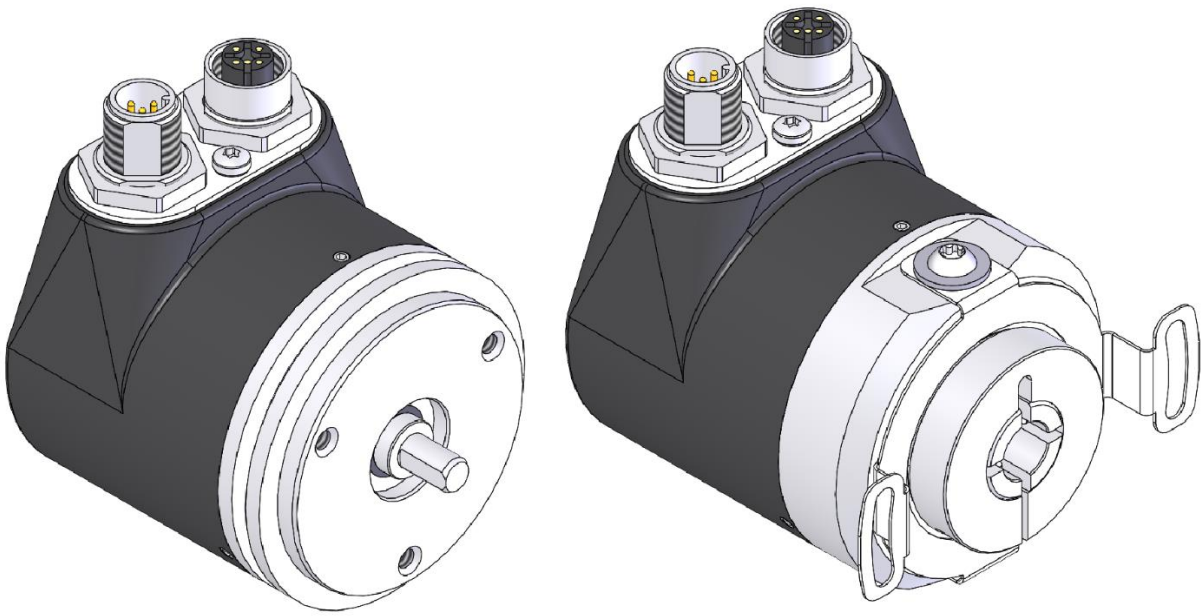
WV5800M/WH5800M

Absolute encoder with SAE J1939 interface

User manual



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1 General Information

1.1 Documentation

The following documents are associated with this document:

- The data sheet describes the technical data, the dimensions, the pin assignment, the accessories and the order key.
- The installation instructions describe the mechanical and electrical installation with all safety-relevant conditions and the associated technical specifications.
- The User manual for actuator commissioning and integration into a fieldbus system.

You can also download these documents at **http://www.siko-global.com/p/wv5800m** and **http://www.siko-global.com/p/wh5800m**.

1.1.1 History

Mod. status	Date	Description
83/25	23.04.2025	Document prepared

1.1 Definitions

Decimal values are given as numbers without addition (e. g. 1234), except when indicated in direct connection with binary or hexadecimal values, in which case the extension d will be used (e. g. 1234d). Binary values are identified by adding b (e. g. 1011B) to the figures whereas hexadecimal values are extended by h (e. g. 280h).

2 Intended use

The WV5800M / WH5800M records the absolute travel information. The encoder can be parameterized and read out via the SAE J1939 interface using the SAE J1939 protocol.

Both encoders are equipped with 3 LEDs (yellow, red, green), which indicate error or status information for diagnostic purposes.

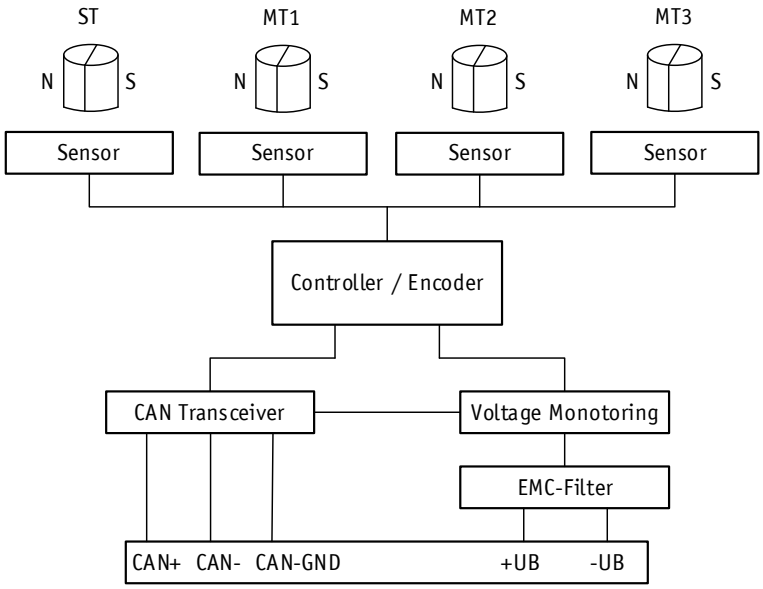

Fig. 1: Block diagram

2.1 Switching on the supply voltage

WV5800M / WH5800M initializes after being switched on. During initialization, the LEDs light up one after the other and the configuration parameters are loaded from the non-volatile memory to the random memory of the controller.

Each sensor will work with its default values as long as no changes have been made to it. With parameters changed, the sensor will work with the changed data, which must be stored if they are intended to be used after power off/on (see object 1010h: Store Parameter).

3 LED-signal

The transmitter has 3 LEDs in the colors yellow, green and red for diagnosis and status purposes.

- A yellow LED for device-specific states
- A green LED to indicate device switched on or address claiming active
- A red LED for CAN error states

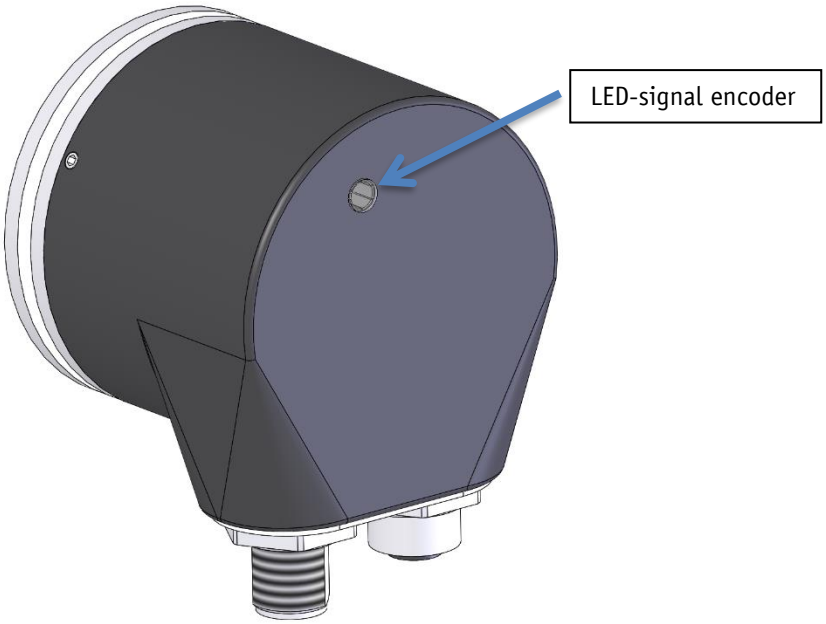

Fig. 2: LED-signal

Device-specific diagnosis:

Error status	LED status
Maximum speed exceeded	Flashing
Encoder is in the valid speed range	Off

Table 1: Device-specific status LED

LED status:

LED status	Description
On	LED is permanently on
Off	LED is permanently off
Flashing	LED flashes on/off

Table 2: LED status

Green LED:

Device status	LED status
Address Claiming active	Flashing
No error	On

Table 3: Green LED

Red LED:

Error states	LED status
No error (No error)	Off
Warning limit reached (at least one error counter (Transmit Error Counter CANTEC or Receive Error Counter CANREC) of the CAN controller has reached or exceeded the warning limit (too many error frames).	On
Bus off	On

Table 4: Red LED

4 Functional description

4.1 Measuring range

The measuring range depends on the chosen device design and the APU set (6001h: Measurement steps per revolution (Display per revolution = APU)).

