CiA Draft Standard 406

CANopen

Device Profile for Encoders

Version 3.0

17 May 2002

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History

The document has been re-chattered. In addition, all object descriptions and entry descriptions have been reviewed and edited in accordance to CiA DS-301 version 4.01. In particular, all Array objects have been reviewed. Type error corrections and other editorial changes (mostly clarifications and rewordings) are not listed in detail, only changes with technical content are recorded in the following table:

Chapter	Comment
Error behavior	Object 1029_h definitions have been added.
TPDO	The event timer of the 1st TPDO shall be hard-wired with the cyclic timer (object 6200_h). They may be used alternatively.
	The 2nd PDO is now compliant to CiA DS-301 version 4.01 meaning that this PDO shall use 1801_h PDO communication parameter set object and $1A01_h$ PDO mapping parameter set.
1st TPDO	This TPDO shall be transmitted when the device enters the Operational state.
Object 6000_h	Additional parameter definition
Object 6500_h	Additional parameter definition
Object $65C0_h$	New object: offset values for multi-sensor device

1 Scope

This document represents the CANopen device profiles for incremental and absolute, linear and rotary encoders. Besides position and velocity output possibility complete cam functionality is covered. In addition, it is possible to handle multi-sensors through one CANopen device.

All the above devices use communication techniques, which conform to those described in the CANopen Application Layer and Communication Profile specification [1]. This document should be consulted in parallel to this profile.

2 Normative references

[1] CANopen Application Layer and Communication Profile, June 2000 (CiA DS-301, V4.01)

3 Definitions, acronyms and abbreviations

CAN

Controller Area Network, data link layer protocol as specified in ISO 11898

CiA

CAN in Automation international user and manufacturer group

PDO

Process Data Object

SDO

Service Data Object

4 Operating principle

4.1 Introduction

The purpose of encoders is to detect positions of any kind of machine tools. Encoders detect positions and transmit the position values across the CANopen network. They may receive configuration information via SDO, e.g. conversion parameters for calculating an - to the application adapted - position value. In the Operational status, the position value may be transmitted by remotely requested PDO or by synchronously PDO. Additionally, the encoders may transmit asynchronously a PDO scheduled by the elapsing of the event timer.

The device profile defines two encoder classes, a standard device C1 and an extended device C2. The standard device C1 specifies basic functionality, which each device within that class shall provide. The C2 extended device provides a variety of features with mandatory and optional functions. The mandatory functions of both, C1 class and C2 class, are necessary to ensure non-manufacturer specific operations of a device.

By defining mandatory device characteristics in C1 class basic network and encoder operation is guaranteed. By defining C2 extended class a degree of defined flexibility may be built in. By leaving 'hooks' for optional and manufacturer-specific functionality, the device developer will not be constrained to an out-of-date standard.

4.2 C1 class

C1 is the mandatory class with a basic range of functions that all encoders shall support. The C1 class encoder may optionally support C2 class functions, however these functions shall be implemented according to the profile.

4.3 C2 class

C2 class encoders support all C1 class functions and extended functions defined in C2 class.

4.4 Diagnostic area

In addition to the C1 and C2 classes, there are pre-defined areas and reserved parameters for manufacturer-specific functions in this device profile.

4.5 Functional overview

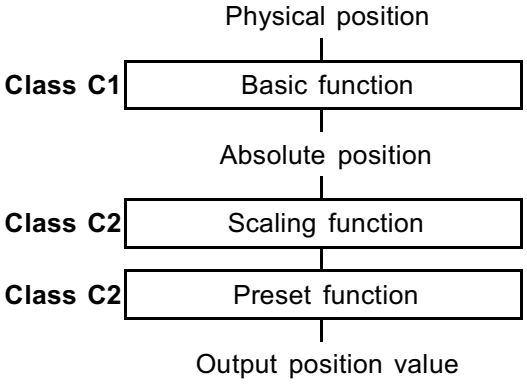


Figure 1: Class C1 and class C2 functions

5 Error handling

5.1 Principle

Emergency Messages shall be triggered by internal errors in the device and they are assigned the highest possible priority to ensure that they get access to the bus without latency. By default, the Emergency Messages shall contain the error field with pre-defined error numbers and additional information.

5.2 Error behavior

If a serious device failure is detected the module shall enter by default autonomously the pre-operational state. If object 1029_h is implemented, the device may be configured to enter alternatively the stopped state or remain in the current state in case of a device failure. Device failures shall include the following communication errors:

- Bus-off conditions of the CAN interface
- Life guarding event with the state ‘occurred’
- Heartbeat event with state ‘occurred’

Severe device errors also may be caused by device internal failures.

5.3 Additional error code meanings

Error Code	Meaning
2110_h	Input current too high
3110_h	Input voltage out of range
5100_h	Hardware memory error

6 Pre-defined communication objects

6.1 Device type (1000_h)

Contains information about the device type. The object at index 1000_h describes the type of device and its functionality. It is composed of a 16-bit field, which describes the device profile that is used (Device Profile Number 406 = 196_h) and a second 16-bit field, which gives information on the type of encoder.

Object Description

INDEX	1000_h
Name	Device_type
Object Code	VAR
Data Type	Unsigned32
Category	Mandatory

Entry Description

Access	ro
PDO Mapping	no
Value Range	Unsigned32
Default Value	no

Parameter Definitions

Device Type			
Device Profile Number		Encoder Type	
Byte 0	Byte 1	Byte 2	Byte 3
196_h		2^7 to 2^0	2^{15} to 2^8

ENCODER TYPE

Code	Definition
01	SingleTurn absolute rotary encoder
02	MultiTurn absolute rotary encoder
03	SingleTurn absolute rotary encoder with electronic turn-count
04	Incremental rotary encoder
05	Incremental rotary encoder with electronic counting
06	Incremental linear encoder
07	Incremental linear encoder with electronic counting
08	Absolute linear encoder
09	Absolute linear encoder with cyclic coding
10	Multi-Sensor encoder interface
11 ... 65,535	Currently not assigned

6.2 Error register (1001_h)

The device-specific bits in the status word are reserved for future use.

6.3 Error behavior (1029_h)

The object specifies to which state an encoder module shall be set, when a communication error or severe internal encoder error is detected.

0 = pre-operational (only if the current state is operational)

1 = no state change

2 = stopped

In addition to the specification in /1/ the following sub-indices may be implemented.

Sub-Index	2_h
Description	Internal Encoder Error
Access	rw
Entry Category	Optional
PDO Mapping	No
Value Range	0 to 2
Default Value	0h

Note: If the object 1029_h is not implemented the device shall be set into the pre-operational state in the case a communication error is detected.

6.4 Process data objects

Two PDOs to be transmitted shall be implemented in each encoder device by default. One is used for asynchronous transmission and the other one for the cyclic transmission functions.

6.4.1 1st Transmit PDO (asynchronous transmission)

This PDO transmits asynchronously the position value of the encoder. The event timer and the cyclic timer object (6200_h) are hard-wired, meaning that a SDO write access will cause changes in the event timer as well as object 6200_h. The 1st TPDO shall be transmitted when entering the Operational state.

Transmit PDO Communication Parameter

Index	Sub-Index	Comment	Default Value
1800_h	0	Largest sub-index supported	No
	1	COB-ID used by PDO	See /1/
	2	Transmission type	254
	3	Inhibit time	0
	4	reserved	See /1/
	5	Event timer	0

Transmit PDO Mapping Parameter

Index	Sub-Index	Comment	Default Value
$1A00_h$	0	Number of mapped objects	1
	1	Position value	6004 00 20_h*

* The default value for multi-sensor devices is 6020 01 20_h.

6.4.2 2nd Transmit PDO (synchronous transmission)

This PDO transmits cyclically the position value of the encoder.

Transmit PDO Communication Parameter

Index	Sub-Index	Comment	Default Value
1801_h	0	Largest sub-index supported	No
	1	COB-ID used by PDO	See /1/
	2	Transmission type	1
	3	Inhibit time	0
	4	reserved	See /1/
	5	Event timer	0

Transmit PDO Mapping Parameter

Index	Sub-Index	Comment	Default Value
$1A01_h$	0	Number of mapped objects	1
	1	Position value	6004 00 20_h*

* The default value for multi-sensor devices is 6020 01 20_h.

7 Application object definitions

7.1 Overview on application objects

Each encoder shares the dictionary entries from 6000_h to $65FF_h$. 'C1' and 'C2' stand for the C1 and C2 device classes, 'm' and 'o' stand for mandatory and optional functions respectively.

