KONTURflex
QUATTRO-CANopen

Technical Description

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1 General information

1.1 Notes on this Technical Description

This additional technical description contains the description of the CANopen Interface for the KONTURflex CANopen CANopen Device. For better understanding of this description it is needed to read the technical description of the KONTURflex because the QUATTRO CANopen is really a Modbus device with an internal Modbus to CANopen gateway.

Also if it is referred to "KONTURflex CANopen-Register", please see the attachment A of the instruction.

It is important to note that the described system must not be used as a safety related sensor.

These technical description should be stored carefully. It should be available for the entire operating time of the KONTURflex CANopen.

The Leuze electronic GmbH + Co. KG is not liable for damages caused by improper use. Acquaintance with these instructions is an element of the knowledge required for proper use.

1.2 Explanation of symbols

The symbols used in this technical description are explained below.

Attention!

This symbol appears before text passages which must absolutely be observed. Failure to heed this information may lead to injuries to personnel or damage to the equipment.

Notice!

This symbol indicates text passages containing important information.

↳ *This symbol asks you to carry out an action.*

1.3 Contact address

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2 Using the QUATTRO Software (PC)

The software on the PC for the KONTURflex CANopen configuration and diagnostic is also usable with the KONTURflex CANopen CANopen device.

The following things must be paid attention:

- The Firmware of the KONTURflex CANopen doesn't know anything about the internal connected CANopen gateway. So the QUATTRO Software is identifying the CANopen device as a Modbus Device.
- It is possible to do some diagnostics or to create test configurations for getting the programming values, but It makes no sense to do any configuration for the application by the QUATTRO software because all configuration is overwritten by the CANopen Master at connection establishment.
- Never change the Modbus address, it must be "1".
- While the QUATTRO Software is communicating with the device the CANopen communication is stopped. With the menu "Measurement Data/ view/stop" the CANopen communication can be started again. If the QUATTRO Software is terminated in an irregularly way the device must be switched off to start the CANopen communication again.

3 Connections and switches

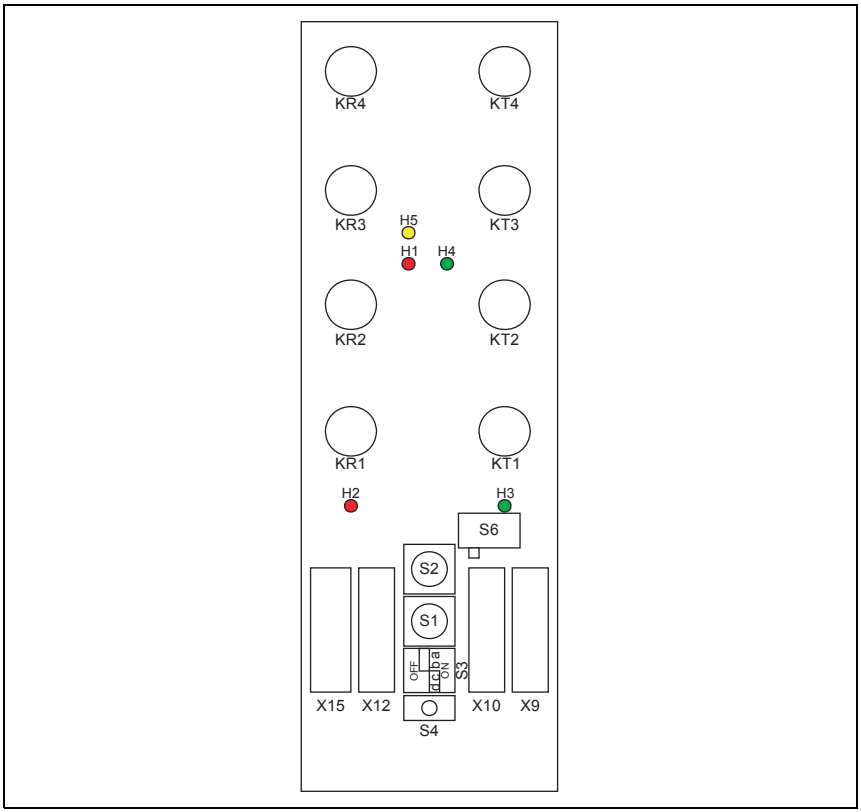

Figure 3.1: QUATTRO-CANopen

Please note, that the QUATTRO-CANopen schematic is different regarding the connecting and operating instructions of KONTURflex CANopen.

Baud rate

The baud rate setting is done by the dip switch S3 abc

S3c	S3b	S3a	CAN-Baud Rate/Bus length		
off	off	off	1	Mbit/sec	25 m [1)]
off	off	on	800	kbit/sec	50 m [1)]
off	on	off	500	kbit/sec	100 m [2)]
off	on	on	250	kbit/sec	250 m [2)]

on	off	off	125	kbit/sec	500m [3]
on	off	on	50	kbit/sec	1000m [3]
on	on	off	20	kbit/sec	2500m [3]
on	on	on	10	kbit/sec	5000m [3]

1) Calculation without optocouplers.
For optocouplers bus length is reduced for about 4m per 10nsec propagation delay of employed optocoupler type.

2) Calculation with 40nsec optocoupler propagation delay.

3) Calculation with 100nsec optocoupler propagation delay.
The calculation of the bus length is based on a line propagation delay of 5nsec/m.

CAN Identifier

The CAN Identifier is set by the hex-switch S1 (low) and S2 (high).

All Identifiers from 1 to 127 are valid settings. Identifier 0 is used to load the ID from object 2100.

Bus termination

The bus termination can be activated by dip switch S3d.

Reset

A reset like powerup reset can be done by the pushbutton S4.

Firmware update

By setting the switch S6 to the right and then powerup or reset the KONTURflex CANopen CANopen a Firmware update can be done.

Power supply connection

Plug X9 (grey)	
PIN G	+24V
PIN F	GND
PIN J	PNP OUT
PIN H	free
PIN K	free

RS232 connection

Plug X10 (black)	
PIN 6	free
PIN 7	free
PIN 8	GND
PIN 9	RS232 Transmitter
PIN 10	RS232 Receiver

Can Bus Connection

Plug X12 (green) and X15 (blue)		
X12	X15	
PIN 1	PIN 1 (UL)	Gnd
PIN 2	PIN 2	CanL
PIN 3	PIN 3	schield
PIN 4	PIN 4	CanH
PIN 5	PIN	+24 V (no connection to X9 PIN G)

Please refer at the description.

Indication Leds

Led H3(green)
• flashing while searching for light curtains after powerup, or if a light curtain is disconnected while in operation
• off in normal operation
Led H2(red)
• off in normal operation
• on when switch S6 is set to the right position for a Firmware update
Led H1(red) and H4(green)
• as defined in CANopen specification
Led H5(yellow)
• flashing 10% on/90% off ready for operation
• flashing 50% on/50% off warning (bus status, non critical)
• flashing 80% on/20% off error

4 Object Dictionary

The KONTURflex CANopen implements a complex object dictionary for CANopen I/O devices.

Notice!

For detailed information about CANopen objects see additional brochure "CANopenCAN-open Guideline" to be downloaded at http://www.leuze.de/downloads/los/08/CANopen_Guidelines.zip" or refer to the CiA-webpage http://www.can-cia.org/canopen.

4.1 DS 301: Global Objects

For the objects tables all values are shown in hexadecimal way. For access type the following settings are valid:

ro read only
wo write only
rw read and write access enabled

Index	Sub-Index	Name	Access
0005	-	Dummy 8	wo
0006	-	Dummy 16	wo
0007	-	Dummy 32	wo
1000	-	Device Type	ro
1001	-	Error Register	ro
1002	-	Manufacturer Status Register	ro
1005	-	COB-ID Sync [1)] Identifier Sync Object	rw
1008	-	Device Name [2)]	ro
1009	-	Hardware Version [2)]	ro
100A	-	Software Version [2)]	ro
100B	-	Node Id [3)]	-
100C	-	Guard Time	rw
100D	-	Life Time Factor	rw
100E	-	COB-ID Guard [3)]	-
1014	-	COB ID Emergency	rw
1015	-	Inhibit Time Emergency	rw
1017	-	Producer Heartbeat Time	rw
1018	0	Identity Object	ro
	1	Vendor ID	ro
	2	Product Code	ro

	3	Revision Number	ro
	4	Serial Number	ro
1029	0	Error Behaviour	ro
	1	In case of bus errors	rw
	2	In case of output errors	rw
2000	-	Device Manufacturer [4)]	ro
2101	-	System Configuration	ro
2102	-	Remapping Enabled Info	ro
2103	-	Enable Guarding Warning	rw
2105	-	Internal Api State Register	ro
2110		CiA Conformance Test Entry	
	1	Conformance Test Entry 1	rw
2180	-	CAN Restart Time	rw
5000	-	Debug-Register	rw

1) This object cannot be written to in operational device state.
Only use this command in pre-operational device state, otherwise the KONTURflex CANopen CANopen will answer requests with SDO abort telegrams.

