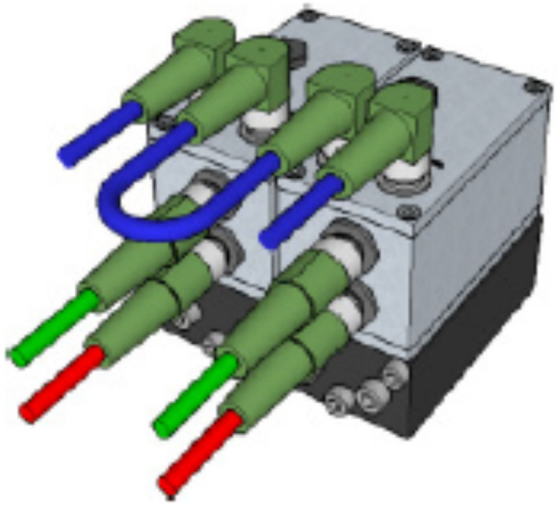
Manual for

ODC CANopen

Universal On-Board and Stand-Alone Digital Amplifier and Controller

Applicable for SW Versions
V2.2x*
V2.8x*
x = 1, 2 …
*** = d, e …**



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Revision History

Revision	Date	Description
Released	23.02.2017	Revision R1.0 released
Released	22.03.2017	Few changes VB
Released	27.03.2017	Info SDO parameters in PreOperational mode
Released	04.03.2017	Added Quick Start
R1.0	15.09.2017	General review
R1.0	11.10.2018	Minor additional comments in “Startup, DSM “DISABLE”
R1.1	27.05.2019	Chapter 2.8.3. Connection description of X101 corrected. Pin 2 +3 switched.
R1.1	27.05.2019	Bit-Description 0x1400 and 0x1800 extended,
R1.1	27.05.2019	Table 297: Object Dictionary corrected.. Header “Preoperational Access” changed to “Operational Access”.
R1.2	29.05.2019	The object 0x1800 (COB-ID of the 1st TxPDO) is defined as non volatile, but the V2.22a does not store this object in the EEPROM. This bug is fixed in V2.22b. Also the object 0x1016 (Heartbeat) is now a non volatile object. Table 297: Items in column “access”, “non volatile” corrected.
R1.3	3.09.2019	Diagram /circuit for digital output corrected.
R1.4	18.10.2021	Corrected Description of 0x505F and following. (changed type of access from ro to rw)
R1.5	22.01.2022	Side Connector for Solenoids added
R1.5	03.02.2022	Adding In explanation object 0x1F80 NMT startup
R1.5	01.07.2022	Status LED display rework
R1.6	31.08.2022	Communication error handling while startup the device added
R1.6	08.09.2022	Version V 2.81 integrated, CAN error handling since “d” Version updated. New section included: 6 Reset the CANopen parameter to default values **Fehler! Textmarke nicht definiert.**
R1.7	11.01.2023	Details added for NMT “stopped remote mode”

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1 General information

1.1 About this manual

This document describes the CAN field bus interface of the HCS digital amplifier.
It describes and explains the general structure of the CAN field bus interface and in a second part the device specific profile for hydraulic valves will be explained.
All parameters follow the common CANopen communication profile CiA 301 / CiA 301-1 / CiA 305 and the device specific CANopen profile "Device profile fluid power technology proportional valves and hydrostatic transmissions", CiA 408 released by the CAN in Automation (CiA) organization.

This document is not a replacement for the CANopen standards as listed in the references.
□ Chapter "1.4 References", page 12

This manual was prepared with great care and the contents reflect the author's best knowledge. However, the possibility of error remains and improvements are possible. Please feel free to submit any comments regarding errors or possibly incomplete information to HCS GmbH.

1.1.1 Reservation of changes and validity

The information contained in this manual is valid at the time of this version's release. See footer for version number and release date of this manual.
We reserve the right to make changes to this manual at any time without specified reasons.

1.1.2 Completeness

This manual is complete only when used in conjunction with the product related hardware and software documentation required for the relevant application.

1.1.3 Place of storage

This manual and all other associated documentation for hardware and software must always be kept in a location where they will be readily accessible and close to the amplifier or the equipment in which it is installed.

1.1.4 Warranty and liability

This manual only describes the functionality and influence of the parameters. The described software functionality can be used in various amplifier models which can be implemented in a vast range of applications. Hence it is not possible to assume liability for the influence of the parameters. Please refer to the safety instructions and remarks in the related operating instructions.

1.1.5 Typographical conventions

⚠ DANGER

Identifies safety instructions that are intended to warn of an immediate and impending danger to life and limb.
Failure to observe these safety instructions will inevitably lead to death, serious personal injury (disablement)!

⚠ WARNING

Identifies safety instructions that are intended to warn of potential danger to life and limb.
Failure to observe these safety instructions might lead to death, serious personal injury (disablement)!

⚠ CAUTION
Identifies safety instructions that are intended to warn of slight personal injury. Failure to observe these safety instructions might lead to slight personal injury.

NOTICE
Failure to observe this safety notice can result in property damage!

Identifies important information

●/ -	Identifies listings
□	Identifies references to another chapter, page, table or figure in this manual
blue text	Identifies a hyperlink within the PDF file
1., 2., …	Identifies steps in a procedure that should be performed in consecutive order
'STATE'	Identifies states of a state machine
«ES»	Identifies LEDs of the amplifier (for example, «ES»)
< >	Identifies a parameter name
"…"	Used for references

1.2 Structure of warning notices

(1) ⚠ DANGER (2)
Moving machine parts! (3) Entrapment hazard! (4) □ Do not enter danger zone! (5)

Legend:

1	Warning symbol
2	Signal word
3	Type and source of hazard
4	Possible consequences if a potential hazard
5	Hazard prevention measures

1.3 Selection and qualification of personnel

Only qualified users may work with the amplifier. Qualified users are properly trained experts with the required knowledge and experience. In particular, these experts must have the authorization to bring into operation systems and power circuits in accordance with safety engineering standards. They must be familiar with safety concepts common in automation.

1.3.1 Service and repair

⚠ WARNING

Do not attempt - under any circumstances - to repair the product yourself

After repair, certain adjustments and test procedures must be performed; this can only be made by qualified and authorized personnel. Products that need repair can be sent to the addresses:
See □ Chapter "10 HCS distributors and partners", page 147

Please enclose a detailed description of the error, malfunction or failure with the sent item and state the serial number and the purchase date. This will speed up the process and guarantees a fast and reliable repair.
See □ Chapter "10 HCS distributors and partners", page 147

In the case of a fault or a malfunction, your distributor can give you instructions on the phone or in writing before accepting a repair order. For service and repair, we offer experienced and qualified personnel. In case you need our assistance, please contact the address:
See □ Chapter "10 HCS distributors and partners", page 147

1.3.2 Cleaning, storage, transport

The product should only be transported and stored in the original packaging to ensure suitable protection against mechanical damage as well as electrostatic discharge.
If it should be necessary to clean the amplifier, we recommend sending it back to the manufacturer or any distributor and partner:
See □ Chapter "10 HCS distributors and partners", page 147

⚠ CAUTION

Unpacking and handling should be left to suitably trained personnel.
Beware of damaging the module by electrostatic

1.3.3 Delivery state (default setting)

The product is shipped in a ready-to-use state (default settings). After correct installation and setting of all parameters relevant for the application, the amplifier module is ready for use.

1.4 References

In this chapter you will find information about standards for CAN, CANopen and the used device profile. In the following table you see all relevant organizations for standardization.

ISO	International Organization for Standardization 1, ch. de la Voie-Creuse, Case postale 56 CH-1211 Geneva 20 http://www.iso.org
IEC	International Engineering Consortium 233 S. Wacker Drive, Suite 8400 Chicago, IL 60606-6338 USA http://www.iec.org
CiA	CAN in Automation Kontumazgarten 3 DE-90429 Nuremberg http://www.can-cia.org
VDMA	Verband Deutscher Maschinen- und Anlagenbau e.V. Lyoner Strasse 18 60528 Frankfurt/Main http://www.vdma.org

1.4.1 CAN field bus

The CAN field bus interface provides a connection to the amplifier using standard CAN frames according to ISO 11898-1…3 and ISO 11898-5.

CiA 301	CANopen application layer and communication profile CiA 303
CiA 303-1	Cabling and connector pin assignment
CiA 305	Layer setting services (LSS) and protocols
ISO 11898-1	Road vehicles -- Controller area network (CAN) -- Part 1: Data link layer and physical
ISO 11898-2	Road vehicles -- Controller area network (CAN) -- Part 2: High-speed medium access unit
ISO 11898-3	Road vehicles -- Controller area network (CAN) -- Part 3: Low-speed, fault-tolerant, medium-dependent interface
ISO 11898-5	Road vehicles -- Controller area network (CAN) -- Part 5: High-speed medium access unit with low-power mode

1.4.2 Device Profile

VDMA Profile Fluid Power	Device profile for Proportional Valves and Hydrostatic Transmissions VDMA Profile Fluid Power Technology Version 1.6
CiA 408 or Device Profile Fluid Power	CiA 408 Device profile for fluid power technology proportional valves and hydrostatic transmissions, Version 2.0

1.5 Definitions

1.5.1 Internal resolution (iR)

The internal resolution is 16383 (0x3FFF) at 100 % and –16383 (0xC001) at –100 % of the value range.

1.5.2 Abbreviations

Abbreviation	Explanation
AC	Alternating Current
CAN	Controller Area Network
CANopen	ISO/OSI Layer 7 protocol, specified by CAN in Automation (CiA)
CiA	CAN in Automation
COB-ID	Communication Object Identifier
DAC	HCS digital amplifier controller (19“ Rack)
DC	Direct Current
DMA	HCS digital module amplifier (DIN rail module)
DSM	Device State Machine
DSP	Digital Signal Processor
DSV	Device specific value
EDS	Electronics Datasheet, containing a description of the CANopen object dictionary
EEPROM	Electrically erasable programmable read-only memory
EMCY	CANopen Emergency protocol
iR	Internal resolution defined by CiA 408
ISO	International Engineering Consortium
LED	Light Emitting Diode
LVDT	Linear Variable Differential Transformer used to measure the valves spool position
NMT	Network management according CANopen
NS	Network Status
OD	Object Dictionary
ODC	HCS digital onboard amplifier (aluminum housing package)
P	Proportional gain element
PD	Proportional derivative element
PDO	Process Data Object
PE	Protective earth / Electrical grounding
PT1	Proportional first order lag element
ro	Read only
rw	Read write
RxPDO	Receive Process Data Object
RxPDO remote	Receive Process Data Object remote
RxSDO	Receive Service Data Object
SDO	Service Data Object
TR	State transmission of the valve application state machine
TxPDO	Transmit Process Data Object
TXPDO remote	Transmit Process Data Object remote
TxSDO	Transmit Service Data Object
URL	Uniform Resource Locator / Internet address
VDMA	Verband Deutscher Maschinen- und Anlagenbau e.V.
Wo	Write only
Xn	Physical connector n for electrical connection

Table 1: Abbreviations

2 Technical data

2.1 Supply Voltage

12 VDC -10%.. 24VDC +20 %
Supply current 150 mA @ 24 VDC (estimated, solenoid deactivated)

2.2 Operating ambient temperature

-40 deg C to +55 deg C , higher temperature range on request.

2.3 Mechanical and connection

Protection class: IP67 – up to IP67k on request.
Connection with M12 connectors – others on request

2.3.1 Analogue Inputs

Analogue1, Analogue2, Analogue 3 (Valve FB)

- Feedback signal or set value (depending on SW Version) configurable by parameter.
  10 V; 0 ... 10 V; 0 ... 20 mA; 4 ... 20 mA; 5 V ± 5 V; 5 V ± 4,5 V…..
  Differential voltage and current input applicable.
- Voltage input resistance 240 kΩ
- Current shunt 205R.
- With or without cable fracture detection – selectable by parameter when applicable
- Timer input, can be used as PWM set value, pulse FB

2.4 CAN Interface

With CANopen protocol. Baud rate and CAN address defined by parameter.

- 1 CAN-Bus according to ISO11898
- CAN-Baud rate adjustable up to 1 Mbit
- node number adjustable from 1 .. 127
- CANopen draft standard DS301 V4.0 / DS401 V2.1
- 1 receive / 1 transmit PDOs
- 1 SDO server
- PDO event timer
- PDO inhibit timer
- PDO transmit modes: event triggered, synchronous, asynchronous, cyclic, anticyclical
- variable PDO identifier
- dynamic PDO mapping
- emergency
- node guarding / lifeguarding / heartbeat
- EDS file

2.5 Programming PC Interfaces

Onboard USB interface in cooperation with HCSTool or hyperterminal.

2.6 Inputs

Digital Input, normally used as enable signal.
For more information see
□ Chapter "4.7 Digital inputs", page 126

2.7 Outputs:

- Current outputs: for two solenoids of up 0,8 A
  (maximum current defined by parameter)
- Switched output: Output for supply of (external) sensor electronic
  24 V / 100 mA, internal overload protection (Mutifuse). Can also used as error indication, selectable by parameter
  □ Chapter "127 Digital outputs", page 127
- Internal supply output: Output for internal sensor or potentiometer
  10 V /10 mA, current limited. (Output voltage defined by hardware revision)
- Error output DC: Output for used in daisy chain application. An external resistor is recommended for error indication. In case of error this line is connected to ground with 1K input resistance.
  □ Chapter "127 Digital outputs", page 127

2.8 Top M12 connector definition

2.8.1 Connection diagram

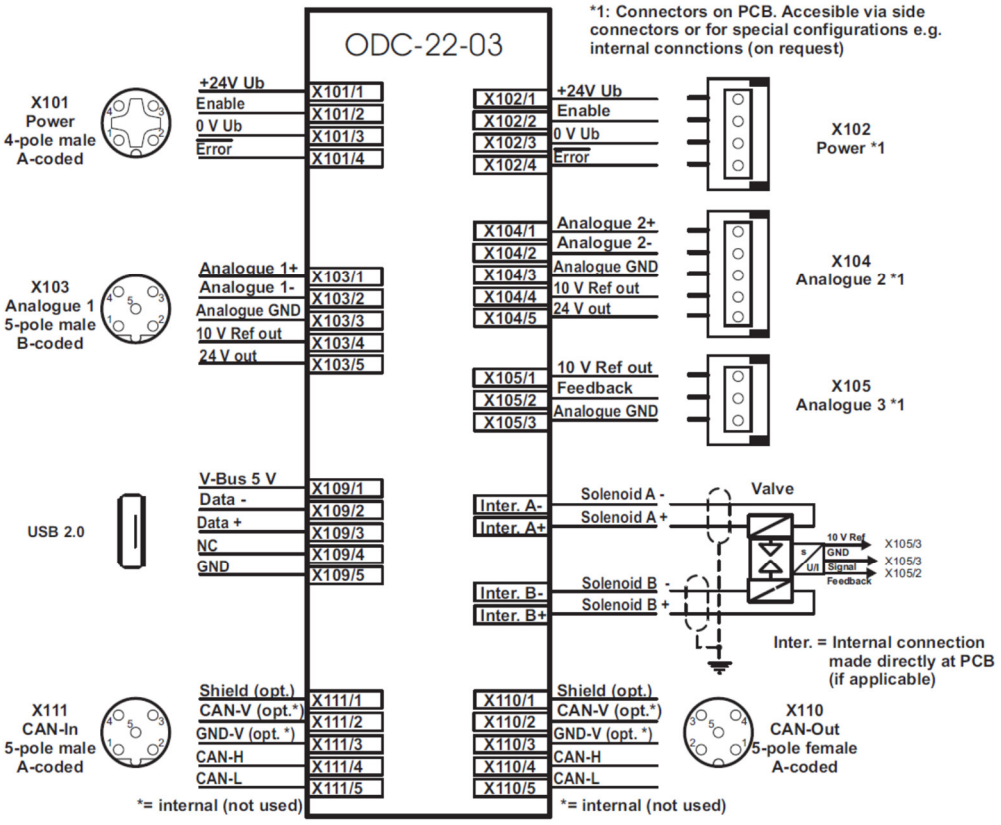


Figure 1 : Connection diagram

2.8.2 Connector position layout

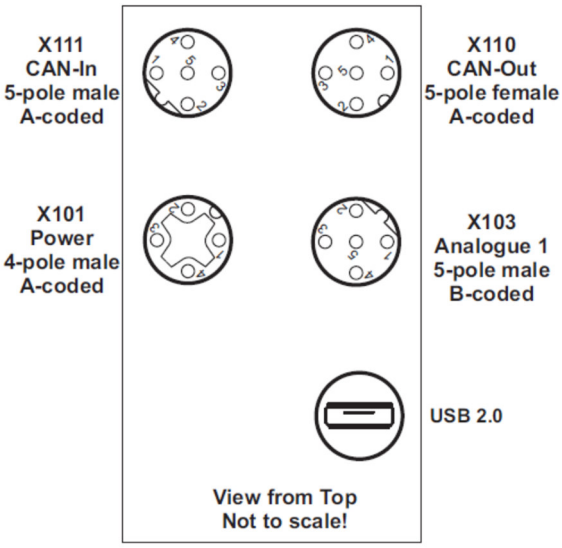


Figure 2 : Connector position layout

2.8.3 Power, Error, Enable (X101)

4pol., Female, A-coding
1 = 24V, 12V-10%...24V+20%
2 = Enable input.
3 = 0V
4 = Error output DC, for daisy chain

2.8.4 Analogue1 input (X103)

5pol., Male, B-coding
1 = External FB1+
2 = External FB1- (if not bridged internal to Analog GND) or Timer Signal input (defined by HW)
3 = Analog GND
4 = 10V Ref output
5 = Switched output 24V

2.8.5 CanOpen (X110,X111)

Input: Phoenix 5pol. Male-A coding
Output: Phoenix 5pol. Female-A coding

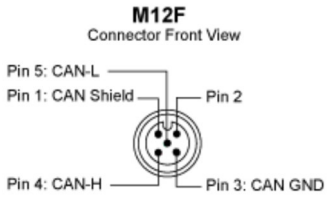


Figure 3 : Connection example

2.9 Additional side M12 connector definition

2.9.1 Power, Error, Enable (X102)

1 = 24V, 12V-10%...24V+20%
2 = 0V
3 = Enable input.
4 = Error output DC, for daisy chain

2.9.2 Analogue2 input (104)

1 = Set value S6+, External FB2+
2 = Set value S6-, External FB2- - (if not bridged internal to Analog GND) or Timer Signal input (defined by HW)
3 = Analog GND
4 = 10V Ref output
5 = Switched output 24V-

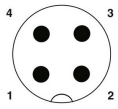
2.9.3 Analogue3 (Valve FB) input (X105)

1 = 10V Ref output
2 = Valve FB, ground based
3 = Analog GND

2.9.4 Valve Solenoids (X106)

1 = Valve B-
2 = Valve A-
3 = Valve B+
4 = Valve A+

M12F A-coding
Frontview



2.10 Possible connector options (on customer request)

Options are only possible by hwardware changes !
The possibility of some options is depending on the combination of all needed options.

Usage	Option 1	Option 2	Option 3	Connector	PIN
Power M12, 4 pol. A Male	Power +24V (12V -10% ...24V+20%)	-	-	X101	1
	Enable Input	-	Timer PT0/PT3 Input (PWM, pulse...)		2
	Power 0V	-	-		3
	Error Output	+24V Output (switched)	Timer PT0/PT3 Input (PWM, pulse...)		4
	Shield	-	-		Case
Power (for side connectors)	Power +24V (12V -10% ...24V+20%)	-	-	X102	1
	Enable Input	-	Timer PT0/PT3 Input (PWM, pulse...)		2
	Power 0V	-	-		3
	Error Output	-	Timer PT0/PT3 Input (PWM, pulse...)		4
Analog1 (U/I) M12, 5 pol. B Male (Set-,FB- Input)	Set/FB Value1+ (Differential)	Set/FB Value1+ (AGND based)	Set/FB Value1+ (Base to supply voltage/2)	X103	1
	Set/FB Value1- (Differential)	Set/FB Value2+ (AGND based)	Timer PT0/PT3 Input (PWM, pulse...)		2
	AGND	-	-		3
	+10V Ref Output	-	-		4
	+24V Output (switched)	+24V Output	Timer PT0/PT3 Input (PWM, pulse...)		5
	Shield	-	-		case
Analog2 (U/I) (for side connector) (Set-, FB- Input)	Set/FB Value2+ (Differential)	Set/FB Value2+ (AGND based)		X104	1
	Set/FB Value2- (Differential)	Timer PT0/PT3 Input (PWM, pulse...)			2
	AGND	-			3
	+10V Ref Output	-			4
	+24V Output (switched)	+24V Output	Timer PT0/PT3 Input (PWM, pulse…)		5

Table 2: Connection definition, part 1

Usage	Option 1	Option 2	Option 3	Connector	PIN
Analog3 (U) (Int/Ext Valve)	+24V Output	+10V Ref Output	-	X105	1
	Int FB+ (AGND based)	-	-		2
	AGND	-	-		3
BUS M12 male (CanOpen) 5 pol. A (Profibus) 5pol. B (Profinet) 4 pol. D	(CanOpen) -	(Profibus) PB-5V	(Profinet) TD+	X111	1
	-	PB-	RD+		2
	Power 0V/open	PB-GND	TD-		3
	CAN-H	PB+	RD-		4
	CAN-L	-	not used		5
	Shield	Shield	Shield		case
BUS M12 female (CanOpen) 5 pol. A (Profibus) 5pol. B (Profinet) 4 pol. D	(CanOpen) -	(Profibus) PB-5V	(Profinet) TD+	X110	1
	-	PB-	RD+		2
	Power 0V/open	PB-GND	TD-		3
	CAN-H	PB+	RD-		4
	CAN-L	-	not used		5
	Shield	Shield	Shield		case

