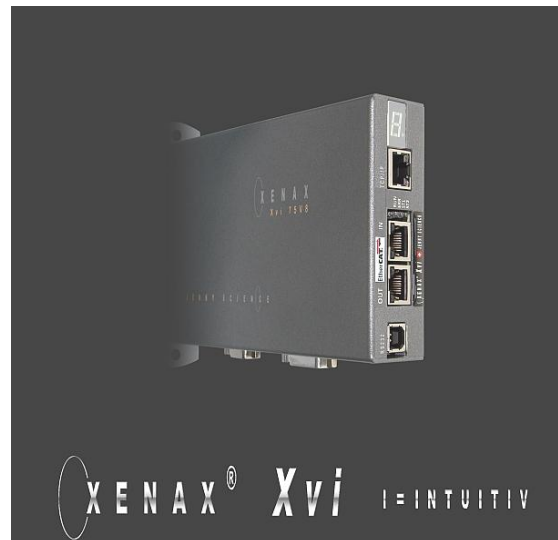


XENAX® Xvi 75V8
Bus coupling

CANopen over EtherCAT
CANopen over Powerlink
CANopen over CAN-Bus



V1.00



This bus coupling manual describes the CANopen Protocol stack of the XENAX® Xvi 75V8 servo controller.

The CANopen communication profile CiA **DS301** as well as the device profile CiA **DS402** for drive and motion control are described in detail.

EtherCAT and Powerlink over CANopen and CANopen direct are available as Protocol stacks.

Ethernet 100 BASE-TX or CAN-Bus are used as physical layers.

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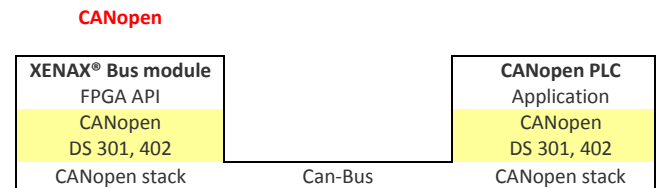
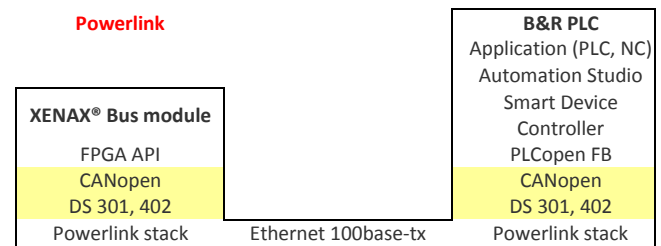
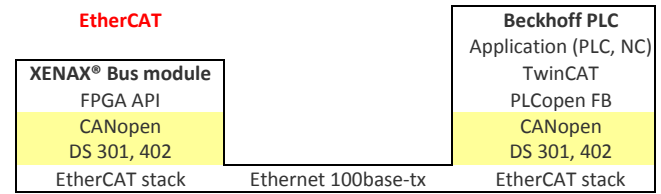
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1 General

The XENAX® Xvi 75V8 servo controller use an optional bus module for coupling the drive to different bus systems, like EtherCAT, Powerlink or CANopen.

The CANopen protocol with DS301 and DS402 is the central, common layer for the protocol stacks.



2 Bus module

EtherCAT (article no. 30 10 00)
 Powerlink (article no. 30 10 10)

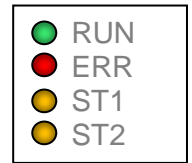


CANopen (article no. 30 10 05)



The protocol stack can be updated by WebMotion via Webbrowser

2.1 Bus module LED status



	RUN	ERR	ST1 Jenny Science specific	ST12 Jenny Science specific
EtherCAT				
<OFF>	In init process or no power	Bus module operable	Bus module ready	unused
<ON>	Operational state	State bus off	Protocol download in progress	
<BLINK>	Pre-Operational state	Internal EEPROM blank		
Powerlink				
<OFF>	In init process or no power	Bus module no error	Bus module ready	
<ON>	Operational state	State bus off	Protocol download in progress	
<BLINK>	Pre-Operational state			
CANopen				
<OFF>	In init process or no power	Bus module no error	Bus module ready	
<ON>	Operational state	State bus off	Protocol download in progress	
<BLINK>	Pre-Operational state			

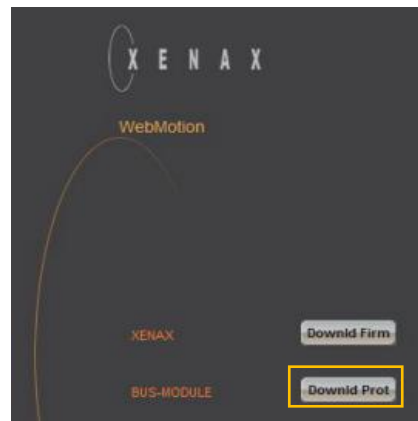
At delivery time of XENAX[®] servo controller, the latest bus protocol stack version is installed in the bus module. An upgrade could be installed with webmotion in menu *loading / firmware -> Downld Prot.*

The bus protocol software `Xenax_XXXXXX_protocol_Vx.x.flash` is available on www.jennyscience.ch.

Important:

The upgraded bus protocol version has to be activated by power OFF and power ON. You could check the installed version with the command VERB (version bus protocol) in menu *online control / terminal*.

2.2 Bus protocol upgrade



2.3 Bus protocol stacks on the website

Each protocol stack is provided on the website for download. It includes the bus module protocol stack software together with the electronic datasheets.

EtherCAT	Xenax_EtherCAT.eds	Electronic datasheet of CANopen interface
	Xenax_EtherCAT.xml	XML device description
	Xenax_EtherCAT_eeprom.bin	Slave information interface, stored data in EEPROM
	Xenax_EtherCAT_protocol_V1.3.flash	EtherCAT firmware of the busmodule
Powerlink	Xenax_Powerlink.xdd	XML based device description for Powerlink
	Xenax_Powerlink_protocol_V0.2.flash	Powerlink firmware of the busmodule
CANopen	Xenax_CANopen.eds	Electronic datasheet of CANopen interface
	Xenax_CANopen.xdd	XML based device description
	Xenax_CANopen_protocol_V1.1.flash	CANopen firmware of the busmodule

2.4 XENAX bus protocol parameterization

The parameterization is depend on the type of protocol stack.

The actual value can be checked with the additional character “?” at the end of the terminal command.
For example PCT?

	XENAX [®] bus protocol parameter		Unit	Bus protocol specific relevance
EtherCAT	PCT	PDO cycle time	µs	The master device (i.e.TwinCAT) writes the position cycle time into the object 0x60C2. Typical values: 125, 250, 500,1000
Powerlink	PCT	PDO cycle time	µs	The Powerlink Managing Node (MN) writes the position cycle time into hidden object 0x1006 that is automatic forwarded to object 0x2007 Typical values:
	CI	Card Identifier	-	Powerlink Node number, default = 0 Range: 0-99
CANopen	CAB	CAN Baud rate	-	Available CAN Baudrates: 10'000 20'000 50'000 125'000 250'000 500'000 800'000 1'000'000 Default: 500'000
	CI	Card Identifier	-	CAN Node ID, default = 0 Range: 0-99

3 CANopen communication profile DS301

3.1 Communication profile 1000 – 1FFF

3.1.1 Device Type, bus protocol, 1000h

The lower 16 bit contains the device profile number and the upper 16 bit additional information.

Data Type	Access (PreOp/SafeOp/Op)	PDO Mapping	Default Value	Lower Limit	Upper Limit
Unsigned 32	RO/RO/RO	no	0x00420192 (EtherCAT) 0x00020192 (CANopen) 0x00030191 (Powerlink)	0x00000000	0xFFFFFFFF

3.1.2 Error bit register, 1001h

Data Type	Access (PreOp/SafeOp/Op)	PDO Mapping	Default Value	Low Limit	Up Limit
Unsigned 8	RO/RO/RO	no	0x00	0x00	0xFF

0	generic error
1	current
2	voltage
3	temperature
4	communication (overrun)
5	device profile specific
6	reserved
7	manufacturer specific

3.1.3 COB-ID SYNC, CANopen, 1005h

COB-ID of the Synchronization object.
The device generates a SYNC message if bit 30 is set. The meaning of other bits is equal to the other communication objects.

Data Type	Access	PDO Mapping	Default Value	Lower Limit	Upper Limit
Unsigned 32	RW	no	0x80000080	0x00000000	0xFFFFFFFF

3.1.4 NMT_CycleLen_U32, Powerlink, 1006h

Data Type	Access (PreOp/SafeOp/Op)	PDO Mapping	Default Value	Lower Limit	Upper Limit
Unsigned 32	RW	no	0x3E8	0x00000000	0xFFFFFFFF

3.1.5 Manufacturer Device Name, 1008h

Data Type	Access (PreOp/SafeOp/Op)	PDO Mapping	Value	Lower Limit	Upper Limit
Visible string	RO/RO/RO	no	Xenax Xvi 75V8	0	0

3.1.6 Manufacturer Hardware Version, 1009h

This object contains the hardware version of:
XENAX servo controller and BUS-Module

Data Type	Access (PreOp/SafeOp/Op)	PDO Mapping	Value
VISIBLE_STRING	RO/RO/RO	no	XENAX HW Vx.xx, BUS Module HW Vx.xx

3.1.7 Manufacturer Software Version, 100Ah

This object contains the software version of:
XENAX Firmware, Bus-Module software, SMU-Module software (optional)

Data Type	Access (PreOp/SafeOp/Op)	PDO Mapping	Value
VISIBLE_STRING	RO/RO/RO	no	XENAX SW Vx.xx, BUS Portocol SW Vx.xx, SMU SW Vx.xx

3.1.8 COB-ID EMCY, CANopen, 1014h

COB-ID used for emergency message

Data Type	Access (PreOp/SafeOp/Op)	PDO Mapping	Default Value
Unsigned 32	RO/RO/RO	no	0x00000080

3.1.9 Producer Heartbeat Time, CANopen, 10017h

Defines the cycle time of the heartbeat. If the time is 0 it is not used. The time has to multiply by 1 msec

Data Type	Access (PreOp/SafeOp/Op)	PDO Mapping	Default Value
Unsigned 32	RO/RO/RO	no	0x00000000

3.1.10 Identity Object Record, 1018h

Sub-Index 1
contains a unique value allocated to the manufacturer.

Sub-Index 2
identifies the manufacturer specific product code

Sub-Index 3
Bit 31-16 is the major revision number,
Bit 15-0 the minor revision number.

Sub-Index 4
identifies a manufacturer specific serial number.

Sub Index	Description	Data Type	Access (PreOp/SafeOp/Op)	Default Value	Lower Limit	Upper Limit
000	Nbr of Entries	IDENTITY	RO/RO/RO	0x04	0x1	0x4
001	Vendor Id	Unsigned 32	RO/RO/RO	0x00000557	0x0	0xFFFFFFFF
002	Product Code	Unsigned 32	RO/RO/RO	0x7508 (EtherCAT) 0x29960 (CANopen)	0x0	0xFFFFFFFF
003	Revision number	Unsigned 32	RO/RO/RO	0x02000100	0x0	0xFFFFFFFF
004	Serial number	Unsigned 32	RO/RO/RO	0x1	0x0	0xFFFFFFFF

3.1.11 CFM_VerifyConfiguration, Powerlink, 1020h

CFM_VerifyConfiguration contains device local configuration date and time.. The object may be implemented on each Ethernet Powerlink Node.

