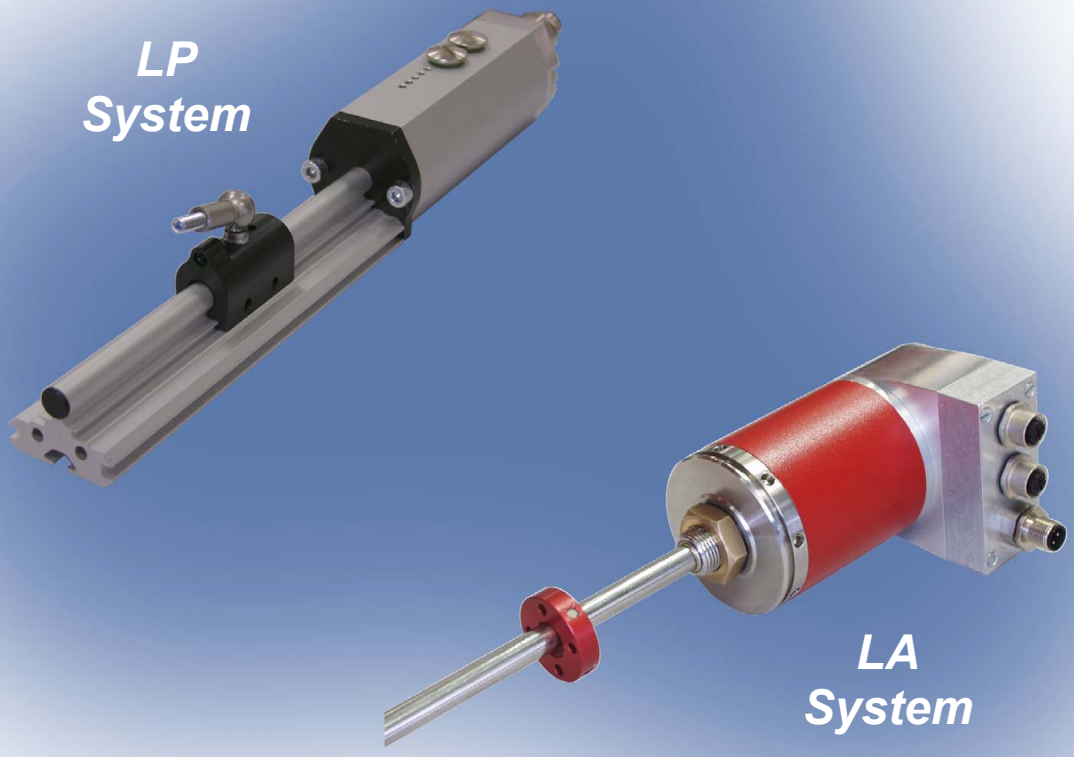
DeviceNet™



- **Software/Support CD: 490-01001**
  - Soft-No.: 490-00407

5139 / 5163 / 5503

User Manual

Absolute linear encoder LA/LP with CAN DeviceNet™ interface

- **Additional safety instructions**
- **Installation**
- **Commissioning**
- **Configuration / Parameterization**
- **Cause of faults and remedies**

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Italic or **bold** font styles are used for the title of a document or are used for highlighting.

`Courier` font displays text, which is visible on the display or screen and software menu selections.

″ < > ″ indicates keys on your computer keyboard (such as <RETURN>).

Trademarks

DeviceNet is a registered trademark of ODVA (Open DeviceNet Vendor Association)

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Appendix

Revision index

Revision	Date	Index
First release	01/20/97	00
Completion of the pin assignment pin3/4	10/06/97	01
Complete revision of the document Addition of the devices LA-41 / LA-65-H	05/26/99	02
Completion of parameters	10/06/99	03
General technical modifications, layout modifications	08/17/07	04

1 General information

This interface-specific User Manual includes the following topics:

- Safety instructions in additional to the basic safety instructions defined in the Assembly Instructions
- Electrical characteristics
- Installation
- Commissioning
- Configuration / parameterization
- Causes of faults and remedies

As the documentation is arranged in a modular structure, this User Manual is supplementary to other documentation, such as product datasheets, dimensional drawings, leaflets and the assembly instructions etc.

The User Manual may be included in the customer's specific delivery package or it may be requested separately.

1.1 Applicability

This User Manual applies exclusively to the following measuring system models with ***CAN DeviceNet™*** interface:

- LA
- LP

The products are labelled with affixed nameplates and are components of a system.

