TURCK

Your Global Automation Partner

DWE-…-…-9D16B-…
CANopen Draw-wire-encoder

Instructions for Use

Contents

1 About these instructions

These instructions describe the setup, functions and use of the product and help you to operate the product according to its intended purpose. Read these instructions carefully before using the product. This will prevent the risk of personal injury and damage to property.
Keep these instructions safe during the service life of the product. If the product is passed on, pass on these instructions as well.

1.1 Target groups

These instructions are aimed at qualified personal and must be carefully read by anyone mounting, commissioning, operating, maintaining, dismantling or disposing of the device.

1.2 Explanation of symbols

The following symbols are used in these instructions:

⚠	**DANGER** DANGER indicates a hazardous situation with a high level of risk, which, if not avoided, will result in death or serious injury.
⚠	**WARNING** WARNING indicates a hazardous situation with a medium level of risk, which, if not avoided, will result in death or serious injury.
⚠	**CAUTION** CAUTION indicates a hazardous situation with a medium level of risk, which, if not avoided, will result in moderate or minor injury.
❗	**NOTICE** CAUTION indicates a situation which, if not avoided, may cause damage to property.
ℹ	**NOTE** NOTE indicates tips, recommendations and important information about special action steps and issues. The notes simplify your work and help you to avoid additional work.
▶	**MANDATORY ACTION** This symbol denotes actions that the user must carry out.
⇨	**RESULT OF ACTION** This symbol denotes the relevant results of an action.

1.3 Other documents

Besides this document, the following material can be found on the Internet at **www.turck.com**:

- Data sheet
- EU Declaration of Conformity (current version)
- Quick Start Guide

1.4 Feedback about these instructions

We make every effort to ensure that these instructions are as informative and as clear as possible. If you have any suggestions for improving the design or if some information is missing in the document, please send your suggestions to **techdoc@turck.com**.

2 Notes on the product

2.1 Product identification

These instructions apply to the following draw-wire sensors with CANopen interface:

DWE	–	1000	–	60	–	9D16B	–	CA

DWE	Draw Wire	–	1000	Measuring length	–	60	Design	–

Funktion
DWE Draw Wire

Measuring length
1000   1000 mm Measuring length
3000   3000 mm Measuring length
5000   5000 mm Measuring length
10000 10000 mm Measuring length

Housing design
60
120

9D16B	Interface	–	CA	Electrical connection

Interface
9D16B   CANopen, 16 Bit

Electrical connection
C   Cable, 2 m, radial
CA   Cable, 2 m, axial

2.2 Scope of delivery

The following are included in the scope of delivery:

- Draw-wire sensor

2.3 Turck service

Turck supports you in your projects – from the initial analysis right through to the commissioning of your application. The Turck product database at **www.turck.com** offers you several software tools for programming, configuring or commissioning, as well as data sheets and CAD files in many export formats.

For the contact details of our branches worldwide, please see page [▶ 27].

3 For your safety

The product is designed according to state of the art technology. Residual hazards, however, still exist. Observe the following safety instructions and warnings in order to prevent danger to persons and property. Turck accepts no liability for damage caused by failure to observe these safety instructions.

3.1 Intended use

The draw-wire sensors of the DWE-… product series determine the position or the change in position of objects and output the information via the CANopen interface.

The device must only be used as described in these instructions. Any other use is not in accordance with the intended use. Turck accepts no liability for any resulting damage.

3.2 Obvious misuse

- The devices are not safety components and must not be used for personal or property protection.
- Do not extend the cable beyond the specified measuring range.
- Do not route the cable around corners or over edges. If necessary, use pulleys to change the direction that the cable is being drawn.

3.3 General safety instructions

- The device must only be fitted, installed, operated, parameterized and maintained by trained and qualified personnel.
- Only use the device in compliance with the applicable national and international regulations, standards and laws.
- Do not use the sensor if kinks or damage to the cable have been identified.
- Do not open the device. The high stored energy of the drive spring can lead to risk of injury.
- Avoid contact with the cable during operation.
- Protect the sensor from ice formation when it is mounted outdoors at temperatures below 0 °C.