Design	Default measuring range	With changed APU (Object 6001h)
Singleturn	0 ... 16383	0 ... ((APU*1) – 1)
4 bit Multiturn	0 ... 262143	0 ... ((APU*16) – 1)
8 bit Multiturn	0 ... 4194303	0 ... ((APU*256) – 1)
12 bit Multiturn	0 ... 67108863	0 ... ((APU*4096) – 1)

Counting direction:

The encoder delivers ascending position values when the shaft is rotated clockwise (CW, view on the shaft). This property can be changed via Object 6000h: Operating Parameters.

4.2 Calibration

Owing to the absolute system, calibration is required only once when the system is taken into operation and can be performed at any position. This enables alignment of the encoder zero point with the system's mechanical zero point. Calibration can be carried out with 6003h: Preset value (calibration value). With calibration, the calibration value is adopted for calculation of the position value. The resulting offset value is output in 6509h: Offset value. The following equation is applied in case of calibration:

Position value = 0 + calibration value + application offset

4.3 Reset to factory settings

To return to the original condition of the device as delivered, there exist the following options:

Access	Coding		Settings are restored
see object 1011h: Restore Parameter	1011h "load"	Sub-index 1	All parameters
		Sub-index 2	Only bus parameters
		Sub-index 3	Only CiA DS-406 parameter
		Sub-index 4	Only manufacturer-specific parameters

Table 5: Access to factory settings

5 Communication via CAN bus (SAE J1939 protocol)

The basis for the WV5800M / WH5800M with SAE J1939 are the documents Encoder Device profile CiA 406-J V1.3.0, Part J: Mapping to J1939, J1939 parameter groups for SDO and EMCY CiA 510 V1.1.1 and the Device profile for Encoders CiA 406 V4.0.2.

The parameter groups (PG) CAM11 and CAM21 contain the SDO protocols as specified in the CANopen communication protocol. The SDO protocols shown give the user access to the CANopen object directory that is implemented in devices with CiA profile functionality.

When using SIKO sensors with SAE J1939, it is possible to use PGs with parameter group numbers (PGN) uniquely assigned by SAE (position value = #64607, speed value = #64609) or proprietary PGs (Proprietary B = #65450).

5.1 Telegram structure

The data telegram of a CAN message consists of the following fields:

SOF	Identifier (COB-ID)	Control field	Data field (max. 8 byte)	CRC	ACK / EOF

SOF:

Start of Frame start bit of the telegram.

Identifier (COB-ID):

By means of the identifier, all bus subscribers check whether the message is relevant for each of them.

Priority	Reserved	Data page (DP)	PDU format (PF)	PDU specific (PS)	Source Address (SA)
			Parameter Group Number (PGN)		
3 bits	1 bit	1 bit	8 bits	8 bits	8 bits

Table 6: Structure 29 bit identifier

Control field:

Contains bit-by-bit information concerning the number of user data and determines whether a data frame or RTR frame (Remote Transmission Request frame) is concerned.

Data field:

Contains up to 8 bytes of user data. The user data has a different meaning depending on the channel selection.

CRC:

Contains bits for error detection.

ACK/EOF:

The ACK/EOF field contains telegram acknowledgment bits as well as bits for determining the end of telegram.

For a detailed description of the telegram please refer to the applicable technical CAN literature. For simplification, only identifier (COB ID) and data field will be dealt with in the subsequent telegram descriptions.

5.2 Device Name

Each device in an SAE J1939 network must have a unique 64-bit device name for identification purposes and this must be issued after start-up. If the device is set to its factory settings, it starts with the default address 239 (EFh).

Designation	Size
Arbitrary Address Capable, support of dynamic addressing	1 bit
Industry Group	3 bit
Vehicle System Instance	4 bit
Vehicle System	7 bit
Reserved	1 bit
Function	8 bit
Function Instance	5 bit
ECU Instance	3 bit
Manufacturer Code	11 bit
Identity Number	21 bit

Table 7: Structure NAME identifier

5.3 Address Claiming

The address claim procedure is designed to assign addresses to ECUs directly after initialization of the network and thus ensure that the assigned address is unique for the ECU. The address assignment depends on the value of the NAME identifier. A subscriber with a higher NAME identifier has priority right to the claimed address.

The following illustration shows the address claiming process:

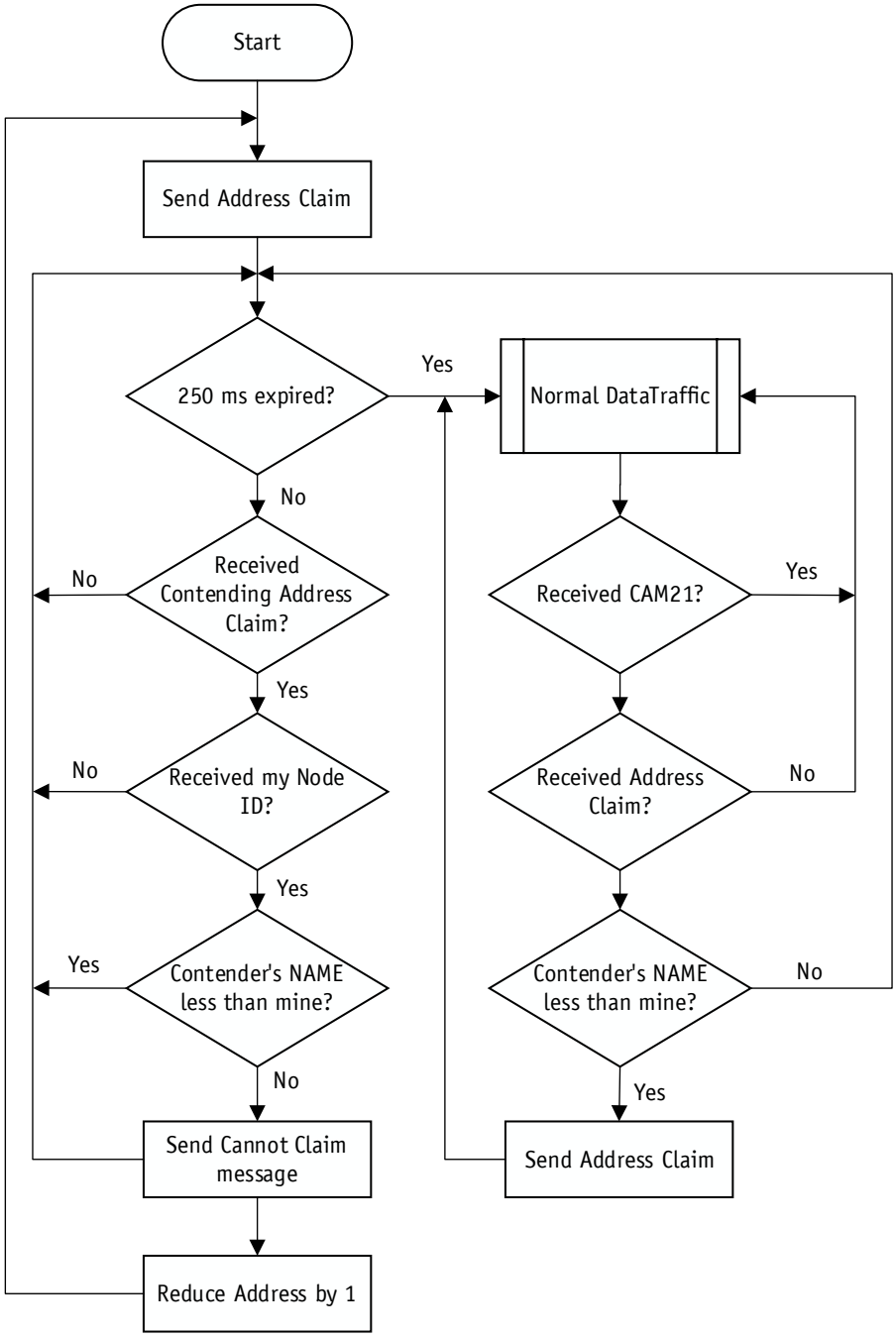

Fig. 3: Address Claiming

5.4 Process data exchange PGN Overview

Process data is used for the fast cyclical exchange of process data. A maximum of 8 bytes of user data can be transmitted with an adjustable time. A cycle time of 0 ms deactivates the transmission. The mapping from CANopen to SAE J1939 is specified in the CiA 406-J encoder profile and corresponding PGs are defined for the position and speed values.

5.4.1 Position value (EPOS)

The position value corresponds to the value of object 6004h in CANopen. The cycle time can be changed via object 3000h subindex 03h or via object 6200h. These two objects are linked to each other.

Meaning	Contents
Transmission	50 ms
Data length	8 byte
Extended Data Page	0
Data Page	0
PDU Format (PF)	252 (FCh)
PDU Specific (PS)	95 (5Fh)
Default priority	3
Parameter Group Number	64607 (00FC5Fh)

Process data in binary code

Byte 0 (LSB)	Byte 1	Byte 2	Byte 3 (MSB)	Byte 4	Byte 5	Byte 6	Byte 7
Position value				FFh	FFh	FFh	FFh

5.4.2 Speed value (ESPD)

The speed value corresponds to the value of object 6030h subindex 01h in CANopen. The cycle time can be set via object 3000h subindex 02h.

Meaning	Contents
Transmission	50 ms
Data length	8 byte
Extended Data Page	0
Data Page	0
PDU Format (PF)	252 (FCh)
PDU Specific (PS)	97 (61h)
Default priority	3
Parameter Group Number	64609 (00FC61h)

Process data in binary code

Byte 0 (LSB)	Byte 1 (MSB)	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
Speed value		FFh	FFh	FFh	FFh	FFh	FFh

5.4.3 Position value and speed value (Proprietary B)

Proprietary B is a message with manufacturer-specific content.

Meaning	Contents
Transmission	0 ms
Data length	8 byte
Extended Data Page	0
Data Page	0
PDU Format (PF)	255 (FFh)
PDU Specific (PS)	170 (AAh)
Default priority	6
Parameter Group Number	65450 (00FFAAh)

Process data in binary code

Byte 0 (LSB)	Byte 1	Byte 2	Byte 3 (MSB)	Byte 4 (LSB)	Byte 5 (MSB)	Byte 6	Byte 7
Position value				Speed value		00h	00h

5.4.4 Example of process data exchange

On delivery, the WV5800M / WH5800M sends the parameter groups 64607 - position value and 64609 - speed. The telegram of a parameter group is sent as soon as a corresponding cycle time >0 is entered. The process data exchange can therefore be easily adapted to the respective application by activating or deactivating the individual PGNs.

PGN	Cycle time in ms
64607 Position value 64609 Speed value 65450 Properitary B	0 = deactivated
	1h … FFFFh = activated

5.5 Parameter data exchange

5.5.1 Parameter group "CAM11"

Maps the SDO client protocol according to CiA 510 V1.1.1 in the 8 byte user data.

Meaning	Contents
Transmission	On event: initiated by the application
Data length	8 byte
Extended Data Page	0
Data Page	0
PDU Format (PF)	5 (5h)
PDU Specific (PS)	218 (DAh)
Default priority	7
Parameter Group Number	1280 (000500h)

Process data in binary code

Byte 0	Byte 1 (LSB)	Byte 2 (MSB)	Byte 3	Byte 4 (LSB)	Byte 5	Byte 6	Byte 7 (MSB)
Command	Object	Object	Sub-index	User data			

Read-write command

Read	Writing	Byte length
4Fh	2Fh	1 byte
4Bh	2Bh	2 byte
43h	23h	4 byte

5.5.2 Parameter group "CAM21"

Maps the SDO server protocol according to CiA 510 V1.1.1 in the 8 byte user data.

Meaning	Contents
Transmission	On event: Response to the SDO client request
Data length	8 byte
Extended Data Page	0
Data Page	0
PDU Format (PF)	6 (6h)
PDU Specific (PS)	218 (DAh)
Default priority	7
Parameter Group Number	1536 (000600h)

Process data in binary code

Byte 0	Byte 1 (LSB)	Byte 2 (MSB)	Byte 3	Byte 4 (LSB)	Byte 5	Byte 6	Byte 7 (MSB)
Command	Object	Object	Sub-index	User data			

Read-write command

Read	Writing	Byte length
40h	2Fh	1 byte
40h	2Bh	2 byte
40h	23h	4 byte

5.5.3 Examples

5.5.3.1 Reading a parameter

The calibration value stored in object 6003h of the object dictionary is to be read from the WV5800M with device address EFh. The parameter group CAM21 can be used for this purpose.

Identifier: 1C06h + Destination Address (DA) + Source Address (SA) = 1C06EF00h

Command: 40h read
Index: 6003h
Sub-index: 00h
The current value is 530d = 0212h.

Request from master to slave with device address EFh:

ID	User data							
	Command	Index L	Index H	Sub-index	Data 0	Data 1	Data 2	Data 3
1C06EF00h	40h	03h	60h	00h	x	x	x	x

Response to the request by the slave:

Identifier: 1C05h + Destination Address (DA) + Source Address (SA) = 1C0500EFh

ID	User data							
	Command	Index LB	Index HB	Sub-index	Data 0	Data 1	Data 2	Data 3
1C0500EFh	43h (4 bytes valid)	03h	60h	00h	FEh	01h	00h	00h

5.5.3.2 Writing a parameter

In the WH5800M with device address 4Ah, the cycle timer of position PGN 64607, which is stored with 2 bytes in object 3000h subindex 03h of the object dictionary, is to be changed to 100 ms.

