MAG integra

EtherCAT Interface

Operating Instructions 300416363_002_C0

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Contents

Original installation and operating instructions.

Safety Information

NOTICE

Obligation to Provide Information
Before installing and commissioning the device, carefully read these Operating Instructions and follow the information so as to ensure optimum and safe working right from the start.

The Leybold **MAG integra** has been designed for safe and efficient operation when used properly and in accordance with these Operating Instructions. It is the responsibility of the user to carefully read and strictly observe all safety precautions described in this section and throughout the Operating Instructions. The equipment must only be operated in the proper condition and under the conditions described in the Operating Instructions. It must be operated and maintained by trained personnel only. Consult local, state, and national agencies regarding specific requirements and regulations. Address any further safety, operation and/or maintenance questions to our nearest office.

DANGER

DANGER indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

WARNING

WARNING indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION

CAUTION indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury.

NOTICE

NOTICE is used to notify users of installation, operation, programming or maintenance information that is important, but not hazard related.

We reserve the right to alter the design or any data given in these Operating Instructions. The illustrations are not binding.

Retain the Operating Instructions for further use.

Installation and operation of the MAG integra is described in Operating Instructions 300324726. Described in these Operating Instructions is only the EtherCAT interface of the MAG integra.

WARNING
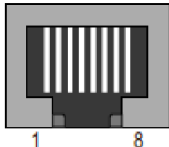
Before making any connections, deenergise the pump and wait until it no longer turns. Since in spite of this dangerous voltages can remain present, the equipment must only be opened by a trained electrician.

1   Description

EtherCAT is an open high performance Ethernet-based fieldbus system that overcomes the system limitations of other Ethernet solutions. The Ethernet packet is no longer received, then interpreted and copied as process data at every connection; instead the Ethernet frame is processed on the fly. The development goal of EtherCAT was to apply Ethernet to automation applications that require short data update times (also called cycle times) with low communication jitter (for synchronization purposes) and low hardware costs.

1.2   Communication connector

The EtherCAT® Option is connected to the network using a RJ45 connector. The pin assignment is shown below.

Pin	Signal	Note	EtherCAT® Connector
1	Tx+	-	
2	Tx-	-	
3	Rx+	-	
4	-	Normally left unused; to ensure signal integrity, these pins are tied together and terminated to PE via a filter circuit in the module.	
5	-		
6	Rx-	-	
7	-	Normally left unused; to ensure signal integrity, these pins are tied together and terminated to PE via a filter circuit in the module.	
8	-		

1.3   EtherCAT® Option Status LEDs

LED	Item
1	Run LED (a)
2	Error LED (a)
3	EtherCat (port 1)
4	EtherCat (port 2)
5	Link/Activity (port 1)
6	Link/Activity (port 2)
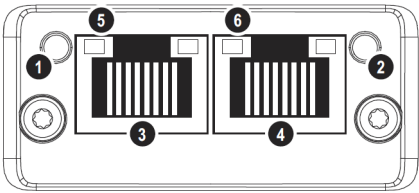
The flash sequences for these LEDs are defined in DR303-3 (CiA).

Description

Run LED
This LED reflects the status of the CoE (CANopen over EtherCAT) communication.

Led State	Indication	Description
Off	INIT	CoE device in 'INIT'-state (or no power)
Green	OPERATIONAL	CoE device in 'OPERATIONAL'-state
Green blinking	PRE-OPERATIONAL	CoE device in 'PRE-OPERATIONAL'-state
Green, single flash	SAFE-OPERATIONAL	CoE device in 'SAFE-OPERATIONAL'-state
Red	(Fatal Event)	If RUN and ERR turns red, this indicates a fatal event, forcing the bus interface to a physically passive state.

ERR LED
This LED indicates EtherCAT communication errors etc.

Led State	Indication	Description
Off	No error	No error (or no power)
Red, blinking	Invalid configuration	State change received from master is not possible die to invalid register or object settings
Red, double flash	Application watchdog timeout	Snyc manager watchdog timeout
Red	Application controller failure	Anybus module in Exception
		If RUN and ERR turns red, this indicates a fatal event, forcing the bus interface to a physically passive state.

Link/Activity
These LEDs indicate the EtherCAT link status and activity.

Led State	Indication	Description
Off	No link	Link not sensed (or no power)
Green	Link sensed, no activity	Link sensed, no traffic detected
Green, flickering	Link sensed, activity detected	Link sensed, traffic detected

2 Object Dictionary

The Object Dictionary consists of two sections:

The tables below give an overview of the communication objects available in the implementation of the MAG Integra

Communication Profile Objects (DSP 301)

Index (hex)	Name
1000	Device Type
1001	Error register
1003	Predefined error Field
1008	Device name
1009	Hardware version
1011	Restore default parameters
1018	Identity
1600	DO RxPDO Map
1A00	DI TxPDO Map
1C00	Sync manager type
1C12	RxPDO assing
1C13	TxPDO assign
1C32	SM output parameter
1C33	SM input parameter

Manufacturer Specific Profile Objects (DS 301)

Index (hex)	Name
2001	Process Config
2002	Input Points
2003	Output Points
2004	Warning Bytes
2005	Actual Error
2006	Error Code
2007	Frequency Error
2008	Operation hours
2009	AC/DC Drive
200A	Turbo Status

2.1 Process Data Objects (PDO)

Cyclic data is implemented on EtherCAT networks by using „Process Data Objects" or PDOs. Separate data objects are used for transmitting (TxPDOs) and receiving (RxPDOs) data.

2.2 Service Data Object (SDO) parameter access

The service data object (SDO) provides access to all objects in the EtherCAT object Dictionary.

CANopen over EtherCAT

3 CANopen over EtherCAT (CoE)

The CoE protocol over EtherCAT uses a modified form of the CANopen object dictionary. This is specified in the table below:

Index	Description	Sub-index	Name Subindex	Access
0x1000	Device Type	-	-	R
0x1001	Error Register	-	-	R
0x1008	Device Name	-	-	R
0x1009	Hardware Version	-	-	R
0x1018	Identity	0x00	Number of Elements	R
		0x01	Vendor ID	R
		0x02	Product Code	R
		0x03	Revision Number	R
		0x04	Serial Number	R
0x1600	RxPDO 1	0x00	Number of elements	R
		0x01-0xXX	Output Object 1..x	R
0x1A00	TxPDO 1	0x00	Number of elements	R
		0x01-0xXX	Input Object 1..x	R
0x1C00	Sync Man Communication type	0x00	Number of elements	R
		0x01	Channel 1	R
		0x02	Channel 2	R
		0x03	Channel 3	R
		0x04	Channel 4	R
0x1C12	Sync Man 2 Assignment	0x00	Number of elements	R
		0x01	PDO Mapping object index of assigned RxPDO	R
0x1C13	Sync Man 3 Assignment	0x00	Number of elements	R
		0x01	PDO Mapping object index of assigned TxPDO	R
0x1032	Sync Man 2 Synchronization	0x00	Number of elements	R
		0x01	Synchronization type	R
0x1033	Sync Man 3 Synchronization	0x00	Number of elements	R
		0x01	Synchronization type	R
0x2001	Process Configuration	0x00	Number of elements	R
		0x01	Configuration Input Assemblies	R
		0x02	Configuration Output Assemblies	R
0x2002	Discrete Inputs points	0x00	Number of elements	R
		0x01	Pump On/Off status	R
		0x02	Normal speed reached	R
		0x03	Acceleration	R
		0x04	Decelleration	R
		0x05	Generator mode	R
		0x06	Standby mode	R
		0x07	Standstill	R
		0x08	Control via Ethercat	R
		0x09	At standby speed	R

Index	Description	Sub-index	Name Subindex	Access
0x2003	Discrete output points	0x00	Number of elements	R
		0x01	Pump On/Off command	R/W
		0x02	Purge Valve On/Off command	R/W
		0x03	Quit failure command	R/W
		0x04	Standby command	R/W
		0x05	Venting Valve On/Off command	R/W
		0x06	Enable discrete outputs	R/W
0x2004	Warning bytes	0x00	Number of elements	R
		0x01	Warning bytes 1	R
		0x02	Warning bytes 2	R
		0x03	Warning bytes 3	R
0x2005	Actual error	0x00	Number of elements	R
		0x01	Error code	R
		0x02	Rotational frequency at error	R
		0x03	Operation hours at error	R
0x2006	Error code	0x00	Number of elements	R
		0x01… 0x28	Failure storage error code	R
0x2007	Frequency at error	0	Number of elements	R
		0x01… 0x28	Failure storage frequency at error	R
0x2008	Operation hours at error	0x00	Number of elements	R
		0x01… 0x28	Failure storage operation hours	R
0x2009	AC DC Drive object	0x00	Number of elements	R
		0x01	At reference speed	R
		0x02	Frequency setpoint set by Network (EtherCat) system	R/W
		0x03	Process control	R/W
		0x04	Drive Mode	R
		0x05	Actual speed	R
		0x06	Speed reference	R/W
		0x07	Actural motor current	R
		0x08	Limit motor current	R
		0x09	Actual power mains side	R
		0x0A	Input voltage	R
		0x0B	Low speed limit	R
		0x0C	High speed limit	R
		0x0D	Speed control	R/W
		0x0E	Speed status	R
		0x0F	Speed trip time	R
		X010	Max rated speed	R
		0x11	Standby speed	R/W
		0x12	Speed actual data units	R
		0x13	Speed reference actual data units	R
		0x14	Pump operation hours	R
		0x15	Pump operation cycles	R
		0x16	Converter operation hours	R

CANopen over EtherCAT

Index	Description	Sub-index	Name Subindex	Access
0x200A	Turbo status	0x00	Number of elements	R
		0x01	Pump On/Off status	R
		0x02	Normal	R
		0x03	Acceleration	R
		0x04	Deceleration	R
		0x05	Local/remote mode	R
		0x06	Reserved	R
		0x07	Turbo low speed	R
		0x08	Reserved	R
		0x09	Alarm	R
		0x0A	Warning is present	R
		0x0B	Reserved	R
		0x0C	Reserved	R

3.1 CoE object dictionary

Index (hex)	Name
0x0000 to 0x0FFF	Data type area
0x1000 to 0x1FFF	CoE communication area
0x2000 to 0x5FFF	Manufacturer specific area
0x6000 to 0x9FFF	Profile area
0xA000 to 0xFFFF	Reserved area

The object description format describes object related information such as size, range and descriptions.

Object description format

Index	Object Name		
Access	Range	Size	Unit
Default			
Description			

Index	Object Name		
Sub index 0			
Access	Range	Size/data type	Unit
Default			
Description			

Sub index 1			
Access	Range	Size/data type	Unit
Default			
Description			

Sub index ...			
Access	Range	Size/data type	Unit
Default			
Description			

Index	A signed 16-bit number. This is the index of the object dictionary entry specified in four hexadecimal characters.
Access	A value describing how the object may be accessed (RW = read/ write, RO = read-only and WO = write-only).
Size	The size of the object/sub-index in bytes
Unit	The physical unit (e.g. ms, counts per second etc.)

