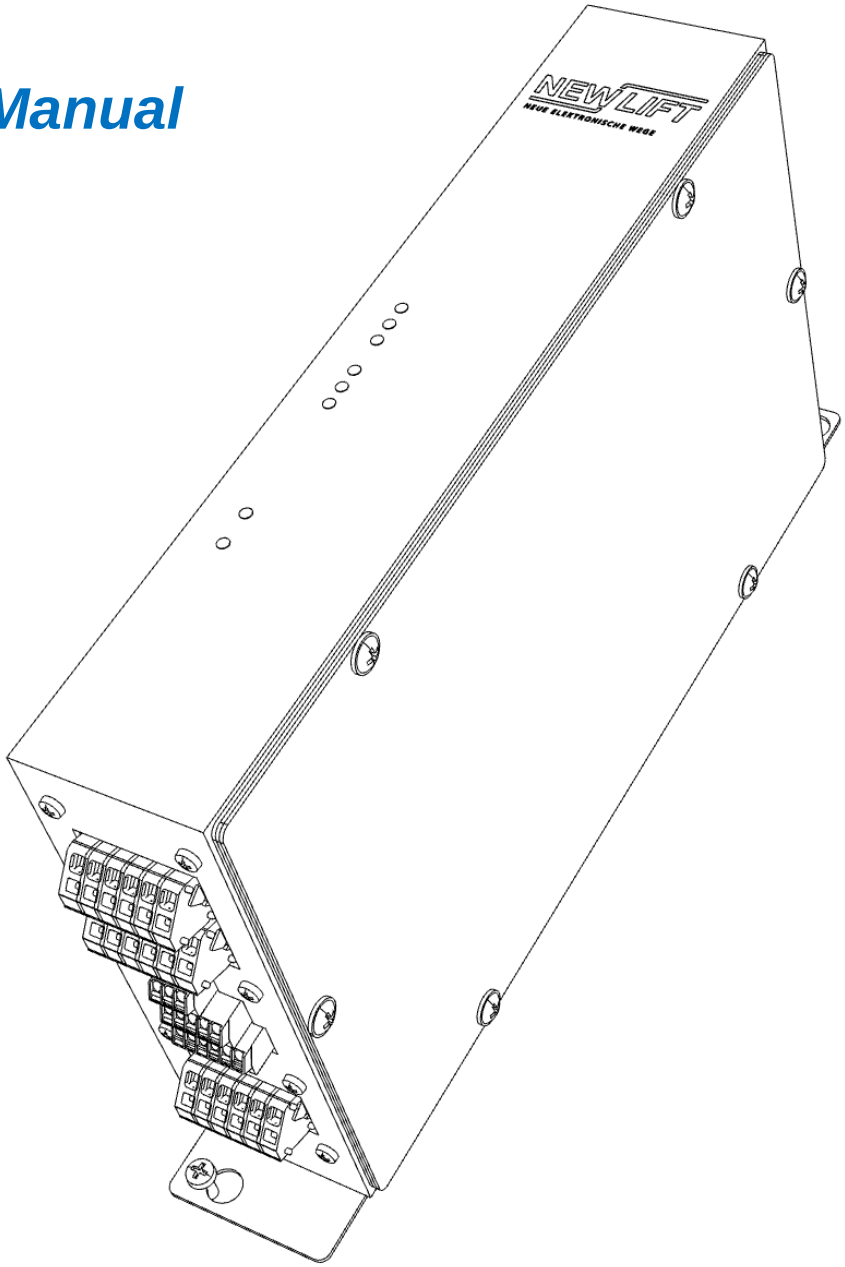
NEW LIFT
NEUE ELEKTRONISCHE WEGE

CBM

Contactorless Brake Module

CANopen Manual



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Content

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Version	Date	Remarks
1.0	31.10.2018	First version

1. About this manual

1.1 General

The CBM CANopen Manual is a reference book for integrating the module into a CANopen network.

Objectives of this manual:

- Describe the features of the CBM CAN bus interface

The CBM is a module that can control brake coils of all voltages (40-200VDC) and currents (up to 4A) up to a power of 240VA without protection. It is type-tested according to DIN EN81-20. In addition, it can perform brake test and evacuation (for machine roomless systems). In addition, other functions are available, such as the connection of a motor PTC or brake monitoring. The function of the brake circuits is monitored by a continuous current measurement.