The following documentation therefore also applies:

- the operator's operating instructions specific to the system,
- this User Manual,
- and the assembly instructions **TR-ELA-BA-DGB-0004**, which is enclosed when the device is delivered

1.2 Abbreviations used / Terminology

CAN	***C***ontroller ***A***rea ***N***etwork (manufacturer independent, open field bus standard)
CiA	***C***AN ***i***n ***A***utomation (CAN User Organization, "Holding organization")
DeviceNet™	CAN protocol, defined in the Application Layer (layer 7)
DUP- MAC-ID-Test	DUPLICATE-MAC-ID-Test Checking the master for duplicates of slave MAC-IDs. Each address of the connected slaves may occur only once.
EMC	***E***lectro ***M***agnetic ***C***ompatibility
EDS	***E***lectronic-***D***ata-***S***heet
LA	***L***inear-***A***bsolute Measuring System, type with tube-housing
LP	***L***inear-Absolute Measuring System, type with ***P***rofile-housing
MAC-ID	***M***edia ***A***ccess ***C***ontrol ***Id***entifier (node address)
ODVA	***O***pen ***D***eviceNet ***V***endor ***A***ssociation (CAN User Organization, especially for DeviceNet™)

2 Additional safety instructions

2.1 Definition of symbols and instructions

 ***WARNING!***	means that death, serious injury or major damage to property could occur if the stated precautions are not met.
 ***CAUTION !***	means that minor injuries or damage to property can occur if the stated precautions are not met.
	indicates important information's or features and application tips for the product used.

2.2 Additional instructions for proper use

The measurement system is designed for operation with CAN DeviceNet™ networks according to the International Standard ISO/DIS 11898 and 11519-1 up to max. 500 kbit/s.

The technical guidelines for the structure of the CAN DeviceNet™ network from the CAN User Organization ODVA are always to be observed in order to ensure safe operation.

Proper use also includes:

- observing all instructions in this User Manual,
- observing the assembly instructions. The ***"Basic safety instructions"*** in particular must be read and understood prior to commencing work.

2.3 Organizational measures

- This User Manual must always kept accessible at the site of operation of the measurement system.
- Prior to commencing work, personnel working with the measurement system must have read and understood
  - the assembly instructions, in particular the chapter ***"Basic safety instructions"***,
  - and this User Manual, in particular the chapter "Additional safety instructions".

  This particularly applies for personnel who are only deployed occasionally, e.g. at the parameterization of the measurement system.

3 Technical data

3.1 Electrical characteristics

Supply voltage ..... 19-27 V DC, twisted in pairs and shielded

Current consumption without load ..... < 250 mA

Measuring principle ..... magnetostrictive

*** Resolution** ..... 0.01 mm / 0.005 mm, see nameplate

Baud rate (adjustable) ..... 125 kBaud, line length up to 500 m
250 kBaud, line length up to 250 m
500 kBaud, line length up to 100 m

Cycle time internally, LA-41/LP-38

≤ 0.75 m ..... 1.4 ms
≤ 1.00 m ..... 1.8 ms
≤ 1.50 m ..... 2.7 ms
≤ 2.00 m ..... 3.6 ms
≤ 2.50 m ..... 4.5 ms
> 2.50 m ..... 5.4 ms

Cycle time internally, LA-46/LP-46

≤ 1.0 m ..... 1.0 ms
≤ 1.5 m ..... 1.5 ms
≤ 2.0 m ..... 2.0 ms
≤ 2.5 m ..... 2.5 ms
> 2.5 m ..... 3.0 ms

Station addresses ..... 0 – 63, adjustable via DIP switches

Transmission ..... twisted in pairs and shielded copper cable

CAN DeviceNet interface ..... CAN field bus interface (opto-isolated)
Data transmission ..... CAN bus driver (ISO/DIS 11898)

Data protocol ..... CAN 2.0 A

Terminating resistor ..... 121 ohm, selectable via DIP switches or external

Special features ..... Programming of the following parameters via the CAN-BUS:
- Code sequence
- Output code (binary, gray)
- Measuring length in steps
- Direct adjustment via bus

