

## ITB-DC-CANopen

**Device:** ITB-DC

**Protocol:** CANopen

**Protocol Version:** 1

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<a href="https://svn.rnd.motortech.local/development/projects/P921350/trunk/900-Software/930-Design">//svn.rnd.motortech.local/development/projects/P921350/trunk/900-Software/930-Design</a>			
Date	2025-11-25 12:02	Status	Approved

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# 1 Introduction

## 1.1 Purpose of the Document

This document lists the communication objects of the ITB-DC's CANopen object dictionary.

This manual repeats certain CiA standards and includes MOTORTECH GmbH-specific information. It explains how to implement CiA 301 communication with ITB-DC. Most of the communication functionality is standard, based on CiA 301 CANopen, version 4.2.0

## 1.2 Validity of the Document

This document applies only to device *ITB-DC COP*, hereinafter referred to as *ITB-DC*. It does not apply to devices *ITB-DC ESP* or *ITB-DC HTQ*.

## 1.3 Applicable Documents

Used standards and specifications:

- 98.007.0235/trunk/900-Software/980-Evaluation/VerhaltenImFehlerfall/VerhaltenImFehlerfall.pdf
- 98.007.0235/trunk/300-Architecture/310-SystemRequirements/Specification\_SMK2\_preliminary.odt
- CiA 301 V4.2.0, CANopen application layer and communication profile <https://www.can-cia.org/cia-groups/technical-documents>

## 1.4 Definitions of Terms and Abbreviations

CAN	<b>C</b> ontroller <b>a</b> rea <b>n</b> etwork
CAN-ID	CAN- <b>I</b> dentifier
COB	<b>C</b> ommunication <b>o</b> bject
COB-ID	COB- <b>I</b> dentifier
ITB-DC	<b>I</b> ntegrated <b>T</b> hrottle <b>B</b> ody – <b>D</b> irect <b>C</b> ontrol
ITB-DC COP	ITB-DC <b>C</b> ontinuous <b>O</b> peration
ITB-DC ESP	ITB-DC <b>E</b> mergency <b>S</b> tandby
ITB-DC HTQ	ITB-DC <b>H</b> igh <b>T</b> orque
LSB	<b>L</b> east <b>S</b> ignificant <b>B</b> it
MSB	<b>M</b> ost <b>S</b> ignificant <b>B</b> it
M	<b>M</b> andatory
M/O	<b>M</b> andatory or <b>O</b> ptional
O	<b>O</b> ptional
PDO	<b>P</b> rocess <b>D</b> ata <b>O</b> bject
RPDO	<b>R</b> ecieve-PDO
RTR	<b>R</b> emote <b>T</b> ransmission <b>R</b> equest
SDO	<b>S</b> ervice <b>D</b> ata <b>O</b> bject
SYNC	<b>S</b> ynchr <b>o</b> nization object
TPDO	<b>T</b> ransmit-PDO

## 1.5 Notation Notes

Scale *boolean* means 0 = false/no and non-zero (preferably 1) = true/yes. Hexadecimal numbers are prefixed by 0x or postfix by <sub>h</sub>. (i.e. 0x20 / 20<sub>h</sub> hexadecimal is 32 decimal)



## 2 Commands

The objects described below can be found in chapter [Command](#). There are the following command types:

- Standard commands without parameters
- Extended Commands with up to four parameters

The command type can be selected via subobject *Type*. The values for the command types are:

Name	Value
Standard Command	0
Extended Command	1
Unknown Command	2

The status of the command can be read from registers 0x000C and 0x000D. The status values are:

Name	Value
OK	0
FAILED Command	1
UNKNOWN COMMAND TYPE	2
UNKNOWN COMMAND CODE	4

### 2.1 Standard Commands

To execute a standard command the following sequence must be sent:

- Write **0** into *Type* subobject.
- Write the cmd into *Code* subobject.
- Reading the *Status* subobject tells you the result of the command.

The following standard command codes are valid:

Value	Name	Comments
0	Start Configuration	Switch from Ready/Idle to Configuration
1	End Configuration	Switch from Configuration to Ready/Idle, the changed configuration will be used if it is valid
5	Drive to Open Position	
6	Drive to Close Position	
7	Drive to Position 1	
8	Drive to Position 2	
9	Reference Drive	
10.	Acknowledge the operational error	
13	Clear the inter frame step loss error	
14	Clear the stopped step loss error	

## 2.2 Extended Commands

To execute a extended command the following sequence must be sent:

- Write **1** into *Type* subobject.
- Write the parameter into the *Parameter* subobject 0 to 3.
- Write the cmd into *Code* subobject.
- Reading the *Status* subobject tells you the result of the command.

The following extended command codes are valid:

### 2.2.1 Manual Adjustment

To execute a extended command the following sequence must be sent:

Comand	0x00000002
Param 0	0=Start; 1=Set; 2=End
Param 1	Scale: 0.002%; Limits: 0%=Close; 100%=Open
Param 2	
Param 3	

### 2.2.2 Operation Mode

Hardware control is only removed in this dokument!

Comand	0x00000003
Param 0	0=Manual; 1=Auto
Param 1	
Param 2	
Param 3	

### 3 Device Information

General information about the ITB-DC and its CANopen capabilities.

#### Device

Vendor	MOTORTECH GmbH
VendorNumber	0x000002FD
Product	ITB-DC
ProductNumber	33554945
RevisionNumber	1
OrderCode	0
Controller Type	Classic
Physical Medium	High Speed

#### Supported Baud Rates

10	false
20	false
50	true
125	true
250	true
500	true
800	true
1000	true

#### CANopen Features

Simple BootUp Master	false
Simple BootUp Slave	true
Granularity	8
Dynamic Channels Supported	false
Group Messaging	false
Nr of Rx PDOs	4
Nr of Tx PDOs	4
LSS Supported	false

#### Supported dummy types for RX PDO mapping

0001	false
------	-------

0002	false
0003	false
0004	false
0005	true
0006	true
0007	true

## 4 Communication Segment

This chapter uses text passages from ('CiA 301 V4.2.0, CANopen application layer and communication profile' from <https://www.can-cia.org/cia-groups/technical-documents>, chapter 9.6, page 113ff) in a modified form.

### 4.1 Device Type

This object provides information about the device type. The object describes the type of the logical device and its functionality. It is composed of a 16-bit field that describes the device profile or the application profile that is used and a second 16-bit field, which gives additional information about optional functionality of the logical device. The additional information parameter is device profile specific and application profile specific.

#### VALUE DEFINITION

The value 0000<sub>h</sub> for the device profile number indicates a logical device that does not follow a standardized profile. In this case the additional information is 0000<sub>h</sub> (if no further logical device is implemented) or FFFF<sub>h</sub> (if a further logical device is implemented). For multiple logical device modules the additional information parameter is FFFF<sub>h</sub> and the device profile number referenced by object 1000<sub>h</sub> is the profile of the first logical device in the object dictionary. All other profiles of a multiple logical device module are identifies their profiles at objects 67FF<sub>h</sub> + x \* 800<sub>h</sub> with x = internal number of the logical device (from 1 to 8) minus 1. These objects describes the device type of the preceding logical device, having the very same value definition as object 1000<sub>h</sub>.

Index	1000 <sub>h</sub>
Name	Device Type
Object Code	Value

#### ENTRY DESCRIPTION

Sub-Index	00 <sub>h</sub>
Access	ReadOnly
Type	UNSIGNED32
Default Value	0x00000000
Mapping	False

### 4.2 Error Register

This object provides error information. The ITB-DC maps his internal errors into this object. It is also part of the emergency objects.

#### VALUE DEFINITION

Bit	M/O	Meaning
0	M	Generic error
1	O	Current
2	O	Voltage
3	O	Temperature
4	O	Communication error (overrun, error state)
5	O	Device profile specific
6	O	reserved (always 0 <sub>b</sub> )
7	O	manufacturer-specific

The generic error is signaled at any error situation.

Index	1001 <sub>h</sub>
Name	Error Register
Object Code	Value

## ENTRY DESCRIPTION

Sub-Index	00 <sub>h</sub>
Access	ReadOnly
Type	UNSIGNED8
Mapping	False

### 4.3 Predefined Error field

This object shall provide the errors that occurred on the ITB-DC and were signaled via the emergency object. In doing so it provides an error history.

#### VALUE DEFINITION

The object entry at sub-index 00<sub>h</sub> shall contain the number of actual errors that are recorded in the array starting at sub-index 01<sub>h</sub>. NOTE: If no error is present the value of sub-index 00<sub>h</sub> is 00<sub>h</sub> and a read access to sub-index 01<sub>h</sub> is responded with an SDO abort message (abort code: 0800 0024<sub>h</sub> or 0800 0000<sub>h</sub>).

Every new error shall be stored at sub-index 01<sub>h</sub>; older errors shall be moved to the next higher sub-index.

Writing 00<sub>h</sub> to sub-index 00<sub>h</sub> shall delete the entire error history (empties the array). Other values than 00<sub>h</sub> are not allowed and shall lead to an abort message (error code: 0609 0030<sub>h</sub>).

The error numbers are of type UNSIGNED32 and are composed of a 16-bit error code and a 16-bit additional error information field, which is manufacturer-specific. The error code shall be contained in the lower 2 bytes (LSB) and the additional information shall be included in the upper 2 bytes (MSB). If this object is supported it shall consist of two object entries at least. The length entry on sub-index 00<sub>h</sub> and at least one error entry at sub-index 01<sub>h</sub>.

Bits	Meaning
32-16	Additional information
15-0	Error code

Index	1003 <sub>h</sub>
Name	Predefined Error field
Object Code	Array

#### 4.3.1 Number of errors

Sub-Index	00 <sub>h</sub>
Access	ReadWrite
Type	UNSIGNED8
Default Value	0
Mapping	False

#### 4.3.2 Standard error field

Sub-Index	01 <sub>h</sub>
Access	ReadOnly
Type	UNSIGNED32
Mapping	False

### 4.4 COB-ID SYNC

This object indicate the configured COB-ID of the synchronization object (SYNC). Further, it defines whether the ITB-DC generates the SYNC.

