C O M B I C O M

GB

Instruction Manual **EtherCAT**

CT.F5.0E0-K100

KEB

02/2008

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1. Introduction

1.1 Preface

We welcome you as a customer of the Karl E. Brinkmann GmbH and congratulate you to the aquisition of this product. You have chosen a product on highest technical standard.
This manual as well as the specified hardware and software are developments of the Karl E. Brinkmann GmbH. The Karl E. Brinkmann GmbH have prepared the documentation, hardware and software to the best of their knowledge, however, no guarantee is given that the specifications will provide the efficiency aimed at by the user. Karl E. Brinkmann GmbH reserves itself the right to change/adapt specifications and technical data without previous notification. Errors and ommissions excepted!
The safety and warning directions in this manual as well as in further documentation must be observed for a safe operation. The safety and warning directions specified in this manual is not exhaustive.
The pictographs used in this manual have following meaning:

Danger
Warning
Caution

Attention
observe at all costs

Information
Help
Tip

The information contained in the technical documentation, as well as any user-specific advice in spoken and written and through tests, are made to best of our knowledge and information about the application. However, they are considered for information only without responsibility. This also applies to any violation of industrial property rights of a third-party.
Inspection of our units in view of their suitability for the intended use must be done generally by the user. Inspections are particulary necessary, if changes are executed, which serve for the further development or adaption of our products to the applications (hardware, software or download lists). Inspections must be repeated completely, even if only parts of hardware, software or download lists are modified.
Application and use of our units in the target products is outside of our control and therefore exclusively in the area of responsibility of the user.