1.2 Abbreviations, characters and symbols used

CBM
Contactless Brake Module for elevators

DRIVE
Driving signal from the end of the safety chain

BRAKE
Brake signal to open the brake

EVAK
Evacuation signal for evacuation in the event of a fault in the system

TEST
Test signals for brake test

CANopen
CAN interface with CANopen protocol according to CiA Standard Draft 301

1.3 Further information

For integration with FST see the manual of the FST.

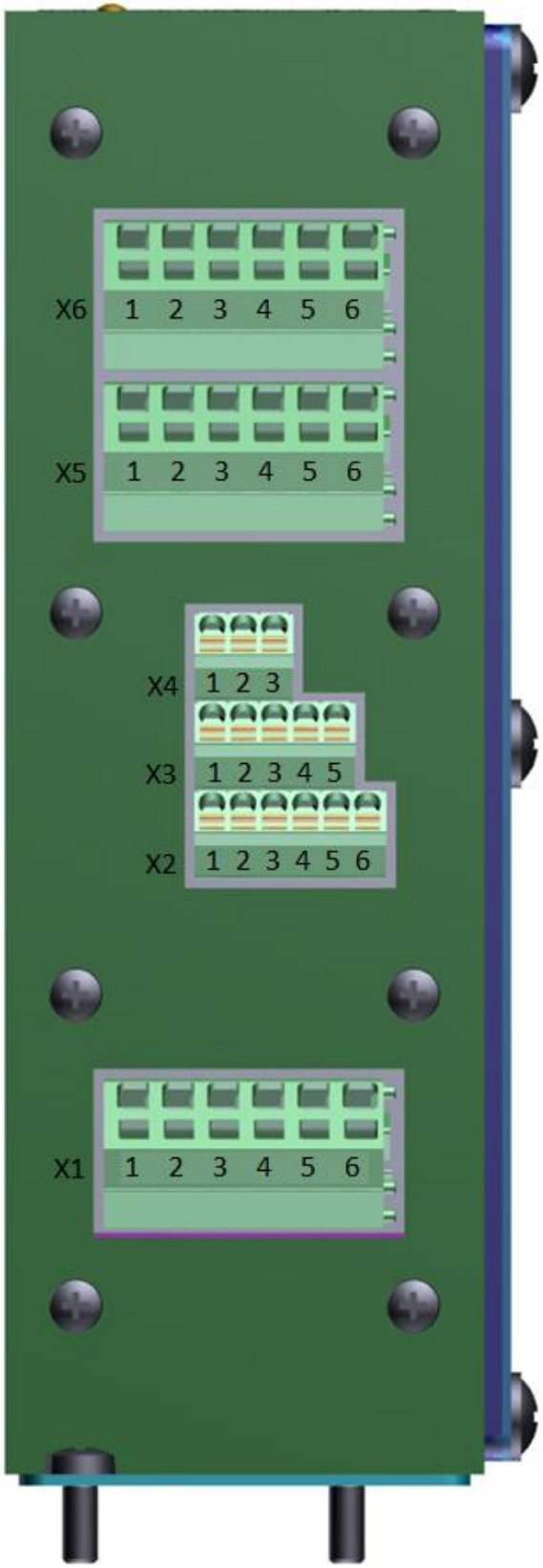
1.4 How to contact us

If, after referring to this manual, you still require assistance, our service line is there for you:

Tel: +49 6589 919 540
Mail: service@newlift-sc.de

Mon-Thurs: 8:00 a.m. – 12:00 p.m. and 1:00 p.m. – 5:00 p.m.
Fr: 8:00 a.m. – 3:00 p.m.