Sub Index	Description	Data Type	Access	PDO Mapping	Default Value
000	Nbr of Entries	CVM_VERIFY_CONFIGURATION_T	RO	no	0x04
001	ConfDate_U32	Unsigned 32	RW	no	0x0
002	ConfTime_U32	Unsigned 32	RW	no	0x0
003	ConfID_U32	Unsigned 32	RW	no	0x0
004	VerifyConfInvalid_U32	Unsigned 32	RW	no	0x1

3.1.12 NMT_InterfaceGroup_0h_REC Powerlink, 1030h

The InterfaceGroup_REC object is a subset of the Interface Group RFC1213

Sub Index	Description	Data Type	Access	PDO Mapping	Default Value
000	Nbr of Entries	NMT_INTERFACE_GROUP_T	RO	no	0x09
001	InterfaceIndex_U16	Unsigned 16	RO	no	0x1
002	InterfaceDescription_VSTR	VISIBLE_STRING	RO	no	0
003	InterfaceType_U8	Unsigned 8	RO	no	0x6
004	InterfaceMtu_U32	Unsigned 16	RO	no	0x286
005	InterfacePhysAddress_OSTR	OCTET_STRING	RO	no	0
006	InterfaceName_VSTR	VISIBLE_STRING	RO	no	0
007	InterfaceOperStatus_U8	Unsigned 8	RO	no	0x0
008	InterfaceAdminState_U8	Unsigned 8	RO	no	0x1
009	Valid_BOOL	BOOLEAN	RO	no	0x0

3.1.13 Server SDO Parameter 1, CANopen, 1200h

The object contains the served SDO parameters.

Sub Index	Description	Data Type	Access (PreOp/SafeOp/Op)	PDO Mapping	Default Value
000	Nbr of Entries	SDO_PARAMETER	RO	no	0x02
001	COB-ID Client -> Server	Unsigned 32	RO	no	0x00000600
002	COB-ID Server -> Client	Unsigned 32	RO	no	0x00000580

3.1.14 SDO_SequLayerTimeout, Powerlink, 1300h

The object provides a timeout value in [ms] for the connection abort recognition of the SDO sequence layer.

The object shall be implemented if SDO communication via UDP/IP or EPL-ASnd is supported.

Data Type	Access	Unit	PDO Mapping	Default Value
Unsigned 32	RW	ms	no	0x000007D0

3.1.15 SDO_CmdLayerTimeout, Powerlink, 1301h

The object provides a timeout value in ms for the connection abort recognition of the SDO commandlayer.

Data Type	Access	Unit	PDO Mapping	Default Value
Unsigned 32	RW	ms	no	0x000003E8

3.1.16 Sync Manager Communication Type, 1C00h

Up to 32 sync manager types can be described. The first 4 sync manager are fixed and the following can be configured to one type out of the first four. The default configuration is:

1	mailbox receive
2	mailbox send
3	process data output
4	process data input

Sub Index	Name	Data Type	Access (PreOp/SafeOp/Op)	Default Value	Lower Limit	Upper Limit
000	No of used sync Manager Channel	Unsigned 8	RO/RO/RO	0x05	0x00	0x20
001	Com Type Sync Manager 1	Unsigned 8	RO/RO/RO	0x1	0x0	0x4
002	Com Type Sync Manager 2	Unsigned 8	RO/RO/RO	0x2	0x0	0x4
003	Com Type Sync Manager 3	Unsigned 8	RO/RO/RO	0x3	0x0	0x4
004	Com Type Sync Manager 4	Unsigned 8	RO/RO/RO	0x4	0x0	0x4
005	Com Type Sync Manager 5	Unsigned 8	RO/RO/RO	0x0	0x0	0x4

3.1.17 Sync Manager PDO Assignment 0, 1C10h

Using this object PDOs can be assigned to the Sync Managers starting at Sync Manager 2.

SubIndex	Description	Data Type	Access (PreOp/SafeOp/Op)	Default Value	Lower Limit	Upper Limit
000	Nbr of Entries	Unsigned 16	RO/RO/RO	0x00	0x00	0x00

3.1.18 Sync Manager PDO Assignment 1, 1C11h

SubIndex	Description	Data Type	Access (PreOp/SafeOp/Op)	Default Value	Lower Limit	Upper Limit
000	Nbr of Entries	Unsigned 16	RO/RO/RO	0x00	0x00	0x00

3.1.19 Sync Manager PDO Assignment 2, 1C12h

Sub Index	Description	Data Type	Access (PreOp/SafeOp/Op)	Default Value	Lower Limit	Upper Limit
000	nbr of assigned RxPDO	Unsigned 16	RW/RW/RW	0x01	0x00	0x06
001	PDO Mapping index of assigned RxPDOs	Unsigned 16	RW/RW/RW	0x1601	0x1600	0x17FF

3.1.20 Sync Manager PDO Assignment 3, 1C13h

SubIndex	Description	Data Type	Access (PreOp/SafeOp/Op)	Default Value	Lower Limit	Upper Limit
000	Number of assigned TxPDO	Unsigned 16	RW/RW/RW	0x01	0x00	0x05
001	PDO Mapping index of assigned TxPDOs	Unsigned 16	RW/RW/RW	0x1A13	0x1A00	0x1BFF

3.2 Powerlink used Objects 1C0B – 1FFF

3.2.1 DLL_CNLossSoC , 1C0Bh

The following objects are used to monitor Loss of Soc error symptoms detected by a CN. The record consists of a cumulative counter and a threshold counter data object and its threshold data object.

SubIndex	Description	DataType	Access	Default Value
000	NumberOfEntries	DLL_ERR_CNTREC_T	RO	0x03
001	CumulativeCnt_U32	Unsigned 32	RW	0x00
002	ThresholdCnt_U32	Unsigned 32	RO	0x00
003	Threshold_U32	Unsigned 32	RW	0x0F

3.2.2 DLL_CNCRCErrror, 1C0Fh

The following objects are used to monitor CRC errors.

SubIndex	Description	DataType	Access	Default Value
000	NumberOfEntries	DLL_ERR_CNTREC_T	RO	0x03
001	CumulativeCnt_U32	Unsigned 32	RW	0x00
002	ThresholdCnt_U32	Unsigned 32	RO	0x00
003	Threshold_U32	Unsigned 32	RW	0x0F

3.2.3 DLL_CNLossOfSocTolerance, 1C14h

DataType	Access	Unit	PDO Mapping	Default Value
Unsigned 32	RW	ns	no	0x5F5E100

3.2.4 NWL_IpAddrTable_0h, 1E40h

The IP address table contains this entity's IP addressing information. The NWL_IpAddrTable_Xh object is a subset of the IP Group RFC1213. It assigns IP parameters to an interface indicated by NMT_ItfGroup_Xh.

SubIndex	Description	DataType	Access	Default Value
000	NumberOfEntries	NWL_IP_ADDR_TABLE_T	RO	0x05
001	IfIndex_U16	Unsigned 16	RO	0x01
002	Addr_IPAD	IP_ADDRESS	RW	0x00
003	Netmask_IPAD	IP_ADDRESS	RW	0xFFFFFFFF00
004	ReasmMaxSize_U16	Unsigned 16	RO	0x11E
005	DefaultGateway_IPAD	IP_ADDRESS	RW	0xC0A864FE

3.2.5 NWL_IpGroup, 1E4Ah

The NWL_IpGroup_REC object is a subset of the IP Group RFC1213. The object specifies information about the IP stack.

SubIndex	Description	DataType	Access	Default Value
000	NumberOfEntries	NWL_IP_GROUP_T	RO	0x03
001	Forwarding_BOOL	BOOLEAN	RW	0x00
002	DefaultTTL_U16	Unsigned 16	RW	0x40
003	ForwardDatagrams_U32	Unsigned 32	RO	0x00

3.2.6 NMT_FeatureFlags, 1F82h

DataType	Access	PDO Mapping	Default Value
Unsigned 32	RO	no	0x00000247

3.2.7 NMT_EPLVersion, 1F83h

DataType	Access	PDO Mapping	Default Value
Unsigned 8	RO	no	0x20

3.2.8 NMT_CurrNMTState, 1F8Ch

DataType	Access	PDO Mapping	Default Value
Unsigned 8	RO	no	0x1C

3.2.9 NMT_EPLNodeID, 1F93h

The object stores the device's EPL NodeID.

Sub-Index 01h: NodeID_U8:

The sub-index holds the device's actual Node ID. NodeID_U8 may be provided by hardware settings (dip switch etc.) or set up by software.

Sub-Index 02h: NodeIDByHW_BOOL:

The sub-index displays the NodeID setup mode of the device. It shall be setup during system initialisation.

On devices, that setup the EPL NodeID exclusively by HW, the object sub-index be set to TRUE.

On devices, that setup the EPL NodeID exclusively by SW, the object sub-index be set to FALSE.

On devices, that enable SW EPL NodeID setup by a special HW setup, the sub-index shall be set to FALSE, if EPL NodeID setup by SW is enabled.

If SW EPL NodeID setup is enabled by a NodeID HW switch, it's recommended to use NodeID setup = 0.

The ability to define the EPL NodeID by SW shall be indicated in the object dictionary entry

NMT_FeatureFlags_U32 Bit 10. HW setup ability is indicated in the device description by

D_NMT_NodeIDByHW_BOOL .

SubIndex	Description	Data Type	Access	Default Value
000	NumberOfEntries	NMT_EPLNODEID_TYPE	RO	0x02
001	NodeID_U8	Unsigned 8	RO	0x01
002	NodeIDByHW_BOOL	BOOLEAN	RO	0x00

3.2.10 NMT_CycleTiming, 1F98h

NMT_CycleTiming_REC provides node specific timing parameters, that influence the EPL cycle timing. All entries must be supported by a CN. On the MN, some of the entries are irrelevant.

SubIndex	Description	Data Type	Access	Default Value
000	NumberOfEntries	NMT_CYCLE_TIMING_T	RO	0x09
001	IsochrTxMaxPayload_U16	Unsigned 16	RO	0x24
002	IsochrRxMaxPayload_U16	Unsigned 16	RO	0x24
003	PResMaxLatency_U32	Unsigned 32	RO	0x00
004	PReqActPayloadLimit_U16	Unsigned 16	RW	0x24
005	PResActPayloadLimit_U16	Unsigned 16	RW	0x24
006	ASndMaxLatency_U32	Unsigned 32	RO	0x00
007	MultiplCycleCnt_U8	Unsigned 8	RW	0x00
008	AsyncMTUSize_U16	Unsigned 16	RW	0x12C
009	Prescaler_U16	Unsigned 16	RW	0x2

3.2.11 NMT_CNBasicEthernetTimeout, 1F99h

Provide the time in us to be applied before changing from NMT_CS_NOT_ACTIVE to NMT_CS_BASIC_ETHERNET.

Data Type	Access	PDO Mapping	Default Value
Unsigned 32	RW	no	0x4C4B40

3.2.12 NMT_HostName, 1F9Ah

Provides the node's DNS host name.

Data Type	Access	PDO Mapping	Default Value
VISIBLE_STRING	RW	no	0

3.2.13 NMT_ResetCmd, 1F9Eh

NMT_ResetCmd may be used to initiate the reset of a node. Setting NMT_ResetCmd to the NMT Command ID NMTResetNode, NMTResetConfiguration, NMTResetCommunication or NMTSwReset shall trigger the node internal generation of a respective NMT command to itself. NMT_ResetCmd shall be automatically reset to NMTInvalidService by the node, when the reset has been completed. On read access, NMT_ResetCmd will always show NMTInvalidService. If applied in NMT_CS_EPL_MODE or NMT_MS_EPL_MODE, resets by NMT_ResetCmd may violate the NMT rules and stimulate DLL and NMT Guarding errors.

Data Type	Access	PDO Mapping	Default Value
Unsigned 8	RW	no	0xFF

3.3 XENAX® specific objects

3.3.1 S-curve profile (Jerk), 2000h

This object indicates the commanded S-curve parameter (0-100%) during the acceleration / deceleration ramp. This parameter is used in the profile position mode only.

