



CA340 and CA541

Process value and parameter indicators for CAN-Bus

Product Features:

- The CA340 variant is a simple indicator unit for remote display of all actual data which are available on the connected CAN-Bus network. Arbitrary parameters or actual values can be read or displayed.
- CA541 is a combination of preset switch and indicator. While the BCD switch allows to make register changes via CAN-Bus, the LED display provides information about the actual setting of the same or any other register value.

Available Devices:

- **CA340:** Display unit only
- **CA541:** Display / Preset combination (SDO / PDO switchable)

Version:	Description:
Ca340_01a ... 03a	Diverse version updates
Ca340_03b_oi/Nov-11/ag	Safety instructions and legal Notices supplemented. Specifications updated. Dual language version separated in two stand-alone versions.

Legal notices:
All contents included in this manual are protected by the terms of use and copyrights of motrona GmbH. Any reproduction, modification, usage or publication in other electronic and printed media as well as in the internet requires prior written authorization by motrona GmbH.

Table of Contents

1. Safety Instructions and Responsibility	3
1.1. General Safety Instructions.....	3
1.2. Use according to the intended purpose	3
1.3. Installation.....	4
1.4. Cleaning, Maintenance and Service Notes	4
2. Allgemeines	5
3. Block diagram.....	5
4. Connections.....	6
5. Setting of the network Baud rate and sign.....	7
6. Setting of unit address and transmission mode	8
7. Data transmission by SDO (Service Data Object)	9
8. Datenübertragung als Prozessdaten mit PDO (Process Data Object).....	11
9. Error Messages	14
10. Dimensions.....	14
11. Technical Specifications	15

1. Safety Instructions and Responsibility

1.1. General Safety Instructions

This operation manual is a significant component of the unit and includes important rules and hints about the installation, function and usage. Non-observance can result in damage and/or impairment of the functions to the unit or the machine or even in injury to persons using the equipment!

Please read the following instructions carefully before operating the device and observe all safety and warning instructions! Keep the manual for later use.

A pertinent qualification of the respective staff is a fundamental requirement in order to use these manual. The unit must be installed, connected and put into operation by a qualified electrician.

Liability exclusion: The manufacturer is not liable for personal injury and/or damage to property and for consequential damage, due to incorrect handling, installation and operation. Further claims, due to errors in the operation manual as well as misinterpretations are excluded from liability.

In addition the manufacturer reserve the right to modify the hardware, software or operation manual at any time and without prior notice. Therefore, there might be minor differences between the unit and the descriptions in operation manual.

The raiser respectively positioner is exclusively responsible for the safety of the system and equipment where the unit will be integrated.

During installation or maintenance all general and also all country- and application-specific safety rules and standards must be observed.

If the device is used in processes, where a failure or faulty operation could damage the system or injure persons, appropriate precautions to avoid such consequences must be taken.

1.2. Use according to the intended purpose

The unit is intended exclusively for use in industrial machines, constructions and systems. Non-conforming usage does not correspond to the provisions and lies within the sole responsibility of the user. The manufacturer is not liable for damages which has arisen through unsuitable and improper use.

Please note that device may only be installed in proper form and used in a technically perfect condition (in accordance to the Technical Specifications, see chapter [11](#)).

The device is not suitable for operation in explosion-proof areas or areas which are excluded by the EN 61010-1 standard.

1.3. Installation

The device is only allowed to be installed and operated within the permissible temperature range. Please ensure an adequate ventilation and avoid all direct contact between the device and hot or aggressive gases and liquids.

Before installation or maintenance, the unit must be disconnected from all voltage-sources. Further it must be ensured that no danger can arise by touching the disconnected voltage-sources.

Devices which are supplied by AC-voltages, must be connected exclusively by switches, respectively circuit-breakers with the low voltage network. The switch or circuit-breaker must be placed as near as possible to the device and further indicated as separator.

Incoming as well as outgoing wires and wires for extra low voltages (ELV) must be separated from dangerous electrical cables (SELV circuits) by using a double resp. increased isolation.

All selected wires and isolations must be conform to the provided voltage- and temperature-ranges. Further all country- and application-specific standards, which are relevant for structure, form and quality of the wires, must be ensured. Indications about the permissible wire cross-sections for wiring are described in the Technical Specifications (see chapter [11](#)).

