

CANopen® Protocol Description SDS

Description of the CANopen® protocol and objection dictionary of the SDS

This document describes and explains the CANopen® services supported by the SDS bar and the implemented object dictionary.

Supported CANopen® services

The following standard CANopen® services / transfer types are supported:

- NMT protocols
- Node monitoring
- EMCY protocol
- LSS services
- SDO transfer
- PDO transfer

NMT protocols

The Network Management (NMT) protocols allow the master to control the selected SDS bar / the entire CANopen® network. All NMT commands are always sent by the master to the CANopen® slaves. Below you can see the protocol used to transmit NMT commands:

COB-ID	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
0x000	NMT Command	Node ID	x	x	x	x	x	x

- NMT Command
Command for controlling the selected node
 - 0x01: Switch node to "operational"
 - 0x02: Stop node
 - 0x80: Switch node to "pre-operational"
 - 0x81: Restart node
 - 0x82: Restart CANopen® communication of the node
- Node ID
Address of the selected node
 - 0x00: NMT command is executed globally for all nodes
 - 0x01 – 0x7F: NMT command is executed for the selected node
- X
Not used

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Node monitoring

The Heartbeat Protocol can be used to monitor the CANopen® node with the SDS bar. The electrode sends the heartbeat at a regular time interval that can be set in increments of 100 ms. The structure of the protocol is as follows:

COB-ID	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
0x700 + Node-ID	Node State	x	x	x	x	x	x	x

- Node State
Status of the node
 - 0x00: Boot up node
 - 0x04: Node stopped
 - 0x05: Node operational
 - 0x7F: Node pre-operational

EMCY protocol

The Emergency (EMCY) protocol is used to transmit error and warning messages from the SDS bar to the consumer of the EMCY messages. The protocol also transmits a confirmation once an error or warning has been successfully eliminated. The following is a graphical representation of the EMCY protocol.

COB-ID	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
0x080 + Node-ID	EMCY Error Code	Error Register	Type	Code	x	x	x	x

- EMCY Error Code
CANopen®-specific code of the error or warning
 - 0x0000: No error or warning has occurred.
 - 0x1000 – 0xFFFF: CANopen®-specific error code; see CiA 301 for details
- Error Register
Shows the error type
 - 0x00: No error or warning occurred/eliminated
 - 0x01 – 0xFF: An error/warning has occurred; see CiA 301 for details
- Type
Shows the error type
- 0x01: Error
- 0x05: Warning
- Code
Error/warning number; see ch. 6.1 and 6.2 in the SDS bar operating manual for details.
- X
Not used: always 0x00

LSS services

The LSS services can be used to specify the CANopen® node address and baud rate. The procedure for setting the node address and the baud rate is basically the same. First, the node is started in the LSS Config status, then the new configuration parameters are transmitted with the Configure Node-ID service / Configure Bit Timing Parameters service. The parameters are saved with the Store Configuration service.

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The new parameters are available after a restart of the node or the communication via NMT protocols. The new baud rate can also be activated via the Activate Bit Timing Parameter service. Note that the new baud rate will need to be applied to all devices in the CANopen® network to prevent communication errors at the individual devices. See CiA 305 for more information on the LSS services.

PDO transfer

The Process Data Object (PDO) transfer is a direct transfer (without confirmation) by the recipient. Data is transmitted without supplementary information – only with the CAN identifier (COB-ID) – for identification. The objects marked for PDO mapping in the object dictionary are mapped in the respective data bytes. The PDO transfer is only available in operational mode. PDO data is not transferred or evaluated in other CANopen® modes.

Refer to the object dictionary of the SDS bar and specification CiA 301 for details about the PDO transfer and the set parameters.

SDO transfer

All entries of the object dictionary can be accessed with the Service Data Object (SDO) protocol. The transfer is always confirmed with a response from the selected node. The SDS bar is configured as an SDO server. This means that other devices (SDO clients) in the CANopen® network can access the individual objects via download (read access) and upload (write access). Due to the maximum data length of four bytes, segmented SDO transfers and block transfers are not supported. Below you can see the structure of the protocol for the SDO transfer.

COB-ID	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
COB-ID	Command Byte	Object Index LSB	Object Index MSB	Object Subindex	Data LSB first			

- COB-ID
CAN identifier of the message
 - 0x580 + Node-ID: Transfer from SDS bar to SDO client
 - 0x600 + Node-ID: Transfer from SDO client to SDS bar
- Command Byte
Type of SDO access to the selected object
 - 0x22: Write access by SDO client
 - 0x40: Read access by SDO client
 - 0x43: Confirmation by SDO server, reading of 4 bytes
 - 0x4B: Confirmation by SDO server, reading of 2 bytes
 - 0x4F: Confirmation by SDO server, reading of 1 byte
 - 0x80: SDO transfer canceled by SDO server
- Object Index LSB
Low byte of object index
- Object Index MSB
High byte of object index

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- Object Subindex
Subindex of the object
- Data (LSB first)
Data field showing the content of the object data. The least significant (low) byte is the first in the data field. This is where the new data is transferred in case of a write access. During reading, the data is included in the response of the SDO server. Also, in the event of an error, certain CANopen®-specific error codes are transferred in the data field. If the entries are not needed for the transfer, they must always be filled with 0x00.
See CANopen® specification CiA 301 for more details.

Overview of the SDS CANopen® object dictionary

The following table lists all CANopen® objects supported by the SDS bar.