Data Type	Access (PreOp/SafeOp/Op)	PDO Mapping	Default Value	Lower Limit	Upper Limit
Unsigned 32	RW/RW/RW	RxPDO	0x1	0x0	0x64

3.3.2 Limited Force LINAX®, 2001h

Limited force in force / speed control mode.
The force is defined in [10mN] units.
Currently not implemented, reserved for future.

Data Type	Access (PreOp/SafeOp/Op)	PDO Mapping	Default Value	Lower Limit	Upper Limit
Unsigned 32	RW/RW/RW	RxPDO	0x00	0x00000000	0xFFFFFFFF

3.3.3 Requested Force LINAX® 2002h

Requested force in force / speed control mode.
The force is defined in [10mN] units.
Currently not implemented, reserved for future.

Data Type	Access (PreOp/SafeOp/Op)	PDO Mapping	Default Value	Lower Limit	Upper Limit
Unsigned 32	RW/RW/RW	RxPDO	0x00	0x00000000	0xFFFFFFFF

3.3.4 Limited position by force control, 2003h

Limited position in force control mode.
Currently not implemented, reserved for future.

Data Type	Access (PreOp/SafeOp/Op)	PDO Mapping	Default Value	Lower Limit	Upper Limit
Unsigned 32	RW/RW/RW	RxPDO	0x00	0x00000000	0xFFFFFFFF

3.3.5 Error number, XENAX®, 2004h

Data Type	Access	PDO Mapping	Default Value	Lower Limit	Upper Limit
INTEGER 8	RO/RO/RO	no	0x00	0x0	0x7F

Error number	Description	Notes
0	no error	
01 to 12	Waiting for input (low or high)	Continues if status has been reached or restarts new if SM, HO, HORM or PQ, PW
40	Soft-Limit right / left reached	The motion has stopped at a Soft-Limit position. Set-up of Soft-Limit is done by serial command or with WinMotion in "motion"
41	Limit switch right / left active	Hardware Limit switches will be defined as Input Function LL / LR
50	Position deviation is too large	The difference between the internal calculated position and the present motor position (encoder) is larger than the value defined as DP (deviation position) in Closed Loop, Setup.
54	LINAX® readhead signal go off	The signal in the measurement system of glass scale is not ok. Clean the glass scale, see LINAX® glass scale.
60	Over-temperature power stage	Above 85° detected by separate temperature sensor on power stage. Power stage will be switched off.
61	Over-voltage, motor inverter supply	Power supply voltage too high or retarding energy from servo motor too high
62	Ballast circuit too long active	The ballast circuit is still more than 5 sec continuously active: Retarding energy too high or the power supply voltage is too high, the power stage will be switched off.
63	Over-temperature LINAX® linear axis	Above 80° coil temperature in LINAX® linear motor. Power stage will be switched off
64	Low-voltage motor inverter supply	Motor inverter voltage is (transient) too low. The power supply probably is not able to deliver demanded current.
65	Field vector adjustment on the magnet pole	The adjustment on the magnet pole was not successful, travel-plate of LINAX® or rotor of a rotative motor is blocked or break of encoder / motor cable.
66	HORM error	Push the travel-plate by hand to a "free range" and try again with command >HORM
67	Z-Mark distance failure	The measured distance of coded reference marks are not plausible. Start HORM again.
68	Speed too high during HORM	Start HORM again. Could be consecutive fault of vector field adjustment on the magnet pole.
70	Over-current power stage	Probably short circuit or ground fault of motor lines or coil
71	Power stage disabled	Release signal via PLC I/O Pin 9 not present (if activated) or power stage is disabled by Safe Motion Unit (SMU)
80	Over-current PLC Output	One or more outputs of the PLC interface in source configuration were overloaded. $I_{max,out}=100mA$ per channel.
81	Master / Slave	Communication failure with one or more slaves in master / slave operation
82	Communication error I2C bus	Check encoder and extension cables. Cable shield must be grounded on servo and motor side.
83	Internal FRAM error	Persistent data storage not possible ¹ .
84	Startup-key error	Test with other key. Functionality in master-slave mode not supported.
85	I2C switch error	Test without master-slave cabling
86	wrong checksum of application data	Error possible after firmware download. Execute Reset (RES)
87	Remote controller missing	Master slave configuration: One or more remote controllers defined in master are missing. Check master programs for nonexistent controllers (RemID) and delete them out of programs.
88	I2C device initialization failure	

3.3.6 Actual Force LINAX®, 2005h

Actual force value in [10mN] units
Currently not implemented, reserved for future.

Data Type	Access (PreOp/SafeOp/Op)	PDO Mapping	Default Value	Lower Limit	Upper Limit
INTEGER32	RW/RW/RW	TxPDO	0x00	0x80000000	0x7FFFFFFF

3.3.7 Process Status Register XENAX®, 2006h

Binary coded definition of PSR (Process Status Register)

Data Type	Access (PreOp/SafeOp/Op)	PDO Mapping	Default Value	Lower Limit	Upper Limit
INTEGER32	RO/RO/RO	TxPDO	0x00	0x80000000	0x7FFFFFFF

Bit 0	Error
Bit 1	Home
Bit 2	In Motion
Bit 3	In Position (within target position window)
Bit 4	End of Program
Bit 5*	In Force (requested force reached, motion in stop)
Bit 6*	In Sector (The liner axis is in the specific distance part of a movement)
Bit 7*	Force window reached in Sector (a minimum force is reached and a maximum force is not exceed within the sector)
Bit 8	Inverter voltage present
Bit 9	End of gantry Init
Bit 10	Hardware Limit Switch Left reached
Bit 11	Hardware Limit Switch Right reached
Bit 12	Emergency Exit 1
Bit 13	Emergency Exit
Bit 14	Cogging Reference Drive Active
Bit 15-28	unused
Bit 29-31	Reserved

* Currently not implemented, reserved for future.

3.3.8 PDO Cycle Time, 2007h

PDO update cycle time in [μs] units

Data Type	Access (PreOp/SafeOp/Op)	PDO Mapping	Default Value	Lower Limit	Upper Limit
Unsigned 16	RO/RO/RO	no	0x3E8	0x64	0x2710

3.3.9 Type of LINAX® liner motor axis, 2008h

This object indicates the type of LINAX® linear motor axis connected to the XENAX® servo controller.
Currently not implemented, reserved for future.

Data Type	Access (PreOp/SafeOp/Op)	PDO Mapping	Default Value	Lower Limit	Upper Limit
VISIBLE_STRING	RO/RO/RO	no	none	0	0

3.4 XENAX® Command set

3.4.1 Direct commands, no parameter, 5000h

This object contains commands without any additional parameters. The object value represents the command.
See manual for detailed information.

Data Type	Access (PreOp/SafeOp/Op)	PDO Mapping	Default Value	Lower Limit	Upper Limit
Unsigned 32	RW/RW/RW	no	0x0	0x0	0xFFFFFFFF

Homing/Power	
0x1000	HORM Home Reference Mark, program sequence for Power On, search electrical angle (phasing) and calculate absolute position. Obligatory for first startup of LINAX® linear motor axes after power on.
0x1010	HO Home, according the Program HOME in Webmotion, for all measurement systems without reference marks, for example rotative motors.
Power	
0x2000	PW Power On (for rotative motors only)
0x2010	PWC Power Power continues at actual position (linear motor axes, after error, or after PQ)
0x2020	PWR Power Reset (search electrical angle, phasing, for test only)
0x2030	PQ Power Quit
Motion	
0x3000	GP Go Position
0x3010	GW Go Way
0x3020	JP Jog Positive
0x3030	JN Jog Negative
0x3040	SM Stop Motion
0x3050	GZ Rotate to Z-Mark
Cogging	
0x4000	CRD Cogging Reference Drive
0x4001	CCM1 Cogging Compensation Mode on
0x4002	CCM0 Cogging Compensation Mode off
Init	
0x5000	RES Reset
0x5010	CLCP Clear all Captured Positions
0x5020	CLPO Clear position counter (only rotative motors)

3.4.2 Read parameter, XENAX®, 5001h

The sub indexes represent the specific parameter.

SubIndex	Description	Data Type	Access (PreOp/ SafeOp/Op)	PDO Map	Default Value	Lower Limit	Upper Limit
000	NumOfEntries	Unsigned 32	RO/RO/RO	no	0x12	0x00	0xFFFFFFFF
001	TS Tell Status	Unsigned 32	RO/RO/RO	no	0x00	0x00	0xFFFFFFFF
002	TE Tell Error number	Unsigned 32	RO/RO/RO	no	0x00	0x00	0xFFFFFFFF
003	TP Tell Position	Unsigned 32	RO/RO/RO	no	0x00	0x00	0xFFFFFFFF
004	TT Tell Temperature	Unsigned 32	RO/RO/RO	no	0x00	0x00	0xFFFFFFFF
005	TOX Tell Output Hex	Unsigned 32	RO/RO/RO	no	-	0x00	0xFFFFFFFF
006	TIX Tell Input Hex	Unsigned 32	RO/RO/RO	no	-	0x00	0xFFFFFFFF
007	TMC Tell Motor Current	Unsigned 32	RO/RO/RO	no	-	0x00	0xFFFFFFFF
008	TMT Tell Motion Time	Unsigned 32	RO/RO/RO	no	-	0x00	0xFFFFFFFF
009	TCP Tell Captured Pos 1	Unsigned 32	RO/RO/RO	no	-	0x00	0xFFFFFFFF
010	TCP Tell Captured Pos 2	Unsigned 32	RO/RO/RO	no	-	0x00	0xFFFFFFFF
011	TCP Tell Captured Pos 3	Unsigned 32	RO/RO/RO	no	-	0x00	0xFFFFFFFF
012	TCP Tell Captured Pos 4	Unsigned 32	RO/RO/RO	no	-	0x00	0xFFFFFFFF
013	TCP Tell Captured Pos 5	Unsigned 32	RO/RO/RO	no	-	0x00	0xFFFFFFFF
014	TCP Tell Captured Pos 6	Unsigned 32	RO/RO/RO	no	-	0x00	0xFFFFFFFF
015	TCP Tell Captured Pos 7	Unsigned 32	RO/RO/RO	no	-	0x00	0xFFFFFFFF
016	TCP Tell Captured Pos 8	Unsigned 32	RO/RO/RO	no	-	0x00	0xFFFFFFFF
017	TH Tell Homing State	Unsigned 32	RO/RO/RO	no	0x00	0x00	0xFFFFFFFF
018	VER Version of Firmware	Unsigned 32	RO/RO/RO	no	0x00	0x00	0xFFFFFFFF

3.4.3 Write parameter, XENAX®, 5002h

The sub indexes represent the specific parameter.

SubIndex	Description	Data Type	Access (PreOp/ SafeOp/Op)	PDO Mapg	Default Value	Lower Limit	Upper Limit
000	NumOfEntries	INTEGER32	RO/RO/RO	no	0xC	0x00	0xFFFFFFFF
001	CO Clear Output	INTEGER32	WO/WO/WO	no	0x1	0x1	0x8
002	EVT Event Activation	INTEGER32	WO/WO/WO	no	0x0	0x0	0x1
003	G Go Immediately	INTEGER32	WO/WO/WO	no	0x0	0x800000 00	0x7FFFFFFF
004	IX Index number	INTEGER32	WO/WO/WO	no	0x1	0x1	0x32
005	PG Program number	INTEGER32	WO/WO/WO	no	0x1	0x1	0x3F
006	SO Set Output number	INTEGER32	WO/WO/WO	no	0x1	0x1	0x8
007	SOX Set Output Hex	INTEGER32	WO/WO/WO	no	0x0	0x0	0xFF
008	TGD Set Trigger Pos Downward	INTEGER32	WO/WO/WO	no	0x0	0x88CA6C 00	0x77359400
009	TGU Set Trigger Pos Upward	INTEGER32	WO/WO/WO	no	0x0	0x88CA6C 00	0x77359400
010	ETI Event Track Input	INTEGER32	WO/WO/WO	no	0x0	0x0	0xC
011	DTI Disable Track Input	INTEGER32	WO/WO/WO	no	0x0	0x0	0xC
012	PRF Positioning Profile number	INTEGER32	WO/WO/WO	no	0x1	0x1	0x5

3.4.4 Read / Write parameter XENAX®, 5003h

The sub indexes represent the specific parameter.

