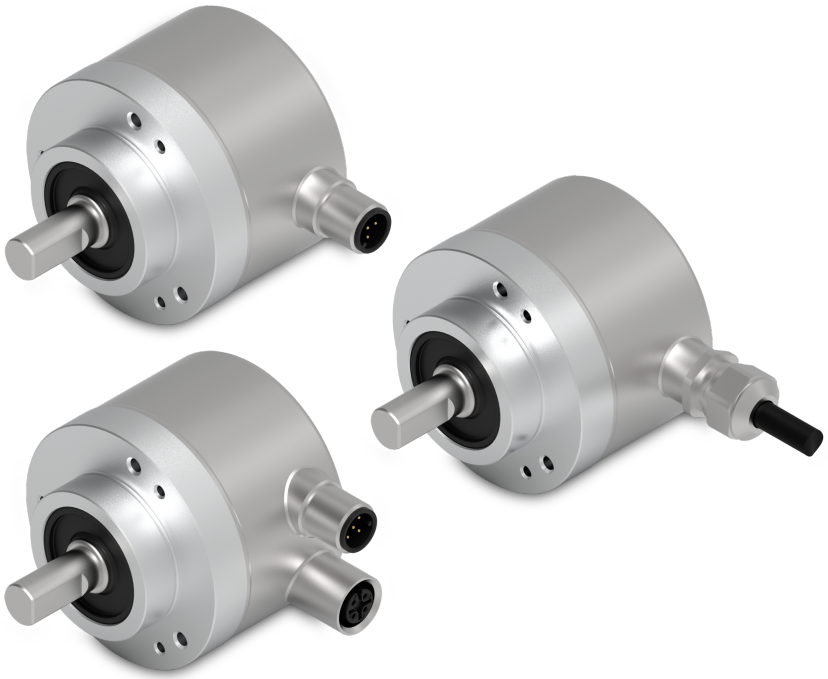
Baumer
Passion for Sensors



Description of functions and interfaces

EAM580RS

Absolute encoders for safety applications

EN-US

V1.0 | 1/17/2024

Table of contents

1 About this document

1.1 Instruction manual: purpose and scope of application

The present manual describes the functions and configurable parameters/commands of *Baumer* industrial encoders.

This manual applies to the following product families:

- *EAM580RS MT*
- *EAM580RS ST*

1.2 Applicable documents

- Available for download at www.baumer.com:
  - Data sheet
  - Safety Manual
  - EU Declaration of Conformity
- Attached to product:
  - Original operating and mounting instructions
  - General information sheet (11042373)

1.3 Labels in this manual

Identifier	Usage	Example
Dialog element	Indicates dialog elements.	Click the ***OK*** button.
Unique name	Indicates the names of products, files, etc.	*Internet Explorer* is not supported in any version.
`Code`	Indicates entries.	Enter the following IP address: `192.168.0.250`

1.4 Warnings in this manual

Warnings draw attention to potential personal injury or material damage. The warnings in this manual indicate different hazard levels:

Symbol	Warning term	Explanation
	**DANGER**	Indicates an imminent potential danger with high risk of death or serious personal injury if not being avoided.
	WARNING	Indicates potential danger with medium risk of death or (serious) personal injury if not being avoided.
	CAUTION	Indicates a danger with low risk, which could lead to light or medium injury if not avoided.
	NOTE	Indicates a warning of material damage.
	**INFO**	Indicates practical information and tips that enable optimal use of the devices.

2 General functionality

Absolute encoder 58 mm diameter. Safety-related position, speed and acceleration information is transmitted via CANopen Safety interface/protocol (EN 50325-5). Moreover, CANopen data is transmitted via standard CANopen interface as non-safety-related data. The encoder is developed in accordance with the CiA standards:

- CiA DS301 (communication profile)
- CiA DSP305 (LSS profile)
- CiA DS406 (encoder device profile)

Do not exceed the service life of the integrated ball bearings since wear and fatigue may result in bearing failure. The encoder may only be operated within the specified service life (see Safety Manual).

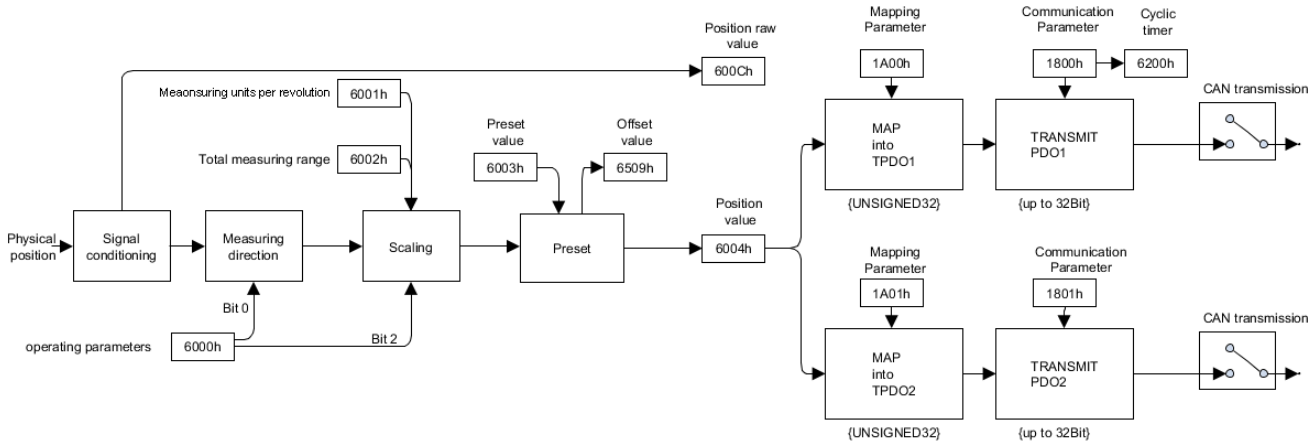
Once the service life has been reached, the encoder must be replaced. Depending on the application, service life may be limited by the service life of the integrated ball bearings.

3 Operating principle

The sensor element delivers the measurement signals for the absolute motion of the magnetic rotor. Absolute encoders assign a unique value to each position. For doing so, a magnet rotates across a detecting chip (Hall sensor) and measures the change in the magnetic field (Hall effect).

In the event of power failure, the unique shaft position will be retained. This eliminates the need for any reference run relating to the start or home position after power supply has been restored.

4 Block diagram



III. 1: Operating principle, overview

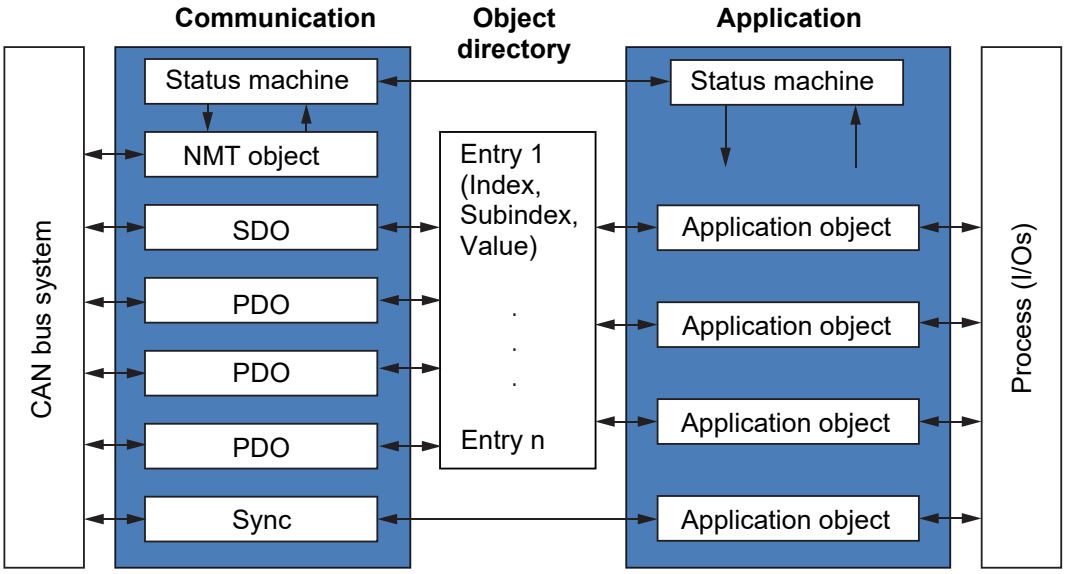
5 Interfaces

5.1 CANopen

CANopen is a common *CAN* application layer, optimized for fast data exchange in real-time systems. The organization CAN in Automation (CiA) is responsible for the standards applicable to the related profiles.

CANopen comprises the protocol definition (communication profile) as well as the device profiles for the respective device class. Process data objects (PDO) serve for fast communication of input and output data. The *CANopen* device parameters and process data are structured in an object directory.

Any data in this object directory are accessible via service data objects (SDO). There are more objects (e.g. telegram types) for network management (NMT), synchronization, error messages, etc.



Ill. 2: CANopen model

CANopen allows for:

- Easy access to all device and communication parameters
- Synchronization of several devices
- Automatic network configuration
- cyclic and event-driven process data traffic

CANopen consists of four communication objects (COB) with different properties:

- Process data objects for real-time data (PDO)
- Service data objects for parameter and program transfer (SDO)
- Network management (NMT, Heartbeat)
- Predefined objects (for synchronization, emergency messaging)

All device and communication parameters are organized in an object directory. An object includes object name, data type, number of sub indexes, structure of parameters and address. According to CiA, this object directory comprises three parts: Communication profile, device profile and manufacturer-specific profile.

5.1.1 Supported profiles

The following CANopen profiles are supported:

- CiA 301 / Version 4.2.0 (Communication)
- CiA 305 / Version 3.0.0 (LSS)
- CiA 406 / Version 4.1.0 (encoder profile)
- EN 50325-5 CANopen Safety protocol (formerly CiA 304)

5.1.2 Supported CANopen services

The device supports the following CANopen services:

- 1 Network Management (according to CiA 301)
- 1 SDO server (according to CiA 301)
- 2 TPDOs (according to CiA 301/CiA 406)
- 1 Emergency Producer (according to CiA 301/CiA 406)
- 1 Heartbeat Producer (according to CiA 301)
- 1 Node guarding (according to CiA 301)
- 1 LSS client (according to CiA 305)
- 3 SRDOs (in accordance with CiA 304/CiA 319/CiA 406)

5.1.3 SDO Service

The sensor supports 1 SDO server (expedited read/write, segmented read).

Structure of a *SDO* telegram:

COB ID	DLC	Com-mand	Object L	Object H	Subindex	Data 0	Data 1	Data 2	Data 3

A *SDO-COB ID* is structured as follows:

- Master → Encoder : 600h + *Node-ID*
- Encoder ← Master : 580h + *Node-ID*

DLC (Data length code) denotes the telegram length. It is structured as follows:

1 byte command + 2 byte object + 1 byte subindex + number of data bytes (0...4).

The command byte defines whether data is read or set and the number of data bytes:

SDO command	Function	Length	Description
22h	Download Request	Max. 4 bytes	Send parameters to rotary encoder
23h	Download Request	4 bytes	
2Bh	Download Request	2 bytes	
2Fh	Download Request	1 bytes	
60h	Download Response	–	Transfer confirmation to Master
40h	Upload Request	–	Parameter request to encoder
42h	Upload Request	Max. 4 bytes	Parameters to master with max. 4 bytes
43h	Upload Request	4 bytes	
4Bh	Upload Request	2 bytes	
4Fh	Upload Request	1 bytes	
80h	Abort Message		Rotary encoder reports error code to master

abort message signals an object access error. SDO command byte is 80h. Object and subindex are those of the requested object. The error code comes in bytes 8...5.

COB ID	DLC	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
580h + Node-ID	8	80h	Object L	Object H	Subindex	ErrByte 0	ErrByte 1	ErrByte 2	ErrByte 3

Bytes 8...5 equal SDO *abort message* (byte 8 = MSB). The following messages are supported:

- 05030000h - Toggle bit unchanged
- 05040001h - Command not valid or unknown
- 06010001h - Read access to write only
- 06010002h - Write access to read only
- 06020000h - Object supported
- 06040041h - No object mapping to PDO
- 06040042h - would exceed PDO length

- 06040042h - Parameter incompatible
- 06060000h - Access error due to hardware error
- 06070010h - Incorrect data type
- 06090011h - Subindex not supported
- 06090030h - Value outside the limit
- 06090031h - Value too high
- 06090032h - Value too small
- 08000000h - General error
- 08000020h - Incorrect memory signature
- 08000022h - Error due to current device status
- 08000024h - No data available

SDO examples

Master requests value from slave. Typical query is a position query: Object 6004h

COB ID	DLC	Com-mand	Object L	Object H	Subindex	Data 0	Data 1	Data 2	Data 3
600h + Node-ID	8	40h	04h	60h	0	x	x	x	x

Slave responds position value to master. The position value has a length of 4 bytes, detailed values can be found at object 6004h.

COB ID	DLC	Com-mand	Object L	Object H	Subindex	Data 0	Data 1	Data 2	Data 3
580h + Node-ID	8	43h	04h	60h	0	a	b	c	d

Master writes value to slave. Setting the position value is in preset object 6003h.

COB ID	DLC	Com-mand	Object L	Object H	Subindex	Data 0	Data 1	Data 2	Data 3
600h + Node-ID	8	22h	03h	60h	0	a	b	c	d

Response of slave to written value.

COB ID	DLC	Com-mand	Object L	Object H	Subindex	Data 0	Data 1	Data 2	Data 3
580h + Node-ID	8	60h	03h	60h	0	a	b	c	d

5.1.3.1 Store parameters

Writing the ASCII value ***save*** to 1010h-xwill save the corresponding to the non-volatile memory. The parameters are loaded from the non-volatile memory after reset or power-on.

The SDO request to 1010h-x is answered after the parameters have been saved.

⚠ WARNING

Unexpected device behavior caused by incorrect settings

Interruption of power supply immediately after transmission of the save command will restore the default parameters at next power-on.

a) Make sure power supply is not interrupted immediately after transmission of the save command.

For more detailed information on the following please refer to chapter *Annex [▶ 63]*.

CANopen access: 1010h

Name	Object	Subindex	Description
Store parameters	1010h	–	
Highest subindex supported		00h	5
Save all parameters		01h	=“evas“ (65766173h) to save
Communication parameters		02h	=“evas“ (65766173h) to save
Application parameters		03h	=“evas“ (65766173h) to save
Manuf. specific parameters		04h	=“evas“ (65766173h) to save
Manufacturer LSS Group		05h	=“evas“ (65766173h) to save

Signature	MSB			LSB	
ISO 8859	**e**	**v**	**a**	**s**	character
	0x65	**0x76**	**0x61**	**0x73**	hex
	1702257011				dez

5.1.3.2 Restore default parameters

Writing the ASCII value ***load*** to 1011h-x will immediately restore default in the corresponding objects.

NOTICE

Changes will not be adopted until reset or at next power-on.

For more detailed information on the following please refer to chapter *Annex [▶ 63]*.

CANopen access: 1011h

Name	Object	Subindex	Description
Restore default parameters	1011h	–	
Highest subindex supported		00h	5
All parameters		01h	=“daol“ (64616F6Ch) to load
Communication parameters		02h	=“daol“ (64616F6Ch) to load
Application parameters		03h	=“daol“ (64616F6Ch) to load
Manuf. specific parameters		04h	=“daol“ (64616F6Ch) to load
Manufacturer LSS Group		05h	=“daol“ (64616F6Ch) to load

Signature	MSB			LSB	
ISO 8859	**d**	**a**	**o**	**l**	character
	0x64	**0x61**	**0x6F**	**0x6C**	hex
	1684107116				dez

5.1.4 PDO Service

TPDO1 and TPDO2 are supported. PDO transmission is only in NMT operating mode **Operational**.

