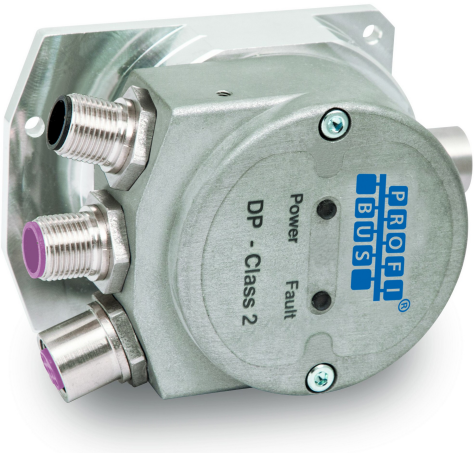
Smart encoders & actuators

User's guide

IF55 LIN PB



Profibus-DP profile for encoders

- SSI to Profibus converter
- Suitable for SSI linear encoders
- Accepts MSB & LSB Aligned protocols up to 30 bits
- Cable and M12 connector outputs
- Profibus DP configurable as Class 1 or Class 2 Slave

Suitable for the following models:

- IF55 LIN PB
- IF55 LIN PB-C

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 both of the device and the 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:

	This icon, followed by the word **WARNING**, 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.
	This icon, followed by the word **NOTE**, 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.
	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 **EXAMPLE** when instructions for setting parameters are accompanied by examples to clarify the explanation.

Preliminary information

This guide is designed to describe the technical characteristics, installation and use of the **SSI to Profibus gateways of the IF55 series**.

IF55 series gateways allow the **integration of SSI encoders**, both rotary and linear, **into conventional fieldbuses or industrial Ethernet networks**.
The present manual is specifically designed to describe the SSI to Profibus IF55 model for linear encoders (order code IF55 LIN PB). For information on the SSI to Profibus IF55 model for rotary encoders (order code IF55 ROT PB) refer to the specific documentation.
For information on the gateways designed for the integration of other fieldbus/Ethernet encoders (for example: SSI to CANopen: order codes IF55 ROT CB and IF55 LIN CB; and SSI to EtherCAT: order codes IF55 ROT EC and IF55 LIN EC), refer to the specific documentation.

Please note that the present manual does not prescind from the user's guide of the SSI encoder it has to be connected to. Please read carefully the encoder's documentation before installing, connecting and operating the measuring system.
For detailed technical specifications please refer also to the product datasheet.

To make it easier to read the text, this guide can be divided into two main sections.
In the first section general information concerning the safety, the mechanical installation and the electrical connection as well as tips for setting up and running properly and efficiently the unit are provided.
In the second section, entitled **Profibus Interface**, both general and specific information is given on the Profibus interface. In this section the interface features and the parameters implemented in the unit are fully described.

Glossary of Profibus terms

Profibus, 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 Profibus interface. They are listed in alphabetical order.

Address (Station)	IEC 61158-2: Medium attachment unit identification - unique number of a station connected to a segment (participant).
Address Space	Within PROFIBUS DP the maximum possible number of addressable network nodes per segment, e.g. 127.
Alarm	Notification of an abnormal or unexpected event within a system. Alarms in PROFIBUS DP require in addition to the standard diagnosis event mechanism within the cyclic data exchange a separate acyclic acknowledgement procedure between a host and a Slave application. Since DP-V1, "Device related diagnosis" is the basis for the "Alarm" and "Status" types of diagnosis events (GSD: "DPV1"=1). PROFIBUS DP defines the following alarm types: Diagnosis, Status, Process, Update, Pull and Plug Alarm. See "Device Related Diagnosis". The PNO maintains a Profile Guideline, Part3: Diagnosis, Alarms and Time Stamping, order no. 3.522.
Alert	Alert is a generic term for two different types of notifications within a PROFIBUS DP/PA network especially arranged but not exclusively for the process automation: • alarm; • event. Both alert types may be used with or without a user acknowledgement mechanism. The PNO maintains a PROFIBUS guideline "Time Stamp", order no. 2.192.
Application Profile	Within PROFIBUS a specified agreement within families of field devices on how to use the general PROFIBUS communication platform and its subsystems (e.g. device integration via GSD, EDD, FDT/DTM and Communication Function Blocks). Communication profiles are not a part of the PROFIBUS DP application profiles. See "Profile".
Baud rate (Data Rate)	Other common terms are "data transfer rate" and "transmission rate". Within PROFIBUS DP this is the amount of data transferred across a fieldbus segment per second. A data rate is measured in units of bits per second ("b/s" or "bps"), or baud.
Bus Cycle	The period of time the bus Master needs to poll every participant (Slave) once. More bus Masters can be activated by using the token principle which consequently prolong the bus cycle.

Class	See "DP Master", "DP Master Class 1 (DPM1)" and "DP Master Class 2 (DPM2)".
Class 1 encoder	Encoder class must be set when you configure the device. Mandatory Class 1 provides the basic functions of the device and can be used for: • sending the position value (see **Position value** parameter); • changing the counting direction (see **Code sequence** parameter); • setting the preset value (see **Preset value** parameter); • acquiring reduced diagnostic information (see **Diagnostic type (16- or 63-byte)** parameter = "16 bytes fixed (6+10)").
Class 2 (+VEL) encoder	Encoder class must be set when you configure the device. Class 2 (+VEL) provides all the Class 1 and Class 2 functions and additional velocity-related functions: • transmission of the velocity value (see **Position and velocity values** parameter); • setting of the velocity measuring unit (see **Velocity unit of measurement** parameter).
Class 2 encoder	Encoder class must be set when you configure the device. Class 2 provides all the Class 1 functions and additional advanced functions such as: • scaling function (see **Scaling function control**, **Physical Total Resolution [bits]** and **Programmable Total Resolution [pulses]** parameters); • extended diagnostic information (see **Diagnostic type (16- or 63-byte)** parameter = "16 bytes (6+10)" or "63 bytes (6+57)").
Communication Function Block (Comm FB)	A basic function block defined for PROFIBUS DP and supplied by the PLC manufacturer for the standardized access of user programs to field devices. The standardization is based on IEC 61131-3. The PNO maintains a guideline "PROFIBUS Communication and Proxy Function Blocks acc. to IEC 61131-3", order no. 2.182.
Communication Parameter	Communication parameters are parameters, which adjust the communication protocol function to the current net configuration. Communication parameters exist for all phases of the communication protocols. Examples are bus address, token rotation time, idle time. See "Slave parametrization" and "Device parametrization".
Communication Profile	IEC 61158 comprises a summary of layer stacks of several different fieldbusses. IEC 61784 defines the useful combinations of these stacks via communication profiles CPF3/1 up to CPF3/3 (PROFINET). One of these is PROFIBUS DP. Within this communication profile three different physical profiles are defined: • RS 485 (RS 485-IS);

	• MBP-IS (MBP-LP, MBP); • Fibre Optics.
Cyclic Data Exchange	IEC 61158-3: Term used to describe events which repeat in a regular and repetitive manner. The MS0 services of PROFIBUS DP are based on cyclic data exchange. See "State machine".
Cyclic Redundancy Check (CRC)	Error-checking technique in which the frame recipient calculates a remainder by dividing frame contents by a prime binary divisor and compares the calculated remainder to a value stored in the frame by the sending node.
Data Rate (Baud rate)	Other common terms are "data transfer rate" and "transmission rate". Within PROFIBUS DP this is the amount of data transferred across a fieldbus segment per second. A data rate is measured in units of bits per second ("b/s" or "bps"), or baud.
Decentralized Peripherals (DP)	The term "Decentralized Peripherals" and the acronym "DP" stand for the simple, fast, cyclic and deterministic I/O data exchange between a bus Master and its assigned Slave devices. The corresponding PROFIBUS communication protocol is called PROFIBUS DP.
Device Identifier	Ident number: The primary device identification is an ident number of data type Unsigned16. This number is unique and assigned by the PNO business office upon application. It is stored within the device and defined in the corresponding GSD file via keyword. In addition it is part of the GSD file name. At runtime the ident number is used within: • the set Slave address procedure; • the parametrization telegram (octet 5 + 6); • the standard part of a diagnosis message (octet 5 + 6). The ident number explicitly cannot be retrieved from a device. Its main purpose is to make sure that a GSD file and configuration/parametrization data between Master Class 1 and its Slave are matching. The PNO maintains a technical guideline "Specification for PROFIBUS device description and device integration, Volume 1: GSD", Version 5.0, order no. 2.122. For a secondary identification possibility see the identification & maintenance functions (I&M). See "Ident Number".
Device Parametrization	The device parametrization within PROFIBUS DP consists of three phases. The first phase takes place during start-up of the communication system and provides basic communication parametrization and simple additional device parameters. Both are defined within the GSD file of a device, stored within a Master Class 1 after configuration in an engineering tool, and transmitted to the Slave at start-up time. Most of the automation cases in factory automation are covered by this method. More complex devices such as drives, laser scanners, scales, robots, transmitters, etc. require further individual parametrization before final production start. This is done in a

	second phase. In process automation certain device parameters such as value limits, value range, gain, etc. need to be adjusted even at run-time. For this second and third phase PROFIBUS DP provides two ways to accomplish the task: DTM/FDT and EDD. See "Slave parametrization" and "Communication parameter".
Device Profile	See "Profile".
DP Master	IEC 61158-5: Within PROFIBUS DP a fieldbus node that can be either Master Class 1 or Master Class 2. A Master Class 1 is a controlling device which controls several DP Slaves (field devices). NOTE: This is usually hosted by a programmable controller or a process controller. A Master Class 2 is a controlling device which manages configuration data (parameter sets) and diagnosis data of a DP Master Class 1, and that additionally can perform all communication capabilities of a DP Master Class 1.
DP Master Class1 (DPM1)	IEC 61158-5: A controlling device which controls several DP-Slaves (field devices). Usually programmable (logic) controllers or process control systems are hosts for Master Class 1.
DP Master Class2 (DPM2)	IEC 61158-5: A controlling device which manages configuration data (parameter sets) and diagnosis data of a DP-Master (Class 1). Additionally the DP-Master (Class 2) can perform all communication capabilities of a DP-Master (Class 1). Usually personal computers are hosts for DP Master Class 2 for programming, parametrizing, diagnosing and monitoring purposes.
DP Slave	IEC 61158-5: A field device that is assigned to one DP Master Class 1 as a provider for cyclic I/O data exchange. In addition acyclic functions and alarms could be supported.
Event	Within PROFIBUS DP/PA this is a signal or I/O data or process value within a certain field device at that point in time where a trigger condition arises. The values are associated with a time stamp and stored in a buffer. The time-stamped sample values are used to archive and visualize significant changes over the course of the production process. Such an event mechanism does not prevent from the cyclic transmission of these signals. A separate event alarm is requesting the transfer of the events to the main system.
Frame	A single set of data transmission from a device.
General Station Description (GSD)	A GSD is an electronically readable ASCII text file and contains both general and device-specific parameters for communication and network configuration. By means of keywords, a configuration tool allows to: • read device information (manufacturer, type, versions, bitmaps, etc.); • read texts for comfortable and easy to use configuration;

	• select transmission rates; • select modules and their I/O data length (configuration identifier); • read texts to assign diagnosis IDs to HMI displays; • select supported services (freeze, sync, etc.); from the GSD for the configuration of the device. A GSD replaces the previously conventional manuals or data sheets and thus already supports plausibility checks during the configuration phase. Distinction is made between a device GSD (for an individual device only) and a profile GSD, which may be used for devices that comply exactly with a profile such as a "PA device". GSDs for different languages may be provided in separate files with corresponding file extensions (*.gse for English, *.gsg for German, etc.) or altogether in one file (*.gsd). The device manufacturers are responsible for the scope and quality of the GSD of their devices.
Ident Number	See "Device Identifier". Notes: • the ident number is necessary for all DP devices except for Master Class 2; • the same ident number may be used for modular devices as long as the device can be described in the GSD file as a modular device.
Identifier	In general: a symbol that establishes the identity of the one bearing it. Within this context here it represents an absolute value of a parameter such as a physical address. It is intended for systematic and performance handling capabilities within computer systems, e.g. sorting, consistency checking, physical localization and alike. Usually an absolute value is associated with a logical value to represent the particular deployment of the identifier. Typical abbreviation for identifier is ID. IEC 61131-3: A combination of letters, numbers and underline characters, which begins with a letter or underline and which names a language element. Some of the major identifiers within PROFIBUS DP are: - Data type numeric identifier; - Configuration identifier (Cfg); - Device identifier (ident number); - Manufacturer identifier (MANUFACTURER ID); - Profile ident number (PROFILE ID).
Index	IEC 61158-5: Address of an object within an application process. The permitted range in PROFIBUS DP is 0 - 255. Indexes are used to address records of data (parameters, variables, state information, commands, etc.) within modules of a field device.
PDU (Protocol Data Unit)	A packet of data passed across a network via telegrams. The term implies a specific layer of the OSI seven layer model and a specific protocol. Each layer has its own PDU that is extended subsequently from the physical layer up to the