#### VALUE DEFINITION

Bit(s)	Name	Description
31		do not care
30	gen	0 <sub>b</sub> = Device does not generate SYNC message 1 <sub>b</sub> = Device generates SYNC message
29	frame	0 <sub>b</sub> = 11-bit CAN-ID valid (CAN base frame) 1 <sub>b</sub> = 29-bit CAN-ID valid (CAN extended frame)
28-11		0 0000 <sub>h</sub>
10-0	11-bit CAN-ID	11-bit CAN-ID of the CAN base frame

<i>or</i>		
28-0	29-bit CAN-ID	29-bit CAN-ID of the CAN extended frame

Bits 29 (frame) and bit 30 (gen.) may be static (not changeable). If a CANopen device is not able to generate SYNC messages, an attempt to set bit 30 (gen.) to 1<sub>b</sub> is responded with the SDO abort transfer service (abort code: 0609 0030<sub>h</sub>). CANopen devices supporting the CAN base frame type only, an attempt to set bit 29 (frame) to 1<sub>b</sub> is responded with the SDO abort transfer service (abort code: 0609 0030<sub>h</sub>). The first transmission of SYNC object starts within 1 sync cycle after setting bit 30 to 1<sub>b</sub>. By setting bit 30 to 1<sub>b</sub> while the synchronous counter overflow value is greater than 0 the first SYNC message starts with the counter reset to 1. It is not allowed to change bits 0 to 29, while the object exists (bit 30 = 1<sub>b</sub>).

Index	1005 <sub>h</sub>
Name	COB-ID SYNC
Object Code	Value

## ENTRY DESCRIPTION

Sub-Index	00 <sub>h</sub>
Access	ReadWrite
Type	UNSIGNED32
Default Value	0x00000080
Mapping	False

## 4.5 Synchronous window length

This object indicates the configured the length of the time window for synchronous PDOs.

If the synchronous window length expires all synchronous TPDOs are discarded and an EMCY message transmitted. All synchronous RPDOs are discarded until the next SYNC message is received. Synchronous RPDO processing is resumed with the next SYNC message.

### VALUE DEFINITION

The value is given in multiple of  $\mu$ s. If the value is set to 0000 0000<sub>h</sub> the synchronous window is disabled.

Index	1007 <sub>h</sub>
Name	Synchronous window length
Object Code	Value

## ENTRY DESCRIPTION

Sub-Index	00 <sub>h</sub>
Access	ReadWrite



Type	UNSIGNED32
Default Value	0x00000000
Mapping	False

#### 4.6 Guard Time

The objects at index 100C<sub>h</sub> and 100D<sub>h</sub> indicates the configured guard time respectively the life time factor. The life time factor multiplied with the guard time gives the life time for the life guarding protocol.

##### VALUE DEFINITION

The value is given in multiple of ms. The value of 0000<sub>h</sub> disable the life guarding.

Index	100C <sub>h</sub>
Name	Guard Time
Object Code	Value

##### ENTRY DESCRIPTION

Sub-Index	00 <sub>h</sub>
Access	ReadWrite
Type	UNSIGNED16
Default Value	0
Mapping	False

#### 4.7 Life Time Factor

The life time factor multiplied with the guard time gives the life time for the life guarding protocol.

##### VALUE DEFINITION

The value of 00<sub>h</sub> disable the life guarding.

Index	100D <sub>h</sub>
Name	Life Time Factor
Object Code	Value

##### ENTRY DESCRIPTION

Sub-Index	00 <sub>h</sub>
Access	ReadWrite
Type	UNSIGNED8

Default Value	0
Mapping	False

#### 4.8 COB-ID Emergency Message

This object indicates the configured COB-ID for the emergency message write service.

##### VALUE DEFINITION

Bit(s)	Name	Description
31	valid	0 <sub>b</sub> = EMCY exist / is valid 1 <sub>b</sub> = EMCY does not exist / is not valid
30		reserved (always 0 <sub>b</sub> )
29	frame	0 <sub>b</sub> = 11-bit CAN-ID valid (CAN base frame) 1 <sub>b</sub> = 29-bit CAN-ID valid (CAN extended frame)
28-11		0 0000 <sub>h</sub>
10-0	11-bit CAN-ID	11-bit CAN-ID of the CAN base frame
or		
28-0	29-bit CAN-ID	29-bit CAN-ID of the CAN extended frame

CANopen devices supporting the CAN base frame type only, responds with the SDO abort transfer service in the case of an attempt to set bit 29 (frame) to 1<sub>b</sub>. The bits 0 to 29 shall not be changed, while the object exists and is valid (bit 31 = 0<sub>b</sub>).

Index	1014 <sub>h</sub>
Name	COB-ID Emergency Message
Object Code	Value

##### ENTRY DESCRIPTION

Sub-Index	00 <sub>h</sub>
Access	ReadWrite
Type	UNSIGNED32
Default Value	0x80000000
Mapping	False

#### 4.9 Producer heartbeat time

The producer heartbeat time indicates the configured cycle time of the heartbeat.

##### VALUE DEFINITION

The value is given in multiples of 1 ms. The value 0 disable the producer heartbeat.

Index	1017 <sub>h</sub>
Name	Producer heartbeat time
Object Code	Value

##### ENTRY DESCRIPTION

Sub-Index	00 <sub>h</sub>
Access	ReadWrite
Type	UNSIGNED16
Default Value	0
Mapping	False

#### 4.10 Identity Object

This object provides general identification information of the ITB-DC.

Index	1018 <sub>h</sub>
Name	Identity Object
Object Code	Record

##### 4.10.1 Highest Subindex Supported

Sub-Index	00 <sub>h</sub>
Access	Const
Type	UNSIGNED8
Default Value	1
Mapping	False

##### 4.10.2 Vendor-ID

It contains the unique value that is allocated for MOTORTECH GmbH.

Sub-Index	01 <sub>h</sub>
Access	ReadOnly

Type	UNSIGNED32
Default Value	0x000002FD
Mapping	False

#### 4.11 SDO server parameter

This data describes the SDO accesses to the ITB-DC and its response. The description is encoded in a 32 bit value.

##### VALUE DEFINITION

Bit(s)	Name	Description
31	valid	0 <sub>b</sub> = SDO exists / is valid 1 <sub>b</sub> = SDO does not exist / is not valid
30	dyn	0 <sub>b</sub> = Value is assigned statically 1 <sub>b</sub> = Value is assigned dynamically
29	frame	0 <sub>b</sub> = 11-bit CAN-ID valid (CAN base frame) 1 <sub>b</sub> = 29-bit CAN-ID valid (CAN extended frame)
28-11		0 0000 <sub>h</sub>
10-0	11-bit CAN-ID	11-bit CAN-ID of the CAN base frame
<b>or</b>		
28-0	29-bit CAN-ID	29-bit CAN-ID of the CAN extended frame

An SDO exists only if at both sub-index 01<sub>h</sub> and sub-index 02<sub>h</sub> the bit valid (bit 31) is set to 0<sub>b</sub>. ITB-DC supporting the CAN base frame type only, an attempt to set bit 29 (frame) to 1<sub>b</sub> is responded with the SDO abort transfer service. It is not allowed to change bits 0 to 29 while the object exists and is valid (bit 31 = 0<sub>b</sub> ).

If the bit dyn (bit 30) of sub-index 01<sub>h</sub> or sub-index 02<sub>h</sub> is set to 1<sub>b</sub> the values of all sub-indices of this object are not stored in non-volatile memory. The bit dyn is used to mark dynamic SDO connections between CANopen devices. Dynamic SDO connections are temporarily configured. Static SDO connections are configured non-temporarily and are saved in non- volatile memory. The CANopen manager may use the dyn bit to detect temporarily configured SDO connections.

Index	1200 <sub>h</sub>
Name	SDO server parameter
Object Code	Record

##### 4.11.1 Highest supported Subindex

Contains the number of valid object entries within the record.

Sub-Index	00 <sub>h</sub>
Access	Const
Type	UNSIGNED8
Default Value	2
Mapping	False

#### 4.11.2 COB-ID client to server

Specify the COB-ID for rx SDOs.

Sub-Index	01 <sub>h</sub>
Access	ReadWrite
Type	UNSIGNED32
Mapping	False

#### 4.11.3 COB-ID server to client

Specify the COB-ID for tx SDOs.

Sub-Index	02 <sub>h</sub>
Access	ReadWrite
Type	UNSIGNED32
Mapping	False

### 4.12 RPDO Communication Parameter 1

This object contains the communication parameters for the PDOs the ITB-DC is able to receive.

Index	1400 <sub>h</sub>
Name	RPDO Communication Parameter 1
Object Code	Record

#### 4.12.1 Highest supported Subindex

Contains the number of valid object entries within the record.

Sub-Index	00 <sub>h</sub>
Access	Const
Type	UNSIGNED8

Default Value	3
Mapping	False

#### 4.12.2 Rx COB-ID

Contains the COB-ID of the RPDO.

##### VALUE DEFINITION

Bit(s)	Name	Description
31	valid	0 <sub>b</sub> = PDO exists / is valid 1 <sub>b</sub> = PDO does not exist / is not valid
30	gen	0 <sub>b</sub> = Device does not generate SYNC message 1 <sub>b</sub> = Device generates SYNC message
29	frame	0 <sub>b</sub> = 11-bit CAN-ID valid (CAN base frame) 1 <sub>b</sub> = 29-bit CAN-ID valid (CAN extended frame)
28-11		0 0000 <sub>h</sub>
10-0	11-bit CAN-ID	11-bit CAN-ID of the CAN base frame
<b>or</b>		
28-0	29-bit CAN-ID	29-bit CAN-ID of the CAN extended frame

The bit valid (bit 31) allows selecting which RPDOs are used in the NMT state Operational. There may be PDOs fully configured (e.g. by default) but not used, and therefore set to "not valid" (deleted). CANopen devices supporting the CAN base frame type only an attempt to set bit 29 (frame) to 1<sub>b</sub> is responded with the SDO abort transfer service (abort code: 0609 0030<sub>h</sub>). It is not allowed to change bit 0 to 29 while the PDO exists and is valid (bit 31 = 0<sub>b</sub>). CANopen devices supporting the enabling (bit 31 = 0<sub>b</sub>) and disabling (bit 31 = 1<sub>b</sub>) of an RPDO only responds with the SDO abort transfer service on an attempt to change the values from bit 0 to bit 30.

Sub-Index	01 <sub>h</sub>
Access	ReadWrite
Type	UNSIGNED32
Default Value	0x80000000
Mapping	False

#### 4.12.3 Rx Transmission Type

An attempt to change the value of the transmission type to any not supported value is responded with the SDO abort transfer service (abort code: 0609 0030<sub>h</sub>).