5.1.4.1 Communication types

CANopen supports different communication types of process data objects. The following communication types are supported (object 180xh-2):

Communication type	Description
Synchronous transmission (1-240)	In synchronous data transmission, PDO transmission is after the n-th sync frame.
Asynchronous transmission (255)	In asynchronous data transmission, PDO transmission is time-triggered. The time interval between 2 PDOs can be set in object 180xh-5 or alternatively in 6200h.
Manufacturer-specific transmission (254)	Standard setting. Corresponds to asynchronous transmission.

For detailed parameter information see chapter *Annex [▶ 63]*.

5.1.4.2 COB-ID

The COB ID for both PDOs is changed by object 180xh-1.

Standard values:

- TPDO1: 180h + *Node-ID*
- TPDO2: 280h + *Node-ID*

Changes are immediately adopted.

NOTICE

Overwriting and saving the COB ID for TPDOx will retain it even in the event of later changes to the *Node-ID*.

5.1.4.3 PDO mapping

The encoder supports dynamic mapping. Both objects *1A00h* and *1A01* are used for configuration.

The standard configuration is defined in the object directory.

Instruction:

a) Disable mapping by writing 0 to object *1A0xh-0*.

b) Write the desired mapping entry.

c) Re-enable mapping by writing the number of the PDO content to object *1A0xh-0*.

INFO

In the object directory, in column *Access rights* the mappable objects are flagged with *m*.

5.1.4.3.1 TPDO mapping parameter

For more detailed information on the following please refer to chapter *Annex [▶ 63]*.

CANopen access: 1A00h

Name	Object	Subindex	Description
Transmit PDO1 mapping	1A00h	–	
Highest subindex supported		00h	Maximum value is 8
1st mapping parameter		01h	Position encoder

CANopen access: 1A01h

Name	Object	Subindex	Description
Transmit PDO2 mapping	1A01h	–	
Highest subindex supported		00h	Maximum value is 8
1st mapping parameter		01h	Position encoder

5.1.4.3.2 TPDO communication parameter

For more detailed information on the following please refer to chapter *Annex [▶ 63]*.

CANopen access: 1800h

Name	Object	Subindex	Description
Transmit PDO1 mapping	1800h	–	
Highest subindex supported		00h	
COB-ID		01h	COB-ID for TPDO 1
PDO type		02h	Transmission type
Event timer		05h	Cycle time [in ms]

CANopen access: 1801h

Name	Object	Subindex	Description
Transmit PDO2 mapping	1801h	–	
Highest subindex supported		00h	
COB-ID		01h	COB-ID for TPDO 2
PDO type		02h	Transmission type
Event timer		05h	Cycle time [in ms]

5.1.4.3.3 Cycle timer PDO1

This object mirrors object 1800:05h (*Event timer*).

For more detailed information on the following please refer to chapter *Annex [▶ 63]*.

CANopen access: 6200h

Name	Object	Subindex	Description
Cycle timer PDO1	6200h	–	In milliseconds, internally linked to object 1800:05h

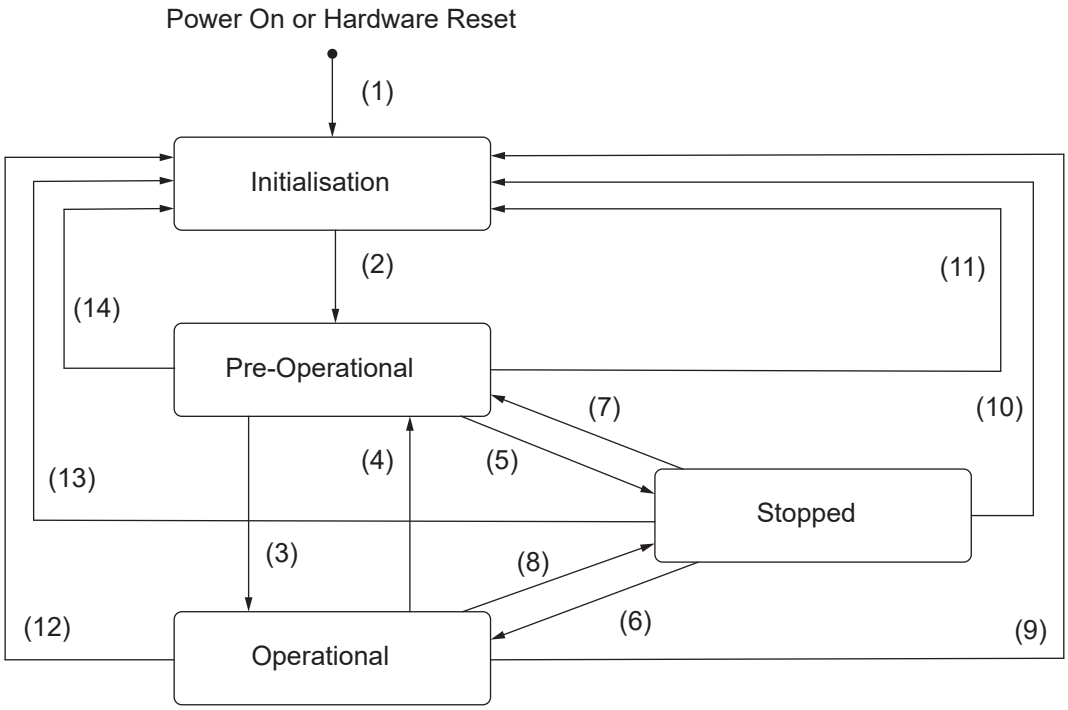
5.1.5 Network management (NMT)

Network management (NMT) defines the communication behavior of a *CANopen* node.

There are two categories of network management: The NMT services for device control can be used to initialize, start and stop the bus devices. There are also NMT services for connection monitoring.

There are the following status:

- *Init (Initialisation)*
- *Pre-Operational*
- *Operational*
- *Stopped*



Ill. 3: Status of a *CANopen* node

(1)	At Power On the NMT state initialisation is entered autonomously
(2)	NMT state initialisation finished - enter NMT state Pre-Operational automatically
(3)	NMT service start remote node indication or by local control
(4), (7)	NMT service enter Pre-Operational indication
(5), (8)	NMT service stop remote node indication
(6)	NMT service start remote node indication
(9), (10), (11)	NMT service reset node indication
(12), (13), (14)	NMT service reset communication indication

Status	Description
Init (Initialisation)	After power on, a *CANopen* node is automatically in status *Init*. Having completed *Init*, the node is automatically in status *Pre-Operational*.

Status	Description
Pre-Operational	The service data objects (SDO) are active and the node can be configured. The process data objects (PDO/SRDO) are still blocked. Reading/writing SDO parameters is only enabled in NMT status . *Pre-Operational*
Operational	The process data objects (PDO/SRDO) are active. If reading or communication is no longer feasible due to a problem (e.g. CAN error), the encoder will try to transmit a corresponding emergency message. This way, the *CANopen* master will immediately recognize any fatal error.
Stopped	Communication with node is not possible. Only NMT messages are received. The outputs go into error state.

5.1.5.1 NMT Reset Communication

This function will trigger CAN controller restart.

Internal initialization time is <1s. Next, the boot-up message is transmitted.

NOTICE

Any configuration parameters which had not been saved will be lost.

CANopen: NMT Reset Communication

COB-ID	Byte 0	Byte 1
0	82h (NMT Communication Reset)	*Node-ID* (0=Broadcast)

Tab. 1: NMT-Frame

Once having successfully completed the function, the encoder transmits a *Boot-up Message*.

COB-ID	Byte 0
700h + *Node-ID*	00

5.1.5.2 NMT Reset Node

Command *NMT Reset Node* will completely reset the encoder.

Internal initialization time is <1s. Next, the boot-up message is transmitted.

NOTICE

Any configuration parameters which had not been saved will be lost.

CANopen: NMT Reset Node

COB-ID	Byte 0	Byte 1
0	81h (NMT Reset)	*Node-ID* (0=Broadcast)

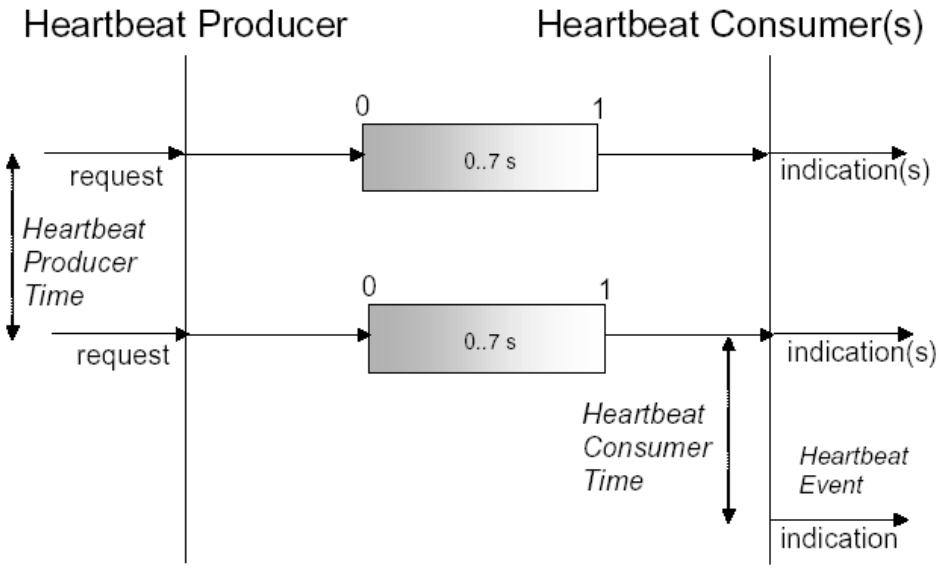
Tab. 2: NMT-Frame

Once having successfully completed the function, the encoder transmits a *Boot-up Message*.

COB-ID	Byte 0
700h + *Node-ID*	00

5.1.6 Heartbeat

The sensor supports heartbeat producer functionality. Configuration is in done via object 1017h.



A *Heartbeat Producer* is cyclically transmitting the heartbeat message at the frequency specified in object *Producer heartbeat time*. One or more *Heartbeat Consumer* can receive the message. The relationship between producer and consumer is configured via object directory entries. The *Heartbeat Consumer* monitors heartbeat reception within the *Heartbeat Consumer Time*. Not receiving the heartbeat within this time will generate a heartbeat event.

Example of a heartbeat protocol

COB-ID	Data/Remote	Byte 0
701h	d	7Fh (127d)

Heartbeat messages comprise the *COB-ID* and one byte. The NMT status is delivered in the byte.

- 0: Boot up event
- 4: Stopped
- 5: Operational
- 127: Pre-Operational

In other words, in the example, the sensor is in state Pre-Operational (7Fh = 127).

5.1.6.1 Producer heartbeat time

Function *Producer heartbeat time* is used to read/write the producer heartbeat time in [ms].

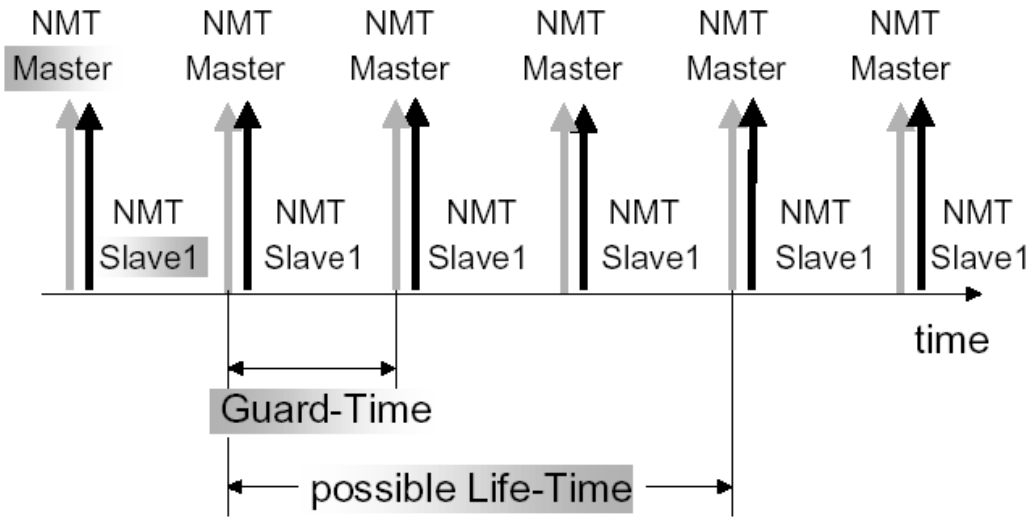
For more detailed information on the following please refer to chapter *Annex [▶ 63]*.

CANopen access: 1017h

Name	Object	Subindex	Description
Producer heartbeat time	1017h	–	Producer heartbeat time [ms]. 0=deaktiviert

5.1.7 Node and life guarding

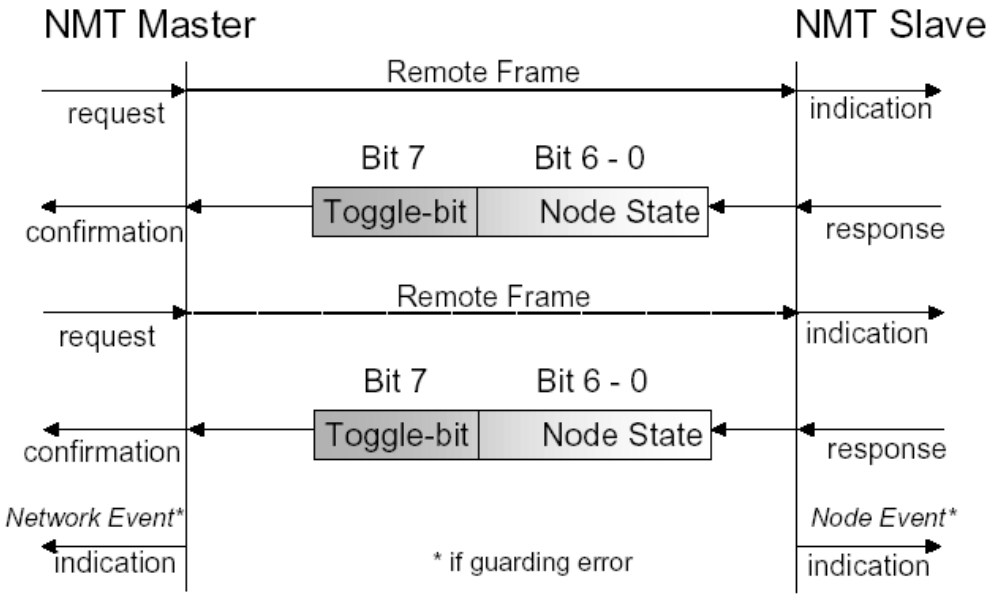
The sensor supports the node and life guarding functionality. Configuration is via CANopen objects 100Ch and 100Dh.



The NMT master can create a database with the respective NMT status of each node. This log can be used to check whether a node has withdrawn from the bus connection. Furthermore, each node can also monitor whether the control unit is still active.

The NMT master starts monitoring by a remote frame to the desired node. Each remote frame resets the life time at the station. In addition, the station returns its NMT status. This allows the NMT master to check whether the node is in correct NMT state and to react in the event of error.

Lifetime having expired will trigger a "node event". The behavior in the event of error is defined in object 1029h-1h.



5.1.7.1 Guard time

This function is for reading/writing of Guard time. Guard time defines the sensor monitoring interval (node guarding). 0 means no monitoring.

Multipliying the values of Guard time and Life Time equals the watchdog length for mutual monitoring (Life Guarding/Node Guarding).

For more detailed information on the following please refer to chapter *Annex [▶ 63]*.

CANopen access: 100Ch

Name	Object	Subindex	Description
Guard time	100Ch	–	Guard time (actual guard time is Object 100Ch*100Dh [ms])

Also see about this

- Node and life guarding [▶ 22]
- Life time factor [▶ 23]

5.1.7.2 Life time factor

This function is for reading/writing the Life time factor.