Index	Object	Name	C1	C2
Parameters				
6000_h	VAR	Operating parameters	m	m
6001_h	VAR	Measuring units per revolution	o	m
6002_h	VAR	Total measuring range in measuring units	o	m
6003_h	VAR	Preset value	o	m
6004_h	VAR	Position value	m	m
6005_h	REC	Linear encoder measuring step settings	o	m
6010_h	VAR	Preset value for multi-sensor devices	o	m
6020_h	VAR	Position value for multi-sensor devices	m	m
6030_h	ARRAY	Speed value	o	c*
6200_h	VAR	Cyclic timer	o	m
6300_h	ARRAY	Cam state register	o	o
6301_h	ARRAY	Cam enable register	o	o
6302_h	ARRAY	Cam polarity register	o	o
6310_h	ARRAY	Cam 1 low limit	o	o
6311_h	ARRAY	Cam 2 low limit	o	o
etc.				
6317_h	ARRAY	Cam 8 low limit	o	o
6320_h	ARRAY	Cam 1 high limit	o	o
6321_h	ARRAY	Cam 2 high limit	o	o
etc.				
6327_h	ARRAY	Cam 8 high limit	o	o
6330_h	ARRAY	Cam 1 hysteresis	o	o
6331_h	ARRAY	Cam 2 hysteresis	o	o
etc.				
6337_h	ARRAY	Cam 8 hysteresis	o	o
6400_h	ARRAY	Area state register	o	o
6401_h	ARRAY	Work area low limit	o	o
6402_h	ARRAY	Work area high limit	o	o

* Only mandatory for multi-sensor encoders

Diagnostics				
6500_h	VAR	Operating status	m	m
6501_h	VAR	SingleTurn resolution (rotary), Measuring step (linear)	m	m
6502_h	VAR	Number of distinguishable revolutions	m	m
6503_h	VAR	Alarms	o	c
6504_h	VAR	Supported alarms	o	m
6505_h	VAR	Warnings	o	c
6506_h	VAR	Supported warnings	o	m
6507_h	VAR	Profile and software version	o	m
6508_h	VAR	Operating time	o	m
6509_h	VAR	Offset value	o	m
$650A_h$	ARRAY	Module identification	o	m
$650B_h$	VAR	Serial number	o	m
$650C_h$	ARRAY	Offset values for multi-sensor device	o	o

7.2 Encoder parameters

7.2.1 Operating parameters (6000_h)

This object contains the functions for Code sequence, Commissioning diagnostic control and Scaling function control.

CODE SEQUENCE: The code sequence defines whether increasing or decreasing position values are output when the encoder shaft rotates clockwise or counterclockwise as seen on the shaft.

COMMISSIONING DIAGNOSTIC CONTROL: With the commissioning diagnostic function it is possible to check the encoder components responsible for position detection at encoder stand still. This enables an extensive check of the correctness of the position values.

The commissioning bit in the operating parameter initiates the commissioning diagnostic. If errors are detected it will be announced by the according alarm bits.

SCALING FUNCTION CONTROL: With the scaling function the encoder numerical value is converted in software to change the physical resolution of the encoder.

The parameters „Measuring units per revolution“ and „Total measuring range in measuring units“ are the scaling parameters. The scaling function bit is set in the operating parameters. If the scaling function bit is set to zero, the scaling function is disabled.

Object Description

INDEX	6000_h
Name	Operating_parameters
Object Code	VAR
Data Type	Unsigned16
Category	Mandatory

Entry Description

Access	rw
PDO Mapping	no
Value Range	Unsigned16
Default Value	no

Parameter definitions

Bit	Function	Bit = 0	Bit =1	C1	C2
0	Code Sequence	CW	CCW	m*	m*
1	Commissioning Diagnostic Control	Disabled	Enabled	o	o
2	Scaling function control	Disabled	Enabled	o	m
3	Measuring direction	Forward	Reward	o**	o**
4..11	Reserved for further use				
12	Manufacturer specific functions	N.A.	N.A.	o	o
13	Manufacturer specific functions	N.A.	N.A.	o	o
14	Manufacturer specific functions	N.A.	N.A.	o	o
15	Manufacturer specific functions	N.A.	N.A.	o	o

* not for linear encoders ** not for rotary encoders

7.2.2 Measuring units per revolution (6001_h)

The parameter „Measuring units per revolution“ sets the number of distinguishable steps per revolution.

Object Description

INDEX	6001_h
Name	Measuring_units_per_revolution
Object Code	VAR
Data Type	Unsigned32
Category	Optional (C2 Mandatory)

Entry Description

Access	rw
PDO Mapping	no
Value Range	Unsigned32
Default Value	no

Parameter definitions

Measuring units per revolution			
Byte 0	Byte 1	Byte 2	Byte 3
2^7 to 2^0	2^{15} to 2^8	2^{23} to 2^{16}	2^{31} to 2^{24}

7.2.3 Total measuring range in measuring units (6002_h)

The parameter „Total measuring range in measuring units“ sets the number of distinguishable steps over the total measuring range.

Object Description

INDEX	6002_h
Name	Total_measuring_range_in_measuring_units
Object Code	VAR
Data Type	Unsigned32
Category	Optional (C2 Mandatory)

Entry Description

Access	rw
PDO Mapping	no
Value Range	Unsigned32
Default Value	no

Parameter definitions

Total measuring range in measuring units			
Byte 0	Byte 1	Byte 2	Byte 3
2^7 to 2^0	2^{15} to 2^8	2^{23} to 2^{16}	2^{31} to 2^{24}

7.2.4 Preset value (6003_h)

The Preset function supports adaptation of encoder's zero point to the mechanical zero point of the system. For multi-sensor devices refer to object 6010_h.

The output position value is set to the parameter „Preset value“ and the offset from the position value is calculated and stored in the encoder.

Object Description

INDEX	6003_h
Name	Preset_value
Object Code	VAR
Data Type	Unsigned32
Category	Optional (C2 Mandatory)

Entry Description

Access	rw
PDO Mapping	no
Value Range	Unsigned32
Default Value	no

Parameter definitions

Preset value			
Byte 0	Byte 1	Byte 2	Byte 3
2^7 to 2^0	2^{15} to 2^8	2^{23} to 2^{16}	2^{31} to 2^{24}

7.2.5 Position value (6004_h)

The object 6004_h „Position value“ defines the output position value for the communication objects 1800_h and 1801_h. For multi-sensor devices refer to object 6020_h.

Object Description

INDEX	6004_h
Name	Position_value
Object Code	VAR
Data Type	Unsigned32
Category	Mandatory

Entry Description

Access	ro
PDO Mapping	Optional
Value Range	Unsigned32
Default Value	no

Parameter definitions

Position value			
Byte 0	Byte 1	Byte 2	Byte 3
2^7 to 2^0	2^{15} to 2^8	2^{23} to 2^{16}	2^{31} to 2^{24}

7.2.6 Linear encoder measuring step settings (6005_h)

The parameter „Linear encoder measuring step settings“ defines the measuring step settings for the position value(s) and the speed value(s) for linear encoders in 0.001 μm (Sub-index 1) and/or in 0.01 mm/s.

Object Description

INDEX	6005_h
Name	Linear_encoder_measuring_step_settings
Object Code	ARRAY
Data Type	Unsigned32
Category	Optional (C2 Mandatory)*

*This object is only mandatory for linear encoders (refer to object 1000_h).

Entry Description

Sub-Index	00_h
Description	Number_of_objects
Entry Category	Mandatory
Access	ro
PDO Mapping	no
Value Range	1 to 2
Default Value	no

Sub-Index	01_h
Description	Position measuring step in 0.001 μm
Entry category	Mandatory
Access	rw
PDO Mapping	no
Value Range	Unsigned32
Default Value	no

Sub-Index	02_h
Description	Speed measuring step in 0.01 mm/s
Entry Category	Optional
Access	rw
PDO Mapping	no
Value Range	Unsigned32
Default Value	no

7.2.7 Preset values for multi-sensor devices (6010_h)

The parameter „Preset values for multi-sensor devices“ is similar to object 6003_h. In sub-index 00_h the number of supported channels is defined.

The Preset function supports adaptation of the encoder's zero point to the mechanical zero point of the system.

The output position values in the sub-indices of object 6020_h are set to the sub-indices of the parameter „Preset value“ in object 6010_h, accordingly. The offset from the position value is calculated and stored in the encoder.

This object is only mandatory for multi-sensor encoders (object 1000_h encoder type: code 10).

Object Description

INDEX	6010_h
Name	Preset_value_for_multisensor_devices
Object Code	ARRAY
Data Type	Unsigned32
Category	Optional (C2 Mandatory)

Entry Description

Sub-Index	00_h
Description	Number_of_available_channels
Entry Category	Mandatory
Access	ro
PDO Mapping	no
Value Range	1 - 254
Default Value	no

Sub-Index	01_h
Description	Preset_value_channel_1
Entry Category	Mandatory
Access	rw
PDO Mapping	no
Value Range	Unsigned32
Default Value	no

Sub-Index	02_h
Description	Preset_value_channel_2
Entry Category	Optional
Access	rw
PDO Mapping	no
Value Range	Unsigned32
Default Value	no

to

Sub-Index	FE_h
Description	Preset_value_channel_254
Entry Category	Optional
Access	rw
PDO Mapping	no
Value Range	Unsigned32
Default Value	no

Parameter definitions

Preset value for multi-sensor devices			
Byte 0	Byte 1	Byte 2	Byte 3
2^7 to 2^0	2^{15} to 2^8	2^{23} to 2^{16}	2^{31} to 2^{24}

7.2.8 Position values for multi-sensor devices (6020_h)

Similar to object 6004_h the parameter „Position values for multi-sensor devices“ defines the output position value(s) for the communication objects 1800_h and 1801_h.

This object is only mandatory for multi-sensor encoders (object 1000_h encoder type: code 10).

