TWK - ELEKTRONIK GmbH

CANopen safety standard specifications

Valid for:

NBN / S3

with CANopen safety profile

CANopen EN50325-5
(Formerly CiA DS304)

Contents

These specifications describe the inclinometers certified by TÜV-Nord together with their variants. Any changes to the article designation, such as e.g. different measuring angles, plug or cable connection and different variants, etc. do not influence the CANopen functionality, with the result that these specifications remain valid. If necessary, special CANopen safety profiles are described in separate specifications.

Safety instructions

Scope of validity

This user manual applies exclusively to the following inclinometers with CANopen Safety interface:

- NBN / S3

Documentation

The following documents must be noted:

- The owner's system-specific operating instructions
- This specification 12599
- Data sheet number NBN12054
- The pin assignment enclosed with each device

Proper use

TWK-ELEKTRONIK GmbH's rotary encoders, inclinometers and linear transducers are used to record rotary and linear positions, and make their measured values available as an electric output signal. As part of a system, they must be connected to the downstream electronics and must only be used for this purpose.

Commissioning

- The relevant device must only be set up and operated using this document and the documentation specified in point 1.2.
- Protect the device against mechanical damage during installation and operation.
- The device must only be commissioned and set up by a specialist electrician.
- Do not operate the device outside of the limit values which are specified in the data sheet.

• Check all electrical connections before commissioning the system.

1 Intended use

The sensor is intended for use in safety-relevant systems. Thanks to its robust design, the sensor can be used for applications in rough environments such as cranes, vehicles, solar collectors, lifting platforms, constructions, etc. The sensor is designed for connection to a control system which evaluates the measured values securely transmitted via the CAN bus and which responds according to the relevance of the error in the event of error messages or on absence of the process data, thereby preventing a hazardous status.

If necessary, the customer may also activate the CANopen PDOs - non-safety - (objects 1800/1801). However, these are not subject to the CANopen safety conditions! Under regular circumstances, these objects are not activated when the NBN is used in a safety environment. The regular CiA profile definition enables the parallel output of PDO and SRDO.

2 Design

The sensor consists of a redundant inclinometer module. The inclinometers are one-, two- or three-axis acceleration sensors in MEMS technology, and are oriented towards gravity.

The sensor module is optimised for the relevant measurement task.

The sensor module is connected to an evaluation module which undertakes measurement signal processing, e.g. measurement signal filtering, plausibility checking, linearisation and calibration, and which supplies the measured values to the user via the CANopen safety protocol.

The evaluation module has a standardised interface (SPI) to the sensor unit, with the result that various sensor units are able to work together with the evaluation module.

3 Device versions

The nomenclature of the device designation is defined in data sheet NBN 12054.

4 Documents

EN 61508	Functional safety of electronic systems.
ISO 11898	CAN interface.
CiA DS 301	Application layer and communication profile version 4.02.
CiA DS 304	Safety-relevant communication.
CiA DSP 305	Layer setting service.
CiA DSP 310	Framework for safety-relevant communication version 1.01.
CiA DS 410	Device profile for inclinometer version 3.0.
EN 61508	Functional safety of electronic systems
EN 61000-6-2	Interference immunity for industrial sectors
EN 61000-4-2	EMC ESD
EN 61000-4-2	EMC burst
EN 61000-6-4	Interference emission
EN 60068-2-6	Vibration sinus
EN 60068-2-27	Mechanical shock

Certificates:

NBN12651	SIL 2 Certificate TÜV Nord
NBN12652	Testreport of certificate NBN12651
NBN13607	Testreport of certificate NBN12651 (Additional tests)

Test reports:

NBN13523	EN61000-4-4 (Burst)
NBN13524	EN61000-4-2 (ESD)
NBN13525	EN60068-2-64 (Vibration, noise)
NBN13526	EN60068-2-27 (Shock)
NBN13527	EN60068-2-6 (Vibration, sinusoidal)
NBN13528	EN61000-6-4 (Emission)
ZE13214	EN60068-2-52 (Salt mist, cyclic)
ZE13215	EN60068-2-52 additional informations to ZE13214
ZE13469	EN 60068-2-30 (Damp heat, cyclic)
ZE13470	EN 60068-2-78 (Damp heat, steady state)
ZE13471	EN 60068-2-78 and EN 60068-2-30 (Damp heat, steady state)
ZE14326	IEC 60529 und ISO 20653 (Protection class (IP) Tests)

5   Electrical specifications

5.1   General

Refer to the NBN data sheet NBN12054 and the variant specifications for the precise electrical specifications.

1. Supply voltage .... 11 ... 36 VDC
2. Power consumption .... < 1.5 W
3. Temperature range .... - 40 °C to + 85 °C
4. Communication profile.................... Full CAN part A (11-bit) CANopen 301 V 4.1
                                            Inclinometer CANopen DS410 V 1.2
                                                 CANopen safety DSP 304 V 1.01

5.2   Measuring system

5.2.1   NBN / S3 with a measuring range of ± 90°

5. Number of axes ....….............… 1
6. Measuring range ….....…............ x axis ± 90°
7. Resolution .….............….......... 0.01°
8. Accuracy .... .……….......……….. ± 0.5° (lateral inclination ± 3°)
                                         ± 0.25° in the ± 20° range (lateral inclination ± 3°)
9. Zero point error .…….......…………. ± 0.5°
10. Lateral sensitivity ....…..…………. Target specification ± 0.2° (in the ± 5° range)
11. Repeatability ....…...…………. ± 0.05°
12. Starting drift .…........……………. ± 0.3°
13. Noise ...….........…....…………... ± 0.05°
14. Sensor synchronisation error ..…... Target specification ± 1° at room temperature
15. Temperature drift .…......………… ± 0.3° -10 °C to 60 °C   (in the ± 60° range)
                                            ± 0.4°   (in the ± 90° range)
                                            ± 0.5° -40 °C to 85 °C   (in the ± 60° range)
                                            ± 0.6°   (in the ± 90° range)
16. Reaction time .... 1 s (averaging is linear)
17. Permitted synchronous run deviation ≤ 2°

Unless otherwise specified, the above values apply to the following boundary conditions:
- Measuring axes aligned orthogonally
- Without external acceleration

5.2.2   NBN / S3 with a measuring range of ± 20° at maximum

5. Number of axes 2
6. Measuring range .... x axis ± 20°, y axis ± 20°
7. Resolution .... 0.01°
8. Accuracy ……….....……………….. ± 0.25° (lateral inclination ± 5°) otherwise ± 0.5°
9. Zero point error ……...…………… ± 0.5°
10. Lateral sensitivity ......……………… Target specification ± 0.5° in the ± 20° range
11. Repeatability ....…………….. ± 0.05°
12. Starting drift ……………………….. ± 0.3°
13. Noise ……………………….......... ± 0.05°
14. Sensor synchronisation error ..…….. Target specification ± 1° at room temperature
15. Temperature drift ……………….…   ± 0.3° -10 °C to 60 °C
                                             ± 0.5° -40 °C to 85 °C
16. Reaction time .... 1 s (averaging is linear)
17. Permitted synchronous run deviation ≤ 2°

Unless otherwise specified, the above values apply to the following boundary conditions:
- Measuring axes aligned orthogonally
- Without external acceleration

5.3 System

1. Cyclical duration factor (rise time)
    Supply voltage ....……………. 200 ms (10 % to 90 %)
2. Message density ...….…………….. 10,000 messages / s
3. Memory cycle density ……………... 3 s per memory cycle
4. Set-up time ……………………….… 2 s

5.4 Tolerance in case of error

The following two versions are available which have different behavior in case of error due to an exposition of high shock and vibration:

1. Standard version: An error message (emergency message, override or sensor error) is immediately output and the machine/system switches to its safe status.

