CO401-Mem02-BD

frenzel + berg
electronic

CANopen bus memory board

General description

**The CO401Mem02-BD is a CANopen bus memory module providing non volatile memory for CANopen access.**

The CO401Mem02-BD module is especially designed for automotive and industrial applications. The module supports 4 kByte of non volatile EEPROM based memory. The memory is organized as 1k x 32Bits.

The CANopen implementation uses the DS401 draft standard for remote I/O modules. It offers 4 digital input and output lines. The memory is accessible with SDO transfer to each memory location.

Additionally there are two different multiplexed addressing schemes implemented, in order to provide random memory addressing using PDOs without the need of remapping these PDOs.

It is possible to use either a memory address based addressing scheme or a CANopen dictionary object based addressing mode.

The module uses an own power supply monitoring unit, in order to avoid writing of inconsistent data to memory during power down.
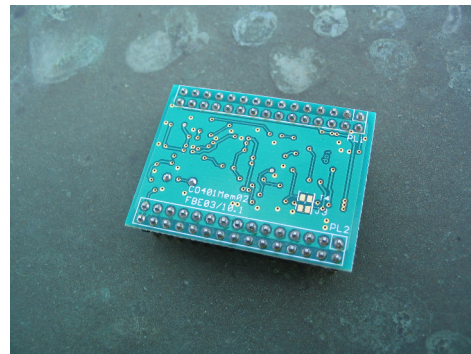
Top view
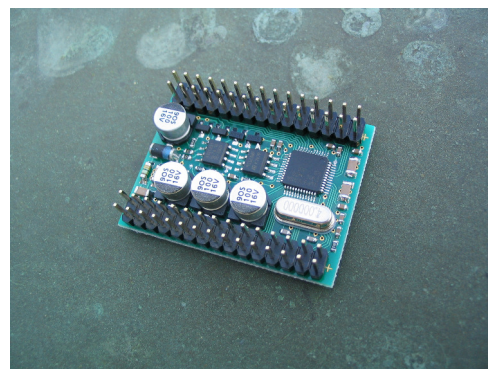
Bottom view

Features

- **According to CiA Draft Standards DS301 Version 4.0 and DS401 Version 2.0**
- **Baud rate up to 1MBit**
- **CAN bus ISO11898 transceiver 82C251**
- **Output drivers with 4mA**
- **Watchdog output**
- **Temperature ranges up to –40 to 85 ºC**
- **Package 60 pin module**
- **Dimensions (41mm x 31mm x 18mm)**

Applications

The boards are optimized for automotive and industrial applications such as:

- **CANopen general purpose bus memory**
- **CANopen memory of bus relevant configuration or system data.**

CANopen features

- **4 Transmit- and 8 Receive PDOs**
- **Dynamic PDO mapping**
- **Variable PDO identifier**
- **All CANopen specific PDO transmission types supported:**
  synchronous, asynchronous, event driven, cyclic, acyclic and remote frame dependent.
- **Event timer and inhibit timer features for all transmit PDOs.**
- **Node guarding, Life guarding, Heartbeat**
- **Variable SYNC identifier**
- **Emergency messages**
- **Minimum boot up**

Ordering information

CO401Mem02-BD (both include license)

Part	Temp. Range	Package
CO401Mem02A-BD	0ºC to 70ºC	BD-module
CO401Mem02AE-BD	-40ºC to 85ºC	BD-module

Pin assignment
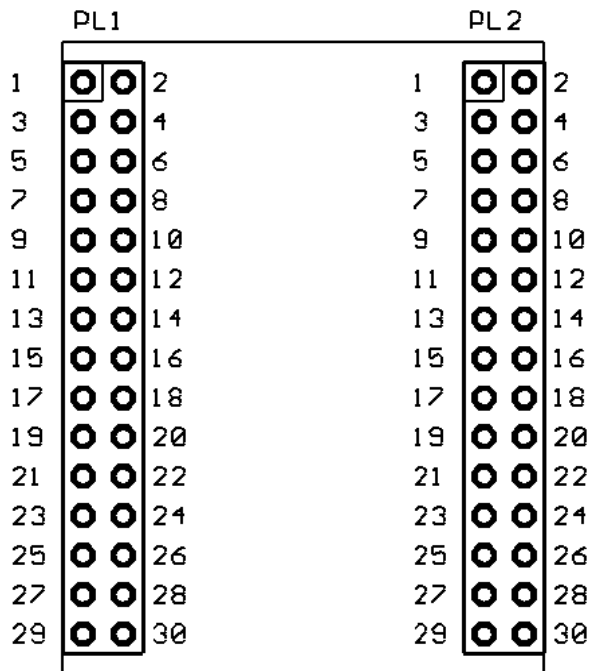
Top view

Pin listing CO401Mem02-BD

PL1

Pin No.	Pin Name	Function
1	GND	Ground
2	LED	4 mA limited output (anode) for a status LED
3	WD	Watch dog out
10	STXD	Serial Interface TxD
11	SRXD	Serial Interface RxD
16 to 19	IN3.. IN0	Digital input pins
4 to 7	IO4 .. IO7	input/output pins
23 to 25	BD2 .. BD0	Baud rate selection input
27 to 29	CF2 .. CF0	Configuration bits 0 to 2 for I/O setting
30	VCC	Power supply

PL2

Pin No.	Pin Name	Function
1	VCC	Power supply
2	CANH	CAN high line
3	CANL	CAN low line
5	RES#	Reset
18 to 21	OUT11 .. OUT0	output pins
22 to 28	ID6 .. ID0	Identifier selection input
29	BOOT#	Firmware Update
30	GND	Ground

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Preventing latch up

The CO401MEM02 is a CMOS device and may suffer latch up under the following conditions:
1) A voltage higher than VCC or lower than VSS is applied to any pin.
2) Absolute maximum ratings are exceeded

Handling unused input Pins

The CO401MEM02 provides internal pull up devices, so unused pins may be left unconnected.

