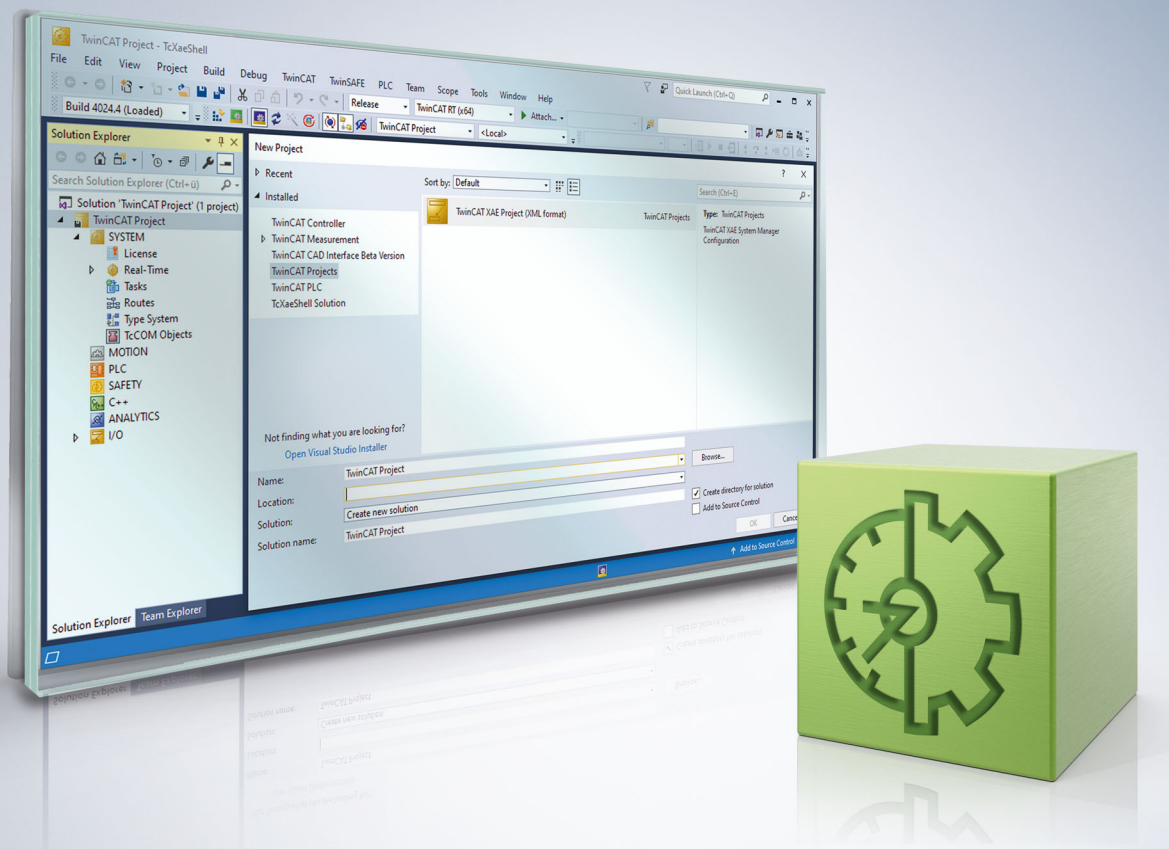
BECKHOFF New Automation Technology

Manual | EN

TE1000

TwinCAT 3 | ADS Basics



2024-01-03 | Version: 2.3.0

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1 Foreword

1.1 Notes on the documentation

This description is intended exclusively for trained specialists in control and automation technology who are familiar with the applicable national standards.
For installation and commissioning of the components, it is absolutely necessary to observe the documentation and the following notes and explanations.
The qualified personnel is obliged to always use the currently valid documentation.

The responsible staff must ensure that the application or use of the products described satisfies all requirements for safety, including all the relevant laws, regulations, guidelines, and standards.

Disclaimer

The documentation has been prepared with care. The products described are, however, constantly under development.
We reserve the right to revise and change the documentation at any time and without notice.
No claims to modify products that have already been supplied may be made on the basis of the data, diagrams, and descriptions in this documentation.

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EP1590927, EP1789857, EP1456722, EP2137893, DE102015105702
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1.2 For your safety

Safety regulations

Read the following explanations for your safety.
Always observe and follow product-specific safety instructions, which you may find at the appropriate places in this document.

Exclusion of liability

All the components are supplied in particular hardware and software configurations which are appropriate for the application. Modifications to hardware or software configurations other than those described in the documentation are not permitted, and nullify the liability of Beckhoff Automation GmbH & Co. KG.

Personnel qualification

This description is only intended for trained specialists in control, automation, and drive technology who are familiar with the applicable national standards.

Signal words

The signal words used in the documentation are classified below. In order to prevent injury and damage to persons and property, read and follow the safety and warning notices.

Personal injury warnings

⚠ DANGER

Hazard with high risk of death or serious injury.

⚠ WARNING

Hazard with medium risk of death or serious injury.

⚠ CAUTION

There is a low-risk hazard that could result in medium or minor injury.

Warning of damage to property or environment

NOTICE

The environment, equipment, or data may be damaged.

Information on handling the product

This information includes, for example:
recommendations for action, assistance or further information on the product.

1.3 Notes on information security

The products of Beckhoff Automation GmbH & Co. KG (Beckhoff), insofar as they can be accessed online, are equipped with security functions that support the secure operation of plants, systems, machines and networks. Despite the security functions, the creation, implementation and constant updating of a holistic security concept for the operation are necessary to protect the respective plant, system, machine and networks against cyber threats. The products sold by Beckhoff are only part of the overall security concept. The customer is responsible for preventing unauthorized access by third parties to its equipment, systems, machines and networks. The latter should be connected to the corporate network or the Internet only if appropriate protective measures have been set up.

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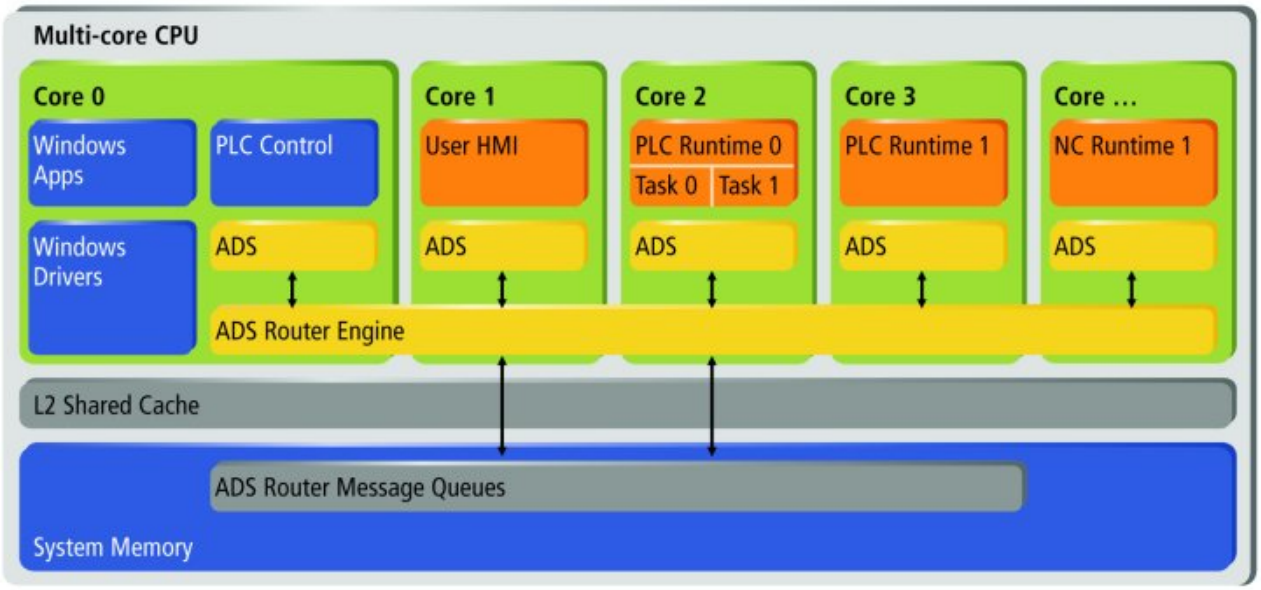
2 ADS device concept

The TwinCAT system architecture allows the individual modules of the software (e.g. TwinCAT PLC, User HMI, ...) to be treated as independent devices: For every task there is a software module ("Server" or "Client"). The servers in the system are the executing working "devices" in the form of software, whose operating behaviour is exactly like that of a hardware device. For this reason we can speak of "virtual" devices implemented in the software. The "clients" are programs which request the services of the "servers", e.g. a visualisation, or even a "programming device" in the form of a program. It is thus possible for TwinCAT to grow, since there can always be new servers and clients for tasks such as camshaft controllers, oscilloscopes, PID controllers etc..

The messages between these objects are exchanged through a consistent ADS (**A**utomation **D**evice **S**pecification) interface by the "message router". This manages and distributes all the messages in the system and over the TCP/IP connections.

TwinCAT message routers exist on every TwinCAT device.
This allows all TwinCAT server and client programs to exchange commands and data, to send messages, transfer status information, etc..

The following picture shows the TwinCAT device concept, based on ADS:



3 ADS device identification

The unique identification of ADS devices is implemented with the aid of two identifiers:

- PortNr
- NetId

AMS ports

ADS devices in a TwinCAT message router are uniquely identified by a number, called the ADS port no. This is specified and fixed for ADS devices, whereas pure ADS client applications (e.g. a HMI system) are allocated a variable port number when they first access the message router.

The following AMS port numbers are already assigned:

AMS port	Device
1	**ADS router**
2	**AMS debugger**
10	**TCom server**
11	**TCom server task, RT context**
12	**TCom server, passive level**
20	**TwinCAT debugger**
21	**TwinCAT debugger task**
30	**License server**
100	**Logger**
110	**Event logger**
120	**Application for EtherCAT devices**
130	**Event logger user mode (V2)**
131	**Event logger real-time (V2)**
132	**Event logger publisher (V2)**
200	**Ring 0 real-time**
290	**Ring 0 trace**
300	**Ring 0 IO**
400	**Ring 0 PLC (legacy)**
500	**Ring 0 NC**
501	**Ring 0 NC SEC**
511	**Ring 0 NC SPP**
520	**NC instance**
550	**Ring ISG**
600	**Ring 0 CNC**
700	**Ring 0 line**
800	**Ring 0 TC2 PLC**
801	**TC2 PLC runtime system 1**
811	**TC2 PLC runtime system 2**
821	**TC2 PLC runtime system 3**
831	**TC2 PLC runtime system 4**
850	**Ring 0 TC3 PLC**
851	**TC3 PLC runtime system 1**
852	**TC3 PLC runtime system 2**
853	**TC3 PLC runtime system 3**
854 - …	**TC3 PLC runtime system 4 - …**
900	**Cam controller**
950	**CAM tool**
1000–1199	**Ring 0 IO ports**
2000	**Ring 0 user**
2500	**Crestron server**
10000	**System service**
10201	**TCP/IP server**
10300	**System Manager**
10400	**SMS server**
10500	**Modbus server**
10502	**AMS logger**
10600	**XML data server**
10700	**Automatic configuration**

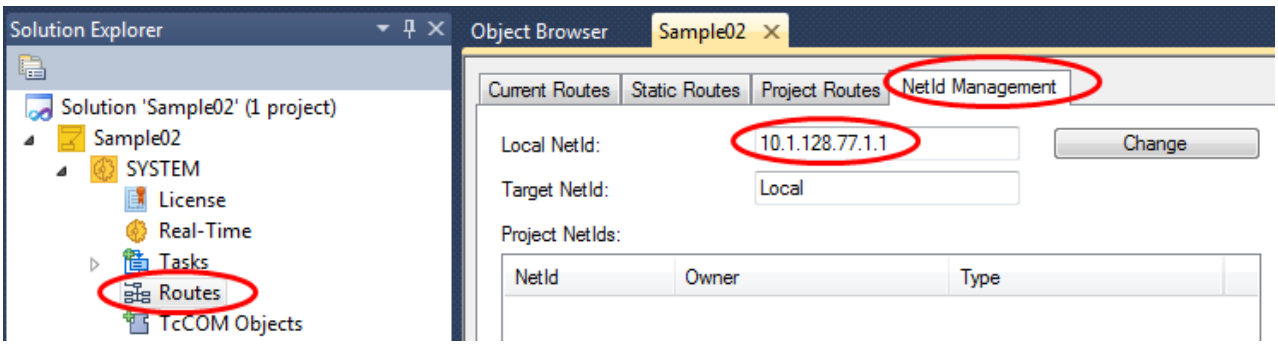
AMS port	Device
10800	**PLC control**
10900	**FTP client**
11000	**NC control system**
11500	**NC interpreter**
11600	**GST interpreter**
12000	**Track control**
13000	**CAM control**
14000	**Scope server**
14100	**Condition monitoring**
15000	**Sine CH1**
16000	**CONTROL NET**
17000	**OPC server**
17500	**OPC client**
18000	**Mail server**
19000	**Virtual COM EL60xx**
19100	**Management server**
19200	**Miele@home server**
19300	**CP-Link 3**
19310	**Touch lock**
19500	**Vision service**
19800	**HMI server**
21372	**Database server**
25000–25999	**Reserved port range for ADS servers**
25013	**FIAS server**
25014	**Bang&Olufsen server**
26000–26999	**Private port range for customers**
32768–65535	**Reserved port range for ADS clients**

AMS NetId

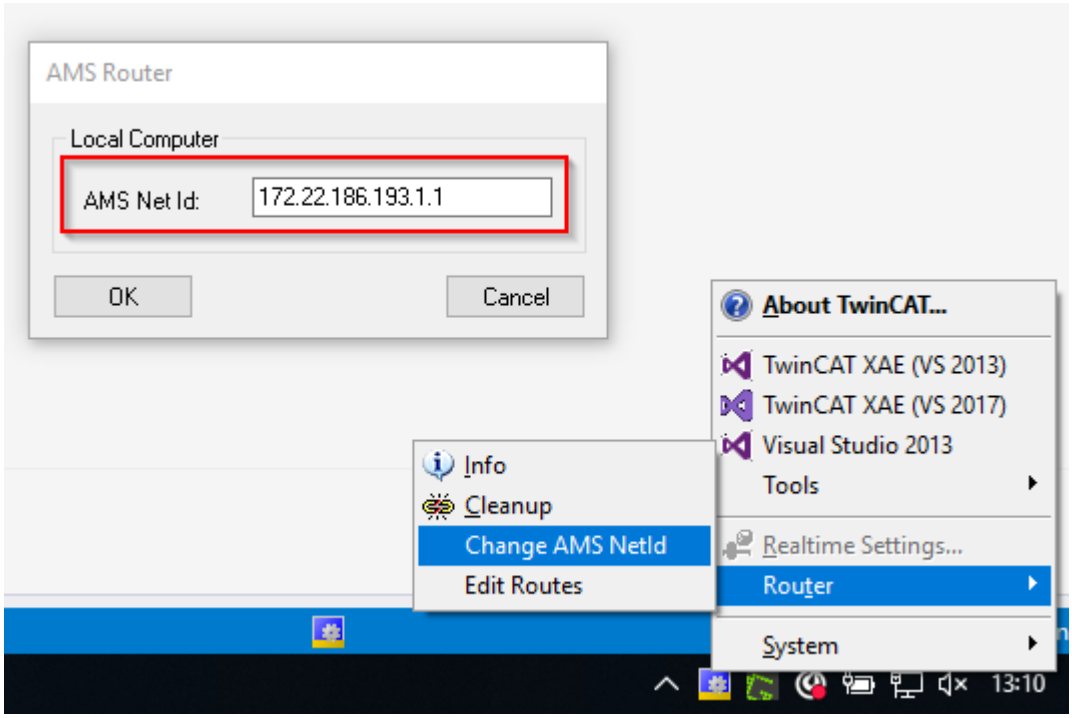
Each TwinCAT device in the network is identified by the AMS NetId. The AMS NetId consists of six octets. The first four octets can be freely selected. The last two octets (usually .1.1) serve as subnet mask for fieldbuses or further devices. The AMS NetId must be unique for all communication partners.

Configuration:

The AMS NetId of a local or remote TwinCAT device can be set in SYSTEM\Routes\NetId Management of a TC3 project.



Alternatively, the AMS NetId can be configured locally via the Router category in the TwinCAT SysTray menu. The device must be restarted after changing the AMS NetId.


AMS Router
Local Computer
AMS Net Id:
172.22.186.193.1.1
OK
Cancel
About TwinCAT...
TwinCAT XAE (VS 2013)
TwinCAT XAE (VS 2017)
Visual Studio 2013
Tools
Realtime Settings...
Router
System
Info
Cleanup
Change AMS NetId
Edit Routes
13:10

4 Client-server relationship

ADS services can initially be categorized into "confirmed" and "unconfirmed" services.

ADS-Client	ADS-Server
Request ->	-> Indication
Confirmation <-	<- Response

The progress of an ADS communication begins with an ADS request, which arrives at the ADS server where it is viewed as an ADS indication.

The ADS server replies with an ADS response, which in turn is received by the ADS client as an ADS confirmation.

Messages that are sent autonomously by an ADS server (e.g. error or other status messages) are registered by the ADS client as a notification indication.

General ADS services

The general ADS communication services are classified into

- Asynchronous
  - the client makes the ADS request to the server
  - the client continues to operate (without the ADS confirmation)
  - the server processes the ADS request, and provides the client with the result with a call-back (ADS confirmation to the client)
- Notification
  - the client registers itself with an ADS request to the server for a specific service
  - the server provides the service to the client autonomously by call-back (ADS confirmation to the client), until the client cancels its request for the service
  - the advantage of this kind of communication is the low additional ADS protocol overhead, since cyclical ADS requests from the client program are not occurring

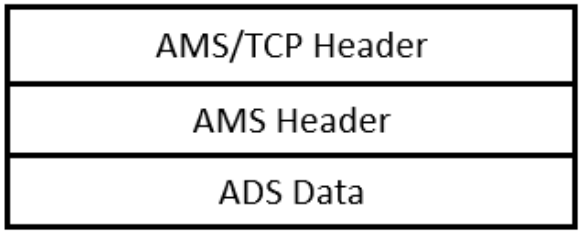
Specific ADS services

Over and above the general ADS services, additional functions that encapsulate ADS communications and permit operation with, e.g., Visual Basic or Visual C++ are defined. These "specific ADS services " are implemented in ADS-OCX or in the ADS-DLL, and provide, for instance, facilities for synchronous communication, or consider restrictions that might exist (in Visual Basic, for example, variable types with no leading sign).

- Synchronous
  - the client makes the ADS request to the server
  - the client thread that makes the call is suspended for the duration of the ADS communication
  - when the ADS request call returns, the result from the ADS server is already available
  - the advantage of this kind of communication is the low administrative overhead required from the client program

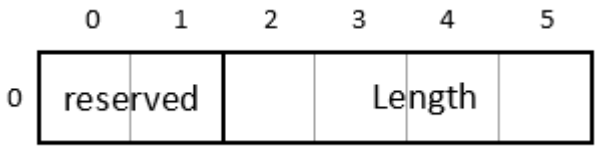
5 AMS/TCP Packet

5.1 Structure AMS/TCP Packet



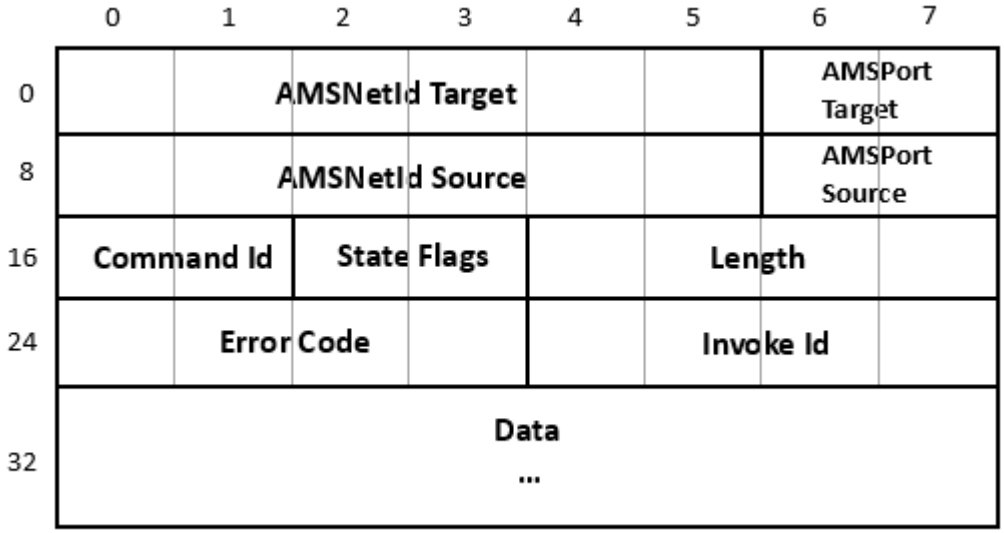
Data array	Size	Description
AMS/TCP Header	6 bytes	Contains the length of the data packet.
AMS Header	32 bytes	The AMS/TCP-Header contains the addresses of the transmitter and receiver. In addition the AMS error code , the ADS command Id and some other information.
ADS Data	n bytes	The ADS data range contains the parameter of the single ADS commands. The structure of the data array depends on the ADS command. Some ADS commands require no additional data.

5.2 AMS/TCP Header



Data array	Size	Description
reserved	2 bytes	These bytes must be set to 0.
Length	4 bytes	This array contains the length of the data packet. It consists of the AMS-Header and the enclosed ADS data. The unit is bytes.

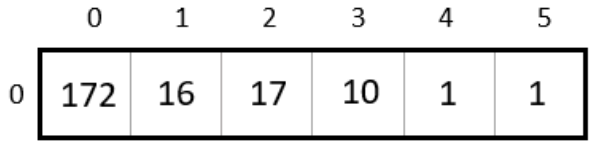
5.3 AMS Header



Data array	Size	Description
AMSNetId Target	6 bytes	This is the AMSNetId of the station, for which the packet is intended. Remarks see below [▶ 15].
AMSPort Target	2 bytes	This is the AMSPort of the station, for which the packet is intended.
AMSNetId Source	6 bytes	This contains the AMSNetId of the station, from which the packet was sent.
AMSPort Source	2 bytes	This contains the AMSPort of the station, from which the packet was sent.
Command Id	2 bytes	see below [▶ 15].
State Flags	2 bytes	see below [▶ 15].
Data Length	4 bytes	Size of the data range. The unit is byte.
Error Code	4 bytes	AMS error number. See ADS Return Codes.
Invoke Id	4 bytes	Free usable 32 bit array. Usually this array serves to send an Id. This Id makes is possible to assign a received response to a request, which was sent before.
Data	n bytes	Data range. The data range contains the parameter of the considering ADS commands.

AMS Net Id

The AMSNetId consists of 6 bytes and addresses the transmitter or receiver. One possible AMSNetId would be e.g.. 172.16.17.10.1.1. The storage arrangement in this example is as follows:



The AMSNetId is purely logical and has usually no relation to the IP address. The AMSNetId is configurated at the target system. At the PC for this the TwinCAT System Control is used. If you use other hardware, see the considering documentation for notes about settings of the AMS NetId.

Command Id

Cmd	Description
0x0000	Invalid
0x0001	ADS Read Device Info [▶ 16]
0x0002	ADS Read [▶ 17]
0x0003	ADS Write [▶ 17]
0x0004	ADS Read State [▶ 18]
0x0005	ADS Write Control [▶ 18]
0x0006	ADS Add Device Notification [▶ 19]
0x0007	ADS Delete Device Notification [▶ 20]
0x0008	ADS Device Notification [▶ 20]
0x0009	ADS Read Write [▶ 22]

Other commands are not defined or are used internally. Therefore the *Command Id* is only allowed to contain the above enumerated values!

State Flags

Flag	Description
0x0001	0: Request / 1: Response
0x0004	ADS command

The first bit marks, whether it´s a request or response. The third bit must be set to 1, to exchange data with ADS commands. The other bits are not defined or were used for other internal purposes.

Therefore the other bits must be set to 0!

Flag	Description
0x000x	TCP Protocol
0x004x	UDP Protocol

Bit number 7 marks, if it should be transferred with TCP or UDP.

5.4 ADS Commands

5.4.1 Command Overview

Command	Description
ADS Read Device Info [▶ 16]	Reads the name and the version number of the ADS device.
ADS Read [▶ 17]	With *ADS Read* data can be read from an ADS device
ADS Write [▶ 17]	With *ADS Write* data can be written to an ADS device.
ADS Read State [▶ 18]	Reads the ADS status and the device status of an ADS device.
ADS Write Control [▶ 18]	Changes the ADS status and the device status of an ADS device.
ADS Add Device Notification [▶ 19]	A notification is created in an ADS device.
ADS Delete Device Notification [▶ 20]	One before defined notification is deleted in an ADS device.
ADS Device Notification [▶ 20]	Data will carry forward independently from an ADS device to a Client
ADS Read Write [▶ 22]	With *ADS ReadWrite data will be written to an ADS device. Additionally, data can be read from the ADS device.*

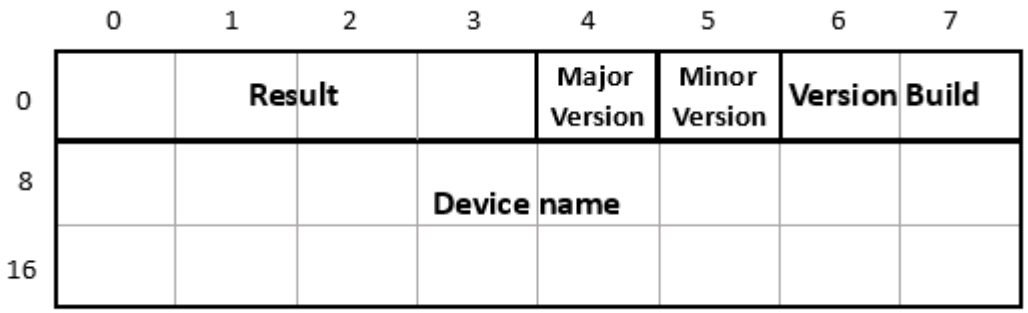
5.4.2 ADS Read Device Info

Reads the name and the version number of the ADS device.

Request

No additional data required

Response

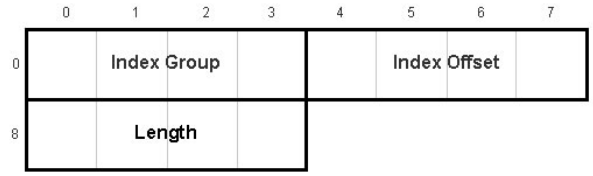


Data array	Size	Description
Result	4 bytes	ADS error number.
Major Version	1 byte	Major version number
Minor Version	1 byte	Minor version number
Version Build	2 bytes	Build number
Device Name	16 bytes	Name of ADS device

5.4.3 ADS Read

With *ADS Read* data can be read from an ADS device. The data are addressed by the *Index Group* and the *Index Offset*

Request



Data array	Size	Description
Index Group	4 bytes	Index Group of the data which should be read.
Index Offset	4 bytes	Index Offset of the data which should be read.
Length	4 bytes	Length of the data (in bytes) which should be read.

Response

Data array	Size	Description
Result	4 bytes	ADS error number
Length	4 bytes	Length of data which are supplied back.
Data	n bytes	Data which are supplied back.

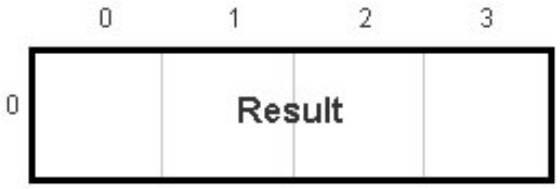
5.4.4 ADS Write

With *ADS Write* data can be written to an ADS device. The data are addressed by the *Index Group* and the *Index Offset*

Request

Data array	Size	Description
Index Group	4 bytes	Index Group in which the data should be written
Index Offset	4 bytes	Index Offset, in which the data should be written
Length	4 bytes	Length of data in bytes which are written
Data	n bytes	Data which are written in the ADS device.

Response



Data array	Size	Description
Result	4 bytes	ADS error number

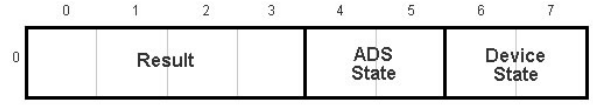
5.4.5 ADS Read State

Reads the ADS status and the device status of an ADS device.

Request

No additional data required

Response

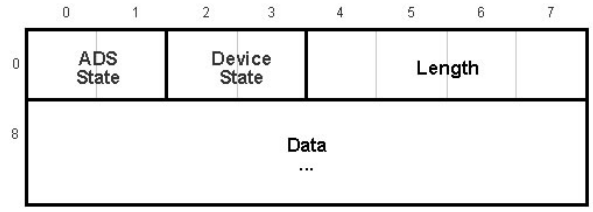


Data array	Size	Description
Result	4 bytes	ADS error number.
ADS State	2 bytes	ADS status (see data type ADSSTATE of the ADS-DLL).
Device State	2 bytes	Device status

5.4.6 ADS Write Control

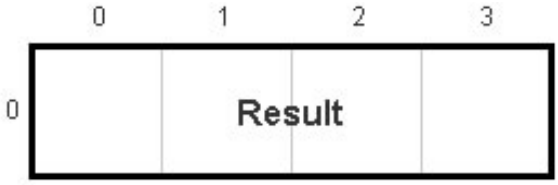
Changes the ADS status and the device status of an ADS device. Additionally it is possible to send data to the ADS device to transfer further information. These data were not analyzed from the current ADS devices (PLC, NC, ...)

Request



Data array	Size	Description
ADS State	2 bytes	New ADS status (see data type ADSSTATE of the ADS-DLL).
Device State	2 bytes	New device status.
Length	4 bytes	Length of data in byte.
Data	n bytes	Additional data which are sent to the ADS device

Response



Data array	Size	Description
Result	4 bytes	ADS error number.

5.4.7 ADS Add Device Notification

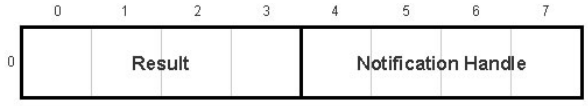
A notification is created in an ADS device.

Note: We recommend to announce not more than 550 notifications per device. Otherwise increase the payload by working with structures or use sum commands.

Request

Data array	Size	Description
Index Group	4 bytes	Index Group of the data, which should be sent per notification.
Index Offset	4 bytes	Index Offset of the data, which should be sent per notification.
Length	4 bytes	Length of data in bytes, which should be sent per notification.
Transmission Mode	4 bytes	See description of the structure ADSTRANSMODE at the ADS-DLL.
Max Delay	4 bytes	At the latest after this time, the *ADS Device Notification* is called. The unit is 1ms.
Cycle Time	4 bytes	The ADS server checks if the value changes in this time slice. The unit is 1ms
reserved	16bytes	Must be set to 0

Response



Data array	Size	Description
Result	4 bytes	ADS error number
Notification Handle	4 bytes	Handle of notification

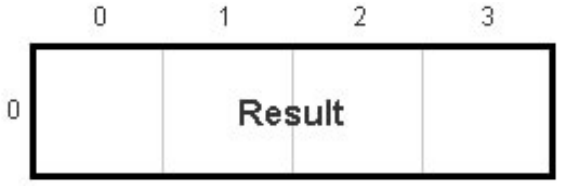
5.4.8 ADS Delete Device Notification

One before defined notification is deleted in an ADS device.

Request

Data array	Size	Description
Notification Handle	4 bytes	Handle of notification. The handle is created by the ADS command *Add Device Notification*

Response



Data array	Size	Description
Result	4 bytes	ADS error number

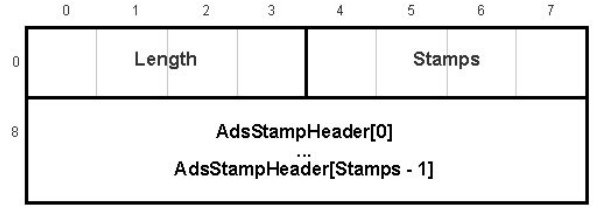
5.4.9 ADS Device Notification

Data will carry forward independently from an ADS device to a Client.

Request

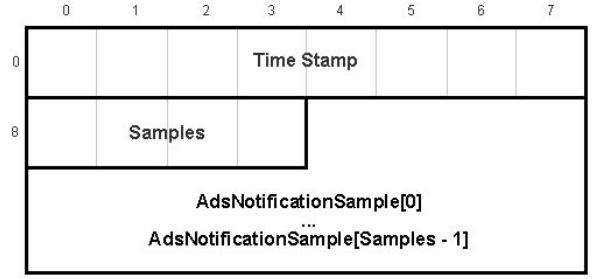
The data which are transferred at the *Device Notification* are multiple nested into one another. The *Notification Stream* contains an array with elements of type *AdsStampHeader.* This array again contains elements of type *AdsNotificationSample*.

AdsNotificationStream



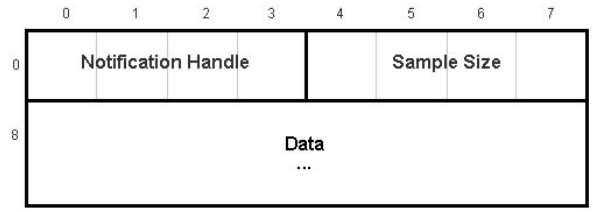
Data array	Size	Description
Length	4 bytes	Size of data in byte.
Stamps	4 bytes	Number of elements of type AdsStampHeader [▶ 21]
AdsStampHeader	n bytes	Array with elements of type AdsStampHeader [▶ 21]

AdsStampHeader



Data array	Size	Description
TimeStamp	8 bytes	The timestamp is coded after the Windows FILETIME format. I.e. the value contains the number of the 100-nanosecond intervals, which passed since 1.1.1601. In addition, the local time change is not considered. Thus the time stamp is present as universal Coordinated time (UTC).
Samples	4 bytes	Number of elements of type AdsNotificationSample [▶ 21]
AdsNotificationSample	n bytes	Array with elements of type AdsNotificationSample [▶ 21]

AdsNotificationSample



Data array	Size	Description
Notification Handle	4 Bytes	Handle of notification.
Sample Size	4 Bytes	Size of data range in bytes.
Data	n Bytes	Data

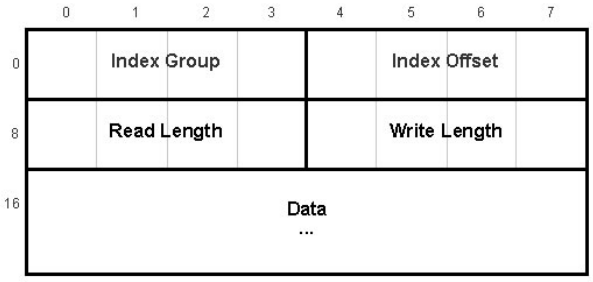
If your handle becomes invalid, one notification without data will be send once as advice.

5.4.10 ADS Read Write

With *ADS ReadWrite* data will be written to an ADS device. Additionally, data can be read from the ADS device.

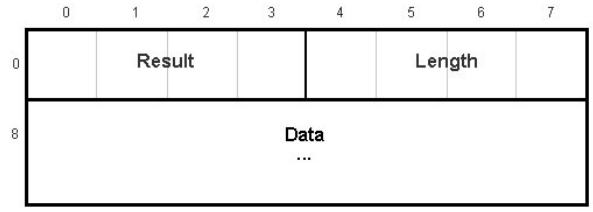
The data which can be read are addressed by the *Index Group* and the *Index Offset*

Request



Data array	Size	Description
Index Group	4 bytes	Index Group, in which the data should be written.
Index Offset	4 bytes	Index Offset, in which the data should be written
Read Length	4 bytes	Length of data in bytes, which should be read.
Write Length	4 bytes	Length of data in bytes, which should be written
Data	n bytes	Data which are written in the ADS device.

Response



Data array	Size	Description
Result	4 bytes	ADS error number
Length	4 bytes	Length of data which are supplied back.
Data	n bytes	Data which are supplied back.

6 Specification for ADS devices

6.1 General

The PLC software can be described as a virtual field unit (Automation Device), since it is a pure software PLC. It therefore provides a Beckhoff ADS (Automation Device Specification) interface for other communication partners (e.g. other virtual field units or Windows programs), via which it can be parameterised or interrogated. Use of the ADS standardises access to the PLC and incorporates it into the range of available virtual field units.

The READ and WRITE operations take place on the PLC interface (as defined by ADS) via two numbers: the index group (16 bit) and the index offset (32 bit). The ADS interface of the PLC will be described in more detail in the following pages with regard to the group and offset indices.

Specification "Index-Group" of the PLC

The four global ranges of an ADS unit are shown as follows for the PLC as four sections in the index groups:

Index-Group (0x = hex)	Index Group description
0x00000000 0x00000FFF	reserved
0x00001000	PLC ADS parameter range
0x00002000	PLC ADS status range
0x00003000	PLC ADS unit function range
0x00004000	PLC ADS services (includes services to access PLC memory range (%M field)) [▶ 23]
0x00006000 0x0000EFFF	reserved for PLC ADS extension
0x0000F000 0x0000FFFF	general TwinCAT ADS system services (includes services to access PLC process diagram of the physical inputs and outputs) [▶ 24]

6.2 Specification of the PLC services

This section includes services to access the PLC memory range (%M field).

Index Group	Index Offset	Access	Data type	Description	Remarks
0x00004020	0x00000000-0x0000FFFF	R/W	UINT8[n]	**READ_M - WRITE_M** PLC memory range(%M field).Offset is byte offset.	
0x00004021	0x00000000-0xFFFFFFFF	R/W	UINT8	**READ_MX - WRITE_MX** PLC memory range (%MX field).The low word of the index offset is the byte offset. The index offset contains the bit address calculated from the byte number *8 + bit number	
0x00004025	0x00000000	R	ULONG	**PLCADS_IGR_RMSIZE** Byte length of the process diagram of the memory range	
0x00004030	0x00000000-0xFFFFFFFF	R/W	UINT8	**PLCADS_IGR_RWRB** Retain data range. The index offset is byte offset	
0x00004035	0x00000000	R	ULONG	**PLCADS_IGR_RRSIZE** Byte length of the retain range	
0x00004040	0x00000000-0xFFFFFFFF	R/W	UINT8	**PLCADS_IGR_RWDB** Data range. The index offset is byte offset.	
0x00004045	0x00000000	R	ULONG	**PLCADS_IGR_RDSIZE** Byte length of the data range	

6.3 Specification of the ADS system services

This section covers those ADS services which have identical meanings and effects with every TwinCAT ADS unit. In this section are also included services to access the PLC process diagram of the physical inputs and outputs.

