains all the commands that you require for your work.
- 3. **Toolbar**: the toolbar provides you with buttons for commands you will use frequently. This gives you faster access to these commands.
- 4. **Project Tree**: using the Project Tree features gives you access to all components and project data. You can perform the following tasks in the Project Tree:
  - add new components
  - edit existing components
  - scan and modify the properties of existing components
- 5. **Changeover switches**: they allow the user to switch among the three working areas of the **Hardware and network editor**: Topology view, Network view and Device view. See point 7 for more information.
- 6. **Details view**: it shows certain content of the selected object in the **Overview Window** or in the **Project Tree**. This might include text lists or tags. The content of the folders is not shown, however. To display the content of the folders, use the **Project Tree** or the **Inspector Window**.
- 7. Graphic Area of the Hardware and network editor. The Hardware and network editor opens when you double-click on the Devices and Networks entry in the Project Tree. The Hardware and network editor is the integrated development environment for configuring, networking and assigning parameters to devices and modules. It provides maximum support for the realization of the automation project. This pane is the graphic area where the current configuration of

the installed devices with information on the topology and the network can be found. The **Hardware and network editor** provides you with three views of your project. You can switch between these three views at any time depending on whether you want to produce and edit individual devices and modules, entire networks and device configurations or the topological structure of your project.

See the **Changeover switches**, point 5: **Device view** for parametrisation and configuration of the individual devices, it allows to configure and assign both device and module parameters, see on page 52; **Network view** for graphical connections between devices, it allows to configure and assign device parameters and to network the devices with one another, see on page 52; and **Topology view** for current interconnection of Profinet devices, it allows to display and configure the Ethernet topology as well as to identify and minimize differences between the desired and actual topology, see on page 53. In the Figure above the SIEMENS PLC CPU 1512SP-1 PN is the Master device and is connected to Lika's EXM5XX-13-14 encoder, i.e. the Slave device, through the PLC\_1.PROFINET IO-... connection.

- 8. **Overview Navigation**, it allows to quickly scroll through the objects available in the **Work Area** by pressing the left button of the mouse.
- 9. **Inspector window**: additional information on an object selected or on actions executed are displayed in the **Inspector window**, the available properties and parameters shown for the object selected can be edited in the Inspector window using the **Properties** tab.
- 10. It allows to enter the **Portal view**. The Portal view provides you with a task-oriented view of the tools.
- 11. **Editor bar**: it displays the open editors. If you have opened a lot of editors, they are shown grouped together. You can use the Editor bar to change quickly between the open elements.
- 12. **Status bar with progress display**. In the status bar, you will find the progress display for processes that are currently running in the background. This also includes a progress bar that shows the progress graphically. Hover the mouse pointer over the progress bar to display a tooltip providing additional information on the active background process. You can cancel the background processes by clicking the button next to the progress bar. If no background processes are currently running, the status bar displays the last generated alarm.
- 13. **Table Area** of the **Hardware and network editor**: it offers a general overview of the characteristics of the Device (when **Device view** is selected), of the Network (when **Network view** is selected) and of the Topology (when **Topology view** is selected).
- 14. **Task Cards**: depending on the edited or selected object, task cards are available, they allow you to perform additional actions. These actions include:

- selecting objects from a library or from the hardware catalog
- searching for and replacing objects in the project
- dragging predefined objects to the work area

The task cards available can be found in a bar on the right-hand side of the screen. You can collapse and reopen them at any time. Which task cards are available depends on the products installed. More complex task cards are divided into panes that you can also collapse and reopen. The **Hardware catalog** can be selected in the **Task Cards**; it allows to install the available components just dragging and dropping them onto the **Work Area**. Customarily the field devices that have been integrated into the TIA Portal via GSDML files are listed under **Other field devices > Profinet IO**.

#### 5.2.3 Device view

Press the **Device view** changeover switch in the **Hardware and network editor** to enter the **Device view**.

The configuration of devices and assigning of addresses etc. is performed in the **Device view**. All devices are represented in a photo-realistic way.

- Buffering of configured hardware modules and reuse with module clipboard
- When zoomed to at least 200%, I/Os are displayed with the symbolic names / addresses
- Automatic readout of available hardware with hardware detect
- Full text search in the Hardware catalogue
- Option of filtering the Hardware catalogue to show modules that can currently be used
- All parameters and configuration data are displayed on a hierarchical and context-sensitive basis

### 5.2.4 Network view

Press the **Network view** changeover switch in the **Hardware and network** editor to enter the **Network view**.

The **Network view** enables the configuration of plant communication. The communication links between individual stations are displayed here graphically and very clearly.

- Combined view of all network resources and network components
- Fully graphical configuration of the individual stations
- Resources are networked by linking communication interfaces using drag & drop



- Multiple controllers, peripherals, HMI devices, SCADA stations, PC stations, and drives possible in a single project
- Procedure for integrating AS-i devices identical to PROFIBUS/PROFINET
- Zoom and page navigation
- Copying/pasting entire stations, incl. configuration, or individual hardware modules

A subnet (PLC\_1.PROFINET IO) is added to the operator panel. Click the subnet (PLC\_1.PROFINET IO) to apply the network settings. Specify the required network settings under **Properties > Network Settings** in the **Properties** area (see point 9 on page 50). Make sure that you use the same settings throughout the entire network.

### 5.2.5 Topology view

Press the **Topology view** changeover switch in the **Hardware and network** editor to enter the **Topology view**.

Decentralised peripherals on Profinet are configured in the Network view. The controllers and the decentralised peripherals assigned to them can be shown graphically. During ongoing operation, however, it is not possible to see which ports are actually connected and communicating with each other.

Yet this is precisely what is often important for diagnostics. For Profinet networks, the **Topology view** enables this information to be displayed quickly and easily. An offline/online comparison identifies the communicating ports. By detecting, presenting and monitoring the physical connections between devices on Profinet, the administrator can easily monitor and maintain even complex networks.

### 5.3 Network and communication settings

The **MAC** address of the device is reported in the label applied to the device enclosure. See the following section.

The IP address and the subnet mask as well as the Profinet device name must be assigned by the user to each interface of the unit to be connected in the network. By default, before delivery the device name of the encoder is set to a **blank string** and its IP address is set to **0.0.0.0**. See on page 62.

# 5.4 Mac address

The MAC address is an identifier unique worldwide.

The MAC-ID consists of two parts: the first 3 bytes are the manufacturer ID and are provided by IEE standard authority; the last three bytes represent a consecutive number of the manufacturer.



# NOTE

The MAC address is always printed on the encoder label for commissioning purposes.

The MAC address has the following structure:

| Bit | t value 47   | 24   | Bi  | t value 23   | 0    |
|-----|--------------|------|-----|--------------|------|
| Х   | Х            | Х    | Х   | Х            | Х    |
| Com | npany code ( | OUI) | Con | secutive nun | nber |

### 5.5 Installing the encoder under TIA PORTAL environment

### 5.5.1 Description of the GSDML file

The functionality of a PROFINET IO device is always described in a GSDML file. This file contains all data that are relevant for engineering as well as for data exchange with the IO device.

PROFINET IO devices can be described using XML-based GSD. The description language of the GSD file, i.e. GSDML (General Station Description Markup Language) is based on international standards. As the name suggests, the GSD file is a language-independent XML file (Extensible Markup Language).

EXM58 & EXO58 Profinet encoders from Lika Electronic are supplied with their own GSDML file **GSDML-V2.35-LIKA-0239-EXM-XXXXXXXX.XML** where XXXXXXXX is the release date of the file in a 8-digit format encompassing information about year (4 digits), month (2 digits), and day (2 digits): **20230417** is the first GSDML file released by Lika Electronic for EXM58 & EX058 Profinet encoders. Enter Lika's web site **www.lika.biz** to get the GSDML file.

The XML file has to be installed in the Profinet Controller.

### Version structure of GSDML files

The GSDML file structure is in compliance with the ISO 15745 "Open Systems Application Integration Framework" and is oriented on the defined profile of a field device via the following model:

| GSDML-                  | V2.35-                     | LIKA-0239-   | EXM            | 20230417                               | .xml           |
|-------------------------|----------------------------|--------------|----------------|--|----------------|
| GSD data identification | Version of<br>GSDML scheme | Manufacturer | Name of device | Version number,<br>format:<br>yyyymmdd | File extension |

- The version of the GSDML model used defines which scope of language a GSD file uses.
- The version date is updated, if, for example, an error is cleared or a function extended.



# WARNING

Please always comply with the specifications indicated in the following table:

| GSDML file<br>version | Encoder HW<br>version | Encoder SW<br>version | User's guide<br>version |
|-----------------------|-----------------------|-----------------------|-------------------------|
| 20230417              | 1                     | V1.1.0                | -                       |
| 20230804              | 1                     | V1.1.1, V1.1.2        | 1.0                     |
| 20230804              | 1                     | V1.1.2a               | 1.1                     |

# 5.5.2 Installing the GSDML file

lika

In the menu bar of the main window, press **Options** and then **Manage general station description files (GSD)** command.



Figure 2 - Installing the GSDML file

The **Manage general station description files** dialog box will appear. Press the **SOURCE PATH** button to choose the folder where the GSDML file is located. Please make sure that the bitmap file representing the encoder is located in the same folder as the GSDML file. Select the GSDML file specific to the device you need to install and press the **INSTALL** button to install it.

| Manage general station descriptio<br>Installed GSDs GSDs in the<br>Source path: C:\Lavoro\Bus\Profine | project |          |                   | ×          |
|---|---------|----------|-------------------|------------|
| Content of imported path  |         |          |                   |            |
| File  | Version | Language | Status            | Info       |
| GSDML-V2.35-LIKA-0239-EXM-20  | V2.35   | English  | Not yet installed | Absolute e |
|   |         | 1        |                   |            |
|   |         |          |                   |            |
|   |         |          | Delete Insta      | II Cancel  |

Figure 3 - Selecting the GSDML file

lika

Wait for the installation to be completed.



Figure 4 - GSDML file installation in progress

As soon as the operation is carried out, a confirmation message will appear on the screen. Press the **CLOSE** button to close the **Manage general station description files** dialog box.

| anage general station description files                      | ×     |
|--|-------|
|  |       |
|  |       |
| Installation result  |       |
| ! Message  |       |
| <ul> <li>Installation was completed successfully.</li> </ul> |       |
|  |       |
|  |       |
|  |       |
|  |       |
|  |       |
|  |       |
|  |       |
|  |       |
|  |       |
|  |       |
|  |       |
| Save log Install additional files                            | Close |

Figure 5 - GSDML file installation completed

lika

Now scroll through the directory tree in the Hardware Catalog pane of the main window (task cards) and select the path Catalog \ Other Field devices \ PROFINET IO \ Encoders \ Lika Electronic: the LIKA EXM-EXO family can be found inside the folder. The installation modules are contained inside the directories MULTITURN (for multiturn version encoders) and SINGLETURN (for singleturn version encoders).



Figure 6 - Scrolling through Profinet families and categories

# 5.5.3 Adding a node to the project

Now we need to install the module of the desired model. For instance, we want to configure the EXMxx-13-14-PT4-... model.

In the right pane, open the **Hardware catalog** task card to display the field devices integrated into TIA Portal via the Profinet file (GSDML file); select the LIKA EXM-EXO directory; drag the required module LIKA EXM5xx-13-14 to the **Network view** and drop it next to the PLC module. Then assign the module to the network.



Figure 7 – Adding a node to the project

#### 5.5.4 Establishing the bus connection

As soon as the device has been inserted into the project, the bus connection with the PLC can be established in the **Network view**.

A PROFINET IO system is comprised of a PROFINET IO controller and its assigned PROFINET IO devices. After these devices have been placed in the network or topology view, TIA assigns default values for them.

The "Not assigned" information message appears in the picture of the node: it warns that the connection between the PLC and the Slave device is not established yet. Right-click on the message and select, through the Select IO controller drop-down box, the PLC the node has to be connected to. When doing so, make sure that you are in the Network function mode in the Network view.

After configuring the networking, the device is connected to the PLC via the Profinet network.

| ***                                  | ofinet\Progetti\TIA\CPU 1500W15\RT\encoder\exm5xx-13-14_V16\exm5xx-13-14_V16 |   | - •   |
|--------------------------------------|--|---|---|
| Project Edit View Insert Online Op   |  |   | Totally Integrated Automation   |
| 📑 🎦 🔚 Save project 🛛 🚢 🐰 🗐 🗔         | 🕻 🍋 🛨 🤁 🛄 🕼 🖳 🖓 Goonline 🖉 Gooffline 🏭 🔝 💷 🛠 🚽 🔲 < Search in                 | n project>                                      | PORTAL  |
| Project tree 🛛 🕄 📢                   | exm5xx-13-14_V16 > Devices & networks  | _ # = ×   | Hardware catalog 📰 🗈 🕨  |
| Devices                              | 🚰 Topology view  | h Network view                                  | Options   |
| 10 m m                               | Network 🛗 Connections HM connection 💌 👿 🖏 🗃 🖽 🛄 🔍 ±                          | Network overview                                | ↓ Catalog   |
|                                      |  | A Pevice  | ✓ Catalog   |
| <ul> <li>exm5xx-13-14_V16</li> </ul> |  | ET2005P station 1                               | Search> MI MT   |
| Add new device                       |  | PLC_1   |   |
| d Devices & networks                 | PLC_1 EXM13  | GSD device 1                                    | Filter Profile: <ali></ali>   |
| PLC_1 [CPU 15125P-1 PN]              | CPU 1512SP-1 PN LIKA EXM5XX-1  | <ul> <li>GSD device_1</li> <li>EXM13</li> </ul> |   |
| Ungrouped devices                    | Not assigned   | <ul> <li>EXMIS</li> <li>Interface</li> </ul>    | Drives & starters   |
| Security settings                    | PLC_1.PROFINET interface_1   | Port 1  | Image: Imag |
| Cross-device functions               |  | Port 1  | (m) Network components     (m) Detecting & Monitoring     (m) Distributed IIO     (m) Distributed IIO     (m) Prior Supply and distribution     (m) Prior Supply and distribution     (m) Prior Supply and distribution   |
| Unassigned devices                   | PN/IE_1  | - Port 2  | Distributed I/O   |
| Common data                          |  | <u>*</u>  | Im Power supply and distribution  |
| Documentation settings               |  |   | Field devices   |
| Languages & resources                |  |   | ▼ In Other field devices  |
| Version control interface            |  |   | Additional Ethernet devices   |
| Online access                        |  |   | ✓      ✓    |
| Card Reader/USB memory               |  |   | Drives  |
|                                      |  |   | ✓ Im Encoders   |
|                                      |  | ×   | - Tita Electronic   |
|                                      | < II > 100%  | - 🗐 < 🗉 🔿                                       | LIKA DRAW_WRE   |
|                                      | EXM13 [LIKA EXM5XX-13-14]  Properties  | 🐪 Info 🕕 🖏 Diagnostics 👘 💷 🗸                    | ✓ [] LIKA EXMEXO     ✓ [] Multitum     UIKA EXM5XX-13-14  |
|                                      |  | Taure Classification                            | - Multiturn =   |
|                                      | General IO tags System constants Texts                                       |   | LIKA EXM5XX-13-14   |
|                                      | General     Catalog information  | ^   | LIKA EXM5XX-18-12   |
|                                      | Catalog Information  |   | LIKA EXO5XX-16-14   |
|                                      | PROFINET interface [X1]  |   | Singleturn     III LIKA EXO5XX-18-00  |
| <ul> <li>Details view</li> </ul>     | General Short designation: LIKA EXM5XX-13-14                                 |   | LIKA EXO5XX-18-00   |
| - Details view                       | Ethernet addresses Description: Multitum magnetic encoder 27 bit             | t (13 bit singletum, 14 bit multitum)           | LIKA ROTACOD  |
|                                      | <ul> <li>Advanced options</li> </ul>   |   | SIEMENS AG  |
|                                      | Interface options  |   | Gateway   |
| Name                                 | Media redundancy   |   | General   |
|                                      | Isochronous mode   |   | > 🛅 1/0   |
|                                      | Real time settings     Article no.: EXM5XX-13-14                             |   | Sensors   |
|                                      | IO cycle   |   | PROFIBUS DP   |
|                                      | Port 1 [X1 P1 R]     Firmware version: V1.0                                  |   | × 2 ministration M  |
|                                      | Port 2 [X1 P2 R]      Hardware product version: 1                            |   | > Information   |

Figure 8 - Establishing the bus connection

#### 5.5.5. Inserting the telegrams

Now we need to choose the data length and the type of data that should be sent to and from the IO controller, thus we need to install a Standard Telegram. Four types of telegrams with different characteristics are available: Standard Telegram 81, Standard Telegram 82, Standard Telegram 83, and Standard Telegram 84. For detailed information on the Standard Telegrams refer to the "7.1 Telegrams" section on page 95.

For instance, we need to install the Standard Telegram 83. To do this switch to the **Device view** first, then select the desired Telegram available for the module LIKA EXM5xx-13-14 under the SUBMODULES directory in the **Catalog** task card. Drag and drop the STANDARD TELEGRAM 83 submodule onto the table area, as shown in the Figure.



Figure 9 - Adding the Standard Telegrams

### 5.5.6 Device name and IP address at delivery

In a Profinet network it is mandatory that each IO device is provided with its own Device name and IP address. By default, before delivery the device name of the encoder is set to a **blank string** and its IP address is set to **0.0.0**.

Before the PROFINET IO controller can address a PROFINET IO device, a name has to be assigned to the PROFINET IO device. PROFINET uses this method because names are easier to use and recall than complex IP addresses. Devices on an Ethernet subnet must have unique names.



# NOTE

An IO Device does not have a device name when delivered. By default, the device name of Lika's Profinet encoders is set to a **blank string**.

The device names must satisfy DNS (Domain Name System) conventions:

- Names are limited to a total of 127 characters (letters, numbers, dashes or dots).
- Any component part (that is, a character string between two dots) of the device name may only be up to 63 characters long.
- Names cannot contain any special character such as umlauts, parentheses, underscores, forward or backward slashes, empty spaces, etc. The dash is the only special character allowed.
- Names must neither start nor end with the minus "-" sign.

### Steps for system start-up



### Start-up response



# 5.5.7 Setting the device name and the IP address in the project

As stated, to completely establish the connection, you have to set and assign the Profinet device name and the IP address to the Slave device. First of all you need to set the Profinet device name and the IP address in the project. To do so, enter the **Device view** working area, select the device you need to configure in the drop-down box on the top left of the graphic area, right-click on the image of the module and select the **Properties** command from the shortcut menu (or the **Assign device name** command as an alternative).



Figure 10 - Setting device name and IP address

In the **Properties** inspector window, **General** tab, you can now use the **Ethernet addresses** menu option to enter the Profinet name of the Device and set the Ethernet address (IP address, subnet mask, ...).



Figure 11 - Setting device name

Enter the **PROFINET** group box and set a desired name in the **PROFINET device name** field or select the **Generate PROFINET device name automatically** check box if you want the name to be generated automatically by TIA.



# NOTE

The device name default setting is the name from the GSD file. With integral Profinet interfaces, the device name is derived from the short description. If several devices of the same type are arranged in the same Profinet IO system, TIA automatically supplements the name from the GSD file with a serial number. The second device is assigned the extension "-1", the third device the extension "-2", etc.



Then enter the IP Address in the IP Protocol group box.

Figure 12 – Setting IP address

# 5.5.8 Compiling and transferring the project

After setting you must compile and then transfer the project to the device by pressing the **DOWNLOAD TO DEVICE** button III in the toolbar; or by pressing the **ONLINE** button in the toolbar and the **Download to device** command in the drop-down menu that appears.

|                           | : 🐚 🛨 (🛎 🐻 🗓 🗓 🚆 📮 🍠 Go online 🖉 Go offline 🛔 🖪 🖪 😿 🚽 🕕 🥧 cearch in project | < 4 m   | , ,  | utomation<br>PORTA |
|---------------------------|---|---|--|--------------------|
| oject tree 🛛 🕄 📢          | exm5xx-13-14_V16 Devices & networks   | _#=X  | Hardware catalog                               | e II )             |
| Devices                   | 🚰 Topology view 🔥   | Network view                                    | Options  |                    |
| 🔤 🔿                       | 👔 Network 📋 Connections 🛛 HM connection 🔍 🕎 📆 📆 🔛 🛄 🔍 ± 📑                   | Network overview                                |  |                    |
|                           | IO system: PLC_1.PROFINET IO-System (100)                                   | -   | ✓ Catalog                                      |                    |
| exm5xx-13-14_V16          |   | Device     ET 2005P station_1                   | Search>  | 694 6              |
| Add new device            |   | PLC 1   |  |                    |
| Devices & networks        | PLC_1 EXM13   | GSD device 1                                    | Filter Profile: All>                           |                    |
| BLC_1 [CPU 15125P-1 PN]   | CPU 15125P-1 PN   | <ul> <li>GSD Gevice_1</li> <li>FXM13</li> </ul> | PC systems                                     |                    |
| 🔚 Ungrouped devices       | PLC_1   | ▼ Interface                                     | Drives & starters                              |                    |
| Security settings         |   | Port 1  | Network components                             |                    |
| Cross-device functions    | PLC_1.PROFINET IO-Syste   |   | <ul> <li>Detecting &amp; Monitoring</li> </ul> |                    |
| Common data               | rec_rection interior system   |   | Distributed I/O                                |                    |
| Documentation settings    |   |   | Power supply and distribution                  |                    |
| Languages & resources     |   |   | Field devices                                  |                    |
| Version control interface |   |   | <ul> <li>Other field devices</li> </ul>        |                    |
| Online access             |   |   | Additional Ethernet devices                    |                    |
| Card Reader/USB memory    |   |   | - ROFINETIO                                    |                    |
|                           |   |   | Drives   |                    |
|                           | <ul> <li>★ 100%</li> <li>★</li></ul>  | < = >   | ▼ Im Encoders                                  |                    |
|                           |   |   | Lika Electronic                                |                    |
|                           | ET 200SP station_1 [ET 200SP-Station]                                       | fo 追 🗓 Diagnostics 👘 🗐 🖃 🥆                      | LIKA DRAW_WIRE                                 |                    |
|                           | General IO tags System constants Texts                                      |   | <ul> <li>LIKA EXMEXO</li> </ul>                |                    |
|                           | General   |   | - Multitum                                     |                    |
|                           | General   |   | LIKA EXM5XX-13-14                              |                    |
|                           |   |   | LIKA EXM5XX-18-12                              |                    |
|                           |   |   | LIKA EXO5XX-16-14                              |                    |
|                           | Name: ET 2005P station_1  |   | ✓ Im Singleturn                                |                    |
| Details view              | Author: LIKA73  |   | LIKA EXO5XX-18-00                              |                    |
|                           | Comment:  | ~   | LIM LIKA ROTACOD                               |                    |
|                           |   |   |  |                    |
|                           |   |   | Gateway  |                    |
| ame                       |   | ~   | General  |                    |
|                           |   |   | Sensors  |                    |
|                           |   |   | PROFIBUS DP                                    |                    |
|                           |   |   | E PROFIBUS DP                                  | -                  |

Figure 13 - Downloading the project

# 5.5.9 Assigning the device name and the IP address to the device

After having set the Profinet device name and the IP address to the device in the project, you must assign them to your real device in the network.

In the **Online** menu bar select the **Assign device name** command.

|                       | Online Options Tools Window Help                                      | Ctrl+K                     | line 🖉 Go offline 🛔 🖪 🖪 🐺 🗶 🚽 🔲 Gearch in projects 👍 POR  |
|-----------------------|---|----------------------------|---|
|                       | 💕 Extended go online<br>🕅 Go offine                                   | Ctrl+M                     | s _ P = X Hardware catalog P =  |
|                       | Simulation  |                            | Topology view 🔥 Network view 👔 Device view Options  |
| 8                     | Stop runtime/simulation   |                            | V W W W W V V V   |
|                       | Download to device  | Ctrl+L                     |   |
| exm5xx-13-14_V16      | Extended download to device   | CUIVE                      | Device  |
| Add new device        | Download and reset PLC program  |                            |   |
| A Devices & networks  | Download user program to Memory Card                                  |                            | M13 PLC_1 Profile: <all></all>  |
| > D PLC_1 [CPU 15125P |   |                            | A EXMSXX-1  |
|                       | Snapshot of the actual values Load snapshots as actual values         |                            | EXAt13 EXAt13   |
| Security settings     | Load snapshots as actual values<br>Load start values as actual values |                            | Interface     Imterface     Imterface     Imterface   |
| Cross-device function |   |                            | Port 1 Put Detecting & Monitoring   |
| Common data           | Upload from device (software)   |                            | TIO-Syste Port 2 Por |
| Documentation set     | Upload device as new station (hardware an                             | d software)                | Power supply and distribution   |
| Languages & resou     | Backup from online device   |                            | > The Field devices   |
| Version control inte  | Hardware detection  | ,                          | Other field devices   |
| Online access         | HM Device maintenance   | •                          | Multiple Additional Ethernet devices  |
| Card Reader/USB mem   | a Assessible devices  | Ctrl+U                     | ▼ Cm PROFINETIO   |
|                       |   |                            | Drives  |
|                       | Start CPU   | Ctrl+Shift+E               | V Encoders  |
| 1                     | Stop CPU  | Ctrl+Shift+Q               | > 100% 💌 🕂 🗧 🤇 🗉 > 👻 🖬 Like Electronic  |
| 3                     | Online & diagnostics  | Ctrl+D                     | Properties 🚺 Info 😮 🖉 Diagnostics 💿 🖃 🗸 🕨 🚺 LIKA DRAW, WRE  |
|                       | Assign device name  |                            | Properties Linto J Diagnostics  |
|                       | Receive alarms  |                            | nts Texts   |
|                       | ▼ General   |                            |   |
|                       | Catalog information   | Etherne                    | addresses E KA EXABSION 3-14  |
|                       | <ul> <li>PROFINET interface [X1]</li> </ul>                           | Interf                     | ice networked with  |
|                       | General   | intern                     | ■ Construction of the second seco  |
| 0                     | Ethernet addresses  |                            | Subnet: PNIE_1  |
| Details view          | Advanced options  |                            |   |
|                       | Identification & Maintenance  | •                          | Add new subnet  |
|                       |   |                            |   |
|                       |   | <ul> <li>IP pro</li> </ul> | ocol I a Garevay  |
| lame                  |   |                            |   |
|                       |   |                            |   |
|                       |   |                            | IP address: 192 . 168 . 20 . 1  |
|                       |   |                            | Subnet mask: 255, 255, 0  |
|                       |   |                            | Synchronize router settings with IQ controller  |

Figure 14 - Assigning the device name

The Assign PROFINET device name dialog box will be displayed.

In the **PROFINET device name** field the device name will be automatically displayed. It cannot be changed. If you want a different name to be assigned, you must repeat the procedure by setting the device name again in the **Ethernet addresses** menu option (see the "5.5.7 Setting the device name and the IP address in the project" section on page 64).

| Assign PROFINET device     | name.          |                      |             |                           |                   | ×           |
|----------------------------|----------------|----------------------|-------------|---------------------------|-------------------|-------------|
|                            |                | Configured PRO       | FINET de    | vice                      |                   |             |
|                            |                | PROFINET devic       | e name:     | exm13                     |                   | •           |
|                            |                | Dev                  | vice type:  | LIKA EXM5XX-13-14         |                   |             |
|                            |                | Online access        |             |                           |                   |             |
|                            |                | Type of the PG/PC i  | interface:  | PN/IE                     |                   | <b>T</b>    |
|                            |                | PG/PC i              | interface:  | ASIX AX88179 USB 3.0      | to Gigabit Ethern | iet A 🔻 💎 💁 |
| a b                        |                | Device filter        |             |                           |                   |             |
| · · · ·                    |                | 🛃 Only show          | devices of  | the same type             |                   |             |
|                            |                | Only show            | devices wit | th bad parameter settings |                   |             |
|                            |                | Only show            | devices wit | thout names               |                   |             |
|                            | Accessible day | ices in the network: |             |                           |                   |             |
|                            | IP address     | MAC address          | Device      | PROFINET device name      | Status            |             |
|                            |                |                      |             |                           |                   |             |
|                            |                |                      |             |                           |                   |             |
|                            |                |                      |             |                           |                   |             |
| Flash LED                  |                |                      |             |                           |                   |             |
|                            | <              |                      |             | 111                       |                   | >           |
|                            |                |                      |             |                           | date list         | Assign name |
|                            |                |                      |             |                           |                   |             |
|                            |                |                      |             |                           |                   |             |
| Online status information: | :              |                      |             |                           |                   |             |
|                            |                |                      |             |                           |                   |             |
|                            |                |                      |             |                           |                   |             |
| <                          |                |                      |             |                           |                   | >           |
|                            |                |                      |             |                           |                   |             |
|                            |                |                      |             |                           |                   |             |
|                            |                |                      |             |                           |                   | Close       |
|                            |                |                      |             |                           |                   |             |

Figure 15 - Profinet device name

To pair the Profinet device name with your device, press the **UPDATE LIST** button to scroll through the network and find the accessible devices.