Table 3: Connection definition, part 2

2.11 Connection possibilities

2.11.1 CAN and top connector

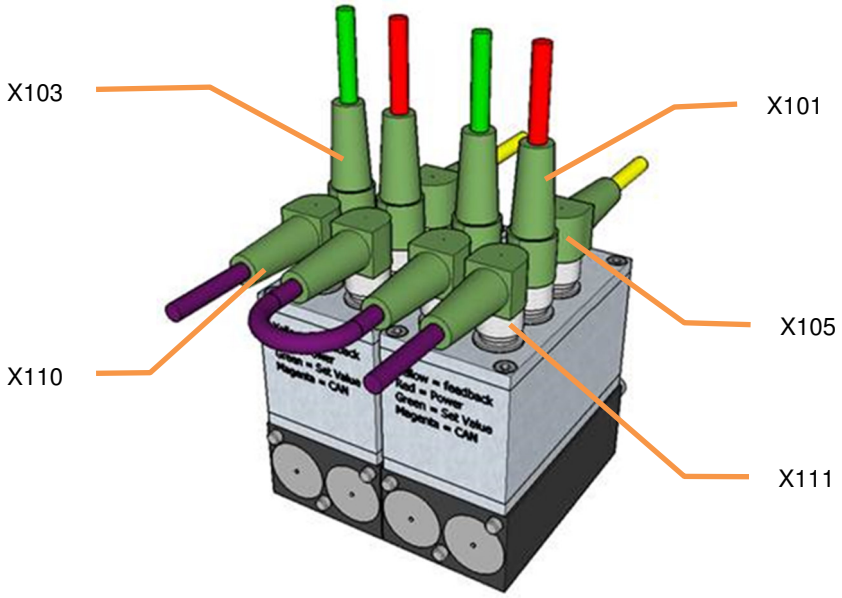


Figure 4: Connection example, Top connection

2.11.2 CAN an side connector

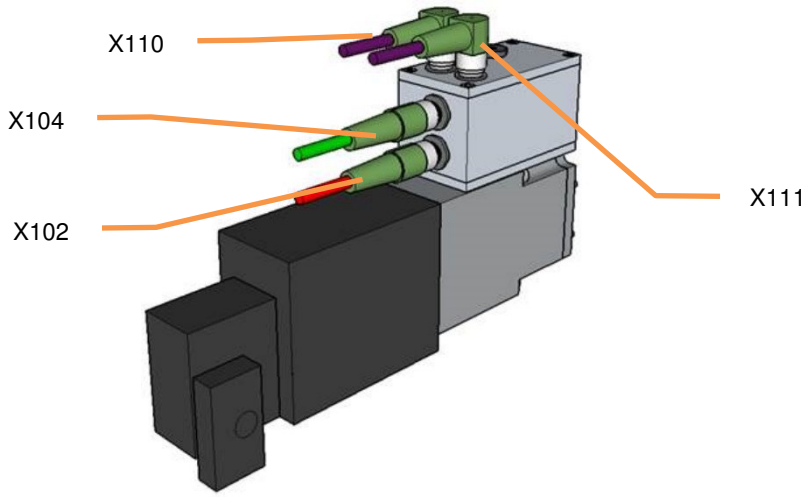


Figure 5: Connection example, side and top connection

2.12 Technical data overview

Feature	Range, characteristics
Supply voltage	12 V - 10 % ... 24 V + 20 %, residual ripple < 10 % (max. 50 VA power draw) Power consumption approx. 150 mA @ 24 V (solenoids deactivated)
Solenoid system selection	0.15 A; 0.24 A; 0.50 A; 0.63 A; 0.80 A (intermediate values adjustable; other on request)
Control voltage for digital input	(12) 24 V +/- 10 %, residual ripple < 10 %, current draw < 20 mA
Temperature ranges *1	Ambient: - 25° C ... + 80° C; storage - 40° C ... + 105° C
EMC	In accordance with applicable standards (CE); Germanischer Lloyd VI-7-2 on request IEC 60533: 11/2010 EMC, Civil ship (General Zone) EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-4-16 Surge: 55V 30ms Isolation between housing and connector terminals > 10 MΩ (50V DC)
Analogue inputs (set values and/or feedback values)	Analogue1, Analogue2, Analogue 3 (valve feedback); Differential voltage and current input applicable with 12 bit resolution 0 ... +- 10 V, 5 V +- 5 V; 5 V +- 4,5 V, 0 ... 20 mA, 4 ... 20 mA; also poss.: 12 V +- 6 V Voltage input resistance 240 kΩ; current meas. shunt 205 Ω With or without cable fracture detection – selectable by parameter when applicable Timer input, can be used as PWM set value, pulse feedback
Digital input	1 digital input (Enable)
Solenoid current (output)	2 output stages, each for up to max. 1.0 A (with over-energ. and quick de-energization);
Digital output	1 output, voltage level 0 V / 24 V, 10 mA (ERROR)
Reference output	1 Reference output 10 V (max. 20 mA), short circuit protected
Analogue output	1 Analogue output 0 ... + - 10 V (max. 5 mA)
Supply output f. (external) sensor	24 V / 100 mA; overload protected (Mutifuse). Can also be used as error indication
Interface 1	USB 2.0 with USB micro connector
Interface 2 (Versions with Bus-Interf. only!) CANopen	CAN field bus interface provides a connection to the amplifier using standard CAN frames according to ISO 11898-1...3 and ISO 11898-5 (CiA 301; CiA 202-1; CiA 305; ISO 11898-1; ISO 11898-2; ISO 11898-3; ISO 11898-5); baudrate and CAN address defined by parameter. For details refer to document: „ODC CANopen Specification Rxx) Device Profile: VDMA Profile Fluid Power; CiA 408 or Device Profile Fluid Power
Status signals	1 status LED's 2 colors at top lid (Run/OK; Enable, Error)
PWM frequency, cycle times	Approx. 22 kHz PWM frequency, cycle time 0,255 msec

*1: higher temperatures (storage or during operation) will reduce the life cycle of the product

Table 4: Electrical properties

Feature	Range, characteristics
Housing	Aluminum EN AW-6060 [AlMgSi] or EN AW-6082 [AlSi1MgMn] additional protected with treatment Main housing extruded profile cut to length and machined Bottom plate and top lid machined from blocks including form seals All screws in stainless steel (quality A4)
Main dimensions	l = 89,8; h = 53,5; w = 47 [mm] standard version without connectors
Vibrations	EN 60068-2-6: tests Fc: vibration sinusoidal 10g rms (10 -2000Hz; test 3 x 100h per axis)
Shock	EN 60068-2-27: tests Ea: shock 30g, 11ms, half sine
IP protection	EN 60529: max. IP69k (depending on connectors)
Salt spray	EN 60068-2-52 (IEC68-2-52) Level 1
Connection to application	M12 connectors (standard version); depending on configuration up to 6 connectors Position of connectors: 4 / 5 x M12 connectors top side; 2 x 2 connectors small side all depending on configuration or appliaction requirements Other possible connectors (on request): AMP junior timer; Deutsch; EN 175301-803 /Ex DIN 43650 (top side lid mounted) Cable glands M12 or M16 also available in stainless steel (small side mounted) Flying leads.
	Version „Hawe PSL/PSV“ --> direct ,ounting on twin solenoid and internally conencted Mounting on other solenoids on request Cable connection via cable glands, M12 connectors or flying lead possible

Table 5: Mechanical properties

3 Access over CANopen

3.1 Introduction

CANopen is a communication protocol and device profile specification for embedded systems used in automation. In terms of the Open Systems Interconnection (OSI) model, CANopen implements the above layers and the network layer. The CANopen standard consists of an addressing scheme, several communication protocols and an application layer defined by specific device profiles. The communication protocols have support for network management, device monitoring and communication between nodes. The lower level protocol implementing the data link and physical layers is usually Controller Area Network (CAN). The basic CANopen application and communication profiles are given in the CiA 301 specification released by CAN in Automation (CiA). The device profiles for different devices are built on top of this basic profile.

3.2 Device profiles

The German Engineering Federation (VDMA), together with the manufacturers of hydraulic devices, have developed the "profile for fluid power technology". This profile defines common functionality and parameters for the communication of hydraulic components via field bus in a standardized format across manufacturers. This profile is implemented in all HCS amplifier with field bus interface. The CiA organization transformed the bus-independent device profile from the VDMA to the CANopen specific device profile CiA 408 "Device Profile Fluid Power Technology - proportional valves and hydrostatic transmissions". The device profiles describe the application parameters and the functional behavior of the devices including the device class-specific state machines. For many device classes, field bus technology already offers reliable device profiles for example for generic I/O-modules (CiA 401), drives and motion control (CiA 402) or for fluid power technology, proportional valves and hydrostatic transmissions (CiA 408). Users should be familiar with the associated profile.

3.3 CANopen slave reference model

The architecture of the CANopen stack with Physical Layer (Phy), Data Link Layer (DL) and Application Layer (AL) was taken from the ISO Reference Model (ISO/IEC standard 7498-1:1994). Layers three to six of this 7-layer reference model were not implemented, as these layers are intended for exchanging and sending telegrams. In a real-time field bus system, such functionalities are not required. The CANopen communication concept can be described similar to the ISO/OSI reference model.

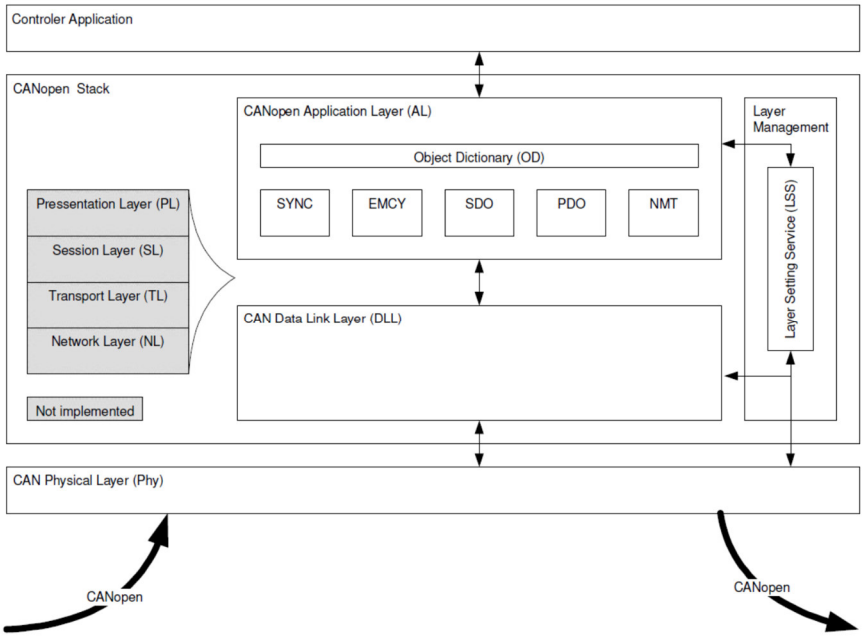


Figure 6: CANopen slave reference model

CANopen is based on the CAN data link layer and high-speed transceiver as specified in ISO 11898. CANopen specifies in CiA 303-1 the bit-timing and recommends connectors and their pin-assignments. CANopen represents a standardized application layer and communication profile as defined in CiA 301. The CiA 305 specifies the layer setting services (LSS). These protocols are used to inquire or to change the settings of the physical layer, data link layer and application layer on a device.

Layer	Description	References CAN / CANopen
Layer 7	Application layer	CiA 301 (CANopen application layer and communication profile) CiA 305 (CANopen LSS)
Layer 6	Presentation layer (not implemented)	
Layer 5	Session layer (not implemented)	
Layer 4	Transport layer (not implemented)	
Layer 3	Network layer (not implemented)	
Layer 2	Data link layer	ISO 11898-1 (CAN) CiA 305 (CANopen LSS)
Layer 1	Physical layer	ISO 11898-1/2/3/5 (CAN) CiA 303-1 (CANopen Additional Specification)

Table 6: CANopen slave reference model

3.4 ODC Connection example

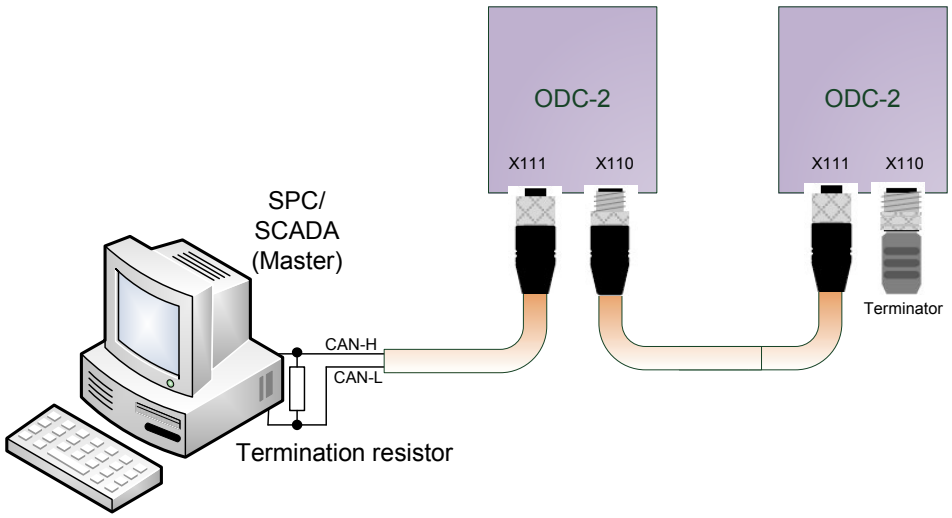


Figure 7: Connection example with termination

3.5 CANopen objects

A CANopen object is a set of CANopen parameters with the same index and object name. It consists of one or more parameters and their values. Objects are grouped in thematic blocks.

3.5.1 Parameter value

A parameter value is a real value stored in the amplifier with the attributes of the parameter explained in the next chapter.

3.5.2 Parameter and their attributes

A parameter is an abstract representation of a particular parameter value within a CANopen object dictionary in a device. Parameters are described in this document in the following tabular form:

Block name							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default

If the standard setting differs from the standard firmware V2.2x*, this is specifically noted with the corresponding firmware.

In the parameter list in chapter "0

Object dictionary, page 130" you will find a form like the following one in which the attributes are explained in detail:

Column name	Description
Block name	Describes the family of the object. If the object does not belong to a block, the object name is taken as block name.
Index	16 bit index that addresses the entry in the object dictionary. In case of a simple variable this references the value of this variable directly. In case of records and arrays, the index addresses the whole data structure. Then the 8 bit sub-index allows access to individual elements in the structure.
Sub-index	If the object is defined as a record or array, the sub-index defines an element in the structure.
Parameter name	Defined name of the parameter.
Data type	Data type of the parameter. INTn Integer with n bits FLOAT32 Floating point with 32 bit char Character (ASC II) STRING String of characters UINTn Unsigned integer with n bits DOMAIN Application specific data block
Access	Access permission for the parameter. rw Read and write allowed wo Write only ro Read only
non-volatile	Defines whether the parameter can be saved in non-volatile memory. If the persistence is set to "Y", the saved value stays in memory even after the device is turned off. Parameters not marked as persistent ("N") lose their settings after the device is turned off. The parameters with the access type "read only" are marked with "-". This means that the parameter cannot be changed by the user.
Range	Allowed value range for the object.
Default	Default values: The default values in this document are firmware preset values. These values can be changed during calibration or set up with model specific parameters during production of the amplifier. Factory settings: The factory settings are values which are set up model specific during production of the amplifier. These parameters no longer contain the firmware default preset values.

Table 7: Field bus independent attributes

The listed default values contain the firmware preset values and not necessarily the configuration of the delivered amplifier.

3.5.3 Units and prefix parameter

This chapter describes the coding of units and prefix parameters according to CiA 303-2. Some objects provide unit and prefix in the sub-indices 2 and 3 to allow the master controller the correct visualization.

Name of unit	International symbol	Notation index (hex)
None	Dimensionless or iR	0x00
Meter	m	0x01
Second	s	0x03
Hertz	Hz	0x20
Liter	l	0x44
Pascal	Pa	0x22
Watt	W	0x24
Volt	V	0x26
Minute	m	0x47
Hour	h	0x48
Day	d	0x49
Year	a	0x4A
bar	bar	0x4E
Meter per square second	m/s^2	0x55

Table 8: Unit representation

Prefix	Factor	Symbol	Notation index (hex)
none	10^{-0}		0x00
deci	10^{-1}	d	0xFF
centi	10^{-2}	c	0xFE
milli	10^{-3}	m	0xFD
	10^{-4}		0xFC

Table 9: Prefix representation

3.6 CANopen object dictionary (OD)

CANopen devices have an object dictionary, which is used for configuration and non-real-time communication with the device. It is essentially a grouping of objects accessible via the network. Each object within the object dictionary is addressed using a 16 bit index and an 8 bit sub-index. So an object can contain 256 parameters which are addressed by the sub-index. The object dictionary is structured in several index ranges. The classification of the object dictionary is defined in the CiA 301.

Index	Object name	Reference
0x0000	Not used	
0x0001…0x001F	Data types	CiA 301
0x0020…0x003F	Complex data types (not used) CiA 301	CiA 301
0x0040…0x005F	Manufacturer-specific complex data types (not used)	
0x0040…0x025F	Device profile specific data types (not used)	CiA 408
0x0260…0x03FF	Reserved for further use	
0x0400…0x0FFF	Reserved for further use	
0x1000…0x1FFF	Communication profile area	CiA 301 / IEC 61158-5-12
0x5000…0x5FFF	Manufacturer-specific area	HCS
0x6000…0x67FF	Standardized profile area 1st logical device	CiA 408
0x6800…0x9FFF	Standardized profile area 2nd…8th logical device (not used)	CiA 301
0xA000…0xAFFF	Standardized network variable area (not used)	
0xB000…0xBFFF	Standardized system variable area (not used)	
0xC000…0xFFFF	Reserved for further use	

Table 10: Structure of the CANopen object dictionary (OD)

3.7 CAN data link layer

The CAN data frame can carry up to 8 bytes data. The header has an 11 bit communication object identifier (COB-ID) used to address a CAN service. The lowest COB-ID has the highest transmission priority. 29-bit COB-IDs are not supported.

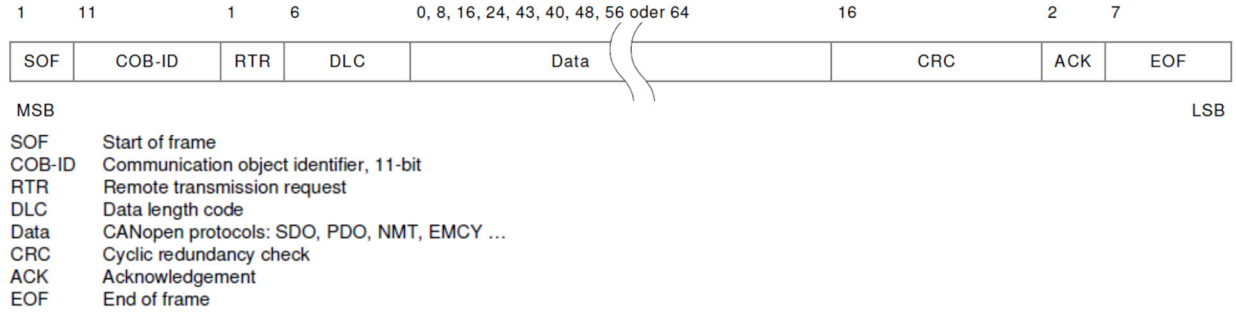


Figure 8: CAN data link layer

3.8 CAN bit rate and Node-ID configuration

The bit rate of the CAN bus communication can be changed to achieve a maximal transmission rate by a given length of the cable. Each node in the network has a unique Node-ID which must be configured before initial operation.
The Node-ID and the bit rate can be changed using:

- Service Data Objects (SDO)

The following standardized CANopen bit rates and maximum cable lengths can be configured:

- See also document CA63420-001 "User Manual Electrical Interfaces"

Baud Rate	Maximum cable length
20 kBit/s	2500 meter
50 kBit/s	1000 meter
125 kBit/s	500 meter
250 kBit/s	250 meter
500 kBit/s	100 meter
800 kBit/s	50 meter
1 Mbit/s	25 meter

Table 11: CANopen maximal bit rates, length depended

3.8.1 CAN bit rate and Node-ID configuration using SDO protocol

The bit rate and the Node-ID in the amplifier can be configured by the SDO protocol. Therefore two SDO objects were introduced.
When changing these settings, they will get active not before either a power-up or a NMT-reset communication are initiated. That makes sure that the CAN communication will not get interrupted by changing these basic settings.

3.8.1.1 Object 0x4200: Module identifier (Node-ID)

This parameter represents the CAN Node-ID of the amplifier. To activate the new Node-ID either a power up or a NMT-reset communication has to be initiated.

- NMT protocol CiA 203

□ Chapter "3.10.6 Reset communication command (COB-ID:0, CS:130)", page 34

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x4200	0	ModuleIdentifier	UINT8	rw	y	0..127	127

Attention, if the node-id is set to zero, the CanOpen module of the amplifier is deactivated.
Use the HCSTool to set the node id via parameter E 24 !

3.8.1.2 Object 0x4201: Bit rate

The bit rate will be configured in bits per second. To activate the new bit rate either a power-up or a NMT-reset communication has to be initiated.

- NMT protocol CiA 203

□ Chapter "3.10.6 Reset communication command (COB-ID:0, CS:130)", page 34

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x4201	0	Bitrate	UINT8	rw	y	1..7	3

Value description
The following standardized CANopen bit rates can be configured:

Bit Rate	Parameter value
20 kBit/s	1
50 kBit/s	2
125 kBit/s	3
250 kBit/s	4
500 kBit/s	5
800 kBit/s	6
1 Mbit/s	7

Table 12: CANopen bit rates

3.9 CANopen communication protocols

CANopen communication protocols are classified as follows:

- The real-time data are transferred with the process data object (PDO) protocol.
- The configuration parameters are transferred with the service data object (SDO) protocol.
- Special protocols provide application-specific network synchronization (SYNC) protocol, time stamping and emergency message (EMCY) protocol.
- The network management (NMT) protocol provides services for network initialization, error control and
- network status control.

Protocol	COB-ID	Description	SDO objects used for protocol configuration	Reference	Chapter
NMT	0x000	Network Management (NMT) protocol (Broadcast)		CiA 301	□ Chapter "3.10.1 Network management (NMT) protocol (COB-ID: 0x000, 0x700)", page 34
NMT	0x000+Node-ID	Network Management (NMT) protocol		CiA 301	
SYNC	0x080	Synchronization (Broadcast) protocol	0x1005	CiA 301	□ Chapter "3.9.1 Synchronization (SYNC) protocol (COB-ID: 0x080)", page 27
EMCY	0x080+Node-ID	Emergency protocol	0x1014	CiA 301	□ Chapter "3.9.1.1 Object 0x1005: SYNC protocol COB-ID configuration", page 27
TxPDO	0x180+Node-ID	1st Transmit PDO protocol	0x1800.0x1A00	CiA 301	□ Chapter "3.9.3 Process data object (PDO) protocol ", page 27
RxPDO	0x200+Node-ID	1st Receive PDO protocol	0x1400.0x1600	CiA 301	
SDO	0x580+Node-ID	Transmit SDO protocol	0x1200	CiA 301	□ Chapter "3.9.4 Service data object (SDO) protocol (COB-ID: 0x580, 0x600)", page 3127
SDO	0x600+Node-ID	Receive SDO protocol	0x1200	CiA 301	
NMT	0x700+Node-ID	Network Management (NMT) error control protocol (Bootup, Node Guarding)	0x100C, 0x100D, 0x1016, 0x1017	CiA 301	□ Chapter "3.10.1 Network management (NMT) protocol (COB-ID: 0x000, 0x700) ", page 34

Table 13: CANopen communication objects

3.9.1 Synchronization (SYNC) protocol (COB-ID: 0x080)

The SYNC protocol is a network wide system trigger generated by one CANopen device in the network. The SYNC protocol has a very high priority and has no data in order to guarantee a minimum of jitter. The SYNC protocol is sent by a sync producer and can trigger PDO transmissions in the sync consumer nodes when activated in the corresponding PDO transmission types.

□ Chapter "3.9.3.1.1 Object 0x1400: 1st RxPDO protocol configuration", page 28
□ Chapter "3.9.3.4.1 Object 0x1800: 1st TxPDO protocol configurationObject 0x1400: 1st RxPDO protocol configuration", page 29
□ Chapter "3.9.3.6 Object 0x4211: TxPDO trigger", page 31

3.9.1.1 Object 0x1005: SYNC protocol COB-ID configuration

This object defines the COB-ID of the sync object itself. The COB-ID is fixed to 0x80 and cannot be changed.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x1005	0	CobIdSyncMessage	UINT32	ro	-	0x80000080	0x80000080

Value description

<CobIdSyncMessage>				
Bit	31	30	29..11	10..0
Descrip.	Reserved	0: SYNC client 1: SYNC server (not implemented)	Reserved	11 Bit COB-ID (always 0x80)

Table 14: Possible values of parameter <CobIdSyncMessage> (0x1005)

3.9.2 Emergency (EMCY) protocol (COB-ID: 0x080+Node-ID)

The emergency protocol is a high priority message triggered by an error event in the device. The error codes sent with the emergency message are device profile independent and are specified in the CANopen communication profile CiA 301. They are described in the chapter Diagnostics.

□ Chapter "4.6 Diagnostics", page 121

3.9.2.1 Object 0x1014: EMCY protocol COB-ID configuration

This object defines the COB-ID of the emergency object itself.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x1014	0	CobIdEmergencyMessage	UINT32	rw	y	0x0080….0x00FF	0x0080+127

Value description

<CobIdEmergencyMessage>					
Bit	31	30	29	29..11	10..0
Description	0: EMCY exists	0	0: 11Bit	Reserved	11 Bit COB-ID

Table 15: Possible values of parameter < CobIdEmergencyMessage > (0x1014)

3.9.3 Process data object (PDO) protocol

The process data object (PDO) communication allows cyclic sending and receiving of parameters in real time. Different transmission modes are available: asynchronous, event or timer driven transmission.
One TxPDO and one RxPDO are implemented.

3.9.3.1 RxPDO protocol configuration (COB-ID: 0x200)

To enable receive process data object (RxPDO) transmission, the local application parameters must be mapped to the RxPDO and a transmission type must be selected for each RxPDO channel. Four RxPDO channels are available.