4   Product description

The draw-wire sensors of the DWE… product series with CANopen interface measure the position or the change in position of objects.

4.1   Device overview
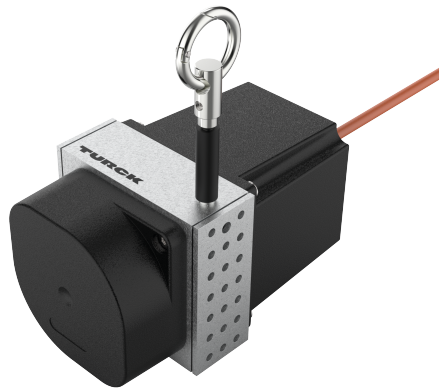
Fig. 1: DWE-…-60-…-…
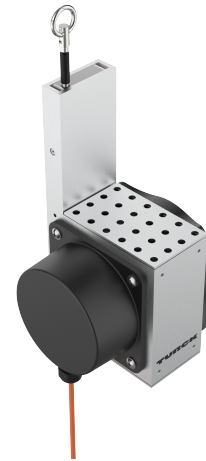
Fig. 2: DWE-…-120-…-…

4.2   Functional principle

Draw-wire sensors consist of a measuring system and a cable. The cable of the draw-wire sensor is unrolled over a drum in the sensor housing. The draw-wire sensors converts the extended length into electrical signals. The devices pass these electrical signals on to a higher-level controller for evaluation.

4.3   Functions and operating modes

The steel cable stored in the draw-wire sensor must be connected to the measuring object. If the distance between the measuring object and the sensor is changed, the cable is pulled out of the draw-wire sensor against the spring force and unrolled from the drum.

The devices use a potentiometer to measure the revolutions.

4.3.1   Output function

The device has a CANopen interface that complies with the following standards:

- CAL-based Communication Profile for Industrial System
- CiA Draft Standard 301 Communication Profile
- CiA Draft Standard 406 Device Profile for Encoders

Various device functions can be set and parameterized by using the control software (see "Setting" section). All measured values and parameters can be accessed via the object directory.

4.3.2   Terminating resistor

A bus terminating resistor can be switched on and off via the CANopen interface.

4.4 Network management

The device supports the simplified network management (minimum boot-up) concept specified in the profile for "minimum capability devices."

The status diagram in accordance with DS301 shows the different node statuses and their respective network commands. The network master controls the commands via NMT services.
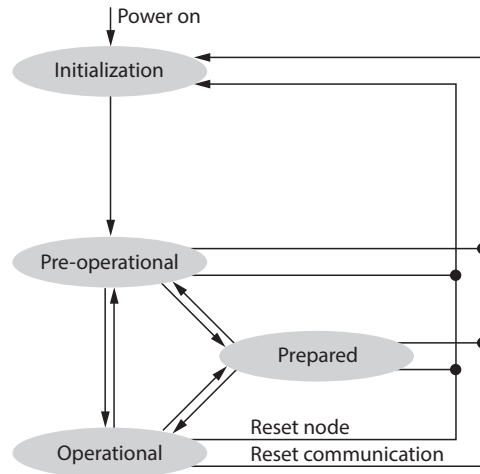
Fig. 3: Status diagram in accordance with DS 301

Initialization

After a reset or after the supply voltage is switched on, the node will be in the "Initialization" mode. Once the reset or initialization cycle is completed, the node automatically switches to the "Pre-operational" mode.

Pre-operational

In the pre-operational mode, the CAN nodes can be activated via SDO messages or with NMT commands in the standard identifier. The device parameters or communication parameters can be programmed.

Operational

The node is active. Process values are issued via the PDOs. The NMT commands can be evaluated.

"Prepared" or "stopped"

The node is not active. SDO and PDO communication is not possible. The node can be set via the NMT commands to the "Operational" and "Pre-operational" modes.

Structure of an NMT object

An NMT object is structured as follows:

COB-ID of the NMT	Byte 0	Byte 1
0x000	Command byte	Node ID (module address)

The COB-ID of the NMT object is always 0x000.