	application layer: • Physical layer protocol data unit (PhPDU); • Data link protocol data unit (DLPDU); • Application protocol data unit (APDU).
PI	The *PROFIBUS Nutzerorganisation e.V.* (PROFIBUS User Organisation, or PNO) was created in 1989. This group was composed mainly of manufacturers and users from Europe. In 1992, the first regional PROFIBUS organization was founded (PROFIBUS Schweiz in Switzerland). In the following years, additional Regional PROFIBUS & PROFINET Associations (RPAs) were added. In 1995, all the RPAs joined together under the international umbrella association PROFIBUS & PROFINET International (PI). Today, PROFIBUS is represented by 25 RPAs around the world (including PNO) with over 1400 members, including most if not all major automation vendors and service suppliers, along with many end users.
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PROFIBUS	PROcess FIeldBUS. PROFIBUS is a manufacturer independent fieldbus standard for applications in manufacturing, process and building automation. The PROFIBUS family is composed of three types of protocol, each of which is used for different tasks. The three types of protocols are: PROFIBUS FMS, DP and PA. IEC 61784-1: Communication network according to communication profile family 3 (CPF3); incorporating application profiles and system integration aspects like interfaces and languages for engineering tools and HMI. PROFIBUS is an open, digital communication system with a wide range of applications, particularly in the fields of factory and process automation. PROFIBUS is suitable for both fast, time-critical applications and complex communication tasks. The PROFIBUS logo is a registered trademark.
PROFIBUS DP	Acronym for "PROFIBUS for Decentralized Peripherals". Specification of an open fieldbus system with the following characteristics: • polling Master-Slave-system (cyclic communications, MS0); • flying Masters with robin round token passing

	coordination (MM); • connection based (MS1) and connectionless (MS2, MS3) acyclic communication between Masters and Slaves. Options (e.g.): • Data exchange broadcast (DXB), i.e. Slave to Slaves communication; • isochronous mode of Slaves; • clock synchronization; • redundancy. PROFIBUS DP is standardized within IEC 61158 and IEC 61784, communication profile families 3/1 and 3/2. The term "PROFIBUS DP" is also a synonym for the RS-485 based deployments within factory automation.
PROFIdrive	Communication technology especially adopted to the requirements of position and speed controlled drive applications (e.g. speed synchronized axis). Within the scope of PROFIBUS, "PROFIdrive" is used for the application of the PROFIBUS DP protocol (DP-V2) in motion control automation together with the corresponding application profiles ("PROFIdrive - Profile for variable speed drives" and "PROFIdrive - Profile drive technology") for the transmission technology RS-485.
Profile	Besides other things profiles in common define agreements on how to use communication means in a standardized manner. Within the context of fieldbusses several types of profiles are known: • communication profiles (e.g. IEC 61784); • physical profiles (MBP-IS, RS-485); • application profiles (see PROFIBUS TC3); • device profiles (e.g. robots); • branch profiles (e.g. extruder).
Profile Ident Number	Identifier of a particular profile definition. The profile ident number is taken from the pool of ident numbers handled by the PNO. It plays a role within the following scenarios. (1) In cases where the device of a manufacturer A should be replaceable by an equivalent device, the PNO is assigning number ranges to dedicated device types (Profile specific IDs) in combination with certain "Profile GSDs". Profiles using this methodology are e.g. "PA Devices" and "PROFIdrive". (2) Usually these Slave devices are designed to communicate with a Master Class 2 application (e.g. profile application or profile DTM). In order to ensure a Master application is communicating with an appropriate Slave, it is sending a profile specific ID during the establishment of the connection (MS2 Initiate Service). The Slave may answer with the same profile specific ID (if it is supporting this profile), with another ID (if it is supporting another profile) or with "0000h" if it is not supporting any profile.

	(3) I&M functions: Besides its basic I&M information devices - following a certain profile - are enabled to provide more detailed profile specific information.
Protocol Data Unit (PDU)	A packet of data passed across a network via telegrams. The term implies a specific layer of the OSI seven layer model and a specific protocol. Each layer has its own PDU that is extended subsequently from the physical layer up to the application layer: • Physical layer protocol data unit (PhPDU); • Data link protocol data unit (DLPDU); • Application protocol data unit (APDU).
Slave Parametrization	For a DP Slave several levels of parametrization exist. (1) The parameters on the DP communication level can be defined via a GSD file and comprise features such as baud rates, timing constraints, identification, options, transferable data structures, publisher subscriber links, etc. This level supports parametrization of simple modular Slaves and also special common additional communication layers such as PROFIsafe. This parametrization is fixed for a given operational life cycle after start-up. (2) More complex devices may be parametrized via EDD and/or FDT/DTM technology via an acyclic communication service (MS2). (3) For parameter changes at run-time such as batch operation (recipes) or motion control, special "parameter channels" associated with the cyclic data structures may be added or the MS1 services together with proxy function blocks may be used.
State Machine (DP)	An abstract machine consisting of a set of states (including the initial state), a set of input events, a set of output events, and a state transition function. A state machine describes the behaviour of a field device how to react in different situations. The state machine for DP Slaves comprises the following states/actions: - Power_On_Reset --> Set Slave address --> if successful, a transition follows to: - Wait_Prm --> Parametrization, diagnosis (optional) --> if successful, a transition follows to: - Wait_Cfg --> Configuration, diagnosis (optional) --> if successful, a transition follows to: - Data_Exch --> Normal operation: cyclic data exchange. On top of this basic communication layer state machine application profiles are defining their own additional state machines, e.g. PA devices, PROFIdrive, PROFIsafe, Ident Systems, Weighing and Dosage Systems. State machines are best modelled and documented with the help of the "Unified Modelling Language (UML)".
Station Address	Within PROFIBUS DP the address of a communication participant (Master or Slave). The permitted range is 0 to 127,

	with: - 126 intended to be used for the "soft" addressing of Slave devices; - 127 intended to be used for broadcast messages to all the Slaves.
Topology	In a communication network, the pattern of interconnection between network nodes; e.g. bus, ring, star configuration.
Transmission Rate (Baud rate)	The signalling rate of a digital communication line. It is the switching speed, or number of transitions (voltage or frequency changes) that are made per second. Within PROFIBUS DP the possible transmission rates depend on the MAU (Medium Attachment Unit) in use.
Watchdog Control	IEC 61158-6: This timer is part of the DP layer within a Slave. It is restarted by received requests from the bus Master and will set the outputs of a Slave to a fail-safe state after the expiration of the timer.
Watchdog Time (Twd)	IEC 61158-5: The watchdog timer is part of the DP layer within a Slave. The watchdog time is set by parametrization at run-up and consists of a watchdog time base (1 or 10 ms) and 2 factors. A selection can be made during configuration via the GSD file of a Slave. This is a Slave parameter. See "Watchdog control".

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 must 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 explanation in the "4 - Electrical connections" section on page 23;
- in compliance with the 2014/30/EU norm on electromagnetic compatibility, following precautions must be taken:
  - before handling and installing, 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 cap, use one TCEI M3 x 6 cylindrical head screw with two tooth lock washers.

1.3 Mechanical safety

- Install the device following strictly the information in the "3 - Mechanical installation" section on page 20;
- mechanical installation has to be carried out with stationary mechanical parts;
- do not disassemble the device unless otherwise indicated;
- do not tool the device;
- delicate electronic equipment: handle with care;
- do not subject the device to knocks or shocks;
- respect the environmental characteristics declared by manufacturer.

2 - Identification

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

Warning: devices 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 and mechanical parts compulsorily in stop.

3.1 Overall dimensions

(values are expressed in mm)

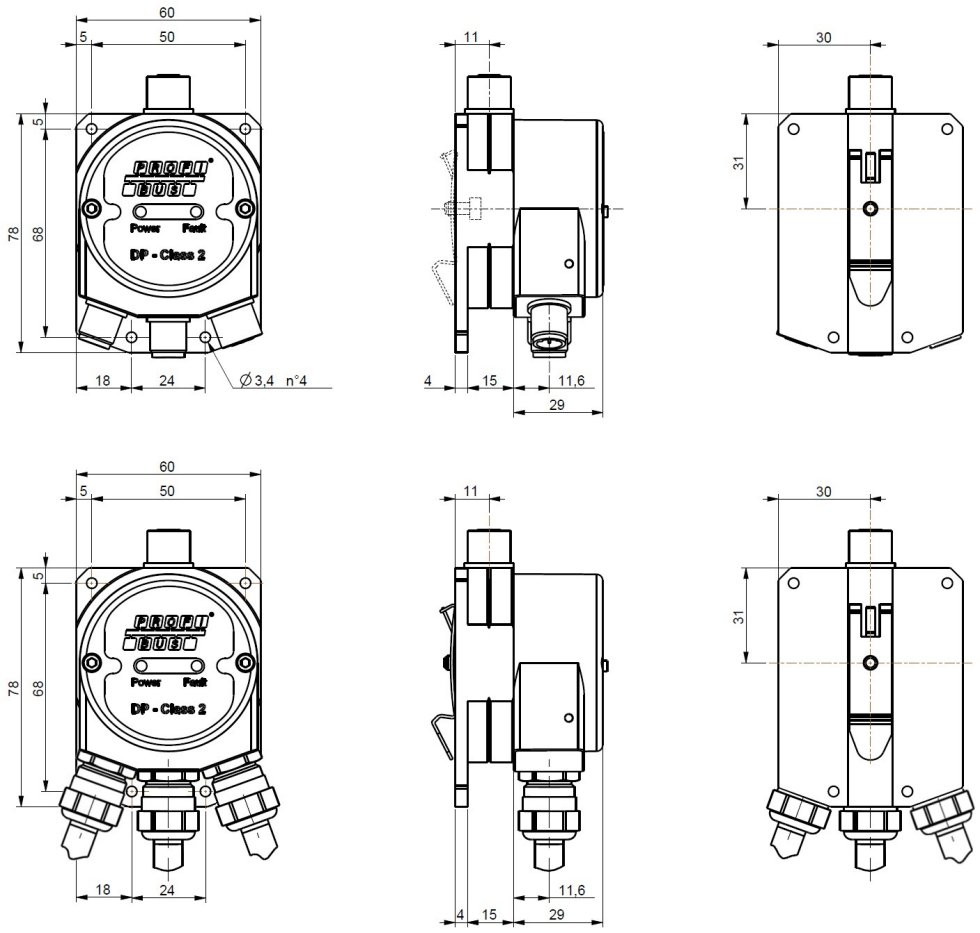


Figure 1

3.2 Installation on panel (Figure 2)

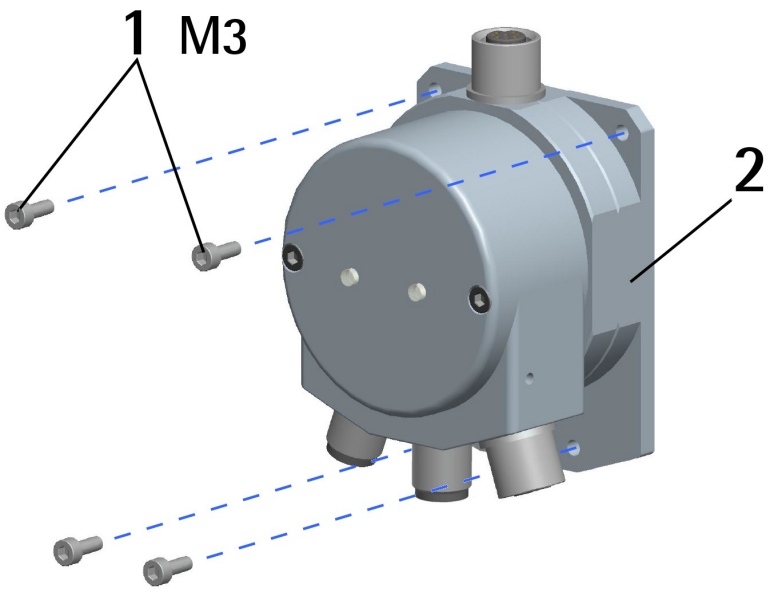


Figure 2

The unit is designed for installation on the even surface of a panel.
The back flange **2** is fitted with four holes for inserting the fixing screws **1**. Tighten the four fixing screws **1** until the unit is properly fastened to the support. Use **four M3 8 mm min. long cylinder head screws**. The recommended tightening torque is **1.1 Nm**.

3.3 Installation with DIN rail clip (Figure 3)

The unit can be installed on DIN profiles inside a rack. A clip **3** for direct fitting on DIN TS35 rails is supplied for free. It has to be fixed on the back of the flange **2** by means of the provided screw **4**.

WARNING
To mount the clip **3** you need to remove the cap **5** and drill a hole **A** in the back flange **2**. Delicate electronic circuits and wirings are located inside the cap **5**. Thus this operation has to be accomplished by skilled personnel only. Please pay careful attention and observe great precaution when carrying out this operation.

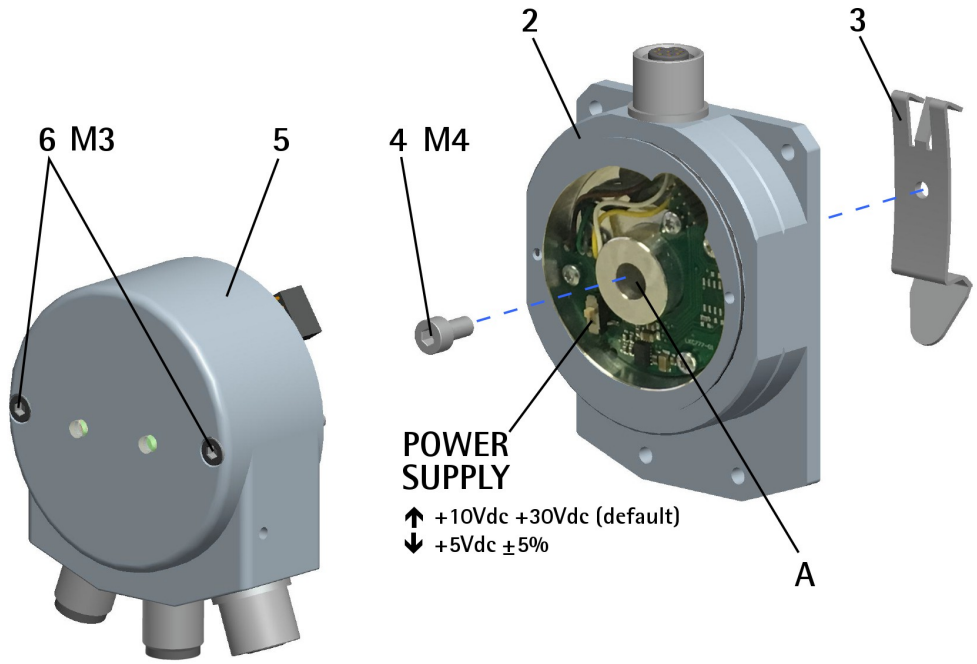


Figure 3

- Loosen the two screws **6** that fasten the cap **5** to the back flange **2**;
- open the cap **5** and separate it from the flange **2**; please pay attention to the internal wirings and connectors;
- drill a 4.5 mm diameter hole **A** in the flange **2**; use the notch in the inside of the flange **2** to guide the drill bit;

WARNING
Carefully remove the scrap material after drilling.