Power Supply Pins

Make sure that all ground and power supply pins are connected to the same potential. Do not leave any ground or power pins open. Connect at least two ceramic capacitors of 100nF and a tantalum capacitor of 1µF between VCC and VSS as close as possible to the device.

Power Supply for A/D converter

The power supply for the A/D converter must not be turned on before the power supply VCC.
If the A/D converter is not used, connect the pins as follows: AVCC = AVREF = VCC, AVSS = VSS.

Pull up/down resistors

The CO401MEM02 provides internal pull up resistors.

Input / output pins

All input and output pins for digital signals are active low, for default configuration. This means for input pins, that inverted pin level is mapped to PDO. For output pins the inverted byte value from received PDO is written to the output pins.

Pin description

BOOT#: Firmware Update

A low level during reset at this pin activates the firmware update mode. In this case the pins STXD and SRXD will be used for an asynchronous communication.

Pin Name	Pin No.	Normal operation	Firmware update
BOOT#		high	low

The pins TXD and RXD work with 5V TTL-level. So if you need a connection to a PC COM-Port, you have to add a RS232 driver circuit like it is shown by the followed figure.
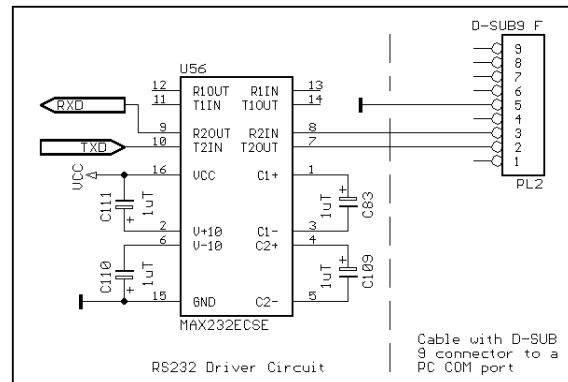
CF0 .. CF2: Configuration input pins

Set device configuration to preferred operation mode using CF0 to CF2. The configuration input pins are active low and provide internal pull up resistors.

Refer to chapter 'Device Configuration' for details and functionality.

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ID0 .. ID6, BD0 .. BD2: Identifier and baud rate input pins

The identifier and baud rate configuration input pins are active low and provide internal pull up resistors.

Refer to chapter 'Device Configuration' for details and functionality.

CANH, CANL (CANTX, CANRX) CAN Interface

The CAN Bus with its associated protocol allows communication between a number of stations which are connected to this bus with high efficiency (transfer speed's up to 1 Mbit).

The on board CAN transceiver (82C251) can be used or not, depending on the setting of Jumper J1, J2, J3, J4.

Without using the CAN transceiver:

In case without using the on board CAN transceiver, a user specific (optoisolated) CAN driver circuit may be realized on the application board. Therefore the Jumpers J3 and J4 have to be set, the jumpers J1 and J2 must be removed.
In this condition the CANH pin is connected to signal TX and CANL to RX (TTL level).

With using the CAN transceiver:
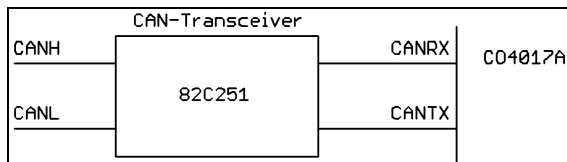
By using the on board CAN transceiver it is possible to connect the board directly to a two wire CAN bus associated to ISO11898. Therefore the Jumpers J1 and J2 have to be closed, jumpers J3 and J4 must be open..

RES#: Bidirectional Reset pin

The on board reset chip does the power up reset. It pulls the RES# line low. So it is possible to reset external components during power up using this signal.

The reset pin may also be used as reset input. For a correct device reset by external components, provide a low level longer than 50ms to the input RES#.

Note: Do never drive a high level to the RES# pin. This may cause permanent damage to the device. Use a push button or an open drain driver for this condition.

Note: Do not connect more than one RES# pins of different modules together. The bidirectional reset pins influence each other and might cause system hang up.

WD: Watch dog output pin

The watchdog output pin toggles during normal operation. The pin is implemented as high side open drain output signal.
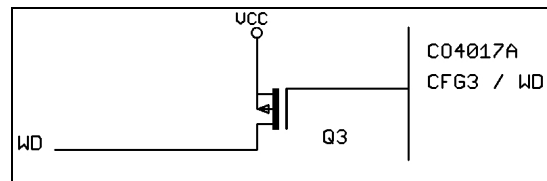
LED: Status LED output pin

The LED output pin outputs the state of the CANopen RUN-LED according to draft standard DS303-3. The pin is implemented as high side open drain output signal.

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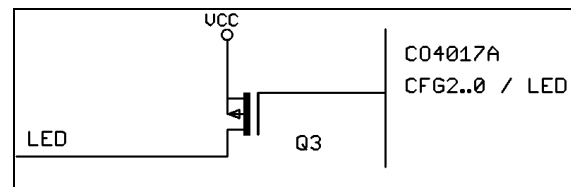
Device configuration

The following sections describe the device configuration with meaning:
1: ViH   logic high level
0: ViL   logic low level

CAN Identifier

The CAN Identifier will be set with Pins ID0 to ID6. This configuration pins use internal inverter. The ID is set as follows:

ID6	ID5	ID4	ID3	ID2	ID1	ID0	CAN-Identifier
1	1	1	1	1	1	1	Programmable ID
1	1	1	1	1	1	0	1 = 0x01
1	1	1	1	1	0	1	2 = 0x02
1	1	1	1	1	0	0	3 = 0x03
1	1	1	1	0	1	1	4 = 0x04
			….				….
1	0	0	0	0	0	0	63 = 0x3F
0	1	1	1	1	1	1	64 = 0x40
0	1	1	1	1	1	0	65 = 0x41
			….				….
0	0	0	0	0	1	0	125 = 0x7C
0	0	0	0	0	0	1	126 = 0x7E
0	0	0	0	0	0	0	127 = 0x7F