Object Index	Object Name
0x1000	Device type
0x1001	Error register
0x1003	Pre-defined Error Field
0x1008	Manufacturer device name
0x100A	Manufacturer software version
0x1010	Store Parameter Field
0x1011	Restore Parameter Defaults
x01014	COB-ID EMCY message
0x1017	Producer Heartbeat time
0x1018	Identity Object
0x1200	Server SDO parameter
0x1400	1. Receive PDO parameter
0x1600	1. Receive PDO Mapping
0x1800	1. Transmit PDO parameter
0x1801	2. Transmit PDO parameter
0x1A00	1. Transmit PDO Mapping
0x1A01	2. Transmit PDO Mapping
0x2000	Read Operating Hours
0x2001	Read Actual Values
0x2002	Read/Write Parameters
0x2003	Clear Error/Warning
0x6000	Read Input 8 Bit
0x6200	Write Output 8 Bit
0x6401	Read Analog Input 16 Bit

On the following pages, you will find a description of each object in terms of the individual access parameters and the included subindexes.

All these objects are also listed in the CANopen® EDS file (SDS.eds) of the SDS bar.

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Object 0x1000 Device type

Object for the CANopen[®] device profile.

Index	0x1000
Subindex	0x00
Name	Device type
Object Code	VAR
Data Type	UNSIGNED32
Data Size	4 Byte
Access Type	Read Only
PDO Mapping	No
Value Range	UNSIGNED32
Default Value	0x191 (401)
Low Limit	
High Limit	

Object 0x1001 Error register

Object for the CANopen[®] error register

Index	0x1001
Subindex	0x00
Name	Error register
Object Code	VAR
Data Type	UNSIGNED8
Data Size	1 Byte
Access Type	Read Only
PDO Mapping	No
Value Range	UNSIGNED8
Default Value	
Low Limit	
High Limit	

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Object 0x1003 Pre-defined Error Field

Object for the CANopen®-specific pre-defined error field

Index	0x1003
Name	Pre-defined Error Field
Object Code	ARRAY

Index	0x1003
Subindex	0x00
Name	Number of Errors
Object Code	VAR
Data Type	UNSIGNED8
Data Size	1 Byte
Access Type	Read/Write
PDO Mapping	No
Value Range	0x00 – 0xFE
Default Value	0
Low Limit	
High Limit	

Index	0x1003
Subindex	0x01
Name	Standard Error Field
Object Code	VAR
Data Type	UNSIGNED32
Data Size	4 Byte
Access Type	Read Only
PDO Mapping	No
Value Range	UNSIGNED32
Default Value	0
Low Limit	
High Limit	

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Object 0x1008 Manufacturer device name

Object for the Eltex device name

Index	0x1008
Subindex	0x00
Name	Manufacturer device name
Object Code	VAR
Data Type	VISIBLE STRING
Data Size	3 Byte
Access Type	CONST
PDO Mapping	No
Value Range	
Default Value	SDS
Low Limit	
High Limit	

Object 0x100A Manufacturer software version

Object for the software version

Index	0x100A
Subindex	0x00
Name	Manufacturer software version
Object Code	VAR
Data Type	VISIBLE STRING
Data Size	3 Byte
Access Type	CONST
PDO Mapping	No
Value Range	
Default Value	
Low Limit	
High Limit	

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Object 0x1010 Store Parameter Field

Object for storing the parameter data. If object 0x1010 subindex 0x01 is addressed with a write access, all parameter values are stored in an internal memory.

Index	0x1010
Name	Store Parameter Field
Object Code	ARRAY

Index	0x100
Subindex	0x00
Name	Number of entries
Object Code	VAR
Data Type	UNSIGNED8
Data Size	1 Byte
Access Type	Read Only
PDO Mapping	No
Value Range	0x01 – 0x7F
Default Value	0x01
Low Limit	
High Limit	

Index	0x1010
Subindex	0x01
Name	Save all Parameters
Object Code	VAR
Data Type	UNSIGNED32
Data Size	4 Byte
Access Type	Read/Write
PDO Mapping	No
Value Range	UNSIGNED32
Default Value	
Low Limit	
High Limit	

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Object 0x1011 Restore Default Parameters

Object for loading default parameter values. If object 0x1011 subindex 0x01 is addressed with a write access, all parameter values are reset to default values. The only exceptions are the CANopen® node address and the bit timing, which are not reset.

Index	0x1011
Name	Restore Parameter Defaults
Object Code	ARRAY

Index	0x101
Subindex	0x00
Name	Number of entries
Object Code	VAR
Data Type	UNSIGNED8
Data Size	1 Byte
Access Type	Read Only
PDO Mapping	No
Value Range	0x01 – 0x7F
Default Value	0x01
Low Limit	
High Limit	

Index	0x1011
Subindex	0x01
Name	Restore all Default Parameters
Object Code	VAR
Data Type	UNSIGNED32
Data Size	4 Byte
Access Type	Read/Write
PDO Mapping	No
Value Range	UNSIGNED32
Default Value	
Low Limit	
High Limit	

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Object 0x1014 COB-ID EMCY Message

Object for the CAN identifier of the EMCY message

Index	0x1014
Subindex	0x00
Name	COB-ID EMCY Message
Object Code	VAR
Data Type	UNSIGNED32
Data Size	4 Byte
Access Type	Read Only
PDO Mapping	No
Value Range	UNSIGNED32
Default Value	0x80 + Node-ID
Low Limit	
High Limit	

Object 0x1017 Producer Heartbeat Time

This object is used to set the heartbeat time for node monitoring. The time can be set in a range from 100 ms to 60000 ms (1 min) in increments of 100 ms. If the value 0 is selected, the heartbeat is deactivated. By default, the heartbeat is generated in 5-second intervals.