The following commands are possible:

Command byte	Description
0x01	Start_Remote_Node: Change to Operational
0x02	Stop_Remote_Node: Change to Prepared
0x80	Enter_Pre-Operational_State: Change to Pre-operational
0x81	Reset_Node: Reset node Resets one or more nodes.
0x82	Reset_Communication: Reset communication Resets the CANopen communication for one or more modules.

CANopen supports up to 127 nodes (from 1 to 127) that can be addressed individually via the node ID (byte 1).

The module addressed in byte 1 reacts to the command of byte 0.

If byte 1 is set to the value 0, all nodes are addressed at the same time. All modules then execute the command of byte 0.

A reset via command 0x81 or 0x82 is equivalent to a restart of the module. The module briefly goes into initialization mode and sends a boot-up sequence (0x701…0x7FF). The sensor then switches to the mode that was set as the start condition.

Access to an object is not always possible.

The following table shows when access is possible:

Object	Operating mode			
	Initialization	Pre-operational	Operational	Stopped
PDO			x	
SDO		x	x	
SYNC		x	x	
Emergency		x	x	x
NMT		x	x	x
Node Guard (Heartbeat)		x	x	x
Boot-Up	x			

4.5   SDO communication

The communication channel for transferring device parameters is mapped via service data objects (SDO). The parameters are transferred acyclically (e.g. only once when the network is started up). The SDO objects therefore have a low priority (high COB identifier).

Structure of the SDO telegram:

COB-ID	DLC	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
SDO identifier	Data length	Command	Index L	Index H	Sub-Index	Data 0	Data 1	Data 2	Data 3

The SDO identifier is defined as follows:

Client (control) → server (absolute encoder): **0x600** + node ID

Server (absolute encoder) → client (controller): **0x580** + node ID

The data length (DLC) is always 8:

1 command byte + 2 index bytes (object) + 1 subindex bytes + 4 data bytes

The command specifies whether data should be written (download) or read (upload) and how many user data bytes are contained:

Command	Description	User data	Function
0x22	SDO(rx), download request	Undetermined	Sends parameters to the sensor
0x23		4 bytes	
0x2B		2 bytes	
0x2F		1 byte	
0x60	SDO(tx), download response	-	Confirms the parameter transfer to the client
0x40	SDO(rx), upload request	-	Requests parameters from sensor
0x42	SDO(tx), upload response	Undetermined	Sends parameters to the client
0x43		4 bytes	
0x4B		2 bytes	
0x4F		1 byte	
0x80	SDO(tx), abort domain transfer (abort due to error)	4 bytes	Sensor reports error code to the client

If an error occurs, a fault signal with the command 0x80 (SDO Abort Message) replaces the normal confirmation (Response). Index and subindex belong to the previously specified object. The error code output is in bytes 5 to 8 (abort code).

4.6 Technical accessories

Dimension drawing	Type	ID	Description
	RDR-1	1544753	Pulley for aluminum draw-wire sensors
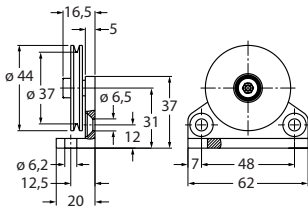
5   Installing

> ⚠️ **CAUTION**
> Cable snapping
> **Risk of injury**
> ▶ Carefully detach the rope and guide it back.

The DWE-…-120-… draw-wire sensors are equipped with threaded holes on two sides of the housing, so that two different installation positions are possible during mounting (see fig. 6). Only after mounting the sensor should you carefully pull the measuring cable out of the sensor and attach it to the measuring object.

Type designation	Number of threaded holes
DWE-…-60-… (see fig. below)	2 × M4 threaded holes (max. depth 5 mm)
DWE-…-120-… (see fig. below)	4 × M4 threaded holes (max. depth 5 mm)