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

Baud rate

The baud rate configuration will be done with configuration inputs BD0 to BD2

BD2	BD1	BD0	CAN-Baud Rate / Bus length
1	1	1	1 Mbit/sec 25 m *1)
1	1	0	800 kbit/sec 50 m *1)
1	0	1	500 kbit/sec 100 m *2)
1	0	0	250 kbit/sec 250 m *2)
0	1	1	125 kbit/sec 500 m *3)
0	1	0	50 kbit/sec 1000 m *3)
0	0	1	20 kbit/sec 2500 m *3)
0	0	0	10 kbit/sec 5000 m *3)

*1) Calculation without optoisolators.
For optoisolators bus length is reduced for about 4m per 10ns propagation delay of employed optoisolator type
*2) Calculation with 40ns optoisolator propagation delay
*3) Calculation with 100ns optoisolator propagation delay
The calculation of the bus length is based on a line propagation delay of 5ns/m.

I/O Configuration

Configuration bits CFG0 to CFG3 select the I/O configuration of the CO401MEM02 chip.

CFG Pins				I/O Configuration		
3	2	1	0	Mode	Description	
X	1	1	1	**0**	Memory address based multiplexed addressing mode for memory data.	
X	1	1	0	**1**	CANopen dictionary object based addressing mode for memory data. NOTE : This operation mode is not fully tested and reserved for future use.	

CFG0 to CFG2: Configuration input pins / LED output pins

Set device configuration to preferred operation mode using CFG0 to CFG2. The CO401MEM02 provides internal pull up devices, so it is recommended to leave unused configuration inputs unconnected.

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Object Dictionary

The CO401MEM02 Single Chip CANopen Controller implements a complex object dictionary for CANopen I/O devices.

For detailed information about CANopen objects see additional brochure "Introduction to CANopen"

DS301: global Objects

Index	Sub-Index	Name	Acc.
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 Identifier Sync Object	rw
1008	-	Device Name *2)	ro
1009	-	Hardware Version *2)	ro
100A	-	Software Version *2)	ro
100B	-	Node Id *5)	-
100C	-	Guard Time	rw
100D	-	Life Time Factor	rw
100E	-	COB-ID Guard *5)	-
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 Behavior	ro
	1	In case of bus errors	rw
	2	In case of output errors	rw
2000	-	Device Manufacturer *3)	ro
2101	-	System Configuration	ro
2102	-	Remapping Enabled Info	ro
2103	-	Enable Guarding Warning	rw
2105	-	Internal Error Code	ro
2110	0	Test Object 01	ro
2110	1	Test Object 01.1	rw
2180	-	CAN Restart Time	rw

For the Object 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

Notes:
*1) This object cannot be written to in operational device state.
Only use this command in preoperational device state, otherwise the CO401MEM02 will answer requests with SDO abort telegrams.
*2) This objects show the chip type and version as visable strings.
*3) This Objects shows "Frenzel + Berg" as visible string data type.
*4) The New Node Id object gives the possibility to set a Node-Nr independent from the Node-Id Input Bits. With this feature the device may be configured by CAN bus line.
*5) This object is not accessible for the application because of standard conforming reasons.
*6) This object is implemented to give the user the possibility to add application related info to the dictionary. This object may be saved to non volatile memory using the "Store Parameters" command.

Note: 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	0083 0191 h
1018	0	Identity Object	04h
	1	Vendor ID	0000 0058 h
	2	Product Code	0140 1FFC h
	3	Revision Number	0 .. 0xFFFFFFFF
	4	Serial Number	0
2101		System Configuration	Set according to the setting of the configuration input bits.

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DS301: 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 CO401MEM02 setting of all parameters may be done in the device state "operational" as well as in "preoperational" state.

Index	Sub-Index	Name	Acc.
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
1401 … 1407		Receive PDO2 to RPDO8 Communication Parameter same as 1400.00 .. 1400.05	rw
1600	0	Receive PDO1: Parameter mapping	rw
	1 to n	Mapped Object (max. 8 objects mappable)	rw
1601 … 1607		Receive PDO2 to RPDO8 Parameter mapping Same as 1600	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 … 1803		Transmit PDO2 to TPDO4 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 … 1A03		Transmit PDO2 to TPDO4 Parameter mapping Same as 1A00	rw

Note:
The CO401MEM02 supports 8 receive and 4 transmit PDOs. All Objects for higher PDO numbers are not implemented.

Note:
For detailed information about CANopen objects see additional brochure "Introduction to CANopen"

DS401: Digital Input Objects

Index	Sub-Index	Name	Acc.
6000	0 to n	Read digital input 8 bit	ro
6005		Global interrupt enable	rw
6006	0 to n	Interrupt mask: any change	rw
6007	0 to n	Interrupt mask rising edge	rw
6008	0 to n	Interrupt mask falling edge	rw

DS401: Digital Output Objects

Index	Sub-Index	Name	Acc.
6200	0 to n	Write Output 8 Bit	rw
6206	0 to n	Error Mode Output	rw
6207	0 to n	Error State Output	rw

Memory Block Objects

These objects are implemented in order to access the modules non volatile data memory. Each memory location may be accessed through the direct memory block data objects 0x400x using SDO transfer.
For PDO based memory access 4 channels using several objects are implemented.