As soon as the search operation is carried out, the list of the accessible devices in the network will appear in the table, as shown in the Figure below. Select the device you want the Profinet device name to be assigned to and then

press the ASSIGN NAME button to complete the pairing operation.

|  | INET device                                      | . Indinie i                                     |                       |              |  |               |              |  |  |
|--|--|---|-----------------------|--------------|--|---------------|--------------|--|--|
|  |  |   | Configured PRO        | FINET dev    | /ice   |               |              |  |  |
|  |  |   | PROFINET devic        | e name:      | exm13  |               | -            |  |  |
|  |  |   | Device type:          |              | LIKA EXM5XX-13-14                                  |               |              |  |  |
| -  |  |   |                       | ince type:   | LIKA EXINDAX-13-14                                 |               |              |  |  |
|  |  |   | Online access         |              |  |               |              |  |  |
|  |  |   | Type of the PG/PC i   |              | PN/IE  |               |              |  |  |
|  |  |   | PG/PC i               | interface:   | 🖼 ASIX AX88179 USB 3.0 to Gigabit Ethernet A 💌 🕏 💁 |               |              |  |  |
|  |  |   | Device filter         |              |  |               |              |  |  |
|  |  |   | 🗹 Only show           | devices of t | he same type                                       |               |              |  |  |
|  |  |   | Only show             | devices with | h bad parameter set                                | tings         |              |  |  |
|  |  |   | Only show             | devices with | houtnames  |               |              |  |  |
|  |  |   |                       | derices ma   | ind a channes                                      |               |              |  |  |
|  |  | Accessible de                                   | vices in the network: |              |  |               |              |  |  |
|  |  | IP address                                      | MAC address           | Device       | PROFINET device name Status                        |               |              |  |  |
|  |  | 0.0.00  | 10-89-FE-00-69-12     | EXM-EXO      | -  | 🚹 No device n | ame assigned |  |  |
|  |  | -   |                       |              |  |               |              |  |  |
|  |  | -   |                       |              |  |               |              |  |  |
|  | <b>L</b>   |   |                       |              |  |               |              |  |  |
|  | <b>.</b>   |   |                       |              |  |               |              |  |  |
| Flash L                                    | LED  |   |                       |              |  |               |              |  |  |
| Flash L                                    | LED  | <   |                       |              | III  |               | 1            |  |  |
| Flash L                                    | LED  | <   |                       |              |  | Update list   |              |  |  |
| Flash L                                    | LED  | <   |                       |              |  | Update list   | Assign name  |  |  |
| Flash L                                    | LED  | <   |                       |              |  | Update list ) |              |  |  |
|  |  |   |                       |              | W  | Update list ] |              |  |  |
| Online statu                               | us information                                   | :   |                       |              |  | Update list ] |              |  |  |
| Online statu<br>D Sear                     | us information<br>rch completed                  | :<br>I. 0 of 1 devices v                        |                       |              |  | Update list   |              |  |  |
| Dnline statu<br>1) Sear<br>1) Sear         | us information<br>rch completed<br>rch completed | :<br>I. O of 1 devices v<br>I. O of 1 devices v | vere found.           |              |  | Update list ) |              |  |  |
| Dnline statu<br>D Sear<br>Sear<br>Sear     | us information<br>rch completed<br>rch completed | :<br>I. 0 of 1 devices v                        | vere found.           |              |  | Update list   | Assign name  |  |  |
| Online statu<br>1) Sear<br>1) Sear         | us information<br>rch completed<br>rch completed | :<br>I. O of 1 devices v<br>I. O of 1 devices v | vere found.           | 111          |  | Update list ) |              |  |  |
| Dnline statu<br>D Sear<br>D Sear<br>D Sear | us information<br>rch completed<br>rch completed | :<br>I. O of 1 devices v<br>I. O of 1 devices v | vere found.           | 10           |  | Update list   | Assign name  |  |  |
| Dnline statu<br>D Sear<br>Sear<br>Sear     | us information<br>rch completed<br>rch completed | :<br>I. O of 1 devices v<br>I. O of 1 devices v | vere found.           | 10           | 111  | Update list   | Assign name  |  |  |

Figure 16 - Assigning the device name



#### WARNING

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Finally you will be required to switch the encoder power supply OFF and then ON again to finalize the process.

The same if you change either the name or the IP address of the device in a later moment: you will be always required to switch the encoder power supply OFF and then ON again to reset the encoder and restart the communication.

### 5.5.10 Module parameters

Press the **Device view** changeover switch in the **Hardware and network editor** to enter the **Device view** working area, then select the device you need to configure in the drop-down box on the top left of the graphic area. Select the **Module Access Point** field in **Device view**. In the **Properties** inspector window, **General** tab, press the **Module parameters** menu option to see and set, if required, the encoder specific parameters implemented by the manufacturer.

Parameters listed in this page are sent at each switching on.

You can change the value of each parameter in the edit field. Parameter data is transferred to the encoder using 0xBF00 data record at each system boot up.

You can change the value of the module parameters also while the device is operational in the Cyclic Data Exchange mode via the Watch table. Please note that the value however will be overwritten at switching on by the value set in the **Module parameters** tabbed page.



Figure 17 - Module parameters

After having changed any parameter values, you must compile and then transfer the project to the device by pressing the **DOWNLOAD TO DEVICE** button in the toolbar; or by pressing the **ONLINE** button in the toolbar and the **Download to device** command in the drop-down menu that appears.

Please note that a description / help message (tooltip) appears on the display when you move the cursor over the items listed in the table.



Figure 18 - Description / help message (tooltip)

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For a comprehensive description of the parameters and how to set them properly refer to the specific explanation in the "9.5 Record Data Object 0xBF00: user parameter data" section on page 121.

# 5.5.11 Establishing an online connection (Online mode)



Figure 19 - Establishing an online connection

In online mode, there is an online connection between the PLC and one or more devices. An online connection between the PLC and the device is required, for example, for the following tasks:

- using the Control Table;
- testing user programs;
- displaying and changing the operating mode of the device;
- displaying module information;
- comparing blocks;
- hardware diagnostics.

Before you can establish an online connection, the PLC and the device must be physically or remotely connected.

After establishing a connection, you can use the **Online and Diagnostics view** or the **Online tools** task card to access the data on the device. The current online status of a device is indicated by an icon to the right of the device in the **Project Tree**.

To establish an online connection between the PLC (Profinet Controller) and the device (Profinet Device) proceed as follows.

- In the **Project Tree** (see point 4 in the "5.2.2 Project overview" section on page 50) mark the folder of the PLC that is configured as the Controller.
- Select the **Go online** command in the **Online** menu bar to establish an online connection to the PLC (Controller) and to the device (Device).

- If the device has already been connected online, the online connection is automatically established using the previously specified connection path.
- If there was no previous connection, the **Go online** dialog opens.
- Select the connection path:
  - select the type of interface;
  - select the interface of the PLC;
  - select the interface or the subnet for the connection.
- Click the **START SEARCH** button. Devices which can be reached by the set connection path are displayed in the **Compatible devices in target subnet**. The connection line in the graphic is displayed as solid.
- Select the device in the **Compatible devices in target subnet table** and confirm the selection with **Go online**. The online connection to the selected target device is established.

| ject tree 🋛 🛛 🕻 📢   |  |                           |   | _ ■ ■ × Online tools  |                                      |  |
|---|--|---------------------------|---|---|--------------------------------------|--|
| levices   |  |                           |   | Options   |                                      |  |
|   | Diagnostics     Functions  | Reset to factory settings |   | V CPU opera   | tor papel                            |  |
| emisori314 V16  Add new device  Add new device  Add new device  Rc. 1 (CPU 3544  Colline & diagnosti.  Cy. Online & diagnosti.  Cy. Online & diagnosti.  Technology object:  Eternis Source file  Rc. tags  Rc. tags  | Assign IP address<br>Assign RPUET drvice na_<br>Reset to factory settings  |                           | 10 -89 -92 -00 -69 -12<br>192. 168. 1 . 10<br>even 13<br>even 13<br>Partain I&M data<br>Deleter I&M data<br>Reset | PLC_1 (CPU 1)<br>RUAL/STO<br>ERROR<br>MAUNT<br>Mode selecto | 5125P-1 PN]<br>P RUN<br>STOP<br>MRES |  |
| Witch and force t.     Witch and force t |  |                           |   | Cycle time     Shortest:     Currentilist:     Longet:      | 1,018 ms<br>1.993 ms<br>3.298 ms     |  |
| Details view  |  |                           |   | ✓ Memory  |                                      |  |
| Name<br>Add new device  | Contemporary Conte | em constants Texts        | Properties Linfo Diagn  | ostics  | Free:87%                             |  |

Figure 20 - Online connection established

After the online connection has been established successfully, the user interface changes (see the Figure above).

- 1. The title bar of the active window gets an orange background as soon as at least one of the devices currently displayed in the editor has been successfully connected online. If one or more devices are unavailable, a symbol for a broken connection appears in the title bar of the editor.
- 2. Now the title bars of inactive windows for the relevant station have an orange line below them.
- 3. An orange, pulsing bar appears at the right-hand edge of the status bar. If the connection has been established but it is not working properly, an icon for an interrupted connection is displayed instead of the bar. You
will find more information on the error in **Diagnostics** in the **Inspector window**.

- 4. Operating mode symbols or diagnostics symbols for the stations connected online and their underlying objects are shown in the **Project Tree**. A comparison of the online and offline status is also made automatically. Differences between online and offline objects are also displayed in the form of symbols.
- 5. The **Diagnostics** > **Device information** area is brought to the foreground in the **Inspector window**.

#### 5.5.12 Closing an online connection

To close the existing online connection, follow these steps.

- 1. Select the device for which you want to disconnect the online connection in the **Project Tree**.
- 2. Select the **Go offline** command in the **Online** menu bar. The online connection is disconnected.

### 5.5.13 Diagnostics

Configuration of the diagnostics is integrated in the system in a user-friendly way and activated with just one click. When new hardware components are introduced, the diagnostic information is updated automatically via the engineering system (HWCN). System diagnostics outputs all relevant information on existing errors in the system. This information is packaged automatically in messages containing the following elements:

- module;
- message text;
- message status.



To access the diagnostics function please proceed as follows.

- 1. Right-click on the module to process.
- 2. Select the **Online & diagnostics** command from the shortcut menu.
- 3. If there is no online connection established, click the **CONNECT ONLINE** button in the **Diagnostics** entry.
- 4. The diagnostic status of the module will be displayed in the **Diagnostic** status group in the **Diagnostics** folder in the **Online and diagnostics** view of the module to be diagnosed.

The following status information is displayed in the **Diagnostic status** area:

- Status of the module as viewed by the CPU, for example:
  - Module available and OK.
  - Module defective.

If the module experiences a fault and you have enabled the diagnostic error interrupt during configuration, the "Module defective" status is displayed.

- Module configured, but not available.
   Example: Diagnostics data is not available because the current online configuration differs from the offline configuration.
- Detected differences between the configured and the inserted module. Provided it can be ascertained, the article number will be displayed for the set and actual type.

The scope of the displayed information depends on the selected module.

#### 5.6 Resetting the parameters to the default factory values

Default values are provided to each parameter of the device and are preset at the factory by Lika Electronic engineers. For the complete list of machine data and relevant default parameters, please refer to page 179. The first time you install the encoder, it will operate using the default values. They allow the operator to run the IO device for standard and safe operation. They are not plainly optimized for specific application yet provide maximum performance for most systems. To suit the specific application requirements it may be advisable and even necessary to enter new parameters instead of the factory default settings.

There could be exceptional circumstances where it would be necessary for you to restore the default values of the settable parameters. When this is the case, you have to use the **Reset** command.



# NOTE

When you restore the default values, please always consider that:

- the encoder parameters will be restored to the default values (see on page 179);
- the encoder offset will be reset;
- the Device Name will be lost and replaced with a blank string;
- the IP address will be set to 0.0.0.0;
- the parameters associated with the IP range will be set to 0.



### WARNING

The execution of this command causes all the values which have been set previously next to each parameter to be overwritten!



### NOTE

The complete list of machine data and relevant default parameters preset by Lika Electronic engineers is available on page 179.

When you need to restore the default values proceed as follows.

Enter the **Device view** working area, select the device you need to configure in the drop-down box on the top left of the graphic area, right-click on the image of the module and select the **Online & diagnostics** command from the shortcut menu (or double-click the **Online & diagnostics** command in the project tree). Confirm your request in the dialog box that appears.



Figure 21 - Restoring default values

To get started with the diagnostic functions you must go online. To do this you must press the **Go online** command in the **Online** menu bar (see also the "5.5.11 Establishing an online connection (Online mode)" section on page 71).

| 🞦 🔚 Save project 进 🐰 🗄 🛅 🗙 崎 |                           |                                 |   | oject> | 2.5         | Online tools                           | PORT |
|------------------------------|---------------------------|---------------------------------|---|--------|-------------|--|------|
| Devices                      | IX-13-14_410 V Orgiouped  | devices ) EXM13 [LIKA EXM5XX-13 | - 14]                                   |        |             | Options                                |      |
| 😫 🔟 📑 🕶 Dia                  | gnostics Ri<br>General Ri | eset to factory settings        |   |        |             |  | 0    |
|                              | Diagnostic status         |                                 |   |        |             | <ul> <li>CPU operator panel</li> </ul> |      |
| exm5xx+13+14_V16             | Channel diagnostics       |                                 |   |        |             | No online connection                   |      |
|                              | PROFINET interface [X1]   | MAC address:                    | 00 - 00 - 00 - 00 - 00                  |        |             | No onine connection                    |      |
|                              | ictions                   | IP address -                    | 0.0.0                                   |        |             |  |      |
| Device configuration         | Assign IP address         |                                 |   |        |             |  |      |
| Online & diagnostics         | Assign PROFINET device na |                                 |   |        |             |  |      |
| Program blocks               | Reset to factory settings |                                 |   |        |             |  |      |
| Technology objects           |                           |                                 | <ul> <li>Retain I&amp;M data</li> </ul> |        |             |  |      |
| External source files        |                           |                                 | 🔵 Delete I&M data                       |        |             |  |      |
| PLC tags                     |                           |                                 | Reset                                   |        |             |  |      |
| PLC data types               |                           |                                 |   |        |             |  |      |
| Watch and force tables       |                           |                                 |   |        |             |  |      |
| Add new watch ta             |                           |                                 |   |        |             | ✓ Cycle time                           |      |
| Asynchronous Req             |                           |                                 |   |        |             | - of the time                          |      |
| Force table                  | -                         |                                 |   |        |             | No online connection                   |      |
| Telegram 0x53                |                           |                                 |   |        |             |  |      |
| Online backups               |                           |                                 |   |        |             |  |      |
| Firaces                      |                           |                                 |   |        |             |  |      |
| Device proxy data            |                           |                                 |   |        |             |  |      |
| Program info                 |                           |                                 |   |        |             |  |      |
| PLC supervisions & ala.      |                           |                                 |   |        |             |  |      |
| PLC alarm text lists         |                           |                                 |   |        |             |  |      |
|                              |                           |                                 |   |        |             |  |      |
| Details view                 |                           |                                 |   |        |             |  |      |
|                              |                           |                                 |   |        |             |  |      |
|                              |                           |                                 |   |        |             | ✓ Memory                               |      |
| <                            | II                        |                                 |   |        |             | No online connection                   |      |
| Name EXM                     | 13 [LIKA EXM5XX-13-14]    |                                 | Q Properties                            | 1 Info | Diagnostics | no onare connection                    |      |
| Add new device               |                           | constants Texts                 |   |        |             |  |      |
|                              |                           | constants Texts                 |   |        |             |  |      |
| PLC_1 Get                    |                           | hemet addresses                 |   |        | ^           |  |      |
|                              | Catalog information       |                                 |   |        |             |  |      |

Figure 22 - Going online

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The **Diagnostics** working area window contains information about the encoder, statuses, events, etc.

Under Functions press Reset to factory settings.

| 10 · | Siemens - C:\roberto_dell_E6540\bus\P  | Profinet/Progetti\TIA/CPU 1500W15/RThencoder/exm5xx-13-14_V16/exm5xx-13-14_V16   |                                       | - • ×        |
|------|--|--|---------------------------------------|--------------|
|      | oject Edit View Insert Online Opti   | tions: Jools: Window: Help<br>K 崎 🛨 (# ± 75) 🔃 🚺 🔛 🕼 🖉 Goonline 💋 Gooffline 🧦 🖪 📑 😿 🚍 🛄 😒 Search in projects 🌰   | Totally Integrated Automation<br>PORT |              |
| -    |  |  | Online tools                          |              |
| -    | Project tree 🔲 📢   | exm5xx-13-14_V16 + Ungrouped devices + EXM13 [LIKA EXM5XX-13-14]   |                                       |              |
|      | Devices  |  | Options                               | Online tools |
|      | 🛍 📖 🛣  | Diagnostics     Reset to factory settings  |                                       |              |
| ĕ.   |  | Functions  | CPU operator panel                    | ne           |
| Ê.   | • 📄 exm5xx-13-14_V16 🗹 🔍 🔿   | Assign Beddess   | PLC 1 [CPU 1512SP-1 PN]               | too          |
| 8    | Add new device   | Reset to factory settings MAC address: 10 - 89 - FE - 00 - 69 - 12   |                                       | 5            |
| 8    | Devices & networks   | IP address: 192.168.1 .10  |                                       | -            |
| ě.   | Device configurati   | PROFINET device name: exm13  | ERROR STOP                            | (1) Tasks    |
| δ    | Conline & diagnosti  | PROFILE LEVILE Hame: Courts  | MAINT MRES                            | ask          |
|      | Program blocks   | Retain IBM data  |                                       |              |
|      | Technology objects   | Delete ISM data  | Mode selector: RUN                    | 📑 Librarie   |
|      | External source files  | <u> </u>   |                                       | E            |
|      | PLC tags   | Reset  |                                       | rar          |
|      | Comparison of the second |  |                                       | es           |
|      | Add new watc   |  | ✓ Cycle time                          |              |
|      | Asynchronous   |  | - Gele unie                           | >            |
|      | Force table  |  |                                       | Add-in       |
|      | Telegram 0x53  |  |                                       | su           |
|      | Online backups   |  |                                       |              |
|      | Traces   |  | e ms                                  |              |
|      | Device proxy data     Program info   |  | 1.993 150                             |              |
|      | PLC supervisions &   |  | Shortest: 1.018 ms                    |              |
|      | PLC alarm text lists   |  | Currentilast: 1.993 ms                |              |
|      | < 11 >   |  | Longest: 3.298 ms                     |              |
| 1    | ✓ Details view   |  |                                       |              |
|      |  |  | ✓ Memory                              | _            |
|      |  |  | wemory                                |              |
|      | Name   |  | Load memory                           | -            |
|      | Add new device   | EXM13 [LIKA EXM5XX-13-14] Characteristics Exmonstration Diagnostics Exmonstration Composition Composit | Free:87%                              | -            |
|      | 📩 Devices & networks 📃   | General IO tags System constants Texts   | Work memory                           |              |
|      | PLC_1  | ▼ General A Ethernet addresses   | Work memory code                      |              |
|      | Ungrouped devices  | Catalog information  | Free:99.78 %                          |              |
| 1    | Security settings  | PROFINET interface IX11     Interface networked with     A D0A13     UX2 2 Watch ta  | Connected to PLC_1, via address IP=19 | *            |
|      | Portal view     Derview  | 00 z viatch ta A Comine & dia  | Connected to PLC_1, via address IP=19 |              |

Figure 23 - Reset to factory settings

# Next to the **MAC** address item in the **Reset to factory settings** graphic area enter the MAC address of the encoder you need to reset (it is written on the encoder label) and then press the **RESET** button to confirm.

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As soon as you press the **RESET** button in the **Reset to factory settings** graphic area, a warning message (**Do you really want to reset the module?**) appears on the screen: it warns the operator about the awkwardness of the operation, thus he is required to confirm the procedure before continuing.

Press the **YES** button to proceed, otherwise press the **NO** button to abort the procedure.



Figure 24 - Confirming the reset to factory settings

When the operation is carried out, if you browse the network to find the accessible devices, you will see the value 0.0.0.0 under the **IP address** item and three dashes under the **PROFINET device name** item, they are followed by the message "No device name assigned". Refer to the "5.5.9 Assigning the device name and the IP address to the device" section on page 66.

| Assign | PROFINET device                          | e name.               |                                  |                   |                      |                        | >             |
|--------|--|-----------------------|----------------------------------|-------------------|----------------------|------------------------|---------------|
|        | -  |                       | Configured PRO                   | FINET dev         | vice                 |                        |               |
|        |  |                       | PROFINET devic                   | e name:           | exm13                |                        | -             |
|        |  |                       |                                  | ice type:         | LIKA EXM5XX-13-14    |                        |               |
|        |  |                       | Online access                    |                   |                      |                        |               |
|        |  |                       | Type of the PG/PC in             | terface           | PN/IE                |                        |               |
|        |  |                       |                                  | nterface:         | ASIX AX88179 U       |                        |               |
|        |  |                       | FGIPC II                         | itenace:          | ASIX AX88179 U       | SB 3.0 to Gigabit Ethe | emet A 💌 🔍 ⊴  |
|        |  |                       | Device filter                    |                   |                      |                        |               |
|        |  |                       | Only show                        | devices of t      | he same type         |                        |               |
|        |  |                       | Only show                        | devices witl      | h bad parameter sett | ings                   |               |
|        |  |                       | Only show                        | devices wit       | hout names           |                        |               |
|        |  |                       |                                  |                   |                      |                        |               |
|        |  |                       | vices in the network:            |                   |                      |                        |               |
|        |  | IP address<br>0.0.0.0 | MAC address<br>10-B9-FE-00-69-12 | Device<br>EXM-EXO | PROFINET device na   |                        | name assigned |
|        |  | 0.0.0.0               | 10-89-FE-00-69-12                | EXIMEXO           | -                    | No device              | name assigned |
|        | · · ·                                    |                       |                                  |                   |                      |                        |               |
|        |  |                       |                                  |                   |                      |                        |               |
|        | Flash LED                                |                       |                                  |                   |                      |                        |               |
|        |  | <                     |                                  |                   |                      |                        | >             |
| -      |  |                       |                                  |                   |                      | Update list            | Assign name   |
|        |  |                       |                                  |                   |                      | opuble list            |               |
|        |  |                       |                                  |                   |                      |                        |               |
|        |  |                       |                                  |                   |                      |                        |               |
| Onlin  | e status information<br>Search completed |                       | and found                        |                   |                      |                        |               |
| Ă      | Search completed                         |                       |                                  |                   |                      |                        |               |
| ě      | Search completed                         |                       |                                  |                   |                      |                        |               |
| <      |  |                       |                                  |                   |                      |                        | >             |
|        |  |                       |                                  |                   |                      |                        |               |
|        |  |                       |                                  |                   |                      |                        |               |
|        |  |                       |                                  |                   |                      |                        | Close         |

Figure 25 - Encoder reset

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### 5.7 TO Technology Objects

In order to be able to facilitate the use of technological functions that can be used with a SIMATIC controller, what is known as **Technology Objects** have been introduced in the programming environment of SIMATIC. Within these technology objects, the available functions are encapsulated and provided to the creator of the user program for easy access and the easy use in the programming environment.

In particular these technology objects are used in the "motion control" area to simplify the control and handling of axes and additional motion control functionalities and to support the user in the creation of a user program with motion control functionalities.

### 5.7.1 Properties of a technology object (TO)

A technology object (TO) for motion control in the SIMATIC has the following properties:

- The technology object represents a software object in the controller.
- The technology object represents the mechanical components.
- The technology object encapsulates the technological functionality.
- The technology object allows a uniform setting and configuration.
- The technology object ensures a simple connection of the drives and encoders as well as the distributed I/O.
- The technology object encapsulates the mechanical configuration, the monitoring and limitations of the drive and the mechanic that is connected to it.
- The technology object is addressed via PLCopen motion control instructions from the user program.

This guarantees a simple and standardized use of the motion control functionalities in the SIMATIC.

### 5.7.2 Installing the encoder as a technology object (TO)

First of all, if the encoder has to be used as a TO Technology Object, please set the **Compatibility Mode** parameter to 0 = Enable = Compatible with Encoder Profile V3.1, see on page 125.



Figure 26 - Checking the Compatibility Mode parameter setting

When you need to add a new technology object, click **Add new object** under the **Technology objects** item in the project tree: the **Add new object** dialog box will be displayed.



Figure 27 - Adding a new technology object

In the **Add new object** dialog box, select the entry **TO\_ExternalEncoder** under the **Motion Control** list. Press the **OK** button to confirm.



Figure 28 - Adding an External Encoder technology object

Under **Basic parameters** in the **Function view** working area set the available items according to the technical features of the encoder to be connected. Please note that when a new object is successfully added, the object node is added to the Project tree and the configuration for this newly added device is opened.



Figure 29 - Setting the TO basic parameters

Under **Hardware interface** set both the **Encoder** parameters and the **Data exchange** parameters. Select the telegrams to be used and set the singleturn resolution and the number of revolutions. In the example an EXM58-13-14-PT4-... encoder is to be connected as TO.



Figure 30 - Setting the TO hardware interface

As soon as the parameters are set, some green ticks will appear in the lateral bar to indicate the proper configuration.

When the TO is configured, the  $\ensuremath{\text{Encoder}}$  page will appear as in the following view:



Figure 31 - Encoder area with configured TO

When the TO is configured, the **Data exchange with encoder** page will appear as in the following view:

| <b>VA</b> | Siemens - C:\roberto_dell_E6540\bus\Profi                              | inet\Progetti\TIA\CPU 1500\V16\EXM5XX                                | -13-14\EXM5XX-13-14  |                      | _ # X              |
|-----------|--|--|--|----------------------|--------------------|
|           | oject <u>E</u> dit <u>V</u> iew Insert <u>O</u> nline Optio <u>n</u> : |  |  | Totally Int          | egrated Automation |
| 2         | 👌 🎦 🔚 Save project 🛛 🚆 🐰 💷 🕅 🗙   | 崎 🛨 (📲 🐘 🚺 🔃 🔛 💋 Go  | online 🖉 Go offine 🛔 🖪 🖪 🗶 🖃 🛄 <earch in="" project=""> 🆓</earch>  |                      | PORTAL             |
|           |  | EXM5XX-13-14 + PLC_1 [CPU 1512                                       | SP-1 PN]   Technology objects  ExternalEncoder_1 [DB7]   |                      | _ # = × <          |
|           | Devices  |  |  | Function view        | Parameter view     |
|           | 19   | *  |  |                      | Tasks              |
|           |  | Basic parameters   |  |                      | ~ <del>5</del>     |
|           | <ul> <li>EXM5XX-13-14</li> </ul>                                       | Hardware interface     Encoder                                       | Data exchange with encoder   |                      |                    |
| ۲         | Add new device   | Encoder 🥥  |  |                      |                    |
| 8         | h Devices & networks   | Data exchange with encoder   |  |                      | 듕                  |
|           | PLC_1 [CPU 15125P-1 PN]  | Leading value settings   |  |                      | 3                  |
|           | Device configuration   | Extended parameters  |  |                      | es                 |
|           | 😵 Online & diagnostics   | Leading value settings<br>Extended parameters<br>Mechanics<br>Homing |  |                      |                    |
|           | Software units   | Homing 🥑   | PLC  |                      |                    |
|           | Program blocks   |  | Local Control of Contr |                      | Add-ins            |
|           | <ul> <li>Technology objects</li> </ul>                                 |  | Data exchange  |                      | ÷                  |
|           | Add new object   |  | Data exchange  |                      | l " l              |
|           | ExternalEncoder_1 [D87   |  |  |                      |                    |
|           | Configuration  |  |  |                      |                    |
|           | Diagnostics  |  |  |                      |                    |
|           | Output cam   |  |  |                      |                    |
|           | 🕨 🚂 Measuring input  |  |  |                      |                    |
|           | External source files  |  |  |                      |                    |
|           | PLC tags   |  | Encoder telegram: Standard telegram 83 💌 🛐 Device configuration  |                      |                    |
|           | Eg PLC data types  |  |  |                      |                    |
|           | Watch and force tables   |  | Automatically apply encoder values during configuration (offine)   |                      |                    |
|           | Online backups   |  |  |                      |                    |
|           | Traces   |  | Automatically apply encoder values during runtime (online)   |                      |                    |
|           | OPC UA communication   |  | Measuring system: Rotary   Measuring system: Rotary  Measuring system: |                      |                    |
|           | 🕨 🔛 Device proxy data  | -  | Increments per revolution: 8192 device configuration.  | 2                    |                    |
|           | ✓ Details view   |  | Number of revolutions: 16384   |                      |                    |
|           |  |  |  |                      |                    |
|           |  |  |  |                      |                    |
|           | Name Offset  |  | Fine resolution  |                      |                    |
|           | Configuration  |  | Bits in Gx_XIST1: 0 bit  |                      |                    |
|           | Diagnostics  |  | Bits in Gx_005T2: 0 bit  |                      |                    |
|           | ActualPosition   |  |  |                      |                    |
|           | ActualVelocity   |  |  | 1                    | ×                  |
|           | <  |  | Properties   | 🗓 Info 🛛 🗓 Dia       | agnostics          |
|           | Portal view     Dverview   | Se ExternalEnc   | 📑 💙 Pi   | oject EXM5XX-13-14 o | pened.             |

Figure 32 - Data exchange area with configured TO

#### 5.7.3 Adding additional data blocks and function blocks

Some data blocks and function blocks are added automatically when you install the new encoder object.

#### Network 1:

lika

|   | %DB8<br>"MC_POWER_DB*<br>MC_POWER             |   |
|---|---|---|
| "MC_POWER_<br>DB".fnable_<br>"MC_POWER_<br>DB".StartMode_<br>"MC_POWER_ | EN<br>Axis<br>Enable<br>StartMode<br>StopMode | ENO<br>*MC_POWER_<br>Status →DB*.Status<br>·MC_POWER_<br>Busy →DB*.Busy<br>*MC_POWER_<br>Error →DB*.Error<br>-DB*.Error<br>DB*.Errorl |

Network 2:



#### Network 3:





Some other blocks need to be added by the operator autonomously.