- mount the clip **3** on the back of the flange **2** and fix it by means of the provided M4 x 8 screw **4**; it has to be screwed on the inner side of the flange **2**;
- replace the cap **5** and fix it by means of the screws **6**.

4 - Electrical connections

WARNING
Power supply must be turned off before performing any electrical connection!

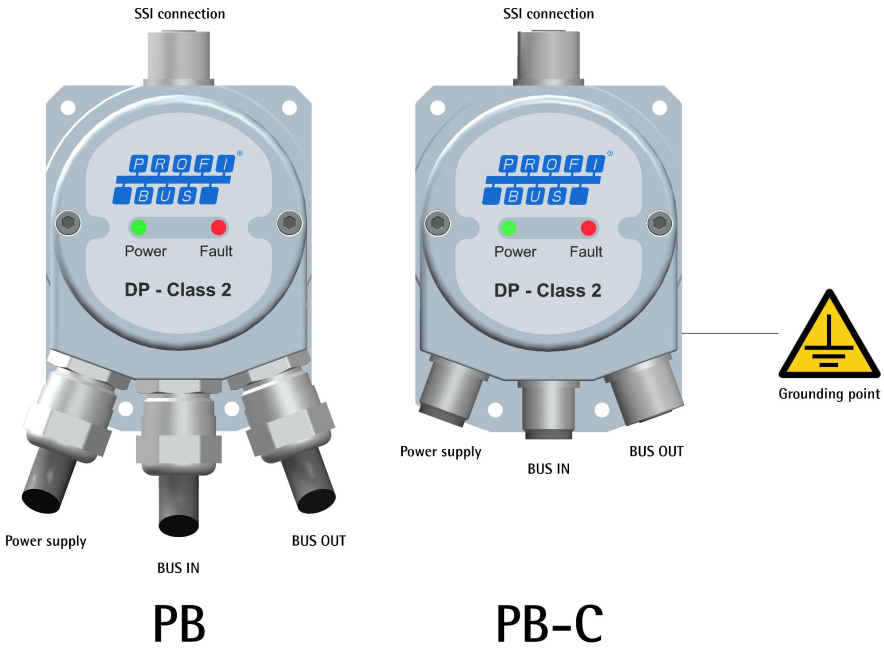


Figure 4

4.1 Connection cap of the converter (Figure 5)

WARNING
Do not remove or mount the connection cap with power supply switched ON. Damage may be caused to internal components.

The terminal connectors for connecting the power supply and the BUS IN and BUS OUT cables (PB connection cap) as well as the DIP switches meant to set the power supply and the node ID and activate the termination resistance (PB and PB-C connection caps) are located inside the converter connection cap. Thus you must remove the connection cap to access any of them.

NOTE
Be careful not to damage the internal components when you perform this operation.

To remove the connection cap loosen the two M3 screws **1** (Figure 5). Please be careful with the internal connector.

Always replace the connection cap at the end of the operation. Take care in re-connecting the internal connector. Tighten the screws **1** using a tightening torque of approx. 2.5 Nm.

WARNING
You are required to check that the converter back flange and the connection cap are at the same potential before replacing the connection cap!

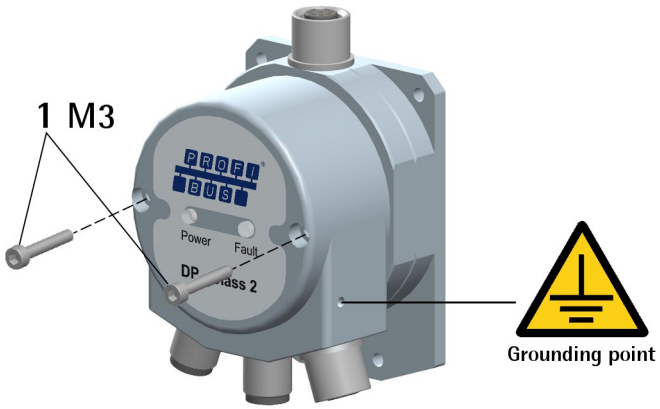
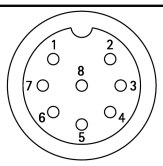


Figure 5

4.2 SSI connection (Figure 4)

The converter is fitted with one M12 8-pin female connector to network the IF55 gateway and the SSI encoder.

M12 8-pin	SSI connection
(frontal side)	 A coding female

Pin	Description
1	0Vdc power supply voltage
2	+Vdc power supply voltage *
3	Clock IN +
4	Clock IN -
5	Data OUT +
6	Data OUT -
7 and 8	not connected

* The power supply voltage level must be set through the POWER SUPPLY DIP switch located inside the enclosure of the converter, see the "4.7 POWER SUPPLY DIP switch (Figure 8)" section on page 28.

WARNING
The max. length of the SSI cable must not exceed 30 m / 98.425 ft.

4.3 Profibus converter with PGs: PB version (Figure 4 and Figure 6)

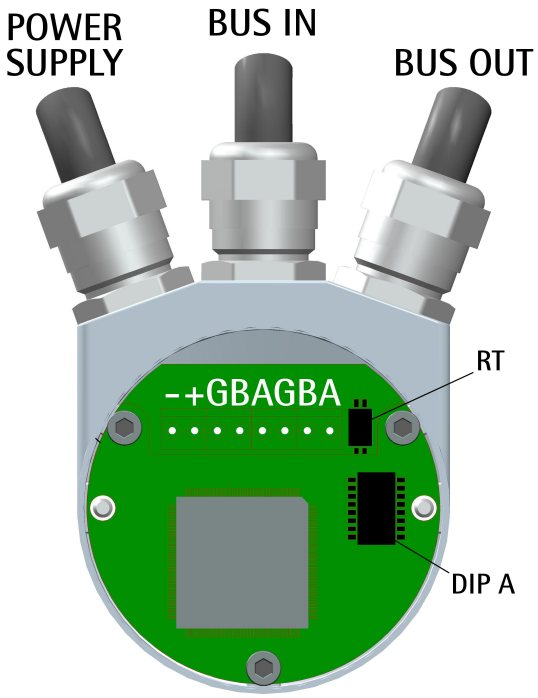


Figure 6

The converter is fitted with three PG9 cable glands for Power Supply, BUS IN and BUS OUT connections. The bus cables can be connected directly to the terminal connectors in front of each cable gland. We recommend Profibus certificated cables to be used. Core diameter should not exceed Ø 1.5 mm (0.06 inches).

Terminal connector	Description
-	0Vdc power supply voltage
+	+10Vdc +30Vdc power supply voltage
G	Profibus GND [1]
B	Profibus B (Red)
A	Profibus A (Green)
PG	Shield [2]

[1] Profibus GND is the 0V reference of Profibus signals, it is not connected to 0Vdc supply voltage.
[2] Connect the cable shield to cable gland.

4.4 Profibus converter with M12 connectors: PB-C version (Figure 4 and Figure 7)

The converter is fitted with three M12 connectors with pin-out in compliance with the Profibus standard. Therefore you can use standard Profibus cables commercially available.

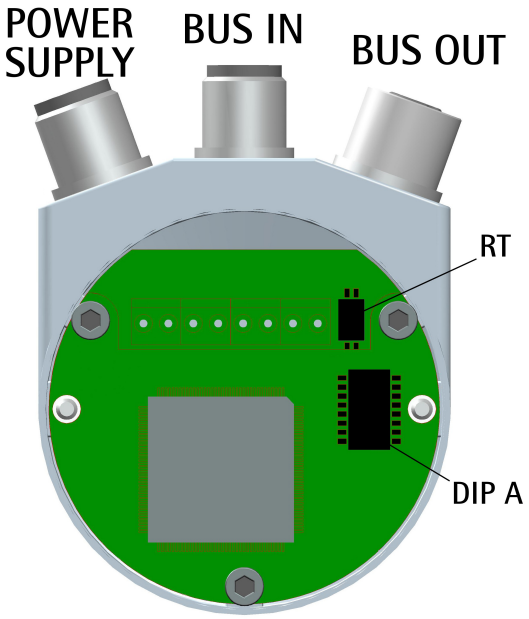
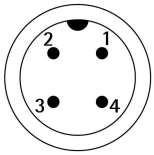


Figure 7

Power supply
M12 connector

A coding

(frontal side)



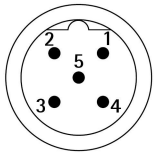
male

Pin	Function
1	+10Vdc +30Vdc power supply voltage
2	not connected
3	0Vdc power supply voltage
4 [1]	Shield
Case	

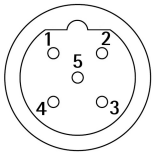
[1] Shield is also connected to pin 4 to allow the connection of the shield even if the plug connector has a plastic case.

Profibus signals
M12 connector
B coding

(frontal side)



male
(BUS IN)



female
(BUS OUT)

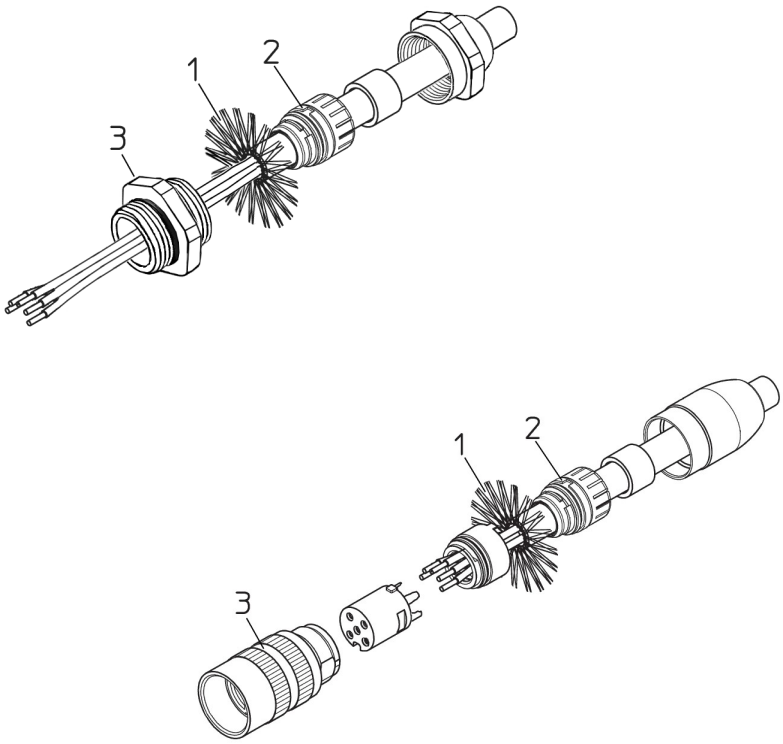
Pin	Function
1	not connected
2	Profibus A (Green)
3	not connected
4	Profibus B (Red)
5	not connected
Case	Shield

4.5 Ground connection (Figure 5)

Minimize noise by connecting the shield and/or the connector housing and/or the enclosure 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. You are advised to provide the ground connection as close as possible to the unit. We suggest using the ground point provided in the connection cap (see Figure 5, use one TCEI M3 x 6 cylindrical head screw with two tooth lock washers).

4.6 Shield connection

Disentangle and shorten the shielding **1** and then bend it over the part **2**; finally place the ring nut **3** of the connector. Be sure that the shielding **1** is in tight contact with the ring nut **3**.



4.7 POWER SUPPLY DIP switch (Figure 8)

WARNING
Power supply must be turned off before performing this operation!

The power supply voltage level to be provided to the connected encoder must be set through the POWER SUPPLY DIP switch located inside the enclosure of the converter. It must be according to the power supply voltage level required by the connected SSI encoder. To access the POWER SUPPLY DIP switch refer to the "4.1 Connection cap of the converter (Figure 5)" section on page 23.

Set the POWER SUPPLY DIP switch to UP position to provide +10Vdc +30Vdc power supply voltage level to the encoder (default setting); set the POWER SUPPLY DIP switch to DOWN position to provide +5Vdc ±5% power supply voltage level to the encoder.