SubIndex	Description	Data Type	Access (PreOp/ SafeOp/Op)	PDO Map	Default Value	Lower Limit	Upper Limit
000	NumOfEntries	INTEGER32	RW/RW/RW	no	0x18	0x00	0xFFFFFFFF
001	AC Acceleration	INTEGER32	RW/RW/RW	no	0xF4240	0x7D0	0x3B9ACA00
002	S-curve percent value 0-100%	INTEGER32	RW/RW/RW	no	0x01	0x00	0x64
003	SP Speed	INTEGER32	RW/RW/RW	no	0x186A0	0xA	0x5F5E100
004	PO Position (absolute)	INTEGER32	RW/RW/RW	no	0x0	0x88CA6C00	0x77359400
005	WA Way (relative)	INTEGER32	RW/RW/RW	no	0x4E20	0x88CA6C00	0x77359400
006	DP Deviation Position	INTEGER32	RW/RW/RW	no	0x1388	0x0	0x186A0
007	DRHR Direction HORM	INTEGER32	RW/RW/RW	no	0x0	0x0	0x5
008	DTP Deviation Target Position	INTEGER32	RW/RW/RW	no	0x3E8	0x0	0x2710
009	ED Emergency Deceleration	INTEGER32	RW/RW/RW	no	0x989680	0x2710	0x3B9ACA00
010	ILAS Input Low Active Single	INTEGER32	RW/RW/RW	no	0x0	0x0	0xFF
011	ILA Input Low Active	INTEGER32	RW/RW/RW	no	0x0	0x0	0x2
012	IN Nominal Current	INTEGER32	RW/RW/RW	no	0x258	0xA	0x708
013	LR Soft-Limit Right, position	INTEGER32	RW/RW/RW	no	0x0	0x0	0x1312D00
014	LL Soft- Limit Left, position	INTEGER32	RW/RW/RW	no	0x0	0x0	0x1312D00
015	MD Mode	INTEGER32	RW/RW/RW	no	0x0	0x0	0xD
016	ML Mass load (WebMotion: Payload / Inertia)	INTEGER32	RW/RW/RW	no	0x0	0x0	0xC350
017	BWS Bandwith current (WebMotion: GAIN CUR)	INTEGER32	RW/RW/RW	no	0x5DC	0x5	0x1388
018	BWP Bandwith positon (WebMotion: GAIN POS)	INTEGER32	RW/RW/RW	no	0x32	0x5	0x1388
019	IP Peak Current	INTEGER32	RW/RW/RW	no	0x4B0	0xA	0x708
020	NIX Preselect Index Number	INTEGER32	RW/RW/RW	no	0x1	0x1	0x32
021	AIX Acceleration of selected index	INTEGER32	RW/RW/RW	no	0xF4240	0x7D0	0x3B9ACA00
022	SIX Speed of selected index	INTEGER32	RW/RW/RW	no	0x186A0	0xA	0x5F5E100
023	DIX Distance of selected index	INTEGER32	RW/RW/RW	no	0x0	0x88CA6C00	0x77359400
024	CI Card Identifier	INTEGER32	RW/RW/RW	no	0x0	0x0	0xFF

4 CANopen motion control DS402


4.1 Objects device profile DS402

4.1.1 Controlword, 6040h

Data Type	Access (PreOp/SafeOp/Op)	PDO Mapping	Default Value	Lower Limit	Upper Limit
Unsigned 16	RW/RW/RW	RxPDO	0x0000	0x0000	0xFFFF

The object is organized bit-wise as follows:

Bit 0	switch on
Bit 1	enable voltage
Bit 2	quick stop
Bit 3	enable operation
Bit 4	Homing start (Homing mode) New Position (Profil position mode)
Bit 5	not used
Bit 6	(Profile position mode) 0: Absolute Position 1: Relative Distance
Bit 7	fault reset
Bit 8	halt
Bit 9	operation mode-specific
Bit 10	reserved
Bit 11-15	manufacturer-specific

Command	Bits of the controlword					Transitions
	Bit 7	Bit 3	Bit 2	Bit 1	Bit 0	
Shutdown	0	X	1	1	0	2,6,8
Switch on	0	0	1	1	1	3
Switch on + enable operation	0	1	1	1	1	3 + 4 (NOTE)
Disable voltage	0	X	X	0	X	7,9,10,12
Quick stop	0	X	0	1	X	7,10,11
Disable operation	0	0	1	1	1	5
Enable operation	0	1	1	1	1	4,16
Fault reset		X	X	X	X	15

NOTE Automatic transition to Enable operation state after executing SWITCHED ON state functionality.

Transition	Event(s)	Action(s)
0	Automatic transition after power-on or reset application	Drive device self-test and/or self initialisation shall be performed.
1	Automatic transition	Communication shall be activated.
2	Shutdown command from control device or local signal	None
3	Switch on command received from control device or local signal	The high-level power shall be switched on, if possible.
4	Enable operation command received from control device or local signal	The drive function shall be enabled and all internal set-points cleared.
5	Disable operation command received from control device or local signal	The drive function shall be disabled.
6	Shutdown command received from control device or local signal	The high-level power shall be switched off, if possible.
7	Quick stop or disable voltage command from control device or local signal	None
8	Shutdown command from control device or local signal	The drive function shall be disabled, and the high-level power shall be switched off, if possible.
9	Disable voltage command from control device or local signal	The drive function shall be disabled, and the high-level power shall be switched off, if possible.
10	Disable voltage or quick stop command from control device or local signal	The high-level power shall be switched off, if possible.
11	Quick stop command from control device or local signal	The quick stop function shall be started.
12	Automatic transition when the quick stop function is completed and quick stop option code is 1, 2, 3 or 4, or disable voltage command received from control device (depends on the quick stop option code)	The drive function shall be disabled, and the high-level power shall be switched off, if possible.
13	Fault signal (see also IEC61800-3)	The configured fault reaction function shall be executed.
14	Automatic transition	The drive function shall be disabled; the high-level power shall be switched off, if possible.
15	Fault reset command from control device or local signal	A reset of the fault condition is carried out, if no fault exists currently on the drive device; after leaving the Fault state, the Fault reset bit in the controlword shall be cleared by the control device.
16	Enable operation command from control device, if the quick stop option code is 5, 6, 7, or 8	The drive function shall be enabled.

4.1.2 Statusword, 6041h

DataType	Access (PreOp/SafeOp/Op)	PDO Mapping	Default Value	Lower Limit	Upper Limit
Unsigned 16	RO/RO/RO	TxPDO	0x0000	0x0000	0xFFFF

Bit 0	ready to switch on
Bit 1	switched on
Bit 2	operation enabled
Bit 3	fault
Bit 4	voltage enabled
Bit 5	quick stop
Bit 6	switch on disabled
Bit 7	warning
Bit 8	manufacturer-specific
Bit 9	remote
Bit 10	target position reached
Bit 11	Soft-Limit position reached
Bit 12	Homing achieved (Homing mode) Acknowledge of target position(Profile Pos Mode)
Bit 13	Homing error (Homing mode) Following position error (Profile Position Mode)
Bit 14-15	manufacturer-specific

Statusword	PDS FSA state
xxxx xxxx x0xx 0000 _b	Not ready to switch on
xxxx xxxx x1xx 0000 _b	Switch on disabled
xxxx xxxx x01x 0001 _b	Ready to switch on
xxxx xxxx x01x 0011 _b	Switched on
xxxx xxxx x01x 0111 _b	Operation enabled
xxxx xxxx x00x 0111 _b	Quick stop active
xxxx xxxx x0xx 1111 _b	Fault reaction active
xxxx xxxx x0xx 1000 _b	Fault

4.1.3 Modes of Operation Requested, 6060h

This object contains the value of the requested operation mode. The actual operation mode is shown in the object 6061

DataType	Access (PreOp/SafeOp/Op)	PDO Mapping	Default Value	Lower Limit	Upper Limit
Integer 8	RW/RW/RW	no	0x00	0xFE	0x0A

The following value definitions are valid:

-2	XENAX® specific, not used
-1	XENAX® specific, nout used
0	no mode change / no mode assigned
1	profile position mode
6	homing mode
8	cyclic synchronous position mode

4.1.4 Modes of Operation Display, 6061h

DataType	Access (PreOp/SafeOp/Op)	PDO Mapping	Default Value	Lower Limit	Upper Limit
Integer 8	RO/RO/RO	no	0x00	0xFE	0x0A

This object shows the actual operation mode.

0	no mode change / no mode assigned
1	profile position mode
6	homing mode
8	cyclic synchronous position mode
11	Reserved (Jenny Science specific)
12	Reserved (Jenny Science specific)

4.1.5 Position Actual Value, 6064h

This object shows the actual absolute position value of XENAX® internal encoder counter in increments.

Data Type	Access (PreOp/SafeOp/Op)	PDO Mapping	Unit	Default Value	Lower Limit	Upper Limit
Integer 32	RO/RO/RO	TxPDO	measured Increments	0x0000	0x80000000	0x7FFFFFFF

4.1.6 Following Position Error Window, 6065h

The following position error window defines the range of tolerated position values symmetrical to the trajectory. If the actual position is out of range a following error (no 50) occurs.

A following error may occur when a motor is blocked (break on), or unreachable acceleration or speed parameters, or by wrong closed-loop parameters. If the value of the following position error window is 0x0h, the following control is disabled.

After this following position error (no 50) occurs, it is not necessary to run the Homing again. Just use the command PWC, Object 5000h, value 2010h.

Data Type	Access (PreOp/SafeOp/Op)	PDO Mapping	Unit	Default Value	Lower Limit	Upper Limit
Unsigned 32	RW/RW/RW	RxPDO	measured Increments	0x7D0 (2000)	0x0	0x2717 (10000)

4.1.7 Target Position Error Window, 6067h

Set the tolerance +/- of position deviation corresponding to the target position. If the actual value of the position encoder is within the tolerance, the corresponding status bit says the target is reached. If the actual position is outside of the tolerance and above following position error is inside the window then the motor will try endlessly to go to the target position. For this case you need a program timeout sequence.

If the value of the position window is 0x0h, the position window control is disabled.