3.9.3.1.1 Object 0x1400: 1st RxPDO protocol configuration

First RxPDO channel configuration.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x1400	0	Number of entries	UINT8	ro	-	UINT8	2
0x1400	1	RPdo1_CobIdUsedByPdo	UINT32	rw	y	0x00000200…0x0000027F| 0x80000200…0x8000027F	0x0200+ Node-ID
0x1400	2	RPdo1_TransmissionType	UINT8	rw	y	255	255

Value description

Parameter	Description
<RPdo1_CobIdUsedByPdo>	COB-ID of the 1st RxPDO.
<RPdo1_TransmissionType>	Type of processing the received data:

Table 16: Object 0x1400: 1st RxPDO configuration

	<RPdo1_CobIdUsedByPdo>				
Bit	31	30	29	28..11	10..0
Description	0: PDO will be processed/received 1: PDO will not be processed/received	reserved	0: only support Can Frames with 11-Bit CAN-ID	Reserved	11 Bit COB-ID

Table 17: Possible values of parameter <RPdo1_CobIdUsedByPdo> (0x1400, sub-index 1)

<RPdo1_TransmissionType>	
Value	Description
255	PDO will be processed immediately after reception (asynchron).

Table 18: Possible values of parameter <RPdo1_TransmissionType> (0x1400, sub-index 2)

3.9.3.2 RxPDO mapping (COB-ID: 0x200)

With the receive process data object (RxPDO) mapping most object dictionary entries can be mapped to a RxPDO. Each CANopen telegram can carry 8 bytes data. The smallest data types used in the digital amplifier are 8 bit integers. Therefore eight object dictionary entries with 8 bit data length or four object dictionary entries with 16 bits or two object dictionary entries with 32 bit can be mapped within one RxPDO. An arbitrary combination of different data types is possible if the sum of the mapped RxPDO data is less or equal 8 bytes.

3.9.3.2.1 Object 0x1600: 1st RxPDO mapping

With the parameter <RPdo1_NumberOfMappedApplicParaInPdo> (0x1600) the number of real-time application parameters to be received can be set. To map the application parameter itself, its index, sub-index and length must be combined to a 32 bit value and written to one of the eight possible positions (corresponding to the sub-indexes 1…8) within the PDO object mapping object.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x1600	0	RPdo1_NumberOfMappedApplicParaInPdo	UINT8	rw	y	0…8	2
0x1600	1	RPdo1_ApplicPara1	UINT32	rw	y	UINT32	0x60400010
0x1600	2	RPdo1_ApplicPara2	UINT32	rw	y	UINT32	0x63000110
0x1600	3	RPdo1_ApplicPara3	UINT32	rw	y	UINT32	0x0
0x1600	4	RPdo1_ApplicPara4	UINT32	rw	y	UINT32	0x0

Value description

Parameter	Description
<RPdo1_NumberOfMappedApplicParaInPdo>	Numbers of mapped application parameters
<RPdo1_ApplicPara1>	Mapping of 1st application parameter
<RPdo1_ApplicPara2>	Mapping of 2nd application parameter
<RPdo1_ApplicPara3>	Mapping of 3rd application parameter
<RPdo1_ApplicPara4>	Mapping of 4th application parameter

Table 19: Object 0x1600: 1st RxPDO configuration

<RPdo1_ApplicPara1>…<RPdo1_ApplicPara4>				
Byte	3	2	1	0
Description	Index MSB	Index LSB	Sub-index	Parameter bit length 0x08 or 0x10 or 0x20
Example	0x60	0x40	0x00	0x10

Table 20: Value description of mapping parameter <RPdo1_ApplicPara1>…<RPdo1_ApplicPara4>

This pointer consists of a combination of index, sub-index and length of the parameter to be used.
The example value is 0x60400010, which refers to the

- <ControlWord> (0x6040),
- sub-index 0x00
- with a lengthof 16 bit (16=0x10).

3.9.3.3 RxPDO counter

The received process data objects (RxPDO) are counted using the object 0x4212. On each power on the counter will be initialized with zero.

3.9.3.3.1 Object 0x4212: RxPDO counter

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x4212	0	RPdo1_Counter	UINT32	rw	N	UINT32	0

3.9.3.4 TxPDO protocol configuration (COB-ID: 0x180)

The transmit process data object (TxPDO) protocol must be configured and the transmit values must be mapped to the local parameters. Four transmit TxPDO channels are available. The transmission of the PDOs can be triggered by following events:

- Event timer elapsed.
- Synchronization (SYNC) telegram received.

Every event forces a PDO transmission. More than one event type can be active at the same time.

3.9.3.4.1 Object 0x1800: 1st TxPDO protocol configuration

First TxPDO channel configuration.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x1800	0	Number of entries	UINT8	ro	-	UINT8	5
0x1800	1	TPdo1_CobIdUsedByPdo	UINT32	rw	y	0x40000180…0xC00001FF	0x0180+ NodeID
0x1800	2	TPdo1_TransmissionType	UINT8	rw	y	UINT8	255
		TPdo1_TransmissionType, SW V2.8x*					1
0x1800	5	TPdo1_EventTimer	UINT16	rw	y	UINT16	03E8

Value description

Parameter	Description
<TPdo1_CobIdUsedByPdo>	COB-ID of the 1st TxPDO.
<TPdo1_TransmissionType>	Defines the transmission behavior for the 1st TxPDO.
<TPdo1_EventTimer>	This parameter defines the event time in milliseconds.This time defines the cycle time of the TxPDO timer event. If the event time elapsed, a trigger to transmit a TxPDO is initiated and the event timer will be restarted.

Table 21: Object 0x1800: 1st TxPDO configuration

	< TPdo1_CobIdUsedByPdo >				
Bit	31	30	29	28..11	10..0
Description	0: PDO will be processed/received 1: PDO will not be processed/received	1: will not support RTR	0: only support Can Frames with 11-Bit CAN-ID	Reserved	11 Bit COB-ID

Table 22: Possible values of parameter <TPdo1_CobIdUsedByPdo> (0x1800, sub-index 1)

<TPdo1_TransmissionType>	
Value	Description
0	The process data for the TxPDO will be updated and send immediately after the next incoming SYNC telegram. (Only one time)
1…240	The process data for the TxPDO will be updated and send immediately every <TPdo1_TransmissionType> SYNC telegrams. (E.g. when set to 3, after the 3rd SYNC)
241…253	Reserved
254…255	The TxPDO will be send after the event time is elapses (when the event time is nonzero).

Table 23: Possible values of parameter <TPdo1_TransmissionType> (0x1800, sub-index 2)

To initiate a single request only, the <TPdo1_EventTimer> (0x1800)…<TPdo4_EventTimer> (0x1803) must be set to 0. The transmission then can be triggered by the parameter <TPdoTrigger> (0x4211).
□ Chapter "3.9.3.6 Object 0x4211: TxPDO trigger", page 31

3.9.3.5 TxPDO mapping (COB-ID: 0x180)

With the transmit process data object (TxPDO) mapping the most object dictionary entries can be mapped to a TxPDO. A CANopen telegram can carry 8 bytes data in one package. The smallest data types used in the digital amplifier are 8 bit integers. Therefore eight object dictionary entries with 8 bit data length or four object dictionary entries with 16 bits or two object dictionary entries with 32 bit can be mapped within one Tx-PDO. An arbitrary combination of different data types is possible, if the sum of the mapped TxPDO data is less or equal 8 bytes.
The default PDO mapping for a hydraulic CANopen device is defined in the device specific profile CiA 408.

3.9.3.5.1 Object 0x1A00: 1st TxPDO mapping

With the parameter <TPdo_NumberOfMappedApplicParaInPdo> (0x1A00) the number of real-time application parameters to be transmitted can be set. To map the application parameter itself, its index, sub-index and length must be combined to a 32 bit value and written to one of the eight possible positions (corresponding to the sub-indexes 1…8) within the PDO object.
Only parameters out of the device profile area can be mapped.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x1A00	0	TPdo1_NumberOfMappedApplicParaInPdo	UINT8	rw	y	0…8	2
0x1A00	1	TPdo1_ApplicPara1	UINT32	rw	y	UINT32	0x60410010
0x1A00	2	TPdo1_ApplicPara2	UINT32	rw	y	UINT32	0x63010110
0x1A00	3	TPdo1_ApplicPara3	UINT32	rw	y	UINT32	0
0x1A00	4	TPdo1_ApplicPara4	UINT32	rw	y	UINT32	0

Value description

Parameter	Description
<TPdo1_NumberOfMappedApplicParaInPdo>	Numbers of mapped application parameters
<TPdo1_ApplicPara1>	1st application parameter
<TPdo1_ApplicPara2>	2nd application parameter
<TPdo1_ApplicPara3>	3rd application parameter
<TPdo1_ApplicPara4>	4th application parameter

Table 24: Object 0x1A00: 1st TxPDO configuration

<TPdo1_ApplicPara1>…<TPdo1_ApplicPara4>				
Byte	3	2	1	0
Description	Index MSB	Index LSB	Sub-index	Parameter bit length 0x08 or 0x10 or 0x20
Example	0x60	0x41	0x00	0x10

Table 25: Value description of mapping parameter <RPdo1_ApplicPara1>…<RPdo1_ApplicPara4>

This pointer contains a combination of index, sub-index and length of the parameter to be used.
The example value is 0x60410010, which refers to the

- <StatusWord> (0x6041),
- sub-index 0x00
- with a length of 16 bit (16=0x10).

3.9.3.6 Object 0x4211: TxPDO trigger

Writing this parameter triggers a single TxPDO. This can be used to transmit a PDO on request only. To trigger the TxPDO, the parameter <TPdoTrigger> (0x4211) value must be set to a value > zero, to trigger the PDO channel to be sent.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x4211	0	TPdoTrigger	UINT8	rw	n	255	None

3.9.4 Service data object (SDO) protocol (COB-ID: 0x580, 0x600)

Service data objects are used to configure the settings for the communication and the application parameters. They are transmitted non real-time with low priority.
Service-Data Objects (SDOs)

3.9.4.1 Service data object (SDO) data structure

3.9.4.1.1 Das SDO-Expedited-Domain-Protocol

As very often only a few utility data bytes are to be transmitted, the SDO transfer can be shortened and up to a maximum of four bytes transmitted already in the initialization phase. This is referred to as an "expedited SDO transfer".

With this service there is a read or an write of parameters in the object dictionary (OD) of the amplifier possible. Structured as follows:

COB-ID	Command	Index		Sub-Index	Data			
11 Bit	Byte 0	Byte1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
		LSB	MSB		LSB			MSB
		LSB	MSB		LSB	MSB	0	0

Table 26: Expedited SDO transfer service

3.9.4.1.2 SDO command byte

The command byte contains the type of telegram. The different types are a “set parameter telegram” (domain download), a “request telegram” (domain upload) and a “warning telegram” (warnings). Parameter data will be send to the controller via the “set parameter telegram”. The stored parameter data can be read back to the master via the “request telegram”.

Command (Hex)	function	definition	Action
0x40	Initiate upload request	Request from master	Get parameter value
0x60	Download response	Acknowledge from ODC	Value stored in ODC
0x22, 0x23, 0x2B,0x2F (*)	Initiate download	Request from master	New value for ODC
0x43,0x4B, 0x4F (*)	Upload response	Answer from ODC	Parameter value from ODC
0x80	Warning	Answer from ODC	Error from ODC

Table 27: Command byte explanation

Command (Hex)	Data length	Data type
0x22, 0x23,0x43	4 Byte	Unsigned 32
0x2B, 0x4B	2 Byte	Unsigned 16
0x2F, 0x4F	1 Byte	Unsigned 8

Table 28: Command and data length

(*) the value of the command byte defines the length of the transferred data

3.9.4.1.3 SDO messaging

Hint: The length of SDO telegrams is defined as 8 bytes. Not used data bytes are filled with zero.

3.9.4.2 Object 0x1200: SDO client/server parameter

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x1200	0	Number of entries	UINT8	ro	-	UINT8	2
0x1200	1	CobIdClientServer	UINT32	ro	-	UINT32	0x0600+127
0x1200	2	CobIdClientClient	UINT32	ro	-	UINT32	0x0580+127

Value description

Parameter	Description
<CobIdClientServer>	This parameter contains the COB-ID for the receive service data object.
<CobIdServerClient>	This parameter contains the COB-ID for the transmit service data object.

Table 29: Object 0x1200: SDO client/server parameter

3.10 Network management state machine (NMT state machine)

The CANopen NMT state machine is used to control the network communication. The network management is node-oriented and follows a master/slave structure. It requires one device in the network, which fulfills the function of the NMT master, the other nodes are NMT slaves. The network management provides the following functions:

- Device control services for initialization and start-up of NMT slave nodes that want to take part in the distributed application.
- Node Guarding of NMT slave nodes.

The CANopen network management (NMT) state machine must not be mistaken with the device state machine.

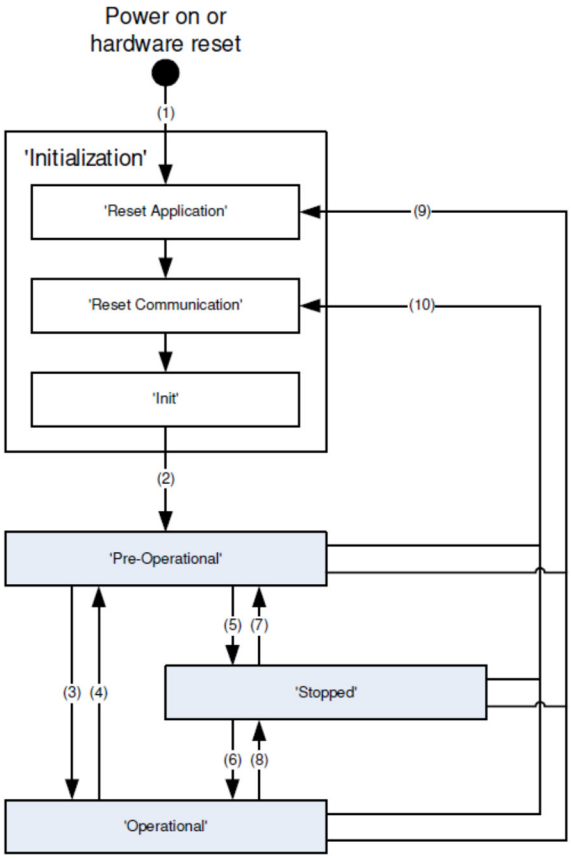


Figure 9: CANopen network state machine (CSM)

The master controls the state transitions of each device in the network. After power-on, the device is initialized and set to the state 'Pre-Operational' or 'Operational', depending on object 0x1F80 NMT startup, automatically. In the 'Pre-Operational' state reading and writing to its object dictionary via the service data objects (SDO) is possible. The device can be configured by setting values and by preparing the PDO transmission.

Afterwards the device can be switched into the 'Operational' state by the NMT command "Start Remote Node" in order to start PDO communication. PDO communication can be stopped by the network master by simply switching the remote node back to 'Pre-Operational' by using the command "Enter Pre-Operational".
With the "Stop Remote Node" command the master can force the slave(s) to the state 'Stopped'. In this state no services besides network and error control mechanism are available. The NMT command "Reset Communication" resets the communication of the node. All communication parameters will be set to their defaults. The application will be reset by the NMT command "Reset Node". This command resets all application parameter. All NMT commands use the COB-ID 0. The different NMT commands are distinguished by a command specifier (CS) located in the first data byte of the message.
NMT state transitions are caused by

- Reception of an NMT node control service
- Hardware reset, or
- Node control services locally initiated by application events.

Transition	Description
(1)	At Power on the NMT state initialization is entered autonomously.
(2)	NMT state initialization finished - enter NMT state Pre-operational automatically (Boot-up message will be sent).
(3)	Receive NMT command "start remote node" or by local control.
(4), (7)	Receive NMT command "enter pre-operational".
(5), (8)	Receive NMT command "stop remote node".
(6)	Receive NMT command "start remote node".
(9)	Receive NMT command "reset node".
(10)	Receive NMT command "reset communication".

Table 30: NMT state transitions

Services on the listed communication objects may only be executed if the CANopen device is in the appropriate NMT state. Reset Node also set the DSM to INIT (reset error)

	Available services				
NMT states	SDO	PDO	EMCY	NMT	NMT Node Guarding
'STOPPED'				x	x
'Pre-Operational'	x		x	x	x
'Operational'	x	x	x	x	x

NOTE: Some SDO's are not writeable in Operation Mode
see: □ Chapter “0

Object dictionary", page 130

Table 31: NMT states

3.10.1 Network management (NMT) protocol (COB-ID: 0x000, 0x700)

The NMT master controls the NMT slave nodes using the following commands:

- Device control services for initialization and start-up of NMT slave nodes that want to take part in the distributed application.
- Node Guarding of NMT slave nodes.

The NMT commands are unconfirmed.

3.10.2 Start remote node command (COB-ID:0, CS:1)

This command requests the selected slave node(s) to enter the state 'Operational'.

3.10.3 Stop remote node command (COB-ID:0, CS:2)

This command requests the selected slave node(s) to enter the state 'Stopped'.
The NMT message "Stop remote node" reset automatically a previously sent setpoint. (e.g. sent via PDO)
The enable signal from the ODC remains unaffected.
Values that are set via parameters e.g. setpoint offset C1.06 are retained.

3.10.4 Enter 'Pre-Operational' command (COB-ID:0, CS:128)

This command requests the selected slave node(s) to enter the state 'Pre-Operational'.

3.10.5 Reset node command (COB-ID:0, CS:129)

This command requests the selected slave node(s) to enter the state 'Reset Application'.

All application parameters will be set to their default. The valve application will be re-started. The TPDO´s will be mapped. After restarting the application, the reset node calls the reset communication command.

3.10.6 Reset communication command (COB-ID:0, CS:130)

This command requests the selected slave(s) to enter the state 'Reset Communication'.

The PDO communication will be stopped. After re-initialization of the network communication, the NMT state 'Pre-Operational' will be entered.

3.10.7 Object 0x1F80: NMT-Startup

Object describes the start-up behavior of the amplifier in NMT (Network-Management)

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x1F80	0	NMT-Startup	UINT32	rw	Y	UINT32	8

Value description

< NMT-Startup>		
Bit,	Value	Description
0	-	Not implemented
1	-	Not implemented
2	0x04	0 = The amplifier moves automatically to the "Operational" state. 1 = The amplifier does not automatically move to the "Operational" state. The status change is defined through the respective application.
3	0x08	(0 = Starting of the slave is permitted , not implemented) 1 = Starting of the slave is not permitted

3.10.8 Bootup message (COB-ID: 0x700)

After a digital amplifier has finished its own initialization and entered the node state 'Pre-Operational' the digital amplifier sends the boot-up message. This message indicates that the slave is ready for operation.

3.10.9 Node guarding (COB-ID: 0x700, RTR:1)

The node guarding is the periodical monitoring of certain network nodes. Each node can be checked by the NMT master with a certain period <GuardTime> (0x100C). A second parameter <LifeTimeFactor> (0x100D) defines a factor after the connection will be detected as lost. The resolution of the guarding time is 1 ms. To enable the node guarding on a slave device, the guard time and life time factor must be set. The guarding is started with the first guarding telegram of the master. During node guarding the master sends a remote transmit request (RTR) frame to each guarded slave. The slave answers with its actual NMT state and a toggle bit. This toggle bit alternates in each cycle.
If a missing lifeguard/ timeout is detected, the amplifier will generate an EMCY message.

3.10.9.1 Object 0x100C: Guard time

This parameter contains the guarding time in milliseconds. The value 0 disables the life guarding.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x100C	0	GuardTime	UINT16	rw	Y	UINT16	0

3.10.9.2 Object 0x100D: Life time factor

This parameter contains the life time factor in milliseconds. The value 0 disables the life guarding.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x100D	0	LifeTimeFactor	UINT8	rw	Y	UINT8	0

3.10.10 Heartbeat

The Heartbeat process does not distinguish between master and slave, but between producers and consumers of Heartbeats. A producer “Heartbeat Producer” automatically sends his status in defined intervals in order to prove his ability to communicate. The interval between two Heartbeat messages from a so-called Heartbeat Producer is defined by the object 1017h. At a value of 0, the sending of Heartbeats is disabled. It is up to the other bus users to evaluate the sent Heartbeats; an evaluation is made by the so-called “Heartbeat Consumer”. A “heartbeat consumer time” is set in object 1016h. This object contains an u32 data field in sub-index 1, which stores the Heartbeat Time in bit 0 to 15. The consumer time should be 1.5 – 2 times longer than the producer time to ensure that a missing heartbeat really is lost and not just delayed. This time interval describes the maximum time until the next Heartbeat Telegram must be received. Otherwise, a Heartbeat Event is generated. For every “Heartbeat Consumer” an associated producer has to be named, whose Heartbeat should be monitored. Corresponding configuration is done by passing the node-ID of the producer, which is denoted in bit 16 to 23 as u8 of the object 1016h.

3.10.10.1 Object 0x1016: Consumer heartbeat

This parameter contains the monitoring time value of the heartbeat signal. Monitoring of the heartbeat producer shall start after the reception of the first heartbeat. This value can only be set one time by the same node.
The consumer time should be 1.5 – 2 times longer than the producer time to ensure that a missing heartbeat really is lost and not just delayed.
If a missing heartbeat timeout is detected, the amplifier will generate an EMCY message.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x1016	0	Number of entries	UINT8	rw	-	UINT8	1
0x1016	1	ConsumerHeartbeatTime 1	UINT32	rw	Y	UINT32	0

Value description

< ConsumerHeartbeatTime1>		
Bit Discription		
31..24	23..16	15..0
reserved	Node-ID	Heartbeat time in ms

Table 32: Possible values of the < ConsumerHeartbeatTime1 > (0x1016-1)

If the value is zero, the function is deactivated

3.10.10.2 Object 0x1017: Producer heartbeat

This parameter contains the time value of the heartbeat signal, send by the amplifier. If a period different from 0 is written to this index, periodically generates a Heartbeat frame. It is expressed in milliseconds and must be comprised between 1 and 65535.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x1017	0	ProducerHeartbeatTime	UINT16	rw	Y	UINT16	0
		ProducerHeartbeatTime, SW V2.8x*					0x3E8

Value description

<DeviceType>	
Value	Description
0	Heartbeat is disabled.
1..0xFFFF	Heartbeat time in ms

3.11 Electronic data sheet (EDS) files

Electronic data sheets (EDS) are files which describe the capabilities and the communication objects of a CANopen device. The EDS is essential to configure CANopen master devices. They are most commonly used when CANopen modules made available to third parties. The digital amplifier EDS file is provided by HCS GmbH and can be downloaded from the HCS website http://www.h-c-s-gmbh.de/download
Parameters of the manufacturer specific profile area are described in detail and explained in the chapters:
see: □ Chapter “4.5.1 Manufacturer specific profile area", page 50

Details can also be found in the software block diagrams:
see: □ Chapter “4.3.1 Block diagram", page 46

A list of the parameters can also be found here
see: □ Chapter “0

Object dictionary", page 13050

4 Device structure

4.1 Device identification

4.1.1 Objects of the CANopen communication profile defined by CiA 301

4.1.1.1 Object 0x1000: Device Type

This parameter indicates the code of the underlying device profile. The default value 408 specifies the device profile CiA 408.

Device							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x1000	0	DeviceType	UINT32	ro	-	UINT32	408

Value description

<DeviceType>	
Value	Description
0	Manufacturer-specific device profile.
408	This device is a valve or a pump. Device profile according to CiA 408 "Device profile for fluid power technology proportional valves and hydrostatic transmissions"

4.1.1.2 Object 0x1008: Manufacturer device name

This parameter indicates the name of the valve amplifier

Device							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x1008	0	ManufacturerDeviceName	STRING	ro	-	None	““

Value description

< ManufacturerDeviceName >	
Value	Description
ODC-22	Example for device name

Table 33: Possible values of parameter <ManufacturerDeviceName > (0x1008)

4.1.1.3 Object 0x1009: Manufacturer hardware version

This parameter indicates the current hardware version of the valve amplifier

Device							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x1009	0	ManufacturerHardwareVersion	STRING	ro	-	None	““

Value description

< ManufacturerHardwareVersion >	
Value	Description
V01.00	Example for hardware version

Table 34: Possible values of parameter < ManufacturerHardwareVersion > (0x1009)

4.1.1.4 Object 0x100A: Manufacturer software version

This parameter indicates the current software version of the valve amplifier

Device							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x100A	0	ManufacturerSoftwareVersion	STRING	ro	-	None	““

Value description

< ManufacturerSoftwareVersion >	
Value	Description

V02.22a	Example for software version

Table 35: Possible values of parameter < ManufacturerSoftwareVersion > (0x100A)

4.1.1.5 Object 0x1018: Identity object

These parameters represent a worldwide unique identification of any CANopen slave device

Device							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x1018	0	Number of entries	UINT8	ro	-	UINT8	4
0x1018	1	VendorId	UINT32	ro	-	UINT32	0x036C
0x1018	2	ProductCode	UINT32	ro	-	UINT32	
0x1018	3	RevisionNumber	UINT32	ro	-	UINT32	
0x1018	4	SerialNumber	UINT32	ro	-	UINT32	

The identification object (ProductCode, RevisionNumber, SerialNumber) is printed on label.