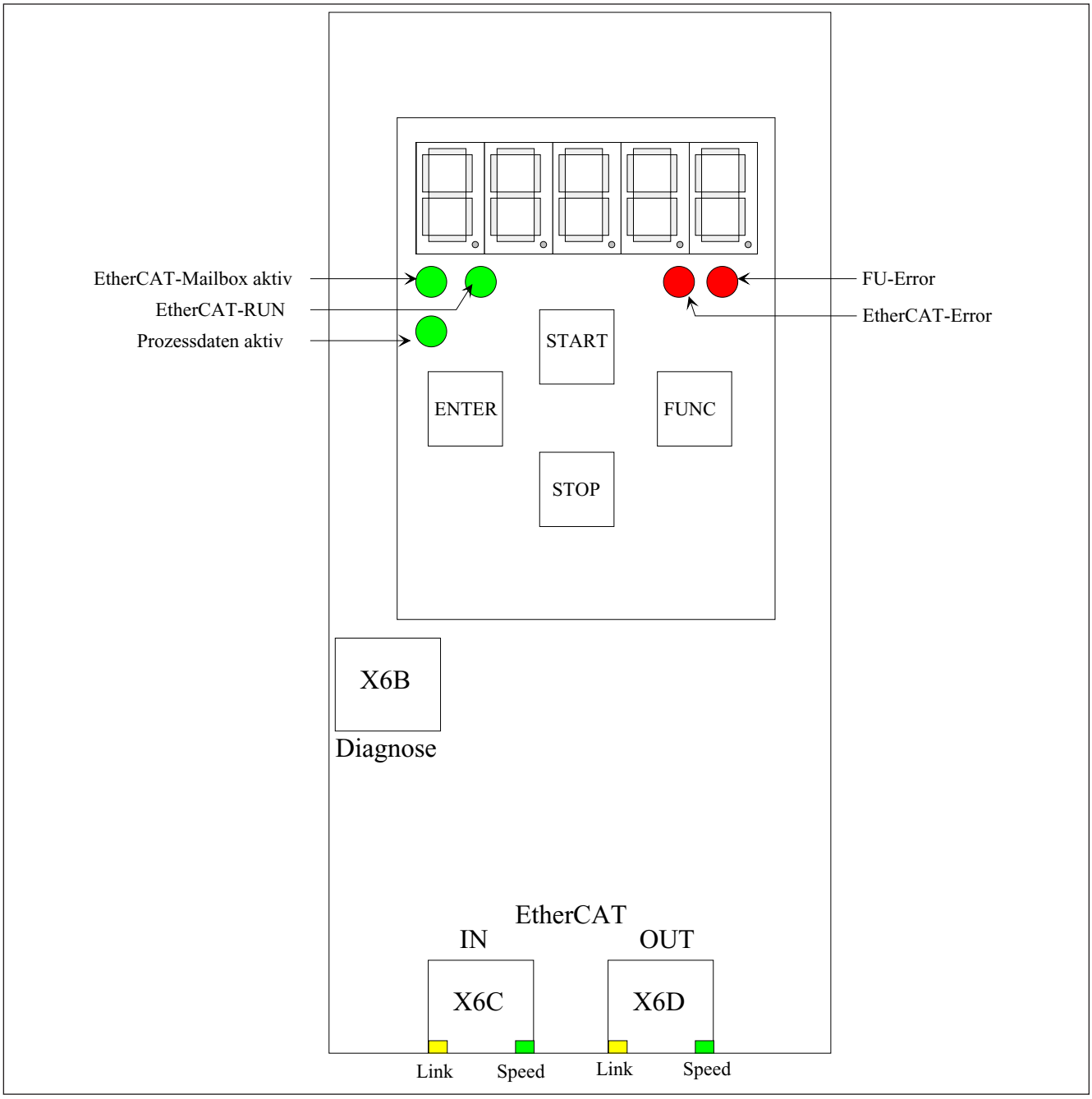
1.2 Product description

KEB develop, produce and sell static frequency inverters worldwide in the industrial power range. The inverters of the type F5 can be equipped optionally with a EhterCAT slave interface. The F5 EtherCAT operator is integrated into the FI housing by simple plug-in and fits into all F5-units. Here it concerns to an intelligent interface which controls the data transfer from EtherCAT to the FI control and reverse.

1.3 List of literature

[1]: ESC10/20 Hardware Data Sheet V1.0 v. 8.3.2005
[2]: CANopen Application Layer and Communication Profile DS301 V4.02
[3]: Application manual of the implemented inverter
[4]: CANopen Device profile drives and motion control DSP402 V2.0

2. Hardware



Component	Description
EtherCAT Mailbox active:	Flashes as long as a mailbox command is carried out.
ProcessData active:	Flashes as long as there is process data communication from and to the inverter.
EtherCAT RUN	Green RUN-Led according to the specification of ‚RUN Indicator' in the EtherCAT specification ([1]):

Flashing	Actual condition
Constantly OFF	INIT
Cyclically blinking with ON(200ms) / OFF(200ms)	PRE-OPERATIONAL
Single flash with ON(200ms) / OFF(1000ms)	SAFE-OPERATIONAL
Constantly ON	OPERATIONAL