2. Terminals



← X6: Brake coils
B1+, B1-, B2+, B2-, B3+, B3-

← X5: Brake monitoring, Motor-PTC
BM1, BM2, BM3, +24V, PTC, PTC

← X4: CAN-Open
GND, CANL, CANH

← X3: Outputs
GND, Test, OK, Open, +24V

← X2: Inputs
+24V, Brake, T3, T2, T1, Evac

← X1: Power, Overvoltage -Test, SHK (Drive)
L, N, OV-Test, OV-Test, Drive, Drive

2.1 Pinout

Clip	Name	Description
X1.1	L	Power Supply – 230VAC
X1.2	N	Power Supply – 230VAC
X1.3	Test	Test Switch to simulate Overvoltage spark
X1.4	Test	Test Switch to simulate Overvoltage spark
X1.5	D	Drive-Signal – 48-230VUC
X1.6	D	Drive-Signal – 48-230VUC
X2.1	+24V	Common pin for inputs on X2
X2.2	Brake	Brake Switch (opens brake)
X2.3	Test 3	Test Switch for Brake 3
X2.4	Test 2	Test Switch for Brake 2
X2.5	Test 1	Test Switch for Brake 1
X2.6	Evac	Evacuation Switch
X3.1	0V	0V – Power Supply for In/Outputs
X3.2	Test	Test active Output (open collector)
X3.3	OK	CBM OK Output (open collector)
X3.4	Open	Brake open Output (open collector)
X3.5	+24V	+24V – Power Supply for In/Outputs
X4.1	GND	GND for CAN
X4.2	CAN-L	CAN-L (CANopen)
X4.3	CAN-H	CAN-H (CANopen)
X5.1	BM1	Brake 1 Monitor Input
X5.2	BM2	Brake 2 Monitor Input
X5.3	BM3	Brake 3 Monitor Input
X5.4	+24V	Common pin for Brake Monitor Inputs
X5.5	PTC	Motor PTC
X5.6	PTC	Motor PTC
X6.1	B1+	Brake 1 Coil +
X6.2	B1-	Brake 1 Coil -
X6.3	B2+	Brake 2 Coil +
X6.4	B2-	Brake 2 Coil -
X6.5	B3+	Brake 3 Coil +
X6.6	B3-	Brake 3 Coil -

3. CANopen-Mode

In CANopen mode, the configuration and the control are carried out via the CANopen interface. The CAN interface is an isolated high-speed interface according to ISO-11898. As a protocol, a CANopen interface according to CiA Draft Standard 301 is integrated.

3.1 Network Management

The CBM is an NMT slave. In the network, an NMT master must operate the NMT protocol.

3.2 Node-ID

An initial CBM has node ID 125. This is the default for unparameterized devices. An NMT master can set the node ID in the range of 85-101, which is the range for vendor-specific devices, through entry 0x2001 in the Set Object Dictionary.

3.3 Bit-Rate

The bit rate is set to 250kbit/s by default, which is standard for CANopen. The bit rate can be changed via the entry 0x2002 in the Object Dictionary.

3.4 NMT-RX-Events

The following events are implemented:

- 1/0x01 – Start node: This puts CBM in Operational Mode
- 2/0x02 – Stop Node: This puts CBM in Stop Mode
- 128/0x80 – Pre-Operational: This puts CBM in Pre-Operational Mode
- 129/0x81 – Reset: This performs a soft reset on CBM
- 130/0x82 – Reset Communication: This resets the CAN-Communication on CBM

When booting, the CBM starts its CAN node up to the Pre-Operational State. In this state, all configurations can be made in the Object Dictionary. An NMT master can then start the CBM. Only then is it possible to control via CANopen.

3.5 Sync

The CBM is a SYNC consumer and can receive SYNC objects via COB-ID 0x080. These are then used when sending the PDOs.

3.6 Emergency

In the event of a faulty SDO access or another error state, an emergency message is sent. This contains the following information:

- Byte 0-1: CANopen Error Code
- Byte 2: CANopen Error Register
- Byte 4: Manufacturer Specific Error
- Byte 5: Manufacturer Specific Error Detail

The possible values have the following meaning:

Error	Error Detail	Description	CANopen Error Register	CANopen Error Code
0x00		No Error	0x00	0x0000
0x01	 1 2 3	Inputs on Bootup not OK Control-Inputs not OK Brakemonitoring configured to NO not OK Brakemonitoring configured to NC not OK	 0x80 0x01 0x01	 0xFF01 0x8000 0x8000
0x02	 1 2	ABC Error Detail 1: DRIVE-Signal was already active Detail 2: Brake-Signal was already active	0x80	0xFF02
0x03		internal Drive-Signals not equal	0x80	0xFF03
0x04		Brake-Signal rises before Drive-Signal	0x80	0xFF04
0x05		Trigger-Signal from Monitor-CPU not detected	0x80	0xFF05
0x06		Overtemperature on PCB	0x08	0x4200
0x07		Overtemperature in Motor	0x08	0x4000
0x08	 1 2	Overcurrent in Brake 1 Overcurrent Short Circuit	0x80	 0xFF08 0xFF48
0x09	 1 2	Overcurrent in Brake 2 Overcurrent Short Circuit	0x80	 0xFF09 0xFF49