Index	0x1017
Subindex	0x00
Name	Producer heartbeat time
Object Code	VAR
Data Type	UNSIGNED16
Data Size	2 Byte
Access Type	Read/Write
PDO Mapping	No
Value Range	UNSIGNED16
Default Value	0
Low Limit	100
High Limit	60000

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Object 0x1018 Identity Object

Object for identification of the CANopen® node

Index	0x1011
Name	Identity Object
Object Code	RECORD

Index	0x118
Subindex	0x00
Name	Number of entries
Object Code	VAR
Data Type	UNSIGNED8
Data Size	1 Byte
Access Type	Read Only
PDO Mapping	No
Value Range	UNSIGNED8
Default Value	0x04
Low Limit	
High Limit	

Index	0x1018
Subindex	0x01
Name	Vendor ID
Object Code	VAR
Data Type	UNSIGNED32
Data Size	4 Byte
Access Type	Read Only
PDO Mapping	No
Value Range	UNSIGNED32
Default Value	0x0000024E
Low Limit	
High Limit	

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Index	0x1018
Subindex	0x02
Name	Product Code
Object Code	VAR
Data Type	UNSIGNED32
Data Size	4 Byte
Access Type	Read Only
PDO Mapping	No
Value Range	UNSIGNED32
Default Value	
Low Limit	
High Limit	

Index	0x1018
Subindex	0x03
Name	Revision Number
Object Code	VAR
Data Type	UNSIGNED32
Data Size	4 Byte
Access Type	Read Only
PDO Mapping	No
Value Range	UNSIGNED32
Default Value	
Low Limit	
High Limit	

Index	0x1018
Subindex	0x04
Name	Serial Number
Object Code	VAR
Data Type	UNSIGNED32
Data Size	4 Byte
Access Type	Read Only
PDO Mapping	No
Value Range	UNSIGNED32
Default Value	
Low Limit	
High Limit	

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Object 0x1200 1. Server SDO parameters

Object with the SDO server parameters

Index	0x1200
Name	1. Server SDO parameters
Object Code	RECORD

Index	0x1200
Subindex	0x00
Name	Number of entries
Object Code	VAR
Data Type	UNSIGNED8
Data Size	1 Byte
Access Type	Read Only
PDO Mapping	No
Value Range	UNSIGNED8
Default Value	0x02
Low Limit	
High Limit	

Index	0x1200
Subindex	0x01
Name	COB-ID Client -> Server (rx)
Object Code	VAR
Data Type	UNSIGNED32
Data Size	4 Byte
Access Type	Read Only
PDO Mapping	No
Value Range	UNSIGNED32
Default Value	0x600 + Node-ID
Low Limit	
High Limit	

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Index	0x1200
Subindex	0x02
Name	COB-ID Server -> Client (tx)
Object Code	VAR
Data Type	UNSIGNED32
Data Size	4 Byte
Access Type	Read Only
PDO Mapping	No
Value Range	UNSIGNED32
Default Value	0x580 + Node-ID
Low Limit	
High Limit	

Object 0x1400 1. Receive PDO parameter

Object with the communication parameters for the 1st Receive PDO

Index	0x1400
Name	1. Receive PDO Parameter
Object Code	RECORD

Index	0x1400
Subindex	0x00
Name	Largest Sub-Index supported
Object Code	VAR
Data Type	UNSIGNED8
Data Size	1 Byte
Access Type	Read Only
PDO Mapping	No
Value Range	UNSIGNED8
Default Value	0x02
Low Limit	
High Limit	

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Index	0x1400
Subindex	0x01
Name	COB-ID used by PDO
Object Code	VAR
Data Type	UNSIGNED32
Data Size	4 Byte
Access Type	Read Only
PDO Mapping	No
Value Range	UNSIGNED32
Default Value	0x200 + Node-ID
Low Limit	
High Limit	

Index	0x1400
Subindex	0x02
Name	Transmission Type
Object Code	VAR
Data Type	UNSIGNED8
Data Size	1 Byte
Access Type	Read Only
PDO Mapping	No
Value Range	UNSIGNED8
Default Value	255
Low Limit	
High Limit	

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Object 0x1400 1. Receive PDO Mapping

Mapping parameters for the 1st Receive PDO

Index	0x1600
Name	1. Receive PDO Mapping
Object Code	RECORD

Index	0x1600
Subindex	0x00
Name	Number of mapped Application Objects supported
Object Code	VAR
Data Type	UNSIGNED8
Data Size	1 Byte
Access Type	Read Only
PDO Mapping	No
Value Range	0x01 – 0x40
Default Value	0x01
Low Limit	
High Limit	

Index	0x1600
Subindex	0x01
Name	1. mapped Object
Object Code	VAR
Data Type	UNSIGNED32
Data Size	4 Byte
Access Type	Read Only
PDO Mapping	No
Value Range	UNSIGNED32
Default Value	0x62000108
Low Limit	
High Limit	

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Object 0x1800 1. Transmit PDO parameter

Object with the communication parameters for the 1st Transmit PDO

Index	0x1800
Name	1. Transmit PDO Parameter
Object Code	RECORD
Data Type	UNSIGNED32