Before first start-up it must be ensured that all connections and wires are firmly seated and secured in the screw terminals. All (inclusively unused) terminals must be fastened by turning the relevant screws clockwise up to the stop.

Overvoltages at the connections must be limited to values in accordance to the overvoltage category II.

For placement, wiring, environmental conditions as well as shielding and earthing/grounding of the supply lines the general standards of industrial automation industry and the specific shielding instructions of the manufacturer are valid.

Please find all respective hints and rules on www.motrona.com/download.html
--> "[General EMC Rules for Wiring, Screening and Earthing]"

1.4. Cleaning, Maintenance and Service Notes

To clean the front of the unit please use only a slightly damp (not wet!), soft cloth. For the rear no cleaning is necessary. For an unscheduled, individual cleaning of the rear the maintenance staff or assembler is self-responsible.

During normal operation no maintenance is necessary. In case of unexpected problems, failures or malfunctions the device must be shipped for back to the manufacturer for checking, adjustment and reparation (if necessary). Unauthorized opening and repairing can have negative effects or failures to the protection-measures of the unit.

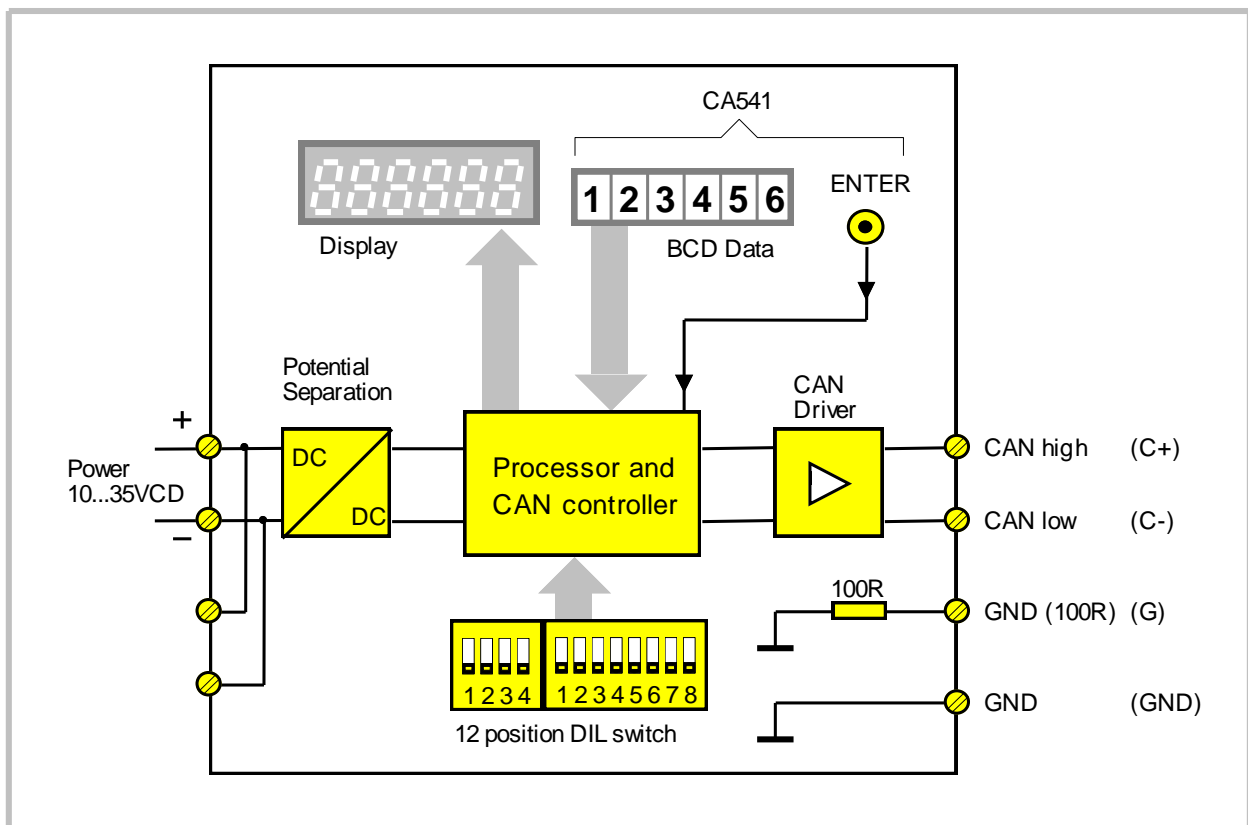
2. Introduction

The CA340/541 display units have been designed to display single parameters or registers (like position or speed) in systems using a CANopen network for communication. CA541 also allows remote setting of a single parameter.