▶   Attach the sensor at the intended mounting location using the mounting holes.
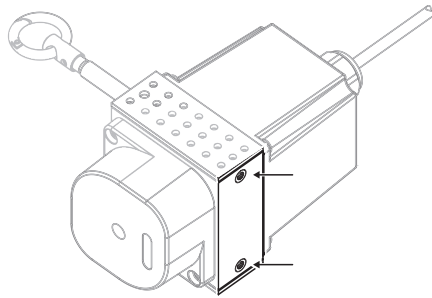
Fig. 4: Mounting holes DWE-…-60-…
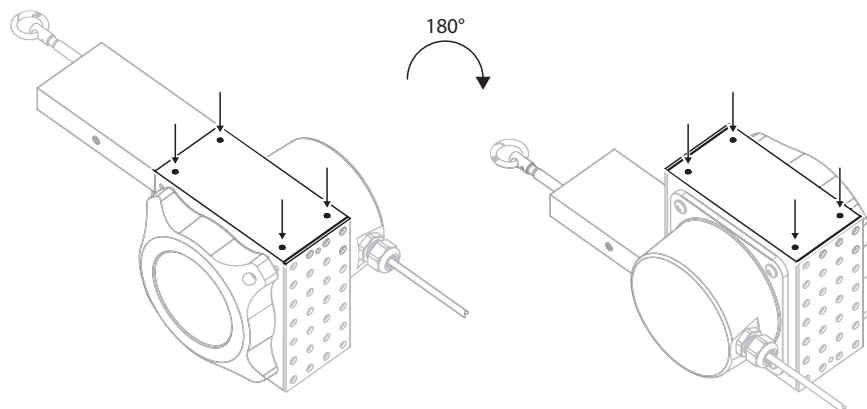
Fig. 5: Mounting holes DWE-…-120-…

5.1 Attaching the cable clip

▶ Open the cable clip and pull the measuring cable vertically out of the sensor using a screwdriver. Avoid pulling out the measuring cable at an angle (maximum deviation from vertical: 3°).

▶ Check the measuring area between the sensor and the measuring object for any potential collisions with persons or objects.

▶ Attach the cable clip to the measuring object and close the cable clip bracket.

▶ Install the sensor so that when the cable is returned, the rubber stop does not come into contact with the cable tower in the sensor.

6 Connection

▶ Connect the device as shown in the wiring diagram.

```
WH ───────── +V
BK ───────── CAN_H
GY ───────── CAN_L
BN ───────── CAN_GND
BU ───────── 0 V
```
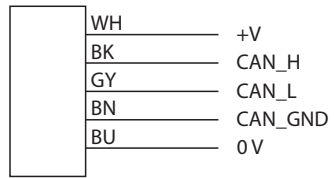
Fig. 6: Wiring diagram

7 Commissioning

The device transmits data synchronously in the factory settings. For asynchronous data transfer (TPDO1), the sub-index must be set manually in object 0x1800.

Set asynchronous transmit parameter TPDO1:

▶ Event timer for asynchronous operation: Object 0x1800, sub-index 0x05 (e.g. 10 ms) (see [▶ 19]).
▶ Save device parameters:
Set object 0x1010 to the value 0x01.

8 Setting

The device can be set via the CANopen interface.

> **NOTE**
> All non-described objects serve as additional information and can be found in the device profile CiA 406.

8.1 Setting the communication profile

8.1.1 Object 0x1000: Device type

The device type is specified via the object.

0x1000	VAR	Device type	Unsigned32	RO	M

8.1.2 Object 0x1001: Error register

Device errors are displayed in the error register.

0x1001	VAR	Error register	Unsigned8	RO	M

Sub-index	Bit	Fault signal
0x00	0	No error
	1	Current
	2	Voltage
	3	Temperature
	4	Communication
	5	Device-specific
	6	Reserved (always 0)
	7	Turck-specific

8.1.3 Object 0x1005: COB-ID SYNC (specify COB-ID for SYNC message)

The object specifies the COB-ID for the SYNC message. It also specifies whether the device is an emitter or receiver of SYNC objects. The sensor acts only as a receiver.

0x1005	VAR	COB-ID SYNC	Unsigned 32	RW	O

Default value COB-ID	0x80 (can be adapted from 0x001…0x7FF)

> **NOTE**
> The sensor reacts only to SYNC commands if the transmission type has been set accordingly in object 0x1800. See

8.1.4 Object 0x1010: Store parameters

This object is used to store the current values of the COB-ID SYNC, the heartbeat timer, the transmission type and the event timer in the non-volatile memory (EEPROM) of the sensor.