Index	0x1800
Subindex	0x00
Name	Largest Sub-Index supported
Object Code	VAR
Data Type	UNSIGNED8
Data Size	1 Byte
Access Type	Read Only
PDO Mapping	No
Value Range	UNSIGNED8
Default Value	0x02
Low Limit	
High Limit	

Index	0x1800
Subindex	0x01
Name	COB-ID used by PDO
Object Code	VAR
Data Type	UNSIGNED32
Data Size	4 Byte
Access Type	Read Only
PDO Mapping	No
Value Range	UNSIGNED32
Default Value	0x180 + Node-ID
Low Limit	
High Limit	

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Index	0x1800
Subindex	0x02
Name	Transmission Type
Object Code	VAR
Data Type	UNSIGNED8
Data Size	1 Byte
Access Type	Read Only
PDO Mapping	No
Value Range	UNSIGNED8
Default Value	255
Low Limit	
High Limit	

Object 0x1801 2. Transmit PDO parameter

Object with the communication parameters for the 2nd Transmit PDO

Index	0x1801
Name	2. Transmit PDO Parameter
Object Code	RECORD

Index	0x1801
Subindex	0x00
Name	Largest Sub-Index supported
Object Code	VAR
Data Type	UNSIGNED8
Data Size	1 Byte
Access Type	Read Only
PDO Mapping	No
Value Range	UNSIGNED8
Default Value	0x02
Low Limit	
High Limit	

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Index	0x1801
Subindex	0x01
Name	COB-ID used by PDO
Object Code	VAR
Data Type	UNSIGNED32
Data Size	4 Byte
Access Type	Read Only
PDO Mapping	No
Value Range	UNSIGNED32
Default Value	0x280 + Node-ID
Low Limit	
High Limit	

Index	0x1801
Subindex	0x02
Name	Transmission Type
Object Code	VAR
Data Type	UNSIGNED8
Data Size	1 Byte
Access Type	Read Only
PDO Mapping	No
Value Range	UNSIGNED8
Default Value	255
Low Limit	
High Limit	

Object 0x1A00 1. Transmit PDO Mapping

Mapping parameters for the 1st Transmit PDO

Index	0x1A00
Name	1. Transmit PDO Mapping
Object Code	RECORD

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Index	0x1A00
Subindex	0x00
Name	Number of mapped Application Objects supported
Object Code	VAR
Data Type	UNSIGNED8
Data Size	1 Byte
Access Type	Read Only
PDO Mapping	No
Value Range	0x01 – 0x40
Default Value	0x05
Low Limit	
High Limit	

Index	0x1A00
Subindex	0x01
Name	1. mapped Object
Object Code	VAR
Data Type	UNSIGNED32
Data Size	4 Byte
Access Type	Read Only
PDO Mapping	No
Value Range	UNSIGNED32
Default Value	0x60000108
Low Limit	
High Limit	

Index	0x1A00
Subindex	0x02
Name	2. mapped Object
Object Code	VAR
Data Type	UNSIGNED32
Data Size	4 Byte
Access Type	Read Only
PDO Mapping	No
Value Range	UNSIGNED32
Default Value	0x60000208
Low Limit	
High Limit	

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Index	0x1A00
Subindex	0x03
Name	3. mapped Object
Object Code	VAR
Data Type	UNSIGNED32
Data Size	4 Byte
Access Type	Read Only
PDO Mapping	No
Value Range	UNSIGNED32
Default Value	0x60000308
Low Limit	
High Limit	

Index	0x1A00
Subindex	0x04
Name	4. mapped Object
Object Code	VAR
Data Type	UNSIGNED32
Data Size	4 Byte
Access Type	Read Only
PDO Mapping	No
Value Range	UNSIGNED32
Default Value	0x60000408
Low Limit	
High Limit	

Index	0x1A00
Subindex	0x05
Name	5. mapped Object
Object Code	VAR
Data Type	UNSIGNED32
Data Size	4 Byte
Access Type	Read Only
PDO Mapping	No
Value Range	UNSIGNED32
Default Value	0x60000508
Low Limit	
High Limit	

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Object 0x1A01 2. Transmit PDO Mapping

Mapping parameters for the 1st Transmit PDO

Index	0x1A01
Name	2. Transmit PDO Mapping
Object Code	RECORD

Index	0x1A01
Subindex	0x00
Name	Number of mapped Application Objects supported
Object Code	VAR
Data Type	UNSIGNED8
Data Size	1 Byte
Access Type	Read Only
PDO Mapping	No
Value Range	0x01 – 0x40
Default Value	0x03
Low Limit	
High Limit	

Index	0x1A00
Subindex	0x01
Name	1. mapped Object
Object Code	VAR
Data Type	UNSIGNED32
Data Size	4 Byte
Access Type	Read Only
PDO Mapping	No
Value Range	UNSIGNED32
Default Value	0x64010110
Low Limit	
High Limit	

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Index	0x1A00
Subindex	0x02
Name	2. mapped Object
Object Code	VAR
Data Type	UNSIGNED32
Data Size	4 Byte
Access Type	Read Only
PDO Mapping	No
Value Range	UNSIGNED32
Default Value	0x64010210
Low Limit	
High Limit	

Index	0x1A00
Subindex	0x03
Name	3. mapped Object
Object Code	VAR
Data Type	UNSIGNED32
Data Size	4 Byte
Access Type	Read Only
PDO Mapping	No
Value Range	UNSIGNED32
Default Value	0x64010310
Low Limit	
High Limit	

Object 0x2000 Read Operating Hours

The object contains a number of entries for reading the operating hour and high voltage hour meter. All entries can be read by the SDO client. A write access is not supported.