Value	Description
00 <sub>h</sub>	synchronous
...	...
F0 <sub>h</sub>	synchronous
F1 <sub>h</sub>	reserved
...	...
FD <sub>h</sub>	reserved
FE <sub>h</sub>	event-driven (manufacturer-specific)
FE <sub>h</sub>	event-driven (profile/application profile specific)

- Synchronous means that ITB-DC actuates the received data with the reception of the next SYNC.
- Event-driven means that the PDO may be received at any time. The ITB-DC will actualize the data immediately.

Sub-Index	02 <sub>h</sub>
Access	ReadWrite
Type	UNSIGNED8
Default Value	0xFF
Mapping	False

#### 4.12.4 Rx Inhibit Time

The value is defined as multiple of 100  $\mu$ s. The value of 0 disables the inhibit time. It is not allowed to change the value while the PDO exists (bit 31 of sub-index 01<sub>h</sub> is set to 0<sub>b</sub> ).

Sub-Index	03 <sub>h</sub>
Access	ReadWrite
Type	UNSIGNED16
Default Value	0
Mapping	False

### 4.13 RPDO Communication Parameter 2

This object contains the communication parameters for the PDOs the ITB-DC is able to receive.

Index	1401 <sub>h</sub>
Name	RPDO Communication Parameter 2
Object Code	Record

#### 4.13.1 Highest supported Subindex

Contains the number of valid object entries within the record.

Sub-Index	00 <sub>h</sub>
Access	Const
Type	UNSIGNED8
Default Value	3
Mapping	False

#### 4.13.2 COB-ID

For Details see [Rx COB-ID](#).

Sub-Index	01 <sub>h</sub>
Access	ReadWrite
Type	UNSIGNED32
Default Value	0x80000000
Mapping	False

#### 4.13.3 Transmission Type

For Details see [Rx Transmission Type](#).

Sub-Index	02 <sub>h</sub>
Access	ReadWrite
Type	UNSIGNED8
Default Value	0xFF
Mapping	False

#### 4.13.4 Inhibit Time

For Details see [Rx Inhibit Time](#).

Sub-Index	03 <sub>h</sub>
Access	ReadWrite
Type	UNSIGNED16
Default Value	0
Mapping	False



## 4.14 RPDO Communication Parameter 3

This object contains the communication parameters for the PDOs the ITB-DC is able to receive.

Index	1402 <sub>h</sub>
Name	RPDO Communication Parameter 3
Object Code	Record

### 4.14.1 Highest supported Subindex

Contains the number of valid object entries within the record.

Sub-Index	00 <sub>h</sub>
Access	Const
Type	UNSIGNED8
Default Value	3
Mapping	False

### 4.14.2 COB-ID

For Details see [Rx COB-ID](#).

Sub-Index	01 <sub>h</sub>
Access	ReadWrite
Type	UNSIGNED32
Default Value	0x80000000
Mapping	False

### 4.14.3 Transmission Type

For Details see [Rx Transmission Type](#).

Sub-Index	02 <sub>h</sub>
Access	ReadWrite
Type	UNSIGNED8
Default Value	0xFF
Mapping	False

### 4.14.4 Inhibit Time

For Details see [Rx Inhibit Time](#).

Sub-Index	03 <sub>h</sub>
Access	ReadWrite
Type	UNSIGNED16
Default Value	0
Mapping	False

#### 4.15 RPDO Communication Parameter 4

This object contains the communication parameters for the PDOs the ITB-DC is able to receive.

Index	1403 <sub>h</sub>
Name	RPDO Communication Parameter 4
Object Code	Record

##### 4.15.1 Highest supported Subindex

Contains the number of valid object entries within the record.

Sub-Index	00 <sub>h</sub>
Access	Const
Type	UNSIGNED8
Default Value	3
Mapping	False

##### 4.15.2 COB-ID

For Details see [Rx COB-ID](#).

Sub-Index	01 <sub>h</sub>
Access	ReadWrite
Type	UNSIGNED32
Default Value	0x80000000
Mapping	False

##### 4.15.3 Transmission Type

For Details see [Rx Transmission Type](#).

Sub-Index	02 <sub>h</sub>
-----------	-----------------

Access	ReadWrite
Type	UNSIGNED8
Default Value	0xFF
Mapping	False

#### 4.15.4 Inhibit Time

For Details see [Rx Inhibit Time](#).

Sub-Index	03 <sub>h</sub>
Access	ReadWrite
Type	UNSIGNED16
Default Value	0
Mapping	False

### 4.16 RPDO Mapping 1

This object contains the mapping parameters for the PDOs the ITB-DC is able to receive.

Index	1600 <sub>h</sub>
Name	RPDO Mapping 1
Object Code	Record

#### 4.16.1 Highest supported Subindex

Contains the number of valid object entries within the record or a specific value (see Table), e.g. if MPDO is supported. The number of valid object entries is the number of the application objects that is received with the corresponding TPDO.

Value	Description
00 <sub>h</sub>	Mapping disabled
01 <sub>h</sub>	Sub-index 01 <sub>h</sub> valid
02 <sub>h</sub>	Sub-index 01 <sub>h</sub> and 02 <sub>h</sub> valid
03 <sub>h</sub>	Sub-index 01 <sub>h</sub> to 03 <sub>h</sub> valid
04 <sub>h</sub>	Sub-index 01 <sub>h</sub> to 04 <sub>h</sub> valid
.....	.....
08 <sub>h</sub>	Sub-index 01 <sub>h</sub> to 08 <sub>h</sub> valid

Sub-Index	00 <sub>h</sub>
-----------	-----------------

Access	Const
Type	UNSIGNED8
Default Value	8
Mapping	False

#### 4.16.2 Rx Application Object 1

the information of the mapped application objects.

##### VALUE DEFINITION

Bit(s)	Description
31-16	Index
15-8	Sub-Index
7-0	Length

The object describes the content of the PDO by their index, sub-index and length. The length contains the length of the application object in bit. This is used to verify the mapping. An attempt to change the value of an object entry to any value that is not supported is responded with the SDO abort transfer service. The cause for a not supported value could be the mapping (index and sub-index) of a non-existing application object, a wrong length for the mapped application object, or a wrong length for the PDO at all. The index and sub-index reference a simple data type for the so-called dummy mapping. This is used if no appropriate application object is available and to fill up the length of the RPDO to fit the length to the according TPDO. Use the following procedure for re-mapping, which take place during the NMT state Pre-operational and during the NMT state Operational, if supported:

1. Destroy RPDO by setting bit valid to 1<sub>b</sub> of sub-index 01<sub>h</sub> of the according RPDO communication parameter.
2. Disable mapping by setting sub-index 00<sub>h</sub> to 00<sub>h</sub>.
3. Modify mapping by changing the values of the corresponding sub-indices.
4. Enable mapping by setting sub-index 00<sub>h</sub> to the number of mapped objects.
5. Create RPDO by setting bit valid to 0<sub>b</sub> of sub-index 01<sub>h</sub> of the according RPDO communication parameter.

If during step 3 the ITB-DC detects that index and sub-index of the mapped object does not exist or the object cannot be mapped the ITB-DC responds with the SDO abort transfer service. If during step 4 the ITB-DC detects that the RPDO mapping is not valid or not possible the ITB-DC responds with the SDO abort transfer service. If the ITB-DC receives a PDO that is having more data bytes than the number of mapped data bytes is (length), then the ITB-DC use the first data bytes up to the length.

Sub-Index	01 <sub>h</sub>
Access	ReadWrite
Type	UNSIGNED32
Default Value	0x00000000
Mapping	False

#### 4.16.3 Application Object 2

For Details see [Rx Application Object 1](#).

Sub-Index	02 <sub>h</sub>
Access	ReadWrite
Type	UNSIGNED32
Default Value	0x00000000
Mapping	False

#### 4.16.4 Application Object 3

For Details see [Rx Application Object 1](#).

Sub-Index	03 <sub>h</sub>
Access	ReadWrite
Type	UNSIGNED32
Default Value	0x00000000
Mapping	False

#### 4.16.5 Application Object 4

For Details see [Rx Application Object 1](#).

Sub-Index	04 <sub>h</sub>
Access	ReadWrite
Type	UNSIGNED32
Default Value	0x00000000
Mapping	False

#### 4.16.6 Application Object 5

For Details see [Rx Application Object 1](#).

Sub-Index	05 <sub>h</sub>
Access	ReadWrite
Type	UNSIGNED32
Default Value	0x00000000
Mapping	False

**4.16.7 Application Object 6**

For Details see [Rx Application Object 1](#).

Sub-Index	06 <sub>h</sub>
Access	ReadWrite
Type	UNSIGNED32
Default Value	0x00000000
Mapping	False

**4.16.8 Application Object 7**

For Details see [Rx Application Object 1](#).

Sub-Index	07 <sub>h</sub>
Access	ReadWrite
Type	UNSIGNED32
Default Value	0x00000000
Mapping	False

**4.16.9 Application Object 8**

For Details see [Rx Application Object 1](#).

Sub-Index	08 <sub>h</sub>
Access	ReadWrite
Type	UNSIGNED32
Default Value	0x00000000
Mapping	False

**4.17 RPDO Mapping 2**

This object contains the mapping parameters for the PDOs the ITB-DC is able to receive.

Index	1601 <sub>h</sub>
Name	RPDO Mapping 2
Object Code	Record

#### 4.17.1 Highest supported Subindex

Contains the number of valid object entries within the record or a specific value (see Table), e.g. if MPDO is supported. The number of valid object entries is the number of the application objects that is received with the corresponding TPDO.

Value	Description
00 <sub>h</sub>	Mapping disabled
01 <sub>h</sub>	Sub-index 01 <sub>h</sub> valid
02 <sub>h</sub>	Sub-index 01 <sub>h</sub> and 02 <sub>h</sub> valid
03 <sub>h</sub>	Sub-index 01 <sub>h</sub> to 03 <sub>h</sub> valid
04 <sub>h</sub>	Sub-index 01 <sub>h</sub> to 04 <sub>h</sub> valid
.....	.....
08 <sub>h</sub>	Sub-index 01 <sub>h</sub> to 08 <sub>h</sub> valid

Sub-Index	00 <sub>h</sub>
Access	Const
Type	UNSIGNED8
Default Value	8
Mapping	False

#### 4.17.2 Application Object 1

For Details see [Rx Application Object 1](#).

Sub-Index	01 <sub>h</sub>
Access	ReadWrite
Type	UNSIGNED32
Default Value	0x00000000
Mapping	False

#### 4.17.3 Application Object 2

For Details see [Rx Application Object 1](#).

Sub-Index	02 <sub>h</sub>
Access	ReadWrite
Type	UNSIGNED32
Default Value	0x00000000
Mapping	False

#### 4.17.4 Application Object 3

For Details see [Rx Application Object 1](#).