0x1010	ARRAY	Store parameters	Unsigned32	RW	O

- Sub index 0x00: Displays how many subindices are supported (in this case 1).
- Sub-index 0x01: Save all parameters.

When the command "save" is written, the parameters are saved in the nonvolatile memory (EEPROM).

Data content for write access (save = 0x65766173):

Bit	Value	Meaning
0	0x73	ASCII code for **s**
1	0x61	ASCII code for **a**
2	0x76	ASCII code for **v**
3	0x65	ASCII code for **e**

8.1.5 Object 0x1011: Restore manufacturer settings (load standard values)

This command deletes the parameters in the working memory and replaces them with standard values (the manufacturer's values as were configured upon delivery of the sensor).

This object can be used to reset the COB-ID SYNC, heartbeat timer, transmission type and event timer parameters to the factory settings.

0x1011	RECORD	Restore manufac-turer settings	Unsigned32	RW	O

The parameters can be reset using the following values:

Parameter	Value
Heartbeat	0x0
COB-ID SYNC	0x80
Event timer	0x0
Transmission type	0x01

- Sub index 0x00: Displays how many subindices are supported (in this case 1).
- Sub-index 0x01: Restore all parameters.

All parameters in the device RAM are reset to their standard values when the command 0x64616F6C (load) is written under sub index 0x01.

Bit	Value	Meaning
0	0x6C	ASCII code for **l**
1	0x6F	ASCII code for **o**
2	0x61	ASCII code for **a**
3	0x64	ASCII code for **d**

8.1.6 Object 0x1014: COB-ID emergency (COB-ID for emergency messages)

The object indicates which COB-ID emergency messages are sent on. The COB-ID is determined by the selected node ID and cannot be changed (read only). Object 0x1029 error behavior describes what happens in the event of an error (see [▶ 19]).

0x1014	VAR	COB-ID EMCY	Unsigned 32	RW	O

8.1.7 Object 0x1017: Producer heartbeat time (specify heartbeat cycle)

The object specifies the heartbeat cycle. The value range is 2 bytes and has the unit ms.

0x1017	VAR	Producer heart-beat time	Unsigned16	RW	O

Sub-index	Value	Meaning
0x00	0x0000	Heartbeat cycle is deactivated
	0x0001…0xFFFF	Selected value must be ≥ 1 ms

Default: 0x0000

- ▶ Activate the function: Specify the time in the range of 1…65535 ms.
- ▶ Deactivate the function: Enter time **0**.

- ▪ Value range: $0…65535_{dec}$ (corresponds to 0…65535 ms)
- ▪ Default value: 0_{dec}

> **NOTE**
> A "heartbeat producer" transmits the message cyclically at intervals of the set time.

The content of the data byte corresponds to the status of the CAN node:

Status of the CAN node	Content of the data byte
Pre-operational	0x7F
Operational	0x05
Stopped	0x04

8.1.8 Object 0x1018: Identity object (device identification)

The device identification can be read via the object.

0x1018	RECORD	Device identification	Identity	RO	O

Sub-index	Meaning
0x00	Number of entries (default: 0x02)
0x01	Turck vendor ID
0x02	Product code

8.1.9 Object 0x1029: Error behavior

The behavior of the device in the event of error can be shown via the object.

0x1029	ARRAY	Error behavior	Unsigned8	RW	O

Sub-index	Meaning
0x00	Number of entries (default: 0x01)
0x01	No change in the NMT status (CiA 0x01)

8.1.10 Object 0x1800: TPDO1 parameter (asynchronous)

The object contains the parameters for the process data object TPDO1. In the standard setting, this service is used to output the process data of the sensor asynchronously.

0x1800	RECORD	TPDO1 communication para-meter (process data object 1)	PDO_COMMUNICA-TION_PARAMETER	RW	M/O

Sub-index	Meaning
0x00	Number of supported sub-indexes Read only Default: 0x05
0x01	COB-ID Read only 0x0000 0180 + node number
0x02	Transmission type Value range: 0x01…0xF0 (cyclical, example: 0x03 = for every third synchronization) Value 0xFE: event-specific Default: 0x01 Value 255 (dec.): Sync mode not working
0x03	Not used
0x04	Not used
0x05	Event timer Value range: 0x0000…0xFFFF (100…65535, corresponds to 100…65,535 ms) 0: no data output Default value: 0x00

8.1.11   Object 0x1A00: TPDO1 Mapping Parameter

The object contains the mapping parameters for the process data object TPDO1.