Value description

< IdentityObject >		
Sub-index	Description	Meaning
1	<VendorId>	Unique vendor ID, 0x36C is reserved for HCS
2	<ProductCode>	Product code of the HCS amplifier. Example: 400421300.
3	<RevisionNumber>	Revision number of the HCS amplifier. Example: 0x00610002 (0002 = Software “2”., 0061 = “a”
4	<SerialNumber>	Serial number HCS amplifier (digits without leading character) as on the name plate. □ Chapter "4.1.2.2 Object 0x6052: Serial number", page 38

Table 36: Possible values of the << IdentityObject > (0x1018)

4.1.2 Objects defined by Device Profile Fluid Power

4.1.2.1 Object 0x6050: Version

This parameter contains the versions family of the HCS amplifier.

Device							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x6050	0	DeviceVersion	STRING	ro	-	None	“”

4.1.2.2 Object 0x6052: Serial number

This parameter contains the serial number of the HCS amplifier.

Device							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x6052	0	SerialNumber	STRING	ro	-	None	“”

4.1.2.3 Object 0x6055: Model URL

This parameter holds the Internet address where additional information about the device is available.

Device							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x6055	0	ModelURL	STRING	ro	-	None	“www.h-c-s-gmbh.de“

4.1.2.4 Object 0x605F: Capability

This object provides information on the capabilities of the used device, e.g. the supported control modes.

Device

Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x605F	0	Capability	UINT32	ro	-		0x1F000000

Value description

<Capability>																	
Description	Hydraulic valve or pump application								Drive application								Reserved
Bit	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15..0
Word	MSB																LSB

Table 37: Possible values of parameter <Capability> (0x605F)

<DeviceType>		
Bit	Description	Default
0..15	Reserved	0
16	Drive capability	0
17	Supports control mode drive open loop movement	0
18	Supports control mode drive velocity control	0
19	Supports control mode drive force control	0
20	Supports control mode drive position control	0
21	Supports control mode drive flow control	0
22..23	Reserved	0
24	Hydraulic valve or pump capability	1
25	Supports control mode spool position open loop	1
26	Supports control mode spool position closed loop	1
27	Supports control mode pressure open loop	1
28	Supports control mode pressure closed loop	1
29	Supports control mode p/Q closed loop	0
30	Reserved	0
31	Supports modular device according CiA 301	0

Table 38: Bit values of parameter <Capability> (0x605F)

4.2 Device control

4.2.1 Object 0x6042: Device mode

The parameter <DeviceMode> (0x6042) is not supported. Reading / Writing is not possible.
If the set value input should be analogue or bus controlled, please use the parameter E 15 (0x506E) and E16 (0x506F). If both parameters are „0“ only the CANopen set value will be used otherwise always one/two analogue Inputs are active.

E15 (0x506E)	E16 (0x506F)	
0	0	Set point via bus
1..8	0	Set point via bus and Analogue 1
0	1..8	Set point via bus and Analogue 2

4.2.2 DSM is controlled via CANopen

4.2.2.1 Object 0x6040: Control word

This bit-coded parameter controls the DSM states and activates some manufacturer defined functions.

Device							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x6040	0	Control Word	UINT16	rw	-	UINT16	0

< Control Word >		
Bit	Description	Specification
0	Bit Disabled (D)	CiA 408
1	Bit Hold (H)	
2	Bit Active (M))	
3	Bit Reset Faults (R)	
4..12	Reserved	
13	Din_1, digital input for control Loop1, switching controller, safety function see □ Chapter “4.5.1.32 Object 0x502A: C1.01, Safety function", page 63	HCS
14	Din_2, digital input for control Loop2, switching controller, safety function see □ Chapter “4.5.1.58 Object 0x5045: C2.01, Safety function4.5.1.58", page 77	
15	Reserved	

Table 39: Value description of <ControlWord>

Bits 0, 1, 2, 3: 'DISABLED', 'HOLD', 'ACTIVE', 'RESET FAULTS'
The lower four bits within the control word represent the device state machine's (DSM) control command.
□ Chapter "4.2.3.2.14.1.2.2 DSM state transitions caused by the control word", page 42

4.2.2.2 Object 0x6041: Device status word

The bit-coded <StatusWord> (0x6041) indicates the current device status.

Device							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x6041	0	Status Word	UINT16	ro	-	UINT16	-

< Control Word >		
Bit	Description	Specification
0	Bit Disabled (D)	CiA 408
1	Bit Hold (H)	
2	Bit Active (M))	
3	Bit Ready (R)	
4..15	Reserved	

Table 40: Value description of <StatusWord>

Bits 0, 1, 2, 3: 'DISABLED', 'HOLD', 'ACTIVE', 'READY'
These bits indicate the state of the device state machine (DSM).

4.2.3 Device state machine (DSM)

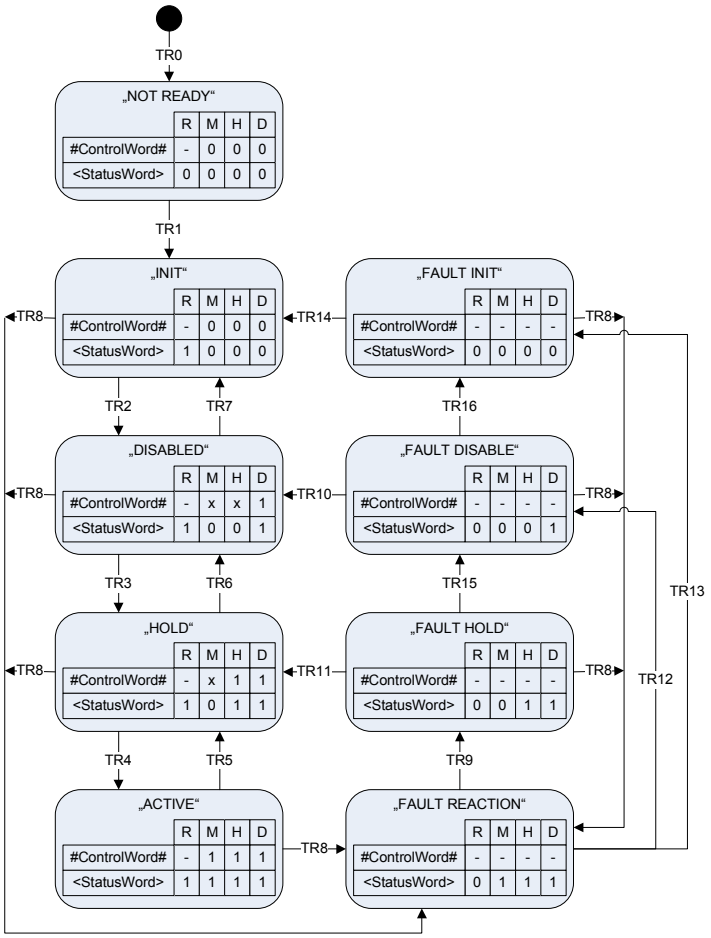


Figure 10: Device state machine

<StatusWord> (0x6041)	#ControlWord# (0x6040)
(Bit 3) R: Ready	(Bit 3) R: Reset fault
(Bit 2) M: Active	(Bit 2) M: Active
(Bit 1) H: Hold	(Bit 1) H: Hold
(Bit 0) D: Disabled	(Bit 0) D: Disabled

4.2.3.1 DSM states

The <StatusWord> (0x6041) indicates the DSM state. The following DSM states are possible:

DSM state	Description
NOT_READY	The electronics circuit has power. Device initialization running (e.g. communication interface, hardware, software). Device function disabled. Solenoid is not powered (Hydraulic failsafe spool position depends on used valve type).
INIT	Device parameters can be set. Device function disabled. All internal display values are set to zero Communication enabled. Solenoid is not powered (Hydraulic failsafe spool position depends on used valve type).
DISABLED	Device parameters can be set. Device function disabled. Actual values of the feedback sensors are available.All other internal display values are set to zero. Solenoid is not powered (Hydraulic failsafe spool position depends on used valve type).
HOLD	Device parameters can be set. Actual values are available. The setpoint values from the bus or from the analog input according to the chosen device mode are not effective. □ Chapter “4.2.1 Object 0x6042: Device mode4.5.1.58", page 40 The valve closed loop is active and the spool goes to the new setpoint, namely the 'spool hold setpoint' as specified by <SplHoldSetPoint> (0x6314). □ Chapter “4.4.1.1.2 Object 0x6314: Hold setpoint4.5.1.58", page 48
ACTIVE	Device parameters can be set. Actual values are available. The setpoint values from the bus or from the analog input according to the chosen settings □ Chapter “4.2.1 Object 0x6042: Device mode4.5.1.58", page 40
FAULT_INIT	Device parameters can be set. Device function disabled. Communication enabled. Solenoid is not powered (Hydraulic failsafe spool position depends on used valve type).
FAULT_DISABLED	Device parameters can be set. Actual values are available. A fault reaction has occurred. Solenoid is not powered (Hydraulic failsafe spool position depends on used valve type).
FAULT_HOLD	Device parameters can be set. Actual values are available. A fault reaction has occurred. The setpoint values from the bus or from the analog input according to the chosen device mode are not effective.
FAULT_REACTION	This state is assumed when the device detects an error. A fault dependent vendor specific action is executed. See □ Chapter “4.6.1 Fault reaction4.5.1.58 ", page 1214.6.1 The resulting fault state depends on the vendor specific fault reaction. Important condition for transitions 9, 12, 13: The RMHD bits of the #ControlWord# do not increase the state of the DSM.

Table 41: Value description of < StatusWord >

⚠ WARNING

Moving machine parts! The word "failsafe" means not a personnel safety. Parts of the machine can move if the amplifier has a fault.

□ If a personnel safety is needed, some additional electrical and hydraulic parts are necessary!

4.2.3.2 State transitions

State transitions are caused by

- The control word #ControlWord#
- Enable signal (digital input X102)
- Internal events

4.2.3.2.1 DSM state transitions caused by the control word

The following table lists the transitions depending on the #ControlWord#. The device control commands, which cause a state transition, are formed by the four low-order bits of the #ControlWord#.

□ Chapter "4.2.2.1 Object 0x6040: Control word”, page 40

Every transition between the actual state and the requested state will be processed.

Transition (TR)	ControlWord	ControlWord Bit								Coments/Conditions
		7	6	5	4	3	2	1	0	
						R	M	H	D	
TR2	Activate ‘DISABLED‘	x	x	x	x	x	x	x	1	
TR3	Activate 'HOLD'	x	x	x	x	x	x	1	1	Depending on enable signal □ Chapter "4.2.3.2.4 Enable behavior“4.2.2.1, page 44
TR4	Activate 'ACTIVE'	x	x	x	x	x	1	1	1	Depending on enable signal □ Chapter "4.2.3.2.4 Enable behavior“, page 44
TR5	Deactivate 'ACTIVE‘	x	x	x	x	x	0	x	x	
TR6	Deactivate 'HOLD'	x	x	x	x	x	0	0	x	
TR7	Deactivate 'DISABLED'	x	x	x	x	x	0	0	0	
TR10	Reset 'FAULT_DISABLED'	x	x	x	x	0	0	0	1	This transition is executed if the reset bit changes from 0 to 1 (rising edge) or the enable signal toggles from 0 to 1 □ Chapter "4.2.3.2.4 Enable behavior“, page 44 Behavior of error output pin: □ Chapter "4.2.3.2.5 Error output pin“, page 45
		Change to								
		x	x	x	x	1	0	0	1	
TR11	Reset 'FAULT_HOLD'	x	x	x	x	0	0	1	1	
		Change to								
		x	x	x	x	1	0	1	1	
TR14	Reset 'FAULT_INIT'	x	x	x	x	0	0	0	0	
		Change to								
		x	x	x	x	1	0	0	0	
TR15	'FAULT_HOLD' to 'FAULT_DISABLED'	x	x	x	x	x	0	0	1	
TR16	'FAULT_DISABLED' to 'FAULT_INIT'	x	x	x	x	x	0	0	0	

4.2.3.2.2 DSM state transitions caused by the enable signal

The following events will lead automatically to state changes by changing the enable input signal.

Transition (TR)	Description	Comments/Conditions
TR2	Activate ‘DISABLED‘	Depending on ControlWord RMHD ≥ x001
TR3	Activate 'HOLD'	Depending on ControlWord RMHD ≥ x011
TR4	Activate 'ACTIVE'	Depending on ControlWord RMHD ≥ x111
TR5	Deactivate 'ACTIVE‘	
TR6	Deactivate 'HOLD'	
TR7	Deactivate 'DISABLED'	
TR9	Transition from 'FAULT_REACTION' to 'FAULT_HOLD'	Depending on the enable behavior
TR10	Reset 'FAULT_DISABLED'	Behavior of error output pin: □ Chapter "4.2.3.2.5 Error output pin“, page 45
TR11	Reset 'FAULT_HOLD'	
TR14	Reset 'FAULT_INIT'	
TR15	'FAULT_HOLD' to 'FAULT_DISABLED'	

4.2.3.2.3 DSM state transitions caused by internal events

The following table shows the internal events which automatically lead to a state change.

Transition (TR)	Description	Comments/Conditions
TR0	Power up	
TR1	Device init successful.	Initialization of device parameters with stored values. Behavior of error output pin: □ Chapter "4.2.3.2.5 Error output pin", page 45
TR4	Device init successful. The safety function of the device is active, Hardware enable is applied	Hardware enable is applied, C1.01 od C2.01 is set to on. □ Chapter "4.5.1.32 Object 0x502A: C1.01, Safety function", page 63 □ Chapter "4.5.1.58 Object 0x5045: C2.01, Safety function4.5.1.58", page 77
TR8	A fault was detected. On entering 'FAULT_REACTION' state an emergency message is sent out.	If state is 'DISABLED' or 'FAULT_DISABLED', state transitions to 'FAULT_HOLD' will be redirected to 'FAULT DISABLED'. Behavior of error output pin: □ Chapter "4.2.3.2.5 Error output pin", page 45
TR9	Transition from 'FAULT_REACTION' to 'FAULT_HOLD' (fault reaction successful).	Depending on enable signal and the enable behavior. □ Chapter "4.2.3.2.4 Enable behavior", page 44
TR12	Transition from 'FAULT_REACTION' to 'FAULT_DISABLED' (fault reaction successful).	
TR13	Transition from 'FAULT_REACTION' to 'FAULT_INIT' (fault reaction successful).	

4.2.3.2.4 Enable behavior

The enable signal comes from the connector X102. The enable signal influences the device state machine and can be used to acknowledge faults.
□ Chapter "4.7.1 Digital input 0 (enable signal)", page 126

4.2.3.2.4.1 DSM state transitions depending on the enable signal

The enable signal can cause different valve responses (HOLD or DISABLE (or fail to center)). The response to the enable signal is specified by the manufactor of the valve.

If the enable signal is switched off (0 V), the spool position is forced to its spring centered failsafe position.

⚠ WARNING

Moving machine parts!
The word "failsafe" means not a personnel safety. Parts of the machine can move if the amplifier has a fault.

□ If a personnel safety is needed, some additional electrical and hydraulic parts are necessary!

Enable Signal	Old DSM state	Transition (TR)	New DSM state	Comments/Conditions
1 → 0	'ACTIVE','HOLD'	TR5,TR6	'DISABLED'	RMHD ≤ 1001
	'FAULT_DISABLE'	TR10	'DISABLED'	RMHD ≤ 1001

4.2.3.2.4.2 Fault confirmation with the enable signal

Toggling the enable signal from low to high causes the device state machine to erase all errors. If no error is pending, the state machine will exit the fault state.

4.2.3.2.5 Error output pin

The error output (digital output 0) is used to indicate fault states (negative logic) according to the Device Profile Fluid Power.

- Digital output is set to 1 on power on (TR1) of the amplifier.
- When a fault is detected (TR8) the digital output 1 is set to 0 to indicate a fault (negative logic).
- When a fault state is left (TR10, TR11) the digital output 1 is set to 1.

□ Chapter "4.8.1 Digital output 0 (error signal)", page 127

The universal output (digital output 1) can also be used to signalize the error state.
To enable this behavior on the digital output 1, the parameter E18 <UniversalOutput> (0x5071) must be set to 1.
□ Chapter "4.8.2 Digital output 1 (universal output)", page 128

4.2.4 Object 0x1002: Manufacturer Status Register

The <ManufacturerStatusRegister> (0x1002) indicates the current status of the internal signals

Device							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x1002	0	ManufacturerStatusRegister	UINT32	ro	-	UINT32	-

< ManufacturerStatusRegister >			
Bit	HEX	Description	Specification
0	0x00000001	Reserved	HCS
1	0x00000002	Reserved	
2	0x00000004	Din_1, input for activate remote control mode of loop 1	
3	0x00000008	Din_2, input for activate remote control mode of loop 2	
4	0x00000010	Comp_1, comparator in the window	
5	0x00000020	Comp_2, comparator in/out of the window	
6	0x00000040	The control loop for the output stages is enabled. DSM is in “ACTIVE” or “HOLD” state.	
7	0x00000080	The control loop 1 running in closed loop	
8	0x00000100	Hardware signal input Enable is set	
9	0x00000200	Error output, an fault is detected, see also parameter E 18. □ Chapter "4.5.1.101 Object 0x5071: E 18, Switchable universal output", page 99	
10	0x00000400	Comparator output, signalizing comparator status, see also parameter E 18.	
11	0x00000800	Reserved	
12	0x00001000	The control loop 2 running in closed loop	
13	0x00002000	Reserved	
14	0x00004000	Sensor_OK , Semi calibration sensor value is valid	
15	0x00008000	Reserved	
16	0x00010000	Safety function of loop1 is active	
17	0x00020000	Safety function of loop2 is active	
18..31	0xyyyy0000	Reserved	

Table 42: Value description of < ManufacturerStatusRegister >

4.3 Device controller structure

4.3.1 Block diagram

4.3.1.1 Mode 1

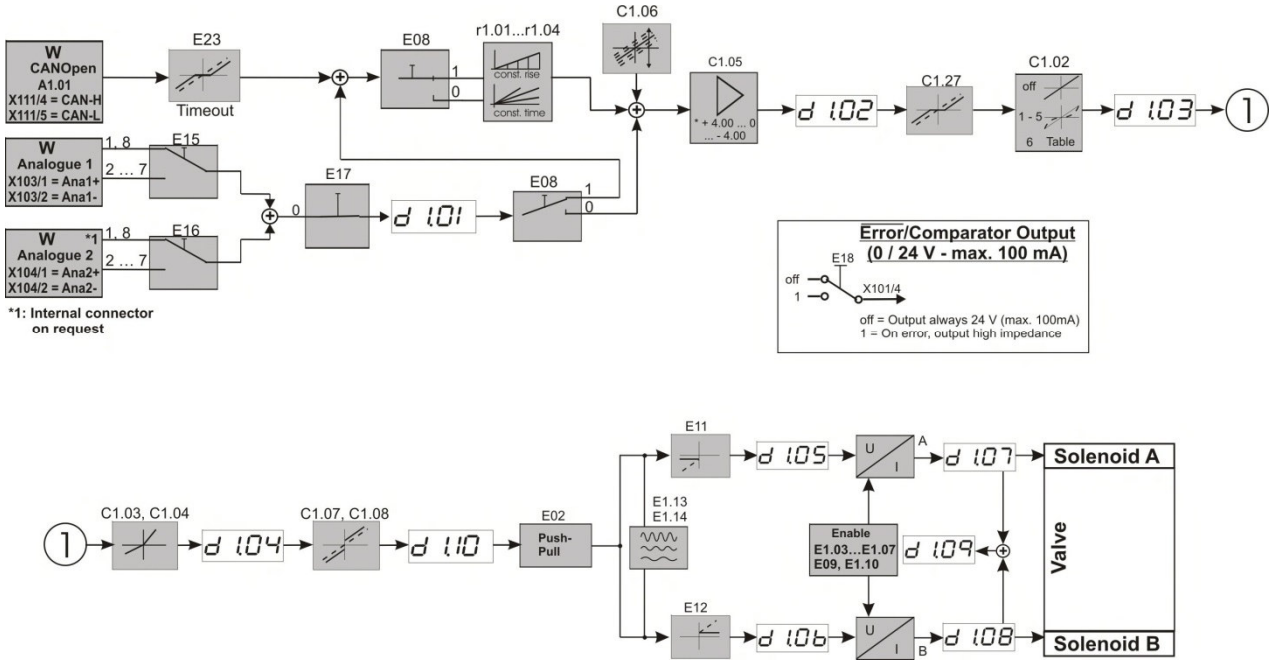


Figure 11: Block diagram mode 1

4.3.1.2 Mode 2

Mode 2 not implemented, only on request.