2) This objects show the chip type and version as visible strings.

3) This object is not accessible for the application because of standard conforming reasons.

4) This objects shows "Frenzel + Berg" as visible string data type.

Notice!

All “visible string” data type objects are restricted to a maximum of 20 characters.
The data type entries Index 0005 to 0007 are implemented for compatibility reasons. They may be mapped to PDOs in order to define the appropriate space in the PDO.

For the read only objects following data is set:

Index	Sub	Name	Value in Hex.
1000		Device Type	0007 0191 h
1018	0	Identity Object	04h
	1	Vendor ID	0000 0058 h
	2	Product Code	FF04 010A h
	3	Revision Number	0 … 0xFFFFFFFF
	4	Serial Number	0
2101		System Configuration	Set according to the setting of the configuration input bits.

4.2 DS 301: PDO Parameter Objects

Description of PDO Parameter objects:

These objects enable dynamic PDO mapping, variable identifier distribution for PDOs and setting of the transmission mode, inhibit and event times.

For the KONTURflex CANopen CANopen setting of all parameters may be done in the device state "operational" as well as in "pre-operational" state.

Index	Sub-Index	Name	Access
1400	0	Receive PDO1 Communication Parameter	ro
	1	COB-ID	rw
	2	Transmission Type	rw
	3	Inhibit Time	rw
	4	Reserved	rw
	5	Event Time	rw
1600	0	Receive PDO1 Parameter mapping	rw
	1 to n	Mapped Object (max. 8 objects mappable)	rw
1800	0	Transmit PDO1 Communication Parameter	ro
	1	COB-ID	rw
	2	Transmission Type	rw
	3	Inhibit Time	rw
	4	Reserved	rw
	5	Event Time	rw
1801 … 1805		Transmit PDO2 to TPDO6 Communication Parameter Same as 1800.00 … 1800.05	rw
1A00	0	Transmit PDO1 Parameter mapping	rw
	1 to n	Mapped Object (max. 8 objects mappable)	rw
1A01 … 1A05		Transmit PDO2 to TPDO6 Parameter mapping Same as 1A00	rw

Notice!

The KONTURflex CANopen CANopen supports 1 receive and 6 transmit PDOs. All objects for higher PDO numbers are not implemented.

4.3 DS 401: Digital Input Objects

The digital input data represents the digital beam data of the KONTURflex CANopen.

Index	Sub-Index	Name	Access
6000	0 to n	Read Digital Input 8 Bit (Digital beam data)	ro
6002	0 to n	Polarity Input 8 Bit	rw
6005		Global Interrupt Enable	rw
6006	0 to n	Interrupt Mask: any change	rw

4.4 DS 401: Analog Input Objects

The analog input objects represent the analog beam data of max. 4 light grid elements.

Index	Sub-Index	Name	Access
6401	0 to n	Read Analog Input 16 Bit	ro
6421	0 to n	Analog Input Interrupt Trigger	rw
6423		Analog Input global Interrupt Enable	rw
6424	0 to n	Analog Input Upper Limit	rw
6425	0 to n	Analog Input Lower Limit	rw
6426	0 to n	Analog Input Interrupt Delta	rw

4.5 DS 401: KONTURflex CANopen Objects Base Unit

Index	Sub-Index	Name	Access
4000	0	Type Identification (KONTURflex CANopen-Register 0x0000)	ro
4002	0	Active Light Grid Ident	ro
4009	0	Serial Number (KONTURflex CANopen-Register 0x0009)	ro
4014	0	Production Date (KONTURflex CANopen-Register 0x0014)	ro
4018	0	Hardware Version (KONTURflex CANopen-Register 0x0018)	ro
4019	0	Software Version (KONTURflex CANopen-Register 0x0019)	ro

40C1	0	Output Control (KONTURflex CANopen-Register 0x00C1)	rw
40C4	0	Base Unit State (KONTURflex CANopen-Register 0x00C4)	ro
40C5	0	Number of Active Beam Bytes	ro

4.6 DS 401: KONTURflex CANopen Objects Sub Unit

Index	Sub-Index	Name	Access
4209	1 to 4	Sub Unit Number of Active Beam-Bytes (light grid 1 to 4)	ro
420A	1 to 4	Sub Unit Number of Active Beams (light grid 1 … 4)	ro
420B	1 to 4	Sub Unit Number of Physical Beam-Bytes (light grid 1 to 4)	ro
420C	1 to 4	Sub Unit Number of Physical Beams (KONTURflex CANopen-Register 0x200C light grid 1 … 4)	ro
420D	1 to 4	Sub Unit Resolution (KONTURflex CANopen-Register 0x200D light grid 1 … 4)	rw
420E	1 to 4	Sub Unit Range (KONTURflex CANopen-Register 0x200E light grid 1 … 4)	rw
4213	1 to 4	Sub Unit Scan Mode (KONTURflex CANopen-Register 0x2013 light grid 1 … 4)	rw
4218	1 to 4	Sub Unit Configuration Reg0 (KONTURflex CANopen-Register 0x2018 light grid 1 … 4)	rw
4219	1 to 4	Sub Unit Configuration Reg1 (KONTURflex CANopen-Register 0x2019 light grid 1 … 4)	rw
421A	1 to 4	Sub Unit Configuration Reg2 (KONTURflex CANopen-Register 0x201A light grid 1 … 4)	rw
421B	1 to 4	Sub Unit Configuration Reg3 (KONTURflex CANopen-Register 0x201B light grid 1 … 4)	rw
422C	1 to 4	Sub Unit State (KONTURflex CANopen-Register 0x202C light grid 1 … 4)	ro

4234	1 to 40	Sub Unit Measuring Field (KONTURflex CANopen-Register 0x2034 of light grid 1)	rw
4235	1 to 40	Sub Unit Measuring Field (KONTURflex CANopen-Register 0x2034 of light grid 2)	rw
4236	1 to 40	Sub Unit Measuring Field (KONTURflex CANopen-Register 0x2034 of light grid 3)	rw
4237	1 to 40	Sub Unit Measuring Field (KONTURflex CANopen-Register 0x2034 of light grid 4)	rw

5 Description of Object Dictionary

The following lists gives a short description of all dictionary entries.

5.1 Index 0005

This object is implemented to enable reservation of data space in PDOs by mapping dummy entries.

Index	0005
Name	Dummy 8
Description	
Data Type	Unsigned 8
Access modes	RO
PDO Mapping	Yes
Value Range	-
Default Value	0

5.2 Index 0006

This object is implemented to enable reservation of data space in PDOs by mapping dummy entries.

Index	0006
Name	Dummy 16
Description	-
Data Type	Unsigned 16
Access modes	RO
PDO Mapping	Yes
Value Range	-
Default Value	0

5.3 Index 0007

This object is implemented to enable reservation of data space in PDOs by mapping dummy entries.

Index	0007
Name	Dummy 32
Description	-
Data Type	Unsigned 32
Access modes	RO
PDO Mapping	Yes
Value Range	-
Default Value	0

6 DS 301: Global Objects

6.1 Index 1000: Device Type

Description of the device type. The Object gives the CiA device profile number and additionally the functionality of the device.

Index	1000h	
Name	Device Type	
Description	-	
Data Type	Unsigned 32	
Access modes	RO	
PDO Mapping	No	
Value Range	-	
Default Value	Operation Mode	Value of Index
	Mode 0	0005 0191 h

6.2 Index 1001: Error Register

This object holds an error of the device.

Index	1001h
Name	Error Register
Description	-
Data Type	Unsigned 8
Access modes	RO
PDO Mapping	Yes
Value Range	-
Default Value	-

The error register has the following structure:

Bit	Meaning
0	Generic error. This bit is set, if any error is active
1	0
2	0
3	0
4	CAN bus or communication error

5	0
6	0
7	Device Error

6.3 Index 1002: Status Register

This object gives additional information for the device

This register shows the emergency coding of the device (see chapter 11 "Emergency Messages" for detailed information).