Sub-Index	03 <sub>h</sub>
Access	ReadWrite
Type	UNSIGNED32
Default Value	0x00000000
Mapping	False

#### 4.17.5 Application Object 4

For Details see [Rx Application Object 1](#).

Sub-Index	04 <sub>h</sub>
Access	ReadWrite
Type	UNSIGNED32
Default Value	0x00000000
Mapping	False

#### 4.17.6 Application Object 5

For Details see [Rx Application Object 1](#).

Sub-Index	05 <sub>h</sub>
Access	ReadWrite
Type	UNSIGNED32
Default Value	0x00000000
Mapping	False

#### 4.17.7 Application Object 6

For Details see [Rx Application Object 1](#).

Sub-Index	06 <sub>h</sub>
Access	ReadWrite
Type	UNSIGNED32
Default Value	0x00000000
Mapping	False



#### 4.17.8 Application Object 7

For Details see [Rx Application Object 1](#).

Sub-Index	07 <sub>h</sub>
Access	ReadWrite
Type	UNSIGNED32
Default Value	0x00000000
Mapping	False

#### 4.17.9 Application Object 8

For Details see [Rx Application Object 1](#).

Sub-Index	08 <sub>h</sub>
Access	ReadWrite
Type	UNSIGNED32
Default Value	0x00000000
Mapping	False

### 4.18 RPDO Mapping 3

This object contains the mapping parameters for the PDOs the ITB-DC is able to receive.

Index	1602 <sub>h</sub>
Name	RPDO Mapping 3
Object Code	Record

#### 4.18.1 Highest supported Subindex

Contains the number of valid object entries within the record or a specific value (see Table), e.g. if MPDO is supported. The number of valid object entries is the number of the application objects that is received with the corresponding TPDO.

Value	Description
00 <sub>h</sub>	Mapping disabled
01 <sub>h</sub>	Sub-index 01 <sub>h</sub> valid
02 <sub>h</sub>	Sub-index 01 <sub>h</sub> and 02 <sub>h</sub> valid
03 <sub>h</sub>	Sub-index 01 <sub>h</sub> to 03 <sub>h</sub> valid
04 <sub>h</sub>	Sub-index 01 <sub>h</sub> to 04 <sub>h</sub> valid
.....	.....
08 <sub>h</sub>	Sub-index 01 <sub>h</sub> to 08 <sub>h</sub> valid

Sub-Index	00 <sub>h</sub>
Access	Const
Type	UNSIGNED8
Default Value	8
Mapping	False

#### 4.18.2 Application Object 1

For Details see [Rx Application Object 1](#).

Sub-Index	01 <sub>h</sub>
Access	ReadWrite
Type	UNSIGNED32
Default Value	0x00000000
Mapping	False

#### 4.18.3 Application Object 2

For Details see [Rx Application Object 1](#).

Sub-Index	02 <sub>h</sub>
Access	ReadWrite
Type	UNSIGNED32
Default Value	0x00000000
Mapping	False

#### 4.18.4 Application Object 3

For Details see [Rx Application Object 1](#).

Sub-Index	03 <sub>h</sub>
Access	ReadWrite
Type	UNSIGNED32
Default Value	0x00000000
Mapping	False

#### 4.18.5 Application Object 4

For Details see [Rx Application Object 1](#).

Sub-Index	04 <sub>h</sub>
Access	ReadWrite
Type	UNSIGNED32
Default Value	0x00000000
Mapping	False

#### 4.18.6 Application Object 5

For Details see [Rx Application Object 1](#).

Sub-Index	05 <sub>h</sub>
Access	ReadWrite
Type	UNSIGNED32
Default Value	0x00000000
Mapping	False

#### 4.18.7 Application Object 6

For Details see [Rx Application Object 1](#).

Sub-Index	06 <sub>h</sub>
Access	ReadWrite
Type	UNSIGNED32
Default Value	0x00000000
Mapping	False

#### 4.18.8 Application Object 7

For Details see [Rx Application Object 1](#).

Sub-Index	07 <sub>h</sub>
Access	ReadWrite
Type	UNSIGNED32
Default Value	0x00000000
Mapping	False

#### 4.18.9 Application Object 8

For Details see [Rx Application Object 1](#).

Sub-Index	08 <sub>h</sub>
Access	ReadWrite
Type	UNSIGNED32
Default Value	0x00000000
Mapping	False

#### 4.19 RPDO Mapping 4

This object contains the mapping parameters for the PDOs the ITB-DC is able to receive.

Index	1603 <sub>h</sub>
Name	RPDO Mapping 4
Object Code	Record

##### 4.19.1 Highest supported Subindex

Contains the number of valid object entries within the record or a specific value (see Table), e.g. if MPDO is supported. The number of valid object entries is the number of the application objects that is received with the corresponding TPDO.

Value	Description
00 <sub>h</sub>	Mapping disabled
01 <sub>h</sub>	Sub-index 01 <sub>h</sub> valid
02 <sub>h</sub>	Sub-index 01 <sub>h</sub> and 02 <sub>h</sub> valid
03 <sub>h</sub>	Sub-index 01 <sub>h</sub> to 03 <sub>h</sub> valid
04 <sub>h</sub>	Sub-index 01 <sub>h</sub> to 04 <sub>h</sub> valid
.....	.....
08 <sub>h</sub>	Sub-index 01 <sub>h</sub> to 08 <sub>h</sub> valid

Sub-Index	00 <sub>h</sub>
Access	Const
Type	UNSIGNED8
Default Value	8
Mapping	False

#### 4.19.2 Application Object 1

For Details see [Rx Application Object 1](#).

Sub-Index	01 <sub>h</sub>
Access	ReadWrite
Type	UNSIGNED32
Default Value	0x00000000
Mapping	False

#### 4.19.3 Application Object 2

For Details see [Rx Application Object 1](#).

Sub-Index	02 <sub>h</sub>
Access	ReadWrite
Type	UNSIGNED32
Default Value	0x00000000
Mapping	False

#### 4.19.4 Application Object 3

For Details see [Rx Application Object 1](#).

Sub-Index	03 <sub>h</sub>
Access	ReadWrite
Type	UNSIGNED32
Default Value	0x00000000
Mapping	False

#### 4.19.5 Application Object 4

For Details see [Rx Application Object 1](#).

Sub-Index	04 <sub>h</sub>
Access	ReadWrite
Type	UNSIGNED32
Default Value	0x00000000
Mapping	False

#### 4.19.6 Application Object 5

For Details see [Rx Application Object 1](#).

Sub-Index	05 <sub>h</sub>
Access	ReadWrite
Type	UNSIGNED32
Default Value	0x00000000
Mapping	False

#### 4.19.7 Application Object 6

For Details see [Rx Application Object 1](#).

Sub-Index	06 <sub>h</sub>
Access	ReadWrite
Type	UNSIGNED32
Default Value	0x00000000
Mapping	False

#### 4.19.8 Application Object 7

For Details see [Rx Application Object 1](#).

Sub-Index	07 <sub>h</sub>
Access	ReadWrite
Type	UNSIGNED32
Default Value	0x00000000
Mapping	False

#### 4.19.9 Application Object 8

For Details see [Rx Application Object 1](#).

Sub-Index	08 <sub>h</sub>
Access	ReadWrite
Type	UNSIGNED32
Default Value	0x00000000
Mapping	False

## 4.20 TPDO Communication Parameter 1

This object contains the communication parameters for the PDOs the ITB-DC is able to receive.

Index	1800 <sub>h</sub>
Name	TPDO Communication Parameter 1
Object Code	Record

### 4.20.1 Highest supported Subindex

Contains the number of valid object entries within the record.

Sub-Index	00 <sub>h</sub>
Access	Const
Type	UNSIGNED8
Default Value	5
Mapping	False

### 4.20.2 Tx COB-ID

Contains the COB-ID of the TPDO.

#### VALUE DEFINITION

Bit(s)	Name	Description
31	valid	0 <sub>b</sub> = PDO exists / is valid 1 <sub>b</sub> = PDO does not exist / is not valid
30	RTR	0 <sub>b</sub> = RTR allowed on this PDO 1 <sub>b</sub> = no RTR allowed on this PDO
29	frame	0 <sub>b</sub> = 11-bit CAN-ID valid (CAN base frame) 1 <sub>b</sub> = 29-bit CAN-ID valid (CAN extended frame)
28-11		0 0000 <sub>h</sub>
10-0	11-bit CAN-ID	11-bit CAN-ID of the CAN base frame
<b>or</b>		
28-0	29-bit CAN-ID	29-bit CAN-ID of the CAN extended frame

The bit valid (bit 31) allows selecting which RPDOs are used in the NMT state Operational. There may be PDOs fully configured (e.g. by default) but not used, and therefore set to "not valid" (deleted). ITB-DC supports the CAN base frame type only an attempt to set bit 29 (frame) to 1<sub>b</sub> or bit 30 (RTR) to 0<sub>b</sub>) is responded with the SDO abort transfer service (abort code: 0609 0030<sub>h</sub>). It is not allowed to change bit 0 to 29 while the PDO exists and is valid (bit 31 = 0<sub>b</sub>). ITB-DC supports the enabling (bit

31 = 0<sub>b</sub>) and disabling (bit 31 = 1<sub>b</sub>) of an RPDO only responds with the SDO abort transfer service on an attempt to change the values from bit 0 to bit 30.

Sub-Index	01 <sub>h</sub>
Access	ReadWrite
Type	UNSIGNED32
Default Value	0x80000000
Mapping	False

#### 4.20.3 Tx Transmission Type

An attempt to change the value of the transmission type to any not supported value is responded with the SDO abort transfer service (abort code: 0609 0030<sub>h</sub>).