2. Special version variant 'V' with vibration filter: As soon as the interference occurs, the position output value is set to -180°. This is not a defined measured value. The control system is thereby notified that inclination measurement is not possible due to shock and vibration stresses. An error message (emergency message) is not output in this case to prevent the system from switching to its safe status. This behaviour is not temporally limited.

As no emergency message is transmitted with this version, the user is required to ensure that the machine/system is in normal operating state during the period of time in which inclination measurement is not possible due to interference accelerations. Via his control system programme, the user must ensure that no dangers arise due to the application during this time.

As soon as there is no further interference acceleration due to shock and vibrations, regular inclination data are output again, and not -180°.

Depending on the current measuring range, interferences which reveal an amplitude of less than 2.2 g are interpreted by the NBN as a measuring range overshoot (the MEMS sensor is an acceleration sensor). In this case, the overflow value of +180° is output.

5.5 Connection

5.5.1   NBN / S3 – without galvanic bus separation

Communication profile .... Full CAN part A (11-bit) CANopen 301 V 4.1
Inclinometer CANopen DS410 V 1.2
CANopen safety DSP 304 V 1.01

Without galvanic bus separation

Connection assignment, plug 1: 5-pin M12, pins, coding A

Pin number	Signal designation
1	Housing
2	+ V_S
3	- V_S / CAN GND
4	CAN High
5	CAN Low

Connection assignment, plug 2: 5-pin M12, socket, coding A

Pin number	Signal designation
1	Housing
2	+ V_S
3	- V_S / CAN GND
4	CAN High
5	CAN Low

5.5.2   NBN / S3 – <u>with</u> galvanic bus separation

Communication profile ....   Full CAN part A (11-bit) CANopen 301 V 4.1
Inclinometer CANopen DS410 V 1.2
CANopen safety DSP 304 V 1.01

Connection assignment, plug 1: 5-pin M12, pins, coding A

Pin number	Signal designation
1	- V_S / GND
2	+ V_S
3	CAN GND
4	CAN High
5	CAN Low

Connection assignment, plug 2: 5-pin M12, socket, coding A

Pin number	Signal designation
1	- V_S / GND
2	+ V_S
3	CAN_GND
4	CAN High
5	CAN Low

5.5.3   NBN / S3 – <u>with</u> galvanic bus separation, M12, 8-pins

Communication profile ....   Full CAN part A (11-bit) CANopen 301 V 4.1
Inclinometer CANopen DS410 V 1.2
CANopen safety DSP 304 V 1.01

Connection assignment, plug 1: 8-pin M12, pins, coding A

Pin number	Signal designation
1	+ V_S
2	- V_S / GND
3	CAN High
4	CAN Low
5	CAN_GND
6	Not connected
7	Not connected
8	Not connected

Connection assignment, plug 2: 8-pin M12, socket, coding A

Pin number	Signal designation
1	+ V_S
2	- V_S / GND
3	CAN High
4	CAN Low
5	CAN_GND
6	Not connected
7	Not connected
8	Not connected

6 Environmental data

6.1 Dust, moisture

Permissible relative humidity ……………… 100 %
Protection type ……………………………… IP 67 (due to connectors M12, else IP 66)

6.2 Vibration, shock

EN 60068-2-6 ……………………………….. Vibration sinus
EN 60068-2-27 ……………………………... Mechanical shock
Resistance to shock ....…… 20 g for 6 ms, 100 times each in 3 axes
Resistance to vibration ....…... Amplitude of 5 mm excursion
(peak value)
or 10 g from 5 to 2000 Hz for 1 h each in 3 axes

6.3 EMC

EN 61000-6-2 ……………………………… Interference immunity for industrial sectors
ESD ………………………………………….. 4 kV   10 positive and negative pulses
contact discharge
Burst …………………………………………. 1 kV   coupling clamp, 5 m cable length
Emission ……………………………………... 39.6 dB (μV/m) 30 to 230 MHz
46.6 dB (μV/m) 230 to 1000 MHz

7 Mechanical system

Sensor plug M12
5-pin, pins

Sensor plug M12
5-pin, socket

$42^{+0.5}$

24 ± 0.1

$65^{+0.5}$

Plugs are not aligned!