Index	**1002h**
Name	Status Register
Description	-
Data Type	Unsigned 32
Access modes	RO
PDO Mapping	Yes
Value Range	-
Default Value	-

6.4 Index 1005: COB-ID Sync

Identifier of Can Object for the Synchronisation message. The KONTURflex CANopen CANopen may only operate in Sync consumer mode. Generating of Sync messages is not possible. Therefore the Identifier for the Sync message can only be set to the value range 1 … 7FFh.

Index	**1005h**
Name	COB-ID Sync
Description	-
Data Type	Unsigned 32
Access modes	RW
PDO Mapping	No
Value Range	1 … 7FFh
Default Value	80h

6.5 Index 1008: Device Name

This object shows the name of the device as visible string.

Index	1008h
Name	Device Name
Description	-
Data Type	Visible String
Access modes	RO
PDO Mapping	No
Value Range	The maximum string length is 20 characters
Default Value	“CO401Leuze01”

6.6 Index 1009: Hardware Version

This object shows the hardware version as visible string. The output format is compatible to the format of the chip.

Index	1009h
Name	Hardware Version
Description	-
Data Type	Visible String
Access modes	RO
PDO Mapping	No
Value Range	The maximum string length is 20 characters
Default Value	-

6.7 Index 100A: Software Version

This object shows the software version as visible string.

Index	100Ah
Name	Software Version
Description	-
Data Type	Visible String
Access modes	RO
PDO Mapping	No
Value Range	The maximum string length is 20 characters
Default Value	-

6.8 Index 100B: Node-ID

This object keeps the actual node Id. The Object is not represented in the object dictionary because of standard conforming reasons.

Index	100Bh
Name	Node ID
Description	-
Data Type	Unsigned 8
Access modes	Not accessible
PDO Mapping	No
Value Range	1 to 127
Default Value	See below

6.9 Index 100C: Guard Time

The objects at index 100Ch (Guard Time in milliseconds) and 100Dh (Life Time Factor) are used to implement the life guarding protocol. The Guard Time multiplied with the Life Time Factor gives the Life Time in milliseconds.

It is "0" (zero) if not used.

Index	100Ch
Name	Guard Time
Description	-
Data Type	Unsigned 16
Access modes	RW
PDO Mapping	No
Value Range	
Default Value	0

6.10 Index 100D: Life Time Factor

The objects at index 100Ch (Guard Time in milliseconds) and 100Dh (Life Time Factor) are used to implement the life guarding protocol. The Guard Time multiplied with the Life Time Factor gives the Life Time in milliseconds.

It is "0" (zero) if not used.

Index	100Dh
Name	Life Time Factor
Description	-
Data Type	Unsigned 8

Access modes	RW
PDO Mapping	No
Value Range	
Default Value	0

6.11 Index 100E: COB-ID Guard

Identifier of Can Object for the Node Guarding protocol. The Object is not represented in the object dictionary because of standard conforming reasons.

Index	**100Eh**
Name	COB-ID Guard
Description	-
Data Type	Unsigned 32
Access modes	-
PDO Mapping	No
Value Range	-
Default Value	700h + Node-ID

6.12 Index 1014: COB-ID Emergency

Identifier of Can Object for the emergency messages.

Index	**1014h**
Name	COB-ID Emergency
Description	-
Data Type	Unsigned 32
Access modes	RW
PDO Mapping	No
Value Range	-
Default Value	80h + Node-ID

6.13 Index 1015: Inhibit Time Emergency

Inhibit Time for emergency messages. If the Inhibit Time is set to "0", inhibit delay is disabled. The Inhibit Time is a multiple of 100usec, but the KONTURflex CANopen CANopen offers a maximum resolution of 1 millisecond.

Index	1015h
Name	Inhibit Time Emergency
Description	-
Data Type	Unsigned 16
Access modes	RW
PDO Mapping	No
Value Range	-
Default Value	0

6.14 Index 1017: Producer Heartbeat Time

The producer heartbeat time defines the cycle time of the heartbeat. The producer heartbeat time is "0" if it not used. The time has to be a multiple of 1ms.

Index	1017h
Name	Producer Heartbeat Time
Description	-
Data Type	Unsigned 16
Access modes	RW
PDO Mapping	No
Value Range	-
Default Value	0

Notice!

Either Heartbeat or node guarding may be allowed at the same time. Do not use both protocols at the same time.

6.15 Index 1018: Identity Object

The object at index 1018h keeps general information about the device and the manufacturer Frenzel + Berg elektronik. It cannot be modified.

Index	1018h
Name	Identity Object
Description	-

Data Type	Structure
Index	**1018h Sub index 0**
Name	Largest Sub index supported
Description	-
Data Type	Unsigned char
Access modes	RO
PDO Mapping	No
Value Range	-
Default Value	4
Index	**1018h Sub index 1**
Name	Vendor ID
Description	Registration Code of Frenzel + Berg elektronik at the CiA
Data Type	Unsigned 32
Access modes	RO
PDO Mapping	No
Value Range	-
Default Value	58h
Index	**1018h Sub index 2**
Name	Product Code
Description	Internal Product Code for CO401LEUZE01 at Frenzel + Berg elektronik
Data Type	Unsigned 32
Access modes	RO
PDO Mapping	No
Value Range	-
Default Value	FF40 100A h
Index	**1018h Sub index 3**
Name	Revision Code
Description	
Data Type	Unsigned 32
Access modes	RO
PDO Mapping	No
Value Range	-
Default Value	Revision of the device
Index	**1018h Sub index 4**
Name	Serial Number

Description	
Data Type	Unsigned 32
Access modes	RO
PDO Mapping	No
Value Range	-
Default Value	0

6.16 Index 1029: Error Behaviour

With object 1029 the CANopen chip can be configured to enter alternatively the pre-operational or the stopped state or remain in the current state in case of a device failure. Device failures shall include the following communication errors:

Bus-off conditions of the CAN interface, Life guarding error, Serious device errors also can be caused by device internal failures.

Index	**1029h**
Name	Error Behaviour Object
Description	-
Data Type	Structure
Index	**1029h Sub index 0**
Name	Largest Sub index supported
Description	-
Data Type	Unsigned char
Access modes	RO
PDO Mapping	No
Value Range	-
Default Value	2
Index	**1029h Sub index 1**
Name	Communication Error
Description	NMT state change in case of communication error
Data Type	Unsigned 8
Access modes	RW
PDO Mapping	No
Value Range	-
Default Value	00h

Index	1029h Sub index 2
Name	Application Error
Description	reserved
Data Type	Unsigned 8
Access modes	RW
PDO Mapping	No
Value Range	-
Default Value	00h

The value of the Error Classes is as follows:

"0" = pre-operational (only if current state is operational)
"1" = no state change
"2" = stopped
"3" … "127" = reserved

6.17 Index 2000: Device Manufacturer

This object shows "Frenzel + Berg" as visible string. If OEMs do not want to give access to this entry, it may be removed from the EDS (electronic data sheet).

Index	2000h
Name	Device Manufacturer
Description	-
Data Type	Visible String
Access modes	RO
PDO Mapping	No
Value Range	The maximum string length is 20 characters
Default Value	"Frenzel + Berg"

6.18 Index 2101: System Configuration

This object returns the operation mode of the CO401LEUZE01. It represents the inverted Setting of the configuration input bits CFG0 to CFG5.

Index	2101h
Name	System Configuration
Description	-
Data Type	Unsigned 32
Access modes	RO

PDO Mapping	No
Value Range	-
Default Value	Depends on CFG0 to CFG5

6.19 Index 2102: Remapping Enabled Info

This object informs the user whether the system configuration enables remapping of the PDOs.

A value of "0" means that remapping is disabled, all other values indicate that remapping of the PDOs is enabled.

Index	**2102h**
Name	Remapping Enabled Info
Description	-
Data Type	Unsigned 8
Access modes	RO
PDO Mapping	No
Value Range	-
Default Value	1

6.20 Index 2103: Enabled Guarding Warning

This object enables/disables transmission of emergency messages in case of a node guarding warning.