CoE communication area

4 CoE communication area

4.1 Device type object

0x1000	Device Type		
Sub index 0x00			
Access RO	Range	Data type: unsigned 32	Unit: N/A
Default	0x00000000		
Description	The device type is vendor specific. The value for fir object is always 0x00000000		

4.2 Error register

0x1001	Error register		
Sub index 0x00			
Access RO	Range	Data type: unsigned 8	Unit: N/A
Default	0x00		
Description	A value of 0x01 indicates, that an actual error is present. The error Led on the Ethercat module and/or the error Led on the MAG.DRIVE i(M) indicates also this error condition.		

If the system is in operational mode, a present error typically causes the turbopump to shut down automatically. If not longer present, the error can be reset. Bit 7 in the output assembly 0x65 can be used for a failure reset. But 7 in the output assembly has only an effect, if Bit 0 has the value 0. This was implemented, to avoid a continuously failure reset.

4.3   Pre defined error field

0x1008	No. of occurred error		
Sub index 0x00			
Access RO	Range 0 to 0x00	Data type: unsigned 8	Unit: N/A
Default	0x00		
Description	The value shows the numer of occurred errors (maximum last 5 errors)		
Sub index 0x01	**1st error**		
Access : RO	Range 0 to 0xFFFFFFFF	Data type: unsigned 32	Unit: N/A
Default	0x00000000		
Description	Independent which failure occurs the value will be alsways 0x00001000. For Details objects 2005, 2006, should be used		
Sub index 0x02	**2nd error**		
Access : RO	Range 0 to 0xFFFFFFFF	Data type: unsigned 32	Unit: N/A
Default	0x00000000		
Description	Independent which failure occurs the value will be alsways 0x00001000. For Details objects 2005, 2006, should be used		
Sub index 0x03	**3rd error**		
Access : RO	Range 0 to 0xFFFFFFFF	Data type: unsigned 32	Unit: N/A
Default	0x00000000		
Description	Independent which failure occurs the value will be alsways 0x00001000. For Details objects 2005, 2006, should be used		
Sub index 0x04	**4th error**		
Access : RO	Range 0 to 0xFFFFFFFF	Data type: unsigned 32	Unit: N/A
Default	0x00000000		
Description	Independent which failure occurs the value will be alsways 0x00001000. For Details objects 2005, 2006, should be used		
Sub index 0x05	**5th error**		
Access : RO	Range 0 to 0xFFFFFFFF	Data type: unsigned 32	Unit: N/A
Default	0x00000000		
Description	Independent which failure occurs the value will be alsways 0x00001000. For Details objects 2005, 2006, should be used.		

CoE communication area

4.4 Device name

0x1008	Manufacturer device name		
Sub index 0x00			
Access RO	Range	Data type: visible string	Unit: N/A
Default	Mag Integra (iM)		
Description	Name of the device as non zero terminated string		

4.5 Hardware version

0x1009	Manufacturer hardware version		
Sub index 0x00			
Access RO	Range	Data type: visible string	Unit: N/A
Default	3		
Description	Hardware version of the device as non zero terminated string		

4.6 Identity object

| 0x1018	Identity object		
Sub index 0x00			
Access	Range 0 to 0x00	Data type: unsigned 8	Unit
Default	4		
Description	Number of sub index		
Sub index 0x01	**Vendor ID**		
Access : RO	Range N/A	Data type: unsigned 32	Unit: N/A
Default	0x00000723		
Description	This contains the EtherCAT Technology Group vendor ID		
Sub index 0x02	**Product Code**		
Access : RO	Range N/A	Data type: unsigned 32	Unit: N/A
Default	0x000000D3		
Description	This has the value of the Product ID code.		
Sub index 0x03	**Revision number**		
Access : RO	Range N/A	Data type: unsigned 32	Unit: N/A
Default	0x00010001		
Description	Contains the option module software version number (the major and minor version parameter placed in the high word of this object, and the sub-version parameter in the low word		
Sub index 0x04	**Serial number**		
Access : RO	Range N/A	Data type: unsigned 32	Unit: N/A
Default	-		
Description	Contains the hardware serial number (only last 6 digits) of the turbopump.		

4.7   PDO Mapping

The mapping for the PDOs is fixed and can not be changed easily.

Off course, there is a possibility of changing the cyclic data traffic. For this reason the frequency converter holds 2 special parameters (Parameter 257 Index 0 and Index 1). These can be changed via the service interface (RS232 port).

The settings of these parameters however influence the number and significance of the sub indices for the objects 1600:0 (RxPDO) and 1A00:0 (TxPDO). Furthermore, the device supports displaying the its PDO configuration.

The following screenshots demonstrate the different how-to steps with utilising the Beckhoff "TwinCAT System Manager" software.

The system has to be in running mode. On the **CoE - Online** tab click on the **Erweitert** button to display the dictionary. All objects should be imported.
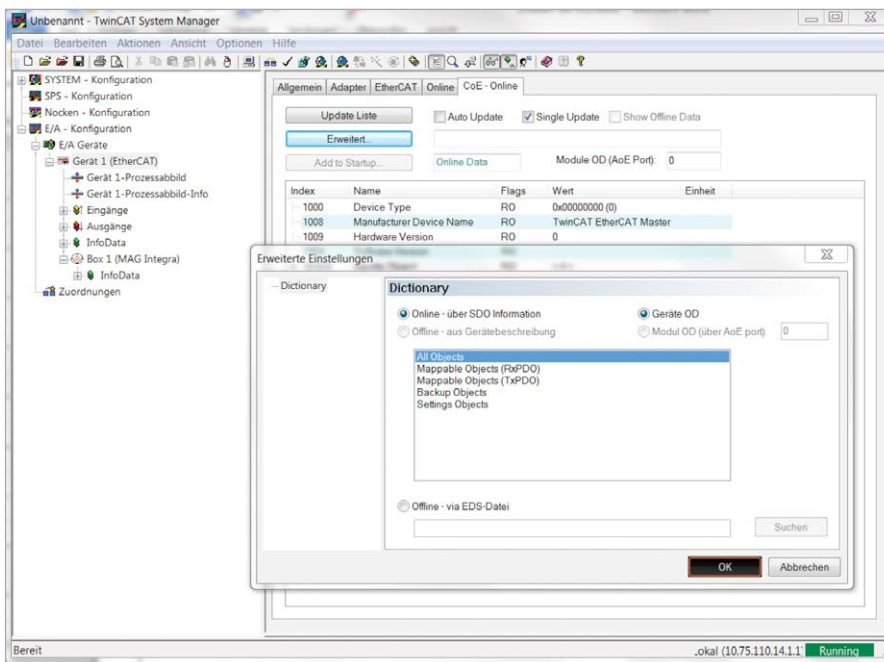
Next, the configuration can be displayed by clicking the **Load PDO info from device** button on the **Process Data** tab.

CoE communication area
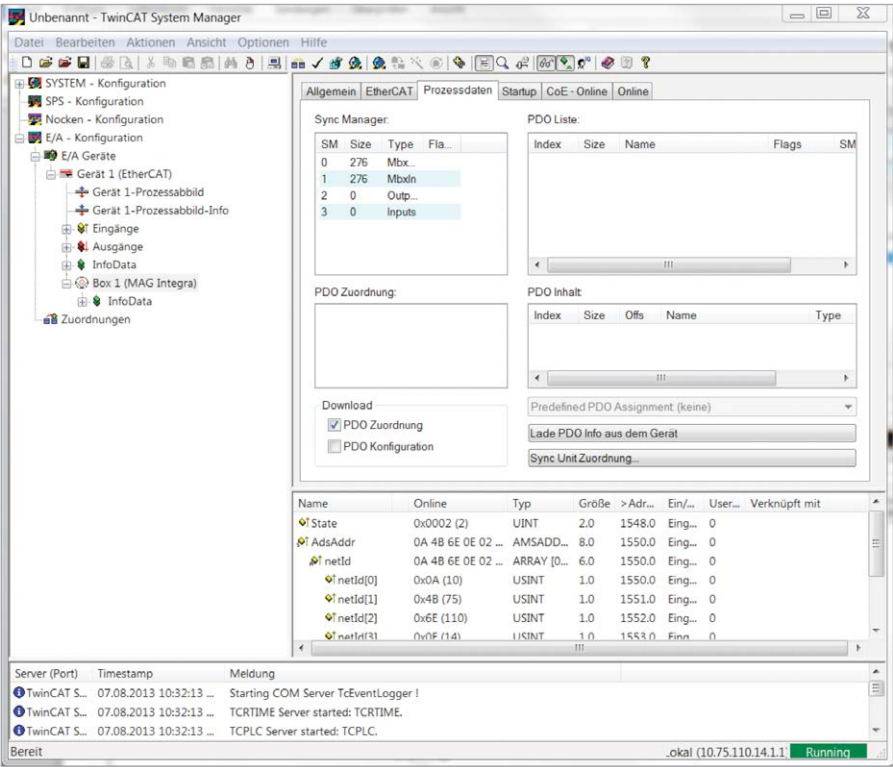
All relevant information are available after loading the data:

4.8 RxPDO - Mapping

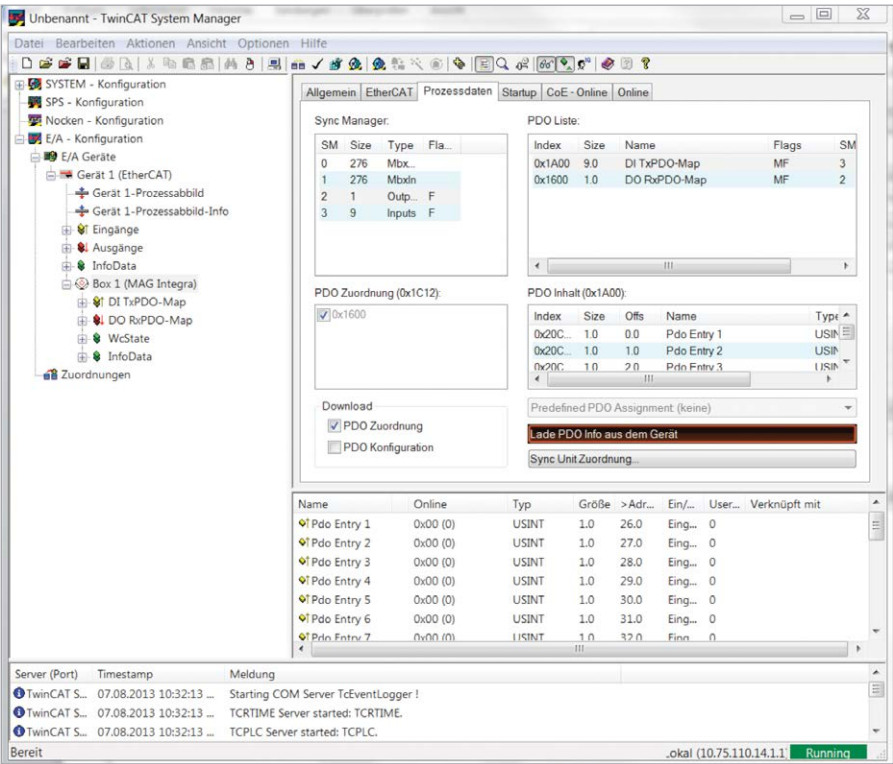Within the frequency converter's configuration the Output Assembly setting (Master to Device) can be set via Parameter 257 Index 0.