Identifier: 1C06h + Destination Address (DA) + Source Address (SA) = 1C064A00h

Command: 2 bytes are to be written: 2Bh
Index: 3000h
Sub-index: 03h
The new value should be 100 ms = 64h.

Writing a value from the master to the slave with device address 4Ah:

COB-ID	User data							
	Command	Index L	Index H	Sub-index	Data 0	Data 1	Data 2	Data 3
1C064A00h	2Bh (2 bytes valid)	00h	30h	03h	64h	00h	x	x

Response of the slave to the command:

Identifier: 1C05h + Destination Address + Source Address = 1C05004Ah

COB-ID	User data							
	Command	Index L	Index H	Sub-index	Data 0	Data 1	Data 2	Data 3
1C05004Ah	60h	00h	30h	03h	00h	00h	00h	00h

5.5.3.3 Saving a configuration

A parameter change must be saved, otherwise the original values will be restored after a voltage reset. The value 65766173h must be sent as data.

Identifier: 1C06h + Destination Address (DA) + Source Address (SA) = 1C060A00h

COB-ID	User data							
	Command	Index L	Index H	Sub-index	Data 0	Data 1	Data 2	Data 3
1C064A00h	23h	10h	10h	01h	73h	61h	76h	65h

Response of the slave to the command:

Identifier: 1C05h + Destination Address (DA) + Source Address (SA) = 1C05004Ah

COB-ID	User data							
	Command	Index L	Index H	Sub-index	Data 0	Data 1	Data 2	Data 3
1C05004Ah	60h	10h	10h	01h	00h	00h	00h	00h

5.6 Emergency Message

In the case of an error, the status of the bus subscriber is transferred via high-priority emergency messages (emergency telegrams). These messages have a data length of 8 bytes and contain error information.

The emergency message is transferred as soon as a sensor or communication error has occurred or when such errors have been corrected. The cause of the error is deposited in the error buffer (see object 1003h: Pre-defined Error Field). An emergency object is sent only once per error event. Removal of the cause of the error is signaled by sending an emergency message with the error code 0000h (no error). If multiple errors have occurred and one cause of error is removed, the error code 0000h is output as well; the persisting error status is indicated in the error register, however.

The emergency protocol is mapped in accordance with CiA 510 V1.1.1.

Meaning	Contents
Transmission	On event: triggered by Wx58MR
Data length	8 byte
Extended Data Page	0
Data Page	0
PDU Format (PF)	252 (FCh)
PDU Specific (PS)	104 (68h)
Default priority	1
Parameter Group Number	64616 (00FC68h)

Process data in binary code

Byte 0 (LSB)	Byte 1 (MSB)	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
Emergency Error Code		Error Register	FFh	FFh	FFh	FFh	FFh

Emergency Error Code	Description
0000h	Cause of the error removed
8120h	Bus status changed over to the error passive mode
8140h	Recovered from Bus Off
FF05h	Position value error
FF12h	Velocity error
FF13h	Error limit speed low
FF14h	Error limit speed high
FF15h	Position error work area 1
FF16h	Position error work area 2

Error Register

Bit	State	Description
Bit 0	0	No Error
	1	Error condition occurred
Bit 1		reserved
Bit 2		reserved
Bit 3		reserved
Bit 4	0	No Error
	1	Communication Error (Can Bus)
Bit 5		reserved
Bit 6		reserved
Bit 7	0	No Error
	1	Manufacturer specific (sensor error)

5.7 Directory of objects

5.7.1 Overview of objects

The following table offers an overview of the objects of the device.

Name	Description	See page
1000h: Device Type	Device profile and encoder type.	18
1001h: Error Register	Current error state of the device.	19
1003h: Pre-defined Error Field	The object stores the 8 error states that have occurred last.	19
100Ah: Manufacturer Software Version	Indicates the software version of the device.	20
1010h: Store Parameter	Object for non-volatile storage of the settings.	20
1011h: Restore Parameter	Object for restoring the factory settings.	22
1018h: Identity Object	Contains the manufacturer number.	23

Name	Description	See page
2001h: Application offset	Manufacturer-specific offset value (is added to the position value encoder-internally).	25
2003h: Limit speed low	Setting of the lower limit speed.	25
2004h: Limit speed High	Setting of the upper limit speed.	25
3000h: SAE J1939 PGN Parameter	Transmission of position value and speed value via Proprietary B.	26
3001h: Parameter of the Device Name	Parameter of the device name.	27
3002h: SAE initialization	SAE initialization and reboot.	29
5000h: Diagnosis CAN Bus error	Informs on the CAN bus errors that occurred.	30
5F0Ah: Node-ID and baud rate Bus CAN	Setting of Node ID and baud rate.	31
6000h: Operating Parameters	Setting of scaling and sense of rotation.	32
6001h: Measurement steps per revolution (Display per revolution = APU)	Setting of the displayed measurement steps per revolution (Display per revolution = APU).	32
6002h: Overall number of measurement steps	Indicates the overall number of the system's measuring steps.	33
6003h: Preset value (calibration value)	Setting the calibration value.	33
6004h: Position value	Position value (offset with calibration and offset value).	34
600Ch: Raw value position	Raw value of position.	34
6030h: Velocity value	Velocity value.	34
6031h: Speed parameters	Adjustment the speed parameter.	35
6200h: Cycle timer	Identical with object 1800h, sub-index 5.	35
6400h: Operating range (Area state register)	Indicates whether the position value is within the set work areas 1 and 2.	36
6401h: Work Area Low Limit	Setting of the lower limits of the work areas 1 and 2.	37
6402h: Work Area High Limit	Setting of the lower limits of the work areas 1 and 2.	38
6500h: Operating Status	Output of scaling and sense of rotation.	39
6501h: Singleturn resolution	The physical number of measurement steps per revolution.	39
6502h: Number of distinguishable revolutions	Number of revolution the encoder is able to sense.	40
6503h: Alarms	Indication of error states.	40
6504h: Supported Alarms	Indicates the alarm messages that are supported.	41
6505h: Warnings	Indication of warnings.	41
6506h: Supported Warnings	Indicates the warnings that are supported.	41

Name	Description	See page
6507h: Profile and Software Version	Indicates the version number of the device profile used and the version number of the encoder's firmware.	42
6508h: Operating Time	Hourmeter (function is not supported).	42
6509h: Offset value	Encoder state at the time of calibration.	42
650Ah: Module Identification	Indicates the manufacturer-specific offset value as well as the smallest and largest transferable position value.	43
650Bh: Serial number	Indicates the serial number.	44
650Dh: Absolute accuracy	Provides the absolute accuracy of the encoder in bits.	44
650Eh: Device functionality	Provides information on device functionality.	44

Table 8: Overview of objects

5.7.2 Object Description

5.7.2.1 1000h: Device Type

Object 1000h indicates the device profile number.

Sub-index	00h			
Description	Information about the device profile and encoder type			
Access	ro			
Data type	UNSIGNED 32			
Default	Singleturn: 00010196h Multiturn: 00020196h			
EEPROM	no			
Data content	Device profile -number		Encoder type	
	Byte 0	Byte 1	Byte 2	Byte 3
	96h	01h	01h / 02h	00h

0196h (= 406d): CANopen Device Profile for Encoders

Encoder type:

0001h: Absolute singleturn encoder

0002h: Absolute multiturn encoder

5.7.2.2 1001h: Error Register

Object 1001h indicates the error state of the device.