The condition of a guarding warning is met, if the time between two node guarding frames increases the guarding time given in object 100C independent of the setting of the life time (object 100D). The node guarding warning does not cause any NMT state change or switching the output pins to the error state. It is implemented to give the CANopen master an early information that the guarding interval has already exceeded the predefined value.

The Guarding Warning is only generated if a valid life time is set. This requires that objects 100C and 100D must be set to a value unequal to zero.

"0": Guarding Warning is disabled

"1": Guarding Warning is enabled

Index	**2103h**
Name	Enable Guarding Warning
Description	-
Data Type	Unsigned 8
Access modes	RW

PDO Mapping	No
Value Range	-
Default Value	0

6.21 Index 2105: Internal API State Register

This object shows the error state of the internal software. This object should always be "0". Otherwise an emergency is triggered.

Index	**2105h**
Name	Internal API state
Description	-
Data Type	Unsigned 32
Access modes	RO
PDO Mapping	No
Value Range	-
Default Value	0

6.22 Index 2110: CiA Test Entry

This object is implemented due to a bug within the CANopen conformance test software. It avoids invalid error messages of the test software.

The test entry does not have any functional behaviour.

Index	**2110h**
Name	CiA Test Entry
Description	-
Data Type	Structure
Index	**2110h Sub index 0**
Name	Largest Sub index supported
Description	-
Data Type	Unsigned char
Access modes	RO
PDO Mapping	No
Value Range	-
Default Value	0x01

Index	2110h Sub index 1
Name	Test Entry 1
Description	-
Data Type	Unsigned 16
Access modes	RW
PDO Mapping	No
Value Range	100 … 1000
Default Value	500

6.23 Index 2180: CAN Restart Time

This object gives the restart time out for the CAN communication layer in case of bus off errors in milliseconds.

If the restart time is set to "0" automatic restart of the device in case of bus off is prohibited.

Index	2180h
Name	CAN Restart Time
Description	-
Data Type	Unsigned 16
Access modes	RW
PDO Mapping	No
Value Range	0 … 50000
Default Value	1000 (restart after one second)

6.24 Index 5000: Debug Register

This object is for factory test purposes and must not be used by the application.

Index	5000h
Name	Debug Register
Description	-
Data Type	Unsigned 32
Access modes	RW
PDO Mapping	No
Value Range	
Default Value	

7 DS 301: PDO Parameter Objects

7.1 Communication Parameter Objects

The following table shows the communication parameter objects for Index 140x (Receive PDOs) and Index 180x (Transmit PDOs). The tables show Index 1400 as an example for all PDOs.

Description of transmission type

Type	PDO transmission				
	cyclic	acyclic	Sync related	Async.	Only on remote
0		X	X		
1-240	X		X		
241-251	Reserved				
252			X		X
253				X	X
254				X	
255				X	

Synchronous (transmission types 0-240 and 252) means that the transmission of the PDO shall be related to the SYNC object. Asynchronous means that the transmission of the PDO is not related to the SYNC object.

A transmission type of zero means that the message shall be transmitted synchronously with the SYNC object but not periodically but only in case of data change.

A value between "1" and "240" means that the PDO is transferred synchronously and cyclically, the transmission type indicating the number of SYNC signals, which are necessary to trigger PDO transmissions or receptions.

The transmission types 252 and 253 mean that the PDO is only transmitted on reception of a remote frame. At transmission type 252, the data is updated (but not sent) immediately after reception of the SYNC object. At transmission type 253 the data is updated at the reception of the remote frame. These values are only possible for transmit PDOs.

Transmission type 255 means, the application event is defined in the device profile. For receive PDOs the reception of a PDO will update the mapped data (normally the analog or digital outputs).

The PDO communication parameter objects have the same structure for all PDOs. The following objects are used.

Sub-index 4h is reserved.

Index	PDO
1400h	Receive PDO1
1800h	Transmit PDO1
1801h	Transmit PDO2
1802h	Transmit PDO3
1803h	Transmit PDO4
1804h	Transmit PDO5
1805h	Transmit PDO6

Index	14xxh/18xxh
Name	Receive/Transmit PDOx Communication Parameters
Description	-
Data Type	Structure
Index	**14xxh/18xxh Sub index 0**
Name	Largest Sub index supported
Description	-
Data Type	Unsigned 8
Access modes	RO
PDO Mapping	No
Value Range	-
Default Value	2/5
Index	**14xxh/18xxh Sub index 1**
Name	COB-ID
Description	Identifier for CAN-Object for PDO
Data Type	Unsigned 32
Access modes	RW
PDO Mapping	No
Value Range	-

Default Value	1400.01	Node-Id + 80000200h
	1800.01	Node-Id + 180h
	1801.01	Node-Id + 280h
	1802.01	Node-Id + 380h
	1803.01	Node-Id + 480h
	1804.01	Node-Id + 80000000h
	1805.01	Node-Id + 80000000h

An Identifier of 8xxxxxxxh means, that this PDO is disabled by default and must be enabled from the CANopen master by assigning a valid PDO ID.

The transmission type (Sub index 2) defines the mode for transmission/reception of the PDO. See table for detailed description of this entry.

Index	**14xxh/18xxh Sub index 2**
Name	Transmission Type
Description	-
Data Type	Unsigned 8
Access modes	RW
PDO Mapping	No
Value Range	-
Default Value	0FFh

Sub index 3h contains the inhibit time. This time is a minimum interval for PDO transmission. The value is defined as multiple of 100ms.

Index	**18xxh Sub index 3**
Name	Inhibit Time
Description	-
Data Type	Unsigned 16
Access modes	RW
PDO Mapping	No
Value Range	-
Default Value	0
Index	**18xxh Sub index 4**
Name	Reserved
Description	-

Data Type	-
Access modes	-
PDO Mapping	No
Value Range	-
Default Value	-

In mode 254/255 additionally an event time can be used for TPDO. If an event timer exists for a TPDO (value not equal to "0") the elapsed timer is considered to be an event. The event time is a multiple of 1 ms. This event will cause the transmission of this TPDO in addition to otherwise defined events.

Index	**18xxh Sub index 5**
Name	Event Time
Description	-
Data Type	Unsigned 16
Access modes	RW
PDO Mapping	No
Value Range	-
Default Value	0

7.2 PDO Mapping Objects

The following table shows the PDO Mapping Objects. The principle of PDO mapping is the same for all PDOs. The PDO Mapping table is the cross reference between the Object dictionary entries (for example the data of an digital output byte) and the data field inside an PDO data field (position in the data field of a CAN message for PDO transfer).

Sub index 0 determines the valid number of objects that have been mapped. The CANopen controller allows a maximum of 8 mapped objects for each PDO. For changing the PDO mapping first sub index 0 must be set to "0" (mapping is deactivated). Then the objects can be remapped. When a new object is mapped by writing a sub index between 1 and 8, the device may check whether the object specified by index/sub index exists. If the object does not exist or the object cannot be mapped, the SDO transfer will be aborted.

Sub indexes 1 to 8 keep the pointers of the mapped objects as unsigned 32 values. The value is "0" if there is no mapped object. The structure for these pointers is as follows.

MSB			**LSB**
Byte3	Byte2	Byte1	Byte0
Mapped index		Sub index	Length

"Mapped index" and "Sub index" together are the Pointer to the Object dictionary data to be mapped at this location. "Length" gives the length of the mapped object in bits.