EMC ..... DIN EN 61000-6-2 / DIN EN 61000-4-2 / DIN EN 61000-4-4

* parameterizable via CAN DeviceNet

4 CAN DeviceNet information

DeviceNet™ was developed by Rockwell Automation and the ODVA as an open field bus standard, based on the CAN protocol and is standardized in the European standard EN 50325. Specification and maintenance of the DeviceNet standard is regulated by the ODVA. DeviceNet™, along with ControlNet and EtherNet/IP, belongs to the family of CIP-based networks. The CIP (Common Industrial Protocol) forms a common application layer for these 3 industrial networks. DeviceNet™, ControlNet and Ethernet/IP are therefore well matched to one another and present the user with a graduated communication system for the physical layer (Ethernet/IP), cell layer (ControlNet) and field layer (DeviceNet™). DeviceNet™ is an object-oriented bus system and works according to the producer/consumer model.

DeviceNet™ Protocol

The DeviceNet™ protocol is an object-oriented protocol. It is typically used for networking sensors and actuators with the superordinate automation devices (PLC, IPC).

DeviceNet™ Data Link Layer

Layer 2 (Data Link Layer) is based on the Controller Area Network (CAN), which was originally designed for use in motor vehicles.

DeviceNet™ Network and Data Transport Layer

The link is set up with the Group 2 Unconnected Port. Selected CAN identifiers are used for the link set-up. A link, once set up, can be used for transmitting explicit messages or for setting up additional I/O links. As soon as an I/O link has been set up, I/O data can be exchanged between the DeviceNet™ users. The 11 bit identifier is used exclusively for coding I/O data. The 8-byte wide CAN data field is fully available for user data.

DeviceNet™ Application Layer – CIP Protocol

The CIP (Common Industrial Protocol) forms the application layer for DeviceNet™. The CIP defines the exchange of I/O data in realtime via I/O messages (I/O messaging or implicit messaging), as well as the exchange of data required for configuration, diagnosis and management via explicit messages (explicit messaging). The communication between two devices always takes place according to a connection-oriented communication model, either via a point-to-point or a multicast-V1 connection. This allows both master/slave and multi-master systems to be realized. Data are known as objects and are logged in the object directory of each device.

Predefined Master-Slave Connection Set

The so-called "Predefined Master/Slave Connection Set" is used for the DeviceNet™ measuring system. This subset of the DeviceNet™ protocol simplifies the transmission of I/O data between an automation system (PLC) and the decentralized peripheral devices (slaves): Only "Group2 Messages" are supported, with the exception of "Group1 Message for Slave I/O Poll Response".

DeviceNet™ Device Profiles

Beyond the specification of the pure communication functions, DeviceNet™ also includes the definition of device profiles. These profiles define the respective device types for minimally available objects and communication functions. The device type number 08hex was defined for the DeviceNet™ measuring system.

Vendor ID

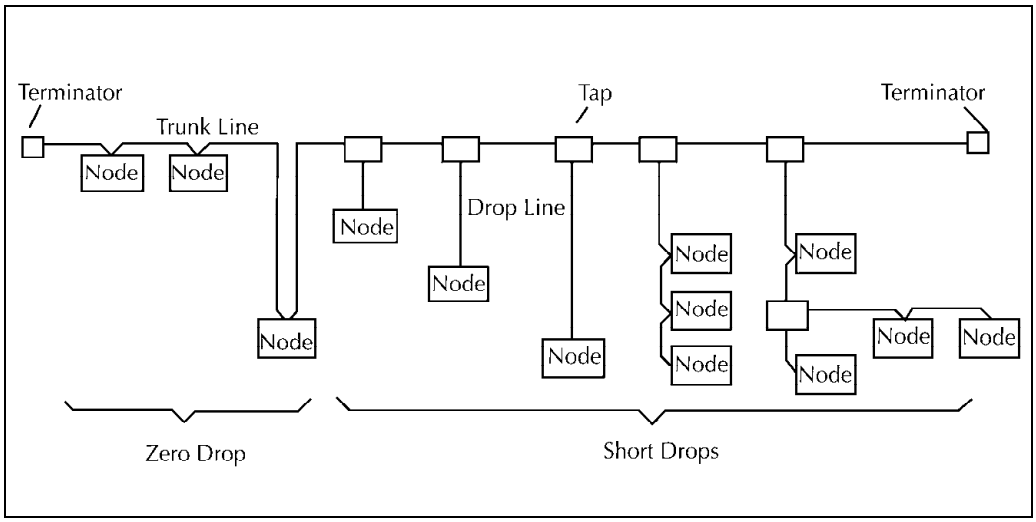
The vendor IDs (manufacturer's identifiers) are assigned and administrated by the ODVA.
The TR-Electronic vendor ID for DeviceNet™ is "134" (dec).