further on next side

<table>
<tr><th>Component</th><th>Description</th></tr>
<tr><td>EtherCAT ERROR</td><td>Red Led according to specification of ‚ERR Indicator‘ in the EtherCAT specification ([1]):
<table>
<tr><th>Flashing</th><th>Description</th></tr>
<tr><td>Constantly OFF</td><td>No Error</td></tr>
<tr><td>Cyclically blinking with ON(200ms) / OFF(200ms)</td><td>General configuration errror</td></tr>
<tr><td>Single flash with ON(200ms) / OFF(1000ms)</td><td>The application of the slave device has automatically changed the communication state</td></tr>
<tr><td>Double Flash with ON(200ms) / OFF(200ms) / ON(200ms) / OFF(1000ms)</td><td>The application watchdog has responded.</td></tr>
<tr><td>Constantly ON</td><td>The process data watchdog has responded. The host controller of the application does not respond any more.</td></tr>
</table></td></tr>
<tr><td>FI error</td><td>Red Led as a repeater of the Error-Led of the FI control:
<table>
<tr><th>Flashing</th><th>Description</th></tr>
<tr><td>Constantly OFF</td><td>No power supply on the FI control board</td></tr>
<tr><td>Blinking</td><td>FI control board in error status</td></tr>
<tr><td>Constantly ON</td><td>Operating condition OK</td></tr>
</table></td></tr>
<tr><td>Link</td><td>Yellow Led in Ethernet connector:
<table>
<tr><th>Flashing</th><th>Description</th></tr>
<tr><td>Constantly OFF</td><td>No Ethernet link present</td></tr>
<tr><td>Constantly ON</td><td>Ethernet link present</td></tr>
<tr><td>Blinking</td><td>Ethernet communication active</td></tr>
</table></td></tr>
<tr><td>Speed</td><td>Green Led in Ethernet connector: Displays, whether the Ethernet communication is running with 100Mbit/s (LED = constantly ON) or not.</td></tr>
<tr><td>X6B</td><td>RJ45 connector of the diagnostic interface.
Attention !!! In order to avoid a destruction of the PC interface, the diagnostic interface may only be connected to the serial interface of the PC by a special HSP5 cable with voltage adaption.</td></tr>
<tr><td>X6C, X6D</td><td>Standard Ethernet-RJ45 connector according to IEEE 802.3 100Base-T</td></tr>
</table>

3. Software

3.1 Fundamentals of the EtherCAT interface connection

The KEB F5 EtherCAT operator contains a EtherCAT slave controller for time-critical operations of the EtherCat communication. By using this EtherCAT controller it is guaranteed that basic communication is compatible to the EtherCAT specification.

3.1.1 EtherCAT Configuration (EEPROM)

All values are saved in intel format (LSbyte first) into the EEPROM. The following table only lists the main features of the KEB-F5-EtherCAT-EEPROM.

Byte Offset	Description	Value
0	PDI-Control	0009h
2	PDI-Config	0400h
4	SyncImpulseLength	000Ah

3.1.2 Mailbox communication

The KEB F5 EtherCAT operator supports the mailbox communication. All parameters of the FI control and the operator can be read out or preset itself via this mailbox by using the CANoverEtherCAT.

Buffer size of the receive mailbox	Minimum	Maximum
	16 Byte	50 Byte
Buffer size of the transmit mailbox	Minimum	Maximum
	16 Byte	50 Byte
Supported mailbox protocols	CANoverEtherCAT(CoE)	
Supported CoE services	Initiate SDO download expedited in server mode, Initiate SDO upload expedited in server mode, Emergency as client	

3.1.2.1 Parameter addressing by 16 bit index plus 8 bit subindex

The following table shows parameter grouping according to [2]:

1.Index	Last index	Description
1000h	1FFFh	Communication parameter according to [2]
2000h	5E00h	Parameter of the FI control with index = KEB-Parameter-Address + 2000h(*1). The subindex is used for set-addressing
5F00h	5FFFh	Parameter of the EtherCAT operator
6000h	9FFFh	Device profile parameters according to [4]

(*1): The KEB parameter address can be found in the application manual of the used FI.

3.1.2.2 Set-addressing with subindex

For KEB parameters (Index = 2000h...5FFFh) the subindex is used for set-addressing. Thereby the following coding is used:

Subindex	Description
0	Indirect set-addressing: The set to be addressed depends on the value of parameter Fr.09 in the FI control.
1	Direct addressing of set 0
2	Direct addressing of set 1
4	Direct addressing of set 2
8	Direct addressing of set 3
16	Direct addressing of set 4
32	Direct addressing of set 5
64	Direct addressing of set 6
128	Direct addressing of set 7

By use of this bit-coding it is possible to address more than one parameter-set simultaneously. However this should not be used for parameter-reading, because an error message is returned if not all values in the addressed

sets are the same. This mechanism can also be used to map PDO-Rx-data simultaneously to the parameters in several sets of the inverter.