Index	160xh/1A0xh
Name	Receive/Transmit PDO Mapping Parameters
Description	-
Data Type	Array
Index	**160xh/1A0xh Sub index 0**
Name	Largest Sub index supported
Description	Number of mapped objects
Data Type	Unsigned 8
Access modes	RW
PDO Mapping	No
Value Range	-
Default Value	See table below
Index	**160xh/1A0xh Sub index 1 to 8**
Name	Mapped object
Description	
Data Type	Unsigned 32
Access modes	RW
PDO Mapping	No
Value Range	-
Default Value	See table below

7.2.1 Receive PDOs

The CANopen chip CO401Leuze01 uses the following default mapping entries for receive PDO mapping:

Index	Entry	Explanation
Receive-PDO1		
1600.00	0	RPDO1: 0 mapped objects
Receive-PDO2		
1601.00	0	RPDO2: 0 mapped objects

7.2.2 Transmit PDOs

The CANopen chip CO401Leuze01 uses the following default mapping entries for transmit PDO mapping:

Index	Entry	Explanation
Transmit-PDO1		
1A00.00	8	TPDO1: 8 mapped objects
1A00.01	60000108h	Digital Input Byte0
1A00.02	60000208h	Digital Input Byte1
1A00.03	60000308h	Digital Input Byte2
1A00.04	60000408h	Digital Input Byte3
1A00.05	60000508h	Digital Input Byte4
1A00.06	60000608h	Digital Input Byte5
1A00.07	60000708h	Digital Input Byte6
1A00.08	60000808h	Digital Input Byte7
Transmit-PDO2		
1A01.00	4	TPDO2: 4 mapped objects
1A01.01	64010110h	Analog Input Integer 0
1A01.02	64010210h	Analog Input Integer 1
1A01.03	64010310h	Analog Input Integer 2
1A01.04	64010410h	Analog Input Integer 3
Transmit-PDO3		
1A02.00	4	TPDO3: 4 mapped objects
1A02.01	64010510h	Analog Input Integer 4
1A02.02	64010610h	Analog Input Integer 5
1A02.03	64010710h	Analog Input Integer 6
1A02.04	64010810h	Analog Input Integer 7
Transmit-PDO4		
1A03.00	4	TPDO4: 4 mapped objects
1A03.01	64010910h	Analog Input Integer 8
1A03.02	64010A10h	Analog Input Integer 9
1A03.03	64010B10h	Analog Input Integer 10
1A03.04	64010C10h	Analog Input Integer 11
Transmit-PDO5		
1A04.00	0	TPDO5: 0 mapped objects
Transmit-PDO6		
1A05.00	0	TPDO6: 0 mapped objects

8 DS 401: Digital Input Objects

The following objects are describing the functionality of the digital input lines of the KONTURflex CANopen CANopen. The KONTURflex CANopen CANopen supports 8 bit access to the digital inputs. The number of digital beam data is forced to 40h. This is the maximum available within a KONTURflex CANopen system.

8.1 Index 6000: Read Digital Input Bit

This object represents the digital beam data of all connected light grids.

Index	**6000h**
Name	Digital Input 8 Bit
Description	-
Data Type	Array
Index	**Sub index 0**
Name	Nr. of Subobjects
Description	
Data Type	Unsigned 8
Access modes	RO
PDO Mapping	No
Value Range	-
Default Value	40h
Index	**Sub index 1 to 40h of input bytes**
Name	Light Grid 1 to 4 Digital Beam Data 8 Bit
Description	
Data Type	Unsigned 8
Access modes	RO
PDO Mapping	Yes
Value Range	-
Default Value	-

If more than one beam is logically connected with a logic AND or a logic OR function, object 6000 does not longer show the single beam information but always the connected beam data.

8.2 Index 6005: Global Interrupt Enable

This object enables or disables globally the interrupt behaviour without changing the interrupt masks.

In event-driven mode the device transmits the input values depending on the interrupt masks in objects 6006h, 6007h, and 6008h and the PDO transmission type.

TRUE ("1") = global interrupt enabled
FALSE ("0")= global interrupt disabled

Index	**6005h**
Name	Global Interrupt Enable
Description	-
Data Type	Boolean
Access modes	RW
PDO Mapping	No
Value Range	-
Default Value	TRUE

8.3 Index 6006: Interrupt Mask Any Change

This object determines, which input lines shall activate an interrupt by any change of the input line. Both negative and positive edge will cause an interrupt, if enabled.

An interrupt will cause a PDO transmission in case of event driven transmission mode.

"1" = interrupt enabled

"0" = interrupt disabled

Index	**6006h**
Name	Interrupt Mask any change
Description	-
Data Type	Array
Index	**Sub index 0**
Name	Nr. of Subobjects
Description	
Data Type	Unsigned 8
Access modes	RO
PDO Mapping	No
Value Range	-
Default Value	Number of digital input bytes

Index	Sub index 1 to Nr. of input bytes
Name	Interrupt Mask any change
Description	
Data Type	Unsigned 8
Access modes	RW
PDO Mapping	No
Value Range	-
Default Value	0FFh (interrupt enabled)

9 DS 401: Analog Input Objects

The following objects are describing the functionality of the analog input lines of the KONTURflex CANopen CANopen.

The number of analog input bytes depends on the selected operation mode.

9.1 Index 6401: Read Analog Input 16 Bit

Object 6401, represents the value of the analog channels. The objects represent the KONTURflex CANopen beam data information field. See table.

Index	**6401h**
Name	Read Analog Input
Description	-
Data Type	Array
Index	**Sub index 0**
Name	
Description	Nr. of Subobjects
Data Type	Unsigned 8
Access modes	RO
PDO Mapping	NO
Value Range	-
Default Value	48h Number of analog input channels
Index	**Sub index 1 to Nr. of input lines**
Name	Read Analog Input
Description	
Data Type	Signed 16
Access modes	RO
PDO Mapping	YES
Value Range	-
Default Value	-

Analog beam information for the light grids 1 to 4 are represented in sub objects 1 to 48h of object 6401. For analog PDO trigger conditions sub objects 1 to 48h of trigger condition objects 6424, 6425 and 6426 are associated with the same sub index of beam information data (object 6401).

The subobjects are associated to the light grids:

LG1 Light grid 1
LG2 Light grid 2
LG3 Light grid 3
LG4 Light grid 4

Index.Sub	KONTURflex CANopen Data
TU	**Lowest interrupted beam (KONTURflex CANopen-Register 0x214F)**
0x6401.01	Lowest interrupted beam: LG1
0x6401.02	Lowest interrupted beam: LG2
0x6401.03	Lowest interrupted beam: LG3
0x6401.04	Lowest interrupted beam: LG4
HU	**Highest interrupted beam (KONTURflex CANopen-Register 0x2150)**
0x6401.05	Highest interrupted beam: LG1
0x6401.06	Highest interrupted beam: LG2
0x6401.07	Highest interrupted beam: LG3
0x6401.08	Highest interrupted beam: LG4
ZU	**Number of interrupted beams (KONTURflex CANopen-Register 0x2151)**
0x6401.09	Nr. of interrupted beams: LG1
0x6401.0A	Nr. of interrupted beams: LG2
0x6401.0B	Nr. of interrupted beams: LG3
0x6401.0C	Nr. of interrupted beams: LG4

Index.Sub	KONTURflex CANopen Data
TNU	**Lowest not interrupted beam (KONTURflex CANopen-Register 0x2152)**
0x6401.0D	Lowest not interrupted beam: LG1
0x6401.0E	Lowest not interrupted beam: LG2
0x6401.0F	Lowest not interrupted beam: LG3
0x6401.10	Lowest not interrupted beam: LG4
HNU	**Highest not interrupted beam (KONTURflex CANopen-Register 0x2153)**
0x6401.11	Highest not interrupted beam: LG1

0x6401.12	Highest not interrupted beam: LG2
0x6401.13	Highest not interrupted beam: LG3
0x6401.14	Highest not interrupted beam: LG4
ZNU	**Number of not interrupted beams (KONTURflex CANopen-Register 0x2154)**
0x6401.15	Nr. of not interrupted beams: LG1
0x6401.16	Nr. of not interrupted beams: LG2
0x6401.17	Nr. of not interrupted beams: LG3
0x6401.18	Nr. of not interrupted beams: LG4

Index.Sub	KONTURflex CANopen Data
TUmin	**Lowest interrupted beam min (KONTURflex CANopen-Register 0x2155)**
0x6401.19	Lowest interrupted beam min: LG1
0x6401.1A	Lowest interrupted beam min: LG2
0x6401.1B	Lowest interrupted beam min: LG3
0x6401.1C	Lowest interrupted beam min: LG4
HUmin	**Highest interrupted beam min (KONTURflex CANopen-Register 0x2156)**
0x6401.1D	Highest interrupted beam min: LG1
0x6401.1E	Highest interrupted beam min: LG2
0x6401.1F	Highest interrupted beam min: LG3
0x6401.20	Highest interrupted beam min: LG4
ZUmin	**Number of interrupted beams min (KONTURflex CANopen-Register 0x2157)**
0x6401.21	Nr. of interrupted beams min: LG1
0x6401.22	Nr. of interrupted beams min: LG2
0x6401.23	Nr. of interrupted beams min: LG3
0x6401.24	Nr. of interrupted beams min: LG4

Index.Sub	KONTURflex CANopen Data
TNUmin	**Lowest not interrupted beam min (KONTURflex CANopen-Register 0x2158)**
0x6401.25	Lowest not interrupted beam min: LG1
0x6401.26	Lowest not interrupted beam min: LG2