You can obtain further information on DeviceNet™ from the Open DeviceNet Vendor Association (ODVA) or the following Internet addresses:

http://www.odva.org
e-mail: mailto:odva@odva.org

5 Installation / Preparation for start-up

Up to 64 bus users can communicate with each other in a DeviceNet™ network with Baud rates of 125, 250 or 500 kbit/s. The DeviceNet™ cable provides both signals for CAN-L and CAN-H data transmission, as well as two lines for the 24 Volt operating voltage supply of the DeviceNet™ bus users. The maximum length of the DeviceNet™ cable is dependent on the type of cable selected and the Baud rate. Installation takes place in a bus topology – with or without taps – and terminators at both ends. The terminators have a resistance value of 120 Ohm.



Bus lines

The bus lines for the DeviceNet™ system are laid down in the DeviceNet™ specification. According to this specification, the maximum extent of a DeviceNet™ system is dependent on the Baud rate:

Cable length	125 kbit/s	250 kbit/s	500 kbit/s
Total length with thick cable	500 m	250 m	100 m
Total length with thin cable	100 m	100 m	100 m
Max. drop line length	6 m	6 m	6 m
Max. length of all drop lines	156 m	78 m	39 m

The DeviceNet™-specification and other applicable standards and guidelines are to be observed to insure safe and stable operation.

In particular, the applicable EMC directive and the shielding and grounding guidelines must be observed!

5.1 Connection

In some cases the connection hood must first be removed from the measuring system to undertake connection.

The pin assignments with view onto the switches are attached in the rear of this document.

For the supply shielded cables with twisted core pairs with min. 0.5 mm^2 have to be used !

5.2 Bus termination

If the measuring system is the last slave in the CAN segment, the bus is to be terminated with the termination switch = ON. With some types of measuring systems an external bus terminal resistance of 120 ohms is to be connected.

5.3 Identifier (MAC-ID)

The identifier (measuring system address) 0 – 63 is adjusted via DIP- or rotary switches. The adjusted address may be assigned only once in the CAN bus.

5.4 Baud rate

The baud rate is adjusted via DIP- or rotary switches.

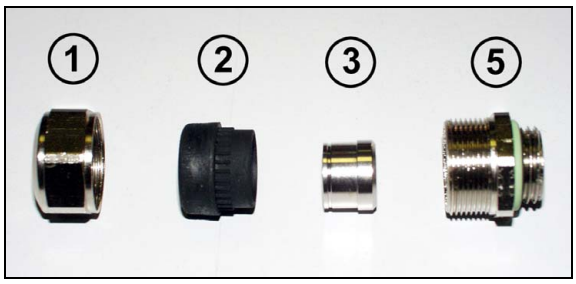
Following baud rates are possible:

- 125 kbit/s
- 250 kbit/s
- 500 kbit/s

5.5 Shield cover

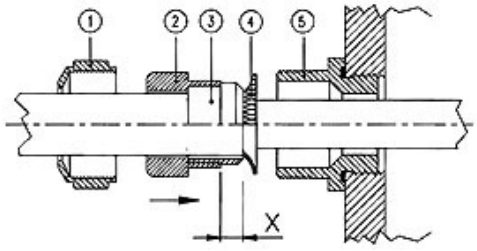
The shield cover is connected with a special EMC cable gland, whereby the cable shielding is fitted on the inside.

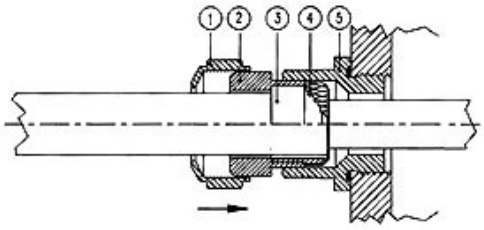
Cable gland assembly, variant A



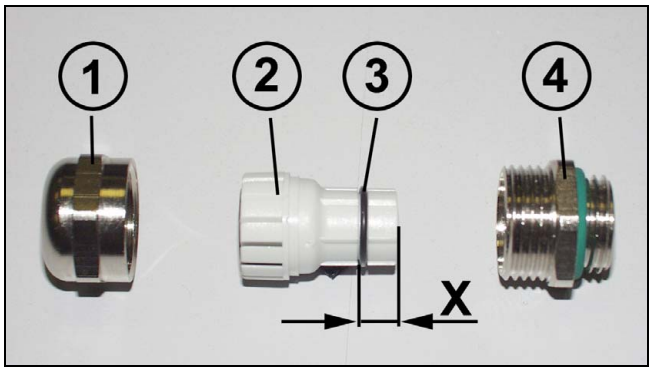
Pos. 1 Nut
Pos. 2 Seal
Pos. 3 Contact bush
Pos. 5 Screw socket