Value	Description
00 <sub>h</sub>	synchronous (acyclic)
01 <sub>h</sub>	synchronous (cyclic every sync)
02 <sub>h</sub>	synchronous (cyclic every 2 <sup>nd</sup> SYNC)
03 <sub>h</sub>	synchronous (cyclic every 3 <sup>rd</sup> SYNC)
04 <sub>h</sub>	synchronous (cyclic every 4 <sup>th</sup> SYNC)
...	...
F0 <sub>h</sub>	synchronous (cyclic every 240 <sup>th</sup> SYNC)
F1 <sub>h</sub>	reserved
...	...
FB <sub>h</sub>	reserved
FC <sub>h</sub>	RTR-only (synchronous)
FD <sub>h</sub>	RTR-only (event-driven)
FE <sub>h</sub>	event-driven (manufacturer-specific)
FE <sub>h</sub>	event-driven (profile/application profile specific)

- Synchronous means that the PDO is transmitted after the SYNC. The ITB-DC will start sampling of the data with the reception of the SYNC. In case it is acyclic the CANopen device internal event is given and with the next SYNC the sampling is started and the PDO is transmitted afterwards. In case it is cyclic the sampling is started with the reception of every SYNC, every 2<sup>nd</sup> SYNC, every 3<sup>rd</sup> SYNC, and s.o. depending on the given value and the PDO is transmitted afterwards.
- RTR-only means that the PDO is not transmitted normally it is requested via RTR. In case it is synchronous the ITB-DC will start sampling with the reception of every SYNC and then will buffer the PDO. In case it is event-driven the ITB-DC will start sampling with the reception of the RTR and will transmit the PDO immediately.
- Event-driven means that the PDO is transmitted at any time based on the occurrence of a ITB-DC internal event.

Sub-Index	02 <sub>h</sub>
-----------	-----------------



Access	ReadWrite
Type	UNSIGNED8
Default Value	0xFF
Mapping	False

#### 4.20.4 Tx Inhibit Time

The time is the minimum interval for PDO transmission if the transmission type is set to FE<sub>h</sub> and FF<sub>h</sub>. The value is defined as multiple of 100 μs. The value of 0 disables the inhibit time. It is not allowed to change the value while the PDO exists (bit 31 of sub-index 01<sub>h</sub> is set to 0<sub>b</sub> ).

Sub-Index	03 <sub>h</sub>
Access	ReadWrite
Type	UNSIGNED16
Default Value	0
Mapping	False

#### 4.20.5 Reserved

Sub-Index	04 <sub>h</sub>
Access	ReadWrite
Type	UNSIGNED8
Default Value	0
Mapping	False

#### 4.20.6 Event Timer

Contains the event-timer. The time is the maximum interval for PDO transmission if the transmission type is set to FE<sub>h</sub> and FF<sub>h</sub>. The value is defined as multiple of 1 ms. The value of 0 disables the event-timer.

Sub-Index	05 <sub>h</sub>
Access	ReadWrite
Type	UNSIGNED16
Default Value	0
Mapping	False

## 4.21 TPDO Communication Parameter 2

This object contains the communication parameters for the PDOs the ITB-DC is able to receive.

Index	1801 <sub>h</sub>
Name	TPDO Communication Parameter 2
Object Code	Record

### 4.21.1 Highest supported Subindex

Contains the number of valid object entries within the record.

Sub-Index	00 <sub>h</sub>
Access	Const
Type	UNSIGNED8
Default Value	5
Mapping	False

### 4.21.2 COB-ID

For Details see [Tx COB-ID](#).

Sub-Index	01 <sub>h</sub>
Access	ReadWrite
Type	UNSIGNED32
Default Value	0x80000000
Mapping	False

### 4.21.3 Transmission Type

For Details see [Tx Transmission Type](#).

Sub-Index	02 <sub>h</sub>
Access	ReadWrite
Type	UNSIGNED8
Default Value	0xFF
Mapping	False

### 4.21.4 Inhibit Time

For Details see [Tx Inhibit Time](#).

Sub-Index	03 <sub>h</sub>
Access	ReadWrite
Type	UNSIGNED16
Default Value	0
Mapping	False

#### 4.21.5 Reserved

Sub-Index	04 <sub>h</sub>
Access	ReadWrite
Type	UNSIGNED8
Default Value	0
Mapping	False

#### 4.21.6 Event Timer

Contains the event-timer. The time is the maximum interval for PDO transmission if the transmission type is set to FE<sub>h</sub> and FF<sub>h</sub>. The value is defined as multiple of 1 ms. The value of 0 disables the event-timer.

Sub-Index	05 <sub>h</sub>
Access	ReadWrite
Type	UNSIGNED16
Default Value	0
Mapping	False

### 4.22 TPDO Communication Parameter 3

This object contains the communication parameters for the PDOs the ITB-DC is able to receive.

Index	1802 <sub>h</sub>
Name	TPDO Communication Parameter 3
Object Code	Record

#### 4.22.1 Highest supported Subindex

Contains the number of valid object entries within the record.

Sub-Index	00 <sub>h</sub>
-----------	-----------------

Access	Const
Type	UNSIGNED8
Default Value	5
Mapping	False

#### 4.22.2 COB-ID

For Details see [Tx COB-ID](#).

Sub-Index	01 <sub>h</sub>
Access	ReadWrite
Type	UNSIGNED32
Default Value	0x80000000
Mapping	False

#### 4.22.3 Transmission Type

For Details see [Tx Transmission Type](#).

Sub-Index	02 <sub>h</sub>
Access	ReadWrite
Type	UNSIGNED8
Default Value	0xFF
Mapping	False

#### 4.22.4 Inhibit Time

For Details see [Tx Inhibit Time](#).

Sub-Index	03 <sub>h</sub>
Access	ReadWrite
Type	UNSIGNED16
Default Value	0
Mapping	False

#### 4.22.5 Reserved

Sub-Index	04 <sub>h</sub>
-----------	-----------------

Access	ReadWrite
Type	UNSIGNED8
Default Value	0
Mapping	False

#### 4.22.6 Event Timer

Contains the event-timer. The time is the maximum interval for PDO transmission if the transmission type is set to FE<sub>h</sub> and FF<sub>h</sub>. The value is defined as multiple of 1 ms. The value of 0 disables the event-timer.

Sub-Index	05 <sub>h</sub>
Access	ReadWrite
Type	UNSIGNED16
Default Value	0
Mapping	False

### 4.23 TPDO Communication Parameter 4

This object contains the communication parameters for the PDOs the ITB-DC is able to receive.

Index	1803 <sub>h</sub>
Name	TPDO Communication Parameter 4
Object Code	Record

#### 4.23.1 Highest supported Subindex

Contains the number of valid object entries within the record.

Sub-Index	00 <sub>h</sub>
Access	Const
Type	UNSIGNED8
Default Value	5
Mapping	False

#### 4.23.2 COB-ID

For Details see Tx COB-ID.

Sub-Index	01 <sub>h</sub>
-----------	-----------------

Access	ReadWrite
Type	UNSIGNED32
Default Value	0x80000000
Mapping	False

#### 4.23.3 Transmission Type

For Details see [Tx Transmission Type](#).

Sub-Index	02 <sub>h</sub>
Access	ReadWrite
Type	UNSIGNED8
Default Value	0xFF
Mapping	False

#### 4.23.4 Inhibit Time

For Details see [Tx Inhibit Time](#).

Sub-Index	03 <sub>h</sub>
Access	ReadWrite
Type	UNSIGNED16
Default Value	0
Mapping	False

#### 4.23.5 Reserved

Sub-Index	04 <sub>h</sub>
Access	ReadWrite
Type	UNSIGNED8
Default Value	0
Mapping	False

#### 4.23.6 Event Timer

Contains the event-timer. The time is the maximum interval for PDO transmission if the transmission type is set to FE<sub>h</sub> and FF<sub>h</sub>. The value is defined as multiple of 1 ms. The value of 0 disables the event-timer.

Sub-Index	05 <sub>h</sub>
Access	ReadWrite
Type	UNSIGNED16
Default Value	0
Mapping	False

## 4.24 TPDO Mapping 1

This object contains the mapping parameters for the PDOs the ITB-DC is able to receive.

Index	1A00 <sub>h</sub>
Name	TPDO Mapping 1
Object Code	Record

### 4.24.1 Highest supported Subindex

Contains the number of valid object entries within the record or a specific value (see Table), e.g. if MPDO is supported. The number of valid object entries is the number of the application objects that is transmitted with the corresponding TPDO.

Value	Description
00 <sub>h</sub>	Mapping disabled
01 <sub>h</sub>	Sub-index 01 <sub>h</sub> valid
02 <sub>h</sub>	Sub-index 01 <sub>h</sub> and 02 <sub>h</sub> valid
03 <sub>h</sub>	Sub-index 01 <sub>h</sub> to 03 <sub>h</sub> valid
04 <sub>h</sub>	Sub-index 01 <sub>h</sub> to 04 <sub>h</sub> valid
.....	.....
08 <sub>h</sub>	Sub-index 01 <sub>h</sub> to 08 <sub>h</sub> valid

Sub-Index	00 <sub>h</sub>
Access	Const
Type	UNSIGNED8
Default Value	8
Mapping	False

### 4.24.2 Tx Application Object 1

the information of the mapped application objects.

#### VALUE DEFINITION

Bit(s)	Description
31-16	Index
15-8	Sub-Index
7-0	Length

The object describes the content of the PDO by their index, sub-index and length. The length contains the length of the application object in bit. This is used to verify the mapping. An attempt to change the value of an object entry to any value that is not supported is responded with the SDO abort transfer service. The cause for a not supported value could be the mapping (index and sub-index) of a non-existing application object, a wrong length for the mapped application object, or a wrong length for the PDO at all. The index and sub-index reference a simple data type for the so-called dummy mapping. This is used if no appropriate application object is available and to fill up the length of the RPDO to fit the length to the according TPDO. Use the following procedure for re-mapping, which take place during the NMT state Pre-operational and during the NMT state Operational, if supported:

1. Destroy RPDO by setting bit valid to 1<sub>b</sub> of sub-index 01<sub>h</sub> of the according RPDO communication parameter.
2. Disable mapping by setting sub-index 00<sub>h</sub> to 00<sub>h</sub>.
3. Modify mapping by changing the values of the corresponding sub-indices.
4. Enable mapping by setting sub-index 00<sub>h</sub> to the number of mapped objects.
5. Create RPDO by setting bit valid to 0<sub>b</sub> of sub-index 01<sub>h</sub> of the according RPDO communication parameter.

If during step 3 the CANopen device detects that index and sub-index of the mapped object does not exist or the object cannot be mapped the ITB-DC responds with the SDO abort transfer service. If during step 4 the CANopen device detects that the RPDO mapping is not valid or not possible the ITB-DC responds with the SDO abort transfer service. If the ITB-DC receives a PDO that is having more data bytes than the number of mapped data bytes is (length), then the ITB-DC use the first data bytes up to the length.

Sub-Index	01 <sub>h</sub>
Access	ReadWrite
Type	UNSIGNED32
Default Value	0x00000000
Mapping	False

#### 4.24.3 Application Object 2

For Details see [Tx Application Object 1](#).