3.1.3 Process data communication

Through the process data channel it is possible to preset non-addressed setpoints to the KEB-F5 and actual values can be requested. Data communication of the process data between application and EtherCAT slave controller occurs via 3-buffer mechanism. The maximum of process data that can be transferred is 8 byte each per direction.

3.1.4 Distributed clocks

The function distributed clocks is used for the synchronous operating mode (see above) in the KEB-F5-EtherCAT operator. In this mode the interrupt cycles of the FI control is synchronized to the EtherCAT distributed clock-cycles. With this a very precise synchronization of several KEB-F5 inverters is possible. Does the EtherCAT master not support distributed clocks or are the distributed clocks not activated, then the KEB-F5-EtherCAToperator is working completely asynchronous to the EtherCAT cycle.

3.2 Functions

3.2.1 Process data mapping

Which parameters of the inverter control concern to the process data is determined by the process data assignment. The default process data assignment for this is:

Process **output data** (EtherCAT-Master → KEB-Slave):

Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
SY.43: Control word (long)				SY.52: Set speed		IN.22: User Parameter 1	
LSByte			MSByte	LSByte	MSByte	LSByte	MSByte

Process **input data** (KEB-Slave → EtherCAT-Master):

Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
SY.44: Status word (long)				SY.53: Actual Speed		IN.22: User Parameter 1	
LSByte			MSByte	LSByte	MSByte	LSByte	MSByte

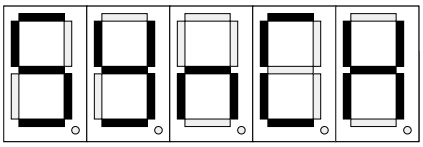
The process data assignment can be adapted by CANopen parameters with index = 1600h and index = 1A00h. The default process data assigment has the following meaning:

Index	**Subindex**	Value
1600h	0	3
1600h	1	202B0120h
1600h	2	20340110h
1600h	3	2E160110h
1A00h	0	3
1A00h	1	202C0120h
1A00h	2	20350110h
1A00h	3	2E160110h

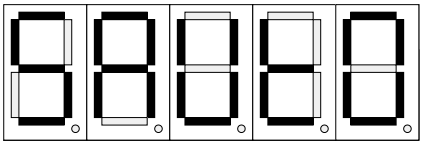
IMPORTANT !!! For synchronous operating mode the process data assignment has to follow the form 1*32-Bit + 1-2times 16-Bit for both data directions.

3.2.2 Synchronous mode

In synchronous mode the SYNCO interrupt preset by the EtherCat slave controller is used as synchronisation signal for the internal communication. Synchronous operating mode is only possible for the F5-EtherCAT operator, if SYNC0 signals are activated by the EtherCAT master and the process data assignment is preset in both data directions according to the above mentioned rules (1 time 32-Bit + 1-2 time 16-Bit).
In synchronous mode the operator displays constantly the following output:



This special operating mode includes some restrictions. As mentioned above the display is static. Furthermore inputs via keyboard are also no longer possible. The diagnostic interface continues to operate. But the processing speed of all services heavy depends on the synchronous cycle time. The cycle time is preset as multiple of 1 ms, the minimum possible value is 1 ms. During each SYNCO cycle the actual process output data are transferred to the FI control and the actual process intput data are read from it.
If the synchronous operating mode is activated, but no SYNC0 interrupts are released, the F5-EtherCAT operator switches in automatic synchronous mode at default setting which can be identified in the following display string:



Herein the operator simulates the SYNC0 interrupts time controlled according to the configured sync0 cycle time. In the following the SYNCO interrupt is meant if we speak from ‚**SYNC event**'. The SYNC timeout time is four times of the adjusted SYNC cycle time (see Com_Cycle).