Valid values are:	5	(0x05)	
	6	(0x06)	
	7	(0x07)	
	101	(0x65)	Default configuration
	102	(0x66)	

4.8.1 Output Assembly set to value (0x05)

Setting this value results in the mapping given below:

0x1600	**Receive PDO mapping 1**		

Sub index 0x00	Number of mapped objects		
Access RO	Range	Data type: unsigned 8	Unit: N/A
Default	1		
Description	The number of mapped objects in the PDO		
Sub index 0x01	**1ˢᵗ mapped object**		
Access : RO	Range 0 to 0xFFFFFFFF	Data type: unsigned 32	Unit: N/A
Default	0x20D30008 control byte 1		
Description	Bits 0 to 7: Length of the mapped object in bits, e.g. a 32-bit parameter would have a length of 32 or 0x20. Bits 8 to 15: Sub-index of the mapped object. Bits 16 to 31: Index of the mapped object.		
Content of control byte 1	Bit 7 Bit 6 Bit 5 Bit 4 Bit 3 Bit 2 Bit 1 Bit 0 – – – – – – – Pump on		
	Bit 0 set to 0: Pump will Stop Bit 0 set to 1: Pump will Start		

CoE communication area

4.8.2 Output Assembly set to value (0x06)

0x1600	**Receive PDO mapping 2**		
Sub index 0x00	Number of mapped objects		
Access	Range	Data type: unsigned 8	Unit: N/A
Default	2		
Description	The number of mapped objects in this PDO		
Sub index 0x01	**1st mapped object**		
Access : RO	Range 0 to 0xFFFFFFFF	Data type: unsigned 32	Unit: N/A
Default	0x20D30008 control byte 1		
Description	Bits 0 to 7: Length of the mapped object in bits, e.g. a 32-bit parameter would have a length of 32 or 0x20. Bits 8 to 15: Sub-index of the mapped object. Bits 16 to 31: Index of the mapped object.		
Content of control byte 1	Bit 7 Bit 6 Bit 5 Bit 4 Bit 3 Bit 2 Bit 1 Bit 0 – – – – – – – Pump on		
	Bit 0 set to 0: Pump will Stop Bit 0 set to 1: Pump will Start		
Sub index 0x02	**2nd mapped object**		
Access : RO	Range 0 to 0xFFFFFFFF	Data type: unsigned 32	Unit: N/A
Default	0x20D40008 control byte 2		
Description	Bits 0 to 7: Length of the mapped object in bits, e.g. a 32-bit parameter would have a length of 32 or 0x20. Bits 8 to 15: Sub-index of the mapped object. Bits 16 to 31: Index of the mapped object.		
Content of control byte 2	Bit 7 Bit 6 Bit 5 Bit 4 Bit 3 Bit 2 Bit 1 Bit 0 Speed Control (see the "Speed Control Attribute and Speed Status Attribute Bit Map" below)		

Bit	Speed Control	Speed Status	Status Description
0	Run request	Running	On and SpeedActual > 0
1	Idle request	At Idle	Zero current
2	Standby request	At Standby Speed	SpeedActual = SpeedStandby
3	-	Coasting	Zero Torque (generator mode)
4	-	Stopped	SpeedActual = 0
5	-	Accelerating	SpeedActual is increasing
6	-	At Reference	SpeedActual = SpeedRef
7	-	Decelerating	SpeedActual is decreasing

4.8.3 Output Assembly set to value (0x07)

0x1600	**Receive PDO mapping 3**		
Sub index 0x00	Number of mapped objects		
Access	Range	Data type: unsigned 8	Unit: N/A
Default	4		
Description	The number of mapped objects in this PDO		
Sub index 0x01	**1st mapped object**		
Access : RO	Range 0 to 0xFFFFFFFF	Data type: unsigned 32	Unit: N/A
Default	0x20D30008 control byte 1		
Description	Bits 0 to 7: Length of the mapped object in bits, e.g. a 32-bit parameter would have a length of 32 or 0x20. Bits 8 to 15: Sub-index of the mapped object. Bits 16 to 31: Index of the mapped object.		

Content of control byte 1	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	–	–	–	–	–	–	–	Pump on
	Bit 0 set to 0: Pump will Stop Bit 0 set to 1: Pump will Start							

Sub index 0x02	**2nd mapped object**		
Access : RO	Range 0 to 0xFFFFFFFF	Data type: unsigned 32	Unit: N/A
Default	0x20D40008 control byte 2		
Description	Bits 0 to 7: Length of the mapped object in bits, e.g. a 32-bit parameter would have a length of 32 or 0x20. Bits 8 to 15: Sub-index of the mapped object. Bits 16 to 31: Index of the mapped object.		

Content of control byte 2	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	Speed Control (see the "Speed Control Attribute and Speed Status Attribute Bit Map" above)							

Sub index 0x03	**3rd mapped object**		
Access : RO	Range 0 to 0xFFFFFFFF	Data type: unsigned 32	Unit: N/A
Default	0x20D50008 control byte 3		
Description	Bits 0 to 7: Length of the mapped object in bits, e.g. a 32-bit parameter would have a length of 32 or 0x20. Bits 8 to 15: Sub-index of the mapped object. Bits 16 to 31: Index of the mapped object.		

Content of control byte 3	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	Speed target (revolutions per second , low byte)							

Sub index 0x04	**4th mapped object**		
Access : RO	Range 0 to 0xFFFFFFFF	Data type: unsigned 32	Unit: N/A
Default	0x20D60008 control byte 4		
Description	Bits 0 to 7: Length of the mapped object in bits, e.g. a 32-bit parameter would have a length of 32 or 0x20. Bits 8 to 15: Sub-index of the mapped object. Bits 16 to 31: Index of the mapped object.		

Content of control byte 4	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	Speed target (revolutions per second , high byte)							

CoE communication area

4.8.4 Output Assembly set to value (0x65)

0x1600	**Receive PDO mapping 4**		
Sub index 0x00	Number of mapped objects		
Access RO	Range	Data type: unsigned 8	Unit: N/A
Default	1		
Description	The number of mapped objects in this PDO		
Sub index 0x01	**1st mapped object**		
Access : RO	Range 0 to 0xFFFFFFFF	Data type: unsigned 32	Unit: N/A
Default	0x20D30008 control byte 1		
Description	Bits 0 to 7: Length of the mapped object in bits, e.g. a 32-bit parameter would have a length of 32 or 0x20. Bits 8 to 15: Sub-index of the mapped object. Bits 16 to 31: Index of the mapped object.		

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Quit failure	–	Standby	–	Venting valve	Purge valve	–	Pump on

Bit 0 set to 0: Function is disabled
Bit 0 set to 1: Function is enabled
A failure reset (Bit 7) will only be possbible if Bit 0 is not set.

4.8.5 Output Assembly set to value (0x66)

0x1600	**Receive PDO mapping 5**		
Sub index 0x00	Number of mapped objects		
Access	Range	Data type: unsigned 8	Unit: N/A
Default	3		
Description	The number of mapped objects in this PDO		
Sub index 0x01	**1ˢᵗ mapped object**		
Access : RO	Range 0 to 0xFFFFFFFF	Data type: unsigned 32	Unit: N/A
Default	0x20D30008 control byte 1		
Description	Bits 0 to 7: Length of the mapped object in bits, e.g. a 32-bit parameter would have a length of 32 or 0x20. Bits 8 to 15: Sub-index of the mapped object. Bits 16 to 31: Index of the mapped object.		

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	Quit failure	–	Standby	–	Venting valve	Purge valve	–	Pump on

Bit 0 set to 0: Function is disabled
Bit 0 set to 1: Function is enabled
A failure reset (Bit 7) will only be possbible if Bit 0 is not set.

Sub index 0x02	**2ⁿᵈ mapped object**		
Access : RO	Range 0 to 0xFFFFFFFF	Data type: unsigned 32	Unit: N/A
Default	0x20D40008 control byte 2		
Description	Bits 0 to 7: Length of the mapped object in bits, e.g. a 32-bit parameter would have a length of 32 or 0x20. Bits 8 to 15: Sub-index of the mapped object. Bits 16 to 31: Index of the mapped object.		

Content of control byte 2	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	Speed target (revolutions per second , low byte)							

Sub index 0x03	**3ʳᵈ mapped object**		
Access : RO	Range 0 to 0xFFFFFFFF	Data type: unsigned 32	Unit: N/A
Default	0x20D50008 control byte 3		
Description	Bits 0 to 7: Length of the mapped object in bits, e.g. a 32-bit parameter would have a length of 32 or 0x20. Bits 8 to 15: Sub-index of the mapped object. Bits 16 to 31: Index of the mapped object.		

Content of control byte 3	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	Speed target (revolutions per second , high byte)							

CoE communication area

4.9 TxPDO mappings

The mapping for the PDOs is fixed and can not be changed.

Off course, there is the possibility of changing the cyclic data traffic. For this reason the frequency converter holds 2 special parameters which can be changed via the RS232 service port.

The settings of these parameters however influence the number and significance of the sub indices for the objects 1600:0 (RxPDO) und 1A00:0 (TxPDO).

4.9.1 Input Assembly set to value (0x01)

Within the frequency converter's configuration the Input Assembly setting (Master from Device) can be set via Parameter 257 Index 1.

Valid values are:	1	(0x01)	
	100	(0x64)	Default configuration

Objects with the indices 0x1A00 specify transmit PDO mappings.

0x1A00	**Transmit PDO mapping 1**							
Sub index 0x00	Number of mapped objects							
Access	Range		Data type: unsigned 8			Unit: N/A		
Default	3							
Description	The number of mapped objects in this PDO							
Sub index 0x01	**1ˢᵗ mapped object**							
Access : RO	Range 0 to 0xFFFFFFFF		Data type: unsigned 32			Unit: N/A		
Default	0x20CA0008 status byte 1							
Description	Bits 0 to 7: Length of the mapped object in bits, e.g. a 32-bit parameter would have a length of 32 or 0x20. Bits 8 to 15: Sub-index of the mapped object. Bits 16 to 31: Index of the mapped object.							
Content of status byte 1	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	Exception status (see table below)							
Sub index 0x02	**2ⁿᵈ mapped object**							
Access : RO	Range 0 to 0xFFFFFFFF		Data type: unsigned 32		Unit: N/A			
Default	0x20CB0008 status byte 1							
Description	Bits 0 to 7: Length of the mapped object in bits, e.g. a 32-bit parameter would have a length of 32 or 0x20. Bits 8 to 15: Sub-index of the mapped object. Bits 16 to 31: Index of the mapped object.							
Content of status byte 2	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	Speed Status (see the "Speed Control Attribute and Speed Status Attribute Bit Map" above)							

Sub index 0x03	3rd **mapped object**		
Access : RO	Range 0 to 0xFFFFFFFF	Data type: unsigned 32	Unit: N/A
Default	0x20CC0008 control byte 2		
Description	Bits 0 to 7: Length of the mapped object in bits, e.g. a 32-bit parameter would have a length of 32 or 0x20. Bits 8 to 15: Sub-index of the mapped object. Bits 16 to 31: Index of the mapped object.		