Data Type	Access (PreOp/SafeOp/Op)	PDO Mapping	Unit	Default Value	Lower Limit	Upper Limit
Unsigned 32	RW/RW/RW	RxPDO	measured Increments	0x64 (100)	0x0	0x3E8 (1000)

4.1.8 Force/Torque control Current, 6073h

This current corresponds to the force of linear motor or the torque of rotative motor. For higher force accuracy with LINAX® linear motors run first the cogging reference drive object 5000h, Sub index 4000h

Data Type	Access (PreOp/SafeOp/Op)	PDO Mapping	Unit	Default Value	Lower Limit	Upper Limit
Unsigned 16	RW/RW/RW	RxPDO	10 mA	0x0	0x0	0x708 (18000mA)

4.1.9 Motor Current actual value, 6078h

This object shows the actual value of the motor current [mA]. This corresponds with the actual force or torque of the motor

Data Type	Access (PreOp/SafeOp/Op)	PDO Mapping	Unit	Lower Limit	Upper Limit
Integer 16	RO/RO/RO	TxPDO	mA	0xB9B0 (-18000mA)	0x4650 (18000mA)

4.1.10 Target Position/Distance, 607Ah

The value of this object is used as absolute position or relative distance depending on bit 6 of the controlword 6060h. This object is used in profile position mode and also in cyclic synchronous position mode. In cyclic synchronous mode the value is the absolute position

Data Type	Access (PreOp/SafeOp/Op)	PDO Mapping	Unit	Default Value	Lower Limit	Upper Limit
Integer 32	RW/RW/RW	RxPDO	measured Increments	0x00	0x80000000	0x7FFFFFFF

4.1.11 Soft-Limit positions, 607Dh

These parameters define the Soft-Limit position absolute with liner axis left and right and rotative axis forward and backward. Every new target position shall be checked against these limits. The limit positions shall be always correspond to the absolute position in the mechanical system.

Sub Index	Description	Data Type	Access (PreOp/SafeOp/Op)	PDO Map	Unit	Default Value	Lower Limit	Upper Limit
000	Highest sub-index supported	INTEGER32	RO/RO/RO	no	-	0x00000002	0x00000002	0x00000002
001	Software Position Limit Left	INTEGER32	RW/RW/RW	no	measured Increments	0x0	0x80000000	0x7FFFFFFF
002	Software Position Limit Right	INTEGER32	RW/RW/RW	no	measured Increments	0x7FFFFFFF	0x80000000	0x7FFFFFFF

4.1.12 Speed, profil position mode, 6081h

DataType	Access (PreOp/ SafeOp/Op)	PDO Mapping	Unit	Default Value	Lower Limit	Upper Limit
Unsigned 32	RW/RW/RW	RxPDO	Increments per second	0x0	0x0	0x5F5E100

4.1.13 Acceleration, profile position mode, 6083h

DataType	Access (PreOp/ SafeOp/Op)	PDO Mapping	Unit	Default Value	Lower Limit	Upper Limit
Unsigned 32	RW/RW/RW	RxPDO	Increments per seconds ²	0x2710	0x2710	0x3B9ACA00

4.1.14 Deceleration, profile position mode, 6084h

This parameter is not supported. Deceleration value is the same as acceleration value.

With WebMotion it is possible to program flexible motion profiles with different accelerations, speeds and decelerations. Browser Navigation "profile".

4.1.15 Deceleration, Quick Stop, 6085h

This fast deceleration is typically used to stop the motor in emergency situation. To do this, the quick stop bit in control word 6040h has to be activated .

DataType	Access (PreOp/ SafeOp/Op)	PDO Mapping	Unit	Default Value	Lower Limit	Upper Limit
Unsigned 32	RW/RW/RW	no	Increments per second ²	0x2710	0x2710	0x3B9ACA00

4.1.16 Homing methods, 6098h

The homing methods are divided in tow separate procedures. For LINAX® linear motors with distance coded reference marks. The HORM must be always the first initial function after power on, because it is used for precise ajustement of the electrical angle of the liner motor. For rotative motors with/without external HOME sensor and with/without Z-mark on the encoder.

DataType	Access (PreOp/ SafeOp/Op)	PDO Mapping	Unit	Default Value	Lower Limit	Upper Limit
INTEGER8	RW/RW/RW	no	-	0x01	0x01	0x0D

LINAX® liner motor axes	
1	HORM (Home Reference Mark), start direction positive
2	HORM (Home Reference Mark), start direction negative
3	HORM, gantry system, direction positive, linear motor axes same measurement system orientation
4	HORM, gantry system, direction negative, linear motor axes same measurement system orientation
5	HORM, gantry system, direction positive, linerar motors axes contrary measurement system orientation
6	HORM, gantry system, direction negative, linerar motors axes contrary measurement system orientation

Rotative motors	
10	HOME, start clockwise -> external Home Sensor, continue counter clockwise -> Z-mark
11	HOME, start clockwise -> external Home Sensor, continue clockwise -> Z-mark
12	HOME, start counter clockwise -> external Home Sensor, continue counter clockwise -> Z-mark
13	HOME, start, counter clockwise -> extranal Home Sensor, continue clockwise -> Z-mark

4.1.17 Homing Speeds, rotative motors 6099h

If there is **no HOME sensor**, then set the Home Speed to 0.
 If there is **no Z-mark** on the encoder, then set the Z-Speed to 0.

Sub Index	Description	Data Type	Access (PreOp/ SafeOp/Op)	PDO Mapping	Unit	Default Value	Lower Limit	Upper Limit
000	Highest sub-index value	Unsigned 32	RO/RO/RO	no	-	0x2	0x2	0x2
001	Home-Speed for search the external Home sensor	Unsigned 32	RW/RW/RW	no	Increments per second	0x0	0x0	0xFFFFFFFF
002	Z-Speed for search the internal encoder Z-mark	Unsigned 32	RW/RW/RW	no	Increments per second	0x0	0x0	0xFFFFFFFF

4.1.18 Homing Acceleration, 609Ah

This object contains the acceleration/deceleration value, used during homing operation. But this object is not supported. This homing acceleration/ deceleration values corresponds to the acceleration value in object 6083h.

4.1.19 Synchronous Cycle Time, 60C2h

This object contains base and exponent values to calculate the cycle time. The cycle time is typically used in cyclic synchronous position mode to transfer the absolute position value in synchronous way. The XENAX® Xvi servocontroller automatically generate a linear interpolation of position value between the synchronous cycle time and his faster internal position-loop time.

Sub-Indexes:
 Sub-Index 1: BASE
 Sub-Index 2: 10^{EXPONENT}
 Synchronous cycle Time in seconds = BASE x 10^{EXPONENT}

Example synchronous cycle time of 500µs:
 Sub-Index 1 value: BASE = 5
 Sub-Index 2 value: 10^{EXPONENT} = -4

Sub Index	Description	Data Type	Access(PreOp/ SafeOp/Op)	PDO Mapping	Unit	Default Value	Lower Limit	Upper Limit
000	Highest sub-index value	P402_IP_PERIOD_T	RO/RO/RO	no	-	0x2	0x2	0x2
001	Base value	Unsigned 8	RW/RW/RW	no	-	0x01	0x0	0xFF
002	10 ^{EXPONENT}	INTEGER8	RW/RW/RW	no	-	0xFD	0x80	0x3F

4.1.20 Actual Position Following Error, 60F4h

The value is the actual deviation of calculated trajectory position and measured position on linear or rotative encoder.

DataType	Access (PreOp/SafeOp/Op)	PDO Mapping	Unit	Lower Limit	Upper Limit
INTEGER32	RO/RO/RO	TxPDO	Increments	0x80000000	0x7FFFFFFF

4.1.21 Digital Inputs XENAX®, 60FDh

This object contains the status of digital inputs on the XENAX® servo controller.

bit value = 0: input is Low
bit value = 1: input is High

(With the XENAX® WebMotion a set-up of Low active or High active Input function is possible)

DataType	Access (PreOp/SafeOp/Op)	PDO Mapping	Default Value	Lower Limit	Upper Limit
Unsigned 32	RO/RO/RO	TxPDO	0x00000000	0x00000000	0xFFFFFFFF

Bit 0-3	not used
Bit 16-28	digital inputs 1-12
Bit 29-31	not used

4.1.22 Digital Outputs XENAX®, 60FEh

Control the digital output signals of XENAX®

Sub-Index 1: for the physical output bit value
Sub-Index 2: mask for the physical outputs (not supported)

Bit value = 0: output is logic 0
Bit value = 1: output is logic 1

Default set-up, all Outputs: SOURCE and HIGH ACTIVE
Logic 1 = 24V
Logic 0 = open

The physical output level can be set-up for every output bit individual (Source, Sink, Source&Sink driver)
See XENAX_Xvi75V8_MANUAL_E.pdf.

Sub Index	Description	DataType	Access(PreOp/SafeOp/Op)	PDO Mapping	Default Value	Lower Limit	Upper Limit
000	Highest Sub-Index value	Unsigned 32	RO/RO/RO		0x02	0x1	0x2
001	Output Bit	Unsigned 32	RW/RW/RW	RxPDO	0x0	0x0	0xFFFFFFFF
002	Output Mask (not supported)	Unsigned 32	RW/RW/RW	no	0x0	0x0	0xFFFFFFFF

Bit 0	set brake (not used)
Bit 16-23	digital outputs 1-8

4.1.23 Supported Modes of Operation, 6502h

The value shows the supported modes of Operation.
 Bit-wise orientated
 1 = Supported
 0 = Not supported

Data Type	Access (PreOp/ SafeOp/Op)	PDO Mapping	Default Value	Lower Limit	Upper Limit
Unsigned 32	RO/RO/RO	no	0x000300A1	0x000300A1	0x000300A1

Bit 0	profile position mode	1
Bit 1	speed mode	0
Bit 2	profile speed mode	0
Bit 3	profile torque mode	0
Bit 4	reserved	0
Bit 5	homing mode	1
Bit 6	interpolated position mode*	0*
Bit 7	cyclic synchronous position mode	1
Bit 8	cyclic synchronous speed mode	0
Bit 9	cyclic synchronous torque mode	0
Bit 10-15	reserved	0
Bit 16	reserved (Jenny Science specific)	1
Bit 17	reserved (Jenny Science specific)	1
Bit 18-31	manufacturer-specific	

*) This interpolated position mode is supported with the cyclic synchronous position mode. Because with the cyclic synchronous position mode, the received position values (trajectory) are automatically linear interpolated between the lower cyclic synchronous time and the faster, internal positioning loop time of the XENAX®.

4.1.24 Product Website Address, 6505h

This object indicates the assigned web address of the drive manufacturer. If the address is not assigned yet, this object shall indicate this by /0 (empty string).

Data Type	Access (PreOp/ SafeOp/Op)	PDO Mapping	Default Value	Lower Limit	Upper Limit
VISIBLE_STRING	RO/RO/RO	no	http://www.jennyscience.ch	-	-

5 Modes of Operation

5.1 Homing Mode

Mode specific bits of the controlword, 6040h

Bit 4	Homing operation start
Bit 5	reserved
Bit 6	reserved

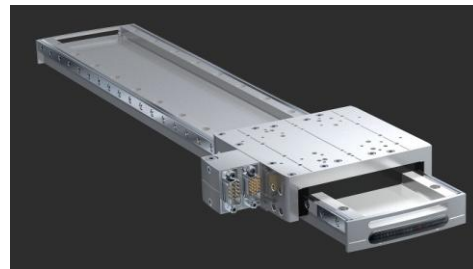
Mode specific bits of the statusword, 6041h

Bit 12	Homing achieved
Bit 13	Homing error

With LINAX® linear motor axes the first start after power On, the Homing Mode (HORM, homing reference marks) must be done. Do HORM also after logic power interruption. Otherwise the automatic adjustment of the electrical angle between magnets and coil poles will not be done. If an error occurs i.e. 50 no HORM is necessary, because with the logical power the position counter remains active. Use the command PWC, object 5000h, Subindex 2010h to continue the process.

On the glass/magnet scale are distance coded reference marks. With a run over two reference marks the absolute position is calculated to the mechanical zero position. At this moment the calculated absolute position is in effect.