Index	Sub-Index	Name	Acc.
4000 .. 4007	0 to n	Memory Block Data 32 Bit	rw
5000	0 to 4	Memory Write Address	wo
5003	0 to 4	Memory Write Data 32 Bit	wo
5008	0 to 4	Memory Write Address ACK	ro
500B	0 to 4	Memory Write Data 32 Bit ACK	ro
5010	0 to 4	Memory Read Address CMD	wo
5018	0 to 4	Memory Read Address	ro
501B	0 to 4	Memory Read Data 32 Bit	ro

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Description of Object Dictionary

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

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

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

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

DS301: Global Objects

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
	0	0083 0191 h
	All other	Reserved

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

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Index 1002 : Status Register

This object gives additional information for the device

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

Index 1005 : COB-ID Sync

Identifier of Can Object for the Synchronisation message. The CO401MEM02 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

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	"CO401MEM02"

Index 1009 : Hardware Version

This object shows the hardware version and firmware version as visible string. The output format is compatible to the format of the chip CO4011A.

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	-

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	-

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Index 100C : Guard Time

The objects at index 100Ch (Guard Time in milli-seconds) 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

Index 100D : Life Time Factor

The objects at index 100Ch (Guard Time in milli-seconds) 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

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

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

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 CO401MEM02 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

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Index 1017 : Producer Heartbeat Time

The producer heartbeat time defines the cycle time of the heartbeat. The producer heartbeat time is 0 if it is 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

Note:
Either Heartbeat or node guarding may be allowed at the same time. Do not use both protocols at the same time.
See additional brochure for further information about heartbeat protocol.

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 Subindex 0
Name	Largest SubIndex supported
Description	-
Data Type	Unsigned char
Access modes	RO
PDO Mapping	No
Value Range	-
Default Value	4

Index	1018h Subindex 1
Name	Vendor ID
Description	Registration Code of frenzel + berg electronic at the CiA
Data Type	Unsigned 32
Access modes	RO
PDO Mapping	No
Value Range	-
Default Value	58h

Index	1018h Subindex 2
Name	Product Code
Description	Internal Product Code for CO401MEM02 at frenzel + berg elektronik
Data Type	Unsigned 32
Access modes	RO
PDO Mapping	No
Value Range	-
Default Value	0140 1FFC h

Index	1018h Subindex 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 Subindex 4
Name	Serial Number
Description	
Data Type	Unsigned 32
Access modes	RO
PDO Mapping	No
Value Range	-
Default Value	0

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Index 1029 : Error Behaviour

With object 1029 the CANopen chip can be configured to enter alternatively the preoperational 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.
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

Index	1029h
Name	Error Behaviour Object
Description	-
Data Type	Structure

Index	1029h Subindex 0
Name	Largest SubIndex supported
Description	-
Data Type	Unsigned char
Access modes	RO
PDO Mapping	No
Value Range	-
Default Value	2

Index	1029h Subindex 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 Subindex 2
Name	Application Error
Description	NMT state change in case of pin EMY0# is at low level
Data Type	Unsigned 8
Access modes	RW
PDO Mapping	No
Value Range	-
Default Value	00h

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"

Index 2101 : System Configuration

This Object returns the operation mode of the CO401MEM02. It represents the inverted Setting of the configuration input bits CFG0 to CFG2.

Index	2101h
Name	System Configuration
Description	-
Data Type	Unsigned 32
Access modes	RO
PDO Mapping	No
Value Range	-
Default Value	Depends on CFG0 to CFG2

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 dsabled, 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

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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.

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

Index 2105 : Internal Error Code

This Object holds error information of the CANopen controller.

Index	2105h
Name	Internal Error Code
Description	-
Data Type	Unsigned 32
Access modes	RO
PDO Mapping	YES
Value Range	-
Default Value	0 (no error condition)

Index 2110 : Test Object

This Object is implemented for testing purposes and should not be used.
The test entry does not have any functional behaviour.

Index	2110h
Name	Test Object 01
Description	-
Data Type	Structure

Index	2110h Subindex 0
Name	Largest SubIndex supported
Description	-
Data Type	Unsigned char
Access modes	RO
PDO Mapping	No
Value Range	-
Default Value	0x01

Index	2110h Subindex 1
Name	Test Object 01
Description	-
Data Type	Unsigned 16
Access modes	RW
PDO Mapping	No
Value Range	100 .. 1000
Default Value	500

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)

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DS301: PDO Parameter Objects

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

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

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 mean 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).

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

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.

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
1401h	Receive PDO2
…	
1800h	Transmit PDO1
1801h	Transmit PDO2
...	

Index	14xxh / 18xxh
Name	Receive / Transmit PDOx Communication Parameters
Description	-
Data Type	Structure

Index	14xxh / 18xxh Subindex 0
Name	Largest SubIndex supported
Description	-
Data Type	Unsigned 8
Access modes	RO
PDO Mapping	No
Value Range	-
Default Value	2 / 5

Index	14xxh / 18xxh Subindex 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 + 200h
	1401.01	Node-Id + 300h
	1402.01	Node-Id + 400h
	1403.01	Node-Id + 500h
	1404.01 .. 1407.01	0x80000000
	1800.01	Node-Id + 180h
	1801.01	Node-Id + 280h
	1802.01	Node-Id + 380h
	1803.01	Node-Id + 480h

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

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

Index	14xxh / 18xxh Subindex 3
Name	Inhibit Time
Description	-
Data Type	Unsigned 16
Access modes	RW
PDO Mapping	No
Value Range	-
Default Value	0

Index	14xxh / 18xxh Subindex 4
Name	Reserved
Description	-
Data Type	-
Access modes	-
PDO Mapping	No
Value Range	-
Default Value	-

Index	14xxh / 18xxh Subindex 5
Name	Event Time
Description	-
Data Type	Unsigned 16
Access modes	RW
PDO Mapping	No
Value Range	-
Default Value	0

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).

Subindex 0 determines the valid number of objects that have been mapped. The CO401SIE04 allows a maximum of 8 mapped objects for each PDO. For changing the PDO mapping first subindex 0 must be set to 0 (mapping is deactivated). Then the objects can be remapped. When a new object is mapped by writing a subindex between 1 and 8, the device may check whether the object specified by index /subindex exists. If the object does not exist or the object cannot be mapped, the SDO transfer will be aborted.