Figure 34 - Data blocks and function blocks

They can be found already created in the projects that are supplied by Lika Electronic. See the watch table in the Figure below. Refer to the Lika TIA V16 CPU1500 Profinet example project.zip compressed file contained in the SW EXM58\_EX058 PT.zip file.

| t Edit View Insert Online Op<br>B 🛃 Save project 🔠 💥 💷 🙃 |              |  | online 💋 Go o      | ffine 🎝 📗 📭 🗶                          | Searc           | n in project> | <b>G</b> 4   |             |           | Tota    | ally Integrated Auto | omation<br>PORT |
|--|--------------|--|--------------------|--|-----------------|---------------|--|-------------|-----------|---------|----------------------|-----------------|
| oject tree 🛛 🕮   | EXM5         | XX-13-14_TO → PLC_1 [CPU 1                                 | 512SP-1 PN]        | <ul> <li>Watch and force ta</li> </ul> | bles > Technolo | gy_Object     |  |             |           |         |                      | - 21            |
| Devices  |              |  |                    |  |                 |               |  |             |           |         |                      |                 |
|  | e 🕫          | 2 10 10 9, 9, 99 92 92                                     | 00                 |  |                 |               |  |             |           |         |                      |                 |
|  |              | Name   | Address            | Display format                         | Monitor value   | Modify value  | 9  | Comment     |           | Tag co  | mment                |                 |
| EXM5XX-13-14 TO  | A 1          | "ExternalEncoder 1".ActualPo                               |                    | Floating-point nu                      |                 |               | 0 1  | 2           |           |         |                      |                 |
| Add new device   | 2            | "ExternalEncoder 1" ActualVe                               |                    |  | -2.74658203125  |               |  |             |           |         |                      |                 |
| h Devices & networks                                     | 3            | "ExternalEncoder_1".ActualAc                               |                    |  | -686.6455078125 |               |  |             |           |         |                      |                 |
| - DE PLC 1 [CPU 15125P-1 PN]                             | 4 //         |  |                    |  |                 |               |  |             |           |         |                      |                 |
| Device configuration                                     | 5            | "MC_HOME_DB".Position                                      |                    | Floating-point nu                      | 0.0             |               |  |             |           |         |                      |                 |
| V. Online & diagnostics                                  | = 6          | "MC HOME DB".Execute                                       |                    | Bool                                   | FALSE           | FALSE         |  |             |           |         |                      |                 |
| Software units   | 7            | "MC HOME DB".Done  |                    | Bool                                   | FALSE           |               |  |             |           |         |                      |                 |
| Program blocks   | 8            | *MC_HOME_DB*.Error   |                    | Bool                                   | FALSE           |               |  |             |           |         |                      |                 |
| Technology objects                                       | 9            | "MC_HOME_DB".Errorld                                       |                    | Hex                                    | 16#0000         |               |  |             |           |         |                      |                 |
| External source files                                    | 10 //        |  |                    |  |                 |               |  |             |           |         |                      |                 |
| PLC tags   | 11           | "MC_POWER_DB".Enable                                       |                    | Bool                                   | FALSE           |               |  |             |           |         |                      |                 |
| Co PLC data types  | 12           | *MC_POWER_DB*.StartMode                                    |                    | DEC+/-                                 | 1               |               |  |             |           |         |                      |                 |
| <ul> <li>Watch and force tables</li> </ul>               | 13           | "MC_POWER_DB".StopMode                                     |                    | DEC+/-                                 | 0               |               |  |             |           |         |                      |                 |
| Add new watch table                                      | 14           | "MC_POWER_DB".Error  | A                  | Bool                                   | FALSE           |               |  |             |           |         |                      |                 |
| Acyclic request  | 15           | *MC_POWER_D8*.Errorld                                      |                    | Hex                                    | 16#0000         |               |  |             |           |         |                      |                 |
| Force table  | 16 <i>II</i> |  |                    |  |                 |               |  |             |           |         |                      |                 |
| III. Technology_Object                                   | 17           | "MC_RESET_DB".Execute                                      |                    | Bool                                   | FALSE           | FALSE         | Image: A state of the state |             |           |         |                      |                 |
| Telegram 0x53  | 18           | "MC_RESET_DB".Restart                                      |                    | Bool                                   | FALSE           |               |  |             |           |         |                      |                 |
| Online backups   | 19           | "MC_RESET_DB".Done   |                    | Bool                                   | FALSE           |               |  |             |           |         |                      |                 |
| 🕨 🔛 Traces   | 20           | "MC_RESET_DB".Error  |                    | Bool                                   | FALSE           |               |  |             |           |         |                      |                 |
| OPC UA communication                                     | 21           | "MC_RESET_DB".Errorld                                      |                    | Hex                                    | 16#0000         |               |  |             |           |         |                      |                 |
| Device proxy data  | 22           |  | <add new=""></add> |  |                 |               |  |             |           |         |                      |                 |
| Program info   | ~ <          |  |                    |  |                 |               |  |             |           |         |                      | _               |
| Details view   | (            |  |                    |  |                 | -             |  |             | -         |         |                      | _               |
|  |              |  |                    |  |                 |               |  |             | Reporties | 1, Info | 🗓 Diagnostics        |                 |
|  | Gen          | eral Cross-references                                      | Compile            |  |                 |               |  |             |           |         |                      |                 |
|  | - <b>0</b> • | Show all messages  |                    |  |                 |               |  |             |           |         |                      |                 |
| Name   |              | Show all messages  |                    |  |                 |               |  |             |           |         |                      |                 |
|  |              |  |                    |  |                 |               |  | -           |           |         |                      |                 |
|  |              | essage   |                    |  | G               | o to ?        |  | lime        |           |         |                      |                 |
|  | 8            | 'MC-Servo' was loaded suce<br>'MC-Interpolator' was loaded |                    |  |                 |               |  | 10:31:44 AM |           |         |                      |                 |
|  | 18           | 'Acyclic Request' was loade                                |                    |  |                 |               | 7/28/2023  | 10:31:44 AM |           |         |                      |                 |

Figure 35 - Data blocks and function blocks

### 5.7.4 Downloading the project and going online

After the project has been successfully completed, the controller can be selected and the created program can be downloaded. To do this press the **DOWNLOAD TO DEVICE** button III in the toolbar.

| ct Edit View Insert Online I                            |  | Ctrl+K line 🖉 Go off    |  |               |              | - Ca.     |             |             | Totally Integrated    | Automation<br>PORTA |
|---|--|-------------------------|--|---------------|--------------|-----------|-------------|-------------|-----------------------|---------------------|
|   | ed go online                               |                         | Watch and force ta                     |               |              |           |             |             |                       |                     |
| Devices Simula  |  | Ctrl+M                  |  |               |              |           |             |             |                       |                     |
|   |  |                         |  |               |              |           |             |             |                       |                     |
| - Stop to   | ntime/simulation                           | 1                       |  |               |              |           |             |             |                       |                     |
|   | ad to device                               | Ctrl+L Address          | Display format                         | Monitor value | Modify value |           | Comment     |             | Tag comment           |                     |
|   | ed download to device                      |                         | Floating-point nu                      |               |              |           | %           |             |                       |                     |
|   | ad and reset PLC program                   |                         | Floating-point nu<br>Floating-point nu |               |              |           | 90<br>90    |             |                       |                     |
|   | ad user program to Memory Card             |                         | Floating-point nu                      |               |              |           | 70          |             |                       |                     |
| PLC_1 [CPU 15125P Snaps]                                | ot of the actual values                    |                         | Figure and an and                      |               |              |           |             |             |                       |                     |
| Device configura to Load s                              | hapshots as actual values                  |                         | Floating-point nu<br>Bool              |               | FALSE        |           |             |             |                       |                     |
| Contine & diagno Load st                                | art values as actual values                |                         | Bool                                   |               | FALSE        |           | •           |             |                       |                     |
| Software units     Upload                               | from device (software)                     |                         | Bool                                   |               |              |           |             |             |                       |                     |
| <ul> <li>Program blocks</li> </ul>                      | device as new station (hardware and softwa | ire)                    | Bool                                   |               |              |           |             |             |                       |                     |
| Technology obje     Backup                              | from online device                         |                         | Hex                                    |               |              |           |             |             |                       |                     |
| External source t     Hardwi                            | re detection                               | •                       | Bool                                   |               |              |           |             |             |                       |                     |
|   | vice maintenance                           |                         | DEC+/-                                 |               |              |           |             |             |                       |                     |
| PLC data types     HM De     Watch and force     Access |  |                         | DEC+/-                                 |               |              |           |             |             |                       |                     |
|   |  | Ctrl+U                  | Bool .                                 |               |              |           |             |             |                       |                     |
|   | *U Ctrl+:                                  | Shift+E                 | Hex                                    |               |              |           |             |             |                       |                     |
| Acyclic reque   | U Ctrl+S                                   | hift+Q                  | Hex                                    |               |              |           |             |             |                       |                     |
| Technology_( V Online                                   | & diagnostics                              | Ctrl+D                  | Bool                                   |               | FALSE        |           |             |             |                       |                     |
| Telegram Oxd  | alarms                                     |                         | Bool                                   |               | THEFE        |           | •           |             |                       |                     |
| Online backups  | 19 "MC RESET DB".Done                      |                         | Bool                                   |               |              |           |             |             |                       |                     |
| Traces  | 20 *MC RESET DB*Error                      |                         | Bool                                   |               |              |           |             |             |                       |                     |
| OPC UA communication                                    | 21 *MC RESET DB* Errorld                   |                         | Hex                                    |               |              |           |             |             |                       |                     |
| Bevice proxy data                                       | 22   | <add new=""></add>      | 114.4                                  |               |              |           |             |             |                       |                     |
| Program info  | ~  |                         |  |               |              |           |             |             |                       |                     |
| Details view  | <  |                         |  |               | 1            |           |             |             |                       |                     |
|   |  |                         |  |               |              |           |             | Properties  | Info 🛛 Diagnostic     |                     |
| Module  |  |                         |  |               |              |           |             | Stroperties | I a mo I a Diagnostic | · ·                 |
|   | General Cross-reference                    |                         |  |               |              |           |             |             |                       |                     |
| Name  | Show all messages                          |                         |  |               |              |           |             |             |                       |                     |
| Device configuration                                    | ^  |                         |  |               |              |           |             |             |                       |                     |
| Online & diagnostics                                    | II ! Message                               |                         |  | Go            | to ?         | Date      | Time        |             |                       |                     |
| Software units  | Connected to PLC 1, via add                | dress IP=192.168.1.180. |  |               |              | 7/28/2023 | 10:31:51 AM |             |                       |                     |
| Program blocks  | Connection to PLC_1 termin                 |                         |  |               |              |           | 10:33:22 AM |             |                       |                     |
| Technology objects                                      | ×  |                         |  |               |              |           |             |             |                       |                     |

Figure 36 - Downloading the TO project

After the download is carried out, you can go online by pressing the **GO ONLINE** button *Go* online in the toolbar.

Once the online connection to the controller is established, you can enter the diagnostic functions. To do this select the Technology Object and then the **Diagnostics** item in the Project tree.

The **Status and error bits** area will be displayed.

| Siemen  | is - C:lroberto_dell_E6540                                     | Nbus\Profi | het\Progetti\TIA\CPU 1500\V16      | 5\EXM5XX-13-14_TO2\EXM5XX-13-14_ | то                   |                   |             |                   |              |                         | -        | • ×        |
|---------|--|------------|------------------------------------|----------------------------------|----------------------|-------------------|-------------|-------------------|--------------|-------------------------|----------|------------|
|         | dit <u>V</u> iew Insert <u>O</u> nline                         |            |                                    | -                                | -                    |                   |             |                   | Т            | otally Integrated Au    | tomation |            |
|         |  | _          |                                    | 🖁 🚿 Go online 🚀 Go offline  🎄 🔢  |                      |                   |             |                   |              |                         | PORTA    |            |
| Project |  | _ □ . (    |                                    |                                  |                      |                   |             |                   |              |                         |          | ×          |
| Devi    | ces  |            |                                    |                                  |                      |                   |             |                   |              |                         |          | 1          |
| 198     |  | 1          | 00                                 |                                  |                      |                   |             |                   |              |                         |          | (IN) Tasks |
|         |  |            | Status and error bits              |                                  |                      |                   |             |                   |              |                         |          | SKS        |
| ▼ D E   | XM5XX-13-14 TO   |            | Motion status                      | Status and error bits            |                      |                   |             |                   |              |                         |          |            |
|         | Add new device   |            | PROFIdrive telegram                |                                  |                      |                   |             |                   |              |                         |          |            |
| š d     | Devices & networks   |            |                                    | Encoder status                   | Motion status        |                   | Error       |                   |              |                         |          | Libraries  |
| - 1     | PLC_1 [CPU 15125P-1 PN]  |            |                                    | Encoder enabled                  | Done (no job running |                   | System      |                   |              |                         |          | ari        |
|         | Device configuration   | -          |                                    |                                  |                      | 0                 |             |                   |              |                         |          | es.        |
|         | Quality Contine & diagnostics                                  |            |                                    | Homed                            | Homing job           |                   | Config      |                   |              |                         |          |            |
|         | Software units   |            |                                    | Error                            |                      |                   | User p      | rogram            |              |                         |          | ×          |
|         | Program blocks   |            |                                    | Restart active                   |                      |                   | Encod       | er                |              |                         |          | Add-ins    |
|         | <ul> <li>Technology objects</li> <li>Add new object</li> </ul> | •          |                                    | Encoder values valid             |                      |                   | Data e      | xchange           |              |                         |          | su         |
|         | <ul> <li>Add new object</li> <li>ExternalEncoder 1</li> </ul>  |            |                                    | Restart required                 |                      |                   | Adapt       |                   |              |                         |          |            |
|         | Configuration  | •          |                                    | Alarm display                    |                      |                   |             |                   |              |                         |          |            |
|         | V Diagnostics  |            |                                    |                                  |                      |                   |             |                   |              |                         |          |            |
|         | Output cam   |            |                                    |                                  |                      |                   |             |                   |              |                         |          |            |
|         | • 🕞 Measuring input  |            |                                    |                                  |                      |                   |             |                   |              |                         |          |            |
|         | External source files  |            |                                    |                                  |                      |                   |             |                   |              |                         |          |            |
|         | PLC tags   | •          |                                    |                                  |                      |                   |             |                   |              |                         |          |            |
|         | PLC data types   | •          |                                    |                                  |                      |                   |             |                   |              |                         |          |            |
|         | Watch and force tables   |            |                                    |                                  |                      |                   |             |                   |              |                         |          |            |
|         | Add new watch table  |            |                                    |                                  |                      |                   |             |                   |              |                         |          |            |
|         | Force table  |            |                                    |                                  |                      |                   |             |                   |              |                         |          |            |
| <       | Sa Porce table   | >          |                                    |                                  |                      |                   |             |                   |              |                         |          |            |
| ✓ Det   | ails view  |            |                                    |                                  |                      |                   |             |                   |              |                         |          | _          |
|         |  |            |                                    |                                  |                      |                   |             | <b>Properties</b> | 1 Info       | 😨 Diagnostics           |          | -          |
|         |  | _          | General Cross-refer                | ences Compile                    |                      |                   |             |                   |              |                         |          |            |
|         |  |            | 3 A Show all message               |                                  |                      |                   |             |                   |              |                         |          |            |
| Nam     | e  | _          | Show all message                   | s                                |                      |                   |             |                   |              |                         |          |            |
|         |  |            | 1. Herris                          |                                  | C                    | 0                 | Time        |                   |              |                         |          | - 11       |
|         |  |            | Message     Connection to PLC_1 te | minated                          | Go to ?              | Date<br>7/28/2023 | 10:33:22 AM |                   |              |                         |          | ~          |
|         |  |            |                                    | a address IP=192.168.1.180.      |                      |                   | 10:34:36 AM |                   |              |                         | 1        | Ĵ          |
|         |  |            |                                    |                                  |                      |                   |             |                   |              |                         | 1        | ~          |
| Po      | rtal view 🔛 Over   | view       | 🔹 Main (OB1) 🔛 Techn               | ology 😵 ExternalEnc              |                      |                   |             |                   | Connected to | PLC_1, via address IP=1 | 9_       |            |

Figure 37 - TO status and error bits area

### 5.7.5 Enabling the encoder

Please note that the encoder is disabled now: it must be enabled.

| EXM5XX-13-14_TO → PLC_  | 1 [CPU 1512SP-1 PN] 	→ Technology of  | jects → ExternalEncoder_1 [DB7]                |  | _ # # × |
|---|---|--|--|---------|
| Status and error bits<br>Motion status<br>PROPidrive telegram | Status and error bits<br>Encoder status<br>Encoder enabled<br>Funcet<br>Restart active<br>Encoder values valid<br>Restart required<br>Alarm display | Motion status Oone (no job running) Homing job | Error<br>System<br>Confguration<br>User program<br>Encoder<br>Data exchange<br>Adapt |         |
|   |   |  |  |         |

Figure 38 - TO encoder disabled

To enable the encoder select the **Watch and force tables** and then the **Telegram 0x53** (Telegram 83) item in the Project tree. The **Telegram 83** watch table will be displayed.

| oject tree                            |       |             | 1± 13 II |  |                   |               |       |               |          |                   |                       |                  | PORT |
|---------------------------------------|-------|-------------|--|--|-------------------|---------------|-------|---------------|----------|-------------------|-----------------------|------------------|------|
| Devices                               |       |             |  |  |                   |               |       |               |          |                   |                       |                  |      |
| 8                                     | III 🖻 | 22          | 1 10 10 11 18 17 19                          | 202  |                   |               |       |               |          |                   |                       |                  |      |
|                                       |       | 1           | Name   | Address  | Display format    | Monitor value | Modi  | fy value      | 9        | Comment           |                       | Tag comment      |      |
| Add new object                        | ^     | 1           | *ExternalEncoder_1* ActualPo                 |  | Floating-point nu | 0.0           |       |               | 2        | 0                 |                       |                  |      |
| <ul> <li>ExternalEncoder_1</li> </ul> |       | 2           | *ExternalEncoder_1* ActualVel                |  | Floating-point nu | 0.0           |       |               | 2        | 3                 |                       |                  |      |
| Configuration                         |       | 3           | *ExternalEncoder_1*.ActualAc                 |  | Floating-point nu | 0.0           |       |               | 2        |                   |                       |                  |      |
| S Diagnostics                         |       | 4 <i>II</i> |  |  |                   |               |       |               |          |                   |                       |                  |      |
| Output cam                            |       | 5           | *MC_HOME_DB*.Position                        |  | Floating-point nu | 0.0           |       |               |          |                   |                       |                  |      |
| Measuring input                       |       | 6           | "MC_HOME_DB".Execute                         |  | Bool              | FALSE         | FALS  | E             |          |                   |                       |                  |      |
| External source files                 |       | 7           | *MC_HOME_DB*.Done                            |  | Bool              | FALSE         |       |               |          |                   |                       |                  |      |
| PLC tags                              |       | 8           | *MC_HOME_DB*.Error                           |  | Bool              | FALSE         |       |               |          |                   |                       |                  |      |
| CO PLC data types                     |       | 9           | *MC HOME DB*.Errorid                         |  | Hex               | 16#0000       |       |               |          |                   |                       |                  |      |
| Watch and force tables                |       | 10 //       |  |  |                   |               |       |               |          |                   |                       |                  |      |
| Add new watch table                   |       | 11          | *MC_POWER_DB*.Enable                         | 1  | Bool              | FALSE         |       |               |          |                   |                       |                  |      |
| Acyclic request                       |       | 12          | "MC POWER DB".StartMode                      | 0  | DEC+/-            | 1             |       | Modify        |          | •                 | Modify to 0           | Ctrl+F3          |      |
| Force table                           |       | 13          | "MC_POWER_DB".StopMode                       |  | DEC+/-            | 0             |       | Monitor all   |          | Ctrl+T            | Modify to 1           | Ctrl+F2          |      |
| Technology_Object                     |       | 14          | "MC_POWER_DB".Error                          |  | Bool              | FALSE         |       | Monitor no    | w        |                   | 🔗 Modify now          | Shift+F9         |      |
| Telegram 0x53                         |       | 15          | "MC_POWER_DB".Errorld                        |  | Hex               | 16#0000       |       | Insert row    |          | Ctrl+Enter        | 🐁 Modify with trigger |                  |      |
| Online backups                        |       | 16 //       |  |  |                   |               |       | Add row       |          | Alt+Ins           | 🖉 Enable peripheral   | outputs          |      |
| Traces                                |       | 17          | *MC RESET DB*.Execute                        |  | Bool              | FALSE         | 6446  | -             |          |                   |                       |                  |      |
| OPC UA communication                  |       | 18          | "MC RESET DB".Restart                        |  | Bool              | FALSE         |       | nt Insert com | mentline | 2                 |                       |                  |      |
| Device proxy data                     |       | 19          | "MC RESET DB".Done                           |  | Bool              | FALSE         |       | X Cut         |          | Ctrl+X            |                       |                  |      |
| Program info                          |       | 20          | "MC RESET DB".Error                          |  | Bool              | FALSE         |       | Copy          |          | Ctrl+C            |                       |                  |      |
| PLC supervisions & alar.              |       | 21          | "MC_RESET_DB".Errorid                        |  | Hex               | 16#0000       |       | Paste         |          | Ctrl+V            |                       |                  |      |
| PLC alarm text lists                  | ~     | 22          |  | <add news<="" td=""><td></td><td></td><td></td><td>X Delete</td><td></td><td>Del</td><td></td><td></td><td></td></add> |                   |               |       | X Delete      |          | Del               |                       |                  |      |
|                                       | >     |             |  |  |                   |               |       | Rename        |          | F2                |                       |                  |      |
| Details view                          |       | <           |  |  |                   |               |       | Go to defin   | itian    | Ctrl+Shift+D      |                       |                  |      |
| octano nen                            |       |             |  |  |                   |               |       | Cross-refer   |          |                   | Properties            | Info 😵 Diagnosti | cs = |
|                                       |       | 6.          | eral Cross-references                        | Compile  |                   |               |       |               |          | rmation Shift+F11 |                       | a broghost       |      |
|                                       |       | Gen         |  |  |                   |               |       | a             |          |                   |                       |                  |      |
| Name                                  |       | 🖸 🚹         | 1 Show all messages                          |  |                   |               |       | Expanded I    | viode    |                   |                       |                  |      |
|                                       |       |             |  |  |                   |               |       |               |          |                   |                       |                  |      |
|                                       |       | I Me        | issage                                       |  |                   |               | Go to | 7 Date        | 1        | ime               |                       |                  |      |
|                                       |       | 0           | Connection to PLC_1 terminated.              |  |                   |               |       | 7/28/         | 2023 1   | 0:33:22 AM        |                       |                  |      |
|                                       |       | ø           | Connected to PLC 1, via address IP           | -102 169 1 190   |                   |               |       | 7/20/         | 2022     | 10:34:36 AM       |                       |                  |      |

Figure 39 - TO Watch and force tables

Select the **MC\_POWER\_DB.Enable** function, right-click on the item in the **Monitor value** column and then press **Modify** and **Modify to 1** commands in the drop-down menus that appear.

|        | "MC HOME_DR" Errorld    |                    | Hex    | 16#0000 |     |     |                         |                 |                                |                           |
|--------|-------------------------|--------------------|--------|---------|-----|-----|-------------------------|-----------------|--------------------------------|---------------------------|
| 0 //   | *MC_POWER_DB*.Enable    |                    | Bool   | FALSE   |     | _   |                         |                 | 11.17                          | Ctrl+F3                   |
| 2      | "MC_POWER_DB".StartMode | /                  | DEC+/- | 1       |     |     | Modify                  | ,               | Modify to 0                    |                           |
| 3      | MC_POWER_DR* Stophiode  |                    | DEC+/- | 0       |     | P   | Monitor all             | Ctrl+T          | Modify to 1                    | Ctrl+F2                   |
| 4      | *MC_POWER_DB*.Error     |                    | Bool   | FALSE   |     | 0   | Monitor now             |                 | Modify now Modify with trigger | Shift+F9<br>Ctrl+Shift+F9 |
| 5      | "MC_POWER_DB".Errorld   |                    | Hex    | 16#0000 |     | 1   | Insert row              | Ctrl+Enter      | Brable peripheral of           |                           |
| 6 11   |                         |                    |        |         |     |     | Add row                 | Alt+Ins         | V chable peripheral o          | Julputs                   |
| 7      | *MC_RESET_DB*.Execute   |                    | Bool   | FALSE   | FAL | d - |                         |                 |                                |                           |
| 8      | "MC_RESET_DB".Restart   |                    | Bool   | FALSE   |     |     | Insert comment line     |                 |                                |                           |
| 9      | "MC_RESET_DB".Done      |                    | Bool   | FALSE   |     | 3   |                         | Ctrl+X          |                                |                           |
| 0      | "MC_RESET_DB".Error     |                    | Bool   | FALSE   |     |     | Сору                    | Ctrl+C          |                                |                           |
| 1      | "MC_RESET_DB".ErrorId   |                    | Hex    | 16#0000 |     | 10  | Paste                   | Ctrl+V          |                                |                           |
| 2      |                         | <add new=""></add> |        |         |     | >   | ( Delete                | Del             |                                |                           |
|        |                         |                    |        |         |     | 1   | Rename                  | F2              |                                |                           |
| <      |                         |                    |        |         |     |     | Go to definition        | Ctrl+Shift+D    |                                |                           |
|        |                         |                    |        |         |     | Ι.  | Cross-references        |                 | Properties                     | nfo 😵 Diag                |
| 6      |                         | c "                |        |         |     |     | Cross-reference informa |                 | 3                              |                           |
| Genera | Cross-references        | Compile            |        |         |     | -   |                         | don shirt+i i i |                                |                           |
| 3 🔺 🤇  | Show all messages       |                    |        |         |     |     | Expanded Mode           |                 |                                |                           |
| 31     | Show all messages       | •                  |        |         |     |     | Expanded Mode           |                 |                                |                           |

Figure 40 - TO enabling the encoder

In the **Status and error bits** pane check that the encoder is enabled now.

| t Edit View Insert Online Opt  |                                 |                     | 🖁 🖉 Go online 💋 Go offline  🍶 📑 📑    | × = III -Search in project> | <b>G</b> 4 |               |           | Totally Integrate | d Automation<br>PORTA |
|--|---------------------------------|---------------------|--------------------------------------|-----------------------------|------------|---------------|-----------|-------------------|-----------------------|
| oject tree 🛛   |                                 |                     | 1 [CPU 1512SP-1 PN] > Technology obj |                             |            |               |           |                   | _ @ = ×               |
| Devices  |                                 |                     |                                      |                             |            |               |           |                   |                       |
| 8 🔟 5  | e 😨                             |                     |                                      |                             |            |               |           |                   |                       |
|  | Status and                      | error bits          | Π                                    |                             |            |               |           |                   |                       |
| Add new object   | <ul> <li>Motion stat</li> </ul> | us                  | Status and error bits                |                             |            |               |           |                   |                       |
| 🔻 📲 ExternalEncoder_1 🔵  | PROFIdrive                      | telegram            |                                      |                             |            |               |           |                   |                       |
| Configuration  |                                 |                     | Encoder status                       | Motion status               |            | Error         |           |                   |                       |
| V. Diagnostics   |                                 |                     | Encoder enabled                      | Done (no job running)       |            | System        |           |                   |                       |
| Output cam   |                                 |                     |                                      |                             |            | <u> </u>      |           |                   |                       |
| Measuring input  |                                 |                     | Homed                                | Homing job                  |            | Configuration |           |                   |                       |
| External source files  |                                 |                     | Error                                |                             |            | User program  |           |                   |                       |
| PLC tags   | -                               |                     | Restart active                       |                             |            | Encoder       |           |                   |                       |
| Collected PLC data types   |                                 |                     | Encoder values valid                 |                             |            | Data exchange |           |                   |                       |
| Watch and force tables   |                                 |                     | Restart required                     |                             |            | Adapt         |           |                   |                       |
| Add new watch table  |                                 |                     |                                      |                             |            | - Analyt      |           |                   |                       |
| Acyclic request  |                                 |                     | Alarm display                        |                             |            |               |           |                   |                       |
|  |                                 |                     |                                      |                             |            |               |           |                   |                       |
| Technology_Object  |                                 |                     |                                      |                             |            |               |           |                   |                       |
| Online backups   |                                 |                     |                                      |                             |            |               |           |                   |                       |
| Traces   |                                 |                     |                                      |                             |            |               |           |                   |                       |
| Contraction  |                                 |                     |                                      |                             |            |               |           |                   |                       |
| Bevice proxy data  |                                 |                     |                                      |                             |            |               |           |                   |                       |
| Program info   |                                 |                     |                                      |                             |            |               |           |                   |                       |
| PLC supervisions & alar.   |                                 |                     |                                      |                             |            |               |           |                   |                       |
| PLC alarm text lists   | ~                               |                     |                                      |                             |            |               |           |                   |                       |
| II   >   |                                 |                     |                                      |                             |            |               |           |                   |                       |
| Details view   | _                               |                     |                                      |                             | _          |               |           |                   |                       |
|  |                                 |                     |                                      |                             |            | Proj          | perties 1 | Info 🗓 Diagnosti  | ics –                 |
|  | General                         | Cross-refere        | ences Compile                        |                             |            |               |           |                   |                       |
| Name   | 0 1 0                           | Show all messages   | s •                                  |                             |            |               |           |                   |                       |
| in the second seco |                                 |                     |                                      |                             |            |               |           |                   |                       |
|  | Message                         |                     |                                      | Go to 2                     | Date       | Time          |           |                   |                       |
|  |                                 | ection to PLC_1 ter | rminated.                            |                             | 7/28/2023  | 10:33:22 AM   |           |                   |                       |
|  |                                 |                     | address IP=192.168.1.180.            |                             |            | 10:34:36 AM   |           |                   |                       |
|  |                                 |                     |                                      |                             |            |               |           |                   |                       |

Figure 41 - TO encoder enabled

#### 5.7.6 Setting and activating the preset value

 $(\mathbf{j})$ 

#### NOTE

We suggest activating the preset value when the encoder is in stop.

Preset function is meant to assign a desired value to a known physical position of the system. The chosen physical position will get the value set next to this index and all the previous and following mechanical positions will get a value according to it.

Open the **Watch and force tables** and select the **Telegram 0x53** (Telegram 83) item in the Project tree. The **Telegram 83** watch table will be displayed.

Please check the current position of the encoder, see the **ExternalEncoder\_1.ActualPosition**. It is "2129.853" currently.