5.1.1 Homing of LINAX® linear motor axes



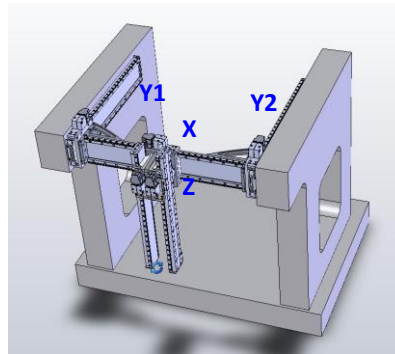
5.1.2 Example HORM LINAX® single axes

Object	Description	Value	Activities
6060	Modes of Operation requested	0x06	Set Homing Mode
6061	Modes of Operation display		Wait until Homing Mode is active, Value = 0x06
6098	Homing method linear	0x ...	0x01 HORM (Home Reference Mark), start direction positive 0x02 HORM (Home Reference Mark), start direction negative
6040	Controlword	0x06	
6040	Controlword	0x1F	Homing operation starts
6041	Statusword		Wait until Homing achieved Bit 12 = 1

5.1.3 Homing of LINAX® gantry systems

Homing of a LINAX® gantry system is using the master-slave connection of the XENAX® Xvi servo controllers.

The gantry initialization is a stand-alone process controlled by master XENAX®. After completion the homing, both servo controllers (axes) must be change to cyclic synchronous position mode, served with identical absolute position information.



Y1, Y2 Axes as a gantry system



Master-Slave connection

5.1.4 Example of Homing LINAX® gantry systems

Object	Description	Value	Activities
6060	Modes of Operation requested	0x06	Set Homing Mode
6061	Modes of Operation display		Wait until Homing Mode is active, Value = 0x06
6098	Homing method gantry	0x ...	Depending on mechanical fitting of the gantry axes 0x03 HORM, gantry system, direction positive, linear motor axes same measurement system orientation 0x04 HORM, gantry system, direction negative, linear motor axes same measurement system orientation 0x05 HORM, gantry system, direction positive, linear motors axes contrary measurement system orientation 0x06 HORM, gantry system, direction negative, linear motors axes contrary measurement system orien
6040	Controlword	0x06	
6040	Controlword	0x1F	Homing operation starts
2006	Process Status Register		Wait until Bit 9 (End of Gantry Init) = 1

5.1.5 Homing of rotative motors

In a typical configuration of rotative axis, there is an external **HOME sensor** to find the mechanical Home range.
 After lock for the precise Home position with the internal **Z-mark** on the encoder.

For an optimal function the motor should turn about a half revolution from the HOME sensor to the Z-mark.

If the HOME sensor and the Z-mark are close-by, there is no reliable function guaranteed.

This configuration is set-up by mechanical adjustment, fixation of motor shaft, positioning of Home sensor.



5.1.6 Example of Homing rotative motors

Object	Description	Value	Activities
6060	Modes of Operation requested	0x06	Set Homing Mode
6061	Modes of Operation display		Wait until Homing Mode is active, Value = 0x06
6098	Homing method rotative	0x ...	0x0A HOME, start clockwise -> external Home Sensor, continue counter clockwise -> Z-mark 0x0B HOME, start clockwise -> external Home Sensor, continue clockwise -> Z-mark 0x0C HOME, start counter clockwise -> external Home Sensor, continue counter clockwise -> Z-mark 0x0D HOME, start, counter clockwise -> external Home Sensor, continue clockwise -> Z-mark
6099,Sub 01	Home-Speed for search the external Home sensor	Unsig 32	If there is no HOME sensor , then set the Home Speed to 0
6099,Sub 02	Z-Speed for search the internal encoder Z-mark	Unsig 32	If there is no Z-mark on the encoder, then set the Z-Speed to 0
6040	Controlword	0x06	
6040	Controlword	0x1F	Homing operation starts
6041	Statusword		Wait until Homing achieved Bit 12 = 1

Notice:

To assign the external HOME sensor to a physical Input, the Input number have to be programmed with WebMotion in menu *programming / home function*

5.1.7 Example of Reset Homing Failure

Object	Description	Value	Activities
6040	Controlword	0x86	
6040	Controlword	0x06	
6040	Controlword	0x1F	Homing operation starts

With the Profile Position Mode the XENAX® servo controller get the profile parameters like S-curve, acceleration, speed, position ect. from the superior controller (PC, PLC). The position profile trajectory is calculated in the XENAX® Xvi servo controller.

A new Position will only be possible, if the actual running position profile reached the target position.

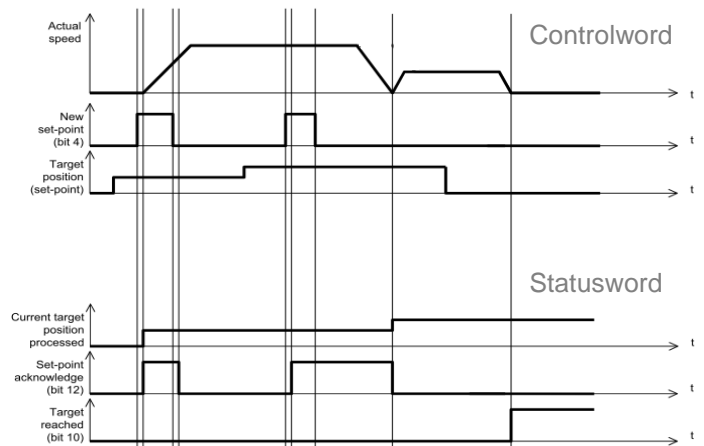
Mode specific bits in the Controlword, 6040h

Bit 4	New Position
Bit 6	(Profile position mode) 0: Absolute Position 1: Relative Distance

Mode specific bits in the Statusword, 6041h

Bit 10	Target position reached
Bit 12	Acknowledge of target position(Profile Position Mode)
Bit 13	Following position error (Profile Position Mode)

5.2 Profile Position Mode



5.2.1 Example of profile position mode

Object	Description	Value	Activities
6060	Modes of Operation requested	0x01	Set Profil Position Mode
6061	Modes of Operation display		Wait until Profil Position Mode is active, Value = 0x01
6040	Controlword	0x0F	
60xx	Profil Position Mode parameters	0x	S-Curve (2000h), Acceleration (6083h), Speed (6081h), Following Positon Error Window (6065h), Target Pos. Error Window (6067h)
607A	Target Position/Distance	0x	
6040	Controlword	0x1F	Start movement to target position absolute (Bit 6=0)
6041	Statusword		Target position reached, Acknowledge of target pos. Bit 10, Bit 12
6040	Controlword	0x0F	
60xx	Profil Position Mode parameters	0x	S-Curve (2000h), Acceleration (6083h), Speed (6081h), Following Positon Error Window (6065h), Target Pos. Error Window (6067h)
607A	Target Position/Distance	0x	
6040	Controlword	0x5F	Start movement to target position relative (Bit 6=1)
6041	Statusword		Target position reached, Acknowledge of target pos. Bit 10, Bit 12

5.2.2 Example of Reset Profile Position Mode Failure

Object	Description	Value	Activities
6040	Controlword	0x86	Fault reset
6040	Controlword	0x06	
6040	Controlword	0x0F	Power Continue, no HORM necessary

5.3 Cyclic Synchronous Position Mode

With the Cyclic Synchronous Position Mode the XENAX® servo controller get always new target positions in synchronous cycle time. The position trajectory is calculated in the superior controller (PC, PLC) which also transfer the target positions in a cyclic synchronous way.

A typical cycle time is 500µs, but the internal position control loop of the XENAX® servocontroller is 100µs.

Now the servo controller calculates an interpolated position value on each internal position control loop. Therefore, the servo controller needs the synchronous cycle time of the superior controller in object 0x60C2 or 0x2007.

Mode specific bits in the Controlword, 6040h

Bit 6	not used
-------	----------

Mode specific bits in the Statusword, 6041h

Bit 12	0 = Target position ignored 1 = Target position is used in the position control loop of XENAX servo controller (Cyclic Synchronous Profile Position Mode)
Bit 13	Following position error

5.3.1 Example of cyclic synchronous position mode

Object	Description	Value	Activities
6060	Modes of Operation requested	0x08	Set Cyclic Synchronous Position Mode
6061	Modes of Operation display		Wait until Cyclic Synchronous Position Mode is active, Value = 0x08
6040	Controlword	0x0F	
60C2	Synchronous cycle time		Example synchronous cycle time of 500µs
Sub 01	Bas value	0x05	Synchronous cycle Time in seconds = BASE x 10 ^{EXPONENT}
Sub 02	10 ^{EXPONENT}	0xFC	5 x 10 ⁻⁴ seconds
6065	Following Position Error Window	0x	XENAX® monitors this following position error window
607A	Target Position	0x	Set target position equal to XENAX® internal absolute position
6040	Controlword	0x06	
6040	Controlword	0x1F	Start Cyclic synchronous position mode
607A	Target Position	0XXXXX 0XXXXX 0XXXXX : :	Set new target positions cyclically

5.3.2 Reset Cyclic Synchronous Position Mode Failure

Object	Description	Value	Activities
6040	Controlword	0x86	Fault reset
6040	Controlword	0x06	
607A	Target Position	0x	Set target position equal to XENAX® internal absolute position
6040	Controlword	0x0F	Power Continue, no HORM necessary Cyclic Synchronous Position Mode operation enabled

6 EtherCAT

6.1 Predefined EtherCAT PDO

6.1.1 EtherCAT in Profile Position Mode

The position profile trajectory is calculated in the XENAX® Xvi servo controller. With dynamic PDO mapping the predefined PDO configuration of the EtherCAT interface can be changed.

RxPDO 1 (1600) PLC/PC -> XENAX®	
6040	Controlword

TxPDO 1 (1A00) XENAX® -> PLC/PC	
6041	Statusword

RxPDO 2 (1601) PLC/PC -> XENAX®	
6040	Controlword
607A	Target Position

TxPDO 2 (1A01) XENAX® -> PLC/PC	
6041	Statusword
6064	Actual Position

RxPDO 17 (1611) PLC/PC -> XENAX®	
6040	Controlword
607A	Target Position
60FE	Digital Outputs

TxPDO 17 (1A10) XENAX® -> PLC/PC	
6041	Statusword
6064	Actual Position
60FD	Digital Inputs
60FE	Digital Outputs

RxPDO 18 (1612) PLC/PC -> XENAX®	
6040	Controlword
607A	Target Position
6081	Speed
6083	Acceleration
6084	Deceleration (reserved for future)
2000	S-curve
6065	Following position error window
6067	Target position error window
60FE	Digital Outputs

TxPDO 18 (1A11) XENAX® -> PLC/PC	
6041	Statusword
6064	Actual Position
60F4	Actual following position error
6078	Actual Current
60FD	Digital Inputs
60FE	Digital Outputs

6.1.2 EtherCAT in Cyclic synchronous Position Mode

With the Cyclic Synchronous Position Mode the XENAX® servo controller get always new target positions in synchronous cycle time.