0x0A		Overcurrent in Brake 3	0x80	
	1	Overcurrent		0xFF0A
	2	Short Circuit		0xFF4A
0x0B		Undercurrent in Brake 1	0x80	0xFF0B
0x0C		Undercurrent in Brake 2	0x80	0xFF0C
0x0D		Undercurrent in Brake 3	0x80	0xFF0D
0x0E		Thyristor in Brake 1 circuit	0x80	
	1	SCR of positive half wave is short circuit		0xFF11
	2	SCR of negative half wave is short circuit		0xFF12
	3	SCR of positive half wave is open circuit		0xFF13
	4	SCR of negative half wave is open circuit		0xFF14
0x0F		High-Side-MosFET in Brake 1 circuit	0x80	
	1	open circuit on positive half wave		0xFF15
	2	open circuit on negative half wave		0xFF16
	3	short circuit		0xFF17
0x10		Low-Side-MosFET in Brake 1	0x80	
	1	open circuit		0xFF18
	2	short circuit		0xFF19
0x11		Thyristor in Brake 2 circuit	0x80	
	1	SCR of positive half wave is short circuit		0xFF21
	2	SCR of negative half wave is short circuit		0xFF22
	3	SCR of positive half wave is open circuit		0xFF23
	4	SCR of negative half wave is open circuit		0xFF24
0x12		High-Side-MosFET in Brake 2 circuit	0x80	
	1	open circuit on positive half wave		0xFF25
	2	open circuit on negative half wave		0xFF26
	3	short circuit		0xFF27
0x13		Low-Side-MosFET in Brake 2	0x80	
	1	open circuit		0xFF28
	2	short circuit		0xFF29
0x14		Thyristor in Brake 3 circuit	0x80	
	1	SCR of positive half wave is short circuit		0xFF31
	2	SCR of negative half wave is short circuit		0xFF32
	3	SCR of positive half wave is open circuit		0xFF33
	4	SCR of negative half wave is open circuit		0xFF34
0x15		High-Side-MosFET in Brake 3 circuit	0x80	
	1	open circuit on positive half wave		0xFF35
	2	open circuit on negative half wave		0xFF36
	3	short circuit		0xFF37
0x16		Low-Side-MosFET in Brake 3	0x80	
	1	open circuit		0xFF38
	2	short circuit		0xFF39
0x17		12V-Power-Supply not OK	0x04	0x3200
0x18		Diagnostic inputs on bootup not OK	0x80	0xFF41
0x19		Brake Monitoring	0x80	
		Contact-Type NO:		
	1	Brake 1 monitored as open but should be closed		0xFF81
		Brake 2 monitored as open but should be closed		
	2	Brake 3 monitored as open but should be closed		0xFF81
		Brake 1 monitored as closed but should be open		
	3	Brake 2 monitored as closed but should be open		0xFF83
		Brake 3 monitored as closed but should be open		
	4	Contact-Type NC:		0xFF84
		Brake 1 monitored as open but should be closed		
	5	Brake 2 monitored as open but should be closed		0xFF85
		Brake 3 monitored as open but should be closed		
	6	Brake 1 monitored as closed but should be open		0xFF86
		Brake 2 monitored as closed but should be open		
		Brake 3 monitored as closed but should be open		
	7			0xFF87
	8			0xFF88
	9			0xFF89
	10			0xFF8A

	11 12			0xFF8B 0xFF8C
0x1A		Diagnostic Error: SCR not fired on Short-Circuit-Check		

3.7 Heartbeat Producer

The CBM acts as a heartbeat producer and cyclically sends heartbeat messages. By default, this happens in the cycle of 2000ms, but can be changed via the entry 0x1017 in the Object Dictionary. The following states can be transmitted with the heartbeat message:

- 0/0x00 – Bootup: CBM is in bootup
- 4/0x04 – Stopped: CBM is in stop mode
- 5/0x05 – Operational: CBM is in Operational-Mode
- 127/0x7F – Pre-Operational: CBM is in Pre-Operational-Mode

3.8 Object Dictionary

3.8.1 Data-Typs

- 0x0001 – boolean
- 0x0002 – integer8
- 0x0003 – integer16
- 0x0004 – integer32
- 0x0005 – unsigned8
- 0x0006 – unsigned16
- 0x0007 – unsigned32