Sub-index	00h	
Description	Pending error status	
Access	ro	
Data type	UNSIGNED 8	
Default	0h	
EEPROM	no	
Data content	Bit	Meaning
	0	Set bit indicates the occurrence of any error condition.
	4	Set bit indicates communication error on the CAN bus (passive or bus-off).
	7	Manufacturer-specific (sensor error)
	1 ... 3, 5, 6	Not used

Faults and errors are signaled at the time of their occurrence by an emergency message.

5.7.2.3 1003h: Pre-defined Error Field

In object 1003h, the 8 latest error states are archived (see chapter 5.6).

- The entry under sub-index 0 indicates the number of errors saved.
- The latest error status is always stored in sub-index 01h. Previous error messages "slip onwards" in their position by one sub-index.
- The whole error list is deleted by writing the value 0 in sub-index 00h.
- The entries in the error list have the format described in chapter 5.6.

Sub-index	00h
Description	Number of the error messages stored
Access	rw
Data type	UNSIGNED 8
Default	0h
EEPROM	yes

Sub-index	01h ... 08h
Description	Error messages that occurred
Access	ro
Data type	UNSIGNED 32
Default	0h
EEPROM	yes

5.7.2.4 100Ah: Manufacturer Software Version

Object 100Ah indicates the software version of the device.

Sub-index	00h			
Description	Software version in ASCII notation			
Access	Const			
Data type	Visible_String			
Default	V001			
EEPROM	no			
Data content	Byte 0	Byte 1	Byte 2	Byte 3
	56h ("V")	31h ("1")	30h ("0")	30h ("0")

5.7.2.5 1010h: Store Parameter

Parameters are transferred into the EEPROM with this object in order to ensure that they are protected from loss of voltage. Different parameter groups are stored depending on the selection of the sub-index to be accessed. The string "Save" must be sent as data content.

Sub-index	00h
Description	Indicates the largest supported sub-index
Access	const
Data type	UNSIGNED 8
Default	4h
EEPROM	no

Sub-index	01h			
Description	Save all parameter			
Access	rw			
Data type	UNSIGNED 32			
Default	1h			
EEPROM	no			
Data content	Write:			
	Byte 0	Byte 1	Byte 2	Byte 3
	73h ("s")	61h ("a")	76h ("v")	65h ("e")
	Read:			
	Bit 31 ... 2	0: reserved		
	Bit 1	0: Device does not independently store parameters		
	Bit 0	1: Device stores parameters after command		

Sub-index	02h			
Description	Save only communication parameters (1000h ... 1FFFh, CiA 301)			
Access	rw			
Data type	UNSIGNED 32			
Default	1h			
EEPROM	no			
Data content	Write:			
	Byte 0	Byte 1	Byte 2	Byte 3
	73h ("s")	61h ("a")	76h ("v")	65h ("e")
	Read:			
	Bit 31 ... 2	0: reserved		
	Bit 1	0: Device does not independently store parameters		
	Bit 0	1: Device stores parameters after command		

Sub-index	03h			
Description	Save only application parameters (6000h ... 9FFFh, CiA 406)			
Access	rw			
Data type	UNSIGNED 32			
Default	1h			
EEPROM	no			
Data content	Write:			
	Byte 0	Byte 1	Byte 2	Byte 3
	73h ("s")	61h ("a")	76h ("v")	65h ("e")
	Read:			
	Bit 31 ... 2	0: reserved		
	Bit 1	0: Device does not independently store parameters		
	Bit 0	1: Device stores parameters after command		

Sub-index	04h			
Description	Save only manufacturer-specific parameters (2000h ... 5FFFh)			
Access	rw			
Data type	UNSIGNED 32			
Default	1h			
EEPROM	no			
Data content	Write:			
	Byte 0	Byte 1	Byte 2	Byte 3
	73h ("s")	61h ("a")	76h ("v")	65h ("e")
	Read:			
	Bit 31 ... 2	0: reserved		
	Bit 1	0: Device does not independently store parameters		
	Bit 0	1: Device stores parameters after command		

5.7.2.6 1011h: Restore Parameter

Object 1011h restores the factory settings of the device depending on the selection. The string "Load" must be sent as data content and the device reset thereafter. If the restored parameters are intended to be permanently available, they must be stored via object 1010h: Store Parameter.

Sub-index	00h
Description	Indicates the largest supported sub-index
Access	const
Data type	UNSIGNED 8
Default	4h
EEPROM	no

Sub-index	01h			
Description	Reset all parameters to factory settings			
Access	rw			
Data type	UNSIGNED 32			
Default	1h			
EEPROM	no			
Data content	Write:			
	Byte 0	Byte 1	Byte 2	Byte 3
	6Ch ("l")	6Fh ("o")	61h ("a")	64h ("d")
	Read:			
	Bit 31 ... 1	0: reserved		
	Bit 0	1: Device permits loading of default parameters		

Sub-index	02h			
Description	Set only communication parameters to factory settings (1000h ... 1FFFh, CiA 301)			
Access	rw			
Data type	UNSIGNED 32			
Default	1h			
EEPROM	no			
Data content	Write:			
	Byte 0	Byte 1	Byte 2	Byte 3
	6Ch ("l")	6Fh ("o")	61h ("a")	64h ("d")
	Read:			
	Bit 31 ... 1	0: reserved		
	Bit 0	1: Device permits loading of default parameters		

Sub-index	03h			
Description	Set only application parameters to factory settings (6000h … 9FFFh, CiA 406)			
Access	rw			
Data type	UNSIGNED 32			
Default	1h			
EEPROM	no			
Data content	Write:			
	Byte 0	Byte 1	Byte 2	Byte 3
	6Ch ("l")	6Fh ("o")	61h ("a")	64h ("d")
	Read:			
	Bit 31 … 1	0: reserved		
	Bit 0	1: Device permits loading of default parameters		

Sub-index	04h			
Description	Set only manufacturer-specific parameters to factory settings (2000h … 5FFFh)			
Access	rw			
Data type	UNSIGNED 32			
Default	1h			
EEPROM	no			
Data content	Write:			
	Byte 0	Byte 1	Byte 2	Byte 3
	6Ch ("l")	6Fh ("o")	61h ("a")	64h ("d")
	Read:			
	Bit 31 … 1	0: reserved		
	Bit 0	1: Device permits loading of default parameters		

5.7.2.7 1018h: Identity Object

The manufacturer identification number (Vendor ID) is indicated by object 1018h.

Sub-index	00h
Description	Indicates the largest supported sub-index
Access	const
Data type	UNSIGNED 8
Default	4h
EEPROM	no

Sub-index	01h
Description	The manufacturer identification number (vendor ID) for the company SIKO GmbH allocated by the CiA
Access	ro
Data type	UNSIGNED 32
Default	195h
EEPROM	no

Sub-index	02h
Description	Product Code (function is not supported, only compatibility entry for various configurators)
Access	ro
Data type	UNSIGNED 32
Default	FFFFFFFFh
EEPROM	no

Sub-index	03h
Description	Revision number (function is not supported, only compatibility entry for various configurators)
Access	ro
Data type	UNSIGNED 32
Default	FFFFFFFFh
EEPROM	no

Sub-index	04h
Description	Serial Number
Access	ro
Data type	UNSIGNED 32
Default	1h
EEPROM	yes

5.7.2.8 2001h: Application offset

The offset value is determined via object 2001h.