Subindexes 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		Subindex	Length

Mapped Index and Subindex 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 Subindex 0
Name	Largest SubIndex 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 Subindex 1 to 8
Name	Mapped object
Description	
Data Type	Unsigned 32
Access modes	RW
PDO Mapping	No
Value Range	-
Default Value	See table below

Receive PDOs for Configuration 0

For configuration mode 0 (CF0..CF2 = 111b), the CANopen chip CO401MEM02 uses the following default mapping entries for receive PDO mapping:

Index	Entry	Explanation
Receive-PDO1		
1600.00	1	RPDO1: 1 mapped object
1600.01	50100110h	Memory Read Address Command 0
Receive-PDO2		
1601.00	1	RPDO2: 1 mapped object
1601.01	50100210h	Memory Read Address Command 1
Receive-PDO3		
1602.00	2	RPDO3: 2 mapped objects
1602.01	50000110h	Memory Write Address 0
1602.02	50030120h	Memory Write Data 32 Bit 0
Receive-PDO4		
1603.00	2	RPDO4: 2 mapped objects
1603.01	50000210h	Memory Write Address 1
1603.02	50030220h	Memory Write Data 32 Bit 1
Receive-PDO5..8		
1604.00	0	RPDO5: no mapped object
1605.00	0	RPDO6: no mapped object
1606.00	0	RPDO7: no mapped object
1607.00	0	RPDO8: no mapped object

Transmit PDOs for Configuration 0

For configuration mode 0 (CF0..CF2 = 111b), the CANopen chip CO401MEM02 uses the following default mapping entries for transmit PDO mapping:

Index	Entry	Explanation
Transmit - PDO1		
1A00.00	2	TPDO1: 2 mapped objects
1A00.01	50180110h	Memory Read Address 0
1A00.02	501B0120h	Memory Read Data 32 Bit 0
Transmit – PDO2		
1A01.00	2	TPDO2: 2 mapped objects
1A01.01	50180210h	Memory Read Address 1
1A01.02	501B0220h	Memory Read Data 32 Bit 1
Transmit – PDO3		
1A02.00	2	TPDO3: 2 mapped objects
1A02.01	50080110h	Memory Write Address ACK 0
1A02.02	500B0120h	Memory Write Data 32 Bit ACK 0
Transmit – PDO4		
1A03.00	2	TPDO4: 2 mapped objects
1A03.01	50080210h	Memory Write Address ACK 1
1A03.02	500B0220h	Memory Write Data 32 Bit ACK 1

The default mapping of the PDOs 1 and 2 is set in a way, that a Master may send the RPDO1(2) with an address it wants to read and the CO401Mem02 will respond with TPDO1(2) with the acknowledge of the address and the 32 bit data for this memory address.

The default mapping of the PDOs 3 and 4 is set in a way, that a Master may send the RPDO3(4) with an address and the 32 bit data it wants to write and the CO401Mem02 will respond with TPDO3(4) holding the acknowledge of the address and the data for this memory address.

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DS401: Digital Input Objects

The following objects are describing the functionality of the digital input lines of the CO401MEM02. The CO401MEM02 supports 8 bit access to the digital input pins.

The mapping of the I/O lines to object 6000 is explained in chapter "Mapping I/O to Object Dictionary"

Index 6000 : Read Digital Input 8 Bit

This object represents the digital input bytes. The value of the input lines is written to this object. Please note, that input pins are active low by default, so the inverted pin level is written to the input objects.

Index	6000h
Name	Digital Input 8 Bit
Description	-
Data Type	Array

Index	Subindex 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	Subindex 1 to Nr of input bytes
Name	Digital Input 8 Bit Byte n
Description	
Data Type	Unsigned 8
Access modes	RO
PDO Mapping	Yes
Value Range	-
Default Value	-

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

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	Subindex 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	Subindex 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)

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Index 6007 : Interrupt Mask Low to High

This object has the same structure and behaviour as object 6006h but will cause interrupts only on rising edge of object index 6000. Note that input lines are active low, so rising edge of input data (object 6000) means falling edge of input port line.
Default value is 0.

Index 6008 : Interrupt Mask High to Low

This object has the same structure and behaviour as object 6006h but will cause interrupts only on falling edge of object index 6000. Note that input lines are active low, so falling edge of input data (object 6000) means rising edge of input port line.
Default value is 0.

DS401: Digital Output Objects

The following objects are describing the functionality of the digital output lines of the CO401MEM02. The CO401MEM02 supports 8, 16 and 32 bit access to the digital outputs.

The number of digital output lines depends on the selected operation mode.
The mapping of the I/O lines to object 6200 is explained in chapter "Mapping I/O to Object Dictionary"

Index 6200 : Write to Digital Output

With object 6200, the digital outputs of the CO401MEM02 can be written to. The Output port bits of the CO401MEM02 device are active low, that means, a bit value of "1" within the output object drives a low level on the output pin.

Index	6200h
Name	Write to digital output
Description	-
Data Type	Array

Index	Subindex 0
Name	
Description	Number of mapped objects
Data Type	Unsigned 8
Access modes	RO
PDO Mapping	NO
Value Range	-
Default Value	Number of digital output bytes

Index	Subindex 1 to Nr of output bytes
Name	Write to digital output
Description	
Data Type	Unsigned 8
Access modes	RW
PDO Mapping	YES
Value Range	-
Default Value	0

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Index 6206 : Error Mode Output 8 Bit

This object indicates, whether an output is forced to a predefined value (given in object 6207) in case of a device error.

1 = Output will be forced to the value selected in object 6207

0 = Output will be unchanged even in case of an error condition.