4.3.1.3 Mode 3

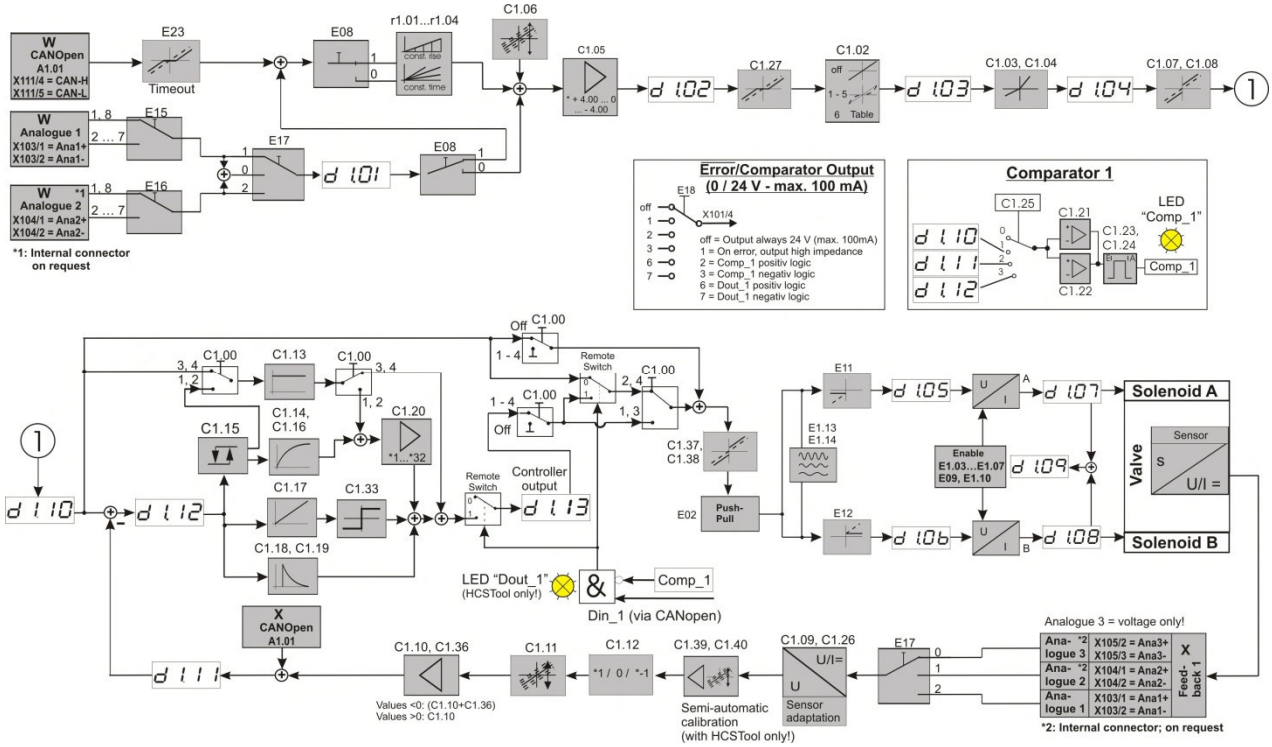


Figure 12: Block diagram mode 3

4.3.1.4 Mode 4

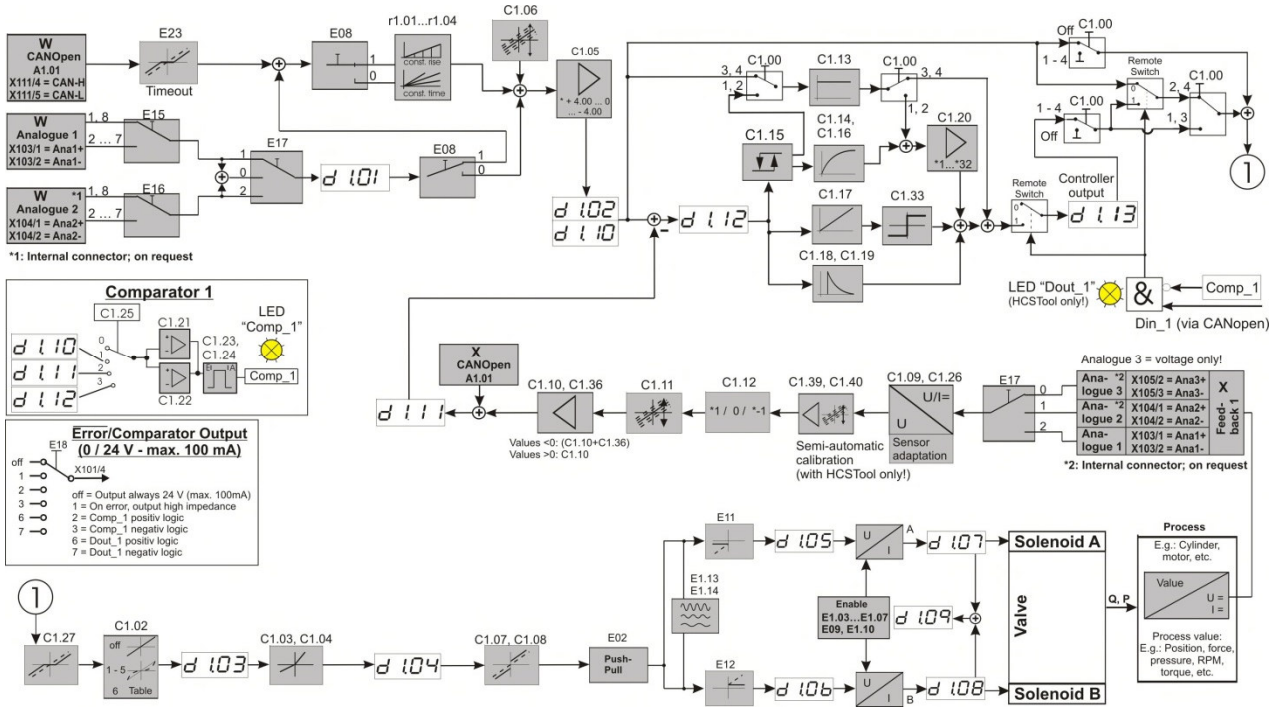


Figure 13: Block diagram mode 4

4.3.1.5 Mode 6

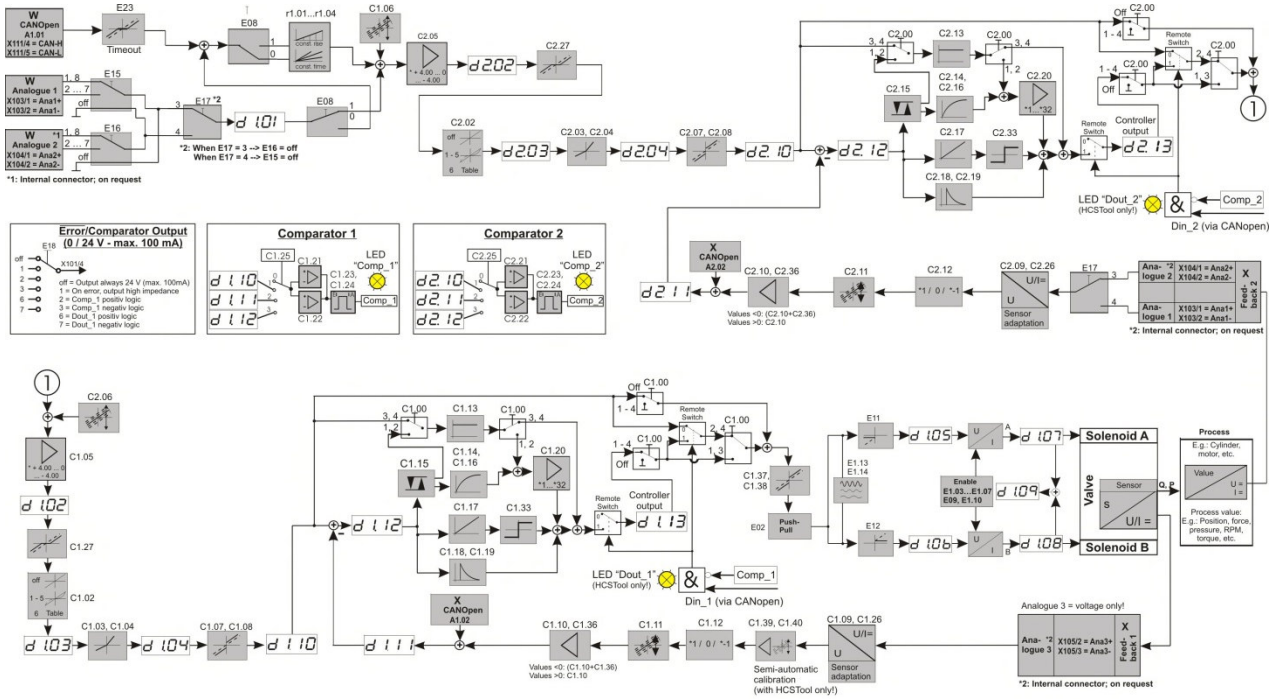


Figure 14: Block diagram mode 6

4.4.1 Signal routing and scaling

4.4.1.1 Spool position set point value path

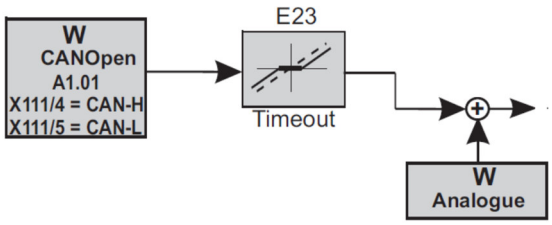


Figure 15: Object 0x6300: Setpoint A1.01

4.4.1.1.1 Object 0x6300: Set point

This parameter contains the spool position set point value which is received from the field bus.
The set point value <SplSetpoint> (0x6300) takes only effect if the <StatusWord> (0x6041) is 0111b ('ACTIVE') and the Parameter E 24 <Node id> 0x50bd contains a certain value. For disable the analogue set-values the parameter E15, E16 <SelectrionOfSetpoint> 0x506E, 0x506F have to set to 0 ,“off“.

ValvePositionControl							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x6300	0	Number of entries	UINT8	ro	N	1	1
0x6300	1	Set point	INT16	wo	N	INT16	none

Value description

<ValvePositionControl >	
Value	Description
-9999	Minimal set point value == -9.999V
9999	Maximal set point value == 9.999V

4.4.1.1.2 Object 0x6314: Hold setpoint

This parameter defines the spool position hold setpoint value.

HoldSetpoint							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x6314	0	Number of entries	UINT8	ro	N	1	1
0x6314	1	HoldSetpoint	INT16	wo	N	INT16	S1.08

Value description

<HoldSetpoint >	
Value	Description
-9999	Minimal hold set point value == -9.999V
9999	Maximal hold set point value == 9.999V

Default value defined by parameter S1.08 0x501A

4.4.1.2 Spool position set point ramp function

The ramp function limits the slew rate of the input signal. The <Type> (0x6330) parameter is used to activate a one-quadrant, two-quadrant or four-quadrant ramp or to deactivate the ramp function.

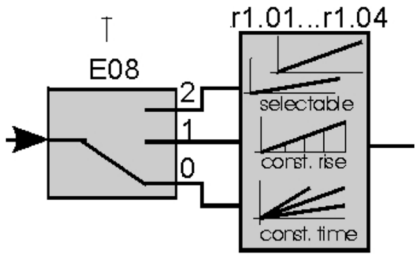


Figure 16: Object 0x6330..0x6336: Ramp function E08 r1.01..r1.04

4.4.1.2.1 Object 0x6330: Type

This parameter defines the slope rate of the ramp dependent on the direction of movement.

ValvePositionControl_DemandValueGenerator_Ramp							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x6330	0	Type	INT8	ro	N	3	3

Value description

<Type>	
Value	Description
3	Four-quadrant ramp

4.4.1.2.2 Object 0x6332: Acceleration time positive

This parameter defines the output signal's maximum rate of change on the positive side. The acceleration time corresponds to the time the signal needs for a change from 0 to 100 %. The acceleration time is specified with a resolution of 10 ms.

ValvePositionControl_DemandValueGenerator_Ramp							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x6332	0	Number of entries	UINT8	ro	N	1	1
0x6332	1	AccelerationTimePositive	UINT16	rw	Y	0..3950	0

4.4.1.2.3 Object 0x6333: Acceleration time negative

This parameter defines the output signal's maximum rate of change on the negative side. The acceleration time corresponds to the time that the signal needs for a change from 0 to 100 %. The acceleration time is specified with a resolution of 10 ms.

ValvePositionControl_DemandValueGenerator_Ramp							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x6333	0	Number of entries	UINT8	ro	N	1	1
0x6333	1	AccelerationTimeNegative	UINT16	rw	Y	0..3950	0

4.4.1.2.4 Object 0x6335: Deceleration time positive

This parameter defines the output signal's maximum rate of change on the positive side. The deceleration time corresponds to the time the signal needs for a change from 0 to 100 %. The acceleration time is specified with a resolution of 10 ms.

ValvePositionControl_DemandValueGenerator_Ramp							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x6335	0	Number of entries	UINT8	ro	N	1	1
0x6335	1	DecelerationTimePositive	UINT16	rw	Y	0..3950	0

4.4.1.2.5 Object 0x6336: Deceleration time negative

This parameter defines the output signal's maximum rate of change on the negative side. The deceleration time corresponds to the time that the signal needs for a change from 0 to 100 %. The acceleration time is specified with a resolution of 10 ms.

ValvePositionControl_DemandValueGenerator_Ramp							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x6336	0	Number of entries	UINT8	ro	N	1	1
0x6336	1	DecelerationTimeNegative	UINT16	rw	Y	0..3950	0

4.4.1.3 Sensor feedback

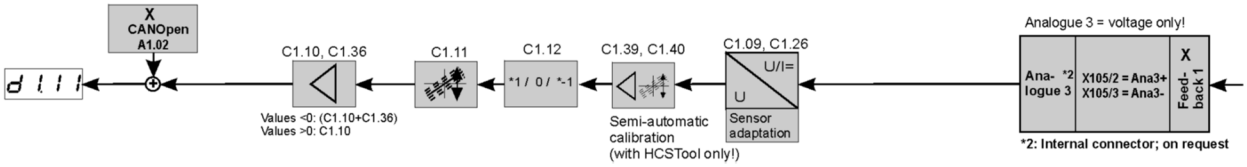


Figure 17: Object 0x6301. Sensor feedback

4.4.1.3.1 Object 0x6301: Actual value

This parameter holds the spool position or process sensor feedback value (d1.11).

HoldSetpoint							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x6301	0	Number of entries	UINT8	ro	N	1	1
0x6301	1	ActualValue	INT16	ro	N	INT16	-

Value description

< ActualValue >	
Value	Description
-9999	Minimal hold set point value == -9.999V
9999	Maximal hold set point value == 9.999V

4.5 Amplifier functions

4.5.1 Manufacturer specific profile area

The parameters listed are the overall available parameters of this product line (ODC).
For parameters of specific application versions please refer to the according software block diagrams.
see: □ Chapter “4.3.1 Block diagram", page 46

4.5.1.1 Object 0x5000: Vers, Software version

This object defines the firmware version of the amplifier.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x5000	0	Vers	UINT16	ro	-	0..9999	-

Value description

<Vers>	
Value	Description
202	Meaning version V2.02

Table 43: Possible values of parameter <Vers> (0x5000)

4.5.1.2 Object 0x5001: d1.01, Sum of analog set value

This object defines the sum of all given analog set values to the amplifier.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x5001	0	d1.01	INT16	ro	-	-9999. .+9999	0

Value description

<d1.01>	
Value	Description
-1000	Sum of analog values == -1.000V
1000	Sum of analog values == 1.000V

Table 44: Possible values of parameter <d1.01> (0x5001)

4.5.1.3 Object 0x5002: d1.02, Sum of all post ramp set values

This object defines the set value after processing internal functions. See table “Mode description” for more info.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x5002	0	d1.02	INT16	ro	-	-9999. .+9999	0

Value description

<d1.02>	
Value	Description
-1000	Set value == -1.000V
1000	Set value == 1.000V

Table 45: Possible values of parameter <d1.02> (0x5002)

Mode description, refer to □ Chapter "4.3.1 Block diagram", page 46

<d1.02>	
Operation Mode	Description
1,3,4	value of <d1.01> (0x5001) after adding digital set value and functions: ramp, offset and amplification.
6	value of <d2.10> (0x5012) after processing controller2 and functions: offset and amplification.

Table 46: Function of parameter referenced to block diagram <d1.02> (0x5002)

4.5.1.4 Object 0x5003: d1.03, Set values after linearization

This object defines the set value after processing internal functions. See table “Mode description” for more info.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x5003	0	d1.03	INT16	ro	-	-9999. .+9999	0

Value description

<d1.03>	
Value	Description
-1000	Set value == -1.000V
1000	Set value == 1.000V

Table 47: Possible values of parameter <d1.03> (0x5003)

Mode description, refer to □ Chapter "4.3.1 Block diagram", page 46

<d1.03>	
Operation Mode	Description
1,3,6	value of <d1.02> (0x5002) after functions: hysteresis and linearization.
4	value of <d1.10> (0x500A) after processing controller1 and functions: hysteresis and linearization

Table 48: Function of parameter referenced to block diagram <d1.03> (0x5003)

4.5.1.5 Object 0x5004: d1.04, Value after gain adjustment

This object defines the internal set value after function: gain adjustment.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x5004	0	d1.04	INT16	ro	-	-9999. .+9999	0

Value description

<d1.04>	
Value	Description
-1000	Set value == -1.000V
1000	Set value == 1.000V

Table 49: Possible values of parameter <d1.04> (0x5004)

4.5.1.6 Object 0x5005: d1.05, Signal A

This object defines the value which is driving solenoid A.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x5005	0	d1.05	INT16	ro	-	0. .9999	0

Value description

<d1.05>	
Value	Description
1000	Value == 1.000V

Table 50: Possible values of parameter <d1.05> (0x5005)

4.5.1.7 Object 0x5006: d1.06, Signal B

This object defines the value which is driving solenoid B.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x5006	0	d1.06	INT16	ro	-	0. .9999	0

Value description

<d1.06>	
Value	Description
1000	Value == 1.000V

Table 51: Possible values of parameter <d1.06> (0x5006)

4.5.1.8 Object 0x5007: d1.07, Current A

This object defines the value of the measured current which is passed through solenoid A.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x5007	0	d1.07	INT16	ro	-	0. .9999	0

Value description

<d1.07>	
Value	Description
1000	Value == 1.000A

Table 52: Possible values of parameter <d1.07> (0x5007)

4.5.1.9 Object 0x5008: d1.08, Current B

This object defines the value of the measured current which is passed through solenoid B.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x5008	0	d1.08	INT16	ro	-	0. .9999	0

Value description

<d1.08>	
Value	Description
1000	Value == 1.000A

Table 53: Possible values of parameter <d1.08> (0x5008)

Object 0x5009: Total current

This object defines the added value of the measured current which is passed through solenoids A and B.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x5009	0	d1.09	INT16	ro	-	0. .9999	0

Value description

<d1.09>	
Value	Description
1000	Value == 1.000A

Table 54: Possible values of parameter <d1.09> (0x5009)

4.5.1.10 Object 0x500A: d1.10, Desired value loop 1

This object defines the set value after processing internal functions. See table “Mode description” for more info.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x500A	0	d1.10	INT16	ro	-	-9999. .+9999	0

Value description

<d1.10>	
Value	Description
-1000	Set value == -1.000V
1000	Set value == 1.000V

Table 55: Possible values of parameter <d1.10> (0x500A)

Mode description, refer □ Chapter "4.3.1 Block diagram", page 46

<d1.10>	
Operation Mode	Description
1,3,6	value of <d1.04> (0x5004) after function: deadband compensation
4	value of <d1.02> (0x5002)

Table 56: Function of parameter referenced to block diagram <d1.10> (0x500A)

4.5.1.11 Object 0x500B: d1.11, Actual value, feedback value loop 1

This object defines the internal value of the given feedback signal.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x500B	0	d1.11	INT16	ro	-	-9999. .+9999	0

Value description

<d1.11>	
Value	Description
-1000	Set value == -1.000V
1000	Set value == 1.000V

Table 57: Possible values of parameter <d1.11> (0x500B)

4.5.1.12 Object 0x500C: d1.12, Lag error loop 1

This object defines the lag error between setvalue and feedback value. See table “Mode description” for more info.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x500C	0	d1.12	INT16	ro	-	-9999. .+9999	0

Value description

<d1.12>	
Value	Description
-1000	Set value == -1.000V
1000	Set value == 1.000V

Table 58: Possible values of parameter <d1.12> (0x500C)

Mode description, refer □ Chapter "4.3.1 Block diagram", page 46

<d1.12>	
Operation Mode	Description
1	Not applicable
3,4,6	value of <d1.10> (0x500A) minus value of <d1.11> (0x500B)

Table 59: Function of parameter referenced to block diagram <d1.12> (0x500C)

4.5.1.13 Object 0x500D: d1.13, Controller output loop 1

This object defines the value which is calculated through the controller1 parameters.
See table “Mode description” for more info.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x500D	0	d1.13	INT16	ro	-	-9999. .+9999	0

Value description

<d1.13>	
Value	Description
-1000	Set value == -1.000V
1000	Set value == 1.000V

Table 60: Possible values of parameter <d1.13> (0x500D)

Mode description, refer □ Chapter "4.3.1 Block diagram", page 46

<d1.13>	
Operation Mode	Description
1	Not applicable
3,4,6	value of <d1.12> (0x500C) processed with controller1 parameters

Table 61: Function of parameter referenced to block diagram <d1.13> (0x500D)

4.5.1.14 Object 0x500E: d2.01, Sum of analog set value

This object defines the sum of all given analog set values to the amplifier. See table “Mode description” for more info.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x500E	0	d2.01	INT16	ro	-	-9999. .+9999	0

Value description

<d2.01>	
Value	Description
-1000	Sum of analog values == -1.000V
1000	Sum of analog values == 1.000V

Table 62: Possible values of parameter <d2.01> (0x500E)

Mode description, refer □ Chapter "4.3.1 Block diagram", page 46

<d2.01>	
Operation Mode	Description
1,3,4,6	Not applicable

Table 63: Function of parameter referenced to block diagram <d2.01> (0x500E)

4.5.1.15 Object 0x500F: d2.02, Sum of all post ramp set values

This object defines the set value after processing internal functions. See table “Mode description” for more info.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x500F	0	d2.02	INT16	ro	-	-9999. .+9999	0

Value description

<d2.02>	
Value	Description
-1000	Set value == -1.000V
1000	Set value == 1.000V

Table 64: Possible values of parameter <d2.02> (0x500E)

Mode description, refer □ Chapter "4.3.1 Block diagram", page 46

<d2.02>	
Operation Mode	Description
1,3,4	Not applicable
6	value of <d1.01> (0x5001) after adding digital set value and functions: ramp, offset and amplification

Table 65: Function of parameter referenced to block diagram <d2.02> (0x500F)

4.5.1.16 Object 0x5010: d2.03, Set values after linearization

This object defines the set value after processing internal functions. See table “Mode description” for more info.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x5010	0	d2.03	INT16	ro	-	-9999. .+9999	0

Value description

<d1.03>	
Value	Description
-1000	Set value == -1.000V
1000	Set value == 1.000V

Table 66: Possible values of parameter <d2.03> (0x5010)

Mode description, refer □ Chapter "4.3.1 Block diagram", page 46

<d2.03>	
Operation Mode	Description
1,3,4	Not Applicable
6	value of <d2.02> (0x500F) after functions: hysteresis and linearization.

Table 67: Function of parameter referenced to block diagram <d2.03> (0x5010)

4.5.1.17 Object 0x5011: d2.04, Value after gain adjustment

This object defines the internal set value after function: gain adjustment. See table “Mode description” for more info.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x5011	0	d2.04	INT16	ro	-	-9999. .+9999	0

Value description

<d2.04>	
Value	Description
-1000	Set value == -1.000V
1000	Set value == 1.000V

Table 68: Possible values of parameter <d2.04> (0x5011)

Mode description, refer □ Chapter "4.3.1 Block diagram", page 46

<d2.04>	
Operation Mode	Description
1,3,4	Not Applicable
6	value of <d2.03> (0x5010) after function: gain adjustment

Table 69: Function of parameter referenced to block diagram <d2.04> (0x5011)

4.5.1.18 Object 0x5012: d2.10, desired value loop 2

This object defines the set value after processing internal functions. See table “Mode description” for more info.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x5012	0	d2.10	INT16	ro	-	-9999. .+9999	0

Value description

<d2.10>	
Value	Description
-1000	Set value == -1.000V
1000	Set value == 1.000V

Table 70: Possible values of parameter <d2.10> (0x5012)

Mode description, refer □ Chapter "4.3.1 Block diagram", page 46

<d2.10>	
Operation Mode	Description
1,3,4	Not Applicable
6	value of <d2.04> (0x5011) after function: deadband compensation

Table 71: Function of parameter referenced to block diagram <d2.10> (0x5012)

4.5.1.19 Object 0x5013: d2.11, Actual value, feedback value loop 2

This object defines the internal value of the given feedback signal. See table “Mode description” for more info.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x5013	0	d2.11	INT16	ro	-	-9999. .+9999	0

Value description

<d2.11>	
Value	Description
-1000	Set value == -1.000V
1000	Set value == 1.000V

Table 72: Possible values of parameter <d2.11> (0x5013)

Mode description, refer □ Chapter "4.3.1 Block diagram", page 46

<d2.11>	
Operation Mode	Description
1,3,4	Not Applicable
6	value of given feedback signal

Table 73: Function of parameter referenced to block diagram <d2.11> (0x5013)

4.5.1.20 Object 0x5014: d2.12, Lag error loop 2

This object defines the lag error between setvalue and feedback value. See table “Mode description” for more info.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x5014	0	d2.12	INT16	ro	-	-9999. .+9999	0

Value description

<d2.12>	
Value	Description
-1000	Set value == -1.000V
1000	Set value == 1.000V

Table 74: Possible values of parameter <d2.12> (0x5014)

Mode description, refer □ Chapter "4.3.1 Block diagram", page 46

<d2.12>	
Operation Mode	Description
1,3,4	Not applicable
6	value of <d2.10> (0x5012) minus value of <d2.11> (0x5013)

Table 75: Function of parameter referenced to block diagram <d2.12> (0x5014)

4.5.1.21 Object 0x5015: d2.13, Controller output loop 2

This object defines the value which is calculated through the controller2 parameters.
See table “Mode description” for more info.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x5015	0	d2.13	INT16	ro	-	-9999. .+9999	0

Value description

<d2.13>	
Value	Description
-1000	Set value == -1.000V
1000	Set value == 1.000V

Table 76: Possible values of parameter <d2.13> (0x5015)

Mode description, refer □ Chapter "4.3.1 Block diagram", page 46

<d2.13>	
Operation Mode	Description
1,3,4	Not applicable
6	value of <d2.12> (0x5014) processed with controller2 parameters

Table 77: Function of parameter referenced to block diagram <d2.13> (0x5015)

4.5.1.22 Object 0x501A: S1.08, Hold set point

This object defines a digital set value which could give to the amplifier. See table “Mode description” for more info.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x501A	0	S1.08	INT16	rw	-	-9999. .+9999	0