Sub-index	00h	
Description	The offset enables the shifting of a scaled value range. The offset value is added to the position value in the encoder. Positive as well as negative values are permitted. Position value = measured value + calibration value + application offset	
Access	rw	
Data type	SIGNED 32	
Default	0h	
EEPROM	yes	
Data content	Singleturn	-16384 ... 16383
	4 bit Multiturn	-262144 ... 262143
	8 bit Multiturn	-4194304 ... 4194303
	12 bit Multiturn	-67108864 ... 67108863

5.7.2.9 2003h: Limit speed low

The lower value for the limit speed can be set via Object 2003h.

Sub-index	00h
Description	Lower limit speed
Access	rw
Data type	SIGNED 16
Default	0h
EEPROM	yes
Data content	-32768...32767

5.7.2.10 2004h: Limit speed High

The upper value for the limit speed can be set via Object 2003h.

Sub-index	00h
Description	Upper limit speed
Access	rw
Data type	SIGNED 16
Default	0h
EEPROM	yes
Data content	-32768...32767

5.7.2.11 3000h: SAE J1939 PGN Parameter

Sub-index	00h
Description	Indicates the largest supported sub-index
Access	const
Data type	UNSIGNED 8
Default	6h
EEPROM	no

Sub-index	01h
Description	Cycle time for Properitary PGN 65450 in ms
Access	rw
Data type	UNSIGNED 16
Default	0h
EEPROM	no
Data content	0h ... FFFFh, 0h = deactivated

Sub-index	02h
Description	Cycle time for speed PGN 64609 in ms
Access	rw
Data type	UNSIGNED 16
Default	32h
EEPROM	no
Data content	0h ... FFFFh, 0h = deactivated

Sub-index	03h
Description	Cycle time for position PGN 64607 in ms
Access	rw
Data type	UNSIGNED 16
Default	32h
EEPROM	no
Data content	0h ... FFFFh, 0h = deactivated

Sub-index	04h
Description	Priority Properitary PGN 65450
Access	rw
Data type	UNSIGNED 8
Default	06h
EEPROM	no
Data content	0h ... 07h

Sub-index	05h
Description	Priority Speed PGN 64609
Access	rw
Data type	UNSIGNED 8
Default	03h
EEPROM	no
Data content	0h ... 07h

Sub-index	06h
Description	Priority Position PGN 64609
Access	rw
Data type	UNSIGNED 8
Default	03h
EEPROM	no
Data content	0h ... 07h

5.7.2.12 3001h: Parameter of the Device Name

Sub-index	00h
Description	Parameter Device Name
Access	ro
Data type	UNSIGNED 8
Default	10h
EEPROM	no

Sub-index	01h
Description	IdentityNumber
Access	ro
Data type	UNSIGNED 32
Default	Serial No.
EEPROM	yes
Data content	xxxxxxxxh

Sub-index	02h
Description	ManufacturerCode
Access	ro
Data type	UNSIGNED 8
Default	0471h
EEPROM	yes
Data content	0471h

Sub-index	03h
Description	ECUInstance
Access	ro
Data type	UNSIGNED 8
Default	0
EEPROM	yes
Data content	0

Sub-index	04h
Description	FunctionInstance
Access	ro
Data type	UNSIGNED 8
Default	0
EEPROM	yes
Data content	0

Sub-index	05h
Description	Function
Access	ro
Data type	UNSIGNED 8
Default	8Eh
EEPROM	yes
Data content	8Eh

Sub-index	06h
Description	VehicleSystem
Access	ro
Data type	UNSIGNED 8
Default	0h
EEPROM	yes
Data content	0

Sub-index	07h
Description	Reserved
Access	ro
Data type	UNSIGNED 8
Default	0
EEPROM	yes
Data content	0

Sub-index	08h
Description	VehicleSystem Instance
Access	ro
Data type	UNSIGNED 8
Default	0
EEPROM	yes
Data content	0

Sub-index	09h
Description	IndustryGroup
Access	ro
Data type	UNSIGNED 8
Default	3h
EEPROM	yes
Data content	3h

Sub-index	0Ah
Description	Arbitrary Address Capable
Access	ro
Data type	UNSIGNED 8
Default	1h
EEPROM	yes
Data content	1h

5.7.2.13 3002h: SAE initialization

Sub-index	00h
Description	Indicates the largest supported sub-index
Access	ro
Data type	UNSIGNED 8
Default	2h
EEPROM	no

Sub-index	01h
Description	Initialize SAE
Access	wo
Data type	UNSIGNED 8
Default	1h
EEPROM	yes
Data content	1h

Sub-index	02h
Description	Restarting the device
Access	wo
Data type	UNSIGNED 8
Default	1h
EEPROM	yes
Data content	1h

5.7.2.14 5000h: Diagnosis CAN Bus error

A prioritized list of CAN bus errors occurring can be read via Object 5000h.

Sub-index	00h			
Description	Indicates the CAN Bus errors Acknowledge, Form, CRC and Stuff Error sorted by frequency			
Access	ro			
Data type	UNSIGNED 32			
Default	0h			
EEPROM	no			
Data content	Byte 0	Byte 1	Byte 2	Byte 3
	General Acknowledgment error	Form error	CRC error	Stuff error
	0, 1, 2, 3, 4	0, 1, 2, 3, 4	0, 1, 2, 3, 4	0, 1, 2, 3, 4

Explanation of the data content:

0: No error occurring at all

4: Error occurring most frequently

5.7.2.15 5F0Ah: Node-ID and baud rate Bus CAN

Node ID and baud rate of the bus can be set via Object 5F0Ah.

Sub-index	00h
Description	Indicates the largest supported sub-index
Access	const
Data type	UNSIGNED 8
Default	2h
EEPROM	no

Sub-index	01h
Description	Node-ID
Access	rw
Data type	UNSIGNED 8
Default	EFh
EEPROM	yes
Data content	80h ... EFh

Sub-index	02h
Description	Baud rate Bus
Access	rw
Data type	UNSIGNED 8
Default	4h (250 kBaud)
EEPROM	yes
Data content	3: 125 kbit/s 4: 250 kbit/s 5: 500 kbit/s

5.7.2.16 6000h: Operating Parameters

Settings of the operating parameters can be made through object 6000h.

Sub-index	00h	
Description	Operating Parameters	
Access	rw	
Data type	UNSIGNED 16	
Default	4h	
EEPROM	yes	
Data content	Bit 15 ... 4	not used
	Bit 3	not used
	Bit 2	1: Scaling enabled
	Bit 1	not used
	Bit 0	0: Clockwise (CW) sense of rotation I 1: Counter-clockwise (CCW) sense of rotation E

Scaling: The encoder works with the preset resolution indicator (measuring step per resolution) which can be configured by object 6001h. The scaling function cannot be disabled.

Sense of rotation I: ascending position values with clockwise (CW) encoder rotation (view on the encoder shaft).

Sense of rotation E: ascending position values with counter-clockwise (CCW) encoder rotation (view on the encoder shaft).