3.8.2 Device Info

- 0x1000 – device type; unsigned32; constant = 0x00000000
- 0x1001 – error register; unsigned8; read only
- 0x1002 – manufacturer status register; unsigned32; read only
- 0x1003 – error code register; unsigned32; read only
- 0x1009 – manufacturer hardware version; char[4](Ascii); constant
- 0x100A – manufacturer software version; char[4](Ascii); constant
- 0x1017 – producer heartbeat time; unsigned16; read/write
    - Values from 500-20000ms are accepted
        - Demand from Master:
          COB-ID: 0x600 + NodeID
          cs: read=2, write=1
          n: read=0, write=2
          e: read=0, write=1
          s: read=0, write=1
          Index: 0x1017
          Subindex: 0x0
          Data: read=0, write=desired value
        - Answer from CBM:
          COB-ID: 0x580 + Node-ID
          cs: read=2, write=3
          n: read=2, write=0
          e: read=1, write=0
          s: read=1, write=0
          Index: 0x1017
          Subindex: 0x0
          Data: read=actual value, write=0
- 0x1018 – identity object
    - 0x00 – Identity Index; unsigned8; constant = 4
    - 0x01 – Vendor ID; unsigned32; constant = 0x0057454E
    - 0x02 – Product Code; unsigned32; constant = 0x004D4243 (“CBM “)
    - 0x03 – Revision Number; unsigned32; constant = 0x00000000
    - 0x04 – Serial Number; unsigned32; constant = 0x00000000

3.8.3 RPDOs

- 0x1400 – RPDO1 Parameter (Controlling)
  - 0x00 – number of supported entries in this record (here 2); unsigned8; read only
  - 0x01 – COB-ID used by PDO; unsigned32; read only
  - 0x02 – transmission type; unsigned8; read only; default=255

  RPDO1 is statically mapped to object 0x3016 which is the controlling via CANopen

3.8.4 TPDOs

- 0x1800 – TPDO1 Parameter (Errors)
  - 0x00 – number of supported entries in this record (here 2); unsigned8; read only
  - 0x01 – COB-ID used by PDO; unsigned32; read only
  - 0x02 – transmission type; unsigned8; read/write; default=1 (1-240)

  TPDO1 is statically mapped to object 0x301F which is the status of the Errors
- 0x1801 – TPDO2 Parameter (Outputs)
  - 0x00 – number of supported entries in this record (here 2); unsigned8; read only
  - 0x01 – COB-ID used by PDO; unsigned32; read only
  - 0x02 – transmission type; unsigned8; read/write; default=1 (1-240)

  TPDO2 is statically mapped to object 0x3014 which is the status of the Outputs

3.8.5 Manufacturer Specific SDOs

ATTENTION: On all SDO-Write-Transfers a reset needs to be executed before the change is assumed!

- 0x2001 – Node-ID; unsigned8; read/write
  - Read: 0xID
  - Write: 0x736574ID (the Ascii-Values of the word “set” need to be appended)
- 0x2002 – Bitrate; unsigned8; read/write
  - Read: 0xBR
  - Write: 0x736574BR (the Ascii-Values of the word “set” need to be appended
    - Bitrates implemented:
      0x0 = 20kbit/s
      0x1 = 50kbit/s
      0x2 = 125kbit/s
      0x3 = 250kbit/s (default)
      0x4 = 500kbit/s
      0x5 = 800kbit/s
- 0x2003 – Lift-ID; unsigned8; read/write
  - Read: 0x0X
  - Write: 0x7365740X (the Ascii-Values of the word “set” need to be appended)
- 0x2004 – Controlling Mode; unsigned8, read/write
  - Read: 0x0X
  - Write: 0x7365740X (the Ascii-Values of the word “set” need to be appended)
    - Modes implemented:
      0x0 = Controlling with IO (Configuration-Values extracted from DIP-Switches)
      0x1 = Controlling with CANopen (Configuration-Values extracted from internal EEPROM)
- 0x2011 – Voltages of the brakes; char[4]; read/write
  - Read: 0x00B3B2B1
  - Write: 0x73B3B2B1 (the Ascii-Values of the character “s” need to be appended)
    Where B1 and B3 is the voltage of the brake from 40-200 VDC (0x28-0xC8)
    If B1=255 and B2=40-200, then only Brake 2 will be enabled! This is the mode for older One-Circuit-Brakes!
- 0x2012 – Power of the brakes; char[4]; read/write
  - Read: 0x00B300B1
  - Write: 0x73B300B1 (the Ascii-Values of the character “s” need to be appended)
    where B1 and B3 is the power of the brake from 40-240 VA (0x28-0xF0)
- 0x2013 – Power reduction level of the brakes; char[4]; read/write
  - Read: 0x00B300B1
  - Write: 0x73B300B1 (the Ascii-Values of the character “s” need to be appended)
    where B1 and B3 is the reduction level of the brake from 50-100 % (0x32-0x64)
- 0x2014 – Power reduction time of the brakes; char[4]; read/write
  - Read: 0x00B300B1
  - Write: 0x73B300B1 (the Ascii-Values of the character “s” need to be appended)
    where B1 and B3 is the reduction time of the brakes in 0, 3-10s, 255 (0x03-0x0A)

A value of 0 means direct power reduction!
A value of 255 means never reduce power!