Index	0x2000
Name	Read Operating Hours
Object Code	RECORD

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Index	0x2000
Subindex	0x00
Name	Number of elements
Object Code	VAR
Data Type	UNSIGNED8
Data Size	1 Byte
Access Type	Read Only
PDO Mapping	No
Value Range	UNSIGNED8
Default Value	0x08
Low Limit	
High Limit	

- Subindex 0x01: Operating hours meter – years

Index	0x2000
Subindex	0x01
Name	Read Operating Hours Years
Object Code	VAR
Data Type	UNSIGNED8
Data Size	1 Byte
Access Type	Read Only
PDO Mapping	No
Value Range	UNSIGNED8
Default Value	
Low Limit	
High Limit	

- Subindex 0x02: Operating hours meter – days

Index	0x2000
Subindex	0x02
Name	Read Operating Hours Days
Object Code	VAR
Data Type	UNSIGNED16
Data Size	2 Byte
Access Type	Read Only
PDO Mapping	No
Value Range	0 - 365
Default Value	
Low Limit	
High Limit	

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- Subindex 0x03: Operating hours meter – hours

Index	0x2000
Subindex	0x03
Name	Read Operating Hours Hours
Object Code	VAR
Data Type	UNSIGNED8
Data Size	1 Byte
Access Type	Read Only
PDO Mapping	No
Value Range	0 - 60
Default Value	
Low Limit	
High Limit	

- Subindex 0x04: Operating hours meter – minutes

Index	0x2000
Subindex	0x04
Name	Read Operating Hours Minutes
Object Code	VAR
Data Type	UNSIGNED8
Data Size	1 Byte
Access Type	Read Only
PDO Mapping	No
Value Range	0 - 60
Default Value	
Low Limit	
High Limit	

- Subindex 0x05: High voltage hours meter – years

Index	0x2000
Subindex	0x05
Name	Read HV Hours Years
Object Code	VAR
Data Type	UNSIGNED8
Data Size	1 Byte
Access Type	Read Only
PDO Mapping	No
Value Range	UNSIGNED8
Default Value	
Low Limit	
High Limit	

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- Subindex 0x06: High voltage hours meter – days

Index	0x2000
Subindex	0x06
Name	Read HV Hours Days
Object Code	VAR
Data Type	UNSIGNED16
Data Size	2 Byte
Access Type	Read Only
PDO Mapping	No
Value Range	0 - 365
Default Value	
Low Limit	
High Limit	

- Subindex 0x07: High voltage hours meter – hours

Index	0x2000
Subindex	0x07
Name	Read HV Hours Hours
Object Code	VAR
Data Type	UNSIGNED8
Data Size	1 Byte
Access Type	Read Only
PDO Mapping	No
Value Range	0 - 60
Default Value	
Low Limit	
High Limit	

- Subindex 0x08: High voltage hours meter – minutes

Index	0x2000
Subindex	0x08
Name	Read HV Hours Minutes
Object Code	VAR
Data Type	UNSIGNED8
Data Size	1 Byte
Access Type	Read Only
PDO Mapping	No
Value Range	0 - 60
Default Value	
Low Limit	
High Limit	

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Object 0x2001 Read Actual Values

The entries for reading the actual values of the currents and voltages measured in the bar are combined in this object and assigned to the measurement parameter; voltages are given in V and currents in μA . The pulsating frequency in Hz and the duty factor in % can also be read out.

Index	0x2001
Name	Read Actual Values
Object Code	RECORD

Index	0x2001
Subindex	0x00
Name	Number of elements
Object Code	VAR
Data Type	UNSIGNED8
Data Size	1 Byte
Access Type	Read Only
PDO Mapping	No
Value Range	UNSIGNED8
Default Value	0x0A
Low Limit	
High Limit	

- Subindex 0x01: Voltage – positive high voltage

Index	0x2001
Subindex	0x01
Name	Read Actual Value Voltage Positive
Object Code	VAR
Data Type	UNSIGNED16
Data Size	2 Byte
Access Type	Read Only
PDO Mapping	No
Value Range	UNSIGNED16
Default Value	
Low Limit	
High Limit	

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- Subindex 0x02: Active current – positive high voltage

Index	0x2001
Subindex	0x02
Name	Read Actual Value Current Positive
Object Code	VAR
Data Type	INTEGER16
Data Size	2 Byte
Access Type	Read Only
PDO Mapping	No
Value Range	INTEGER16
Default Value	
Low Limit	
High Limit	

- Subindex 0x03: Leakage current – positive high voltage

Index	0x2001
Subindex	0x03
Name	Read Actual Value Leakage Current Positive
Object Code	VAR
Data Type	INTEGER16
Data Size	2 Byte
Access Type	Read Only
PDO Mapping	No
Value Range	INTEGER16
Default Value	
Low Limit	
High Limit	

- Subindex 0x04: Passive discharge current – positive high voltage

Index	0x2001
Subindex	0x04
Name	Read Actual Value Passive Current Positive
Object Code	VAR
Data Type	INTEGER16
Data Size	2 Byte
Access Type	Read Only
PDO Mapping	No
Value Range	INTEGER16
Default Value	
Low Limit	
High Limit	