- **CA340** serves as pure readout unit without preset functions. Both units are built into a DIN housing and have a 6 decade, 15mm size LED-display.
- **CA541** additionally includes a 6 digit BCD thumbwheel switch (Preset range 0...999 999).
- With supplementary ordering information **Option VZ000**, the unit is supplied in a "5 digit plus sign" version (preset range: -99 999 ... 0 ... +99 999).

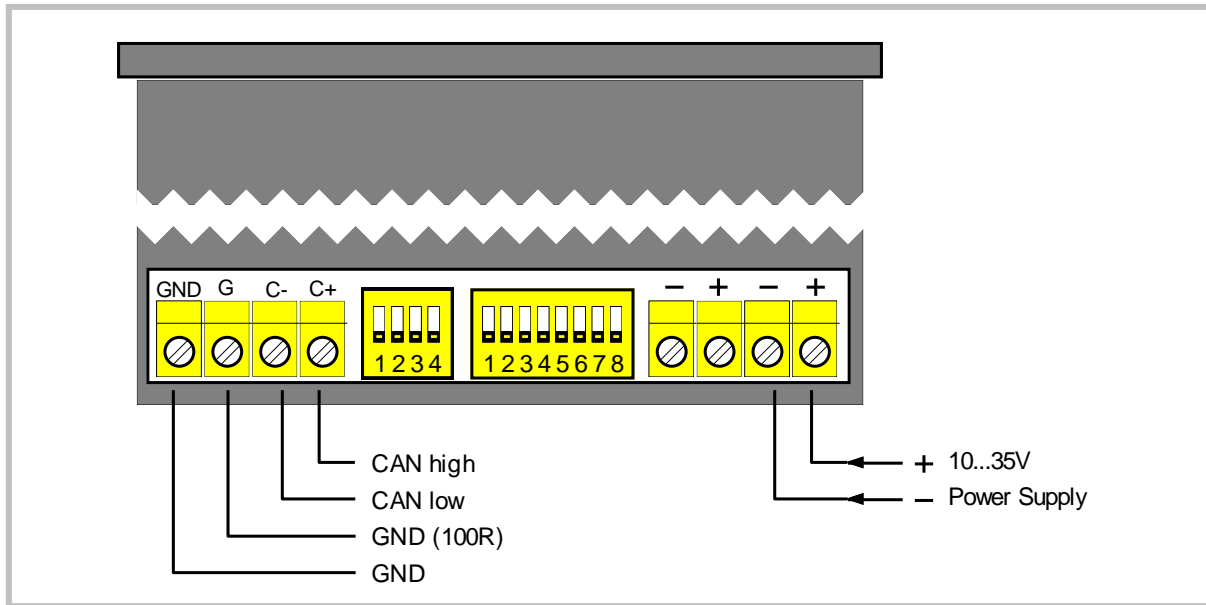
With both units, data can be transmitted as service data (SDO), accessing adjustable register codes of a network participant, or as process data (PDO).

3. Block diagram

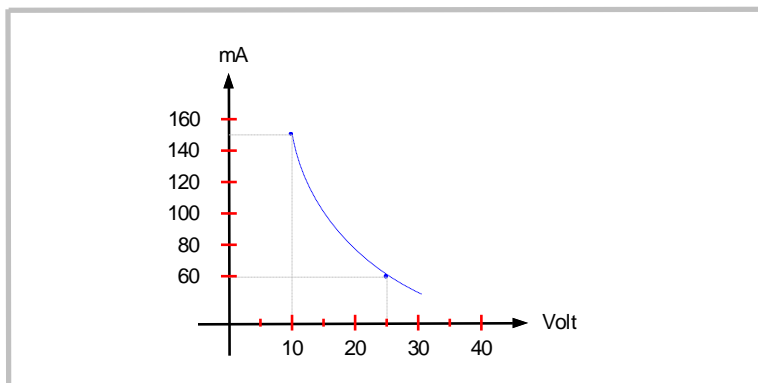


4. Connections

Screw terminals and DIL switches for setup are located on the backplane of the unit:



Current consumption, depending on supply voltage:



The following cables are recommended for CAN communication, depending on the cable length:

Up to 300 meters:

Cable type	LIYCY 2 x 2 x 0,5 mm ² (twisted and screened)
Resistance	≤ 40 Ω /km
Capacity	≤ 130 nF/km

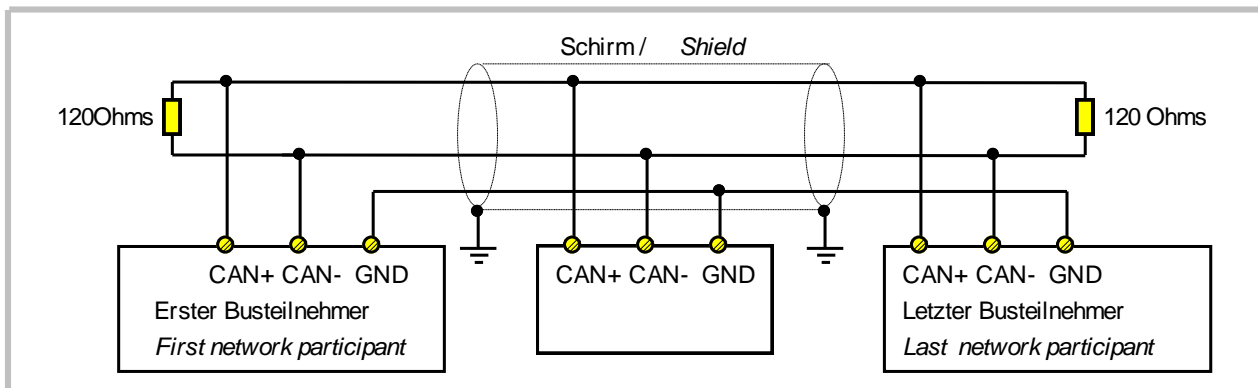
More than 300 meters:

Cable type	CYPIMF 2 x 2 x 0,5 mm ² (twisted and screened)
Resistance	≤ 40 Ω /km
Capacity	≤ 60 nF/km

Please use the leads like shown:

Pair 1 (white/brown)	CAN-Low and CAN-High
Pair 2 (green/yellow)	GND

Both extreme ends of the CAN network must be terminated by a 120 Ohms resistor. The shield must be connected to earth potential.



5. Setting of the network Baud rate and sign

Depending on the Baud rate, the following maximum cable length must not be exceeded:

	maximum cable length				
Baud rate (kbit / s)	50	125	250	500	1000
Cable length (m)	1000	550	250	110	25

Setting the baud rate uses positions 1 to 3 of the 4-position DIL switch on the rear:

0 0 0	=	1 000 kBaud	"0"	=	OFF
1 0 0	=	500 kBaud	"1"	=	ON
0 1 0	=	250 kBaud			
1 1 0	=	125 kBaud			
0 0 1	=	50 kBaud			
1 0 1	=	20 kBaud			
0 1 1	=	10 kBaud			
1 1 1	=	10 kBaud			

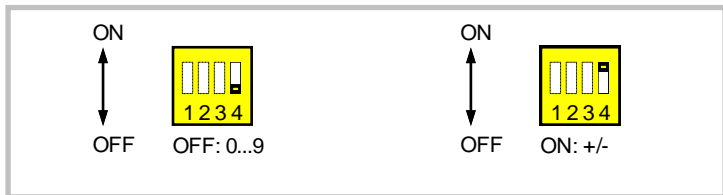
Beispiel : 500 kBaud

Example : 500 kBaud

ON

OFF

Slider 4 defines the most significant digit of the front thumbwheel switches to be transmitted as a number or a sign (CA541 only):



The version with a sign (option **VZ000**) requires slider 4 to be “ON” at any time!