Content of status byte 3	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	–	–	–	–	–	–	–	Pump on

Exception Status Bit Map

Bit	Function
0	ALARM / device common
1	ALARM / device specitic
2	ALARM / manufacturer specific
3	0 (reserved)
4	WARNING / device common
5	WARNING / device specific
6	WARNING / manufacturer specific
7	1 (expand method)

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4.9.2 Input Assembly set to value (0x64)

0x1A00	**Transmit PDO mapping 1**						
Sub index 0x00	Number of mapped objects						
Access	Range		Data type: unsigned 8		Unit: N/A		
Default	9						
Description	The number of mapped objects in this PDO						
Sub index 0x01	**1ˢᵗ mapped object**						
Access : RO	Range 0 to 0xFFFFFFFF		Data type: unsigned 32		Unit: N/A		
Default	0x20CA0008 status byte 1						
Description	Bits 0 to 7: Length of the mapped object in bits, e.g. a 32-bit parameter would have a length of 32 or 0x20. Bits 8 to 15: Sub-index of the mapped object. Bits 16 to 31: Index of the mapped object.						
Content of status byte 1	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	Exception status (see table above)						
Sub index 0x02	**2ⁿᵈ mapped object**						
Access : RO	Range 0 to 0xFFFFFFFF		Data type: unsigned 32		Unit: N/A		
Default	0x20CB0008 status byte 1						
Description	Bits 0 to 7: Length of the mapped object in bits, e.g. a 32-bit parameter would have a length of 32 or 0x20. Bits 8 to 15: Sub-index of the mapped object. Bits 16 to 31: Index of the mapped object.						
Content of status byte 2	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	Speed Status (see the "Speed Control Attribute and Speed Status Attribute Bit Map" above)						
Sub index 0x03	**3ʳᵈ mapped object**						
Access : RO	Range 0 to 0xFFFFFFFF		Data type: unsigned 32		Unit: N/A		
Default	0x20CC0008 control byte 2						
Description	Bits 0 to 7: Length of the mapped object in bits, e.g. a 32-bit parameter would have a length of 32 or 0x20. Bits 8 to 15: Sub-index of the mapped object. Bits 16 to 31: Index of the mapped object.						
Content of status byte 3	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	–	–	–	–	Alarm	Warning	–	Pump on
Sub index 0x04	**4ᵗʰ mapped object**						
Access : RO	Range 0 to 0xFFFFFFFF		Data type: unsigned 32		Unit: N/A		
Default	0x20CD0008 status byte 1						
Description	Bits 0 to 7: Length of the mapped object in bits, e.g. a 32-bit parameter would have a length of 32 or 0x20. Bits 8 to 15: Sub-index of the mapped object. Bits 16 to 31: Index of the mapped object.						
Content of status byte 4	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	Pump Speed (revolutions per second, low byte)						

Sub index 0x05	**5th mapped object**						
Access : RO	Range 0 to 0xFFFFFFFF		Data type: unsigned 32		Unit: N/A		
Default	0x20CE0008 status byte 1						
Description	Bits 0 to 7: Length of the mapped object in bits, e.g. a 32-bit parameter would have a length of 32 or 0x20. Bits 8 to 15: Sub-index of the mapped object. Bits 16 to 31: Index of the mapped object.						
Content of status byte 5	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	Pump Speed (revolutions per second, high byte)						
Sub index 0x06	**6th mapped object**						
Access : RO	Range 0 to 0xFFFFFFFF		Data type: unsigned 32		Unit: N/A		
Default	0x20CF0008 control byte 2						
Description	Bits 0 to 7: Length of the mapped object in bits, e.g. a 32-bit parameter would have a length of 32 or 0x20. Bits 8 to 15: Sub-index of the mapped object. Bits 16 to 31: Index of the mapped object.						
Content of status byte 6	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	No function						
Sub index 0x07	**7th mapped object**						
Access : RO	Range 0 to 0xFFFFFFFF		Data type: unsigned 32		Unit: N/A		
Default	0x20D00008 status byte 1						
Description	Bits 0 to 7: Length of the mapped object in bits, e.g. a 32-bit parameter would have a length of 32 or 0x20. Bits 8 to 15: Sub-index of the mapped object. Bits 16 to 31: Index of the mapped object.						
Content of status byte 7	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	No function						
Sub index 0x08	**8th mapped object**						
Access : RO	Range 0 to 0xFFFFFFFF		Data type: unsigned 32		Unit: N/A		
Default	0x20D10008 control byte 2						
Description	Bits 0 to 7: Length of the mapped object in bits, e.g. a 32-bit parameter would have a length of 32 or 0x20. Bits 8 to 15: Sub-index of the mapped object. Bits 16 to 31: Index of the mapped object.						
Content of status byte 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	Current [1/10 Amps] (actual motor current, low byte)						
Sub index 0x09	**9th mapped object**						
Access : RO	Range 0 to 0xFFFFFFFF		Data type: unsigned 32		Unit: N/A		
Default	0x20D20008 status byte 1						
Description	Bits 0 to 7: Length of the mapped object in bits, e.g. a 32-bit parameter would have a length of 32 or 0x20. Bits 8 to 15: Sub-index of the mapped object. Bits 16 to 31: Index of the mapped object.						
Content of status byte 9	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	Current [1/10 Amps] (actual motor current, high byte)						

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4.10 Sync manager

4.10.1 Sync manager configuration

The sync managers are the EtherCAT means for setting access attributes for different areas of memory and triggering or notifying the application when the memory is accessed. The following objects specify how the sync managers (and thus corresponding memory areas) are utilized by the CoE protocol.

0x1C00	Sync manager communication type		
Sub index 0x00	number of sync manager channels used		
Access: RO	Range: N/A	Data type: unsigned 8	Unit: N/A
Default	4		
Description	The number of sync manager protocols used by the CoE protocol.		
Sub index 0x01	Usage of sync manager 0		
Access : RO	Range N/A	Data type: unsigned 8	Unit: N/A
Default	1		
Description	Sync manager 0 is used by CoE as the mailbox receive channel (master to slave).		
Sub index 0x02	Usage of sync manager 1		
Access : RO	Range N/A	Data type: unsigned 8	Unit: N/A
Default	2		
Description	Sync manager 1 is used by CoE as the mailbox send channel (slave to master).		
Sub index 0x03	Usage of sync manager 2		
Access : RO	Range N/A	Data type: unsigned 8	Unit: N/A
Default	3		
Description	Sync manager 2 is used by CoE as the process data output (RxPDOx - master to slave).		
Sub index 0x04	Usage of sync manager 3		
Access : RO	Range N/A	Data type: unsigned 8	Unit: N/A
Default	-		
Description	Sync manager 3 is used by CoE as the process data input (TxPDOs - slave to master).		

4.10.2 Sync manager 2 PDO assignment object

0x1C12	Sync manager 2 PDO assignment object		
Sub index 0x00			
Access: RO	Range: 0 to 255	Data type: unsigned 8	Unit: N/A
Default	1		
Description	The number of RxPDOs assigned to this sync manager (used for process data output).		
Sub index 0x01	Usage of sync manager 0		
Access : RO	Range: 0x1600 to	Data type: unsigned 16	Unit: N/A
Default	0x1600		
Description	The object index of a RxPDO to assign to this sync manager.		

4.10.3 Sync manager 3 PDO assignment object

0x1C13	**Sync manager 3 PDO assignment object**		
Sub index 0x00			
Access: RO	Range: 0 to 255	Data type: unsigned 8	Unit: N/A
Default	1		
Description	The number of TxPDOs assigned to this sync manager (used for process data input).		
Sub index 0x01	**Usage of sync manager 0**		
Access : RO	Range: 0x1A00 to	Data type: unsigned 16	Unit: N/A
Default	0x1A00		
Description	The object index of a TxPDO to assign to this sync manager.		

4.11 Process config

0x2001	**Active input output assembly**		
Sub index 0x00	Number the following sub index		
Access RO	Range 0 to 0x02	Data type: unsigned 8	Unit: N/A
Default	2		
Description	The number of sub index in this object		
Sub index 0x01	**Active input assembly**		
Access : RO	Range 0 to 0xFFFF	Data type: unsigned 16	Unit: N/A
Default	0x0064		
Description	The number shows which configuration is active for the TxPDO mapping (see above)		
Sub index 0x02	**Active output assembly**		
Access : RO	Range 0 to 0xFFFF	Data type: unsigned 16	Unit: N/A
Default	0x0065		
Description	The number shows which configuration is active for the RxPDO mapping (see above)		

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4.12 Discrete input points, status information

0x2002	Input points object		
Sub index 0x00	number implemented sub indexes		
Access: RO	Range: N/A	Data type: unsigned 8	Unit: N/A
Default	9		
Description	The number input points.		
Sub index 0x01	**Pump On/Off Status**		
Access : RO	Range 0 to 1	Data type: unsigned 8	Unit: Bool
Default	N/A		
Description	0 = Pump Off (or Pump On and Speed = 0) 1 = Pump On (Pump running)		
Sub index 0x02	**Normal speed reached**		
Access : RO	Range 0 to 1	Data type: unsigned 8	Unit: Bool
Default	N/A		
Description	0 = actual speed below normal speed 1 = normal speed reached		
Sub index 0x03	**Acceleration**		
Access : RO	Range 0 to 1	Data type: unsigned 8	Unit: Bool
Default	N/A		
Description	0 = speed is not increasing 1 = the pump speed increases		
Sub index 0x04	**Deceleration**		
Access : RO	Range 0 to 1	Data type: unsigned 8	Unit: Bool
Default	-		
Description	0 = speed is not decreasing 1 = the pump speed decreases		
Sub index 0x05	**Generator mode**		
Access : RO	Range 0 to 1	Data type: unsigned 8	Unit: Bool
Default	-		
Description	1 = The pump is running in generator mode. Mains voltage is missing speed		
Sub index 0x06	**Standby mode**		
Access : RO	Range 0 to 1	Data type: unsigned 8	Unit: Bool
Default	-		
Description	1 = the pump is running in standby mode		
Sub index 0x07	**Standstill**		
Access : RO	Range 0 to 1	Data type: unsigned 8	Unit: Bool
Default	-		
Description	1 = Standstill and drive not active		
Sub index 0x08	Control via Ethercat		
Access : RO	Range 0 to 1	Data type: unsigned 8	Unit: Bool
Default	-		
Description	1 = the pump is under control via EtherCat		
Sub index 0x09	**At Standby**		
Access : RO	Range 0 to 1	Data type: unsigned 8	Unit: Bool
Default	-		
Description	1 = the pump is running at standby speed		

4.13 Discrete output points, control commands

Write access is only possible, if the status of the EtherCat is different than Operational.