1. Cut shield braid / shield foil back to ***dimension "X"***.
2. Slide the nut (1) and seal / contact bush (2) + (3) over the cable.
3. Bend the shield braining / shield foil to 90° (4).
4. Slide seal / contact bush (2) + (3) up to the shield braining / shield foil.
5. Assemble screw socket (5) on the housing.
6. Push seal / contact bush (2) + (3) flush into the screw socket (5).
7. Screw the nut (1) to the screw socket (5).



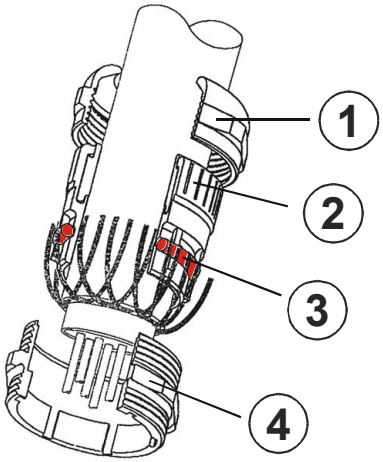


Cable gland assembly, variant B



Pos. 1 Nut
Pos. 2 Clamping ring
Pos. 3 Inner O-ring
Pos. 4 Screw socket

1. Cut shield braid / shield foil back to dimension ***"X" + 2mm***.
2. Slide the nut (1) and clamping ring (2) over the cable.
3. Bend the shield braining / shield foil to approx. 90°.
4. Push clamping ring (2) up to the shield braid / shield foil and wrap the braiding back around the clamping ring (2), such that the braiding goes around the inner O-ring (3), and is not above the cylindrical part or the torque supports.
5. Assemble screw socket (4) on the housing.
6. Insert the clamping ring (2) in the screw socket (4) such that the torque supports fit in the slots in the screw socket (4).
7. Screw the nut (1) to the screw socket (4).



6 Commissioning

6.1 CAN DeviceNet interface

The CAN field bus interface (separated via optoelectronics with CAN-BUS-Driver PCA82C250T) in the measuring system is determined according to the international standard ISO/DIS 11898 and covers the two lower layers of the ISO/OSI reference module.
The transformation of measuring system information into the CAN protocol occurs by the protocol chip SJA1000. The function of the protocol chip is monitored by a watchdog.

The **PREDEFINED MASTER/SLAVE CONNECTION SET** is used for the measuring system who only works as a slave. It will be used only the **Group 2 Messages** with the exception of the **Group 1 Message For Slave I/O Poll Response**.
Establishing or breakdown of a connection must occur via **Group 2 Only Unconnected Explicit Request Message**.
The measuring system contains an **I/O Communication Port** and an **Explicit Message Communication Port**. The I/O **communication port** is used for polling the measuring system position and must be made accessible by setting the watchdog (after the I/O connection master/slave was set up before). Is the I/O port not retriggered (polled) punctually the connection is interrupted and the red LED flashes. The connection for the I/O port must be installed again.

During programming, data is exchanged between the measuring system and the master in binary form.

6.1.1 Bus status

	● = ON ○ = OFF ⦿ = FLASHING
○	**Measuring system is not online** - no DUP-MAC-ID test - Device may not be powered
green	**Online, with connections in the established state** - Device is allocated to a master
green	**DUP-MAC-ID test successful** - No allocation to a master
red	**Recoverable faults** - I/O-connections are in the time-out state - Measuring system has not detected any magnet
red	- Turn off system --> turn on system - Replace measuring system device

6.1.2 EDS file

The EDS (electronic datasheet) contains all information on the measuring system-specific parameters and the measuring system's operating modes. The EDS file is integrated using the DeviceNet™ network configuration tool to correctly configure or operate the measuring system.

The EDS file has the file name "1.EDS". The files are on the Software/Support CD: Order number: 490-01001, Soft-No.: 490-00407.