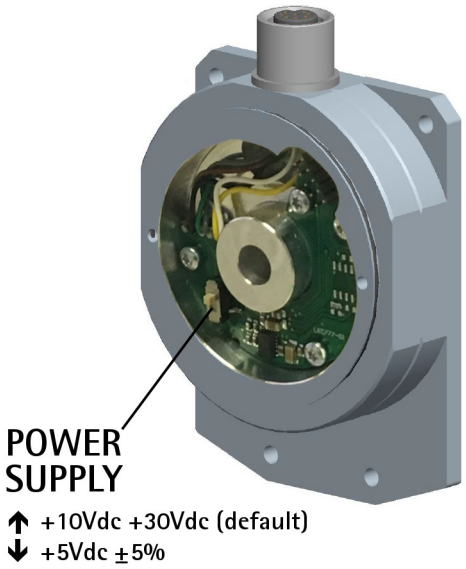
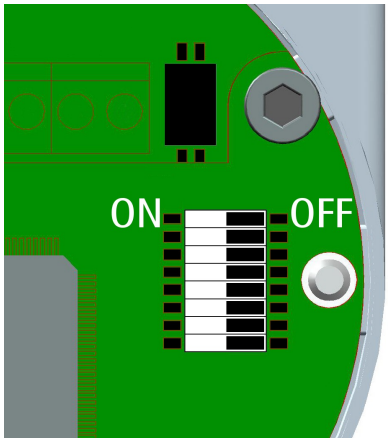


Figure 8

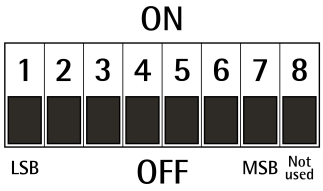
4.8 Node Address: DIP A (Figure 6 and Figure 7)

WARNING
Power supply must be turned off before performing this operation!

The node number must be set via hardware using the DIP A DIP switch.
Allowed addresses are from 0 to 125. The default value is 1.



DIP A:



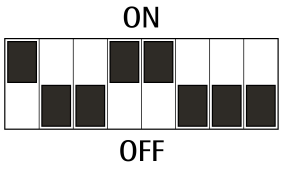
Turn the power supply off and set the node address in binary value; consider that: ON = 1, OFF = 0

bit	1 LSB	2	3	4	5	6	7 MSB	8 not used
	2^0	2^1	2^2	2^3	2^4	2^5	2^6	

EXAMPLE

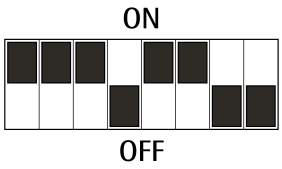
Set node address = 25:
25_{10} = 0001 1001$_2$ (binary value)

bit	1	2	3	4	5	6	7	8
	2^0	2^1	2^2	2^3	2^4	2^5	2^6	
	ON	OFF	OFF	ON	ON	OFF	OFF	OFF



Set node address = 55:
55_{10} = 0011 0111$_2$ (binary value)

bit	1	2	3	4	5	6	7	8
	2^0	2^1	2^2	2^3	2^4	2^5	2^6	
	ON	ON	ON	OFF	ON	ON	OFF	OFF



NOTE
After having set the device address, please check the bus termination switch position (see the "4.10 RT Bus termination (Figure 6 and Figure 7)" section on page 31).

4.9 Baud rate

The baud rate is set by the Master via software at configuration of the node (Slave).
This device supports the following baud rates (they are listed in the .GSD file too):
9.6 kbit/s, 19.2 kbit/s, 93.75 kbit/s, 187.5 kbit/s, 500 kbit/s, 1.5 Mbit/s, 3 Mbit/s, 6 Mbit/s, 12 Mbit/s.

The following table shows the maximum transmission rates in relation to permissible line length:

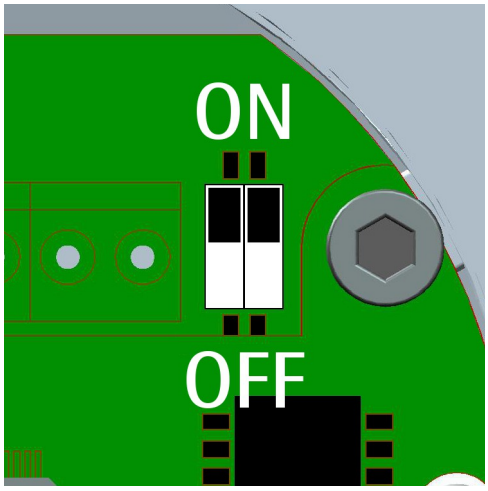
Baud rate [Kbit/s]	9.6	19.2	93.75	187.5	500	1500	12000
Max. cable length	1200 m 4000 ft	1200 m 4000 ft	1200 m 4000 ft	1000 m 3300 ft	400 m 1300 ft	200 m 660 ft	100 m 330 ft

4.10 RT Bus termination (Figure 6 and Figure 7)

WARNING
Power supply must be turned off before performing this operation!

A bus termination resistance is provided inside the encoder enclosure and must be activated as line termination if the encoder is at the ends of the transmission line (i.e. it is either the first or the last device in the transmission line).
Use RT Switch to activate or deactivate the bus termination.

RT	Description
1 = 2 = ON	Activated: if the encoder is the first or the last device in the transmission line
1 = 2 = OFF	Deactivated: if the encoder is not the first or the last device in the transmission line



4.11 Diagnostic LEDs (Figure 4)

Two LEDs located in the connection cap of the device are designed to show the operating or fault status of the Profibus-DP interface.

Fault (red)	Power (green)	Event
OFF	OFF	No power supply or hardware fault
OFF	ON	Correct operation (correct communication)
ON	Flashing	Configuration parameters not valid
Flashing	ON	Bus communication failure
Flashing	Flashing	Flash memory error

5 - Getting started

The following instructions allow the operator to quickly and safely set up the converter in a standard operational mode and to execute its main functions. For complete and detailed information please read the mentioned pages thoroughly.

- Mechanically install the device, see on page 20 ff;
- execute the electrical and network connections, see on page 23 ff;
- if required, set the power supply voltage level of the connected encoder, see on page 28;
- set the node address, see on page 29;
- set the line termination if required, see on page 31;
- switch on the +10Vdc +30Vdc power supply;
- in the software tool install the GSD file, see on page 35;
- set the characteristics of the connected SSI encoder:
  - set the number of SSI clocks next to the **Number of SSI clocks** parameter;
  - set the output code used by the SSI encoder to arrange the output information next to the **Code Type (BINARY/GRAY)** parameter;
  - set the protocol used by the SSI encoder to arrange the absolute information next to the **SSI Protocol** parameter;
  - set the physical resolution of the SSI encoder next to the **Physical pulse measure [nm]** parameter;
  - set the max. number of information the SSI encoder can output for the max. measuring range next to the **Physical Total Resolution [bits]** parameter;
- if you want to use the physical resolution (see the **Physical pulse measure [nm]** parameter), please check that the **Scaling function control** parameter is disabled (the bit 3 in the byte 10 = 0; see on page 46); the scaling function is available only for Class 2 devices (IF55-L Class 2 submodule);
- otherwise, if you need a custom resolution, enable the **Scaling function control** parameter (the bit 3 in the byte 10 = 1; see on page 46) and then set the resolution you need for your application next to the **Programmable pulse measure [nm]** parameter (see on page 52); the scaling function is available only for Class 2 devices (IF55-L Class 2 submodule);
- now you can set a custom measuring range next to the **Programmable Total Resolution [pulses]** parameter (see on page 56);
- if you need you can enter the Preset value next to the **Preset value** parameter and then set it in the desired position; see on page 61.

NOTE

Please consider that if the **Bypass** parameter (see on page 50) is set to "0" = disabled, the position value read by the encoder can be processed according to needs, so the user can scale the value, set a preset, and change the counting direction. On the contrary, if the **Bypass** parameter (see on page 50) is set to "1" = enabled, the information from the encoder is transmitted "as it is" and not processed in any way. The preset, scaling and counting direction functions -even if set and enabled- are ignored; also the output code setting is ignored. If, for example, the user sets a preset while the bypass mode is enabled, the value is accepted, but not activated. As soon as the bypass mode is disabled, the preset, scaling and counting direction functions -if set and enabled- become active and the **Position value** will be accordingly.

EXAMPLE

We need to connect an **SMA5-GA-50** linear encoder.

The main features of the linear encoder are:
Resolution: **0.05 mm** ("50" µm, see the order code in the product datasheet).
Max. measuring length: **5,035 mm** (see the "Mechanical Specifications" in the product datasheet).
Output code: **Gray code** ("GA", see the order code in the product datasheet).
SSI protocol: **25-bit "LSB Right Aligned" protocol** (see the User's manual).

Number of SSI clocks = 25
Code Type (BINARY/GRAY) = 1 = Gray code
SSI Protocol = 0 = 25-bit "LSB Right Aligned" protocol
Physical pulse measure [nm] = 50,000 (0.05 mm resolution = 50,000 nm resolution)
Physical Total Resolution [bits] = 17 (= Max. measuring length / Resolution = 5,035 / 0.05 = 100,700 ≈ 2^{17} = 17 bits)

If you want to use the physical resolution:
Scaling function control bit 3 in the byte 10 = 0

If you need a custom resolution (Class 2 devices only):
Scaling function control bit 3 in the byte 10 = 1
Programmable pulse measure [nm] ≥ **Physical pulse measure [nm]**

Programmable Total Resolution [pulses] ≤ 131,072 (= 5,035 / 0.05 = 100,700 information; max. value 2^{17} = 131,072); the user can set a custom measuring range

If you set a 0 preset along the path, when the encoder moves back and cross the zero, the value immediately after 0 will be $2^{\text{Physical Total Resolution [bits]}}$ - 1, i.e. 131,071 (assuming that **Programmable Total Resolution [pulses]** = 131,072).

...	131069	131070	131071	0	1	2	...

EXAMPLE
We need to connect a **SMAX-BG-100** linear encoder.

The main features of the linear encoder are:
Resolution: **0.1 mm** ("100" µm, see the order code in the product datasheet).
Max. measuring length: **600 mm** (see the "Mechanical Specifications" in the product datasheet).
Output code: **Binary code** ("BG", see the order code in the product datasheet).
SSI protocol: **"MSB Left Aligned" protocol** (see the User's manual).

Number of SSI clocks = 13, according to **Physical Total Resolution [bits]**
Code Type (BINARY/GRAY) = 0 = Binary code
SSI Protocol = 1 = "MSB Left Aligned" protocol
Physical pulse measure [nm] = 100,000 (0.1 mm resolution = 100,000 nm resolution)
Physical Total Resolution [bits] = 13 (= Max. measuring length / Resolution = 600 / 0.1 = 6,000 ≈ 2^{13} = 13 bits)

If you want to use the physical resolution:
Scaling function control bit 3 in the byte 10 = 0

If you need a custom resolution (Class 2 devices only):
Scaling function control bit 3 in the byte 10 = 1
Programmable pulse measure [nm] ≥ **Physical pulse measure [nm]**

Programmable Total Resolution [pulses] ≤ 8,192 (= 600 / 0.1 = 6,000 information; max. value 2^{13} = 8,192); the user can set a custom measuring range

If you set a 0 preset along the path, when the encoder moves back and cross the zero, the value immediately after 0 will be $2^{\text{Physical Total Resolution [bits]}}$ - 1, i.e. 8,191 (assuming that **Programmable Total Resolution [pulses]** = 8,192).

...	8189	8190	8191	0	1	2	...

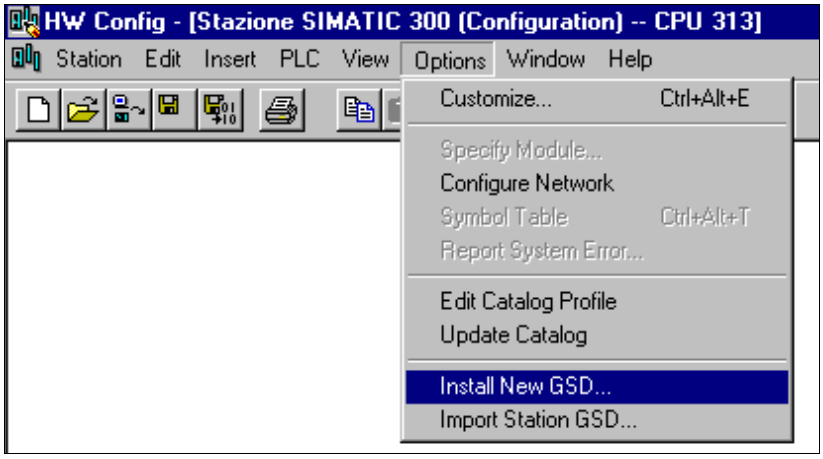
6 - Quick reference

6.1 STEP7 configuration

6.1.1 Importing the GSD file

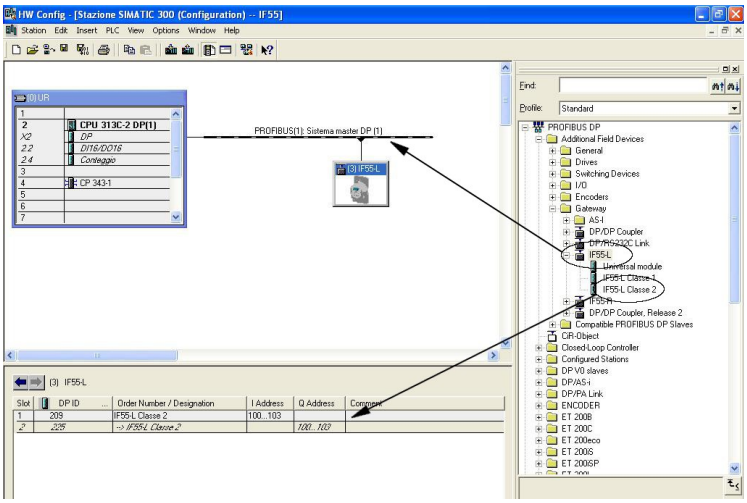
Profibus converters are supplied with their own GSD file **IFL_Vx.GSD** (see at the address **www.lika.biz > DISPLAYS & INTERFACES > SIGNAL CONVERTERS & INTERFACES (POSICONTROL)**.
GSD file is available in both English version (**IFL_Vx.GSE**) and Italian version (**IFL_Vx.GSI**).
GSD file has to be installed in the Profibus Master device.
Vx is intended to indicate the file version.
Please note that the rotary encoder converters and the linear encoder converters have different GSD files. Files for rotary encoders are marked with IFR- in the file name; while files for linear encoders are marked with IFL- in the file name.