0x2003	**Output points objects**		
Sub index 0x00	number implemented sub indexes		
Access: RO	Range: N/A	Data type: unsigned 8	Unit: N/A
Default	6		
Description	The number output points.		
Sub index 0x01	**Pump On/Off command**		
Access : RW	Range 0 to 1	Data type: unsigned 8	Unit: Bool
Default	0x00		
Description	0 = Pump Off 1 = Pump On		
Sub index 0x02	**Purge Valve ON/OFF**		
Access : RW	Range 0 to 1	Data type: unsigned 8	Unit: Bool
Default	0x00		
Description	0 = Purge Valve closed 1 = Purge Valve open		
Sub index 0x03	**Quit failure**		
Access : RW	Range 0 to 1	Data type: unsigned 8	Unit: Bool
Default	0x00		
Description	0 = do not reset error condition 1 = Reset error condition Reset only possible if Pump On/Off ist set to Off		
Sub index 0x04	**Standby request**		
Access : RW	Range 0 to 1	Data type: unsigned 8	Unit: Bool
Default	0x00		
Description	0 = Pump will run at target speed 1 = pump will run at standby speed		
Sub index 0x05	**Vent valve ON/OFF**		
Access : RW	Range 0 to 1	Data type: unsigned 8	Unit: Bool
Default	-		
Description	0 = Vent Valve closed 1 = Vent Valve open		
Sub index 0x06	**Enable discrete outputs**		
Access : RW	Range 0 to 1	Data type: unsigned 8	Unit: Bool
Default	0x00		
Description	Enables the functions for sub index 1 to 5		

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4.14 Warning object

0x2004	**Warning Object**		
Sub index 0x00	number implemented sub indexes		
Access: RO	Range: N/A	Data type: unsigned 8	Unit: N/A
Default	3		
Description	The number implemented sub indexes.		
Sub index 0x01	**Warning Bits 1**		
Access : RO	Range 0 to 0xFFFF	Data type: unsigned 16	Unit: N/A
Default	0x0000		
Description	See attached list below for details description of each bit		
Sub index 0x02	**Warning Bits 2**		
Access : RO	Range 0 to 0xFFFF	Data type: unsigned 16	Unit: N/A
Default	0x0000		
Description	See attached list below for details description of each bit		
Sub index 0x03	**Warning Bits 3**		
Access : RO	Range 0 to 0xFFFF	Data type: unsigned 16	Unit: N/A
Default	0x0000		
Description	See attached list below for details description of each bit		

Warning Bits 1 to 3

Warning Bit 1	Designation	Possible Cause	Remedy
Bit 0	Converter Power Stage Temperature to high	The cooling water flow is too low or the cooling water temperature is too high. The converter is overloaded due to too high gas load. Frequent acceleration and deceleration of the pump.	Cooling system needs to be improved. The gas load needs to be reduced. Allow converter to cool down between the cycles.
Bit 1	Converter Housing Termperature too high	The converter is overloaded due to too high gas load.	The gas load needs to be reduced.
Bit 2	Pump Motor Temperature too high	The cooling water flow is too low or the cooling water temperature is too high.	Cooling system needs to be improved
Bit 3-4	Supply Voltage too high or too low	Usage of a wrong power supply unit. Misaligned output voltage. Too high load. Voltage drop across the supply cable.	Use correct power supply. Adjust the output voltage of the power supply. Replace the power supply by a more powerful one. Increase the copper area of the cable
Bit 5	Overspeed	The frequency setpoint has been set during operation with serial interface e.g. RS232.	Provide for correct speed setting.
Bit 6	Overload	Backing pressure too high during operation. Too high amount of gas flow during operation. Parameter «Normal Operation» is not set correctly.	Reduce backing pressure or process gas flow. Check the chamber pressure during operation. Check the «normal operation» level adjustment.

Warning Bit 1	Designation	Possible Cause	Remedy
Bit 7	Bearing Temperature too high	Frequent acceleration and deceleration of the pump.	Cooling system needs to be improved
Bit 8	Motor Start Locked	There was a fatal error before, which is not resetable.	When the pump is stillstanding, disconnect the pump from the power supply and reconnect it.
			If this behaviour is repeated by the pump, then contact the Leybold service department.
Bit 9	High load	Backing pressure too high during operation. Too high amount of gas flow during operation	Reduce backing pressure or process gas flow. Check the chamber pressure during operation.
Bit 10	Max. Number of Pump Operation Hours are reached	The recommended max. number of operating hours of the pump are reached.	Arrange a service date at Leybold for this pump.
Bit 11	Max. Number of Pump Runup Cycles are reached	The recommended max. number of start cycles of the pump are reached.	Arrange a service date at Leybold for this pump.
Bit 12	Magnetic Bearing has not lifted	There was a fatal error before, which is not resetable.	When the pump is stillstanding, disconnect the pump from the power supply and reconnect it.
			If this behaviour is repeated by the pump, then contact the Leybold service department
Bit 13	reserved		
Bit 14	MAG Bearing Overload 5	The magnetic bearing current for the individual axes is too high. The environmental vibration might be too heavy.	Reduce vibration which might affect the pump.
Bit 15	MAG Bearing Overload 6	The magnetic bearing current for the individual axes is too high. The environmental vibration might be too heavy.	Reduce vibration which might affect the pump.

Warning Bit 2	Designation	Possible Cause	Remedy
Bit 0	MAG Bearing Overload 0	The magnetic bearing current for the individual axes is too high. The environmental vibration might be too heavy.	Reduce vibration which might affect the pump.
Bit 1	MAG Bearing Overload 1	The magnetic bearing current for the individual axes is too high. The environmental vibration might be too heavy.	Reduce vibration which might affect the pump.
Bit 2	MAG Bearing Overload 2	The magnetic bearing current for the individual axes is too high. The environmental vibration might be too heavy.	Reduce vibration which might affect the pump.
Bit 3	MAG Bearing Overload 3	The magnetic bearing current for the individual axes is too high. The environmental vibration might be too heavy.	Reduce vibration which might affect the pump.

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Warning Bit 2	Designation	Possible Cause	Remedy
Bit 4	MAG Bearing Overload 4	The magnetic bearing current for the individual axes is too high. The environmental vibration might be too heavy.	Reduce vibration which might affect the pump.
Bit 5	MAG Unbalance at the Upper Bearing	Deposition of material from the pumped edia at the turbo rotor Due to aggressive media, abrasion at the turbo rotor.	Check the pumped media for suitability with this pump design
Bit 6	MAG Unbalance at the Lower Bearing	Deposition of material from the pumped media at the turbo rotor Due to aggressive media, abrasion at the turbo rotor.	Check the pumped media for suitability with this pump design
Bit 7	MAG Oscillation at the Axial Bearing	The environmental vibration might be too heavy.	Reduce vibration which might affect the pump.
Bit 8	MAG Upper Radial Bearing Displacement X1	The magnetic bearing close to the high vacuum flange has been shifted radially. The environmental vibration might be too heavy.	Reduce vibration which might affect the pump.
Bit 9	MAG Upper Radial Bearing Displacement Y1	The magnetic bearing close to the high vacuum flange has been shifted radially. The environmental vibration might be too heavy.	Reduce vibration which might affect the pump.
Bit 10	MAG Lower Radial Bearing Displacement X2	The magnetic bearing close to the forevacuum lange has been shifted radially. The environmental vibration might be too heavy.	Reduce vibration which might affect the pump.
Bit 11	MAG Lower Radial Bearing Displacement Y2	The magnetic bearing close to the forevacuum lange has been shifted radially. The environmental vibration might be too heavy.	Reduce vibration which might affect the pump.
Bit 12	MAG Axial Bearing Displacement Z	The magnetic bearing has been shifted axially. The environmental vibration might be too heavy.	Reduce vibration which might affect the pump.
Bit 13	High Number of Auxiliary Bearing Impacts	The environmental vibration might be too heavy or to many shocks or impacts interfered the pump. Too many f ull or partial auxiliary bearing run downs affected the pump.	Reduce vibration which might affect the pump. Avoid shocks or impacts at the pump. Avoid stopping the pump by switching off the mains power. Avoid disconnecting the pump cable, when the pump is still running.
Bit 14	High Amount of Cumulated Bearing Touch Down Time	The environmental vibration might be too heavy or to many shocks or impacts interfered the pump. Too many f ull or partial auxiliary bearing run downs affected the pump.	Reduce vibration which might affect the pump. Avoid shocks or impacts at the pump. Avoid stopping the pump by switching off the mains power. Avoid disconnecting the pump cable, when the pump is still running.

Warning Bit 2	Designation	Possible Cause	Remedy
Bit 15	High No. of Touch Down Bearing Run Downs	The number of partial or full touchdowns into the touchdown bearings is too high. The environmental vibration might be too heavy or to many shocks or impacts interfered the pump Too many full or partial auxiliary bearing run downs affected the pump.	Reduce vibration which might affect the pump. Avoid shocks or impacts at the pump. Avoid stopping the pump by switching off the mains power. Avoid disconnecting the pump cable, when the pump is still running.

Warning Bit 3	Designation	Possible Cause	Remedy
Bit 0	Flange temperature above warning limit.	The Cooling water flow is too low or the cooling water temperature is too high. The Converter is overloaded due to too high gas load. Frequent acceleration and deceleration of the pump.	The cooling system needs to be improved. The gas load needs to be reduced. Allow converter to cool down between the cycles.
Bit 1	Temperature power stage bearing electronic	The Cooling water flow is too low or the cooling water temperature is too high. The Converter is overloaded due to too high gas load. Frequent acceleration and deceleration of the pump.	Improve cooling conditions. Reduce the vibration or shocks influence which might affect the pump
Bit 2	-	-	-
Bit 3	-	-	-
Bit 4	-	-	-
Bit 5	-	-	-
Bit 6	-	-	-
Bit 7	-	-	-
Bit 8	-	-	-
Bit 9	-	-	-
Bit 10	-	-	-
Bit 11	-	-	-
Bit 12	-	-	-
Bit 13	-	-	-
Bit 14	-	-	-
Bit 15	-	-	-

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4.15 Errors

4.15.1 Actual error

0x2005	**Actual Error**		
Sub index 0x00	number implemented sub indexes		
Access: RO	Range: N/A	Data type: unsigned 8	Unit: N/A
Default	3		
Description	The number implemented sub indexes.		
Sub index 0x01	**Actual error code**		
Access : RO	Range 0 to 0xFFFFFFFF	Data type: unsigned 32	Unit: N/A
Default	0x00000000		
Description	See attached list below for details description for the error code		
Sub index 0x02	**Rotation frequency when actual error occurs**		
Access : RO	Range 0 to 0xFFFFFFFF	Data type: unsigned 32	Unit: Hz
Default	0x00000000		
Description			
Sub index 0x03	**Operation hours when actual error occurs**		
Access : RO	Range 0 to 0xFFFFFFFF	Data type: unsigned 32	Unit: N/A
Default	0x00000000		
Description			

4.15.2 Failure storage: Error code

0x2006	**Failure Storage error code**		
Sub index 0x00	number implemented sub indexes		
Access: RO	Range: 0.40	Data type: unsigned 8	Unit: N/A
Default	40		
Description	The number implemented sub indexes.		
Sub index 0x01	**Stored error code**		
Access : RO	Range 0 to 0xFFFF	Data type: unsigned 16	Unit: N/A
Default	0x0000		
Description	See attached list below for details description for the error code. Index 1 stores the error code of the newest failure event. Index 40 stores the oldest one.		