0x6401.27	Lowest not interrupted beam min: LG3
0x6401.28	Lowest not interrupted beam min: LG4
HNUmin	**Highest not interrupted beam min (KONTURflex CANopen-Register 0x2159)**
0x6401.29	Highest not interrupted beam min: LG1
0x6401.2A	Highest not interrupted beam min: LG2
0x6401.2B	Highest not interrupted beam min: LG3
0x6401.2C	Highest not interrupted beam min: LG4
ZNUmin	**Number of not interrupted beams min (KONTURflex CANopen-Register 0x215A)**
0x6401.2D	Nr. of not interrupted beams min: LG1
0x6401.2E	Nr. of not interrupted beams min: LG2
0x6401.2F	Nr. of not interrupted beams min: LG3
0x6401.30	Nr. of not interrupted beams min: LG4

Index.Sub	**KONTURflex CANopen Data**
TUmax	**Lowest interrupted beam max (KONTURflex CANopen-Register 0x215B)**
0x6401.31	Lowest interrupted beam max: LG1
0x6401.32	Lowest interrupted beam max: LG2
0x6401.33	Lowest interrupted beam max: LG3
0x6401.34	Lowest interrupted beam max: LG4
HUmax	**Highest interrupted beam max (KONTURflex CANopen-Register 0x215C)**
0x6401.35	Highest interrupted beam max: LG1
0x6401.36	Highest interrupted beam max: LG2
0x6401.37	Highest interrupted beam max: LG3
0x6401.38	Highest interrupted beam max: LG4
ZUmax	**Number of interrupted beams max (KONTURflex CANopen-Register 0x215D)**
0x6401.39	Nr. of interrupted beams max: LG1
0x6401.3A	Nr. of interrupted beams max: LG2
0x6401.3B	Nr. of interrupted beams max: LG3
0x6401.3C	Nr. of interrupted beams max: LG4

Index.Sub	KONTURflex CANopen Data
TNUmax	**Lowest not interrupted beam max (KONTURflex CANopen-Register 0x215E)**
0x6401.3D	Lowest not interrupted beam max: LG1
0x6401.3E	Lowest not interrupted beam max: LG2
0x6401.3F	Lowest not interrupted beam max: LG3
0x6401.40	Lowest not interrupted beam max: LG4
HNUmax	**Highest not interrupted beam max (KONTURflex CANopen-Register 0x215F)**
0x6401.41	Highest not interrupted beam max:LG1
0x6401.42	Highest not interrupted beam max:LG2
0x6401.43	Highest not interrupted beam max:LG3
0x6401.44	Highest not interrupted beam max:LG4
ZNUmax	**Number of not interrupted beams max (KONTURflex CANopen-Register 0x2160)**
0x6401.45	Nr. of not interrupted. beams max: LG1
0x6401.46	Nr. of not interrupted. beams max: LG2
0x6401.47	Nr. of not interrupted beams max: LG3
0x6401.48	Nr. of not interrupted beams max: LG4

9.2 Index 6421: Analog Input Interrupt Trigger

Object 6421 selects the event that shall cause a transmission interrupt for the selected analog channel. See also description of objects 6424, 6425 and 6426 for further information how to cause a PDO transmission.

There is one Sub index for each channel to enable individual setting according to application requirements.

Table of possible Trigger Conditions

Bit Nr.	Interrupt Trigger Selection
0	Input voltage greater than Upper Limit
1	Input voltage less than Lower Limit
2	Input changed by more than Delta
3	Input reduced more than Negative Delta
4	Input increased more than Positive Delta
3 to 7	Reserved (must be forced to zero)

Index	6421h
Name	Analog Input Interrupt Trigger
Description	-
Data Type	Array
Index	**Sub index 0**
Name	
Description	Nr. of Subobjects
Data Type	Unsigned 8
Access modes	RO
PDO Mapping	NO
Value Range	-
Default Value	48h Nr. of Analog Input Channels
Index	**Sub index 1 to Nr. of input lines**
Name	Analog Input Interrupt Trigger
Description	Selects trigger condition
Data Type	Unsigned 8 (see chapter "Table of possible Trigger Conditions")
Access modes	RW
PDO Mapping	No
Value Range	-
Default Value	7

9.3 Index 6423: Analog Input Interrupt Enable

This object enables or disables globally the interrupt behaviour without changing the interrupt masks.

The interrupt is disabled by default, in order to avoid transmission of analog input values.

TRUE ("1") = global interrupt enabled
FALSE ("0") = global interrupt disabled

Index	6423h
Name	Analog Input Interrupt Enable
Description	-
Data Type	Boolean
Access modes	RW

PDO Mapping	No
Value Range	-
Default Value	FALSE

9.4 Index 6424/5/6: Analog Input Interrupt Limits

These objects give the Limit for generation of interrupts. All objects have the same structure.

The function of the interrupt limit is only enabled, if the corresponding bit of object 6421 is set.

All values of limit parameters are signed 32. So the user must take care not to exceed the range of the input data objects.

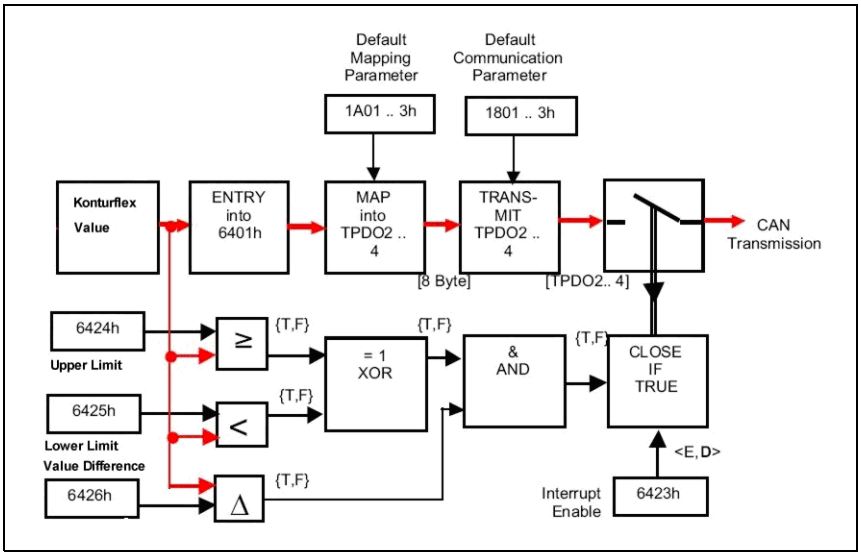

Figure 9.1: Flowchart for generating a PDO trigger condition

Table of Limit Function

Object	Object Name and Function
6424	Analog Input Upper Limit Generate interrupt if input voltage is greater than or equal to Upper Limit (6424).
6425	Analog Input Lower Limit Generate interrupt if input voltage is less than Lower Limit (6425).
6426	Analog Input Interrupt Delta Generate interrupt if input voltage changed by more than Interrupt Delta.

Index	**6424/6425/6426**
Name	See table above
Description	-
Data Type	Array
Index	**Sub index 0**
Name	
Description	Nr. of Subobjects
Data Type	Unsigned 8
Access modes	RO
PDO Mapping	NO
Value Range	-
Default Value	Number of analog input channels
Index	**Sub index 1 to Nr. of input lines**
Name	See table above
Description	
Data Type	Integer 32
Access modes	RW
PDO Mapping	No
Value Range	-
Default Value	0

10 DS 401: KONTURflex CANopen Base Unit Objects

The following objects are describing the functionality of the KONTURflex CANopen base unit.

10.1 Index 4000: KONTURflex CANopen Type Identification

Object 4000 shows the type of the KONTURflex CANopen system.

Index	4000h
Name	KONTURflex CANopen Type Identification
Description	This object is forced to 0x32 in order to identify the KONTURflex CANopen system. This object is directly read from the KONTURflex CANopen-Register 0x0000.
Data Type	Unsigned 16
Access modes	RO
PDO Mapping	NO
Value Range	-
Default Value	0x32

10.2 Index 4002: Active Light Grid Ident

Object 4002 shows the active state of connected light grids.