CANopen® Protocol Description SDS

- Subindex 0x05: Voltage – negative high voltage

Index	0x2001
Subindex	0x05
Name	Read Actual Value Voltage Negative
Object Code	VAR
Data Type	UNSIGNED16
Data Size	2 Byte
Access Type	Read Only
PDO Mapping	No
Value Range	UNSIGNED16
Default Value	
Low Limit	
High Limit	

- Subindex 0x06: Active current – negative high voltage

Index	0x2001
Subindex	0x06
Name	Read Actual Value Current Negative
Object Code	VAR
Data Type	INTEGER16
Data Size	2 Byte
Access Type	Read Only
PDO Mapping	No
Value Range	INTEGER16
Default Value	
Low Limit	
High Limit	

- Subindex 0x07: Leakage current – negative high voltage

Index	0x2001
Subindex	0x07
Name	Read Actual Value Leakage Current Negative
Object Code	VAR
Data Type	INTEGER16
Data Size	2 Byte
Access Type	Read Only
PDO Mapping	No
Value Range	INTEGER16
Default Value	
Low Limit	
High Limit	

CANopen® Protocol Description SDS

- Subindex 0x08: Passive discharge current – negative high voltage

Index	0x2001
Subindex	0x08
Name	Read Actual Value Passive Current Negative
Object Code	VAR
Data Type	INTEGER16
Data Size	2 Byte
Access Type	Read Only
PDO Mapping	No
Value Range	INTEGER16
Default Value	
Low Limit	
High Limit	

- Subindex 0x09: Pulsating frequency of the high voltage

Index	0x2001
Subindex	0x09
Name	Read Pulsating Frequency
Object Code	VAR
Data Type	UNSIGNED8
Data Size	1 Byte
Access Type	Read Only
PDO Mapping	No
Value Range	UNSIGNED8
Default Value	
Low Limit	
High Limit	

- Subindex 0x0A: Duty factor of the high voltage

Index	0x2001
Subindex	0x0A
Name	Read Pulsating Duty Cycle
Object Code	VAR
Data Type	UNSIGNED8
Data Size	1 Byte
Access Type	Read Only
PDO Mapping	No
Value Range	UNSIGNED8
Default Value	
Low Limit	
High Limit	

CANopen® Protocol Description SDS

Object 0x2002 Read/Write Parameter

All parameters for the operation of the bar can be read and written with the entries of object 0x2002. These entries represent the sum of possible settings.

Index	0x2002
Name	Read/Write Parameter
Object Code	RECORD

Index	0x2002
Subindex	0x00
Name	Number of elements
Object Code	VAR
Data Type	UNSIGNED8
Data Size	1 Byte
Access Type	Read Only
PDO Mapping	No
Value Range	UNSIGNED8
Default Value	0x09
Low Limit	
High Limit	

- Subindex 0x01: Read/Write Actual Value Transfer Time
Setting of the cycle time for transmission of the actual values that are mapped in the two Transmit PDOs. The cycle times can be set in the range of 100 ms – 60000 ms (1 min). The default setting is 500 ms. In setting this parameter, it is important to consider the total bus load. If a low time value is selected, the bus load increases.

Index	0x2002
Subindex	0x01
Name	Read/Write Actual Value Transfer Time
Object Code	VAR
Data Type	UNSIGNED16
Data Size	2 Byte
Access Type	Read/Write
PDO Mapping	No
Value Range	UNSIGNED16
Default Value	500
Low Limit	100
High Limit	60000

CANopen® Protocol Description SDS

- Subindex 0x02: Read/Write Pollution Factor

This parameter is used to set the degree of pollution at which pollution warnings and errors are generated. The parameter value specifies the maximum permissible pollution. A pollution warning is issued at 80% of this value, a pollution error at 100%. External influences such as the substrate, installation site etc. may cause the pollution warning system to respond even with a brand-new bar. That is why the pollution factor must be adjusted to the on-site conditions.

Index	0x2002
Subindex	0x02
Name	Read/Write Polluting Factor
Object Code	VAR
Data Type	UNSIGNED8
Data Size	1 Byte
Access Type	Read/Write
PDO Mapping	No
Value Range	UNSIGNED8
Default Value	75
Low Limit	1
High Limit	100

- Subindex 0x03: Read Active Length
Entry for reading the active length of the bar

Index	0x2002
Subindex	0x03
Name	Read Active Length
Object Code	VAR
Data Type	UNSIGNED16
Data Size	2 Byte
Access Type	Read Only
PDO Mapping	No
Value Range	UNSIGNED16
Default Value	
Low Limit	
High Limit	

CANopen® Protocol Description SDS

- Subindex 0x04: Read/Write HV Adjustment
Object entry for adjusting the balance of positive and negative high voltage in order to improve discharging. The individual bars are preset to a default value in terms of this balance. If the measured discharge / residual charge is not satisfactory, the discharge result can be improved with this function. The setting represents the relation between the two voltages. At a setting of 50, both voltages are identical. If the value is smaller than 50, the positive voltage is decreased to reduce positive overcharging. If the residual charge is negative, the negative voltage can be adjusted with a setting greater than 50.