Object Description

INDEX	6020_h
Name	Position_value_for_multisensor_devices
Object Code	ARRAY
Data Type	Unsigned8
Category	Mandatory

Entry Description

Sub-Index	00_h
Description	Number_of_available_channels
Entry Category	Mandatory
Access	ro
PDO Mapping	no
Value Range	1 - 254
Default Value	no

Sub-Index	01_h
Description	Position_value_channel_1
Entry Category	Mandatory
Access	rw
PDO Mapping	Optional
Value Range	Integer32
Default Value	no

Sub-Index	02_h
Description	Position_value_channel_2
Entry Category	Optional
Access	rw
PDO Mapping	Optional
Value Range	Integer32
Default Value	no

to

Sub-Index	FE_h
Description	Position_value_channel_254
Entry Category	Optional
Access	rw
PDO Mapping	Optional
Value Range	Integer32
Default Value	no

Parameter definitions

Position value for multi-sensor devices			
Byte 0	Byte 1	Byte 2	Byte 3
2^7 to 2^0	2^{15} to 2^8	2^{23} to 2^{16}	2^{31} to 2^{24}

7.2.9 Speed value (6030_h)

The parameter „Speed value“ defines the output speed value(s). For linear encoders the speed-measuring step is defined in object 6005_h, sub-index 02_h. For rotary encoders the speed dimension is always measuring units per second:

speed = measuring units / second

This object is only mandatory for multi-sensor encoders (object 1000_h encoder type: code 10).

Object Description

INDEX	6030_h
Name	Speed_value
Object Code	ARRAY
Data Type	Integer16
Category	Optional (C2 Mandatory)

Entry Description

Sub-Index	00_h
Description	Number_of_available_channels
Entry Category	Mandatory
Access	ro
PDO Mapping	no
Value Range	0 - 254
Default Value	no

Sub-Index	01_h
Description	Speed_value_channel_1
Entry Category	Mandatory
Access	ro
PDO Mapping	Optional
Value Range	Integer16
Default Value	no

Sub-Index	02_h
Description	Speed_value_channel_2
Entry Category	Optional
Access	ro
PDO Mapping	Optional
Value Range	Integer16
Default Value	no

to

Sub-Index	FE_h
Description	Speed_value_channel_254
Entry Category	Optional
Access	ro
PDO Mapping	Optional
Value Range	Integer16
Default Value	no

Parameter definitions

Speed value	
Byte 0	Byte 1
2^7 to 2^0	2^{15} to 2^8

7.2.10 Cyclic timer (6200_h)

Object 6200_h defines the transmission period for TPDO_1. It is hard-wired to the PDO's event timer meaning that a change in the event timer causes a change in object 6200_h and vice versa. A cyclic transmission of the position value is set, when the cyclic timer is programmed > 0. Values between 1 ms and 65,535 ms shall be selectable.

e.g.: 1 ms = 1_h

256 ms = 100_h

Object Description

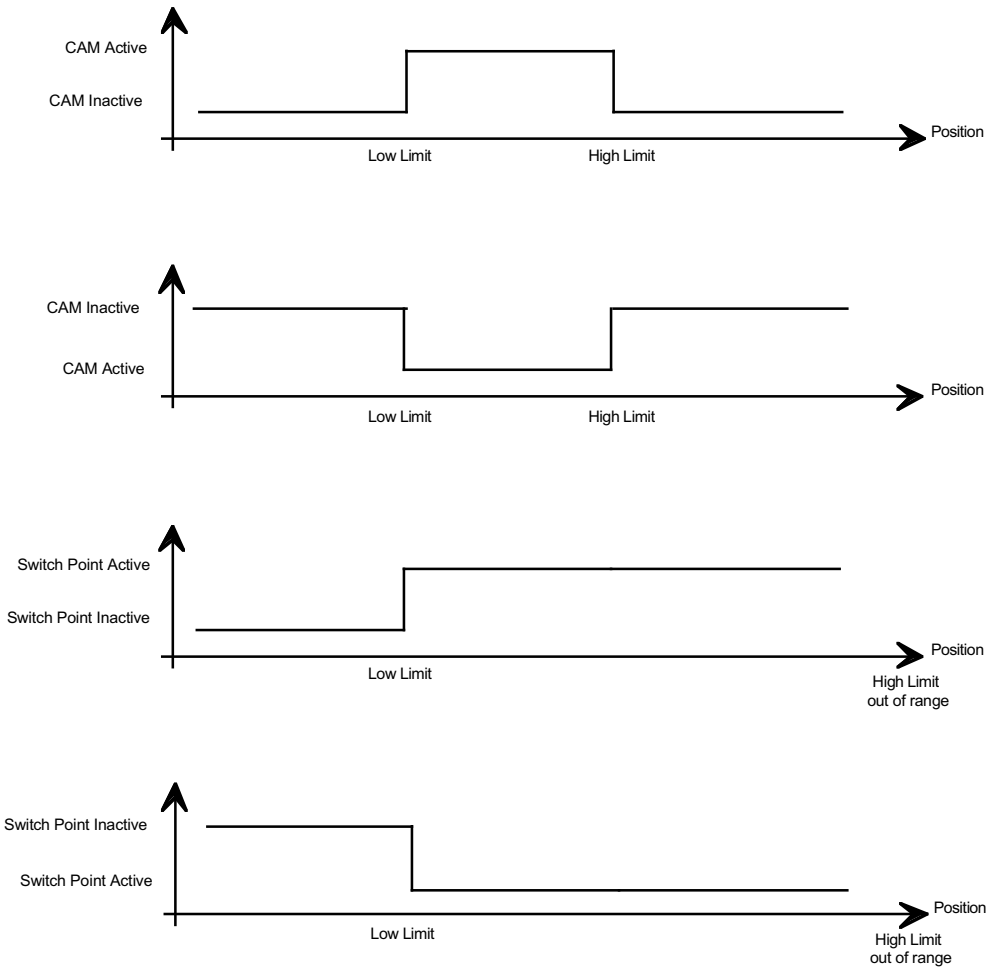
INDEX	6200_h
Name	Cyclic timer
Object Code	VAR
Data Type	Unsigned16
Category	Optional (C2 Mandatory)

Entry Description

Access	rw
PDO Mapping	no
Value Range	Unsigned16
Default Value	See event timer of 1st TPDO

7.3 Encoder Cams

Optional up to 254 cam position channels with a maximum of 8 cams each channel may be supported by encoder devices. Each cam has parameters for the minimum switch point, the maximum switch point and setting a hysteresis to the switch points.



Usage of hysteresis:

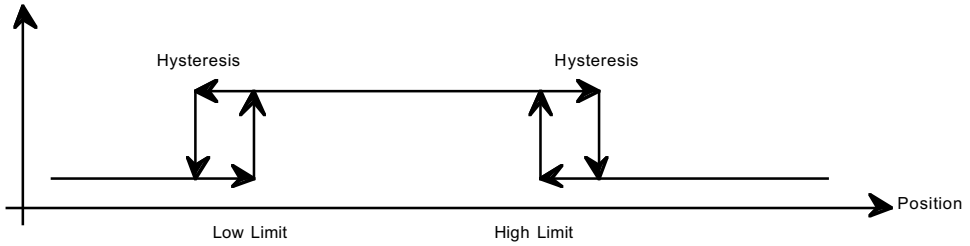


Figure 2: Possible usage of cams and switch points

7.3.1 Cam state register (6300_h)

The parameter „Cam state register“ defines the status bit of the cam in a cam channel. The status bit set to 1 defines „cam active“. The status bit set to 0 defines „cam inactive“. If the polarity bit of a cam is set (refer to index 6302_h) the actual cam state will be inverted.

Object Description

INDEX	6300_h
Name	Cam_state_register
Object Code	ARRAY
Data Type	Unsigned8
Category	Optional

Entry Description

Sub-Index	00_h
Description	Number_of_available_channels
Entry Category	Mandatory
Access	ro
PDO Mapping	no
Value Range	1 - 254
Default Value	no

Sub-Index	01_h
Description	Cam_state_channel_1
Entry Category	Mandatory
Access	ro
PDO Mapping	Optional
Value Range	Unsigned8
Default Value	no

Sub-Index	02_h
Description	Cam_state_channel_2
Entry Category	Optional
Access	ro
PDO Mapping	Optional
Value Range	Unsigned8
Default Value	no

to

Sub-Index	FE_h
Description	Cam_state_channel_254
Entry Category	Optional
Access	ro
PDO Mapping	Optional
Value Range	Unsigned8
Default Value	no

Parameter definitions

Cam state register							
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
CAM_No_8	CAM_No_7	CAM_No_6	CAM_No_5	CAM_No_4	CAM_No_3	CAM_No_2	CAM_No_1
State	State	State	State	State	State	State	State

7.3.2 Cam enable (6301_h)

Each Cam_enable_channel contains the calculation state for a maximum of 8 cams for one position channel. If the enable bit is set to 1, the cam state will be calculated by the device. In the other case the cam state of the related cam will be set permanently to 0.

Object Description

INDEX	6301_h
Name	Cam_enable
Object Code	ARRAY
Data Type	Unsigned8
Category	Optional

Entry Description

Sub-Index	00_h
Description	Number_of_available_channels
Entry Category	Mandatory
Access	ro
PDO Mapping	no
Value Range	1 - 254
Default Value	no

Sub-Index	01_h
Description	Cam_enable_channel_1
Entry Category	Mandatory
Access	rw
PDO Mapping	Optional
Value Range	Unsigned8
Default Value	0_h

Sub-Index	02_h
Description	Cam_enable_channel_2
Entry Category	Optional
Access	rw
PDO Mapping	Optional
Value Range	Unsigned8
Default Value	0_h

to

Sub-Index	FE_h
Description	Cam_enable_channel_254
Entry Category	Optional
Access	rw
PDO Mapping	Optional
Value Range	Unsigned8
Default Value	0_h

Parameter definitions

Cam Enable							
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
CAM_No_8	CAM_No_7	CAM_No_6	CAM_No_5	CAM_No_4	CAM_No_3	CAM_No_2	CAM_No_1
Enable	Enable	Enable	Enable	Enable	Enable	Enable	Enable

7.3.3 Cam polarity (6302_h)

Each Cam_polarity_channel contains the actual polarity settings for a maximum of 8 cams for one position channel. If the polarity bit is set to 1, the cam state of an active cam will signal by setting the related cam state bit to zero. In the other case the cam state of the related cam will not be inverted.