To set the preset value select the MC\_HOME\_DB.Position function and set a desired value in the Monitor value field (for example, "50" in Figure 42). Press ENTER to confirm. Then select the MC\_HOME\_DB\_Execute function and right-click in the Monitor value column. Then press Modify and Modify to 1 commands in the drop-down box that appears. Finally deactivate back the function by using the commands Modify and Modify to 0.

| oject tree 🛛                               |      | C <sup>#</sup> ± 10 10 10 10 10 00 00 00 00 00 00 00 00 | -                  |                    |               |           |              |                           |  | _ * * |
|--|------|---|--------------------|--------------------|---------------|-----------|--------------|---------------------------|--|-------|
| Devices                                    |      |   |                    |                    |               |           |              |                           |  |       |
| )  | e 🖉  | 0 <u>0 10 10 2 2 2</u> 9                                | 0.00               |                    |               |           |              |                           |  |       |
|  |      | Name  | Address            | Display format     | Monitor value | Modify ve | ilue 🔗       | Comment                   | Tag comment                                |       |
| Add new object                             | A 1  | *ExternalEncoder_1*.Actual                              | Po )               | Floating-point nu. | 2129,853      |           |              | %                         |  |       |
| ExternalEncoder_1 🧧                        |      | GeternalEncoder_1" Actual                               | -                  | Floating-point nu. |               |           |              | 20                        |  |       |
| Configuration                              | 3    | "ExternalEncoder_1".Actual                              | Ac                 | Floating-point nu. |               |           |              | 20                        |  |       |
| <b>Diagnostics</b>                         | 4    | V   | -                  |                    |               |           |              |                           |  |       |
| Output cam                                 | 5    | "MC_HOME_DB".Position                                   |                    | Floating-point nu. |               | 50.0      |              | 1                         |  |       |
| Measuring input                            | 6    | *MC_HOME_DB*.Execute                                    |                    | Bool               | FALSE         | FALSE     | Modify       |                           | Modify to 0 Ctrl+F3                        |       |
| External source files                      | 7    | MC HOME DR" Done  | -                  | Bool               | FALSE         |           |              | ,                         | Modify to 0 Ctrl+F3<br>Modify to 1 Ctrl+F2 |       |
| 🕨 🌄 PLC tags 🖉                             | = 8  | "MC_HOME_DB".Error                                      |                    | Bool               | FALSE         |           | Monitor all  | Ctrl+T                    | Modify to 1 Ctri+F2                        |       |
| PLC data types                             | 9    | "MC_HOME_DB".Errorld                                    |                    | Hex                | 16#0000       |           | Monitor nov  | v                         | A Modify with trigger Ctrl+Shift+F9        |       |
| <ul> <li>Watch and force tables</li> </ul> | 10   |   |                    |                    |               |           | Pinsert row  | Ctrl+Enter                | 2 Enable peripheral outputs                |       |
| Add new watch table                        | - 11 | "MC_POWER_DB".Enable                                    |                    | Bool               | TRUE          | TRUE      | Add row      | Alt+Ins                   |  |       |
| Acyclic request                            | 12   | "MC_POWER_DB".StartMode                                 |                    | DEC+/-             | 1             |           | * Insert com | nentline                  |  |       |
| Ell. Force table                           | 13   | *MC_POWER_DB*.StopMode                                  |                    | DEC+/-             | 0             |           |              | CtrlaX                    |  |       |
| Technology_Object                          | 14   | "MC_POWER_DB".Error                                     |                    | Bool               | FALSE         |           | Cut          | Ctrl+X<br>Ctrl+C          |  |       |
| telegram 0x53                              | 15   | "MC_POWER_DB".Errorld                                   |                    | Hex                | 16#0000       |           | De Paste     | Ctrl+C<br>Ctrl+V          |  |       |
| Online backups                             | 16   |   |                    |                    |               |           |              |                           |  |       |
| Traces                                     | 17   | "MC_RESET_DB".Execute                                   |                    | Bool               | FALSE         | FALSE     | X Delete     | Del                       |  |       |
| OPC UA communication                       | 18   | "MC_RESET_DB".Restart                                   |                    | Bool               | FALSE         |           | Rename       | F2                        |  |       |
| Device proxy data                          | 19   | "MC_RESET_DB".Done                                      |                    | Bool               | FALSE         |           | Go to defini |                           |  |       |
| Program info                               | 20   | "MC_RESET_DB".Error                                     |                    | Bool               | FALSE         |           | Cross-refere |                           |  |       |
| PLC supervisions & alar.                   | 21   | "MC_RESET_DB".ErrorId                                   |                    | Hex                | 16#0000       |           | Cross-refere | nce information Shift+F11 |  |       |
| PLC alarm text lists                       | ♥ 22 |   | <add new=""></add> |                    |               |           | Expanded N   | Aode .                    |  |       |
| II )>                                      |      | <   |                    |                    |               |           |              |                           |  |       |
| Details view                               |      | •   |                    |                    |               |           |              | 101 o                     | a Hule Inter a                             | 1.00  |
|  |      |   |                    |                    |               |           |              | Q, Pro                    | operties 🚺 Info 😨 Diagnostics              |       |
|  | G    | eneral Cross-references                                 | Compile            |                    |               |           |              |                           |  |       |
| Name                                       |      | 1 Show all messages                                     |                    |                    |               |           |              |                           |  |       |
| ranne                                      |      | - I - I - I - I - I - I - I - I - I - I                 |                    |                    |               |           |              |                           |  |       |
|  |      | Message   |                    |                    |               | Go to 7   | Date         | Time                      |  |       |
|  | 0    | Connection to PLC 1 terminated                          |                    |                    |               | 0010      | 7/28/2023    | 10:33:22 AM               |  |       |
|  | l 🏅  | Connected to PLC 1, via addres                          |                    |                    |               |           |              | 10:34:36 AM               |  |       |

Figure 42 - TO setting and activating the preset

Now check again the current position of the encoder, see the **ExternalEncoder\_1.ActualPosition**. It is "50.000" now.

# 6 **Profinet interface**

### 6.1 A brief introduction to Profinet

PROFINET IO is the open industrial network devised for automation applications and built on the Ethernet application layer (TCP/IP and IT standards). For PROFINET IO the layers 1 through 7a of the ISO/OSI (Open Systems Interconnection) reference model are exclusively based on internationally proven standards. The functionality of PROFINET is defined in layer 7b. PROFINET IO complies with IEEE802.3 Ethernet Standard and follows the standards IEC 61158 and IEC61784, so it is 100% Ethernet compatible.

Its technology development and standardization are entrusted to Profibus & Profinet International (PI), the international umbrella organization including members of more than 1400 companies (<u>www.profibus.com</u>).

PROFINET IO is expressly developed to connect controllers (named IO controllers, equivalent to Profibus DP Masters), peripheral devices (named IO devices, similar to Profibus DP Slaves) and programming devices / PCs (named IO supervisors) with Ethernet Real Time (RT) and Isochronous Real Time (IRT) communication all the way. Real Time channel is used for time-critical process data and allows to meet the real-time requirements of the automation engineering (cycle times < 500  $\mu$ s, jitter < 1  $\mu$ s); while IRT is suitable for sophisticated motion control and high performance applications in factory automation and permits cycle times lower than 250  $\mu$ s with less than 1  $\mu$ s jitter. The standard TCP/IP channel is used for parametrization, configuration, and acyclic read/write operations.

A PROFINET IO system requires at least one IO Controller and one IO Device. The most frequent network topologies can be implemented and even mixed together including Star, Line, Tree, and Ring structures by means of copper or fiber-optic cables. The number of devices (each one fitted with its own MAC address, IP address, and device name) which can be connected in the PROFINET network is virtually unlimited. The transmission rate is 100Mbit/s with full duplex communication (Fast Ethernet).

PROFINET IO Devices are configured using a configuration tool which acts as the IO Supervisor. The IO Supervisor uses a GSD (General Station Description) file based on XML language, thus it is called GSDML file, see on page 54.

### 6.2 Profinet encoders from Lika Electronic

PROFINET encoders from Lika Electronic fully comply with the specifications of the encoder profile V4.1 version 3.162, the encoder profile is based on the PROFIdrive profile. For any information on the encoder profile please refer to the following document:

# PROFILE ENCODER. Technical Specification for PROFIBUS and PROFINET related to PROFIdrive

edited by PI International.

They also fulfil the requirements of the Application Classes 3 and 4, thus they are intended for clock-synchronous (isochronous) real-time applications with cyclic and synchronous data transmission. Anyway they can also be used in applications without clock synchronization. For detailed information on the application classes refer to the "6.3 Application Class definition" section on page 92.

PROFINET encoders support the Standard Telegrams 81, 82, 83, and 84. Further information can be found in the "7.1 Telegrams" section on page 95.

The IO data is transferred to and from the Encoder Object (EO, see the "6.4 Encoder Object model" section on page 93) via the Cyclic Data Exchange Service. The EO comprises the following mandatory functionalities:

- parameters;
- measuring task (i.e. position value, velocity value, ...);
- IO data (cyclical transmission of control and actual values);
- support for Alarm Mechanism.

Among the parameters available in the Profinet encoders from Lika Electronic: code sequence, scaling function, preset (Class 4 functionalities), position readout, offset value, velocity value, velocity measuring unit, acyclic Error Data communication, and diagnostic information.

| Number<br>of stations  | Setting<br>the IP-<br>Address      | Setting<br>the baud<br>rate | Transmission<br>rate      | Cable<br>length         | Connection                                |
|------------------------|------------------------------------|-----------------------------|---------------------------|-------------------------|---|
| Virtually<br>unlimited | Software /<br>automatic<br>via DCP | _                           | 100 Mbit/s full<br>duplex | Up to 100<br>m / 330 ft | M12 D-<br>coded<br>Profinet<br>connectors |

#### PROFINET at a glance

### 6.2.1 Overview of the encoder profiles

lika



### 6.3 Application Class definition

The encoder supports two application classes: **Class 3** and **Class 4**. A number of mandatory functions are specified for each application class, in addition all optional functions must be recognized by the encoder and handled so that the controller is able to determine whether an optional function is supported.



#### NOTE

There is no relation between the Encoder application classes and the application classes defined in the PROFIdrive profile.

### 6.3.1 Application Class 3

Encoder with base mode parameter access and limited parametrization of the encoder functionality. Isochronous mode is not supported.

### 6.3.2 Application Class 4

Encoder with scaling, preset, isochronous mode, and base mode parameter access. A Class 4 configured encoder fully supports all functionalities according to the encoder profile 4.1.

### Lika Electronic encoders fulfil the requirements of CLASS 4

#### 6.4 Encoder Object model

The Figure shows the general Encoder Object (EO) architecture. The central element of the EO is the Process Control Task where the measurements are made and the results are calculated. The properties of the EO and the Process Control task are represented and controlled by parameters. The parameters are administered in the Parameter Data Base. To access EO parameters, the Acyclic Data Exchange service is used. For periodic transportation of control values to the EO and actual values from the EO, the Cyclic Data Exchange service is used. Exceptions which occur in the Process Control Task shall be signalled by the Alarm Mechanism to the controlling device.

The EO shall comprise as minimum mandatory functionality:

- Parameters;
- Measuring Task;
- IO Data (control value, actual value);
- Support for Alarm Mechanism;
- Optional functionality;
- Clock Synchronous operation.



### 6.5 Encoder object architecture

The Figure shows the general architecture and the mapping of the Encoder Object (EO) architectural elements to Communication Objects of the Peripheral Device for PROFINET IO. Generally with PROFINET IO the EO is mapped exactly to one Module/Slot. Slot 0 is exclusively reserved for Device representative purpose and therefore shall not be used for any Encoder module. Valid Slot numbers for Encoder Objects are from 1 to 0x7FFF. Every EO contains at least the mandatory Module Access Point (MAP) which is mapped to a dedicated EO representative Submodule. This MAP Submodule contains at least the mandatory Parameter Access Point (PAP) which is mapped to a dedicated Record Data Object. Via the EO representative Submodule (MAP) and the specified Record Data Object the access to the EO parameter manager is possible. The EO parameter manager has access to the EO local Parameter Data Base. In addition to the mandatory MAP submodule, the EO may contain additional submodules which may be used:

- to represent communication end points for IO Data (cyclic data channel) and also to structure the IO Data in data blocks (telegrams, signals).
- to represent physical or logical Subobjects of the EO.



# 7 PROFINET IO data description

# 7.1 Telegrams

A telegram is a rigidly defined bit stream carrying data and an aggregation of one or multiple Signals. In each telegram the data length and the type of data which is sent to and from the IO controller is specified. PROFINET interface devices communicate and stay in sync by sending telegrams each other. The encoder profile supports four types of telegrams: Standard Telegram 81, Standard Telegram 82, Standard Telegram 83, and Standard Telegram 84. They are described hereafter. Standard signals are fully described in the "Cyclic Data Exchange – Std signals" section on page 97.

### 7.1.1 Standard Telegram 81

The Standard Telegram 81 is the default telegram and mandatory for all classes. It uses 4 bytes to output data from the IO controller to the encoder and 12 bytes to input data from the encoder to the IO controller.

Output data CONTROLLER => DEVICE

|           | 2 bytes  | 2 bytes |
|-----------|----------|---------|
| IO Data   | 1        | 2       |
| Set point | STW2_ENC | G1_STW  |

#### Input data DEVICE => CONTROLLER

|              | 2 bytes  | 2 bytes | 4 b' | ytes  | 4 b' | ytes  |
|--------------|----------|---------|------|-------|------|-------|
| IO Data      | 1        | 2       | 3    | 4     | 5    | 6     |
| Actual value | ZSW2_ENC | G1_ZSW  | G1_> | KIST1 | G1_> | (IST2 |

### 7.1.2 Standard Telegram 82

The Standard Telegram 82 uses 4 bytes to output data from the IO controller to the encoder and 14 bytes to input data from the encoder to the IO controller.

Output data CONTROLLER => DEVICE

|           |          | 110L    |
|-----------|----------|---------|
|           | 2 bytes  | 2 bytes |
| IO Data   | 1        | 2       |
| Set point | STW2_ENC | G1_STW  |

#### Input data DEVICE => CONTROLLER

|              | 2 bytes  | 2 bytes | 4 b' | ytes  | 4 b  | ytes  | 2 bytes |
|--------------|----------|---------|------|-------|------|-------|---------|
| IO Data      | 1        | 2       | 3    | 4     | 5    | 6     | 7       |
| Actual value | ZSW2_ENC | G1_ZSW  | G1_> | (IST1 | G1_> | (IST2 | NIST_A  |

### 7.1.3 Standard Telegram 83

The Standard Telegram 83 uses 4 bytes to output data from the IO controller to the encoder and 16 bytes to input data from the encoder to the IO controller.

Output data CONTROLLER => DEVICE

|           | 2 bytes  | 2 bytes |
|-----------|----------|---------|
| IO Data   | 1        | 2       |
| Set point | STW2_ENC | G1_STW  |

Input data DEVICE => CONTROLLER

|              | 2 bytes  | 2 bytes | 4 b' | ytes  | 4 b  | ytes  | 4 bʻ   | ytes |  |
|--------------|----------|---------|------|-------|------|-------|--------|------|--|
| IO Data      | 1        | 2       | 3    | 4     | 5    | 6     | 7      | 8    |  |
| Actual value | ZSW2_ENC | G1_ZSW  | G1_> | (IST1 | G1_> | (IST2 | NIST_B |      |  |

#### 7.1.4 Standard Telegram 84

The Standard Telegram 84 uses 4 bytes to output data from the IO controller to the encoder and 20 bytes to input data from the encoder to the IO controller.

Output data CONTROLLER => DEVICE

|           | 2 bytes  | 2 bytes |
|-----------|----------|---------|
| IO Data   | 1        | 2       |
| Set point | STW2_ENC | G1_STW  |

#### Input data DEVICE => CONTROLLER

|              | 2 bytes  | 2 bytes |   | 8 b' | ytes        | 5 | 4 b  | ytes  | 4 bytes |    |  |  |
|--------------|----------|---------|---|------|-------------|---|------|-------|---------|----|--|--|
| IO Data      | 1        | 2       | 3 | 4    | 5           | 6 | 7    | 8     | 9       | 10 |  |  |
| Actual value | ZSW2_ENC | G1_ZSW  | G | 1_)  | <b>KIST</b> | 3 | G1_> | (IST2 | NIST_B  |    |  |  |



# NOTE

In the Standard Telegram 84, **G1\_XIST2** is used to transfer the error codes and optionally the position values if the measuring length exceeds 64 bits.

# 8 Cyclic Data Exchange – Std signals

IO data is transferred via the Cyclic Data Exchange, i.e. cyclically, between the EO and other devices (controller, supervisor, device). A series of standard signals is defined to configure the IO data. In the following table the standard signals are summarily described. A telegram is the aggregation of one or multiple Signals.

| Significance                         | Abbreviation | Length (bits) | Data type | Page |
|--------------------------------------|--------------|---------------|-----------|------|
| Sensor 1 current position value 1    | G1_XIST1     | 32            | Unsigned  | 99   |
| Sensor 1 current position value 2    | G1_XIST2     | 32            | Unsigned  | 101  |
| Sensor 1 position<br>current value 3 | G1_XIST3     | 64            | Unsigned  | 102  |
| Encoder Control word 2               | STW2_ENC     | 16            | Unsigned  | 102  |
| Encoder Status word 2                | ZSW2_ENC     | 16            | Unsigned  | 103  |
| Sensor 1 Control word                | G1_STW       | 16            | Unsigned  | 104  |
| Sensor 1 Status word                 | G1_ZSW       | 16            | Unsigned  | 107  |
| Speed current value A                | NIST_A       | 16            | Signed    | 108  |
| Speed current value B                | NIST_B       | 32            | Signed    | 108  |



#### 8.1 List of the available standard signals

### G1\_XIST1

[Unsigned, 32 bits]

It is defined as Sensor 1 current position value 1. This signal is the current (real) absolute position of the encoder expressed in binary notation.

Format definition:

- all values are represented in binary notation;
- the shifting factors in P979 Sensor format (see on page 117) display the actual format; the recommended default shift factor is zero (0, right aligned value) for both G1\_XIST1 and G1\_XIST2;
- the settings in the encoder parameter data affect the position value in both G1\_XIST1 and G1\_XIST2;
- when the Scaling function control parameter is disabled = 0, G1\_XIST1 provides the current position value in a 32 bit format: position values are from 0 to 4,294,967,295; integrated position values (between 2<sup>28</sup> and 2<sup>32</sup> for EXM58-13-14-...; between 2<sup>19</sup> and 2<sup>32</sup> for EX058-18-00-...; between 2<sup>31</sup> and 2<sup>32</sup> for EXM58-18-12-... and EX058-16-14-...) are retained as long as the power supply is ON; if you turn the power supply OFF, the integrated position values are lost. At next power on, the physical position value will be provided;
- when the Scaling function control is enabled = 1, G1\_XIST1 provides the current position value according to the resolution values set next to the parameters Measuring units / Revolution and Total measuring range (see on page 126 and ff).



### EXAMPLE

We install the EXM58-13-14-... encoder with 27-bit resolution. The **Scaling function control** parameter is disabled = 0, so **G1\_XIST1** provides the current position value in a 32 bit format: position values are from 0 to 4,294,967,295. Let's say the encoder reaches the max. physical position value ( $2^{27} = 134,217,727$ ) and then adds further 1,500,000 counts: **G1\_XIST1** will show 135,717,727. If we switch the power OFF and then ON, **G1\_XIST1** will show 1,499,999 instead.



### NOTE

The data type for **G1\_XIST1** and **G1\_XIST2** is Unsigned32. Therefore there are no negative position values. The next position value after 0, if the encoder is moved in the negative direction, is 0xFFFFFFFF or the (total resolution – 1) for **G1\_XIST1**; it is the (total physical/scaled resolution – 1) for **G1\_XIST2**.

LSB

LSB



# EXAMPLE

Here follows a format example.

EXM58-13-14 27-bit absolute multiturn encoder, 13-bit singleturn resolution (8,192 counts per revolution), 14-bit multiturn resolution (16,384 revolutions)

- M = Multiturn value, number of revolutions
- S = Singleturn value, number of counts per revolution

#### MSB

#### MSB

parameter is enabled = 1): it is according to the values set next to the **Measuring units / Revolution** and **Total measuring range** parameters; they are set to default in the example.

| Μ | SB |    |     |      |     |    |     |     |    |      |     |     |    |    |    |    |      |      |    |     |      |     |    |     |    |    |     |    |     |    |   | LSB |
|---|----|----|-----|------|-----|----|-----|-----|----|------|-----|-----|----|----|----|----|------|------|----|-----|------|-----|----|-----|----|----|-----|----|-----|----|---|-----|
|   | 31 | 30 | 29  | 28   | 27  | 26 | 25  | 24  | 23 | 22   | 21  | 20  | 19 | 18 | 17 | 16 | 15   | 14   | 13 | 12  | 11   | 10  | 9  | 8   | 7  | 6  | 5   | 4  | 3   | 2  | 1 | 0   |
|   |    |    |     |      |     | Μ  | Μ   | M   | Μ  | Μ    | Μ   | Μ   | Μ  | Μ  | M  | Μ  | Μ    | M    | Μ  | S   | S    | S   | S  | S   | S  | S  | S   | S  | S   | S  | S | S   |
|   |    |    | Abs | soli | ite | nc | sit | ion | V  | alue | e i | n ( | 31 | XI | ST | 2. | it i | is a |    | oro | lind | t r | 06 | ith | er | th | e r | hv | sic | al |   |     |

Absolute position value in **G1\_XIS12**: it is according to either the physical resolution (raw encoder position, when the **Scaling function control** parameter is disabled = 0) or the values set next to the **Measuring units / Revolution** and **Total measuring range** parameters (when the **Scaling function control** parameter is enabled = 1); they are set to default in the example.



### NOTE

The preset operation always affects **G1\_XIST2** and **G1\_XIST3**. It does not affect **G1\_XIST1** if **G1\_XIST1** Preset control is disabled = 1.

#### G1\_XIST2

#### [Unsigned, 32 bits]

It is defined as Sensor 1 current position value 2. By default this signal is the current (real) absolute position of the encoder expressed in binary notation yet it has a different meaning if an error is active.

#### If no error is active:

this signal informs about the current position value of the encoder, provided that the bit **Request absolute value cyclically** (bit 13 of **G1\_STW** control word) is set to 1; otherwise this value is 0.

#### If an error is active:

this signal informs about the active error. For the complete list of the error codes refer to the "10.3 Error codes in G1\_XIST2" section on page 133.

Format definition:

- all values are represented in binary notation;
- the shifting factors in **P979 Sensor format** (see on page 117) display the actual format; the recommended default shift factor is zero (0, right aligned value) for both **G1\_XIST1** and **G1\_XIST2**;
- the settings in the encoder parameter data affect the position value in both G1\_XIST1 and G1\_XIST2;
- **G1\_XIST2** displays the error telegram instead of the position value if an error occurs.



# NOTE

Be aware that **G1\_XIST2** always shows the absolute position delivered from the encoder sensor (raw encoder position). This means that **G1\_XIST2** will never show a position count value which exceeds the maximum physical position value.



### NOTE

The preset operation always affects **G1\_XIST2** and **G1\_XIST3**. It does not affect **G1\_XIST1** if the **G1\_XIST1** Preset control parameter is disabled = 1.

For the format example see **G1\_XIST1** above.

### G1\_XIST3

#### [Unsigned, 64 bits]

It is defined as Sensor 1 current position value 3. This 64-bit position value is intended to support the encoders having a measuring length which exceeds 32 bits. **G1\_XIST3** has the following format:

- binary format;
- the current position value is always right aligned, a shifting factor is not used;
- the settings in the encoder parameter data affect the position value in G1\_XIST3 if the Class 4 functionality parameter is enabled.

| IO data | 1                     | 2 | 3 | 4 |  |  |  |
|---------|-----------------------|---|---|---|--|--|--|
| Format  | 64-bit position value |   |   |   |  |  |  |



### NOTE

The preset operation always affects **G1\_XIST2** and **G1\_XIST3**. It does not affect **G1\_XIST1** if the **G1\_XIST1** Preset control parameter is disabled = 1.

### STW2\_ENC

[Unsigned, 16 bits]

It is defined as Encoder control word 2. Control word **STW2\_ENC** includes the **Control by PLC** mechanisms from PROFIdrive STW1 and the **Controller Sign-Of-Life** mechanism from PROFIdrive STW2.

| Bit               | Meaning                 |
|-------------------|-------------------------|
| 0 6               | Reserved                |
| 7                 | Not used                |
| 8 <del>Et</del> 9 | Reserved                |
| 10                | Control by PLC          |
| 11                | Reserved                |
| 12 15             | Controller Sign-Of-Life |

### Control by PLC

Bit 10

If the **Compatibility Mode** parameter is enabled (see on page 125: 0 = Compatibility with Encoder Profile V3.1), then the bit 10 **Control by PLC** is ignored. In this case the control word **G1\_STW** and the setpoint are always checked.

If the **Compatibility Mode** parameter is disabled (see on page 125: 1 = Compatibility with Encoder Profile V4.1), then the bit 10 **Control by PLC** is checked. So the control word **G1\_STW** and the setpoints are checked only if the bit **Control by PLC** is set.

| Bit | Value | Significance         | Comment                                     |
|-----|-------|----------------------|---|
|     | 1     | Control by PLC       | Control via interface, EO IO Data is valid. |
| 10  | 0     | No control by<br>PLC | EO IO Data not valid, except Sign-Of-Life.  |

#### Controller Sign-Of-Life

Bits 12 ... 15

For complete information on the Sign-Of-Life mechanism refer to the PROFIdrive Technical Specification document.

For more information on the control word **STW2\_ENC** please refer to the PROFIdrive Technical Specification document.

#### ZSW2\_ENC

[Unsigned, 16 bits]

It is defined as Encoder status word 2. The encoder status word 2 **ZSW2\_ENC** includes the Control by PLC mechanism from PROFIdrive ZSW1 and the Slave Sign-Of-Life mechanism from PROFIdrive ZSW2.

| Bit     | Meaning              |
|---------|----------------------|
| 0 2     | Reserved             |
| 3       | Not used             |
| 4 8     | Reserved             |
| 9       | Control requested    |
| 10 & 11 | Reserved             |
| 12 15   | Encoder Sign-Of-Life |

**Control requested** 

Bit 9

|   | Bit | Value | Significance | Comment                               |  |  |  |  |  |  |
|---|-----|-------|--------------|---------------------------------------|--|--|--|--|--|--|
| Γ | 9   | 1     | Control      | The automation system is requested to |  |  |  |  |  |  |
|   |     |       | Requested    | assume control.                       |  |  |  |  |  |  |



|  | 0 |  | Control by the automation system is not possible, only possible at the device or by another interface. |
|--|---|--|--|
|--|---|--|--|

#### Encoder Sign-Of-Life

Bits 12 ... 15

For complete information on the Sign-Of-Life mechanism refer to the PROFIdrive Technical Specification document.

For more information on the status word 2 **ZSW2\_ENC** please refer to the PROFIdrive Technical Specification document.

### G1\_STW

[Unsigned, 16 bits]

It is defined as Sensor 1 control word. This control word controls the functionality of major encoder functions.

| Bit  | Meaning                            |
|------|------------------------------------|
| 0 7  | Not used                           |
| 8 10 | Reserved                           |
| 11   | Home position mode                 |
| 12   | Request set/shift of home position |
| 13   | Request absolute value cyclically  |
| 14   | Activate parking sensor            |
| 15   | Acknowledging a sensor error       |



#### NOTE

If the Activate parking sensor is activated (bit 14 = 1) the encoder is still operational with the Slave Sign-Of-Life active and the encoder error and diagnostics switched off.

Home position mode Bit 11

**Request set/shift of home position** Bit 12

The preset function is controlled by bits 11 and 12 in this Sensor 1 control word **G1\_STW** and acknowledged by the bit 12 **Set/shift of home position executed** in the sensor status word **G1\_ZSW**. The preset value is 0 by default and can be set by an acyclic data exchange parameter defined in the parameters section (see **P65000 – Preset value** on page 118). The preset function has an absolute and a relative operating mode selectable by means of the bit 11 **Home position mode** in this Sensor 1 control word **G1\_STW** (0 = absolute; 1 = relative). Bit 11 and bit 12 in the Sensor 1 control word **G1\_STW** control the preset function as described in the table below.

| Bit 12 | Bit 11 | Action  |  |  |  |  |
|--------|--------|---|--|--|--|--|
| 0      | Х      | Normal operating mode.  |  |  |  |  |
|        |        | The encoder will make no change in the output value.  |  |  |  |  |
| 1      | 0      | Preset mode absolute<br>The encoder reads the current position value and calculates<br>an internal offset value from the preset value P65000 –<br>Preset value and the read position value. The position value<br>is then shifted with the calculated offset value to get the<br>current position value equal to the preset value. The<br>encoder acknowledges the preset by setting the bit 12   |  |  |  |  |
|        |        | Set/shift of home position executed in the sensor status<br>word G1_ZSW. Now the bit 12 Request set/shift of home<br>position in the sensor 1 control word G1_STW can be set<br>to zero by the Master. The encoder will end the preset cycle<br>by clearing the bit 12 Set/shift of home position<br>executed in the sensor status word G1_ZSW. The new<br>internal offset value can be read with an acyclic data<br>exchange parameter (if implemented) and is securely stored<br>in case of voltage breakdown and uploaded again at each<br>power on.   |  |  |  |  |
| 1      | 1      | Preset mode relative (offset)<br>The encoder uses the preset value P65000 – Preset value<br>as a relative offset value. In this mode the current position<br>value is shifted by the value deriving from the preset value.<br>EXAMPLE<br>A preset value "1000" is intended to shift the<br>current position value by 1000 steps in the<br>positive counting direction. So a "real"<br>position value of "5000" will have the value "6000" after the<br>relative shifting sequence. The encoder will set the bit 12<br>Set/shift of home position executed in the sensor status<br>word G1_ZSW to acknowledge the execution of the<br>shifting. The bit 12 Request set/shift of home position in<br>the sensor control word G1_STW can be set to zero by the |  |  |  |  |



|  | Master now. The encoder will end the preset cycle by           |
|--|--|
|  | clearing the bit 12 Set/shift of home position executed in     |
|  | the sensor status word G1_ZSW. The internal offset value       |
|  | will be shifted according to the transferred preset value. The |
|  | new offset value is securely stored in case of voltage         |
|  | breakdown and uploaded again at each power on.                 |

The Preset command automatically saves the calculated internal offset values.



# NOTE

Refer also to the index **P65000 – Preset value** on page 118; to the **G1\_XIST1 Preset control** on page 122; and to the "15.2 Preset diagram" section on page 163. See also the "5.1.3 Setting and executing the preset" section on page 41.



# EXAMPLE

An example of setting the Preset value is provided on page 41.

#### **Request absolute value cyclically** Bit 13

| Bit | Significance          | Comment                              |  |  |  |  |  |
|-----|-----------------------|--------------------------------------|--|--|--|--|--|
| 13  | =1 : Request absolute | Request of additional cyclic         |  |  |  |  |  |
|     | value cyclically      | transmission of the current absolute |  |  |  |  |  |
|     |                       | position in G1_XIST2.                |  |  |  |  |  |

#### Activate parking sensor Bit 14

| Bit | Significance          | Comment                                   |  |  |  |  |  |  |
|-----|-----------------------|---|--|--|--|--|--|--|
| 14  | =1 : Activate parking | Request to stop monitoring the            |  |  |  |  |  |  |
|     | sensor                | measuring system and the current          |  |  |  |  |  |  |
|     |                       | value measurements in the drive. This     |  |  |  |  |  |  |
|     |                       | makes it possible to disconnect the       |  |  |  |  |  |  |
|     |                       | encoder from the line without needing     |  |  |  |  |  |  |
|     |                       | to change the drive configuration or      |  |  |  |  |  |  |
|     |                       | causing a fault. In this case all current |  |  |  |  |  |  |
|     |                       | errors of the encoder are cleared. The    |  |  |  |  |  |  |
|     |                       | parking of the encoder while the drive    |  |  |  |  |  |  |

|  | is rur | nning  | is  | not   | allowed    | and    | will  |
|--|--------|--------|-----|-------|------------|--------|-------|
|  | result | in a s | ens | or in | terface ei | ror (e | error |
|  | code   | 0x00   | 003 |       | Failure    | parl   | king  |
|  | senso  | r in G | 1_) | (IST2 | , see on p | bage 1 | 33).  |

See also "15.3 Parking sensor diagram" on page 164.