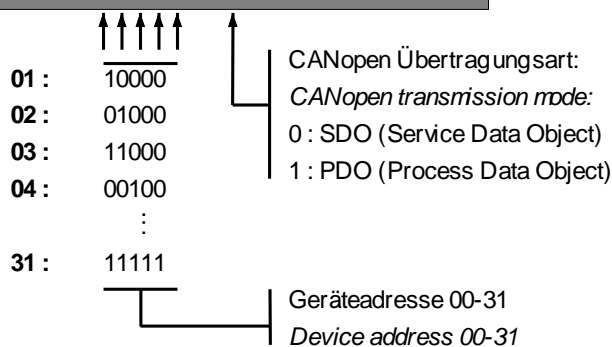
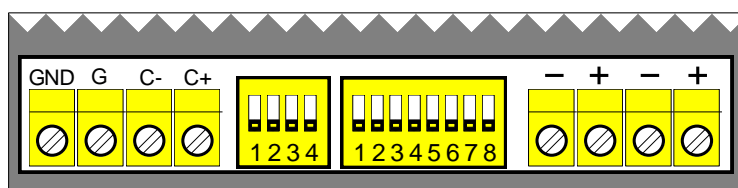
6. Setting of unit address and transmission mode

Sliders 1-5 of the 8-position DIL switch select the unit address (01-31).

Slider 8 determines the CANopen transmission mode: Set to OFF, data is transmitted by SDO (Service Data Object, see chapter [7](#)). Set to ON, data is transmitted by PDO (Process Data Object, see chapter [8](#)).



Important note: All DIL switch settings are only read upon initialization and changes during normal operation will not be recognized! After change of DIL switch settings, the unit must be powered up again!



7. Data transmission by SDO (Service Data Object)

[DIL switch slider 8 = OFF]

The unit requests the display value by an SDO (Service Data Object) read request and transmits the preset value (CA541 only) by an SDO write request. Within the next 2.5 sec (Timeout) a corresponding read or write response is awaited.

The unit operates similar to a CANopen master (But it is not a master!). Therefore, the selected unit address must match with the target device. No other CANopen communication objects are supported, except the SDOs.

Transmit SDO:

Identifier:	Data-Byte 0	Data-Byte 1	Data-Byte 2	Data-Byte 3	Data-Byte 4	Data-Byte 5	Data-Byte 6	Data-Byte 7
SDO1: 1536 (600h) + unit adress SDO2: 1600 (640h) + unit adress	Command specif ier: 23h= Write request 40h= Read request	(low) Index (high): (= 5FFFh - Code)		Sub- Index	(low)	32Bit data		(high)

Receive SDO:

Identifier:	Data-Byte 0	Data-Byte 1	Data-Byte 2	Data-Byte 3	Data-Byte 4	Data-Byte 5	Data-Byte 6	Data-Byte 7
SDO1: 1408 (580h) + unit adress SDO2: 1472 (5C0h) + unit adress	Command specif ier: 60h= Write response 4xh= Read response	(low) Index (high): (= 5FFFh - Code)		Sub- Index	(low)	32Bit data		(high)

The register codes to be accessed in the target unit refer to LENZE series 9300 drives. Other code classifications are possible on demand at any time.

Slider 7 of the 8-position DIL switch selects transmission of data on parameter channel 1 (SDO 1) or parameter channel 2 (SDO 2). Thus it is possible to connect two display units to one target unit without disturbing each other (Version CA34002A and later).

The code of the register to be displayed and the code of the register to be Set are requested from register code 473 of the target unit. When transmitting on parameter channel 1 (SD01) Subcode 3...6 is used, transmitting on parameter channel 2 (SD02) Subcode 7...10 is used.

Therefore, it is possible to display respectively to preset two different values of one target device by using two display units running on different parameter channels (Version CA34002A and later).

The values of register code 473 have to be organized like shown in the following table:

Subcode 5 (SD01) / Subcode 9 (SD02):
Code of register to be displayed
Subcode 6 (SD01) / Subcode 10 (SD02):
1. figure = 0: Display value without factor n: Display value x 10 000 (<i>Lenze data type FIX32</i>) n-1: decimal places are displayed**
2./3. figure = Display update time (x 100 ms)
4./5. figure = Subcode of display value
Subcode 3 (SD01) / Subcode 7 (SD02):
Code of register to be preset (only CA541)
Subcode 4 (SD01) / Subcode 8 (SD02):
1. figure = 0: Preset value without factor 1: Preset value x 10 000 (<i>Lenze data type FIX32</i>)
4./5. figure = Subcode of register to be preset

*) Register Code 473 is limited to +/-32768. Therefore a maximum of 2 decimal places can be displayed.