3.2.3 Emergency

If this function is activated via parameter EmergencyCycle, the EtherCat operator reads cyclically parameter RU.00 from the FI control. The operator starts an emergency message via CoE channel of the mailbox communication if an error status is recognized .This is also done if the error is no longer present. The message contains 8 bytes of data. The first 3 bytes of this data are defined by [2], the last 5 bytes can be assigned manufacturer-specific. The KEB-F5-EtherCAT operator fills the emergency message as follows:

Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
ErrorCode		Error register	InverterState (ru.00)		00h (KEB)	00h (KEB)	00h (KEB)
LB	HB		LB	HB			

3.2.4 Field bus watchdog

The field bus watchdog is a function in the EtherCAT operator. It serves to set the FI control into error (E.BUS) or warning (A.BUS), if certain events on the field bus do not occur cyclically within an adjustable cycle-time. Two operator parameters (**Watchdog inhibit**, **Watchdog activation**) exist for activating the field bus watchdog. Additionally the parameters **Pn.05**,Pn.06 have to be set in the FI control to define the cycle time and the reaction on the timeout.
The EtherCAT operator monitors the occurance of the configured field bus events. Different events can cause the reset of the watchdog. Does the timeout-time expire without one of the configured events occur, then the operator triggers the watchdog event via the serial interface to the FI. If and how the FI control reacts on this, is determined by the responded parameters in the FI control of the inverter.

4 Operator Parameters

Name:	**Com_Cycle**
Index:	**1006h**
Subindex:	0
Description:	Servs for activating/deactivating of synchronous operating mode. The value is coded in µs, but it has an internal resolution of 1 ms.
Data length:	4 Byte
Coding:	0 = OFF (normal operating mode), otherwise 1 µs.
Value range:	0, 1000, 2000, 3000, ..., 65000
Remarks:	This parameter is only writeable via mailbox communication with CANopen-SDO. The value is not stored and thus the value after each restart is 0.

Name:	**HS_SyncToutMode**
Index:	**5FD7h**
Subindex:	0
Description:	Defines the reaction on the SYNC timeout event. See also chapter synchronous operation
Data length:	1 Byte
Coding:	0: Automatic return into normal mode.
	1: Change into automatic synchronous mode.
Default value:	1
Remarks:	A new value will be immediately active and saved non-voletily.

Name:	**HS_SyncToutDelay**
Index:	**5FE0h**
Subindex:	0
Description:	Here it can be configured how many SYNC events have to be received until the SYNC timeout-supervising is activated after switching on. This parameter can be used if the cyclic SYNC events cannot be guaranteed immediately after switching into the synchronous operating mode.
Data length:	2 Byte
Coding:	Number of SYNC events
Default value:	0
Remarks:	A new value will be immediately active and stored non-volatile.

Name:	**Device type**
Index:	**1000h**
Description:	Displays the type of device according to [2]:
Subindex:	0
Data length:	4 Byte
Coding:	Byte4 / Byte5 / Byte6 / Byte7 Device profile no. / Additional informations LB / HB / LB / HB
Default value:	0

Name:	**Error register**
Index:	**1001h**
Description:	Displays the actual error status according to [2]:
Subindex:	0
Data length:	1 Byte
Coding:	Bit7: Manufacturer spec. / Bit6: Reserv. / Bit5: Device profile spec. / Bit4: Communication / Bit3: Temperature / Bit2: Voltage / Bit1: Current / Bit0: Error generally
Default value:	0
Remarks:	This parameter is read-only.

Name:	**Manufactuer Status Register**
Index:	**1002h**
Description:	Returns the value of parameter RU.00 as 4 byte value.
Subindex:	0
Data length:	4 Byte
Coding:	s. [3]
Remarks:	This parameter is read-only.

Name:	**Pre-defined error field**
Index:	**1003h**
Description:	This parameter contains a field of maximum 6 entries where the error-history can be read out. Subindex = 0 contains the number of errors that have been saved whereby the entries with subindex = 1-5 contain the real error entries
Subindex:	**0: number of errors**
Data length:	4 Byte
Coding:	1
Remarks:	Writing on subindex = 0 deletes the error-history completely.
Subindex:	**1-5: standard error field**
Data length:	4 Byte
Coding:	according to [2], as follows: Byte4 (LB): ErrorCode; Byte5 (HB): ErrorCode; Byte6 (LB): InverterState(RU.00); Byte7 (HB): InverterState(RU.00)
Remarks:	The entries are read-only.