Index Group	Index Offset	Access	Data type	Description
0x0000F003	0x00000000	R&W	W: UINT8[n] R: UINT32	**GET_SYMHANDLE_BYNAME** A handle (code word) is assigned to the name contained in the write data and is returned to the caller as a result.
0x0000F004	0x00000000			Reserved.
0x0000F005	0x00000000-0xFFFFFFFF=symHandle	R/W	UINT8[n]	**READ_/WRITE_SYMVAL_BYHANDLE** Reads the value of the variable identified by ‚symHdl' or assigns a value to the variable. The ‚symHdl' must first have been determined by the GET_SYMHANDLE_BYNAME services.
0x0000F006	0x00000000	W	UINT32	**RELEASE_SYMHANDLE** The code (handle) contained in the write data for an interrogated, named PLC variable is released.
0x0000F020	0x0001F400-0xFFFFFFFF	R/W	UINT8[n]	**READ_I - WRITE_I** PLC process diagram of the physical inputs (%I field). Offset is byte offset.
0x0000F021	0x000FA000-0xFFFFFFFF	R/W	UINT8	**READ_IX - WRITE_IX** PLC process diagram of the physical inputs (%IX field). The index offset contains the bit address which is calculated from base offset (0xFA000) + byte number +8 + bit number
0x0000F025	0x00000000	R	ULONG	**ADSIGRP_IOIMAGE_RISIZE**Byte length of the PLC process diagram of the physical inputs.
0x0000F030	0x0003E800-0xFFFFFFFF	R/W	UINT8[n]	**READ_Q - WRITE_Q** PLC process diagram of the physical outputs (%Q field). Offset is byte offset.
0x0000F031	0x001F4000-0xFFFFFFFF	R/W	UINT8	**READ_QX - WRITE_QX** PLC process diagram of the physical outputs(%QX field). The index offset contains the bit address which is calculated from the base offset (0x1F4000) + byte number *8 + bit number.
0x0000F035	0x00000000	R	ULONG	**ADSIGRP_IOIMAGE_ROSIZE** Byte length of the PLC process diagram of the physical outputs.

Index Group	Index Offset	Access	Data type	Description
0x0000F080	0x00000000-0xFFFFFFFF= n (number of internal sub-commands)n(max) = 500	R&W	W: n * ULONG[3] := IG1, IO1, Len1, IG2, IO2, Len2, ..., IG(n), IO(n), Len(n) R: n * ULONG + UINT8[Len1] + UINT8[Len2] + ..., + UINT8[Len(n)] := Result1, Result2, ..., Result(n), Data1, Data2, ..., Data(n)	**ADSIGRP_SUMUP_READ** The write-data contains a list of multiple, separate AdsReadReq(IG, IO, Len, Data) sub-commands. The read-data contains a list of return codes followed by the requested data.
0x0000F081	0x00000000-0xFFFFFFFF= n (number of internal sub-commands)n(max) = 500	R&W	W: (n * ULONG[3]) + UINT8[Len1] + UINT8[Len2] + ..., + UINT8[Len(n)] := **IG1, IO1, Len1,** **IG2, IO2, Len2,** **...,** **IG(n), IO(n), Len(n),** **Data1, Data2, ..., Data(n)** R: n * ULONG := **Result1, Result2, ...,** **Result(n)**	**ADSIGRP_SUMUP_WRITE** The write-data contains a list of multiple, separate AdsWriteReq(IG, IO, Len, Data) sub-commands. The read-data contains a list of return codes.

Index Group	Index Offset	Access	Data type	Description
0x0000F082	0x00000000-0xFFFFFFFF= n (number of internal sub-commands)n(max) = 500	R&W	W: (n * ULONG[4]) + UINT8[WriteLen1] + UINT8[WriteLen2] + ..., + UINT8[WriteLen(n)] := **IG1, IO1, ReadLen1, WriteLen1,** **IG2, IO2, ReadLen2, WriteLen2,** **...,** **IG(n), IO(n), ReadLen(n), ..., WriteLen(n),** **WriteData1, WriteData2, ..., WriteData(n)** R: (n * ULONG[2]) + UINT8[ReturnLen1] + UINT8[ReturnLen2] + ..., + UINT8[ReturnLen(n)] := **Result1, ReturnLen1,** **Result2, ReturnLen2,** **...,** **Result(n), ReturnLen(n),** **Read**Data1, ReadData2, ..., ReadData(n)	**ADSIGRP_SUMUP_READWRITE** The write-data contains a list of multiple, separate AdsReadWriteReq(IG, IO, readLen, writeLen, Data) sub-commands. The read-data contains a list of return codes and return data length followed by the requested data.
0x0000F083	0x00000000-0xFFFFFFFF= n (number of internal sub-commands)n(max) = 500	R&W	W: n * ULONG[3] := IG1, IO1, Len1, IG2, IO2, Len2, ..., IG(n), IO(n), Len(n) R: n * ULONG + UINT8[Len1] + UINT8[Len2] + ..., + UINT8[Len(n)] := Result1, Result2, ..., Result(n), Data1, Data2, ..., Data(n)	**ADSIGRP_SUMUP_READEX** The write-data contains a list of multiple, separate AdsReadReq(IG, IO, Len, Data) sub-commands.The read-data contains a list of return codes followed by the requested data.

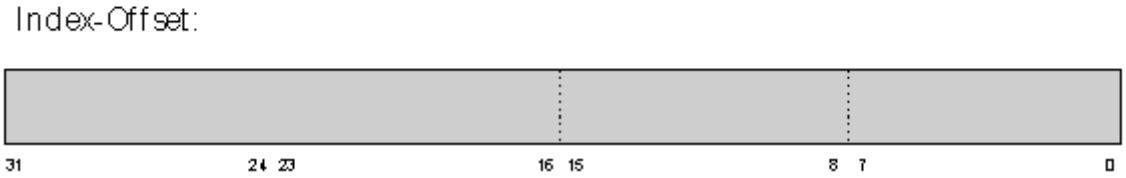
Index Group	Index Offset	Access	Data type	Description
0x0000F084	0x00000000-0xFFFFFFFF= n (number of internal sub-commands)n(max) = 500	R&W	W: n * ULONG[3] := IG1, IO1, Len1, IG2, IO2, Len2, ..., IG(n), IO(n), Len(n) R: n * ULONG + UINT8[Len1] + UINT8[Len2] + ..., + UINT8[Len(n)] := Result1, Result2, ..., Result(n), Data1, Data2, ..., Data(n)	**ADSIGRP_SUMUP_READEX2** The write-data contains a list of multiple, separate AdsReadReq(IG, IO, Len, Data) sub-commands.The read-data contains a list of return codes followed by the requested data.
0x0000F085	0x00000000-0xFFFFFFFF= n (number of internal sub-commands)n(max) = 500	R&W	W: (n * ULONG[3]) := **IG1, IO1, Len1,** **IG2, IO2, Len2,** **...,** **IG(n), IO(n), Len(n)** R: (n * ULONG) + UINT8[Len1] + UINT8[Len2] + ..., + UINT8[Len(n)] := **Result1, Result2, ...,** **Result(n),** **Handle1, Handle2,...,** **Handle(n)**	**ADSIGRP_SUMUP_ADDDEVNOTE** The write-data contains a list of multiple, separate AdsAddDeviceNotifications(IG, IO, Len, Data) sub-commands.The read-data contains a list of return codes followed by the requested notification handles.
0x0000F086	0x00000000-0xFFFFFFFF= n (number of internal sub-commands)n(max) = 500	R&W	W: **Handle1, Handle2,...,** **Handle(n)** R: (n * ULONG) + UINT8[Len1] + UINT8[Len2] + ..., + UINT8[Len(n)] := **Result1, Result2, ...,** **Result(n)**	**ADSIGRP_SUMUP_DELDEVNOTE** The write-data contains a list of multiple handles.The read-data contains a list of return codes.

6.4 Specification of the NC

This documentation contains all TC3 specific modifications and new features.

Index-Group (Hex)	Description	Remarks
0x1000	Ring-0-Manager: Parameter [▶ 31]	Optional!
0x1100	Ring-0-Manager: State [▶ 32]	Optional!
0x1200	Ring-0-Manager: Functions [▶ 32]	Optional!
0x1300	Ring-0-Manager: Cyclic process data	Not implemented!
0x2000 + ID	Channel with corresponding ID: parameters [▶ 33]	
0x2100 + ID	Channel with corresponding ID: state [▶ 36]	
0x2200 + ID	Channel with corresponding ID: functions [▶ 39]	
0x2300 + ID	Channel with corresponding ID: cyclic process data [▶ 42]	
0x3000 + ID	Group with corresponding ID: parameters [▶ 43]	Optional!
0x3100 + ID	Group with corresponding ID: state [▶ 48]	Optional!
0x3200 + ID	Group with corresponding ID: functions [▶ 54]	Optional!
0x3300 + ID	Group with corresponding ID: cyclic process data	Not implemented!
0x4000 + ID	Axis with corresponding ID: parameters [▶ 60]	
0x4100 + ID	Axis with corresponding ID: state [▶ 73]	
0x4200 + ID	Axis with corresponding ID: functions [▶ 83]	
0x4300 + ID	Axis with corresponding ID: cyclic process data [▶ 105]	
0x5000 + ID	Encoder with corresponding ID: parameters [▶ 110]	Optional!
0x5100 + ID	Encoder with corresponding ID: state [▶ 115]	Optional!
0x5200 + ID	Encoder with corresponding ID: functions [▶ 120]	Optional!
0x5300 + ID	Encoder with corresponding ID: cyclic process data [▶ 123]	Optional!
0x6000 + ID	Controller with corresponding ID: Parameter [▶ 127]	Optional!
0x6100 + ID	Controller with corresponding ID: State [▶ 131]	Optional!
0x6200 + ID	Controller with corresponding ID: Functions [▶ 134]	Optional!
0x6300 + ID	Controller with corresponding ID: cyclic process data	Not implemented!
0x7000 + ID	Drive with corr. ID: parameters [▶ 135]	Optional!
0x7100 + ID	Drive with corr. ID: state [▶ 139]	Optional!
0x7200 + ID	Drive with corr. ID: functions [▶ 141]	Optional!
0x7300 + ID	Drive with corr. ID: cyclic process data [▶ 142]	Optional!
0x**0**A0**00** + **ID**	Tables (n x m) with corresponding ID: parameters [▶ 145] 0x0A000+ID for table ID [1..255] 0x1A000+ID for table ID [256..4095] . . . 0xFA000+ID for table ID [3840..4095]	Maximum number of tables extended to 4095 (from TC3.1 B4021)
0x**0**A1**00** + **ID**	Tables (n x m) with corresponding ID: state [▶ 149] 0x0000A100+IDLowByte for table ID [1..255] 0x0001A100+IdLowByte for table ID [256..4095] … 0x000FA100+IdLowByte for table ID [3840..4095] 0x000**n**A1**00**+**IdLowByte** for table ID [1..4095] (TabID = n * 256 + IdLowByte)	

Index-Group (Hex)	Description		Remarks
0x*0*A2*00* + *ID*	Tables (n x m) with corresponding ID: functions [▶ 150] 0x0000A1*00+IDLowByte* for table ID [1..255] 0x0001A1*00+IdLowByte* for table ID [256..4095] … 0x000*F*A1*00+IdLowByte* for table ID [3840..4095] 0x000*n*A1*00+IdLowByte* for table ID [1..4095] (TabID = n * 256 + IdLowByte)		
0x0A300 + ID	Tables (n x m) with corresponding ID: cyclic process data 0x0000A100+IDLowByte for table ID [1..255] 0x0001A100+IdLowByte for table ID [256..4095] … 0x000FA100+IdLowByte for table ID [3840..4095] 0x000nA100+IdLowByte for table ID [1..4095] (TabID = n * 256 + IdLowByte)		Not implemented!
0xF000 ... 0xFFFF	reserved area (TwinCAT system area)		
IndexGroup:	IndexOffset:		
0xF081	0x00000000 ... 0xFFFFFFFF (n elements)	ADSIGRP_SUMUP_WRITE The *Read-Write-command* contains a list in the Write-data of multiple separate *ADS-Write-commands* (like a group request). Structure of the Write-Data: *[IdxGrp(1), IdxOff(1), WriteLen(1), ..., IdxGrp(n), IdxOff(n), WriteLen(n), WriteData(1), ..., WriteData(n)]* Structure of the Read-Data: *[* Error*(1), ..., Error(n)]*	
0xF082	0x00000000 ... 0xFFFFFFFF (n elements)	ADSIGRP_SUMUP_READWRITE The *Read-Write-command* contains a list in the Write-data of multiple separate *ADS-Read-Write-commands* (like a group request). Structure of the Write-Data: *[IdxGrp(1), IdxOff(1),ReadLen(1), WriteLen(1), ..., IdxGrp(n), IdxGrp(n), ReadLen(n), WriteLen(n), WriteData(1), ..., WriteData(n)]* Structure of the Read-Data: *[Error(1), ReadLen(1), ..., Error(n), ReadLen(n), ReadData(1), ..., ReadData(n)]*	
0xF084	0x00000000 ... 0xFFFFFFFF (n elements)	ADSIGRP_SUMUP_READ (READEX2) The *Read-Write-command* contains a list in the Write-data of multiple separate *ADS-Read-commands* (like a group request). Structure of the Write-Data: *[IdxGrp(1), IdxOff(1), ReadLen(1), ..., IdxGrp(n), IdxGrp(n), ReadLen(n)]* Structure of the Read-Data: *[Error(1), ReadLen(1), ..., Error(n), ReadLen(n), ReadData(1), ..., ReadData(n)]*	



6.4.1 Specification Ring-0-Manager

6.4.1.1 "Index offset" specification for Ring-0 parameter (Index group 0x1000)

Index offset (Hex)	Access	Ring-0-Manager	Data type	Phys. unit	Definition range	Description	Remarks
0x00000010	Read	every	UINT32	100 ns		Cycle time SAF task	
0x00000012	Read	every	UINT32	100 ns		Cycle time SVB task	
0x00000014	Read	every	INT32	ns		Global Time Compensation Shift (for SAF Task)	
0x00000020	Read/Write	every	UINT16	1	0/1	Cyclic data consistence check and correction of the NC setpoint values	

6.4.1.2 "Index offset" specification for Ring-0 state (Index group 0x1100)

Index offset (Hex)	Access	Ring-0-Manager	Data type	Phys. unit	Definition range	Description	Remarks
0x00000001	Read	every	UINT32	1	0, 1...255	Quantity of Channel	
0x00000002	Read	every	UINT32	1	0, 1...255	Quantity of group	
0x00000003	Read	every	UINT32	1	0, 1...255	Quantity of Axis	
0x00000004	Read	every	UINT32	1	0, 1...255	Quantity of Encoder	
0x00000005	Read	every	UINT32	1	0, 1...255	Quantity of controller	
0x00000006	Read	every	UINT32	1	0, 1...255	Quantity of Drives	
0x0000000A	Read	every	UINT32	1	0, 1...255	Quantity of table (n x m)	
0x00000010	Read	every	UINT32	1		Cycle time error counter SAF task (not scopeable)	Reserved!
0x00000014	Read	every	UINT32	1		IO-cycle time error counter SAF task (not scopeable)	Reserved!
0x00000020	Read	every	UINT32	s		Computing time SAF task (not scopeable)	Reserved!
0x00000031	Read	every	UINT32[n]	1	0, 1...255	Supplies the channel IDs for all channels in the system	
0x00000032	Read	every	UINT32[n]	1	0, 1...255	Supplies the group IDs for all groups in the system	
0x00000033	Read	every	UINT32[n]	1	0, 1...255	Supplies the axis IDs for all axes in the system	
0x00000034	Read	every	UINT32[n]	1	0, 1...255	Supplies the encoder IDs for all encoders in the system	
0x00000035	Read	every	UINT32[n]	1	0, 1...255	Supplies the controller IDs for all controllers in the system	
0x00000036	Read	every	UINT32[n]	1	0, 1...255	Supplies the drive IDs for all drives in the system	
0x0000003A	Read	every	UINT32[n]	1	0, 1...255	Supplies the table IDs for all tables in the system	
0x000001nn	Read	every	UINT32	1	0, 1...255	Supplies for the encoder ID the appropriate axis IDnn = Encoder ID	Reserved!
0x000002nn	Read	every	UINT32	1	0, 1...255	Supplies for the controller ID the appropriate axis IDnn = Controller ID	Reserved!
0x000003nn	Read	every	UINT32	1	0, 1...255	Supplies for the drive ID the appropriate axis IDnn = Drive ID	Reserved!

6.4.1.3 "Index offset" specification for Ring-0 functions (Index group 0x1200)

Index offset (Hex)	Access	Ring-0-Manager	Data type	Phys. unit	Definition range	Description	Remarks
0x00000020	Write	every	VOID	1		Clear cycle time error counter SAF & SVB	Reserved!

6.4.2 Specification Channels

6.4.2.1 "Index offset" specification for channel parameter (Index group 0x2000 + ID)

Index-Offset (Hex)	Access	Channel type	Data type	Phys. unit	Definition range	Description	Remarks
0x00000001	Read	every	UINT32	1		Channel ID	
0x00000002	Read	every	UINT8[30+1]	1		Channel name	
0x00000003	Read	every	UINT32	1	ENUM	Channel type [▶ 150]	
0x00000004	Read	every	UINT32	1	ENUM	Interpreter type [▶ 150]	
0x00000005	Read	every	UINT32	1		Program load buffer size in bytes	
0x00000006	Read	every	UINT32	1		Program no. according to job list	
0x00000007	Read/Write	every	UINT32	1	ENUM	Set load log mode [▶ 151]	
0x00000008	Read/Write	every	UINT32	1	ENUM	Set trace mode [▶ 151]	
0x00000009	Read/Write	every	UINT32	1		RESERVED	
0x0000000A	Read/Write	every	UINT32	1	0/1	Records all feeder entries in a log file named "TcNci.log"	
0x0000000B	Read/Write	every	UINT32	1	0/1	Channel specific level for NC logger messages 0: errors only 1: all NC messages	
0x00000010	ReadWrite	every	**Write**				
			{				
			UINT32	1	0..159	Start index of M function	
			UINT32	1	1..160	Number of M functions to be read	
			}				
			Read [n]				
			{				
			UINT8	1	0..159	Rule bit mask of the M function	
			INT32[10]	1	-1..159	Number of M functions to be cleared	
			}				
0x00000011	Write	Interpolation				Write M function description	Only used internally!
0x00000012	Read/Write	Interpolation	LREAL64	1		Factor for G70	
0x00000013	Read/Write	Interpolation	LREAL64	1		Factor for G71	
0x00000014	Write	Interpolation	{			Axes user symbols	not yet released
			char[32]			User symbol (null-terminated)	
			char[10]			System symbol (null-terminated)	
			}				
0x00000015	Read/Write	Interpolation	UINT16 resp. UINT32	1	0/1 default: FALSE	Activation of default G-code	NEW from TC3.1 B4014
0x00000021	Read	every	UINT32	1		Group ID (only explicit for 3D and FIFO channel)	
0x00000031	Read/Write	Interpolation	UINT16	1		Standard output port of the interpreter	Reserved function, no standard!
0x00000032	Read/Write	Interpolation	UINT16	1	0/1	Cartesian tool offset entry	Reserved function, no standard!

Index-Offset (Hex)	Access	Channel type	Data type	Phys. unit	Definition range	Description	Remarks
0x00000040	Read/Write	Interpolation	{			**Target address of interpreter hooks**	Reserved function, no standard!
			char[6]			Ams Net ID	
			UINT16			Port	
			UINT32			Index group	
			UINT32			Index offset	
			}				
0x00000050	Read/Write	Interpolation	UINT32	1	ENUM	Reaction if at the radius compensation a bottle neck is recognized 0: Error and abort 1: Note & trouble shooting 2: Only note, without outline modulation	
0x00000051	Read/Write	Interpolation	UINT32	1	1..24	Look ahead for bottleneck detection	
0x00000052	Read/Write	Interpolation	UINT32	1	0/1	Chamfer on/off	reserved function, no standard!
0x00000053	Read/Write	Interpolation	UINT32	1		Activation for reading the currently effective interpolation rules, zero shifts and rotation 0: off 1: on	
0x00000054	Read/Write	Interpolation	UINT32	1	0/1	Retrace on/off	Reserved function, no standard!
0x00000055	Read/Write	Interpolation	UINT32[4]	1		Configuration of the cyclic channel interface for UINT32; up to 4 index offsets can be configured.	
0x00000056	Read/Write	Interpolation	UINT32[4]	1		Configuration of the cyclic channel interface for LREAL; up to 4 index offsets can be configured.	
0x00010K0L	Read/Write	every	REAL64	e.g. mm	±MAX REAL64	Value for zero shift (NPV)	
					[1..3]	Axis index K=1 → X K=2 → Y K=3 → Z	
					[1..0xA]	L=1 → G54F L=2 → G54G L=3 → G55F ...	
0x0002ww00	Read/Write	every	UINT16			Tool number: values for tool compensation	
0x0003ww00	Read/Write	every	UINT16		[1...50]	Tool type: ww = tool 1...50	
0x0004wwnn	Read/Write	every	REAL64		[1...14]	Parameter: nn = Index 1...14	
0x000500gg	Read/Write	every	REAL64	e.g. mm	≥ 0 (value) [1...9] (g)	Radius of the tolerance sphere gg = channel group (default: 1)	

6.4.2.2 "Index offset" specification for channel state (Index group 0x2100 + ID)

Index-Offset (Hex)	Access	Channel type	Data type	Phys. unit	Definition range	Description	Remarks
0x00000001	Read	every	INT32	1	ENUM	Error code Channel	
0x00000002	Read	every	UINT32	1		Number of groups in the Channel	
0x00000003	Read	every	UINT32	1	ENUM	Interpreter status [▶ 151]	Cannot be traced by oscilloscope!
0x00000004	Read	every	UINT32	1	ENUM	Interpreter/channel operation mode [▶ 151]	
0x00000005	Read	every	UINT32	1		Currently loaded program	
0x00000007	Read	every	UINT8[...]	1		Program name of currently loaded program (100 characters, null-terminated)	Max. 100 characters, null-terminated
0x00000008	Read	Interpreter	UINT32	1	[0,1]	Interpreter simulation mode 0: off (default) 1: on	Cannot be traced by oscilloscope!
0x00000010	Read	Interpreter	UINT32	1		Text index If the interpreter is in the aborted state, the current text index can be read out here	Cannot be traced by oscilloscope!
0x00000011	ReadWrite	Interpreter	**Write**				Cannot be traced by oscilloscope!
			UINT32	1		Text index	
			Read				
			UINT8[..]	1		Line of the NC part program from the text index	
0x00000012	Read	Interpreter	{				
			UINT32	1		Current display for 1: SAF 2: Interpreter 3: Error offset	
			UINT32	1		File offset	
			UINT8[260]	1		Path + program name	
			}				
0x00000013	Read	Interpreter	UINT32[18]			Display for currently effective G-code	
0x00000014	Read	Interpreter	{			Determines the currently effective zero shift	
			UINT32	1		Block counter	
			UINT32			Dummy	
			LREAL[3]	1		Zero shift G54..G57	
			LREAL[3]	1		Zero shift G58	
			LREAL[3]	1		Zero shift G59	
			}				
0x00000015	Read	Interpreter	{			Determines the currently effective rotation	
			UINT32	1		Block counter	
			UINT32	1		Dummy	
			LREAL[3]	1		Rotation of X, Y & Z in degrees	
			}				
0x00000016	Read	Interpreter	UINT32	1	[0,1]	Feeder Info	Only used internally! Not standard

Index-Offset (Hex)	Access	Channel type	Data type	Phys. unit	Definition range	Description	Remarks
0x00000100	Read	every	UINT32 [n]	1	[0, 1...255]	Returns the respective axis IDs in the channel number: [1...255] axis ID's: [0, 1...255]	Cannot be traced by oscilloscope!

6.4.2.3 "Index offset" specification for channel functions (Index group 0x2200 + ID)

Index offset (Hex)	Access	Channel type	Data type	Phys. unit	Definition range	Description	Remarks
0x00000001	Write	every	UINT32	1		Load NC program with program number	
0x00000002	Write	every	VOID			Start Interpreter	
0x00000003	Write	every	VOID			RESERVED	
0x00000004	Write	every	UINT8[...]			Load NC program by name. The standard NC path does not have to be given although it may. Other paths are also permitted.	
0x00000005	Write	every	UINT16	ENUM	cf. appendix interpreter operation mode [▶ 151]	Set the interpreter/ channel operation mode	
0x00000006	Write	Interpreter	UINT8[...]			Set path for subroutines	
0x00000008	Write	Interpreter	UINT32	1		Interpreter simulation mode: 0: off (default) 1: on	Not yet released
0x0000000F	Write	every	VOID			RESERVED	
0x00000010	Write	every	VOID			"Reset" Channel	
0x00000011	Write	every	VOID			"Stop" Channel	
0x00000012	Write	every	VOID			"Retry" Channel (restart Channel)	
0x00000013	Write	every	VOID			"Skip" Channel (skip task/block)	
0x00000014/0 x00000015	Write	every	{			"Enable Retrace" /"Disable Retrace"	Reserved function, no standard!
			UINT32	1	>0	Feeder directiion: 1: forward 2: backward	
			UINT32	1	≥ 0	Entry index	
			REAL64[3]	mm	±∞	Pos. of the main axes X, Y, Z	
			REAL64[5]	mm	±∞	Pos. of the auxiliary axes Q1, ..., Q5	
			}				
0x00000020	Write	every	VOID			"Save" zero offset shift (NPV)	
0x00000021	Write	every	VOID			"Load" zero offset shift (NPV)	
0x00000022	Write	every	VOID			"Save" tool compensations	
0x00000023	Write	every	VOID			"Load" tool compensations	
0x00000024	Write	Interpolation	{			Saves snapshot of the interpreter in a given file	
			char[32]			Filename in TwinCAT\CNC-folder	
			UINT32	1	0..1	Mask: 0x1: R-Parameters 0x2: Zeroshifts 0x4: Tool Desc	
			}				

Index offset (Hex)	Access	Channel type	Data type	Phys. unit	Definition range	Description	Remarks
0x00000025	Write	Interpolation	{			Reads snapshot of a given file to the interpreter	
			char[32]			Filename in TwinCAT\CNC-folder	
			UINT32	1	0..1	Mask: 0x1: R-Parameters 0x2: Zeroshifts 0x4: Tool Desc	
			}				
0x00000026	Write	Interpolation	VOID			Set all tool parameters (incl. type & number) to null	
0x00000027	Write	Interpolation	VOID			Set all zero offset shifts to null	
0x00000030	Write	every	VOID			Restart (Go Ahead) of the Interpreter after programmed Interpreter stop	
0x00000040	Write	every	VOID			Triggerevent for deletion of any remaining travel in the NCI	
0x00000041	Write	every				RESERVED for fair events	
0x00000050	Write	Interpolation	VOID	1		Set *ExecIdleInfo*in the interpreter	Reserved function, no standard!
0x00000051	Write	Interpolation	UINT32	1		Set block skip mask in the interpreter parameter: *SkippingMask*	Reserved function, no standard!
0x00000052	Write	Intepolation	UINT32	1		Set *ItpOperationMode* in the interpreter parameter: OperationMode mask	Reserved function, no standard!
0x00000053	Write	Interpolation	VOID			Set *ScanningFlag* in the NC device	Reserved function, no standard!
0x00000054	Write	Interpolation				Scan position	Reserved function, no standard!
double[8]			position				
0x00000055	Write	Interpolation				Reserved	
0x00000056	Write	Interpolation	VOID			Set Interpreter in the *Aborted* state	Reserved function, no standard!
0x00000060	Write	Interppolation	UINT16	1	0..159	Manual reset of a fast M Function	

6.4.2.4 "Index offset" specification for cyclic channel process data (Index group 0x2300 + ID)

Index offset (Hex)	Access	Channel type	Data type	Phys. unit	Definition range	Description	Remarks
0x00000000	Read	every (PLC→NC)	{128 Byte}		STRUCT s. Channel interface	CHANNEL STRUCTURE (PLC→NC) Remark: Size and alignment changed.	Current PLC structure: NciChannelFromPlc *PLCTONC_NCICHANNEL_REF*
0x00000001	Read	every	UINT8[...] min. 30 Byte	1		Interpreter program display	Cannot be traced by oscilloscope!
0x00000002	Read/Write	every (PLC→NC)	UINT32	%	[0...1000000]	Speed override channel (Axis in the Channel)	1000000 = 100%
0x00000003	Read/Write	every (PLC→NC)	UINT32	%	[0...1000000]	Speed override spindle	1000000 = 100%
0x00000080	Read	every (NC→PLC)	{160 Byte}		STRUCT s. Channel interface	CHANNEL STRUCTURE (NC→PLC) Remark: Size and alignment changed.	Current PLC structure: NciChannelToPlc *NCTOPLC_NCICHANNEL_REF*
0x10000000 +RegIndex	Read/Write	every	REAL64	1	[0...999]	R parameter of the Interpreter	Cannot be traced by oscilloscope!
0x20000001	Read	every	UINT8[...] min. 30 Byte	1	[1...9]	Program display of group attention handling (SAF)	Cannot be traced by oscilloscope!

6.4.3 Specification Groups

6.4.3.1 "Index offset" specification for group parameter (Index group 0x3000 + ID)

Index-Offset (Hex)	Access	Group type	Data type	Phys. unit	Definition range	Description	Remarks
0x00000001	Read	every	UINT32	1		Group ID	
0x00000002	Read	every	UINT8[30+1]	1		Group name	
0x00000003	Read	every	UINT32	1	ENUM	Group type [▶ 151]	
0x00000004	Read	every	UINT32	µs		SAF cycle time group	
0x00000005	Read	every	UINT32	µs		SVB cycle time group	
0x00000006	Read/Write	every	UINT16	1	0/1	Single block operation mode?	
0x0000000B	Read	every	UINT32	1		Size of the SVB table (max. number of SVB entries	
0x0000000C	Read	every	UINT32	1		Size of the SAF table (max. number of SAF entries	
0x00000010	Read/Write	every	UINT32	1	[1,2...32] Default: 1	Internal SAF cycle time divisor (divides the internal SAF cycle time by this factor)	e.g. for DXD group
0x00000021	Read	Channel: every	UINT32	1		Channel ID	
0x00000022	Read	Channel: every	UINT8[30+1]	1		Channel name	
0x00000023	Read	Channel: every	UINT32	1	ENUM	Channel type [▶ 150]	
0x00000024	Read	Channel: every	UINT32	1	>0	Number in the Channel	
0x00000500	Read/Write	DXD group	INT32	ENUM	[0, 1]	Cornering velocity reduction method [▶ 151] 0: Coulomb-Scattering 1: Cosinus law 2: VeloJump	
0x00000501	Read/Write	DXD group	REAL64	1	[0.0...1.0]	Velocity reduction factor C0 transition (continuous, but neither once nor twice continuously differentiable)	
0x00000502	Read/Write	DXD group	REAL64	1	[0.0...1.0]	Velocity reduction factor C1 transition (continuous and continuously differentiable once)	
0x00000503	Read/Write	DXD group	REAL64	degree	[0.0...180.0]	Critical angle at segment transition "Low" (must be strictly less than or equal to the velocity reduction angle C0)	
0x00000504	Read/Write	DXD group	REAL64	degree	[0.0...180.0]	Critical angle at segment transition "High" (must be strictly less than or equal to the velocity reduction angle C0)	
0x00000505	Read/Write	DXD group	REAL64	mm/s	≥ 0	Minimum velocity, which must not be undershot at segment transitions, despite possible velocity reduction.	Attention: Parameter is not saved in the solution and is not transferred as NC boot parameter!
0x00000506	Read/Write	DXD group	REAL64	e.g. mm	[0.0...1000.0]	Radius of the tolerance sphere for blending	Not implemented!
0x00000507	Read/Write	DXD group	REAL64	1		Velocity reduction factor C2 transition	

Index-Offset (Hex)	Access	Group type	Data type	Phys. unit	Definition range	Description	Remarks
0x00000508	Read/Write	DXD group	UINT16	1	0/1	Enables calculation of the total remaining path length	NEW from TC3.1 B4020.40
0x00000509	Read/Write	DXD group	UINT16	1	0/1 Default: 1	General activation of the software limit position monitoring for the main axes (X, Y, Z) (see encoder parameters)	
0x0000050A	Read/Write	DXD group	UINT32	1	0/1	NCI Overridetype 0: related to internal reduced velocity (without iteration) 1: related to original external (programmed) velocity 2: Relative to the internally reduced velocity (0 ... >100%)	
0x0000050C	Read	DXD group	UINT32	1	[128 ... 1024] Default: 128	User-defined maximum number of the NCI SAF tables entries	NEW from TC3.1 B4014 boot parameters
0x00000510	Read/Write	DXD group	REAL64	1	≥ 0	For reduction method VeloJump Reductionfactor for C0 transitions: X axis	Not implemented!
0x00000511	Read/Write	DXD group	REAL64	1	≥ 0	For reduction method VeloJump Reductionfactor for C0 transitions: Y axis	Not implemented!
0x00000512	Read/Write	DXD group	REAL64	1	≥ 0	For reduction method VeloJump Reductionfactor for C0 transitions: Z axis	Not implemented!
0x00000513	Read/Write	DXD group	LREAL64	1	]0.0..1.0[	Blending for auxiliary axes: If the effective path velo is smaller than the programmed one multiplied with this factor, then an accurate stop is inserted and the tolerance ball is deleted	Not yet released
0x00000514	Read/Write	DXD group	UINT32	1	[1 … 20] Default: 1	Maximum number of transferred jobs per NC cycle (from SVB to SAF)	NEW from TC3.1 B4020.40
0x00000604	Read/Write	Encoder group	REAL64	e.g. mm/s	[0.0...1000.0]	Velocity window resp. standstill window	Base Unit / s
0x00000605	Read/Write	Encoder group	REAL64	s	[0.0...60.0]	Filter time for standstill window in seconds	
0x00000606	Read/Write	Encoder group	REAL64	s	[0.0...60.0]	Dead time compensation master/slave coupling ("angle pre-control")	
0x00000701	Read	FIFO group	UINT32	1	[1...16]	FIFO dimension (m = number of axes) Note: The FIFO dimension was increased to 16.	(n x m) FIFO boot data

Index-Offset (Hex)	Access	Group type	Data type	Phys. unit	Definition range	Description	Remarks
0x00000702	Read	FIFO group	UINT32	1	[1...10000]	FIFO size (length) (n = number of FIFO entries)	(n x m) FIFO boot data
0x00000703	Read	FIFO group	UINT32	1	[0, 1, 4]	Interpolation type for FIFO setpoint generator 0: INTERPOLATIONTYPE_LINEAR (default) 1: INTERPOLATIONTYPE_4POINT 4: INTERPOLATIONTYPE_CUBICSPLINE (with 6 points)	NEW from TC3.1 B4020
0x00000704	Read/Write	FIFO group	UINT32	1	[1, 2]	Override type for FIFO setpoint generator Type 1: OVERRIDETYPE_INSTANTANEOUS (default) Type 2: OVERRIDETYPE_PT2	
0x00000705	Read/Write	FIFO group	REAL64	s	> 0.0	P-T2 time for override change (T1=T2=T0)	
0x00000706	Read/Write	FIFO group	REAL64	s	≥ 0.0	Time delta for two sequenced FIFO entries (FIFO entry timebase)	
0x00000801	ReadWrite	Kinematic group	**Write**			Calculation of the kinematic forward transformation for the positions (ACS -> MCS)	
			{				
			REAL64[8]	e.g. degree	±∞	ACS (Axis Coordinate System) axis positions, max. dimension: 8	
			UINT32	1	≥ 0	Reserve	
			UINT32	1	≥ 0	Reserve	
			}				
			Read				
			{				
			REAL64[8]	e.g. mm	±∞	MCS (Machine Coordinate System) axis positions, max. dimension: 8	
			UINT32	1	≥ 0	Reserve	
			UINT32	1	≥ 0	Reserve	
			}				

Index-Offset (Hex)	Access	Group type	Data type	Phys. unit	Definition range	Description	Remarks
0x00000802	ReadWrite	Kinematic group	**Write**			Calculation of the kinematic inverse transformation for the positions (MCS -> ACS)	
			{				
			REAL64[8]	e.g. mm	±∞	MCS (Machine Coordinate System) axis positions, max. dimension: 8	
			UINT32	1	≥ 0	Reserve	
			UINT32	1	≥ 0	Reserve	
			}				
			Read				
			{				
			REAL64[8]	e.g. degree	±∞	ACS (Axis Coordinate System) axis positions, max. dimension: 8	
			UINT32	1	≥ 0	Reserve	
			UINT32	1	≥ 0	Reserve	
			}				

6.4.3.2 "Index offset" specification for group state (Index group 0x3100 + ID)

Index offset (Hex)	Access	Group type	Data type	Phys. unit	Definition range	Description	Note
0x00000001	Read	every	INT32	1	ENUM	Error code group	
0x00000002	Read	every	UINT32	1		Number of master axes	
0x00000003	Read	every	UINT32	1		Number of slave axes	
0x00000004	Read	every	UINT32	1	s. ENUM	SVB group state (state)	
0x00000005	Read	every	UINT32	1	s. ENUM	SAF group state (main state)	
0x00000006	Read	every	UINT32	1	s. ENUM	Moving state (state)	
0x00000007	Read	every	UINT32	1	s. ENUM	SAF sub-group state (sub state)	
0x00000008	Read	every	UINT32	1	s. ENUM	Referencing state (state)	
0x00000009	Read	every	UINT32	1	s. ENUM	Coupling state (state)	Cannot be traced by oscilloscope!
0x0000000A	Read	every	UINT32	1	≥0	Coupling table index	Cannot be traced by oscilloscope!
0x0000000B	Read	every	UINT32	1	≥0	current number of SVB entries/tasks	*Symbolic access: 'SvbEntries' (DXD)*
0x0000000C	Read	every	UINT32	1	≥0	Current number of SAF entries/tasks	*Symbolic access: 'SafEntries' (DXD)*
0x0000000D	Read	every	UINT32	1		Current block number (only active for interpolation group)	*Symbolic access: 'BlockNumber' (DXD)*
0x0000000E	Read	every	UINT32	1	≥0	current number of free SVB entries/tasks	Cannot be traced by oscilloscope!
0x0000000F	Read	every	UINT32	1	≥0	Current number of free SAF entries/tasks	Cannot be traced by oscilloscope!
0x00000011	Read	every	UINT16	1	0/1	Emergency Stop (E-Stop) active?	Cannot be traced by oscilloscope!