□ 65

max.13

7

20

$66^{+0.5}$

100 ± 0.5

2

10

5

10

5.3

52 ± 0.1

5.3

15°

52 ± 0.1

5.3
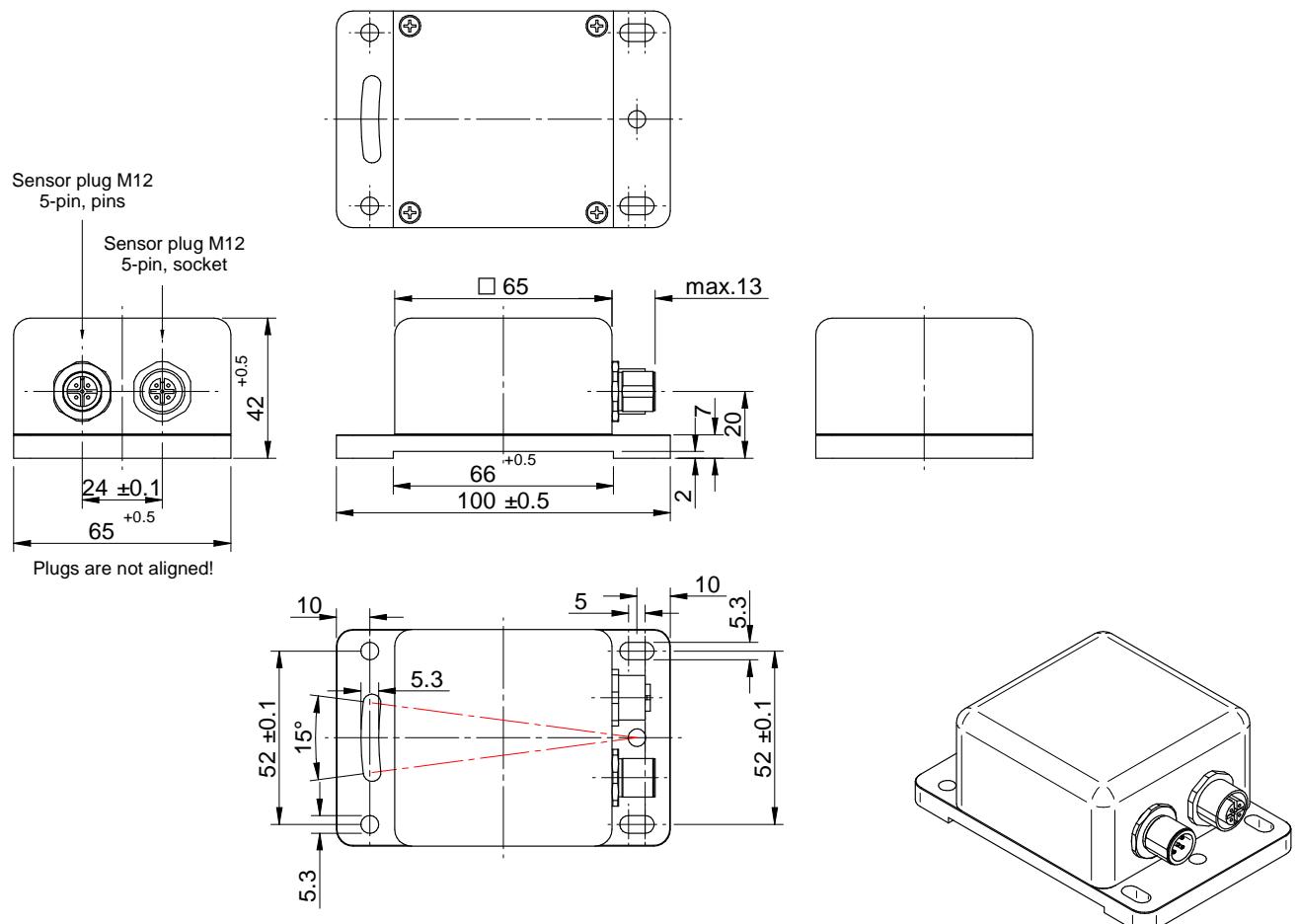
8 CANopen functionality

The baud rates are implemented according to the following table. The baud rate 125 kBit/s is defined as the default setting.

Baud rate table

Oscillator [MHz]	Baud rate [kBit/s]	Number of time units	Sample point	BRPR	SJW	PRS	PHS1	PHS2
50	1000	10	6	5	1	2	4	4
	500	10	6	10	1	2	4	4
	250	10	6	20	1	2	4	4
	125	16	9	25	1	2	6	7
	50	10	6	100	1	2	4	4
	20	10	6	250	1	2	4	4

8.1 Redundant system design

The CANopen profile definition for the inclinometer is designed according to CAN DS 304.

The sensor system is of a redundant design. The sensor system's measured values are transmitted to the self-monitoring controller using separate buses. This compares the inclination values of both sensors. If the measured values lie within a tolerance of 1°, the signals are transferred as secured for downstream evaluation. Otherwise, an error message is generated and the controller assumes a secure status (pre-operational).

8.2 Error behaviour

8.2.1 General

All sensor errors are classified as critical errors. Exceeding the measuring range is not evaluated as an error status. The sensor errors which the sensor chip is able to output are summarised in one bit (sensor error flag). For extended error diagnosis, the error bytes on object 2010 are output in the manufacturer_state registers in the manufacturer-specific range.

If the measuring range is exceeded, the device outputs a measured value of 180° on all 3 axes irrespective of the number of measurement exes. The axis which causes the measuring range to be exceeded can be determined in object 2020.

8.2.2 Fatal errors

Errors which place the functional capability of the controller in doubt (ROM or RAM CRC errors, oscillator drift and watchdog triggering) are not responded to with a CAN message. Following detection of the error, the controller then immediately assumes a secure status (endless loop without actions). This error must be detected and processed by the control system.

8.2.3 CANopen

If the inclinometer has determined an error, an emergency message is transmitted if the node is not set to STOP status. The error code is additionally entered in the error register and object 6503. Object 1029 error behaviour is not implemented. In the event of an error, the sensor switches to the NMT status PRE-OPERATIONAL. If an error disappears (CAN channel error), an EMC message is again transmitted with a deleted error bit. The time interval between the emergency

messages is determined by object 1015 inhibit time EMCY. The inclinometer's error statuses remain in existence up to reset or power on.

The emergency message has the following design:

Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
EMC error code	Error register	Object 6503		n.u.	n.u.	n.u.

n.u.   not used

EMC error codes:

0x FFFF   Customer-specific error; error in the sensor system

0x8120   Passive error status

0x8140   Return from bus off status

0x8110   Overrun error; not all messages have been transmitted by the sensor.

Error register codes, see object 1001.

The data are implemented on the bus in Intel format.

A distinction is made between two types of error:

    1. Error in the sensor system (error code 0xFFFF)
       All errors which render proper operation of the sensor impossible.

    2. Communication error (error code 0x81xx)
       Errors due to the bus system; these are not usually caused by the sensor but indicate a malfunction in the bus system.

All sensor errors are critical errors.

The user of the overall system must assess errors in the bus system and determine his reaction on this basis.

Examples:

EEPROM CRC error

0	1	2	3	4	5	6	7
Error code		Error register	Device-specific error		Not used		
0xFF	0xFF	0x81	0x00	Obj. 6503 0x20	0x00	0x00	0x00

Passive error

0	1	2	3	4	5	6	7
Error code		Error register	Device-specific error		Not used		
0x20	0x81	0x11	0x00	0x00	0x00	0x00	0x00

Return from bus off

0	1	2	3	4	5	6	7
Error code		Error register	Device-specific error		Not used		
0x40	0x81	0x11	0x00	0x00	0x00	0x00	0x00

Expiry of the inhibit time is followed by the message "error-free operation":

0	1	2	3	4	5	6	7
Error code		Error register	Device-specific error		Not used		
0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00