Sub-Index	02 <sub>h</sub>
Access	ReadWrite
Type	UNSIGNED32
Default Value	0x00000000
Mapping	False



#### 4.24.4 Application Object 3

For Details see [Tx Application Object 1](#).

Sub-Index	03 <sub>h</sub>
Access	ReadWrite
Type	UNSIGNED32
Default Value	0x00000000
Mapping	False

#### 4.24.5 Application Object 4

For Details see [Tx Application Object 1](#).

Sub-Index	04 <sub>h</sub>
Access	ReadWrite
Type	UNSIGNED32
Default Value	0x00000000
Mapping	False

#### 4.24.6 Application Object 5

For Details see [Tx Application Object 1](#).

Sub-Index	05 <sub>h</sub>
Access	ReadWrite
Type	UNSIGNED32
Default Value	0x00000000
Mapping	False

#### 4.24.7 Application Object 6

For Details see [Tx Application Object 1](#).

Sub-Index	06 <sub>h</sub>
Access	ReadWrite
Type	UNSIGNED32
Default Value	0x00000000
Mapping	False

#### 4.24.8 Application Object 7

For Details see [Tx Application Object 1](#).

Sub-Index	07 <sub>h</sub>
Access	ReadWrite
Type	UNSIGNED32
Default Value	0x00000000
Mapping	False

#### 4.24.9 Application Object 8

For Details see [Tx Application Object 1](#).

Sub-Index	08 <sub>h</sub>
Access	ReadWrite
Type	UNSIGNED32
Default Value	0x00000000
Mapping	False

### 4.25 TPDO Mapping 2

This object contains the mapping parameters for the PDOs the ITB-DC is able to receive.

Index	1A01 <sub>h</sub>
Name	TPDO Mapping 2
Object Code	Record

#### 4.25.1 Highest supported Subindex

Contains the number of valid object entries within the record or a specific value (see Table), e.g. if MPDO is supported. The number of valid object entries is the number of the application objects that is transmitted with the corresponding TPDO.

Value	Description
00 <sub>h</sub>	Mapping disabled
01 <sub>h</sub>	Sub-index 01 <sub>h</sub> valid
02 <sub>h</sub>	Sub-index 01 <sub>h</sub> and 02 <sub>h</sub> valid
03 <sub>h</sub>	Sub-index 01 <sub>h</sub> to 03 <sub>h</sub> valid
04 <sub>h</sub>	Sub-index 01 <sub>h</sub> to 04 <sub>h</sub> valid
.....	.....
08 <sub>h</sub>	Sub-index 01 <sub>h</sub> to 08 <sub>h</sub> valid

Sub-Index	00 <sub>h</sub>
Access	Const
Type	UNSIGNED8
Default Value	8
Mapping	False

#### 4.25.2 Application Object 1

For Details see [Tx Application Object 1](#).

Sub-Index	01 <sub>h</sub>
Access	ReadWrite
Type	UNSIGNED32
Default Value	0x00000000
Mapping	False

#### 4.25.3 Application Object 2

For Details see [Tx Application Object 1](#).

Sub-Index	02 <sub>h</sub>
Access	ReadWrite
Type	UNSIGNED32
Default Value	0x00000000
Mapping	False

#### 4.25.4 Application Object 3

For Details see [Tx Application Object 1](#).

Sub-Index	03 <sub>h</sub>
Access	ReadWrite
Type	UNSIGNED32
Default Value	0x00000000
Mapping	False

#### 4.25.5 Application Object 4

For Details see [Tx Application Object 1](#).

Sub-Index	04 <sub>h</sub>
Access	ReadWrite
Type	UNSIGNED32
Default Value	0x00000000
Mapping	False

#### 4.25.6 Application Object 5

For Details see [Tx Application Object 1](#).

Sub-Index	05 <sub>h</sub>
Access	ReadWrite
Type	UNSIGNED32
Default Value	0x00000000
Mapping	False

#### 4.25.7 Application Object 6

For Details see [Tx Application Object 1](#).

Sub-Index	06 <sub>h</sub>
Access	ReadWrite
Type	UNSIGNED32
Default Value	0x00000000
Mapping	False

#### 4.25.8 Application Object 7

For Details see [Tx Application Object 1](#).

Sub-Index	07 <sub>h</sub>
Access	ReadWrite
Type	UNSIGNED32
Default Value	0x00000000
Mapping	False

#### 4.25.9 Application Object 8

For Details see [Tx Application Object 1](#).

Sub-Index	08 <sub>h</sub>
Access	ReadWrite
Type	UNSIGNED32
Default Value	0x00000000
Mapping	False

#### 4.26 TPDO Mapping 3

This object contains the mapping parameters for the PDOs the ITB-DC is able to receive.

Index	1A02 <sub>h</sub>
Name	TPDO Mapping 3
Object Code	Record

##### 4.26.1 Highest supported Subindex

Contains the number of valid object entries within the record or a specific value (see Table), e.g. if MPDO is supported. The number of valid object entries is the number of the application objects that is transmitted with the corresponding TPDO.

Value	Description
00 <sub>h</sub>	Mapping disabled
01 <sub>h</sub>	Sub-index 01 <sub>h</sub> valid
02 <sub>h</sub>	Sub-index 01 <sub>h</sub> and 02 <sub>h</sub> valid
03 <sub>h</sub>	Sub-index 01 <sub>h</sub> to 03 <sub>h</sub> valid
04 <sub>h</sub>	Sub-index 01 <sub>h</sub> to 04 <sub>h</sub> valid
.....	.....
08 <sub>h</sub>	Sub-index 01 <sub>h</sub> to 08 <sub>h</sub> valid

Sub-Index	00 <sub>h</sub>
Access	Const
Type	UNSIGNED8
Default Value	8
Mapping	False

#### 4.26.2 Application Object 1

For Details see [Tx Application Object 1](#).

Sub-Index	01 <sub>h</sub>
Access	ReadWrite
Type	UNSIGNED32
Default Value	0x00000000
Mapping	False

#### 4.26.3 Application Object 2

For Details see [Tx Application Object 1](#).

Sub-Index	02 <sub>h</sub>
Access	ReadWrite
Type	UNSIGNED32
Default Value	0x00000000
Mapping	False

#### 4.26.4 Application Object 3

For Details see [Tx Application Object 1](#).

Sub-Index	03 <sub>h</sub>
Access	ReadWrite
Type	UNSIGNED32
Default Value	0x00000000
Mapping	False

#### 4.26.5 Application Object 4

For Details see [Tx Application Object 1](#).

Sub-Index	04 <sub>h</sub>
Access	ReadWrite
Type	UNSIGNED32
Default Value	0x00000000
Mapping	False

#### 4.26.6 Application Object 5

For Details see [Tx Application Object 1](#).

Sub-Index	05 <sub>h</sub>
Access	ReadWrite
Type	UNSIGNED32
Default Value	0x00000000
Mapping	False

#### 4.26.7 Application Object 6

For Details see [Tx Application Object 1](#).

Sub-Index	06 <sub>h</sub>
Access	ReadWrite
Type	UNSIGNED32
Default Value	0x00000000
Mapping	False

#### 4.26.8 Application Object 7

For Details see [Tx Application Object 1](#).

Sub-Index	07 <sub>h</sub>
Access	ReadWrite
Type	UNSIGNED32
Default Value	0x00000000
Mapping	False

#### 4.26.9 Application Object 8

For Details see [Tx Application Object 1](#).

Sub-Index	08 <sub>h</sub>
Access	ReadWrite
Type	UNSIGNED32
Default Value	0x00000000
Mapping	False

## 4.27 TPDO Mapping 4

This object contains the mapping parameters for the PDOs the ITB-DC is able to receive.

Index	1A03 <sub>h</sub>
Name	TPDO Mapping 4
Object Code	Record

### 4.27.1 Highest supported Subindex

Contains the number of valid object entries within the record or a specific value (see Table), e.g. if MPDO is supported. The number of valid object entries is the number of the application objects that is transmitted with the corresponding TPDO.

Value	Description
00 <sub>h</sub>	Mapping disabled
01 <sub>h</sub>	Sub-index 01 <sub>h</sub> valid
02 <sub>h</sub>	Sub-index 01 <sub>h</sub> and 02 <sub>h</sub> valid
03 <sub>h</sub>	Sub-index 01 <sub>h</sub> to 03 <sub>h</sub> valid
04 <sub>h</sub>	Sub-index 01 <sub>h</sub> to 04 <sub>h</sub> valid
.....	.....
08 <sub>h</sub>	Sub-index 01 <sub>h</sub> to 08 <sub>h</sub> valid

Sub-Index	00 <sub>h</sub>
Access	Const
Type	UNSIGNED8
Default Value	8
Mapping	False

### 4.27.2 Application Object 1

For Details see [Tx Application Object 1](#).

Sub-Index	01 <sub>h</sub>
Access	ReadWrite
Type	UNSIGNED32
Default Value	0x00000000
Mapping	False



#### 4.27.3 Application Object 2

For Details see [Tx Application Object 1](#).

Sub-Index	02 <sub>h</sub>
Access	ReadWrite
Type	UNSIGNED32
Default Value	0x00000000
Mapping	False

#### 4.27.4 Application Object 3

For Details see [Tx Application Object 1](#).

Sub-Index	03 <sub>h</sub>
Access	ReadWrite
Type	UNSIGNED32
Default Value	0x00000000
Mapping	False

#### 4.27.5 Application Object 4

For Details see [Tx Application Object 1](#).

Sub-Index	04 <sub>h</sub>
Access	ReadWrite
Type	UNSIGNED32
Default Value	0x00000000
Mapping	False

#### 4.27.6 Application Object 5

For Details see [Tx Application Object 1](#).

Sub-Index	05 <sub>h</sub>
Access	ReadWrite
Type	UNSIGNED32
Default Value	0x00000000
Mapping	False

#### 4.27.7 Application Object 6

For Details see [Tx Application Object 1](#).

Sub-Index	06 <sub>h</sub>
Access	ReadWrite
Type	UNSIGNED32
Default Value	0x00000000
Mapping	False

#### 4.27.8 Application Object 7

For Details see [Tx Application Object 1](#).

Sub-Index	07 <sub>h</sub>
Access	ReadWrite
Type	UNSIGNED32
Default Value	0x00000000
Mapping	False

#### 4.27.9 Application Object 8

For Details see [Tx Application Object 1](#).

Sub-Index	08 <sub>h</sub>
Access	ReadWrite
Type	UNSIGNED32
Default Value	0x00000000
Mapping	False

## 5 Manufacturer Segment

### 5.1 Command

This object contains the command and its parameter variables. For details see [Commands](#).