Value description

< Hold set point >	
Value	Description
-1000	Set value == -1.000V
1000	Set value == 1.000V

Table 78: Possible values of parameter <S1.08> (0x501A)

Mode description, refer □ Chapter "4.3.1 Block diagram", page 46

<S1.08>	
Operation Mode	Description
1,3,4,6	Set value for DSM = “Hold”

Table 79: Function of parameter referenced to block diagram <S1.08> (0x501A)

4.5.1.23 Object 0x501B: r1.01, Ramp from 0 -> -

This object defines the ramp time which is valid for changes at set value in negative direction, if the value is zero or less.
More detailed information about the Ramp selection:
□ Chapter "4.5.2.3 Detailed Information about r1.01 to r1.04 and E08", page 119

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x501B	0	r1.01	UINT16	rw	-	0. .3950	0

Value description

<r1.01>	
Value	Description
0550	Ramptime == 5,5 seconds
1000	Ramp time == 10 seconds

Table 80: Possible values of parameter <r1.01> (0x501B)

4.5.1.24 Object 0x501C: r1.02, Ramp from - -> 0

This object defines the ramp time which is valid for changes at set value in positive direction, if the value is zero or less.
More detailed information about the Ramp selection:
□ Chapter "4.5.2.3 Detailed Information about r1.01 to r1.04 and E08", page 119

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x501C	0	r1.02	UINT16	rw	-	0. .3950	0

Value description

<r1.02>	
Value	Description
0550	Ramptime == 5,5 seconds
1000	Ramp time == 10 seconds

Table 81: Possible values of parameter <r1.02> (0x501C)

4.5.1.25 Object 0x501D: r1.03, Ramp from 0 -> +

This object defines the ramp time which is valid for changes at set value in positive direction, if the value is zero or more.
More detailed information about the Ramp selection:
□ Chapter "4.5.2.3 Detailed Information about r1.01 to r1.04 and E08", page 119

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x501D	0	r1.03	UINT16	rw	-	0. .3950	0

Value description

<r1.03>	
Value	Description
0550	Ramptime == 5,5 seconds
1000	Ramp time == 10 seconds

Table 82: Possible values of parameter <r1.03> (0x501D)

4.5.1.26 Object 0x501E: r1.04, Ramp from + -> 0

This object defines the ramp time which is valid for changes at set value in negative direction, if the value is zero or more.
More detailed information about the Ramp selection:
□ Chapter "4.5.2.3 Detailed Information about r1.01 to r1.04 and E08", page 119

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x501E	0	r1.04	UINT16	rw	-	0. .3950	0

Value description

<r1.04>	
Value	Description
0550	Ramptime == 5,5 seconds
1000	Ramp time == 10 seconds

Table 83: Possible values of parameter <r1.04> (0x501E)

4.5.1.27 Object 0x501F: A1.01, CANopen set value (Branch 1)

This object defines the digital set value which is given by CANopen. See table “Mode description” for more info.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x501F	0	A1.01	INT16	rw	-	-9999. .+9999	0

Value description

<A1.01>	
Value	Description
-1000	Set value == -1.000V
1000	Set value == 1.000V

Table 84: Possible values of parameter <A1.01> (0x501F)

4.5.1.28 Object 0x5020: A1.02, CANopen feedback value (Branch 1)

This object defines the value which is added by CANopen to the feedback value.
See table “Mode description” for more info.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x5020	0	A1.02	INT16	rw	-	-9999. .+9999	0

Value description

<A1.02>	
Value	Description
-1000	Set value == -1.000V
1000	Set value == 1.000V

Table 85: Possible values of parameter <A1.02> (0x5020)

Mode description, refer □ Chapter "4.3.1 Block diagram", page 46

<A1.02>	
Operation Mode	Description
1	Not applicable
3,4,6	value of <A1.02>(0x5020) is added to value of <d1.11> (0x500B)

Table 86: Function of parameter referenced to block diagram <A1.02> (0x5020)

4.5.1.29 Object 0x5027: A2.01, CANopen set value (Branch 2)

This object defines the digital set value which is given by CANopen.
See table “Mode description” for more info.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x5027	0	A2.01	INT16	rw	-	-9999. .+9999	0

Value description

<A2.01>	
Value	Description
-1000	Set value == -1.000V
1000	Set value == 1.000V

Table 87: Possible values of parameter <A2.01> (0x5027)

Mode description, refer □ Chapter "4.3.1 Block diagram", page 46

<A2.01>	
Operation Mode	Description
1,3,4,6	Not applicable

Table 88: Function of parameter referenced to block diagram <A2.01> (0x5027)

4.5.1.30 Object 0x5028: A2.02, CANopen feedback value (Branch 2)

This object defines the value which is added by CANopen to the feedback value.
See table “Mode description” for more info.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x5028	0	A2.02	INT16	rw	-	-9999. .+9999	0

Value description

<A2.02>	
Value	Description
-1000	Set value == -1.000V
1000	Set value == 1.000V

Table 89: Possible values of parameter <A2.02> (0x5028)

Mode description, refer □ Chapter "4.3.1 Block diagram", page 46

<A2.02>	
Operation Mode	Description
1,3,4	Not applicable
6	value of <A2.02>(0x5027) is added to value of <d2.11> (0x5013)

Table 90: Function of parameter referenced to block diagram <A2.02> (0x5028

4.5.1.31 Object 0x5029: C1.00, Controller selection loop 1

This object defines the type of controller which is used to drive the solenoid

The usage of the safety function C1.01, together with remote loop control (C1.00 = 2 or C1.00 = 4) is not possible
□ Chapter "4.5.1.32 Object 0x502A: C1.01, Safety function", page 63

See table “Mode description” for more info.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x5029	0	C1.00	UINT16	rw	-	0...4	0

Value description

<C1.00>	
Value	Description
0	No controller is active, set value is directly forwarded to the solenoid
1	Processing set value with P-PT1-I-DT1-regulator parameters and forwarded to the solenoid
2	Processing set value with P-PT1-I-DT1-regulator parameters, only forwarded to the solenoid if remote switch is on. If switch is off, set value of <d1.10>(500A) is used to drive the solenoid.
3	Processing set value with dff-function (**d**irect **f**eed **f**orward). Signal is using by-pass function parallel to P-PT1-I-DT1-regulator parameters.
4	Processing set value in combination of selection “2” and “3”

Table 91: Possible values of parameter <C1.00> (0x5029)

Mode description, refer □ Chapter "4.3.1 Block diagram", page 46

<C1.00>	
Operation Mode	Description
1	Not applicable
3,4,6	Processing value of <d1.10>(500A) with value of <d1.11>(500B)

Table 92: Function of parameter referenced to block diagram <C1.00> (0x5029)

4.5.1.32 Object 0x502A: C1.01, Safety function

This object defines a type of an ”enable mode” or a sequence that allows a controlled shifting from the deactivated position to the activated position which is especially helpful for a restart after an emergency stop.

The usage of the safety function together with remote loop control (C1.00 = 2 or C1.00 = 4) is not possible
□ Chapter "4.5.1.31 Object 0x5029: C1.00, Controller selection", page 62

See table “Mode description” for more info.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x502A	0	C1.01	UINT16	rw	-	0...1	0

Value description

<C1.01>	
Value	Description
0	function deactivated
1	Processing set value with following conditions: After restarting the amplifier (supply voltage on) the amplifier is waiting for the hardware enable, after applying the enable signal, the DSM state is changed to the “ACTIVE” state. □ Chapter “ 4.2.3.2.3 DSM state transitions caused by internal events”, page 44 The controller output is set (d1.13) = 0.000 and any drive movement is avoided. Activating the signal Din_1 in the control word, reactivates the regulator and the drive moves to a position defined by parameter S1.08. See table”logic table” for more info.

Table 93: Possible values of parameter <C1.01> (0x502A

<C1.01> Logic table			
Step	state	Input	Signal at input
1	Emergency-stop Can be done by disable or by Supply Voltage off.	Supply voltage	off
		Enable	Low
		Set Value	--
		DSM <StatusWord> (0x6041)	--
		Bit Din_1: <Control word> (0x6040)	--
2	Supply on and enable activated, actual feedback value is stored and set point = feedback value So the hydraulic axis will remain in this position. So any movement is prevented.	Supply voltage	On
		Enable	High
		Set Value	Internal bus set value set to 0 V[1]
		DSM <StatusWord> (0x6041)	“Active”
		Bit Din_1: <Control word> (0x6040)	low
3	Value for hold position in <Control word> is set to “Hold” (Can be the home position for an axis) Otherwise set <control word> to “Active”	Supply voltage	On
		Enable	High
		Set Value	S1.08 Hold setpoint (0x501A) [1]
		DSM <StatusWord> (0x6041)	Depends on DSM <Control word>
		Bit Din_1: <Control word> (0x6040) and	High
4	Drive goes to start position. The start position corresponds to the active set points. The selected digital set point and the analogous set point are used	Supply voltage	On
		Enable	High
		Set Value	vpoc_set_point. (0x6300) [1]
		DSM <StatusWord> (0x6041)	“Active”
		Bit Din_1: <Control word> (0x6040)	High or low

Table 94: Logic table of parameter <C1.01> (0x502A

Mode description, refer □ Chapter "4.3.1 Block diagram", page 46

<C1.01>	
Operation Mode	Description
1	Not applicable
3,4,6	Processing value of <d1.13>(0x500D) with value of <d1.11>(0x500B)

Table 95: Function of parameter referenced to block diagram <C1.01> (0x502A)

[1] Be careful, all internal offset parameter and the analogue set value (depending on E 15) are still active.

4.5.1.33 Object 0x502B: C1.02, Linearization

This object defines the type of linearization which is used to operate with different valve characteristics.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x502B	0	C1.02	UINT16	rw	-	0...6	0

Value description

<C1.02>	
Value	Description
0	function deactivated
1	general linearization for NC curve
2	linearization for proportional directional valves with flow characteristic >10 l/min (NG6)
3	linearization for proportional directional valves with flow characteristic at 10 l/min (NG6)
4	linearization for proportional directional valves with flow characteristic > 50 l/min (NG10)
5	linearization for proportional pressure valves
6	customized curve, referring to parameter <L1.x0>(50C4) to <L1.y8>(50D7)

Table 96: Possible values of parameter <C1.02> (0x502B)

Mode description, refer □ Chapter "4.3.1 Block diagram", page 46

<C1.02>	
Operation Mode	Description
1,3,6	processing value of <d1.02>(5002) with consideration of <C1.27>(50A4)
4	processing outputvalue of controller1 with consideration of <C1.27>(50A4)

Table 97: Function of parameter referenced to block diagram <C1.02> (0x502B)

4.5.1.34 Object 0x502C: C1.03, Gain A

This object defines the value which is used for amplification adjustment at negative set values (e.g. the speed of differential cylinders).
See table “Mode description” for more info.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x502C	0	C1.03	UINT16	rw	-	0 - 200	100

Value description

<C1.03>	
Value	Description
0	negative set value is multiplicity by 0, so new set value is zero
100	negative set value is multiplicity by 1.00, so new set value is not changed
200	negative set value is multiplicity by 2.00, so new set value is doubled

Table 98: Possible values of parameter <C1.03> (0x502C)

Mode description, refer □ Chapter "4.3.1 Block diagram", page 46

<C1.03>	
Operation Mode	Description
1,3,4,6	value of <d1.03> (0x5003) processed with value of <C1.03> (502C)

Table 99: Function of parameter referenced to block diagram <C1.03> (0x502C)

4.5.1.35 Object 0x502D: C1.04, Gain B

This object defines the value which is used for amplification adjustment at positive setvalues (e.g. the speed of differential cylinders).
See table “Mode description” for more info.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x502D	0	C1.04	UINT16	rw	-	0 - 200	100

Value description

<C1.04>	
Value	Description
0	positive set value is multiplicity by 0, so new set value is zero
100	positive set value is multiplicity by 1.00, so new set value is not changed
200	positive set value is multiplicity by 2.00, so new set value is doubled

Table 100: Possible values of parameter <C1.04> (0x502D)

Mode description, refer □ Chapter "4.3.1 Block diagram", page 46

<C1.04>	
Operation Mode	Description
1,3,4,6	value of <d1.03> (0x5003) processed with value of <C1.04> (502D)

Table 101: Function of parameter referenced to block diagram <C1.04> (0x502D)

4.5.1.36 Object 0x502E: C1.05, Set value sign and gain

This object defines the value which is used for exchange the polarity sign of the set points or to adapt the signal or in order to completely deactivate the signal. This enables to change the direction of a valve as well as the scaling of the set point signals.
See table “Mode description” for more info.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x502E	0	C1.05	INT16	rw	-	-400… +400	100

Value description

<C1.05>	
Value	Description
-200	set value is multiplicity by -200, so new set value is inverted and doubled
0	set value is multiplicity by 0, so new set value is zero
100	set value is multiplicity by 1.00, so new set value is not changed
200	set value is multiplicity by 2.00, so new set value is doubled

Table 102: Possible values of parameter <C1.05> (0x502E)

Mode description, refer □ Chapter "4.3.1 Block diagram", page 46

<C1.05>	
Operation Mode	Description
1,3,4	sum of all set value processed with value of <C1.05> (502E)
6	processing outputvalue of controller2 with value of <C1.05>(502E) and consideration of <C2.06>(504A)

Table 103: Function of parameter referenced to block diagram <C1.05> (0x502E)

4.5.1.37 Object 0x502F: C1.06, Set value offset

This object defines the value which is used to correct the drift of the drive or hydraulic system by an offset.
The offset can also be regarded as an additional set point.
This allows a very fine positioning of the system e.g. if it is used on a NC axis.
See table “Mode description” for more info.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x502F	0	C1.06	INT16	rw	-	-9999… +9999	0

Value description

<C1.06>	
Value	Description
-1000	set value is decreased by 1.000V
0	set value is not changed
+1000	set value is increased by 1.000V

Table 104: Possible values of parameter <C1.06> (0x502F)

Mode description, refer □ Chapter "4.3.1 Block diagram", page 46

<C1.06>	
Operation Mode	Description
1,3,4,6	sum of all set value processed with value of <C1.06> (502F)

Table 105: Function of parameter referenced to block diagram <C1.06> (0x502F)

4.5.1.38 Object 0x5030: C1.07, Dead band compensation A

This object defines the value which is used to compensate a possible spool overlap for solenoid A.
The compensation works as an additional set point that is activated as soon as the polarity of the set point changes to positive. Overlaps of valve are empirically around 10 % to 15 % of full stroke (depending on manufacturer and valve type!). The setting has a decisive effect on the quality (precision and speed) when positioning the axis drives.
The amplification in the small signal range is essentially determined by this function.
The pre-set value is directly applied as a current on the solenoids. The programming is standardized in volt, 9.999 V equals the maximum set current.
See table “Mode description” for more info.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x5030	0	C1.07	UINT16	rw	-	0….9999	0

Value description

<C1.07>	
Value	Description
0	No additional current is given, set value is not changed
1000	set value is increased by 1.000V

Table 106: Possible values of parameter <C1.07> (0x5030)

Mode description, refer □ Chapter "4.3.1 Block diagram", page 46

<C1.07>	
Operation Mode	Description
1,3,4,6	Value of <d1.04>(5004) processed with value of <C1.07> (5030)

Table 107: Function of parameter referenced to block diagram <C1.07> (0x5030)

4.5.1.39 Object 0x5031: C1.08, Dead band compensation B

This object defines the value which is used to compensate a possible spool overlap for solenoid B.
The compensation works as an additional set point that is activated as soon as the polarity of the set point changes to positive. Overlaps of valve are empirically around 10 % to 15 % of full stroke (depending on manufacturer and valve type!). The setting has a decisive effect on the quality (precision and speed) when positioning the axis drives.
The amplification in the small signal range is essentially determined by this function.
The pre-set value is directly applied as a current on the solenoids. The programming is standardized in volt, 9.999 V equals the maximum set current.
See table “Mode description” for more info.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x5031	0	C1.08	UINT16	rw	-	0....9999	0

Value description

<C1.08>	
Value	Description
0	No additional current is given, set value is not changed
1000	set value is increased by 1.000V

Table 108: Possible values of parameter <C1.08> (0x5031)

Mode description, refer □ Chapter "4.3.1 Block diagram", page 46

<C1.08>	
Operation Mode	Description
1,3,4,6	Value of <d1.04>(5004) processed with value of <C1.08> (5031)

Table 109: Function of parameter referenced to block diagram <C1.08> (0x5031)

4.5.1.40 Object 0x5032: C1.09, Sensor type

This object defines the type of sensor which is used for the feedback signal.
See table “Mode description” for more info.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x5032	0	C1.09	UINT16	rw	-	0....26	4

Value description

<C1.09>		
Value	Description	Wire Monitor
0	Only feedback signal via CANopen is used, sensor signal is disabled	
1	0…20mA	No
2	4…20mA	Yes
3	12mA +/- 8mA	Yes
4	0…10V	No
5	0….+/-10V	No
6	6V +/- 2,5V	Yes
7	7,5V +/- 2,5V	Yes
8	6V +/- 4V	Yes
9	7,5V +/- 2,5V	Yes
10	0…20mA with only positive controller output possible	No
11	4…20mA with only positive controller output possible	No
12	0…10V with only positive controller output possible	No
14	5V +/- 3V	Yes
21	Bipolar voltage semiautomatic calibration	Yes
22	Unipolar voltage semiautomatic calibration	Yes
23	Unipolar voltage semiautomatic calibration with only positive controller output possible	Yes
24	Bipolar (internal) current semiautomatic calibration	Yes
25	Unipolar current semiautomatic calibration	Yes
26	Unipolar current semiautomatic calibration with only positive controller output possible	Yes

Table 110: Possible values of parameter <C1.09> (0x5032)

Mode description, refer □ Chapter "4.3.1 Block diagram", page 46

<C1.09>	
Operation Mode	Description
1	Not applicable
3,4,6	Type of Sensor depending on settings of <C1.26>(5043),<E15>(506E), <E16>(506F) and <E17>(5070)

Table 111: Function of parameter referenced to block diagram <C1.09> (0x5032)

Modus	Parameter				
E 00	E 15	E 16	E 17	C1.09	C2.09
Modus	Ana1	Ana2	Set Value activation mode	(Ana1,Ana2,Ana3)	(Ana1,Ana2,Ana3)
3,4,6	Off..8	Off..8		Off ... 4-26	Off ... 4-12
3,4	Off means, not used	Off means, not used	0 = set(CAN + Ana1 + Ana2), FB1(Ana3 only voltage)	Off means, only CANopen feedback value A1.02 (Branch1) is used. (If Ana3 E17 = 0,3,4 only voltage is possible) or (If E17 = 1,2 current is available)	Off means, only CANopen feedback value A2.02 (Branch2) is used.
			1 = set(CAN + Ana1), FB1 (Ana2),---(E16 = OFF)		
			2 = set(CAN + Ana2), FB1 (Ana1),---(E15 = OFF)		
6					
			3 = set(CAN + Ana1), FB2 (Ana2), FB1 (Ana3 only voltage),---(E16 = OFF)		
			4 = set(CAN + Ana2), FB2 (Ana1), FB1 (Ana3 only voltage),---(E15 = OFF)		
	OFF = Only CAN input 1 = Voltage 2 = 0..20mA w/o cable fract. det. 3 = 10+-10mA w/o cable fract. det. 4 = 4..20mA w/o cable fract. det. 5 = 4..20mA with cable fract. det. 6 = 12+-8mA w/o cable fract. det. 7 = 12+-8mA with cable fract. det. 8 = Voltage 5V+-5V		When E17 is set to 0,3,4 FB1 is defined for voltage only input. But in this case C1.09 can not automatically set to a proper voltage signal input.	OFF = Only CAN input 1 = 0...20mA 2 = 4...20mA 3 = 12mA +-8mA 4 = 0...10V 5 = 0...+-10V 6 = 6V +-2.5V 7 = 7.5V +-2.5V 8 = 6V +-4V 9 = 7.5V +-2.5V 10 = 0..20mA (positive controller output only) 11 = 4..20mA (positive controller output only) 12 = 0..10V (positive controller output only) 14 = 5V+-3,0V 21 = Bipolar voltage semiautomatic calibration 22 = Unipolar voltage semiautomatic calibration 23 = Unipolar volt. semiauto. calib. (pos. contr. outp. only) 24 = Bipolar (internal) current semiauto. calibration 25 = Unipolar current semiautomatic calibration 26 = Unipolar current semi. calib. (pos. contr. outp. only)	

Table 112: Possible setting of analogue inputs depending on the operation mode E 00

4.5.1.41 Object 0x5033: C1.10, Actual value gain

This object defines the value which is used for amplifying a feedback signal.
See table “Mode description” for more info.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x5033	0	C1.10	UINT16	rw	-	0....400	100

Value description

<C1.10>	
Value	Description
0	feedback signal is multiplicity by 0, so new signal value is zero
100	feedback signal is multiplicity by 1.00 so new signal value is not changed
200	feedback signal is multiplicity by 2.00 so new signal value is doubled

Table 113: Possible values of parameter <C1.10> (0x5033)

Mode description, refer □ Chapter "4.3.1 Block diagram", page 46

<C1.10>	
Operation Mode	Description
1	Not applicable
3,4,6	Amplifiying feedback value which is coming from Analogue 3

Table 114: Function of parameter referenced to block diagram <C1.10> (0x5033)

4.5.1.42 Object 0x5034: C1.11, Actual value offset

This object defines the value which is used for adjusting a feedback signal.
See table “Mode description” for more info.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x5034	0	C1.11	INT16	rw	-	-9999… +9999	0

Value description

<C1.11>	
Value	Description
-1000	feedback signal is decreased by -1.000V
0	feedback signal is not changed
+1000	feedback signal is increased by 1.000V

Table 115: Possible values of parameter <C1.11> (0x5034)

Mode description, refer □ Chapter "4.3.1 Block diagram", page 46

<C1.11>	
Operation Mode	Description
1	Not applicable
3,4,6	Adjusting feedback value which is coming from Analogue 3

Table 116: Function of parameter referenced to block diagram <C1.11> (0x5034)

4.5.1.43 Object 0x5035: C1.12, Actual value sign

This object defines the value which is used for exchange the polarity sign of the feedback signal or to completely deactivate the signal. This enables to change the direction of the process.
See table “Mode description” for more info.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x5035	0	C1.12	INT16	rw	-	-1… +1	1

Value description

<C1.12>	
Value	Description
-1	feedback signal is multiplied by -1, so new feedback signal is inverted
0	feedback signal is deactivated
+1	feedback signal is mulriplied by +1, so new feedback signal is not changed

Table 117: Possible values of parameter <C1.12> (0x5035)

Mode description, refer to □ Chapter "4.3.1 Block diagram", page 46

<C1.12>	
Operation Mode	Description
1	Not applicable
3,4,6	Set polarity of feedback value which is coming from Analogue 3

Table 118: Function of parameter referenced to block diagram <C1.12> (0x5035)

4.5.1.44 Object 0x5036: C1.13, P-Portion KP1

This object defines the value for the P-amplification (KP1).
More detailed information about the control parameters:
□ Chapter "4.5.2.1 Detailed Information about C1.13, C1.14, C1.15, C1.16", page 118
See table “Mode description” for more info.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x5036	0	C1.13	UINT16	rw	-	0… 400	0

Value description

<C1.13>	
Value	Description
0	P-Portion is off
100	P-Portion is set to 1.00
400	P-Portion is set to 4.00

Table 119: Possible values of parameter <C1.13> (0x5036)

Mode description, refer to □ Chapter "4.3.1 Block diagram", page 46

<C1.13>	
Operation Mode	Description
1	Not applicable
3,4,6	Processing the value of <d1.10>(500A) or <d1.12>(500C) depending on setting of <C1.00>(5029) and <C1.15>(5038)

Table 120: Function of parameter referenced to block diagram <C1.13> (0x5036)

4.5.1.45 Object 0x5037: C1.14, T-Portion for PT1 (to C1.16)

This object defines the value for the T-portion.
More detailed information about the control parameters:
□ Chapter "4.5.2.1 Detailed Information about C1.13, C1.14, C1.15, C1.16", page 118
See table “Mode description” for more info.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x5037	0	C1.14	UINT16	rw	-	0…1000	0