Object Description

INDEX	6302_h
Name	Cam_polarity
Object Code	ARRAY
Data Type	Unsigned8
Category	Optional

Entry Description

Sub-Index	00_h
Description	Number_of_available_channels
Entry Category	Mandatory
Access	ro
PDO Mapping	no
Value Range	1 - 254
Default Value	no

Sub-Index	01_h
Description	Cam_polarity_channel_1
Entry Category	Mandatory
Access	rw
PDO Mapping	Optional
Value Range	Unsigned8
Default Value	0_h

Sub-Index	02_h
Description	Cam_polarity_channel_2
Entry Category	Optional
Access	rw
PDO Mapping	Optional
Value Range	Unsigned8
Default Value	0_h

to

Sub-Index	FE_h
Description	Cam_polarity_channel_254
Entry Category	Optional
Access	rw
PDO Mapping	Optional
Value Range	Unsigned8
Default Value	0_h

Parameter definitions

Cam polarity							
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
CAM_No_8	CAM_No_7	CAM_No_6	CAM_No_5	CAM_No_4	CAM_No_3	CAM_No_2	CAM_No_1
Polarity	Polarity	Polarity	Polarity	Polarity	Polarity	Polarity	Polarity

7.3.4 Cam 1 low limit (6310_h)

Each Cam_low_limit_channel contains the switch point for the lower limit setting for a maximum of 8 cams for one position channel.

Object Description

INDEX	6310_h
Name	Cam1_low_limit
Object Code	ARRAY
Data Type	Integer32
Category	Optional

Entry Description

Sub-Index	00_h
Description	Number_of_available_channels
Entry Category	Mandatory
Access	ro
PDO Mapping	no
Value Range	1 - 254
Default Value	no

Sub-Index	01_h
Description	Cam1_low_limit_channel_1
Entry Category	Mandatory
Access	rw
PDO Mapping	no
Value Range	Integer32
Default Value	no

Sub-Index	02_h
Description	Cam1_low_limit_channel_2
Entry Category	Optional
Access	rw
PDO Mapping	no
Value Range	Integer32
Default Value	no

to

Sub-Index	FE_h
Description	Cam1_low_limit_channel_254
Entry Category	Optional
Access	rw
PDO Mapping	no
Value Range	Integer32
Default Value	no

Parameter definitions

Cam 1 low limit			
Byte 0	Byte 1	Byte 2	Byte 3
2^7 to 2^0	2^{15} to 2^8	2^{23} to 2^{16}	2^{31} to 2^{24}

7.3.5 Cam 2 low limit (6311_h)

Object Description

INDEX	6311_h
Name	Cam2_low_limit
Object Code	ARRAY
Data Type	Integer32
Category	Optional

Entry Description

Sub-Index	00_h
Description	Number_of_available_channels
Entry Category	Mandatory
Access	ro
PDO Mapping	no
Value Range	1 - 254
Default Value	no

Sub-Index	01_h
Description	Cam2_low_limit_channel_1
Entry Category	Mandatory
Access	rw
PDO Mapping	no
Value Range	Integer32
Default Value	no

Sub-Index	02_h
Description	Cam2_low_limit_channel_2
Entry Category	Optional
Access	rw
PDO Mapping	no
Value Range	Integer32
Default Value	no

to

Sub-Index	FE_h
Description	Cam2_low_limit_channel_254
Entry Category	Optional
Access	rw
PDO Mapping	no
Value Range	Integer32
Default Value	no

Parameter definitions

Cam 2 low limit			
Byte 0	Byte 1	Byte 2	Byte 3
2^7 to 2^0	2^{15} to 2^8	2^{23} to 2^{16}	2^{31} to 2^{24}

7.3.6 Cam 3 low limit (6312_h)

Object Description

INDEX	6312_h
Name	Cam3_low_limit
Object Code	ARRAY
Data Type	Integer32
Category	Optional

Entry Description

Sub-Index	00_h
Description	Number_of_available_channels
Entry Category	Mandatory
Access	ro
PDO Mapping	no
Value Range	1 - 254
Default Value	no

Sub-Index	01_h
Description	Cam3_low_limit_channel_1
Entry Category	Mandatory
Access	rw
PDO Mapping	no
Value Range	Integer32
Default Value	no

Sub-Index	02_h
Description	Cam3_low_limit_channel_2
Entry Category	Optional
Access	rw
PDO Mapping	no
Value Range	Integer32
Default Value	no

to

Sub-Index	FE_h
Description	Cam3_low_limit_channel_254
Entry Category	Optional
Access	rw
PDO Mapping	no
Value Range	Integer32
Default Value	no

Parameter definitions

Cam 3 low limit			
Byte 0	Byte 1	Byte 2	Byte 3
2^7 to 2^0	2^{15} to 2^8	2^{23} to 2^{16}	2^{31} to 2^{24}

7.3.7 Cam 4 low limit (6313_h)

Object Description

INDEX	6313_h
Name	Cam4_low_limit
Object Code	ARRAY
Data Type	Integer32
Category	Optional

Entry Description

Sub-Index	00_h
Description	Number_of_available_channels
Entry Category	Mandatory
Access	ro
PDO Mapping	no
Value Range	1 - 254
Default Value	no

Sub-Index	01_h
Description	Cam4_low_limit_channel_1
Entry Category	Mandatory
Access	rw
PDO Mapping	no
Value Range	Integer32
Default Value	no

Sub-Index	02_h
Description	Cam4_low_limit_channel_2
Entry Category	Optional
Access	rw
PDO Mapping	no
Value Range	Integer32
Default Value	no

to

Sub-Index	FE_h
Description	Cam4_low_limit_channel_254
Entry Category	Optional
Access	rw
PDO Mapping	no
Value Range	Integer32
Default Value	no

Parameter definitions

Cam 4 low limit			
Byte 0	Byte 1	Byte 2	Byte 3
2^7 to 2^0	2^{15} to 2^8	2^{23} to 2^{16}	2^{31} to 2^{24}

7.3.8 Cam 5 low limit (6314_h)

Object Description

INDEX	6314_h
Name	Cam5_low_limit
Object Code	ARRAY
Data Type	Integer32
Category	Optional

Entry Description

Sub-Index	00_h
Description	Number_of_available_channels
Entry Category	Mandatory
Access	ro
PDO Mapping	no
Value Range	1 - 254
Default Value	no

Sub-Index	01_h
Description	Cam5_low_limit_channel_1
Entry Category	Mandatory
Access	rw
PDO Mapping	no
Value Range	Integer32
Default Value	no

Sub-Index	02_h
Description	Cam5_low_limit_channel_2
Entry Category	Optional
Access	rw
PDO Mapping	no
Value Range	Integer32
Default Value	no

to

Sub-Index	FE_h
Description	Cam5_low_limit_channel_254
Entry Category	Optional
Access	rw
PDO Mapping	no
Value Range	Integer32
Default Value	no

Parameter definitions

Cam 5 low limit			
Byte 0	Byte 1	Byte 2	Byte 3
2^7 to 2^0	2^{15} to 2^8	2^{23} to 2^{16}	2^{31} to 2^{24}

7.3.9 Cam 6 low limit (6315_h)

Object Description

INDEX	6315h
Name	Cam6_low_limit
Object Code	ARRAY
Data Type	Integer32
Category	Optional

Entry Description

Sub-Index	00_h
Description	Number_of_available_channels
Entry Category	Mandatory
Access	ro
PDO Mapping	no
Value Range	1 - 254
Default Value	no

Sub-Index	01_h
Description	Cam6_low_limit_channel_1
Entry Category	Mandatory
Access	rw
PDO Mapping	no
Value Range	Integer32
Default Value	no

Sub-Index	02_h
Description	Cam6_low_limit_channel_2
Entry Category	Optional
Access	rw
PDO Mapping	no
Value Range	Integer32
Default Value	no

to

Sub-Index	FE_h
Description	Cam6_low_limit_channel_254
Entry Category	Optional
Access	rw
PDO Mapping	no
Value Range	Integer32
Default Value	no

Parameter definitions

Cam 6 low limit			
Byte 0	Byte 1	Byte 2	Byte 3
2^7 to 2^0	2^{15} to 2^8	2^{23} to 2^{16}	2^{31} to 2^{24}

7.3.10 Cam 7 low limit (6316_h)

Object Description

INDEX	6316_h
Name	Cam7_low_limit
Object Code	ARRAY
Data Type	Integer32
Category	Optional

Entry Description

Sub-Index	00_h
Description	Number_of_available_channels
Entry Category	Mandatory
Access	ro
PDO Mapping	no
Value Range	1 - 254
Default Value	no

Sub-Index	01_h
Description	Cam7_low_limit_channel_1
Entry Category	Mandatory
Access	rw
PDO Mapping	no
Value Range	Integer32
Default Value	no