Error code	Designation	Description	Possible cause	Remedy
2	Motor temperature error	The motor temperature has exceeded the error threshold.	Forevacuum pressure too high, gas flow too high, defective fan, Water cooling switched off.	Check ultimate pressure of the forevacuum pump and if required install a larger forevacuum pump. Seal off leak, check process. Replace fan. Switch water cooling on.
3	Supply voltage failure	Intermediate circuit voltage is too low or maximum generator operating mode duration exceeded.	Mains supply voltage is too low. Mains voltage has failed.	Check voltage at the mains feed point. Remedy mains power failure.
4	Converter temperature failure	Overtemperature at the power output stage or inside the frequency converter.	Ambient temperature too high. Inadequate cooling owing to cooling water which is too warm.	Do not exceed the maximum ambient temperature of 45 °C. Improve cooling, comply with specified cooling water temperature and cooling water quantity.
5	Overload failure	Rotational speed has dropped below the minimum speed.	Forevacuum pressure is too high. Gas flow is too high.	Check ultimate of the forevacuum pump and if required install a larger forevacuum pump. Seal off leak, check process.
6	Run-up failure	Pump has not attained its normal operating frequency after the maximum run-up time has elapsed.	Forevacuum pressure is too high. Gas flow is too high.	Check ultimate pressure of the forevacuum pump and if required install a larger forevacuum pump. Seal off leak, check process.
7	Run-up time failure	Maximum permissible bearing temperature was exceeded.	Forevacuum pressure is too high. Gas flow is too high.	Check ultimate pressure of the forevacuum pump and if required install a larger forevacuum pump. Seal off leak. Check process.
9	Bearing temperature failure	Maximum permissible bearing temperature was exceeded.	Forevacuum pressure is too high. Gas flow is too high. Water cooling switched off. Water cooling disabled or cooling water throughput or cooling water temperature inadequate.	Check ultimate pressure of the forevacuum pump and if required install a larger forevacuum pump. Seal off leak. Replace fan. Ensure sufficient water cooling.
12	Orbit monitoring, level XY1	Deflection of the rotor at the radial magnetic bearing on the high vacuum side is too high.	Mechanical impacts, possibly through maintenance work. Cross influences of vibrations between several pumps. Vibration influences through external exciting. Balancing condition of the rotor insufficient due to deposits or wear.	Remove external influences. Should the error still occur inform Leybold Service; have the pump replaced.
13	Orbit monitoring, level XY2	Deflection of the rotor at the radial magnetic bearing on the forevacuum side is too high.	Mechanical impacts, possibly through maintenance work. Cross influences of vibrations between several pumps. Vibration influences through external exciting. Balancing condition of the rotor insufficient due to deposits or wear.	Remove external influences. Should the error still occur inform Leybold Service; have the pump replaced.
14	Axial orbit monitoring	Deflection of the rotor at the axial bearing is too high.	Venting gas flow is too high, mechanical impacts, possibly through maintenance work. Cross influences of vibrations between several pumps. Vibration influences through external exciting.	Remove external influences. Should the error still occur inform Leybold Service; have the pump replaced.

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Error code	Designation	Description	Possible cause	Remedy
16	Overload duration failure	After having attained its normal operating frequency the pump was operated for a longer period of time below its normal operating frequency.	Forevacuum pressure too high. Gas flow too high.	Check ultimate pressure of the forevacuum pump and if required install a larger forevacuum pump. Seal off leak. Check process.
17	Motor current failure	Motor current below setpoint current.	With start command being present: frequency converter not properly connected to the pump or damaged connector between pump and frequency converter. Internal fault within the frequency converter.	Inform Leybold Service; have connectors and if required the cable checked. Have the converter replaced.
19	Passthrough time failure	The pump did not attain its minimum speed within the maximum passthrough time.	Forevacuum pressure too high when starting the system. Seized rotor.	Reduce forevacuum pressure. Check to ensure that the rotor rotates freely.
26	Bearing temperature sensor failure	Bearing temperature sensor is defective.	Component is defective, sensor short-circuit or interruption.	Inform Leybold Service. If required have converter respectively pump replaced.
28	Motor temperature sensor failure	Motor temperature sensor is defective.	Component is defective, sensor short-circuit or interruption.	Inform Leybold Service. If required have converter respectively pump replaced.
31	High load duration failure	Motor current has exceeded the warning threshold too long (time span defined through parameter "Overload time 2").	Forevacuum pressure is too high. Gas flow is too high.	Check ultimate pressure of the forevacuum pump and if required install a larger forevacuum pump. Seal off leak. Check process conditions.
39	Magnetic bearing start-up failure	Magnetic bearing is not able to lift the rotor properly.	Pump was shock vented. Excessively high vibrations or mechanical impacts from the system. Vibration influences between several pumps.	Refer to the pump manual for correct venting of the pump. Avoid vibrations or mechanical impacts.
43	Overspeed failure	The actual frequency exceeds the setpoint frequency.	Setpoint frequency was changed during operation via a serial interface, RS 232, for example.	Provide for correct speed setting.
63	Internal parameter failure		There is a parameter mismatch which occurred during start-up or while saving the parameters. The pump was disconnected from its power supply while storing important system data was in progress.	If required, stop the pump respectively wait for it to arrive at standstill, switch power supply voltage OFF and ON; if required have the frequency converter replaced.
65	Internal communication failure	Failure of internal data communication with the frequency converter.	Cyclic pump communication has failed.	If required, stop the pump respectively wait for it to arrive at standstill, switch power supply voltage OFF and ON.
66	Magnetic bearing current too high	Overloading of one or several magnetic bearing power output stages.	Excessively high vibrations or mechanical impacts from the system.	Reduce the level of vibrations or mechanical impacts.
67	Internal overload		Internal drive overload.	Stop the pump. Wait for standstill. Switch mains power OFF and ON again and restart the system.

Error code	Designation	Description	Possible cause	Remedy
71	First time initialisation failure of the parameter list.	Interface parameter/table mapping error.	First time initialisation of the pump parameters has failed.	If required, stop the pump respectively wait for it to arrive at standstill, switch power supply voltage OFF and ON.
73	First time initialisation failure of the parameter list.	The registered number of start and standby cycles exceeds the maximum permissible number for safe operation.	Very high number of starts respectively much use of the standby function.	Have the pump serviced.
74	Number of operating hours exceeded.	The number of operating hours of the pump exceeds the maximum permissible number of hours for safe operation.	The number of operating hours of the system has reached the level necessary for servicing.	Have the pump serviced.
75	Failure during the initialisation of the pump data.	Failure during identification and initialisation of the pump.	Failure in frequency converter or in the pump.	If required, stop the pump respectively wait for it to arrive at standstill, switch power supply voltage OFF and ON; if required have the frequency converter replaced.
77	Too many touchdown bearing contacts were detected.	The registered number of touchdown bearing contacts exceeds the permissible alarm limit.	Due to external or internal influences of the pump the turbo rotor makes contact with the emergency bearings (touchdown bearings): mechanical impacts, possibly due to maintenance work. Vibration influences between several pumps. Vibration influences due to external exciting. Balancing condition of the rotor inadequate due to deposits or wear. Magnetic suspension is defective. Full or partial shutdown of the pump without magnetic bearing support due to mains power failure or failure in the frequency converter.	Have the pump serviced. If required check frequency converter and the connections. Check installation orientation of the pump and if required correct it. Avoid external influences (vibrations, impacts etc.). Review electric power supply and control concept.
78	Bearing contact time too long was detected.	The registered total duration of all touchdown bearing contacts exceeds the permissible alarm limit.	Due to external or internal influences of the pump the turbo rotor makes contact with the emergency bearings (touchdown bearings): mechanical impacts, possibly due to maintenance work. Vibration influences between several pumps. Vibration influences due to external exciting. Balancing condition of the rotor inadequate due to deposits or wear. Magnetic suspension is defective. Full or partial shutdown of the pump without magnetic bearing support due to mains power failure or failure in the frequency converter.	Have the pump serviced. If required check frequency converter and the connections. Check installation orientation of the pump and if required correct it. Avoid external influences (vibrations, impacts etc.). Review electric power supply and control concept.
79	Internal communication failure.	Failure of the internal data communication of the frequency converter.	Failure in the frequency converter.	If required, stop the pump respectively wait for it to arrive at standstill, switch power supply voltage OFF and ON; if required have the frequency converter replaced.

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Error code	Designation	Description	Possible cause	Remedy
80	Invalid interface module combination.	Configuration of the interface module slots is inconsistent.	Two active Fieldbus modules were inserted, the X1 24 V PLC module has been inserted into the "Service" slot.	Correct installation of the interface modules: use control interface slot (CONTROL) with Fieldbus module (Profibus), RS 485, RS 232 or X1. Equip the service slot with a RS 232, a RS 485 or an USB module only.
81	Watchdog for monitoring of USS communication has responded.	Cyclic communication has failed for a longer period of time than defined through P 182.	Cable running to the controller was removed. Controller has interrupted communication. Interface module is defective.	Reinsert cable. Check controller. Inform Leybold Service.
82	Watchdog for monitoring Fieldbus communication has responded.	Cyclic communication has failed for a longer period of time than defined through P 925.	Cable running to the controller was removed. Controller has interrupted communication. Fieldbus interface is defective.	Reinsert cable. Check controller. Inform Leybold Service; have frequency converter replaced.
90	Setpoint speed setting higher than permissible.	Frequency setpoint is higher than the maximum value defined through parameter 45.	Incorrect setpoint entry or parameterisation of the pump is in error.	Correct setpoint entry or run a software respectively parameter update.
200	Pump identification temperature failure	Temperature in the pump identification is too high.	Forevacuum pressure is too high. Gas flow is too high. Water cooling switched off.	Check ultimate pressure of the forevacuum pump and if required install a larger forevacuum pump. Seal off leak. Check process. Water cooling disabled or cooling water throughput or cooling water temperature inadequate.
201	Unidentifiable failure on control board	Failure affecting the control computer of the frequency converter.	External interference or hardware failure affecting the frequency converter electronics.	If required, stop the pump respectively wait for it to arrive at standstill, switch power supply voltage OFF and ON; if required have the frequency converter replaced.
203	Failure during self test	Failure affecting the parameter table mapping.	External interference or hardware failure affecting the frequency converter electronics.	If required, stop the pump respectively wait for it to arrive at standstill, switch power supply voltage OFF and ON; if required have the frequency converter replaced.
204	RAM area insufficient for scope functionality	Failure in the control computer of the frequency converter.	External interference or hardware failure affecting the frequency converter electronics.	If required, stop the pump respectively wait for it to arrive at standstill, switch power supply voltage OFF and ON; if required have the frequency converter replaced.
206	Pump parameter failure	Failure during identification and initialisation of the pump or the frequency converter.	Failure in the frequency converter, in the pump respectively in the pump's cables.	If required, stop the pump respectively wait for it to arrive at standstill, switch power supply voltage OFF and ON; if required have the frequency converter replaced.
209	Pump initialisation failure	Failure during identification and initialisation of the pump or the frequency converter.	Failure in the frequency converter, in the pump respectively in the pump's cables.	If required, stop the pump respectively wait for it to arrive at standstill, switch power supply voltage OFF and ON; if required have the frequency converter replaced.