9 CANopen profile definition

9.1 Overview

Table of all objects contained in the NBN profile

Index	Data type	Designation	Data length	Memory type	M / O	
1000	VAR	device_type	LONG	ro	M	
1001	VAR	error_register	BYTE	ro	M	
1005	VAR	COB-ID_SYNC	LONG	rw	O	
1008	VAR	manufacturer_device_name	STRING	ro	O	
1009	VAR	manufacturer_hardware_version	STRING	ro	O	
100A	VAR	manufacturer_software_version	STRING	ro	O	
100E	ARRAY	COB-ID-guarding	LONG	ro	O	
1010	ARRAY	store_parameters	LONG	-	O	
1011	ARRAY	restore_default_parameters	LONG	-	O	
1014	VAR	COB-ID-EMCY	LONG	rw	O	
1015	VAR	inhibit_time_EMCY	LONG	rw	O	
1017	VAR	producer_heartbeat_time	WORD	rw	O	
1018	RECORD	identity object		ro	M	
Transmit SRDO / PDO communication parameters						
1301	RECORD	SRDO communication parameter		rw	M	
1800	RECORD	PDO 1 communication parameter		rw	M	
1801	RECORD	PDO 2 communication parameter		rw	M	
Encoder objects						
6000	VAR	resolution	WORD	ro	M	
6010	VAR	position_x_axis	LONG	ro	M	
6011	VAR	operating_x_axis	LONG	fp	M	
6012	VAR	preset_x_axis	WORD	fp	M	
6020	VAR	position_y_axis	LONG	ro	O	
6021	VAR	operating_y_axis	WORD	fp	O	
6022	VAR	preset_y_axis	WORD	fp	O	
6030	VAR	position_z_axis	LONG	ro	O	
6031	VAR	operating_z_axis	WORD	ro	O	
6032	VAR	preset_z_axis	WORD	fp	O	
Encoder diagnostic objects						
6503	VAR	alarms	WORD	ro	M	
6504	VAR	supported_alarms	WORD	ro	M 2	
6506	VAR	supported_warnings	WORD	ro	M 2	
6507	VAR	profile_and_software_version	LONG	ro	M 2	
6508	VAR	operating_time	LONG	ro	O	
650B	VAR	serial_number	LONG	fp	M 2	
LMT objects						
2000	VAR	node ID	BYTE	rw	O	

2001	VAR	bit_rate	BYTE	rw	O	
Manufacturer-specific objects						
2020	RECORD	sensor_state		ro	O	
Manufacturer-specific objects for synchronisation and diagnosis						
2100	RECORD	adjust_sensor_1		ro		
2101	RECORD	adjust_sensor_2		ro		
2102	RECORD	adjust_sensor_3		ro		
2103	RECORD	adjust_sensor_4		ro		
2110	RECORD	adjust_checksum__sensor_1		ro		
2111	RECORD	adjust_checksum__sensor_2		ro		
2112	RECORD	adjust_checksum__sensor_3		ro		
2113	RECORD	adjust_checksum__sensor_4		ro		
2118	RECORD	adjust_mode		ro		
2120	RECORD	adjust_calibration		ro		
Mapping objects						
1381	ARRAY	SRDO mapping parameter		ro	M	
1A00	ARRAY	PDO1 mapping parameter		ro	M	
1A01	ARRAY	PDO2 mapping parameter		ro	M	
Safety CAN objects						
13FE	VAR	configuration valid	BYTE	rw	M	
13FF	ARRAY	safety configuration checksum		ro	M	

rw   read/write
ro   read only
fp   factory programming

9.2 Safety-relevant data object SRDO

The sensor supplies 16 significant data bits in signed format. Three axes are output on the SRDO from objects 6010, 6020 and 6030.

Byte 0								Byte 1							
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
LSB							x axis								MSB

Byte 2								Byte 3							
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
LSB							y axis								MSB

Byte 4								Byte 5							
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
LSB							z axis								MSB

The inclination values are transmitted cyclically with the refresh time (object 1301/2 or object 1302/2).

9.3 Service data objects SDOs

9.3.1 Object 1000 device_type

The inclinometer types are defined as follows:

Coding	Device type designation
1	One axis with resolution max. 16-bit
2	Two axes with resolution max. 16-bit
3	One axis with resolution max. 32-bit
4	Two axes with resolution max. 32-bit
0005h to 0FFFh	Reserved
1000h 000 FFFEh	Manufacturer-specific

Structure of device_type:

	Byte 0	Byte 1	Byte 2	Byte 3
Device type	Device profile number		Inclinometer type	

The device profile has the number 410.

Device type 1000 (customer-specific):
Resolution: 16-bit,
Number of axes: One- or two-axis system.
                         The concrete version is determined from the type designation according
                         to the data sheet.

device_type

Index	Sub	Description	Length COM	MEM	Memory Type	Location	Range/ value	Action	Default
1000	0	device_type	Long -	Long	ro	ROM	0x1000019A	-	-

9.3.2 Object 1001 error_register

Bit	M / O	Designation
0	M	generic error
1	O	current
2	O	voltage
3	O	temperature
4	O	communication error (overrun, error state)
5	O	device profile-specific
6	O	reserved (always 0)
7	O	manufacturer-specific

The error register is the global error register. It summarises all errors in bit 0.
Generic, communication and manufacturer-specific errors are supported. The generic error bit is always set in the event of an error. Which error has occurred can be seen in the alarms 6503 object.

error_register

Index	Sub	Description	Length COM	MEM	Memory Type	Location	Range/ value	Action	Default
1001	0	error_register	Byte	Byte	ro	RAM	0, 0x11, 0x81	-	-

9.3.3   Object 1005 COB-ID-SYNC

Identifier of the sync message which is transmitted from the master.
No range or plausibility check takes place. 29-bit identifiers are not supported.

COB-ID-SYNC

Index	Sub	Description	Length COM	MEM	Memory Type	Location	Range/ value	Action	Default
1005	0	COB-ID-SYNC	Long	Long	rw	E²ROM	1...0x7FF	-	0x80

9.3.4   Object 1008 manufacturer_device_name

The name of the device is stored as a string and is output via SDO segment transfer.

"Inclinometer NBN Safety"

manufacturer_device_name

Index	Sub	Description	Length COM	MEM	Memory Type	Location	Range/ value	Action	Default
1008	0	manufacturer_device_name	String	String	ro	ROM	See above	-	-

9.3.5   Object 1009 manufacturer_hardware_version

Hardware version of the device. It is stored as a string
"P-0641 P-0631"
It is output via SDO segment transfer.

manufacturer_hardware_version

Index	Sub	Description	Length COM	MEM	Memory Type	Range/ value	Action	Default
1009	0	manufacturer_hardware_version	String	String	ro	ROM	See above	-	-

9.3.6   Object 100A manufacturer_software_version

Software version of the device. It is stored as a string
"Safety Standard"
"Safety dyn. Unklarzeit" (for version V)

It is output via SDO segment transfer.

manufacturer_software_version

Index	Sub	Description	Length COM	MEM	Memory Type	Range/ value	Action	Default
100A	0	manufacturer_software_version	String	String	ro	ROM	See above	-	-

9.3.7 Object 100E COB-ID_GUARD

This object is in the object list because the guard identifier is a factory programming parameter. It is defined as read only and has no relevance to the customer.

29-bit identifiers are not supported.