Name:	**Manufactuer Device Name**
Index:	**1008h**
Description:	Displays the value of parameter inverter identification SY.02 as 4-character hexadecimal coded string.
Subindex:	0
Data length:	4 Byte
Coding:	Value 0864h/2148 would appear in the CAN telegram as follows: Byte4: 30h:‘0‘ / Byte5: 38h:‘8‘ / Byte6: 36h:‘6‘ / Byte7: 34h:‘4‘

Remarks:	This parameter is read-only.

Name:	**Manufactuer Software Version**
Index:	**100Ah**
Description:	Displays the value of parameter software version (IN.06) as 4-character hexadecimal coded string.
Subindex:	0
Data length:	4 Byte
Coding:	Value 014Ah/330 would appear in the CAN telegram as follows:

Byte4	Byte5	Byte6	Byte7
30h:‘0‘	31h:‘1‘	34h:‘4‘	41h:‘A‘

Remarks:	This parameter is read-only.

Name:	**Identity Object**
Index:	**1018h**
Description:	Indicates the identification of the node in form of a structure.
Subindex:	**0 : Nr of entries**
Description:	Indicates the number of objects in this PDO.
Data length:	1 Byte
Coding:	1
Default value:	2
Subindex:	**1 : Vendor ID**
Description:	Indicates the code that has been distributed by the CAN in automation user group.
Coding:	
Default value:	00000014h (KEB)
Subindex:	**1 : Product Code**
Description:	Indicates the product code of the node. This parameter is coded manufacturer-specific.
Data length:	4 Byte
Coding:	00000005h: Type F5
Default value:	00000005h
Remarks:	All members of this parameter are read-only.

Name:	**1st receive PDO Mapping**
Index:	**1600h**
Description:	This parameter defines the process data assignment of the first PDO that carries data frommaster to slave.
Subindex:	**0 : Nr of Mapped objects**
Description:	Indicates the number of mapped objects in this PDO.
Data length:	1 Byte
Coding:	1
Default value:	3
Remarks:	Value = 0 deactivates the operation of this PDO. When activating the PDO by writing a value unequal to zero the operator first checks the process data mapping for general validity, then this mapping is converted into the inverter process data assignment and written to the FI control. If everything could be done without error, the process data assignment is activated and stored non-volatile.
Subindex:	**1-4 : Nth mapped object**

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Description:	Indicates an object mapping.
Data length:	4 Byte
Coding:	According to [2] as follows: Byte7 / Byte6 / Byte5 / Byte4 Index (HB / LB) / Subindex / Bitlength Please note that the sequence in the CAN telegram follows the Intel format. That means that the first byte (byte4) in the CAN telegram contains the bit length of this mapping and the last byte (byte7) contains the high-byte of the index.
Default value:	s.a.
Remarks:	Writing on the mapping automatically deactivates the PDO operation by resetting the value of subindex = 0 to zero. Please note that not all parameters of the FI control can be mapped to process data. Operator parameters can not be mapped to process data.

Name:	**1st transmit PDO Mapping**
Index:	**1A00h**
Description:	This parameter defines the process data assignment of the firstPDO that carries data from slave to master. All further informations can be taken from the description of parameter 1st receive PDO mapping.

Name:	**EmergencyCycle**
Index:	**5FDDh**
Subindex:	0
Description:	Serves for activation of the emergency function. Values unequal to zero define the cycle time in ms, in which the value of the FI parameter RU.00 is read. On occurance and leaving of an error-state an emergency message is output via the emergency mechanism.
Data length:	4 Byte
Coding:	1ms, 0 = OFF (no Emergency)
Default value:	0
Remarks:	A changed value will be immediately active and stored non-volatile.