In the menu bar of the **HW Config** window, press **Options** and then **Install New GSD...** command.
Select the correct GSD file in the installation window and install it.



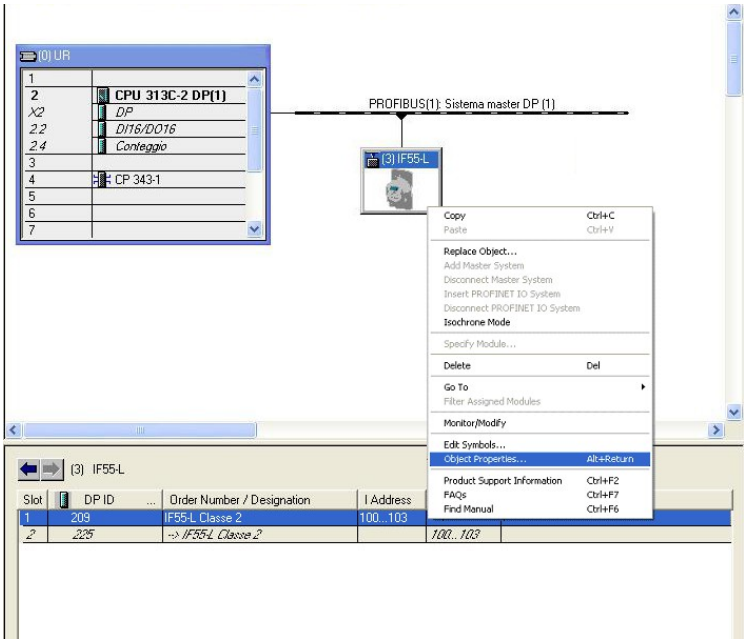
6.1.2 Adding a node to the project

In the side pane of the **HW Config** window, open the directory tree and select **Catalog\PROFIBUS_DP\Additional Field Devices\Gateway**; drag the "IF55-L" module to the main window and drop it on the bus line.
Then drag the desired submodule (Class 1 or Class 2) to the variables table in the bottom; in this way you set the class of the device (for further details on the available classes see the "7.2 Classes of the Device profile" section on page 42).

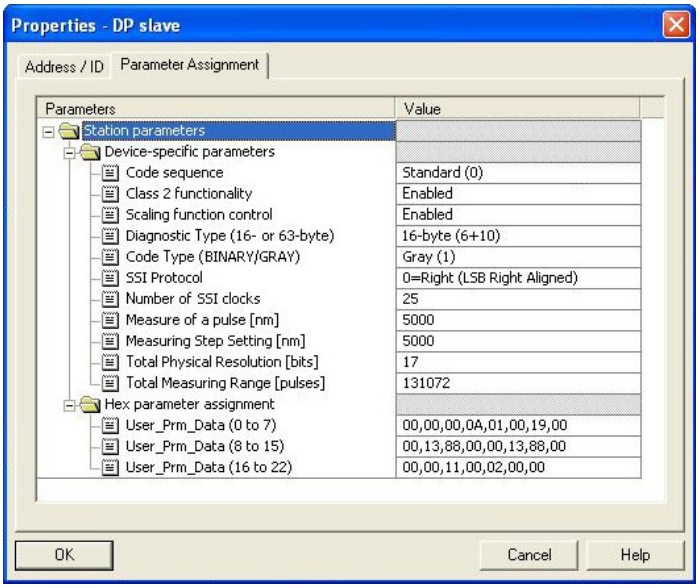


6.1.3 Converter configuration parameters

To enter the converter configuration parameters window, select the device in the submodule page in the bottom of the **HW Config** window and right-click to open the menu; then choose the **Object Properties...** command.



The **Properties – DP slave** window will appear; in the **Parameter Assignment** page the list of all converter parameters is available.
For any information on using and setting each parameter refer to the "7.4 DDLM_Set_Prm" section on page 44.



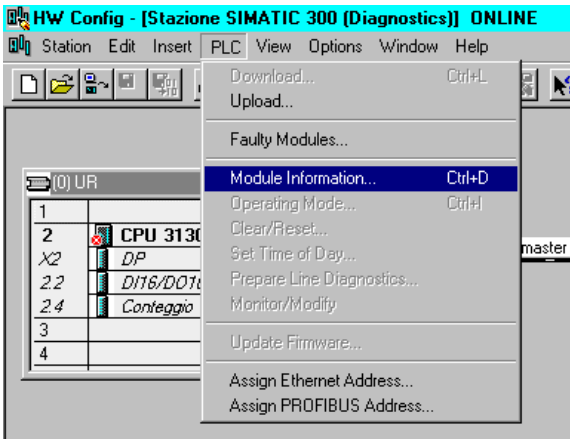
Example of parametrization of a Class 2 device

After having set new parameter values, press the **OK** button to close the **Properties – DP slave** window and then press the **Download** button (see the icon on the left) in the toolbar of the **HW Config** window to download set parameters.

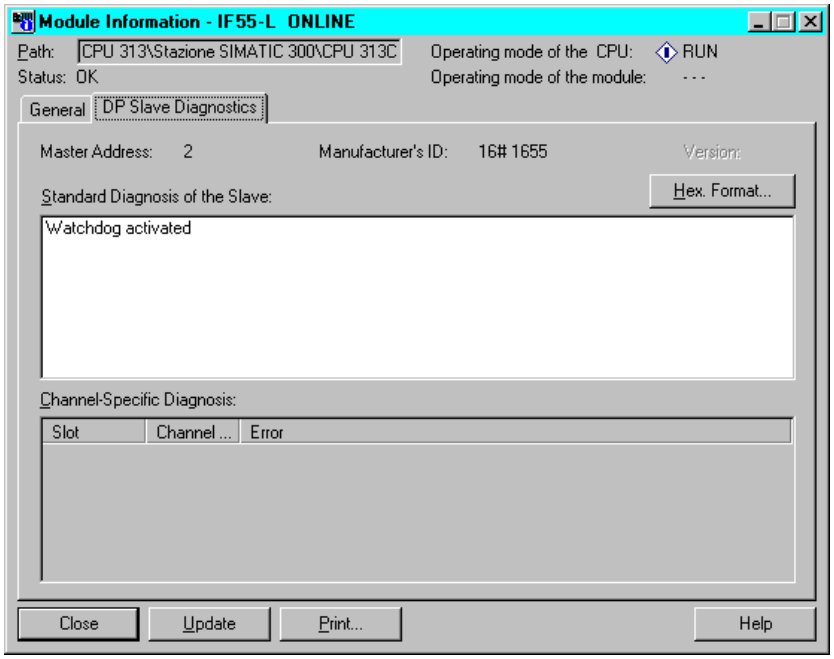
6.2 Reading the diagnostic information

The diagnostic information message can be set to either 16 or 63 bytes, see **Diagnostic type (16- or 63-byte)** in the encoder parameters.

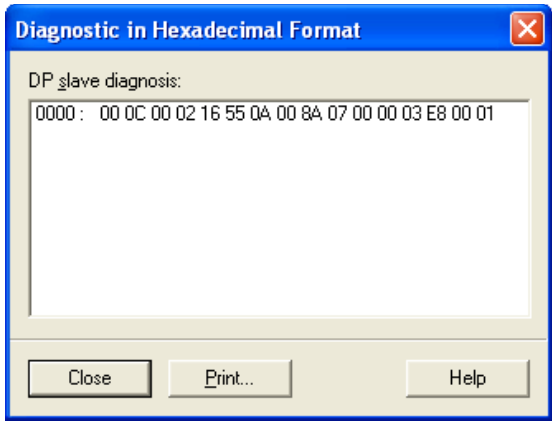
Before entering the diagnostic page, it is necessary to connect to the unit (enter online status). To do this, select **Station\Open online** in the **HW Config** window or click the **Online<->Offline** button (see the icon on the left). Then select **PLC\Module information...** to enter the **Module information** window. Finally open the **DP Slave Diagnostic** page.



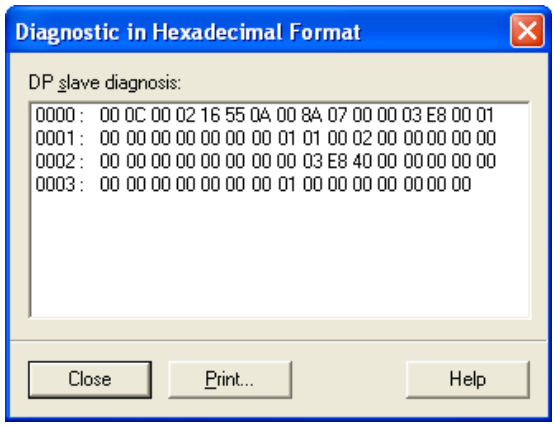
Click the **Hex. Format...** button to display the diagnostic information:



16-byte reduced diagnostics:



63-byte extended diagnostics:



NOTE

If the 63-byte diagnostics does not work properly with STEP7 software we suggest setting the 16-byte diagnostics.

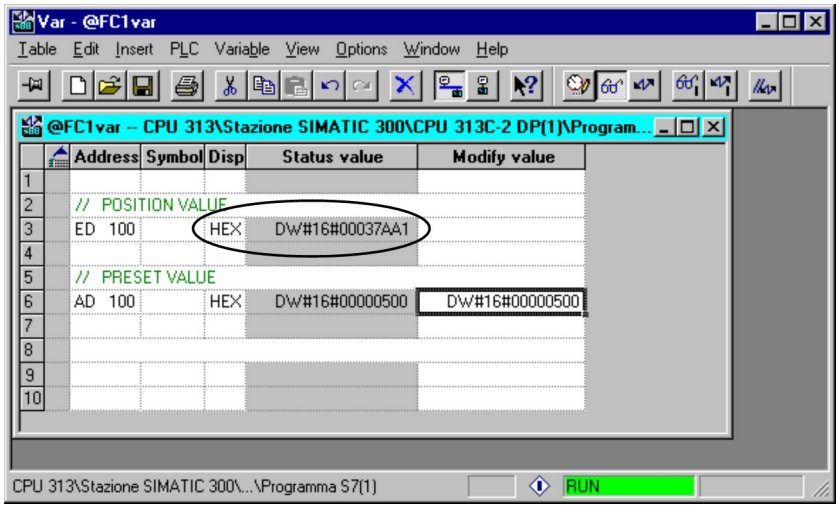
If the diagnostic information is not used, we recommend the 16-byte diagnostics to be set (see the "6.1.3 Converter configuration parameters" section on page 36).

See the "7.7 DDLM_Slave_Diag" section on page 63 for a complete list and meaning of each diagnostic byte.

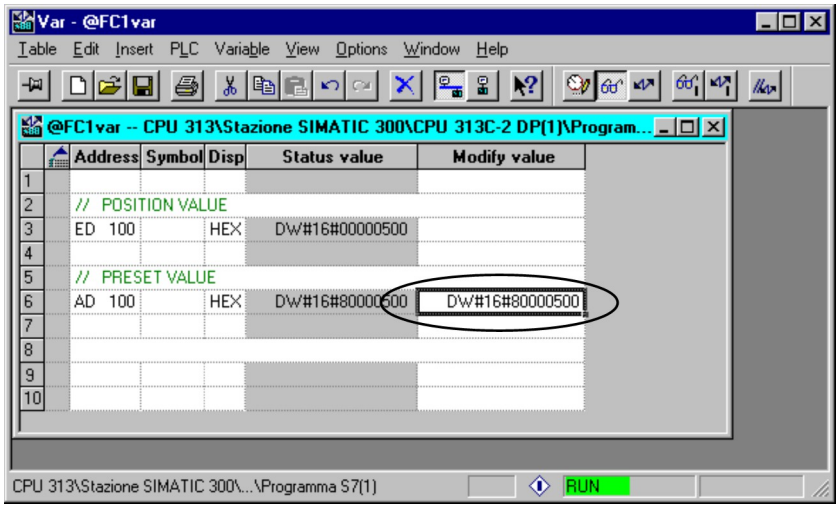
6.3 Setting the Preset value

EXAMPLE

The encoder having device address 1 transmits the **Position value** to the Master.
The **Position value** is loaded into variables ED 100...103 (4 bytes).
The **Preset value** is sent to the encoder using variables AD 100...103 (4 bytes).



The current position of the encoder is 0003 7AA1hex.
To set the **Preset value** = 0000 0500hex, set the bit 31 in the variable AD 100 = "1" (8000 0500hex).



Finally press the **Command variables** button in the Toolbar (see the icon here on the right).

Now the position of the encoder is 0000 0500hex.
To close the "Preset" procedure set the bit 31 of the variable AD 100 back to "0" and then press the **Command variables** button again.

NOTE

It may occur that data variables having index higher than 127 or data greater than 4 bytes are not treated properly in STEP7 software. Should this happen, we recommend "MD" reference operators (pointers) for encoder position and Preset to be used.

7 - Profibus® interface

Lika encoders with IF55 converters are Slave devices and comply with the "Profibus-DP Profile for Encoders"; they can be set as Class 1 or Class 2 devices (see the "7.2 Classes of the Device profile" section on page 42).
For any omitted information refer to the official Profibus website **www.profibus.com**.

7.1 GSD file

Profibus converters are supplied with their own GSD file **IFL_Vx.GSD** (see at **www.lika.biz > DISPLAYS & INTERFACES > SIGNAL CONVERTERS & INTERFACES (POSICONTROL)**.
GSD file is available in both English version (**IFL_Vx.GSE**) and Italian version (**IFL_Vx.GSI**).
GSD file has to be installed in the Profibus Master device.
Vx is intended to indicate the file version.
Please note that the rotary encoder converters and the linear encoder converters have different GSD files. Files for rotary encoders are marked with IFR- in the file name; while files for linear encoders are marked with IFL- in the file name.