COB-ID_GUARD

Index	Sub	Description	Length		Memory		Range/ value	Action	Default
			COM	MEM	Type	Location			
100E	0	COB-ID_GUARD	Long	Long	ro	ROM	0...0x7FF	1)	0x700+node ID

1) The node address is added to the selected identifier

9.3.8 Object 1010 store_parameters

On inputting "save" as the password in sub-index 01, all writable objects are saved to the E²PROM. The object cannot be changed on writing. Reading the object is possible. "Save" = 0x65766173.

1 (saving via command, page 93 DS 301 4.1) is returned.

store_parameters

Index	Sub	Description	Length		Memory		Range/ value	Action	Default
			COM	MEM	Type	Location			
1010	0	largest_supported_sub-index	-	-	ro	ROM	1	-	-
	1	save_all_parameters (except nodeID* + baudrate*)	Long	Long	rd / (rw)	ROM	"save" 0x65766173	1)	1

1) When the correct password is input (save), parameters are backed-up in the E²PROM.

9.3.9 Object 1011 restore_Default_parameters

On inputting "load" as the password in sub-index 01, the sensor's default parameters are loaded into the RAM. Reading the object is possible. "Load" = 0x64616F6C.

1 (device restores parameters) is returned.

restore_Default_parameters

Index	Sub	Description	Length		Memory		Range/ value	Action	Default
			COM	MEM	Type	Location			
1011	0	largest_supported_sub-index	-	-	ro	ROM	1	-	-
	1	load_all_default_parameters (except nodeID* + baudrate*)	Long	Long	rd / (rw)	ROM	"load" 0x64616F6C	1)	1

1) When the correct password is input (load), the default parameters are loaded from the ROM.

9.3.10 Object 1014 COB-ID-EMCY

Identifier for the emergency message which the sensor transmits on occurrence of an alarm.
After "load default", the identifier is COB-ID-EMCY + node ID.
If the user changes the COB ID, the node address is no longer added.
No range or plausibility check takes place.
29-bit identifiers are not supported.

COB-ID-EMCY

Index	Sub	Description	Length		Memory		Range/ value	Action	Default
			COM	MEM	Type	Location			
1014	0	COB-ID-EMCY	Long	Long	rw	E²PROM	-	1)	0x80+node ID

1) Default status evaluation then addition of the node address.

9.3.11 Object 1015 inhibit_time_EMCY

Blocking time to limit bus load in the case of EMCY messages following on in quick succession.
The basic unit is 100 µs.

inhibit_time_EMCY

Index	Sub	Description	Length COM	MEM	Memory Type	Location	Range/ value	Action	Default
1015	0	inhibit_time_EMCY	Word	Word	rw	E²PROM	0...0xFFFF	-	1000

9.3.12 Object 1017 producer_heartbeat_time

If a value greater than zero is entered here, the heartbeat message on the identifier guard COB ID + node ID is transmitted in the producer_heartbeat_time interval in ms.

producer_heartbeat_time

Index	Sub	Description	Length COM	MEM	Memory Type	Location	Range/ value	Action	Default
1017	0	producer_heartbeat_time	Word	Word	rw	E²PROM	0...0xFFFF	-	0

The heartbeat message format:

Bit No.	7	6	5	4	3	2	1	0
Content	0	Subscriber status						

0: BOOTUP

4: STOPPED

5: OPERATIONAL

127: PRE-OPERATIONAL

9.3.13 Object 1018 identity_object

This object contains data assigned to the individual sensor. The object is the address for the Layer Setting Service (LSS).
The following data must be entered:

1. Manufacturer/vendor ID   Assigned by CiA
2. Product code   TWK-internal
3. Revision number   TWK software revision number
4. Serial number

In factory programming status, the serial number can be written via LSS.

identity_object

Index	Sub	Description	Length COM	MEM	Memory Type	Location	Range/ value	Action	Default
1018	0	largest_supported_sub-index	-	-	ro	ROM	4	-	-
	1	vendor ID	Long	Long	ro	ROM	0x0000 010D	-	-
	2	product_code	Long	Long	ro	ROM	0x0000 8000	-	-
	3	revision_number	Long	Long	ro	ROM	0x0002 0001	-	-
	4	serial_number	Long	Long	ro(rw)	E²PROM	0	1)	-

1) Written in factory programming status.

9.4 Control of the process data objects (SRDO and PDO)

The process data are output via two safety-relevant data objects (SRDOs).

Attention:
The SRDO is only active if the object configuration_valid (object 13FE) is set (written with the datum 0xA5). The configuration_valid object is stored in the E²PROM. The flag is deleted if one of the safety-relevant data objects is changed.

COB ID structure

MSB   LSB

EN	x	x	x	x	x	x	x	0	COB ID High	COB ID Low

The MSB represents the enable bit.
Bit 31 (EN) = 0   SRDO enabled
Bit 31 (EN) = 1   SRDO disabled

The plausibility of the other bits is not checked. 29-bit identifiers are not supported.

Only transmission type 254 is supported.

The CANopen standard profile's PDOs may also be activated, see Chapter 9.4.2.

Attention: they are not subject to the safety conditions!

9.4.1 Object 1301 SRDO_communication_parameter

The object under this index can only be written in PRE-OPERATIONAL status. After each write access, the configuration_valid byte is reset.

SRDO_communication_parameter

In-dex	Sub	Description	Length COM	MEM		Memory Type/Loc.	Range/ value	Action	Default
1301	0	largest_supported_sub-index	-	-	ro	ROM	6	-	-
	1	information_direction	Byte	Byte	ro	ROM	1	-	-
	2	refresh_time (SCT)	Word	Word	rw	E²PROM	1..65,535	-	25
	3	validation_time (SRVT)	Byte	Byte	ro	ROM	20	-	-
	4	transmission_type	Byte	Byte	ro	ROM	254	-	-
	5	COB-ID_1	Long	Long	rw	E²PROM	257..384		0xFF + (2x node ID)
	6	COB-ID_2	Long	Long	rw	E²PROM	257..384	1)	0x100 + (2x node ID)

1) Default status evaluation then addition of the node address.
   Addition is no longer carried out after overwriting.
   The configuration_valid byte is reset.
   The plausibility of the COB IDs is not checked.

The node address must not be set via 64, as the SRDO is otherwise disabled. In this case the COB IDs have to be entered manually in object 1301, sub 05 and sub 06.
If both of an SRDO's COB IDs are disabled, setting the configuration_valid flag is rejected.

9.4.2   COB ID structure (PDO)

The CANopen profile (non-safety) process data are output via two process data objects (PDOs).

MSB   LSB

EN	x	x	x	x	x	X	x	0	COB ID High	COB ID Low

The MSB represents the enable bit.

Bit 31 (EN) = 0   PDO enabled
Bit 31 (EN) = 1   PDO disabled

The plausibility of the other bits is not checked. 29-bit identifiers are not supported.