Index	0x2002
Subindex	0x04
Name	Read/Write HV Adjustment
Object Code	VAR
Data Type	UNSIGNED8
Data Size	1 Byte
Access Type	Read/Write
PDO Mapping	No
Value Range	UNSIGNED8
Default Value	
Low Limit	35
High Limit	65

- Subindex 0x05: Read Burn-In Test State
Reading the burn-in test state
0x00: No burn-in test was performed.
0x01: Burn-in test completed successfully.

Index	0x2002
Subindex	0x05
Name	Read Burn-In Test State
Object Code	VAR
Data Type	UNSIGNED8
Data Size	1 Byte
Access Type	Read Only
PDO Mapping	No
Value Range	UNSIGNED8
Default Value	
Low Limit	
High Limit	

CANopen® Protocol Description SDS

- Subindex 0x06: Read/Write CANopen Node ID
Setting of the CANopen node address.
Before the new node address can be applied, it must be saved using the SDO object 0x1010. Then the node must be restarted. This may be done by NMT command or by switching the supply voltage off and on.

Index	0x2002
Subindex	0x06
Name	Read/Write CANopen Node ID
Object Code	VAR
Data Type	UNSIGNED8
Data Size	1 Byte
Access Type	Read/Write
PDO Mapping	No
Value Range	UNSIGNED8
Default Value	99
Low Limit	1
High Limit	127

- Subindex 0x07: Read/Write CANopen Bit Timing
Setting of the CANopen baud rate via selection of the corresponding table entry for the bit timing.
Before the new baud rate can be applied, it must be saved using the SDO object 0x1010. Then the node must be restarted. This may be done by NMT command or by switching the supply voltage off and on.

0x00: 1000 kBit/s, 0x01: 800 kBit/s, 0x02: 500 kBit/s, 0x03: 250 kBit/s
0x04: 125 kBit/s, 0x06: 50 kBit/s, 0x07: 25 kBit/s, 0x08: 10 kBit/s

Index	0x2002
Subindex	0x07
Name	Read/Write CANopen Bit Timing
Object Code	VAR
Data Type	UNSIGNED8
Data Size	1 Byte
Access Type	Read/Write
PDO Mapping	No
Value Range	UNSIGNED8
Default Value	4
Low Limit	0
High Limit	8

CANopen® Protocol Description SDS

- Subindex 0x08: Read/Write Working Distance
Entries for adjusting the working distance in order to optimize discharging. The distance can be adjusted in centimeters for the individual variants:
 - SDS/N
10 cm – 15 cm
 - SDS/E
15 cm – 30 cm

Index	0x2002
Subindex	0x08
Name	Read/Write Working Distance
Object Code	VAR
Data Type	UNSIGNED8
Data Size	1 Byte
Access Type	Write Only
PDO Mapping	Yes
Value Range	UNSIGNED8
Default Value	
Low Limit	
High Limit	

- Subindex 0x08: Read/Write Pulse Frequency
Parameter for setting the pulse frequency in Hz.

Index	0x2002
Subindex	0x09
Name	Read/Write Pulse Frequency
Object Code	VAR
Data Type	UNSIGNED8
Data Size	1 Byte
Access Type	Write Only
PDO Mapping	Yes
Value Range	UNSIGNED8
Default Value	48 SDS/N, 40 SDS/E
Low Limit	30
High Limit	50

CANopen® Protocol Description SDS

Object 0x2003 Clear Error/Warning

Object with entries used to clear errors and warnings

Index	0x2003
Name	Clear Error/Warning
Object Code	RECORD

Index	0x2003
Subindex	0x00
Name	Number of elements
Object Code	VAR
Data Type	UNSIGNED8
Data Size	1 Byte
Access Type	Read Only
PDO Mapping	No
Value Range	UNSIGNED8
Default Value	0x05
Low Limit	
High Limit	

- Subindex 0x01: Clear Error
Entry for clearing errors. The transmitted error code is deleted after an internal check.

Index	0x2003
Subindex	0x01
Name	Clear Error
Object Code	VAR
Data Type	UNSIGNED8
Data Size	1 Byte
Access Type	Write Only
PDO Mapping	No
Value Range	UNSIGNED8
Default Value	
Low Limit	0x01
High Limit	0x50

CANopen® Protocol Description SDS

- Subindex 0x02: Clear Warning
Entry for clearing warnings. The transmitted warning code is deleted after an internal check.

Index	0x2003
Subindex	0x02
Name	Clear Warning
Object Code	VAR
Data Type	UNSIGNED8
Data Size	1 Byte
Access Type	Write Only
PDO Mapping	No
Value Range	UNSIGNED8
Default Value	
Low Limit	0x01
High Limit	0x60

Object 0x6000 Read Input 8 Bit

Object with 8 bit input data. These entries are mapped to the 1st Transmit PDO. This means direct monitoring data of the bar can be easily transmitted.

Index	0x6000
Name	Read Input 8 Bit
Object Code	ARRAY

Index	0x6000
Subindex	0x00
Name	Number of elements
Object Code	VAR
Data Type	UNSIGNED8
Data Size	1 Byte
Access Type	Read Only
PDO Mapping	No
Value Range	UNSIGNED8
Default Value	0x05
Low Limit	
High Limit	

CANopen® Protocol Description SDS

- Subindex 0x01: Read System Status
Entry for reading the current system status. This entry indicates whether an error or warning has been issued or whether the high voltage is output.
 - 1st bit – high voltage output
 - 0 – high voltage deactivated
 - 1 – high voltage activated
 - 2nd bit – error marking
 - 0 – no active error
 - 1 – an error has occurred
 - 3rd bit – warning marking
 - 0 – no active warning
 - 1 – a warning has been issued

Index	0x6000
Subindex	0x01
Name	Read System Status
Object Code	VAR
Data Type	UNSIGNED8
Data Size	1 Byte
Access Type	Read Only
PDO Mapping	Yes
Value Range	UNSIGNED8
Default Value	
Low Limit	
High Limit	

- Subindex 0x02: Read High Voltage Balance
Indicates the relation between positive and negative high voltage. At a value of 50, both voltages are identical. If the value is smaller than 50, the positive voltage is smaller than the negative one. If the value is greater than 50, the negative voltage is smaller than the positive one. The value represents the relation in percent between the two voltages.