Sub-Index	02_h
Description	Cam7_low_limit_channel_2
Entry Category	Optional
Access	rw
PDO Mapping	no
Value Range	Integer32
Default Value	no

to

Sub-Index	FE_h
Description	Cam7_low_limit_channel_254
Entry Category	Optional
Access	rw
PDO Mapping	no
Value Range	Integer32
Default Value	no

Parameter definitions

Cam 7 low limit			
Byte 0	Byte 1	Byte 2	Byte 3
2^7 to 2^0	2^{15} to 2^8	2^{23} to 2^{16}	2^{31} to 2^{24}

7.3.11 Cam 8 low limit (6317_h)

Object Description

INDEX	6317_h
Name	Cam8_low_limit
Object Code	ARRAY
Data Type	Integer32
Category	Optional

Entry Description

Sub-Index	00_h
Description	Number_of_available_channels
Entry Category	Mandatory
Access	ro
PDO Mapping	no
Value Range	1 - 254
Default Value	no

Sub-Index	01_h
Description	Cam8_low_limit_channel_1
Entry Category	Mandatory
Access	rw
PDO Mapping	no
Value Range	Integer32
Default Value	no

Sub-Index	02_h
Description	Cam8_low_limit_channel_2
Entry Category	Optional
Access	rw
PDO Mapping	no
Value Range	Integer32
Default Value	no

to

Sub-Index	FE_h
Description	Cam8_low_limit_channel_254
Entry Category	Optional
Access	rw
PDO Mapping	no
Value Range	Integer32
Default Value	no

Parameter definitions

Cam 8 low limit			
Byte 0	Byte 1	Byte 2	Byte 3
2^7 to 2^0	2^{15} to 2^8	2^{23} to 2^{16}	2^{31} to 2^{24}

7.3.12 Cam 1 high limit (6320_h)

Each Cam_high_limit_channel contains the switch point for the higher limit setting for a maximum of 8 cams for one position channel.

Object Description

INDEX	6320_h
Name	Cam1_high_limit
Object Code	ARRAY
Data Type	Integer32
Category	Optional

Entry Description

Sub-Index	00_h
Description	Number_of_available_channels
Entry Category	Mandatory
Access	ro
PDO Mapping	no
Value Range	1 - 254
Default Value	no

Sub-Index	01_h
Description	Cam1_high_limit_channel_1
Entry Category	Mandatory
Access	rw
PDO Mapping	no
Value Range	Integer32
Default Value	no

Sub-Index	02_h
Description	Cam1_high_limit_channel_2
Entry Category	Optional
Access	rw
PDO Mapping	no
Value Range	Integer32
Default Value	no

to

Sub-Index	FE_h
Description	Cam1_high_limit_channel_254
Entry Category	Optional
Access	rw
PDO Mapping	no
Value Range	Integer32
Default Value	no

Parameter definitions

Cam 1 high limit			
Byte 0	Byte 1	Byte 2	Byte 3
2^7 to 2^0	2^{15} to 2^8	2^{23} to 2^{16}	2^{31} to 2^{24}

7.3.13 Cam 2 high limit (6321_h)

Object Description

INDEX	6321_h
Name	Cam2_high_limit
Object Code	ARRAY
Data Type	Integer32
Category	Optional

Entry Description

Sub-Index	00_h
Description	Number_of_available_channels
Entry Category	Mandatory
Access	ro
PDO Mapping	no
Value Range	1 - 254
Default Value	no

Sub-Index	01_h
Description	Cam2_high_limit_channel_1
Entry Category	Mandatory
Access	rw
PDO Mapping	no
Value Range	Integer32
Default Value	no

Sub-Index	02_h
Description	Cam2_high_limit_channel_2
Entry Category	Optional
Access	rw
PDO Mapping	no
Value Range	Integer32
Default Value	no

to

Sub-Index	FE_h
Description	Cam2_high_limit_channel_254
Entry Category	Optional
Access	rw
PDO Mapping	no
Value Range	Integer32
Default Value	no

Parameter definitions

Cam 2 high limit			
Byte 0	Byte 1	Byte 2	Byte 3
2^7 to 2^0	2^{15} to 2^8	2^{23} to 2^{16}	2^{31} to 2^{24}

7.3.14 Cam 3 high limit (6322_h)

Object Description

INDEX	6322_h
Name	Cam3_high_limit
Object Code	ARRAY
Data Type	Integer32
Category	Optional

Entry Description

Sub-Index	00_h
Description	Number_of_available_channels
Entry Category	Mandatory
Access	ro
PDO Mapping	no
Value Range	1 - 254
Default Value	no

Sub-Index	01_h
Description	Cam3_high_limit_channel_1
Entry Category	Mandatory
Access	rw
PDO Mapping	no
Value Range	Integer32
Default Value	no

Sub-Index	02_h
Description	Cam3_high_limit_channel_2
Entry Category	Optional
Access	rw
PDO Mapping	no
Value Range	Integer32
Default Value	no

to

Sub-Index	FE_h
Description	Cam3_high_limit_channel_254
Entry Category	Optional
Access	rw
PDO Mapping	no
Value Range	Integer32
Default Value	no

Parameter definitions

Cam 3 high limit			
Byte 0	Byte 1	Byte 2	Byte 3
2^7 to 2^0	2^{15} to 2^8	2^{23} to 2^{16}	2^{31} to 2^{24}

7.3.15 Cam 4 high limit (6323_h)

Object Description

INDEX	6323_h
Name	Cam4_high_limit
Object Code	ARRAY
Data Type	Integer32
Category	Optional

Entry Description

Sub-Index	00_h
Description	Number_of_available_channels
Entry Category	Mandatory
Access	ro
PDO Mapping	no
Value Range	1 - 254
Default Value	no

Sub-Index	01_h
Description	Cam4_high_limit_channel_1
Entry Category	Mandatory
Access	rw
PDO Mapping	no
Value Range	Integer32
Default Value	no

Sub-Index	02_h
Description	Cam4_high_limit_channel_2
Entry Category	Optional
Access	rw
PDO Mapping	no
Value Range	Integer32
Default Value	no

to

Sub-Index	FE_h
Description	Cam4_high_limit_channel_254
Entry Category	Optional
Access	rw
PDO Mapping	no
Value Range	Integer32
Default Value	no

Parameter definitions

Cam 4 high limit			
Byte 0	Byte 1	Byte 2	Byte 3
2^7 to 2^0	2^{15} to 2^8	2^{23} to 2^{16}	2^{31} to 2^{24}

7.3.16 Cam 5 high limit (6324_h)

Object Description

INDEX	6324_h
Name	Cam5_high_limit
Object Code	ARRAY
Data Type	Integer32
Category	Optional

Entry Description

Sub-Index	00_h
Description	Number_of_available_channels
Entry Category	Mandatory
Access	ro
PDO Mapping	no
Value Range	1 - 254
Default Value	no

Sub-Index	01_h
Description	Cam5_high_limit_channel_1
Entry Category	Mandatory
Access	rw
PDO Mapping	no
Value Range	Integer32
Default Value	no

Sub-Index	02_h
Description	Cam5_high_limit_channel_2
Entry Category	Optional
Access	rw
PDO Mapping	no
Value Range	Integer32
Default Value	no

to

Sub-Index	FE_h
Description	Cam5_high_limit_channel_254
Entry Category	Optional
Access	rw
PDO Mapping	no
Value Range	Integer32
Default Value	no

Parameter definitions

Cam 5 high limit			
Byte 0	Byte 1	Byte 2	Byte 3
2^7 to 2^0	2^{15} to 2^8	2^{23} to 2^{16}	2^{31} to 2^{24}

7.3.17 Cam 6 high limit (6325_h)

Object Description

INDEX	6325_h
Name	Cam6_high_limit
Object Code	ARRAY
Data Type	Integer32
Category	Optional

Entry Description

Sub-Index	00_h
Description	Number_of_available_channels
Entry Category	Mandatory
Access	ro
PDO Mapping	no
Value Range	1 - 254
Default Value	no

Sub-Index	01_h
Description	Cam6_high_limit_channel_1
Entry Category	Mandatory
Access	rw
PDO Mapping	no
Value Range	Integer32
Default Value	no

Sub-Index	02_h
Description	Cam6_high_limit_channel_2
Entry Category	Optional
Access	rw
PDO Mapping	no
Value Range	Integer32
Default Value	no

to

Sub-Index	FE_h
Description	Cam6_high_limit_channel_254
Entry Category	Optional
Access	rw
PDO Mapping	no
Value Range	Integer32
Default Value	no

Parameter definitions

Cam 6 high limit			
Byte 0	Byte 1	Byte 2	Byte 3
2^7 to 2^0	2^{15} to 2^8	2^{23} to 2^{16}	2^{31} to 2^{24}

7.3.18 Cam 7 high limit (6326_h)

Object Description

INDEX	6326_h
Name	Cam7_high_limit
Object Code	ARRAY
Data Type	Integer32
Category	Optional

Entry Description

Sub-Index	00_h
Description	Number_of_available_channels
Entry Category	Mandatory
Access	ro
PDO Mapping	no
Value Range	1 - 254
Default Value	no

Sub-Index	01_h
Description	Cam7_high_limit_channel_1
Entry Category	Mandatory
Access	rw
PDO Mapping	no
Value Range	Integer32
Default Value	no