List of transmission types

0   Take-over with sync data and output in the event of a change.
1-240   Take-over with the 1st sync data, output with the nth (1-240) sync command.
252   Take-over with sync data, output with RTR.
253   Take-over and output with RTR data.
254   Data take-over and output in the event of a change.

9.4.3   Object 1800 PDO_asynchronous

Attention: they are not subject to the safety conditions!

All asynchronous and cyclical results.

The cycle timer object 6200 acts on this PDO.
No synchronous data output is possible.
Data take-over can be carried out synchronously with transmission type 252.
The following applies to the PDO COB ID: input: PDO COB ID; return: PDO COB ID + node ID.
No plausibility check takes place in the case of the COB ID.

The inhibit time can be set in 100 µs steps. The minimum time which can be set is 1 ms.

Transmit PDO 1

Index	Sub	Description	Length COM	MEM	Memory Type	Location	Range/ value	Action	Default
1800	0	Largest sub-index	-	-	ro	ROM	3	-	-
	1	COB ID	Long	Long	rd / wr	E²PROM	-	1)	0x180
	2	Transmission type	Byte	Byte	rd / wr	E²PROM	252, 253, 254	-	253
	3	Inhibit time	Word	Word	rd / wr	E²PROM	-	-	0

1) On reading (upload), the node address is added to the selected identifier.

9.4.4   Object 1801 transmit PDO synchronously

Attention: they are not subject to the safety conditions!

All **synchronous** results are processed via this PDO.
The inhibit timer is not implemented for this PDO, as no bus overload can occur in the event of synchronous data output. No plausibility check takes place in the case of the COB ID.

Transmit PDO 2

Index	Sub	Description	Length COM	MEM	Memory Type	Location	Range/ value	Action	Default
1801	0	Largest sub-index	-	-	ro	ROM	2	-	-
	1	COB ID	Long	Long	rd / wr	E²PROM	-	1)	0x280
	2	Transmission type	Byte	Byte	rd / wr	E²PROM	0....240	-	1

1)   On reading (upload), the node address is added to the selected identifier.

9.5 Mapping objects (SRDO and PDO)

9.5.1 Object 1381 SRDO mapping parameter

The parameter contains the following coding for each "mapping" object:

Byte 0	Byte 1	Byte 2	Byte 3
Index		Sub-index	Length

The length is specified as the hex-coded number of bits.

SRDO mapping parameter

Index	Sub	Description	Length COM	MEM	Memory Type	Location	Range/ value	Action	Default
1381	0	largest_supported_sub_index	-	-	ro	ROM	6	-	-
	1	first_SRDO_mapping_object	Long	Long	ro	ROM	0x6010 0010	-	-
	2	second_SRDO_mapping_object	Long	Long	ro	ROM	0x6010 0010	-	-
	3	third_SRDO_mapping_object	Long	Long	ro	ROM	0x6020 0010	-	-
	4	fourth_SRDO_mapping_object	Long	Long	ro	ROM	0x6020 0010	-	-
	5	fifth_SRDO_mapping_object	Long	Long	ro	ROM	0x6030 0010	-	-
	6	sixth_SRDO_mapping_object	Long	Long	ro	ROM	0x6030 0010	-	-

9.5.2 Object 1A00 transmit PDO 1 mapping

Attention: they are not subject to the safety conditions!

The parameter contains the following coding for each "mapping" object:

Byte 0	Byte 1	Byte 2	Byte 3
Index		Sub-index	Length

The length is specified as the hex-coded number of bits.

Transmit PDO 1 Mapping

Index	Sub	Description	Length COM	MEM	Memory Type	Location	Range/ value	Action	Default
1A00	0	Largest sub-index	-	-	ro	ROM	3	-	-
	1	first_PDO_mapping_object	Long	Long	ro	ROM	0x6010 0010	-	-
	2	second_PDO_mapping_object	Long	Long	ro	ROM	0x6020 0010	-	-
	3	third_PDO_mapping_object	Long	Long	ro	ROM	0x6030 0010	-	-

9.5.3   Object 1A01 transmit PDO 2 mapping

Attention: they are not subject to the safety conditions!

The parameter contains the following coding for each "mapping" object:

Byte 0	Byte 1	Byte 2	Byte 3
Index		Sub-index	Length

The length is specified as the hex-coded number of bits.

Transmit PDO 2 mapping

Index	Sub	Description	Length COM	MEM	Memory Type	Location	Range/ value	Action	Default
1A01	0	Largest sub-index	-	-	ro	ROM	3	-	-
	1	first_PDO_mapping_object	Long	Long	ro	ROM	0x6010 0010	-	-
	2	second _PDO_mapping_object	Long	Long	ro	ROM	0x6020 0010	-	-
	3	third _PDO_mapping_object	Long	Long	ro	ROM	0x6030 0010	-	-

9.6 Safety CAN objects

9.6.1 Object 13FE configuration_valid

This parameter is reset (= 0) each time a "safety-relevant parameter" is accessed. The configuration is switched to valid by entering 0xA5. In the event of an invalid value (not 0 or 0xA5) in the configuration_valid flag or an incorrect F parameter setting, write access is rejected and the SRDOs are not transmitted when requested.
The parameter is stored in the E²PROM.

configuration_valid

Index	Sub	Description	Length COM	Length MEM	Memory Type	Memory Location	Range/ value	Action	Default
13FE	0	configuration_valid	Byte	Byte	rw	E²PROM	0xA5	-	0

9.6.2 Object 13FF safety_configuration_checksum

This parameter contains the checksum laterally through the safety CAN parameters according to the table below. The checksum is written by the master. The checksum is checked on setting the configuration_valid flag. If correspondence with the checksum stored in this object is not ascertained, setting the flag is blocked (configuration_valid flag remains ZERO).

safety_configuration_checksum

Index	Sub	Description	Length COM	Length MEM	Memory Type	Memory Location	Range/ value	Action	Default
13FF	0	largest_supported_sub-index	Byte	Byte	ro	ROM	1	-	-
	1	SRDO1_checksum	Word	Word	rw	E²PROM	0 ... 0xFFFF	-	0xD05D

The checksum can be calculated by a TWK tool. Download:
www.twk.de/files/CRC-Calculator20.zip
SRDO1 scheme of checksum calculation; calculation type: MSB – first.

Object	Length	Value	Generator polynomial
information_direction	8	1301/1	
refresh_time (SCT)	16	1301/2	
validation_time (SRVT)	8	1301/3	
COB-ID_1	32	1301/5	
COB-ID_2	32	1301/6	
largest_supported_sub-index	8	1381/0	
	8	1	
first_SRDO_mapping_object	32	1381/1	
	8	2	
second_SRDO_mapping_object	32	1381/2	
	8	3	$2^{16} + 2^{12} + 2^5 + 1$
third_SRDO_mapping_object	32	1381/3	
	8	4	
fourth_SRDO_mapping_object	32	1381/4	
	8	5	
fifth_SRDO_mapping_object	32	1381/5	
	8	6	
sixth_SRDO_mapping_object	32	1381/6	

9.7 LMT objects

9.7.1 Object 2000 node ID

The node address of the sensor.