Error code	Designation	Description	Possible cause	Remedy
210	Non-cyclic data transfer to pump identification interrupted (parameter transfer)	Communication malfunction with data memory of pump identification.	Temporary EMC interference. Defective hardware.	If required, stop the pump respectively wait for it to arrive at standstill, switch power supply voltage OFF and ON; if required have the frequency converter replaced.
213	Intermediate circuit over-voltage	The power supply voltage is too high.	The frequency converter has detected an intermediate circuit voltage which is too high.	Check power supply on the mains power side.
913	Temperature Power Stage Bearing electronic	The temperature has exceeded the error threshold.	The Cooling water flow is too low or the cooling water temperature is too high. Ambiant temperature to high. Too high amplitude or force of mechanical shocks or vibration fto the system.	Check cooling conditions Check ambiant conditions Reduce the vibration or shocks influence which might affect the pump
914	Initialisation of parameter 893 was not yet run	Movement range in yM saved in the pump's memory needs to be updated.	When shifting the values this failure should no longer be able to occur.	
915	Intermediate circuit voltage is too low	Intermediate circuit voltage has dropped below the necessary value.	Unstable mains power supply. Equipment failure.	Check the mains power supply
916	Sensor alignment Channel Z	Automatic sensor alignment for channel Z resulted for parameter SGAIN and/or SOFFS values outside the range which can be typically tolerated.	Parameter changes in the pump's memory.	System needs to be recalibrated and aligned by Leybold.
917	Sensor alignment channel Y2	Automatic sensor alignment for channel Y2 resulted for parameter SGAIN and/or SOFFS in values outside the range which can be typically tolerated.	Parameter changes in the pump's memory.	System needs to be recalibrated and aligned by Leybold.
918	Sensor alignment Channel X2	Automatic sensor alignment for channel X2 resulted for parameter SGAIN and/or SOFFS in values outside the range which can be typically tolerated.	Parameter changes in the pump's memory.	System needs to be recalibrated and aligned by Leybold.
919	Sensor alignment Channel Y1	Automatic sensor alignment for channel Y1 resulted for parameter SGAIN and/or SOFFS in values outside the range which can be typically tolerated.	Parameter changes in the pump's memory.	System needs to be recalibrated and aligned by Leybold.
920	Sensor alignment Channel X1	Automatic sensor alignment for channel X1 resulted for parameter SGAIN and/or SOFFS in values outside the range which can be typically tolerated.	Parameter changes in the pump's memory.	System needs to be recalibrated and aligned by Leybold.
921	Current controller initialisation	Initialisation failure affecting the current controllers.		Re-initialisation attempt by the system by restarting.

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Error code	Designation	Description	Possible cause	Remedy
922	Initialisation MM module	Initialisation failure of different controller modules.		Re-initialisation attempt by the system by restarting.
923	Initialisation position task 2	Initialisation failure of software module position task 2.		Re-initialisation attempt by the system by restarting.
924	Initialisation position task 1	Initialisation failure of software module position task 1.		Re-initialisation attempt by the system by restarting.
925	Software not capable of running on the target system	Software is not capable of running on this control board.	Uploading of an incorrect software version.	Load correct software version.
926	Floating point error has occurred	The floating point unit has signalled a failure, error code in debug variable, error code floating point, message after software reset.		Re-initialisation attempt by the system by restarting.
927	System stack overflow	Not enough unoccupied memory in the system stack, message after software reset.		Re-initialisation attempt by the system by restarting.
928	User stack overflow	Not enough unoccupied memory any more.		Re-initialisation attempt by the system by restarting.
929	System stack overflow	System stack overflow, message after software reset.		Re-initialisation attempt by the system by restarting.
930	System stack underflow	System stack underflow, message after software reset.		Re-initialisation attempt by the system by restarting.
931	Word access failure	Illegal word access, message after software reset.		Re-initialisation attempt by the system by restarting.
932	Undefined operation code for protected commands	Programme was detected as incorrect and cannot be run.	Temporary problem or inadmissible changes in the flash/RAM memory.	After the system has arrived at standstill, disconnect it from the power supply to re-initialise the software.
933	Memory access error	Access to the system memory has been found to be in error.	Temporary problem or inadmissible changes in the flash/RAM memory.	After the system has arrived at standstill, disconnect it from the power supply to re-initialise the software.
934	Undefined operation code	Programme code was detected as being in error and cannot be run.	Temporary problem or inadmissible changes in the flash/RAM memory.	After the system has arrived at standstill, disconnect it from the power supply to re-initialise the software.
935	External failure affecting the safety processors	At least one of the safety processors has detected a failure.	For further analysis the status words and control words of the processors need to be read out.	System locks the power output stage of the drive unit. Wait for the system to arrive at standstill and try to enable the system by switching the mains power off and on again.
936	The current offset and gain values deviate from the initial data.			
937	The Soffset values are outside of the defined range (initialisation).			
938	Cable parameters soffs, sgain and xgain are at their factory defaults.			

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Error code	Designation	Description	Possible cause	Remedy
939	Cancellation during calculation of the checksum across the range of the static parameters in the pump identification.			
940	Cancellation during the calculation of the checksum across the range of the static parameters in the frequency converter.			
941	Incompatible compiling of the profile adapter version.	Interface parameter table mapping error.	Failure during software update.	If required repeat the software update, respectively check combination of software and profile adapter file.
949	Checksum error during initialisation of the equipment settings.	Failure while operating or identifying and initialising the pump.	Failure in the frequency converter, in the pump respectively in the pump's cable.	If required, stop the pump respectively wait for it to arrive at standstill, switch power supply voltage OFF and ON; if required have the frequency converter replaced.
950	Checksum error during initialisation of the autosave parameters	Failure while operating or identifying and initialising the pump.	Failure in the frequency converter, in the pump respectively in the pump's cable.	If required, stop the pump respectively wait for it to arrive at standstill, switch power supply voltage OFF and ON; if required have the frequency converter replaced.
951	Error while writing a string parameter to the fixed parameter memory.	Failure while operating or identifying and initialising the pump.	Failure in the frequency converter, in the pump respectively in the pump's cable.	If required, stop the pump respectively wait for it to arrive at standstill, switch power supply voltage OFF and ON; if required have the frequency converter replaced.
952	Failure during reading of the permanent parameter memory during the start-up phase.	Failure during operation or while identifying and initialising the pump.	Malfunction in the frequency converter, in the pump respectively in the pump's cable.	If required, stop the pump respectively wait for it to arrive at standstill, switch power supply voltage OFF and ON; if required have the frequency converter replaced.
953	Failure while writing to the fixed parameter memory.	Failure during operation or while identifying and initialising the pump.	Malfunction in the frequency converter, in the pump respectively in the pump's cable.	If required, stop the pump respectively wait for it to arrive at standstill, switch power supply voltage OFF and ON; if required have the frequency converter replaced.
955	Watchdog for monitoring the communication via Lustbus has responded.	Failure affecting the internal data communication of the frequency converter.	Malfunction in the frequency converter.	If required, stop the pump respectively wait for it to arrive at standstill, switch power supply voltage OFF and ON; if required have the frequency converter replaced.
956	Profile adapter: no opcode	Failure affecting the internal data communication of the frequency converter.	Malfunction in the frequency converter.	If required, stop the pump respectively wait for it to arrive at standstill, switch power supply voltage OFF and ON; if required have the frequency converter replaced.
957	Profile adapter: invalid opcode	Profile adapter: invalid opcode	Malfunction in the frequency converter.	If required, stop the pump respectively wait for it to arrive at standstill, switch power supply voltage OFF and ON; if required have the frequency converter replaced.

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Error code	Designation	Description	Possible cause	Remedy
958	Profile adapter: failure during reading of parameters.	Failure affecting the internal data communication of the frequency converter.	Malfunction in the frequency converter.	If required, stop the pump respectively wait for it to arrive at standstill, switch power supply voltage OFF and ON; if required have the frequency converter replaced.
959	Profile adapter: failure during writing of parameters	Failure affecting the internal data communication of the frequency converter.	Malfunction in the frequency converter.	
979	General failure during floating point calculation	Failure affecting the control computer of the frequency converter.	External interference or hardware fault of the frequency converter electronics.	
980	Not enough memory for module parameters	Failure affecting the control computer of the frequency converter.		
982	Failure during initialisation of the generator mode.	Internal frequency converter failure.		
983	Failure during initialisation of the speed controller.	Internal frequency converter failure.		
984	Failure during initialisation of rotational speed calculation.	Internal frequency converter failure.		
985	Failure during initialisation of the current controller.	Internal frequency converter failure.		
986	Failure during initialisation of the controller.	Internal frequency converter failure.		
987	Internal failure of the state machine controller.	Internal frequency converter failure.		
988	Failure during initialisation of the motor protection module.	Internal frequency converter failure.		
989	Internal failure affecting the number formats.	Internal frequency converter failure.		
990	Failure during internal parameter access via KP 200. A parameter could not be read or written.	Internal frequency converter failure.		

Error code	Designation	Description	Possible cause	Remedy
991	Failure during initialisation of a parameter with its saved setting.	Internal frequency converter failure.	External interference or hardware fault in the frequency converter electronics.	If required, stop the pump respectively wait for it to arrive at standstill, switch power supply voltage OFF and ON; if required have the frequency converter replaced.
992	User stack has exceeded the maximum size.			
994	Runtime error during checking of the assisting parameter			
995	An exception was initiated.			
996	Non-identifiable parameter access level.			
997	Runtime error during enabling of an assisting parameter.			

Theoretically there are further error codes. Should these be displayed, please contact Leybold.
In the case of malfunctions also note the troubleshooting information provided in the Operating Instructions for the pump.

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4.15.3 Failure storage: Error frequency

0x2007	**Actual frequency when failure occured**		
Sub index 0x00	number implemented sub indexes		
Access: RO	Range: 0.40	Data type: unsigned 8	Unit: N/A
Default	40		
Description	The number implemented sub indexes.		
Sub index 0x01	**Stored error frequency**		
Access : RO	Range 0 to 0xFFFF	Data type: unsigned 16	Unit: N/A
Default	0x0000		
Description	Index 1 stores frequency which was present at the newest failure event. Index 40 stores the oldest one.		

4.15.4 Failure storage: Operation hours

0x2008	**Pump Operation hours when failure occured**		
Sub index 0x00	number implemented sub indexes		
Access: RO	Range: 0.40	Data type: unsigned 8	Unit: N/A
Default	40		
Description	The number implemented sub indexes.		
Sub index 0x01	**Stored operation hour**		
Access : RO	Range 0 to 0xFFFF	Data type: unsigned 16	Unit: N/A
Default	0x0000		
Description	Index 1 stores the operation hour which was present at the newest failure event. Index 40 stores the oldest one.		