Multiplying the values of Guard time and Life time equals the watchdog length for mutual monitoring (life guarding/node guarding).

For more detailed information on the following please refer to chapter *Annex [▶ 63]*.

CANopen access: 100D

Name	Object	Subindex	Description
Life time factor	100D	–	

5.1.8 Layer Setting Service (LSS)

Baud rate and *Node-ID* can be configured via LSS (compliant to CiA 305). Alternatively, baud rate and *Node-ID* can be changed by accessing objects 2100h and 2101h.

INFO

The values required for LSS addressing, such as *Vendor ID*, revision number, product code and serial number, are printed on the label provided at the encoder housing.

5.1.8.1 Supported functions

- Switch state global
- Switch state selective
- Enable bit timing parameter
- Configure bit timing parameters
- *Node-ID*-Configure protocol
- Save configuration
- Polling the LSS address
  - Polling the Identity *vendor ID*
  - Polling the product code identity
  - Polling the identity revision number
  - Polling the identity serial number
- Polling the *Node-ID*
- Identify LSS slave
- LSS Fastscan

5.1.8.2 Message structure

COB-ID

Consumer → Producer : 2021 = 7E5h

Consumer ← Producer : 2020 = 7E4h

The COB-ID is followed by a LSS comand specifier (cs) . In the next step, up to seven data bytes will be transmitted.

COB-ID	cs	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7

Switch state global

7E5h →	04h	State	Reserved

State: 0: Operational state
1: Configuration state

Switch state selective

7E5h →	40h	Vendor ID	Reserved
7E5h →	41h	Product code	Reserved
7E5h →	42h	Revision number	Reserved Reserved
7E5h →	43h	Serial number	Reserved
7E4h ←	44h	Status	Reserved

Vendor ID:	5Fh
Product code:	Internal product code for the respective sensor
Revision number	Current sensor revision number
Serial number	Unique, consecutive serial number
Status	The sensor returns the new status (0=operating status; 1=configuration status)

Node-ID setting

7E5h →	11h	*Node-ID*	Reserved	
7E4h ←	11h	*Error-Code*	*Specific Error*	Reserved

Node-ID	New sensor *Node-ID*
Error-Code	▪ 0 = OK ▪ 1 = *Node-ID* outside range ▪ 2...254 = reserved ▪ 255 = specific error
Specific Error	*Error-Code* = 255 will output the application-specific error code here.

Setting the bit timing (baud rate)

7E5h →	13h	*Table-Sel*	*TableInd*	Re-served
7E4h ←	13h	*Error-Code*	*Specific Error*	Re-served

TableSel	Selects the bit timing table; 0 = standard CiA bit timing table
TableInd	Bit timing entry in the selected table.
Error-Code	▪ 0 = OK ▪ 1 = *Node-ID* outside range ▪ 2...254 = reserved ▪ 255 = specific error
Specific Error	*Error-Code* = 255 will output the application-specific error code here.

Notes:

- To set the bit timing via LSS, use the values according to the standard CIA bit timing table.
- For non-volatile storage, *Save configuration* must be executed.
- The changed baud rate or *Node-ID* become effective after device restart.

5.1.9 Baudrate

This function sets the encoder to a specific baud rate.

For more detailed information on the following please refer to chapter *Annex [▶ 63]*.

CANopen access: 2100h

Name	Object	Subindex	Description
Baudrate	2100h	–	▪ 0: 10 kBit/s (not supported) ▪ 1: 20 kBit/s (not supported) ▪ 2: 50 kBit/s ▪ 3: 100 kBit/s ▪ 4: 125 kBit/s ▪ 5: 250 kBit/s ▪ 6: 500 kBit/s ▪ 7: 800 kBit/s ▪ 8: 1000 kBit/s

NOTICE

Table is different from the CiA standard bit timing LSS table.

- Save the new baud to the non-volatile memory using object 1010h.
- The new baud rate will become effective after device restart or NMT Reset.
- Alternatively LSS can be used for baud rate / bit timing configuration.

5.1.10 Node-ID

This function is for reading and writing the *Node-ID*.

CANopen access: 2101h

The new *Node-ID* becomes effective after NMT Reset or power on (provided the parameters were saved to the non-volatile memory).

Name	Object	Subindex	Description
Node-ID	2101h	–	Node-ID 1...127 possible

5.1.11 SRDO COB-ID configuration

The COB ID for each of the 3 SRDOs will be automatically assigned and according to the formulas and tables below:

NOTICE

a) Node IDs configured within the range 1 ... 22 will be automatically assigned the COB IDs for SRDOs without the risk of collisions.

b) Node IDs configured within the range 23 ... 127 may cause colliding SRDO COB-IDs and require manual intervention (see the following tables)

	COB-ID 1 normal	COB-ID 2 inverted
SRDO 1	FFh + (2 * Node-ID); If result > 17Fh then 17Fh is automatically assigned as default value	FFh + 1 + (2 * Node-ID);If result > 180h then 180h is automatically assigned as default value
SRDO 2	129h + (2 * Node-ID); If result > 17Fh then 17Fh is automatically assigned as default value	129h + 1 + (2 * Node-ID);If result > 180h then 180h is automatically assigned as default value
SRDO 3	153h + (2 * Node-ID); If result > 17Fh then 17Fh is automatically assigned as default value	153h + 1 + (2 * Node-ID);If result > 180h then 180h is automatically assigned as default value

Tab. 3: SRDO COB-ID calculation

Node-ID	SRDO1 COB-ID				SRDO2 COB-ID				SRDO3 COB-ID			
	normal		invert.		normal		invert.		normal		invert.	
	dez	hex	dez	hex	dez	hex	dez	hex	dez	hex	dez	hex
1	257	101h	258	102h	299	12Bh	300	12Ch	341	155h	342	156h
2	259	103h	260	104h	301	12Dh	302	12Eh	343	157h	344	158h
3	261	105h	262	106h	303	12Fh	304	130h	345	159h	346	15Ah
4	263	107h	264	108h	305	131h	306	132h	347	15Bh	348	15Ch
5	265	109h	266	10Ah	307	133h	308	134h	349	15Dh	350	15Eh
6	267	10Bh	268	10Ch	309	135h	310	136h	351	15Fh	352	160h
7	269	10Dh	270	10Eh	311	137h	312	138h	353	161h	354	162h
8	271	10Fh	272	110h	313	139h	314	13Ah	355	163h	356	164h
9	273	111h	274	112h	315	13Bh	316	13Ch	357	165h	358	166h
10	275	113h	276	114h	317	13Dh	318	13Eh	359	167h	360	168h
11	277	115h	278	116h	319	13Fh	320	140h	361	169h	362	16Ah
12	279	117h	280	118h	321	141h	322	142h	363	16Bh	364	16Ch
13	281	119h	282	11Ah	323	143h	324	144h	365	16Dh	366	16Eh
14	283	11Bh	284	11Ch	325	145h	326	146h	367	16Fh	368	170h
15	285	11Dh	286	11Eh	327	147h	328	148h	369	171h	370	172h
16	287	11Fh	288	120h	329	149h	330	14Ah	371	173h	372	174h
17	289	121h	290	122h	331	14Bh	332	14Ch	373	175h	374	176h
18	291	123h	292	124h	333	14Dh	334	14Eh	375	177h	376	178h
19	293	125h	294	126h	335	14Fh	336	150h	377	179h	378	17Ah
20	295	127h	296	128h	337	151h	338	152h	379	17Bh	380	17Ch
21	297	129h	298	12Ah	339	153h	340	154h	381	17Dh	382	17Eh
22	299	12Bh	300	12Ch	341	155h	342	156h	383	17Fh	384	180h
23	301	12Dh	302	12Eh	343	157h	344	158h	383	17Fh	384	180h
24	303	12Fh	304	130h	345	159h	346	15Ah	383	17Fh	384	180h
25	305	131h	306	132h	347	15Bh	348	15Ch	383	17Fh	384	180h
26	307	133h	308	134h	349	15Dh	350	15Eh	383	17Fh	384	180h
27	309	135h	310	136h	351	15Fh	352	160h	383	17Fh	384	180h
28	311	137h	312	138h	353	161h	354	162h	383	17Fh	384	180h
29	313	139h	314	13Ah	355	163h	356	164h	383	17Fh	384	180h
30	315	13Bh	316	13Ch	357	165h	358	166h	383	17Fh	384	180h
31	317	13Dh	318	13Eh	359	167h	360	168h	383	17Fh	384	180h
32	319	13Fh	320	140h	361	169h	362	16Ah	383	17Fh	384	180h
33	321	141h	322	142h	363	16Bh	364	16Ch	383	17Fh	384	180h
34	323	143h	324	144h	365	16Dh	366	16Eh	383	17Fh	384	180h
35	325	145h	326	146h	367	16Fh	368	170h	383	17Fh	384	180h
36	327	147h	328	148h	369	171h	370	172h	383	17Fh	384	180h
37	329	149h	330	14Ah	371	173h	372	174h	383	17Fh	384	180h
38	331	14Bh	332	14Ch	373	175h	374	176h	383	17Fh	384	180h
39	333	14Dh	334	14Eh	375	177h	376	178h	383	17Fh	384	180h
40	335	14Fh	336	150h	377	179h	378	17Ah	383	17Fh	384	180h
41	337	151h	338	152h	379	17Bh	380	17Ch	383	17Fh	384	180h
42	339	153h	340	154h	381	17Dh	382	17Eh	383	17Fh	384	180h
43	341	155h	342	156h	383	17Fh	384	180h	383	17Fh	384	180h
44	343	157h	344	158h	383	17Fh	384	180h	383	17Fh	384	180h
45	345	159h	346	15Ah	383	17Fh	384	180h	383	17Fh	384	180h
46	347	15Bh	348	15Ch	383	17Fh	384	180h	383	17Fh	384	180h
47	349	15Dh	350	15Eh	383	17Fh	384	180h	383	17Fh	384	180h
48	351	15Fh	352	160h	383	17Fh	384	180h	383	17Fh	384	180h
49	353	161h	354	162h	383	17Fh	384	180h	383	17Fh	384	180h
50	355	163h	356	164h	383	17Fh	384	180h	383	17Fh	384	180h
51	357	165h	358	166h	383	17Fh	384	180h	383	17Fh	384	180h
52	359	167h	360	168h	383	17Fh	384	180h	383	17Fh	384	180h
53	361	169h	362	16Ah	383	17Fh	384	180h	383	17Fh	384	180h
54	363	16Bh	364	16Ch	383	17Fh	384	180h	383	17Fh	384	180h
55	365	16Dh	366	16Eh	383	17Fh	384	180h	383	17Fh	384	180h
56	367	16Fh	368	170h	383	17Fh	384	180h	383	17Fh	384	180h
57	369	171h	370	172h	383	17Fh	384	180h	383	17Fh	384	180h
58	371	173h	372	174h	383	17Fh	384	180h	383	17Fh	384	180h
59	373	175h	374	176h	383	17Fh	384	180h	383	17Fh	384	180h
60	375	177h	376	178h	383	17Fh	384	180h	383	17Fh	384	180h
61	377	179h	378	17Ah	383	17Fh	384	180h	383	17Fh	384	180h
62	379	17Bh	380	17Ch	383	17Fh	384	180h	383	17Fh	384	180h
63	381	17Dh	382	17Eh	383	17Fh	384	180h	383	17Fh	384	180h
64	383	17Fh	384	180h	383	17Fh	384	180h	383	17Fh	384	180h

Node-ID	SRDO1 COB-ID		SRDO2 COB-ID		SRDO3 COB-ID	
	normal	invert.	normal	invert.	normal	invert.
65	383 17Fh	384 180h	383 17Fh	384 180h	383 17Fh	384 180h
66	383 17Fh	384 180h	383 17Fh	384 180h	383 17Fh	384 180h
67	383 17Fh	384 180h	383 17Fh	384 180h	383 17Fh	384 180h
68	383 17Fh	384 180h	383 17Fh	384 180h	383 17Fh	384 180h
69	383 17Fh	384 180h	383 17Fh	384 180h	383 17Fh	384 180h
70	383 17Fh	384 180h	383 17Fh	384 180h	383 17Fh	384 180h
71	383 17Fh	384 180h	383 17Fh	384 180h	383 17Fh	384 180h
72	383 17Fh	384 180h	383 17Fh	384 180h	383 17Fh	384 180h
73	383 17Fh	384 180h	383 17Fh	384 180h	383 17Fh	384 180h
74	383 17Fh	384 180h	383 17Fh	384 180h	383 17Fh	384 180h
75	383 17Fh	384 180h	383 17Fh	384 180h	383 17Fh	384 180h
76	383 17Fh	384 180h	383 17Fh	384 180h	383 17Fh	384 180h
77	383 17Fh	384 180h	383 17Fh	384 180h	383 17Fh	384 180h
78	383 17Fh	384 180h	383 17Fh	384 180h	383 17Fh	384 180h
79	383 17Fh	384 180h	383 17Fh	384 180h	383 17Fh	384 180h
80	383 17Fh	384 180h	383 17Fh	384 180h	383 17Fh	384 180h
81	383 17Fh	384 180h	383 17Fh	384 180h	383 17Fh	384 180h
82	383 17Fh	384 180h	383 17Fh	384 180h	383 17Fh	384 180h
83	383 17Fh	384 180h	383 17Fh	384 180h	383 17Fh	384 180h
84	383 17Fh	384 180h	383 17Fh	384 180h	383 17Fh	384 180h
85	383 17Fh	384 180h	383 17Fh	384 180h	383 17Fh	384 180h
86	383 17Fh	384 180h	383 17Fh	384 180h	383 17Fh	384 180h
87	383 17Fh	384 180h	383 17Fh	384 180h	383 17Fh	384 180h
88	383 17Fh	384 180h	383 17Fh	384 180h	383 17Fh	384 180h
89	383 17Fh	384 180h	383 17Fh	384 180h	383 17Fh	384 180h
90	383 17Fh	384 180h	383 17Fh	384 180h	383 17Fh	384 180h
91	383 17Fh	384 180h	383 17Fh	384 180h	383 17Fh	384 180h
92	383 17Fh	384 180h	383 17Fh	384 180h	383 17Fh	384 180h
93	383 17Fh	384 180h	383 17Fh	384 180h	383 17Fh	384 180h
94	383 17Fh	384 180h	383 17Fh	384 180h	383 17Fh	384 180h
95	383 17Fh	384 180h	383 17Fh	384 180h	383 17Fh	384 180h
96	383 17Fh	384 180h	383 17Fh	384 180h	383 17Fh	384 180h
97	383 17Fh	384 180h	383 17Fh	384 180h	383 17Fh	384 180h
98	383 17Fh	384 180h	383 17Fh	384 180h	383 17Fh	384 180h
99	383 17Fh	384 180h	383 17Fh	384 180h	383 17Fh	384 180h
100	383 17Fh	384 180h	383 17Fh	384 180h	383 17Fh	384 180h
101	383 17Fh	384 180h	383 17Fh	384 180h	383 17Fh	384 180h
102	383 17Fh	384 180h	383 17Fh	384 180h	383 17Fh	384 180h
103	383 17Fh	384 180h	383 17Fh	384 180h	383 17Fh	384 180h
104	383 17Fh	384 180h	383 17Fh	384 180h	383 17Fh	384 180h
105	383 17Fh	384 180h	383 17Fh	384 180h	383 17Fh	384 180h
106	383 17Fh	384 180h	383 17Fh	384 180h	383 17Fh	384 180h
107	383 17Fh	384 180h	383 17Fh	384 180h	383 17Fh	384 180h
108	383 17Fh	384 180h	383 17Fh	384 180h	383 17Fh	384 180h
109	383 17Fh	384 180h	383 17Fh	384 180h	383 17Fh	384 180h
110	383 17Fh	384 180h	383 17Fh	384 180h	383 17Fh	384 180h
111	383 17Fh	384 180h	383 17Fh	384 180h	383 17Fh	384 180h
112	383 17Fh	384 180h	383 17Fh	384 180h	383 17Fh	384 180h
113	383 17Fh	384 180h	383 17Fh	384 180h	383 17Fh	384 180h
114	383 17Fh	384 180h	383 17Fh	384 180h	383 17Fh	384 180h
115	383 17Fh	384 180h	383 17Fh	384 180h	383 17Fh	384 180h
116	383 17Fh	384 180h	383 17Fh	384 180h	383 17Fh	384 180h
117	383 17Fh	384 180h	383 17Fh	384 180h	383 17Fh	384 180h
118	383 17Fh	384 180h	383 17Fh	384 180h	383 17Fh	384 180h
119	383 17Fh	384 180h	383 17Fh	384 180h	383 17Fh	384 180h
120	383 17Fh	384 180h	383 17Fh	384 180h	383 17Fh	384 180h
121	383 17Fh	384 180h	383 17Fh	384 180h	383 17Fh	384 180h
122	383 17Fh	384 180h	383 17Fh	384 180h	383 17Fh	384 180h
123	383 17Fh	384 180h	383 17Fh	384 180h	383 17Fh	384 180h
124	383 17Fh	384 180h	383 17Fh	384 180h	383 17Fh	384 180h
125	383 17Fh	384 180h	383 17Fh	384 180h	383 17Fh	384 180h
126	383 17Fh	384 180h	383 17Fh	384 180h	383 17Fh	384 180h
127	383 17Fh	384 180h	383 17Fh	384 180h	383 17Fh	384 180h

Ill. 4: SRDO COB-ID table

COB IDs highlighted in orange must be set to a not yet used COB ID that is within the valid range (not marked in orange): for doing so write SDOs *130xh-05h* and *130xh-06h*.