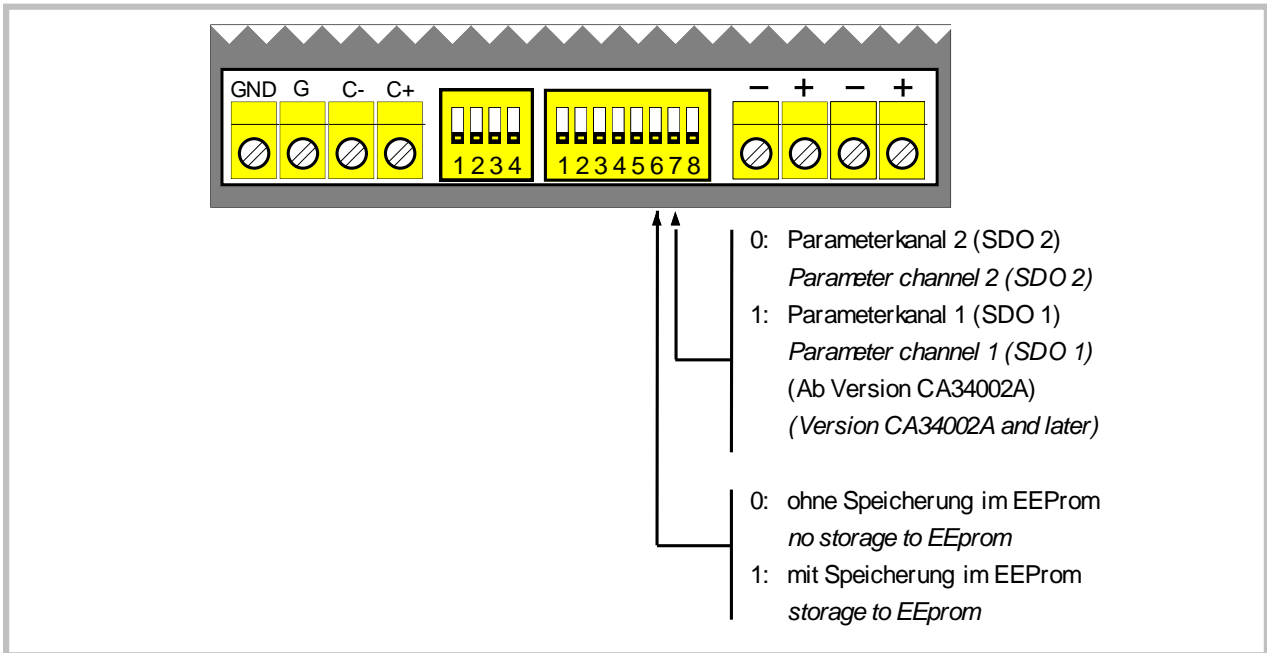
Example: You want to display register Code 472 / Subcode 19. That register contains 4 decimal places (x10 000), but you want to display only 2 decimal places. The display value shall be transmitted on parameter channel 2 with an update time of 500 ms..

This results in the following settings of register 473:

C 473 / 9 = **00472**
C 473 / 10 = **30519**

Where register code 473 contains invalid values, initialization will canceled off and error message E 016 will appear.

With the CA541, Position 6 of the 8-position DIL switch selects only temporary use of transmit data in the target device (no storage to EEPROM), or continuous use even after power down (nonvolatile storage to EEPROM by setting register Code C003 "Par. Save" to 1 after transmitting the value).



8. Datenübertragung als Prozessdaten mit PDO (Process Data Object)

[DIL switch slider 8 = ON]

The unit operates like a CANopen device corresponding to CiA DS 301 V4.01.

The unit receives the display value and transmits the BCD value (CA541 only) as 32 bit-data by PDOs (Process Data Objects).

After power on the unit enters CANopen state "Initialising". After successful initialization, the unit enters state "Pre-Operational". Now the unit is ready for CANopen communication and sends a Bootup-Message to the CANopen master:

Identifier:	Data-Byte 0
1792 (700h) + unit address	0

To start the PDO communication the NMT (Network management) message "Start Remote Node" has to be sent by the CANopen master device:

Identifier:	Data-Byte 0	Data-Byte 1
0 (NMT)	01 (Command specifier "Start Remote Node")	Geräteadresse <i>unit adress</i> oder 00 (Alle Geräte) <i>00 (all units)</i>

By that means the unit enters CANopen state „Operational“ and is ready for PDO data exchange.