7.2 Classes of the Device profile

Encoder class must be set when configuring the device.

Both Class 1 and Class 2 provide the parameters for setting the connected SSI encoder features, such as:

- SSI code type (see **Code Type (BINARY/GRAY)** parameter);
- SSI protocol (see **SSI Protocol** parameter);
- number of SSI clocks (see **Number of SSI clocks** parameter);
- encoder resolution (see **Physical pulse measure [nm]** and **Physical Total Resolution [bits]** parameters).

Mandatory **Class 1** provides the basic functions of the device and can be used for:

- sending the position value (see **Position value** parameter);
- changing the counting direction (see **Code sequence** parameter);
- setting the preset value (see **Preset value** parameter);
- acquiring reduced diagnostic information (see **16-byte reduced diagnostic** parameter).

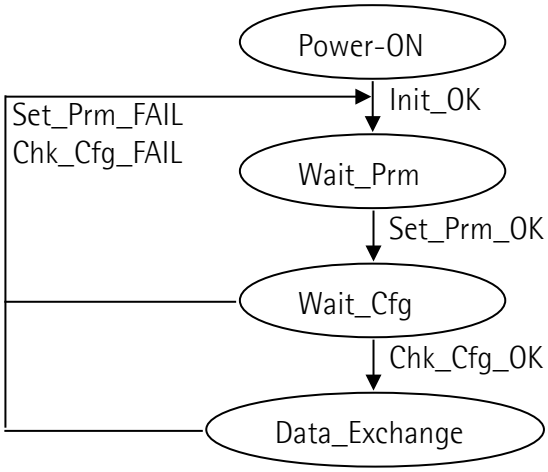
Class 2 provides all the Class 1 functions and additional advanced functions such as:

- scaling function (see **Scaling function control**, **Programmable pulse measure [nm]** and **Programmable Total Resolution [pulses]** parameters);

- extended diagnostic information (see **Diagnostic type (16- or 63-byte)** parameter).

7.3 Modes of operation

Profibus-DP devices allow operation using different communication modes (see the Figure below):



NOTE
All parameters -except for the **Preset value**- are transmitted in **Set_Prm** mode. **Preset value** is transmitted only in **Data_Exchange** mode.

Types of communication

Transmission of data between the Master and the Slave is carried out using the following types of messages:

- **DDLM_Set_Prm:**
  it is used for configuring the Slave. This communication mode is active immediately after the power is turned ON and used to send parameters from the Master to the Slave (see the "7.4 DDLM_Set_Prm" section on page 44).

- **DDLM_Chk_Cfg:**
  it sets the number of bytes used for data transmission in **Data_Exchange** mode (see the "7.5 DDLM_Chk_Cfg" section on page 59).

- **DDLM_Data_Exchange:**
  it is used as "standard operation mode".
  Used by the Master to send the **Preset value**; used by the Slave to transmit the position value (see the "7.6 DDLM_Data_Exchange" section on page 60).

- **DDLM_Slave_Diag:**
  it is used when the power is turned on and whenever the Master needs to know diagnostic information from the Slave device (see the "7.7 DDLM_Slave_Diag" section on page 63).

7.4 DDLM_Set_Prm

When the system is turned on, configuration data set by the operator is sent to the absolute encoder by the controller. Parameters transmission depends on the configuration chosen by the operator. Customarily data is sent automatically while data setting is carried out through a user's interface available in the controller's software (for instance, STEP7, see the "6.1 STEP7 configuration" section on page 35).
However sometimes it is necessary to set some bits and bytes according to the working specifications you want to set.
Data transmission is carried out in compliance with the values set for the encoder profile and shown in the following tables.

DDLM_Set_Prm with Class 1 (IF55-L Class 1 submodule):

Byte	Parameter	
0 ... 9	Reserved for PROFIBUS network	
10	Operating parameters	
	bit 0	Code sequence
	bits 1 ... 5	Reserved
	bit 6	16-byte reduced diagnostic
	bit 7	Reserved
11	bit 0	Code Type (BINARY/GRAY)
	bit 1	SSI Protocol
	bit 2	Bypass
	bits 3 ... 7	Reserved
12	Reserved	
13	Number of SSI clocks	
14 ... 17	Physical pulse measure [nm]	
18 ... 21	Reserved	
22 ... 25	Physical Total Resolution [bits]	

DDLM_Set_Prm with Class 2 (IF55-L Class 2 submodule):

Byte	Parameter	
0 ... 9	Reserved for PROFIBUS network	
10	Operating parameters	
	bit 0	Code sequence
	bit 1	Class 2 functionality
	bit 2	Reserved
	bit 3	Scaling function control
	bits 4, 5	Reserved
	bit 6	Diagnostic type (16- or 63-byte)
	bit 7	Reserved
11	0	Code Type (BINARY/GRAY)
	1	SSI Protocol
	bit 2	Bypass
	bits 3 ... 7	Reserved
12	Reserved	
13	Number of SSI clocks	
14 ... 17	Physical pulse measure [nm]	
18 ... 21	Programmable pulse measure [nm]	
22 ... 25	Physical Total Resolution [bits]	
26 ... 29	Programmable Total Resolution [pulses]	

7.4.1 Byte 10 - Operating parameters 1

Bit	Function	bit = 0	bit = 1
0	Code sequence	**Standard**	Inverted
1	Class 2 functionality	Disabled	**Enabled**
2	Reserved		
3	Scaling function control	Disabled	**Enabled**
4, 5	Reserved		
6	Diagnostic type (16- or 63-byte)	**16-byte (6+10)**	63-byte (6+57)
7	Reserved		

Default values are highlighted in **bold**.

Code sequence

This is intended to set if the count is increasing (count up information) either when the encoder moves in the standard direction (it is indicated in the encoder's manual) or when the encoder moves in reverse of the standard direction. Setting 0 (bit 0 Code sequence = 0 = STANDARD) causes the encoder counting to increment when the encoder moves in the standard direction;

setting 1 (bit 0 **Code sequence** = 1 = INVERTED) causes the encoder counting to increment when the encoder moves in reverse of the standard direction.
For any information on the standard and inverted counting direction please refer to the specific manual of the encoder.
Default = 0 (min. = 0, max. = 1)

WARNING
Changing this value causes also the position calculated by the controller to be necessarily affected. Every time you change the **Code sequence**, then you are required to set a new preset value (see the **Preset value** parameter).

NOTE
Please consider that if the **Bypass** parameter (see on page 50) is set to "1" = enabled, the counting direction function -if set differently from default- is ignored.

Class 2 functionality

This is only available when the encoder Class 2 is installed (IF55-L Class 2 submodule).
Two device classes are defined in the encoder profile, one mandatory class (Class 1) and an optional class with advanced functions (Class 2). This converter implements functions of both Class 1 and Class 2 for encoders. For any information on the available encoder classes see the "7.2 Classes of the Device profile" section on page 42.
0 = Disabled = Encoder Class 1 is set.
1 = Enabled = Encoder Class 2 is set.
Default = 1 (min. = 0, max. = 1)

Scaling function control

This is only available when the encoder Class 2 is installed (IF55-L Class 2 submodule).
When this option is disabled (bit 3 **Scaling function control** = 0 = DISABLED), the device uses the physical resolution and the max. number of physical information to arrange the absolute position information (see **Physical pulse measure [nm]** and **Physical Total Resolution [bits]** parameters; **Programmable pulse measure [nm]** and **Programmable Total Resolution [pulses]** parameters are ignored).
On the contrary, if it is enabled (bit 3 **Scaling function control** = 1 = ENABLED), the custom resolution and the number of information set in the **Programmable pulse measure [nm]** and **Programmable Total Resolution [pulses]** parameters are used to calculate the position information.
Default = 1 (min. = 0, max. = 1)

WARNING

When you enable the scaling function (**Scaling function control** = 1), please enter scaled values next to the **Programmable pulse measure [nm]** and **Programmable Total Resolution [pulses]** parameters that are consistent with the physical values. In the case of inconsistent values, the system does not go online and visually warns about the wrong parametrization and fault condition by means of the diagnostic LEDS.

WARNING

When you enable the scaling function (**Scaling function control** = 1), a counting error, i.e. a jump in the position count, may occur if the following conditions arise:

- a physical zero setting has been performed in the encoder;
- the **Programmable pulse measure [nm]** parameter value is not a multiple of the physical resolution as set next to the **Physical pulse measure [nm]** parameter;
- the measuring range (**Programmable Total Resolution [pulses]** parameter) is not a power of 2 submultiple of the maximum measuring range.

If the above described conditions arise, a counting error may occur when the sensor crosses the physical zero point.
If the scaling function is disabled (**Scaling function control** = 0), the transmitted position values are always consistent.
If the scaling function is enabled (**Scaling function control** = 1) yet no physical zero setting has been performed in the linear sensor, the transmitted position values are always consistent.
If the scaling function is enabled (**Scaling function control** = 1), the **Programmable pulse measure [nm]** parameter value is a multiple of the physical resolution and the measuring range (**Programmable Total Resolution [pulses]** parameter) is a power of 2 submultiple of the maximum measuring range, the transmitted position values are consistent, regardless of the physical zero setting.

The **scaling conversion constant** (**k**) has to be as follows:

$$k = \frac{\text{Physical pulse measure [nm]}}{\text{Programmable pulse measure [nm]}} \leq 1$$

The value in the **Programmable pulse measure [nm]** parameter has to be equal to or greater than the value in the **Physical pulse measure [nm]** parameter.
If the scaling function is enabled (**Scaling function control** = 1), the following condition has to be met:

Programmable Total Resolution [pulses] ≤ k * Physical Total Resolution [bits]

WARNING

Every time you enable the scaling function and/or change the scaling values (see the **Programmable Total Resolution [pulses]** and **Programmable pulse measure [nm]** parameters) then you are required to set a new preset value (see the **Preset value** parameter).

WARNING

You can activate new values next to the **Programmable pulse measure [nm]** and **Programmable Total Resolution [pulses]** parameters only if **Class 2 functionality** = ENABLED; if **Scaling function control** = ENABLED the set custom resolution values are enabled and used by the encoder; on the contrary, if **Scaling function control** = DISABLED you are allowed to set new resolution values, however they are not enabled even if sent to the encoder: the encoder still goes on using the physical values, NOT the new entered values, until you enable the **Scaling function control**.

NOTE

Please consider that if the **Bypass** parameter (see on page 50) is set to "1" = enabled, the scaling function -if set differently from default- is ignored.

16-byte reduced diagnostic

This is only available when the encoder Class 1 is installed (IF55-L Class 1 submodule).
Class 1 devices only provide reduced 16-byte diagnostic.
The meaning of each diagnostic byte is detailed in the "7.7 DDLM_Slave_Diag" section on page 63.
Default = 0 (min. = 0, max. = 0)

Diagnostic type (16- or 63-byte)

This is only available when the encoder Class 2 is installed (IF55-L Class 2 submodule).
It allows to set either reduced or extended diagnostics.
0 = Reduced = 16-byte diagnostic information
1 = Extended = 63-byte diagnostic information
The meaning of each diagnostic byte is detailed in the "7.7 DDLM_Slave_Diag" section on page 63.
Default = 0 (min. = 0, max. = 1)

7.4.2 Byte 11 - Operating parameters 2

Bit	Function	bit = 0	bit = 1
0	Code Type (BINARY/GRAY)	**Binary**	Gray
1	SSI Protocol	**Right (LSB Right Aligned)**	Left (MSB Left Aligned)
2	Bypass	**Disabled**	Enabled
3 ... 7	Reserved		

Default values are highlighted in **bold**.

Code Type (BINARY/GRAY)

It sets the output code used by the SSI encoder to output the absolute position information. The output code can be Binary (bit 0 Code Type (BINARY/GRAY) = 0) or Gray (bit 0 Code Type (BINARY/GRAY) = 1). For any information on the output code please refer to the "User's manual" of the connected encoder.
Default = 0 (min. = 0, max. = 1)

EXAMPLE
We need to connect the following linear encoder: **SMA5-GA-50**.
SMA5 encoder uses the Gray code to output the absolute position information. Thus you have to set the value 1 = Gray in this bit. For further information refer to the "User's manual".

EXAMPLE
We need to connect the following linear encoder: **SMAX-BG-100**.
"BG" in the order code means that "MSB Left Aligned" protocol and Binary code are used to arrange the absolute position information. Thus you have to set the value 0 = Binary in this bit. For further information refer to the "User's manual".

SSI Protocol

It sets the SSI protocol used by the SSI encoder to arrange the absolute position information. The SSI protocol can be the 25-bit "LSB Right Aligned" protocol (bit 1 SSI Protocol = 0) or the "MSB Left Aligned" protocol (bit 1 SSI Protocol = 1). For any information on the SSI protocol please refer to the "User's manual" of the connected encoder.
Default = 0 (min. = 0, max. = 1)

EXAMPLE
We need to connect the following linear encoder: **SMA5-GA-50**.
SMA5 encoder uses the 25-bit "LSB Right Aligned" protocol to arrange the absolute position information. Thus you have to set the value 0 in this bit. For further information refer to the "User's manual".

EXAMPLE
We need to connect the following linear encoder: **SMAX-BG-100**.
"BG" in the order code means that "MSB Left Aligned" protocol and Binary code are used to arrange the absolute position information. Thus you have to set the value 1 in this bit. For further information refer to the "User's manual".