# Acknowledging a sensor error

Bit 15

|   | Bit | Significance         | Comment                               |
|---|-----|----------------------|---------------------------------------|
| Γ | 15  | =1 : Acknowledging a | Request to acknowledge a sensor error |
|   |     | sensor error         | (bit 15 Sensor error of G1_ZSW).      |

### G1\_ZSW

#### [Unsigned, 16 bits]

It is defined as Sensor 1 status word. This status word defines the states, acknowledgements, and error messages of the encoder and its main functions.

| Bit | Meaning                                   |  |
|-----|---|--|
| 0 9 | 0 9 Not used                              |  |
| 10  | Reserved                                  |  |
| 11  | Requirement of error acknowledge detected |  |
| 12  | Set/shift of home position executed       |  |
| 13  | 13 Transmit absolute value cyclically     |  |
| 14  | Parking sensor active                     |  |
| 15  | Sensor error                              |  |



### NOTE

If the bit 13 **Transmit absolute value cyclically** or the bit 15 **Sensor error** are not set, there is no valid value or error code transferred in **G1\_XIST2**.



### NOTE

The bit 13 **Transmit absolute value cyclically** and the bit 15 **Sensor error** cannot be set at the same time as they are used to indicate either a valid position value transmission (bit 13) or the error code transmission (bit 15) in **G1\_XIST2**.

# NIST\_A

[Signed, 16 bits] It is defined as current velocity value A expressed in a <u>16 bit format</u>. Velocity value is calculated every 100 ms. Refer also to the **Velocity measuring unit** parameter on page 128.

### NIST\_B

[Signed, 32 bits]

It is defined as current velocity value B expressed in a <u>32 bit format</u>. Velocity value is calculated every 100 ms.

Refer also to the Velocity measuring unit parameter on page 128.
# 9 Acyclic Data Exchange

In addition to the Cyclic Data Exchange (see the "Cyclic Data Exchange – Std signals" section on page 97), the Acyclic Data Exchange gives the possibility to read and write parameters over the non real time channel.



#### 9.1 Index 0xAFF0: Identification & Maintenance (I&M) functions

Profinet encoders from Lika Electronic only implement I&M 0 Module (IM0).

IMO is accessible with record 0xAFFO and provides general information on the device such as vendor ID, order ID, serial number, etc.

| Description                 | Number of bytes |
|-----------------------------|-----------------|
| BLOCKHEADER                 | 6               |
| MANUFACTURER ID (VENDOR ID) | 6               |
| ORDER ID                    | 20              |
| SERIAL NUMBER               | 16              |
| HARDWARE REVISION           | 2               |
| SOFTWARE REVISION           | 4               |
| REVISION COUNTER            | 2               |
| PROFILE ID (API)            | 2               |
| PROFILE SPECIFIC TYPE       | 2               |
| IM VERSION                  | 2               |
| IM SUPPORTED                | 2               |

#### 9.2 Record Data Objects

Record Data Objects are used as PAP to transfer requests to the parameter manager and to transfer responses from the parameter manager to the Controller or the Supervisor.

MAP Index (Record Data Object) 0xB02E parameters which are specific to the PROFIdrive profile are described in the "9.3 Record Data Object 0xB02E: supported PROFIdrive specific parameters" section on page 115. They are not sent to the encoder at each start-up and are not available in the **Module parameters** tabbed page under TIA Portal. To access these parameters follow the description in the next "9.2.1 How to access (read and write) acyclic parameters" section on page 111.

MAP Index (Record Data Object) 0xB02E parameters which are specific to the Encoder profile are described in the "9.4 Record Data Object 0xB02E: supported encoder specific parameters" section on page 118. They are not sent to the encoder at each start-up and are not available in the **Module parameters** tabbed page under TIA Portal. To access these parameters follow the description in the next "9.2.1 How to access (read and write) acyclic parameters" section on page 111.

MAP Index (Record Data Object) 0xBF00 parameters which are specific to the user are described in the "9.5 Record Data Object 0xBF00: user parameter data" section on page 121. They are sent to the encoder at each start-up using the

record data object 0xBF00 and are available in the **Module parameters** tabbed page under TIA Portal, see the "5.5.10 Module parameters" section on page 69.

### 9.2.1 How to access (read and write) acyclic parameters

As previously stated, only Index (Record Data Object) 0xBF00 parameters can be accessed by using the **Module parameters** tabbed page under TIA Portal. Index (Record Data Object) 0xB02E parameters must be accessed for reading and writing purposes only by using the program described hereafter. Please refer also to the example projects provided by Lika. See the Lika TIA V16 CPU1500 Profinet example project.zip compressed file contained in the SW EXM58\_EXO58 PT.zip file.



Figure 43 - Acyclic parameters - Main program

The program shown above must be inserted into a cyclic Organization Block. It is possible to use the main OB1 organization block or add a new organization block according to the user's needs, as in the example (OB123).



Figure 44 - Acyclic parameters - Adding a new block

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In the example two Global DB type data blocks have been added further. **Request\_DB [DB1]** data block is used to group request data.

|    | F | Req | uest_DB                    |           |        |             |        |           |       |            |          |   |
|----|---|-----|----------------------------|-----------|--------|-------------|--------|-----------|-------|------------|----------|---|
|    |   | -   | lame                       | Data type | Offset | Start value | Retain | Accessibl | Writa | Visible in | Setpoint | Comment   |
| 1  | - | •   | <ul> <li>Static</li> </ul> |           |        |             |        |           |       |            |          |   |
| 2  | - | •   | Request_reference          | Byte      | 0.0    | 16#1        |        |           |       |            |          | Request header:unique identification of request/response      |
| 3  | - |     | Request_ID                 | Byte      | 1.0    | 16#2        |        |           |       |            |          | Request header:0x01=request parameter,0x02=change parameter   |
| 4  | - | •   | Axis_No_DO_ID              | Byte      | 2.0    | 16#0        |        |           |       |            |          | Request header:DO addressing for multi-axis or modular device |
| 5  | - | •   | No_of_parameters           | Byte      | 3.0    | 1           |        |           |       |            |          | Request header:number of parameter (range 0x010x27)           |
| 6  |   | •   | Attribute_parameter        | Byte      | 4.0    | 16#10       |        |           |       |            |          | Parameter address:type of object (0x10=value)                 |
| 7  | - | •   | No_of_elements_01          | Byte      | 5.0    | 16#1        |        |           |       |            |          | Parameter address:num. of elements (0=special function)       |
| 8  | - | •   | Parameter_number_01        | Word      | 6.0    | 65000       |        |           |       |            |          | Parameter address   |
| 9  | 4 | •   | SubIndex                   | Word      | 8.0    | 16#0        |        |           |       |            |          | Parameter address:subindex                                    |
| 10 | - |     | Format                     | Byte      | 10.0   | 16#43       |        |           |       |            |          | Parameter value:data type (0x43=double word)                  |
| 11 | - |     | No_of_value                | Byte      | 11.0   | 16#1        |        |           |       |            |          | Parameter value:number of following values                    |
| 12 |   |     | Value                      | Dint      | 12.0   | 16#1000     |        |           |       |            |          | Parameter value   |

Figure 45 - Acyclic parameters - Request\_DB [DB1] data block

Response\_DB [DB2] data block is used to group response data.

|   |   | Nam | ne                       | Data type | Offset | Start value | Retain | Accessible f | Writa | Visible in | Setpoint |
|---|---|-----|--------------------------|-----------|--------|-------------|--------|--------------|-------|------------|----------|
| 1 | - | • • | Static                   |           |        |             |        |              |       |            |          |
| 2 | - |     | Request_reference_mirror | Byte      | 0.0    | 16#0        |        |              |       |            |          |
| 3 | - |     | Response_ID              | Byte      | 1.0    | 16#0        |        |              |       |            |          |
| 1 | - |     | Axis_No_DO_ID_mirrored   | Byte      | 2.0    | 16#0        |        |              |       |            |          |
| 5 | - |     | No_of_parameters         | Byte      | 3.0    | 16#0        |        |              |       |            |          |
| 5 | - |     | Format                   | Byte      | 4.0    | 16#0        |        |              |       |            |          |
| 7 | - |     | No_of_value              | Byte      | 5.0    | 16#0        |        |              |       |            |          |
| 3 | - |     | Value                    | DWord     | 6.0    | 16#0        |        |              |       |            |          |

Figure 46 - Acyclic parameters - Response\_DB [DB2] data block

Their addresses are set in the **Record** field of **WRREC\_DB** and **RDREC\_DB** function blocks respectively (see Network 2 and Network 5 in the main program shown in Figure 43).

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A boolean **Request R/W param single** variable at address %M0.0 is used as a flag to start the parameter read/write process.

| i    | Name                                   | Address    | Display format | Monitor value  | Modify value | 9 |  |
|------|--|------------|----------------|----------------|--------------|---|--|
| 11   |  |            |                |                | Start flag   | 1 |  |
|      | "Request R/W param single"             | %M0.0      | Bool           | FALSE          | TRUE         |   |  |
| 11   | Input WRR                              | REC DB     |                |                |              |   |  |
|      | "WRREC_Data".REQ                       |            | Bool           | FALSE          |              |   |  |
|      | "WRREC_Data".ID                        |            | DEC            | 264            | 264          |   |  |
|      | "WRREC_Data".INDEX                     |            | Hex            | 16#0000_B02E   | 16#0000_B02E |   |  |
|      | "WRREC_Data".LEN                       |            | DEC            | 1              | 1            |   |  |
|      | Request d                              | ata        |                |                |              |   |  |
|      | "Request_DB".Request_reference         | %DB1.DBB0  | Hex            | 16#01          | 16#01        |   |  |
| 0    | "Request_DB".Request_ID                | %DB1.DBB1  | Hex            | 16#01          | 16#01        |   |  |
| 1    | "Request_DB".Axis_No_DO_ID             | %DB1.DBB2  | Hex            | 16#00          | 16#00        |   |  |
| 2    | "Request_DB".No_of_parameters          | %DB1.DBB3  | Hex            | 16#01          | 16#01        |   |  |
| 3    | "Request_DB".Attribute_parameter_01    | %DB1.DBB4  | Hex            | 16#10          | 16#10        |   |  |
| 4    | "Request_DB".No_of_elements_01         | %DB1.DBB5  | Hex            | 16#01          | 16#01        |   |  |
| 5    | "Request_DB".Parameter_number_01       | %DB1.DBW6  | DEC            | 65000          | 65000        |   |  |
| 6    | "Request_DB".SubIndex                  | %DB1.DBW8  | Hex            | 16#0000        | 16#0000      |   |  |
| 7    | "Request_DB".Format                    | %DB1.DBB10 | Hex            | 16#43          | 16#43        |   |  |
| 8    | "Request_DB".No_of_value               | %DB1.DBB11 | Hex            | 16#01          | 16#01        |   |  |
| 9    | "Request_DB".Value                     | %DB1.DBD12 | Hex            | ▼ 16#0000_1000 | 16#0000_1000 |   |  |
| 0 // |  |            |                |                |              | - |  |
| 1    | "Response_DB".Request_reference_mirror | %DB2.DBB0  | Hex            | 16#01          |              |   |  |
| 2    | "Response_DB".Response_ID              | %DB2.DBB1  | Hex            | 16#01          |              |   |  |
| 3    | "Response_DB".Axis_No_DO_ID_mirrored   | %DB2.DBB2  | Hex            | 16#00          |              |   |  |
| 4    | "Response_DB".No_of_parameters         | %DB2.DBB3  | Hex            | 16#01          |              |   |  |
| 5    | "Response_DB".Format                   | %DB2.DBB4  | Hex            | 16#43          |              |   |  |
| 6    | "Response_DB".No_of_value              | %DB2.DBB5  | Hex            | 16#01          |              |   |  |
| 7    | "Response_DB".Value                    | %DB2.DBD6  | Hex            | 16#0000_1000   |              |   |  |

Figure 47 – Acyclic parameters – Acyclic Request control table

To execute the parameter read/write process the **Acyclic Request** control table has been created in the example project, see the previous Figure 47.

It contains all the variables required by the process. Variables are grouped in four sections highlighted by coloured borders in the Figure.

In the first section (Start flag, highlighted in blue in Figure 47) the **Request R/W param single** start flag is available: it must be set to TRUE to start the process.

The second section (Input WRREC DB, highlighted in violet in Figure 47) groups the headers of the function block that is used to write the parameter (see also Network 1 in Figure 43).

In details, the **WRREC\_Data.ID** field (it is highlighted in pink in Figure 47) must contain the address (hardware identifier) of the encoder's hardware module.

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To know the hardware identifier of the installed encoder module, go to the **Device view** and select the **Parameter Access Point**. Then enter the **System constants** tab in the Inspector window: in the **Hardware identifier** column you will find the address of the installed encoder module ("264" in the example).



Figure 48 - Acyclic parameters - Finding the hardware identifier

The **WRREC\_Data.INDEX** field (it is highlighted in dark violet in Figure 47) contains the index of the record you have to access to. It is 16#B02E (45102 in decimal notation) for encoders complying with the PROFIdrive profile, this value is fixed and cannot be modified.

The third section (Request data, highlighted in green in Figure 47) groups the request data to be entered.

**Request\_reference** shows an arbitrary value that is used to identify the request and then is sent back in the response.

**Request\_ID** allows you to set whether the parameter is to be read (value 1) or to be written (value 2).

**Axis\_No\_DO\_ID** contains the number of the axis; for an encoder it is "0" (first and only axis of the device).

**No\_of\_parameters** contains the number of parameters to read/write; in the example, only one parameter can be set at a time.

**Attribute\_parameter\_01** contains the type of data contained in the parameter; 16#10 identifies a single value (not an array or a record, for example).

**No\_of\_elements\_01** contains the number of items of the parameter to read (again, in the example one item only can be accessed).

**Parameter\_number\_01** contains the number of the parameter to access (it is "65000" for the preset value in the example, see the **P65000 – Preset value** parameter on page 118).

**SubIndex** contains the sub-index of the desired item, if required.

**Format** contains the data type of the item: 16#41 is used for an 8 bit integer, 16#42 for a 16 bit integer, 16#43 for a 32 bit integer (as in the case of the preset value).

**No\_of\_value** contains the number of values contained in the request, they are set in the following fields. Also in this case the example allows to enter one value only.

**Value** contains the parameter value; enter one value only when you need to send a writing request; if you need to read a parameter this value has not to be considered.

The fourth section (Response data, highlighted in red in Figure 47) groups the response data following a request.

The first six fields (Request\_reference\_mirror, Response\_ID, Axis\_No\_DO\_ID\_mirrored, No\_of\_parameters, Format, No\_of\_value) contain the same data as in the relevant fields in the request, see the explanation above.

**Value** contains the value of the parameter requested. If you are writing to a parameter, it will contain the value just entered.

#### 9.3 Record Data Object 0xB02E: supported PROFIdrive specific parameters

#### P922 – Telegram Selection

[Unsigned16, RO]

It shows the type of telegram which is currently in use. Possible values: 81, 82, 83, and 84.

#### P964 – PROFIdrive Parameter : Device identification

[Array[0 ... 5], unsigned16, RO]

| Index | Sub | Meaning                                    | Value | Access |
|-------|-----|--|-------|--------|
| 964   | 0   | Manufacturer ID (Vendor ID assigned by PI) | 0x239 | RO     |
| 964   | 1   | DU Drive unit type (Vendor specific)       | 1     | RO     |
| 964   | 2   | Software version                           | ххуу  | RO     |
| 964   | 3   | Software year                              | уууу  | RO     |
| 964   | 4   | Software day and month                     | dd.mm | RO     |
| 964   | 5   | Number of Drive Object (DO)                | 1     | RO     |



# NOTE

Software version, Software year, and Software day and month are expressed in decimal notation.

For example: Software version = xxyy (decimal). Version 2.1 results in 0201 decimal.

#### P965 – Encoder profile number

[Octet string 2, RO]

Parameter **P965 – Encoder profile number** is the Profile identification number which identifies the profile and the profile version.

| Index | Sub | Meaning                                  | Value    | Access |
|-------|-----|--|----------|--------|
| 965   | 0   | Encoder profile number                   | 0x3D     | RO     |
| 965   | 1   | Encoder profile version, set by customer | 31 or 41 | RO     |

#### P971 – Transfer to non volatile memory

[Unsigned16, RW]

It is used to save the current local parameters on the non volatile memory. Write "1" to save the parameters. The encoder confirms the operation by writing "0" to this parameter.

| Index | Sub | Meaning                     | Value    | Access |
|-------|-----|-----------------------------|----------|--------|
| 971   | 0   | Save on non volatile memory | variable | RW     |

#### P975 – Encoder object identification

[Array[0 ... 7], unsigned16, R0] It contains the encoder object identification.

| Index | Sub | Meaning                           | Value             | Access |
|-------|-----|-----------------------------------|-------------------|--------|
| 975   | 0   | Manufacturer ID (Vendor ID        | 0x239             | RO     |
| 975   | 0   | assigned by PI)                   | 0x239             | nu     |
| 975   | 1   | DO type (Vendor specific)         | 0x101             | RO     |
| 975   | 2   | Software version                  | ххуу              | RO     |
| 975   | 3   | Software year                     | уууу              | RO     |
| 975   | 4   | Software day and month            | dd.mm             | RO     |
| 975   | 5   | PROFIdrive DO type classification | 0x05              | RO     |
| 975   | 5   | TROTIUTIVE DO TYPE Classification | encoder interface | NU     |
| 975   | 6   | PROFIdrive DO subclassification 1 | 0x8000 (encoder   | RO     |

|     |   |                         | Application Class<br>4 supported) |  |
|-----|---|-------------------------|-----------------------------------|--|
| 975 | 7 | Drive object ID (DO ID) |                                   |  |



# NOTE

Software version, Software year, and Software day and month are expressed in decimal notation.

For example: Software version = xxyy (decimal). Version 2.1 results in 0201 decimal.

#### P979 – Sensor format

[Array[0 ... 5], unsigned16, RO]

| Index | Sub | Meaning                         | Value      | Access |
|-------|-----|---------------------------------|------------|--------|
| 979   | 0   | Header                          | 0x00005011 | RO     |
| 979   | 1   | Sensor type (0 = rotary sensor) | 0x80000000 | RO     |
| 979   | 2   | Sensor Resolution               | variable   | RO     |
| 979   | 3   | Shift factor for G1_XIST1       | 0          | RO     |
| 979   | 4   | Shift factor for G1_XIST2       | 0          | RO     |
| 979   | 5   | Determinable revolutions        | variable   | RO     |

#### P980 – Number list of defined parameter

[Array[0 ... 8], unsigned16, RO]

The parameter **P980 – Number list of defined parameter** contains the list for the identification of all parameters the encoder supports.

| Index | Sub | Meaning                              | Value | Access |
|-------|-----|--------------------------------------|-------|--------|
| 980   | 0   | P922 – Telegram Selection            | 922   | RO     |
| 980   | 1   | P964 – PROFIdrive Parameter : Device | 964   | RO     |
| 980   |     | identification                       | 964 K | nυ     |
| 980   | 2   | P965 – Encoder profile number        | 965   | RO     |
| 980   | 3   | P971 – Transfer to non volatile      | 971   | RO     |
| 960   | 5   | memory                               | 971   | NO     |
| 980   | 4   | P975 – Encoder object identification | 975   | RO     |
| 980   | 5   | P979 – Sensor format                 | 979   | RO     |
| 980   | 6   | P61001 – IP of station               | 61001 | RO     |
| 980   | 7   | P65000 – Preset value                | 65000 | RO     |
| 980   | 8   | P65001 – Operating status            | 65001 | RO     |

#### P61001 – IP of station

[Unsigned32, RO]

| Index | Sub | Meaning                            | Value    | Access |
|-------|-----|------------------------------------|----------|--------|
| 61001 | 0   | IP address assigned to the encoder | variable | RO     |

#### 9.4 Record Data Object 0xB02E: supported encoder specific parameters

#### P65000 – Preset value

[Unsigned32, RW]

#### Preset mode absolute

Preset function is meant to assign a desired value to a known physical position of the system. The chosen physical position will get the value set next to this index and all the previous and following mechanical positions will get a value according to it.

#### Preset mode relative (offset)

The encoder uses the preset value **P65000 – Preset value** as a relative offset value. In this mode the current position value is shifted by the value deriving from this preset value.

Preset value can be saved on the internal memory using the parameter **P971 – Transfer to non volatile memory**.

See also **Home position mode** and **Request set/shift of home position** in **G1\_STW** on page 104; and **G1\_XIST1 Preset control** on page 122.

| Index | Sub | Meaning      | Value    | Access |
|-------|-----|--------------|----------|--------|
| 65000 | 0   | Preset value | variable | RW     |



#### EXAMPLE

An example of setting the Preset value is provided on page 41.



#### NOTE

The preset operation always affects **G1\_XIST2** and **G1\_XIST3**. It does not affect **G1\_XIST1** if **G1\_XIST1** Preset control is disabled = 1.

### P65001 – Operating status

[Array[0 ... 11], unsigned32, RO]

This parameter has a read only structure. It provides information on the operating status of the encoder and on the current status of the Faults and Warnings. It is a complement to the PROFIdrive parameter **P979 – Sensor format** described in the PROFIdrive profile.

| Index | Sub | Meaning                                | Value          | Access |  |
|-------|-----|--|----------------|--------|--|
| 65001 | 0   | Header                                 | 0x000C0101     | RO     |  |
|       |     |  | See "Operating |        |  |
| 65001 | 1   | Operating status                       | status table   | RO     |  |
|       |     |  | values"        |        |  |
| 65001 | 2   | Faults                                 | See "Table of  | RO     |  |
| 03001 | 2   |  | faults"        |        |  |
| 65001 | 3   | Supported faults                       | 0x0031         | RO     |  |
| 65001 | 4   | Warnings (*)                           | 0x0            | RO     |  |
| 65001 | 5   | Supported warnings (*)                 | 0x0            | RO     |  |
| 65001 | 6   | Encoder profile version (**)           | 0x401          | RO     |  |
| 65001 | 7   | Operating time (not used)              | OxFFFFFFFF     | RO     |  |
| 65001 | 8   | Offset value (related to G1_XIST1)     | variable       | RO     |  |
| 65001 | 9   | Measuring units per revolution         | variable       | RO     |  |
| 65001 | 10  | Total measuring range in               | variable       | RO     |  |
| 05001 | 10  | measuring units                        | variable       | KU     |  |
| 65001 | 11  | Velocity measuring unit (user setting) | variable (***) | RO     |  |

(\*) Warnings are not supported in this encoder.

(\*\*) The encoder profile version is the version of the encoder profile document implemented in the encoder. This parameter is not affected by the **Compatibility Mode** parameter setting.

(\*\*\*) See the **Velocity measuring unit** parameter in the "9.5 Record Data Object OxBF00: user parameter data" section on page 128.

#### Operating status table values

| Bit | Meaning                  |
|-----|--------------------------|
| 0   | Code sequence            |
| 1   | Class 4 functionality    |
| 2   | G1_XIST1 Preset control  |
| 3   | Scaling function control |
| 4   | Alarm channel control    |
| 5   | Compatibility Mode       |
| 6   | Not used                 |

| 7 27  | Reserved for future use by the profile |
|-------|--|
| 28 31 | Reserved to the encoder manufacturer   |

### Table of faults

| Bit  | Meaning                   |
|------|---------------------------|
| 0    | Position error            |
| 1 3  | Not used                  |
| 4    | Commissioning diagnostics |
| 5    | Memory error              |
| 6 31 | Not used                  |

For complete information refer to the "10.2.1 Use of the ChannelErrorType" section on page 133.

## Table of supported faults

| Bit  | Meaning                             |
|------|-------------------------------------|
| 0    | Position error supported            |
| 1 3  | Not used                            |
| 4    | Commissioning diagnostics supported |
| 5    | Memory error supported              |
| 6 31 | Not used                            |

#### 9.5 Record Data Object 0xBF00: user parameter data

The 31-byte user parameter data listed in the table below is sent to the encoder at each start-up using the record data object 0xBF00. These parameters are available in the **Module parameters** tabbed page under TIA Portal, see the "5.5.10 Module parameters" section on page 69.

| Parameter  | Data Type  | Default                        | Comment                                 | User Data<br>Octet Number |
|--|------------|--------------------------------|---|---------------------------|
| Code sequence  | Bit        | 0 (CW)                         |   | Byte 0 bit 0              |
| Class 4 functionality                                    | Bit        | 1 (enabled)                    |   | Byte 0 bit 1              |
| G1_XIST1 Preset control                                  | Bit        | 0 (enabled)                    |   | Byte 0 bit 2              |
| Scaling function control                                 | Bit        | 0 (disabled)                   |   | Byte 0 bit 3              |
| Alarm channel control                                    | Bit        | 0 (disabled)                   | Only supported in<br>Compatibility Mode | Byte 0 bit 4              |
| Compatibility Mode                                       | Bit        | 1 (disabled)<br>(profile V4.1) |   | Byte 0 bit 5              |
| Reserved   |            | 0                              | Set to 0                                | Byte 0 bits 6-7           |
| Measuring units /<br>Revolution                          | Unsigned64 | variable                       |   | Bytes 1-8                 |
| Total measuring range                                    | Unsigned64 | variable                       |   | Bytes 9-16                |
| Maximum tolerated<br>failures of Master Sign-Of-<br>Life | Unsigned8  | 1                              | Only supported in<br>Compatibility Mode | Byte 17                   |
| Velocity measuring unit                                  | Unsigned8  | 0 (Steps/s)                    |   | Byte 18                   |
| Reserved   |            | 0x00                           | Set to 0                                | Bytes 19-30               |



#### NOTE

Default values are highlighted in **bold** in the following tables.

#### **Code sequence**

This parameter is processed only if **Class 4 functionality** is enabled.

**Code sequence** sets whether the absolute position value output by the encoder increases (count up information) when the encoder shaft rotates clockwise (0 = CW) or counter-clockwise (1 = CCW). CW and CCW rotations are viewed from the shaft end.

| Attribute | Meaning  | Value |
|-----------|--|-------|
| CW        | Absolute position value increasing (count<br>up information) when the shaft rotates<br>clockwise (viewed from shaft end) |       |



| CCW | Absolute position value increasing (count<br>up information) when the shaft rotates<br>counter-clockwise (viewed from shaft<br>end) | 1 |
|-----|---|---|
|-----|---|---|

Default = 0 = CW (min. = 0, max. = 1)



### WARNING

Changing this value causes also the position calculated by the controller to be necessarily affected. Therefore it is mandatory to execute a new preset after setting this parameter.

#### **Class 4 functionality**

For any information on the implemented Application Classes refer to the "6.3 Application Class definition" section on page 92.

If it is enabled, **Code sequence**, **G1\_XIST1 Preset control**, and **Scaling function control** affect the position value in **G1\_XIST1**, **G1\_XIST2**, and **G1\_XIST3**. However the preset will not affect the position value in **G1\_XIST1** if the parameter **G1\_XIST1 Preset control** is disabled; it will always affect **G1\_XIST2** and **G1\_XIST3** instead.

| Attribute | Meaning  | Value |
|-----------|--|-------|
|           | Codesequence,G1_XIST1Presetcontrol,andScalingfunctioncontroldo not affect the position value |       |
|           | Codesequence,G1_XIST1Presetcontrol,andScalingfunctioncontrolaffect the position value        |       |

Default = 1 = enable (min. = 0, max. = 1)

#### G1\_XIST1 Preset control

This parameter is available only if **Class 4 functionality** is enabled.

This parameter controls the effect of a preset on the  $G1_XIST1$  current value. When it is enabled, Preset will affect the position value in  $G1_XIST1$ . For complete information on  $G1_XIST1$  signal see on page 99.

| Attribute | Meaning  |    |          |    |   |        | Value |
|-----------|----------|----|----------|----|---|--------|-------|
| Enable    | G1_XIST1 | is | affected | by | а | Preset | 0     |
| LIIAUIC   | command  |    |          |    |   |        | 0     |



| Disable            | Disable Preset does not affect G1_XIST1 |  |
|--------------------|---|--|
| Default = 0 = enab |   |  |



### WARNING

**G1\_XIST1 Preset control** is disabled by setting the value 1.

# NOTE

There is no functionality of this parameter if the **Class 4 functionality** parameter is disabled.



# **EXAMPLE**

An example of setting the Preset value is provided on page 41.

### Scaling function control

This parameter is processed only if **Class 4 functionality** is enabled.

This parameter enables / disables the Scaling function. When this parameter is disabled, the device uses the hardware singleturn and multiturn resolutions (but see the **NOTE** below); when it is enabled, the device uses the resolutions set next to the parameters Measuring units / Revolution and Total measuring range. Refer also to the "Scaling function parameters" section on page 126.

| Attribute | Meaning                   | Value |
|-----------|---------------------------|-------|
| Disable   | Scaling function disabled | 0     |
| Enable    | Scaling function enabled  | 1     |

Default = 0 = disable (min. = 0, max. = 1)



## NOTE

There is no functionality of this parameter if the Class 4 functionality parameter is disabled.



## NOTE

When the Scaling function control parameter is disabled = 0, G1\_XIST1 provides the current position value in a 32 bit format: position values are from 0 to 4,294,967,295; integrated position values (between 2<sup>28</sup> and 2<sup>32</sup> for EXM58-13-14-...; between 2<sup>19</sup> and 2<sup>32</sup> for EX058-18-00-...; between 2<sup>31</sup> and 2<sup>32</sup> for EXM58-18-12-... and EXO58-16-14-...) are retained as long as the power supply



is ON; if you turn the power supply OFF, the integrated position values are lost. At next power on, the physical position value will be provided.

When the **Scaling function control** is enabled = 1, **G1\_XIST1** provides the current position value according to the resolution values set next to the parameters **Measuring units / Revolution** and **Total measuring range** (see on page 126 and ff).



#### EXAMPLE

We install the EXM58-13-14 encoder with 27-bit resolution. The **Scaling function control** parameter is disabled = 0, so **G1\_XIST1** provides the current position value in a 32 bit format: position values are from 0 to 4,294,967,295. Let's say the encoder reaches the max. physical position value ( $2^{27} = 134,217,727$ ) and then adds further 1,500,000 counts: **G1\_XIST1** will show 135,717,727. If we switch the power OFF and then ON, **G1\_XIST1** will show 1,499,999 instead.

#### Alarm channel control

This parameter enables / disables the encoder specific Alarm channel transferred as Channel Related Diagnosis. This functionality is used to limit the amount of data sent in isochronous mode.

If the value is zero (0 = default value), only the communication related alarms are sent via the alarm channel. If the value is one (1), also the encoder specific faults and warnings are sent via the alarm channel.

For further information refer also to the "10.2 Error messages via the Alarm Channel" section on page 132.

| Attribute | Meaning                       | Value |
|-----------|-------------------------------|-------|
| Disable   | No profile specific diagnosis | 0     |
| Enable    | Profile specific diagnosis    | 1     |

Default = 0 = disable (min. = 0, max. = 1)



#### NOTE

This parameter is only supported in compatibility mode (see the **Compatibility Mode** parameter hereafter).