Index	0x6000
Subindex	0x02
Name	Read High Voltage Balance
Object Code	VAR
Data Type	UNSIGNED8
Data Size	1 Byte
Access Type	Read Only
PDO Mapping	Yes
Value Range	UNSIGNED8
Default Value	
Low Limit	
High Limit	

CANopen® Protocol Description SDS

- Subindex 0x03: Read Power Capacity
Indicates the utilization in percent of the SDS bar

Index	0x6000
Subindex	0x03
Name	Read Power Capacity
Object Code	VAR
Data Type	UNSIGNED8
Data Size	1 Byte
Access Type	Read Only
PDO Mapping	Yes
Value Range	UNSIGNED8
Default Value	
Low Limit	
High Limit	

- Subindex 0x04: Read Pollution
Indicates the conductive pollution between the two tip rows in percent as a function of the selected pollution factor (object 2002 index 2).

Index	0x6000
Subindex	0x04
Name	Read Pollution
Object Code	VAR
Data Type	UNSIGNED8
Data Size	1 Byte
Access Type	Read Only
PDO Mapping	Yes
Value Range	UNSIGNED8
Default Value	
Low Limit	
High Limit	

CANopen® Protocol Description SDS

- Subindex 0x05: Read Working Distance
Readout of the set working distance in centimeters

Index	0x6000
Subindex	0x05
Name	Read Working Distance
Object Code	VAR
Data Type	UNSIGNED8
Data Size	1 Byte
Access Type	Read Only
PDO Mapping	Yes
Value Range	UNSIGNED8
Default Value	
Low Limit	
High Limit	

Object 0x6200 Write Output 8 Bit

Object with 8 bit output data. These entries are mapped to the 1st Receive PDO. This means that direct monitoring data of the bar can be easily transmitted.

Index	0x6200
Name	Write Output 8 Bit
Object Code	ARRAY

Index	0x6200
Subindex	0x00
Name	Number of elements
Object Code	VAR
Data Type	UNSIGNED8
Data Size	1 Byte
Access Type	Read Only
PDO Mapping	No
Value Range	UNSIGNED8
Default Value	0x02
Low Limit	
High Limit	

CANopen® Protocol Description SDS

- Subindex 0x01: Write HV Release
Object entry for the release of the high voltage. For a permanent release of the high voltage, this object must be written on at regular intervals. If the object is not written on within a timeout of 10 s, the high voltage is automatically deactivated.
 - Release status
0x00: Release disabled
0x0F: High voltage released

Index	0x6200
Subindex	0x01
Name	Write HV Release
Object Code	VAR
Data Type	UNSIGNED8
Data Size	1 Byte
Access Type	Write Only
PDO Mapping	Yes
Value Range	UNSIGNED8
Default Value	
Low Limit	
High Limit	

Object 0x6401 Read Analog Input 16 Bit

Object with 16 bit analog input data. These entries are mapped to the 1st Receive PDO. This means that direct monitoring data of the bar can be easily transmitted.

Index	0x6401
Name	Read Analog Input 16 Bit
Object Code	ARRAY

Index	0x6401
Subindex	0x00
Name	Number of elements
Object Code	VAR
Data Type	UNSIGNED8
Data Size	1 Byte
Access Type	Read Only
PDO Mapping	No
Value Range	UNSIGNED8
Default Value	0x03
Low Limit	
High Limit	

CANopen® Protocol Description SDS

- Subindex 0x01: Read Effective High Voltage
Effective high voltage in V. This value is calculated based on the actual values of the positive and negative polarity of the high voltage.

Index	0x640
Subindex	0x01
Name	Read Effective High Voltage
Object Code	VAR
Data Type	INTEGER16
Data Size	2 Byte
Access Type	Read Only
PDO Mapping	Yes
Value Range	INTEGER16
Default Value	
Low Limit	
High Limit	

- Subindex 0x02: Read Effective Current
Effective current in μA . This value is calculated based on the actual values of the positive and negative effective current.

Index	0x6401
Subindex	0x02
Name	Read Effective Current
Object Code	VAR
Data Type	INTEGER16
Data Size	2 Byte
Access Type	Read Only
PDO Mapping	Yes
Value Range	INTEGER16
Default Value	
Low Limit	
High Limit	

CANopen® Protocol Description SDS

- Subindex 0x02: Read DC Discharging Current
Sum of effective and leakage currents (+ or -) of the positive and negative polarity in μA . This value can be used to estimate the predominant web charge.

Index	0x6401
Subindex	0x03
Name	Read DC Discharging Current
Object Code	VAR
Data Type	INTEGER16
Data Size	2 Byte
Access Type	Read Only
PDO Mapping	Yes
Value Range	INTEGER16
Default Value	
Low Limit	
High Limit	