Index	2000 <sub>h</sub>
Name	Command
Object Code	Record

#### 5.1.1 Highest sub-index supported

Sub-Index	00 <sub>h</sub>
Access	Const
Type	UNSIGNED8
Default Value	7
Mapping	False

#### 5.1.2 Type

Sub-Index	01 <sub>h</sub>
Access	WriteOnly
Type	UNSIGNED32
Value	0 = Standard 1 = Extended
Mapping	False

#### 5.1.3 Code

Sub-Index	02 <sub>h</sub>
Access	WriteOnly
Type	UNSIGNED32
Value	For details see ??
Mapping	False

#### 5.1.4 Status

Sub-Index	03 <sub>h</sub>
Access	ReadOnly

Type	UNSIGNED32
Value	0 = OK 1 = Failed Command 2 = Unknown TYPE 4 = Unknown CODE
Mapping	False

#### 5.1.5 Parameter 0

Sub-Index	04 <sub>h</sub>
Access	ReadWrite
Type	UNSIGNED32
Mapping	False

#### 5.1.6 Parameter 1

Sub-Index	05 <sub>h</sub>
Access	ReadWrite
Type	UNSIGNED32
Mapping	False

#### 5.1.7 Parameter 2

Sub-Index	06 <sub>h</sub>
Access	ReadWrite
Type	UNSIGNED32
Mapping	False

#### 5.1.8 Parameter 3

Sub-Index	07 <sub>h</sub>
Access	ReadWrite
Type	UNSIGNED32
Mapping	False

## 5.2 Configuration

Contains objects for general configuration.

Index	2200 <sub>h</sub>
Name	Configuration
Object Code	Record

### 5.2.1 Highest sub-index supported

Sub-Index	00 <sub>h</sub>
Access	Const
Type	UNSIGNED8
Default Value	15
Mapping	False

### 5.2.2 Position 1

Sub-Index	01 <sub>h</sub>
Access	ReadWrite
Type	UNSIGNED16
Value	Value = raw * 0.002 [%] Range: 0..50000 Preset position 1.
Mapping	False

### 5.2.3 Position 2

Sub-Index	02 <sub>h</sub>
Access	ReadWrite
Type	UNSIGNED16
Value	Value = raw * 0.002 [%] Range: 0..50000 Preset position 2.
Mapping	False

### 5.2.4 Input Open Position

Sub-Index	03 <sub>h</sub>
Access	ReadWrite
Type	UNSIGNED16
Value	Value = raw * 0.002 [%] % = 0 mA; 100% = 20 mA
Mapping	False

### 5.2.5 Input Close Position

Sub-Index	04 <sub>h</sub>
Access	ReadWrite
Type	UNSIGNED16
Value	Value = raw * 0.002 [%] % = 0 mA; 100% = 20 mA
Mapping	False

### 5.2.6 Output Open Position

Sub-Index	05 <sub>h</sub>
Access	ReadWrite
Type	UNSIGNED16
Value	Value = raw * 0.002 [%] % = 0 mA; 100% = 20 mA
Mapping	False

### 5.2.7 Output Close Position

Sub-Index	06 <sub>h</sub>
Access	ReadWrite
Type	UNSIGNED16
Value	Value = raw * 0.002 [%] % = 0 mA; 100% = 20 mA
Mapping	False

### 5.2.8 Input Selection

Sub-Index	07 <sub>h</sub>
Access	ReadWrite
Type	UNSIGNED8
Value	0 = n.c 1 = Analog current 2 = n.c 3 = n.c 4 = n.c 5 = Field bus
Mapping	False

### 5.2.9 Output Selection

Sub-Index	08 <sub>h</sub>
Access	ReadWrite
Type	UNSIGNED8
Value	0 = n.c 1 = Analog current
Mapping	False

### 5.2.10 Input Direction

Sub-Index	09 <sub>h</sub>
Access	ReadWrite
Type	UNSIGNED8
Value	0 = Direction close 1 = Direction open
Mapping	False

### 5.2.11 Input Initial Position

Sub-Index	0A <sub>h</sub>
Access	ReadWrite
Type	UNSIGNED8
Value	0 = Open 1 = Close
Mapping	False

**5.2.12 Hardware Control Mode****Obsolete!**

Sub-Index	0B <sub>h</sub>
Access	ReadWrite
Type	UNSIGNED8
Value	0 = Disable 1 = Enable
Mapping	False

**5.2.13 External Device Type**

Sub-Index	0C <sub>h</sub>
Access	ReadOnly
Type	UNSIGNED8
Value	0 = n.c 1 = Throttle 2 = Unknown 3 = None
Mapping	False

**5.2.14 External Device ID**

Sub-Index	0D <sub>h</sub>
Access	ReadOnly
Type	UNSIGNED32
Value	0 = Unknown Device Depends on device type
Mapping	False

**5.2.15 Configuration Timestamp**

Sub-Index	0E <sub>h</sub>
Access	ReadOnly
Type	UNSIGNED64
Mapping	False



### 5.2.16 External Record Revision

Sub-Index	0F <sub>h</sub>
Access	ReadOnly
Type	UNSIGNED32
Value	Depends on device type
Mapping	False

## 5.3 Service Contact Information

The contact to the respective service partner should be stored in these objects.

Index	2201 <sub>h</sub>
Name	Service Contact Information
Object Code	Record

### 5.3.1 Highest sub-index supported

Sub-Index	00 <sub>h</sub>
Access	Const
Type	UNSIGNED8
Default Value	5
Mapping	False

### 5.3.2 Service Contact Line 1

Sub-Index	01 <sub>h</sub>
Access	ReadWrite
Type	VISIBLE STRING [41]
Value	Zero terminated string, max 40 characters + trailing 0
Mapping	False

### 5.3.3 Service Contact Line 2

Sub-Index	02 <sub>h</sub>
Access	ReadWrite
Type	VISIBLE STRING [41]

Value	Zero terminated string, max 40 characters + trailing 0
Mapping	False

#### 5.3.4 Service Contact Line 3

Sub-Index	03 <sub>h</sub>
Access	ReadWrite
Type	VISIBLE STRING [41]
Value	Zero terminated string, max 40 characters + trailing 0
Mapping	False

#### 5.3.5 Service Contact Line 4

Sub-Index	04 <sub>h</sub>
Access	ReadWrite
Type	VISIBLE STRING [41]
Value	Zero terminated string, max 40 characters + trailing 0
Mapping	False

#### 5.3.6 Service Contact Line 5

Sub-Index	05 <sub>h</sub>
Access	ReadWrite
Type	VISIBLE STRING [41]
Value	Zero terminated string, max 40 characters + trailing 0
Mapping	False

#### 5.3.7 Side

Not implemented yet. To be included in the next release.

Sub-Index	06 <sub>h</sub>
Access	ReadWrite

Type	VISIBLE STRING [41]
Value	Zero terminated string, max 40 characters + trailing 0
Mapping	False

### 5.3.8 Module

Not implemented yet. To be included in the next release.

Sub-Index	07 <sub>h</sub>
Access	ReadWrite
Type	VISIBLE STRING [41]
Value	Zero terminated string, max 40 characters + trailing 0
Mapping	False

### 5.3.9 Location

Not implemented yet. To be included in the next release.

Sub-Index	08 <sub>h</sub>
Access	ReadWrite
Type	VISIBLE STRING [41]
Value	Zero terminated string, max 40 characters + trailing 0
Mapping	False

## 5.4 Tests and Fault Behavior

Not implemented yet. To be included in the next release.

Contains the detection of external error conditions and the handling of them.

Index	2300 <sub>h</sub>
Name	Tests and Fault Behavior
Object Code	Record

### 5.4.1 Highest sub-index supported

Sub-Index	00 <sub>h</sub>
-----------	-----------------

Access	Const
Type	UNSIGNED8
Default Value	5
Mapping	False

#### 5.4.2 Error Position Enable

Sub-Index	01 <sub>h</sub>
Access	ReadWrite
Type	UNSIGNED8
Value	0 = Disabled 1 = Enabled Switching on the approach to the error position.
Default Value	0
Mapping	False

#### 5.4.3 Error Position

Sub-Index	02 <sub>h</sub>
Access	ReadWrite
Type	UNSIGNED16
Value	Value = raw * 0.002 [%] Range: 0..50000 This position is approached in the event of an error.
Default Value	0
Mapping	False

#### 5.4.4 Field bus timeout Enable

Sub-Index	03 <sub>h</sub>
Access	ReadWrite
Type	UNSIGNED8
Value	0 = Disabled 1 = Enabled
Default Value	0
Mapping	False

**5.4.5 Field bus timeout**

Sub-Index	04 <sub>h</sub>
Access	ReadWrite
Type	UNSIGNED16
Value	[ms] Range: 50..10000
Default Value	0
Mapping	False

**5.4.6 Cable Break Detection Enable**

Sub-Index	05 <sub>h</sub>
Access	ReadWrite
Type	UNSIGNED8
Value	0 = Disabled 1 = Enabled Switching on the cable break detection for 4-20 mA input.
Default Value	0
Mapping	False

**5.4.7 Cable Break Detection Limit**

Sub-Index	06 <sub>h</sub>
Access	ReadWrite
Type	UNSIGNED16
Value	Value = raw * 0.1 [mA] Range: 0..40
Default Value	36
Mapping	False

**5.4.8 Error Output Polarity**

Sub-Index	07 <sub>h</sub>
Access	ReadWrite
Type	UNSIGNED8

Value	0 = Normally Open 1 = Normally Closed Reverses the polarity of the error output.
Default Value	0
Mapping	False

## 5.5 Runtime Data

These objects contain current values of the ITB-DC and the status.

Index	2700 <sub>h</sub>
Name	Runtime Data
Object Code	Record

### 5.5.1 Highest sub-index supported

Sub-Index	00 <sub>h</sub>
Access	Const
Type	UNSIGNED8
Default Value	7
Mapping	False

### 5.5.2 Actual Value

Sub-Index	01 <sub>h</sub>
Access	ReadOnly
Type	UNSIGNED16
Value	Value = raw * 0.002 [%] 0% = Close; 100% = Open
Mapping	True
Update	10 ms

### 5.5.3 Target Value

Sub-Index	02 <sub>h</sub>
Access	ReadWrite
Type	UNSIGNED16

Value	Value = raw * 0.002 [%] 0% = Close; 100% = Open
Mapping	True
Update	10 ms

#### 5.5.4 Voltage Input Value

Obsolet!