Index	4002h
Name	Active Light Grid Ident
Description	An active light grid is marked with a binary 1 at the associated bit position within this object. Bit 0 light grid 1 Bit 1 light grid 2 Bit 2 light grid 3 Bit 3 light grid 4
Data Type	Unsigned 8
Access modes	RO
PDO Mapping	NO
Value Range	-
Default Value	

10.3 Index 4009: KONTURflex CANopen Serial Number

This object shows the name of the device as visible string.

Index	4009h
Name	KONTURflex CANopen Serial Number
Description	This object is directly read from the KONTURflex CANopen-Register 0x0009.
Data Type	Visible String
Access modes	RO
PDO Mapping	No
Value Range	The maximum string length is 10 characters
Default Value	

10.4 Index 4014: KONTURflex CANopen Production Date

This object shows the production date of the KONTURflex CANopen system in visible string format.

Index	4014h
Name	KONTURflex CANopen Production Date
Description	This object shows the production date of the KONTURflex CANopen system. This object is directly read from the KONTURflex CANopen-Register 0x0014.
Data Type	Visible String
Access modes	RO
PDO Mapping	No
Value Range	The maximum string length is 8 characters
Default Value	YYYYMMDD YYYY Year: 4 digits MM Month: 2 digits DD Day: 2 digits

10.5 Index 4018: KONTURflex CANopen Hardware Version

This object shows the hardware version of the KONTURflex CANopen system in unsigned integer format.

Index	4018h
Name	KONTURflex CANopen Hardware Version
Description	This object shows the hardware version of the KONTURflex CANopen system. This object is directly read from the KONTURflex CANopen-Register 0x0018.
Data Type	Unsigned 16
Access modes	RO
PDO Mapping	No
Value Range	-
Default Value	MSByte Main version LSByte Sub version

10.6 Index 4019: KONTURflex CANopen Software Version

This object shows the software version of the KONTURflex CANopen system in unsigned integer format.

Index	4019h
Name	KONTURflex CANopen Software Version
Description	This object shows the software version of the KONTURflex CANopen system. This object is directly read from the KONTURflex CANopen-Register 0x0019.
Data Type	Unsigned 16
Access modes	RO
PDO Mapping	No
Value Range	-
Default Value	MSByte Main version LSByte Sub version

10.7 Index 40C1: KONTURflex CANopen Output Control

This object is used to configure the hardware output of the KONTURflex CANopen system.

Index	40C1h
Name	KONTURflex CANopen Output Control
Description	The PNP output is switched to active mode if the selected conditions are active on the selected light grid module: Bit0 no beam detects object Bit1 all beams detect object Bit2 object path in the middle Bit3 object path too high Bit4 object path too low Bit5 hole detected Bit6,7 reserved The rest of the bits are used to setup the PNP output. Bit8,9 light grid module number Bit14 changes after every scan Bit15 active polarity for PNP output. 1: active high 0: active low This object is directly exchanged with the KONTURflex CANopen-Register 0x00C1.
Data Type	Unsigned 16
Access modes	RW
PDO Mapping	No
Value Range	-
Default Value	1

10.8 Index 40C4: KONTURflex CANopen Base Unit State

This object shows the state of the KONTURflex CANopen base unit.

Index	40C4h
Name	KONTURflex CANopen Base Unit State
Description	Bit0 Emergency Is set if any error detected. Bit1 PNP output is active Bit2 no light grid connected Bit4 … 15 Internal error. This object is directly read from the KONTURflex CANopen-Register 0x00C4.
Data Type	Unsigned 16

Access modes	RO
PDO Mapping	YES
Value Range	-
Default Value	0

10.9 Index 40C5: Number of Active Beam Bytes

This object shows the number of all active beam bytes for the complete KONTURflex CANopen system. For calculating the “Number of Active Beam Bytes” all light grid modules are added.

Notice!

Calculation of active beam bytes is only done directly after reset. This object cannot be used for monitoring the light grid modules.

Index	**40C5h**
Name	Number of Active Beam Bytes
Description	
Data Type	Unsigned 16
Access modes	RO
PDO Mapping	YES
Value Range	-
Default Value	0

10.10 Index 4209: Sub Unit Active Beam Bytes

This object shows the number of bytes of active beams of the light grid modules. The number of active beams may differ from the number of physical beams, if more than one physical beams are connected together using object 4218h.

Index	**4209h**
Name	Sub Unit Active Beam Bytes
Description	-
Data Type	Array
Index	**Sub index 0**
Name	Max number of light grids
Description	Nr. of Subobjects
Data Type	Unsigned 8
Access modes	RO

PDO Mapping	NO
Value Range	-
Default Value	4
Index	**Sub index 1 to Nr. of input lines**
Name	Sub Unit Active Beam Bytes
Description	Number of active beam bytes within light grid module 1 … 4.
Data Type	Unsigned 16
Access modes	RO
PDO Mapping	No
Value Range	-
Default Value	

10.11 Index 420A: Sub Unit Active Beams

This object shows the number of active beams of the light grid modules. The number of active beams may differ from the number of physical beams, if more than one physical beams are connected together using object 4218h.

Index	**420Ah**
Name	Sub Unit Active Beams
Description	-
Data Type	Array
Index	**Sub index 0**
Name	Max. number of light grids
Description	Nr. of Subobjects
Data Type	Unsigned 8
Access modes	RO
PDO Mapping	NO
Value Range	-
Default Value	4
Index	**Sub index 1 to Nr. of input lines**
Name	Sub Unit Active Beams
Description	Number of active beams within light grid module 1 … 4.
Data Type	Unsigned 16
Access modes	RO

PDO Mapping	No
Value Range	-
Default Value	

10.12 Index 420B: Sub Unit Physical Beam Bytes

This object shows the number of bytes of physical beams of the light grid modules. The number of physical beams gives the number of hardware light barriers within a light grid module.

Index	**420Bh**
Name	Sub Unit Physical Beam Bytes
Description	-
Data Type	Array
Index	**Sub index 0**
Name	Max. number of light grids
Description	Nr. of Subobjects
Data Type	Unsigned 8
Access modes	RO
PDO Mapping	NO
Value Range	-
Default Value	4
Index	**Sub index 1 to Nr. of input lines**
Name	Sub Unit Physical Beam Bytes
Description	Number of Physical Beam Bytes within light grid module 1 … 4.
Data Type	Unsigned 16
Access modes	RO
PDO Mapping	No
Value Range	-
Default Value	

10.13 Index 420C: Sub Unit Physical Beams

This object shows the number of physical beams of the light grid modules. The number of physical beams gives the number of hardware light barriers within a light grid module.

Index	420Ch
Name	Sub Unit Physical Beams
Description	-
Data Type	Array
Index	**Sub index 0**
Name	Max. number of light grids
Description	Nr. of Subobjects
Data Type	Unsigned 8
Access modes	RO
PDO Mapping	NO
Value Range	-
Default Value	4
Index	**Sub index 1 to Nr. of input lines**
Name	Sub Unit Physical Beams
Description	Number of physical beams within light grid module 1 … 4.
Data Type	Unsigned 16
Access modes	RO
PDO Mapping	No
Value Range	-
Default Value	

10.14 Index 420D: Sub Unit Resolution

This object sets the resolution of the light grid modules. The object has no effect on the light grid modules.

Index	420Dh
Name	Sub Unit Resolution
Description	-
Data Type	Array
Index	**Sub index 0**
Name	Max. number of light grids
Description	Nr. of Subobjects
Data Type	Unsigned 8
Access modes	RW
PDO Mapping	NO

Value Range	-
Default Value	4
Index	**Sub index 1 to Nr. of input lines**
Name	Sub Unit Resolution
Description	This object is directly exchanged with the KONTURflex CANopen-Register 0x200D.
Data Type	Unsigned 16
Access modes	RW
PDO Mapping	No
Value Range	5, 10, 20, 40 mm/Degrees
Default Value	5

10.15 Index 420E: Sub Unit Range

This object sets the range of the light grid modules.

Index	**420Eh**
Name	Sub Unit Range
Description	-
Data Type	Array
Index	**Sub index 0**
Name	Max. number of light grids
Description	Nr. of Subobjects
Data Type	Unsigned 8
Access modes	RO
PDO Mapping	NO
Value Range	-
Default Value	4
Index	**Sub index 1 to Nr. of input lines**
Name	Sub Unit Resolution
Description	This object is directly exchanged with the KONTURflex CANopen-Register 0x200E.
Data Type	Unsigned 16
Access modes	RO

PDO Mapping	No
Value Range	0 … 5 0: 5 – 30cm 1: 20 – 100cm 2: 50 – 150cm 3: 100 – 250cm 4: 200 – 350cm 5: 300 – 400cm
Default Value	5

10.16 Index 4213: Sub Unit Scan Mode

This object sets the scan mode of the light grid modules. Number of scans for integration.