5.1.12 Identification

5.1.12.1 Baumer Device Information

This function is for readout manufacturer-specific device information.

For more detailed information on the following please refer to chapter *Annex [▶ 63]*.

CANopen access: 2800h

Name	Object	Subindex	Description
Baumer Device Information	2800h		
Highest subindex supported		00h	
Serial Number		01h	String version of 1018h-04h, resp. 650Bh
Article Number		02h	SAP number of the encoder
Order Number		03h	Baumer order number
Product key		04h	EAM580RS_MT / EAM580RS_ST
Product name		05h	e.g. EAM580RS-SCB.EJCS.14180.J
Manufacturer date		06h	Date in format "DD.MM.YYYY hh:mm:ss"

5.1.12.2 Device Name

This function is for readout the sensor's device name (manufacturer's device name).

For more detailed information on the following please refer to chapter *Annex [▶ 63]*.

CANopen access: 1008h

Name	Object	Subindex	Description
DeviceName	1008h	–	DeviceName: `EAM580RS_MT` bzw. `EAM580RS_ST`

5.1.12.3 Device Type

Function *Device type* is for readout the device type.

For more detailed information on the following please refer to chapter *Annex [▶ 63]*.

CANopen access: 1000h

Name	Object	Subindex	Description
Device Type	1000h	–	▪ `00010196h`: Singleturn encoder ▪ `00020196h`: Multiturn encoder

5.1.12.4 Identity object

Function *Identify Object* is for readout of product information. This includes

- *Vendor ID*
- Product code
- Revision number
- Serial number

For more detailed information on the following please refer to chapter *Annex [▶ 63]*.

CANopen access: 1018h

Name	Object	Subindex	Description
Identity object	1018h		
Highest subindex supported		00h	
Vendor ID		01h	Vendor ID
Product code		02h	▪ `80h`: EAM580RS_MT Multiturn Encoder ▪ `81h`: EAM580RS_ST Singleturn Encoder
Revision number		03h	Product revision No.
Serial number		04h	Serial No.

5.1.12.5 Module identification

This function reads out the manufacturer-specific offset.

For more detailed information on the following please refer to chapter *Annex [▶ 63]*.

CANopen access: 650Ah

Name	Object	Subindex	Description
Module identification	650Ah		
Highest subindex supported		00h	
Manufacturer offset		01h	

5.1.12.6 Profile & software version

This function reads out software version and profile as a hex value.

For more detailed information on the following please refer to chapter *Annex [▶ 63]*.

CANopen access: 6507h

Name	Object	Subindex	Description
Profile & software version	6507h	–	Contains the implemented encoder device profile version and the manufacturer specific software version.

5.1.12.7 Serial number

Function *serial number* reads out the sensor's serial.

For more detailed information on the following please refer to chapter *Annex [▶ 63]*.

CANopen access: 650Bh

Name	Object	Subindex	Description
Serial number	650Bh	–	Internally linked to object 1018h-4h

5.1.12.8 Software version

This function reads out the sensor's firmware version.

For more detailed information on the following please refer to chapter *Annex [▶ 63]*.

CANopen access: 100Ah

Name	Object	Subindex	Description
Software version	100Ah	–	Manufacturer software version

5.1.13 Diagnostic functions

5.1.13.1 Operating Status

Function *Operating Status* reads out the current operating status of the sensor.

For more detailed information on the following please refer to chapter *Annex [▶ 63]*.

CANopen access: 6500h

Name	Object	Subindex	Description
Operating Status	6500h	–	Bit 0: ▪ 0: Position CW ▪ 1: Position CCW Bit 2: ▪ 0: Scaling function disabled ▪ 1: Scaling function enabled

5.1.13.2 Operation Time

Function *Operation Time* reads out the operating time of the sensor.

For more detailed information on the following please refer to chapter *Annex [▶ 63]*.

CANopen access: 2A00h

Name	Object	Subindex	Description
Operation Time	2A00h	–	–
Highest subindex supported		00h	–
Current		01h	Currrent operation time since boot up [s].
Total		02h	Total operation time [s].

CANopen access: 6508h

Name	Object	Subindex	Description
Operating Time	6508h	–	Operating time in 0.1 hours

5.1.13.3 Operation Cycle Counter

Function *Operation Cycle Counter* reads out the number of operating cycles.

For more detailed information on the following please refer to chapter *Annex [▶ 63]*.

CANopen access: 2A01h

Name	Object	Subindex	Description
Operation Cycle Counter	2A01h	–	Number of operating cycles. Incremented at Power On.

5.1.13.4 External Supply Voltage

Function *External power supply* reads out information on external power supply.

For more detailed information on the following please refer to chapter *Annex [▶ 63]*.

CANopen access: 2A20h

Name	Object	Subindex	Description
External Supply Voltage	2A20h	–	
Highest subindex supported		00h	
Current		01h	Current external supply voltage [mV]
Min		02h	Min. external supply voltage [mV]
Max		03h	Max. external supply voltage [mV]

5.1.13.5 Battery Voltage

Function *battery voltage* reads out the sensor inforamation on the battery voltage.

For more detailed information on the following please refer to chapter *Annex [▶ 63]*.

CANopen access: 2A80h

Name	Object	Subindex	Description
Battery Voltage	2A80h		
Highest subindex supported		00h	
Current		01h	Current battery voltage [mV]

5.1.13.6 Temperature

This function reads the sensor's temperature information.

For more detailed information on the following please refer to chapter *Annex [▶ 63]*.

CANopen access: 2A40h

Name	Object	Subindex	Description
Temperature	2A40h		
Highest subindex supported		00h	
Current		01h	Current Temperature [°C]
Min		02h	Min. Temperature [°C]
Max		03h	Max. Temperature [°C]

5.1.13.7 CW / CCW Information

This function reads out the number of swept revolutions swept per direction of rotation.

For more detailed information on the following please refer to chapter *Annex [▶ 63]*.

CANopen access: 2A81h

Name	Object	Subindex	Description
CW / CCW Information	2A81h	–	
Highest subindex supported		00h	
CW Counter		01h	Total number of revolutions clockwise
CCW Counter		02h	Total number of counter-clockwise revolutions

5.2 CANopen safety

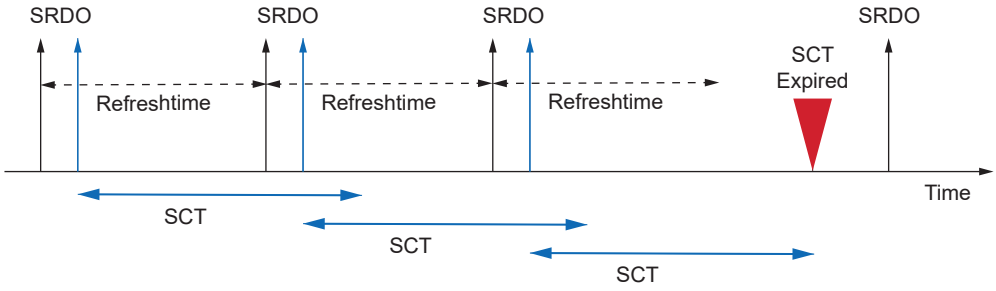
5.2.1 SRDO communication

Further to conventional CANopen services for data transmission (e.g. SDO and PDO), safety extended by service SRDO defines a special data transmission service (Safety Related Data Object).

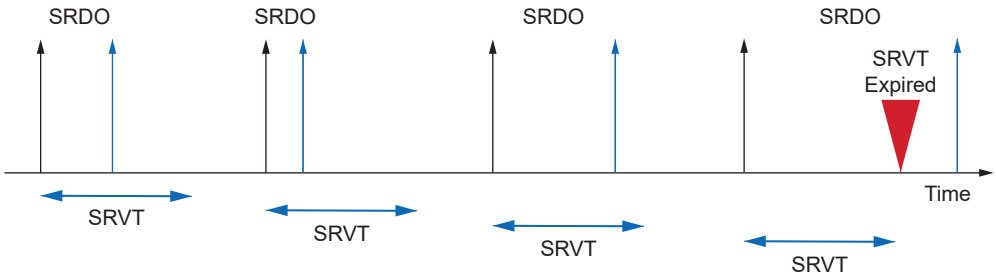
Configuration and type of communication is similar to PDO. However, SRDO communication provides the following additional features:

- cyclical data transmission with timeout monitoring
- double transmission of user data, once inverted bit by bit
- data consistency checks
- Checks of the time interval between inverted and non-inverted data
- CRC protected configuration

Diagram CANopen Safety Timing



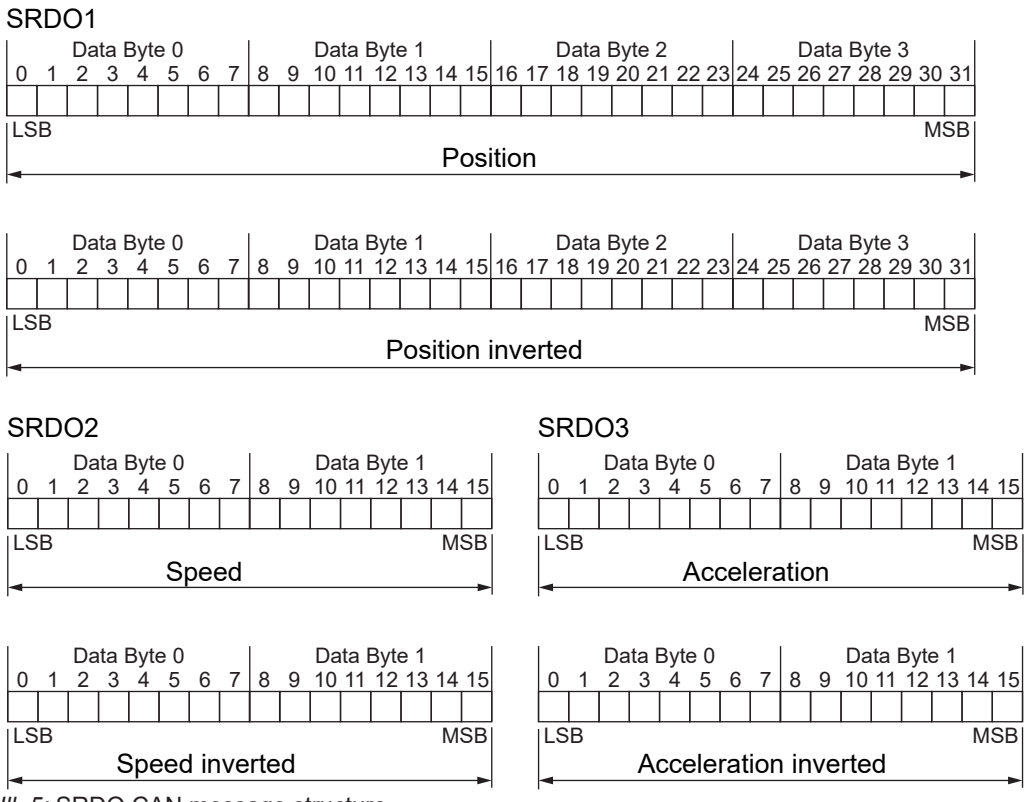
SCT (Safety Cycle Time)	Time interval to be kept in cyclical SRDO transmission. Exceeding SCT will be recognized by the consumers and make them go to safe state.



SRVT (Safety-related Validation Time)	Describes the time allowed to elapse between 2 CAN messages of a SRDO.

COB IDs in the range from 100h to 180h are used to prevent transmissions within the CANopen network from interfering with other services and to ensure the priority of CAN IDs is higher than that of PDOs.

5.2.1.1 SRDO-CAN message structure



Ill. 5: SRDO CAN message structure

5.2.2 Safety functions

5.2.2.1 Configuriation of safe communication parameters

- 1301h - 1303h ... SRDO communication parameters
- 1381h - 1383h ... SRDO mapping parameters
- 13FEh ... Indicator for valid configuration
- 13FFh ... CRC safety configuration

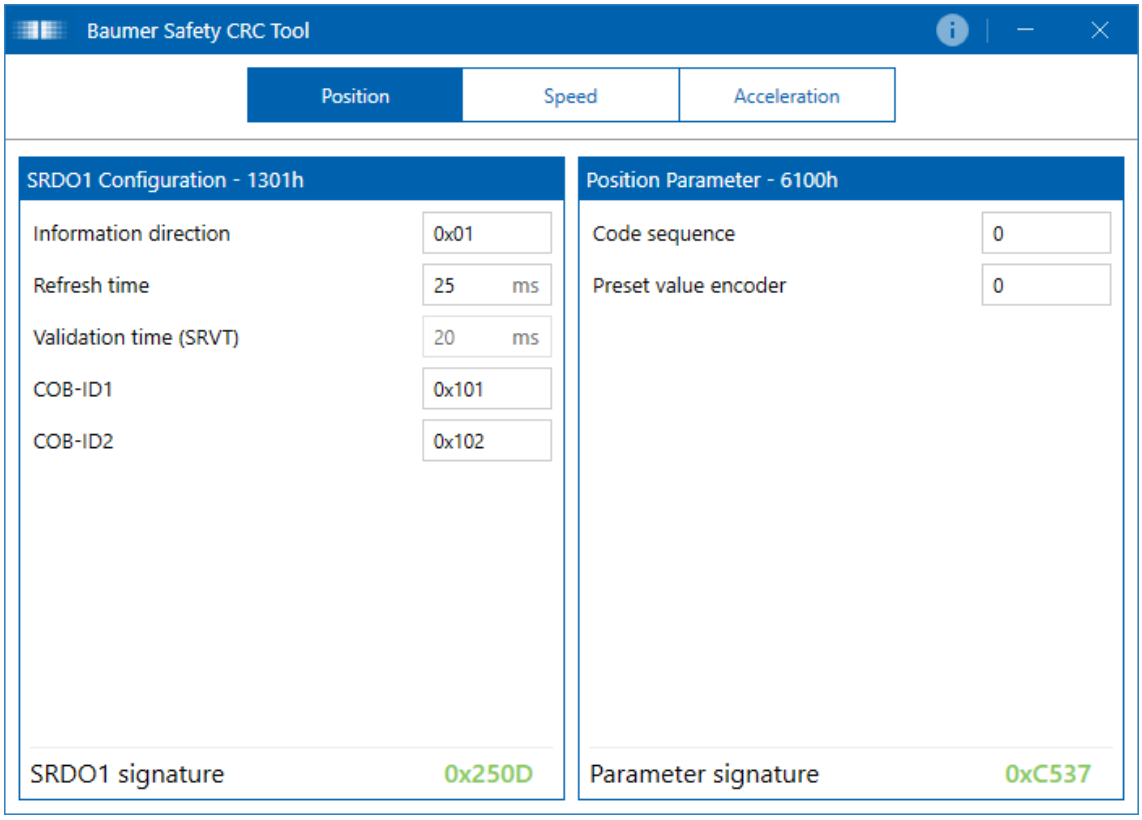
The CRC polynomial specified in the standard *EN50325-5* for calculating the security configuration signature (object 13FFh) must use the data in accordance with *EN50325-5*.