Bypass
If the bit 2 **Bypass** = 0 = disabled, the "Bypass mode" is disabled, that is: the position value (refer to the **Position value** parameter on page 60) read by the encoder can be processed according to needs, so the user can scale the value, set a preset and change the counting direction.
If the bit 2 **Bypass** = 1 = enabled, the "Bypass mode" is enabled, that is: the information from the encoder is transmitted "as it is" and not processed in any way. The preset, scaling and counting direction functions -even if set and enabled- are ignored. If, for example, the user sets a preset while the "Bypass mode" is enabled, the value is accepted, but not activated. As soon as the "Bypass mode" is disabled, the preset, scaling and counting direction functions -if set and enabled- become active and the **Position value** will be accordingly.
Default = 0 (min. = 0, max. = 1)

7.4.3 Byte 13

Number of SSI clocks
It sets the number of SSI clocks required by the SSI encoder to send the complete data word. The number of clocks depends on the max. number of information and the type of SSI protocol. The value has to be comprised between 1 and 32. For any information on the SSI clocks required please refer to the "User's manual" of the connected encoder.
Default = 32 (min. = 1, max. = 32)

NOTE
If the bit 1 **SSI Protocol** = 1 = "MSB Left Aligned" protocol (see on page 49), the **Number of SSI clocks** must be equal to the number of bits of the total physical resolution (**Physical Total Resolution [bits]** parameter).

EXAMPLE
We need to connect the following linear encoder: **SMA5-GA-50**.
SMA5 encoder always requires 25 clocks (the length of the word is always 25 bits, regardless of the max. number of information to provide). Thus you have to set 25 here. For further information refer to the "User's manual".

EXAMPLE
We need to connect the following linear encoder: **SMAX-BG-100**.
The number of clocks depends on the max. number of information (see the example in the following parameter). Let's say the max. number of information is 6,000, thus it requires 13 clocks. You have to set 13 here. For further information refer to the "User's manual".

7.4.4 Bytes 14 ... 17

Physical pulse measure [nm]

Byte	14	15	16	17
Bit	31-24	23-16	15-8	7-0
Data	2^{31} to 2^{24}	2^{23} to 2^{16}	2^{15} to 2^{8}	2^{7} to 2^{0}

WARNING
This parameter is active only if the **Scaling function control** parameter is set to "=0"; otherwise it is ignored and the system uses the custom values (**Programmable pulse measure [nm]** and **Programmable Total Resolution [pulses]**) to calculate the position information.
Furthermore, if the **Bypass** parameter (see on page 50) is set to "1" = enabled, the scaling function -even if enabled- is ignored and the position information is outputted as it is.

It sets the physical resolution of the linear encoder expressed in nanometres (nm). The value has to be comprised between 1 and 1 000 000 (1 mm). Usually the physical resolution can be read in the order code (see the product datasheet).
Default = 5000 (min. = 1, max. = 1 000 000)

EXAMPLE
We need to connect the following linear encoder: **SMA5-GA-50**.
As you can see in the product datasheet, "50" in the order code means a 0.05 mm resolution = 50,000 nm resolution. Thus you have to set the value 50,000 here. For further information refer also to the "User's manual".

EXAMPLE
We need to connect the following linear encoder: **SMAX-BG-100**.
As you can see in the product datasheet, "100" in the order code means a 0.1 mm resolution = 100,000 nm resolution. Thus you have to set the value 100,000 here. For further information refer also to the "User's manual".

7.4.5 Bytes 18 ... 21

Programmable pulse measure [nm]

Byte	18	19	20	21
Bit	31-24	23-16	15-8	7-0
Data	2^{31} to 2^{24}	2^{23} to 2^{16}	2^{15} to 2^{8}	2^{7} to 2^{0}

WARNING

This is only available when the encoder Class 2 is installed (IF55-L Class 2 submodule).

You can activate a new value next to the **Programmable pulse measure [nm]** parameter only if **Class 2 functionality** = ENABLED; if **Scaling function control** = ENABLED the set resolution values are enabled and used by the encoder; on the contrary, if **Scaling function control** = DISABLED you are allowed to set new resolution values and they are accepted, however the encoder still goes on using the physical values, NOT the new entered values, until you enable the **Scaling function control**. See the "7.4.1 Byte 10 - Operating parameters 1" section on page 45.

Furthermore, if the **Bypass** parameter (see on page 50) is set to "1" = enabled, the scaling function -even if enabled- is ignored and the position information is outputted as it is.

If **Class 2 functionality** = DISABLED or **Scaling function control** = DISABLED, then **Programmable pulse measure [nm]** = **Physical pulse measure [nm]**.

This parameter is used to set a custom resolution (otherwise referred to as measuring step) expressed in nanometres [nm].

The resolution can be defined as the smallest change in the underlying quantity that produces a response in the measurement, the response being the information that is provided to output.

The custom resolution value must be greater than or equal to the physical resolution of the connected encoder.

We suggest setting a value that is a multiple of the physical resolution as set next to the **Physical pulse measure [nm]** parameter not to cause a counting error, i.e. a jump in the position count when the sensor crosses the physical zero point (see the WARNING below).

Default = 5000 (min. = 1, max. = 1 000 000)

WARNING

When you enable the scaling function (**Scaling function control** = 1), please enter scaled values next to the **Programmable pulse measure [nm]** and **Programmable Total Resolution [pulses]** parameters that are consistent with the physical values. In the case of inconsistent values, the system does not go online and visually warns about the wrong parametrization and fault condition by means of the diagnostic LEDS.

EXAMPLE

We need to connect the following linear encoder: **SMA5-GA-50**.
As you can see in the product datasheet, "50" in the order code means a **0.05 mm resolution** = 50,000 nanometres resolution. The user has to confirm this value in the **Physical pulse measure [nm]** parameter; if the **Scaling function control** parameter is disabled the system uses the physical resolution to calculate the position information. After enabling the **Scaling function control** parameter the system uses the custom resolution set next to the **Programmable pulse measure [nm]** parameter: it must be greater than or equal to 50,000.

EXAMPLE

We need to connect the following linear encoder: **SMAX-BG-100**.
As you can see in the product datasheet, "100" in the order code means a **0.1 mm resolution** = 100,000 nanometres resolution. The user has to confirm this value in the **Physical pulse measure [nm]** parameter; if the **Scaling function control** parameter is disabled the system uses the physical resolution to calculate the position information. After enabling the **Scaling function control** parameter the system uses the custom resolution set next to the **Programmable pulse measure [nm]** parameter: it must be greater than or equal to 100,000.

WARNING

When you enable the scaling function (**Scaling function control** = 1), a counting error, i.e. a jump in the position count, may occur if the following conditions arise:

- a physical zero setting has been performed in the linear sensor;
- the **Programmable pulse measure [nm]** parameter value is not a multiple of the physical resolution as set next to the **Physical pulse measure [nm]** parameter;
- the measuring range (**Programmable Total Resolution [pulses]** parameter) is not a power of 2 submultiple of the maximum measuring range.

If the above described conditions arise, a counting error may occur when the sensor crosses the physical zero point.
If the scaling function is disabled (**Scaling function control** = 0), the transmitted position values are always consistent.
If the scaling function is enabled (**Scaling function control** = 1) yet no physical zero setting has been performed in the linear sensor, the transmitted position values are always consistent.
If the scaling function is enabled (**Scaling function control** = 1), the **Programmable pulse measure [nm]** parameter value is a multiple of the physical resolution and the measuring range is a power of 2 submultiple of the maximum measuring range, the transmitted position values are consistent, regardless of the physical zero setting.

NOTE
If you have set and activated the preset, when you change the value next to the **Programmable pulse measure [nm]** parameter, then you must check the value in the **Preset value** parameter and perform the homing operation.

EXAMPLE
The main and default features of the **SMAX-BG-100** linear encoder are as follows:

- **Default resolution** = 0.1 mm = 100,000 nm
- **MTAX max. measuring length** = 600 mm
- **Max. number of information** = 6,000 (13 bits)

As stated, the max. number of information provided to output is calculated as follows:

$$\text{Number of information} = \frac{\text{Max. measuring length}}{\text{Resolution}}$$

Thus, in a default configuration the number of information is:

$$\text{Number of information} = \frac{\text{Max. measuring length}}{\text{Resolution}} = \frac{600}{0.1} = 6000$$

Let's assume that you need **2000 information** to be provided to output for the max. measuring length. It follows that you need to calculate and then set a custom resolution.
The resolution value results from the following calculation:

$$\text{Resolution} = \frac{\text{Max. measuring length}}{\text{Number of information}}$$

Thus, in the example the resolution will be:

$$\text{Resolution} = \frac{\text{Max. measuring length}}{\text{Number of information}} = \frac{600}{2000} = 0.3$$

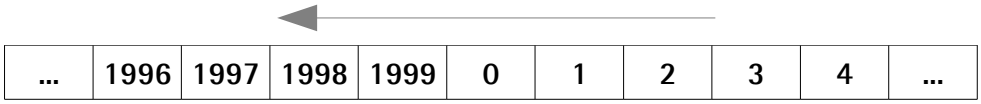
As the value next to the **Programmable pulse measure [nm]** parameter has to be expressed in nanometres, then you have to enter the value **300,000**.

The complete programming sequence will be:

1. Enable the **Scaling function control**: bit 3 of byte 10 = 1
2. Set the custom resolution: **Programmable pulse measure [nm]** = 300,000
3. Set the custom number of information: **Programmable Total Resolution [pulses]** = 2,000

NOTE

Please note that, if you set a preset along the path, when the encoder moves back and cross the zero, the value immediately after 0 will be 1,999 as shown below.



7.4.6 Bytes 22 ... 25

Physical Total Resolution [bits]

Byte	22	23	24	25
Bit	31-24	23-16	15-8	7-0
	MSbyte	...	...	LSbyte

WARNING

This parameter is active only if the **Scaling function control** parameter is set to "=0"; otherwise it is ignored and the system uses the custom values (**Programmable pulse measure [nm]** and **Programmable Total Resolution [pulses]**) to calculate the position information.
Furthermore, if the **Bypass** parameter (see on page 50) is set to "1" = enabled, the scaling function -even if enabled- is ignored and the position information is outputted as it is.

It sets the max. number of information (expressed in bits) the SSI encoder can output for the max. measuring length. The value depends on the encoder resolution and the max. measuring length and has to be comprised between 1 and 30. For any information on the max. number of information please refer to the "User's manual" of the connected encoder.
Default = 30 (min. = 1, max. = 30)

EXAMPLE

We need to connect the following linear encoder: **SMA5-GA-50**. Its resolution is 0.05 mm (see the order code).

The max. measuring length of the the SMA5 linear encoder on the MTA5 scale is 5,035 mm.
The max. number of information the encoder can output results from the following calculation:

$$\text{Total Physical Resolution} = \frac{\text{Max. measuring range}}{\text{Resolution}}$$

$$\text{Total Physical Resolution} = \frac{5{,}035}{0.05} = \mathbf{100{,}700}$$

Now you have to "round up" the result to the next highest power of 2, that is: 131,072 = 2^{17}. Thus the number of bits is "17". The value to be set here is 17.

EXAMPLE
We need to connect the following linear encoder: **SMAX-BG-100**. Its resolution is 0.1 mm (see the order code).
The max. measuring length of the SMAX linear encoder on the MTAX scale is 600 mm.
The max. number of information the encoder can output results from the following calculation:

$$\text{Total Physical Resolution} = \frac{\text{Max. measuring range}}{\text{Resolution}}$$

$$\text{Total Physical Resolution} = \frac{600}{0.1} = \mathbf{6{,}000}$$

Now you have to "round up" the result to the next highest power of 2, that is: 8,192 = 2^{13}. Thus the number of bits is "13". The value to be set here is 13.

7.4.7 Bytes 26 ... 29
Programmable Total Resolution [pulses]

Byte	26	27	28	29
Bit	31-24	23-16	15-8	7-0
	MSbyte	...	...	LSbyte

WARNING
This is only available when the encoder Class 2 is installed (IF55-L Class 2 submodule).

You can activate a new value next to the **Programmable Total Resolution [pulses]** parameter only if **Class 2 functionality** = ENABLED; if **Scaling function control** = ENABLED the set resolution values are enabled and used by the encoder; on the contrary, if **Scaling function control** = DISABLED you are allowed to set new resolution values and they are accepted, however the encoder still goes on using the physical values, NOT the new entered values, until you enable the **Scaling function control**. See the "7.4.1 Byte 10 - Operating parameters 1" section on page 45.
Furthermore, if the **Bypass** parameter (see on page 50) is set to "1" = enabled, the scaling function -even if enabled- is ignored and the position information is outputted as it is.

If **Class 2 functionality** = DISABLED or **Scaling function control** = DISABLED, then **Programmable Total Resolution [pulses]** = $2^{\text{Physical Total Resolution [bits]}}$.
If the scaling function is enabled (**Scaling function control** = 1), the following condition has to be met:

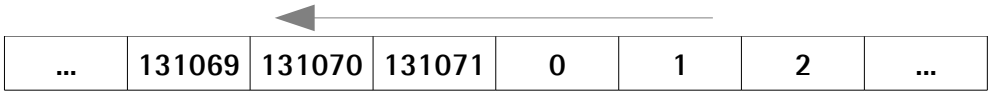
Programmable Total Resolution [pulses] ≤ k * Physical Total Resolution [bits]

It sets the length of the travel the encoder has to measure. The value is expressed in number of information. It has to be comprised between 1 and 2^{30} = 1 073 741 824.
It can be either the number of information for the max. measuring length (for instance, if the application needs the whole path); or the number of information for just a part of the scale if the application only uses a section of the scale. Thus this value must be lower than or equal to the number of information resulting from the scale max. measuring length ($2^{\text{Physical Total Resolution [bits]}}$).
We suggest setting a value that is a power of 2 submultiple of the maximum measuring range (**Physical Total Resolution [bits]**) not to cause a counting error, i.e. a jump in the position count when the sensor crosses the physical zero point (see the WARNING below).
Default = 1 073 741 824 (min. = 1, max. = 1 073 741 824)

WARNING
When you enable the scaling function (**Scaling function control** = 1), please enter scaled values next to the **Programmable pulse measure [nm]** and **Programmable Total Resolution [pulses]** parameters that are consistent with the physical values. In the case of inconsistent values, the system does not go online and visually warns about the wrong parametrization and fault condition by means of the diagnostic LEDS.