Index offset (Hex)	Access	Group type	Data type	Phys. unit	Definition range	Description	Note
0x00000110	Read	PTP group	{			Internal NC information (resolutions)	Reserved!
			REAL64	e.g. mm	± ∞	ExternalEndPosition	
			REAL64	e.g. mm/s	>0	ExternalTargetVelocity	
			REAL64	e.g. mm/s^2	>0	ExternalAcceleration	
			REAL64	e.g. mm/s^2	>0	ExternalDeceleration	
			REAL64	e.g. mm/s^3	>0	ExternalJerk	
			UINT32	1	>0	ExternalOverrideType	
			REAL64	e.g. mm	± ∞	InternalEndPosition	
			REAL64	e.g. mm/s	>0	InternalTargetVelocity (refers to 100 %)	
			REAL64	%	[0 ... 100]	InternalActualOverride	
			REAL64	e.g. mm/s^2	>0	InternalAcceleration	
			REAL64	e.g. mm/s^2	>0	InternalDeceleration	
			REAL64	e.g. mm/s^3	>0	InternalJerk	
			REAL64	e.g. mm	>0	PositionResolution	
			REAL64	e.g. mm/s	≥0	VelocityResolution	
			REAL64	e.g. mm/s^2	≥0	AccelerationResolution	
			REAL64	e.g. mm/s	≥0	VelocityResolutionAtAccelerationZero	
			}				
0x00000500	Read	DXD group	REAL64	e.g. mm	≥ 0	Path rest way (remaining arc length) on the current path segment	*Symbolic access: 'SetPathRemLength'*
0x00000501	Read	DXD group	REAL64	e.g. mm	≥ 0	Racked out arc length on the current path segment	*Symbolic access: 'SetPathLength'*
0x00000502	Read	DXD group	REAL64	e.g. mm/s	≥ 0	Current path set velocity	*Symbolic access: 'SetPathVelo'*
0x00000503	Read	DXD group	REAL64	e.g. mm/s^2	± ∞	Current path set acceleration	*Symbolic access: 'SetPathAcc'*
0x00000504	Read	DXD group	REAL64	e.g. mm/s^2	≥ 0	Amount of the current vectorial set acceleration	*Symbolic access: 'SetPathAbsAcc'*
0x00000505	Read	DXD group	REAL64	e.g. mm/s	≥ 0	Maximum segment end path set velocity	*Symbolic access: 'SetPathVeloEnd'*
0x00000506	Read	DXD group	REAL64	e.g. mm/s	≥ 0	Segment maximum path set velocity	*Symbolic access: 'SetPathVeloMax'*
0x00000507	Read	DXD group	REAL64	e.g. mm	≥ 0	Current relative braking distance based on the current arc length	*Symbolic access: 'SetPathStopDist'*
0x00000508	Read	DXD group	REAL64	e.g. mm	± ∞	Safety distance = segment arc length - current arc length - relative braking distance	*Symbolic access: 'SetPathSecurityDist'*

Index offset (Hex)	Access	Group type	Data type	Phys. unit	Definition range	Description	Note
0x00000509	Read	DXD group	REAL64	1	0/1	Segment transition	*Symbolic access: 'SetPathSegmentChange'*
0x0000050A	Read	DXD group	REAL64	%	[0 ... 100]	Path velocity override	*Symbolic access: 'SetPathOverride'*
0x00000511	Read	DXD group	REAL64	e.g. mm/s	≥ 0	Component of the actual path velocity	*Symbolic access: 'ActPathAbsVelo'*
0x00000512	Read	DXD group	REAL64	e.g. mm/s^2	± ∞	Actual path acceleration on the current segment	*Symbolic access: 'ActPathAcc'*
0x00000513	Read	DXD group	REAL64	e.g. mm/s^2	≥ 0	Component of the actual path acceleration on the current segment	*Symbolic access: 'ActPathAbsAcc'*
0x00000514	Read	DXD group	REAL64	e.g. mm	± ∞	Position error on the path in tangential direction (signed to indicate leading and lagging)	*Symbolic access: 'PathDiffTangential'*
0x00000515	Read	DXD group	REAL64	e.g. mm	≥ 0	Position error on the path in orthogonal direction	*Symbolic access:'PathDiffOrthogonal'*
0x00000520	Read	DXD group	REAL64	1	≥ 0	Covered arc length of the current segment, normalized to 1.0	
0x00000521	Read	DXD group	REAL64	1	0/1	Change of partial segment (radius of tolerance ball)	
0x00000522	Read	DXD group	REAL64	1	≥ 0	Total remaining path length to the last geometry entry or the next accurate stop. Refers to group parameter 0x508.	
0x00000523	Read	DXD group	REAL64	1	≥ 0	Programmed velocity of the current segment	
0x00000524	Read	DXD group	REAL64	e.g. mm	≥ 0	Path distance (arc length) travelled since the program start	from TC 3.1 B4022.31 from TC 3.1 B4024.0
0x00000530	Read	DXD group	{			Current or last MCS-target position of the main axes X, Y and Z	
			REAL64	e.g. mm	± ∞	Target position X-axis	
			REAL64	e.g. mm	± ∞	Target position Y-axis	
			REAL64	e.g. mm	± ∞	Target position Z-axis	
			}				
0x00000531	Read	DXD group	{			Current or last MCS-target position of the auxiliary axes Q1 to Q5	
			REAL64[5]	e.g. mm	± ∞	Target position of axis Q1 to Q5	
			}				

Index offset (Hex)	Access	Group type	Data type	Phys. unit	Definition range	Description	Note
0x00000532	Read	DXD group	{			Reads path length, H parameter and Entry ID of the next 11 segments in relation to the current DC time	not generally released
			UINT32			DC Time	
			UINT32			Reserved	
			PreViewTab[11]			11*24 Bytes	
			}				
			PreViewTab				
			{				
			REAL64	e.g. mm		Segment length	
			UINT32	1		block number	
			UINT32	1		H-Parmeter	
			UINT32	1		Entry ID	
			UINT32	1		Reserved	
			}				
0x0000054n	Read	DXD group	REAL64	1	0/1	Within the tolerance ball of the auxiliary axis n = 1..5 Number of the auxiliary axis (not axis ID)	
0x00000546	Read	DXD group	REAL64[8]	e.g. mm	± ∞	Set position array of the (3+5) axes of the 3D group	from TC3.1 B4022.17
0x00000547	Read	DXD group	REAL64[8]	e.g. mm	± ∞	Actual position array of the (3+5) axes of the 3D group	from TC3.1 B4022.17
0x00000548	Read	DXD group	REAL64[8]	e.g. mm	± ∞	Position difference (set/actual) or lag error as array of the (3+5) axes of the 3D group	from TC3.1 B4022.17
0x00000550	Read	DXD group	{			Reads the axis IDs within a 3D group:	
			UINT32	1	[0, 1...255]	X axis ID	
			UINT32	1	[0, 1...255]	Y axis ID	
			UINT32	1	[0, 1...255]	Z axis ID	
			}				
0x00000552	Read	DXD group FIFO group Kinematic group	{ UINT32[m] }	1	[0, 1...255]	Axis allocation of the group: 1st axis ID – mth axis ID m: Dimension of the 3D group with main and auxiliary axes (X, Y, Z, Q1, Q2, Q3, Q4, Q5) or the FIFO group or the ACS axes of the kinematic group	
0x00000553	Read	Kinematic group	{			Reading the axis allocation (ID's) inside the kinematic group:	
			UINT32[8]	1	[0, 1...255]	MCS axis IDs (machine coordinate system)	
			UINT32[8]	1	[0, 1...255]	ACS axis IDs (axis coordinate system)	
			UINT32	1	≥ 0	Reserve	
			UINT32	1	≥ 0	Reserve (NEW)	
			}				

Index offset (Hex)	Access	Group type	Data type	Phys. unit	Definition range	Description	Note
0x0000056n	Read	DXD group	REAL64	1	± ∞	Current position error of the auxiliary axis within the tolerance ball (set value side only) Only for auxiliary axes n = 1..5 Number of the auxiliary axis (not axis ID)	

6.4.3.3 "Index offset" specification for group functions (Index group 0x3200 + ID)

Index-Offset (Hex)	Access	Group type	Data type	Phys. unit	Definition range	Description	Remarks
0x00000001	Write	every	VOID			Reset group	
0x00000002	Write	every	VOID			Stop group	
0x00000003	Write	every	VOID			Clear group (buffer/ task)	
0x00000004	Write	PTP group, 3D group	{			Emergency stop (E-stop) (emergency stop with controlled ramp)	
			REAL64	e.g. mm/ s^2	≥ 0.0	Deceleration (must be greater than or equal to the original deceleration)	
			REAL64	e.g. mm/ s^3	≥ 0.0	Jerk (must greater than or equal to the original jerk)	
			}				
0x00000005	Write	PTP group	{			Parameterizable stop (with controlled ramp)	Reserved function, no standard!
			REAL64	e.g. mm/ s^2	≥ 0.0	Deceleration	
			REAL64	e.g. mm/ s^3	≥ 0.0	Jerk	
			}				
0x00000006	Write	PTP group, 3D group	VOID			"Step on" after Emergency Stop (E-Stop)	
0x00000050	Write	PTP group, 3D group	{			Axis allocation of the group:	
			UINT32	1	[0, 1...255]	X axis ID	
			UINT32	1	[0, 1...255]	Y axis ID	
			UINT32	1	[0, 1...255]	Z axis ID	
			}				
0x00000051	Write	PTP group, 3D group FIFO group	{			axis allocation of the group:	
			UINT32	1	[1...255]	Axis ID	
			UINT32	1	[0 ... (m-1)]	Place index of the axis in the group m: group dimension (PTP: 1;DXD: 3, FIFO: 16)	
			}				
0x00000052	Write	3D group FIFO group	{ UINT32[m] }	1	[0, 1...255]	Axis allocation of the group: First axis ID, ... , m. axis ID m: dimension of the 3D group (X, Y, Z, Q1, Q2, Q3, Q4, Q5) resp. FIFO group	
0x00000053	Write	3D group FIFO group Kinematic group	VOID			Delete the 3D axis allocation, FIFO axis allocation or Kinematic axis allocation and return of the axes to their own PTP groups	
0x00000054	Write	Kinematic group	{			Axis allocation of the kinematic group:	
			UINT32[8]	1	[0, 1...255]	MCS axis IDs (Machine Coordinate System)	
			UINT32[8]	1	[0, 1...255]	ACS axis IDs (Axis Coordinate System)	
			UINT32	1	≥ 0	Reserved	
			UINT32	1	≥ 0	Reserved (NEW)	
			}				

Index-Offset (Hex)	Access	Group type	Data type	Phys. unit	Definition range	Description	Remarks
0x00000060	ReadWrite	3D group		1		Internal "feed group" command ("Feeder")	Execute command!
0x00000061	ReadWrite	3D group		1		Internal "feed group" command ("Feeder")	Execute command!
0x00000110	Write	1D group	VOID			Reference 1D group ("calibration")	
0x00000111	Write	1D group	{			New end position 1D group	
			UINT32	ENUM	s. appendix	End position type [▶ 153] (s. appendix)	
			REAL64	e.g. mm	±∞	New end position (target position)	
			}				
0x0000011A	Write	1D group	{			Set actual position 1D group	**Caution by using!** Always to SAF Port 501!
			UINT32	ENUM	s. appendix	Actual position type [▶ 153] (s. appendix)	
			REAL64	e.g. mm	±∞	Actual position for axis	
			}				
0x0000011B	Write	1D group	UINT32	1	0/1	Set reference flag ("calibrate flag")	**Caution by using!**
0x00000120	Write	1D group	{			Start 1D group (standard start):	
			UINT32	ENUM	s. appendix	Start type [▶ 152] (s. appendix)	
			REAL64	e.g. mm	±∞	End position (target position)	
			REAL64	mm/s	≥ 0.0	Required velocity	
			}				
0x00000121	Write	1D group (SERVO)	{			Start 1D group (extended start):	
			UINT32	ENUM	s. appendix	Start type [▶ 152] (s. appendix)	
			REAL64	e.g.mm	±∞	End position (target position)	
			REAL64	mm/s	≥0.0	Required velocity	
			UINT32	1	0/1	Standard acceleration?	
			REAL64	mm/s^2	≥ 0.0	Acceleration	
			UINT32	1	0/1	Standard deceleration?	
			REAL64	mm/s^2	≥ 0.0	Deceleration	
			UINT32	1	0/1	Standard jerk?	
			REAL64	mm/s^3	≥ 0.0	Jerk	
			}				

Index-Offset (Hex)	Access	Group type	Data type	Phys. unit	Definition range	Description	Remarks
0x00000122	Write	1D group (MW servo)	{			Start 1D group (special start):	Reserved start function, no standard!
			UINT32	ENUM	s. appendix	Start type [▶ 152] (s. appendix)	
			REAL64	e.g. mm	±∞	End position (target position)	
			REAL64	mm/s	≥0.0	required start velocity	
			REAL64	e.g. mm	±∞	Position for a new velocity level	
			REAL64	mm/s	≥0.0	new end velocity level	
			UINT32	1	0/1	Standard acceleration?	
			REAL64	mm/s^2	≥0.0	Acceleration	
			UINT32	1	0/1	Standard deceleration?	
			REAL64	mm/s^2	≥0.0	deceleration	
			UINT32	1	0/1	Standard jerk?	
			REAL64	mm/s^3	≥0.0	Jerk	
			}				
0x00000126	Write	1D group	{			Start drive output:	
			UINT32	ENUM	s. appendix	Output type [▶ 160] (s. appendix)	
			REAL64	e.g. %	±∞	Required output value (e.g. %)	
			}				
0x00000127	Write	1D group	VOID			Stop drive output	
0x00000128	Write	1D group	{			Change the drive output:	
			UINT32	ENUM	s. appendix	Output type [▶ 160] (s. appendix)	
			REAL64	e.g. %	±∞	Required output value (e.g. %)	
			}				
0x00000130	Write	1D group (SERVO)	{			1D section compensation (SERVO):	
			UINT32	ENUM	s. appendix	Compensation type [▶ 153] (s. appendix)	
			REAL64	mm/s/s	≥ 0.0	Max. acceleration increase	
			REAL64	mm/s/s	≥ 0.0	Max. deceleration increase	
			REAL64	mm/s	≥ 0.0	Max. increase velocity	
			REAL64	mm/s	≥ 0.0	Base velocity for the process	
			REAL64	e.g. mm	±∞	Path difference to be compensated	
			REAL64	e.g. mm	≥ 0.0	Path distance for compensation	
			}				
0x00000131	Write	1D group SERVO	VOID			Stop section compensation (SERVO)	

Index-Offset (Hex)	Access	Group type	Data type	Phys. unit	Definition range	Description	Remarks
0x00000140 (0x00n00140)	Write	Master/Slave coupling: 1D group(SERVO)	{			Master/slave coupling (SERVO):	Extension for "flying saw"! angle >0.0 and <= 90.0 degrees(parallel saw: 90.0 degrees)
			UINT32	ENUM	s. appendix	Slave type/coupling type [▶ 154] (s. appendix)	
			UINT32	1	[1...255]	Axis ID of the master axis/group	
			UINT32	1	[0...8]	Subindex n of the master axis (default value: 0)	
			UINT32	1	[0...8]	Subindex n of the slave axis (default value: 0)	
			REAL64	1	[±1000000.0]	Parameter 1: linear: Gearing factor FlySawVelo: Reserve FlySaw: Abs. synchronous position master [mm]	
			REAL64	1	[±1000000.0]	Parameter 2: linear: Reserve FlySawVelo: Reserve FlySawPos: Abs. synchronous position slave [mm]	
			REAL64	1	[±1000000.0]	Parameter 3: linear: Reserve FlySawVelo: Angle of inclination in [DEGREE] FlySawPos: angle of inclination in [DEGREE]	
			REAL64	1	[±1000000.0]	Parameter 4: linear: Reserve FlySawVelo: Gearing factor FlySawPos: Gearing factor	
			}				
0x00000141	Write	Master/Slave decoupling: 1D group(SERVO)	VOID			Master/slave decoupling (SERVO)	
0x00000142	Write	Master / slave parameter 1D group(servo)	{			Change of the coupling parameters (SERVO):	
			REAL64	1	[±1000000.0]	Parameter 1: linear: Gearing factor	
			REAL64	1	[±1000000.0]	Parameter 2: Linear: Reserve	
			REAL64	1	[±1000000.0]	Parameter 3: Linear: Reserve	
			REAL64	1	[±1000000.0]	Parameter 4: Linear: Reserve	
			}				
0x00000144	Write	Slave stop 1D group (SERVO)	VOID			Stop the "flying saw" (SERVO)	Only for "flying saw"
0x00000149	Write	Slave tables 1D group (SERVO)	REAL64	1	±∞	set the slave table scaling of a solo table coupling (SERVO)	Only for Solo table slave
0x00000150	Write	1D group	VOID			Deactivate complete 1D group/axis (disable)	

Index-Offset (Hex)	Access	Group type	Data type	Phys. unit	Definition range	Description	Remarks
0x00000151	Write	1D group	VOID			Activate complete 1D group / axis (enable)	
0x00000160	Write	1D group	VOID			Deactivate drive output of the 1D group (disable)	
0x00000161	Write	1D group	VOID			Activate drive output of the 1D group (enable)	
0x00000362	Write	High/low speed group	UINT16	1	0/1	Release parking brake? 0: automatic activation (default) 1: mandatorily always released!	
0x00000701	Write	FIFO group	VOID			Start FIFO group (FIFO table must have been filled in advance)	(n*m)-FIFO
0x00000710	Write	FIFO group	{ REAL64[x*m]}	e.g. mm	±∞	Write x FIFO entries (lines): (x*m)-values (one or more lines) n: FIFO length (number of lines) m: FIFO dimension (number of columns) range of values x: [1 ... n]	Only possible on a line-by-line basis! (integer multiple)
0x00000711	Write	FIFO group	{ REAL64[x*m]}	e.g. mm	±∞	Overwrite the last x FIFO entries (lines): (x*m)-values (one or more lines) n: FIFO length (number of lines) m: FIFO dimension (number of columns) range of values x: [1 ... n]	Only possible on a line-by-line basis! (integer multiple)
0x00000801	Write	Kinematic group	VOID			Start kinematic group	Reserved function, no standard!

6.4.4 Specification Axes

6.4.4.1 "Index offset" specification for axis parameter (Index group 0x4000 + ID)

Index offset (Hex)	Access	Axis type	Data type	Phys. unit	Definition range	Description	Note
0x00n00000	Read	every (Structure for all axis parameters)	{			General AXIS PARAMETER STRUCTURE (NC/CNC), also contains the sub-elements such as encoder, controller and drive (s. MC_ReadParameterSet in TcMc2.lib) Note: Size and alignment changed.	Modified from TC3
			UINT32	1		Axis ID	
			STRING[30+1]	1		Axis name	
			UINT32	1	ENUM	Axis type [▶ 151]	
			. . .	. . .	. . .	. . .	
			}			1024 bytes (instead of 512 bytes)	
0x00000001	Read	every	UINT32	1		Axis ID	
0x00000002	Read	every	STRING[30+1] UINT8[. . .]	1		Axis name	Any number of characters from TC3.1 Build 4022.32 or 4024.6
0x00000003	Read	every	UINT32	1	ENUM	Axis type [▶ 151]	
0x00000004	Read	every	UINT32	µs		Cycle time axis (SEC)	
0x00000005	Read	every	STRING[10+1]	1		Physical unit	
0x00000006	Read/Write	every	REAL64	e.g. mm/s		Ref. velocity in cam direction	
0x00000007	Read/Write	every	REAL64	e.g. mm/s		Ref. velocity in sync direction	
0x00000008	Read/Write	every	REAL64	e.g. mm/s		Velocity hand slow	
0x00000009	Read/Write	every	REAL64	e.g. mm/s		Velocity hand fast	
0x0000000A	Read/Write	every	REAL64	e.g. mm/s	[0.0...1.0E20]	Velocity rapid traverse	
0x0000000F	Read/Write	every	UINT16	1	0/1	Position range monitoring?	
0x00000010	Read/Write	every	REAL64	e.g. mm	[0.0...1.0E6]	Position range window	
0x00000011	Read/Write	every	UINT16	1	0/1	Motion monitoring?	
0x00000012	Read/Write	every	REAL64	s	[0.0...600]	Motion monitoring time	
0x00000013	Read/Write	every	UINT16	1	0/1	Loop?	
0x00000014	Read/Write	every	REAL64	e.g. mm		Looping distance (±)	
0x00000015	Read/Write	every	UINT16	1	0/1	Target position monitoring?	
0x00000016	Read/Write	every	REAL64	e.g. mm	[0.0...1.0E6]	Target position window	
0x00000017	Read/Write	every	REAL64	s	[0.0...600]	Target position monitoring time	
0x00000018	Read/Write	every	REAL64	e.g. mm		Pulse way in pos. direction	
0x00000019	Read/Write	every	REAL64	e.g. mm		Pulse way in neg. direction	
0x0000001A	Read/Write	every	UINT32	1	ENUM (≥0)	Error reaction mode: 0: instantaneous (default) 1: delayed (e.g. for Master/Slave-coupling)	
0x0000001B	Read/Write	every	REAL64	s	[0...1000]	Error delay time (if delayed error reaction is selected)	

Index offset (Hex)	Access	Axis type	Data type	Phys. unit	Definition range	Description	Note
0x0000001C	Read/Write	every	UINT16	1	0/1	Couple slaves via actual values if not ready to operate?	
0x0000001D	Read/Write	every	REAL64	e.g. mm/s^2	[0, 0.01...1.0E10]	Acceleration for fading profile when switching from set to actual values: Default: 0 (in this case the minimum from the axis acceleration is used, i.e. MIN(Acc, Dec))	
0x0000001E	Read/Write	every	UINT32	1	ENUM (≥0)	Fast Axis Stop Signal Type: Selection of the signal type that triggers a fast axis stop (see bit 7 in Drive->nStatus4) *"0 (SignalType_OFF)",* *"1 (SignalType_RisingEdge)","2 (SignalType_FallingEdge)","3 (SignalType_BothEdges)","4 (SignalType_HighActive)","5 (SignalType_LowActive)"*	
0x00000020	Read/Write	every	UINT16	1	0/1	Allow motion commands for slave axis? Default: FALSE	
0x00000021	Read/Write	every	UINT16	1	0/1	Allow motion commands for axes with active external setpoint generator? Default: FALSE	
0x00000026	Read/Write	every	UINT32	1		Interpretation of the units (position, velocity, time) Bit 0: Velocity in x/min instead of x/s Bit 1: Position in thousandths of the base unit Bit 2: Modulo position display	See encoder! Bit array
0x00000027	Read/Write	every	REAL64	e.g. mm/s	[>0...1.0E20]	Max. allowed velocity	
0x00000028	Read/Write	every	REAL64	e.g. mm	[0.0...1.0E6]	Motion monitoring window	
0x00000029	Read/Write	every	UINT16	1	0/1	PEH time monitoring?	Position end and accurate stop
0x0000002A	Read/Write	every	REAL64	s	[0.0...600]	PEH monitoring time	
0x0000002C	Read/Write	every	REAL64	e.g. mm	[-1000.0 ...1000.0]	Backlash	
0x00000030	Read	every	UINT16	1	[0,1]	Persistent data e.g. for actual position and reference state of the encoder?	Boot parameters, cannot be changed online.

Index offset (Hex)	Access	Axis type	Data type	Phys. unit	Definition range	Description	Note
0x00000031	Read	every	{ UINT8[6] UINT16 UINT16 } 10 bytes	AmsAddr: AmsNetId, AmsPort No. Channel No	1	Read the hardware AMS address (AMS Net ID and AMS Port No) and the EtherCAT channel number (communication channel 0,1,2,3…)	
0x00000031	Read	every	{ UINT8[6] UINT16 UINT16 // UINT16 UINT32 UINT32 UINT32 UINT32 UINT32 UINT32 UINT32 UINT32 UINT32 UINT32 UINT32[3] } 64 bytes	AmsAddr: AmsNetId, AmsPort No. Channel No Reserviert NcDriveID NcDriveIndex NcDriveType NcEncID NcEncIndex NcEncType NcAxisID NcAxisType TcDriveObjectId TcEncObjectId reserved	1	Read the hardware AMS address (AMS Net ID and devices AMS Port No) and the EtherCAT channel number (communication channel 0,1,2,3…) Supplemented by additional NC information such as NcDriveID, NcDriveType (see appendix) etc..	NEW from TC3 DriveObjectId and EncObjectId from NC build 4437
0x00000033	Read	every	{ UINT16 ApplRequestBit UINT16 ApplRequestType UINT32 ApplCmdNo UINT32 ApplCmdVersion . . . } 1024 bytes	 1 1 Not implemented 1	0/1 ≥0 >0 ≥0	General APPLICATION REQUEST STRUCTURE (NC/NCI), e.g. for ApplicationHoming request (see *MC_ReadApplicationRequest* in *TcMc2.lib*) Application request types: 0: NONE (IDLE) 1: HOMING	Changed in TC3
0x00000051	Read	Channel: every	UINT32			Channel ID	
0x00000052	Read	Channel: every	STRING[30+1]			Channel name	
0x00000053	Read	Channel: every	UINT32	1	ENUM	Channel type [▶ 150]	
0x00000054	Read	Group: every	UINT32			Group ID	
0x00000055	Read	Group: every	STRING[30+1]			Group name	
0x00000056	Read	Group: every	UINT32	1	ENUM	Group type [▶ 151]	
0x00000057	Read	every	UINT32			Number of encoders	
0x00000058	Read	every	UINT32			Number of controllers	
0x00000059	Read	every	UINT32			Number of drives	
0x0000005A	Read	every	{			Read all sub-elements of an axis:	
			UINT32[9]	1	[0, 1...255]	Axis encoder IDs	
			UINT32[9]	1	[0, 1...255]	Axis controller IDs	
			UINT32[9]	1	[0, 1...255]	Axis drive IDs	
			} 108 bytes				

Index offset (Hex)	Access	Axis type	Data type	Phys. unit	Definition range	Description	Note
0x000000F1	Read/Write	every	REAL64	e.g. mm/s^2	Default: 1.0E5	Maximum permitted acceleration	NEW from TC 3.2
0x000000F2	Read/Write	every	REAL64	e.g. mm/s^2	Default: 1.0E6	Maximum permitted deceleration	NEW from TC 3.2
0x00000101	Read/Write	Servo	REAL64	e.g. mm/s^2	[0.01...1.0E20]	Acceleration (default data set)	
0x00000102	Read/Write	Servo	REAL64	e.g. mm/s^2	[0.01...1.0E20]	Deceleration (default data set)	
0x00000103	Read/Write	Servo	REAL64	e.g. mm/s^3	[0.1...1.0E30]	Jerk (default data set)	
0x00000104	Read/Write	Servo	REAL64	s	[0.0 ... 1.0] Default: 0.0 s	Deceleration time between velocity and position values of the setpoint generator in seconds	
0x00000105	Read/Write	Servo	UINT32	1	ENUM Default: type 1	Override type [▶ 152] for velocity: 1: Related to internal reduced velocity (without iteration) 2: Related to original external start velocity (without iteration) 3: Related to internal reduced velocity (optimization by means of iteration) 4: Related to original external start velocity (optimization by means of iteration)	
0x00000106	Read/Write	Servo	REAL64	1	[0.0 ... 1.0E6] Default: 0.0	Maximum permitted step change in velocity for dynamic reduction *DV = factor *min(A+, A-) * DT*	
0x00000107	Read/Write	Servo	UINT16	1	[0.1] Default: 1	Activates acceleration and jerk limitation for the auxiliary axis (Q1 to Q5)	
	Read/Write	Servo	REAL64	e.g. mm	[0.0..1000.0]	Radius of the tolerance sphere for the auxiliary axes	
	Read/Write	Servo	REAL64	e.g. mm	[0.0..10000.0]	Maximum allowed position deviation if the tolerance sphere is reduced Only for auxiliary axes	
0x0000010A	Read/Write	Servo	REAL64	e.g. mm/s^2	[0.01 ... 1.0E20]	Fast Axis Stop: Acceleration (s.a. Fast Axis Stop Signal Type)	
0x0000010B	Read/Write	Servo	REAL64	e.g. mm/s^2	[0.01 ... 1.0E20]	Fast Axis Stop: Deceleration (s.a. Fast Axis Stop Signal Type)	
0x0000010C	Read/Write	Servo	REAL64	e.g. mm/s^3	[0.1 ... 1.0E30]	Fast Axis Stop: Jerk (s.a. Fast Axis Stop Signal Type)	

Index offset (Hex)	Access	Axis type	Data type	Phys. unit	Definition range	Description	Note
0x0000010D	Read/Write	Servo	UINT32	1		Index offset of the axis state that is passed in the cyclic interface as "UserData". 0x00000000: deactivated 0x00010012: Encoder position with position bias voltage (without position correction and without dead time compensation) 0x00010014: DriveActVelo 0x00010017: MC_SetPosition offsets	
0x00000201	Read/Write	Stepper motor	UINT32	1	ENUM	Operation mode stepper motor	
0x00000202	Read/Write	Stepper motor	REAL64	e.g. mm/ STEP	[1.0E-6 ... 1000.0]	Distance scaling of a motor step	
0x00000203	Read/Write	Stepper motor	REAL64	e.g. mm/ s	[0.0 ... 1000.0]	Minimum velocity for velocity profile	
0x00000204	Read/Write	Stepper motor	UINT32	1	[0 ... 100]	Number of steps per frequency/velocity step	
0x00000205	Read/Write	Stepper motor	UINT32	1		Motor mask as sync pulse	Not implemented!
0x00000301	Read/Write	high/low	REAL64	e.g. mm	[0.0 ... 100000.0]	Creep distance in pos. direction	
0x00000302	Read/Write	high/low	REAL64	e.g. mm	[0.0 ... 100000.0]	Creep distance in neg. direction	
0x00000303	Read/Write	high/low	REAL64	e.g. mm	[0.0 ... 100000.0]	Braking distance in pos. direction	
0x00000304	Read/Write	high/low	REAL64	e.g. mm	[0.0 ... 100000.0]	Braking distance in neg. direction	
0x00000305	Read/Write	high/low	REAL64	s	[0.0 ... 60.0]	Braking deceleration in pos. direction	
0x00000306	Read/Write	high/low	REAL64	s	[0.0 ... 60.0]	Braking deceleration in neg. direction	
0x00000307	Read/Write	high/low	REAL64	s	[0.0 ... 60.0]	Switching time from high to low velocity	
0x00000308	Read/Write	high/low	REAL64	e.g. mm	[0.0 ... 100000.0]	Creep distance stop	
0x00000309	Read/Write	high/low	REAL64	s	[0.0 ... 60.0]	Delay time to release brake	
0x0000030A	Read/Write	high/low	REAL64	s	[0.0 ... 60.0]	Pulse time in pos. direction	
0x0000030B	Read/Write	high/low	REAL64	s	[0.0 ... 60.0]	Pulse time in neg. direction	
ENCODER							
0x00n10001	Read	Encoder: every	UINT32	1	[1 ... 255]	Encoder ID n = 0: standard encoder of the axes > 0: nth encoder of the axis (optional)	
0x00n10002	Read	Encoder: every	STRING[30+1]	1	30 characters	Encoder name	
0x00n10003	Read	Encoder: every	UINT32	1	ENUM (>0)	Encoder type [▶ 156]	
0x00n10004	Read/Write	Encoder: every	UINT32	1	Byteoffset	Input address offset (I/O-Input-Image)	Change I/O address
0x00n10005	Read/Write	Encoder: every	UINT32	1	Byteoffset	Output address offset (I/O-Output-Image)	Change I/O address

Index offset (Hex)	Access	Axis type	Data type	Phys. unit	Definition range	Description	Note
0x00n10006	Read/Write	Encoder: every	REAL64	e.g. mm/ INC	[1.0E-12 ... 1.0E+30]	Resulting scaling factor (numerator / denominator) Note: from TC3 the scaling factor consists of two components – numerator and denominator (default: 1.0).	Writing is not allowed if the controller enable has been issued.
0x00n10007	Read/Write	Encoder: every	REAL64	e.g. mm	[±1.0E+9]	Position offset	Writing is not allowed if the controller enable has been issued.
0x00n10008	Read/Write	Encoder: every	UINT16	1	[0,1]	Encoder count direction	Writing is not allowed if the controller enable has been issued.
0x00n10009	Read/Write	Encoder: every	REAL64	e.g. mm	[0.001 ... 1.0E+9]	Modulo factor	
0x00n1000A	Read/Write	Encoder: every	UINT32	1	s. ENUM (>0)	Encoder mode [▶ 157]	
0x00n1000B	Read/Write	Encoder: every	UINT16	1	0/1	Soft end min. monitoring?	
0x00n1000C	Read/Write	Encoder: every	UINT16	1	0/1	Soft end max. monitoring?	
0x00n1000D	Read/Write	Encoder: every	REAL64	mm		Soft end position min.	
0x00n1000E	Read/Write	Encoder: every	REAL64	mm		Soft end position max.	
0x00n1000F	Read/Write	Encoder: every	UINT32	1	s. ENUM (≥0) in the appendix	Encoder evaluation direction [▶ 157] (enable for log. counting direction)	
0x00n10010	Read/Write	Encoder: every	REAL64	s	[0.0...60.0]	Filter time for actual position value in seconds (P-T1)	
0x00n10011	Read/Write	Encoder: every	REAL64	s	[0.0...60.0]	Filter time for actual velocity value in seconds (P-T1)	
0x00n10012	Read/Write	Encoder: every	REAL64	s	[0.0...60.0]	Filter time for actual acceleration value in seconds (P-T1)	
0x00n10013	Read/Write	Encoder: every	STRING[10+1]	1		Physical unit	Not implemented!
0x00n10014	Read/Write	Encoder: every	UINT32	1		Interpretation of the units (position, velocity, time) Bit 0: Velocity in x/min instead of x/s Bit 1: Position in thousandths of the base unit	Not implemented! Bit array
0x00n10015	Read	Encoder: every	UINT32	INC	[0x0... 0xFFFFFFFF]	Encoder mask (maximum value of the encoder actual value in increments Note: The encoder mask may be any numerical value (e.g. 3600000). Unlike in the past, it no longer has to correspond to a continuous series off binary one's (2^n-1).	Read-only parameter see also "Encoder Sub Mask" parameter
0x00n10016	Read/Write	Encoder: every	UINT16	1	0/1	Actual position correction (measurement system error correction)?	

Index offset (Hex)	Access	Axis type	Data type	Phys. unit	Definition range	Description	Note
0x00n10017	Read/Write	Encoder: every	REAL64	s	[0.0...60.0]	Filter time for actual position correction in seconds (P-T1)	
0x00n10019	Read/Write	Encoder: every	UINT32	1	ENUM (>0)	Encoder absolute dimensioning system [▶ 157]	Writing is not allowed if the controller enable has been issued.
0x00n1001A	Read	Encoder: every	UINT32	1	ENUM (>0)	Encoder position initialization	Not implemented!
0x00n1001B	Read/Write	Encoder: every	REAL64	e.g. mm	[≥0, modulo factor/2]	Tolerance window for modulo-start	
0x00n1001C	Read	Encoder: every	UINT32	1	ENUM (>0)	Encoder sign interpretation [▶ 157] (data type)	
0x00n1001D	Read	Encoder: every	UINT16	1	0/1	Incremental or absolute encoder ? 0: Incremental encoder type 1: Absolute encoder type	
0x00n10023	Read/Write	Encoder: every	REAL64	e.g. mm/ INC	[1.0E-12 ... 1.0E+30]	Component of the scaling factor: numerator (=> scaling factor numerator / scaling factor denominator)	NEW from TC3 Writing is not allowed if the controller enable has been issued.
0x00n10024	Read/Write	Encoder: every	REAL64	1	[1.0E-12 ... 1.0E+30]	Component of the scaling factor: denominator (=> scaling factor numerator / scaling factor denominator) Default: 1.0	NEW from TC3 Writing is not allowed if the controller enable has been issued.