Name:	**Watchdog inhibit**
Index:	**5FF9h**
Subindex:	0
Description:	Indicates the events that reset the field bus-watchdog from running into timeout.
Data length:	1 Byte
Coding:	Bit7 / Bit6 / Bit5 / Bit4 / Bit3 / Bit2 / Bit1 / Bit0 reserved / BUSOK / SDO-Req / PDOUT
	PDOUT: If this bit is set, the field bus-watchdog is reset on every transfer of process output data to the FI control.
	SDO-Req: If this bit is set, the field bus-watchdog is reset on every receiption of a SDO-request through the mailbox channel.
	BUSOK: If this bit is set, the field bus-watchdog is reset if bit 4 of the AL status register in the EtherCAT slave controller is 0. This means, that the slave did accept the EtherCAT state-transitions requsted by the master..
Default value:	07h
Remarks:	A changed value will be immediately active and stored non-volatile.

Name:	**Watchdog activation**
Index:	**5FDAh**
Subindex:	0
Description:	Defines, when the field bus-watchdog is activated after power on.
Data length:	1 Byte
Coding:	Mixture of value-coding and bit-coding. 0: The field bus-watchdog ist active immediately after power on. Bit7 | Bit6 | Bit5 | Bit4 | Bit3 | Bit2 | Bit1 | Bit0 | | SDO | | PDOUT | STATE_OP | STATE_PREOP | SYNC **SYNC**: If this bit is set, the field bus-watchdog is activated after occurence of the first SYNC event. **STATE_PREOP**: If this bit is set, the field bus-watchdog is activated after first switch to pre-operational-state. **STATE_OP**: If this bit is set, the field bus-watchdog is activated after first switch to operational-state. **PDOUT**: If this bit is set, the field bus-watchdog is activated after the first receiption of process output data. **SDO**: if this bit is set, the fild bus-watchdog is activated after the first receiption of a SDO-request.
Default value:	04h
Remarks:	A new value will be immediately active and saved non-voletily.

5. DSP402-Parameter

In the following parameters are listed that are defined by the CANopen device-profile DSP402 [4]. Some of this parameters are rescaled by the EtherCat operator and then they are mapped to a KEB internal parameter of the inverter control. Partly some of these parameters are completely realized in the operator.

Name:	**DSP402_ErrorCode**
Index:	**603Fh**
Subindex:	0
Description:	Output of an error code.
Data length:	2 Byte
Coding:	according to [4]
Default value:	0
PDO-mapping:	receive PDO: No; transmit PDO: Yes
Remarks:	This parameter is read-only and is internally mapped to parameter **RU.00**.

Name:	**DSP402_Control word**
Index:	**6040h**
Subindex:	0
Description:	Control word according to [4].The parameter is bit-coded.
Data length:	2 Byte
Coding:	Bit-coded according [4] The following table only lists the bits that are realised in this software. Note that some bits are different assigned by the settings of the DSP402-mode (see table below):

Modes of operation	b7	b6	b5	b4	b3	b2	b1	b0
	Fault Reset	Mode-dependent			Enable Operation	Quick Stop	Ennable Voltage	Switch ON
255	„“	Res.	Res.	Res.	„“	„“	„“	„“
2	„“	RFG Use Ref	RFG Unlock	RFG Enable	„“	„“	„“	„“

Default value:	
PDO-mapping:	receive PDO: Yes; transmit PDO: Yes
Remarks:	This parameter is internally mapped to parameter **SY.50**.