0x1A00	RECORD	TPDO1 mapping parameter	PDO MAPPING	RW	M/O

Data content:

Sub-index	Meaning
0x00	Number of supported sub-indexes Read only Value range: 0x00…0xFF
0x01	Reference to object 0x6004 (current position value) Process data value range: 16 bit

8.2   Setting parameters specific to the manufacturer

8.2.1   Object 0x2100: Baud rate (setting the baud rate)

The transmission rate is set without an LSS service via the object. The default value is 250 kbps.

0x2100	VAR	Baud rate	Unsigned16	RW	M

▶   Specify the data content in object 0x2100, sub-index 0x00 as shown in the following table:

Data	Transmission rate	Format
1	1000 kbps	Unsigned8
2	800 kbps	Unsigned8
3	500 kbps	Unsigned8
4	250 kbps	Unsigned8
5	125 kbps	Unsigned8
6	50 kbps	Unsigned8
7	20 kbps	Unsigned8

Loading changes into the device

▶   Execute **Save all bus parameters** (0x2105) to save the changes.
▶   Carry out a voltage reset.

8.2.2 Object 0x2101: Node number (changing the node address)

The node address can be changed via the object. The default value is 0x07.

0x2101	VAR	Node number	Unsigned8	RW	M

▶ Specify the node address in object 0x2101: Enter a value between 0x00 and 0x7F ($0…127_{dec}$).

ℹ **NOTE**
The node number 0 is reserved and must not be used by any nodes.

▶ Execute **Save all bus parameters** (0x2105) to save the changes.
▶ Carry out a voltage reset or a node reset to load the changes into the device. All other settings are retained.

8.2.3 Object 0x2102: CANBus termination (switching the terminating resistor on and off)

A 120-Ω terminating resistor for terminating the bus can be switched on and off via the object.

0x2102	VAR	CAN bus termination	Unsigned8	RW	M

- 1: termination active
- 0: termination inactive

▶ Execute **Save all bus parameters** (0x2105) to save the changes.
▶ Reset the voltage to load the changes into the device.

8.2.4 Object 0x2104: NMT autostart

The start mode of the positioning element can be set via the object when switched on.

0x2104	VAR	NMT autostart	Unsigned8	RW	M

Object	Sub-index	Data
0x2104	0x00	0: Pre-operational
		1: Operational

▶ Execute **Save all bus parameters** (0x2105) to save the changes.
▶ Reset the voltage to load the changes into the device.

8.2.5 Object 0x2105: Manufacturer specific profile area (save)

When the command "save" is written, the parameters are saved in the nonvolatile memory (EEPROM).

0x2105	ARRAY	Store parameters	Unsigned32	RW	O

The following objects are saved using this command: 0x2100, 0x2101, 0x2102, 0x2104. To prevent an object being accidentally saved, the command is only executed when the string "save" is entered as the code word in the index (object 0x1010).

Read access to the CANopen device indicates whether values can be saved (data: 0x01 = save possible).

Bit	Value	Meaning
0	1	Device supports the loading of standard values.
31	Reserved	

Data content for write access (save = 0x65766173):

Bit	Value	Meaning
0	0x73	ASCII code for **s**
1	0x61	ASCII code for **a**
2	0x76	ASCII code for **v**
3	0x65	ASCII code for **e**

If write access is written incorrectly, the device responds via the Abort Transfer Service service data object with code 0x0800 0020.

If saving write access fails, the device responds with code 0x00000606 via the Abort Transfer Service service data object.

8.3 Adjusting the standard device parameters

8.3.1 Object 0x6004: Current position value

The device outputs the current position value.

0x6004	VAR	Position value	Unsigned16	RO	M

Data content:

Byte	Value
0	$2^7 \ldots 2^0$
1	$2^{15} \ldots 2^8$

- Value range: 0…maximum physical resolution
- Default setting: current position

8.4 Fault signals

In the event of faulty communication, an fault signal is output in SDO. The command byte always has the value 0x80.