- 0x2015 – Ramping of the voltage; char[4]; read/write
  - Read: 0x00B300B1
  - Write: 0x73B300B1 (the Ascii-Values of the character “s” need to be appended)
    where B1 and B3 is the ramp value of the brake
    0x00 = slow (100V/s); 0x01 = fast (200V/s)
- 0x2016 – Brake monitoring contacts; char[4]; read/write
  - Read: 0x0000000X
  - Write: 0x7300000X (the Ascii-Values of the character “s” need to be appended)
    where ‘X’ is one of the following values
    0x00 = OFF
    0x01 = ON, Contact-Type NO
    0x02 = ON, Contact-Type NC
- 0x2017 – Evacuation times; unsigned16[2]; read/write
  - 0xSSSSPPPP
    where ‘SSSS’ is the Puls/Strobe duration in ms and ‘PPPP’ is the Period duration in ms; values can be from 500-10000ms (0x1F4-0x2710)
    When setting Strobe and Period to the same value, brakes are always open till evacuation is active!
- 0x2018 – Motor PTC; char; read/write
  - Read: 0x0000000X
  - Write: 0x7300000X (the Ascii-Values of the character “s” need to be appended)
    where ‘X’ is one of the following values
    0x0 = OFF
    0x1 = ON
- 0x3001 – Current Brake 1; unsigned16; read only
  - 0x0XXX
    where ‘XXX’ is the 12-Bit-ADC-Value of the current (1A = 824)
- 0x3002 – Current Brake 2; unsigned16; read only
  - 0x0XXX
    where ‘XXX’ is the 12-Bit-ADC-Value of the current (1A = 824)
- 0x3003 – Current Brake 3; unsigned16; read only
  - 0x0XXX
    where ‘XXX’ is the 12-Bit-ADC-Value of the current (1A = 824)
- 0x3004 – PCB Board Temperature; unsigned 16; read only
  - 0x0XXX
    where ‘XXX’ is the 12-Bit-ADC-Value of an 3900K NTC with a 10k Pulldown on a 5VDC Signal
- 0x3005 – Motor Temperature; unsigned 16; read only
  - 0x0XXX
    where ‘XXX’ is the 12-Bit-ADC-Value of PTC with a 620R Pullup to 5VDC and a amplification of 0,52075.
- 0x3011 – Status of Dip-Switches; unsigned16; read only
  - 0xS2S1
    where ‘S2’ is the second Dip-Switch and ‘S1’ is the first Dip-Switch
- 0x3012 – Status of the Inputs; boolean; read only
  - 0xXX
    where the bits meaning is as follows:
    Bit 0: Evacuation (active low)
    Bit 1: Test Brake 1 (active low)
    Bit 2: Test Brake 2 (active low)
    Bit 3: Test Brake 3 (active low)
    Bit 4: Brake (active low)
    Bit 5: Brake 1 Monitor (configurable to NC or NO)
    Bit 6: Brake 2 Monitor (configurable to NC or NO)
    Bit 7: Brake 3 Monitor (configurable to NC or NO)
- 0x3013 – Status of the two internal Drive signals; boolean; read only
  - 0x0X
    Bit 0: Drive signal for High-Side-MosFET
    Bit 1: Drive signal for Low-Side-MosFET
- 0x3014 – Status of the Outputs; boolean; read only

- 0x0X
  Bit 0: Brake open (active low)
  Bit 1: Control-CPU OK (active low)
  Bit 2: Braketest active (active low)

- 0x3016 – Controlling via CANopen; boolean; read/write
  - 0x0X
    Bit 0: not implemented; reserved for evacuation for later use if it is allowed in the future
    Bit 1: Test Brake 1 via CANopen (active high)
    Bit 2: Test Brake 2 via CANopen (active high)
    Bit 3: Test Brake 3 via CANopen (active high)
    Bit 4: open Brake via CANopen (active high)
- 0x301F – Status of Errors; char[2]; read only
  - 0xDDEE
    where ‘EE’ is the Error number and ‘DD’ is the Detail as described in 10.2.1