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1 General information

This interface-specific User Manual includes the following topics:

- Safety instructions in addition to the basic safety instructions defined in the Assembly Instructions
- Electrical characteristics
- Installation
- Commissioning
- 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:

- CE-65
- CS-65
- CK-65

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-ECE-BA-DGB-0046](#), which is enclosed when the device is delivered

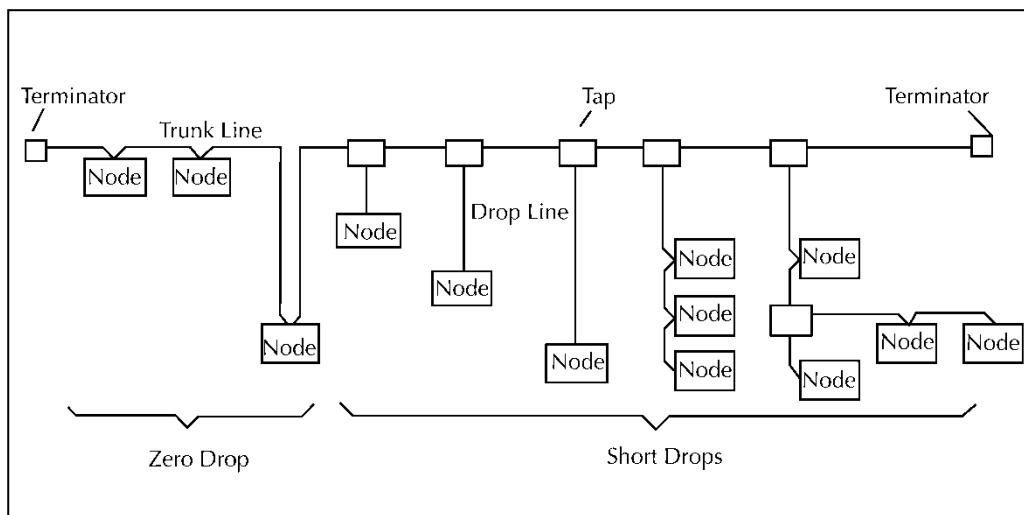
3 Technical data

3.1 Electrical characteristics

Supply voltage	11-27 V DC, twisted in pairs and shielded
Current load	< 200 mA at 11 V DC, < 110 mA at 27 V DC (unloaded)
Total resolution	≤ 24 bit (optional 25 bit)
Number of steps / revolution	≤ 8.192
Measurement range	
Standard.....	≤ 4.096 revolutions (12 bit)
Expanded	≤ 256.000 revolutions
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
Station addresses	0 – 63, adjustable via DIP switches
Transmission	twisted in pairs and shielded copper cable
CAN DeviceNet™ interface	
Data transmission	CAN field bus interface (opto-isolated) CAN bus driver (ISO/DIS 11898)
Terminating resistor	121 ohm, selectable via DIP switches
Special features	Programming of the following parameters via the CAN-BUS:
	- Direction of rotation
	- Output code (binary, gray)
	- Measuring length in steps
	- Measuring length in revolutions
	- Preset adjustment via bus
	- Adjustment
	- Preset value 1
	- Preset value 2
	- 7 special outputs
EMC	
Immunity to disturbance	DIN EN 61000-6-2
Transient emissions	DIN EN 61000-6-3

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

The connection hood must first be removed from the measuring system to undertake connection.

The pin assignments with view on the switches etc. are attached in the rear part of this document.



For the supply shielded cables with twisted core pairs and min. 0.5 mm² 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. In this state, the subsequent CAN-bus is decoupled.

5.3 Identifier (MAC-ID)

The identifier (measuring system address) 0 – 63 is adjusted via 6 DIP-switches. The adjusted address may be assigned only once in the CAN bus.

5.4 Baud rate

The baud rate is adjusted via 2 DIP-switches.

Following baud rates are possible:

- 125 kBaud
- 250 kBaud
- 500 kBaud

6 Commissioning

6.1 CAN 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 PCA82C200. 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 e.g. I/O-connections are in the time-out state
● 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".

"...\10.COD" for multi-turn measuring systems with max. 4096 steps/revolution

"...\11.COD" for multi-turn measuring systems with max. 8192 steps/revolution

Download:

- 10.COD: www.tr-electronic.de/f/TR-ECE-ID-MUL-0024
- 11.COD: www.tr-electronic.de/f/TR-ECE-ID-MUL-0025

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 send 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	2
0Fh: Parameter	21
23h: Position Sensor	1

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	High Byte Position value							
		7. AO	6. AO	5. AO	4. AO	3. AO	2. AO	1. AO	D24

AO = Auxiliary Output

7 Parameterization and configuration

Danger of personal injury and damage to property exists if the measuring system is restarted after positioning in the de-energized state by shifting of the zero point!

If the number of revolutions is not an exponent of 2 or > 4096, it can occur, if more than 512 revolutions are made in the de-energized state, that the zero point of the multi-turn measuring system is lost!