RxPDO 2 (1601, TrioMotion) PLC/PC -> XENAX®	
6040	Controlword
607A	Target Position

TxPDO 2 (1A01, TrioMotion) XENAX® -> PLC/PC	
6041	Statusword
6064	Actual Position

RxPDO 21 (1615, TwinCAT) PLC/PC -> XENAX®	
6040	Controlword
607A	Target Position
6065	Following position error window
6067	Target position error window
6073	Max Current

TxPDO 21 (1A13, TwinCAT) XENAX® -> PLC/PC	
6041	Statusword
6064	Actual Position
60F4	Actual Following position error
6078	Actual current
2006	Process Status Register

6.1.3 EtherCAT Object detail Receive PDO

PLC/PC -> XENAX®

Their structure is as follows:
Object (16bit) SubIndex (8bit) Nbr of Entries (8bit)

Receive PDO 1, 1600h

SubIndex	Description	Data Type	Access (PreOp/SafeOp/Op)	Default Value	Lower Limit	Upper Limit
000	Nbr of Entries	PDO_MAPPING	RO/RO/RO	0x01	0x0	0x08
001	Controlword	Unsigned 32	RO/RO/RO	0x60400010	0x0	0xFFFFFFFF

Receive PDO 2, 1601h

SubIndex	Description	Data Type	Access (PreOp/SafeOp/Op)	Default Value	Lower Limit	Upper Limit
000	Nbr of Entries	PDO_MAPPING	RO/RO/RO	0x02	0x0	0x08
001	Controlword	Unsigned 32	RO/RO/RO	0x60400010	0x0	0xFFFFFFFF
002	Target Position	Unsigned 32	RO/RO/RO	0x607A0020	0x0	0xFFFFFFFF

Receive PDO 17, 1611h

Sub Index	Description	Data Type	Access (PreOp/SafeOp/Op)	Default Value	Lower Limit	Upper Limit
000	Nbr of Entries	PDO_MAPPING	RO/RO/RO	0x03	0x0	0x08
001	Controlword	Unsigned 32	RO/RO/RO	0x60400010	0x0	0xFFFFFFFF
002	Target Position	Unsigned 32	RO/RO/RO	0x607A0020	0x0	0xFFFFFFFF
003	Digital Outputs	Unsigned 32	RO/RO/RO	0x60FE0120	0x0	0xFFFFFFFF

Receive PDO 18, 1612h

Sub Index	Description	Data Type	Access (PreOp/SafeOp/Op)	Default Value	Lower Limit	Upper Limit
000	Nbr of Entries	PDO_MAPPING	RO/RO/RO	0x09	0x0	0x09
001	Controlword	Unsigned 32	RO/RO/RO	0x60400010	0x0	0xFFFFFFFF
002	Target Position	Unsigned 32	RO/RO/RO	0x607A0020	0x0	0xFFFFFFFF
003	Speed,	Unsigned 32	RO/RO/RO	0x60810020	0x0	0xFFFFFFFF
004	Acceleration	Unsigned 32	RO/RO/RO	0x60830020	0x0	0xFFFFFFFF
005	Deceleration (reserved for future)	Unsigned 32	RO/RO/RO	0x60840020	0x0	0xFFFFFFFF
006	S-curve	Unsigned 32	RO/RO/RO	0x20000020	0x0	0xFFFFFFFF
007	Following position error window	Unsigned 32	RO/RO/RO	0x60650020	0x0	0xFFFFFFFF
008	Target position error window	Unsigned 32	RO/RO/RO	0x60670020	0x0	0xFFFFFFFF
009	Digital Outputs	Unsigned 32	RO/RO/RO	0x60FE0120	0x0	0xFFFFFFFF

Receive PDO 19, 1613h
Currently not implemented, reserved for future.

Sub Index	Description	Data Type	Access (PreOp/SafeOp/Op)	Default Value	Lower Limit	Upper Limit
000	Nbr of Entries	PDO_MAPPING	RO/RO/RO	0x05	0x0	0x08
001	Controlword	Unsigned 32	RO/RO/RO	0x60400010	0x0	0xFFFFFFFF
002	Speed	Unsigned 32	RO/RO/RO	0x60810020	0x0	0xFFFFFFFF
003	Limited Force	Unsigned 32	RO/RO/RO	0x20010020	0x0	0xFFFFFFFF
004	Limited Position	Unsigned 32	RO/RO/RO	0x20030020	0x0	0xFFFFFFFF
005	Digital Outputs	Unsigned 32	RO/RO/RO	0x60FE0120	0x0	0xFFFFFFFF

Receive PDO 20, 1614h
Currently not implemented, reserved for future.

Sub Index	Description	Data Type	Access (PreOp/SafeOp/Op)	Default Value	Lower Limit	Upper Limit
000	Nbr of Entries	PDO_MAPPING	RO/RO/RO	0x03	0x0	0x08
001	Controlword	Unsigned 32	RO/RO/RO	0x60400010	0x0	0xFFFFFFFF
002	Force demand value	Unsigned 32	RO/RO/RO	0x20020020	0x0	0xFFFFFFFF
003	Digital Outputs	Unsigned 32	RO/RO/RO	0x60FE0120	0x0	0xFFFFFFFF

Receive PDO 21, 1615h

Sub Index	Description	Data Type	Access (PreOp/SafeOp/Op)	Default Value	Lower Limit	Upper Limit
000	Nbr of Entries	PDO_MAPPING	RO/RO/RO	0x05	0x0	0x08
001	Controlword	Unsigned 32	RO/RO/RO	0x60400010	0x0	0xFFFFFFFF
002	Target Position	Unsigned 32	RO/RO/RO	0x607A0020	0x0	0xFFFFFFFF
003	Following position error window	Unsigned 32	RO/RO/RO	0x60650020	0x0	0xFFFFFFFF
004	Target position error window	Unsigned 32	RO/RO/RO	0x60670020	0x0	0xFFFFFFFF
005	Max Current	Unsigned 32	RO/RO/RO	0x60730010	0x0	0xFFFFFFFF

6.1.4 EtherCAT Object detail Transmit PDO

XENAX® -> PLC/PC

Contains the mapping for the PDOs the device is able to transmit.

The subindex 0h contains the number of valid entries within the mapping record. This number of entries is also the number of the application variables which shall be transmitted with the corresponding PDO.

The subindices from 1h to number of entries contain the information about the mapped application variables.

Transmit PDO 1, 1A00h

Sub Index	Description	Data Type	Access (PreOp/SafeOp/Op)	Default Value	Lower Limit	Upper Limit
000	Nbr of Entries	PDO_MAPPING	RO/RO/RO	0x01	0x0	0x08
001	Statusword	Unsigned 32	RO/RO/RO	0x60410010	0x0	0xFFFFFFFF

Transmit PDO 2, 1A01h

Sub Index	Description	Data Type	Access (PreOp/SafeOp/Op)	Default Value	Lower Limit	Upper Limit
000	Nbr of Entries	PDO_MAPPING	RO/RO/RO	0x02	0x0	0x08
001	Statusword	Unsigned 32	RO/RO/RO	0x60410010	0x0	0xFFFFFFFF
002	Actual Position	Unsigned 32	RO/RO/RO	0x60640020	0x0	0xFFFFFFFF

Transmit PDO 17, 1A10h

Sub Index	Description	Data Type	Access (PreOp/SafeOp/Op)	Default Value	Lower Limit	Upper Limit
000	Nbr of Entries	PDO_MAPPING	RO/RO/RO	0x04	0x0	0x08
001	Statusword	Unsigned 32	RO/RO/RO	0x60410010	0x0	0xFFFFFFFF
002	Actual Position	Unsigned 32	RO/RO/RO	0x60640020	0x0	0xFFFFFFFF
003	Digital Inputs	Unsigned 32	RO/RO/RO	0x60FD0020	0x0	0xFFFFFFFF
004	Digital Outputs	Unsigned 32	RO/RO/RO	0x60FE0120	0x0	0xFFFFFFFF

Transmit PDO 18, 1A11h

Sub Index	Description	Data Type	Access (PreOp/SafeOp/Op)	Default Value	Lower Limit	Upper Limit
000	Nbr of Entries	PDO_MAPPING	RO/RO/RO	0x06	0x0	0x08
001	Statusword	Unsigned 32	RO/RO/RO	0x60410010	0x0	0xFF
002	Actual Position	Unsigned 32	RO/RO/RO	0x60640020	0x0	0xFF
003	Actual Following position error	Unsigned 32	RO/RO/RO	0x60F40020	0x0	0xFF
004	Actual Current	Unsigned 32	RO/RO/RO	0x60780010	0x0	0xFF
005	Digital Inputs	Unsigned 32	RO/RO/RO	0x60FD0020	0x0	0xFF
006	Digital Outputs	Unsigned 32	RO/RO/RO	0x60FE0120	0x0	0xFF

Transmit PDO 19, 1A12h

Currently not implemented, reserved for future.

Sub Index	Description	Data Type	Access (PreOp/SafeOp/Op)	Default Value	Lower Limit	Upper Limit
000	Nbr of Entries	PDO_MAPPING	RO/RO/RO	0x05	0x0	0x08
001	Statusword	Unsigned 32	RO/RO/RO	0x60410010	0x0	0xFF
002	Actual Position	Unsigned 32	RO/RO/RO	0x60640020	0x0	0xFF
003	Actual Force	Unsigned 32	RO/RO/RO	0x20050020	0x0	0xFF
004	Digital Inputs	Unsigned 32	RO/RO/RO	0x60FD0020	0x0	0xFF
005	Digital Outputs	Unsigned 32	RO/RO/RO	0x60FE0120	0x0	0xFF

Transmit PDO 21, 1A13h

Sub Index	Description	Data Type	Access (PreOp/SafeOp/Op)	Default Value	Lower Limit	Upper Limit
000	Nbr of Entries	PDO_MAPPING	RO/RO/RO	0x05	0x0	0x08
001	Statusword	Unsigned 32	RO/RO/RO	0x60410010	0x0	0xFF
002	Actual Position	Unsigned 32	RO/RO/RO	0x60640020	0x0	0xFF
003	Actual Following position error	Unsigned 32	RO/RO/RO	0x60F40020	0x0	0xFF
004	Actual Current	Unsigned 32	RO/RO/RO	0x60780010	0x0	0xFF
005	Process Status Register	Unsigned 32	RO/RO/RO	0x20060020	0x0	0xFF

7 Powerlink

7.1 Powerlink PDO Parameter

7.1.1 Powerlink PDO_RxCommParam_0h, 1400h

A device may implement less than the maximum number of 256 objects. The number of objects shall be equal to the number of RPDO channels provided by the device.

Objects shall be implemented starting at Index 1400h.

The validity of the respective object depends on the NumberOfEntries_U8 entry of the respective RPDO mapping index PDO_RxMappParam_XXh.

To change the PDO communication parameter, first the PDO has to be deactivated by means of setting PDO_RxMappParam_XXh. NumberOfEntries to 0.

Sub Index	Description	Data Type	PDO Mapping	Access	Default Value
000	Nbr of Entries	PDO_COMMPAR_REC	no	RO	0x02
001	NodeID_U8	Unsigned 8	no	RW	0x00
002	MappingVersion_U8	Unsigned 8	no	RW	0x00

7.1.2 Powerlink PDO_RxMappParam_0h, 1600h

To allow access by name _XXh shall be replaced by a name index. Name index shall be _00h if object index is 1600h. It shall be incremented up to _FFh corresponding to object index 16FFh.

To change the PDO mapping, first the PDO has to be deactivated by means of setting NumberOfEntries to 0. The objects may then be remapped.

Sub Index	Description	Data Type	PDO Mapping	Access	Default Value
000	Nbr of Entries	Unsigned 64	no	RW	0x00
001	ObjectMapping 1	Unsigned 64	no	RW	0x0020000000002000
002	ObjectMapping 2	Unsigned 64	no	RW	0x0020002000002001

7.1.3 Powerlink PDO_TxCommParam_0h, 1800h

The validity of the respective object depends on the NumberOfEntries_U8 entry of the respective RPDO mapping index PDO_TxMappParam_XXh.

Sub Index	Description	Data Type	PDO Mapping	Access	Default Value
000	Nbr of Entries	PDO_COMMPAR_REC	no	RO	0x02
001	NodeID_U8	Unsigned 8	no	RW	0x00
002	MappingVersion_U8	Unsigned 8	no	RW	0x00

7.1.4 Powerlink PDO_TxMappParam_0h, 1A00h

To allow access by name _XXh shall be replaced by a name index.

Name index shall be _00h if object index is 1A00h. It shall be incremented up to _FFh corresponding to object index 1AFFh.

To change the PDO mapping, first the PDO has to be deactivated by means of setting NumberOfEntries to 0. The objects may then be remapped.