The parameter only becomes effective after saving with object 1010 and a power on reset.

node ID

Index	Sub	Description	Length COM	MEM	Type	Memory Location	Range/ value	Action	Default
2000	0	node ID	Byte	Byte	rw	E²PROM	1 ...127	-	0x01

9.7.2 Object 2001 bit_rate

Baud rate of the CAN bus.
This object may also be changed by means of the Layer Setting Service.

The bit rate index is set according to the following table:

Index	Baud rate [kBaud/s]
0	1000
1	500
2	500
3	250
4	125
5	125
6	50
7	**20**

The parameter only becomes effective after saving with object 1010 and a power on reset.

bit_rate

Index	Sub	Description	Length COM	MEM	Type	Memory Location	Range/ value	Action	Default
2001	0	bit_rate	Byte	Byte	rw	E²PROM	0 ...7	-	7

9.8 Manufacturer-specific objects

9.8.1 Object 6200 Cyclic Timer

Values > 0: Object 'Position value' is sent cyclic with value ' Cyclic Timer' in ms on PDO 1.

Cyclic Timer

Index	Sub	Description	Length COM	MEM	Storage Typ	Ort	Area/ Value	Action	default
6200	0	cyclic_timer	Word	Word	rw	XRAM	0...0xFFFF	-	0

9.8.2 Object 2020 sensor_state

The sensor outputs the measurement status of the acceleration sensors on this object. With the exception of the first sub-index, this is information for the manufacturer for accuracy and error analysis.

The measuring range status of the axes is output in the first sub-index.

Each axis has a separate status byte with a flag for exceeding the measuring range.

The overflow status is assumed if the sensor exceeds the measuring range by more than 2° on one axis.

sensor_state

Index	Sub	Description	Length COM	MEM	Memory Type	Location	Range/ value	Action	Default
2020	0	largest_supported_sub-index	-	-	ro	ROM	5	-	-
	1	sensor_axis_state	LONG	LONG	ro	RAM	-	-	-
	2	manufacturer_state_sensor_1	LONG	LONG	ro	RAM	-	-	-
	3	manufacturer_state_sensor_2	LONG	LONG	ro	RAM	-	-	-
	4	manufacturer_state_sensor_3	LONG	LONG	ro	RAM	-	-	-
	5	manufacturer_state_sensor_4	LONG	LONG	ro	RAM	-	-	-

sensor_axis_state parameter structure

Byte0	Byte1	Byte2	Byte3
x axis	y axis	z axis	n.u.

Axis structure

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Overflow	n.u.	n.u.	n.u.	n.u.	n.u.	n.u.	n.u.

n.u.   Not used

Manufacturer-internal information is output on the other sub-indices.

9.9 Manufacturer-specific objects for synchronisation and diagnosis

9.9.1   Object 2100 adjust_sensor_1

largest_supported_sub-index = 9

9.9.2   Object 2101 adjust_sensor_2

largest_supported_sub-index = 9

9.9.3   Object 2102 adjust_sensor_3

largest_supported_sub-index = 9

9.9.4   Object 2103 adjust_sensor_4

largest_supported_sub-index = 9

9.9.5   Object 2110 adjust_checksum_sensor_1

largest_supported_sub-index = 9

9.9.6   Object 2111 adjust_checksum_sensor_2

largest_supported_sub-index = 9

9.9.7   Object 2112 adjust_checksum_sensor_3

largest_supported_sub-index = 9

9.9.8   Object 2113 adjust_checksum_sensor_4

largest_supported_sub-index = 9

9.9.9   Object 2118 adjust_mode

largest_supported_sub-index = 2

9.9.10 Object 2120 adjust_calibration

largest_supported_sub-index = 3

9.10 Objects according to profile definition

9.10.1 Object 6000 resolution

Specifies the resolution for the 16-bit objects in 1/1000°.

The object can only be set in the factory.

Status table:

Value	Definition of the resolution
1	0.001°
10	**0.01°**
100	0.1°
1000	1°

resolution

Index	Sub	Description	Length COM MEM	Memory Type Location	Range/ value	Action	Default
6000	0	resolution	Word Word	fp E²PROM	10 for 90° 10 for 20°	Sen	-

9.10.2 Object 6010 position_x_axis

Inclination of the x axis in degrees with the resolution of object 6000.

If the object is disabled in the operating byte (object 6011), zero is output as the measured value. The parameter cannot be changed.

position_x_axis

Index	Sub	Description	Length COM MEM	Memory Type Location	Range/ value	Action	Default
6010	0	position_x_axis	Word Word	ro E²PROM	0 … 65,536	Sen	-

9.10.3 Object 6011 operating_x_axis

Operating byte of the x axis. The parameter specifies how the value of object 6010 is to be interpreted or whether the object is active. Only the scaling and inversion bits are active. All other bits must be constantly zero.

The object can be set in the factory.

The object has the structure:

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
ms			r			s	i

Field	Value	Designation
ms		Manufacturer-specific
r	0	Reserved
s (scaling)	0	Scaling not enabled
	1	Scaling enabled
i (inversion)	0	Inversion not enabled
	1	Inversion enabled

If the scaling bit is disabled, zero is output as the measured value in object 6010. Bit inversion inverts the measured value (the measured value's prefix is reversed).

operating_x_axis

Index	Sub	Description	Length COM	MEM	Memory Type	Location	Range/ value	Action	Default
6011	0	operating_x_axis	Byte	Byte	fp	E²PROM	0x02	Sen	-1)

1) Written in factory programming status.

9.10.4 Object 6012 preset_x_axis

Preset of the x axis in degrees with the resolution of object 6000.

The preset may deviate from the current position by a maximum of $\pm 5°$. In the event of greater deviations, "Value range of parameter exceeded" is returned.
In the case of safety-relevant applications, the parameter can only be programmed in the factory.

preset_x_axis

Index	Sub	Description	Length COM	MEM	Memory Type	Location	Range/ value	Action	Default
6012	0	preset_y_axis	Word	Word	ro	E²PROM	0… 65,536	SEN	- 1)

1) Written in factory programming status.

9.10.5 Object 6020 position_y_axis

Inclination of the y axis in degrees with the resolution of object 6000.

If the object is disabled in the operating byte (object 6021), zero is output as the measured value. The parameter cannot be changed.

position_y_axis

Index	Sub	Description	Length COM	MEM	Memory Type	Location	Range/ value	Action	Default
6020	0	position_y_axis	Word	Word	ro	E²PROM	0… 65,536	SEN	-

9.10.6 Object 6021 operating_y_axis

The parameter specifies how the value of object 6020 is to be interpreted or whether the object is active. Only the scaling and inversion bits are active. All other bits must be constantly zero.