5.2.2.2 CRC generation

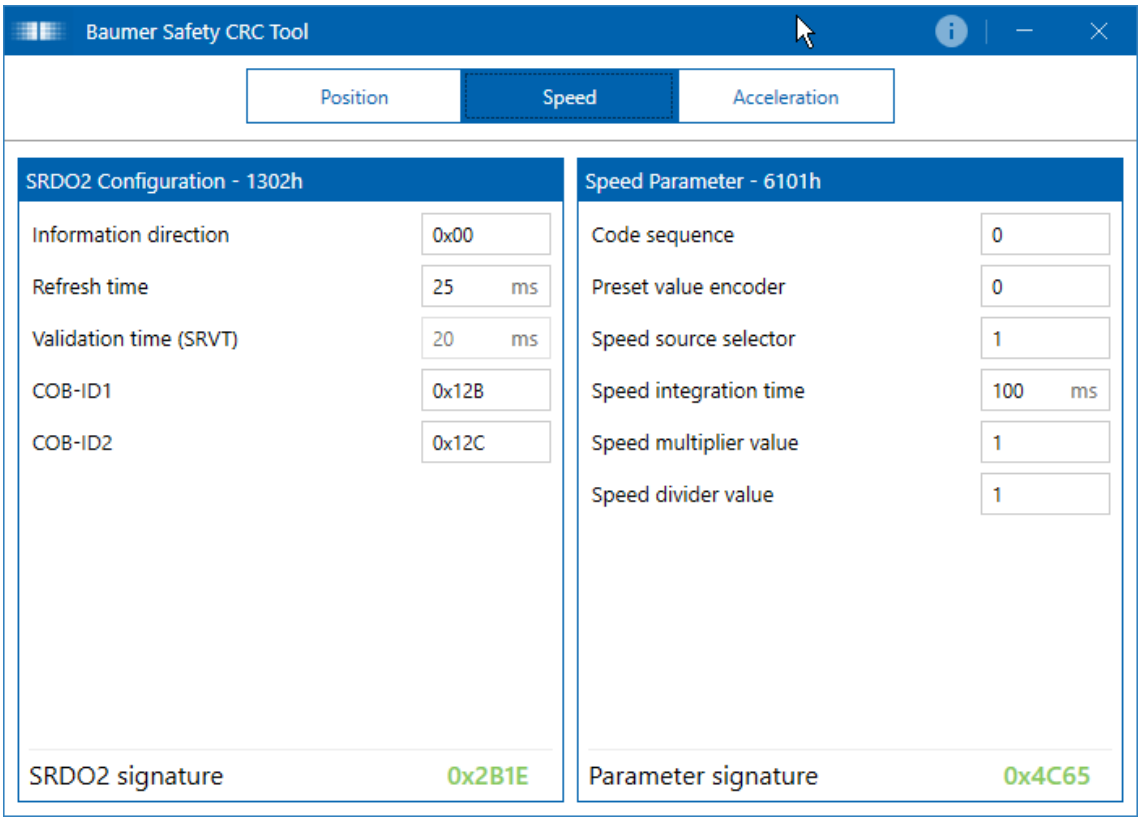
Baumer Safety CRC Tool calculates the CRC checksums (*Cyclic Redundancy Check*) for safe communication and application parameters.

The calculated checksums must be embedded in the corresponding objects (13FFh, 31FFh).

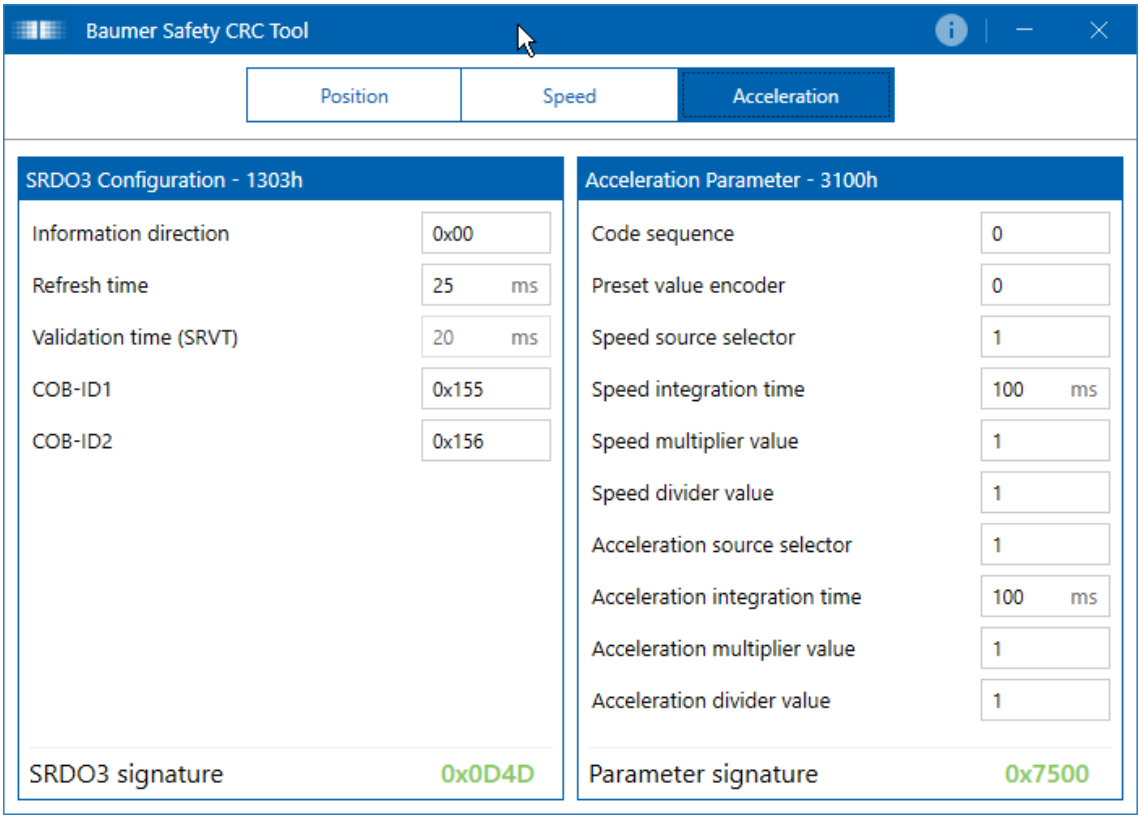
In the following are the CRCs for the factory settings:



Ill. 6: Factory settings - SRDO1



Ill. 7: Factory settings - SRDO2



Ill. 8: Factory settings - SRDO3

5.2.2.3 Configuration valid

Using this function it has to be confirmed that safety configuration has been completed and is valid (value A5h).

For more detailed information on the following please refer to chapter *Annex [▶ 63]*.

CANopen access: 13FEh

Name	Object	Subindex	Description
Configuration valid	13FEh	–	Must be actuated with the value A5h.

5.2.2.4 Safety position configuration parameters

This function is for reading/writing the *Safety position configuration parameters*.

For more detailed information on the following please refer to chapter *Annex [▶ 63]*.

CANopen access: 6100h

Name	Object	Subindex	Description
Safety position configuration parameters	6100h	–	–
Highest subindex supported		00h	–
Code Sequence		01h	Code Sequence
Preset		02h	Preset for safety position

5.2.2.5 Safety speed configuration parameters

This function is for reading/writing the *Safety speed configuration parameters*.

For more detailed information on the following please refer to chapter *Annex [▶ 63]*.

CANopen access: 6101h

Name	Object	Subindex	Description
Safety speed configuration parameters	6101h	–	–
Highest subindex supported		00h	–
Code Sequence		01h	–
Preset		02h	–
Safety speed source selector		04h	–
Safety speed integration time		05h	–
Safety speed multiplier value		06h	–
Safety speed divider value		07h	–

5.2.2.6 Safety position value / Safety inverted position value

In both following objects, the safe positions *standard* and *inverted* is stored as an array. The safe position comprises 14 bits singleturn and 18 bits multiturn.

For more detailed information on the following please refer to chapter *Annex [▶ 63]*.

CANopen access: 6120h

In this object, the safe position *standard* is saved as an array.

Name	Object	Subindex	Description
Safety position value	6120h	–	
Highest subindex supported		00h	
Safety position 1st Byte		01h	
Safety position 2nd Byte		02h	
Safety position 3rd Byte		03h	
Safety position 4th Byte		04h	

CANopen access: 6121h

In this object, the safe position *inverted* is saved as an array.

Name	Object	Subindex	Description
Safety inverted position value	6121h	–	
Highest subindex supported		00h	
Safety position 1st Byte		01h	
Safety position 2nd Byte		02h	
Safety position 3rd Byte		03h	
Safety position 4th Byte		04h	

5.2.2.7 Safety speed value / Safety speed inverted value

In the two following objects, safe speeds *normal* and *inverted* are saved as an array.

For more detailed information on the following please refer to chapter *Annex [▶ 63]*.

CANopen access: 6124h

In this object, safe speed *normal* is saved as an array.

Name	Object	Subindex	Description
Safety speed value	6124h	–	
Highest subindex supported		00h	
Safety speed 1st Byte		01h	
Safety speed 2nd Byte		02h	

CANopen access: 6125h

In this object, the safe speed *inverted* is saved as an array.

Name	Object	Subindex	Description
Safety speed inverted value	6125h	–	
Highest subindex supported		00h	
Safety speed 1st Byte		01h	
Safety speed 2nd Byte		02h	

5.2.2.8 Safety application configuration valid

This function is used for setting the *Safety application configuration valid*.

For more detailed information on the following please refer to chapter *Annex [▶ 63]*.

CANopen access: 61FEh

Name	Object	Subindex	Description
Safety application configuration valid	61FEh	–	is to be set valid (value A5h), after the Safety application configuration is completed

5.2.2.9 Safety acceleration parameter

This function is for reading/writing the *Safety acceleration parameter*.

For more detailed information on the following please refer to chapter *Annex [▶ 63]*.

CANopen access: 3100h

Name	Object	Subindex	Description
Safety acceleration parameter	3100h	–	–
Highest subindex supported		0	–
Code Sequence		01h	–
Preset		02h	–
Safety speed source selector		04h	–
Safety speed integration time		05h	–
Safety speed multiplier value		06h	–
Safety speed divider value		07h	–
Safety acceleration source selector		08h	–
Safety acceleration integration time		09h	–
Safety acceleration multiplier value		0Ah	–
Safety acceleration divider value		0Bh	–

5.2.2.10 Safety acceleration configuration signature

This function is used to write the Safety acceleration signature (CRC).

CANopen access: 31FFh

Name	Object	Subindex	Description
Safety acceleration configuration signature	31FFh	–	CRC value covering objects 3100h-xx

5.2.2.11 Safety configuration signature

This function is used to write the Safety configuration signature (CRC).

For more detailed information on the following please refer to chapter *Annex [▶ 63]*.

CANopen access: 13FFh

Name	Object	Subindex	Description
Safety configuration signature	13FFh	–	
Highest subindex supported		00h	
SRDO1 signature (CRC)		01h	CRC covers objects 1301h-xx
SRDO2 signature (CRC)		02h	CRC covers objects 1302h-xx
SRDO3 signature (CRC)		03h	CRC covers objects 1303h-xx

5.2.2.12 Safety acceleration value

In both following objects, the safe acceleration "normal" and "inverted" are saved as an array.

For more detailed information on the following please refer to chapter *Annex [▶ 63]*.

CANopen access: 3000h

Name	Object	Subindex	Description
Safety acceleration value	3000h	–	In this object the safe acceleration is stored "normal" as an array.
Highest subindex supported		00h	
Safety acceleration 1st byte		01h	
Safety acceleration 2nd byte		02h	

CANopen access: 3001h

Name	Object	Subindex	Description
Safety acceleration inverted value	3001h	–	In this object the safe acceleration is stored "inverted" as an array.
Highest subindex supported		00h	
Safety acceleration 1st byte		01h	
Safety acceleration 2nd byte		02h	

5.2.2.13 SRDOx

5.2.2.13.1 SRDO1 Communication parameters

This function is for read/write the SRDO1 communication parameters.

CANopen access: 1301h

Name	Object	Subindex	Description
SRDO1 communication param.	1301h	–	–
Highest subindex supported		00h	–
Information direction		01h	▪ 00h: not valid ▪ 01h: valid, Tx, SRDO producer
Refresh-time SCT		02h	Safety Cycle Time
Validation Time SRVT		03h	Safety-related Validation Time
Transmission type		04h	–
COB-ID 1		05h	COB-ID for not inverted SRDO frame
COB-ID 2		06h	COB-ID for inverted SRDO frame

5.2.2.13.2 SRDO1 mapping parameters

This function reads the SRDO1 mapping parameters.

For more detailed information on the following please refer to chapter *Annex [▶ 63]*.

CANopen access: 1381h

Name	Object	Subindex	Description
SRDO1 mapping parameter	1381h	–	–
Highest subindex supported		00h	–
SR app. data object 1		01h	Safety position 1st byte (LSB)
SR app. data object 1 inverted		02h	Safety position inverted 1st byte (LSB)
SR app. data object 2		03h	Safety position 2nd byte
SR app. data object 2 inverted		04h	Safety position inverted 2nd byte
SR app. data object 3		05h	Safety position 3rd byte
SR app. data object 3 inverted		06h	Safety position inverted 3rd byte
SR app. data object 4		07h	Safety position 4th byte (MSB)
SR app. data object 4 inverted		08h	Safety position inverted 4th byte (MSB)

5.2.2.13.3 SRDO2 Communication parameters

This function is for read/write the SRDO2 communication parameters.

For more detailed information on the following please refer to chapter *Annex [▶ 63]*.

CANopen access: 1302h

Name	Object	Subindex	Description
SRDO2 communication param.	1302h	–	–
Highest subindex supported		00h	–
Information direction		01h	▪ 00h: not valid ▪ 01h: valid, Tx, SRDO producer
Refresh-time SCT		02h	Safety Cycle Time
Validation Time SRVT		03h	Safety-related Validation Time
Transmission type		04h	–
COB-ID 1		05h	COB-ID for not inverted SRDO frame
COB-ID 2		06h	COB-ID for inverted SRDO frame

5.2.2.13.4 SRDO2 mapping parameters

This function reads the SRDO2 mapping parameters.

For more detailed information on the following please refer to chapter *Annex [▶ 63]*.

CANopen access: 1382h

Name	Object	Subindex	Description
SRDO2 mapping parameter	1382h	–	–
Highest subindex supported		00h	–
SR app. data object 1		01h	Safety speed 1st byte (LSB)
SR app. data object 1 inverted		02h	Safety speed inverted 1st byte (LSB)
SR app. data object 2		03h	Safety speed 2nd byte (MSB)
SR app. data object 2 inverted		04h	Safety speed inverted 2nd byte(MSB)

5.2.2.13.5 SRDO3 Communication parameters

This function is for read/write the SRDO3 communication parameters.

For more detailed information on the following please refer to chapter *Annex [▶ 63]*.