The following fault signals may occur:

Value	Meaning
0x0504 0001	Client/server command specification not valid or unknown.
0x0601 0002	Attempt to write a read-only object.
0x0602 0000	The object does not exist in the object directory.
0x0607 0012	Data type does not match, parameter length of service is too high.
0x0607 0013	Data type does not match, parameter length of service is too low.
0x0609 0011	Sub-index does not exist.
0x0609 0030	Invalid value for parameter.
0x0800 0021	Incorrect password entered for password-protected object.

8.5 Emergency message

In the event of an error, the sensor sends emergency telegrams independently. A distinction is made between SDO error messages in the event incorrect access to an SDO object and correctly sent fault signals as an emergency message. When an error occurs for the first time, an error message is sent. When the error is corrected, an error message with error code 0x0000 is sent.

The COB-ID of the emergency message is calculated from the node ID (module address) + 0x80.

The following fault signals may occur:

Byte 1	Byte 0	Meaning
0x00	0x00	No error
0x81	0x20	CAN in error passive mode
0x81	0x50	CAN ID collision

9 Troubleshooting

If the device does not work as expected, proceed as follows:

- ▶ Exclude environmental disturbances.
- ▶ Check the connections of the device for errors.
- ▶ Check device for parameterization errors.

If the malfunction persists, the device is faulty. In this case, decommission the device and replace it with a new device of the same type.

10 Maintenance

The device is maintenance-free. Clean with a damp cloth if required.

11 Repair

The device is not intended for repair by the user. The device must be decommissioned if it is faulty. Observe our return acceptance conditions when returning the device to Turck.

11.1 Returning devices

If a device has to be returned, bear in mind that only devices with a decontamination declaration will be accepted. This is available for download at
https://www.turck.de/en/return-service-6079.php
and must be completely filled in, and affixed securely and weather-proof to the outside of the packaging.

12 Disposal

The devices must be disposed of properly and do not belong in the domestic waste.

13 Technical data

Type	DWE-…-…-…-…
Measuring principle	Potentiometer
General data	
Resolution	16-bit
Linearity deviation	≤ 0.5 %
Electrical data	
Operating voltage U_B	8…30 VDC
Wire break/reverse polarity protection	No/Yes
Communication protocol	CANopen
Output function	5-wire
Interface	CAN High-Speed in accordance with ISO 11898, basic and full CAN, CAN specification 2.0 B
Node ID	1…127 adjustable via SDO, factory setting: 7
Transmission rate	20…1000 kbit/s adjustable via SDO, factory setting baud rate 250 kbit/s
Sampling rate	1000 Hz
Current consumption	10 mA at 24 VDC, typically
Mechanical data	
Design	Draw-wire sensor
Housing material	Aluminum, plastic
Min. extension force	4 N
Max. extension speed	3 m/s
Max. extension acceleration	50 m/s^2
Wire material	Stainless steel
Electrical connection	Cable
Cable length	2 m
Ambient conditions	
Ambient temperature	-20…+85 °C
Relative humidity	≤ 90 %
Protection class	IP69K

14 Turck branches — contact data

Germany
Hans Turck GmbH & Co. KG
Witzlebenstraße 7, 45472 Mülheim an der Ruhr
www.turck.de

Australia
Turck Australia Pty Ltd
Building 4, 19-25 Duerdin Street, Notting Hill, 3168 Victoria
www.turck.com.au

Austria
Turck GmbH
Graumanngasse 7/A5-1, A-1150 Vienna
www.turck.at

Belgium
TURCK MULTIPROX
Lion d'Orweg 12, B-9300 Aalst
www.multiprox.be

Brazil
Turck do Brasil Automação Ltda.
Rua Anjo Custódio Nr. 42, Jardim Anália Franco, CEP 03358-040 São Paulo
www.turck.com.br

Canada
Turck Canada Inc.
140 Duffield Drive, CDN-Markham, Ontario L6G 1B5
www.turck.ca

China
Turck (Tianjin) Sensor Co. Ltd.
18,4th Xinghuazhi Road, Xiqing Economic Development Area, 300381 Tianjin
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