Sub-Index	02_h
Description	Cam7_high_limit_channel_2
Entry Category	Optional
Access	rw
PDO Mapping	no
Value Range	Integer32
Default Value	no

to

Sub-Index	FE_h
Description	Cam7_high_limit_channel_254
Entry Category	Optional
Access	rw
PDO Mapping	no
Value Range	Integer32
Default Value	no

Parameter definitions

Cam 7 high limit			
Byte 0	Byte 1	Byte 2	Byte 3
2^7 to 2^0	2^{15} to 2^8	2^{23} to 2^{16}	2^{31} to 2^{24}

7.3.19 Cam 8 high limit (6327_h)

Object Description

INDEX	6327_h
Name	Cam8_high_limit
Object Code	ARRAY
Data Type	Integer32
Category	Optional

Entry Description

Sub-Index	00_h
Description	Number_of_available_channels
Entry Category	Mandatory
Access	ro
PDO Mapping	no
Value Range	1 - 254
Default Value	no

Sub-Index	01_h
Description	Cam8_high_limit_channel_1
Entry Category	Mandatory
Access	rw
PDO Mapping	no
Value Range	Integer32
Default Value	no

Sub-Index	02_h
Description	Cam8_high_limit_channel_2
Entry Category	Optional
Access	rw
PDO Mapping	no
Value Range	Integer32
Default Value	no

to

Sub-Index	FE_h
Description	Cam8_high_limit_channel_255
Entry Category	Optional
Access	rw
PDO Mapping	no
Value Range	Integer32
Default Value	no

Parameter definitions

Cam 8 high limit			
Byte 0	Byte 1	Byte 2	Byte 3
2^7 to 2^0	2^{15} to 2^8	2^{23} to 2^{16}	2^{31} to 2^{24}

7.3.20 Cam 1 hysteresis (6330_h)

Each Cam_hysteresis_channel contains the delay setting of switch points for a maximum of 8 cams for one position channel. For illustration of the hysteresis functionality refer to Figure 2.

Object Description

INDEX	6330_h
Name	Cam1_hysteresis
Object Code	ARRAY
Data Type	Unsigned16
Category	Optional

Entry Description

Sub-Index	00_h
Description	Number_of_available_channels
Entry Category	Mandatory
Access	ro
PDO Mapping	no
Value Range	1 - 254
Default Value	no

Sub-Index	01_h
Description	Cam1_hysteresis_channel_1
Entry Category	Mandatory
Access	rw
PDO Mapping	no
Value Range	Unsigned16
Default Value	no

Sub-Index	02_h
Description	Cam1_hysteresis_channel_2
Entry Category	Optional
Access	rw
PDO Mapping	no
Value Range	Unsigned16
Default Value	no

to

Sub-Index	FE_h
Description	Cam1_hysteresis_channel_254
Entry Category	Optional
Access	rw
PDO Mapping	no
Value Range	Unsigned16
Default Value	no

Parameter definitions

Cam 1 hysteresis	
Byte 0	Byte 1
2^7 to 2^0	2^{15} to 2^8

7.3.21 Cam 2 hysteresis (6331_h)

Object Description

INDEX	6331_h
Name	Cam2_hysteresis
Object Code	ARRAY
Data Type	Unsigned16
Category	Optional

Entry Description

Sub-Index	00_h
Description	Number_of_available_channels
Entry Category	Mandatory
Access	ro
PDO Mapping	no
Value Range	1 - 254
Default Value	no

Sub-Index	01_h
Description	Cam2_hysteresis_channel_1
Entry Category	Mandatory
Access	rw
PDO Mapping	no
Value Range	Unsigned16
Default Value	no

Sub-Index	02_h
Description	Cam2_hysteresis_channel_2
Entry Category	Optional
Access	rw
PDO Mapping	no
Value Range	Unsigned16
Default Value	no

to

Sub-Index	FE_h
Description	Cam2_hysteresis_channel_254
Entry Category	Optional
Access	rw
PDO Mapping	no
Value Range	Unsigned16
Default Value	no

Parameter definitions

Cam 2 hysteresis	
Byte 0	Byte 1
2^7 to 2^0	2^{15} to 2^8

7.3.22 Cam 3 hysteresis (6332_h)

Object Description

INDEX	6332_h
Name	Cam3_hysteresis
Object Code	ARRAY
Data Type	Unsigned16
Category	Optional

Entry Description

Sub-Index	00_h
Description	Number_of_available_channels
Entry Category	Mandatory
Access	ro
PDO Mapping	no
Value Range	1 - 254
Default Value	no

Sub-Index	01_h
Description	Cam3_hysteresis_channel_1
Entry Category	Mandatory
Access	rw
PDO Mapping	no
Value Range	Unsigned16
Default Value	no

Sub-Index	02_h
Description	Cam3_hysteresis_channel_2
Entry Category	Optional
Access	rw
PDO Mapping	no
Value Range	Unsigned16
Default Value	no

to

Sub-Index	FE_h
Description	Cam3_hysteresis_channel_254
Entry Category	Optional
Access	rw
PDO Mapping	no
Value Range	Unsigned16
Default Value	no

Parameter definitions

Cam 3 hysteresis	
Byte 0	Byte 1
2^7 to 2^0	2^{15} to 2^8

7.3.23 Cam 4 hysteresis (6333_h)

Object Description

INDEX	6333_h
Name	Cam4_hysteresis
Object Code	ARRAY
Data Type	Unsigned16
Category	Optional

Entry Description

Sub-Index	00_h
Description	Number_of_available_channels
Entry Category	Mandatory
Access	ro
PDO Mapping	no
Value Range	1 - 254
Default Value	no

Sub-Index	01_h
Description	Cam4_hysteresis_channel_1
Entry Category	Mandatory
Access	rw
PDO Mapping	no
Value Range	Unsigned16
Default Value	no

Sub-Index	02_h
Description	Cam4_hysteresis_channel_2
Entry Category	Optional
Access	rw
PDO Mapping	no
Value Range	Unsigned16
Default Value	no

to

Sub-Index	FE_h
Description	Cam4_hysteresis_channel_254
Entry Category	Optional
Access	rw
PDO Mapping	no
Value Range	Unsigned16
Default Value	no

Parameter definitions

Cam 4 hysteresis	
Byte 0	Byte 1
2^7 to 2^0	2^{15} to 2^8

7.3.24 Cam 5 hysteresis (6334_h)

Object Description

INDEX	6334_h
Name	Cam5_hysteresis
Object Code	ARRAY
Data Type	Unsigned16
Category	Optional

Entry Description

Sub-Index	00_h
Description	Number_of_available_channels
Entry Category	Mandatory
Access	ro
PDO Mapping	no
Value Range	1 - 254
Default Value	no

Sub-Index	01_h
Description	Cam5_hysteresis_channel_1
Entry Category	Mandatory
Access	rw
PDO Mapping	no
Value Range	Unsigned16
Default Value	no

Sub-Index	02_h
Description	Cam5_hysteresis_channel_2
Entry Category	Optional
Access	rw
PDO Mapping	no
Value Range	Unsigned16
Default Value	no

to

Sub-Index	FE_h
Description	Cam5_hysteresis_channel_254
Entry Category	Optional
Access	rw
PDO Mapping	no
Value Range	Unsigned16
Default Value	no

Parameter definitions

Cam 5 hysteresis	
Byte 0	Byte 1
2^7 to 2^0	2^{15} to 2^8

7.3.25 Cam 6 hysteresis (6335_h)

Object Description

INDEX	6335_h
Name	Cam6_hysteresis
Object Code	ARRAY
Data Type	Unsigned16
Category	Optional

Entry Description

Sub-Index	00_h
Description	Number_of_available_channels
Entry Category	Mandatory
Access	ro
PDO Mapping	no
Value Range	1 - 254
Default Value	no

Sub-Index	01_h
Description	Cam6_hysteresis_channel_1
Entry Category	Mandatory
Access	rw
PDO Mapping	no
Value Range	Unsigned16
Default Value	no

Sub-Index	02_h
Description	Cam6_hysteresis_channel_2
Entry Category	Optional
Access	rw
PDO Mapping	no
Value Range	Unsigned16
Default Value	no

to

Sub-Index	FE_h
Description	Cam6_hysteresis_channel_254
Entry Category	Optional
Access	rw
PDO Mapping	no
Value Range	Unsigned16
Default Value	no

Parameter definitions

Cam 6 hysteresis	
Byte 0	Byte 1
2^7 to 2^0	2^{15} to 2^8

7.3.26 Cam 7 hysteresis (6336_h)

Object Description

INDEX	6336_h
Name	Cam7_hysteresis
Object Code	ARRAY
Data Type	Unsigned16
Category	Optional

Entry Description

Sub-Index	00_h
Description	Number_of_available_channels
Entry Category	Mandatory
Access	ro
PDO Mapping	no
Value Range	1 - 254
Default Value	no

Sub-Index	01_h
Description	Cam7_hysteresis_channel_1
Entry Category	Mandatory
Access	rw
PDO Mapping	no
Value Range	Unsigned16
Default Value	no

Sub-Index	02_h
Description	Cam7_hysteresis_channel_2
Entry Category	Optional
Access	rw
PDO Mapping	no
Value Range	Unsigned16
Default Value	no

to

Sub-Index	FE_h
Description	Cam7_hysteresis_channel_254
Entry Category	Optional
Access	rw
PDO Mapping	no
Value Range	Unsigned16
Default Value	no

Parameter definitions

Cam 7 hysteresis	
Byte 0	Byte 1
2^7 to 2^0	2^{15} to 2^8

7.3.27 Cam 8 hysteresis (6337_h)

Object Description

INDEX	6337_h
Name	Cam8_hysteresis
Object Code	ARRAY
Data Type	Unsigned16
Category	Optional

Entry Description

Sub-Index	00_h
Description	Number_of_available_channels
Entry Category	Mandatory
Access	ro
PDO Mapping	no
Value Range	1 - 254
Default Value	no

Sub-Index	01_h
Description	Cam8_hysteresis_channel_1
Entry Category	Mandatory
Access	rw
PDO Mapping	no
Value Range	Unsigned16
Default Value	no

Sub-Index	02_h
Description	Cam8_hysteresis_channel_2
Entry Category	Optional
Access	rw
PDO Mapping	no
Value Range	Unsigned16
Default Value	no

to

Sub-Index	FE_h
Description	Cam8_hysteresis_channel_254
Entry Category	Optional
Access	rw
PDO Mapping	no
Value Range	Unsigned16
Default Value	no

Parameter definitions

Cam 8 hysteresis	
Byte 0	Byte 1
2^7 to 2^0	2^{15} to 2^8

7.4 Work area supervision

It is possible for encoders to define a so-called user defined working area. The actual work area information with work area low limit and work area high limit may be stored in objects 6401_h and 6402_h, respectively. This way object 6400_h may also be used as software limit switches.