Sub Index	Description	Data Type	PDO Mapping	Access	Default Value
000	Nbr of Entries	Unsigned 64	no	RW	0x00
001	ObjectMapping 1	Unsigned 64	no	RW	0x0020000000002002
002	ObjectMapping 2	Unsigned 64	no	RW	0x0020002000002003

8 CANopen

8.1 CANopen PDO Parameter

8.1.1 CANopen Receive PDO Comm Param 1, 1400h

It contains the communication parameters of the current PDO the device is able to receive.

Sub-index 0 contains the number of PDO-parameters implemented.

Sub index 1 describes the COB-ID. If bit 31 is set the PDO is disabled. The transmission mode is defined by sub-index 2. An inhibit time can be defined on sub-index 3 in 100 us. The 4th sub-index contains the priority class of the PDO.

At the 5th sub-index can be defined a event time for asynchronous pdos.

SubIndex	Description	DataType	Access	PDO Mapping	Unit	Default Value
000	Nbr of Entries	PDO_COMM_PAR	RO	no		0x05
001	COB-ID	Unsigned 32	RO	no		0x00000200
002	Transmission Type	Unsigned 8	RO	no		0xFF
003	Inhibit Time	Unsigned 16	RO	no	100 us	0x0
004	Compatibility Entry	Unsigned 8	RO	no		0x0
005	Event Timer	Unsigned 16	RO	no	ms	0x0

8.1.2 CANopen Receive PDO Comm Param 2, 1401h

SubIndex	Description	DataType	Access	PDO Mapping	Unit	Default Value
000	Nbr of Entries	PDO_COMM_PAR	RO	no		0x05
001	COB-ID	Unsigned 32	RO	no		0x00000300
002	Transmission Type	Unsigned 8	RO	no		0xFF
003	Inhibit Time	Unsigned 16	RO	no	100 us	0x0
004	Compatibility Entry	Unsigned 8	RO	no		0x0
005	Event Timer	Unsigned 16	RO	no	ms	0x0

8.1.3 CANopen Receive PDO Comm Param 17-24, 1410h-1417h

SubIndex	Description	DataType	Access	PDO Mapping	Unit	Default Value
000	Nbr of Entries	PDO_COMM_PAR	RO	no		0x05
001	COB-ID	Unsigned 32	RO	no		0x80000000
002	Transmission Type	Unsigned 8	RO	no		0xFE
003	Inhibit Time	Unsigned 16	RO	no	100 us	0x0
004	Compatibility Entry	Unsigned 8	RO	no		0x0
005	Event Timer	Unsigned 16	RO	no	ms	0x0

8.1.1 CANopen Transmit PDO Comm Param 1, 1800h

It contains the communication parameters of the current PDO the device is able to transmit.

Sub-index 0 contains the number of PDO-parameters implemented.

Sub index 1 describes the COB-ID. If bit 31 is set the PDO is disabled.

The transmission mode is defined by sub-index 2.

An inhibit time can be defined on sub-index 3 in 100 us.

At the 5th sub-index can be defined a event time for asynchron pdos.

SubIndex	Description	Data Type	Access	PDO Mapping	Unit	Default Value
000	Nbr of Entries	PDO_COMM_PAR	RO	no		0x05
001	COB-ID	Unsigned 32	RO	no		0x00000180
002	Transmission Type	Unsigned 8	RO	no		0xFF
003	Inhibit Time	Unsigned 16	RO	no	100 us	0x0
004	Compatibility Entry	Unsigned 8	RO	no		0x0
005	Event Timer	Unsigned 16	RO	no	ms	0x0

8.1.1 CANopen Transmit PDO Comm Param 2, 1802h

SubIndex	Description	Data Type	Access	PDO Mapping	Unit	Default Value
000	Nbr of Entries	PDO_COMM_PAR	RO	no		0x05
001	COB-ID	Unsigned 32	RO	no		0x00000280
002	Transmission Type	Unsigned 8	RO	no		0xFF
003	Inhibit Time	Unsigned 16	RO	no	100 us	0x0
004	Compatibility Entry	Unsigned 8	RO	no		0x0
005	Event Timer	Unsigned 16	RO	no	ms	0x0

8.1.1 CANopen Transmit PDO Comm Param 17-24, 1810h - 1817h

SubIndex	Description	Data Type	Access	PDO Mapping	Unit	Default Value
000	Nbr of Entries	PDO_COMM_PAR	RO	no		0x05
001	COB-ID	Unsigned 32	RO	no		0x80000000
002	Transmission Type	Unsigned 8	RO	no		0xFE
003	Inhibit Time	Unsigned 16	RO	no	100 us	0x0
004	Compatibility Entry	Unsigned 8	RO	no		0x0
005	Event Timer	Unsigned 16	RO	no	ms	0x0

8.2 Predefined CANopen PDO

8.2.1 CANopen in Profile Position Mode

The position profile trajectory is calculated in the XENAX® Xvi servo controller. With dynamic PDO mapping the predefined PDO configuration of the EtherCAT interface can be changed.

RxPDO 1 (1600)		PLC/PC -> XENAX®
6040	Controlword	

TxPDO 1 (1A00)		XENAX® -> PLC/PC
6041	Statusword	

RxPDO 2 (1601)		PLC/PC -> XENAX®
6040	Controlword	
607A	Target Position	

TxPDO 2 (1A01)		XENAX® -> PLC/PC
6041	Statusword	
6064	Actual Position	

RxPDO 17 (1610)		PLC/PC -> XENAX®
60FE	Digital Outputs	

TxPDO 17 (1A10)		XENAX® -> PLC/PC
60FD	Digital Inputs	
60FE	Digital Outputs	

RxPDO 18 (1611)		PLC/PC -> XENAX®
6083	Acceleration	
2000	S-curve	

TxPDO 20 (1A13)		XENAX® -> PLC/PC
60F4	Actual Following position error	
2006	Process Status Register	

RxPDO 19 (1612)		PLC/PC -> XENAX®
6081	Speed	

TxPDO 21 (1A14)		XENAX® -> PLC/PC
6078	Actual Current	

RxPDO 20 (1613)		PLC/PC -> XENAX®
6065	Following position error window	
6067	Target position error window	

TxPDO 23 (1A16)		XENAX® -> PLC/PC
2005	Actual Force (reserved for future)	
2006	Process Status Register	

RxPDO 21 (1614)		PLC/PC -> XENAX®
6073	Max Current	

RxPDO 24 (1617)		PLC/PC -> XENAX®
6040	Controlword	
2002	Force demand value (reserved for future)	

TxPDO 24 (1A17)		XENAX® -> PLC/PC
6041	Statusword	
2005	Actual Force (reserved for future)	

8.2.1 CANopen Object detail Receive PDO

PLC/PC -> XENAX®

Their structure is as follows:
Object (16bit) SubIndex (8bit) Nbr of Entries (8bit)

Receive PDO 1, 1600h

SubIndex	Description	DataType	Access	PDO Mapping	Unit	Default Value
000	Nbr of Entries	PDO_MAPPING	RO	no		0x01
001	Controlword	Unsigned 32	RO	no		0x60400010

Receive PDO 2, 1601h

SubIndex	Description	DataType	Access	PDO Mapping	Unit	Default Value
000	Nbr of Entries	PDO_MAPPING	RO	no		0x02
001	Controlword	Unsigned 32	RO	no		0x60400010
002	Target Position	Unsigned 32	RO	no		0x607A0020

Receive PDO 17, 1610h

SubIndex	Description	DataType	Access	PDO Mapping	Unit	Default Value
000	Nbr of Entries	PDO_MAPPING	RO	no		0x01
001	Digital Outputs	Unsigned 32	RO	no		0x60FE0120

Receive PDO 18, 1611h

SubIndex	Description	DataType	Access	PDO Mapping	Unit	Default Value
000	Nbr of Entries	PDO_MAPPING	RO	no		0x02
001	Acceleration	Unsigned 32	RO	no		0x60830020
002	S-Curve	Unsigned 32	RO	no		0x20000020

Receive PDO 19, 1612h

SubIndex	Description	DataType	Access	PDO Mapping	Unit	Default Value
000	Nbr of Entries	PDO_MAPPING	RO	no		0x01
001	Speed	Unsigned 32	RO	no		0x60810020

Receive PDO 20, 1613h

SubIndex	Description	Data Type	Access	PDO Mapping	Unit	Default Value
000	Nbr of Entries	PDO_MAPPING	RO	no		0x02
001	Following position error window	Unsigned 32	RO	no		0x60650020
002	Target position error window	Unsigned 32	RO	no		0x60670020

Receive PDO 21, 1614h

SubIndex	Description	Data Type	Access	PDO Mapping	Unit	Default Value
000	Nbr of Entries	PDO_MAPPING	RO	no		0x01
001	Max Current	Unsigned 32	RO	no		0x60730010

Receive PDO 24, 1617h
Currently not implemented, reserved for future.

SubIndex	Description	Data Type	Access	PDO Mapping	Unit	Default Value
000	Nbr of Entries	PDO_MAPPING	RO	no		0x02
001	Controlword	Unsigned 32	RO	no		0x60400010
002	Force demand value	Unsigned 32	RO	no		0x20020020

8.2.1 CANopen Object detail Transmit PDO

XENAX® -> PLC/PC

Transmit PDO 1, 1A00h

Contains the mapping for the PDOs the device is able to transmit.

The subindex 0h contains the number of valid entries within the mapping record. This number of entries is also the number of the application variables which shall be transmitted with the corresponding PDO.

The subindex from 1h to number of entries contain the information about the mapped application variables.

SubIndex	Description	DataType	Access	PDO Mapping	Unit	Default Value
000	Nbr of Entries	PDO_MAPPING	RO	no		0x01
001	Statusword	Unsigned 32	RO	no		0x60410010

Transmit PDO 2, 1A01h

SubIndex	Description	DataType	Access	PDO Mapping	Unit	Default Value
000	Nbr of Entries	PDO_MAPPING	RO	no		0x02
001	Statusword	Unsigned 32	RO	no		0x60410010
002	Actual Position	Unsigned 32	RO	no		0x60640020

Transmit PDO 17, 1A10h

SubIndex	Description	DataType	Access	PDO Mapping	Unit	Default Value
000	Nbr of Entries	PDO_MAPPING	RO	no		0x02
001	Digital Inputs	Unsigned 32	RO	no		0x60FD0020
002	Digital Outputs	Unsigned 32	RO	no		0x60FE0120

Transmit PDO 20, 1A13h

SubIndex	Description	DataType	Access	PDO Mapping	Unit	Default Value
000	Nbr of Entries	PDO_MAPPING	RO	no		0x02
001	Actual Following position error	Unsigned 32	RO	no		0x60F40020
002	Process Status Register	Unsigned 32	RO	no		0x20060020

Transmit PDO 21, 1A14h

SubIndex	Description	DataType	Access	PDO Mapping	Unit	Default Value
000	Nbr of Entries	PDO_MAPPING	RO	no		0x01
001	Actual Current	Unsigned 32	RO	no		0x60780010

Transmit PDO 23, 1A16h

Currently not implemented, reserved for future

SubIndex	Description	DataType	Access	PDO Mapping	Unit	Default Value
000	Nbr of Entries	PDO_MAPPING	RO	no		0x02
001	Actual Force	Unsigned 32	RO	no		0x20050020
002	Process Status Register	Unsigned 32	RO	no		0x20060020

Transmit PDO 24, 1A17h

Currently not implemented, reserved for future

SubIndex	Description	DataType	Access	PDO Mapping	Unit	Default Value
000	Nbr of Entries	PDO_MAPPING	RO	no		0x02
001	Statusword	Unsigned 32	RO	no		0x60410010
002	Actual Force	Unsigned 32	RO	no		0x20050020

Notes

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