The object can be set in the factory.

The object has the structure:

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
ms			r			s	i

Field	Value	Designation
ms		Manufacturer-specific
r	0	Reserved
s (scaling)	0	Scaling not enabled
	1	Scaling enabled
i (inversion)	0	Inversion not enabled
	1	Inversion enabled

If the scaling bit is disabled, zero is output as the measured value in object 6020. Bit inversion inverts the measured value (the measured value's prefix is reversed).

operating_y_axis

Index	Sub	Description	Length COM	MEM	Memory Type	Location	Range/ value	Action	Default
6021	0	operating_y_axis	Byte	Byte	fp	E²PROM	0x00…..0x02	Sen	-1)

1) Written in factory programming status.

9.10.7 Object 6022 preset_y_axis

Preset of the y axis in degrees with the resolution of object 6000.

The preset may deviate from the current position by a maximum of $\pm 5°$. In the event of greater deviations, "Value range of parameter exceeded" is returned.
In the case of safety-relevant applications, the parameter can only be programmed in the factory.

preset_y_axis

Index	Sub	Description	Length COM	MEM	Memory Type	Location	Range/ value	Action	Default
6022	0	preset_y_axis	Word	Word	ro	E²PROM	0… 65,536	SEN	-1)

1) Written in factory programming status.

9.10.8 Object 6030 position_z_axis

Inclination of the z axis in degrees with the resolution of object 6000.

If the object is disabled in the operating byte (object 6031), zero is output as the measured value. The parameter cannot be changed.

position_z_axis

Index	Sub	Description	Length COM	MEM	Memory Type	Location	Range/ value	Action	Default
6030	0	position_z_axis	Word	Word	ro	E²PROM	0… 65,536	SEN	-

9.10.9 Object 6031 operating_z_axis

The parameter specifies how the value of object 6030 is to be interpreted or whether the object is active. Only the scaling and inversion bits are active. All other bits must be constantly zero.

The object is firmly set, as the third axis is not currently supported.

The object has the structure:

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
ms			r			s	i

Field	Value	Designation
ms		Manufacturer-specific
r	0	Reserved
s (scaling)	0	Scaling not enabled
	1	Scaling enabled
i (inversion)	0	Inversion not enabled
	1	Inversion enabled

If the scaling bit is disabled, zero is output as the measured value in object 6030. Bit inversion inverts the measured value (the measured value's prefix is reversed).

operating_z_axis

Index	Sub	Description	Length COM	MEM	Memory Type	Location	Range/ value	Action	Default
6031	0	operating_z_axis	Byte	Byte	ro	E²PROM	0x00….0x02	Sen	-1)

1) Written in factory programming status.

9.10.10   Object 6032 preset_z_axis

Preset of the z axis in degrees with the resolution of object 6000.

The preset may deviate from the current position by a maximum of $\pm 5°$. In the event of greater deviations, "Value range of parameter exceeded" is returned.
In the case of safety-relevant applications, the parameter can only be programmed in the factory.

preset_z_axis

Index	Sub	Description	Length COM	MEM	Memory Type	Location	Range/ value	Action	Default
6032	0	preset_z_axis	Word	Word	rw	E²PROM	0… 65,536	SEN	-1)

1) Written in factory programming status.

9.11 Diagnostic objects

9.11.1 Object 6503 alarms

Internally, there is only one error byte. If an alarm occurs, an emergency message is transmitted.
On SDO upload, the error byte is loaded into the object's MSB.
The following errors are evaluated:

Bit	Error type
0 - 1	Not used
2	Not used
3	Not used
4	Not used
5	CRC error parameter
6	Supply out of range
7	Sensor error

CRC error: The synchronisation parameters and the parameters of the CAN interface are monitored by the CRC. This flag is set in the event of an error in one of the ranges.

9.11.2 Sensor error: MEMS sensor error or the measured values of the form lie too far apart.
The MEMS sensor errors are extensive and are therefore separate object in point 9.8.1 Object 6200 Cyclic Timer

Values > 0: Object 'Position value is sent cyclic with value · Cyclic Timer' in ms on PDO 1.

Cyclic Timer

Index	Sub	Description	Length COM	MEM	Storage Typ	Ort	Area/ Value	Action	default
6200	0	cyclic_timer	Word	Word	rw	XRAM	0...0xFFFF	-	0

Object 2020 sensor_state for the manufacturer for diagnostic purposes; they can be called up there.

alarms

Index	Sub	Description	Length COM	MEM	Memory Type	Location	Range/ value	Action	Default
6503	0	alarms	Word	Byte	ro	RAM	-	See above	-

9.11.3 Object 6504 supported_alarms

Supported alarm messages.
This is a representation of the possible alarms displayed in index 6503.

supported_alarms

Index	Sub	Description	Length COM	MEM	Memory Type	Location	Range/ value	Action	Default
6504	0	supported_alarms	Word	Word	ro	ROM	0xE0	-	-

9.11.4 Object 6506 supported_warnings

Supported warning messages.
No warnings are supported. Object 6505 can therefore be omitted.

supported_warnings

Index	Sub	Description	Length COM	MEM	Memory Type	Location	Range/ value	Action	Default
6506	0	supported_warnings	Word	Word	ro	ROM	0	-	-

9.11.5 Object 6507 profile_and_software_version

The profile and software version of the sensor.
The versions are each BCD-coded by byte.
Version 2.5 results in 0x25.
The current version of the inclinometer profile and the software version are entered.

Profile version		Software version	
Byte 0	Byte 1	Byte 2	Byte 3
Bits 7 - 0	Bits 15 - 8	Bits 7 - 0	Bits 15 - 8

Standard version:

profile_and_software_version

Index	Sub	Description	Length COM	MEM	Memory Type	Location	Range/ value	Action	Default
6507	0	profile_and_software_ version	Long	Long	ro	ROM	0x030B0102	-	-

Version V:

profile_and_software_version

Index	Sub	Description	Length COM	MEM	Memory Type	Location	Range/ value	Action	Default
6507	0	profile_and_software_ version	Long	Long	ro	ROM	0x030C0102	-	-

9.11.6 Object 6508 operating_time

Not supported.

operating_time

Index	Sub	Description	Length COM	MEM	Memory Type	Location	Range/ value	Action	Default
6508	0	operating_time	Long	Long	ro	ROM	0xFFFF FFFF	-	-

9.11.7 Object 650B serial_number

The serial number is written during programming in the factory.

serial_number

Index	Sub	Description	Length COM	MEM	Memory Type	Location	Range/ value	Action	Default
650B	0	serial_number	Long	Long	fp	XRAM	0....	1)	-

1) Written in factory programming status.