0x00n10025	Read/Write	Encoder: every	{
			REAL64
			REAL64
			}
				e.g. mm/ INC
				1
					[1.0E-12 ... 1.0E+30]
					[1.0E-12 ... 1.0E+30]
						Component of the scaling factor: numerator
						Component of the scaling factor: denominator
						(=> scaling factor numerator / scaling factor denominator)
							NEW from TC3

0x00n10030	Read/Write	Encoder: every	UINT32	1		Internal encoder control double word for specifying the operation modes and properties	NEW from TC3
0x00n10101	Read/Write	E: INC	UINT16	1	[0,1]	Inverse search direction for ref.cam?	
0x00n10102	Read/Write	E: INC	UINT16	1	[0,1]	inverse search direction for sync pulse?	
0x00n10103	Read/Write	E: INC	REAL64	e.g. mm	[±1000000.0]	Reference position	
0x00n10104	Read/Write	E: INC	UINT16	1	[0,1]	Distance monitoring between Ref. cams and sync pulse active?	Not implemented!
0x00n10105	Read/Write	E: INC	UINT32	INC	[0 ... 65536]	Minimum gap between Ref. cams and sync pulse in increments	Not implemented!
0x00n10106	Read/Write	E: INC	UINT16	1	[0,1]	External sync pulse?	
0x00n10107	Read/Write	E: INC	UINT32	1	s. ENUM (>0)	Reference mode [▶ 158]	

Index offset (Hex)	Access	Axis type	Data type	Phys. unit	Definition range	Description	Note
0x00n10108	Read/Write	E: INC	UINT32	1	[0x0000000F... 0xFFFFFFFF]binary mask: (2^n - 1)	Encoder Sub Mask (maximum value of the absolute range of the encoder actual value in increments) Used, for example, as a reference mark for the referencing mode "Software Sync" and for the NC Retain Data "ABSOLUTE (MODULO)", "INCREMENTAL (SINGLETURN ABSOLUTE)". Note 1: The Encoder Sub Mask must be smaller than or equal to the Encoder Mask. Note 2: The Encoder Mask must be an integer multiple of the Encoder Sub Mask. Note 3: The Encoder Sub Mask must be a continuous sequence of binary ones (2^n-1), e.g. 0x000FFFFF.	see also "Encoder Mask" parameter
0x00n10110	Read/Write	E: INC (encoder simulation)	REAL64	1	[0.0 ... 1000000.0]	Scaling/weight of the noise part for the simulation encoder	
CONTROLLER							
0x00n20001	Read	Controller: every	UINT32	1	[1 ... 255]	Controller ID n = 0: standard controller of the axes > 0: nth controller of the axis (optional)	
0x00n20002	Read	Controller: every	STRING[30+1]	1	30 characters	Controller name	
0x00n20003	Read	Controller: every	UINT32	1	ENUM (>0)	Controller type [▶ 155]	
0x00n2000A	Read/Write	Controller: every		1	ENUM (>0)	Controller mode	
0x00n2000B	Read/Write	Controller: every	REAL64	%	[0.0 ... 1.0]	Weighting of the velocity pre-control (default value: 1.0 = 100 %)	
0x00n20010	Read/Write	Controller: every	UINT16	1	0/1	Position lag monitoring Pos.?	
0x00n20011	Read/Write	Controller: every	UINT16	1	0/1	Position lag monitoring Velocity?	
0x00n20012	Read/Write	Controller: every	REAL64	e.g. mm		Max. lag error position	
0x00n20013	Read/Write	Controller: every	REAL64	s		Max. lag error filter time position	
0x00n20014	Read/Write	Controller: every	REAL64	e.g. mm/s		Max. lag error velocity	
0x00n20015	Read/Write	Controller: every	REAL64	s		Max. lag error filter time velocity	
0x00n20100	Read/Write	P/PID (pos., (veloc.)	REAL64	1	[0.0...1.0]	Maximum output limitation (±) for controller total output	(default value: 0.5 == 50%)

Index offset (Hex)	Access	Axis type	Data type	Phys. unit	Definition range	Description	Note
0x00n20102	Read/Write	P/PID (pos.)	REAL64	e.g. mm/ s/ mm	[0.0...1000.0]	Proportional gain kp or kv Unit: Base Unit / s / Base Unit	Position control
0x00n20103	Read/Write	PID (pos.)	REAL64	s	[0.0 ... 60.0]	Integral action time Tn	Position control
0x00n20104	Read/Write	PID (pos.)	REAL64	s	[0.0 ... 60.0]	Derivative action time Tv	Position control
0x00n20105	Read/Write	PID (pos.)	REAL64	s	[0.0 ... 60.0]	Damping time Td	Position control
0x00n20106	Read/Write	PP (Pos.)	REAL64	e.g. mm/ s/ mm	[0.0...1000.0]	Additional proportional gain, kp or kv respectively, that applies above a limiting velocity in percent. Unit: Base Unit / s / Base Unit	Position control
0x00n20107	Read/Write	PP (Pos.)	REAL64	%	[0.0...1.0]	Threshold velocity in percent above which the additional proportional gain, kp or kv respectively, applies	
0x00n20108	Read/Write	P/PID (Acc.)	REAL64	s	[0.0 ... 100.0]	Proportional gain ka	Acceleration pre-control
0x00n2010D	Read/Write	P/PID	REAL64	mm	[0.0 ... 10000.0]	"Dead band" for position error (control deviation) (for P/PID controllers with velocity or torque interface)	Reserved function
0x00n2010F	Read/Write	P/PP/PID (pos.) Slave control	REAL64	(mm/s) / mm	[0.0...1000.0]	Slave coupling difference control: Proportional gain k_{cp}	Slave coupling difference control
0x00n20110	Read/Write	P (Pos.)	UINT16	1	0/1	Automatic offset calibration: active/ passive	
0x00n20111	Read/Write	P (Pos.)	UINT16	1	0/1	Automatic offset calibration: hold mode	
0x00n20112	Read/Write	P (Pos.)	UINT16	1	0/1	Automatic offset calibration: Fading mode	
0x00n20114	Read/Write	P (Pos.)	REAL64	%	[0.0 ... 1.0]	Automatic offset calibration: Pre-control limit	
0x00n20115	Read/Write	P (Pos.)	REAL64	s	[0.1 ... 60.0]	Automatic offset calibration: Time constant	
0x00n20116	Read/Write	PID (pos.)	REAL64	%	[0.0...1.0]	Maximum output limitation (±) for I part in percent (default setting: 0.1 = 10%)	
0x00n20117	Read/Write	PID (pos.)	REAL64	%	[0.0...1.0]	Maximum output limitation (±) for D part in percent (default setting: 0.1 = 10%)	
0x00n20118	Read/Write	PID (pos.)	UINT16	1	0/1	Deactivation of the I part during an active positioning process (assuming I part active)? (Default setting: 0 = FALSE)	
0x00n20120	Read/Write	P/PID (pos.)	REAL64	s	≥0	PT-1 filter value for position error (pos. control deviation)	Reserved function, no standard!
0x00n20202	Read/Write	P/PID (velocity)	REAL64	1	[0.0...1000.0]	Proportional gain kp or kv	Velocity control

Index offset (Hex)	Access	Axis type	Data type	Phys. unit	Definition range	Description	Note
0x00n20203	Read/Write	PID (velocity)	REAL64	s	[0.0 ... 60.0]	Integral action time Tn	Velocity control
0x00n20204	Read/Write	PID (velocity)	REAL64	s	[0.0 ... 60.0]	Derivative action time Tv	Velocity control
0x00n20205	Read/Write	PID (velocity)	REAL64	s	[0.0 ... 60.0]	Damping time Td	Velocity control
0x00n20206	Read/Write	PID (velocity)	REAL64	%	[0.0...1.0]	Maximum output limitation (±) for I-part in percent (default setting: 0.1 = 10%)	Velocity control
0x00n20207	Read/Write	PID (velocity)	REAL64	%	[0.0...1.0]	Maximum output limitation (±) for D-part in percent (default setting: 0.1 = 10%)	Velocity control
0x00n2020D	Read/Write	P/PID (velocity)	REAL64	mm/s	[0.0 ... 10000.0]	"Dead band" for velocity error (control deviation) (for P/PID controllers with velocity or torque interface)	Reserved function
0x00n20220	Read/Write	P/PID (velocity)	REAL64	s	≥0	PT-2 filter value for velocity error (vel. control deviation)	Velocity control, not standard!
0x00n20221	Read/Write	P/PID (velocity)	REAL64	s	≥0	PT-1 filter value for velocity error (vel. control deviation)	Reserved function, no standard!
0x00n20250	Read/Write	P/PI (observer)	UINT32	1	ENUM (>0)	Observer mode [▶ 155] for control in the torque interface 0: OFF (default) 1: LUENBERGER	
0x00n20251	Read/Write	P/PI (observer)	REAL64	Nm / A	>0.0	Motor: Torque constant K_T	
0x00n20252	Read/Write	P/PI (observer)	REAL64	kg m^2	>0.0	Motor: Moment of inertia J_M	
0x00n20253	Read/Write	P/PI (observer)	REAL64	Hz	[100.0 ... 2000.0] Default: 500	Bandwidth f_0	
0x00n20254	Read/Write	P/PI (observer)	REAL64	1	[0.0 ... 2.0] Default: 1.0	Correction factor k_c	
0x00n20255	Read/Write	P/PI (observer)	REAL64	s	[0.0 ... 0.01] Default: 0.001	Velocity filter (1st order): Time constant T	
0x00n20A03	Read/Write	P/PID (MW)	REAL64	cm^2	[0.0 ... 1000000]	Cylinder area A_A of the A side in cm^2	Reserved parameters!
0x00n20A04	Read/Write	P/PID (MW)	REAL64	cm^2	[0.0 ... 1000000]	Cylinder area A_B of the B side in cm^2	Reserved parameters!
0x00n20A05	Read/Write	P/PID (MW)	REAL64	cm^3/s	[0.0 ... 1000000]	Nominal volume flow Q_{nom} in cm^3/s	Reserved parameters!
0x00n20A06	Read/Write	P/PID (MW)	REAL64	bar	[0.0 ... 1000000]	Nominal pressure or valve pressure drop, P_{nom} in bar	Reserved parameters!
0x00n20A07	Read/Write	P/PID (MW)	UINT32	1	[1 ... 255]	Axis ID for the system pressure Po	Reserved parameters!
DRIVE:							
0x00n30001	Read	Drive: every	UINT32	1	[1 ... 255]	Drive ID	
0x00n30002	Read	Drive: every	STRING[30+1]	1	30 characters	Drive name	
0x00n30003	Read	Drive: every	UINT32	1	ENUM (>0)	Drive type [▶ 160]	
0x00n30004	Read/Write	Drive: every	UINT32	1	Byteoffset	Input address offset (I/O-Input-Image)	Change I/O address
0x00n30005	Read/Write	Drive: every	UINT32	1	Byteoffset	Output address offset (I/O-Output-Image)	Change I/O address

Index offset (Hex)	Access	Axis type	Data type	Phys. unit	Definition range	Description	Note
0x00n30006	Read/Write	Drive: every	UINT16	1	[0,1]	Motor polarity	Writing is not allowed if the controller enable has been issued.
0x00n3000A	Read/Write	Drive: every	UINT32	1	ENUM (≥0)	Drive mode	
0x00n3000B	Read/Write	Drive: every	REAL64	%	[-1.0 ... 1.0]	Minimum output limit (output limitation) (default setting: -1.0 = -100%)	
0x00n3000C	Read/Write	Drive: every	REAL64	%	[-1.0 ... 1.0]	Maximum output limit (output limitation) (default setting: 1.0 = 100%)	
0x00n3000D	Read	Drive: every	UINT32	INC		Maximum number of output increments (output mask)	
0x00n30010	Read/Write	Drive: every	UINT32	1		Internal Drive Control double word to determine the drive operation modes	Reserved!
0x00n30011	Read/Write	every	UINT32	1	≥ 5	Internal drive reset counter (time in NC cycles for enable and reset)	Reserved!
0x00n30101	Read/Write	D: Servo	REAL64	e.g. mm/s	>0.0	Reference velocity at reference output (velocity pre-control)	
0x00n30102	Read/Write	D: Servo	REAL64	%	[0.0 ... 5.0]	Reference output in percent (default setting: 1.0 = 100%)	
0x00n30103	Read	D: Servo	REAL64	e.g. mm/s	>0.0	Resulting velocity at 100% output	
0x00n30104	Read/Write	D: Servo	REAL64	e.g. mm/s	±∞	Velocity offset (DAC offset) for drift calibration (offset calibration) of the axis	
0x00n30105	Read/Write	D: Servo (Sercos, Profi Drive, AX200x, CANopen)	REAL64	1	[0.0 ... 100000000.0]	Velocity scaling (scaling factor to respond to the weight in the drive)	For Sercos, Profi Drive, AX200x, CANopen
0x00n30106	Read/Write	D: Profi Drive DSC	UINT32	0.001 * 1/s	≥ 0	Profibus/Profi Drive DSC: Position control gain Kpc	Only for Profi Drive DSC
0x00n30107	Read/Write	D: Profi Drive DSC	REAL64	1	≥ 0.0	Profibus/Profi Drive DSC: Scaling for calculation of 'XERR' (default: 1.0)	Only for Profi Drive DSC
0x00n30109	Read/Write	D: Servo (Sercos, CANopen)	REAL64	1	[0.0 ... 100000000.0]	Position scaling (scaling factor to respond to the weight in the drive)	For Sercos, CANopen
0x00n3010A	Read/Write	D: Servo (Sercos, Profi Drive, AX200x, CANopen)	REAL64	1	[0.0 ... 100000000.0]	Acceleration scaling (scaling factor to respond to the weight in the drive)	For Sercos, Profi Drive, AX200x, CANopen
0x00n3010B	Read/Write	D: Servo (Sercos, Profi Drive, AX200x, CANopen)	REAL64	1	[0.0 ... 100000000.0]	Torque scaling (rotary motor) or force scaling (linear motor) (scaling factor for reacting to weighting in the drive) for "TorqueOffset" (additive moment as pre-control)	For Sercos, Profi Drive, AX200x, CANopen

Index offset (Hex)	Access	Axis type	Data type	Phys. unit	Definition range	Description	Note
0x00n3010C	Read/Write	D: Servo (Sercos, Profi Drive, AX200x, CANopen)	REAL64	1	[0.0 ... 100000000.0]	Torque scaling (rotary motor) or force scaling (linear motor) (scaling factor for reacting to weighting in the drive) for "SetTorque" (e.g. MC_TorqueControl) with Drive OpMode CST)	For Sercos, Profi Drive, AX200x, CANopen From TC3.1 B4024.2
0x00n30120	Read/Write	D: servo/ hydraulics/	UINT32	1	≥ 0	Table ID (0: no table)	Only for KL4xxx, M2400, Universal
0x00n30121	Read/Write	D: servo/ hydraulics	UINT32	1	≥ 0	Interpolation type 0: linear 2: spline	Only for KL4xxx, M2400, Universal
0x00n30122	Read/Write	Servo/ hydraulics	REAL64	%	[-1.0 ... 1.0]	Output offset in percent Note: Acts according to the characteristic evaluation!	Only for KL4xxx, M2400, Universal
0x00n30151	Read/Write	D: servo / non-linear	REAL64	1	[0.0 ... 100.0]	Quadrant compensation factor (relationship between quadrant I and III)	
0x00n30152	Read/Write	D: servo / non-linear	REAL64	1	[0.01 ... 1.0]	Velocity reference point in percent (1.0 = 100 %)	
0x00n30153	Read/Write	D: servo / non-linear	REAL64	1	[0.01 ... 1.0]	Output reference point in percent (1.0 = 100 %)	
0x00030301	Read/Write	D: Stepper motor	UINT8	1		Bit mask: Cycle 1	
0x00030302	Read/Write	D: Stepper motor	UINT8	1		Bit mask: Cycle 2	
0x00030303	Read/Write	D: Stepper motor	UINT8	1		Bit mask: Cycle 3	
0x00030304	Read/Write	D: Stepper motor	UINT8	1		Bit mask: Cycle 4	
0x00030305	Read/Write	D: Stepper motor	UINT8	1		Bit mask: Cycle 5	
0x00030306	Read/Write	D: Stepper motor	UINT8	1		Bit mask: Cycle 6	
0x00030307	Read/Write	D: Stepper motor	UINT8	1		Bit mask: Cycle 7	
0x00030308	Read/Write	D: Stepper motor	UINT8	1		Bit mask: Cycle 8	
0x00030310	Read/Write	D: Stepper motor	UINT8	1		Bit mask: Holding current	

6.4.4.2 "Index offset" specification for axis state (Index group 0x4100 + ID)

Index offset (Hex)	Access	Axis type	Data type	Phys. unit	Definition range	Description	Note
0x00n00000	Read	every (online structure for axis data)	{			AXIS ONLINE STRUCTURE (NC/CNC)	Changed from TC3, not oscilloscopeable! (NCAXISSTATE_ONLINESTRUCT)
			INT32	1		Error state	
			INT32			Reserved	
			REAL64	e.g. mm		Actual position	
			REAL64	e.g. degrees		Modulo actual position	
			REAL64	e.g. mm		Set position	
			REAL64	e.g. degrees		Modulo set position	
			REAL64	e.g. mm/s		Optional: Actual velocity	
			REAL64	e.g. mm/s		Set velocity	
			UINT32	%	0...1000000	Velocity override (1000000 == 100%)	
			UINT32			Reserved	
			REAL64	e.g. mm		Lag error position	
			REAL64	e.g. mm		PeakHold value for max. neg. position lag (pos.)	
			REAL64	e.g. mm		Peak hold value for max. pos. position lag (pos.)	
			REAL64	%		Controller output in percent	
			REAL64	%		Total output in percent	
			UINT32	1	≥ 0	Axis state double word	
			UINT32	1	≥ 0	Axis control double word	
			UINT32	1	≥ 0	Slave coupling state (state)	
			UINT32	1	0; 1,2,3...	Axis control loop index	
			REAL64	e.g. mm/s^2		Actual acceleration	
			REAL64	e.g. mm/s^2		Set acceleration	
			REAL64	e.g. mm/s^3		Set jerk (new from TC3.1 B4013)	
			REAL64	e.g. 100% = 1000		Set torque or set force ("SetTorque")	
			REAL64	e.g. 100% = 1000		Actual torque or actual force (new from TC3.1 B4013)	
			REAL64	e.g. %/s		Set torque change or set force change (time derivative of the set torque or set force) (from TC3.1 B4024.2)	
			REAL64	e.g. 100% = 1000		Additive set torque or additive set force ("TorqueOffset") (from TC3.1 B4024.2)	
			. . .				
			}			256 bytes	
0x00000001	Read	every	UINT32	1		Axis state error code	*Symbolic access: "ErrState"*
0x00n00009	Read	every	UINT32	1	≥ 0	Set cycle counter (SAF timestamp)	

Index offset (Hex)	Access	Axis type	Data type	Phys. unit	Definition range	Description	Note
0x00n0000A	Read	every	REAL64	e.g. mm		Set position	*Symbolic access: "SetPos"*
0x00n0000B	Read	every	REAL64	e.g. DEGREES		Modulo set position	*Symbolic access: "SetPosModulo"*
0x00n0000C	Read	every	INT32	1		Modulo set rotation	
0x00n0000D	Read	every	REAL64	1	[-1.0, 0.0, 1.0]	Set travel direction	
0x00n0000E	Read	every	REAL64	e.g. mm/s		Set velocity	*Symbolic access: "SetVelo"*
0x00n0000F	Read	every	REAL64	e.g. mm/s^2		Set acceleration	Symbolic access: *"SetAcc"*
0x00n00010	Read	every	REAL64	e.g. mm/s^3		Set jerk (time derivative of the set acceleration)	Symbolic access: *"SetJerk"*
0x00n00011	Read	every	REAL64	e.g. Nm or N respectively, e.g. 100% = 1000		Set torque (rot. motor) or set force (linear motor) ("SetTorque")	NEW from TC3.1 B4022 *Symbolic access: "SetTorque"*
0x00n00012	Read	every	REAL64	1		Set coupling factor (set gear ratio)	
0x00n00013	Read	every	REAL64	e.g. mm		Expected target position	
0x00n00014	Read	Servo	{			Remaining travel time and distance (SERVO):	Always to SEC Port 501!
			REAL64	s	≥ 0	Remaining travel time	
			REAL64	e.g. mm	≥ 0	Remaining distance	
			}				
0x00n00015	Read	every	UINT32	1	≥ 0	Set command number	*Symbolic access: "CmdNo"*
0x00n00016	Read	Servo	REAL64	s	≥ 0	Positioning time of the last motion command (start → target position window)	
0x00n00017	Read	Servo	REAL64	%	[0.0…1.0] 1.0=100%	Set override value for velocity Note: initially only implemented for FIFO group	NEW from TC3.1 B4020
0x00000018	ReadWrite	Servo	**Write**			Reading the "Stop information" (stop distance, stop time)	Always to SEC Port 501!
			REAL64	e.g. mm/s^2	≥ 0	Deceleration for axis stop	
			REAL64	e.g. mm/s^3	≥ 0	Jerk for axis stop	
			Read				
			REAL64	e.g. mm	≥ 0	Stop distance	
			REAL64	s	≥ 0	Stop time	
0x00n0001A	Read	every	REAL64	e.g. mm		Uncorrected set position	
0x00n0001D	Read	every	REAL64	1	[-1.0, 0.0, 1.0]	Uncorrected set travel direction	
0x00n0001E	Read	every	REAL64	e.g. mm/s		Uncorrected set velocity	
0x00n0001F	Read	every	REAL64	e.g. mm/s^2		Uncorrected set acceleration	

Index offset (Hex)	Access	Axis type	Data type	Phys. unit	Definition range	Description	Note
0x00000020	Read	every	UINT32	1	s. ENUM	Coupling state (state)	
0x00000021	Read	every	UINT32	1	≥ 0	Coupling table index	
0x00000022	Read	Servo master/ slave coupling Type: LINEAR, (&SPECIAL)	{			Reading the coupling parameters (SERVO):	
			REAL64	1	[±1000000.0]	Parameter 1: Linear: Gear ratio	
			REAL64	1	[±1000000.0]	Parameter 2: Linear: Reserve	
			REAL64	1	[±1000000.0]	Parameter 3: Linear: Reserve	
			REAL64	1	[±1000000.0]	Parameter 4: Linear: Reserve	
			}				
0x00000023	Read	Servo master/ slave coupling Type: LINEAR, (&SPECIAL)	REAL64	1	[±1000000.0]	Reading the gear ratio (SERVO) Type: LINEAR	
0x00000024	Read	Servo	UINT32	1	≥ 0	Number / index of the active axis control circuit (triple of encoder, controller and axis interface)	
0x00000025	Read	Servo	UINT16	1	0/1	External setpoint specification via axis interface PCLtoNC active?	
0x00000026	Read	Servo master/ slave coupling Type: SYNCHRONIZING	REAL64 [64]	1	±∞	Reading of the characteristic values of the slave synchronization profile Type: SYNCHRONIZING	Modified from TC3
0x00000027	ReadWrite	Servo master/ slave coupling Type: TABULAR, MF	**Write**			Reading the "table coupling information"	Only port 500! Modified from TC3
			VOID or REAL64 or DWORD, DWORD, REAL64	e.g. mm	±∞	- No data for the "current information" - optional for a certain "master axis position" - for a certain table ID and optional “master axis position” (TC 3.1 B4017)	
			Read				
			REAL64 [32]		±∞	Reading the structure for the table coupling information [▶ 163]	
0x00000028	ReadWrite	Servo master/ slave coupling Type: MULTICAM (CamAddition)	**Write**			Reading the "multi-table coupling information" (CamAddition)	Only port 500!
			UINT32	1	≥ 0	Table ID to which the query relates	
			Read				
			96 bytes			Reading the structure for the multi-table coupling information [▶ 163]	
0x00000029	Read	Servo	UINT32	1		Delayed error code (error pre-warning) in case of a delayed error reaction (see bit *ErrorPropagationDelayed*)	

Index offset (Hex)	Access	Axis type	Data type	Phys. unit	Definition range	Description	Note
0x0000002A	Read	Servo	REAL64	e.g. mm	±∞	Position difference while fading from set position to actual position (fading part)	
0x0000002B	Read	Servo	REAL64	e.g. mm/s	±∞	Relative velocity while fading from set position to actual position (fading part)	
0x0000002C	Read	Servo	REAL64	e.g. mm/s ^2	±∞	Relative acceleration while fading from set position to actual position (fading part)	
0x0000002D	Read	Servo	UINT32	1	≥ 0	Counter for initialization command (InitializeCommandCounter)	NEW
0x0000002E	Read	Servo	UINT32	1	≥ 0	Counter for reset command (ResetCommandCounter)	NEW
0x00000030	Read	Servo	REAL64	e.g. Nm/s or N/s	±∞	Set torque change (rot. motor) or set force change (linear motor) (time derivative of the set torque or set force)	NEW from TC3.1 B4024
0x00000031	Read/Write	Servo	REAL64	e.g. Nm or N respectively, e.g. 100% = 1000		Additive set torque (rot. motor) or additive set force (linear motor) for pre-control. ("TorqueOffset")	From TC3.1 B4024.2 *Symbolic access: "TorqueOffset"*
0x00000040	Read	Servo	UINT32	1	≥ 0	Counter for correction of the NC setpoints in case of data inconsistency (activation with Idx-Group 0x1000 and Idx-Offset 0x0020)	NEW from TC3.1 B4020
0x00000050	Read	every	UINT32	1		Set travel phase (SWGenerator)	Cannot be traced by oscilloscope!
0x00000051	Read	every	UINT16	1		Is the axis disabled?	Cannot be traced by oscilloscope!
0x00n00060	Read/Write	every (online setpoint structure) 40 bytes	{			Simple AXIS SETPOINT STRUCTURE (NC/CNC)	Cannot be traced by oscilloscope! from TC 3.1 B4022.30
			REAL64	e.g. mm		Set position	
			REAL64	e.g. mm/s		Set velocity	
			REAL64	e.g. mm/s^2		Set acceleration / deceleration	
			REAL64	1	[-1.0, 0.0, 1.0]	Set travel direction	
			REAL64	e.g. mm/s^3		Set jerk	
			}				

Index offset (Hex)	Access	Axis type	Data type	Phys. unit	Definition range	Description	Note
0x00n00060	Read/Write	every (online setpoint structure) 56 bytes	{			Extended AXIS SETPOINT STRUCTURE (NC/CNC)	Cannot be traced by oscilloscope! from TC 3.1 B4022.29
			REAL64	e.g. mm		Set position	
			REAL64	e.g. mm/s		Set velocity	
			REAL64	e.g. mm/s^2		Set acceleration / deceleration	
			REAL64	1	[-1.0, 0.0, 1.0]	Set travel direction	
			REAL64	e.g. mm/s^3		Set jerk	
			REAL64	Nm or N or %		Set torque or set force	
			REAL64	Nm/s or N/s or %/s		time derivative of the set torque or set force (ramp)	
			}				
0x00n00061	Read/Write	every (online dynamics setpoint structure) 32 bytes	{			AXIS DYNAMIC SETPOINT STRUCTURE (NC/CNC)	from TC 3.1 B4022.30
			REAL64	e.g. mm/s		Set velocity	
			REAL64	e.g. mm/s^2		Set acceleration / deceleration	
			REAL64	1	[-1.0, 0.0, 1.0]	Set travel direction	
			REAL64	e.g. mm/s^3		Set jerk	
			}				
0x00n00061	Read/Write	every (online dynamics setpoint structure) 48 bytes	{			AXIS DYNAMIC SETPOINT STRUCTURE (NC/CNC)	from TC 3.1 B4022.29
			REAL64	e.g. mm/s		Set velocity	
			REAL64	e.g. mm/s^2		Set acceleration / deceleration	
			REAL64	1	[-1.0, 0.0, 1.0]	Set travel direction	
			REAL64	e.g. mm/s^3		Set jerk	
			REAL64	Nm or N or %		Set torque or set force	
			REAL64	Nm/s or N/s or %/s		time derivative of the set torque or set force (ramp)	
			}				
0x00n00062	Read/Write	every (online TORQUE setpoint structure) 16 bytes	{			TORQUE SETPOINT STRUCTURE (NC/CNC)	from TC 3.1 B4022.30
			REAL64	Nm or N or %		Set torque or set force	
			REAL64	Nm/s or N/s or %/s		time derivative of the set torque or set force (ramp)	
			}				

Index offset (Hex)	Access	Axis type	Data type	Phys. unit	Definition range	Description	Note
0x00000063	ReadWrite	only for SERCOS/SoE and CANopen/ CoE	**Write**			Read active "Drive Operation Mode"	NEW from TC 3.1 B4022 (NC 4443) Always to SEC Port 501!
			UINT32	1		Reserve	
			UINT32	1		Reserve	
			Read				
			INT32	ENUM [▶ 161] (see appendix)	[0; 1, 2, 3, …] Special cases: ≥ 100: SoE <0: CoE	Currently active "Drive Operation Mode" (generic modes)	
			UINT32	1		Reserve	
0x00n10002	Read	every (Encoder)	REAL64	e.g. mm		Actual position (charge with actual position compensation value) n = 0: standard encoder of the axes > 0: nth encoder of the axis (optional)	*Symbolic access: "ActPos"*
0x00n10003	Read	every (Encoder)	REAL64	e.g. DEGREES		Modulo actual position	*Symbolic access: "ActPosModulo"*
0x00n10004	Read	every (Encoder)	INT32	1		Modulo actual rotation	
0x00n10005	Read	every (Encoder)	REAL64	e.g. mm/s		Optional: Actual velocity	*Symbolic access: "ActVelo"*
0x00n10006	Read	every (Encoder)	REAL64	e.g. mm/s^2		Optional: Actual acceleration	*Symbolic access: "ActAcc"*
0x00n10007	Read	every (Encoder)	INT32	INC		Encoder actual increments	
0x00n10008	Read	every (Encoder)	INT64	INC		Software - actual increment counter	
0x00n10009	Read	every (Encoder)	UINT16	1	0/1	Reference flag ("calibrate flag")	
0x00n1000A	Read	every (Encoder)	REAL64	e.g. mm		Actual position correction value (measurement system error correction)	
0x00n1000B	Read	every (Encoder)	REAL64	e.g. mm		Actual position without actual position compensation value	Cannot be traced by oscilloscope!
0x00n10010	Read	every (Encoder)	REAL64	e.g. mm/s		Actual velocity without actual position compensation value	
0x00n10012	Read	every (Encoder)	REAL64	e.g. mm		Unfiltered actual position (charge with actual position compensation value)	
0x00n10014	Read	Encoder: SoE, CoE, MDP 742	REAL64	e.g. mm/s		Optional: actual drive velocity (transferred directly from SoE, CoE or MDP 742 drive)	NEW from TC3.1 B4020.30
0x00n10015	Read	every (Encoder)	REAL64	e.g. mm/s		Optional: Unfiltered actual velocity	
0x00n10017	Read		REAL64	e.g. mm		Reading out the MC_SetPosition offset	

Index offset (Hex)	Access	Axis type	Data type	Phys. unit	Definition range	Description	Note
0x00n10101	Read	INC (Encoder)	REAL64	e.g. mm		Read back of the position difference between activation of the internal hardware latch and the time when it becomes valid	Cannot be traced by oscilloscope!
0x00n20001	Read	R: every	INT32	1		Error state of the controller n = 0: standard controller of the axes > 0: nth controller of the axis (optional)	
0x00n20002	Read	R: every	REAL64	e.g. mm/s		Controller output in absolute units	*Symbolic access: "CtrlOutput"*
0x00n20003	Read	R: every	REAL64	%		Controller output in percent	Cannot be traced by oscilloscope!
0x00n20004	Read	R: every	REAL64	V		Controller output in volts	Cannot be traced by oscilloscope!
0x00n2000D	Read	R: every	REAL64	e.g. mm		Lag error position (without dead time compensation)	Base Unit
0x00n2000F	Read	R: every	REAL64	e.g. mm		Lag error position (with dead time compensation)	*Symbolic access: "PosDiff"*
0x00n20010	Read	R: every	REAL64	e.g. mm		Peak hold value for maximum negative lag error of the position	
0x00n20011	Read	R: every	REAL64	e.g. mm		Peak hold value for minimum positive lag error of the position	
0x00n20012	Read	R: every	REAL64	e.g. mm/s		Lag error velocity	Not implemented!
0x00n20021	Read	R: every	REAL64	e.g. mm		Difference (deviation) between the lag error position of the master axis and that of the slave axis (master lag error minus slave lag error)	*Symbolic access: "PosDiffCouple"*
0x00n20022	Read	R: every	REAL64	e.g. mm		PeakHold value for the maximum negative difference between master and slave axis lag error of the position	Base Unit
0x00n20023	Read	R: every	REAL64	e.g. mm		PeakHold value for the maximum positive difference between master and slave axis lag error of the position	Base Unit
0x00n20101	Read	R: P/PID (Pos.)	REAL64	e.g. mm/s		P part of the controller in absolute units	
0x00n20102	Read	R: PID (Pos.)	REAL64	e.g. mm/s		I part of the controller in absolute units	
0x00n20103	Read	R: PID (Pos.)	REAL64	e.g. mm/s		D part of the controller in absolute units	
0x00n20104	Read	R: PID (Pos.)	UINT16	1	0/1	Limitation of the I part active?	
0x00n20105	Read	R: PID (Pos.)	UINT16	1	0/1	Limitation of the D part active?	

Index offset (Hex)	Access	Axis type	Data type	Phys. unit	Definition range	Description	Note
0x00n20106	Read	R: PID (Pos.)	UINT16	1	0/1	ARW measures of the I-part active? ARW: Anti Reset Windup	Not implemented!
0x00n20110	Read	R: PID (Pos.)	REAL64	e.g. mm/s		Acceleration pre-control Yacc of the controller in absolute units Note: function depends on controller type!	Acceleration pre-control
0x00n20111	Read	R: PP (Pos.)	REAL64	mm/s/mm	≥0	Internal interpolated proportional gain kp or kv	PP controller
0x00n20201	Read	R: P,PID (velocity)	REAL64	e.g. mm/s		Velocity part of the controller	
0x00n20202	Read	R: P,PID (velocity)	REAL64	%		Velocity part of the controller in percent	Cannot be traced by oscilloscope!
0x00n20203	Read	R: P,PID (velocity)	REAL64	V		Velocity part of the controller in volts	Cannot be traced by oscilloscope!
0x00n20201	Read	R: P/PID (velocity)	REAL64	e.g. mm/s		P part of the controller in absolute units	
0x00n20202	Read	R: P/ PID (veloc.)	REAL64	e.g. mm/s		I part of the controller in absolute units	
0x00n20203	Read	R: P/ PID (veloc.)	REAL64	e.g. mm/s		D part of the controller in absolute units	
0x00n20204	Read	R: P/ PID (veloc.)	UINT16	1	0/1	Limitation of the I part active?	
0x00n20205	Read	R: P/ PID (veloc.)	UINT16	1	0/1	Limitation of the D part active?	
0x00n20206	Read	R: P/ PID (veloc.)	UINT16	1	0/1	ARW measures for the I part active? (ARW: Anti Reset Windup)	
0x00n2020A	Read	R: P/ PID (veloc.)	REAL64	e.g. mm/s		Total input size of the velocity controller	
0x00n20A00	Read	R: PID (MW)	REAL64	%	[-1.0...1.0]	Offsetting of the set velocity (pre-control)	Reserved parameters!
0x00n20A01	Read	R: PID (MW)	REAL64	e.g. mm/s		P part of the controller in absolute units or percent (according to output weight)	Reserved parameters!
0x00n20A02	Read	R: PID (MW)	REAL64	e.g. mm/s		I part of the controller in absolute units or percent (according to output weight)	Reserved parameters!
0x00n20A03	Read	R: PID (MW)	REAL64	e.g. mm/s		D part of the controller in absolute units or percent (according to output weight)	Reserved parameters!
0x00n20A04	Read	R: PID (MW)	UINT16	1	0/1	Limitation of the I part active?	Reserved parameters!
0x00n20A05	Read	R: PID (MW)	UINT16	1	0/1	Limitation of the D part active?	Reserved parameters!
0x00n20A06	Read	R: PID (MW)	UINT16	1	0/1	ARW measures for the I part active? ARW: Anti Reset Windup	Reserved parameters!
0x00n20A10	Read	R: PID (MW)	REAL64	e.g. mm/s		Acceleration pre-control Yacc of the controller in absolute units	Reserved parameters!