Index	**4213h**
Name	Sub Unit Scan Mode
Description	-
Data Type	Array
Index	**Sub index 0**
Name	Max. number of light grids
Description	Nr. of Subobjects
Data Type	Unsigned 8
Access modes	RO
PDO Mapping	NO
Value Range	-
Default Value	4
Index	**Sub index 1 to Nr. of input lines**
Name	Sub Unit Scan Mode
Description	This object is directly exchanged with the KONTURflex CANopen-Register 0x2013.
Data Type	Unsigned 16
Access modes	RW
PDO Mapping	No
Value Range	1 … 63
Default Value	1

10.17 Index 4218: Sub Unit Config Register 0

This object enables connecting more than one physical beams to a logical beam.

Index	**4218h**
Name	Sub Unit Config Register 0
Description	-
Data Type	Array
Index	**Sub index 0**
Name	Max. number of light grids
Description	Nr. of Subobjects
Data Type	Unsigned 8

Access modes	RO
PDO Mapping	NO
Value Range	-
Default Value	4
Index	**Sub index 1 to Nr. of input lines**
Name	Sub Unit Config Register 0
Description	This object is directly exchanged with the KONTURflex CANopen-Register 0x2018 Word 0.
Data Type	Unsigned 16
Access modes	RW
PDO Mapping	No
Value Range	Bits 0 … 6 Group counter (1 … 127) Number of physical beams, to connect. Bit 15 Logical connection 0: logical AND 1: logical OR
Default Value	1

Connecting more than one physical beams to a logic beam using the group counter <> 0, affects the following objects: 40C5, 4209, 420A and the assignment of the active beams to object 600x.

If the user wants to connect more than one physical beams using this object must take care of the correct setup step sequence.

It is recommended to use the following order:

- *Setup object 4218 (group counters) for all sub units.*
- *Map the requested digital beam data to the PDOs.*
- *Start node.*

10.18 Index 4219: Sub Unit Config Register 1

This object sets the hold time for a scanning result.

Index	**4219h**
Name	Sub Unit Config Register 1
Description	-
Data Type	Array
Index	**Sub index 0**
Name	Max. number of light grids
Description	Nr. of Subobjects

Data Type	Unsigned 8
Access modes	RO
PDO Mapping	NO
Value Range	-
Default Value	4
Index	**Sub index 1 to Nr. of input lines**
Name	Sub Unit Config Register 1
Description	This object is directly exchanged with the KONTURflex CANopen-Register 0x2018 Word 1.
Data Type	Unsigned 16
Access modes	RW
PDO Mapping	No
Value Range	1 … 255
Default Value	10

10.19 Index 421A: Sub Unit Config Register 2

This object sets the hole size for automatic hole detection within the KONTURflex CANopen system.

Index	**421Ah**
Name	Sub Unit Config Register 2
Description	-
Data Type	Array
Index	**Sub index 0**
Name	Max. number of light grids
Description	Nr. of Subobjects
Data Type	Unsigned 8
Access modes	RO
PDO Mapping	NO
Value Range	-
Default Value	4
Index	**Sub index 1 to Nr. of input lines**
Name	Sub Unit Config Register 2
Description	This object is directly exchanged with the KONTURflex CANopen-Register 0x2018 Word 2.
Data Type	Unsigned 16

Access modes	RW
PDO Mapping	No
Value Range	1 … 255
Default Value	1

10.20 Index 421B: Sub Unit Config Register 3

This object sets the tolerance for detection of the middle of the track.

Index	**421Bh**
Name	Sub Unit Config Register 3
Description	-
Data Type	Array
Index	**Sub index 0**
Name	Max. number of light grids
Description	Nr. of Subobjects
Data Type	Unsigned 8
Access modes	RO
PDO Mapping	NO
Value Range	-
Default Value	4
Index	**Sub index 1 to Nr. of input lines**
Name	Sub Unit Config Register 3
Description	This object is directly exchanged with the KONTURflex CANopen-Register 0x2018 Word 3.
Data Type	Unsigned 16
Access modes	RW
PDO Mapping	No
Value Range	1 … 255
Default Value	2

10.21 Index 422C: Sub Unit State

This object shows the state of the light grid modules of the KONTURflex CANopen system.

Index	**422Ch**
Name	Sub Unit State
Description	-
Data Type	Array
Index	**Sub index 0**
Name	Max. number of light grids
Description	Nr. of Subobjects
Data Type	Unsigned 8
Access modes	RO
PDO Mapping	NO
Value Range	-
Default Value	4
Index	**Sub index 1**
Name	Sub Unit State
Description	Bit0 no beam detects object Bit1 all beams detect object Bit2 object path in the middle Bit3 object path too high Bit4 object path too low Bit5 hole detected Bit6 reserved Bit7 light grid connected This object is directly read from the KONTURflex CANopen-Register 0x202C.
Data Type	Unsigned 8
Access modes	RO
PDO Mapping	YES
Value Range	-
Default Value	

For applications, that require detection of failing of single light grid modules, it is recommended to map these objects to a PDO.

10.22 Index 4234,5,6,7: Sub Unit Measuring Field

This object configures the measuring field for the light grid modules of the KONTURflex CANopen system. The measuring field enables blanking of single beams within the light grid modules.

For each light grid there is an own measuring field object.

Object	Connected light grid
4234	Light grid module 1
4235	Light grid module 2
4236	Light grid module 3
4237	Light grid module 4

Index	4234, 4235, 4236, 4237h
Name	Sub Unit Measuring Field
Description	-
Data Type	Array
Index	**Sub index 0**
Name	Max. number of beams
Description	Nr. of Subobjects
Data Type	Unsigned 8
Access modes	RO
PDO Mapping	NO
Value Range	-
Default Value	40h
Index	**Sub index 1**
Name	Sub Unit Measuring Field
Description	This object is directly exchanged with the KONTURflex CANopen-Register 0x2034.
Data Type	Unsigned 8
Access modes	RW
PDO Mapping	NO
Value Range	-
Default Value	

11 Emergency Messages

The KONTURflex CANopen CANopen supports several emergency messages. For all emergencies the same structure is used:

Byte							
0	1	2	3	4	5	6	7
EMY-Code		1001	0	CO4xxx-Code			

EMY-Code: Emergency-Error-Code according to DS 301
1001: Content of Object 1001
CO4xxx-Code: Emergency-Error-Code for CO4xxx as unsigned 32 value

CO4xxx-Code (hex)	May change		Description
	NMT	I/O	
8000 0000	X	X	CAN bus is bus off
4000 0000			CAN bus in error warning state
2000 0000			Node guarding warning
3000 0000	X	X	Life guarding error
0000 0002	X	X	Host Communication Time-Out
0000 0004	X	X	Host Communication Data Error

Emergency 2000 0000 (Node guarding warning) must be enabled with object 2103.

If more than one error is active at the same time, the bitmap of the CO4xxx-Codes for all active errors are combined with a logical or conjunction.

Some of the emergencies may cause a NMT state change and/or may force the output pins to the error state. This behaviour depends on the setting of object 1029.

The ID for emergency transmission is fixed to:
0x80 + $NodeID.

List of emergency messages:

Node-Guarding Warning							
30	81	01	00	00	00	00	20

This warning occurs, if the masters fails to transmit the guarding remote frame within the specified Guard Time object 100C and if transmission is enabled in object 2103.

Life-Guarding Error							
30	81	01	00	00	00	00	30

This error occurs, if the masters fails to transmit the guarding remote frame within the specified Life Time (Guard Time object 100C multiplied with Life Time Factor object 100D).

Host Communication Time-Out							
10	23	01	00	02	00	00	00

This error occurs, if the communication with the KONTURflex CANopen host controller is lost.

Host Communication Data Error							
10	23	01	00	04	00	00	00

This error occurs, if the communication with the KONTURflex CANopen detects illegal data.

CAN Bus in Error Warning state							
00	81	01	00	00	00	00	40

This error occurs, if the chips internal CAN module is in error warning state.

Return from CAN Bus OFF							
40	81	01	00	00	00	00	80

This message indicates a return from Bus OFF state.