Name:	**DSP402_Statusword**
Index:	**6041h**
Subindex:	0
Description:	Status word with coding according to [4]. The parameter is bit-coded.
Data length:	2 Byte
Coding:	

Mode	b15... b14	b13	b12	b11	b10	b9	b8... b7	b6	b5	b4	b3	b2	b1	b0
		Mode-dependent		Int. Limit Active	Target Reached	Remote		Switch ON Disabl.	Quick Stop	Volt. Enabl.	Fault	Operation Enabl.	Switched ON	Ready To Switch ON
255		Res.	Res.	„“	„“	„“	„“	„“	„“	„“	„“	„“	„“	„“
2		Res.	Res.	„“	„“	„“	„“	„“	„“	„“	„“	„“	„“	„“

Default value:	

PDO-mapping:	receive PDO: No Transmit PDO: Yes
Remarks:	This parameter is internally mapped to parameter **SY.51**.

6. Annex

Overview of operator parameters

Index	Subindex	Diagnosis Param. address	Diagnosis Parameter name	CANopen Parameter name	Data length in Byte	Access
1000h	0	-----	-----	Device type	4	RD
1001h (KEB)	0	-----	-----	Error register	1	RD
1002h (KEB)	0	-----	-----	Manufactuer Status Register	4	RD
1003h	0-5	-----	-----	Predefine Error Field	4	RD_RW
1006h	0	0280h	-----	ComCycle	4	RD_RW
1008h (KEB)	0	-----	-----	Manufactuer Device Name	4	RD
100Ah	0	-----	-----	Manufacturer Software Version	4	RD
1018h (KEB)	-----	-----	-----	Identity Object	-----	
1018h (KEB)	1	-----	-----	Vendor Id	4	RD
1018h (KEB)	2	-----	-----	Product Code	4	RD
1600h	-----	-----	-----	1st receive PDO Mapping	-----	
1600h	0	0297h (KEB)	Nr_PDOut_Objs	Number of mapped objects	1	RD_RW
1600h	1	0298h (KEB)	PDOut1_Map	1st mapped Object	4	RD_WR
1600h	2	0299h (KEB)	PDOut2_Map	2nd mapped Object	4	RD_WR
1600h	3	029Ah	PDOut3_Map	3rd mapped Object	4	RD_WR
1600h	4	029Bh	PDOut4_Map	4th mapped Object	4	RD_WR
1A00h	-----	-----	-----	1st Transmit PDO Mapping	-----	
1A00h	0	0291h	Nr_PDIn_Objs	Number of mapped objects	1	RD_RW
1A00h	1	0292h	PDIn1_Map	1st mapped Object	4	RD_WR
1A00h	2	0293h	PDIn2_Map	2nd mapped Object	4	RD_WR
1A00h	3	0294h	PDIn3_Map	3rd mapped Object	4	RD_WR
1A00h	4	0295h	PDIn4_Map	4th mapped Object	4	RD_WR
5FDAh	0	0287h	Watchdog Activation	Watchdog Activation	1	RD_WR
5FF9h	0	0288h	Watchdog Inhibit	Watchdog Inhibit	1	RD_WR
5FDDh	0	0283h	EmergencyCycle	EmergencyCycle	2	RD_WR
5FDEh	0			CommTimeoutFunc_Addr	4	RD_WR
5FDFh	0			CommTimeoutFunc_Data	4	RD_WR
5FD7h	0	0281h	HS_SyncToutMode	HS_SyncToutMode	1	RD_WR
5FE0h	0	0282h	HS_SyncToutDelay	HS_SyncToutDelay	2	RD_WR
5FE2h	0	0285h	Take Stored PD-Map	Take Stored PD-Map	1	RD_WR
5FE4h	0	0286h (KEB)	PDOUT_WrMode	PDOUT_WrMode	1	RD_WR
5FE6h	0	0290h	PDIN1_Cycle	PDIN1_Cycle	2	RD_WR
5FD9h	0	0284h	FBS Command	FBS Command	2	RD_WR
5FDBh	0	-----	-----	VL_Ramp_CalcMode	1	RD_WR
5FDCh	0	-----	-----	Save_VLRamps	1	RD_WR
603Fh		-----	-----	DSP402_ErrorCode	2	RD

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