CANopen access: 1303h

Name	Object	Subindex	Description
SRDO3 communication param.	1303h	–	–
Highest subindex supported		00h	–
Information direction		01h	▪ 00h: not valid ▪ 01h: valid, Tx, SRDO producer
Refresh-time SCT		02h	Safety Cycle Time
Validation Time SRVT		03h	Safety-related Validation Time
Transmission type		04h	–
COB-ID 1		05h	COB-ID for not inverted SRDO frame
COB-ID 2		06h	COB-ID for inverted SRDO frame

5.2.2.13.6 SRDO3 mapping parameters

This function reads the SRDO3 mapping parameters.

For more detailed information on the following please refer to chapter *Annex [▶ 63]*.

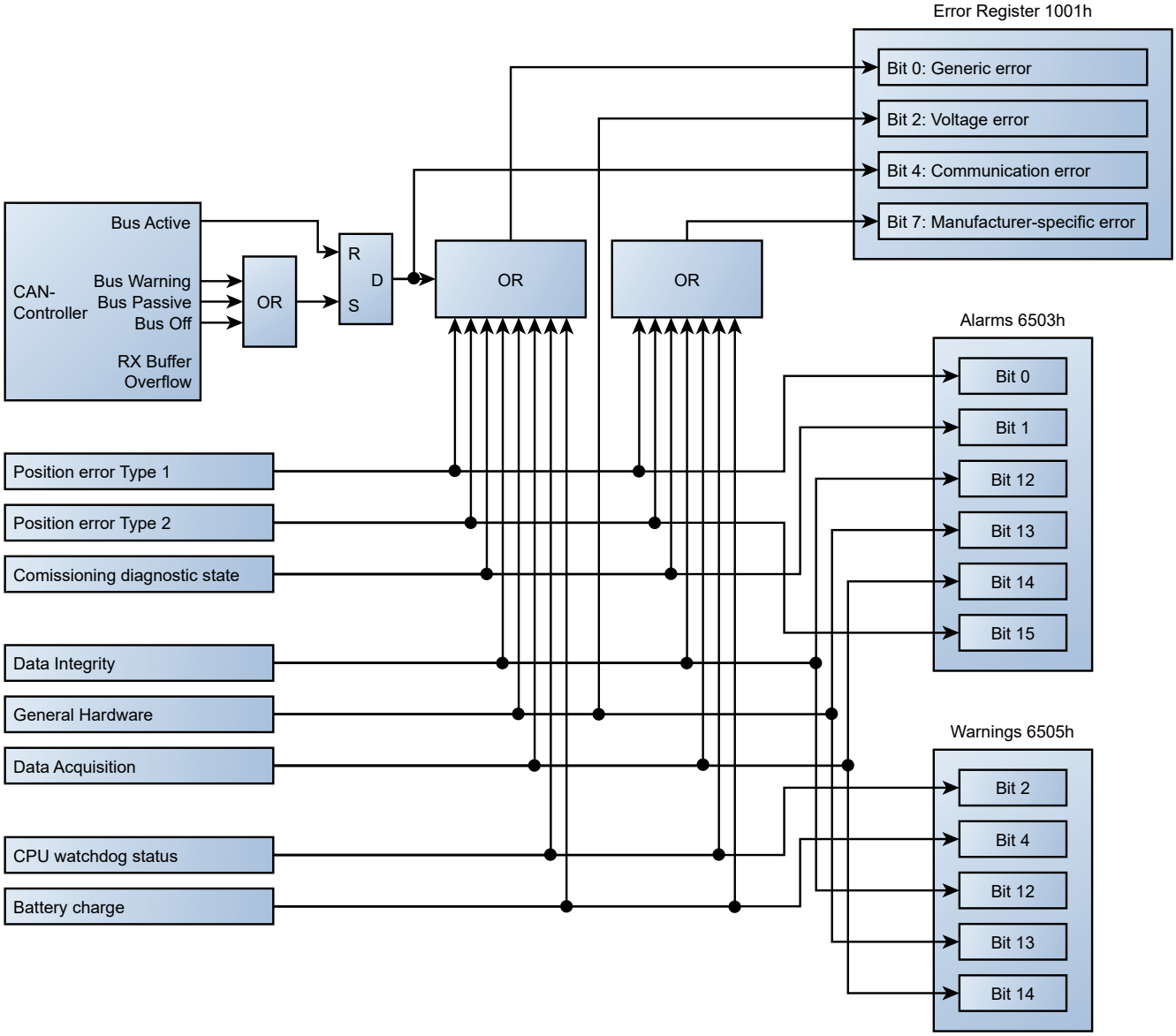
CANopen access: 1383h

Name	Object	Subindex	Description
SRDO3 mapping parameter	1383h	–	–
Highest subindex supported		00h	–
SR app. data object 1		01h	Safety acceleration 1st byte (LSB)
SR app. data object 1 inverted		02h	Safety acceleration inverted 1st byte (LSB)
SR app. data object 2		03h	Safety acceleration 2nd byte (MSB)
SR app. data object 2 inverted		04h	Safety acceleration inverted 2nd byte (MSB)

5.3 Emergency Service

In the event of error, the device transmits an emergency message while setting the corresponding bits in the error register (object 1001h).

Errr code access is via object 1003h-x. The error register saves a history of max. 8 error codes.



Ill. 9: Error register diagram

5.3.1 COB-ID

The COB ID for the Emergency Message can be changed (via object 1014h).

Default value: 80h + Node-ID

Changes are immediately adopted.

NOTICE

Manual editing and saving the COB ID will not change the COB-ID in susequent changes of the Node-ID.

5.3.2 Emergency COB-ID

This function can be used to read/write the sensor's *Emergency COB-ID*.

For more detailed information on the following please refer to chapter *Annex [▶ 63]*.

CANopen access: 1014h

Name	Object	Subindex	Description
Emergency COB-ID	1014h	–	COB-ID of the emergency object

5.3.3 Error Register

Function *Error register* reads out the sensor's error register.

For more detailed information on the following please refer to chapter *Annex [▶ 63]*.

CANopen access: 1001h

Name	Object	Subindex	Description
Error Register	1001h	–	▪ `Bit0`: Generic error ▪ `Bit2`: Voltage error ▪ `Bit4`: Communication error ▪ `Bit7`: Manufacturer-specific error

5.3.4 Error behaviour

Function *error behavior* defines the sensor behavior of in the event of error.

For more detailed information on the following please refer to chapter *Annex [▶ 63]*.

CANopen access: 1029h

Name	Object	Subindex	Description
Error behaviour	1029h	–	
Highest subindex supported		00h	
Communication error		01h	▪ `0h`: Change to pre-operational mode ▪ `1h`: No state change ▪ `2h`: Change to stopped mode
Generic error		02h	
Voltage error		03h	

5.3.5 Error Injection

Function *error simulation* will simulate errors for sensor testing.

For more detailed information on the following please refer to chapter *Annex [▶ 63]*.

CANopen access: 2116h

Name	Object	Subindex	Description
Error Injection	2116h	–	Simulation of encoder errors for test purposes
Highest subindex supported		00h	
Warning		01h	▪ `1`: Emergency Warning is simulated
Alarm		02h	▪ `1`: Emergency Alarm is simulated

5.3.6 Alarms

Function *Alarms* outputs the alarms currently present at the sensor.

For more detailed information on the following please refer to chapter *Annex [▶ 63]*.

CANopen access: 6503h

Name	Object	Subindex	Description
Alarms	6503h	–	Object 6503h provides alarm information according the following table.

The following alarms are supported:

Bit	Description	Value=0	Value=1
0	Position error type 1	Not occurred	Occurred
1	Commissioning diagnostic state	OK	Error
2 ... 11	Reserved	–	–
12	Data Integrity	OK	Not OK
13	General Hardware	OK	Not OK
14	Data Acquisition	OK	Not OK
15	Position error type 2	Not occurred	Occurred

5.3.7 Supported alarms

This function outputs the currently sensor-supported alarms.

For more detailed information on the following please refer to chapter *Annex [▶ 63]*.

CANopen access: 6504h

Name	Object	Subindex	Description
Supported alarms	6504h	–	Contains the information on supported alarms by the encoder.

5.3.8 Warnings

Function *Warnings* function outputs the warnings currently present at the sensor.

For more detailed information on the following please refer to chapter *Annex [▶ 63]*.

CANopen access: 6505h

Name	Object	Subindex	Description
Warnings	6505h	–	Object 6505h provides warning information according the following table

Bit	Description	Value=0	Value=1
0	Reserved	–	–
1	Reserved	–	–
2	CPU watchdog status	OK	Reset generated
3	Reserved	–	–
4	Battery charge	OK	Too low
5	Reserved	–	–
6	Reserved	–	–
7	Reserved	–	–
8	Reserved	–	–
9 ... 11	Reserved	–	–
12	Data Integrity	OK	Not OK
13	General Hardware	OK	Not OK

Bit	Description	Value=0	Value=1
14	Data Acquisition	OK	Not OK
15	Reserved	–	–

5.3.9 Supported warnings

This function outputs the warnings currently supported by the sensor.

For more detailed information on the following please refer to chapter *Annex [▶ 63]*.

CANopen access: 6506h

Name	Object	Subindex	Description
Supported warnings	6506h	–	Contains the information on supported warnings by the encoder.

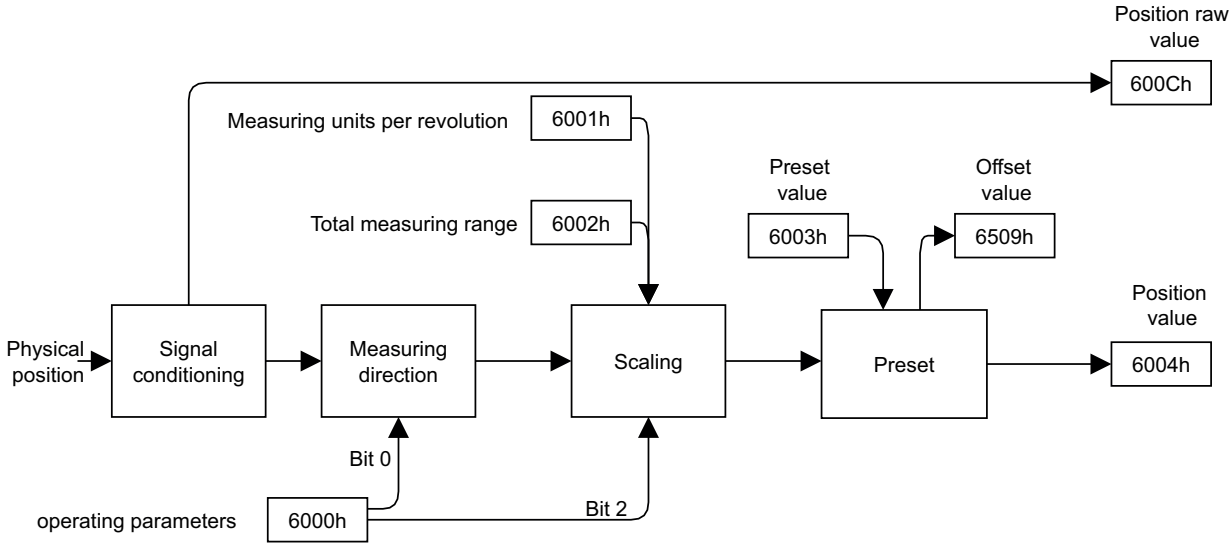
6 Operating functions

6.1 Position encoder value

This function reads out the encoder position.

The position is transmitted as part of the cyclic communication (process data). In addition, the position information is available via acyclic communication.

For more detailed information on the following please refer to chapter *Annex [▶ 63]*.



The position range depends on the settings in objects 6001h and 6002h.

CANopen access: 6004h

Name	Object	Subindex	Description
Position encoder value	6004h	–	Position in steps, scaled value

CANopen access: 600Ch

Name	Object	Subindex	Description
Position encoder raw value	600Ch	–	Position in steps, raw value

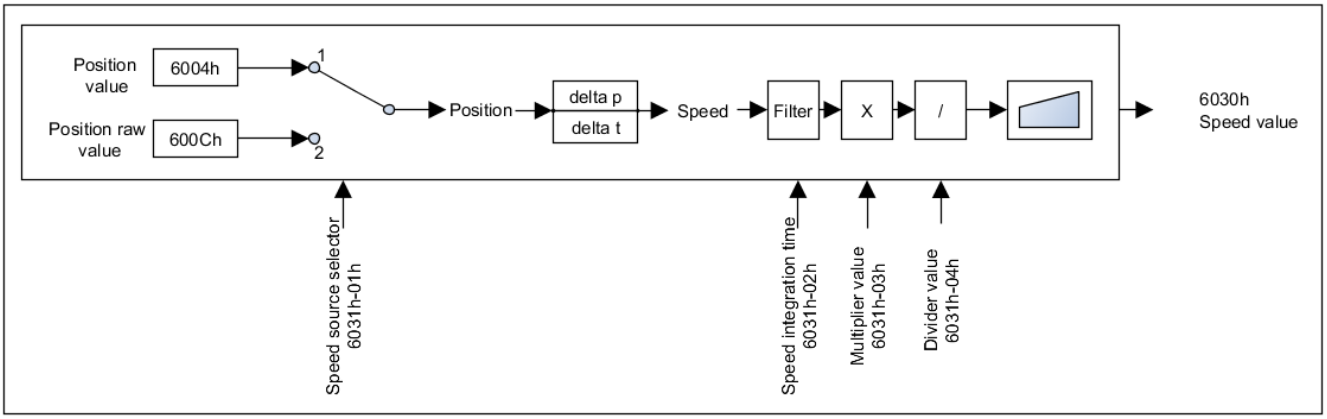
6.2 Speed Value

Function *Speed* provides 16-bit speed information together with the speed unit [steps/sec].

For more detailed information on the following please refer to chapter *Annex [▶ 63]*.

CANopen access: 6030h

Name	Object	Subindex	Description
Speed Value	6030h		
Highest sub-index supported		00h	
Speed Value		01h	Speed value in steps/second



INFO

During *Speed integration time (6031h-02)*, the value determined with *Speed Value (6030h)* is not valid.

6.3 Speed parameter

Function *speed parameter* is for editing various parameters for speed determination.

CANopen access: 6031h

Name	Object	Subindex	Description
Speed parameter	6031h		
Highest sub-index supported		00h	
Speed source selector		01h	▪ 1: 6004h Position value ▪ 2: 600Ch Position raw value
Speed integration time		02h	in ms
Multiplier value		03h	Output value multiplier
Divider value		04h	Output value divider

6.4 Acceleration Value

This function provides 16-bit acceleration information in unit [steps/sec²].

As the acceleration value is highly dynamic, the user should adapt scaling and filter to his application. As the output value is a 16-bit value, the user must pay attention to the limit values.

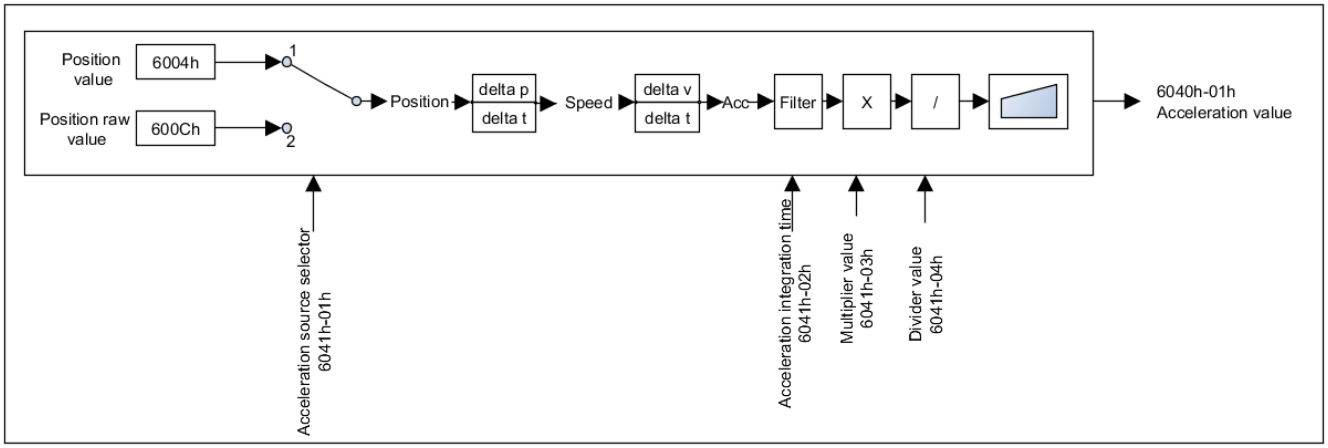
Unit of acceleration value

The acceleration value derives from the position value. In the following is a calculation example where acceleration is calculated by position. In the example, there is a change in speed to 6000rpm within one second.
6000 = rpm/s (revolutions per second)
100 = r/s² (revolutions per second²)
$100*2^{14}$= steps/s² (steps per second²)

For more detailed information on the following please refer to chapter *Annex [▶ 63]*.