Index offset (Hex)	Access	Axis type	Data type	Phys. unit	Definition range	Description	Note
0x00n30001	Read	D: every	INT32	1		Error state of the drive	
0x00n30002	Read	D: every	REAL64	e.g. mm/s		Total output in absolute units	*Symbolic access: "DriveOutput""*
0x00n30003	Read	D: every	REAL64	%		Total output in percent	
0x00n30004	Read	D: every	REAL64	V		Total output in volts	Cannot be traced by oscilloscope!
0x00n30005	Read	D: every	REAL64	e.g. mm/s		PeakHold value for maximum negative total output	
0x00n30006	Read	D: every	REAL64	e.g. mm/s		PeakHold value for maximum positive total output	
0x00n30007	Read	D: every	REAL64	e.g. 100% = 1000, e.g. Nm or N		Actual torque or actual force respectively (typically 100% = 1000)	from TC3.1 B4022 *Symbolic access: "ActTorque"*
0x00n30008	Read	D: every	REAL64	e.g. Nm/s or N/s	±∞	Actual torque change or actual force change respectively (time derivative of the actual torque or actual force respectively)	from TC3.1 B4024
0x00n30013	Read	D: every	REAL64	%		Total output in percent (based on non-linear characteristic curve!)	
0x00n30014	Read	D: every	REAL64	V		Total output in volt (based on non-linear characteristic curve!)	Cannot be traced by oscilloscope!
0x00n3011A	Read	D: Servo (Sercos, CANopen)	REAL64	e.g. mm		Optional output filtering: Filtered set position	NEW For Sercos, CANopen
0x00n3011E	Read	D: Servo (Sercos, CANopen)	REAL64	e.g. mm/s		Optional output filtering: Filtered set velocity	NEW For Sercos, CANopen
0x00n3011F	Read	D: Servo (Sercos, CANopen)	REAL64	e.g. mm/s^2		Optional output filtering: Filtered set acceleration / set deceleration	NEW For Sercos, CANopen

6.4.4.3 "Index offset" specification for axis functions (Index group 0x4200 + ID)

Index offset (Hex)	Access	Axis type	Data type	Phys. unit	Definition range	Description	Note
0x00000001	Write	every	VOID			Reset axis	For FIFO axes too!
0x00000002	Write	every	VOID			Stop axis	For FIFO axes too!
0x00000003	Write	every	VOID			Clear axis (task)	For FIFO axes too!
0x00000004	Write	every	{			Emergency stop (with controlled ramp)	Only for PTP axes!
			REAL64	e.g. mm/ s^2	> 0.0	Deceleration (must be greater than or equal to the original deceleration)	
			REAL64	e.g. mm/ s^3	> 0.0	Jerk (must greater than or equal to the original jerk)	
			}				
0x00000005	Write	PTP axis	{			Parameterizable stop (with controlled ramp)	Only for PTP axes! Reserved function, no standard!
			REAL64	e.g. mm/ s^2	> 0.0	Deceleration	
			REAL64	e.g. mm/ s^3	> 0.0	Jerk	
			}				
0x00000009	Write	PTP axis	{			Oriented stop (oriented end position)	Only for PTP axes!
			REAL64	e.g. degrees	≥ 0.0	Modulo end position (modulo target position)	
			REAL64	e.g. mm/ s^2	> 0.0	Deceleration (currently not active)	
			REAL64	e.g. mm/ s^3	> 0.0	Jerk (not yet implemented)	
			}				
0x00000010	Write	every	VOID			Reference axis ("calibration")	
0x00000011	Write	every	{			New end position axis	Modified from TC3
			UINT32	ENUM	s. appendix	End position type [▶ 153] (see appendix)	
			UINT32			Reserve (TC3)	
			REAL64	e.g. mm	±∞	New end position (target position)	
			}				
0x00000012	Write	every	{			New end position and new velocity axis	
			UINT32	ENUM	s. appendix	Command type [▶ 153] (s. appendix)	
			UINT32	ENUM	s. appendix	End position type [▶ 153] (see appendix)	
			REAL64	e.g. mm	±∞	New end position (target position)	
			REAL64	e.g. mm/s	≥ 0.0	New final velocity (requested travel velocity)	
			REAL64	e.g. mm	±∞	Optional: Switchover position from which the new travel profile is activated	
			}				

Index offset (Hex)	Access	Axis type	Data type	Phys. unit	Definition range	Description	Note
0x00000015	Write	every	{			New dynamic parameters for active positioning	
			REAL64	e.g. mm/ s^2	> 0.0	Acceleration	
			REAL64	e.g. mm/ s^2	> 0.0	Deceleration	
			REAL64	e.g. mm/ s^3	> 0.0	Optional: Jerk (not yet implemented)	
			}				
0x00000016	**ReadWrite**	every SERVO	**Write**(80 bytes)			Universal Axis Start (UAS): Merge of single commands, such as axis start, and online changes in combination with "Buffer Mode" (see TcMc2.lib)	Always to SEC Port 501! Modified from TC3
			{				
			UINT32	ENUM	s. appendix	Start type [▶ 152] (s. appendix)	
			UINT32	1	≥ 0	Bit mask for checks and operation modes (Default value: 0)	
			REAL64	e.g. mm	±∞	End position (target position)	
			REAL64	e.g. mm/s	≥ 0.0	Required velocity *Vrequ*	
			REAL64	e.g. mm/ s^2	≥ 0.0	Optional: Acceleration	
			REAL64	e.g. mm/ s^2	≥ 0.0	Optional: Deceleration	
			REAL64	e.g. mm/ s^3	≥ 0.0	Optional: Jerk	
			UINT32	ENUM	s. appendix	Buffer mode [▶ 152] (command buffer)	
			UINT32			Reserve (TC3)	
			REAL64	e.g. mm	±∞	Optional: Blending position (command blending position)	
			REAL64	e.g. mm/s	≥ 0.0	Optional: Initial segment velocity *Vi* *(0 ≤ Vi ≤ Vrequ)*	
			REAL64	e.g. mm/s	≥ 0.0	Optional: Segment end velocity *Vf* *(0 ≤ Vf ≤ Vrequ)*	
			}				
			Read				
			{				
			UINT16	1	≥ 0	Command number (job number)	
			UINT16	1	≥ 0	Command status	
			}				

Index offset (Hex)	Access	Axis type	Data type	Phys. unit	Definition range	Description	Note
0x00000017	**ReadWrite**	SERVO	**Write**(80 bytes)			"Master/slave decoupling" and "Universal axis start (UAS)": Merge of decoupling command of a slave axis (IdxOffset: 0x00000041) and the subsequent universal axis start (UAS) (IdxOffset: 0x00000016)	Not yet released!
			{				
			UINT32	ENUM	s. appendix	Start type [▶ 152] (s. appendix)	
			UINT32	1	≥ 0	Bit mask for checks and operation modes (Default value: 0)	
			REAL64	e.g. mm	±∞	End position (target position)	
			REAL64	e.g. mm/s	≥ 0.0	Required velocity *Vrequ*	
			REAL64	e.g. mm/s^2	≥ 0.0	Acceleration	
			REAL64	e.g. mm/s^2	≥ 0.0	Deceleration	
			REAL64	e.g. mm/s^3	≥ 0.0	Jerk	
			UINT32	ENUM	s. appendix	Buffer mode [▶ 152] (command buffer)	
			UINT32			Reserve (TC3)	
			REAL64	e.g. mm	±∞	Optional: Blending position (command blending position)	
			REAL64	e.g. mm/s	≥ 0.0	Optional: Initial segment velocity *Vi* *(0 ≤ Vi ≤ Vrequ)*	
			REAL64	e.g. mm/s	≥ 0.0	Optional: Segment end velocity *Vf* *(0 ≤ Vf ≤ Vrequ)*	
			}				
			Read				
			{				
			UINT16	1	≥ 0	Command number (job number)	
			UINT16	1	≥ 0	Command status	
			}				
0x00000018	Write	every	VOID			Release axis lock for motion commands (TcMc2)	
0x00000019	Write	every	UINT32	1	> 0	Set external axis error (runtime error)	**Caution when using!**
0x00n0001A	Write	every	{			Set actual axis position	**Caution when using!** For FIFO axes too! Always to SEC Port 501! Modified from TC3
			UINT32	ENUM	s. appendix	Actual position type [▶ 153] (see appendix)	
			UINT32			Reserve (TC3)	
			REAL64	e.g. mm	±∞	Actual position for axes n = 0: standard encoder of the axis n > 0: n-th encoder for the axis (optional)	
			}				

Index offset (Hex)	Access	Axis type	Data type	Phys. unit	Definition range	Description	Note
0x00n0001B	Write	every	UINT32	1	0/1	Set reference flag ("calibrate flag") n = 0: Standard encoder for the axis n > 0: n-th encoder for the axis (optional)	**Caution when using!** For FIFO axes too!
0x00n0001C	Write	SERVO	{			Set only actual axis position without manipulating the set position (also for slave and with active process)	**Caution when using!**
			UINT32	ENUM	s. appendix	Actual position type [▶ 153] (see appendix)	
			REAL64	e.g. mm	±∞	Actual position for axes n = 0: standard encoder of the axes > 0: nth encoder of the axis (optional) **Caution when using!**	
			}				
0x00n0001D	Write	every	{			Actual value setting of the axis on the drive side (position interface and encoder offset of zero assumed!) n = 0: Standard encoder for the axis n > 0: n-th encoder for the axis (optional)	**Caution when using!** Only for CANopen!
			UINT32	ENUM	s. appendix	Actual position type [▶ 153] (see appendix)	
			REAL64	e.g. mm	±∞	Actual position for axis	
			}				
0x00n0001E	Write	every	{			Set a new encoder scaling factor on the fly (in motion of the axis)	**Caution when using!** Always to SEC Port 501! Modified from TC3
			UINT16	ENUM	1	Encoder scaling factor type 1: Absolute 2: Relative	
			UINT16			ControlWord	
			UINT32			Reserve (TC3)	
			REAL64	e.g. mm/ INC	[1.0E-8 ... 100.0]	New encoder scaling factor n = 0: Standard encoder for the axis n > 0: n-th encoder for the axis (optional)	
			}				

Index offset (Hex)	Access	Axis type	Data type	Phys. unit	Definition range	Description	Note
0x00n0001F	Write	every	{			Set actual axis position on the fly (in motion of the axis)	**Caution when using!** Always to SEC Port 501!
			UINT32	ENUM		Position type for setting actual value on the fly 1: Absolute 2: Relative	
			UINT32	1		Control double word, e.g. for "clearing the lag error"	
			REAL64			Reserve	
			REAL64	e.g. mm	±∞	New actual axis position	
			UINT32			Reserve	
			UINT32			Reserve	
			}				
0x00000020	Write	every 1D start	{			Standard axis start:	Modified from TC3
			UINT32	ENUM	s. appendix	Start type [▶ 152] (s. appendix)	
			UINT32			Reserve (TC3)	
			REAL64	e.g. mm	±∞	End position (target position)	
			REAL64	e.g. mm/s	≥0.0	Required velocity	
			}				
0x00000021	Write	every 1D start	{			Extended axis start (SERVO):	Modified from TC3
			UINT32	ENUM	s. appendix	Start type [▶ 152] (s. appendix)	
			UINT32			Reserve (TC3)	
			REAL64	e.g. mm	±∞	End position (target position)	
			REAL64	e.g. mm/s	≥ 0.0	Required velocity	
			UINT32	0/1	0/1	Standard acceleration?	
			UINT32			Reserve (TC3)	
			REAL64	e.g. mm/ s^2	≥ 0.0	Acceleration	
			UINT32	0/1	0/1	Standard deceleration?	
			UINT32			Reserve (TC3)	
			REAL64	e.g. mm/ s^2	≥ 0.0	Deceleration	
			UINT32	0/1	0/1	Standard jerk?	
			UINT32			Reserve (TC3)	
			REAL64	e.g. mm/ s^3	≥ 0.0	Jerk	
			}				

Index offset (Hex)	Access	Axis type	Data type	Phys. unit	Definition range	Description	Note
0x00000022	Write	SERVO(MW)	{			Special axis start (SERVO):	Reserved start function, no standard! Modified from TC3
			UINT32	ENUM	s. appendix	Start type [▶ 152] (s. appendix)	
			UINT32			Reserve (TC3)	
			REAL64	e.g. mm	±∞	End position (target position)	
			REAL64	mm/s	≥ 0.0	Required start velocity	
			REAL64	e.g. mm	±∞	Position for a new velocity level	
			REAL64	e.g. mm/s	≥ 0.0	New end velocity level	
			UINT32	0/1	0/1	Standard acceleration?	
			UINT32			Reserve (TC3)	
			REAL64	e.g. mm/s^2	≥ 0.0	Acceleration	
			UINT32	0/1	0/1	Standard deceleration?	
			UINT32			Reserve (TC3)	
			REAL64	e.g. mm/s^2	≥ 0.0	Deceleration	
			UINT32	0/1	0/1	Standard jerk?	
			UINT32			Reserve (TC3)	
			REAL64	e.g. mm/s^3	≥ 0.0	Jerk	
			}				
0x00000023	Write	SERVO	{			Start external setpoint specification (setting by cyclic axis interface PLCtoNC)	Modified from TC3
			UINT32	ENUM	1: Absolute 2: Relative	Start type [▶ 152]	
			UINT32			Reserve (TC3)	
			REAL64	e.g. mm	±∞	New end position (target position) optional!	
			REAL64			Reserve (TC3)	
			}				
0x00000024	Write	SERVO	VOID			Stop/disable external setpoint specification (cycl. axis interface PLCtoNC)	
0x00000025	Write	SERVO	{			Start reversing operation for positioning (SERVO):	Modified from TC3
			UINT32	ENUM	1	Start type [▶ 152] (default: 1)	
			UINT32			Reserve (TC3)	
			REAL64	e.g. mm	±∞	End position 1 (target position)	
			REAL64	e.g. mm	±∞	End position 2 (target position)	
			REAL64	0/1	0/1	Required velocity	
			REAL64	s	≥ 0.0	Idle time	
			}				
0x00000026	Write	every	{			Start drive output	Modified from TC3
			UINT32	ENUM	s. appendix	Output type [▶ 160] (s. appendix)	
			UINT32			Reserve (TC3)	
			REAL64	e.g. %	±∞	Required output value (e.g. %)	
			}				
0x00000027	Write	every	VOID			Stop drive output	

Index offset (Hex)	Access	Axis type	Data type	Phys. unit	Definition range	Description	Note
0x00000028	Write	every	{			Change the drive output:	
			UINT32	ENUM	s. appendix	Output type [▶ 160] (s. appendix)	
			REAL64	e.g. %	±∞	Required output value (e.g. %)	
			}				
0x00000029	Write	every	VOID			Instantaneously adopt current override value and freeze until next override change!	Reserved function, no standard!

0x0000002A	Write	every	{
			32 bytes
			}
						Calculate and set encoder offset	Reserved function, no standard!

0x0000002B	ReadWrite	every	WriteData: s. 'UAS' ReadData: s. 'UAS'			Stop external setpoint generator and continuous endless motion ('UAS': Universal axis start)	Reserved function, no standard!
0x0000002C	Write	every	UINT32		≥ 0	Set "homing state" (for internal use)	New from TC3

Index offset (Hex)	Access	Axis type	Data type	Phys. unit	Definition range	Description	Note
0x0000002D	ReadWrite	Servo	Write			Switches an NC-controlled axis to "Cyclic Synchronous Torque Mode" (CST) and sets a torque setpoint for it.	**Danger during use!** (* see end of table)
			{				
			UINT32			Torque-axis start type: 0x3001: Absolute 0x3002: Relative	
			UINT32	1 (bit array)		Internal control mask (bit array): 00000000_00000001 (bit 0): Use manual torque for initialization. 10000000_000000000 (bit 31): Update/ refresh parameter for current command in 'ContinuousUpdate' mode (fTorqueRamp, fVelocityLimitHigh, fVelocityLimitLow), do not increase cmd no.	
			UINT32	0/1	0/1	Mode: 0: Default (discrete) 1: ContinuousUpdate	
			UINT32	ENUM	see appendix	Buffer mode [▶ 152] only ABORTING possible	
			REAL64	Nm or %	[0.0 … 1.0E10]	Torque target value (signed value)	
			REAL64	Nm/s or %/s	[0.0 … 1.0E10]	Torque change velocity	
			REAL64	e.g. mm/s	[0.0 ... 1.0E10] 'VelocityLimitHigh' must be greater than or equal to 'VelocityLimitLow' (both values can be negative).	Velocity limit high	
			REAL64	e.g. mm/s	[0.0 … 1.0E10]	Velocity limit low	
			REAL64	e.g. mm/s^2	[0.0 … 1.0E10]	Acceleration	
			REAL64	e.g. mm/s^2	[0.0 … 1.0E10]	Deceleration	
			REAL64	Nm or %	[0.0 … 1.0E10]	Optional: Manual torque start value (sync value)	
			}				
			Read				
			{				
			UINT16	1	>=0	Command number (job number)	
			UINT16	1	>=0	Command status	
			}				
0x0000002E						Reserved	
0x0000002F						Reserved	

Index offset (Hex)	Access	Axis type	Data type	Phys. unit	Definition range	Description	Note
0x00000030	Write	SERVO	{			Start section compensation (SERVO)	Only affects older TwinCAT 2 systems
			UINT32	ENUM	s. appendix	Compensation type [▶ 153] (see appendix)	
			UINT32			Reserve (TC3)	
			REAL64	e.g. mm/ s^2	≥ 0.0	Max. acceleration increase	
			REAL64	e.g. mm/ s^2	≥ 0.0	Max. deceleration increase	
			REAL64	e.g. mm/s	> 0.0	Max. increase velocity	
			REAL64	e.g. mm/s	> 0.0	Base velocity for the process	
			REAL64	e.g. mm	±∞	Path difference to be compensated	
			REAL64	e.g. mm	> 0.0	Path distance for compensation	
			}				
0x00000030	ReadWrite	SERVO returns the actually implemented parameters as return values	{ **READ+WRITE:**			Start section compensation (SERVO) Note: only contained in 'TcMc2.lib' or 'Tc2_MC2.library'	Changed from TwinCAT 2 211R3 TwinCAT 3
			UINT32	ENUM	s. appendix	Compensation type [▶ 153] (see appendix)	
			UINT32			Reserve (TC3)	
			REAL64	e.g. mm/ s^2	≥ 0.0	=> Max. acceleration increase <= Returns the implemented acceleration increase (new in 'TcMc2.lib' or 'Tc2_MC2.library')	
			REAL64	e.g. mm/ s^2	≥ 0.0	=> Max. deceleration increase <= Returns the implemented deceleration increase (new in 'TcMc2.lib' or 'Tc2_MC2.library')	
			REAL64	e.g. mm/s	> 0.0	=> Requested max. increase velocity <= Returns the implemented increase velocity	
			REAL64	e.g. mm/s	> 0.0	Base velocity for the process	
			REAL64	e.g. mm	±∞	=> Requested path difference to be compensated <= Returns the implemented path difference	
			REAL64	e.g. mm	> 0.0	=> Requested max. distance for compensation <= Returns implemented distance	
			UINT32	1	≥ 0	<= Returns Warning ID (e.g. 0x4243)	
			UINT32			Reserve (TC3)	
			}				
0x00000031	Write	SERVO	VOID			Stop section compensation (SERVO)	

Index offset (Hex)	Access	Axis type	Data type	Phys. unit	Definition range	Description	Note
0x00000032	Write	SERVO	{			Start reversing operation with velocity jumps (SERVO): (can be used to determine the velocity step response)	Modified from TC3
			UINT32	ENUM	1	Start type [▶ 152] (default: 1)	
			UINT32			Reserve (TC3)	
			REAL64	e.g. mm/s	±∞	Required velocity 1 (negative values also permitted)	
			REAL64	e.g. mm/s	±∞	Required velocity 2 (negative values also permitted)	
			REAL64	s	> 0.0	Travel time for velocity 1 and 2	
			REAL64	s	≥ 0.0	Idle time	
			UINT32	1	0, 1,2,3...	Optional: Number of repetitions, Default "0": unlimited in time	
			UINT32			Reserve (TC3)	
			}				
0x00000033	Write	SERVO	{			Sine oscillation sequence - used as single sinus oscillation (sinus generator) - used as sinus oscillation sequence (e.g. for bode plot)	Modified from TC3
			UINT32	ENUM	1	Start type [▶ 152] (fixed to start type 1 yet)	
			UINT32			Reserve (TC3)	
			REAL64	e.g. mm/s	> 0.0	Base amplitude (e.g. 2.5 mm/s)	
			REAL64	Hz	[0.0 .... 10.0]	Base frequency (e.g. 1.953125 Hz)	
			REAL64	e.g. mm/s	≥ 0.0	Start amplitude at begin (e.g. 0.0 mm/s)	
			REAL64	e.g. mm/ REV	> 0.0	Feed constant motor (per motor turn) (e.g. 10.0 mm/REV)	
			REAL64	Hz	≥ 1.0	Frequency range: start frequency (e.g. 20.0 Hz)	
			REAL64	Hz	≤ 1/(2*dT)	Frequency range: stop frequency (e.g. 500.0 Hz)	
			REAL64	s	> 0.0	Step duration (e.g. 2,048s)	
			UINT32	1	[1 ... 200]	Number of measurements (step cycles) (e.g. 20)	
			UINT32	1		Number of parallel measurements (e.g. 1) not used yet!	
			}				

Index offset (Hex)	Access	Axis type	Data type	Phys. unit	Definition range	Description	Note
0x00000034	Write	SERVO	{			Phasing - Start Phasing - Stop Phasing	
			UINT32	ENUM	1	PhasingType: 1: ABSOLUTE 2: RELATIVE 4096: STOP	
			UINT32	1	≥ 0	Control Mask Bit 0: Continuous Update	
			UINT32	1	≥ 0	Master axis ID (for multi master)	
			UINT32			Reserve	
			REAL64	e.g. mm	±∞	Phase shift	
			REAL64	e.g. mm/s	> 0.0	Velocity	
			REAL64	e.g. mm/s^2	≥ 0.0	Acceleration	
			REAL64	e.g. mm/s^2	≥ 0.0	Deceleration	
			REAL64	e.g. mm/s^3	≥ 0.0	Jerk	
			REAL64[4]			Reserve	
			UINT32			Reserve	
			UINT32	1	ENUM	Buffer mode (NOT IMPLEMENTED)	
			REAL64	e.g. mm	±∞	Blending position (NOT IMPLEMENTED)	
			}				

Index offset (Hex)	Access	Axis type	Data type	Phys. unit	Definition range	Description	Note
0x00000040 (0x00n00040)	Write	Master/Slave coupling (SERVO)	{			Master/Slave coupling (SERVO):	Extension for "flying saw"! Angle >0.0 and £ 90.0 degrees (parallel saw: 90.0 degrees)
			UINT32	ENUM	s. appendix	Slave type [▶ 154]/ coupling type (see appendix)	
			UINT32	1	[1...255]	Axis ID of the master axis/group	
			UINT32	1	[0...8]	Subindex n of the master axis (default: value: 0)	
			UINT32	1	[0...8]	Subindex n of the slave axis (default: value: 0)	
			REAL64	1	[±1000000.0]	Parameter 1: Linear: Gear ratio FlySawVelo: Reserve FlySaw: Abs. synchron position master [mm]	
			REAL64	1	[±1000000.0]	Parameter 2:Linear: Reserve FlySawVelo: Reserve FlySawPos: Abs. synchron position slave [mm]	
			REAL64	1	[±1000000.0]	Parameter 3: Linear: Reserve FlySawVelo: Angle of inclination in [DEGREES] FlySawPos: Angle of inclination in [DEGREES]	
			REAL64	1	[±1000000.0]	Parameter 4:Linear: Reserve FlySawVelo: Gear ratio FlySawPos: Gear ratio	
			}				

Index offset (Hex)	Access	Axis type	Data type	Phys. unit	Definition range	Description	Note
0x00000040 (0x00n00040)	Write	Master/Slave coupling (SERVO)	{			Master/Slave coupling (SERVO):	Multi master coupling (MC_GearInMultiMaster) Version V1 and V2 Modified from TC3
			UINT32	ENUM	s. appendix	Slave type [▶ 154]/ coupling type (see appendix)	
			UINT32	1	[1...255]	Axis ID of the master axis/group	
			UINT32	1	[1...8]	Subindex n of the master axis (default: value: 0)	
			UINT32	1	[1...8]	Subindex n of the slave axis (default: value: 0)	
			UINT32	1	[0...255]	Axis ID master 2	
			UINT32	1	[0...255]	Axis ID master 3	
			UINT32	1	[0...255]	Axis ID master 4	
			UINT32	1	[0...255]	Reserve (axis ID master 5)	
			UINT32	1	[0...255]	Reserve (axis ID master 6)	
			UINT32	1	[0...255]	Reserve (axis ID master 7)	
			UINT32	1	[0...255]	Reserve (axis ID master 8)	
			UINT32			Reserve (TC3)	
			REAL64	e.g. mm/ s^2		Maximum acceleration/ deceleration of the slave axis	
			UINT32	1	≥ 0	Control mask, not previously used (check and operation mode for profile)	
			UINT32			Reserve (TC3)	
			Extension V2 (Optional):				
			REAL64	e.g. mm/ s^2	≥ 0.0	Maximum deceleration of the slave axis	
			REAL64	e.g. mm/ s^3	≥ 0.0	Maximum jerk of the slave axis	
			REAL64	e.g. mm/s	≥ 0.0	Maximum velocity of the slave axis	
			REAL64			Reserve	
			REAL64			Reserve	
			} 64 or 104 bytes				
0x00000041	Write	Master/slave decoupling (SERVO)	VOID			Master/slave decoupling (SERVO)	

Index offset (Hex)	Access	Axis type	Data type	Phys. unit	Definition range	Description	Note
0x00000041	Write	Master/Slave decoupling with configurable follow-up function (SERVO)	{			Master/slave decoupling with configurable follow-up function (e.g. new end position, new velocity, stop, E-stop) (SERVO)	Not yet released! Modified from TC3
			UINT32	ENUM	s. appendix	Decoupling type [▶ 154] (see appendix)	
			UINT32			Reserve (TC3)	
			REAL64	e.g. mm	±∞	Optional: New end position	
			REAL64	e.g. mm/s	> 0.0	Optional: New requested velocity	
			REAL64	e.g. mm/ s^2	≥ 0.0 (0: Default)	Optional: Acceleration for new end position, new velocity and emergency stop (E-stop)	
			REAL64	e.g. mm/ s^2	≥ 0.0 (0: Default)	Optional: Deceleration for new end position, new velocity and emergency stop (E-stop)	
			REAL64	e.g. mm/ s^3	≥ 0.0 (0: Default)	Optional: Jerk for new end position, new velocity and emergency stop (E-stop)	
			}				
0x00000042	Write	Master/Slave coupling Type: LINEAR (&SPECIAL)	{			Change of the coupling parameters (SERVO):	
			REAL64	1	[±1000000.0]	Parameter 1: Linear: Gear ratio	
			REAL64	1	[±1000000.0]	Parameter 2: Linear: Reserve	
			REAL64	1	[±1000000.0]	Parameter 3: Linear: Reserve	
			REAL64	1	[±1000000.0]	Parameter 4: Linear: Reserve	
			}				
0x00000043	Write	Master/slave table coupling Type: TABULAR	{			Change of the table coupling parameters (SERVO):	
			REAL64	mm	±∞	Slave position offset	
			REAL64	mm	±∞	Master position offset	
			}				
0x00000043	Write	Master/slave table coupling Type: TABULAR and "Motion Function"	{			Change of the table coupling parameters (SERVO):	Also for "Motion Function"
			REAL64	mm	±∞	Slave position offset	
			REAL64	mm	±∞	Master position offset	
			REAL64	1	±∞ (<> 0.0)	Slave position scaling	
			REAL64	1	±∞ (<> 0.0)	Master position scaling	
			}				

Index offset (Hex)	Access	Axis type	Data type	Phys. unit	Definition range	Description	Note
0x00000043	Write	Master/slave table coupling Type: TABULAR	{			Change of the table coupling parameters (SERVO):	
			REAL64	mm	±∞	Slave position offset	
			REAL64	mm	±∞	Master position offset	
			REAL64	1	±∞ (<> 0.0)	Slave position scaling	
			REAL64	1	±∞ (<> 0.0)	Master position scaling	
			REAL64	e.g. mm	±∞	Absolute master activation position	
			}				
0x00000044	Write	Slave-Stop (SERVO)	VOID			Stop the "flying saw" (SERVO)	Only for "flying saw"
0x00000045 (0x00n00045)	Write	Master/slave table coupling (SERVO)	{			Master/slave table coupling (SERVO):	
			UINT32	ENUM	s. appendix	Slave type/coupling type [▶ 154] (see appendix)	
			UINT32	1	[1...255]	Axis ID of the master axis	
			UINT32	1	[0...8]	Subindex n of the master axis (default: value: 0)	
			UINT32	1	[0...8]	Subindex n of the slave axis (default value: 0)	
						SOLO TABLE SECTION	
			REAL64	mm	±∞	Slave position offset (type: TABULAR)	
			REAL64	mm	±∞	Master position offset (type: TABULAR)	
			UINT32	1	[0,1]	Slave positions absolute (type: TABULAR)	
			UINT32	1	[0,1]	Master positions absolute (type: TABULAR)	
			UINT32	1	[1...255]	Table ID of the coupling table (type: TABULAR)	
						MULTI TABLE SECTION	
			UINT16	1	[0...8]	Number of tables (type: MULTITAB) Note: Misused as interpolation type for solo tables	
			UNIT16	1	[0...8]	Number of profile tables (type: MULTITAB)	
			UNIT32[8]	1	[1...255]	Tables IDs of the coupling tables (type: MULTITAB)	
			}				
0x00000046	Write	Master/slave multi-tables	UINT32	1	[1...255]	Correction table activation, correction table ID	
0x00000046	Write	Master/slave multi-tables	{			Activation of correction table	Modified from TC3
			UINT32	1	[1...255]	Correction table ID	
			UINT32			Reserve (TC3)	
			REAL64	e.g. mm	±∞	Absolute master activation position	
			}				

Index offset (Hex)	Access	Axis type	Data type	Phys. unit	Definition range	Description	Note
0x00000047	Write	Master/slave multi-tables	UINT32	1	[1..255]	Deactivation of profile table at the end of the cycle, table ID of the current monocyclic profile table	
0x00000048	ReadWrite	Master/slave multi-tables	Write: UINT32	1	[1..255]	Reading the last correction offset: Table ID of the correction table	
			Read: REAL32	e.g. mm	±∞	Offset by departing the correction table with the according table ID	
0x00000049	Write	Master/slave table coupling Type: TABULAR	REAL64	1	±∞	Change the slave table scaling factor for the slave table column (Default value: 1.0)	

Index offset (Hex)	Access	Axis type	Data type	Phys. unit	Definition range	Description	Note
0x0000004A(0x00n0004A)	Write	Master/Slave Universal Table Coupling (SERVO)	{			Master/Slave Solo Table Coupling (SERVO):	Modified from TC3
			UINT32	ENUM	s. appendix	Slave type/coupling type [▶ 154] (see appendix)	
			UINT32	1	[1...255]	Axis ID of the master axis	
			UINT32	1	[0...8]	Subindex n of the master axis (default: value: 0)	
			UINT32	1	[0...8]	Subindex n of the slave axis (default: value: 0)	
			UINT32	1	1...255]	Table ID of the coupling table (type: TABULAR)	
			UINT32	1		Table interpolation type	
			REAL64	mm	±∞	Slave position offset (type: TABULAR)	
			REAL64	mm	±∞	Master position offset (type: TABULAR)	
			REAL64	mm	±∞	Slave position scaling (type: TABULAR)	
			REAL64	mm	±∞	Master position scaling (type: TABULAR)	
			UINT32	1	[0,1]	Slave position absolute ? (Type: TABULAR)	
			UINT32	1	[0,1]	Master positions absolute ? (Type: TABULAR)	
			UINT32	ENUM	s. appendix	Activation type of the change: 0: 'instantaneous' (default) 1: 'at master cam position' 2: 'at master axis position' 3: 'next cycle'	
			UINT32			Reserve (TC3)	
			REAL64	mm	±∞	Activation position	
			UINT32	ENUM	s. appendix	Master scaling type: 0: user defined (default) 1: scaling with auto offset 2: off	
			UINT32	ENUM	s. appendix	Slave scaling type: 0: user defined (default) 1: scaling with auto offset 2: off	
			}				

Index offset (Hex)	Access	Axis type	Data type	Phys. unit	Definition range	Description	Note
0x0000004A(0x00n0004A)	Write	Master/Slave Universal Table Coupling (SERVO)	{			Master/Slave Solo Table Coupling (SERVO):	Modified from TC3
			UINT32	ENUM	s. appendix	Slave type/coupling type [▶ 154] (see appendix)	
			UINT32	1	[1...255]	Axis ID of the master axis	
			UINT32	1	[0...8]	Subindex n of the master axis (default: value: 0)	
			UINT32	1	[0...8]	Subindex n of the slave axis (default: value: 0)	
			UINT32	1	1...255]	Table ID of the coupling table (type: TABULAR)	
			UINT32	1		Table interpolation type	
			REAL64	mm	±∞	Slave position offset (type: TABULAR)	
			REAL64	mm	±∞	Master position offset (type: TABULAR)	
			REAL64	mm	±∞	Slave position scaling (type: TABULAR)	
			REAL64	mm	±∞	Master position scaling (type: TABULAR)	
			UINT32	1	[0,1]	Slave position absolute ? (Type: TABULAR)	
			UINT32	1	[0,1]	Master positions absolute ? (Type: TABULAR)	
			UINT32	ENUM	s. appendix	Activation type of the change: 0: 'instantaneous' (default) 1: 'at master cam position' 2: 'at master axis position' 3: 'next cycle'	
			UINT32			Reserve (TC3)	
			REAL64	mm	±∞	Activation position	
			UINT32	ENUM	s. appendix	Master scaling type: 0: user defined (default) 1: scaling with auto offset 2: off	
			UINT32	ENUM	s. appendix	Slave scaling type: 0: user defined (default) 1: scaling with auto offset 2: off	
			Extension for MultiCam:				
			UINT32	ENUM	s. appendix	Cam Operation Mode	
			UINT32	1	[1…255]	Reference table ID	
			BYTE[104]			Reserve (TC3)	
			}				

Index offset (Hex)	Access	Axis type	Data type	Phys. unit	Definition range	Description	Note
0x0000004B(0x00n0004B)	Write	Master/slave universal flying saw (SERVO)	{			Master/slave synchronization coupling (SERVO):	Modified from TC3
			UINT32	ENUM	s. appendix	Slave type/coupling type (see appendix)	
			UINT32	1	[1...255]	Axis ID of the master axis	
			UINT32	1	[0...8]	Subindex n of the master axis (default: value: 0)	
			UINT32	1	[0...8]	Subindex n of the slave axis (default: value: 0)	
			REAL64	1	±∞ (<> 0.0)	Gear ratio	
			REAL64	mm	±∞	Master synchron position	
			REAL64	mm	±∞	Slave synchron position	
			REAL64	mm/s	≥ 0.0	Slave velocity (optional)	
			REAL64	mm/s^2	≥ 0.0	Slave acceleration (optional)	
			REAL64	mm/s^2	≥ 0.0	Slave deceleration (optional)	
			REAL64	mm/s^3	≥ 0.0	Slave jerk (optional)	
			UINT32	1	≥ 0	Bit mask (default value: 0)	
			UINT32			Reserve (TC3)	
			}				

Index offset (Hex)	Access	Axis type	Data type	Phys. unit	Definition range	Description	Note
0x0000004D(0x00n0004D)	Write	Master/slave table coupling Type: TABULAR and MF	{			Change in table scaling (SERVO):	Modified from TC3
			UINT32	ENUM	s. appendix	Activation type of the change 0: 'instantaneous' (default) 1: 'at master cam position' 2: 'at master axis position' 3: 'next cycle'	
			UINT32			Reserve (TC3)	
			REAL64	e.g. mm	±∞	Activation position	
			UINT32	ENUM	s. appendix	Master scaling type 0: user defined (default) 1: scaling with auto offset 2: off	
			UINT32	ENUM	s. appendix	Slave scaling type 0: user defined (default) 1: scaling with auto offset 2: off	
			REAL64	e.g. mm	±∞	Master position offset	
			REAL64	e.g. mm	±∞	Slave position offset	
			REAL64	1	±∞ (<> 0.0)	Master position scaling	
			REAL64	1	±∞	Slave position scaling	
			Optional extension for MultiCam:				
			UINT32	1	≥ 0	Cam Table ID	
			UINT32			Reserve (TC3)	
			}				
0x00000050	Write	every	VOID			Deactivate complete axis (disable)	
0x00000051	Write	every	VOID			Activate complete axis (enable)	
0x00000052	Write	SERVO	{			Change of the active axis control loop (triple from encoder, controller and axis interfaces) with/without external setpoint specification:	Modified from TC3
			UINT32	1	≥ 0	Number/index of the axis control loop (Default value: 0)	
			UINT32	ENUM	s. appendix (>0)	Switching type for synchronization behavior [▶ 164] 1: 'Standard'	
			REAL64	1	±∞	Synchronization value for switching (optional)	
			UINT32	0/ 1	0/1	External setpoint specification by means of axis interface ? Note: Not used so far!	
			UINT32			Reserve (TC3)	
			}				

Index offset (Hex)	Access	Axis type	Data type	Phys. unit	Definition range	Description	Note
0x00000060	Write	every	VOID			Deactivate drive output (disable)	
0x00000061	Write	every	VOID			Activate drive output (enable)	
0x00000062	Write	high/low	UINT16	1	0/1	Release parking brake? 0: automatic activation (default) 1: mandatorily always released Note: Reset to '0' when resetting the axis!	
0x00000063	Write	only for SERCOS/SoE and CANopen/ CoE	{			Activate "Drive Operation Mode" (e.g. Position Velo, Torque, etc.)	NEW from TC 3.1 B4022 (NC 4443) Always to SEC Port 501!
			INT32	ENUM [▶ 161] (see appendix)	[0; 1, 2, 3, …] Special cases: ≥ 100: SoE < 0: CoE	New "Drive Operation Mode" (generic modes)	
			UINT32	1	0	Reserve	
			UINT32	1	0	Reserve	
			UINT32	1	0	Reserve	
			}				
0x00000070	Write	every	VOID			Return of the axis from, e.g. a 3D group to its own PTP group	

* The following warning relates to index offset 0x0000002D:

⚠ DANGER

Danger to life or risk of serious injury or damage to property due to unintentional movements of the axis

When using the function block, the axis is switched to CST mode. After using the function block (especially after error situations), the axis may still be in CST mode. This can lead to sudden and unplanned movements (especially with lifting axes) when the axis is released.

- Ensure that there is no hazard as defined by the risk assessment.
- Check the current operation mode via the function block MC_ReadDriveOperationMode.
- If the axis is not in a position-related operation mode (CSV/CSP), transfer it before an enable:
  – *directly* with MC_WriteDriveOperationMode into the desired position-related operation mode (CSV/CSP) or
  – *indirectly* with MC_Halt / MC_Stop into the desired position-related operation mode (CSV/CSP) (from TwinCAT 3.1.4024.40)
  Other function blocks that switch the axis indirectly into a position-related operation mode can only do this to a limited extent and are therefore not to be used for a deliberate operation mode change.

⇨ Subsequently, it is necessary to check again whether the axis is really in a position-related operation mode (CSV/CSP), if not, an abort with error handling is required.