"...\256.COD" for measuring systems with parameter Counting direction, Output code

"...\257.COD" for measuring systems with parameter Counting direction, Output code Scaling and Adjustment
Firmware: 5139.xx, 5163.xx, 5503.xx

6.1.3 Messages

Following messages are supported by the measuring system:

I/O Poll Command / Respond Message

This message is sent directly by the master to the desired slave (point-to point). For every slave which is polled the master must sent an own poll command message. As response on a Poll Command the slave sends back to the master the Poll Response I/O Message.

Explicit Response / Request Message

Explicit Request Messages are used for processing of WRITE/READ-attribute's. Explicit Response Messages contains the result of an Explicit Request Message Service.

Group 2 Only Unconnected Explicit Request Message

Group 2 Only Unconnected Explicit Request Message serves for the establishing or breakdown of connections for the Predefined Master/Slave Connection Set.

Duplicate MAC ID Check Message

After switch-on the measuring system it reports Duplicate MAC ID Messages.

6.1.4 Classes

The communication objects are divided into classes. The measuring system supports the following classes:

Object Class	Number of instances
01h: Identity	1
02h: Message Router	1
03h: DeviceNet	1
05h: Connection	2
04h: Assembly	1
0Fh: Parameter	5

6.1.5 I/O Instance (polled IO)

Input Instance

Number	Name
1	Position value

Input Data Format

Instance	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	0	D07	Low Byte Position value						D00
	1	D15	.						D08
	2	D23	.						D16
	3	D31	High Byte Position value						D24

7 Parameterization and configuration

7.1 Configuration Assembly Data Attribute Format

7.1.1 Assembly Object 04h

Instance	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Service
42	0	Direction								r/w
	1	Output Code								
	2 to 5	Low Byte Total Number of Steps … High Byte Total Number of Steps								

The ranges of values of the individual parameters are defined in chapter "Parameters / Range of values" starting from page 21.

7.2 Parameter Object Instances

7.2.1 Parameter Object 0Fh

Instance	Name	Data Type	Service	Attribute
1	Direction	USINT	r/w	1
2	Output Code	USINT	r/w	1
3	Total Number of Steps	UDINT	r/w	1
4	Read: Position / Write: Adjustment	UDINT	r/w	1
5	Software version	UDINT	ro	1

The ranges of values of the individual parameters are defined in chapter "Parameters / Range of values" starting from page 21.

7.3 Parameters / Range of values

7.3.1 Direction

Instance	Service	Value	Description	Default
1	r/w	= 0	increasing position values to the rod end	X
		≠ 0	decreasing position values to the rod end	

7.3.2 Output Code

Instance	Service	Value	Description	Default
2	r/w	= 0	Binary code	X
		≠ 0	Gray code	

7.3.3 Total Number of Steps

Instance 3, r/w

Defines the ***Total number of steps*** of the measuring system related to the measuring length and corresponds to the resolution.

lower limit	15 steps
upper limit	16 777 215 steps (24 bit)
default	**15**

Standard value:
The given measuring length on the rating plate multiplied with 100 corresponding to the resolution of 0.01 mm or multiplied with 200 corresponding to the resolution of 0.005 mm

$$\text{Measuring length in steps} = \frac{\text{Measuring length}}{\text{Resolution in mm}}$$

7.3.4 Adjust Absolute Value

WARNING !

Risk of injury and damage to property by an actual value jump when the adjustment function is performed!

- The adjustment function should only be performed when the measuring system is at rest, otherwise the resulting actual value jump must be permitted in the program and application!

Instance 4, r/w

With the adjustment function, the measuring system is set to the desired absolute position value.

Is the adjustment performed via the "Parameter Class", the required position value is set with the "SET-service" and can read as position value with the "GET-service".

0 ≤ **Adjustment** < Total Number of Steps

8 Causes of faults and remedies

Fault	*Cause*	*Remedy*
Position skips of the measuring system	Strong vibrations	Vibrations, impacts and shocks, e.g. on presses, are dampened with "shock modules". If the error recurs despite these measures, the measuring system must be replaced.
	Electrical faults EMC	Perhaps isolated flanges made of plastic help against electrical faults, as well as cables with twisted pair wires for data and supply. Shielding and wire routing must be performed according to the DeviceNet™-specification.
	Scanning defect.	Replace measuring system.