7.4.1 Area state register (6400_h)

The object „area state register“ contains the actual area status of the encoder position. If the position is out of range, a bit will be set in the related position line. If the position is lower than the position value set in object 6401_h „work area low limit“ then bit 2 flags the underflow. If the position is higher than the position value set in object 6402_h „work area high limit“ then bit 1 flags the overflow. If the manufacturer minimum position value or the manufacturer maximum position value (refer to object $650A_h$ „Module identification“) is reached, bit 0 flags „out of range“.

Object Description

INDEX	6400_h
Name	Area_state_register
Object Code	ARRAY
Data Type	Unsigned8
Category	Optional

Entry Description

Sub-Index	00_h
Description	Number_of_available_channels
Entry Category	Mandatory
Access	ro
PDO Mapping	no
Value Range	1 - 254
Default Value	no

Sub-Index	01_h
Description	Work_area_state_channel_1
Entry Category	Mandatory
Access	ro
PDO Mapping	Optional
Value Range	Unsigned8
Default Value	no

Sub-Index	02_h
Description	Work_area_state_channel_2
Entry Category	Optional
Access	ro
PDO Mapping	Optional
Value Range	Unsigned8
Default Value	no

to

Sub-Index	FE_h
Description	Work_area_state_channel_254
Entry Category	Optional
Access	ro
PDO Mapping	Optional
Value Range	Unsigned8
Default Value	no

Parameter definitions

Work_area_state							
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
reserved	reserved	reserved	reserved	reserved	range underflow	range overflow	out of range

7.4.2 Work area low limit (6401_h)

The object „work area low limit“ contains the position value, at which bit 2 of the according work_area_state_channel in object 6400_h flags the underflow of the related work area.

Object Description

INDEX	6401_h
Name	Work_area_low_limit
Object Code	ARRAY
Data Type	Integer32
Category	Optional

Entry Description

Sub-Index	00_h
Description	Number_of_available_channels
Entry Category	Mandatory
Access	ro
PDO Mapping	no
Value Range	1 - 254
Default Value	no

Sub-Index	01_h
Description	Work_area_low_limit_channel_1
Entry Category	Mandatory
Access	rw
PDO Mapping	no
Value Range	Integer32
Default Value	no

Sub-Index	02_h
Description	Work_area_low_limit_channel_2
Entry Category	Optional
Access	rw
PDO Mapping	no
Value Range	Integer32
Default Value	no

to

Sub-Index	FE_h
Description	Work_area_low_limit_channel_254
Entry Category	Optional
Access	rw
PDO Mapping	no
Value Range	Integer32
Default Value	no

Parameter definitions

Work area low limit			
Byte 0	Byte 1	Byte 2	Byte 3
2^7 to 2^0	2^{15} to 2^8	2^{23} to 2^{16}	2^{31} to 2^{24}

7.4.3 Work area high limit (6402_h)

The object „work area high limit“ contains the position value, at which bit 1 of the according work_area_state_channel in object 6400_h flags the overflow of the related work area.

Object Description

INDEX	6402_h
Name	Work_area_high_limit
Object Code	ARRAY
Data Type	Integer32
Category	Optional

Entry Description

Sub-Index	00_h
Description	Number_of_available_channels
Entry Category	Mandatory
Access	ro
PDO Mapping	no
Value Range	1 - 254
Default Value	no

Sub-Index	01_h
Entry Category	Work_area_high_limit_channel_1
Entry Category	Mandatory
Access	rw
PDO Mapping	no
Value Range	Integer32
Default Value	no

Sub-Index	02_h
Description	Work_area_high_limit_channel_2
Entry Category	Optional
Access	rw
PDO Mapping	no
Value Range	Integer32
Default Value	no

to

Sub-Index	FE_h
Description	Work_area_high_limit_channel_254
Entry Category	Optional
Access	rw
PDO Mapping	no
Value Range	Integer32
Default Value	no

Parameter definitions

Work area high limit			
Byte 0	Byte 1	Byte 2	Byte 3
2^7 to 2^0	2^{15} to 2^8	2^{23} to 2^{16}	2^{31} to 2^{24}

7.5 Encoder diagnostics

All encoder diagnostics are read from securely stored parameters.

7.5.1 Operating status (6500_h)

This object contains the operating status of the encoder. It gives information on encoder internal programmed parameters.

Object Description

INDEX	6500_h
Name	Operating Status
Object Code	VAR
Data Type	Unsigned16
Category	Mandatory

Entry Description

Access	ro
PDO Mapping	no
Value Range	Unsigned16
Default Value	no

Parameter definitions

Bit	Function	Bit = 0	Bit =1	C1	C2
0	Code Sequence	CW	CCW	m*	m*
1	Commissioning Diagnostic Control	Not Supp.	Supp.	o	o
2	Scaling function control	Disable	Enable	o	m
3	Measuring direction	Forward	Reward	o**	o**
4..11	Reserved for further use				
12	Manufacturer specific functions	N.A.	N.A.	o	o
13	Manufacturer specific functions	N.A.	N.A.	o	o
14	Manufacturer specific functions	N.A.	N.A.	o	o
15	Manufacturer specific functions	N.A.	N.A.	o	o

* not for linear encoders

** not for rotary encoders

7.5.2 SingleTurn resolution and Measuring step (6501_h)

The object 6501_h has different contents depending on the encoder type.

7.5.2.1 Rotary or angle encoders

For rotary or angle encoders object 6501_h gives the number of measuring steps per revolution that are output for the absolute single-turn position value. The maximum single-turn resolution is 2^{32}.

Object Description

INDEX	6501_h
Name	SingleTurn_resolution
Object Code	VAR
Data Type	Unsigned32
Category	Mandatory

Entry Description

Access	ro
PDO Mapping	no
Value Range	Unsigned32
Default Value	no

Parameter definitions

SingleTurn resolution			
Byte 0	Byte 1	Byte 2	Byte 3
2^7 to 2^0	2^{15} to 2^8	2^{23} to 2^{16}	2^{31} to 2^{24}

7.5.2.2 Linear encoders

For linear encoders object 6501_h indicates the measuring step that is output by the encoder. The measuring step is given in nm (0.001μm).

e.g.: 1 μm = 00 00 03 $E8_h$

Object Description

INDEX	6501_h
Name	Measuring_step
Object Code	VAR
Data Type	Unsigned32
Category	Mandatory

Entry Description

Access	ro
PDO Mapping	no
Value Range	Unsigned32
Default Value	no

Parameter definitions

Measuring step			
Byte 0	Byte 1	Byte 2	Byte 3
2^7 to 2^0	2^{15} to 2^8	2^{23} to 2^{16}	2^{31} to 2^{24}

7.5.3 Number of distinguishable revolutions (6502_h)

This object contains the number of distinguishable revolutions that the encoder may output. For a MultiTurn encoder the number of distinguishable revolutions and the SingleTurn resolution gives the measuring range according to the formula below. The maximum number of distinguishable revolutions is 65,536 (16 bit).

Measuring range = Number of distinguishable revolutions x ·SingleTurn resolution

Object Description

INDEX	6502_h
Name	Number_of_distinguishable_revolutions
Object Code	VAR
Data Type	Unsigned16
Category	Mandatory

Entry Description

Access	ro
PDO Mapping	no
Value Range	Unsigned16
Default Value	no

7.5.4 Alarms (6503_h)

Additionally to the Emergency messages /1/, object 6503_h provides further alarm messages. An alarm is set if a malfunction in the encoder could lead to incorrect position value. If an alarm occurs, the according bit is set to logical high until the alarm is cleared and the encoder is able to provide an accurate position value.