#### **Compatibility Mode**

This parameter defines whether the encoder has to run in a mode compatible with Version 3.1 of the Encoder Profile. See the table below for an overview of the functions affected when the compatibility mode is enabled.

| Attribute | Meaning   | Value |
|-----------|---|-------|
| Enable    | Compatibility with Encoder Profile V3.1                         | 0     |
| Disable   | No backward compatibility, compatible with Encoder Profile V4.1 | 1     |

Default = 1 = disable (min. = 0, max. = 1)

| Function  | Compatibility mode<br>Enabled (=0)  | Compatibility mode<br>Disabled (=1)  |
|---|---|--|
| Control by PLC<br>(STW2_ENC)  | Ignored. The control word<br>G1_STW and setpoint<br>values are always valid.<br>Control requested<br>(ZSW2_ENC) is not<br>supported and is set to 0 |  |
| User parameter<br>Maximum<br>tolerated failures<br>of Master Sign-<br>Of-Life |   | Not supported. One Sign-Of-<br>Life failure tolerated.   |
| User parameter<br>Alarm channel<br>control                                    | Supported   | Not supported. The application alarm channel is always active and controlled by a PROFIdrive parameter |
| P965 – Encoder<br>profile number  | 31 (V3.1)   | 41 (V4.1)  |



#### WARNING

If the encoder is used as a TO Technology Object (see the "5.7 TO Technology Objects" section on page 78), the **Compatibility Mode** parameter must be set to 0 = Enable = Compatible with Encoder Profile V3.1.

#### Scaling function parameters

Using the scaling function parameters the absolute position value of the encoder is converted by the software in order to customize the resolution of the encoder according to needs. The scaling parameters will only be activated if the parameters **Class 4 functionality** (see on page 122) and **Scaling function control** (see on page 123) are enabled.

The permissible range for the scaling parameters is limited by the hardware resolution of the encoder.



#### EXAMPLE

In a 27-bit encoder having a singleturn resolution of 13 bits (8,192 cpr) and a number of revolutions of 14 bits (16,384 revolutions), the permissible value for the **Measuring units / Revolution** is between  $2^0$  and  $2^{13}$  ( $2^{13}$  = 8,192) while the permissible value for the **Total measuring range** is between 2 and  $2^{27}$  ( $2^{27}$  =  $2^{13}$  \*  $2^{14}$  = 134,217,728).

#### Measuring units / Revolution

It is used to program a user specific resolution per each revolution (singleturn resolution). Allowed values are less than or equal to the number of hardware counts per revolution (**physical singleturn resolution**). We suggest setting values that are a power of 2 (1, 2, 4, ... 2048, 4096, ...). See the **Total measuring range** parameter below.

| for EXM58-13-14            |
|----------------------------|
| for EXM58-18-12 and EXO58- |
| 18-00                      |
| for EX058-16-14            |
|                            |



#### NOTE

There is no functionality of this parameter if the **Scaling function control** parameter is disabled.



#### EXAMPLE

The EX058-18-00-PT4-... singleturn encoder has a singleturn resolution of 18 bits (262,144 cpr); the permissible value for the **Measuring units / Revolution** parameter will be between  $2^0$  and  $2^{18}$  ( $2^{18} = 262,144$ ).



# NOTE

When you change the value next to this parameter, then you are required to enter a new preset.

#### Total measuring range

This parameter sets the number of distinguishable steps over the total measuring range. Allowed values are less than or equal to the total hardware resolution value (**physical overall resolution** = number of physical counts per revolution \* number of physical revolutions).

We recommend the **Number of revolutions** to be set to a power of 2.

The set **Number of revolutions** results from the following calculation:

| Number of revolutions   | Total measuring range        |  |
|-------------------------|------------------------------|--|
| Number of revolutions = | Measuring units / Revolution |  |

Setting the **Number of revolutions** to a value which is a power of 2 is meant to avoid problems when using the device in endless operations requiring the physical zero to be overstepped. If you set the **Number of revolutions** which is not a power of 2, a so-called "Red Zone" is generated before the physical zero. For more detailed information refer to the 9.6 "Red Zone" section on page 129).

Default = 134,217,728 (min. = 1, max. = 134,217,728) for EXM58-13-14 262,144 (min. = 1, max. = 262,144) for EX058-18-00 1,073,741,824 (min. = 1, max. = 1,073,741,824) for EXM58-18-12 and EX058-16-14



## NOTE

There is no functionality of this parameter if the **Scaling function control** parameter is disabled.



#### EXAMPLE

The EX058-16-14-PT4-... encoder has a singleturn resolution of 16 bits (65,536 cpr) and a number of revolutions of 14 bits (16,384 revolutions). The permissible value for the **Measuring units / Revolution** will be between  $2^{\circ}$  and  $2^{16}$  ( $2^{16}$  = 65,536) while the permissible value for the **Total measuring range** will be between 2 and  $2^{30}$  ( $2^{30}$  =  $2^{16} * 2^{14}$  = 1,073,741,824).



# NOTE

When you change the value next to this parameter, then you are required to enter a new preset.

#### Maximum tolerated failures of Master Sign-Of-Life

This parameter sets the number of allowed failures of the Master's sign of life. The default value is one (1). Default = 1 (min. = 1, max. = 255)



# NOTE

This parameter is only supported in compatibility mode (see the **Compatibility Mode** parameter on page 125).

#### Velocity measuring unit

This parameter defines the engineering unit of the velocity value used to configure the signals **NIST\_A** and **NIST\_B**. Standard telegram 81 has no velocity information included and the encoder does not use the velocity measuring unit information in that case. Standard telegrams 82, 83, and 84 include velocity output (**NIST\_A** and/or **NIST\_B**) and need a declaration of the velocity measuring unit.

| Parameter               | Meaning  | Value                  |
|-------------------------|--|------------------------|
| Velocity measuring unit | Definition of the engineering unit<br>for the encoder velocity output<br>value | See the table<br>below |

| Velocity measuring units | Value |
|--------------------------|-------|
| Steps / s                | 0     |
| Steps / 100 ms           | 1     |
| Steps / 10 ms            | 2     |
| RPM                      | 3     |

Default = 0 = Step/s (min. = 0, max. = 3)



#### NOTE

Please note that the velocity value is always calculated every 100 ms.

#### 9.6 "Red Zone"

The so-called "Red Zone" problem occurs when the **Number of revolutions** (i.e. the **Total measuring range / Measuring units / Revolution**) is not a power of 2.

When this problem arises, the device must operate within the "red zone" for a certain number of positions. The size of the "red zone" is variable. To calculate it we must subtract the overall set resolution from the overall physical resolution of the device as many times as until the difference is less than the overall set resolution. When the encoder crosses the limit of the last value in the overall physical resolution, a counting error occurs, i.e. a jump in the position count. The problem is represented graphically in the following Figure.



| lika   | EXM58 • EXO58 Profinet                         |
|--|--|
| It results from this:<br>• Number of revolutions | = 6,748 = it is NOT a power of 2               |
| This can be proved easily:                       |  |
| Overall physical resolution                      | $\mathbf{n} = \frac{1,073,741,824}{2} = 2.427$ |
| <b>Overall set resolution</b>                    | = = 2.427<br>442,236,928                       |

It follows that for 189,267,968 positions (1,073,741,824 - 442,236,928 \* 2 = 189,267,968), i.e. for 11,552 revolutions, the encoder will work within the limits of the so-called "red zone". After position 189,267,968 (i.e. at the end of the "red zone") a position error (namely, a "jump" in the position count) would happen as the following position would be "0". See the Figure in the previous page.



# NOTE

Make attention using the values sent by the encoder while working within the limits of the "Red Zone". When the encoder changes from "Red Zone" status to normal status (and vice versa) a jump of position occurs.

# **10 Diagnostics and Alarms**

Diagnostics data is always transferred <u>acyclically</u> using Record Data communication over the non real time channel. A PN-IO controller can request diagnostic data from the PN-IO device using RDO (Record Data Object) services.

Alarm data is transmitted from the IO device to the IO controller via the RT channel.

The encoder errors are divided into **Faults** and **Warnings**, they are defined as follows.

#### FAULT

A Fault is set if a malfunction in the encoder could lead to incorrect position values.

#### WARNING

Warnings indicate that the tolerance for certain internal parameters of the encoder has been exceeded. Unlike faults, warnings do not imply incorrect position values.



## NOTE

Please note that warnings are not supported in this encoder.

There are several diagnosis mechanisms that are used to monitor encoder diagnostics.

Please refer to the table below for an overview of the available diagnosis mechanisms.

| Function  | Reference       |
|---|-----------------|
| Acyclic diagnosis parameter <b>P65001 – Operating</b><br>status | See on page 132 |
| Channel related diagnosis via the Alarm Channel                 | See on page 132 |
| Error codes in G1_XIST2   | See on page 133 |
| LEDs indication   | See on page 136 |

#### 10.1 Acyclic diagnosis parameter P65001 – Operating status

With the **P65001 – Operating status** Acyclic parameter the current status of the Encoder Faults and Warnings as well as the support of the individual Fault and Warning bits can be read from the encoder. For detailed information on the **P65001 – Operating status** parameter please refer to page 119.

#### 10.2 Error messages via the Alarm Channel

The encoder diagnosis is reported to the controller via the Alarm channel as Channel Related Diagnosis. Both warnings and faults are reported in the same manner but with different error types.



## NOTE

In compatibility mode (see the **Compatibility Mode** parameter on page 125), channel related diagnostics can be switched off by setting the **Alarm channel control** parameter, please refer to its description on page 124.

For a detailed definition of the use of the channel related diagnosis please refer to the Alarm mechanism definition for the respective communication system in the mapping part of the profile.



#### 10.2.1 Use of the ChannelErrorType

For Profinet the encoder faults and warnings are mapped to the ChannelErrorTypes defined in the PROFIdrive profile, see the tables below. This means that there are no specific codes defined for stand-alone encoders and a PROFINET controller will interpret the errors from an encoder in the same ways as an error coming from a drive. Refer also to the **P65001 – Operating status** parameter on page 119.

| Error type | Definition   | Explanation  |  |
|------------|--|--|--|
| 0x9000     | Memory errorThe encoder failed to read saved offset or<br>values from the internal non volatile memo |  |  |
| 0x900B     | Position error   | Error and malfunction of the encoder position<br>measurement system or the measured value<br>processing unit. This error causes an invalic<br>position and speed actual value, it may be due to<br>the hardware or the signal guality. |  |
| 0x9011     | Commissioning<br>diagnostics   | User parameter data assignment error.  |  |

#### 10.3 Error codes in G1\_XIST2

Error codes are sent in **G1\_XIST2** if an error in the sensor channel occurs. The list below shows all defined error codes for the sensor channel state machine, they are described even when not implemented in the specific encoder. In case of multiple errors, the error code of the most severe error is transmitted in **G1\_XIST2**. For information about **G1\_XIST2** refer to page 101.

#### 0x0001 | Sensor group error

Error in the processing of the sensor signal which causes an invalid G1\_XIST (e.g. electronic malfunction, invalid sensor signal input, ...).

#### 0x0002 | Zero mark monitoring

Warning about inconsistency between correctly processed G1\_XIST and sensor reference signal (e.g. lost pulses, ...).

#### **0x0003** | Failure parking sensor

Error because transition to **SD12** | **Parking** is not possible. This may be e.g. because the drive is currently running (state S4 operation) and the motor measurement system is forced to parking.

#### 0x0004 | Abort reference value search

Error occurred during the initialisation or during the search for reference mark. There was an internal error or **G1\_STW** bit 7 changed to 1 while the position feedback interface was in state **SD5** | Wait for reference marks.

#### 0x0005 | Abort reference value retrieval

Error occurred during reading of the reference value. There is no valid reference value or the command is not allowed or **G1\_STW** bit 7 changed to 1 while the position feedback interface was in state **SD4** | **Reference value in G1\_XIST2**.

#### **0x0006** | Abort measurement on the fly

Error occurred during the initialisation or during the action of the function "measurement on the fly". There was an internal error or **G1\_STW** bit 7 changed to 0 while the position feedback interface was in state **SD10** | Wait for measured value.

#### 0x0007 | Abort measured value retrieval

Error occurred while reading the result of the function "measurement on the fly". There is no valid value or the command is not allowed or **G1\_STW** bit 7 changed to 0 while the position feedback interface was in state **SD11** | **Measured value in XIST2**.

#### 0x0008 | Abort absolute value transmission

Error because the absolute value transmission from the encoder to the feedback interface is not possible. This may be e.g. because of an absolute value encoder (with serial interface) not present or not working.

**0x0009** | Abort absolute value transmission Reserved.

**Ox000A** | **Abort absolute value transmission** Absolute value track of encoder not readable.

**0x000B** | Abort absolute value transmission Reserved.

# 0x000C ... 0x0F00 | reserved

0x000C ... 0x0F00

#### **0x0F01** | Command not supported

Error because optional function (e.g. shift/preset home position) is not supported.

#### **0x0F02** | Master's sign of life fault

The number of permissible failures of the Master's sign of life was exceeded. <sup>1</sup>

**OxOFO4** | Synchronization fault The number of permissible failures for the bus cycle was exceeded. <sup>1 2</sup>

#### 0x0F05 | Overtemperature fault

The maximum operating temperature of the sensor was exceeded. <sup>1</sup>

#### 0x1001 | Memory error

Error while writing on or reading the internal non volatile memory.

#### **0x1002** | Parametrization error

User parameter data assignment error. Example: Measuring units / Revolution and Total measuring range parameter values not compatible.



#### NOTE 1

Error codes **0x0F02** | Master's sign of life fault, **0x0F04** | Synchronization fault, and **0x0F05** | **Overtemperature fault** are defined here for compatibility to Encoder Profiles V3.1 and V4.1.



### NOTE 2

In Clock cycle synchronous applications the encoder additionally indicates the error described by **0x0F04** | **Synchronization fault** error code by setting the encoder's Sign-Of-Life to zero.

#### 10.4 LEDs indication

Errors are further indicated through LEDs. Five LEDs located in the rear of the encoder (see Figure 1) are designed to show visually the operating or fault status of the encoder and the Profinet interface.

For detailed information refer to the "4.7 Diagnostic LEDs (Figure 1)" section on page 35.

#### 10.5 States

| State   Name                         | Action  | Explanation  | Identification / Status information   |
|--------------------------------------|---|--|---|
| SD1   Normal operation               | None  | The position feedback interface operates<br>normally.<br>Transmission of XIST2 in <b>G1_XIST2</b> is<br>possible if requested by <b>G1_STW</b> bit<br>13=1.  | G1_ZSW bit 0-7 = 0000 0000b,<br>G1_ZSW bit 10-15 = 00x000b                                    |
| SD2   Error<br>acknowledgement       | Error is acknowledged                               | Error acknowledgement is being processed.  | $\begin{array}{llllllllllllllllllllllllllllllllllll$  |
| SD3   Error                          | Error code is posted in G1_XIST2                    | An error is present.   | <b>G1_ZSW</b> bit 15 = 1, Gx_ZSW bit 11 = 0, bit 0-7 = 0000 0000b                             |
| SD4   Reference value<br>in G1_XIST2 | Load reference<br>value in <b>G1_XIST2</b>          | The reference value is loaded in G1_XIST2.   | <b>G1_ZSW</b> bit 4-7 <> 0000b, bit 0-3 = 0000b   |
| SD5   Wait for reference marks       | Wait for reference marks                            | The reference mark is expected.  | <b>G1_ZSW</b> bit 0-3 <> 0000b, bit 4-7 = 0000b   |
| SD7   Set / shift home position      | Set or shift value in<br>G1_XIST1 and<br>G1_XIST2   | <b>G1_XIST1</b> and <b>G1_XIST2</b> are set or shifted by a predefined preset value. Set or shift is controlled by the mode bit <b>G1_STW</b> , bit 11.  |   |
| SD10   Wait for<br>measured value    | Waiting for measured values                         | Measurement Task active, waiting for<br>measured values. At least one of the<br>four measurement latch processes is<br>active and waiting for measured values.<br>Transmission of XIST2 in <b>G1_XIST2</b> is<br>possible if requested by <b>G1_STW</b> bit<br>13=1. |   |
| SD11   Measured value<br>in XIST2    | Load measured value in G1_XIST2                     | The requested measured value is loaded into <b>G1_XIST2</b> .  | <b>G1_ZSW</b> bit 4-7 <> 0000b, for bits 0-3: bit related to the requested measured value = 0 |
| SD12   Parking                       | All errors are cleared if <b>G1_STW</b> bit 14 = 1. | The position feedback interface is in a state where it is inactive and does not deliver a valid <b>G1_XIST1</b> value. This is also the position feedback interface initial state.   | <b>G1_ZSW</b> bit 14 = 1  |

### **10.6 Transitions**

| Transition Number | Source State                         | Destination State                    | Condition   |
|-------------------|--------------------------------------|--------------------------------------|---|
| TD1               | SD2   Error<br>acknowledgement       | SD1   Normal operation               | <b>G1_STW</b> bit 15 = 0 and error removed  |
| TD2               | SD4   Reference<br>value in G1_XIST2 | SD1   Normal operation               | <b>G1_STW</b> bit 4-6 = 000b  |
| TD3               | SD1   Normal<br>operation            | SD4   Reference<br>value in G1_XIST2 | G1_STW bit 7 = 0 and<br>G1_STW bit 4-6 =<br>010b and G1_STW bit<br>0-3 <> 0000b and<br>Reference value is<br>found  |
| TD4               | SD5   Wait for reference marks       | SD1   Normal operation               | G1_STW bit 4-6 = 000b and reference mark found  |
| TD5               | SD5   Wait for reference marks       | SD1   Normal operation               | <b>G1_STW</b> bit 4-6 = 011b  |
| TD7               | SD1   Normal operation               | SD7   Set / shift<br>home position   | <b>G1_STW</b> Bit 12 = 1  |
| TD8               | SD7   Set / shift home position      | SD1   Normal operation               | <b>G1_STW</b> Bit 12 = 0  |
| TD11              | SD1   Normal<br>operation            | SD10   Wait for<br>measured value    | G1_STW bit 7 = 1 and<br>G1_STW bit 4-6 =<br>001b and G1_STW bit<br>0-3 <> 0000b   |
| TD12              | SD10   Wait for measured value       | SD1   Normal operation               | <b>G1_STW</b> bit 4-6 = 011b  |
| TD13              | SD10   Wait for measured value       | SD1   Normal operation               | <b>G1_STW</b> bit 4-6 = 000b and measured values found  |
| TD14              | SD1   Normal<br>operation            | SD11   Measured<br>value in XIST2    | G1_STW bit 7 = 1 and<br>G1_STW bit 4-6 =<br>010b and G1_STW bit<br>0-3 <> 0000b and<br>related measured<br>value found  |
| TD15              | SD11   Measured<br>value in XIST2    | SD1   Normal<br>operation            | (G1_STW bit 4-6 =<br>000b while no<br>measurement process<br>is active (all measured<br>values found)) or<br>(G1_STW bit 7 = 1<br>and G1_STW bit 4-6<br>= 011b) |

| Transition Number | Source State   | Destination State              | Condition  |
|-------------------|----------------|--------------------------------|--|
| TD16              | Every state    | SD12   Parking                 | G1_STW bit 14 = 1<br>additional condition,<br>when SD13, SD14 are<br>implemented:<br>or when (G1_XIST1 is<br>invalid and no error is<br>occurred or present)<br>Notice: If the sensor<br>related to this position<br>feedback interface is<br>the motor<br>measurement system,<br>the condition G1_STW<br>bit 14 = 1 may<br>alternatively result in a<br>sensor interface error<br>(Error code 0x0003  <br>Failure parking<br>sensor) when the drive<br>is running and no<br>transition to SD12  <br>Parking will be<br>performed. |
| TD17              | SD12   Parking | SD1   Normal<br>operation      | <b>G1_STW</b> bit 14 = 0<br>and <b>G1_ZSW</b> bit 14<br>were set for at least<br>100 ms<br>additional condition,<br>when SD13, SD14 are<br>implemented:<br>and <b>G1_XIST1</b> is valid.   |
| TD20              | Every state    | SD3   Error                    | Error occurred or a command is illegal   |
| TD21              | SD3   Error    | SD2   Error<br>acknowledgement | G1_STW bit 15 = 1<br>and G1_XIST1 valid  |

# 11 Real time class communication

Within PROFINET IO, process data and alarms are always transmitted in real time. Real-Time for PROFINET (RT) is based on the definitions of IEEE and IEC for high-performance data exchange of I/O data. RT communication constitutes the basis for data exchange in PROFINET IO.

Real-time data are handled with higher priority compared to TCP(UDP)/IP data. This method of data exchange allows bus cycle times in the range of a few hundred milliseconds to be achieved.

Isochronous data exchange with PROFINET is defined in the Isochronous-Real-Time (IRT) concept. IRT communication is always clock synchronized and only possible within an IRT domain. Isochronous real-time communication differs from real-time communication mainly in its isochronous behaviour: the start of a bus cycle can deviate by a maximum of 1  $\mu$ s (jitter is less than 1  $\mu$ s). IRT is required in motion control applications (positioning operations), for example. This communication is required, for example, for high-accuracy closed-loop control tasks.

#### 11.1 Real-time classes in PROFINET IO

To enable enhanced scaling of communication options and, thus, also of determinism in PROFINET IO, real-time classes have been defined for data exchange. From the user perspective, these classes involve unsynchronized and synchronized communication.

PROFINET IO differentiates the following classes for RT communication. They differ not in terms of performance but in determinism.

#### 11.2 Real-Time class 2 (RT2) – Not synchronized

In real-time class 2, frames are transmitted via unsynchronized communication (anisochronous communication).

#### 11.2.1 Setting an anisochronous communication

To activate the real-time class 2 both the IO controller and the IO device must be configured. To do this proceed as follows.

#### IO controller (Figure 49)

1. Press the **Network view** changeover switch in the **Hardware and network editor** to enter the **Network overview** working area;



- 2. select the IO controller (PLC\_1) in the table area;
- 3. in the **Properties** inspector window, **General** tab, press the **Synchronization** menu option;
- 4. enter the **Synchronization** group box and set the **Unsynchronized** option through the drop-down list box in the **Synchronization role** item.



Figure 49 - Setting the unsynchronized role of the IO controller

#### IO device (Figure 50)

1. Press the **Device view** changeover switch in the **Hardware and network editor** to enter the **Device overview** working area;



Figure 50 - Setting the unsynchronized role of the IO device



- 2. if needed, select the device you need to configure in the drop-down box on the top left of the graphic area;
- 3. select the encoder;
- 4. in the **Properties** inspector window, **General** tab, press the **Real time settings** menu option;
- 5. enter the **Synchronization** group box and select the **RT** option button next to the **RT class** item.

#### 11.3 Real-Time class 3 (IRT\_TOP) (RT3)

Isochronous data exchange with PROFINET is defined in the Isochronous-Real-Time (IRT) concept. IRT communication is always clock synchronized and only possible within an IRT domain. Isochronous real-time communication differs from real-time communication mainly in its isochronous behaviour: the start of a bus cycle can deviate by a maximum of 1  $\mu$ s (jitter is less than 1  $\mu$ s).

This communication is required, for example, for high-accuracy closed-loop control tasks.

Only industrial IRT switches can be used.

Typical cycle time is 1 ms or less. All network components must support PROFINET IRT frame priority processing. Position values are captured with an accuracy of  $\pm 1 \ \mu s$  or better, with respect to the highly accurate bus clock.

#### 11.3.1 Setting an isochronous communication

To activate the real-time class 3 both the IO controller and the IO device must be configured. To do this proceed as follows.

#### IO controller (Figure 51)

- 1. Press the **Network view** changeover switch in the **Hardware and network editor** to enter the **Network overview** working area;
- 2. select the IO controller (PLC\_1) in the table area;
- 3. in the **Properties** inspector window, **General** tab, press the **Synchronization** menu option;
- 4. enter the **Synchronization** group box and set the **Synch master** option through the drop-down list box in the **Synchronization role** item.



Figure 51 - Setting the synchronized role of the IO controller

IO device (Figure 52)

1. Press the **Device view** changeover switch in the **Hardware and network editor** to enter the **Device overview** working area;

| Pojet Life Vero  | Hardware catalog |
|--|------------------|
| Project tree     • exm5xx1314_V16 > Ungrouped devices > EXM13 (UKA EXM5XX1314)     _ # = X     # = X     Handware catalog       Project tree     • #     Exm13 (UKA EXM5XX1314)     _ # = X     Options       Image: State in the image:   |                  |
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| → 🙀 Online backups 🔹 General Watchdog time: 3.000 ms   |                  |
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| G PLC supervisions & ala. Ethernet addresses → Synchronization   |                  |
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| Details view     Media redundancy  | 5                |
| Isochronous mode RT class: O RT  |                  |
| Real time settings   |                  |
| Port 1 [X1 P1 R] Synchronization role: Sync slave  |                  |
| Name   |                  |
| Identification & Maintenance   |                  |
|  |                  |
|  |                  |
| > Information  |                  |
| 🕯 Portal view 📃 Overview 📩 EXM13 🐘 2 Watch ta 🔹 🔍 Online & dia   |                  |

Figure 52 - Setting the synchronized role of the IO device

- 2. if needed, select the device you need to configure in the drop-down box on the top left of the graphic area;
- 3. select the encoder;
- 4. in the **Properties** inspector window, **General** tab, press the **Real time settings** menu option;
- 5. enter the **Synchronization** group box and select the **IRT** option button next to the **RT class** item;



6. now in the **Device overview** working area select the telegram you have installed (Standard Telegram 83 in Figure 53);

| 3 Siemens - C:lroberto_dell_E6540/bus/Profine | Progetti\TIA\CPU 1500\V15\RT\encode  | erlexm5xx-13-14_V16\exm5xx-13-14_V16         |  |               |               |       |                                       | _ • ×        |
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| Device configuration                          | _  |  | Standard Telegram  |               |               | 03    | - Multiturn                           |              |
| Conline & diagnostics                         | _  |  |  | /             |               |       | UKA EXM5XX-13-14                      | Online tools |
| Program blocks                                |  |  |  |               |               |       | Standard Telegram 81                  | 9            |
| Add new block                                 |  |  |  |               |               |       | Standard Telegram 82                  | ne           |
| Request DB (DB6)                              |  |  |  |               |               |       | Standard Telegram 83                  | to           |
| Response_DB [DB2]                             |  |  |  |               |               |       | Standard Telegram 84                  | 5            |
| System blocks                                 |  |  |  |               |               |       | _                                     |              |
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| <ul> <li>Eg PLC data types</li> </ul>         |  | m constants Texts                            |  |               |               |       |                                       |              |
| <ul> <li>Watch and force tables</li> </ul>    |  |  |  |               |               |       |                                       | 2            |
| Add new watch table                           | Catalog information  | Input addresses                              |  |               |               |       | 1                                     | ibr          |
| Asynchronous Request                          | Module parameters  |  |  |               |               |       |                                       | arie         |
| Telegram 0x53                                 | I/O addresses  | Start address: 0                             |  |               |               |       |                                       | 10           |
| Online backups                                |  | End address: 15                              |  |               |               |       |                                       |              |
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|   |  | Process image: None                          |  |               |               |       |                                       | 5            |
|   | 1  | Process image: None                          |  |               |               |       |                                       |              |
|   |  | Output addresses                             |  |               |               |       |                                       |              |
| Name  |  | Output addresses                             |  |               |               |       |                                       |              |
|   |  | Start address: 0                             |  |               |               |       |                                       |              |
|   |  | End address: 3                               |  |               |               |       |                                       |              |
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Figure 53 - Setting the isochronous mode for the telegram

- 7. in the **Properties** inspector window, **General** tab, press the **I/O addresses** menu option;
- 8. enter the **Input addresses** group box and select the **Isochronous mode** check box;

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| E  | 🕆 📑 🔚 Save project 📑 🐰 🗉 🗎 🗙 🏷               |                                      |                               |                        | ect>           |                  |            |                       | - P              | ORTAL   |              |
|    | Project tree 🔲 🖣                             | exm5xx-13-14_V16 → Ungroupe          |                               |                        |                |                  | _ # # ×    | Hardware catalog      |                  |         |              |
|    | Devices                                      |                                      |                               | Topology               | view 🔥 Network | view 👔 C         | evice view | Options               |                  |         |              |
|    | 1 I I I I I I I I I I I I I I I I I I I      | 👉 EXM13 [LIKA EXM5XX-13-14] 💌        | 🗄 📅 📈 🗄 🗍 🔍 ±                 | Device overview        | 7              |                  |            |                       |                  |         | Ha           |
| ž  |  |                                      |                               |                        |                | 1.00             | Comment    | ✓ Catalog             |                  |         | rdw          |
| Å. | Fraces                                       |                                      |                               | Type                   | Article no.    | Firmware<br>V1.0 | Comment    | Search>               |                  | est est | Te           |
| E  | Device proxy data                            |                                      |                               | EXM13                  | ENROLA-19-14   | 41.0             |            |                       |                  |         | 8            |
| 8  | Program info                                 | 5993                                 |                               | Multiturn 27 Bit Mo    |                |                  |            | Filter Profile:       | <ai></ai>        | • 💕     | 8            |
| 8  | PLC supervisions & alarms                    | 650                                  |                               | Parameter Access P.    |                |                  |            | 🕨 🧊 Head module       |                  |         | ġ            |
| Š. | PLC alarm text lists                         |                                      |                               | Standard Telegram      |                |                  |            | Submodules            |                  |         |              |
| -  | Local modules                                |                                      |                               | Synchronous Cycle [OB6 | 11]            |                  |            |                       |                  |         | 8            |
|    | Distributed I/O                              | _                                    |                               | 🖀 Main (OB1)           |                |                  |            |                       |                  |         | 9            |
| -  | <ul> <li>E Ungrouped devices</li> </ul>      | 202                                  |                               |                        |                |                  |            |                       |                  |         | E.           |
|    | ✓ ☐ EXM13 [LIKA EXM5XX-13-14]                |                                      |                               |                        |                |                  |            |                       |                  |         | Online tools |
|    | Device configuration                         |                                      |                               |                        |                |                  |            |                       |                  |         | slo          |
|    | EXM13 [LIKA EXM5XX-13                        |                                      |                               |                        |                |                  |            |                       |                  |         |              |
|    | Multiturn 27 Bit Module 1                    |                                      |                               |                        |                |                  |            |                       |                  |         | 1            |
|    | Security settings                            | < = > 100%                           | · · · · ·                     |                        |                |                  |            |                       |                  |         | H            |
|    | Security settings     Cross-device functions |                                      |                               | -                      |                |                  |            |                       |                  |         | Tasks 👔      |
|    | Common data                                  | Standard Telegram 83 [Standard       |                               |                        |                |                  |            |                       |                  |         |              |
|    | Documentation settings                       | General IO tags Syste                | m constants Texts             |                        |                |                  |            |                       |                  |         | m            |
|    | Languages & resources                        | ▼ General                            | Start address:                |                        |                |                  |            |                       |                  |         | 🛛 Librarie   |
|    | Version control interface                    | Catalog information                  | End address:                  |                        |                |                  |            |                       |                  |         | Ta           |
|    | Online access                                | Module parameters                    | End address:                  |                        |                |                  |            |                       |                  |         | ries         |
|    | Card Reader/USB memory                       | I/O addresses                        |                               |                        |                |                  | Add        | new 🗸 🗙               |                  |         |              |
|    | -  |                                      | Organization block:           | (None)                 |                |                  |            |                       |                  |         |              |
|    | ×  |                                      | Process image:                | None                   |                |                  |            |                       |                  |         | Ad           |
|    | ✓ Details view                               | 1                                    |                               |                        |                |                  |            |                       |                  |         | Add-ins      |
|    | Module                                       | -                                    | Output addresses              |                        |                |                  |            |                       |                  |         | S            |
|    |  |                                      |                               |                        |                |                  |            |                       |                  |         |              |
|    |  | -                                    | Start address:                | 0                      |                |                  |            |                       |                  |         |              |
|    | Name   |                                      | End address:                  | 3                      |                |                  |            |                       |                  |         |              |
|    | Device configuration                         |                                      |                               | Isochronous mode       |                |                  |            |                       |                  |         |              |
|    | Online & diagnostics     EXM13               |                                      |                               |                        |                |                  |            |                       |                  |         |              |
|    | Multitum 27 Bit Module_1                     |                                      | Organization block:           |                        |                |                  |            |                       |                  |         |              |
|    |  |                                      | Process image:                | None                   |                |                  |            | > Information         |                  |         |              |
|    | Portal view     E Overview                   | Synchronous 🎄 EXM13                  |                               |                        |                |                  |            | Loading completed (er | rors: 0; warning |         |              |
|    |  |                                      |                               |                        |                |                  |            |                       |                  |         | <b>—</b> ,   |

Figure 54 - Setting the Synchronous Cycle [OB61]

9. then press the kebab menu next to the **Organization block** item below and open the additional option menu;
- 10. select the **Synchronous Cycle [OB61]** organization block; if it is not present in the menu press the **ADD NEW** button and select it in the **Add new block** page that appears;
- 11. press the green tick button to confirm and close the menu;
- 12. the **PIP 1** option will be selected automatically next to the **Process image** item;
- 13. do the same for the output address: enter the **Output addresses** group box and select the **Isochronous mode** check box;
- 14. then press the kebab menu next to the **Organization block** item below and open the additional option menu;
- 15. select the **Synchronous Cycle [OB61]** organization block; if it is not present in the menu press the **ADD NEW** button and select it in the **Add new block** page that appears;
- 16. press the green tick button to confirm and close the menu;
- 17. the **PIP 1** option will be selected automatically next to the **Process image** item;
- 18. at the end of the setting operation the standard telegram I/O addresses will be set as shown in the following Figure 55;
- 19. finally transfer your project.