6.4.4.4 "Index offset" specification for cyclic axis process data (Index group 0x4300 + ID)

Index offset (Hex)	Access	Axis type	Data type	Phys. unit	Definition range	Description	Note
0x00n00000	Read/Write	every (PLC→NC)	{ 128 bytes}		STRUCT see axis interface	AXIS STRUCTURE (PLC→NC) n = 0: standard axis interface n > 0: n-th axis interface (optional)	Write command only optional! Consider safety aspects! *PLCTONC_AXIS_REF*
0x00n00001	Read/Write	every (PLC→NC)	UINT32	1	>0	Control double word	Write command only optional! *Symbolic access possible!* "ControlDWord"
0x00n00002	Read/Write	every (PLC→NC)	UINT16	1	0/1	Controller enable	Cannot be traced by oscilloscope!
0x00n00003	Read/Write	every (PLC→NC)	UINT16	1	0/1	Feed enable plus	Cannot be traced by oscilloscope!
0x00n00004	Read/Write	every (PLC→NC)	UINT16	1	0/1	Feed enable minus	Cannot be traced by oscilloscope!
0x00n00007	Read/Write	every (PLC→NC)	UINT16	1	0/1	Referencing cam	Cannot be traced by oscilloscope!
0x00n00021	Read/Write	every (PLC→NC)	UINT32	%	0...1000000	Velocity override (1000000 == 100%)	Write command only optional! *Symbolic access possible!* "OverrideV"
0x00n00022	Read/Write	every (PLC→NC)	UINT32	1	ENUM	Operation mode axis	Write command only optional!
0x00n00025	Read/Write	every (PLC→NC)	REAL64	e.g. mm		Actual position correction value (measurement system error correction)	Write command only optional!
0x00n00026	Read/Write	every (PLC→NC)	REAL64	e.g. mm/s		External controller component (position controller component)	Write command only optional!
0x00n00027	Read/Write	every (PLC→NC)	{			External setpoint generation	Write command only optional! Modified from TC3
			REAL64	e.g. mm	±∞	External set position	
			REAL64	e.g. mm/s	±∞	External set velocity	
			REAL64	e.g. mm/s^2	±∞	External set acceleration	
			INT32	1	+1, 0, -1	External set travel direction	
			UINT32			Reserve (TC3)	
			REAL64			Reserve (TC3)	
			}				
0x00n00080	Read	every (PLC→NC)	{ 256 bytes}		STRUCT see axis interface	AXIS STRUCTURE (NC→PLC) Note: size and alignment changed n = 0: standard axis interface n > 0: n-th axis interface (optional)	Changed from TC3.*NCTOPLC_AXIS_REF*

Index offset (Hex)	Access	Axis type	Data type	Phys. unit	Definition range	Description	Note
0x00n00071	Read	every (PLC→NC)	UINT8	1	>0	State double word: byte 1	
0x00n00072	Read	every (PLC→NC)	UINT8	1	>0	State double word: byte 2	
0x00n00073	Read	every (PLC→NC)	UINT8	1	>0	State double word: byte 3	
0x00n00074	Read	every (PLC→NC)	UINT8	1	>0	State double word: byte 4	
0x00n00081	Read	every (PLC→NC)	UINT32	1	>0	State double word (complete)	*Symbolic access possible!* "StateDWord"
0x00n00082	Read	every (PLC→NC)	UINT16	1	0/1	Axis is ready for operation	Cannot be traced by oscilloscope!
0x00n00083	Read	every (PLC→NC)	UINT16	1	0/1	Axis has been referenced	Cannot be traced by oscilloscope!
0x00n00084	Read	every (PLC→NC)	UINT16	1	0/1	Axis in protected operation mode (e.g. slave axis)	Cannot be traced by oscilloscope!
0x00n00085	Read	every (PLC→NC)	UINT16	1	0/1	Axis is in rapid mode	Cannot be traced by oscilloscope!
0x00n00088	Read	every (PLC→NC)	UINT16	1	0/1	Axis has invalid I/O data	Cannot be traced by oscilloscope!
0x00n00089	Read	every (PLC→NC)	UINT16	1	0/1	Axis is in an error state	Cannot be traced by oscilloscope!
0x00n0008A	Read	every (PLC→NC)	UINT16	1	0/1	Axis moving to larger values	Cannot be traced by oscilloscope!
0x00n0008B	Read	every (PLC→NC)	UINT16	1	0/1	Axis moving to smaller values	Cannot be traced by oscilloscope!
0x00n0008C	Read	every (PLC→NC)	UINT16	1	0/1	Axis is at a logical standstill (only setpoints are considered) (position controller?)	Cannot be traced by oscilloscope!
0x00n0008D	Read	every (PLC→NC)	UINT16	1	0/1	Axis is being referenced	Cannot be traced by oscilloscope!
0x00n0008E	Read	every (PLC→NC)	UINT16	1	0/1	Axis is in position window	Cannot be traced by oscilloscope!
0x00n0008F	Read	every (PLC→NC)	UINT16	1	0/1	Axis is at target position (target position reached)	Cannot be traced by oscilloscope!
0x00n00090	Read	every (PLC→NC)	UINT16	1	0/1	Axis has constant velocity or rotary speed	Cannot be traced by oscilloscope!
0x00n0009A	Read	every (PLC→NC)	UINT16	1	0/1	Operation mode not executed (busy)	Cannot be traced by oscilloscope!
0x00n0009B	Read	every (PLC→NC)	UINT16	1	0/1	Axis has instructions, is carrying instructions out	Cannot be traced by oscilloscope!
0x00n000B1	Read	every (PLC→NC)	UINT32	1	≥0	Axis error code	
0x00n000B2	Read	every (PLC→NC)	UINT32	1	ENUM	Motion state of the axis (master state [▶ 161] / slave state [▶ 161])	*Symbolic access possible!* "AxisState"

Index offset (Hex)	Access	Axis type	Data type	Phys. unit	Definition range	Description	Note
0x00n000B3	Read	every (PLC→NC)	UINT32	1	ENUM	Operation mode of the axis (rev. NC)	
0x00n000B4	Read	every (PLC→NC)	UINT32	1	ENUM	Axis referencing status	*Symbolic access possible!* "HomingState"
0x00n000B5	Read	every (PLC→NC)	UINT32	1	ENUM	Axis coupling state	*Symbolic access possible!* "CoupleState"
0x00n000B6	Read	every (PLC→NC)	UINT32	1	≥0	SVB entries/tasks of the axis (PRE table)	
0x00n000B7	Read	every (PLC→NC)	UINT32	1	≥0	SAF entries/tasks of the axis (EXE table)	
0x00n000B8	Read	every (PLC→NC)	UINT32	1	≥0	Axis ID	
0x00n000B9	Read	every (PLC→NC)	UINT32	1	≥0	Operation modes state double word:Bit 0: Position range monitoring active? Bit 1: target position window monitoring active? Bit 2: looping distance active? Bit 3: physical motion monitoring active? Bit 4: PEH time monitoring active? Bit 5: backlash compensation active? Bit 6: delayed error reaction mode active? Bit 7: modulo operation mode active (modulo axis)? Bit 16: following error monitoring position active? Bit 17: following error monitoring vel. active? Bit 18: end position monitoring min. active? Bit 19: end position monitoring max. active? Bit 20: actual position correction active?	
0x00n000BA	Read	every (PLC→NC)	REAL64	e.g. mm		Actual position (calculated absolute value)	
0x00n000BB	Read	every (PLC→NC)	REAL64	e.g. mm		Modulo actual position	
0x00n000BC	Read	every (PLC→NC)	INT32	1		Modulo rotations	
0x00n000BD	Read	every (PLC→NC)	REAL64	e.g. mm/s		Actual velocity (optional)	
0x00n000BE	Read	every (PLC→NC)	REAL64	e.g. mm		Following error position	
0x00n000BF	Read	every (PLC→NC)	REAL64	e.g. mm		Set position	
0x00n000C0	Read	every (PLC→NC)	REAL64	e.g. mm/s		Set velocity	

Index offset (Hex)	Access	Axis type	Data type	Phys. unit	Definition range	Description	Note
0x00n000C1	Read	every (PLC→NC)	REAL64	e.g. mm/ s^2		Set acceleration	
0x00n10000	Read/Write	Encoder: every (NC→IO)	{ 40 bytes }		STRUCT see encoder IO interface	ENCODER OUTPUT STRUCTURE (NC→IO, 40 bytes)*NCENCODERSTRUCT_OUT2*	Write command only optional! Consider safety aspects!
0x00n10080	Read	Encoder: every (IO→NC)	{ 40 bytes }		STRUCT see encoder IO interface	ENCODER-INPUT-STRUCTURE (IO→NC, 40 bytes)*NCENCODERSTRUCT_IN2*	
0x00n30000	Read/Write	Drive: every (NC→IO)	{ 40 bytes }		STRUCT see drive IO interface	DRIVE-OUTPUT-STRUCTURE (NC→IO, 40 bytes)*NCDRIVESTRUCT_OUT2*	Write command only optional! Consider safety aspects!
0x00n30080	Read	Drive: every (IO→NC)	{ 40 bytes }		STRUCT see drive IO interface	DRIVE-INPUT-STRUCTURE (NC→IO, 40 bytes)*NCDRIVESTRUCT_IN2*	

6.4.5 Specification Encoder

6.4.5.1 "Index offset" specification for encoder parameter (Index group 0x5000 + ID)

Index offset (Hex)	Access	Group type	Data type	Phys. unit	Definition range	Description	Note
0x00000001	Read	every	UINT32	1	[1 ... 255]	Encoder ID	
0x00000002	Read	every	UINT8[30+1]	1	30 characters	Encoder name	
0x00000003	Read	every	UINT32	1	s. ENUM (>0)	Encoder type [▶ 156]	
0x00000004	Read/Write	every	UINT32	1	Byteoffset	Input address offset (IO-Input-Image)	change I/O address
0x00000005	Read/Write	every	UINT32	1	Byteoffset	Output address offset (IO-Output-Image)	change I/O address
0x00000006	Read/Write	every	REAL64	e.g. mm/ INC	[1.0E-12 ... 1.0E+30]	resulting scaling factor (numerator / denominator) Note: from TC3 the scaling factor consists of two components – numerator and denominator (default: 1.0).	Writing is not allowed if the controller enable has been issued.
0x00000007	Read/Write	every	REAL64	e.g. mm	[±1.0E+9]	Position offset	Writing is not allowed if the controller enable has been issued.
0x00000008	Read/Write	every	UINT16	1	[0,1]	encoder count direction	Writing is not allowed if the controller enable has been issued.
0x00000009	Read/Write	every	REAL64	e.g. mm	[0.001 ... 1.0E+9]	modulo factor	
0x0000000A	Read/Write	every	UINT32	1	s. ENUM (>0) in the appendix	Encoder mode [▶ 157]	
0x0000000B	Read/Write	every	UINT16	1	0/1	soft end min. monitoring?	
0x0000000C	Read/Write	every	UINT16	1	0/1	soft end max. monitoring?	
0x0000000D	Read/Write	every	REAL64	mm		Soft end position min.	
0x0000000E	Read/Write	every	REAL64	mm		Soft end position max.	
0x0000000F	Read/Write	every	UINT32	1	s. ENUM (≥0) in the appendix	Encoder evaluation direction [▶ 157] (enable for log. counting direction)	
0x00000010	Read/Write	every	REAL64	s	[0.0...60.0]	Filter time for actual position value in seconds (P-T1)	
0x00000011	Read/Write	every	REAL64	s	[0.0...60.0]	Filter time for actual velocity value in seconds (P-T1)	
0x00000012	Read/Write	every	REAL64	s	[0.0...60.0]	filter time for actual acceleration value in seconds (P-T1)	
0x00000013	Read/Write	every	UINT8[10+1]	1		physical unit	Not implemented!
0x00000014	Read/Write	every	UINT32	1		interpretation of the units (position, velocity, time) Bit 0: velocity in x/min instead of x/s Bit 1: position in thousandths of the base unit	Not implemented! bit array

Index offset (Hex)	Access	Group type	Data type	Phys. unit	Definition range	Description	Note
0x00000015	Read/Write	every	UINT32	INC	[0x0... 0xFFFFFFFF]	Encoder mask (maximum value of the encoder actual value in increments) Note: The encoder mask may be any numerical value (e.g. 3600000). Unlike in the past, it no longer has to correspond to a continuous series off binary one's (2^n-1).	Axis has to be disabled for write access. see also "Encoder Sub Mask" parameter
0x00000016	Read/Write	every	UINT16	1	0/1	Actual position correction (measurement system error correction)?	
0x00000017	Read/Write	every	REAL64	s	[0.0...60.0]	Filter time for actual position correction in seconds (P-T1)	
0x00000018	Read/Write	every	UINT32	1	[0x0... 0xFFFFFFFF]	Filter mask for raw incremental value (0x0: full pass)	
0x00000019	Read/Write	every	UINT32	1	s. ENUM (≥0) in the appendix	Encoder absolute dimensioning system [▶ 157]	Writing is not allowed if the controller enable has been issued.
0x0000001A	Read/Write	every	UINT32	1	s. ENUM (≥0)	Encoder position initialization	Not implemented!
0x0000001B	Read/Write	every	REAL64	e.g. mm	[≥0, modulo factor/2]	Tolerance window for modulo-start	
0x0000001C	Read	every	UINT32	1	s. ENUM (≥0)	Encoder sign interpretation [▶ 157] (data type)	
0x0000001D	Read	every	UINT16	1	0/1	Incremental or absolute encoder ? 0: incremental encoder type 1: absolute encoder type	
0x00000020	Read/Write	every	UINT32	1	s. ENUM (≥0)	Encoder dead time compensation mode 0: off (Default) 1: on (with velocity) 2: on (with velocity and acceleration)	
0x00000021	Read/Write	every	UINT32	1		Control double word (32 bits) for the encoder dead time compensation: Bit 0 = 0: relative I/O times (default) Bit 0 = 1: absolute I/O times	
0x00000022	Read/Write	every	INT32	ns	[±1.0E+9]	Sum of the parameterized time shifts for the encoder dead time compensation (typically positive numerical values)	
0x00000023	Read/Write	every	REAL64	e.g. mm/ INC	[1.0E-12 ... 1.0E+30]	Component of the scaling factor: numerator (=> scaling factor numerator / scaling factor denominator)	NEW from TC3 Writing is not allowed if the controller enable has been issued.

Index offset (Hex)	Access	Group type	Data type	Phys. unit	Definition range	Description	Note
0x00000024	Read/Write	every	REAL64	1	[1.0E-12 ... 1.0E+30]	Component of the scaling factor: denominator (=> scaling factor numerator / scaling factor denominator) Default: 1.0	NEW from TC3 Writing is not allowed if the controller enable has been issued.
0x00000025	Read/Write	every	{ REAL64 REAL64 } 16 bytes	e.g. mm/ INC 1	[1.0E-12 ... 1.0E+30] [1.0E-12 ... 1.0E+30]	Component of the scaling factor: numerator Component of the scaling factor: denominator (=> scaling factor numerator / scaling factor denominator)	NEW from TC3
0x00000030	Read/Write	every	UINT32	1		Internal encoder control double word for specifying the operation modes and properties	NEW from TC3
0x00000101	Read/Write	INC	UINT16	1	[0,1]	inverse search direction for ref.cam?	
0x00000102	Read/Write	INC		1	[0,1]	inverse search direction for sync pulse?	
0x00000103	Read/Write	INC	REAL64	e.g. mm	[±1.0E+9]	Reference position	
0x00000104	Read/Write	INC	UINT16	1	[0,1]	distance monitoring between Ref. cams and sync pulse active?	Not implemented!
0x00000105	Read/Write	INC	UINT32	INC	[0 ...65536]	minimum distance between Ref. cams and sync pulse in increments	Not implemented!
0x00000106	Read/Write	INC	UINT16	1	[0,1]	external sync pulse?	
0x00000107	Read/Write	INC	UINT32	1	s. ENUM (>0)	Referencing mode (Sync Condition) [▶ 158]	
0x00000108	Read/Write	INC	UINT32	1	[0x0000000F... 0xFFFFFFFF]binary mask: (2^n - 1)	Encoder Sub Mask (maximum value of the absolute range of the encoder actual value in increments) Used, for example, as a reference mark for the referencing mode "Software Sync" and for the NC Retain Data "ABSOLUTE (MODULO)", "INCREMENTAL (SINGLETURN ABSOLUTE)". Note 1: The Encoder Sub Mask must be smaller than or equal to the Encoder Mask. Note 2: The Encoder Mask must be an integer multiple of the Encoder Sub Mask. Note 3: The Encoder Sub Mask must be a continuous sequence of binary ones (2^n-1), e.g. 0x000FFFFF.	NEW see also param. "Encoder Mask"

Index offset (Hex)	Access	Group type	Data type	Phys. unit	Definition range	Description	Note
0x00000109	Read/Write	INC	UINT32	1	s. ENUM (≥0)	Homing Sensor Source [▶ 158] Sets the source of the digital input of the referencing cam.	
0x00000110	Read/Write	INC (encoder simulation)	REAL64	1	[0.0 ... 1000000.0]	scaling/weight of the noise part for the simulation encoder	

6.4.5.2 "Index offset" specification for encoder state (Index group 0x5100 + ID)

Index offset (Hex)	Access	Group type	Data type	Phys. unit	Definition range	Description	Note
0x00000001	Read	every	INT32			Error state encoder	
0x00000002	Read	every	REAL64			Actual position (charge with actual position compensation value)	Symbolic access possible! *'ActPos'*
0x00000003	Read	every	REAL64			Modulo actual position	Symbolic access possible! *'ActPosModulo'*
0x00000004	Read	every	INT32			Modulo actual rotation	
0x00000005	Read	every	REAL64			Optional: Actual velocity	Base unit / s *Symbolic access possible! 'ActVelo'*
0x00000006	Read	every	REAL64			Optional: Actual acceleration	Base unit / s^2 *Symbolic access possible! 'ActAcc'*
0x00000007	Read	every	INT32			Encoder actual increments	
0x00000008	Read	every	INT64			Software - actual increment counter	
0x00000009	Read/Write	every	UINT16			Reference flag ("calibrate flag")	
0x0000000A	Read	every	REAL64			Actual position correction value (measuring system error correction)	
0x0000000B	Read	every	REAL64			Actual position without actual position compensation value	
0x0000000C	Read	every	REAL64	e.g. mm		Actual position compensation value due to the dead time compensation	
0x0000000D	Read	every	REAL64	s		Sum of time shift for encoder dead time compensation (parameterized and variable dead time)Note: A dead time is specified in the system as a positive value.	
0x0000000E	Read	every	REAL64	e.g. mm		Internal position offset as a correction value for a value reduction to the base period (modulo range)	
0x00000010	Read	every	REAL64	e.g. mm/s		Actual velocity without actual position compensation value	
0x00000012	Read	every	REAL64	e.g. mm		Unfiltered actual position (charge with actual position compensation value)	
0x00000013	Read	every	REAL64	e.g. mm		Filtered actual position (offset with actual position correction value, without dead time compensation)	
0x00000014	Read	Type: SoE, CoE, MDP 742	REAL64	e.g. mm/s		Optional: actual drive velocity (transferred directly from SoE, CoE or MDP 742 drive)	Base Unit / s NEW from TC3.1 B4020.30
0x00000015	Read	every	REAL64	e.g. mm/s		Optional: Unfiltered actual velocity	Base Unit / s

Index offset (Hex)	Access	Group type	Data type	Phys. unit	Definition range	Description	Note
0x00000016	Read	every	**READ**(16 bytes * N)			Read the actual position buffer	
			{				
			UINT32	ns	≥0	DcTimeStamp with 32 bits	
			UINT32			Reserve	
			REAL64	e.g. mm	±∞	Actual position for the associated timestamp	
			} [N]				
0x00000017	Read		REAL64	e.g. mm		Reading out the MC_SetPosition offset	
0x00000101	Read	INC	REAL64	e.g. mm		Read back the position difference between the hardware latch being activated and becoming valid	Cannot be traced by oscilloscope!
0x00000200	**Read Write**	**Function group "TouchProbeV2": - SERCOS/ SoE - EtherCAT/ CoE (CANopen DS402) - SoftDrive (TCom), - MDP 511 (EL5101, EL5151, EL5021, EL7041, EL7342)**	**WRITE**(24 bytes)			Read "Touch Probe" state (state of external latch)	Only for SAF-port 501
			{				
			UINT32	1	[1,2,3,4]	Probe unit (probe 1, 2, 3, 4)	
			UINT32[5]			Reserved	
			}				
			READ(64 bytes)				
			{				
			UINT32	1	[0/1]	Touch probe rising edge active?	
			UINT32	1	[0/1]	Touch probe rising edge became valid?	
			REAL64	e.g. mm		Touch probe rising edge position value	
			UINT32	1	≥0	Touch probe rising edge counter (continuous mode)	
			UINT32			Reserved	
			UINT32	1	[0/1]	Touch probe falling edge active?	
			UINT32	1	[0/1]	Touch probe falling edge became valid?	
			REAL64	e.g. mm		Touch probe falling edge position value	
			UINT32	1	≥0	Touch probe falling edge counter (continuous mode)	
			UINT32[5]			Reserved	
			}				
0x00000201	Read	**KL5101, SERCOS, AX2xxx, ProviDrive**	UINT16	1	[0,1]	"External latch function" active? or "Touch probe function" active ? *(edge-independent)*	Cannot be traced by oscilloscope!
0x00000201	Read	**CANopen**	UINT32[4]	1	[0,1]	"External latch functions 1 to 4" active? or "Touch probe functions 1 to 4" active?	Cannot be traced by oscilloscope!

Index offset (Hex)	Access	Group type	Data type	Phys. unit	Definition range	Description	Note
0x00000202	Read	**KL5101, SERCOS, AX2xxx, ProviDrive**	UINT16	1	[0,1]	External latch value became valid? or touch probe latched? *(edge-independent)*	see also Axis interface NcToPlc (state double word)
0x00000202	Read	**CANopen**	UINT32[4]	1	[0,1]	External latch values 1 to 4 became valid? or touch probes 1 to 4 latched?	see also Axis interface NcToPlc (state double word)
0x00000203	Read	**KL5101, SERCOS, AX2xxx, ProviDrive**	UINT32	INC		External / touch probe hardware incremental latch value	
0x00000204	Read	**KL5101, SERCOS, AX2xxx, ProviDrive**	UINT64	INC		External / touch probe Software incremental latch value	
0x00000205	Read	**KL5101, SERCOS, AX2xxx, ProviDrive**	REAL64	e.g. mm		External / touch probe position latch value	Base Unit
0x00000205	Read	**CANopen**	REAL64[4]	e.g. mm		External touch probe values / position latch values	Base Unit
0x00000206	Read	**KL5101, SERCOS, AX2xxx, ProviDrive**	UINT32	INC		Difference hardware incremental latch values (NewLatch - LastLatch)	Cannot be traced by oscilloscope!
0x00000207	Read	**KL5101, SERCOS, AX2xxx, ProviDrive**	UINT64	INC		Difference software incremental latch values (NewLatch - LastLatch)	Cannot be traced by oscilloscope!
0x00000208	Read	**KL5101, SERCOS, AX2xxx, ProviDrive**	REAL64	e.g. mm		Difference position latch values (NewLatch - LastLatch)	Cannot be traced by oscilloscope! Base Unit
0x00000210	Read	**KL5101, AX2xxx, ProviDrive**	UINT16	1	[0,1]	"External latch function" for *rising edge* active? or "Touch probe function" for *rising edge* active?	Cannot be traced by oscilloscope!
0x00000210	Read	**CANopen**	UINT16[4]	1	[0,1]	"External latch function" for *rising edge* active? or "Touch probe function" for *rising edge* active?	Cannot be traced by oscilloscope!
0x00000211	Read	**KL5101, AX2xxx, ProviDrive**	UINT16	1	[0,1]	"External latch function" for *falling edge* active? or "Touch probe function" for *falling edge* active?	Cannot be traced by oscilloscope!
0x00000211	Read	**CANopen**	UINT16[4]	1	[0,1]	"External latch function" for *falling edge* active? or "Touch probe function" for *falling edge* active?	Cannot be traced by oscilloscope!

Index offset (Hex)	Access	Group type	Data type	Phys. unit	Definition range	Description	Note
0x00000212	Read	**CANopen**	UINT16	1	[0,1]	Status of "Touch Probe 1" input signal	Cannot be traced by oscilloscope! From TC3.1 B4024.11
0x00000213	Read	**CANopen**	UINT16	1	[0,1]	Status of "Touch Probe 2" input signal	Cannot be traced by oscilloscope! From TC3.1 B4024.11

6.4.5.3 "Index offset" specification for encoder functions (Index group 0x5200 + ID)

Index-Offset (Hex)	Access	Group type	Data type	Phys. unit	Definition range	Description	Remarks
0x0000001A	Write	every	{			Set actual position encoder/axis	Base Unit
			UINT32	ENUM	s. appendix	Actual position type [▶ 153] (s. appendix)	
			REAL64	mm	±∞	Actual position for encoder/axis **Caution when using!**	
			}				
0x0000001B	Write	every	VOID			Re-initialization of the actual encoder position Note: Takes effect for reference system „ABSOLUTE MULTITURN RANGE (with single overflow)“ and „ABSOLUTE SINGLETURN RANGE (with single overflow)“.	NEW from TC3
0x00000200	Write	Function group "TouchProbeV2": - SERCOS/ SoE, - EtherCAT/ CoE (CANopen DS402) - SoftDrive (TCom), - MDP 511 (EL5101, EL5151, EL5021, EL7041, EL7342)	{			Activate "Touch Probe" (external latch)	Only for SAF-port 501
			UINT32	1	[1,2,3,4]	Probe unit (probe 1, 2, 3, 4)	
			UINT32	1	[0,1]	Signal edge (0=rising edge, 1=falling edge)	
			UINT32	1	[1,2]	Probe mode (1=single, 2=continuous, ...)	
			UINT32	1	[1,2,3,4; 128,129]	Signal source (1=input 1, 2=input 2, ...)	
			UINT32			Reserved	
			UINT32			Reserved	
			} 24 bytes				
0x00000201	Write	KL5101,SERCOS,AX2xxx,PROFIDrive	VOID			Activate "External Latch" or activate "measuring probe function" *(typically rising edge)*	
0x00000201	Write	CANopen	UINT32[4]			Activate "External Latch" 1 to 4 or activate "measuring probe function" 1 to 4 *(typically rising edge)*	
0x00000202	Write	KL5101,SERCOSAX2xxx,PROFIDrive	VOID			Activate "external latch" or activate "measuring probe function" *(falling edge)*	
0x00000202	Write	CANopen	UINT32[4]			Activate "external latch" 1 to 4 or activate "measuring probe function" 1 to 4 *(falling edge)*	

Index-Offset (Hex)	Access	Group type	Data type	Phys. unit	Definition range	Description	Remarks
0x00000205	Write	Function group "TouchProbeV2": - SERCOS/ SoE, - EtherCAT/ CoE (CANopen DS402) - SoftDrive (TCom), - MDP 511 (EL5101, EL5151, EL5021, EL7041, EL7342)	{			Deactivate "touch probe" (external latch)	Only for SAF-port 501
			UINT32	1	[1,2,3,4]	Probe unit (probe 1, 2, 3, 4)	
			UINT32	1	[0,1]	Signal edge (0=rising edge, 1=falling edge)	
			UINT32			Reserved	
			UINT32			Reserved	
			UINT32			Reserved	
			UINT32			Reserved	
			} 24 bytes				
0x00000205	Write	KL5101,SERCOS,AX2xxx,PROFIDrive	VOID			Deactivate "external latch" or deactivate "measuring probe function"	
0x00000205	Write	CANopen	UINT32[4]			Deactivate "external latch" or deactivate "measuring probe function"	
0x00000210	Write	KL5101,SERCOS,AX2xxx,PROFIDrive	REAL64	e.g. mm	±∞	Set "External latch event" and "External latch position"	Only for EtherCAT:

6.4.5.4 "Index offset" specification for cyclic encoder process data (Index group 0x5300 + ID)

Index offset (Hex)	Access	Group type	Data type	Phys. unit	Definition range	Description	Remarks
0x00000000	Read/Write	every (NC→IO)	{		STRUCT s. encoder interface	ENCODER-OUTPUT-STRUCTURE (NC→IO, 40 Byte) NCENCODERSTRUCT_OUT2	Write command only optional! Consider safety aspects!
			INT32	INC	≥ 0	nDataOut1	
			INT32	INC	≥ 0	nDataOut2	
			UINT8	1	≥ 0	nCtrl1	
			UINT8	1	≥ 0	nCtrl2	
			UINT8	1	≥ 0	nCtrl3	
			UINT8	1	≥ 0	nCtrl4	
			INT32	INC	≥ 0	nDataOut3	
			INT32	INC	≥ 0	nDataOut4	
			INT32	INC	≥ 0	nDataOut5	
			INT32	INC	≥ 0	nDataOut6	
			UINT8	1	≥ 0	nCtrl5	
			UINT8	1	≥ 0	nCtrl6	
			UINT8	1	≥ 0	nCtrl7	
			UINT8	1	≥ 0	nCtrl8	
			INT32	1	≥ 0	Reserved	
			INT32	1	≥ 0	Reserved	
			} 40 bytes				
0x00000000	Read/Write	every (NC→IO), optional 64 bit encoder interface (e.g. MDP513 with 64Bit)	{		STRUCT s. encoder interface	Optional ENCODER-OUTPUT-STRUCTURE (NC→IO, 80 Byte) NCENCODERSTRUCT_OUT3	Write command only optional! Consider safety aspects! NEW from TC3
			UINT64	INC	≥ 0	nDataOut1	
			UINT64	INC	≥ 0	nDataOut2	
			UINT64	INC	≥ 0	nDataOut3	
			UINT64	INC	≥ 0	nDataOut4	
			UINT64	INC	≥ 0	nDataOut5	
			UINT64	INC	≥ 0	nDataOut6	
			UINT64	INC	≥ 0	nDataOut7	
			UINT64	INC	≥ 0	nDataOut8	
			UINT16	1	≥ 0	nCtrl1	
			UINT16	1	≥ 0	nCtrl2	
			UINT16	1	≥ 0	nCtrl3	
			UINT16	1	≥ 0	nCtrl4	
			UINT16	1	≥ 0	nCtrl5	
			UINT16	1	≥ 0	nComCtrl	
			INT32	1	≥ 0	reserved	
			} 80 bytes				

Index offset (Hex)	Access	Group type	Data type	Phys. unit	Definition range	Description	Remarks
0x00000001	Write	Every (NC→IO)	{		STRUCT s. encoder interface	Bitwise access to ENCODER-OUTPUT-STRUCTURE (NC→IO, 40 Byte) NCENCODERSTRUCT_OUT2	Write command only optional! Consider safety aspects!
			UINT32	1	[0 … 39]	ByteOffset Relative address offset [0..39] in output structure. E.G.: To write “nControl1” the ByteOffset must be 8.	
			UINT32	1	[0x00000000… 0xFFFFFFFF]	BitSelectMask (BSM) The mask defines write enabled bits in a DWORD. Zero bits are protected and remain unaffected.	
			UINT32	1	[0x00000000… 0xFFFFFFFF]	Value Only those bits in value are overwritten where BSM equals 1.	
			}				
0x00000080	Read	every (IO→NC)	{		STRUCT s. encoder interface	ENCODER-INPUT-STRUCTURE (IO→NC, 40 Byte) NCENCODERSTRUCT_IN2	
			INT32	INC	≥ 0	nDataIn1	
			INT32	INC	≥ 0	nDataIn2	
			UINT8	1	≥ 0	nState1	
			UINT8	1	≥ 0	nState2	
			UINT8	1	≥ 0	nState3	
			UINT8	1	≥ 0	nState4 (Bit0: *WcState*, Bit1: *InputToggle*)	
			INT32	INC	≥ 0	nDataIn3	
			INT32	INC	≥ 0	nDataIn4	
			INT32	INC	≥ 0	nDataIn5	
			INT32	INC	≥ 0	nDataIn6	
			UINT8	1	≥ 0	nState5	
			UINT8	1	≥ 0	nState6	
			UINT8	1	≥ 0	nState7	
			UINT8	1	≥ 0	nState8	
			INT32	[ns]	≥ 0	nDcInputTime (absolute/ relative *DcInputShift* for deadtime compensation)	
			INT32	1	≥ 0	Reserved	
			} 40 bytes				

Index offset (Hex)	Access	Group type	Data type	Phys. unit	Definition range	Description	Remarks
0x00000080	Read	every (NC→IO), optional 64 bit encoder interface (e.g. MDP513 with 64Bit)	{		STRUCT s. encoder interface	optional ENCODER-INPUT-STRUCTURE (IO→NC, 80 Byte) NCENCODERSTRUCT_IN3	NEW from TC3
			UINT64	INC	≥ 0	nDataIn1	
			UINT64	INC	≥ 0	nDataIn2	
			UINT64	INC	≥ 0	nDataIn3	
			UINT64	INC	≥ 0	nDataIn4	
			UINT64	INC	≥ 0	nDataIn5	
			UINT64	INC	≥ 0	nDataIn6	
			UINT64	INC	≥ 0	nDataIn7	
			UINT64	INC	≥ 0	nDataIn8	
			UINT16	1	≥ 0	nState1	
			UINT16	1	≥ 0	nState2	
			UINT16	1	≥ 0	nState3	
			UINT16	1	≥ 0	nState4	
			UINT16	1	≥ 0	nState5	
			UINT16	1	≥ 0	nComState (Bit0: *WcState*, Bit1: *InputToggle*)	
			INT32	[ns]	≥ 0	nDcInputTime (absolute/ relative *DcInputShift* for deadtime compensation)	
			} 80 bytes				

6.4.6 Specification Controller

6.4.6.1 "Index offset" specification for controller parameter (Index group 0x6000 + ID)

Index offset (Hex)	Access	Controller type	Data type	Phys. unit	Definition range	Description	Remarks
0x00000001	Read	every	UINT32	1	[1 ... 255]	Controller ID	
0x00000002	Read	every	UINT8[30+1]	1	30 symbol	Controller name	
0x00000003	Read	every	UINT32	1	s. ENUM (>0)	Controller type [▶ 155]	
0x0000000A	Read/Write	every	UINT32	1	s. ENUM (>0)	Controller mode	DEFAULT: 1=STANDARD
0x0000000B	Read/Write	every	REAL64	%	[0.0 ... 1.0]	Weight of the velocity pre control (standard value: 1.0 = 100 %)	
0x00000010	Read/Write	every	UINT16	1	0/1	Following error monitoring positon?	
0x00000011	Read/Write	every	UINT16	1	0/1	Following error monitoring velocity?	
0x00000012	Read/Write	every	REAL64	mm	[0.0…1.0E.6]	Max. following error position	
0x00000013	Read/Write	every	REAL64	s	[0.0...600]	Max. following error time position	
0x00000014	Read/Write	every	REAL64	mm/s	[0.0…1.0E.6]	Max. following error velocity	
0x00000015	Read/Write	every	REAL64	s	[0.0…1.0E.6]	Max. following error time velocity	
0x00000021	Read/Write	every	REAL64	1	[0.0...1000000.0]	Scaling factor (multiplier) for position differences between master and slave axis (conversion in the same coordinate system)	Reserved function, no standard!
0x00000100	Read/Write	P/PID (Pos., (velocity)	REAL64	1	[0.0...1.0]	Maximum output limitation ( ) for controller total output	(Standard value: 0.5 == 50%)
0x00000102	Read/Write	P/PID (Pos.)	REAL64	mm/s/ mm	[0.0...1000.0]	Proportional amplification factor k_p resp. k_v	Base unit / s / base unit position control
0x00000103	Read/Write	PID (Pos.)	REAL64	s	[0.0 ... 60.0]	Integral action time Tn	Position control
0x00000104	Read/Write	PID (Pos.)	REAL64	s	[0.0 ... 60.0]	Derivative action time Tv	position control
0x00000105	Read/Write	PID (Pos.)	REAL64	s	[0.0 ... 60.0]	Damping time Td	Position control
0x00000106	Read/Write	PP (Pos.)	REAL64	mm/s/ mm	[0.0...1000.0]	Add proportional amplification factor kp resp. kv that applies above a limit velocity in percent.	Base unit / s / base unit position control
0x00000107	Read/Write	PP (Pos.)	REAL64	%	[0.0...1.0]	Threshold level velocity in percent, above which the additional proportional amplification factor kp resp. kv applies.	(Standard value: 0.01 == 1%)
0x00000108	Read/Write	P/PID (Acc.)	REAL64	s	[0.0 ... 100.0]	proportional amplification factor ka	Acceleration pre control
0x0000010A	Read/Write	every	UINT32	1	ENUM	Filter for maximum slope of the nominal velocity (acceleration restricted): 0: Off, 1: Velo, 2: Pos+Velo	Reserved function, no standard!
0x0000010B	Read/Write	every	REAL64	mm/s^2		Filter value for the maximum slope of the nominal velocity (max. acceleration)	Reserved function, no standard!
0x0000010D	Read/Write	P/PID	REAL64	mm	[0.0 ... 10000.0]	'dead band' for position error (position deviation) (for P/PID-controller with velocity or torque interface)	Reserved function

Index offset (Hex)	Access	Controller type	Data type	Phys. unit	Definition range	Description	Remarks
0x0000010F	Read/Write	P/PP/PID (Pos.) slave-control	REAL64	(mm/s) / mm	[0.0...1000.0]	Slave coupling control: Proportional gain k_{cp} for position deviation between master and slave	Slave coupling control
0x00000110	Read/Write	P (Pos.)	UINT16	1	0/1	Automatic offset calibration: active/passive	
0x00000111	Read/Write	P (Pos.)	UINT16	1	0/1	Automatic offset calibration: hold mode	
0x00000112	Read/Write	P (Pos.)	UINT16	1	0/1	Automatic offset calibration: fading mode	
0x00000114	Read/Write	P (Pos.)	REAL64	%	[0.0 ... 1.0]	Automatic offset calibration: pre control limit	(Standard value: 0.05 == 5%)
0x00000115	Read/Write	P (Pos.)	REAL64	s	[0.1 ... 60.0]	automatic offset calibration: time constant	
0x00000116	Read/Write	PID (Pos.)	REAL64	%	[0.0...1.0]	Maximum output limitation ( ) for I- part in percent (default setting: 0.1 == 10 %)	
0x00000117	Read/Write	PID (Pos.)	REAL64	%	[0.0...1.0]	Maximum output limitation ( ) for D- part in percent (default setting: 0.1 == 10 %)	
0x00000118	Read/Write	PID (Pos.)	UINT16	1	0/1	Switch off the I-part during an active positioning process (as far as I-part active)? (default setting: 0 = FALSE)	
0x00000120	Read/Write	P/PID (Pos.)	REAL64	s	≥0	PT-1 filter time for position error (position-difference)	Reserved function, no standard!
0x00000202	Read/Write	P/PID (velocity)	REAL64	1	[0.0...1000.0]	Proportional amplification factor k_p resp. k_v	Velocity control
0x00000203	Read/Write	PID (velocity)	REAL64	s	[0.0 ... 60.0]	Integral-action time T_n	Velocity control
0x00000204	Read/Write	PID (velocity)	REAL64	s	[0.0 ... 60.0]	Derivative action time T_v	Velocity control
0x00000205	Read/Write	PID (velocity)	REAL64	s	[0.0 ... 60.0]	Damping timeT_d	Velocity control
0x00000206	Read/Write	PID (velocity)	REAL64	%	[0.0...1.0]	Maximum output limitation ( ) for I-part in percent (default setting: 0.1 == 10 %)	Velocity control
0x00000207	Read/Write	PID (velocity)	REAL64	%	[0.0...1.0]	Maximum output limitation ( ) for D-part in percent (default setting: 0.1 = 10 %)	Velocity control
0x0000020D	Read/Write	P/PID (velocity)	REAL64	mm/s	[0.0 ... 10000.0]	'dead band' for velocity error (velocity deviation) (for P/PID-controller with velocity or torque interface)	Reserved function
0x00000220	Read/Write	P/PID (velocity)	REAL64	s	≥0	PT-2 filter time for velocity error (velocity-difference)	Velocity control, no standard!
0x00000221	Read/Write	P/PID (velocity)	REAL64	s	≥0	PT-1 filter time for velocity error (velocity-difference)	Reserved function, no standard!