Object Description

INDEX	6503_h
Name	Alarms
Object Code	VAR
Data Type	Unsigned16
Category	Conditional for C2, if alarms are supported (see 6504_h)

Entry Description

Access	ro
PDO Mapping	Optional
Value Range	Unsigned16
Default Value	no

Parameter definitions

Bit	Function	Bit = 0	Bit =1	C1	C2
0	Position error	No	Yes	o	o
1	Commissioning diagnostics	OK	Error	o	o
2	Reserved for further use				
3	Reserved for further use				
4	Reserved for further use				
5	Reserved for further use				
6	Reserved for further use				
7	Reserved for further use				
8	Reserved for further use				
9	Reserved for further use				
10	Reserved for further use				
11	Reserved for further use				
12	Manufacturer-specific function	N.A.	N.A.	o	o
13	Manufacturer-specific function	N.A.	N.A.	o	o
14	Manufacturer-specific function	N.A.	N.A.	o	o
15	Manufacturer-specific function	N.A.	N.A.	o	o

7.5.5 Supported alarms (6504_h)

Object 6504_h contains the information on supported alarms by the encoder.

Object Description

INDEX	6504_h
Name	Supported_alarms
Object Code	VAR
Data Type	Unsigned16
Category	Mandatory for C2 class encoders

Entry Description

Access	ro
PDO Mapping	no
Value Range	Unsigned16
Default Value	no

Parameter definitions

Bit	Function	Bit = 0	Bit =1
0	Position error	No	Yes
1	Commissioning diagnostics	No	Yes
2	Reserved for further use		
3	Reserved for further use		
4	Reserved for further use		
5	Reserved for further use		
6	Reserved for further use		
7	Reserved for further use		
8	Reserved for further use		
9	Reserved for further use		
10	Reserved for further use		
11	Reserved for further use		
12	Manufacturer specific functions	N.A.	N.A.
13	Manufacturer specific functions	N.A.	N.A.
14	Manufacturer specific functions	N.A.	N.A.
15	Manufacturer specific functions	N.A.	N.A.

7.5.6 Warnings (6505_h)

Warnings indicate that tolerance for certain internal parameters of the encoder have been exceeded. In contrast to alarm and emergency messages warnings do not imply incorrect position values. All warnings are cleared if the tolerances are again within normal parameters. For the operating time limit warning (bit 3) the warning is only set again after a power-on sequence.

Object Description

INDEX	6505_h
Name	Warnings
Object Code	VAR
Data Type	Unsigned16
Category	Conditional for C2, if warnings are supported (see 6506_h)

Entry Description

Access	ro
PDO Mapping	Optional
Value Range	Unsigned16
Default Value	no

Parameter definitions

Bit	Function	Bit = 0	Bit =1	C1	C2
0	Frequency exceeded	No	Yes	o	o
1	Light control reserve	Not reached	Error	o	o
2	CPU watchdog status	OK	Reset generated	o	o
3	Operating time limit warning	No	Yes	o	o
4	Battery charge	OK	Too low	o	o
5	Reference point	Reached	Not reached	o	o
6	Reserved for further use				
7	Reserved for further use				
8	Reserved for further use				
9	Reserved for further use				
10	Reserved for further use				
11	Reserved for further use				
12	Manufacturer specific functions	N.A.	N.A.	o	o
13	Manufacturer specific functions	N.A.	N.A.	o	o
14	Manufacturer specific functions	N.A.	N.A.	o	o
15	Manufacturer specific functions	N.A.	N.A.	o	o

7.5.7 Supported warnings (6506_h)

Object 6506_h contains the information on supported warnings by the encoder.

Object Description

INDEX	6506_h
Name	Supported_warnings
Object Code	VAR
Data Type	Unsigned16
Category	Mandatory for C2 class encoders

Entry Description

Access	ro
PDO Mapping	no
Value Range	Unsigned16
Default Value	no

Parameter definitions

Bit	Function	Bit = 0	Bit =1
0	Frequency exceeded	Not supp.	Supported
1	Light control reserve	Not supp.	Supported
2	CPU watchdog status	Not supp.	Supported
3	Operating time limit warning	Not supp.	Supported
4	Battery charge	Not supp.	Supported
5	Reference point	Not supp.	Supported
6	Reserved for further use		
7	Reserved for further use		
8	Reserved for further use		
9	Reserved for further use		
10	Reserved for further use		
11	Reserved for further use		
12	Manufacturer specific functions	N.A.	N.A.
13	Manufacturer specific functions	N.A.	N.A.
14	Manufacturer specific functions	N.A.	N.A.
15	Manufacturer specific functions	N.A.	N.A.

7.5.8 Profile and software version (6507_h)

This object contains in the 1st 16-bits the profile version, which is implemented in the encoder. It is combined to a revision number and an index.

e.g.: Profile version: 2.1

Binary code: 00000010 00000001

Hexadecimal: 2_h 1_h

The 2nd 16-bits contain the software version, which is implemented in the encoder. It is combined to a revision number and an index.

e.g.: Software version: 1.40

Binary code: 00000001 01000000

Hexadecimal: 1_h 40_h

Object Description

INDEX	6507_h
Name	Profile_and_software_version
Object Code	VAR
Data Type	Unsigned32
Category	Optional (C2 Mandatory)

Entry Description

Access	ro
PDO Mapping	no
Value Range	Unsigned32
Default Value	no

Parameter definitions

Profile version		Software version	
Byte 0	Byte 1	Byte 2	Byte 3
2^7 to 2^0	2^{15} to 2^8	2^7 to 2^0	2^{15} to 2^8

7.5.9 Operating time (6508_h)

Object 6508_h contains the parameter operating time. The operating time monitor stores the operating time for the encoder in operating hours. The operating time is stored in the encoder non-volatile memory as long as the encoder is power supplied. The operating time value is presented in 0.1 hours as an unsigned 32 binary value.

If the operating time function is not used the operating time value is set to the maximum value (FF FF FF FF $_h$) by the encoder manufacturer.

Object Description

INDEX	6508_h
Name	Operating time
Object Code	VAR
Data Type	Unsigned32
Category	Optional (C2 Mandatory)

Entry Description

Access	ro
PDO Mapping	no
Value Range	Unsigned32
Default Value	no

7.5.10 Offset value (6509_h)

Object 6509_h contains the parameter-offset value. The offset value is calculated by the preset function and shifts the position value with the calculated value. The offset value is stored and may be read from the encoder.

Object Description

INDEX	6509_h
Name	Offset_value
Object Code	VAR
Data Type	Integer32
Category	Optional (C2 Mandatory)

Entry Description

Access	ro
PDO Mapping	no
Value Range	Integer32
Default Value	no

7.5.11 Module identification ($650A_h$)

Object $650A_h$ contains manufacturer-specific offset value, manufacturer-specific minimum position value, and maximum position value.

In sub-index 01_h, the offset value is stored. This value gives information on the shift of the zero point in the number of positions from the physical zero point of the encoder disk.

In sub-index 02_h and 03_h the minimum and maximum position value is stored, respectively.

All three values are given in number of steps according to the basic resolution of the encoder and are located in write protected memory area only changeable by the encoder manufacturer.

Object Description

INDEX	$650A_h$
Name	Module_identification
Object Code	ARRAY
Data Type	Integer32
Category	Optional (C2 Mandatory)

Entry Description

Sub-Index	00_h
Description	number_of_entries
Entry Category	Mandatory
Access	ro
PDO Mapping	no
Value Range	1 - 3
Default Value	no

Sub-Index	01_h
Description	manufacturer_offset_value
Entry Category	Mandatory
Access	ro
PDO Mapping	no
Value Range	Integer32
Default Value	0_h

Sub-Index	02_h
Description	manufacturer_min_position_value
Entry Category	Optional
Access	ro
PDO Mapping	no
Value Range	Integer32
Default Value	no

Sub-Index	03_h
Description	manufacturer_max_position_value
Entry Category	Optional
Access	ro
PDO Mapping	no
Value Range	Integer32
Default Value	no

7.5.12 Serial number ($650B_h$)

Object $650B_h$ contains the encoder serial number. This object is hard-wired to object 1018h (sub-index 4h). If the parameter serial number is not used the value is set to maximum value FF FF FF FF_h by the encoder manufacturer and object 1018h 4h shall not be implemented.

Object Description

INDEX	$650B_h$
Name	Serial_number
Object Code	VAR
Data Type	Unsigned32
Category	Optional (C2 Mandatory)

Entry Description

Access	ro
PDO Mapping	no
Value Range	Unsigned32
Default Value	no

7.5.13 Offset values for multi-sensor devices ($650C_h$)

This object is similar to object 6509_h. The offset value is calculated by the preset function in object 6010_h and shifts the position value with calculated value. The offset value is stored and can be read from the encoder for diagnostics. This object is only optional for multi-sensor encoders (encoder type code 10 in object 1000_h)

Object Description

INDEX	$650C_h$
Name	Offset_value_for_multi-sensor_device
Object Code	ARRAY
Data Type	Integer32
Category	Optional

Entry Description

Sub-Index	00_h
Description	number_of_available_channels
Entry Category	Mandatory
Access	ro
PDO Mapping	no
Value Range	1 - 254
Default Value	no

Sub-Index	01_h
Description	Offset_value_channel_1
Entry Category	Mandatory
Access	ro
PDO Mapping	no
Value Range	Integer32
Default Value	0_h

Sub-Index	02_h
Description	Offset_value_channel_2
Entry Category	Optional
Access	ro
PDO Mapping	no
Value Range	Integer32
Default Value	0_h

to

Sub-Index	FE_h
Description	Offset_value_channel_254
Entry Category	Optional
Access	ro
PDO Mapping	no
Value Range	Integer32
Default Value	0_h

7.6 Other objects

Objects $650C_h$ to $65FF_h$ are reserved for further use.

7.7 General device profile objects

7.7.1 Device type ($67FF_h$)

This object shall describe the first virtual device in a multiple device module according to /1/.