Index	6206h
Name	Error Mode Output 8 Bit
Description	-
Data Type	Array

Index	Subindex 0
Name	Nr of Subobjects
Description	
Data Type	Unsigned 8
Access modes	RO
PDO Mapping	No
Value Range	-
Default Value	Number of digital output bytes

Index	Subindex 1 to Nr of output bytes
Name	Error Mode Output 8 Bit Byte n
Description	
Data Type	Unsigned 8
Access modes	RW
PDO Mapping	No
Value Range	-
Default Value	0FFh (Take error condition from object 6207)

Index 6207 : Error Value Output 8 Bit

This object selects the level the outputs are forced to in case of device error mode if the error mode (object 6206 is enabled)

1 = Output will be forced to active state

0 = Output will be forced to inactive state.

Note: Outputs of CO401MEM02 are active low.

Index	6207h
Name	Error Value Output 8 Bit
Description	-
Data Type	Array

Index	Subindex 0
Name	Nr of Subobjects
Description	
Data Type	Unsigned 8
Access modes	RO
PDO Mapping	No
Value Range	-
Default Value	Number of digital output bytes

Index	Subindex 1 to Nr of output bytes
Name	Error Value Output 8 Bit Byte n
Description	
Data Type	Unsigned 8
Access modes	RW
PDO Mapping	No
Value Range	-
Default Value	0 (Inactive, high level)

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Memory Block Objects

These objects are implemented in order to access the non volatile data memory of CO401Mem02-BD module. Each memory location may be accessed through the direct memory block data objects 0x400x using SDO transfer. Each single object 0x400x allocates a 32 bit data double word in memory.
So object 0x4000 sub index 0x01 allocates memory address 0..3, sub index 0x02 allocates memory address 4..7 etc.

For PDO based memory access 4 channels using several objects are implemented.
Please note that the address calculation always is made for byte address locations.
Example:
If you use a memory write address object (0x5000) in conjunction with a memory data 32 bit object (0x5003) the CO401Mem02 always forces bits 0 and 1 of the address to zero.

Index 400x : Memory Block x 32 Bit

These objects enable direct 32 bit data access to the complete memory area using SDO telegrams.
For a total of 4 kBytes of non volatile memory objects 0x4000 to 0x4007 with sub index range of 1 .. 0x80 are used.

Index	400xh
Name	Memory Block 32 Bit
Description	-
Data Type	Array

Index	Subindex 0
Name	
Description	Number of mapped objects
Data Type	Unsigned 8
Access modes	RO
PDO Mapping	NO
Value Range	-
Default Value	0x80

Index	Subindex 1 to 0x80
Name	Memory Block 32 Bit Data
Description	Single 32 bit data double word.
Data Type	Unsigned 32
Access modes	RW
PDO Mapping	NO
Value Range	
Default Value	

Index 5000 : Memory Write Address

This object is implemented to support address based access to the memory using PDOs. It represents the address for memory write data objects.
The address is given as a byte address of the memory. If the address is used for 32 bit data write access, bit 0 and bit 1 are forced to 0.

There are four independent channels implemented. These are represented by the corresponding sub index. A write access to the memory write address object 0x5000 does not cause any action on the CO401Mem02.

Note:
Bit 15 is interpreted as an enable flag and must be set to 1 in order to enable write access to the data memory.

Index	5000h
Name	Memory Write Address
Description	-
Data Type	Array

Index	Subindex 0
Name	
Description	Number of mapped objects Each sub index represents an own channel.
Data Type	Unsigned 8
Access modes	RO
PDO Mapping	NO
Value Range	-
Default Value	4

Index	Subindex 1 to 0x80
Name	Memory Write Address
Description	16 Bit address. Bit15 is used as write enable flag Bits 14..0 are used as address.
Data Type	Unsigned 16
Access modes	WO
PDO Mapping	YES
Value Range	
Default Value	0

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Index 5003 : Memory Write Data 32 Bit

This object is implemented to support address based access to the memory using PDOs. It represents the 32 bit data value, that must be written to the memory address given in the associated sub index of object 5000h.

A write access to the memory write data object 0x5003 initiates the write procedure within the CO401Mem02 in case of bit 15 of the associated write address object 0x5000 is set.

Index	5003h
Name	Memory Write Data 32 Bit
Description	-
Data Type	Array

Index	Subindex 0
Name	
Description	Number of mapped objects Each sub index represents an own channel.
Data Type	Unsigned 8
Access modes	RO
PDO Mapping	NO
Value Range	-
Default Value	4

Index	Subindex 1 to 4
Name	Memory Write Data 32 Bit
Description	Data value, that is written to non volatile memory
Data Type	Unsigned 16
Access modes	WO
PDO Mapping	YES
Value Range	
Default Value	0

Index 5008 : Memory Write Address ACK

Acknowledge of memory write address. Object 0x5008 is copied from object 0x5000 in order to enable PDO based handshaking for the write access under following conditions:

1) If an address value with bit 15 = 0 is written to object 0x5000, ACK object 0x5008 is written immediately, in order to indicate, that any write access is disabled.

2) If a data value is written to object 0x5003 and bit 15 of address object 0x5000 is set (write access enabled), ACK object 0x5008 is copied from object 0x5000 after write cycle is completed.

Index	5008h
Name	Memory Write Address ACK
Description	-
Data Type	Array

Index	Subindex 0
Name	
Description	Number of mapped objects Each sub index represents an own channel.
Data Type	Unsigned 8
Access modes	RO
PDO Mapping	NO
Value Range	-
Default Value	4

Index	Subindex 1 to 4
Name	Memory Write Address ACK
Description	Acknowledge of memory write cycle.
Data Type	Unsigned 16
Access modes	RO
PDO Mapping	YES
Value Range	
Default Value	0

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Index 500B : Memory Write Data 32 Bit ACK

Acknowledge of memory write address. Object 0x500B is copied from object 0x5003 in order to enable PDO based handshaking for the write access if a valid write cycle to the data memory using object 0x5003 is completed.