Value description

<C1.14>	
Value	Description
0	T-Portion is off
500	T-Portion is set to 5.00 seconds
1000	T-Portion is set to 10.00 seconds

Table 121: Possible values of parameter <C1.14> (0x5037)

Mode description, refer to □ Chapter "4.3.1 Block diagram", page 46

<C1.14>	
Operation Mode	Description
1	Not applicable
3,4,6	Processing the value of <d1.12>(500C) depending on setting of <C1.00>(5029) and <C1.15>(5038)

Table 122: Function of parameter referenced to block diagram <C1.14> (0x5037)

4.5.1.46 Object 0x5038: C1.15, Threshold (C1.13 or C1.16)

This object defines the value for the threshold for controlling C1.13 or C1.16.
More detailed information about the control parameters:
□ Chapter "4.5.2.1 Detailed Information about C1.13, C1.14, C1.15, C1.16", page 118
table “Mode description” for more info.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x5038	0	C1.15	UINT16	rw	-	0…9999	9999

Value description

<C1.15>	
Value	Description
0	Threshold is off
1000	Threshold is set to 1.000V
9999	Threshold is set to 9.999V

Table 123: Possible values of parameter <C1.15> (0x5038)

Mode description, refer to □ Chapter "4.3.1 Block diagram", page 46

<C1.15>	
Operation Mode	Description
1	Not applicable
3,4,6	Processing the value of <d1.12>(500C)

Table 124: Function of parameter referenced to block diagram <C1.15> (0x5038)

4.5.1.47 Object 0x5039: C1,16, P-Portion KP2

This object defines the value for the P-amplification (KP2).
More detailed information about the control parameters:
□ Chapter "4.5.2.1 Detailed Information about C1.13, C1.14, C1.15, C1.16", page 118
table “Mode description” for more info.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x5039	0	C1.16	UINT16	rw	-	0… 400	0

Value description

<C1.16>	
Value	Description
0	P-Portion is off
100	P-Portion is set to 1.00
400	P-Portion is set to 4.00

Table 125: Possible values of parameter <C1.16> (0x5039)

Mode description, refer to □ Chapter "4.3.1 Block diagram", page 46

<C1.16>	
Operation Mode	Description
1	Not applicable
3,4,6	Processing the value of <d1.12>(500C) depending on setting of <C1.15>(5038)

Table 126: Function of parameter referenced to block diagram <C1.16> (0x5039)

4.5.1.48 Object 0x503A: C1.17, I-Portion

This object defines the value for the I-portion of the controller (integrating controller). C1.17 is limited to the value of C 1.33 to avoid an overdrive or saturation. Small values do indicate a slow reaction. Large values do indicate a fast reaction!
See table “Mode description” for more info.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x503A	0	C1.17	UINT16	rw	-	0….4000	0

Value description

<C1.17>	
Value	Description
0	I-Portion is off
1000	I-Portion is set to 1.000 V/s
4000	I-Portion is set to 4.000 V/s

Table 127: Possible values of parameter <C1.17> (0x503A)

Mode description, refer to □ Chapter "4.3.1 Block diagram", page 46

<C1.17>	
Operation Mode	Description
1	Not applicable
3,4,6	Processing the value of <d1.12>(500C)

Table 128: Function of parameter referenced to block diagram <C1.17> (0x503A)

Object 0x503B: C1.18, D-Portion
This object defines the value for the D-portion and together with C1.19 forms a PT1 term (differential controller).
See table “Mode description” for more info.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x503B	0	C1.18	UINT16	rw	-	0….400	0

Value description

<C1.18>	
Value	Description
0	D-Portion is off
100	D-Portion is set to 1.00 V/s
400	D-Portion is set to 4.00 V/s

Table 129: Possible values of parameter <C1.18> (0x503B)

Mode description, refer to □ Chapter "4.3.1 Block diagram", page 46

<C1.18>	
Operation Mode	Description
1	Not applicable
3,4,6	Processing the value of <d1.12>(500C)

Table 130: Function of parameter referenced to block diagram <C1.18> (0x503B)

4.5.1.49 Object 0x503C: C1.19, T-Portion for DT1

This object defines the value for the T-portion and together with C1.18 forms a PT1 term (differential controller).
See table “Mode description” for more info.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x503C	0	C1.19	UINT16	rw	-	0….400	0

Value description

<C1.19>	
Value	Description
0	T-Portion is off
100	T-Portion is set to 1.00 second
400	T-Portion is set to 4.00 seconds

Table 131: Possible values of parameter <C1.19> (0x503C)

Mode description, refer to □ Chapter "4.3.1 Block diagram", page 46

<C1.19>	
Operation Mode	Description
1	Not applicable
3,4,6	Processing the value of <d1.12>(500C)

Table 132: Function of parameter referenced to block diagram <C1.19> (0x503C)

4.5.1.50 Object 0x503D: C1.20 Additional gain for C1.13 and C1.16

This object defines the value for a additional proportional factor to increase the effect of C1.13 and C1.16, especially for process control.
See table “Mode description” for more info.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x503D	0	C1.20	UINT16	rw	-	1….32	1

Value description

<C1.20>	
Value	Description
1	Proportional factor is 1
8	Proportional factor is 8
32	Proportional factor is 32

Table 133: Possible values of parameter <C1.20> (0x503D)

Mode description, refer to □ Chapter "4.3.1 Block diagram", page 46

<C1.20>	
Operation Mode	Description
1	Not applicable
3,4,6	Processing the value of <d1.12>(500C)

Table 134: Function of parameter referenced to block diagram <C1.20> (0x503D)

4.5.1.51 Object 0x503E: C1.21, Comparator upper level

This object defines the value for upper level of the comparator threshold. If the signal reaches this comparative value the comparator changes its signal.
See table “Mode description” for more info.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x503E	0	C1.21	INT16	rw	-	-9999 +9999	0

Value description

<C1.21>	
Value	Description
-9999	Upper level is -9.999V
0	Upper level is 0V
+9999	Upper level is +9.999V

Table 135: Possible values of parameter <C1.21> (0x503E)

Mode description, refer to □ Chapter "4.3.1 Block diagram", page 46

<C1.21>	
Operation Mode	Description
1	Not applicable
3,4,6	Processing the value of <d1.10>(500A),<d1.11>(500B) or <d1.12>(500C) depending on value of <C1.25>(5042)

Table 136: Function of parameter referenced to block diagram <C1.21> (0x503E)

4.5.1.52 Object 0x503F: C1.22, Comparator lower level

This object defines the value for lower level of the comparator threshold. If the signal reaches this comparative value the comparator changes its signal.
See table “Mode description” for more info.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x503F	0	C1.22	INT16	rw	-	-9999 +9999	0

Value description

<C1.22>	
Value	Description
-9999	Lower level is -9.999V
0	Lower level is 0V
+9999	Lower level is +9.999V

Table 137: Possible values of parameter <C1.22> (0x503F)

Mode description, refer to □ Chapter "4.3.1 Block diagram", page 46

<C1.22>	
Operation Mode	Description
1	Not applicable
3,4,6	Processing the value of <d1.10>(500A),<d1.11>(500B) or <d1.12>(500C) depending on value of <C1.25>(5042)

Table 138: Function of parameter referenced to block diagram <C1.22> (0x503F)

4.5.1.53 Object 0x5040: C1.23, Comparator delay into window

This object defines the value for the comparator signal delay time. The signal is changed only when the threshold value had been reached for a longer time than the time programmed.
See table “Mode description” for more info.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x5040	0	C1.23	UINT16	rw	-	0....9999	0

Value description

<C1.23>	
Value	Description
0	Signal is changed immediately
1000	Delay time for signal change is 10.00 seconds
9999	Delay time for signal change is 99.99 seconds

Table 139: Possible values of parameter <C1.23> (0x5040)

Mode description, refer to □ Chapter "4.3.1 Block diagram", page 46

<C1.23>	
Operation Mode	Description
1	Not applicable
3,4,6	Processing the value of <d1.10>(500A),<d1.11>(500B) or <d1.12>(500C) depending on value of <C1.25>(5042)

Table 140: Function of parameter referenced to block diagram <C1.23> (0x5040)

4.5.1.54 Object 0x5041: C1.24, Comparator delay out of window

This object defines the value for the comparator signal delay time. The signal is changed only when the threshold value had been reached for a longer time than the time programmed.
See table “Mode description” for more info.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x5041	0	C1.24	UINT16	rw	-	0....9999	0

Value description

<C1.24>	
Value	Description
0	Signal is changed immediately
1000	Delay time for signal change is 10.00 seconds
9999	Delay time for signal change is 99.99 seconds

Table 141: Possible values of parameter <C1.24> (0x5041)

Mode description, refer to □ Chapter "4.3.1 Block diagram", page 46

<C1.24>	
Operation Mode	Description
1	Not applicable
3,4,6	Processing the value of <d1.10>(500A),<d1.11>(500B) or <d1.12>(500C) depending on value of <C1.25>(5042)

Table 142: Function of parameter referenced to block diagram <C1.24> (0x5041)

4.5.1.55 Object 0x5042: C1.25, Comparator selection KOMP_1

This object defines the value which one of the signals will be compared with the comparator values.
See table “Mode description” for more info.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x5042	0	C1.25	UINT16	rw	-	0....3	0

Value description

<C1.25>	
Value	Description
0	Comparator is off
1	Compare with <d1.10>(500A)
2	Compare with <d1.11>(500B)
3	Compare with <d1.12>(500C)

Table 143: Possible values of parameter <C1.25> (0x5042)

Mode description, refer to □ Chapter "4.3.1 Block diagram", page 46

<C1.25>	
Operation Mode	Description
1	Not applicable
3,4,6	Processing the value of <d1.10>(500A),<d1.11>(500B) or <d1.12>(500C) with <C1.21>(503E) and <C1.22>(503F) depending on value of <C1.25>(5042)

Table 144: Function of parameter referenced to block diagram <C1.25> (0x5042)

4.5.1.56 Object 0x5043: C1.26, Cable fracture detection feedback loop 1

This object defines the value how the cable fracture will be work.
See table “Mode description” for more info.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x5043	0	C1.26	UINT16	rw	-	0....2	0

Value description

<C1.26>	
Value	Description
0	Cable fracture detection is off
1	Cable fracture detection is on
2	Cable fracture detection is only working in closed loop

Table 145: Possible values of parameter <C1.26> (0x5043)

Mode description, refer to □ Chapter "4.3.1 Block diagram", page 46

<C1.26>	
Operation Mode	Description
1	Not applicable
3,4,6	Checking the feedback signal about valid values

Table 146: Function of parameter referenced to block diagram <C1.26> (0x5043)

4.5.1.57 Object 0x5044: C2.00, Controller selection loop 2

This object defines the type of controller which is used to drive the solenoid

The usage of the safety function C2.01, together with remote loop control (C2.00 = 2 or C2.00 = 4) is not possible
□ Chapter “4.5.1.594.5.1.58 Object 0x5045: C2.01, Safety function", page 77

See table “Mode description” for more info.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x5044	0	C2.00	UINT16	rw	-	0...4	0

Value description

<C2.00>	
Value	Description
0	No controller is active, set value is directly forwarded to <d1.02>(5002)
1	Processing set value with P-PT1-I-DT1-regulator parameters and forwarded to <d1.02>(5002)
2	Processing set value with P-PT1-I-DT1-regulator parameters, only forwarded to <d1.02>(5002) if remote switch is on. If switch is off, set value of <d2.10>(5012) is used for <d1.02>(5002).
3	Processing set value with dff-function (**d**irect **f**eed **f**orward). Signal is using by-pass function parallel to P-PT1-I-DT1-regulator parameters.
4	Processing set value in combination of selection “2” and “3”

Table 147: Possible values of parameter <C2.00> (0x5044)

Mode description, refer to □ Chapter "4.3.1 Block diagram", page 46

<C2.00>	
Operation Mode	Description
1,3,4	Not applicable
6	Processing value of <d2.10>(5012) with value of <d2.11>(5013)

Table 148: Function of parameter referenced to block diagram <C2.00> (0x5044)

4.5.1.58 Object 0x5045: C2.01, Safety function

This object defines a type of an ”enable mode” or a sequence that allows a controlled shifting from the deactivated position to the activated position which is especially helpful for a restart after an emergency stop.

The usage of the safety function together with remote loop control (C1.00 = 2 or C1.00 = 4) is not possible
□ Chapter “4.5.1.594.5.1.58 Object 0x5045: C2.01, Safety function", page 77

See table “Mode description” for more info.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x5045	0	C2.01	UINT16	rw	-	0...1	0

Value description

<C2.01>	
Value	Description
0	function deactivated
1	Processing set value with following conditions: After restarting the amplifier (supply voltage on) the amplifier is waiting for the hardware enable, after applying the enable signal, the DSM state is changed to the “ACTIVE” state. □ Chapter “ 4.2.3.2.3 DSM state transitions caused by internal events”, page 44 The controller output is set (d2.13) = 0.000 and any drive movement is avoided. Activating the signal Din_2 in the control word, reactivates the regulator and the drive moves to a position defined by parameter S1.08. See table”logic table” for more info.

Table 149: Possible values of parameter <C2.01> (0x5045

<C2.01> Logic table			
Step	state	Input	Signal at input
1	Emergency-stop Can be done by disable or by Supply Voltage off.	Supply voltage	off
		Enable	Low
		Set Value	--
		DSM <StatusWord> (0x6041)	--
		Bit Din_2: <Control word> (0x6040)	--
2	Supply on and enable activated actual feedback value is stored and set point = feedback value So the hydraulic axis will remain in this position. So any movement is prevented	Supply voltage	On
		Enable	High
		Set Value	Internal bus set value set to 0 V[2]
		DSM <StatusWord> (0x6041)	"Active"
		Bit Din_2: <Control word> (0x6040)	low
3	Value for hold position in <Control word> is set to "Hold" (Can be the home position for an axis) Otherwise set <control word> to "Active"	Supply voltage	On
		Enable	High
		Set Value	S1.08 Hold setpoint (0x501A) [2]
		DSM <StatusWord> (0x6041)	Depends on DSM <Control word>
		Bit Din_2: <Control word> (0x6040)	High
4	Drive goes to start position. The start position corresponds to the active set points. The selected digital set point and the analogous set point are used	Supply voltage	On
		Enable	High
		Set Value	vpoc_set_point. (0x6300) [2]
		DSM <StatusWord> (0x6041)	"Active"
		Bit Din_2: <Control word> (0x6040)	High or low

Table 150: Logic table of parameter <C2.01> (0x5045

Mode description, refer to □ Chapter "4.3.1 Block diagram", page 46

<C2.01>	
Operation Mode	Description
1,3,4	Not applicable
6	Processing value of <d2.13>(0x5015) with value of <d2.11>(0x5013)

Table 151: Function of parameter referenced to block diagram <C2.01> (0x5045)

[2] Be careful, all internal offset parameter and the analogue set value (depending on E 15) are still active.

4.5.1.59 Object 0x5046: C2.02, Linearization

This object defines the type of linearization which is used to operate with different valve characteristics.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x5046	0	C2.02	UINT16	rw	-	0...6	0

Value description

<C2.02>	
Value	Description
0	function deactivated
1	general linearization for NC curve
2	linearization for proportional directional valves with flow characteristic >10 l/min (NG6)
3	linearization for proportional directional valves with flow characteristic at 10 l/min (NG6)
4	linearization for proportional directional valves with flow characteristic > 50 l/min (NG10)
5	linearization for proportional pressure valves
6	customized curve, referring to parameter <L2.x0>(50DA) to <L2.y8>(50EB)

Table 152: Possible values of parameter <C2.02> (0x5046)

Mode description, refer to □ Chapter "4.3.1 Block diagram", page 46

<C2.02>	
Operation Mode	Description
1,3,4	Not applicable
6	processing value of <d2.02>(500F) with consideration of <C2.27>(50A5)

Table 153: Function of parameter referenced to block diagram <C2.02> (0x5046)

4.5.1.60 Object 0x5047: C2.03,Gain A

This object defines the value which is used for amplification adjustment at negative setvalues (e.g. the speed of differential cylinders).
See table “Mode description” for more info.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x5047	0	C2.03	UINT16	rw	-	0 - 200	100

Value description

<C2.03>	
Value	Description
0	negative set value is multiplicity by 0, so new set value is zero
100	negative set value is multiplicity by 1.00, so new set value is not changed
200	negative set value is multiplicity by 2.00, so new set value is doubled

Table 154: Possible values of parameter <C2.03> (0x5047)

Mode description, refer to □ Chapter "4.3.1 Block diagram", page 46

<C2.03>	
Operation Mode	Description
1,3,4	Not applicable
6	value of <d2.03> (0x5010) processed with value of <C2.03> (5047)

Table 155: Function of parameter referenced to block diagram <C2.03> (0x5047)

4.5.1.61 Object 0x5048: C2.04, Gain B

This object defines the value which is used for amplification adjustment at positive setvalues (e.g. the speed of differential cylinders).
See table “Mode description” for more info.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x5048	0	C2.04	UINT16	rw	-	0 - 200	100

Value description

<C2.04>	
Value	Description
0	positive set value is multiplicity by 0, so new set value is zero
100	positive set value is multiplicity by 1.00, so new set value is not changed
200	positive set value is multiplicity by 2.00, so new set value is doubled

Table 156: Possible values of parameter <C2.04> (0x5048)

Mode description, refer to □ Chapter "4.3.1 Block diagram", page 46

<C2.04>	
Operation Mode	Description
1,3,4	Not applicable
6	value of <d2.03> (0x5010) processed with value of <C2.04> (5048)

Table 157: Function of parameter referenced to block diagram <C2.04> (0x5048)

4.5.1.62 Object 0x5049: C2.05, Set value sign and gain

This object defines the value which is used for exchange the polarity sign of the set points or to adapt the signal or in order to completely deactivate the signal. This enables to change the direction of a valve as well as the scaling of the set point signals.
See table “Mode description” for more info.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x5049	0	C2.05	INT16	rw	-	-400… +400	100

Value description

<C2.05>	
Value	Description
-200	set value is multiplicity by -200, so new set value is inverted and doubled
0	set value is multiplicity by 0, so new set value is zero
100	set value is multiplicity by 1.00, so new set value is not changed
200	set value is multiplicity by 2.00, so new set value is doubled

Table 158: Possible values of parameter <C2.05> (0x5049)

Mode description, refer to □ Chapter "4.3.1 Block diagram", page 46

<C2.05>	
Operation Mode	Description
1,3,4	Not applicable
6	sum of all set value processed with value of <C2.05> (5049)

Table 159: Function of parameter referenced to block diagram <C2.05> (0x5049)

4.5.1.63 Object 0x504A: C2.06, Set value offset

This object defines the value which is used to correct the drift of the drive or hydraulic system by an offset.
The offset can also be regarded as an additional set point.
This allows a very fine positioning of the system e.g. if it is used on a NC axis.
See table “Mode description” for more info.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x504A	0	C2.06	INT16	rw	-	-9999… +9999	0

Value description

<C2.06>	
Value	Description
-1000	set value is decreased by 1.000V
0	set value is not changed
+1000	set value is increased by 1.000V

Table 160: Possible values of parameter <C2.06> (0x504A)

Mode description, refer to □ Chapter "4.3.1 Block diagram", page 46

<C2.06>	
Operation Mode	Description
1,3,4	Not applicable
6	Output of controller 1 is processed with value of <C2.06> (504A)

Table 161: Function of parameter referenced to block diagram <C2.06> (0x504A)

4.5.1.64 Object 0x504B: C2.07, Dead band compensation A

This object defines the value which is used to compensate a possible spool overlap for solenoid A.
The compensation works as an additional set point that is activated as soon as the polarity of the set point changes to positive. Overlaps of valve are empirically around 10 % to 15 % of full stroke (depending on manufacturer and valve type!). The setting has a decisive effect on the quality (precision and speed) when positioning the axis drives.
The amplification in the small signal range is essentially determined by this function.
The pre-set value is directly applied as a current on the solenoids. The programming is standardized in volt, 9.999 V equals the maximum set current.
See table “Mode description” for more info.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x504B	0	C2.07	UINT16	rw	-	0….9999	0

Value description

<C2.07>	
Value	Description
0	No additional current is given, set value is not changed
1000	set value is increased by 1.000V

Table 162: Possible values of parameter <C2.07> (0x504B)

Mode description, refer to □ Chapter "4.3.1 Block diagram", page 46

<C2.07>	
Operation Mode	Description
1,3,4	Not applicable
6	Value of <d2.04>(5011) processed with value of <C2.07> (504B)

Table 163: Function of parameter referenced to block diagram <C2.07> (0x504B)

4.5.1.65 Object 0x504C: C2.08, Dead band compensation B

This object defines the value which is used to compensate a possible spool overlap for solenoid B.
The compensation works as an additional set point that is activated as soon as the polarity of the set point changes to positive. Overlaps of valve are empirically around 10 % to 15 % of full stroke (depending on manufacturer and valve type!). The setting has a decisive effect on the quality (precision and speed) when positioning the axis drives.
The amplification in the small signal range is essentially determined by this function.
The pre-set value is directly applied as a current on the solenoids. The programming is standardized in volt, 9.999 V equals the maximum set current.
See table “Mode description” for more info.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x504C	0	C2.08	UINT16	rw	-	0....9999	0

Value description

<C2.08>	
Value	Description
0	No additional current is given, set value is not changed
1000	set value is increased by 1.000V

Table 164: Possible values of parameter <C2.08> (0x504C)

Mode description, refer to □ Chapter "4.3.1 Block diagram", page 46

<C2.08>	
Operation Mode	Description
1,3,4	Not applicable
6	Value of <d2.04>(5011) processed with value of <C2.08> (504C)

Table 165: Function of parameter referenced to block diagram <C2.08> (0x504C)

4.5.1.66 Object 0x504D: C2.09, Sensor type

This object defines the type of sensor which is used for the feedback signal.
See table “Mode description” for more info.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x504D	0	C2.09	UINT16	rw	-	0....12	4

Value description

<C2.09>		
Value	Description	Wire Monitor
0	Only feedback signal via CANopen is used, sensor signal is disabled	
1	0…20mA	No
2	4…20mA	Yes
3	12mA +/- 8mA	Yes
4	0…10V	No
5	0….+/-10V	No
6	6V +/- 2,5V	Yes
7	7,5V +/- 2,5V	Yes
8	6V +/- 4V	Yes
9	7,5V +/- 2,5V	Yes
10	0…20mA with only positive controller output possible	No
11	4…20mA with only positive controller output possible	No
12	0…10V with only positive controller output possible	No

Table 166: Possible values of parameter <C2.09> (0x504D)

Mode description, refer to □ Chapter "4.3.1 Block diagram", page 46

<C2.09>	
Operation Mode	Description
1,3,4	Not applicable
6	Type of Sensor depending on settings of <C2.26>(505E),<E15>(506E) and <E17>(5070)

Table 167: Function of parameter referenced to block diagram <C2.09> (0x504D)

Modus	Parameter				
E 00	E 15	E 16	E 17	C1.09	C2.09
Modus	Ana1	Ana2	Set Value activation mode	(Ana1,Ana2,Ana3)	(Ana1,Ana2,Ana3)
3,4,6	Off..8	Off..8		Off ... 4-26	Off ... 4-12
3,4	Off means, not used	Off means, not used	0 = set(CAN + Ana1 + Ana2), FB1(Ana3 only voltage)	Off means, only CANopen feedback value A1.02 (Branch1) is used. (If Ana3 E17 = 0,3,4 only voltage is possible) or (If E17 = 1,2 current is available)	Off means, only CANopen feedback value A2.02 (Branch2) is used.
			1 = set(CAN + Ana1), FB1 (Ana2),---(E16 = OFF)		
			2 = set(CAN + Ana2), FB1 (Ana1),---(E15 = OFF)		
6					
			3 = set(CAN + Ana1), FB2 (Ana2), FB1 (Ana3 only voltage),---(E16 = OFF)		
			4 = set(CAN + Ana2), FB2 (Ana1), FB1 (Ana3 only voltage),---(E15 = OFF)		
	OFF = Only CAN input 1 = Voltage 2 = 0..20mA w/o cable fract. det. 3 = 10+-10mA w/o cable fract. det. 4 = 4..20mA w/o cable fract. det. 5 = 4..20mA with cable fract. det. 6 = 12+-8mA w/o cable fract. det. 7 = 12+-8mA with cable fract. det. 8 = Voltage 5V+-5V		When E17 is set to 0,3,4 FB1 is defined for voltage only input. But in this case C1.09 can not automatically set to a proper voltage signal input.	OFF = Only CAN input 1 = 0...20mA 2 = 4...20mA 3 = 12mA +-8mA 4 = 0...10V 5 = 0...+-10V 6 = 6V +-2.5V 7 = 7.5V +-2.5V 8 = 6V +-4V 9 = 7.5V +-2.5V 10 = 0..20mA (positive controller output only) 11 = 4..20mA (positive controller output only) 12 = 0..10V (positive controller output only) 14 = 5V+-3,0V 21 = Bipolar voltage semiautomatic calibration 22 = Unipolar voltage semiautomatic calibration 23 = Unipolar volt. semiauto. calib. (pos. contr. outp. only) 24 = Bipolar (internal) current semiauto. calibration 25 = Unipolar current semiautomatic calibration 26 = Unipolar current semi. calib. (pos. contr. outp. only)	