4.16 AC DC Drive

0x2009	**AC DC Drive Object**		
Sub index 0x00	number implemented sub indexes		
Access: RO	Range: 0.23	Data type: unsigned 8	Unit: N/A
Default	23		
Description	The number implemented sub indexes.		
Sub index 0x01	**At reference speed**		
Access : RO	Range 0 to 0xFFFF	Data type: unsigned 16	Unit: N/A
Default	0x0000		
Description	Bit 0 will be set if the target speed is reached		
Sub index 0x02	**Frequency setpoint set by Network (EtherCat) system**		
Access : RO	Range 0 to 0xFFFF	Data type: unsigned 16	Unit: N/A
Default	0x0000		
Description	Bit 0 will be set, if the frequency converter accept the frequency setpoint from the EtherCat network.		
Sub index 0x03	**Process control**		
Access : RO	Range 0 to 0xFFFF	Data type: unsigned 16	Unit: N/A
Default	0x0000		
Description	Bit 0 =0 local mode of the system Bit 0 =1 cosystem will be control via EtherCat		
Sub index 0x04	**Drive Mode**		
Access : RO	Range 0 to 0xFFFF	Data type: unsigned 16	Unit: N/A
Default	0x0002		
Description	Only value 2 (closed loop mode) is implemented		
Sub index 0x05	**Actual speed**		
Access : RO	Range 0 to 0xFFFF	Data type: unsigned 16	Unit: RPS
Default	0x0000		
Description	Value show the actual speed of the turbo pump in rotation per seconds		
Sub index 0x06	**Speed reference**		
Access : RW	Range 0 to 0xFFFF	Data type: unsigned 16	Unit: RPS
Default	0x0000		
Description	Reference speed for Normal Operation.Value can be written via EtherCat, but will not stored in the frequency converter. Default value depends on pump size		
Sub index 0x07	**Actual Motor current**		
Access : RO	Range 0 to 0xFFFF	Data type: unsigned 16	Unit: 0,1A
Default	0x0000		
Description	Value of the present motor current. Scaling ist 0.1 A. Max motor current ist about 1,8A		
Sub index 0x08	**Limit Motor current**		
Access : RO	Range 0 to 0xFFFF	Data type: unsigned 16	Unit: 0,1A
Default	0x0000		
Description	Value of the present motor current. Scaling ist 0.1 A. Max motor current ist about 1,8A		
Sub index 0x09	**Actual power on mains side**		
Access : RO	Range 0 to 0xFFFF	Data type: unsigned 16	Unit: 0,1W
Default	0x0000		
Description			

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Sub index 0x0A	**Input Voltage**		
Access : RO	Range 0 to 0xFFFF	Data type: unsigned 16	Unit: 0,1V
Default	0x0000		
Description	Actual value of the supply voltage (Mains)		
Sub index 0x0B	Low speed limit		
Access : RO	Range 0 to 0xFFFF	Data type: unsigned 16	Unit: RPS
Default	0x0000		
Description	Low limit of the pump speed, Value in rotation per second. Default value depends on pump size		
Sub index 0x0C	**High speed limit**		
Access : RO	Range 0 to 0xFFFF	Data type: unsigned 16	Unit: RPS
Default	0x0000		
Description	High limit of the pump speed, Value in rotation per second. Default value depends on pump size.		
Sub index 0x0D	**Speed control**		
Access : RW	Range 0 to 0xFFFF	Data type: unsigned 16	Unit: RPS
Default	0x0000		
Description	Bit	Speed Control	Description
	0	Run request	Starts the pump if set.
	1	Idle	Stops the pump if set.
	2	Standby	Run the pump at Standby Speed if set.
Sub index 0x0E	**Speed Status**		
Access : RW	Range 0 to 0xFFFF	Data type: unsigned 16	Unit: RPS
Default	0x0000		
Description	Bit	Speed Status	Description
	0	Running	On and Speed Actual > 0
	1	At idle	Zero current
	2	At standby speed	Speed Actual = Speed Standby
	3	Coasting	Zero Torque (generator mode)
	4	Stopped	Speed Actual = 0
	5	Accelerating	Speed Actual is increasing
	6	At reference speed	Actual = Speed Reference
	7	Decelerating	Speed actual is decreasing
Sub index 0x0F	**SpeedTripTime**		
Access : RO	Range 0 to 0xFFFF	Data type: unsigned 16	Unit: s
Default	0x0000		
Description	Maximum run up time; maximum overload time [s]. (Exceeding of this limit leads to the corresponding error message) Default value depends on pump size.		
Sub index 0x10	**MaxRatedSpeed**		
Access : RO	Range 0 to 0xFFFF	Data type: unsigned 16	Unit: RPS
Default	0x0000		
Description	Maximum pump speed [RPS]. Default value depends on pump size.		

Sub index x011	**StandbySpeed**		
Access : RO	Range 0 to 0xFFFF	Data type: unsigned 16	Unit: RPS
Default	0x0000		
Description	Speed setting for the Standby function [RPS]. Default value depends on pump size.		
Sub index 0x12	**Speed actual Data Units**		
Access : RO	Range 0 to 0xFFFF	Data type: unsigned 16	Unit: RPS
Default	0x1F0E		
Description	Fixed value: RPS --> 0x1F0E (rotations per second)		
Sub index 0x13	**Speed Ref Data Units**		
Access : RO	Range 0 to 0xFFFF	Data type: unsigned 16	Unit: RPS
Default	0x1F0E		
Description	Fixed value: RPS --> 0x1F0E (rotations per second)		
Sub index 0x14	**Pump operation hours**		
Access : RO	Range 0 to 0xFFFF	Data type: unsigned 16	Unit: hours
Default	0x0000		
Description			
Sub index 0x15	**Pump operation cycles**		
Access : RO	Range 0 to 0xFFFF	Data type: unsigned 16	Unit: N/A
Default	0x0000		
Description	Fixed value: RPS --> 0x1F0E (rotations per second)		
Sub index 0x16	**Converter Operation hours**		
Access : RO	Range 0 to 0xFFFF	Data type: unsigned 16	Unit: hours
Default	0x1F0E		
Description	Fixed value: RPS --> 0x1F0E (rotations per second)		

4.17 Turbo Status

0x200A	**Turbo Pump Status**		
Sub index 0x00	number implemented sub indexes		
Access: RO	Range: 0.12	Data type: unsigned 8	Unit: N/A
Default	12		
Description	The number implemented sub indexes.		
Sub index 0x01	**Pump On/Off Status**		
Access : RO	Range 0 to 0x00	Data type: unsigned 8	Unit: Bool
Default	0x00		
Description	Bit set = pump is rotating		
Sub index 0x02	**Normal**		
Access : RO	Range 0 to 0x00	Data type: unsigned 8	Unit: Bool
Default	0x0000		
Description	Bit = 1 pump is running under normal operation		

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Sub index 0x03	**Acceleration**		
Access : RO	Range 0 to 0x00	Data type: unsigned 8	Unit: Bool
Default	0x0000		
Description	Bit = 1 Accelerating		
Sub index 0x04	**Deceleration**		
Access : RO	Range 0 to 0x00	Data type: unsigned 8	Unit: Bool
Default	0x0000		
Description	Bit = 1 Decelerating		
Sub index 0x05	**Local/Remote mode**		
Access : RO	Range 0 to 0x00	Data type: unsigned 8	Unit: Bool
Default	0x0000		
Description	Bit = 1 Local Hand control enabled		
Sub index 0x06	**Reserved**		
Access : RO	Range 0 to 0x00	Data type: unsigned 8	Unit: Bool
Default	0x0000		
Description	Bit is always 0		
Sub index 0x07	**Turbo low speed**		
Access : RO	Range 0 to 0x00	Data type: unsigned 8	Unit: Bool
Default	0x0000		
Description	Bit = 1 pump is running at standby speed		
Sub index 0x08	**Reserved**		
Access : RO	Range 0 to 0x00	Data type: unsigned 8	Unit: Bool
Default	0x0000		
Description	Bit is always 0		
Sub index 0x09	**Alarm**		
Access : RO	Range 0 to 0x00	Data type: unsigned 8	Unit: Bool
Default	0x0000		
Description	Bit = 1 Alarm is present		
Sub index 0x0A	**Warning is present**		
Access : RO	Range 0 to 0x00	Data type: unsigned 8	Unit: Bool
Default	0x0000		
Description	Bit = 1 Warning is present		
Sub index 0x0B	**Reserved**		
Access : RO	Range 0 to 0x00	Data type: unsigned 8	Unit: Bool
Default	0x0000		
Description	Bit is always 0		
Sub index 0x0C	**Reserved**		
Access : RO	Range 0 to 0x00	Data type: unsigned 8	Unit: Bool
Default	0x0000		
Description	Bit is always 0		

4.18 CoE Objects Snapshots

The following Snapshots were taken from a configuration tool from the manufacturer Beckhoff.

TwinCAT System Manager
v2.11 (Build 2222)

TwinCAT PLC
v2.11 (Build 2228)

zeitlimitiert bis:01.08.2013
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http://www.beckhoff.com

left:TwinCat System manager

below and next page:
Snapshot MAG.Integra

Index	Name	Flags	Wert
1000	Device type	RO	0x00000000 (0)
1001	Error register	RO	0x00 (0)
1003:0	Pre-defined error field	RW	> 0 <
1003:01	SubIndex 001	RO	---
1003:02	SubIndex 002	RO	---
1003:03	SubIndex 003	RO	---
1003:04	SubIndex 004	RO	---
1003:05	SubIndex 005	RO	---
1008	Device name	RO	Mag Integra (iM)
1009	Hardware version	RO	3
1011:0	Restore default parameters	RO	> 1 <
1011:01	SubIndex 001	RW	0x00000001 (1)
1018:0	Identity	RO	> 4 <
1018:01	Vendor ID	RO	0x00000723 (1827)
1018:02	Product code	RO	0x000000D3 (211)
1018:03	Revision	RO	0x00010001 (65537)
1018:04	Serial number	RO	0x000F423F (999999)
1600:0	DO RxPDO-Map	RO	> 1 <
1600:01	SubIndex 001	RO	0x20D3:00, 8
1A00:0	DI TxPDO-Map	RO	> 9 <
1A00:01	SubIndex 001	RO	0x20CA:00, 8
1A00:02	SubIndex 002	RO	0x20CB:00, 8
1A00:03	SubIndex 003	RO	0x20CC:00, 8
1A00:04	SubIndex 004	RO	0x20CD:00, 8
1A00:05	SubIndex 005	RO	0x20CE:00, 8
1A00:06	SubIndex 006	RO	0x20CF:00, 8
1A00:07	SubIndex 007	RO	0x20D0:00, 8
1A00:08	SubIndex 008	RO	0x20D1:00, 8
1A00:09	SubIndex 009	RO	0x20D2:00, 8
1C00:0	Sync manager type	RO	> 4 <
1C00:01	SubIndex 001	RO	0x01 (1)

Tabs: Allgemein | EtherCAT | Prozessdaten | Startup | CoE - Online | Online

Update Liste   ☑ Auto Update   ☑ Single Update   ☐ Show Offline Data
Erweitert...   All Objects
Add to Startup...   Online Data   Module OD (AoE Port): 0

XML File

5   XML File

The XML file serves the integration into specific tools for configuring EtherCat interfaces. The section regarding the RxPDO and TxPDO entries within the XML file is valid exclusively for the default configuration of the system.

RxPDO 1 Byte   Default configuration 101 (0x65)

TxPDO 9 Byte   Default configuration 100 (0x64)

With other configurations the XML file may be customised if applicable. But in general, it is recommended to follow the procedures of how-to display the configuration, as described in Section 4.7.

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