Index	500Bh
Name	Memory Write Data 32 Bit ACK
Description	-
Data Type	Array

Index	Subindex 0
Name	
Description	Number of mapped objects Each sub index represents an own channel.
Data Type	Unsigned 8
Access modes	RO
PDO Mapping	NO
Value Range	-
Default Value	4

Index	Subindex 1 to 4
Name	Memory Write Data 32 Bit ACK
Description	Acknowledge of memory write cycle.
Data Type	Unsigned 32
Access modes	RO
PDO Mapping	YES
Value Range	
Default Value	0

Index 5010 : Memory Read Address CMD

This object sets the read address for the next memory read cycle. Reading object 501B always reads the memory location, object 5010 points to. So it works as a read command object.

So setting of object 5010 to a new address initiates a memory read cycle to the given address. The data is copied to object 501B. After the read cycle the value of object 5010 is copied to 5018 in order to enable hand shaking for PDO based random read.

An enable flag as defined for object 5000 is not needed, so bit 15 is always forced to zero.

Index	5010h
Name	Memory Read Address CMD
Description	-
Data Type	Array

Index	Subindex 0
Name	
Description	Number of mapped objects Each sub index represents an own channel.
Data Type	Unsigned 8
Access modes	RO
PDO Mapping	NO
Value Range	-
Default Value	4

Index	Subindex 1 to 4
Name	Memory Read Address CMD
Description	Initiates a memory read cycle to the given address
Data Type	Unsigned 16
Access modes	WO
PDO Mapping	YES
Value Range	
Default Value	0

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Index 5018 : Memory Read Address

This object shows the read address for the data represented in object 501B

Setting of object 5010 to a new address initiates a memory read cycle to the given address. The data is copied to object 501B. After the read cycle the value of object 5010 is copied to 5018 in order to enable hand shaking for PDO based random read.

Index	5018h
Name	Memory Read Address
Description	-
Data Type	Array

Index	Subindex 0
Name	
Description	Number of mapped objects Each sub index represents an own channel.
Data Type	Unsigned 8
Access modes	RO
PDO Mapping	NO
Value Range	-
Default Value	4

Index	Subindex 1 to 4
Name	Memory Read Address
Description	Shows the memory address for the data represented in object 501B
Data Type	Unsigned 16
Access modes	RO
PDO Mapping	YES
Value Range	
Default Value	0

Index 501B : Memory Read Data 32 Bit

This object holds the data of the memory read cycle initiated from object 5010 as unsigned 32 bit value.

Setting of object 5010 initiates a memory read cycle to the given address. The data read from non volatile memory is copied to object 501B. After the read cycle the value of object 5010 is copied to 5018 in order to enable hand shaking for PDO based random read.

Index	501Bh
Name	Memory Read Data 32 Bit
Description	-
Data Type	Array

Index	Subindex 0
Name	
Description	Number of mapped objects Each sub index represents an own channel.
Data Type	Unsigned 8
Access modes	RO
PDO Mapping	NO
Value Range	-
Default Value	4

Index	Subindex 1 to 4
Name	Memory Read Data 32 Bit
Description	Data content of memory address held in object 5010
Data Type	Unsigned 32
Access modes	RO
PDO Mapping	YES
Value Range	
Default Value	0

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Emergency Messages

The CO401MEM02 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	CO4-Code		

EMY-Code: Emergency-Error-Code according to DS301
1001: Content of Object 1001
CO4-Code: Emergency-Error-Code for CANopen chip as unsigned 32 value

CO4011-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 0080			Undervoltage detected
0000 0020			Reading from non volatile memory failed
0000 0010			Writing to non volatile memory failed

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 CO4-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	11	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)

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	C0

This message indicates a return from Bus OFF state.

Undervoltage							
00	10	01	00	80	00	00	00

This error occurs, if the supply voltage is falling below the non volatile voltage protection level. No more write or read access to the memory will be initiated.

NV-Memory Read Failure							
00	10	01	00	20	00	00	00

This error occurs, if a read access to the non volatile memory fails.

NV-Memory Write Failure							
00	10	01	00	20	00	00	00

This error occurs, if a write access to the non volatile memory fails. The emergency is also set, if a write command to the non volatile memory is initiated during undervoltage condition.

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Absolute maximum ratings

Stresses greater than those parameters listed may cause permanent damage to the device. Functional operation should be restricted to recommended operation conditions. Exposure to absolute maximum rating conditions for extended times may affect reliability.

Parameter	Symbol	Rated Value		Units	Remarks
		Min.	Max.		
Power supply voltage	VCC	VSS – 0.3	VSS + 6.0	V	
Input voltage	Vi	VSS – 0.3	VSS + 6.0	V	Vi < VCC + 0.3V
Output voltage	Vo	VSS – 0.3	VSS + 6.0	V	Vo < VCC + 0.3V
L level maximum output current	I_{OLMAX}		15	mA	Time < 20 msec
L level maximum output current	I_{OL}		4	mA	
H level maximum output current	I_{OHMAX}		15	mA	Time < 20 msec
H level maximum output current	I_{OH}		4	mA	
Maximum Power dissipation	P_{MAX}		800	mW	
Operating temperature	T_A	0	+70	°C	CO401xA-BD
	T_A	-40	+105	°C	CO401xAE-BD
Storing temperature	T_A	-55	+150	°C	

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Recommended operation conditions and characteristics

Functional operation should be restricted to recommended operation conditions.