Sub-Index	03 <sub>h</sub>
Access	ReadOnly
Type	UNSIGNED16
Value	Value = raw * 1 [mV]
Mapping	True
Update	10 ms

#### 5.5.5 Current Input Value

Sub-Index	04 <sub>h</sub>
Access	ReadOnly
Type	UNSIGNED16
Value	Value = raw * 1 [μA]
Mapping	True
Update	10 ms

#### 5.5.6 Device Status

Sub-Index	05 <sub>h</sub>
Access	ReadOnly
Type	UNSIGNED16
Value	0x0001 = Closed Position 0x0002 = Open Position 0x0004 = Manual/Auto 0x0008 = Offline 0x0010 = Reference Run 0x0020 = Configured 0x0040 = n.c 0x0080 = Stepper Motor 0x0100 = Error 0x0200 = Warning

Mapping	True
Update	10 ms

### 5.5.7 Supply Voltage

Sub-Index	06 <sub>h</sub>
Access	ReadOnly
Type	UNSIGNED16
Value	[mV]
Mapping	True

### 5.5.8 Operating Hours

Sub-Index	07 <sub>h</sub>
Access	ReadOnly
Type	UNSIGNED32
Value	[s]
Mapping	True

## 5.6 Error Status

The objects contain bit-coded error states.

Index	2701 <sub>h</sub>
Name	Error Status
Object Code	Record

### 5.6.1 Highest sub-index supported

Sub-Index	00 <sub>h</sub>
Access	Const
Type	UNSIGNED8
Default Value	1
Mapping	False



### 5.6.2 Error Flags

Sub-Index	01 <sub>h</sub>
Access	ReadOnly
Type	UNSIGNED16
Value	0x0001 = Step Error 0x0002 = Time Out Error 0x0004 = Low Power Error 0x0008 = Over Temperature Error 0x0010 = Over Current Error 0x0020 = Analog Input Range 0x0040 = Fieldbus Timeout
Mapping	True

## 5.7 Runtime Data Diagnostics

These objects contain internal values and states for diagnostics.

Index	2710 <sub>h</sub>
Name	Runtime Data Diagnostics
Object Code	Record

### 5.7.1 Highest sub-index supported

Sub-Index	00 <sub>h</sub>
Access	Const
Type	UNSIGNED8
Default Value	6
Mapping	False

### 5.7.2 System State

Sub-Index	01 <sub>h</sub>
Access	ReadOnly
Type	UNSIGNED8

Value	0 = Operational Analog 1 = Operational Digital 2 = reserved 3 = Operational Pos 1 4 = Operational Pos 2 5 = Operational Error 6 = Configuration 7 = Configuration Error 8 = Manual Drive 9 = Manual Drive Error 10 = Open Drive 11 = Open Drive Error 12 = Close Drive 13 = Close Drive Error 14 = Pos 1 Drive 15 = Pos 1 Drive Error 16 = Pos 2 Drive 17 = Pos 2 Drive Error 18 = Reference Drive 19 = Reference Drive Error 20 = Steps 21 = Steps Error 22 = Button Ctrl 23 = Button Ctrl Error 24 = Auto Mode 25 = Auto Mode Error 26 = Manual Mode 27 = Manual Mode Error 28 = Start Up Mode 29 = Start Up Mode Error 30 = Ready Mode 31 = Ready Mode Error 32 = Low Power Error 33 = Over Current Error 34 = Over Temp Error 35 = External Reset 36 = Internal Reset 37 = Error Acknowledge 38 = Manual Adjust 39 = Manual Adjust Error 40 = Operational Fieldbus 41 = Unconfigured 42 = Unconfigured Error 43 = Operational Speed Ctl 44 = Step Loss 45 = Step Loss Error 46 = Pos Error Drive 47 = Pos Error Drive Error
Mapping	True

**5.7.3 Stepper Motor FSM State**

Sub-Index	02 <sub>h</sub>
Access	ReadOnly
Type	UNSIGNED8
Value	0 = Idle 1 = Stop 2 = Accelerate 3 = Maximum Speed 4 = Decelerate 5 = Constant Speed 6 = Error
Mapping	True

**5.7.4 Reference Drive FSM State**

Sub-Index	03 <sub>h</sub>
Access	ReadOnly
Type	UNSIGNED8
Value	0 = Not Found 1 = Init 2 = Search Direction First 3 = Search Direction Second 4 = Found 5 = Error
Mapping	True

**5.7.5 Operation Mode**

Sub-Index	04 <sub>h</sub>
Access	ReadOnly
Type	UNSIGNED8
Value	0 = hardware controlled 1 = Fieldbus/MICT 2 = Unknown
Mapping	True

**5.7.6 Operation Mode Value**

Sub-Index	05 <sub>h</sub>
Access	ReadOnly

Type	UNSIGNED8
Value	0 = Manual 1 = Auto 2 = Unknown
Mapping	True

### 5.7.7 OS CPU Usage

Sub-Index	06 <sub>h</sub>
Access	ReadOnly
Type	UNSIGNED8
Value	[%]
Mapping	True

## 5.8 Digital Inputs

This object contains the status of the digital inputs. See also CiA 402-2 Object 60FD<sub>h</sub>

Index	27FD <sub>h</sub>
Name	Digital Inputs
Object Code	Record

### 5.8.1 Highest sub-index supported

Sub-Index	00 <sub>h</sub>
Access	Const
Type	UNSIGNED8
Default Value	1
Mapping	False

### 5.8.2 Digital Inputs

The status of the digital inputs are represented here as bits.

Sub-Index	01 <sub>h</sub>
Access	ReadOnly
Type	UNSIGNED16

Value	0x0004 = Position 1 0x0008 = Position 2 0x0010 = Reset
Mapping	True
Update	100 ms

## 5.9 Digital Outputs

This object contains the status of the digital outputs. See also CiA 402-2 Object 60FE<sub>h</sub>

Index	27FE <sub>h</sub>
Name	Digital Outputs
Object Code	Record

### 5.9.1 Highest sub-index supported

Sub-Index	00 <sub>h</sub>
Access	Const
Type	UNSIGNED8
Default Value	1
Mapping	False

### 5.9.2 Digital Outputs

The status of the digital outputs are represented here as bits.

Sub-Index	01 <sub>h</sub>
Access	ReadOnly
Type	UNSIGNED16
Value	0x0001 = Error 0x0002 = Close 0x0004 = Open 0x0008 = Position 1 0x0010 = Position 2 0x0020 = Offline
Mapping	True
Update	100 ms

## 5.10 Temperatures

These objects contain the devices internal temperatures.

Index	2F00 <sub>h</sub>
Name	Temperatures
Object Code	Record

### 5.10.1 Highest sub-index supported

Sub-Index	00 <sub>h</sub>
Access	Const
Type	UNSIGNED8
Default Value	3
Mapping	False

### 5.10.2 Current Temperature

Sub-Index	01 <sub>h</sub>
Access	ReadOnly
Type	INTEGER16
Value	Value = raw * 0.1 [°C]
Mapping	True
Update	1000 ms

### 5.10.3 Min Temperature

Sub-Index	02 <sub>h</sub>
Access	ReadOnly
Type	INTEGER16
Value	Value = raw * 0.1 [°C]
Mapping	False

### 5.10.4 Max Temperature

Sub-Index	03 <sub>h</sub>
Access	ReadOnly
Type	INTEGER16

Value	Value = raw * 0.1 [°C]
Mapping	False

## 5.11 Device Info

These objects contain various version and equipment information.

Index	2FFF <sub>h</sub>
Name	Device Info
Object Code	Record

### 5.11.1 Highest sub-index supported

Sub-Index	00 <sub>h</sub>
Access	Const
Type	UNSIGNED8
Default Value	10
Mapping	False

### 5.11.2 Device ID

Sub-Index	01 <sub>h</sub>
Access	ReadOnly
Type	UNSIGNED32
Value	8 bit Device Class, 16 bit Device Number, 8 bit Device variant
Mapping	False

### 5.11.3 Extended Device ID

Sub-Index	02 <sub>h</sub>
Access	ReadOnly
Type	UNSIGNED32
Value	Optional, Missing means 0
Mapping	False

**5.11.4 Firmware Version**

Sub-Index	03 <sub>h</sub>
Access	ReadOnly
Type	UNSIGNED64
Value	8 bit major, 8 bit minor, 16 bit bugfix, 32 bit SVN
Mapping	False

**5.11.5 Hardware Version**

Sub-Index	04 <sub>h</sub>
Access	ReadOnly
Type	UNSIGNED64
Value	8 bit major, 8 bit minor, 16 bit bugfix, 32 bit SVN
Mapping	False

**5.11.6 Bootloader Version**

Sub-Index	05 <sub>h</sub>
Access	ReadOnly
Type	UNSIGNED64
Value	8 bit major, 8 bit minor, 16 bit bugfix, 32 bit SVN
Mapping	False

**5.11.7 Controller Board Serial Number**

Sub-Index	06 <sub>h</sub>
Access	ReadOnly
Type	VISIBLE STRING [29]
Value	Zero terminated string, max 28 characters + trailing 0
Mapping	False

**5.11.8 Device Serial Number**



Sub-Index	07 <sub>h</sub>
Access	ReadOnly
Type	VISIBLE STRING [29]
Value	Zero terminated string, max 28 characters + trailing 0
Mapping	False

#### 5.11.9 Arrangement Number

Sub-Index	08 <sub>h</sub>
Access	ReadOnly
Type	VISIBLE STRING [29]
Value	Zero terminated string, max 28 characters + trailing 0
Mapping	False

#### 5.11.10 Add-On Board Serial Number

Obsolet!

Sub-Index	09 <sub>h</sub>
Access	ReadOnly
Type	VISIBLE STRING [29]
Value	Zero terminated string, max 28 characters + trailing 0
Mapping	False

#### 5.11.11 Add-On Board Hardware Version

Obsolet!

Sub-Index	0A <sub>h</sub>
Access	ReadOnly
Type	UNSIGNED64
Mapping	False

## I Revision History

Date	Name	Comment	Rev.
2021-11-12	VZA	Init. Add to VariStep3: Chapter 'Tests and Fault Behavior'. Append two error bits in <a href="#">Error Status</a> . Append two states in <a href="#">System State</a> .	
2024-06-12	VZA	General error correction. Objects marked for removal.	
2025-11-24	Zabe, Volker	Approved	1

## II Used Tools

Tool	Version
MUSE-Link	0.2
MUSE	1.0
MUSE-CANopen	0.2
MUSE-Link	0.2
MUSE-Latex	0.3

### III Copyright

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