Receive PDO:

Identifier:	Data-Byte 0	Data-Byte 1	Data-Byte 2	Data-Byte 3	Data-Byte 4	Data-Byte 5	Data-Byte 6	Data-Byte 7
synchronous: 512 (200h) + unit address	(low) 32 bit display data (high)				(low) 32 bit display data (high)			
asynchronous: 768 (300h) + unit address	(DIL switch pos. 7 = OFF)				(DIL switch pos. 7 = ON)			

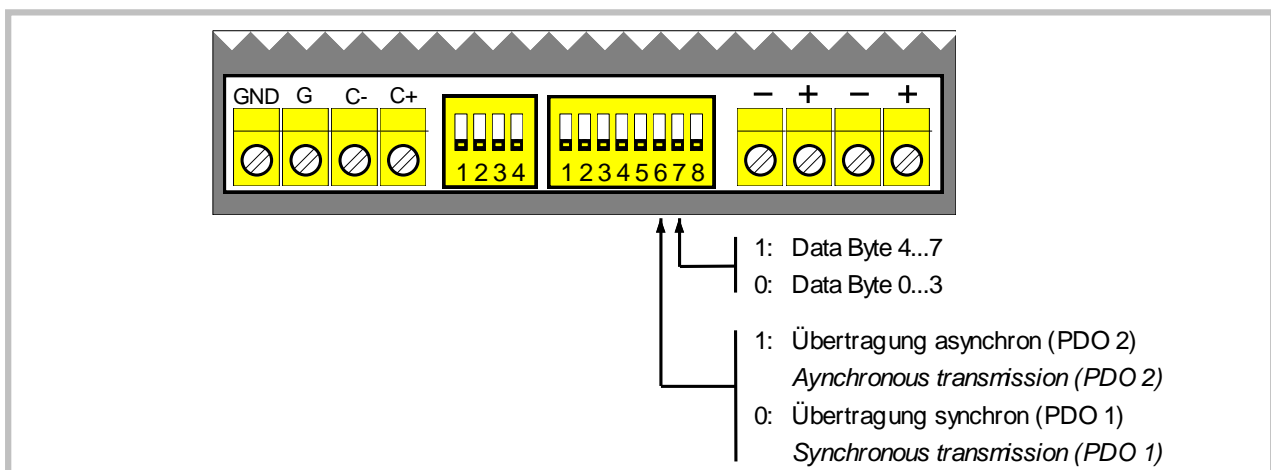
Transmit PDO:

Identifier:	Data-Byte 0	Data-Byte 1	Data-Byte 2	Data-Byte 3	Data-Byte 4	Data-Byte 5	Data-Byte 6	Data-Byte 7
synchronous: 384 (180h) + unit address	(low) 32 bit BCD data (high)				(low) 32 bit BCD data (high)			
asynchronous: 640 (280h) + unit address	(DIL switch pos. 7 = OFF)				(DIL switch pos. 7 = ON)			

Slider 6 of the 8-position DIL switch selects asynchronous or synchronous PDO transmission.

- **Asynchronous PDO transmission:** The display value will be displayed immediately after reception of the corresponding PDO. The CA541 BCD data will be transmitted immediately after the pressing the Enter-button.
- **Synchronous PDO transmission:** The display value received by PDO will only be displayed after reception of SYNC message sent by the master. The CA541 BCD data is latched when pressing the Enter-button and transmitted after reception of SYNC-Message.

Slider 7 allocates the display- and BCD-value to the lower or higher section of the PDO data bytes.



Decimal Place: If required, a decimal point can be set by SDO with index 5100hex / Subindex 0 (number of decimal places). However, the value will not be stored to non-volatile memory. Therefore the number of decimal places must be re-set on every power on.

Node Guarding: The CA340/CA541 provides CANopen Node Guarding. By this function the master can supervise the unit and detect any device breakdown.

The master can request a Node Guarding Message by sending a RTR (Remote Transmit Request) with the corresponding identifier to the slave unit.