Figure 55 - I/O addresses set



#### NOTE

For more information on PIPs (Process Image Partitions) refer to the "11.5 PIP (Process Image Partition)" section on page 147.

#### 11.4 OB61



#### WARNING

Use of OBs requires both in-depth skills and specific expertise in TIA PORTAL programming environment. For detailed information please consult the TIA PORTAL Programmer's handbook and documentation.

Organization blocks (OBs) form the interface between the CPU operating system and the user program. The order in which the user program is executed is defined in the organization blocks.

The synchronization with the user program is maintained through the clocked interrupt OB61. OB61 is a synchronous cycle interrupt; in other words it is an isochronous event that is called with the start of every PROFINET cycle. It is synchronous with the Profinet send clock.

| 泐   | Siemens - C:/roberto_dell_E6540/bus/Profinet/                            | Progetti/TIA/CPU 1500/v16/EXM5XX-13-14/EXM5XX-13-14   | - 🗖   | ×           |
|-----|--|---|---|-------------|
|     | oject <u>E</u> dit <u>V</u> iew Insert <u>O</u> nline Optio <u>n</u> s ] |   | Totally Integrated Automation               |             |
| 2   |  | ± 🥐 ± 🐘 🗓 🔛 🔛 🖓 Goonline 🖉 Gooffine 🎄 🖪 🕼 🛠 🖃 🛄 <earch in="" project=""></earch>  | PORTAL                                      |             |
|     | Project tree 🛛 🔳 📢   | EXM5XX-13-14 → PLC_1 [CPU 1512SP-1 PN] → Program blocks → Main [OB1] _ i = i = ×  | Instructions 🖬 🗉 🕨                          |             |
|     | Devices  |   | Options                                     |             |
|     | 8  | 영 영 등 등 같 돈 글 글 🖻 월 # 월 # 금 월 🗞 승 연 생 승 👌 년 년 년 🖗 💩 🤭 📑   | eal eat 🐼 ' 🗔 🔟                             | 10          |
|     |  | Block interface   | → Favorites<br>→ Favorites                  | E           |
| ΞĮ. | Software units   | Block title: "Main Program Sweep (Cycle)"   |   | ŧ.          |
|     | ▼ → Program blocks   | Comment   | ⊣⊢⊣⊢⊡ ⊐                                     | 5           |
| 2   | Add new block  | Network 1: REO = 1: Transfer data record  |   | 5           |
| Ĵ,  | Main [OB1]     Request_DB [DB1]  |   |   | P Testing   |
|     | Response_DB [DB2]  | Comment   |   | esti        |
|     | 👻 🗟 System blocks 🛛 🔵  | 300.1   |   | - Bu        |
|     | 🔻 🕞 Program resources 🛛 🔵  | "Request R/W "WRREC_Data". "RDREC_Data". "WRREC_Data".  |   |             |
|     | 🙀 RDREC_Data [DB6] 🛛 🔵   | param single" BUSY BUSY REQ REQ   | ✓ Basic instructions                        | Tasks       |
|     | RDREC_DB [DB5]   |   | Name Description                            | 1se         |
|     | WRREC_Data [DB4]   |   |   | 6           |
|     | Technology objects   | 1   | Bit logic operations     G Timer operations |             |
|     | External source files  | ▼ Network 2:  | G limer operations                          | 🗄 Libraries |
|     | 🕨 🌄 PLC tags 🛛 🔍 🔍   | Comment   | Comparator operations                       | bran        |
|     | Call PLC data types  | The second |   | ries        |
|     | Watch and force tables     Add new watch table                           | %D83<br>*WREC_D8*   | < II >                                      |             |
|     | Add new watch table  | WIREC   | ✓ Extended instructions                     |             |
|     | Ell Force table  | Variant   | Name Description                            | Add-ins     |
|     | Online backups   | EN ENO  | Date and time-of-day                        | sui         |
|     | 🕨 🔯 Traces 🛛 🗹   | "WRREC_Data". "WRREC_Data".   | String + Char     Process image             |             |
|     | <  | REQ DONE DONE DONE  | Distributed I/O                             |             |
|     | Details view   | "WREC_Data".ID "WREC_Data".<br>"WREC_Data". BUSY  | PROFlenergy                                 |             |
|     |  | WREC_Data : BODY ************************************   | Module parameter assig                      |             |
|     |  | P#DB1_DBX0_0 ERROR -ERROR   | Interrupts                                  |             |
|     | Name Address   | BYTE 16 - RECORD "WRREC_Data".  | Alarming                                    |             |
|     |  | <ul> <li>STATUS</li> </ul>  | < II >                                      |             |
|     |  | · · · · · · · · · · · · · · · · · · ·   | > Technology                                |             |
|     |  | 100%  | > Communication                             |             |
|     |  | 🔍 Properties 🔃 Linfo 以 Diagnostics 👘 🖃 📥  | > Optional packages                         |             |
|     | Portal view 🗄 Overview 🛃   | 🛿 4 Data bloc 🔒 🏰 Main (OB1) 🛛 🛄 Asynchrono   | 1 objects have been printed successfully.   |             |

Figure 56 - OB61

#### 11.5 PIP (Process Image Partition)



#### WARNING

Use of PIPs requires both in-depth skills and specific expertise in TIA PORTAL programming environment. For detailed information please consult the TI PORTAL Programmer's handbook and documentation.

#### 11.5.1 Consistency

PIPs (Process Image Partitions) are used to update the distributed IO device synchronously with the constant bus cycle time clock.

Compared with direct access to the input/output modules, the main advantage of accessing the process image is that the CPU has a consistent image of the process signals for the duration of one program cycle. If a signal state on an input module changes while the program is being executed, the signal state in the process image is retained until the process image is updated again in the next cycle. The process of repeatedly scanning an input signal within a user program ensures that consistent input information is always available. You define process image partition with TIA PORTAL when you assign addresses (which input/output addresses of the modules are listed in which process-image partition). The process image partition is updated by the user with SFCs.

| utput addresses     |                   |  |  |
|---------------------|-------------------|--|--|
|                     |                   |  |  |
| Start address:      | 4                 |  |  |
| End address:        | 7                 |  |  |
|                     | Sochronous mode   |  |  |
| Organization block: | Synchronous Cycle |  |  |
| Process image:      | PIP 1             |  |  |
|                     |                   |  |  |
|                     |                   |  |  |

Figure 57 - Process Image Partition

### 12 Encoder replacement using LLDP

LLDP (Link Layer Discovery Protocol) is a Layer 2 protocol that is used to detect the closest neighbours in the network. It enables a device to send information about itself and to save information received from neighbouring devices, i.e. it provides the option of communicating data between neighbouring devices (e.g. device name, port, MAC address). This information allows a network management system to determine the network topology. The protocol is formally referred to by the IEEE as *Station and Media Access Control Connectivity Discovery* specified in standards document IEEE 802.1AB.

Among the main uses, LLDP allows to replace a device of the Profinet network. The partner ports before and behind the replaced device save the relevant information so that no additional configuration is necessary. The flag **Support device replacement without exchangeable medium** must be activated in the Controller.

When you need to activate / deactivate the **Support device replacement without exchangeable medium** function in the IO controller, proceed as follows:

- 1. In the Device or Network view of TIA Portal select the PROFINET interface of the corresponding IO controller. The properties of the PROFINET interface are displayed in the inspector window.
- In the Properties of the PROFINET interface, under Advanced options
   Interface options enable the Support device replacement without exchangeable medium option.



Figure 58 - Link Layer Discovery Protocol (LLDP)



### NOTE

When you replace a device, make sure that the PROFINET cable is then inserted into the correct port as it is configured in TIA Portal. Otherwise, the system will not run.

### 13 Media Redundancy Protocol (MRP)

MRP (Media Redundancy Protocol) is a redundancy protocol supported by all Profinet capable devices that will allow a network to be configured in a ring topology. It is standardized by the International Electrotechnical Commission as IEC 62439-2. It is suitable to most Industrial Ethernet applications. Since Profinet is an open standard, this means that MRP is a manufacturer independent protocol and can be used to form a ring with devices from different manufacturers (so long as all devices are fully IEC 62439-2 compliant).

It allows rings of Ethernet devices to overcome any single failure with recovery time much faster than achievable with Spanning Tree Protocol. In other words, it allows to prevent interruptions in an automation machine caused by a defect of a cable or a device. In an MRP ring, the ring manager is named **Media Redundancy Manager** (MRM), while ring clients are named **Media Redundancy Clients** (MRCs). Any MRC is connected to the MRM via two ways of communication. During normal work status (network without failure in the ring) the telegrams will only be sent via one way of communication; the second way of communication will be blocked by the MRM. If a failure in the ring occurs (for instance because of a cable break), the second way of communication will be opened by the MRM.

Requirements are:

- all devices in the ring support MRP;
- you have complied with the rules for topology.

For complete information on the MRP please refer to the documentation provided by Siemens.



Figure 59 - Example of a ring topology with the MRP media redundancy protocol

#### 13.1 Setting MRP roles

Within an MRP ring, each device must be assigned a role. One device will be the MRP Manager (MRM) and will be responsible for sending out test frames to detect for a network failure and for blocking network traffic on one port (except for the test frames) to prevent a network loop. The other devices must be assigned a Client role (MRC) so they know how to handle the test frames.

So let's set our PLC as the manager.

Go to the **Device view** for the PLC and look at the properties of the network interface. Under **Advanced Options**, look for **Media redundancy** item. Here you can select the role for the device: set the **Manager (Auto)** option in the **Media redundancy role** drop-down menu.



Figure 60 - Setting the PLC as the MRM

### EXM58 • EXO58 Profinet

We do the same for the encoder: it must be set as a client.

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Go to the **Device view** for the encoder and look at the properties of the network interface. Under **Advanced Options**, look for **Media redundancy** item. Here you can select the role for the encoder: set the **Client** option in the **Media redundancy role** drop-down menu.



Figure 61 - Setting the encoder as the MRC

#### 13.2 Configuring the network topology

To configure the network topology proceed as follows.

Navigate to the **Topology view** tab of the **Devices and Networks** view.

Configure the topology to create a ring by connecting the ports, for instance as shown in the Figure. Of course you must comply with the rules for topology as required by your own network. For detailed information please refer to specific documentation.



Figure 62 - Configuring the network topology

#### 13.3 Interconnecting the ports in the Inspector window

To interconnect the ports, follow these steps.

- 1. In the **Device view** tab or **Network view** tab, select the PROFINET device or PROFINET interface.
- 2. In the **Table Area** of the **Hardware and network editor** select the port which you want to configure (Port 1 and Port 2).
- 3. In the Inspector window, navigate to the **Properties** tab and select **Port interconnection** in the navigation area.
- 4. In the Local port section, you can find the settings at the local port.
- 5. In the **Partner port** area, select the drop-down list for **Partner port** in order to display the available partner ports and make a selection.



Figure 63 - Interconnecting port 1



Figure 64 - Interconnecting port 2

### 14 Read & write in acyclic comm

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1) Error because the parameter manager is busy but not finished with the processing yet, or the parameter manager is idle

2) Processing of only one parameter requests per connection. Multiple connections cause multiple state machines for the processing each for every connection

3) Also error 0xB0 may be used if there is no PAP available and error 0xB7 if there is an error in the request header

Figure 65 - Base mode parameter request and response

14.1 Example: reading and writing a parameter (Preset Value)

14.1.1 Data Block 1 (DB1)

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| tt Edit View Insert Online Opt        |       |            |                      | online 🖉 Go | offline       | • × = :      |               |                  | ii i     |               |                |          | Totally Integrated A                 | utomation<br>PORTA |
|---------------------------------------|-------|------------|----------------------|-------------|---------------|--------------|---------------|------------------|----------|---------------|----------------|----------|--------------------------------------|--------------------|
|                                       | E < E | XM5XX-1    | 3-14 > PLC_1 [CPU 1! | 12SP-1 PN]  | Program block | s 🕨 Reques   | t_DB [DB1]    |                  |          |               |                | _ # = ×  | Tasks                                |                    |
| Devices                               |       |            |                      |             |               |              |               |                  |          |               |                |          | Options                              |                    |
| 3                                     |       | o 🕫 🔍      | Keep ac              | tual values | Snapshot      | 18 Copy sn   | apshots to st | art values 📓.    | B. Los   | d start value | s as actual va | lues 🎙 📑 |                                      |                    |
|                                       |       | Reques     |                      |             |               |              |               |                  |          |               |                |          | <ul> <li>Find and replace</li> </ul> |                    |
| EXM5XX-13-14                          | ~     | Nam        | e                    | Data type   | Offset S      | itart value  | Retain        | Accessible f     | Writa    | Visible in    | Setpoint       | Supervis |                                      |                    |
| Add new device                        | 1     |            | itatic               |             |               |              |               |                  |          |               |                |          | Find:                                |                    |
| h Devices & networks                  | 2     | - 0        | Request_reference    | Byte        | 0.0           | 16#1         |               |                  |          |               |                |          |                                      |                    |
| PLC_1 [CPU 15125P-1 PN]               | 3     |            | Request_ID           | Byte        | 1.0           | 16#2         |               |                  |          |               |                |          | Whole words only                     |                    |
| Device configuration                  | = 4   |            | Axis_No_DO_ID        | Byte        | 2.0           | 16#0         | - E           |                  |          |               |                |          |                                      |                    |
| Online & diagnostics                  | 5     |            | No_of_parameters     | Byte        | 3.0           |              | ă             |                  |          |               |                |          | Match case                           |                    |
| Software units                        | 6     |            | Attribute_parameter  | Byte        | 4.0           | 16#10        | Ă             |                  |          |               | ĕ              |          | Find in substructures                |                    |
| <ul> <li>Regram blocks</li> </ul>     | 7     |            | No_of_elements_01    | Byte        | 5.0           | 16#1         |               |                  |          |               |                |          | Find in hidden texts                 |                    |
| Add new block                         | 8     | - 10-      | Parameter_number_01  | Word        | 6.0           | 55000        |               |                  |          |               | ē              |          | Use wildcards                        |                    |
| 📥 Main [OB1]                          | 9     | - 10-      | SubIndex             | Word        | 8.0           | 16#0         |               |                  |          |               |                |          |                                      |                    |
| Request_DB [DB1]                      | 10    | • 🗗 •      | Format               | Byte        | 10.0          | 16#43        |               |                  |          |               |                |          | Use regular expressions              |                    |
| Response_DB [DB2]                     | 11    |            | No_of_value          | Byte        | 11.0          | 16#1         |               |                  |          |               |                |          | Down                                 |                    |
| <ul> <li>System blocks</li> </ul>     | 12    |            | Value                | Dint        | 12.0          | 16#1000      |               |                  |          |               |                |          |                                      |                    |
| <ul> <li>Program resources</li> </ul> |       |            |                      |             |               |              |               |                  |          |               |                |          | Oup                                  |                    |
| RDREC_Data [DB6]                      |       |            |                      |             |               |              |               |                  |          |               |                |          | Find                                 |                    |
| RDREC_DB (DB5)                        |       |            |                      |             |               |              |               |                  |          |               |                |          |                                      |                    |
| WRREC_Data [DB4]                      |       |            |                      |             |               |              |               |                  |          |               |                |          | Replace with:                        |                    |
| WRREC_DB (DB3)                        |       |            |                      |             |               |              |               |                  |          |               |                |          |                                      |                    |
| Technology objects                    |       |            |                      |             |               |              |               |                  |          |               |                |          | Whole document                       |                    |
| External source files                 |       | <          |                      |             |               |              |               |                  |          |               |                |          |                                      |                    |
| PLC tags                              |       | -1 · A     | 1                    |             |               |              | 1001          | -                | (m)      |               |                |          | From current position                |                    |
| PLC data types                        | R     | equest_n   | eference             |             |               |              | 9             | Properties       | 1 Info   | 🔒 🛂 Dia       | agnostics      |          | <ul> <li>Selection</li> </ul>        |                    |
| Watch and force tables                | ~     | General    | Texts Superv         | isions      |               |              |               |                  |          |               |                |          | Replace Replace all                  |                    |
| Details view                          | -     | General    |                      |             |               |              |               |                  |          |               |                | ^        |                                      |                    |
|                                       |       | Attributes |                      | General _   |               |              |               |                  |          |               |                |          | ✓ Languages & resources              |                    |
|                                       |       |            |                      |             |               |              |               |                  |          |               |                |          |                                      |                    |
|                                       |       |            |                      |             | Nam           | Request      | eference      |                  |          |               |                |          | Editing language:                    |                    |
| Name Offset                           | -     |            | i.                   |             |               | e Byte       |               |                  |          |               |                | 1.41     | English (United States)              | - 📑                |
| Request_reference 0.0                 | - ^   |            |                      |             |               |              |               |                  |          |               |                | 3        |                                      |                    |
| Request_ID 1.0                        | - =   |            | -                    |             | Default value | Je 16#0      |               |                  |          |               |                |          | Reference language:                  |                    |
| Axis_No_DO_ID 2.0                     | -     |            |                      |             | Start value   | Je 16#1      |               |                  |          |               |                |          | English (United States)              |                    |
| No_of_parameters 3.0                  | × *   |            |                      |             | Comme         | nt Request h | eader:unique  | identification o | frequest | response      |                |          |                                      |                    |

Figure 66 - DB1

14.1.2 Data Block 2 (DB2)

| 💁 🔚 Save project 📑 🐰 🛄 💼 🗄            | × ≌) ± (™ ± 🔃 | 🛄 🗓 🚆 🐺 🏓 Gi         | online 🖉 G  | o offline 🛔 🖪 | . * - 1         | -Search i     | in project>  | ù .         |              |              |            | Totally Integrated A                 | PORT |
|---------------------------------------|---------------|----------------------|-------------|---------------|-----------------|---------------|--------------|-------------|--------------|--------------|------------|--------------------------------------|------|
|                                       | П ∢ ЕХМБХХ-1  | 13-14 → PLC_1 [CPU 1 | 512SP-1 PN] | Program bloc  | ks 🕨 Response   | _DB [DB2      | ]            |             |              |              | _ # = X    | Tasks                                |      |
| Devices                               |               |                      |             |               |                 |               |              |             |              |              |            | Options                              |      |
| 8                                     |               | Keepa                | tual values | Snapshot M    | BB, Copysnaps   | shots to star | rt values 🛃  | B. Los      | d start valu | es as actual | values 🔭 📑 |                                      |      |
|                                       |               | ise DB               |             |               |                 |               | -            | -           |              |              |            | <ul> <li>Find and replace</li> </ul> |      |
| EXM5XX-13-14                          | A Nam         | 10                   | Data type   | Offset        | Start value     | Retain        | Accessible f | Write       | Visible in   | Setpoint     | Supervis   | - This and replace                   | _    |
| Add new device                        | 1 🕣 🕶         | Static               |             |               |                 |               |              |             |              |              |            | Find:                                |      |
| h Devices & networks                  | 2 😋 •         | Request_reference_mi | Byte        | 0.0           | 16#0            |               |              |             |              |              |            |                                      |      |
| PLC_1 [CPU 1512SP-1 PN]               | 3 💶 •         | Response_ID          | Byte        | 1.0           | 16#0            | Ē             |              |             |              |              |            | Whole words only                     |      |
| Device configuration                  | 4             | Axis No DO ID mirr   | Byte        | 2.0           | 16#0            |               |              |             |              | Ē            |            |                                      |      |
| Q Online & diagnostics                | 5 💶 •         | No_of_parameters     | Byte        | 3.0           | 16#0            | - E           |              | <b>SSSS</b> |              |              |            | Match case                           |      |
| Software units                        | 6 😋 •         | Format               | Byte        | 4.0           | 16#0            | Ä             |              |             |              | ŏ            |            | Find in substructures                |      |
| <ul> <li>Program blocks</li> </ul>    | 7 💶 🖷         | No_of_value          | Byte        | 5.0           | 16#0            |               |              |             |              |              |            | Find in hidden texts                 |      |
| Add new block                         | 8 😋 =         | Value                | DWord       | 6.0           | 16#0            | Ē             |              |             |              | Ē            |            | Use wildcards                        |      |
| Main [OB1]                            |               |                      |             |               |                 |               |              |             |              |              |            |                                      |      |
| Request_DB [DB1]                      |               |                      |             |               |                 |               |              |             |              |              |            | Use regular expressions              |      |
| Response_DB [DB2]                     |               |                      |             |               |                 |               |              |             |              |              |            | Down                                 |      |
| <ul> <li>System blocks</li> </ul>     |               |                      |             |               |                 |               |              |             |              |              |            | -                                    |      |
| <ul> <li>Program resources</li> </ul> |               |                      |             |               |                 |               |              |             |              |              |            | Oup                                  |      |
| RDREC_Data [DB6]                      |               |                      |             |               |                 |               |              |             |              |              |            | Find                                 |      |
| RDREC_DB (DB5)                        |               |                      |             |               |                 |               |              |             |              |              |            |                                      |      |
| WRREC_Data [DB4]                      |               |                      |             |               |                 |               |              |             |              |              |            | Replace with:                        |      |
| 📷 WRREC_DB (DB3)                      |               |                      |             |               |                 |               |              |             |              |              |            |                                      |      |
| Technology objects                    |               |                      |             |               |                 |               |              |             |              |              |            | Whole document                       |      |
| External source files                 | <             |                      |             |               |                 |               |              |             |              |              | >          |                                      |      |
| PLC tags                              |               | eference mirror      |             |               |                 | 1921 -        |              |             |              |              |            | O From current position              |      |
| <ul> <li>Eg PLC data types</li> </ul> | Keques(_r     |                      |             |               |                 | <u>Q</u> P    | roperties    | 24 Info     | 1 S D        | agnostics    |            | <ul> <li>Selection</li> </ul>        |      |
| Watch and force tables                | ✓ General     | Texts Super          | visions     |               |                 |               |              |             |              |              |            | Replace Replace all                  |      |
| Details view                          | General       |                      |             |               |                 |               |              |             |              |              | ^          |                                      |      |
|                                       | Attributes    |                      | General _   |               |                 |               |              |             |              |              |            | ✓ Languages & resources              |      |
|                                       |               |                      |             |               |                 |               |              |             |              |              |            |                                      |      |
|                                       |               | 1                    |             | No            | me Request_refe | rence mirr    | or           |             |              |              |            | Editing language:                    |      |
| Name Offset                           | -             | E                    |             |               | pe Byte         | -             |              |             |              |              | 1.00       | English (United States)              | - 📑  |
| Request_reference_mirro 0.0           |               |                      |             |               |                 |               |              |             |              |              |            |                                      |      |
| Response_ID 1.0                       | - =           |                      |             | Default va    | lue 16#0        |               |              |             |              |              |            | Reference language:                  |      |
| Axis_No_DO_ID_mirrored 2.0            | 1             |                      |             | Start va      | lue 16#0        |               |              |             |              |              |            | English (United States)              |      |
| No_of_parameters 3.0                  | 2             |                      |             | Comm          | ant l           |               |              |             |              |              |            |                                      |      |



#### 14.1.3 Organization Block 1 (OB1)

| JA Siemens - C:/roberto_dell_E6540/bus/Profine | \ProgettiTIA\CPU1500\V16\EXM5XX-13-14\EXM5XX-13-14  | _ # X                                     |
|--|---|---|
| Project Edit View Insert Online Options        | ]ool: Window Help<br>호 (객 호 집: []: []: 월 집: 彡 Go online 彡 Go offline බ: []: []: [: [: []: []: []: []: []: []: | Totally Integrated Automation<br>PORTAL   |
| Project tree 🔲 🖣                               | EXM5XX-13-14 → PLC_1 [CPU 1512SP-1 PN] → Program blocks → Main [OB1]  | Instructions 🖬 🗉 🕨                        |
| Devices  |   | Options                                   |
| 1 I I I I I I I I I I I I I I I I I I I        | 사사 등 등 문제 문제 등 명 위 문제 등 이 이 이 이 이 이 이 이 이 이 이 이 이 이 이 이 이 이   | 64 MT 🐼 🗖 🛄 🗟                             |
| 2  | Block interface   | v Favorites                               |
| 🕨 🙀 Software units 📃 🔺                         | Block title: "Main Program Sweep (Cycle)"   |   |
| 👻 😓 Program blocks 🛛 🔵                         | Comment   |   |
| Add new block                                  |   |   |
| 🖴 Mein [OB1] 🛛 🔍                               | Network 1: REQ = 1: Transfer data record  | 8   |
| Request_DB [DB1]                               | Comment   | es  |
| Response_DB [DB2]                              |   | ting                                      |
| System blocks     Fig. Program resources       | SAND.1     'WRREC Data', "RDREC Data', "RDREC Data', "WRREC Data',  | T I I I I I I I I I I I I I I I I I I I   |
| RDREC_Data [DB6]                               | "Request RVW "WRREC_Data", "RDREC_Data", "RDREC_Data", "WRREC_Data", param single" BUSY BUSY REQ REQ          | ✓ Basic instructions                      |
| RDREC_DB [DB5]                                 |   | Basic instructions                        |
| WRREC_Data [DB4]                               |   | General                                   |
| 🕞 WRREC_DB (DB3) 🕒                             |   | Generations                               |
| Technology objects                             |   | Imer operations                           |
| External source files                          | Network 2:  | Counter operations                        |
| 🕨 🌄 PLC tags 🛛 🔍                               | Comment   | Comparator operations                     |
| Dig PLC data types                             |   | ▶ 1 Math functions ✓ 🖗                    |
| <ul> <li>Watch and force tables</li> </ul>     | \$DB3<br>"WREC D8"  | < II >                                    |
| Add new watch table                            | WARC  | ✓ Extended instructions                   |
| Ell Force table                                | Verient   | Name Description d.                       |
| Online backups                                 | EN ENO  | > 🔄 Date and time-of-day                  |
| Traces   | "WRREC Data".   | String + Char                             |
| < II >   | REQ REQ DONE DONE   | Process image                             |
| ✓ Details view                                 | "WRREC_Data".ID "WRREC_Data".   | Distributed I/O                           |
|  | "WRREC_Data". BUSY HOUSY  | PROFlenergy     Module parameter assig    |
|  | INDEX "WRREC_Data".   | Module parameter assig                    |
|  | P#DB1.DBX0.0 ERROR - ERROR  | Alarming                                  |
| Name Address                                   | BYTE 16 RECORD *WRREC_Data*.  | N Discoursion                             |
|  | <ul> <li>STATUS — STATUS</li> </ul>   | < II >                                    |
|  |   | > Technology                              |
|  | 100%  | > Communication                           |
|  | 🦉 Properties 🚺 Info 🔣 Diagnostics 👘 🖃 📥   | > Optional packages                       |
| Portal view     Dverview                       | 4 Deta bloc 🛓 🖶 Main (OB1) 🔐 Asynchrono 😩 👔   | 1 objects have been printed successfully. |
|  |   |   |