CANopen access: 6040h

Name	Object	Subindex	Description
Acceleration Value	6040h		
Highest subindex supported		00h	
Acceleration value		01h	Acceleration value [steps/s²]



INFO

During *Acceleration integration time (6041h-02)*, the value determined with *Acceleration Value (6040h)* is not valid.

6.5 Acceleration parameter

This function is for editing the parameters for determining acceleration.

For more detailed information on the following please refer to chapter *Annex [▶ 63]*.

CANopen access: 6041h

Name	Object	Subindex	Description
Acceleration parameter	6041h		
Highest sub-index supported		00h	
Acceleration source selector		01h	▪ 1: 6004h Position value ▪ 2: 600Ch Position raw value
Acceleration integration time		02h	
Multiplier value		03h	Output value multiplier
Divider value		04h	Output value divider

6.6 Gear Factor

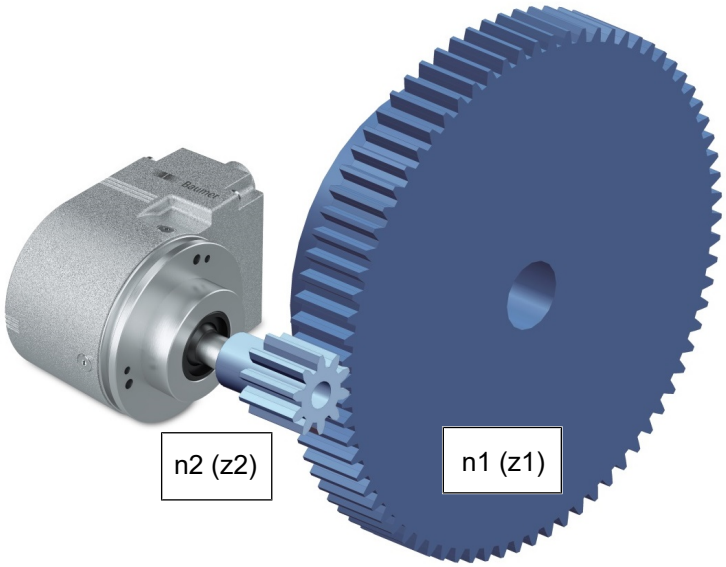
This function is used to configure the electronic gear function.

NOTICE

This function is also known as *Zähler/Nenner-Skalierung* or *Rundachsenfunktion*.

Enabled gear factor () means the encoder mounted to the primary side (gearbox input) will output position data as if mounted to the secondary side (gearbox output).

Parameter *total measuring range* always defines the number of steps required for one revolution at the gearbox output (secondary side).



Primary side (drive side)
Denominator

Secondary side (driven side)
Nominator

$$\text{Gear factor } i = \frac{\text{Numerator}}{\text{Denominator}} = \frac{\text{Speed at drive side (n2)}}{\text{Speed at driven side (n1)}} = \frac{\text{Number of teeth at driven side (z1)}}{\text{Number of teeth at drive side (z2)}}$$

The values for gear factor numerator and denominator result directly from the number of teeth. In the above example, the number of teeth at the secondary side is 75 and 10 on the primary side.

Parameter *Measuring units per revolution* is not set in the gear factor function, but results from the total measuring range, numerator and denominator.

$$\text{Measuring units per revolution} = \text{total measuring range} * \frac{\text{denominator}}{\text{numerator}}$$

Example

Transmission factor to be 75:10 (i.e. 7.5). Required resolution on the secondary side of the gearbox to be "1 revolution = 10000 steps".

Numerator 75, denominator 10. Both numerator and denominator must be integer values. Total measuring range is 10000.

Encoder completes 7.5 revolutions within one revolution on the gearbox secondary side. The encoder value resulting from *Measuring units per revolution* is 10000 / 7.5 = 1333.3333.

For more detailed information on the following please refer to chapter *Annex [▶ 63]*.

CANopen Access: 2001h

Name	Object	Subindex	Description
Gear Factor Configuration	2001h	–	Configuration of electronic gear function
Highest subindex supported		00h	
Mode Control		01h	▪ 0: electronic gear function disabled ▪ 1: electronic gear function enabled
Numerator		02h	Numerator of the gear factor
Denominator		03h	Denominator of the gear factor

The formula below equals valid combinations of numerator, denominator and total measuring range.

$$\text{Measuring units per revolution} = \text{total measuring range} * \frac{\text{denominator}}{\text{numerator}} = 2\text{^}32 * 1/16384 = 262144$$

Measuring units per revolution = 2^32 * 1/16384 = 262144

Parameter *Measuring units per revolution* must not exceed the maximum permitted encoder limits.

NOTICE

Parameter *Measuring units per revolution* is calculated by the encoder itself and does not need to be configured.

In this mode, please only configure the following parameters:

- Total measuring range 6002h
- Gear factor counter 2001h-02h
- Denominator of the transmission factor 2001h-03h

Gear factor: numerator 2001h-02h

This parameter is only considered with enabled gear factor functionality.

When using gear reduction (n2 < n1), the gear factor numerator is bigger than the denominator.

NOTICE

Term *numerator* is used as a synonym for *counter*.

Gear factor: denominator 2001h-03h

This parameter is only considered with enabled gear factor functionality.

When using transmission (n2 > n1), the denominator is bigger than the numerator.

NOTICE

Term *denominator* is used as a synonym for *denominator*.

The formula below equals valid combinations of numerator, denominator and total measuring range.

$$\text{Measuring units per revolution} = \text{total measuring range} * \frac{\text{denominator}}{\text{numerator}} = 2\text{^}32 * 1/16384 = 262144$$

Parameter *Measuring units per revolution* must not exceed the maximum permitted encoder limits.

Gear factor - Counter

This parameter is only considered with enabled gear factor functionality.

When using gear reduction (n2 < n1), the gear factor numerator is bigger than the denominator.

Gear factor - denominator

This parameter is only considered with enabled gear factor functionality.

When using transmission (n2 > n1), the denominator is bigger than the numerator.

6.7 Number of distinguishable revolutions

This function outputs the maximum number of revolutions.

For more detailed information on the following please refer to chapter *Annex [▶ 63]*.

CANopen access: 6502h

Name	Object	Subindex	Description
Number of distinguishable revolutions	6502h	–	max. multiturn revolutions

6.8 Used single turn resolution

This function outputs the current resolution for one revolution [steps/revolution].

For more detailed information on the following please refer to chapter *Annex [▶ 63]*.

CANopen access: 6501h

Name	Object	Subindex	Description
Used single turn resolution [step/rev]	6501h	–	max. Measuring units per revolution

6.9 Operating parameter

This function is used for editing the sensor's operating parameters.

For more detailed information on the following please refer to chapter *Annex [▶ 63]*.

CANopen access: 6000h

Name	Object	Subindex	Description
Operating parameter	6000h	–	Bit 0: ▪ `0`: Position CW ▪ `1`: Position CCW Bit 2: ▪ `0`: Scaling function disabled ▪ `1`: Scaling function enabled

6.10 is

This function will have an influence on the measuring range [Measuring range in steps].

For more detailed information on the following please refer to chapter *Annex [▶ 63]*.

CANopen access: 6002h

Name	Object	Subindex	Description
Total measuring range	6002h	–	Total measuring range in Steps. Exception: Value 0h means 1’0000’0000h Steps

6.11 Measuring units per revolution

This function sets the required resolution for a single revolution [steps/revolution].

For more detailed information on the following please refer to chapter *Annex [▶ 63]*.

CANopen access: 6001h

Name	Object	Subindex	Description
Measuring units per revolution [Step/rev]	6001h	–	Measuring units per revolution.

Limitations

According to the settings in Measuring units per revolution (6001h) and Total measuring range (6002h) as well as the maximum permitted number of encoder revolutions (2^{30} = 1'073'741'824) the encoder operates automatically in endless mode.

Endless mode is a prerequisite for operation:

$$2^{30}\frac{measuring\ units\ per\ revolution\ (6001h)}{total\ measuring\ range\ (6002h)} \neq 2^{x}$$

$$x \in \mathbb{N}\ (1, 2, 3, \ldots)$$

In endless operation, the maximum encoder revolution must be less than^{229} (536,870,912) revolutions while the encoder not live or the duty cycle is less than 5 minutes. Exceeding this number of revolutions requires encoder referencing at every power on (see Preset value, 6003h).

Example 1: Parameter settings for encoder operation without restrictions

Maximum possible revolutions:	1'073'741'824 (30 bit multiturn)
Measuring units per revolution:	3600
Total measuring range:	29'491'200
Calculation:	1'073'741'824 x 3600 / 29'491'200 = 131'072 = (2^{17})

Example 2: Parameter settings for automatic encoder operation in endless mode

Maximum possible revolutions:	1'073'741'824 (30 bit multiturn)
Measuring units per revolution:	3600
Total measuring range:	100'000
Calculation:	1'073'741'824 x 3600 / 100'000 = 38'654'705.664 ≠ (2^{x})

6.12 Offset encoder

This function reads out the sensor offset.

CANopen access: 6509h

Name	Object	Subindex	Description
Offset encoder	6509h	–	Internal offset calculated during the preset process.

6.13 Preset value encoder

This function has an influence on the preset value.

For more detailed information on the following please refer to chapter *Annex [▶ 63]*.

CANopen access: 6003h

Name	Object	Subindex	Description
Preset value encoder	6003h	–	Preset value in steps

7 Annex

7.1 CANopen object dictionary

The tables below show a summary of all SDO objects supported by the encoder.

Object	Object number in Hex
Subindex	
Name	Object name
Data type	U/I = Unsigned/Integer , No. = no of bits, ARR = Array, REC = Record, STR = String
Access rights	ro = read only, wo = write only, rw = read write, m = mappable
Default	Factory settings
Save	X = can be saved in EEPROM
Description	additional explanation

7.1.1 Communication profile

Object	Subindex	Name	Data type	Access rights	Default	Save	Description
1000h		Device type	U32	ro			▪ Singleturn: 30010196h ▪ Multiturn : 30020196h
1001h		Error Register	U8	ro	0h		▪ `Bit0`: Generic error ▪ `Bit2`: Voltage error ▪ `Bit4`: Communication error ▪ `Bit7`: Manufacturer-specific error
1003h		Predefined error field	Array				
	00h	Highest subindex supported	U8	rw	0h		Number of stored messages (0 - 8)
	01h	Last entry	U32	ro			Newest Error Code
	...	...	...	...			...
	08h	Oldest entry	U32	ro			Oldest Error Code
1005h		Sync COB-ID	U32	rw	80h	X	COB-ID of the sync object
1008h		Device name	STR	ro			▪ Singleturn: "EAM580RS_ST"

Object	Subindex	Name	Data type	Access rights	Default	Save	Description
							▪ Multiturn : "EAM580RS_MT"
100Ah		Software version	STR	ro			Software version in ASCII
100Ch		Guard time	U16	rw	0h	X	Guard time (actual guard time is Object 100Ch*100Dh [ms])
100D		Life time factor	U8	rw	0h	X	Life time factor
1010h		Store parameters	Array				
	00h	Highest subindex supported	U8	ro	4h		No. of save possibilities 5
	01h	Save all parameters	U32	rw	1h		=“evas“ (65766173h) to save
	02h	Communication parameters	U32	rw	1h		=“evas“ (65766173h) to save
	03h	Application parameters	U32	rw	1h		=“evas“ (65766173h) to save
	04h	Manuf. specific parameters	U32	rw	1h		=“evas“ (65766173h) to save
	05h	Manufacturer LSS group	U32	rw	1h		=“evas“ (65766173h) to save
1011h		Restore default parameters	Array				
	00h	Highest subindex supported	U8	ro	4h		No. of reset possibilities = 5
	01h	All parameters	U32	rw	1h		=“daol“ (64616F6Ch) to load
	02h	Communication parameters	U32	rw	1h		=“daol“ (64616F6Ch) to load
	03h	Application parameters	U32	rw	1h		=“daol“ (64616F6Ch) to load
	04h	Manuf. specific parameters	U32	rw	1h		=“daol“ (64616F6Ch) to load
	05h	Manufacturer LSS group	U32	rw	1h		=“daol“ (64616F6Ch) to load
1014h		Emergency COB-ID	U32	rw	80h + Node-ID	X	COB-ID of the emergency object
1017h		Producer heartbeat time	U16	rw	0h	X	Producer heartbeat time in ms (0 = disabled)
1018h		Identity object	REC	ro			
	00h	Highest subindex supported	U8	ro	4h		
	01h	Vendor ID	U32	ro	5Fh	–	Vendor ID
	02h	Product code	U32	ro			▪ `80h`: EAM580RS MT ▪ `81h`: EAM580RS ST
	03h	Revision number	U32	ro			Product revision No.

Object	Subindex	Name	Data type	Access rights	Default	Save	Description
	04h	Serial number	U32	ro			Serial No.