Parameter	Symbol	Rated Value			Units	Remarks
		Min.	Typ.	Max.		
Power supply voltage	V_{CC}	4.5	5.0	5.5	V	*1)
Undervoltage detection level	V_{uv}	4.6	4.65	4.75	V	
Power supply current	I_{CC}		65	110	mA	All inputs V_{IL} or V_{IH} All outputs open CAN bus open
Input H voltage	V_{IH}	0.8 * VCC		VCC + 0.3	V	
Input L voltage	V_{IL}	VSS – 0.3		0.2 * VCC	V	
Output H voltage	V_{OH}	VCC – 0.5			V	I_{OH} = -4.0mA
Output L voltage	V_{OL}			0.4	V	I_{OL} = 4.0mA
Input leakage current	I_{LKC}	-5		5	µA	
Crystal frequency	f_{osc}		4		MHz	
Reset pulse width	t_{res}	10			µs	
Power on rise time	t_{RESLH}	0.05		30	ms	
Maximum CANopen Delay input pin to bus telegram	t_{DITB}	0.05	1	2	ms	No additional bus distribution delay
Maximum CANopen Delay bus telegram to output pin	t_{DBTO}	0.05	1	2	ms	
Watchdog trigger frequency	f_{WDT}	0.5	1	20	kHz	Delayed max. 500 ms after reset
Maximum Power dissipation	P_{MAX}			300	mW	
Operating temperature	T_A	-25		+85	° C	CO401MEM02A-BD
	T_A	-40		+105	° C	CO401MEM02AE-BD

*1) Access to the non volatile memory is blocked, if the supply voltage falls below the undervoltage detection level.

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Package dimensions CO401MEM02

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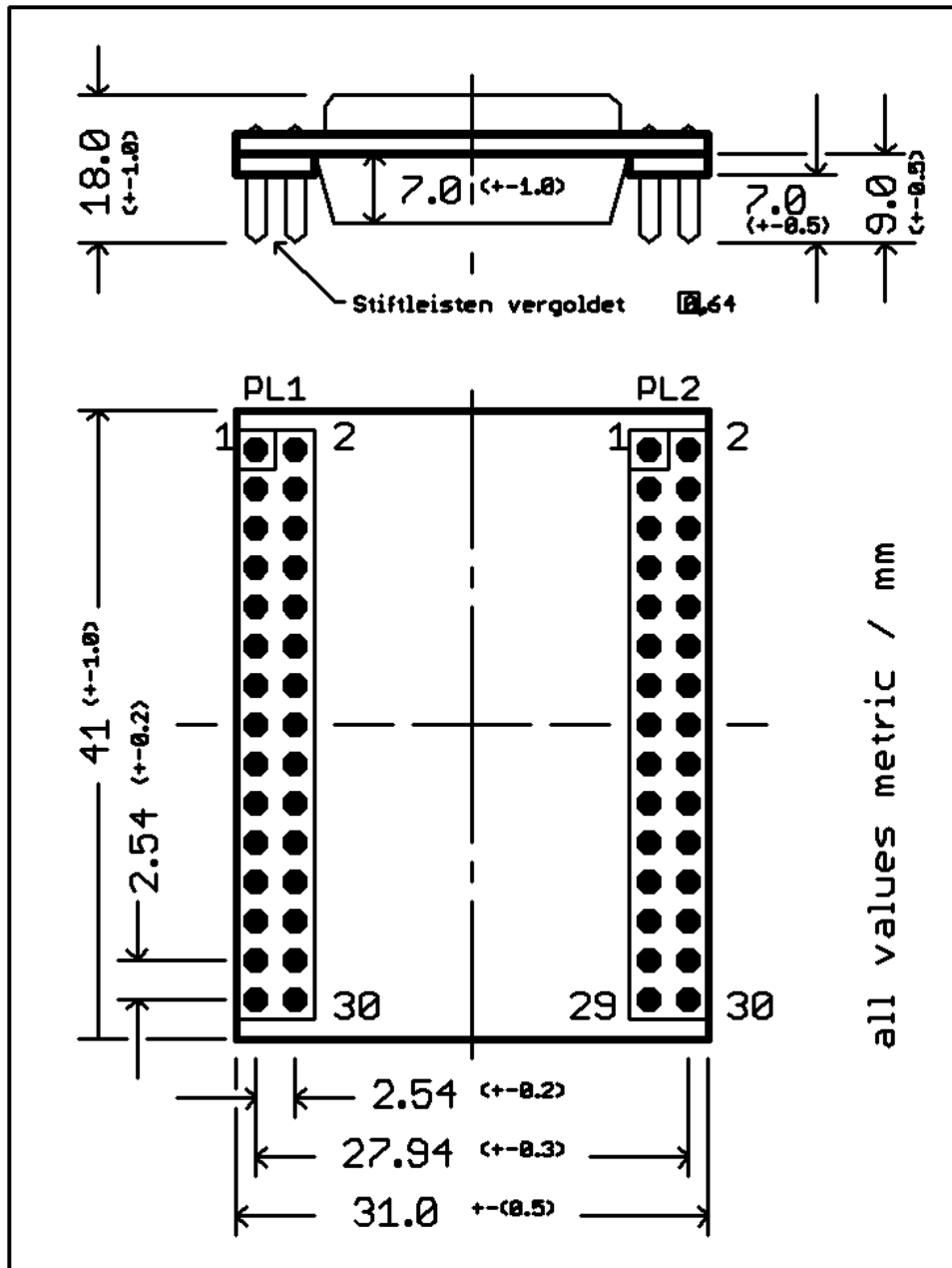
Revision History

Version	Date of Change	Changes
1.600	Apr/19/2010	First Chip Version

Problem History (latest Version)

The list of existing problems was started with chip version 1.600. All earlier versions might have additional problems not reported within this list. See also revision history for further information.

Color	Description	Priority to fix
	Problem is fixed in the latest version of this chip	-
	Problem is still open but uncritical or a workaround is possible	Low
	Problem is still open and critical or there is no workaround	Medium
	Problem is still open and very critical and might cause stability of application	High

List of problems and restrictions:

Problem	Description	State	Affected Version
P1	Emergency-Message: In case of more than one emergency condition is active at the same time the Error Code of the emergency message might be not the code of the newest emergency but belongs to one of the older emergency events. *Workaround:* *Use the manufacturer specific error field to select the required emergency reaction. This data field always keeps the coding for all possible emergency reasons.*	Open	all

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