Node Guarding request by master:

Identifier:	RTR-Bit
1792 (700h) + unit address	1

Node Guarding Message of unit:

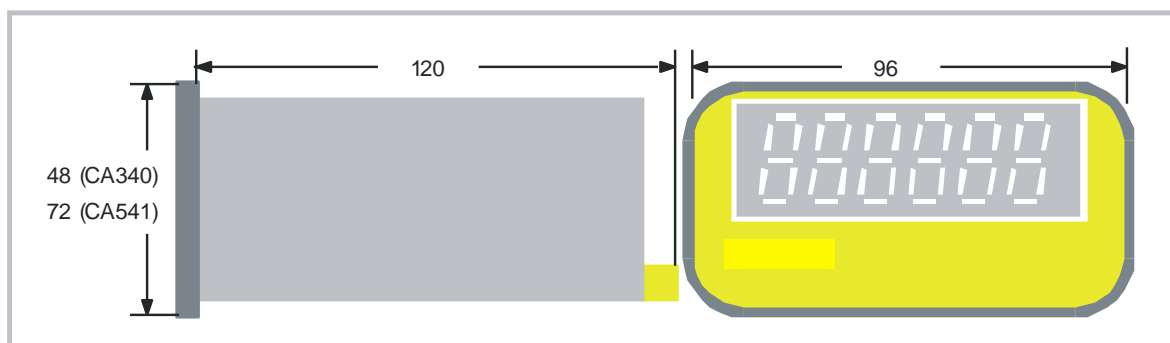
Identifier:	RTR-Bit	Data-Byte 0	
		Bit 7	Bit 6...0
1792 (700h) + unit address	0	Toggle Bit	State:
		0 ↔ 1	04h = Stopped 05h = Pre-Operational 7Fh = Operational

The Node Guarding function becomes active after entering CANopen state „Pre-Operational“, i.e. after transmission of the Bootup-Message. The initial value of the toggle bit is 0. The toggle bit alternates with every Node Guarding message.

9. Error Messages

Message:	Meaning:
"-----"	Invalid display value - during initialisation - while waiting for response - when display value range exceeded
E 001:	CAN Busoff: serious bus disturbance, CAN communication switched off (Reset only by power up)
E 002:	CAN warning (CAN error counter has exceeded warning limit): - unit is the only working device on the bus and gets no acknowledge or - light bus disturbance (non-fatal error, communication is being continued)
E 003:	No write response to preset value
E 004:	No write response to "Store EEPROM"
E 005: E 006: E 007:	Error response to preset value or "Store EEPROM": - wrong code - wrong subcode - no access
E 008:	No read response to display value request
E 009: E 010: E 011:	Error response to display value request: - wrong code - wrong subcode - no access
E 012:	No read response during initialisation
E 013: E 014: E 015:	Error response during initialization: - wrong code - wrong Subcode - no access
E 016:	Initialization error

10. Dimensions



11. Technical Specifications

Power supply:	Input voltage: 10 ... 35 VDC Protection circuit: reverse polarity protection Consumption: approx. 70 mA (at 24 V) Connections: screw terminal, 1,5 mm ² / AWG 16
Bus connection:	Communication profile: DIN ISO 11898, CANopen (CiA DS301) Available EDS files: CA340.eds / CA307.eds / CA541.eds Baud Rates (selectable): 10, 20, 50, 125, 250, 500, 1000 kbit/s
BCD switch (CA 541):	Adjustment range: 0 ... 999 999 (standard) - 99 999 ... + 99 999 (Option VZ000)
Display:	Range: - 99 999 ... 999 999 Type: LED, red, seven segments Digit height: 14 mm / 0.551" Number of digits: 6
Housing:	Material: plastic Mounting: panel Dimensions: CA340: outer dimensions (w x h x d): 96 x 48 x 149 mm / 3.78 x 1.89 x 5.87 inch CA541: cut out (w x h): 92 x 43 mm / 3.62 x 1.69 inch outer dimensions (w x h x d): 96 x 72 x 149 mm / 3.78 x 2.83 x 5.87 inch cut out (w x h): 92 x 67 mm / 3.62 x 2.64 inch Protection class: CA340: front side: IP 44 / rear: IP20 CA541: front side: IP 40 / rear: IP20 IP 65 (front side) is available as an option Weight: CA340: approx. 270 g CA541: approx. 350 g
Temperature range:	Operation: 0 °C ... +45 °C / +32 ... +113 °F (not condensing) Storage: -25 °C ... +70 °C / -13 ... +158 °F (not condensing)
Conformity & standards:	EMC 2004/108/EC: EN 61000-6-2, EN 61000-6-3, EN 61000-6-4 Guideline 2011/65/EU: RoHS-conform