Object	Subindex	Name	Data type	Access rights	Default	Save	Description
1029h		Error behaviour	Array				
	00h	Highest subindex supported	U8	ro	3h		
	01h	Communication error	U8	rw	1h	X	▪ 0h: Change to pre-operational mode ▪ 1h: No state change ▪ 2h: Change to stopped mode
	02h	Generic error	U8	rw	1h	X	
	03h	Voltage error	U8	rw	1h	X	
1301h		SRDO1 communication param.	REC			X	
	00h	Highest subindex supported	U8	ro	6h	X	
	01h	Information direction	U8	rw	1h	X	▪ 00h: not valid ▪ 01h: valid, Tx, SRDO producer
	02h	Refresh-time SCT	U16	rw	25	X	Safety Cycle Time
	03h	Validation Time SRVT	U8	ro	20	X	Safety-related Validation Time
	04h	Transmission type	U8	ro	FEh	X	
	05h	COB-ID 1	U32	rw	101h	X	COB-ID for not inverted SRDO frame
	06h	COB-ID 2	U32	rw	102h	X	COB-ID for inverted SRDO frame
1302h		SRDO2 communication param.	REC			X	
	00h	Highest subindex supported	U8	ro	6h	X	
	01h	Information direction	U8	rw	00h	X	▪ 00h: not valid ▪ 01h: valid, Tx, SRDO producer
	02h	Refresh-time SCT	U16	rw	25	X	Safety Cycle Time
	03h	Validation Time SRVT	U8	ro	20	X	Safety-related Validation Time
	04h	Transmission type	U8	ro	FEh	X	
	05h	COB-ID 1	U32	rw	12Bh	X	COB-ID for not inverted SRDO frame
	06h	COB-ID 2	U32	rw	12Ch	X	COB-ID for inverted SRDO frame

Object	Subindex	Name	Data type	Access rights	Default	Save	Description
1303h		SRDO3 communication param.	REC			X	
	00h	Highest subindex supported	U8	ro	6h	X	
	01h	Information direction	U8	rw	00h	X	▪ `00h`: not valid ▪ `01h`: valid, Tx, SRDO producer
	02h	Refresh-time SCT	U16	rw	25	X	Safety Cycle Time
	03h	Validation Time SRVT	U8	ro	20	X	Safety-related Validation Time
	04h	Transmission type	U8	ro	FEh	X	
	05h	COB-ID 1	U32	rw	155h	X	COB-ID for not inverted SRDO frame
	06h	COB-ID 2	U32	rw	156h	X	COB-ID for inverted SRDO frame
1381h		SRDO1 mapping parameter	REC				
	00h	Highest subindex supported	U32	ro	8h		
	01h	SR app. data object 1	U32	ro	61200108h		Safety position 1st byte (LSB)
	02h	SR app. data object 1 inverted	U32	ro	61210108h		Safety position inverted 1st byte (LSB)
	03h	SR app. data object 2	U32	ro	61200208h		Safety position 2nd byte
	04h	SR app. data object 2 inverted	U32	ro	61210208h		Safety position inverted 2nd byte
	05h	SR app. data object 3	U32	ro	61200308h		Safety position 3rd byte
	06h	SR app. data object 3 inverted	U32	ro	61210308h		Safety position inverted 3rd byte
	07h	SR app. data object 4	U32	ro	61200408h		Safety position 4th byte (MSB)
	08h	SR app. data object 4 inverted	U32	ro	61210408h		Safety position inverted 4th byte (MSB)
1382h		SRDO2 mapping parameter	REC				
	00h	Highest subindex supported	U32	ro	4h		
	01h	SR app. data object 1	U32	ro	61244108h		Safety speed 1st byte (LSB)
	02h	SR app. data object 1 inverted	U32	ro	61250108h		Safety speed inverted 1st byte (LSB)
	03h	SR app. data object 2	U32	ro	61240208h		Safety speed 2nd byte (MSB)
	04h	SR app. data object 2 inverted	U32	ro	61250208h		Safety speed inverted 2nd byte (MSB)

Object	Subindex	Name	Data type	Access rights	Default	Save	Description
1383h		SRDO3 mapping parameter	REC				
	00h	Highest subindex supported	U32	ro	4h		
	01h	SR app. data object 1	U32	ro	30000108h		Safety acceleration 1st byte (LSB)
	02h	SR app. data object 1 inverted	U32	ro	30010108h		Safety acceleration inverted 1st byte (LSB)
	03h	SR app. data object 2	U32	ro	30000208h		Safety acceleration 2nd byte (MSB)
	04h	SR app. data object 2 inverted	U32	ro	30010208h		Safety acceleration inverted 2nd byte (MSB)
13FEh		Configuration valid	U8	rw	0h	X	Must be actuated with the value A5h.
13FFh		Safety configuration signature	Array				
	00h	Highest subindex supported	U8	ro	3h		
	01h	SRDO1 signature (CRC)	U16	rw	0h	X	CRC covers objects 1301h-xx
	02h	SRDO2 signature (CRC)	U16	rw	0h	X	CRC covers objects 1302h-xx
	03h	SRDO3 signature (CRC)	U16	rw	0h	X	CRC covers objects 1303h-xx
1800h		Transmit PDO1 parameter	REC			X	
	00h	Highest subindex supported	U8	ro	5h	X	
	01h	COB-ID	U32	rw	40000180h + Node-ID	X	COB-ID for TPDO 1
	02h	PDO type	U8	rw	FEh	X	Transmission type
	05h	Event timer	U16	rw	100	X	Cycle time [in ms]
1801h		Transmit PDO2 parameter	REC			X	
	00h	Highest subindex supported	U8	ro	5h	X	
	01h	COB-ID	U32	rw	40000280h + Node-ID	X	COB-ID for TPDO 2
	02h	PDO type	U8	rw	1h	X	Transmission type
	05h	Event timer	U16	rw	100	X	Cycle time [in ms]

Object	Subindex	Name	Data type	Access rights	Default	Save	Description
1A00h		Transmit PDO1 mapping	Array				
	00h	Highest subindex supported	U8	rw	1	X	Maximum value is 8
	01h	1st mapping parameter	U32	rw	6004’0020h	X	Position encoder
	02h	mapping parameter entry 2	U32	rw	0h	X	
	03h	mapping parameter entry 3	U32	rw	0h	X	
	04h	mapping parameter entry 4	U32	rw	0h	X	
	05h	mapping parameter entry 5	U32	rw	0h	X	
	06h	mapping parameter entry 6	U32	rw	0h	X	
	07h	mapping parameter entry 7	U32	rw	0h	X	
	08h	mapping parameter entry 8	U32	rw	0h	X	
1A01h		Transmit PDO2 mapping	Array				
	00h	Highest subindex supported	U8	rw	1	X	Maximum value is 8
	01h	1st mapping parameter	U32	rw	6004’0020h	X	Position encoder
	02h	mapping parameter entry 2	U32	rw	0h	X	
	03h	mapping parameter entry 3	U32	rw	0h	X	
	04h	mapping parameter entry 4	U32	rw	0h	X	
	05h	mapping parameter entry 5	U32	rw	0h	X	
	06h	mapping parameter entry 6	U32	rw	0h	X	
	07h	mapping parameter entry 7	U32	rw	0h	X	
	08h	mapping parameter entry 8	U32	rw	0h	X	

7.1.2 Manufacturer-specific objects

Object	Subindex	Name	Data type	Access rights	Default	Save	Description
2001h		Gear Factor Configuration	ARR				Configuration of gear function
	00h	Highest subindex supported	U8	ro	3	X	
	01h	Mode Control	U8	rw	1	X	▪ 0: electronic gear function disabled ▪ 1: electronic gear function enabled
	02h	Numerator	U32	rw	1	X	Numerator of the gear factor
	03h	Denominator	U32	rw	1	X	Denominator of the gear factor
2100h		Baud rate	U8	rw	5	X	▪ 0: 10 kBit/s (not supported) ▪ 1: 20 kBit/s (not supported) ▪ 2: 50 kBit/s ▪ 3: 100 kBit/s ▪ 4: 125 kBit/s ▪ 5: 250 kBit/s ▪ 6: 500 kBit/s ▪ 7: 800 kBit/s ▪ 8: 1000 kBit/s The baud rate is activated after a reset or power-on (if parameter is saved to non volatile memory).
2101h		Node-ID	U8	rw	1	X	Node-ID 1...127 possible The new Node-ID is activated after a reset or power-on (if parameter is saved to non volatile memory).
2116h		Error Injection	ARR				Simulation of encoder errors for test purposes
	00h	Highest subindex supported	U8	ro	2		
	01h	Warning	U32	rw	0		▪ 1: Emergency Warning is simulated
	02h	Alarm	U32	rw	0		▪ 1: Emergency Alarm is simulated

Object	Subindex	Name	Data type	Access rights	Default	Save	Description
2800h		Baumer Device Information	REC				
	00h	Highest subindex supported	U8	ro	6		
	01h	Serial Number	STR	ro	0		String version of 1018h-04h, resp. 650Bh
	02h	Article Number	U32	ro	0		SAP number of the encoder
	03h	Order Number	U32	ro	0		Baumer order number
	04h	Product key	STR	ro	0		EAM580RS_MT / EAM580RS_ST
	05h	Product name	STR	ro	0		e.g. EAM580RS-SCB.EJCS.14180.J
	06h	Manufacturer date	STR	ro	0		Date in format "DD.MM.YYYY hh:mm:ss"
2A00h		Operation Time	ARR				
	00h	Highest subindex supported	U8	ro	2		
	01h	Current	U32	ro,m	0		Currrent operation time since boot up [s].
	02h	Total	U32	ro,m	0		Total operation time [s].
2A01h		Operation Cycle Counter	U32	ro,m	0		
2A20h		External Supply Voltage	ARR				
	00h	Highest subindex supported	U8	ro	3		
	01h	Current	I32	ro,m	0		Current external supply voltage [mV]
	02h	Min	I32	ro,m	0		Min. external supply voltage [mV]
	03h	Max	I32	ro,m	0		Max. external supply voltage [mV]
2A40h		Temperature	ARR				
	00h	Highest subindex supported	U8	ro	3		
	01h	Current	I8	ro,m	0		Current Temperature [°C]
	02h	Min	I8	ro,m	0		Min. Temperature [°C]
	03h	Max	I8	ro,m	0		Max. Temperature [°C]
2A80h		Battery Voltage	ARR				
	00h	Highest subindex supported	U8	ro	1		
	01h	Current	I16	ro,m	0		Current battery voltage [mV]

Object	Subindex	Name	Data type	Access rights	Default	Save	Description
2A81h		CW / CCW Information	ARR				
	00h	Highest subindex supported	U8	ro	2		
	01h	CW Counter	U32	ro,m	0		
	02h	CCW Counter	U32	ro,m	0		
3000h		Safety acceleration value	ARR				
	00h	Highest subindex supported	U8	ro	2		
	01h	Safety acceleration 1st byte	I8	ro	0		
	02h	Safety acceleration 2nd byte	I8	ro	0		
3001h		Safety acceleration inverted value	ARR				
	00h	Highest subindex supported	U8	ro	2		
	01h	Safety acceleration 1st byte	I8	ro	0		
	02h	Safety acceleration 2nd byte	I8	ro	0		
3100h		Safety acceleration parameter	REC				
	00h	Highest subindex supported	U8	ro	11		
	01h	Code sequence	U16	rw	0	X	
	02h	Preset	U32	rw	0	X	
	04h	Safety speed source selector	U8	rw	1	X	
	05h	Safety speed integration time	U16	rw	100	X	
	06h	Safety speed multiplier value	U16	rw	1	X	
	07h	Safety speed divider value	U16	rw	1	X	
	08h	Safety acceleration source selector	U8	rw	1	X	
	09h	Safety acceleration integration time	U16	rw	100	X	
	0Ah	Safety acceleration multiplier value	U16	rw	1	X	
	0Bh	Safety acceleration divider value	U16	rw	1	X	

Object	Subindex	Name	Data type	Access rights	Default	Save	Description
31FFh		Safety acceleration configuration signature	U16	rw	0	X	CRC value covering objects 3100h-xx

7.1.3 Standardized device profile

Object	Subindex	Name	Data type	Access rights	Default	Save	Description
6000h		Operating parameter	U16	rw	4h	X	Configuration of encoder operating parameters Bit0: Code sequence ▪ 0: Rising values on CW Rotation ▪ 1: Rising values on CCW Rotation Bit2: Scaling function control ▪ 0: Scaling disabled ▪ 1: Scaling enabled If scaling is disabled the position value (6004h) will be calculated with the default values of the measuring units per revolution (6001h) and total measuring range (6002h) instead of the user settings.
6001h		Measuring units per revolution [Step/rev]	U32	rw	4000h	X	Measuring units per revolution.
6002h		Total measuring range	U32	rw	0h	X	Total measuring range in Steps. Number of distinguishable steps over total measuring range in [steps]. Allowed range: 2 to 2^{32}-1 steps (value 0h means 2^{32} steps, i.e. 4'294'967'296dec or 1'0000'0000h steps)
6003h		Preset value encoder	U32	rw	0h	X	Preset value in steps
6004h		Position encoder value	U32	ro,m			Position in steps , scaled value
600Ch		Position encoder raw value	U32	ro,m			Position in steps, raw value
6030h		Speed Value	Array	–			
	00h	Highest sub-index supported	U8	ro	1		
	01h	Speed Value	I16	ro,m			Speed value in steps/second

Object	Subindex	Name	Data type	Access rights	Default	Save	Description
6031h		Speed parameter	REC	–			
	00h	Highest sub-index supported	U8	ro	4		
	01h	Speed source selector	U8	rw	1	X	▪ 1: 6004h Position value ▪ 2: 600Ch Position raw value
	02h	Speed integration time	U16	rw	100	X	in ms
	03h	Multiplier value	U16	rw	1	X	Output value multiplier
	04h	Divider value	U16	rw	1	X	Output value divider

Object	Subindex	Name	Data type	Access rights	Default	Save	Description
6040h		Acceleration Value	Array				
	00h	Highest subindex supported	U8	ro	1		
	01h	Acceleration value	I16	ro,m			Acceleration value [steps/s²]
6041h		Acceleration parameter	REC				
	00h	Highest sub-index supported	U8	ro	4		
	01h	Acceleration source selector	U8	rw	1	X	▪ 1: 6004h Position value ▪ 2: 600Ch Position raw value
	02h	Acceleration integration time	U16	rw	100	X	in ms
	03h	Multiplier value	U16	rw	1	X	Output value multiplier
	04h	Divider value	U16	rw	1	X	Output value divider
6100h		Safety position configuration parameters	REC				
	00h	Highest subindex supported	U8	ro	2		
	01h	Code Sequence	U16	rw	0	X	
	02h	Preset	U32	rw	0	X	
6101h		Safety speed configuration parameters	REC				
	00h	Highest sub-index supported	U8	ro	7		
	01h	Code Sequence	U16	rw	0	X	
	02h	Preset	U32	rw	0	X	
	04h	Safety speed source selector	U8	rw	1	X	
	05h	Safety speed integration time	U16	rw	100	X	
	06h	Multiplier value	U16	rw	1	X	
	07h	Divider value	U16	rw	1	X	

Object	Subindex	Name	Data type	Access rights	Default	Save	Description
6120h		Safety position value	Array				
	00h	Highest sub-index supported	U8	ro	4		
	01h	Safety position 1st Byte	U8	ro			
	02h	Safety position 2nd Byte	U8	ro			
	03h	Safety position 3rd Byte	U8	ro			
	04h	Safety position 4th Byte	U8	ro			
6121h		Safety inverted position value	Array				
	00h	Highest sub-index supported	U8	ro	4		
	01h	Safety position 1st Byte	U8	ro			
	02h	Safety position 2nd Byte	U8	ro			
	03h	Safety position 3rd Byte	U8	ro			
	04h	Safety position 4th Byte	U8	ro			
6124h		Safety speed value	Array				
	00h	Highest sub-index supported	U8	ro	2		
	01h	Safety speed 1st Byte	I08	ro			
	02h	Safety speed 2nd Byte	I08	ro			
6125h		Safety speed inverted value	Array				
	00h	Highest sub-index supported	U8	ro	2		
	01h	Safety speed 1st Byte	U8	ro			
	02h	Safety speed 2nd Byte	U8	ro			
61FEh		Safety application configuration valid	U8	rw	0	X	is to be set valid (value A5h), after the Safety application configuration is completed

Object	Subindex	Name	Data type	Access rights	Default	Save	Description
61FFh		Safety application configuration signature	Array				
	00h	Highest sub-index supported	U8	ro	2		
	01h	Safety position configuration signature	U16	rw		X	CRC covering objects 6100h-xx
	02h	Safety speed configuration signature	U16	rw		X	CRC covering objects 6101h-xx
6200h		Cycle timer PDO1	U16	rw	100		In milliseconds, internally linked to object 1800h-5
6500h		Operating Status	U16	ro	4h		Bit 0: ▪ 0: Position CW ▪ 1: Position CCW Bit 2: ▪ 0: Scaling function disabled ▪ 1: Scaling function enabled
6501h		Used single turn resolution [step/rev]	U32	ro	16777216		
6502h		Number of distinguishable revolutions	U32	ro	1073741824		
6503h		Alarms	U16	ro,m	0h		
6504h		Supported alarms	U16	ro	F003h		
6505h		Warnings	U16	ro,m	0h		
6506h		Supported warnings	U16	ro	7014h		
6507h		Profile & software version	U32	ro	1000401h		
6508h		Operating time	U32	ro			
6509h		Offset encoder	I32	ro	0h		

Object	Subindex	Name	Data type	Access rights	Default	Save	Description
650Ah		Module identification	Array				
	00h	Highest sub-index supported	U8	ro	1		
	01h	Manufacturer offset	I32	ro	0		
650Bh		Serial number	U32	ro			Internally linked to object 1018h-4h

List of illustrations

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