5.7.2.17 6001h: Measurement steps per revolution (Display per revolution = APU)

The number of measurement steps is determined via Object 6001h.

Sub-index	00h
Description	Number of measurement steps per revolution
Access	rw
Data type	UNSIGNED 32
Default	16384d (4000h)
EEPROM	yes
Data content	1d ... 65535d (1h ... FFFFh)

5.7.2.18 6002h: Overall number of measurement steps

Object 6002h indicates the overall number of the system's measuring steps.

Sub-index	00h	
Description	Overall number of measuring units	
Access	rw	
Data type	UNSIGNED 32	
Default	Singleturn	16384
	4 bit Multiturn	262144
	8 bit Multiturn	4194304
	12 bit Multiturn	67108864
EEPROM	yes	
Data content	Encoder type	With changed APU (Object 6001h)
	Singleturn	APU*1
	4 bit Multiturn	APU*16
	8 bit Multiturn	APU*256
	12 bit Multiturn	APU*4096

5.7.2.19 6003h: Preset value (calibration value)

Via object 6003h, the position value of the encoder can be set to a calibration value with calibration. Position value = measured value + calibration value + application offset (see chapter 4.2).

Sub-index	00h		
Description	Calibration value		
Access	rw		
Data type	SIGNED 32		
Default	0h		
EEPROM	yes		
Data content	Encoder type	Default	With changed APU (Object 6001h)
	Singleturn	0 … 16383	0 … ((APU*1) – 1)
	4 bit Multiturn	0 … 262143	0 … ((APU*16) – 1)
	8 bit Multiturn	0 … 4194303	0 … ((APU*256) – 1)
	12 bit Multiturn	0 … 67108863	0 … ((APU*4096) – 1)

5.7.2.20 6004h: Position value

Object 6004h indicates the actual position value of the device.

Sub-index	00h
Description	Position value
Access	ro
Data type	UNSIGNED 32
Default	0h
EEPROM	no

Position value = measured value + calibration value + application offset

5.7.2.21 600Ch: Raw value position

Sub-index	00h
Description	Raw value of the item value
Access	ro
Data type	UNSIGNED 32
Default	0h
EEPROM	no

5.7.2.22 6030h: Velocity value

Velocity can be read via object 6030h.

Sub-index	00h
Description	Indicates the largest supported sub-index
Access	ro
Data type	UNSIGNED 8
Default	1h
EEPROM	no

Sub-index	01h
Description	Speed value in increments per ms (Inc/ms)
Access	ro
Data type	SIGNED 16
Default	0h
EEPROM	no

Speed value in increments per ms (Inc/ms):

Speed [rpm] = speed value [Inc/ms] * 6000 [rpm] / 1638.4 [Inc/ms]

5.7.2.23 6031h: Speed parameters

Sub-index	00h
Description	Indicates the largest supported sub-index
Access	ro
Data type	UNSIGNED 8
Default	4h
EEPROM	no

Sub-index	01h
Description	Speed source selector
Access	rw
Data type	UNSIGNED 8
Default	02h
EEPROM	yes
Data content	02h: Object 600C raw value of position is used

Sub-index	02h
Description	Integration time of speed
Access	ro
Data type	UNSIGNED 16
Default	64h
EEPROM	yes
Data content	64h 100 ms C8h 200 ms

Sub-index	03h
Description	Multiplicator
Access	rw
Data type	UNSIGNED 16
Default	01h
EEPROM	yes
Data content	01h

Sub-index	04h
Description	Divisor
Access	rw
Data type	UNSIGNED 16
Default	01h
EEPROM	yes
Data content	01h

Velocity value [Inc/ms] = (new raw position value object 600Ch- old raw position value object 600Ch) / (Integration time [ms] object 6031h sub-index 02h * 10-3) * multiplier object 6031h sub-index 03h / divisor object 6031h sub-index 04h.

5.7.2.24 6200h: Cycle timer

Object 6200h sets a cycle time with which the position is to be output. his value is permanently linked to object 3000h: SAE J1939 PGN Parameter sub-index 03h. The timer-controlled output is active as soon as a valid cycle time is entered. The value 0h deactivates the function.

Sub-index	00h
Description	Cycle Timer
Access	rw
Data type	UNSIGNED 16
Default	0h
EEPROM	yes
Data content	0d ... 65535d (0h...FFFFh)

5.7.2.25 6400h: Operating range (Area state register)

Object 6400h outputs whether the position value is within the set work areas 1 and 2.

Sub-index	00h
Description	Indicates the largest supported sub-index
Access	ro
Data type	UNSIGNED 8
Default	2h
EEPROM	no

Sub-index	01h	
Description	Status of operating range 1	
Access	ro	
Data type	UNSIGNED 8	
Default	0h	
EEPROM	no	
Data content	Bit 7 ... 3	not used
	Bit 2	0: Position value is within the work area 1: Position value is smaller than the limit set in Object 6401.1h
	Bit 1	0: Position value is within the work area 1: Position value is larger than the limit set in Object 6402.1h
	Bit 0	0: Position value is within the work area set 1: Position value is beyond the work area set

Sub-index	02h	
Description	Status of work area 2	
Access	ro	
Data type	UNSIGNED 8	
Default	0h	
EEPROM	no	
Data content	Bit 7 … 3	not used
	Bit 2	0: Position value is within the work area 1: Position value is smaller than the limit set in Object 6401.2h
	Bit 1	0: Position value is within the work area 1: Position value is larger than the limit set in Object 6402.2h
	Bit 0	0: Position value is within the work area set 1: Position value is beyond the work area set

5.7.2.26 6401h: Work Area Low Limit

Each a lower limit can be set for one of the two work areas via Object 6401h.

Sub-index	00h
Description	Indicates the largest supported sub-index
Access	ro
Data type	UNSIGNED 8
Default	2h
EEPROM	no

Sub-index	01h		
Description	Lower limit of work area 1		
Access	rw		
Data type	SIGNED 32		
Default	0h		
EEPROM	yes		
Data content	Encoder type	Default	With changed APU (Object 6001h)
	Singleturn	0 … 16383	0 … ((APU*1) – 1)
	4 bit Multiturn	0 … 262143	0 … ((APU*16) – 1)
	8 bit Multiturn	0 … 4194303	0 … ((APU*256) – 1)
	12 bit Multiturn	0 … 67108863	0 … ((APU*4096) – 1)

Sub-index	02h		
Description	Lower limit of work area 2		
Access	rw		
Data type	SIGNED 32		
Default	0h		
EEPROM	yes		
Data content	Encoder type	Default	With maximum APU (Object 6001h)
	Singleturn	0 … 16383	0 … ((APU*1) – 1)
	4 bit Multiturn	0 … 262143	0 … ((APU*16) – 1)
	8 bit Multiturn	0 … 4194303	0 … ((APU*256) – 1)
	12 bit Multiturn	0 … 67108863	0 … ((APU*4096) – 1)

5.7.2.27 6402h: Work Area High Limit

Each an upper limit can be set for one of the two work areas via Object 6402h.