Index offset (Hex)	Access	Controller type	Data type	Phys. unit	Definition range	Description	Remarks
0x00000250	Read/Write	P/PI (observer)	UINT32	1	s. ENUM (≥0)	OBSERVER mode [▶ 155] for controller with torque interface 0: OFF (default) 1: LUENBERGER	
0x00000251	Read/Write	P/PI (observer)	REAL64	Nm / A	>0.0	Motor: torque constant K_T	
0x00000252	Read/Write	P/PI (observer)	REAL64	kg m^2	>0.0	Motor: moment of inertia J_M	
0x00000253	Read/Write	P/PI (observer)	REAL64	Hz	[100.0 ... 2000.0] Default: 500	Bandwidth f_0	
0x00000254	Read/Write	P/PI (observer)	REAL64	1	[0.0 ... 2.0] Default: 1.0	Correction factor k_c	
0x00000255	Read/Write	P/PI (observer)	REAL64	s	[0.0 ... 0.01] Default: 0.001	Velocity filter (1. order): filter time constant T	
0x00000A03	Read/Write	PID (MW)	REAL64	cm^2	[0.0 ...1000000]	Cylinder area A_A of side A in cm^2	
0x00000A04	Read/Write	PID (MW)	REAL64	cm^2	[0.0 ...1000000]	Cylinder area A_B of side B in cm^2	
0x00000A05	Read/Write	PID (MW)	REAL64	cm^3/s	[0.0 ...1000000]	Nominal volume flow Q_{nenn} in cm^3/s	
0x00000A06	Read/Write	PID (MW)	REAL64	bar	[0.0 ...1000000]	nominal pressure resp. valve pressure reduction P_{nenn} in bar	
0x00000A07	Read/Write	PID (MW)	UINT32	1	[1 ... 255]	Axis ID for the system pressure P_o	

6.4.6.2 "Index offset" specification for controller state (Index group 0x6100 + ID)

Index offset (Hex)	Access	Controller type	Data type	Phys. unit	Definition range	Description	Note
0x00000001	Read	every	INT32			Error state controller	
0x00000002	Read	every	REAL64	e.g. mm/s		Controller output in absolute units	Base Unit / s *Symbolic access possible! "CtrlOutput"*
0x00000003	Read	every	REAL64	%		Controller output in percent	Cannot be traced by oscilloscope!
0x00000004	Read	every	REAL64	V		Controller output in volts	Cannot be traced by oscilloscope!
0x0000000D	Read	every	REAL64	mm		Following error position (without dead time compensation)	Base Unit
0x0000000E	Read	every	REAL64	mm		Following error position (without set position correction)	Base Unit
0x0000000F	Read	every	REAL64	mm		Following error position (with set position correction and dead time compensation)	Base Unit *Symbolic access possible! "PosDiff"*
0x00000010	Read	every	REAL64	mm		Peak hold value for maximum negative following error of the position	Base Unit
0x00000011	Read	every	REAL64	mm		Peak hold value for minimum positive following error of the position	Base Unit
0x00000012	Read	every	REAL64	mm/s		Following error velocity	Base Unit / s
0x00000021	Read	every	REAL64	mm		Difference (deviation) between the following error from master and slave axis (master error minus slave error)	Base Unit *Symbolic access possible via axis!* *"PosDiffCouple"*
0x00000022	Read	every	REAL64	mm		PeakHold value for the maximum negative difference between master and slave axis following error of the position	Base Unit
0x00000023	Read	every	REAL64	mm		PeakHold value for the maximum positive difference between master and slave axis following error of the position	Base Unit
0x00000101	Read	P/PID (pos.)	REAL64	e.g. mm/s		P-part of the controller in absolute units	
0x00000102	Read	PID (pos.)	REAL64	e.g. mm/s		I-part of the controller in absolute units	
0x00000103	Read	PID (pos.)	REAL64	e.g. mm/s		D-part of the controller in absolute units	
0x00000104	Read	PID (pos.)	UINT16	1	0/1	Limitation of the I-part active?	
0x00000105	Read	PID (pos.)	UINT16	1	0/1	Limitation of the D-part active?	
0x00000106	Read	PID (pos.)	UINT16	1	0/1	ARW measures for the I-part active?	ARW: Anti Reset Windup

Index offset (Hex)	Access	Controller type	Data type	Phys. unit	Definition range	Description	Note
0x0000010F	Read	P/PP/PID (veloc.)	REAL64	e.g. mm/s		Proportion of automatic offset compensation in absolute units	NEW
0x00000110	Read	PID (pos.)	REAL64	e.g. mm/s		Acceleration pre-control Y_{acc} of the controller in absolute units Note: function depends on controller type!	Acceleration pre-control
0x00000111	Read	PP (Pos.)	REAL64	mm/s/mm	≥0	Internal interpolated proportional gain kp or kv	PP controller
0x0000011A 0x0000011B 0x0000011C 0x0000011D 0x0000011E 0x0000011F 0x00000120 0x00000121 0x00000122 0x00000123 0x00000124	Read	P (Pos.)	UINT32 REAL64 REAL64 REAL64 REAL64 REAL64 REAL64 REAL64 REAL64 REAL64 REAL64	1 mm mm/s mm/s mm/s^2 mm mm mm/s mm/s^2 mm/s mm/s^2		Set velocity filter: InternalPhase InternalPosSollError! TestVeloSoll InternalLimitedVeloSoll InternalAccSollRel InternalPosSollRel PosSollCorrected! VeloSollCorrected! AccSollCorrected! TestVeloSollCorrected TestAccSollCorrected	List!Reserved function, no standard!
0x00000201	Read	P,PID (velocity)	REAL64	e.g. mm/s		Velocity part of the controller	Base Unit / s
0x00000202	Read	P,PID (velocity)	REAL64	%		Velocity part of the controller in percent	Cannot be traced by oscilloscope!
0x00000203	Read	P,PID (velocity)	REAL64	V		Velocity part of the controller in volts	Cannot be traced by oscilloscope!
0x00000201	Read	P/PID (velocity)	REAL64	e.g. mm/s		P-part of the controller in absolute units	
0x00000202	Read	P/PID (velocity)	REAL64	e.g. mm/s		I-part of the controller in absolute units	
0x00000203	Read	P/PID (velocity)	REAL64	e.g. mm/s		D-part of the controller in absolute units	
0x00000204	Read	P/PID (velocity)	UINT16	1	0/1	Limitation of the I-part active?	
0x00000205	Read	P/PID (velocity)	UINT16	1	0/1	Limitation of the D-part active?	
0x00000206	Read	P/PID (velocity)	UINT16	1	0/1	ARW measures for the I-part active?	ARW: Anti Reset Windup
0x0000020A	Read	P/PID (velocity)	REAL64	e.g. mm/s		Total input size of the velocity controller	
0x00000250	Read	P/PI (observer)	REAL64	e.g. mm		Observer: position difference (actual position - observer position	
0x00000251	Read	P/PI (observer)	REAL64	e.g. mm		Observer: position	
0x00000252	Read	P/PI (observer)	REAL64	e.g. mm/s		Observer: velocity 2 (for P-part)	
0x00000253	Read	P/PI (observer)	REAL64	e.g. mm/s		Observer: velocity 1 (for I-part)	
0x00000254	Read	P/PI (observer)	REAL64	e.g. mm/s^2		Observer: acceleration	

Index offset (Hex)	Access	Controller type	Data type	Phys. unit	Definition range	Description	Note
0x00000255	Read	P/PI (observer)	REAL64	A		Observer: motor actual current	
0x00000256	Read	P/PI (observer)	UINT16	1	0/1	Observer: limitation of the I-part active?	
0x00000A00	Read	PID (MW)	REAL64	%	[-1.0...1.0]	Calculation of the set velocity (pre-control) in percent	
0x00000A01	Read	PID (MW)	REAL64	e.g. mm/s		P-part of the controller in absolute units or percent (according to output weight)	
0x00000A02	Read	PID (MW)	REAL64	e.g. mm/s		I-part of the controller in absolute units or percent (according to output weight)	
0x00000A03	Read	PID (MW)	REAL64	e.g. mm/s		D-part of the controller in absolute units or percent (according to output weight)	
0x00000A04	Read	PID (MW)	UINT16	1	0/1	Limitation of the I-part active?	
0x00000A05	Read	PID (MW)	UINT16	1	0/1	Limitation of the D-part active?	
0x00000A10	Read	PID (pos.)	REAL64	e.g. mm/s		Acceleration pre-control Y_{acc} of the controller in absolute units	Acceleration pre-control

6.4.6.3 "Index offset" specification for controller functions (Index group 0x6200 + ID)

Index offset (Hex)	Access	controller type	Data type	Phys. unit	Definition range	Description	Remarks

6.4.7 Specification Drive

6.4.7.1 "Index offset" specification for drive parameter (Index group 0x7000 + ID)

Index offset (Hex)	Access	Drive type	Data type	Phys. Unit	Definition range	Description	Note
0x00000001	Read	every	UINT32	1	[1 ... 255]	Drive ID	
0x00000002	Read	every	UINT8[30+1]	1	30 characters	Drive name	
0x00000003	Read	every	UINT32	1	s. ENUM (>0)	Drive type [▶ 160]	
0x00000004	Read/Write	every	UINT32	1	Byteoffset	Input address offset (IO-Input-Image)	change I/O address
0x00000005	Read/Write	every	UINT32	1	Byteoffset	Output address offset (IO-Output-Image)	change I/O address
0x00000006	Read/Write	every	UINT16	1	[0,1]	motor polarity	Writing is not allowed if the controller enable has been issued.
0x0000000A	Read/Write	every	UINT32	1	s. ENUM (>0)	drive mode	Default: 1 = STANDARD
0x0000000B	Read/Write	every	REAL64	%	[-1.0 ... 1.0]	Minimum output limit (output limitation) (default setting: -1.0 == -100%)	
0x0000000C	Read/Write	every	REAL64	%	[-1.0 ... 1.0]	Maximum output limit (output limitation) (default setting: 1.0 == 100%)	
0x0000000D	Read	every	UINT32	INC		Maximum number of output increments (output mask)	
0x00000010	Read/Write	every	UINT32	1		Internal Drive Control double word to determine the drive operation modes	Reserved!
0x00000011	Read/Write	every	UINT32	1	≥ 5	Internal drive reset counter (time in NC cycles for enable and reset)	Reserved!
0x00000020	Read/Write	every	UINT32	1	see ENUM (≥0) see appendix	Drive dead time compensation mode 0: Off (default) 1: On (with velocity) 2: On (with velocity and acceleration)	
0x00000021	Read/Write	every	UINT32	1		Control double word (32 bits) for the drive dead time compensation: Bit 0 = 0: relative IO times (default) Bit 0 = 1: absolute IO times	
0x00000022	Read/Write	every	INT32	ns	[±1.0E+9]	Sum of the parameterized time shifts for the drive dead time compensation (typically positive numerical values)	
0x00000031	Read/Write	every	REAL64	e.g. %/ INC	[-1.0E+30 ... 1.0E+30]	Scaling factor for actual torque value of drive (or actual value of force or current respectively) e.g. AX5xxx: 0.1 => ±100%	NEW from TC3.1

Index offset (Hex)	Access	Drive type	Data type	Phys. Unit	Definition range	Description	Note
0x00000032	Read/Write	every	REAL64	s	[0.0 ... 60.0]	P-T1 filter time for actual torque value (or actual value of force or current respectively)	NEW from TC3.1
0x00000033	Read/Write	every	REAL64	s	[0.0 ... 60.0]	P-T1 filter time for temporal derivation of the actual torque value (or actual value of force or current respectively)	NEW from TC3.1
0x00000101	Read/Write	Servo	REAL64	e.g. mm/s	>0.0	Reference velocity at reference output (velocity pre-control)	Base Unit / s
0x00000102	Read/Write	Servo	REAL64	%	[0.0 ... 5.0]	reference output in percent	
0x00000103	Read	Servo	REAL64	e.g. mm/s	>0.0	resulting velocity at 100% output	Base Unit / s
0x00000104	Read/Write	Servo	REAL64	e.g. mm/s	±∞	velocity offset (DAC offset) for drift calibration (offset calibration) of the axis	Base Unit / s
0x00000105	Read/Write	Servo (Sercos, Profi Drive, AX200x, CANopen)	REAL64	1	[0.0 ... 100000000.0]	velocity scaling (scaling factor to react to the weight in the drive)	For Sercos, Profi Drive, AX200x, CANopen
0x00000106	Read/Write	Profi Drive DSC	UINT32	0.001 * 1/s	≥ 0	Profibus/Profi Drive DSC: position control gain Kpc	Only for Profi Drive DSC
0x00000107	Read/Write	Profi Drive DSC	REAL64	1	≥ 0.0	Profibus/Profi Drive DSC: scaling for calculating 'XERR' (Default: 1.0)	Only for Profi Drive DSC
0x00000109	Read/Write	Servo	REAL64	1	[0.0 ... 100000000.0]	Position scaling (scaling factor to react to the weight in the drive)	For Sercos, CANopen
0x0000010A	Read/Write	Servo	REAL64	1	[0.0 ... 100000000.0]	Acceleration scaling (scaling factor to react to the weight in the drive)	For Sercos, Profi Drive, AX200x, CANopen
0x0000010B	Read/Write	Servo	REAL64	1	[0.0 ... 100000000.0]	Torque scaling (rotary motor) or force scaling (linear motor) (scaling factor for reacting to weighting in the drive) for "TorqueOffset" (additive moment as pre-control)	For Sercos, Profi Drive, AX200x, CANopen
0x0000010C	Read/Write	Servo	REAL64	1	[0.0 ... 100000000.0]	Torque scaling (rotary motor) or force scaling (linear motor) (scaling factor for reacting to weighting in the drive) for "SetTorque" (e.g. MC_TorqueControl) with Drive OpMode CST)	For Sercos, Profi Drive, AX200x, CANopen From TC 3.1 B4024.2
0x0000010D	Read/Write	Servo (Sercos, CANopen)	REAL64	s	[0.0 ... 1.0]	Damping time for drive velocity output	For Sercos, CANopen
0x0000010E	Read/Write	Servo (Sercos, CANopen)	REAL64	s	[0.0 ... 1.0]	Damping time for drive acceleration output	For Sercos, CANopen
0x0000010F	Read/Write	Servo (Sercos, CANopen)	REAL64	s	[0.0 ... 1.0]	Damping time for drive torque output or force output	For Sercos, CANopen

Index offset (Hex)	Access	Drive type	Data type	Phys. Unit	Definition range	Description	Note
0x00000120	Read/Write	Servo/ hydraulics/	UINT32	1	≥ 0	Table ID (0: no table)	Only for KL4xxx, M2400, Universal
0x00000121	Read/Write	Servo/ hydraulics	UINT32	1	≥ 0	Interpolation type 0: Linear 2: Spline	Only for KL4xxx, M2400, Universal
0x00000122	Read/Write	Servo/ hydraulics	REAL64	%	[-1.0 ... 1.0]	Output offset in percent Note: Acts according to the characteristic evaluation!	Only for KL4xxx, M2400, Universal
0x00000151	Read/Write	Servo / non-linear	REAL64	1	[0.0 ... 100.0]	Quadrant compensation factor (relationship between quadrant I and III)	
0x00000152	Read/Write	Servo / non-linear	REAL64	1	[0.01 ... 1.0]	Velocity reference point in percent (1.0 == 100 %)	
0x00000153	Read/Write	Servo / non-linear	REAL64	1	[0.01 ... 1.0]	Output reference point in percent (1.0 == 100%)	
0x00000301	Read/Write	Stepper motor	UINT8			Bit mask: cycle 1	
0x00000302	Read/Write	Stepper motor	UINT8			Bit mask: cycle 2	
0x00000303	Read/Write	Stepper motor	UINT8			Bit mask: cycle 3	
0x00000304	Read/Write	Stepper motor	UINT8			Bit mask: cycle 4	
0x00000305	Read/Write	Stepper motor	UINT8			Bit mask: cycle 5	
0x00000306	Read/Write	Stepper motor	UINT8			Bit mask: cycle 6	
0x00000307	Read/Write	Stepper motor	UINT8			Bit mask: cycle 7	
0x00000308	Read/Write	Stepper motor	UINT8			Bit mask: cycle 8	
0x00000310	Read/Write	Stepper motor	UINT8			Bit mask: holding current	

6.4.7.2 "Index offset" specification for drive state (Index group 0x7100 + ID)

Index offset (Hex)	Access	Drive type	Data type	Phys. unit	Definition range	Description	Note
0x00000001	Read	every	INT32			Error state drive	
0x00000002	Read	every	REAL64	e.g. mm/s		Total output in absolute units	Base unit / s *Symbolic access possible!* "DriveOutput"
0x00000003	Read	every	REAL64	%		Total output in percent	
0x00000004	Read	every	REAL64	V		Total output in volts	Cannot be traced by oscilloscope!
0x00000005	Read	every	REAL64	e.g. mm/s		PeakHold value for maximum negative total output	Base Unit / s
0x00000006	Read	every	REAL64	e.g. mm/s		PeakHold value for maximum positive total output	Base Unit / s
0x00000007	Read	every	REAL64	e.g. 100% = 1000, e.g. Nm or N		Actual torque or actual force respectively (typically 100% = 1000)	from TC3.1 B4022 *Symbolic access possible!* "ActTorque"
0x00000008	Read	every	REAL64	e.g. Nm/s or N/s	±∞	Actual torque change or actual force change respectively (time derivative of the actual torque or actual force respectively)	from TC3.1 B4024
0x0000000C	Read	every	REAL64	e.g. mm		Set position correction value for drive output on account of dead time compensation	
0x0000000D	Read	every	REAL64	s		Sum of the time shifts for drive dead time compensation (parameterized and variable dead time) Note: a dead time is specified in the system as a positive value.	
0x00000013	Read	every	REAL64	%		Total output in percent (based on non-linear characteristic curve!)	
0x00000014	Read	every	REAL64	V		Total output in volt (based on non-linear characteristic curve!)	Cannot be traced by oscilloscope!
0x0000011A	Read	Servo (Sercos, CANopen)	REAL64	e.g. mm		Optional output filtering: Filtered set position	NEW For Sercos, CANopen
0x0000011E	Read	Servo (Sercos, CANopen)	REAL64	e.g. mm/s		Optional output filtering: Filtered set velocity	NEW For Sercos, CANopen
0x0000011F	Read	Servo (Sercos, CANopen)	REAL64	e.g. mm/s^2		Optional output filtering: Filtered set acceleration / set deceleration	NEW For Sercos, CANopen

Index offset (Hex)	Access	Drive type	Data type	Phys. unit	Definition range	Description	Note
0x00000200	ReadWrite		**READ:**			Reading the state of the digital inputs 1 to 8	from TC3.1 B4024.12
			UINT32	1	0/1	State of the selected input	Only for SAF-Port 501!
			WRITE:				
			UINT32	1	[1…8]	Selection of input 1 to 8	

6.4.7.3 "Index offset" specification for drive functions (Index group 0x7200 + ID)

Index offset (Hex)	Access	Drive type	Data type	Phys. unit	Definition range	Description	Remarks
0x00000102	Write	SERVO	{			Remove and delete the characteristic drive table	Only for SAF-port 501!
			ULONG	1	>0	Table-ID s.a. axis function with index offset 0x00000012	
			}				

6.4.7.4 "Index offset" specification for cyclic drive process data (Index group 0x7300 + ID)

Index offset (Hex)	Access	Drive type	Data type	Phys. unit	Definition range	Description	Remarks
0x00000000	Read/Write	every (NC→IO)	{		STRUCT s. drive interface	DRIVE-OUTPUT-STRUCTURE (NC→IO, 40 Byte) *NCDRIVESTRUCT_OUT 2*	Write command only optional! Consider safety aspects!
			INT32	INC	≥ 0	nOutData1	
			INT32	INC	2^31	nOutData2	
			UINT8	1	≥ 0	nControl1	
			UINT8	1	≥ 0	nControl2	
			UINT8	1	≥ 0	nControl3	
			UINT8	1	≥ 0	nControl4	
			INT32	INC	≥ 0	nOutData3	
			INT32	INC	≥ 0	nOutData4	
			INT32	INC	≥ 0	nOutData5	
			INT32	INC	≥ 0	nOutData6	
			UINT8	1	≥ 0	nControl5	
			UINT8	1	≥ 0	nControl6	
			UINT8	1	≥ 0	nControl7	
			UINT8	1	≥ 0	nControl8	
			INT32	1	≥ 0	Reserved	
			INT32	1	≥ 0	Reserved	
			}				
0x00000001	Write	every (NC→IO)	{		STRUCT s. drive interface	Bitwise access to DRIVE-OUTPUT-STRUCTURE (NC→IO, 40 Byte) *NCDRIVESTRUCT_OUT 2*	Write command only optional! Consider safety aspects
			UINT32	1	[0 … 39]	ByteOffset Relative address offset [0..39] in output structure. E.G.: To write “nControl1” the ByteOffset must be 8.	
			UINT32	1	[0x00000000… 0xFFFFFFFF]	BitSelectMask (BSM) The mask defines write enabled bits in a DWORD. Zero bits are protected and remain unaffected.	
			UINT32	1	[0x00000000… 0xFFFFFFFF]	Value Only those bits in value are overwritten where BSM equals 1.	
			}				

Index offset (Hex)	Access	Drive type	Data type	Phys. unit	Definition range	Description	Remarks
0x00000080	Read	every (IO→NC)	{		STRUCT s. drive interface	DRIVE-INPUT-STRUCTURE (IO→NC, 40 Byte) *NCDRIVESTRUCT_IN2*	
			INT32	INC	≥ 0	nInData1	
			INT32	INC	≥ 0	nInData2	
			UINT8	1	≥ 0	nStatus1	
			UINT8	1	≥ 0	nStatus2	
			UINT8	1	≥ 0	nStatus3	
			UINT8	1	≥ 0	nStatus4	
			INT32	INC	≥ 0	nInData3	
			INT32	INC	≥ 0	nInData4	
			INT32	INC	≥ 0	nInData5	
			INT32	INC	≥ 0	nInData6	
			UINT8	1	≥ 0	nStatus5	
			UINT8	1	≥ 0	nStatus6	
			UINT8	1	≥ 0	nStatus7	
			UINT8	1	≥ 0	nStatus8	
			INT32	1	≥ 0	Reserved	
			INT32	1	≥ 0	Reserved	
			}				

6.4.8 Specification Tables

6.4.8.1 "Index offset" specification for table parameter (Index group 0xA000 + ID)

Index offset (Hex)	Access	table type	Data type	Phys. unit	Definition range	Description	Remarks
0x00000001	Read	every	UINT32	1	[1 ... 255]	Table ID	
0x00000002	Read	every	UINT8[30+1]	1	30 symbol	Table name	
0x00000003	Read	every	UINT32	1	s. ENUM (>0)	Table sub type [▶ 162]	
0x00000004	Read	every	UINT32	1	s. ENUM (>0)	Table main type [▶ 162]	
0x00000010	Read	every	UINT32	1	[0... 16777216]	Number of lines (n)	
0x00000011	Read	every	UINT32	1	[0... 16777216]	Number of columns (m)	
0x00000012	Read	every	UINT32	1	≥0	Number of total elements (n*m)	
0x00000013	Read	equidistant Tab.	REAL64	e.g. mm	≥0.0	Step width (position delta) (equidistant table)	Base unit
0x00000014	Read	cyclic Tab.	REAL64	e.g. degree	≥0.0	Master period (cyclic table)	Base unit
0x00000015	Read	cyclic Tab.	REAL64	e.g. degree	≥0.0	Slave difference per master period (cyclic table)	Base unit
0x0000001A	Read /Write	"Motion Function"	{			Activation mode for online change from table data (only MF)	
			UINT32	ENUM	s. appendix	Activation mode: 0: 'instantaneous' (default) 1: 'master cam pos.' 2: 'master' axis pos.' 3: 'next cycle' 4: 'next cycle once' 5: 'as soon as possible' 6: 'off' 7: 'delete queued data'	
			REAL64	e.g. mm	±∞	Activation position	
			UINT32	ENUM	s. appendix	Master scaling type 0: user defined (default) 1: scaling with auto offset 2: off	
			UINT32	ENUM	s. appendix	Slave scaling type 0: user defined (default) 1: scaling with auto offset 2: off	
			}				
0x00000020	Read /Write	every	{			Write single value [n,m]:	
			UINT32	1	[0 ... 16777216]	n-th line	
			UINT32	1	[0 ... 16777216]	m-th column	
			REAL64	e.g. mm	±∞	Single value	Base unit
			}				
0x00000021	ReadWrite	every	*REAL64	e.g. mm	±∞	Read slave position to the given master position (relates only to the "row values" of the table)	

Index offset (Hex)	Access	table type	Data type	Phys. unit	Definition range	Description	Remarks
0x00000022	ReadWrite	"Motion Function"	**Write**			Read the "Motion Function" as fixed values ("scatter plot")	Only line by line possible! (multiple integer)
			{				
			UINT16	1	0/1	Initialization of data (copy of actual data)?	
			UINT16	1	Bitmask (≥0)	Select bit mask (number of columns is one column for the master position plus number of bits): Bit 0: Pos (Slave) Bit 1: Velo (Slave) Bit 2: Acc (Slave) Bit 3: Jerk (Slave)	
			REAL64	e.g. mm	±∞	Startposition (Master)	
			REAL64	e.g. mm	> 0.0	Inkrement	
			}				
			Read				
			{				
			REAL64[x*m]	e.g. mm	±∞	Generating the values of x rows beginning with the master start position: (x*m)-values (one or more rows)	
			}				
0x00000023	ReadWrite	every	**Write**			Read slave values to given master position (relates only to the "row values" of the table)	
			REAL64	e.g. mm	±∞	Master position	
			Read				
			{				
			REAL64	e.g. mm	±∞	Slave position	
			REAL64	mm/s	±∞	Slave velocity	
			REAL64	mm/s^2	±∞	Slave acceleration	
			}				
0x00000050	Read /Write	every	REAL64 [64]	1	±∞	Characteristic table values [▶ 164]	
0x00000050	ReadWrite	every	**Write**			Read the characteristic table values in dependency to the nominal master velocity	
			REAL64 [64]	...	±∞	Optional nominal master velocity "fMasterVeloNom" (normed => 1.0 mm/s), the other values are not used	
			Read				
			REAL64 [64]	...	±∞	Read the characteristic table values [▶ 164]	

Index offset (Hex)	Access	table type	Data type	Phys. unit	Definition range	Description	Remarks
0x00000115	Write	monoton linear, monoton zykl.,	{			Set/change the table scaling:	
			REAL64	1	[±1000000.0]	Original wightning of the table	
			REAL64	e.g. mm	[±1000000.0]	Position offset of the master column	
			REAL64	1	[±1000000.0]	Scaling of the master column	
			REAL64	e.g. mm	[±1000000.0]	Position offset of the slave column	
			REAL64	1	[±1000000.0]	Scaling of the slave column	
			REAL64	e.g. mm	[±1000000.0]	Lower area boundary (start position)	
			REAL64	e.g. mm	[±1000000.0]	Upper area boundary (end position)	
			}				
0x01000000 +n-te start line	Read/ Write[<=16777216]	every	{ REAL64[x*m] }	e.g. mm	±∞	Read/write x lines from the n-th line: (x*m)-values (one or more lines)value range n: [0 ... 16777216]	Only line by line possible! (multiple integer)
0x02000000 +m-te Startspold	Read/ Write[<=16777216]	every	{ REAL64[x*n] }	e.g. mm	∞	Read/write x columns from m-th column: (x*n)-values (one or more columns)value range m: [0 ... 16777216]	Only column by column possible! (multiple integer)
0x05000000 +n-te start line	Read/ Write[<=16777216]	"Motion Function"(law of motion)Data:STRUCT[x*m]	{			Read/write x lines from the n-th line: (x*m)-values (one or more lines) value range n: [0 ... 16777216]	Only line by line possible! (multiple integer)
			UINT32	1		Absolute point index (not checked)	
			UINT16	ENUM		Function type 1: Polynom 1 15: Polynom 5	
			UINT16	ENUM		Point type 0: default 1: ignore	
			INT32	1		Relative address index to target point (default: 1)	
			REAL64	mm		Master position	
			REAL64	mm		Slave position	
			REAL64	mm/s		Slave velocity	
			REAL64	mm/s^2		Slave acceleration	
			REAL64	mm/s^3		Slave jerk	
			}				

Index offset (Hex)	Access	table type	Data type	Phys. unit	Definition range	Description	Remarks
0x06000000 +m-te Startspold	Read/ Write[<=16777216]	"Motion Function"(law of motion)Data:STRUCT[x*n]	{			Read/write x columns from m-th column: (x*n)-values (one or more columns)value range m: [0 ... 16777216]	Only column by column possible! (multiple integer)
			UINT32	1		Absolute point index (not checked)	
			UINT16	ENUM		Function type 1: Polynom 1 15: Polynom 5	
			UINT16	ENUM		Point type 0: default 1: ignore	
			INT32	1		Relative address index to target point (default: 1)	
			REAL64	mm		Master position	
			REAL64	mm		Slave position	
			REAL64	mm/s		Slave velocity	
			REAL64	mm/s^2		Slave acceleration	
			REAL64	mm/s^3		Slave jerk	
			}				

6.4.8.2 "Index offset" specification for table state (Index group 0xA100 + ID)

Index offset (Hex)	Access	Table type	Data type	Phys. unit	Definition range	Description	Remarks
0x0000000A	Read	every	INT32	1	≥ 0	'User Counter' (number of table user)	Cannot be traced by oscilloscope!

6.4.8.3 "Index offset" specification for table functions (Index group 0xA200 + ID)

Index offset (Hex)	Access	Table type	Data type	Phys. unit	Definition range	Description	Remarks
0x00010000	Write	every	{			Generates table with dimension (n*m):	Table types: 1,2,3,4 Dimension: at least 2x1
			UINT32	1	s. ENUM (>0)	Table type [▶ 162] (s. appendix)	
			UINT32	1	[2...16777216]	Quantity of lines	
			UINT32	1	[1...16777216]	Quantity of columns	
			}				
0x00010001	Write	valve diagram	{			Generates valve diagram table with dimension (n*m):	Table types: 1,3 Dimension: at least 2x1
			UINT32	1	s. ENUM (>0)	Table type [▶ 162] (s. appendix)	
			UINT32	1	[2...16777216]	Quantitiy of lines	
			UINT32	1	[1...16777216]	Quantitiy of columns	
			}				
0x00010010	Write	"Motion Function" (law of motion)	{			Generates "Motion Function" table with dimension (n*m):	Table types: 3,4 Dimension: at least 2x1
			UINT32	1	s. ENUM (>0)	Table type (s. appendix)	
			UINT32	1	[2...16777216]	Quantity of lines	
			UINT32	1	[1...16777216]	Quantity of columns	
			}				
0x00020000	Write	every	VOID			Deletes table with dimension (n*m)	Table types: 1,2,3,4
0x00030000	Write	every	VOID			Initialized table Initialization is no longer needed, because now it happens automatically in the following casesa) by coupling with table b) by selecting the slave position (s. table para.)	

6.4.9 Appendix

Enum Channel types

Define	Channel types
1	Standard
2	Interpreter
3	FIFO
4	Kinematic transformation

Enum Interpreter types

Define	Interpreter types
0	NOT DEFINED
1	NC Interpreter DIN 66025 (GST)
2	NC Interpreter DIN 66025 (Classic Dialect)

Enum Interpreter Operation modes

Define	interpreter/channel operation mode
0x0	Default (deactivates the other modes)
0x1	Single block mode in the NC core (Block execution task/SAF)
0x1000	reserved
0x2000	reserved
0x4000	Single block mode in the interpreter

Enum Interpolation load log mode

Define	Load log mode
0	Loader log off
1	Source only
2	Source & Compiled

Enum Interpolation Trace mode

Define	Trace mode
0	Trace off
1	Trace line numbers
2	Trace Source

Enum Interpreter state

moved to: System Manager interface for the interpreter - interpreter element

Enum Group types

Define	Group types
0	NOT DEFINED
1	PTP-Group + x Slave
2	1D-Group + x Slave
3	2D-Group + x Slave
4	3D-Group + x Slave
5	High/low speed + x Slave
6	Low cost stepper motor (dig. IO) + x Slave
7	Table Group + x Slave
9	Encoder Group + x Slave
11	FIFO Group + x Slave
12	Kinematic Transformation Group + x Slave

Enum Curve velocity reduction method

moved to: System Manager interface for the interpreter - group element

Enum Axis types

Define	Axis types
0	NOT DEFINED
1	Continuous axis (Servo)
2	Discrete axis (high/low speed)
3	Continuous axis (stepper motor)
5	Encoder axis
6	Continuous axis (with operation mode switch for position/pressure control)
7	Time Base Generator
100	

Enum Stepper motor operation mode

Define	Stepper motor operation mode
0	NOT DEFINED
1	2-phase excitation (4 cycles)
2	1-2-phase excitation (6 cycles)
3	Power section

Enum Override types for PTP axes (velocity override)

Define	Override types
1	Reduced Old variant, replaced by "(3) Reduced (iterated)"
2	Original Old variant, replaced by "(4) Original (iterated)"
3	Reduced (iterated) Default value: the override value is related to the velocity which is internally reduced in a special case. This results in a directly proportional velocity (=> linear relationship) for the entire override range from 0 to 100%.
4	Original (iterated) The override value is always referred to the velocity programmed by the user. If this velocity cannot be driven, however, then a maximum override value results from which no higher velocity can be reached (=> limitation).

Enum Group/axis start types

Define	Group/axis start types
0	NOT DEFINED
1	Absolute start
2	Relative start
3	Continuous start positive
4	Continuous start negative
5	Modulo start (OLD)
261	Modulo start on the shortest distance
517	Modulo start in positive direction (with modulo tolerance window)
773	Modulo start in negative direction (with modulo tolerance window)
4096	Stop and lock (axis locked for motion commands)
8192	Halt (without motion lock)

Enum Command buffer types (buffer mode) for universal axis start (UAS)

Define	Buffer mode
0	ABORTING (default) (instantaneous, aborts current movement and deletes any buffered commands)
1	BUFFERED (stored in command buffer to be executed after an active movement)
18	BLENDING LOW (buffered, no stop, runs through intermediate target position at the lowest velocity of two commands)
19	BLENDING PREVIOUS (buffered, no stop, runs through intermediate target position at the velocity of the active command)
20	BLENDING NEXT (buffered, no stop, runs through intermediate target position at the velocity of the buffered command)
21	BLENDING HIGH (buffered, no stop, runs through intermediate target position at the highest velocity of two commands)

Enum End position types (new end position)

Define	End position types
0	NOT DEFINED
1	Absolute position
2	Relative position
3	Continuous position positive
4	Continuous position negative
5	Modulo position

Enum Command types for new end position with new velocity (new end position and/or new velocity)

Define	Command types for new end position with new velocity
0	NOT DEFINED
1	Position (instantaneous)
2	Velocity (instantaneous)
3	Position and velocity (instantaneous)
9	Position (switching position)
10	Velocity (switching position)
11	Position and velocity (switching position)

Enum Actual position types (set actual position)

Define	Actual position types
0	NOT DEFINED
1	Absolute position
2	Relative position
5	Modulo position

Enum Compensation types (section compensation or superimposed)

Define	Compensation types
0	NOT DEFINED
1	VELOREDUCTION_ADDITIVEMOTION The max. velocity VelocityDiff is reduced. The path over which the compensation trip is effective consists of length + distance.
2	VELOREDUCTION_LIMITEDMOTION The max. velocity VelocityDiff is reduced. The path over which the compensation trip is effective is defined by the Length parameter.
3	LENGTHREDUCTION_ADDITIVEMOTION The max. available path is reduced and consists of length + distance. The system tries to utilize the max. veloc. VelocityDiff.
4	LENGTHREDUCTION_LIMITEDMOTION The max. available path is reduced and is limited by the Length parameter. The system tries to utilize the max. veloc. VelocityDiff.