Figure 68 - OB1

#### 14.1.4 Function 1 (FC1)

| 3 Siemens - C: voberto_dell_E6540/bus/Profine | \Progetti\TIA\CPU 1500\V16\EXM5XX-13-14\EXM5XX-13-14                   | _ # X   |
|---|--|---|
| Project Edit View Insert Online Options       |  | Totally Integrated Automation   |
| 📑 💁 🔚 Save project 📑 🐰 🗐 🗎 🗙 🍤                | 🗄 (# 🗄 🔃 🕼 🖳 🖓 Go online 💋 Go offline 🎄 🖪 🖪 🛠 🚍 🛄 Search in project> 🆓 | PORTAL  |
| Project tree 🔳 🖣                              | EXM5XX-13-14 + PLC_1 [CPU 1512SP-1 PN] + Program blocks + Main [OB1]   | Instructions 📑 🗉 🕨  |
| Devices                                       |  | Options   |
| 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1         |  | eat eat 🐼 ' 🗔 🛄 🛱   |
| 2   | Block interface  | v Favorites   |
| 🕨 😹 Software units 📃 🔨                        | Network 3: REO = 1: Transfer data record                               |   |
| 👻 😓 Program blocks 🛛 🔵                        |  |   |
| Add new block                                 | Comment  |   |
| 📥 🤷 Main (OB1) 🛛 🔍                            | Landau Martin Contractor Contractor                                    | 24 Testing  |
| Request_DB [DB1]                              | "WRREC_Data".<br>BUSY REO  | e.  |
| Response_DB [DB2]                             |  | tin   |
| <ul> <li>System blocks</li> </ul>             |  |   |
| <ul> <li>Program resources</li> </ul>         |  |   |
| RDREC_Data [DB6]                              | 1  | ✓ Basic instructions  |
| RDREC_DB [DB5]                                | Network 4: REQ = 1: Transfer data record                               | Basic instructions  |
| 📓 WRREC_Data (DB4) 🔵                          | Comment  |   |
| WRREC_DB (DB3)                                |  | Bit logic operations  |
| External source files                         | 5M0.1  | O The operations     O The operations     O Comparator operations     Comparator operations     Comparator operations |
| PLC tags                                      | "Request RIW "WRREC_Data". "RDREC_Data". "WRREC_Data". "RDREC_Data".   | Counter operations  |
| PLC data types                                | param single* BUSY BUSY BUSY REQ                                       | Comparator operations   |
| Watch and force tables                        |  | V I Math functions  |
| Add new watch table                           |  | < II >  |
| Asynchronous request                          |  | ✓ Extended instructions >>  |
| Fill Force table                              | Network 5:   | Name Description  |
| Online backups                                |  | Date and time-of-day  |
| 🕨 🔄 Traces 🗸 🗸                                | Comment  | String + Char   |
|   |  | Process image   |
| ✓ Details view                                | ND85<br>"RDREC DB"   | Distributed I/O   |
| · beauster                                    | ROREC  | PROFlenergy   |
|   | KONEC<br>Variant   | Module parameter assig  |
|   | EN ENO   | Interrupts  |
| Name Address                                  | "RDREC Data".  | Alarming  |
|   | RURE_DISTS. NURE_DISTS.<br>REQ REQ VALID -VALID                        | <   |
|   | "RDREC_Data".  | > Technology  |
|   | 100% V   | > Communication   |
|   | Reporties Diagnostics -  | Optional packages   |
| Portal view     Dverview                      |  | 1 objects have been printed successfully.   |
|   |  | a robjecti nive been printed successfully.  |



| ct Edit View Insert Online Options J<br>B Save project 📑 💥 🗐 🗟 🗙 🏷  | ors yandow Heip<br>(#± to III III III III III III III III IIII IIII  | Totally Integrated Automation<br>PORTAL  |
|---|--|--|
| roject tree 🔲 🖣   | EXM5XX-13-14 + PLC_1 [CPU 1512SP-1 PN] + Program blocks + Main [OB1]   | 🗙 Instructions 🗊 🗈 🕨   |
| Devices   |  | Options  |
| Software units     Program blocks     Add new block     Main [081]     Request_DB [081]     Request_DB [082]     Software blocks     Software | Block interface           Network 5:           Comment           "SORE, Og"           "RORE", Og"           RORE", Og"           NORE", Og"           NORE", Og"   | Al At 50 *   |
| OREC.DE DISH     OREC.DE IDSH     WREC.DE (DESH     WREC.DE (DESH)     Technology Adjects     Ore Desh     Ore Desh   | "1004C_D14"         "004C_D14"           F(0)         F(0)           "1004C_D14"         0           "1004C_D14"         0           "1004C_D14"         0           "1004C_D14"         0           "1004C_D14"         0           "1004C_D14"         1004C_D14"           "1004C_D14"         1004C_D14" | Here         Description           • General         • General           • Estade instructions         • General instructions           • Testende instructions         • General instructions   |
| ▶      >       ■     >       ■     >       ■     >       ■     >       ■     >       ■     >       ■     >       ■     >       ■     >       ■     >       ■     >       Name     Address   | Network 6:   | Stong - Char     Stong - Char     Char |

Figure 70 - FC1

#### 14.1.5 Function 2 (FC2)

| A Siemens - C:\roberto_dell_E6540\bus\Profinet | tiProgettiiTIAICPU 1500IV16\EXM5XX-13-14\EXM5XX-13-14                     |  | _ # X              |
|--|---|--|--------------------|
| Project Edit View Insert Online Options        | Jools Window Help   | Totally Integrated Au                        | utomation          |
| 📑 🎦 🖫 Save project 🚢 🐰 🗉 🖀 🗙 🍤                 | 🗈 (* 🗄 🗓 🖆 🔛 🎧 🖉 Go online 💋 Go online 🛔 🎼 👫 🐥 🔄 📋 🕓 Search in projects 👘 | Totally integrated in                        | PORTAL             |
| Project tree 🔳 📢                               | EXM5XX-13-14 → PLC_1 [CPU 1512SP-1 PN] → Program blocks → Main [OB1]      | Instructions                                 | ■ □ >              |
| Devices  |   | Options                                      | 100                |
| 19 🖬 📰 🖬                                       |   | 64 661 Sz                                    | ۵ 🗆 🖬 🖥            |
|  |   | ✓ Favorites                                  | )                  |
| 🗧 🕨 🙀 Software units 🗖                         | "RDREC Data". ERROR -ERROR  |  | tion               |
| 🔹 🙀 Program blocks 🛛 🔵                         | MURE_DISta  | ┊⊣⊢⊣⊢⊣── 🕾 🚅                                 | 5                  |
| Add new block                                  | PEDE2 DEXO 0 STATUS STATUS  |  |                    |
| 🕹 😂 Main (OB1) 🔷                               | BYTE10 RECORD *RDEC Data*.  |  | P Testing          |
| Request_DB [DB1]                               |   |  | ē                  |
| Response_DB [DB2]                              | A   |  | stii               |
| 👻 😹 System blocks 🛛 🔵                          | 4 1   |  | 19                 |
| Program resources                              |   |  |                    |
| 🗿 RDREC_Data [DB6] 🔵                           | Network 6:  | ➤ Basic instructions                         | escription         |
| 🕞 RDREC_DB [DB5]                               | Comment   |  | escription         |
| 🕞 WRREC_Data (DB4) 🔵                           |   | General                                      | escription ski     |
| 🕞 WRREC_DB (DB3) 🔵                             | "RDREC_Data". "RDREC_Data".   | General     Bit logic operations             |                    |
| Technology objects                             | BUSY REQ  | Go Timer operations                          | - 00               |
| External source files                          |   | Counter operations                           | 5                  |
| PLC tags                                       | 4 1   | Counter operations     Comparator operations | Librarie           |
| PLC data types                                 | 4   | Comparator operations     Math functions     | v ie               |
| <ul> <li>Watch and force tables</li> </ul>     |   | Math functions                               | > "                |
| Add new watch table                            | Network 7:  | Extended instructions                        |                    |
| 😹 Asynchronous request                         | Comment   |  | 2 March 2          |
| Force table                                    | 4   | Name     De     Date and time-of-day         | escription ^dd-ins |
| Doline backups                                 | 5040.1  |  | <u>^ ins</u>       |
| 🕨 🔀 Traces 🛛 🗹                                 | "RDREC_Data". "Request RW   | String + Char                                | -                  |
| < II >   | VALID param single  | Process image                                |                    |
| ✓ Details view                                 |   | Distributed I/O                              |                    |
|  | 4   | PROFlenergy                                  |                    |
|  | "RDREC_Data".   | Module parameter assig                       |                    |
|  | ERIOR   | Interrupts                                   |                    |
| Name Address                                   |   | Alarming                                     | ~                  |
|  |   | <  | >                  |
|  |   | > Technology                                 |                    |
|  | 100%  | > Communication                              |                    |
|  | 🔍 Properties 🔡 Info 🚯 Diagnostics 👘 🗆 🗠                                   | > Optional packages                          |                    |
| ✓ Portal view                                  | 🙀 4 Data bloc 🔒 🕿 Main (OB1) 🔣 Asynchrono                                 | 1 objects have been printed successfi        | fully.             |



#### 14.1.6 Acyclic request of Preset

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See P65000 – Preset value on page 118.

|                                   |     |       |                                       |                    |                |               |              |        | - 7 T X | Testing                 | ■ ■ ▶ |
|-----------------------------------|-----|-------|---------------------------------------|--------------------|----------------|---------------|--------------|--------|---------|-------------------------|-------|
|                                   |     |       |                                       |                    |                |               |              |        |         | Options                 |       |
|                                   | 💷 🐋 |       | e 🖉 🕼 🕼 9, 9, 97 🕾 🕾                  |                    |                |               |              |        |         |                         | -     |
|                                   |     |       | Name                                  | Address            | Display format | Monitor value | Modify value | 2 Comm | nent    | ✓ CPU operator panel    |       |
| Software units                    | ^   | 1 //  |                                       |                    |                |               |              |        |         | Cro operator paner      |       |
| - Rrogram blocks                  |     | 2     | "Request param value single"          | %M0.0              | Bool           | FALSE         |              |        |         | PLC_1 [CPU 1512SP-1 PN] |       |
| Add new block                     | -   | 3     | "Request R/W param single"            | %M0.1              | Bool           | FALSE         | TRUE         |        |         | RUN / STOP RUN          |       |
| Main [OB1]                        | •   | 4 //  |                                       |                    |                |               |              |        |         | ERROR STOP              | 5     |
| Request DB [DB1]                  |     | 5     | "WRREC_Data".REQ                      |                    | Bool           | FALSE         |              |        |         |                         |       |
| Response DB [DB2]                 |     | 6     | "WRREC_Data".ID                       |                    | DEC            | 264           | 264          |        |         | MAINT MRES              |       |
| <ul> <li>System blocks</li> </ul> |     | 7     | "WRREC_Data".INDEX                    |                    | Hex            | 16#0000_802E  | 16#0000_802E |        |         |                         |       |
| Program resources                 |     | 8     | "WRREC_Data".LEN                      |                    | DEC            | 1             | 1            |        |         | Mode selector: RUN      |       |
| RDREC_Data [DB6]                  |     | 9 11  |                                       |                    |                |               |              |        |         |                         |       |
| RDREC_DB [DB5]                    |     | 10    | "Request DB" Request reference        | %D81.D880          | Hex            | 16#01         | 16#01        |        |         |                         |       |
| WRREC_Data [DB4]                  | ē   | 11    | "Request_DB".Request_ID               | %D81.D881          | Hex            | 16#02         | 16#02        |        |         |                         |       |
| WRREC DB [DB3]                    | ē   | 12    | "Request_DB".Axis_No_DO_ID            | %081.0882          | Hex            | 16#00         | 16#00        |        |         |                         |       |
| Technology objects                |     | 13    | "Request_DB".No_of_parameters         | %D81.D883          | Hex            | 16#01         | 16#01        | A 1    |         |                         |       |
| External source files             |     | 14    | "Request_DB".Attribute_parameter_01   | %D81.D884          | Hex            | 16#10         | 16#10        |        |         |                         |       |
| PLC tags                          |     | 15    | "Request_DB".No_of_elements_01        | %D81.D885          | Hex            | 16#01         | 16#01        |        |         |                         |       |
| PLC data types                    |     | 16    | "Request_DB".Parameter_number_01      | %D81.D8W6          | DEC            | 65000         | 65000        |        |         |                         |       |
| Watch and force tables            |     | 17    | "Request_DB".SubIndex                 | %DB1.DBW8          | Hex            | 16#0000       | 16#0000      |        |         |                         |       |
| Add new watch table               |     | 18    | "Request DB" Format                   | %D81.D8810         | Hex            | 16#43         | 16#43        |        |         |                         |       |
| Acyclic request                   |     | 19    | "Request DB" No of value              | %D81.D8811         | Hex            | 16#01         | 16#01        |        |         |                         |       |
| EIL Force table                   |     | 20    | "Request DB".Value                    | %D81.D8D12         | Hex            | 16#0000 1000  | 16#0000 1000 |        |         |                         |       |
| Online backups                    |     | 21 JJ |                                       |                    |                |               |              |        | _       |                         |       |
| Fraces                            | ~   | 22    | "Response_DB".Request_reference_mirro | * %D82.D880        | Hex            | 16#01         |              |        |         |                         |       |
|                                   | >   | 23    | "Response_DB".Response_ID             | %D82.D881          | Hex            | 16#02         |              |        |         |                         |       |
| Details view                      |     | 24    | "Response_DB".Axis_No_DO_ID_mirrored  | %D82.D882          | Hex            | 16#00         |              |        |         |                         |       |
|                                   |     | 25    | "Response_DB".No_of_parameters        | %D82.D883          | Hex            | 16#01         |              |        |         |                         |       |
|                                   |     | 26    | "Response_DB".Format                  | %DB2.DBB4          | Hex            | 16#43         |              |        |         |                         |       |
|                                   |     | 27    | "Response_DB".No_of_value             | %D82.D885          | Hex            | 16#01         |              |        |         |                         |       |
| Name                              |     | 28    | "Response_DB".Value                   | %DB2.DBD6          | Hex            | 16#0000_1000  |              |        |         |                         |       |
|                                   |     | 29    |                                       | <add new=""></add> |                |               |              |        |         |                         |       |
|                                   |     |       |                                       |                    |                |               |              |        |         |                         |       |
|                                   |     | <     |                                       |                    |                |               |              |        | 1       |                         |       |

Figure 72 - Acyclic request of Preset value



#### NOTE

Please always ascertain that **Data.ID** is the same as the **hardware identifier** of the installed module.



#### 14.2 Monitoring a variable

Below is an example of variable monitor in case of Telegram 83 and IRT communication.



#### NOTE

Controller Sign-Of-Life is active.



Figure 73 – Monitoring a variable

### 15 Encoder state machine

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Figure 74 - Encoder state machine

#### 15.1 Normal operation diagram



#### 15.2 Preset diagram



#### 15.3 Parking sensor diagram



15.4.1 Acknowledgement of acknowledgeable sensor error





### 16 Integrated web server

Profinet encoders from Lika Electronic integrate a web server. This web-based user interface is designed to offer helpful functions and deliver complete information on the device that can be accessed through the Internet. In particular it allows:

- to display the current position and speed values;
- to display and check the currently set parameters;
- to set and activate the preset;
- to update the firmware.

The web server can be accessed from any PC running a web browser. Since its only requirement is an HTTP connection between the web browser and the web server running on the device, it is perfectly fitted also for remote access scenarios.

Before opening the web server of the Profinet encoder please ascertain that the following requirements are fully satisfied:

- the encoder is connected to the network;
- the encoder has valid device name and IP address;
- the PC is connected to the network;
- a web browser (Internet Explorer, Mozilla Firefox, Google Chrome, Opera, ...) is installed in the PC or in the device used for connection.



#### NOTE

This web server has been tested and verified using the following web browsers:

- Internet Explorer IE11 version 11.1593.14393.0
- Mozilla Firefox version 116.0.1
- Google Chrome version 115.0.5790.111
- Opera version 68.0.3618.165



### NOTE

Please note that the appearance of the snapshot may vary depending on the web browser used. The following snapshots were taken from Google Chrome.

#### 16.1 Web server Home page

To open the Profinet encoder web server proceed as follows:

1. type the IP address of the encoder you want to connect to (in the example: 192.168.20.1) in the address bar of your web browser and confirm by pressing **ENTER**;

| Mewtab     X +       |                               |     | ~ - Ø X |
|----------------------|-------------------------------|-----|---------|
| ← → C @ 192.168.20.1 |                               |     | * 🕹 🖬 : |
|                      |                               |     |         |
|                      |                               |     |         |
|                      |                               |     |         |
|                      | Casala                        |     |         |
|                      | Google                        |     |         |
|                      | •                             |     |         |
|                      | Q Search Google or type a URL | ♣ ⊕ |         |
|                      | +                             |     |         |
|                      |                               |     |         |
|                      | Add shortcut                  |     |         |
|                      |                               |     |         |
|                      |                               |     |         |
|                      |                               |     |         |
|                      |                               |     |         |
|                      |                               |     |         |
|                      |                               |     |         |
|                      |                               |     |         |
|                      |                               |     |         |
|                      |                               |     |         |
|                      |                               |     |         |
|                      |                               |     |         |
|                      |                               |     |         |

Figure 75 - Opening the web server

2. as soon as the connection is established, the web server **Home** page will appear on the screen;

| 📕 lika   | Documentation |
|--|---------------|
| Encoder Position-Speed<br>Preset<br>Encoder Information<br>Firmware Update | PROF PROFI    |
|  |               |

Figure 76 - Web server Home page

Some buttons are available in the menu bar of the **Home** page. Press the **Lika logo** to enter Lika's web site (www.lika.biz).

Press the **DOCUMENTATION** button to enter the Profinet encoder technical documentation page available on Lika's web site (<u>https://www.lika.it/eng/products/rotary-encoders/absolute/ethernet/</u>) where specific technical information and documentation concerning the Profinet encoder can be found.

Furthermore some buttons are available in the left navigation bar. All the pages except the **Firmware update** page are freely accessible through the buttons in the bar. The **Firmware update** page requires a password.

These buttons allow to enter specific pages where information and diagnostics on the connected encoder as well as useful functions can be achieved. They are described in the following sections.

#### **16.2** Encoder position and speed

Press the **ENCODER POSITION-SPEED** button in the left navigation bar of the Web server **Home** page to enter the page where the <u>current encoder position</u> and the <u>current encoder speed</u> are displayed.

| <b>li</b> ka | Home page<br>Position   | profit<br>Net |
|--------------|-------------------------|---------------|
|              | 350253 (350253) Speed 0 |               |
|              |                         |               |
|              |                         |               |
|              |                         |               |

Figure 77 - Encoder position and speed page

The first value is the absolute position calculated considering scaling and preset functions, if activated; the value in brackets is the raw value (physical absolute

position). Both encoder positions are expressed in counts. For any information refer to G1\_XIST1, G1\_XIST2, and G1\_XIST3 signals on page 99.

The current speed is expressed according to the setting next the Velocity measuring unit parameter on page 128 (by default it is expressed in counts per second). For any information refer to the NIST\_A and NIST\_B signals on page 108.



#### NOTE

The current encoder position and speed values are real-time processed and continuously updated (every 200 msec. on the screen).

Press the **HOMEPAGE** button to move back to the Web server **Home** page.

#### 16.2.1 Specific notes on using Internet Explorer

The following options must be set properly on Internet Explorer in order to get the **Encoder position and speed** page to be continuously updated.

- Open the **Settings** menu;
- open the Internet Options property sheet;
- in the **General** tabbed page, press the **Setting** button available in the **History Browsing** section;
- under Check for newer versions of stored pages, click Every time I visit the webpage;
- press the **OK** button to confirm whenever requested.

#### 16.3 Setting and activating the preset

Press the **PRESET** button in the left navigation bar of the Web server **Home** page to enter the **Preset** page and set/activate a Preset value. If you need to set the preset occasionally, we suggest using the web server. For complete information on the preset function please refer to the **P65000 – Preset value** parameter on page 118.

To set and execute the preset via web server proceed as follows:

- press the **PRESET** button in the left navigation bar of the Web server **Home** page and enter the **Preset** page;
- as soon as you press the PRESET button a warning message (Are you sure you want to change Preset Value?) appears on the screen: it warns the operator about the awkwardness of the operation, thus he is required to confirm the procedure before continuing;
- press the **OK** button to proceed;
- otherwise press the EXIT button to abort the procedure. The Set Preset cancelled! message will appear on the screen. Press the OK button to move back to the Web server Home page;
- if you confirm the procedure, the **Preset** page will appear on the screen;

| li li        | ka | <u>Home page</u> |       | PROFT <sup>®</sup><br>India |
|--------------|----|------------------|-------|-----------------------------|
| Preset value | 0  |                  | Send  |                             |
|              |    |                  | Reset |                             |
|              |    |                  |       |                             |
|              |    |                  |       |                             |
|              |    |                  |       |                             |
|              |    |                  |       |                             |

Figure 78 - Preset page

• to change the Preset enter a suitable value next to the **Preset value** item and then press the **SEND** button to confirm. The value has to

be set in decimal notation. The preset value is set and activated at the same time.

| li li        | <b>{a</b>   | o <u>me page</u> | PROPP <sup>®</sup><br>Initia |
|--------------|-------------|------------------|------------------------------|
| Preset value | 1234        | Send             |                              |
| _            |             | Reset            |                              |
| Prese        | et executed | d correctly!     |                              |
|              |             |                  |                              |
|              |             |                  |                              |
|              |             |                  |                              |
|              |             |                  |                              |
|              |             |                  |                              |

Figure 79 – Setting the preset value



#### WARNING

The preset value is set and activated for the position of the encoder in the moment when the preset value is transmitted. It is activated as soon as the value is confirmed by pressing the **SEND** button. We suggest activating the preset value when the encoder is in stop.



#### NOTE

At each confirmation / activation of the Preset setting, a message will appear under the button (e.g. **No Command sent** message). It informs whether the operation has been accomplished properly or an error occurred (for example **Preset executed correctly!** if everything went well, see Figure 79; or **Command Error!** if something went wrong).

Press the **RESET** button to zero set the internal offset value. For complete information please refer to the **P65000 – Preset value** parameter on page 118 and to the **Offset value** status bit on page 119.

Press the **HOMEPAGE** button to move back to the Web server **Home** page.

#### 16.4 Encoder information (Profinet user parameters)

Press the **ENCODER INFORMATION** button in the left navigation bar of the Web server **Home** page to enter the **Encoder Information** page. In this page the complete list of the available Profinet parameters is displayed. Parameters are specific to each DAP.

|                   | Home pag            | <u>e</u>                 |                                  | PRQ<br>Néi |
|-------------------|---------------------|--------------------------|----------------------------------|------------|
|                   | Enco                | der information          | n                                |            |
| MAC address       | 10:b9:fe:00:69:ac   | Code Sequence            | 0=CW                             |            |
| Order ID          | EXM5XX-13-14        | Class4 functionality     | 1=enabled                        |            |
| Serial Number     | 232800942           | G1_XIST1 preset control  | 0=enabled                        |            |
|                   | ,                   | Scaling function control | 0=disabled                       |            |
| Hardware revision | 1                   | Alarm channel control    | 1=enabled                        |            |
| Software revision | V 1.1.0             | Compatibility mode       | 0=enabled => Profile version 3.1 |            |
| Production Date   | 2023-08-04 15:09:20 | Measuring units/rev      | 8192                             | _          |
|                   | 0                   | Total measuring range    | 134217728                        |            |
| Preset Value      |                     |                          |                                  |            |

Figure 80 - Encoder Information page

For a complete description of the available encoder parameters please refer to the "9.5 Record Data Object 0xBF00: user parameter data" section on page 121.



#### NOTE

Please note that the values shown in the **Encoder Information** page are "frozen" in the moment when the page is displayed. To update the values you must refresh the web page.



#### NOTE

The parameters in the **Encoder Information** page cannot be changed. User parameters can be changed only in the **Module parameters** tabbed page under TIA Portal, see the "5.5.10 Module parameters" section on page 69. For the preset parameter see the previous "16.3 Setting and activating the preset" section on page 171.

Press the **Homepage** command to move back to the Web server **Home** page.

#### 16.5 Firmware update

Press the **FIRMWARE UPDATE** button in the left navigation bar of the Web server **Home** page to enter the **Firmware Update** page. Please note that this is a password protected page, thus a password is requested to access the page.

Password: LiKa ("L" and "K" in uppercase letters; "i" and "a" in lowercase letters)



#### WARNING

Firmware updating process has to be accomplished by skilled and competent personnel. It is mandatory to perform the update according to the instructions provided in this section.

Before installation always ascertain that the firmware program is compatible with the hardware and software of the device. Furthermore never turn off power during flash update. In case of flash update error, the program is lost irreversibly (there is not a bootloader) and the device must be sent back to Lika Electronic for restoring.

This operation allows to update the unit firmware by downloading updating data to the flash memory.

Firmware is a software program which controls the functions and operation of a device; the firmware program, sometimes referred to as "user program", is stored in the flash memory integrated inside the unit. These encoders are designed so that the firmware can be easily updated by the user himself. This allows Lika Electronic to make new improved firmware programs available during the lifetime of the product.

Typical reasons for the release of new firmware programs are the necessity to make corrections, improve and even add new functionalities to the device.

The firmware upgrading program consists of a single file having .ZIP extension. It is released by Lika Electronic Technical Assistance & After Sale Service.

If the latest firmware version is already installed in the unit, you do not need to proceed with any new firmware installation. The firmware version currently installed can be read next to the **Software revision** item in the **Encoder Information** page after connection to the web server (see on page 173).



#### NOTE

If you are not confident that you can perform the update successfully please contact Lika Electronic Technical Assistance & After Sale Service.

Before proceeding with the firmware update please ascertain that the following requirements are fully satisfied:

- the encoder is connected to the Ethernet network;
- the encoder has valid device name and IP address;
- the PC is connected both to the network and to the IO controller;
- a web browser (Internet Explorer, Mozilla Firefox, Google Chrome, Opera, ...) is installed in the PC or device used for connection;
- you have the .ZIP file for firmware update.

To update the firmware program please proceed as follows:

- 1. press the **FIRMWARE UPDATE** button in the left navigation bar of the Web server **Home** page to enter the **Firmware Update** page;
- 2. the operator is requested to submit a password before starting the firmware update procedure;

|                 | ka I | Home page |      |   | eqoqu<br>Thet |
|-----------------|------|-----------|------|---|---------------|
| Insert password |      |           | Send | I |               |
|                 |      |           |      |   |               |
|                 |      |           |      |   |               |
|                 |      |           |      |   |               |
|                 |      |           |      |   |               |

Figure 81 – Firmware Update page

3. in the **Insert password** text box type the password **LiKa** ("L" and "K" in uppercase letters; "i" and "a" in lowercase letters) and then press the **SEND** button;

| lika                 | Home Page                                      | <u>paoan</u> ®<br>Data |
|----------------------|--|------------------------|
| Select firmware file | No firmware file currently selected for upload |                        |
| Send file            |  |                        |
| Reset                |  |                        |
|                      |  |                        |
|                      |  |                        |
|                      |  |                        |
|                      |  |                        |

Figure 82 - Firmware Update page

- 4. if the password you typed is correct, the **Firmware Update** page will appear on the screen;
- 5. press the SELECT FIRMWARE FILE button; once you press the SELECT FIRMWARE FILE button an OPEN dialog box appears on the screen: open the folder where the firmware updating .ZIP file released by Lika Electronic is located, select the file and confirm. The name of the .zip file will show the Ethernet protocol (Profinet) and the software version of the firmware updating file (e.g. V1.1.0). Please check the file properties and ascertain that you are installing the correct update file;

| Select firmware file Profinet V1.1.0.zip |  |
|--|--|
| Send file                                |  |
| Reset                                    |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |

Figure 83 - Selecting the firmware update .zip file



#### WARNING

Before installation always ascertain that the firmware program is compatible with the hardware and software of the device.

Never turn the power supply off during the flash update operation.

- 6. press the **SEND FILE** button to start the upload of the firmware program;
- 7. during the operation and as soon as the operation is carried out successfully, some messages will appear on the screen;

| lika                        | Home Page                    | ₽₽₽₽₽<br>Diside |
|-----------------------------|------------------------------|-----------------|
| Select firmware file        | Profinet.zip                 |                 |
| Send file                   |                              |                 |
| Reset                       |                              |                 |
|                             | Upload: Upload in progress   |                 |
| 4/8/2023, 15:23:59 Firmware | Upload: Upload is successful |                 |
|                             |                              |                 |
|                             |                              |                 |

Figure 84 - Messages during firmware upload



8. finally press the **RESET** button to automatically reset and restart the encoder and complete the operation.

| lika                        | Home Page                     | <b>月月91</b><br>水油市 |
|-----------------------------|-------------------------------|--------------------|
| Select firmware file        | Profinet V 1.1.0.zip          |                    |
| Send file                   |                               |                    |
| Reset                       |                               |                    |
| 7/8/2023, 14:14:50 Firmware | eUpload: Upload in progress   |                    |
| 7/8/2023, 14:14:55 Firmware | eUpload: Upload is successful |                    |
|                             |                               |                    |

Figure 85 - Firmware update process accomplished



#### NOTE

While downloading the firmware updating program, unexpected conditions may arise which could lead to a failure of the installation process. When such a matter occurs, the download process cannot be carried out successfully and thus the operation is aborted. In case of flash update error, please switch the encoder off and then on again and retry the operation.

Press the **Homepage** command to move back to the Web server **Home** page.

### 17 Default parameters list

| Parameters list          | Default value                     |  |
|--------------------------|-----------------------------------|--|
| Code sequence            | 0 = CW(0)                         |  |
| Class 4 functionality    | 1 = enable                        |  |
| G1_XIST1 Preset control  | 0 = enable                        |  |
| Scaling function control | 0 = disable                       |  |
| Alarm channel control    | 0 = disable                       |  |
| Compatibility Mode       | 1 = disable = Profile version 4.1 |  |
|                          | 8192 = EXM58-13-14                |  |
| Measuring units /        | 262144 = EXM58-18-12              |  |
| Revolution               | 262144 = EX058-18-00              |  |
|                          | 65536 = EXO58-16-14               |  |
|                          | 134217728 = EXM58-13-14           |  |
| Total measuring range    | 1073741824 = EXM58-18-12          |  |
| Total incasuring range   | 262144 = EX058-18-00              |  |
|                          | 1073741824 = EX058-16-14          |  |
| Maximum tolerated        |                                   |  |
| failures of Master Sign- | 1                                 |  |
| Of-Life                  |                                   |  |
| Velocity measuring unit  | 0 = steps/s                       |  |

| Document release | Release date | Description                                    | HW | SW                         | GSDML file<br>version |
|------------------|--------------|--|----|----------------------------|-----------------------|
| 1.0              | 28.09.2023   | First issue                                    | 1  | V1.1.0<br>V1.1.1<br>V1.1.2 | 20230417<br>20230804  |
| 1.1              | 10.10.2023   | New firmware, web server's Preset page updated | 1  | V1.1.2a                    | 20230804              |





This device is to be supplied by a Class 2 Circuit or Low-Voltage Limited Energy or Energy Source not exceeding 30 Vdc. Refer to the order code for supply voltage rate.

**US** Ce dispositif doit être alimenté par un circuit de Classe 2 ou à très basse tension ou bien en appliquant une tension maxi de 30Vcc. Voir le code de commande pour la tension d'alimentation.





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