Sub-index	00h
Description	Indicates the largest supported sub-index
Access	ro
Data type	UNSIGNED 8
Default	2h
EEPROM	no

Sub-index	01h		
Description	Upper limit of work area 1		
Access	rw		
Data type	SIGNED 32		
Default	0h		
EEPROM	yes		
Data content	Encoder type	Default	With changed APU (Object 6001h)
	Singleturn	0 … 16383	0 … ((APU*1) – 1)
	4 bit Multiturn	0 … 262143	0 … ((APU*16) – 1)
	8 bit Multiturn	0 … 4194303	0 … ((APU*256) – 1)
	12 bit Multiturn	0 … 67108863	0 … ((APU*4096) – 1)

Sub-index	02h		
Description	Upper limit of work area 2		
Access	rw		
Data type	SIGNED 32		
Default	0h		
EEPROM	yes		
Data content	Encoder type	Default	With changed APU (Object 6001h)
	Singleturn	0 … 16383	0 … ((APU*1) – 1)
	4 bit Multiturn	0 … 262143	0 … ((APU*16) – 1)
	8 bit Multiturn	0 … 4194303	0 … ((APU*256) – 1)
	12 bit Multiturn	0 … 67108863	0 … ((APU*4096) – 1)

5.7.2.28 6500h: Operating Status

The object 6500h indicates the settings programmed with object 6000h.

Sub-index	00h	
Description	Operating Status	
Access	ro	
Data type	UNSIGNED 16	
Default	4h	
EEPROM	no	
Data content	Bit 15 … 4	not used
	Bit 3	not used
	Bit 2	0: Scaling disabled 1: Scaling enabled
	Bit 1	not used
	Bit 0	0: Clockwise (CW) sense of rotation I 1: Counter-clockwise (CCW) sense of rotation E

5.7.2.29 6501h: Singleturn resolution

Object 6501h indicates the physical number of measurement steps per revolution.

Sub-index	00h
Description	Physical resolution
Access	ro
Data type	UNSIGNED 32
Default	16384d (4000h)
EEPROM	no

5.7.2.30 6502h: Number of distinguishable revolutions

Object 6502h indicates the number of resolutions the encoder is able to sense.

Sub-index	00h	
Description	Physical resolution	
Access	ro	
Data type	UNSIGNED 16	
Default	Singleturn	1
	4 bit Multiturn	16
	8 bit Multiturn	256
	12 bit Multiturn	4096
EEPROM	no	

5.7.2.31 6503h: Alarms

Object 6503h indicates other device-specific alarm messages in addition to the errors reported via the Emergency message. In the case of an error, the associated bit is set to 1.

Sub-index	00h	
Description	Alarm messages	
Access	ro	
Data type	UNSIGNED 16	
Default	0h	
EEPROM	no	
Data content	Bit 15 ... 14	Not used
	Bit 13	0: Position value within work area 2 1: Position limit 2 exceeded or undershot (Work area 2)
	Bit 12	0: Position value within work area 1 1: Position limit 1 exceeded or undershot (Work area 1)
	Bit 11 ... 1	Not used
	Bit 0	0: Position value valid 1: position value invalid

5.7.2.32 6504h: Supported Alarms

This Object 6504h indicates the alarm messages that are supported. The relevant bits are set.

Sub-index	00h	
Description	Supported alarm messages	
Access	ro	
Data type	UNSIGNED 16	
Default	3001h	
EEPROM	no	
Data content	Bit 15 … 14	Not used
	Bit 13	Position limit 2 error
	Bit 12	Position limit 1 error
	Bit 11 … 1	Not used
	Bit 0	Position error

5.7.2.33 6505h: Warnings

The warnings displayed via Object 6505h indicate that tolerances of internal encoder parameters have been exceeded. However, unlike with alarm messages, the position value can be valid in case of a warning.

Sub-index	00h	
Description	Warnings	
Access	ro	
Data type	UNSIGNED 16	
Default	0h	
EEPROM	no	
Data content	Bit 1 … 15	Not used
	Bit 0	0: Speed ok 1: Maximum speed exceeded or limit speed set exceeded or undershot (2003h: Limit speed low and 2004h: Limit speed High)

5.7.2.34 6506h: Supported Warnings

The Object 6506h indicates the warnings that are supported.

Sub-index	00h	
Description	The Object 6506h indicates the warnings that are supported	
Access	ro	
Data type	UNSIGNED 16	
Default	0001h	
EEPROM	no	
Data content	Bit 1 … 15	Not used
	Bit 0	Speed warning

5.7.2.35 6507h: Profile and Software Version

The object 6507h indicates the encoder profile used (CANopen Device profile for encoders) and the version number of the firmware state.

Sub-index	00h			
Description	Profile and Software Version			
Access	ro			
Data type	UNSIGNED 32			
Default	01000302h			
EEPROM	no			
Data content	Profile version		Software version	
	Byte 0 (LSB)	Byte 1	Byte 2	Byte 3 (MSB)
	00h	04h	00h	01h

5.7.2.36 6508h: Operating Time

The operating hours can be indicated via object 6508h. This function is not supported.

Sub-index	00h
Description	Hourmeter
Access	ro
Data type	UNSIGNED 32
Default	FFFFFFFFh
EEPROM	no

5.7.2.37 6509h: Offset value

The Object 6509h indicates the difference between encoder value and the scaled and offset against preset and application offset position value.

Sub-index	00h
Description	Encoder state at the time of calibration
Access	ro
Data type	SIGNED 32
Default	0h
EEPROM	yes

5.7.2.38 650Ah: Module Identification

Object 650Ah Indicates the manufacturer-specific offset value as well as the smallest and largest transferable position value.

Sub-index	00h
Description	Indicates the largest supported sub-index
Access	ro
Data type	UNSIGNED 8
Default	3h
EEPROM	no

Sub-index	01h
Description	Manufacturer-specific offset value
Access	ro
Data type	SIGNED 32
Default	0h
EEPROM	no

Sub-index	02h
Description	Smallest transferable position value
Access	ro
Data type	SIGNED 32
Default	0h
EEPROM	no

Sub-index	03h		
Description	Largest transferable position value		
Access	ro		
Data type	SIGNED 32		
EEPROM	yes		
Data content	Encoder type	Default	With maximum APU (Object 6001h)
	Singleturn	16383	65534 ((65535 * 1) - 1)
	4 bit Multiturn	262143	1048559 ((65535 * 16) - 1)
	8 bit Multiturn	4194303	16776959 ((65535 * 256) - 1)
	12 bit Multiturn	67108863	268431359 ((65535 * 4096) - 1)

5.7.2.39 650Bh: Serial number

Object 650Bh provides the serial number of the encoder.

Sub-index	00h
Description	Serial number
Access	ro
Data type	UNSIGNED 32
Default	0h
EEPROM	yes

5.7.2.40 650Dh: Absolute accuracy

The object 650Dh provides the absolute accuracy of the encoder in bits.

Sub-index	00h
Description	Absolute accuracy
Access	ro
Data type	UNSIGNED 8
Default	08h
EEPROM	no

5.7.2.41 650Eh: Device functionality

Speed settings can be made via object 6031h.

Sub-index	00h	
Description	Device functionality	
Access	ro	
Data type	UNSIGNED 32	
Default	CANopen: 0002h (class2)	
EEPROM	yes	
Data content	Bit 15 ... 4	Not used
	Bit 3	0: normal resolution 1: high resolution
	Bit 2 ... 0	000: reserved 001: class C1 010: class C2 011: class C3

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