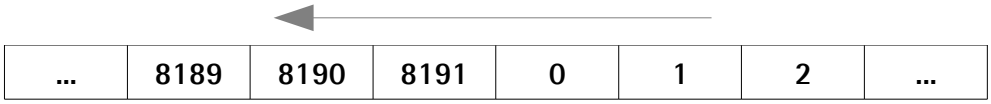
EXAMPLE
We need to connect the following linear encoder: **SMA5-GA-50**.
As you can see in the product datasheet, "50" in the order code means a 0.05 mm resolution. Let's say the mechanical travel of our application is the max.

measuring length the SMA5 linear encoder is allowed to run on the MTA5 scale, i.e. 5035 mm. Thus the max. number of information is 100,700 ≈ 17 bits (for the complete explanation refer to the **Physical Total Resolution [bits]** parameter). If you need a custom measuring range, you need to enable the **Scaling function control** and then set a value lower than 2^{17} = 131,072 here.
If you set a preset along the path, when the encoder moves back and cross the zero, the value immediately after 0 will be $2^{\text{Physical Total Resolution [bits]}}$ - 1, i.e. 131,071.



...	131069	131070	131071	0	1	2	...

EXAMPLE
We need to connect the following linear encoder: **SMAX-BG-100**.
As you can see in the product datasheet, "100" in the order code means a 0.1 mm resolution. Let's say the mechanical travel of our application is the max. measuring length the SMAX linear encoder is allowed to run on the MTAX scale, i.e. 600 mm. Thus the max. number of information is 6,000 ≈ 13 bits (for the complete explanation refer to the **Physical Total Resolution [bits]** parameter). If you need a custom measuring range, you need to enable the **Scaling function control** and then set a value lower than 2^{13} = 8,192 here.
If you set a preset along the path, when the encoder moves back and cross the zero, the value immediately after 0 will be $2^{\text{Physical Total Resolution [bits]}}$ - 1, i.e. 8,191.



...	8189	8190	8191	0	1	2	...

EXAMPLE
We need to connect an **SMA5-GA-50**, its physical resolution is 0.05 mm. Let's say the mechanical travel of our application is 1000 mm. Thus the max. number of information is 20,000 ≈ 15 bits (for the complete explanation refer to the **Physical Total Resolution [bits]** parameter). Thus you must enable the **Scaling function control** parameter and set here the value 20,000 (instead of the physical value 131,072).
In this way you will obtain several 20,000 information sections following each other all along the whole measuring length. The position information will be from 0 to 19,999; then again from 0 to 19,999 and so on.

...	19997	19998	19999	0	1	2	...	19997	19998	19999	0	1	2	...

← max measuring length →

WARNING

When you enable the scaling function (**Scaling function control** = 1), a counting error, i.e. a jump in the position count, may occur if the following conditions arise:

- a physical zero setting has been performed in the linear sensor;
- the **Programmable pulse measure [nm]** parameter value is not a multiple of the physical resolution as set next to the **Physical pulse measure [nm]** parameter;
- the measuring range (**Programmable Total Resolution [pulses]** parameter) is not a power of 2 submultiple of the maximum measuring range.

If the above described conditions arise, a counting error may occur when the sensor crosses the physical zero point.
If the scaling function is disabled (**Scaling function control** = 0), the transmitted position values are always consistent.
If the scaling function is enabled (**Scaling function control** = 1) yet no physical zero setting has been performed in the linear sensor, the transmitted position values are always consistent.
If the scaling function is enabled (**Scaling function control** = 1), the **Programmable pulse measure [nm]** parameter value is a multiple of the physical resolution and the measuring range is a power of 2 submultiple of the maximum measuring range, the transmitted position values are consistent, regardless of the physical zero setting.

WARNING

When you change the value next to **Programmable Total Resolution [pulses]** parameter, then you must check the value in the **Preset value** parameter and perform the preset operation.

7.5 DDLM_Chk_Cfg

The Configuration function allows the Master to send configuration data to the Slave for any check operation. The main purpose of this function is to set the number of bytes used for the Data_Exchange as viewed from the Master side.

Chk_Cfg message structure (1 byte):

bit 7	= Consistency (="1")
bit 6	= Word format ("0"=byte,"1"=word=4bytes)
bits 5 and 4	= In/out data ("01"=Input, "10"=output)
bits 3 ... 0	= Length code

EXAMPLE

bit	7	6	5	4	3	2	1	0	
Data	1	1	0	1	0	0	0	1	D1h
	1	1	1	0	0	0	0	1	E1h

Class 1 and Class 2:
D1hex = 4 byte input
E1hex = 4 byte output

7.6 DDLM_Data_Exchange

This is the normal operation status of the system. The Slave (for both Class 1 and Class 2) can transmit the **Position value** and receive the **Preset value** from the Master.

Position value

when either Class 1 or Class 2 is set (Encoder → Master)

Byte	1	2	3	4
Bit	31-24	23-16	15-8	7-0
	MSbyte	...	...	LSbyte

It has a mandatory length of 32 bits and is right aligned in the data field.
This parameter contains the current position value of the encoder.
If the scaling function is enabled, the output value is scaled according to the scaling parameters (see **Scaling function control** on page 46).

To convert the read position value into nanometres [nm] (and into micrometres or millimetres or any other engineering unit afterwards) you must multiply the read position by the value set next to the **Physical pulse measure [nm]** parameter (if the bit 3 **Scaling function control** in the byte 10 is disabled = 0); otherwise you must multiply the read position by the value set next to the **Programmable pulse measure [nm]** parameter (if the bit 3 **Scaling function control** in the byte 10 is enabled = 1).

EXAMPLE
We have the following linear encoder: **SMA5-GA-50**.
Scaling function control bit 3 in the byte 10 = 0 = disabled
Physical pulse measure [nm] = 50,000 nm = 0.05 mm
Position value = 69,637
Position = **Position value** * **Physical pulse measure [nm]** = 50,000 * 69,637 = 3,481,850,000 nm
3,481,850,000 nm = 3,481,850 µm = 3,481.85 mm

EXAMPLE
We have the following linear encoder: **SMA5-GA-50**.
Scaling function control bit 3 in the byte 10 = 1 = enabled
Programmable pulse measure [nm] = 100,000 nm = 0.1 mm
Position value = 5,984
Position = **Position value** * **Programmable pulse measure [nm]** = 100,000 * 5,984 = 598,400,000 nm
598,400,000 nm = 598,400 µm = 598.4 mm

Preset value

when either Class 1 or Class 2 is set (Master → Slave)

Byte	1	2	3	4
Bit	31-24	23-16	15-8	7-0
	MSbyte	...	...	LSbyte

This parameter allows to set the encoder position to a Preset value. The Preset function is meant to assign a desired value to a physical position of the encoder. The chosen physical position will get the value set next to this parameter and all the previous and following positions will get a value according to it. This function is useful, for example, when the zero position of the encoder and the zero position of the axis need to match.
The preset value will be set for the position of the encoder in the moment when the preset value is sent. The **Preset value** value is sent by the Master to the Slave in **Data_Exchange** mode by setting the bit 31 = "1" for 3 cycles.
The MSB of the preset value controls the preset function in the following way:
Normal operating mode: MSB = 0 (bit 31): the encoder will make no change in the preset value.
Preset mode: MSB = 1 (bit 31): with the MSB = 1 the encoder accepts the transferred value (bits 0 ... 30) as a preset value in binary code.
- If **Scaling function control** = DISABLED,
  then the **Preset value** must be less than or equal to the **Physical Total Resolution [bits]** - 1 (for instance: **Physical Total Resolution [bits]** = 13 bits; 2^{13} - 1 = 8191).
- If **Scaling function control** = ENABLED,
  then the **Preset value** must be less than or equal to the **Programmable Total Resolution [pulses]** -1.

EXAMPLE

Preset value to be set = 0000 1000hex
Current **Position value** = 0005 5000hex

	Byte	1	2	3	4
Cycle	Bit	31-24	23-16	15-8	7-0
1°	M→S	80	00	10	00
	S→M	00	05	50	00
2°	M→S	80	00	10	00
	S→M	00	05	50	00
3°	M→S	80	00	10	00
	S→M	00	00	10	00

NOTE

We suggest setting the **Preset value** when the encoder is at a standstill.
The new **Preset value** is saved immediately after receipt.

WARNING

Check the value in the **Preset value** parameter and perform the preset operation every time you change the value next to **Code sequence**, **Programmable Total Resolution [pulses]** or **Programmable pulse measure [nm]** parameters.

NOTE

Please consider that if the **Bypass** parameter (see on page 50) is set to "1" = enabled, the preset function -even if set and activated- is ignored. If the user sets a preset while the "Bypass mode" is enabled, the operation is not carried out.

7.7 DDLM_Slave_Diag

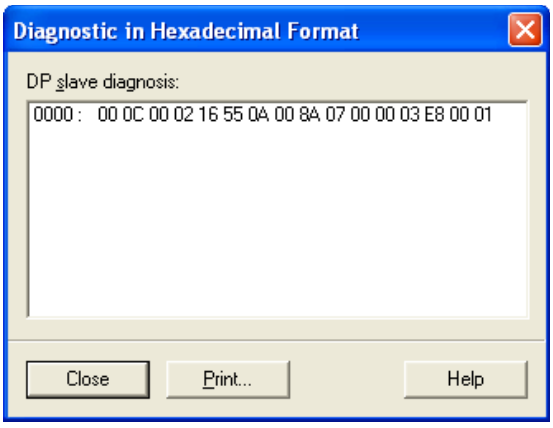
The Master device can send a request for diagnostic information at any time to the Slave device.
Lika devices can provide two types of diagnostics (see the **Diagnostic type (16- or 63-byte)** parameter on page 48):

- reduced diagnostics (16-byte diagnostics);
- extended diagnostics (63-byte diagnostics).

Class 1 devices only provide 16-byte reduced diagnostics (see the **16-byte reduced diagnostic** parameter on page 48).

Set the diagnostic type during DDLM_Set_Prm, operating parameters (byte 10), see the "7.4.1 Byte 10 - Operating parameters 1" section on page 45.

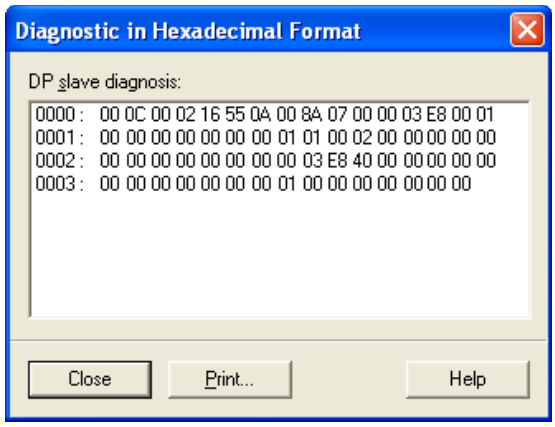
16-byte reduced diagnostics:



Byte	Description
0	Status 1
1	Status 2
2	Status 3
3	Master ID
4	Manufacturer ID
5	
6	Extended diagnostic header
7	Alarms

Byte	Description
8	Operating status
9	Encoder type
10	Measuring step
11	
12	
13	
14	Number of distinguishable revolutions
15	

63-byte extended diagnostics:



Byte	Description
0	Status 1
1	Status 2
2	Status 3
3	Master ID
4	Manufacturer ID
5	
6	Extended diagnostic header
7	Alarms
8	Operating status
9	Encoder type
10	Measuring step
11	
12	
13	
14	Number of distinguishable revolutions
15	
16	Additional alarms
17	Supported alarms
18	
19	Warnings
20	
21	Supported warnings
22	
23	Profile version
24	
25	Software version
26	
27	Operating time
28	
29	
30	

Byte	Description
31	Offset
32	
33	
34	
35	Manufacturer offset value
36	
37	
38	
39	Position Step Setting
40	
41	
42	
43	Total Measuring Range
44	
45	
46	
47	Serial number
48	
49	
50	
51	
52	
53	
54	
55	
56	
57	Reserved
58	Reserved
59	Reserved
60	Reserved
61	Reserved
62	Reserved

8 - Default parameters list

Parameters list	Default values		
Code sequence	0 = Standard		
Class 2 functionality	1 = Enabled		
Scaling function control	1 = Enabled		
Diagnostic type (16- or 63-byte)	0 = 16-byte diagn.		
Code Type (BINARY/GRAY)	0 = Binary		
SSI Protocol	0 = LSB Right Aligned		
Bypass	0 = Disabled		
Number of SSI clocks	32		
Physical pulse measure [nm]	5000		
Programmable pulse measure [nm]	5000		
Physical Total Resolution [bits]	30		
Programmable Total Resolution [pulses]	1073741824		
Preset value	0		

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Document release	Release date	Description	HW	SW	GSD file version
1.0	24.04.2015	1st issue	1.0	1.1	1655
1.1	18.05.2015	**Position value** parameter updated	1.0	1.1	1655
1.2	18.09.2019	New firmware, new GSD files, bypass function added and related parameters updated, setting range updated in some parameters, new POWER SUPPLY DIP switch	1.0	2.0	V2

Dispose separately

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