⚠ WARNING

NOTICE

- Ensure that the quotient of **Revolutions Numerator / Revolutions Denominator** for a multi-turn measuring system is an exponent of 2 of the group $2^0, 2^1, 2^2 \dots 2^{12}$ (1, 2, 4...4096).
or
- Ensure that every positioning in the de-energized state for a multi-turn measuring system is within 512 revolutions.

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								
	6 to 9	High Byte Total Number of Steps								
	10	Low Byte Revolutions Numerator								
	11 to 14	High Byte Revolutions Numerator								
	15	Revolutions Denominator								
	16 to 19	Low Byte Lower Safety Limit								
	20 to 23	High Byte Lower Safety Limit								
	24 to 27	Low Byte Lower Operating Limit								
	28 to 31	High Byte Lower Operating Limit								
	32 to 35	Low Byte Upper Operating Limit								
	36 to 39	High Byte Upper Operating Limit								
	40 to 43	Low Byte Upper Safety Limit								
	44 to 47	High Byte Upper Safety Limit								

Continuation, see following page

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	Revolutions Numerator	UDINT	r/w	1
5	Revolutions Denominator	USINT	r/w	1
6	Lower Safety Limit	UDINT	r/w	1
7	Lower Operating Limit	UDINT	r/w	1
8	Upper Operating Limit	UDINT	r/w	1
9	Upper Safety Limit	UDINT	r/w	1
10	Auxiliary Output 1	USINT	r/w	1
11	Auxiliary Output 2	USINT	r/w	1
12	Auxiliary Output 3	USINT	r/w	1
13	Auxiliary Output 4	USINT	r/w	1
14	Auxiliary Output 5	USINT	r/w	1
15	Auxiliary Output 6	USINT	r/w	1
16	Auxiliary Output 7	USINT	r/w	1
17	Value for Preset1	UDINT	r/w	1
18	Value for Preset2	UDINT	r/w	1
19	Data-Check	UINT	r/w	1
20	Read: Position / Write: Adjustment	UDINT	r/w	1
21	Software version	UDINT	ro	1

7.3.6 Value for Preset 1 and 2

Instance 17 and 18, r/w

Specification of the position value, on which the measuring system is adjusted when the preset function is executed (see "I/O Instance (polled IO)" on page 19).

$0 \leq \text{Preset value} < \text{Total Number of Steps}$

Continuation "Parameterization errors"

	Bit	Description	Cause	Remedy
Low Byte	$2^7 = 1$	Preset 2 out of range	While programming the predefined preset value2, the permissible range was exceeded	Carry out new programming Permissible range: $0 \leq \text{Preset value 2} < \text{Total Number of Steps}$
	$2^0 = 1$	Preset 1 out of range	While programming the predefined preset value1, the permissible range was exceeded	Carry out new programming Permissible range: $0 \leq \text{Preset value 1} < \text{Total Number of Steps}$
High Byte	$2^1 = 1$	Lower safety limit out of range	While programming the switching point, the permissible range was exceeded	Carry out new programming Permissible range: $1 \leq \text{lower safety limit} \leq \text{lower operating limit} \leq \text{upper operating limit} \leq \text{upper safety limit} \leq \text{Total Number of Steps} - 2$
	$2^2 = 1$	Lower operating limit out of range	While programming the switching point, the permissible range was exceeded	Carry out new programming Permissible range: $1 \leq \text{lower safety limit} \leq \text{lower operating limit} \leq \text{upper operating limit} \leq \text{upper safety limit} \leq \text{Total Number of Steps} - 2$
	$2^3 = 1$	Upper operating limit out of range	While programming the switching point, the permissible range was exceeded	Carry out new programming Permissible range: $1 \leq \text{lower safety limit} \leq \text{lower operating limit} \leq \text{upper operating limit} \leq \text{upper safety limit} \leq \text{Total Number of Steps} - 2$
	$2^4 = 1$	Upper safety limit out of range	While programming the switching point, the permissible range was exceeded	Carry out new programming Permissible range: $1 \leq \text{lower safety limit} \leq \text{lower operating limit} \leq \text{upper operating limit} \leq \text{upper safety limit} \leq \text{Total Number of Steps} - 2$
	$2^5 = 1$	Revolutions Numerator = 0	While programming the measuring length in revolutions numerator, a "0" was programmed.	Valid range: Measuring length in revolutions numerator $1 \leq \text{Measuring length in revolutions numerator} \leq 256\,000$ Measuring length in revolutions denominator $1 \leq \text{Measuring length in revolutions denominator} < 100$
	$2^6 = 1$	Steps per revolution out of range	The max resolution of the measuring system was exceeded (see rating plate)	Valid range: $\left[\frac{\text{Total Number of Steps}}{\text{Number of revolutions}} \right] \leq \text{Hardware steps per revolution (rating plate)}$

8.3 Other faults

Fault	Cause	Remedy
Position skips of the measuring system	Loose contacts in the wiring	Check all the cabling and wiring used for connecting the encoder.
	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 and couplings 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.
	Extreme axial and radial load on the shaft may result in a scanning defect.	Couplings prevent mechanical stress on the shaft. If the error still occurs despite these measures, the measuring system must be replaced.