Enum Slave types

Define	Slave types
0	NOT DEFINED
1	Linear
2	Flying saw (velocity, jerk restricted profile)
3	Flying saw (position and velocity, jerk restricted profile)
5	Synchronization generator (velocity, jerk restricted profile)
6	Synchronization generator (position and velocity, jerk restricted profile)
10	Tabular
11	Multi-tabular
13	'Motion Function' (MF)
15	Linear with cyclic gearing factor change (ramp filter for acceleration limits)
100	Specific

Enum Slave decoupling types (for subsequent axis command)

Define	Slave decoupling types (for subsequent axis command)
0	Stop, E-stop or P-stop (default) (STOP)
1	Oriented stop (O-stop) (ORIENTEDSTOP)
2	Reduce any acceleration to 0 (force-free) and continue to endless target position (ENDLESS)
3	Continue to endless target position at new requested velocity (ENDLESS_NEWVELO)
4	New end position (NEWPOS)
5	New end position and new requested velocity (NEWPOSANDVELO)
6	Logical decoupling and stopping of axis immediately without velocity ramp (INSTANTANEOUSSTOP)

Enum Controller types

Define	Controller types
0	NOT DEFINED
1	P-controller (standard) (Position)
2	PP-controller (with ka) (Position)
3	PID-controller (with ka) (Position)
5	P-controller (Velocity)
6	PI controller (Velocity)
7	High/low speed controller (Position)
8	Stepper motor controller (Position)
9	SERCOS controller (Position in the drive)
10	RESERVED
11	RESERVED
12	RESERVED
13	RESERVED
14	TCom Controller (Soft Drive) (Position in the drive)

Enum Controller Observer mode

Define	Controller observer mode
0	No observer active (default)
1	"Luenberger" observer (classic observer design)

Enum Encoder types

Define	Encoder types
0	NOT DEFINED
1	Simulation Encoder (Incremental)
2	M3000 Encoder (Multi/Single-Turn) (Absolute)
3	M31x0 / M2000 Encoder (Incremental)
4	MDP 511 Encoder: EL7041, EL7342, EL5101, EL5151, EL2521, EL5021, IP5101 (Incremental)
5	MDP 500/501 Enc.: EL5001, IP5009, KL5001 (SSI) (Absolute)
6	MDP 510 Encoder: KL5051, KL2502-30K Encoder (BiSSI) (Incremental)
7	KL30xx Encoder (Analog) (Absolute)
8	SERCOS and EtherCAT SoE (Position) (Incremental)
9	SERCOS and EtherCAT SoE (Position and velocity) (Incremental)
10	Binary encoder (0/1) (Incremental)
11	M2510 Encoder (Absolut)
12	FOX50 Encoder (Absolute)
14	AX2000 (Lightbus) (Incremental)
15	Provi-Drive MC (Simodrive 611U) (Incremental)
16	Universal encoder (variable bit mask) (Incremental)
17	NC rear panel (Incremental)
18	Special CANopen type (e.g. Lenze Drive 9300) (Incremental)
19	MDP 513 (DS402): CANopen and EtherCAT CoE (AX2xx-B1x0/ B510, EL7201) (Incremental)
20	AX2xx-B900 (Ethernet) (Incremental)
21	KL5151 Encoder (Incremental)
24	IP5209 Encoder (Incremental)
25	KL2531/KL2541 Encoder (Stepper Motor) (Incremental)
26	KL2532/KL2542 Encoder (DC motor), KL2535/KL2545 (PWM current terminal) (Incremental)
27	Time base encoder (Time Base Generator) (Incremental)
28	TCom Encoder (Soft Drive) (Incremental)

Enum Encoder mode

Define	Encoder mode
0	NOT DEFINED
1	Determination of position
2	Determination of position and velocity
3	Determination of position, velocity and acceleration

Enum Encoder evaluation direction (log. counting direction)

Define	Encoder evaluation direction (log. counting direction)
0	Evaluation in positive and negative counting direction (default configuration, i.e. compatible with the previous state)
1	Evaluation only in positive counting direction
2	Evaluation only in negative counting direction
3	Evaluation neither in positive nor in negative counting direction (evaluation blocked)

Not for all encoder types; only for KL5101, KL5151, KL2531, KL2541, IP5209, Universal encoder, etc.

	Encoder types		
Encoder evaluation direction (log. counting direction)	KL5101, ...	Universal Encoder	other types
0: positive and negative	√	√	—
1: only positive	√	√	—
2: only negative	√	√	—
3: blocked	√	√	—

Enum Encoder sign interpretation (data type)

Define	Sign interpretation (data type) of the encoder actual increments
0	NOT DEFINED (default configuration, i.e. compatible with the previous state)
1	UNSIGNED: unsigned interpretation of the encoder actual increments
2	SIGNED: signed interpretation of the encoder actual increments

For KL30xx/KL31xx only for the time being

Enum Encoder absolute dimensioning system

Define	Encoder absolute dimensioning system
0	INC: Incremental absolute dimension system with underflow and overflow offset (default, i.e. compatible with the previous state)
1	ABS: Absolute dimension system without underflow and overflow offset (no underflow or overflow of the encoder allowed)
2	ABS MODULO: Conditionally absolute dimension system, since it has underflow and overflow offset (absolute value that modulo (endless) continues)

Not for all encoder types; only for Profi Drive MC, M3000, KL5001/EL5001, IP5009, SERCOS, UNIVERSAL, etc.

Enum referencing mode for incremental encoder

Define	Parameter text	Referencing mode for incremental encoder
0	Default	NOT DEFINED (default assignment, i.e. compatible with the previous status)
1	Homing Sensor Only (PLC cam or digital input)	Latch event: shutdown of the PLC cam (negative edge)
2	Hardware Sync (feedback reference pulse)	Latch event: hardware sync pulse (zero track)
3	Hardware Latch 1 (pos. Edge)	Latch event: external hardware latch with positive edge (measuring probe or, respectively, measurement on the fly with positive edge)
4	Hardware Latch 1 (neg. Edge)	Latch event: external hardware latch with negative edge (measuring probe or, respectively, measurement on the fly with negative edge)
5	Software Sync	Latch event: synthetically emulated software sync pulse (software zero track); PREREQUISITE: absolute per motor revolution, e.g. resolver!
6	Hardware Latch 1 (pos. Edge), Drive defined	Latch event: hardware latch event defined in the drive with positive edge (e.g. for SoftDrive)
7	Hardware Latch 1 (neg. edge), Drive defined	Latch event: hardware latch event defined in the drive with negative edge (e.g. for SoftDrive)
20	Application (PLC code)	User-specific implementation of referencing (PLC code): user request is signaled to the PLC by means of the ApplicationRequest bit

	: latch event					
Encoder types	**0: not defined**	**1: PLC cam (neg. edge)**	**2: hardware sync pulse (zero/C-track)**	**3: external hardware latch with pos. edge**	**4: external hardware latch with neg. edge**	**5: software sync pulse (software zero track)**
AX2xxx-B200 (Lightbus)	—	√	√	√	√	√ (resolver only)
AX2xxx-B510 (CANopen)	—	√	—	—	—	√ (resolver only) (see "Reference mask" parameter)
AX2xxx-B1x0 (EtherCAT)	—	√	√	√	√	√ (resolver only) (fixed 20-bit)
AX2xxx-B900 (Ethernet)	—	√	√	√	√	√ (resolver only)
Sercos	—	√	√	√ (AX5xxx specific implemented)	√	√ (see "Reference mask" parameter)
Profi Drive	—	√	√	√	√	√
KL5101 IP5109	—	√	√	√	√	√
KL5111	—	√	√	—	—	√
KL5151	—	√	√	√	√	√ (not meaningful)
IP5209	—	√	√	—	—	√ (not meaningful)
CANopen (e.g. Lenze)	—	√	—	√ (input E1)	√ (input E2)	√ (resolver only) (fixed 16-bit)
other types	—	—	—	—	—	—

Enum Homing Sensor Source

The parameter sets the source of the digital input of the referencing cam (homing sensor). At the same time it is determined whether the signal is Active High or Active Low.

Define	Parameter text	Homing Sensor Source
0	Default: PLC cam (MC_Home)	Referencing cam is provided by the PLC. Input bCalibrationCam of the MC_Home function block.
1	Digital Input 1 (Active High), device dependent mapping	Drive->Inputs->nState8.bit0 or E1 of MDP703/733 device e.g. 7031,7041,7201,7411
2	Digital Input 2 (Active High), device dependent mapping	Drive->Inputs->nState8.bit1 or E2 of MDP703/733 device e.g. L7031,7041,7201,7411
3	Digital Input 3 (Active High)	Drive->Inputs->nState8.bit2
4	Digital Input 4 (Active High)	Drive->Inputs->nState8.bit3
5	Digital Input 5 (Active High)	Drive->Inputs->nState8.bit4
6	Digital Input 6 (Active High)	Drive->Inputs->nState8.bit5
7	Digital Input 7 (Active High)	Drive->Inputs->nState8.bit6
8	Digital Input 8 (Active High)	Drive->Inputs->nState8.bit7
9	Digital Input 1 (Active Low), device dependent mapping	Drive->Inputs->nState8.bit2
10	Digital Input 2 (Active Low), device dependent mapping	Drive->Inputs->nState8.bit0 or E1 of MDP703/733 device e.g. L7031,7041,7201,7411
11	Digital Input 3 (Active Low)	Drive->Inputs->nState8.bit1 or E2 of MDP703/733 device e.g. L7031,7041,7201,7411
12	Digital Input 4 (Active Low)	Drive->Inputs->nState8.bit2
13	Digital Input 5 (Active Low)	Drive->Inputs->nState8.bit3
14	Digital Input 6 (Active Low)	Drive->Inputs->nState8.bit4
15	Digital Input 7 (Active Low)	Drive->Inputs->nState8.bit5
16	Digital Input 8 (Active Low)	Drive->Inputs->nState8.bit6

Digital Input [1-8]

A digital input linked to the NC process is used. For this purpose, a general Drive Status Byte with 8 digital inputs is defined in the process image (Drive->Inputs->nState8), which can serve as a signal source for the homing sensor. A digital input to be used must therefore be mapped manually to the desired position in this byte.

The digital inputs 1 and 2 may differ depending on the hardware used. For the MDP703/733 hardware (e.g. EL7031, EL7041, EL7201, EL7411) the direct digital inputs E1 and E2 of the terminal are used instead, which are located in the Drive.nState2 byte of the terminal at bit position 3 (E1) and 4 (E2). The lower two bits of Drive.nState8 are not assigned in this case.

Enum Drive types

Define	Drive types
0	NOT DEFINED
1	Analog Servo Drive: M2400 DAC 1 (Analog)
2	Analog Servo Drive: M2400 DAC 2 (Analog)
3	Analog Servo Drive: M2400 DAC 3 (Analog)
4	Analog Servo Drive: M2400 DAC 4 (Analog)
5	MDP 252 Drive: Analog Servo Drive: KL4xxx, KL2502-30K (Analog)
6	MDP 252 Drive: Analog Servo Drive (non-linear): KL4xxx, KL2502-30K (Analog)
7	High/low speed drive (Digital)
8	Stepper motor drive (Digital)
9	SERCOS-Drive (Digital)
10	MDP 510 Drive: KL5051 (BiSSI-Interface) (Digital)
11	AX2000 (Lightbus) (Digital)
12	Provi-Drive MC (Simodrive 611U) (Digital)
13	Universal Drive (Analog)
14	NC rear panel (Analog)
15	Special CANopen type (e.g. Lenze Drive 9300) (Digital)
16	MDP 742 (DS402): CANopen and EtherCAT CoE (AX2xx-B1x0/ B510) (Digital)
17	AX2xx-B900 Drive (Ethernet) (Digital)
20	KL2531/KL2541 Encoder (Stepper Motor) (Digital)
21	KL2532/KL2542 Encoder (DC motor), KL2535/KL2545 Encoder (PWM current terminal) (Digital)
22	TCom Drive (Soft Drive) (Digital)
23	MDP 733 Drive: Profile MDP 733 (EL7332, EL7342, EP7342) (Digital)
24	MDP 703 Drive: Profile MDP 703 (EL7031, EL7041, EP7041) (Digital)

Enum Drive-Output-Start types

Define	Enum Drive-Output-Start types
0	NOT DEFINED
1	Output value in percent
2	Output as velocity, e.g. m/min

Enum Drive Operation Mode

Define	Drive Operation Mode (generic operation modes independent from drive)
0	DEFAULT Mode (reactivates the NC default operation mode if mode is known)
1 (standard type)	torque control
2 (standard type)	velocity control with feedback 1
3 (standard type)	velocity control with feedback 2
4 (standard type)	position control with feedback 1 (lag less)
5 (standard type)	position control with feedback 2 (lag less)
6 (CANopen/CoE specific)	torque control with commutation angle
17 (oversampling type)	torque control using dynamic container
18 (oversampling type)	velocity control with feedback 1 using dynamic container
19 (oversampling type)	velocity control with feedback 2 using dynamic container
20 (oversampling type)	position control with feedback 1 (lag less) using dynamic container
21 (oversampling type)	position control with feedback 2 (lag less) using dynamic container
38 (CANopen/CoE specific)	IO drive controlled homing mode (for third party devices)
100 (Sercos/SoE specific)	Sercos/SoE primary operation mode 0 (s. S-0-0032)
101 (Sercos/SoE specific)	Sercos/SoE secondary operation mode 1 (s. S-0-0033)
102 (Sercos/SoE specific)	Sercos/SoE secondary operation mode 2 (s. S-0-0034)
103 (Sercos/SoE specific)	Sercos/SoE secondary operation mode 3 (s. S-0-0035)
104 (Sercos/SoE specific)	Sercos/SoE secondary operation mode 4 (s. S-0-0284)
105 (Sercos/SoE specific)	Sercos/SoE secondary operation mode 5 (s. S-0-0285)
106 (Sercos/SoE specific)	Sercos/SoE secondary operation mode 6 (s. S-0-0286)
107 (Sercos/SoE specific)	Sercos/SoE secondary operation mode 7 (s. S-0-0287)

Enum Moving phases / Movement state for master axes

Define	Moving phases / Movement state (distinction between internal and external setpoint generation)
Internal setpoint generation	
0	Setpoint generator not active (INACTIVE)
1	Setpoint generator active (RUNNING)
2	Velocity override is zero (OVERRIDE_ZERO)
3	Constant velocity (PHASE_VELOCONST)
4	Acceleration phase (PHASE_ACCPOS)
5	Deceleration phase (PHASE_ACCNEG)
External setpoint generation:	
41	External setpoint generation active (EXTSETGEN_MODE1)
42	Internal and external setpoint generation active (EXTSETGEN_MODE2)

Enum Moving phases / Movement state for slave axes

Define	Moving phases / Movement state
0	Slave generator not active (INACTIVE)
11	Slave is in a movement pre-phase (PRE-PHASE)
12	Slave is synchronizing (SYNCHRONIZING)
13	Slave is synchronized and moves synchronously (SYNCHRON)

Only for slaves of the type synchronization generator for the time being

Enum Table main types

Define	Table main types
1	(n*m) Cam plate tables (Camming)
10	(n*m) Characteristic curves tables (Characteristics) (e.g. hydraulic valve characteristic curves) Only non-cyclic table sub-types (1, 3) are supported!
16	(n*m) "Motion Function" tables (MF) Only non-equidistant table sub-types (3, 4) are supported!

Enum Table sub-types

Define	Table sub types
1	(n*m) Table with equidistant master positions and no cyclic continuation of the master profile (equidistant linear)
2	(n*m) Table with equidistant master positions and cyclic continuation of the master profile (equidistant cyclic)
3	(n*m) Table with non-equidistant, but strictly monotonously increasing master positions and a non-cyclic continuation of the master profile (monotonously linear)
4	(n*m) Table with non-equidistant, but strictly monotonously increasing master positions and a cyclic continuation of the master profile (monotonously cyclic)

Enum Table interpolation types

Define	Table interpolation types between the reference points
0	Linear interpolation (NC_INTERPOLATIONTYPE_LINEAR) (Standard)
1	4-point interpolation (NC_INTERPOLATIONTYPE_4POINT) (for equidistant table types only)
2	Cubic spline interpolation of all reference points ("global spline") (NC_INTERPOLATIONTYPE_SPLINE
3	Sliding cubic spline interpolation via n interpolation points ("local spline") (NC_INTERPOLATIONTYPE_SLIDINGSPLINE)

Enum table operation mode

Define	Table operation mode for adding, exchange and removal of tables
0	(default)
1	Additive – addition of a further table
2	Exchange – replacement of an existing table with a new table
3	Remove – removal of an existing table

Structure of tabular (cam) coupling informationen

Tables		(CAM) Coupling information
nTableID;	1.	cam table ID
nTableMainType;	2.	e.g. CAMMING, CHARACTERISTIC, MOTIONFUNCTION
nTableSubType;	3.	e.g. EQUIDIST_LINEAR, EQUIDIST_CYCLE, NONEQUIDIST_LINEAR, NONEQUIDIST_CYCLE
nInterpolationType;	4.	e.g. LINEAR, 4POINT, SPLINE
nNumberOfRows;	5.	number of rows/elements
nNumberOfColumns;	6.	number of columns
fMasterCamStartPos	7.	master camming start position (first point in tabular)
fSlaveCamStartPos	8.	slave camming start position (first point in tabular)
fRawMasterPeriod;	9.	master period/cycle (raw value, not scaled)
fRawSlaveStroke;	10.	slave difference per master period/cycle (raw value, not scaled)
fMasterAxisCouplingPos	11.	total absolute master offset of cam origin when slave has been coupled
fSlaveAxisCouplingPos	12.	total absolute slave offset of cam origin when slave has been coupled
nMasterAbsolute	13.	master absolute position (0/1)
nSlaveAbsolute	14.	slave absolute position (0/1)
fMasterOffset;	15.	total master offset
fSlaveOffset;	16.	total slave offset
fMasterScaling;	17.	total master scaling
fSlaveScaling;	18.	total slave scaling
fSumOfSlaveStrokes	19.	sum of the slave srokes up to “fActualMasterAxisPos”
fSumOfSuperpositionDistance	20.	sum of superposition distance (position compensation offset)
fActualMasterAxisPos;	21.	actual master axis setpos (absolute)
fActualSlaveAxisPos;	22.	actual slave axis setpos (absolute)
fActualMasterCamPos;	23.	actual master cam setpos
fActualSlaveCamPos;	24.	actual master cam setpos
nSlaveStateDWord	25.	slave state DWORD (s. AxisRef)
. . .	. . .	. . .

Structure of the characteristic values

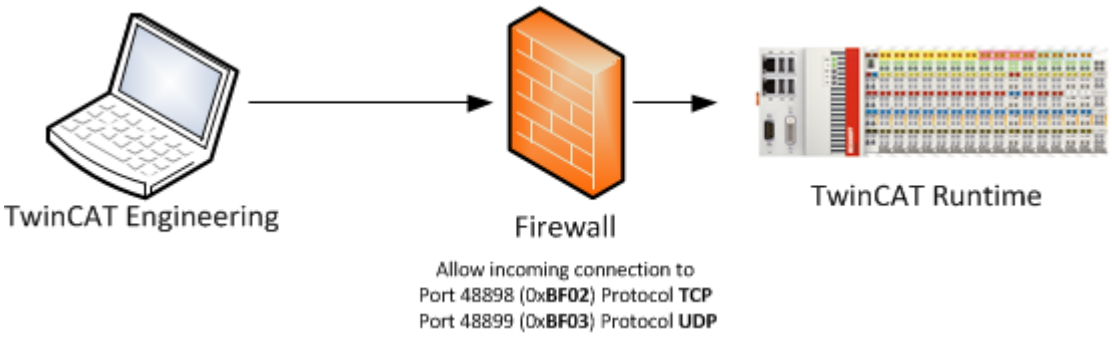
Characteristic values		
fMasterVeloNom;	1.	master nominal velocity (standardized: => 1.0)
fMasterPosStart;	2.	master start position
fSlavePosStart;	3.	slave start position
fSlaveVeloStart;	4.	slave start velocity
fSlaveAccStart;	5.	slave start acceleration
fSlaveJerkStart;	6.	slave start jerk
fMasterPosEnd;	7.	master end position
fSlavePosEnd;	8.	slave end position
fSlaveVeloEnd;	9.	slave end velocity
fSlaveAccEnd;	10.	slave end acceleration
fSlaveJerkEnd;	11.	slave end jerk
fMPosAtSPosMin;	12.	master pos. at slave min. position
fSlavePosMin;	13.	slave minimum position
fMPosAtSVeloMin;	14.	master pos. at slave min. velocity
fSlaveVeloMin;	15.	slave minimum velocity
fMPosAtSAccMin;	16.	master pos. at slave min. acceleration
fSlaveAccMin;	17.	slave minimum acceleration
fSVeloAtSAccMin;	18.	slave velocity at slave min. acceleration
fSlaveJerkMin;	19.	slave minimum jerk
fSlaveDynMomMin;	20.	slave minimum dynamic momentum (NOT SUPPORTED YET!)
fMPosAtSPosMax;	21.	master pos. at slave max. position
fSlavePosMax;	22.	slave maximum position
fMPosAtSVeloMax;	23.	master pos. at slave max. velocity
fSlaveVeloMax;	24.	slave maximum velocity
fMPosAtSAccMax;	25.	master pos. at slave max. acceleration
fSlaveAccMax;	26.	slave maximum acceleration
fSVeloAtSAccMax;	27.	slave velocity at slave max. acceleration
fSlaveJerkMax;	28.	slave maximum jerk
fSlaveDynMomMax;	29.	slave minimum dynamic momentum (NOT SUPPORTED YET!)
fSlaveVeloMean;	30.	slave mean absolute velocity
fSlaveAccEff;	31.	slave effective acceleration
nCamTableID;	32.	Cam table ID
nNumberOfRows;	33.	Number of rows/entries e.g. number of points
nNumberOfColums;	34.	Number of columns (typically1 or 2)
nCamTableType;	35.	cam table type (10=EQUIDIST, 11=NONEQUIDIST, 22=MOTIONFUNC, 23=CHARACTERISTIC)
nPeriodic;	36.	linear or cyclic/periodic
nReserved	37.	reserved

Enum Axis control loop switch types

Define	Axis control loop switch types
0	NOT DEFINED
1	Simple switching (similar to an axis reset) (STANDARD)
2	Switching/synchronization by means of I/D-part of the controller to an internal initial value (jerk-free/smooth)
3	Switching/synchronization by means of I/D-part of the controller to a parameterizable initial value

7 ADS connection through a firewall

This example is used to describe how an ADS device (e.g. TwinCAT Engineering PC, third-party Scada systems etc...) can communicate with a TwinCAT Runtime through a firewall.



Firewallrules/Portfilter settings

You have to configure following rules for incoming connections to your TwinCAT Runtime to establish the ADS communication:

Direction	Local Port	Remote Port	Protocol	Action	Usage
Incoming	48898	*	TCP	Allow	Communication
Incoming	48899	*	UDP	Allow	Broadcast search
Incoming	8016	*	TCP	Allow	Secure ADS

8 ADS Return Codes

Grouping of error codes:
Global error codes: ADS Return Codes [▶ 166]... (0x9811_0000 ...)
Router error codes: ADS Return Codes [▶ 166]... (0x9811_0500 ...)
General ADS errors: ADS Return Codes [▶ 167]... (0x9811_0700 ...)
RTime error codes: ADS Return Codes [▶ 169]... (0x9811_1000 ...)

Global error codes

Hex	Dec	HRESULT	Name	Description
0x0	0	0x98110000	ERR_NOERROR	No error.
0x1	1	0x98110001	ERR_INTERNAL	Internal error.
0x2	2	0x98110002	ERR_NORTIME	No real time.
0x3	3	0x98110003	ERR_ALLOCLOCKEDMEM	Allocation locked – memory error.
0x4	4	0x98110004	ERR_INSERTMAILBOX	Mailbox full – the ADS message could not be sent. Reducing the number of ADS messages per cycle will help.
0x5	5	0x98110005	ERR_WRONGRECEIVEHMSG	Wrong HMSG.
0x6	6	0x98110006	ERR_TARGETPORTNOTFOUND	Target port not found – ADS server is not started or is not reachable.
0x7	7	0x98110007	ERR_TARGETMACHINENOTFOUND	Target computer not found – AMS route was not found.
0x8	8	0x98110008	ERR_UNKNOWNCMDID	Unknown command ID.
0x9	9	0x98110009	ERR_BADTASKID	Invalid task ID.
0xA	10	0x9811000A	ERR_NOIO	No IO.
0xB	11	0x9811000B	ERR_UNKNOWNAMSCMD	Unknown AMS command.
0xC	12	0x9811000C	ERR_WIN32ERROR	Win32 error.
0xD	13	0x9811000D	ERR_PORTNOTCONNECTED	Port not connected.
0xE	14	0x9811000E	ERR_INVALIDAMSLENGTH	Invalid AMS length.
0xF	15	0x9811000F	ERR_INVALIDAMSNETID	Invalid AMS Net ID.
0x10	16	0x98110010	ERR_LOWINSTLEVEL	Installation level is too low –TwinCAT 2 license error.
0x11	17	0x98110011	ERR_NODEBUGINTAVAILABLE	No debugging available.
0x12	18	0x98110012	ERR_PORTDISABLED	Port disabled – TwinCAT system service not started.
0x13	19	0x98110013	ERR_PORTALREADYCONNECTED	Port already connected.
0x14	20	0x98110014	ERR_AMSSYNC_W32ERROR	AMS Sync Win32 error.
0x15	21	0x98110015	ERR_AMSSYNC_TIMEOUT	AMS Sync Timeout.
0x16	22	0x98110016	ERR_AMSSYNC_AMSERROR	AMS Sync error.
0x17	23	0x98110017	ERR_AMSSYNC_NOINDEXINMAP	No index map for AMS Sync available.
0x18	24	0x98110018	ERR_INVALIDAMSPORT	Invalid AMS port.
0x19	25	0x98110019	ERR_NOMEMORY	No memory.
0x1A	26	0x9811001A	ERR_TCPSEND	TCP send error.
0x1B	27	0x9811001B	ERR_HOSTUNREACHABLE	Host unreachable.
0x1C	28	0x9811001C	ERR_INVALIDAMSFRAGMENT	Invalid AMS fragment.
0x1D	29	0x9811001D	ERR_TLSSEND	TLS send error – secure ADS connection failed.
0x1E	30	0x9811001E	ERR_ACCESSDENIED	Access denied – secure ADS access denied.

Router error codes

Hex	Dec	HRESULT	Name	Description
0x500	1280	0x98110500	ROUTERERR_NOLOCKEDMEMORY	Locked memory cannot be allocated.
0x501	1281	0x98110501	ROUTERERR_RESIZEMEMORY	The router memory size could not be changed.
0x502	1282	0x98110502	ROUTERERR_MAILBOXFULL	The mailbox has reached the maximum number of possible messages.
0x503	1283	0x98110503	ROUTERERR_DEBUGBOXFULL	The Debug mailbox has reached the maximum number of possible messages.
0x504	1284	0x98110504	ROUTERERR_UNKNOWNPORTTYPE	The port type is unknown.
0x505	1285	0x98110505	ROUTERERR_NOTINITIALIZED	The router is not initialized.
0x506	1286	0x98110506	ROUTERERR_PORTALREADYINUSE	The port number is already assigned.
0x507	1287	0x98110507	ROUTERERR_NOTREGISTERED	The port is not registered.
0x508	1288	0x98110508	ROUTERERR_NOMOREQUEUES	The maximum number of ports has been reached.
0x509	1289	0x98110509	ROUTERERR_INVALIDPORT	The port is invalid.
0x50A	1290	0x9811050A	ROUTERERR_NOTACTIVATED	The router is not active.
0x50B	1291	0x9811050B	ROUTERERR_FRAGMENTBOXFULL	The mailbox has reached the maximum number for fragmented messages.
0x50C	1292	0x9811050C	ROUTERERR_FRAGMENTTIMEOUT	A fragment timeout has occurred.
0x50D	1293	0x9811050D	ROUTERERR_TOBEREMOVED	The port is removed.

General ADS error codes

Hex	Dec	HRESULT	Name	Description
0x700	1792	0x98110700	ADSERR_DEVICE_ERROR	General device error.
0x701	1793	0x98110701	ADSERR_DEVICE_SRVNOTSUPP	Service is not supported by the server.
0x702	1794	0x98110702	ADSERR_DEVICE_INVALIDGRP	Invalid index group.
0x703	1795	0x98110703	ADSERR_DEVICE_INVALIDOFFSET	Invalid index offset.
0x704	1796	0x98110704	ADSERR_DEVICE_INVALIDACCESS	Reading or writing not permitted.
0x705	1797	0x98110705	ADSERR_DEVICE_INVALIDSIZE	Parameter size not correct.
0x706	1798	0x98110706	ADSERR_DEVICE_INVALIDDATA	Invalid data values.
0x707	1799	0x98110707	ADSERR_DEVICE_NOTREADY	Device is not ready to operate.
0x708	1800	0x98110708	ADSERR_DEVICE_BUSY	Device is busy.
0x709	1801	0x98110709	ADSERR_DEVICE_INVALIDCONTEXT	Invalid operating system context. This can result from use of ADS blocks in different tasks. It may be possible to resolve this through multitasking synchronization in the PLC.
0x70A	1802	0x9811070A	ADSERR_DEVICE_NOMEMORY	Insufficient memory.
0x70B	1803	0x9811070B	ADSERR_DEVICE_INVALIDPARM	Invalid parameter values.
0x70C	1804	0x9811070C	ADSERR_DEVICE_NOTFOUND	Not found (files, ...).
0x70D	1805	0x9811070D	ADSERR_DEVICE_SYNTAX	Syntax error in file or command.
0x70E	1806	0x9811070E	ADSERR_DEVICE_INCOMPATIBLE	Objects do not match.
0x70F	1807	0x9811070F	ADSERR_DEVICE_EXISTS	Object already exists.
0x710	1808	0x98110710	ADSERR_DEVICE_SYMBOLNOTFOUND	Symbol not found.
0x711	1809	0x98110711	ADSERR_DEVICE_SYMBOLVERSIONINVALID	Invalid symbol version. This can occur due to an online change. Create a new handle.
0x712	1810	0x98110712	ADSERR_DEVICE_INVALIDSTATE	Device (server) is in invalid state.
0x713	1811	0x98110713	ADSERR_DEVICE_TRANSMODENOTSUPP	AdsTransMode not supported.
0x714	1812	0x98110714	ADSERR_DEVICE_NOTIFYHNDINVALID	Notification handle is invalid.
0x715	1813	0x98110715	ADSERR_DEVICE_CLIENTUNKNOWN	Notification client not registered.
0x716	1814	0x98110716	ADSERR_DEVICE_NOMOREHDLS	No further handle available.
0x717	1815	0x98110717	ADSERR_DEVICE_INVALIDWATCHSIZE	Notification size too large.
0x718	1816	0x98110718	ADSERR_DEVICE_NOTINIT	Device not initialized.
0x719	1817	0x98110719	ADSERR_DEVICE_TIMEOUT	Device has a timeout.
0x71A	1818	0x9811071A	ADSERR_DEVICE_NOINTERFACE	Interface query failed.
0x71B	1819	0x9811071B	ADSERR_DEVICE_INVALIDINTERFACE	Wrong interface requested.
0x71C	1820	0x9811071C	ADSERR_DEVICE_INVALIDCLSID	Class ID is invalid.
0x71D	1821	0x9811071D	ADSERR_DEVICE_INVALIDOBJID	Object ID is invalid.
0x71E	1822	0x9811071E	ADSERR_DEVICE_PENDING	Request pending.
0x71F	1823	0x9811071F	ADSERR_DEVICE_ABORTED	Request is aborted.
0x720	1824	0x98110720	ADSERR_DEVICE_WARNING	Signal warning.
0x721	1825	0x98110721	ADSERR_DEVICE_INVALIDARRAYIDX	Invalid array index.
0x722	1826	0x98110722	ADSERR_DEVICE_SYMBOLNOTACTIVE	Symbol not active.
0x723	1827	0x98110723	ADSERR_DEVICE_ACCESSDENIED	Access denied.
0x724	1828	0x98110724	ADSERR_DEVICE_LICENSENOTFOUND	Missing license.
0x725	1829	0x98110725	ADSERR_DEVICE_LICENSEEXPIRED	License expired.
0x726	1830	0x98110726	ADSERR_DEVICE_LICENSEEXCEEDED	License exceeded.
0x727	1831	0x98110727	ADSERR_DEVICE_LICENSEINVALID	Invalid license.
0x728	1832	0x98110728	ADSERR_DEVICE_LICENSESYSTEMID	License problem: System ID is invalid.
0x729	1833	0x98110729	ADSERR_DEVICE_LICENSENOTIMELIMIT	License not limited in time.
0x72A	1834	0x9811072A	ADSERR_DEVICE_LICENSEFUTUREISSUE	Licensing problem: time in the future.
0x72B	1835	0x9811072B	ADSERR_DEVICE_LICENSETIMETOLONG	License period too long.
0x72C	1836	0x9811072C	ADSERR_DEVICE_EXCEPTION	Exception at system startup.
0x72D	1837	0x9811072D	ADSERR_DEVICE_LICENSEDUPLICATED	License file read twice.
0x72E	1838	0x9811072E	ADSERR_DEVICE_SIGNATUREINVALID	Invalid signature.
0x72F	1839	0x9811072F	ADSERR_DEVICE_CERTIFICATEINVALID	Invalid certificate.
0x730	1840	0x98110730	ADSERR_DEVICE_LICENSEOEMNOTFOUND	Public key not known from OEM.
0x731	1841	0x98110731	ADSERR_DEVICE_LICENSERESTRICTED	License not valid for this system ID.
0x732	1842	0x98110732	ADSERR_DEVICE_LICENSEDEMODENIED	Demo license prohibited.
0x733	1843	0x98110733	ADSERR_DEVICE_INVALIDFNCID	Invalid function ID.
0x734	1844	0x98110734	ADSERR_DEVICE_OUTOFRANGE	Outside the valid range.
0x735	1845	0x98110735	ADSERR_DEVICE_INVALIDALIGNMENT	Invalid alignment.
0x736	1846	0x98110736	ADSERR_DEVICE_LICENSEPLATFORM	Invalid platform level.

Hex	Dec	HRESULT	Name	Description
0x737	1847	0x98110737	ADSERR_DEVICE_FORWARD_PL	Context – forward to passive level.
0x738	1848	0x98110738	ADSERR_DEVICE_FORWARD_DL	Context – forward to dispatch level.
0x739	1849	0x98110739	ADSERR_DEVICE_FORWARD_RT	Context – forward to real time.
0x740	1856	0x98110740	ADSERR_CLIENT_ERROR	Client error.
0x741	1857	0x98110741	ADSERR_CLIENT_INVALIDPARM	Service contains an invalid parameter.
0x742	1858	0x98110742	ADSERR_CLIENT_LISTEMPTY	Polling list is empty.
0x743	1859	0x98110743	ADSERR_CLIENT_VARUSED	Var connection already in use.
0x744	1860	0x98110744	ADSERR_CLIENT_DUPLINVOKEID	The called ID is already in use.
0x745	1861	0x98110745	ADSERR_CLIENT_SYNCTIMEOUT	Timeout has occurred – the remote terminal is not responding in the specified ADS timeout. The route setting of the remote terminal may be configured incorrectly.
0x746	1862	0x98110746	ADSERR_CLIENT_W32ERROR	Error in Win32 subsystem.
0x747	1863	0x98110747	ADSERR_CLIENT_TIMEOUTINVALID	Invalid client timeout value.
0x748	1864	0x98110748	ADSERR_CLIENT_PORTNOTOPEN	Port not open.
0x749	1865	0x98110749	ADSERR_CLIENT_NOAMSADDR	No AMS address.
0x750	1872	0x98110750	ADSERR_CLIENT_SYNCINTERNAL	Internal error in Ads sync.
0x751	1873	0x98110751	ADSERR_CLIENT_ADDHASH	Hash table overflow.
0x752	1874	0x98110752	ADSERR_CLIENT_REMOVEHASH	Key not found in the table.
0x753	1875	0x98110753	ADSERR_CLIENT_NOMORESYM	No symbols in the cache.
0x754	1876	0x98110754	ADSERR_CLIENT_SYNCRESINVALID	Invalid response received.
0x755	1877	0x98110755	ADSERR_CLIENT_SYNCPORTLOCKED	Sync Port is locked.
0x756	1878	0x98110756	ADSERR_CLIENT_REQUESTCANCELLED	The request was cancelled.

RTime error codes

Hex	Dec	HRESULT	Name	Description
0x1000	4096	0x98111000	RTERR_INTERNAL	Internal error in the real-time system.
0x1001	4097	0x98111001	RTERR_BADTIMERPERIODS	Timer value is not valid.
0x1002	4098	0x98111002	RTERR_INVALIDTASKPTR	Task pointer has the invalid value 0 (zero).
0x1003	4099	0x98111003	RTERR_INVALIDSTACKPTR	Stack pointer has the invalid value 0 (zero).
0x1004	4100	0x98111004	RTERR_PRIOEXISTS	The request task priority is already assigned.
0x1005	4101	0x98111005	RTERR_NOMORETCB	No free TCB (Task Control Block) available. The maximum number of TCBs is 64.
0x1006	4102	0x98111006	RTERR_NOMORESEMAS	No free semaphores available. The maximum number of semaphores is 64.
0x1007	4103	0x98111007	RTERR_NOMOREQUEUES	No free space available in the queue. The maximum number of positions in the queue is 64.
0x100D	4109	0x9811100D	RTERR_EXTIRQALREADYDEF	An external synchronization interrupt is already applied.
0x100E	4110	0x9811100E	RTERR_EXTIRQNOTDEF	No external sync interrupt applied.
0x100F	4111	0x9811100F	RTERR_EXTIRQINSTALLFAILED	Application of the external synchronization interrupt has failed.
0x1010	4112	0x98111010	RTERR_IRQLNOTLESSOREQUAL	Call of a service function in the wrong context
0x1017	4119	0x98111017	RTERR_VMXNOTSUPPORTED	Intel VT-x extension is not supported.
0x1018	4120	0x98111018	RTERR_VMXDISABLED	Intel VT-x extension is not enabled in the BIOS.
0x1019	4121	0x98111019	RTERR_VMXCONTROLSMISSING	Missing function in Intel VT-x extension.
0x101A	4122	0x9811101A	RTERR_VMXENABLEFAILS	Activation of Intel VT-x fails.

Specific positive HRESULT Return Codes:

HRESULT	Name	Description
0x0000_0000	S_OK	No error.
0x0000_0001	S_FALSE	No error. Example: successful processing, but with a negative or incomplete result.
0x0000_0203	S_PENDING	No error. Example: successful processing, but no result is available yet.
0x0000_0256	S_WATCHDOG_TIMEOUT	No error. Example: successful processing, but a timeout occurred.

TCP Winsock error codes

Hex	Dec	Name	Description
0x274C	10060	WSAETIMEDOUT	A connection timeout has occurred - error while establishing the connection, because the remote terminal did not respond properly after a certain period of time, or the established connection could not be maintained because the connected host did not respond.
0x274D	10061	WSAECONNREFUSED	Connection refused - no connection could be established because the target computer has explicitly rejected it. This error usually results from an attempt to connect to a service that is inactive on the external host, that is, a service for which no server application is running.
0x2751	10065	WSAEHOSTUNREACH	No route to host - a socket operation referred to an unavailable host.
More Winsock error codes: Win32 error codes			

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