Table 168: Possible setting of analogue inputs depending on the operation mode E 00

4.5.1.67 Object 0x504E: C2.10, Actual value gain

This object defines the value which is used for amplifiying a feedback signal.
See table “Mode description” for more info.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x504E	0	C2.10	UINT16	rw	-	0....400	100

Value description

<C2.10>	
Value	Description
0	feedback signal is multiplicity by 0, so new signal value is zero
100	feedback signal is multiplicity by 1.00 so new signal value is not changed
200	feedback signal is multiplicity by 2.00 so new signal value is doubled

Table 169: Possible values of parameter <C2.10> (0x504E)

Mode description, refer to □ Chapter "4.3.1 Block diagram", page 46

<C2.10>	
Operation Mode	Description
1,3,4	Not applicable
6	Amplifiying feedback value which is coming from Analogue 1 or 2, depending on setting of <E17>(5070)

Table 170: Function of parameter referenced to block diagram <C2.10> (0x504E)

4.5.1.68 Object 0x504F: C2.11, Actual value offset

This object defines the value which is used for adjusting a feedback signal.
See table “Mode description” for more info.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x504F	0	C2.11	INT16	rw	-	-9999… +9999	0

Value description

<C2.11>	
Value	Description
-1000	feedback signal is decreased by -1.000V
0	feedback signal is not changed
+1000	feedback signal is increased by 1.000V

Table 171: Possible values of parameter <C2.11> (0x504F)

Mode description, refer to □ Chapter "4.3.1 Block diagram", page 46

<C2.11>	
Operation Mode	Description
1,3,4	Not applicable
6	Adjusting feedback value which is coming from Analogue 1 or 2, depending on setting of <E17>(5070)

Table 172: Function of parameter referenced to block diagram <C2.11> (0x504F)

4.5.1.69 Object 0x5050: C2.12, Actual value sign

This object defines the value which is used for exchange the polarity sign of the feedback signal or to completely deactivate the signal. This enables to change the direction of the process.
See table “Mode description” for more info.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x5050	0	C2.12	INT16	rw	-	-1… +1	1

Value description

<C2.12>	
Value	Description
-1	feedback signal is multiplied by -1, so new feedback signal is inverted
0	feedback signal is deactivated
+1	feedback signal is mulriplied by +1, so new feedback signal is not changed

Table 173: Possible values of parameter <C2.12> (0x5050)

Mode description, refer to □ Chapter "4.3.1 Block diagram", page 46

<C2.12>	
Operation Mode	Description
1,3,4	Not applicable
6	Set polarity of feedback value which is coming from Analogue 1 or 2, depending on setting of <E17>(5050)

Table 174: Function of parameter referenced to block diagram <C2.12> (0x5050)

4.5.1.70 Object 0x5051: C2.13, P-Portion KP1

This object defines the value for the P-amplification (KP1).
More detailed information about the control parameters:
□ Chapter "4.5.2.2 Detailed Information about C2.13, C2.14, C2.15, C2.16", page 118
See table “Mode description” for more info.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x5051	0	C2.13	UINT16	rw	-	0… 400	0

Value description

<C2.13>	
Value	Description
0	P-Portion is off
100	P-Portion is set to 1.00
400	P-Portion is set to 4.00

Table 175: Possible values of parameter <C2.13> (0x5051)

Mode description, refer to □ Chapter "4.3.1 Block diagram", page 46

<C2.13>	
Operation Mode	Description
1,3,4	Not applicable
6	Processing the value of <d2.10>(5012) or <d2.12>(5014) depending on setting of <C2.00>(5044) and <C2.15>(5053)

Table 176: Function of parameter referenced to block diagram <C2.13> (0x5051)

4.5.1.71 Object 0x5052: C2.14, T-Portion for PT1 (to C2.16)

This object defines the value for the T-portion.
More detailed information about the control parameters:
□ Chapter "4.5.2.2 Detailed Information about C2.13, C2.14, C2.15, C2.16", page 118
See table “Mode description” for more info.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x5052	0	C2.14	UINT16	rw	-	0…1000	0

Value description

<C2.14>	
Value	Description
0	T-Portion is off
500	T-Portion is set to 5.00 seconds
1000	T-Portion is set to 10.00 seconds

Table 177: Possible values of parameter <C2.14> (0x5052)

Mode description, refer to □ Chapter "4.3.1 Block diagram", page 46

<C2.14>	
Operation Mode	Description
1,3,4	Not applicable
6	Processing the value of <d2.12>(5014) depending on setting of <C2.00>(5044) and <C2.15>(5053)

Table 178: Function of parameter referenced to block diagram <C2.14> (0x5052)

4.5.1.72 Object 0x5053: C2.15, Threshold (C2.13 or C2.16)

This object defines the value for the threshold for controlling C2.13 or C2.16.
More detailed information about the control parameters:
□ Chapter "4.5.2.2 Detailed Information about C2.13, C2.14, C2.15, C2.16", page 118
table “Mode description” for more info.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x5053	0	C2.15	UINT16	rw	-	0…9999	9999

Value description

<C2.15>	
Value	Description
0	Threshold is off
1000	Threshold is set to 1.000V
9999	Threshold is set to 9.999V

Table 179: Possible values of parameter <C2.15> (0x5053)

Mode description, refer to □ Chapter "4.3.1 Block diagram", page 46

<C2.15>	
Operation Mode	Description
1,3,4	Not applicable
6	Processing the value of <d2.12>(5014)

Table 180: Function of parameter referenced to block diagram <C2.15> (0x5053)

4.5.1.73 Object 0x5054: C2.16, P-Portion KP2

This object defines the value for the P-amplification (KP2).
More detailed information about the control parameters:
□ Chapter "4.5.2.2 Detailed Information about C2.13, C2.14, C2.15, C2.16", page 118
table “Mode description” for more info.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x5054	0	C2.16	UINT16	rw	-	0… 400	0

Value description

<C2.16>	
Value	Description
0	P-Portion is off
100	P-Portion is set to 1.00
400	P-Portion is set to 4.00

Table 181: Possible values of parameter <C2.16> (0x5054)

Mode description, refer to □ Chapter "4.3.1 Block diagram", page 46

<C2.16>	
Operation Mode	Description
1,3,4	Not applicable
6	Processing the value of <d2.12>(5014) depending on setting of <C2.15>(5053)

Table 182: Function of parameter referenced to block diagram <C2.16> (0x5054)

4.5.1.74 Object 0x5055: C2.17, I-Portion

This object defines the value for the I-portion of the controller (integrating controller). C2.17 is limited to the value of C 2.33 to avoid an overdrive or saturation. Small values do indicate a slow reaction. Large values do indicate a fast reaction!
See table “Mode description” for more info.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x5055	0	C2.17	UINT16	rw	-	0….4000	0

Value description

<C2.17>	
Value	Description
0	I-Portion is off
1000	I-Portion is set to 1.000 V/s
4000	I-Portion is set to 4.000 V/s

Table 183: Possible values of parameter <C2.17> (0x5055)

Mode description, refer to □ Chapter "4.3.1 Block diagram", page 46

<C2.17>	
Operation Mode	Description
1,3,4	Not applicable
6	Processing the value of <d2.12>(5014)

Table 184: Function of parameter referenced to block diagram <C2.17> (0x5055)

4.5.1.75 Object 0x5056: C2.18, D-Portion

This object defines the value for the D-portion and together with C2.19 forms a PT1 term (differential controller).
See table “Mode description” for more info.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x5056	0	C2.18	UINT16	rw	-	0….400	0

Value description

<C2.18>	
Value	Description
0	D-Portion is off
100	D-Portion is set to 1.00 V/s
400	D-Portion is set to 4.00 V/s

Table 185: Possible values of parameter <C2.18> (0x5056)

Mode description, refer to □ Chapter "4.3.1 Block diagram", page 46

<C2.18>	
Operation Mode	Description
1,3,4	Not applicable
6	Processing the value of <d2.12>(5014)

Table 186: Function of parameter referenced to block diagram <C2.18> (0x5056)

4.5.1.76 Object 0x5057: C2.19, T-Portion for DT1

This object defines the value for the T-portion and together with C2.18 forms a PT1 term (differential controller).
See table “Mode description” for more info.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x5057	0	C2.19	UINT16	rw	-	0….400	0

Value description

<C2.19>	
Value	Description
0	T-Portion is off
100	T-Portion is set to 1.00 second
400	T-Portion is set to 4.00 seconds

Table 187: Possible values of parameter <C2.19> (0x5057)

Mode description, refer to □ Chapter "4.3.1 Block diagram", page 46

<C2.19>	
Operation Mode	Description
1	Not applicable
3,4,6	Processing the value of <d2.12>(5014)

Table 188: Function of parameter referenced to block diagram <C2.19> (0x5057)

4.5.1.77 Object 0x5058: C2.20, Additional gain for C2.13 and C2.16

This object defines the value for a additional proportional factor to increase the effect of C2.13 and C2.16, especially for process control.
See table “Mode description” for more info.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x5058	0	C2.20	UINT16	rw	-	1….32	1

Value description

<C2.20>	
Value	Description
1	Proportional factor is 1
8	Proportional factor is 8
32	Proportional factor is 32

Table 189: Possible values of parameter <C2.20> (0x5058)

Mode description, refer to □ Chapter "4.3.1 Block diagram", page 46

<C2.20>	
Operation Mode	Description
1,3,4	Not applicable
6	Processing the value of <d2.12>(5014)

Table 190: Function of parameter referenced to block diagram <C2.20> (0x5058)

4.5.1.78 Object 0x5059: C2.21, Comparator upper level

This object defines the value for upper level of the comparator threshold. If the signal reaches this comparative value the comparator changes its signal.
See table “Mode description” for more info.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x5059	0	C2.21	INT16	rw	-	-9999 +9999	0

Value description

<C2.21>	
Value	Description
-9999	Upper level is -9.999V
0	Upper level is 0V
+9999	Upper level is +9.999V

Table 191: Possible values of parameter <C2.21> (0x5059)

Mode description, refer to □ Chapter "4.3.1 Block diagram", page 46

<C2.21>	
Operation Mode	Description
1,3,4	Not applicable
6	Processing the value of <d2.10>(5012),<d2.11>(5013) or <d2.12>(5014) depending on value of <C2.25>(505D)

Table 192: Function of parameter referenced to block diagram <C2.21> (0x5059)

4.5.1.79 Object 0x505A: C2.22, Comparator lower level

This object defines the value for lower level of the comparator threshold. If the signal reaches this comparative value the comparator changes its signal.
See table “Mode description” for more info.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x505A	0	C2.22	INT16	rw	-	-9999 +9999	0

Value description

<C2.22>	
Value	Description
-9999	Lower level is -9.999V
0	Lower level is 0V
+9999	Lower level is +9.999V

Table 193: Possible values of parameter <C2.22> (0x505A)

Mode description, refer to □ Chapter "4.3.1 Block diagram", page 46

<C2.22>	
Operation Mode	Description
1,3,4	Not applicable
6	Processing the value of <d2.10>(5012),<d2.11>(5013) or <d2.12>(5014) depending on value of <C2.25>(505D)

Table 194: Function of parameter referenced to block diagram <C2.22> (0x505A)

4.5.1.80 Object 0x505B: C2.23, Comparator delay into window

This object defines the value for the comparator signal delay time. The signal is changed only when the threshold value had been reached for a longer time than the time programmed.
See table “Mode description” for more info.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x505B	0	C2.23	UINT16	rw	-	0....9999	0

Value description

<C2.23>	
Value	Description
0	Signal is changed immediately
1000	Delay time for signal change is 10.00 seconds
9999	Delay time for signal change is 99.99 seconds

Table 195: Possible values of parameter <C2.23> (0x505B)

Mode description, refer to □ Chapter "4.3.1 Block diagram", page 46

<C2.23>	
Operation Mode	Description
1,3,4	Not applicable
6	Processing the value of <d2.10>(5012),<d2.11>(5013) or <d2.12>(5014) depending on value of <C2.25>(505D)

Table 196: Function of parameter referenced to block diagram <C2.23> (0x505B)

4.5.1.81 Object 0x505C: C2.24, Comparator delay out of window

This object defines the value for the comparator signal delay time. The signal is changed only when the threshold value had been reached for a longer time than the time programmed.
See table “Mode description” for more info.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x505C	0	C2.24	UINT16	rw	-	0....9999	0

Value description

<C2.24>	
Value	Description
0	Signal is changed immediately
1000	Delay time for signal change is 10.00 seconds
9999	Delay time for signal change is 99.99 seconds

Table 197: Possible values of parameter <C2.24> (0x505C)

Mode description, refer to □ Chapter "4.3.1 Block diagram", page 46

<C2.24>	
Operation Mode	Description
1,3,4	Not applicable
6	Processing the value of <d2.10>(5012),<d2.11>(5013) or <d2.12>(5014) depending on value of <C2.25>(505D)

Table 198: Function of parameter referenced to block diagram <C2.24> (0x505C)

4.5.1.82 Object 0x505D: C2.25, Comparator selection KOMP_2

This object defines the value which one of the signals will be compared with the comparator values.
See table “Mode description” for more info.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x505D	0	C2.25	UINT16	rw	-	0....3	0

Value description

<C2.25>	
Value	Description
0	Comparator is off
1	Compare with <d2.10>(5012)
2	Compare with <d2.11>(5013)
3	Compare with <d2.12>(5014)

Table 199: Possible values of parameter <C2.25> (0x505D)

Mode description, refer to □ Chapter "4.3.1 Block diagram", page 46

<C2.25>	
Operation Mode	Description
1,3,4	Not applicable
6	Processing the value of <d2.10>(5012),<d2.11>(5013) or <d2.12>(5014) with <C2.21>(5059) and <C2.22>(505A) depending on value of <C2.25>(505D)

Table 200: Function of parameter referenced to block diagram <C2.25> (0x505D)

4.5.1.83 Object 0x505E: C2.26, Cable fracture detection feedback loop 2

This object defines the value how the cable fracture will be work.
See table “Mode description” for more info.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x505E	0	C2.26	UINT16	rw	-	0....2	0

Value description

<C2.26>	
Value	Description
0	Cable fracture detection is off
1	Cable fracture detection is on
2	Cable fracture detection is only working in closed loop

Table 201: Possible values of parameter <C2.26> (0x505E)

Mode description, refer to □ Chapter "4.3.1 Block diagram", page 46

<C2.26>	
Operation Mode	Description
1,3,4	Not applicable
6	Checking the feedback signal about valid values

Table 202: Function of parameter referenced to block diagram <C2.26> (0x505E)

4.5.1.84 Object 0x505F: E 00, Operation mode (depends on HW + SW version)

This object defines the value how the module itself will be work.

Attention, when changed via CANopen, due to the internal programming time, an CANopen timeout will occur.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x505F	0	E 00	UINT16	rw	-	1.....8	1

Value description

<E 00>	
Value	Description
1	Open loop, 1 valve
2	n.A.
3	Closed loop, 1 valve
4	Closed loop, 1 process
5	n.A.
6	Closed loop , 1valve, 1 process
7	n.A.
8	Closed loop , 2 process

Table 203: Possible values of parameter <E 00> (0x505F)

4.5.1.85 Object 0x5061: E 02, Push-pull function

This object defines the value in which way the energization of the solenoids will be done.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x5061	0	E 02	UINT16	rw	-	0….4	0

Value description

<E 02>	
Value	Description
0	Push-Pull function off
1	Push-Pull function active
2	Common connection point with wire break detection
3	n.A.
4	Push-Pull function off with wire break detection

Table 204: Possible values of parameter <E 02> (0x5061)

4.5.1.86 Object 0x5062: E 03, E1.03, Solenoid selection A+B/A

This object defines the value which set the nominal current through the solenoids at maximum setvalue.

The programming of the parameter E 03 has an effect on both output stages.
Depending on operation mode, parameter E1.03 instead of E03 is available.
Then the effect works only on output stage A.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x5062	0	E 03	UINT16	rw	-	1…..7	6

Value description

<E 03>	
Value	Description
1	150mA
2	150mA
3	150mA
4	240mA
5	500mA
6	630mA
7	800mA

Table 205: Possible values of parameter <E 03> (0x5062)

4.5.1.87 Object 0x5063: E 04, E1.04, P-Portion current controller energization A+B/A

This object defines the energization P-Portion value for the solenoids.

The programming of the parameter E 04 has an effect on both output stages.
Default value of E 04 depends on setting of E 03.
Depending on operation mode, parameter E1.04 instead of E04 is available.
Then the effect works only on output stage A.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x5063	0	E 04	UINT16	rw	-	0..9999	500

Value description

<E 04>	
Value	Description
0	Value == 0
2000	Value == 2000
9999	Value == 9999

Table 206: Possible values of parameter <E 04> (0x5063)

4.5.1.88 Object 0x5064: E 05, E1.05, I-Portion current controller energization A+B/A

This object defines the energization I-Portion value for the solenoids.

The programming of the parameter E 05 has an effect on both output stages.
Default value of E 05 depends on setting of E 03.
Depending on operation mode, parameter E1.05 instead of E05 is available.
Then the effect works only on output stage A.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x5064	0	E 05	UINT16	rw	-	0..9999	500

Value description

<E 05>	
Value	Description
0	Value == 0
2000	Value == 2000
9999	Value == 9999

Table 207: Possible values of parameter <E 05> (0x5064)

4.5.1.89 Object 0x5065: E 06, E1.06, P-Portion current controller de-energization A+B/A

This object defines the DE energization P-Portion value for the solenoids.

The programming of the parameter E 06 has an effect on both output stages.
Default value of E 06 depends on setting of E 03.
Depending on operation mode, parameter E1.06 instead of E06 is available.
Then the effect works only on output stage A.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x5065	0	E 06	UINT16	rw	-	0..9999	1300

Value description

<E 06>	
Value	Description
0	Value == 0
2000	Value == 2000
9999	Value == 9999

Table 208: Possible values of parameter <E 06> (0x5065)

4.5.1.90 Object 0x5066: E 07, E1.07, I-Portion current controller de-energization A+B/A

This object defines the DE energization I-Portion value for the solenoids.

The programming of the parameter E 07 has an effect on both output stages.
Default value of E 07 depends on setting of E 03.
Depending on operation mode, parameter E1.07 instead of E07 is available.
Then the effect works only on output stage A.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x5066	0	E 07	UINT16	rw	-	0..9999	500

Value description

<E 07>	
Value	Description
0	Value == 0
2000	Value == 2000
9999	Value == 9999

Table 209: Possible values of parameter <E 07> (0x5066)

4.5.1.91 Object 0x5067: E 08, Ramp selection

This object defines the type of ramp which is used for handling the analogue setvalue.
More detailed information about the Ramp selection:
□ Chapter "4.5.2.3 Detailed Information about r1.01 to r1.04 and E08", page 119

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x5067	0	E 08	UINT16	rw	-	0..1|	1

Value description

<E 08>	
Value	Description
0	Only digital set values will be processed, (constant rise)
1	All set values will be processed, (constant time)

Table 210: Possible values of parameter <E 08> (0x5067)

4.5.1.92 Object 0x5068: E 09, Time delay enable signal

This object defines the value how long the module remains in disabled state after giving the enable signal.
Parameter E09 sets the time delay of the enable signal. The activation of the output stages will be delayed even though the enable signal is active.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x5068	0	E 09	UINT16	rw	-	0..9999	0

Value description

<E 09>	
Value	Description
0	Wait Time == 0 sec.
1000	Wait Time == 1.000 sec.
9999	Wait Time == 9.999 sec.

Table 211: Possible values of parameter <E 09> (0x5068)

4.5.1.93 Object 0x5069: E 10, E1.10, Solenoid current adaptation A+B/A

This object defines the value to adjust the solenoid current.
This parameter allows a fine and variable adjustment and this also allows to adjust the already set maximum current.

The programming of the parameter E 10 has an effect on both output stages.
Depending on operation mode, parameter E1.10 instead of E10 is available.
Then the effect works only on output stage A.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x5069	0	E 10	UINT16	rw	-	50…110	100

Value description

<E 10>	
Value	Description
50	Current is set to 50%
100	Current is set to 100%
110	Current is set to 110%t

Table 212: Possible values of parameter <E 10> (0x5069)

4.5.1.94 Object 0x506A: E 11, Initial current solenoid A

This object defines the value how to set a additional set value for solenoid A.
Initial current is used, e.g. for valves with feedback, to keep the bolt of the magnet always at the spool. This places the spool solidly between the solenoids and prevents the spool being hit by the bolt of the solenoid. An initial magnetizing helps to improve the reaction of the solenoids.
The programming is done in Volt: the programmable maximum current is 10 V.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x506A	0	E 11	UINT16	rw	-	0..9999	0

Value description

<E 11>	
Value	Description
0	Value == 0
1000	Value == 1.000V
9999	Value == 9.999V

Table 213: Possible values of parameter <E 11> (0x506A)

4.5.1.95 Object 0x506B: E 12, Initial current solenoid B

This object defines the value how to set a additional set value for solenoid A.
Initial current is used, e.g. for valves with feedback, to keep the bolt of the magnet always at the spool. This places the spool solidly between the solenoids and prevents the spool being hit by the bolt of the solenoid. An initial magnetizing helps to improve the reaction of the solenoids.
The programming is done in Volt: the programmable maximum current is 10 V.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x506B	0	E 12	UINT16	rw	-	0..9999	0

Value description

<E 12>	
Value	Description
0	Value == 0
1000	Value == 1.000V
9999	Value == 9.999V

Table 214: Possible values of parameter <E 12> (0x506B)

4.5.1.96 Object 0x506C: E 13, E1.13, Dither Amplitude A+B/A

This object defines the value of the dither amplitude.
The dither function can be matched to the valve or to the process with the parameters E13 (for the amplitude) and E14 (for the frequency). This is independent of the used operation modes and has an effect on both output stages. The frequency of the signal is adjusted stepwise. The dither signal reduces the hysteresis of the valve or drive movement and improves the reaction of the system. This has positive effects on the precision and repeatability.

In general, low frequency signals are more effective, but they can result in noticeable disturbances (noise, oscillations). Values under 100 Hz are for systems with a low characteristic frequency, higher values are used for systems with a high characteristic frequency. Dither amplitudes are set for a range of 2% to 12% (related to current or set point).
Dither signals have an influence on the characteristic curve of the current caused by a physical dynamic correlation. In some cases, this has an effect on the linearity from U to I.

The programming of the parameter E 13 has an effect on both output stages.
Depending on operation mode, parameter E1.13 instead of E13 is available.
Then the effect works only on output stage A.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x506C	0	E 13	UINT16	rw	-	0..3000	0

Value description

<E 13>	
Value	Description
0	Value == 0
1000	Value == 1.000V
3000	Value == 3.000V

Table 215: Possible values of parameter <E 13> (0x506C)

4.5.1.97 Object 0x506D: E 14, E1.14, Dither Frequency A+B/A

This object defines the value of the dither frequency.
The dither function can be matched to the valve or to the process with the parameters E13 (for the amplitude) and E14 (for the frequency). This is independent of the used operation modes and has an effect on both output stages. The frequency of the signal is adjusted stepwise. The dither signal reduces the hysteresis of the valve or drive movement and improves the reaction of the system. This has positive effects on the precision and repeatability.

In general, low frequency signals are more effective, but they can result in noticeable disturbances (noise, oscillations). Values under 100 Hz are for systems with a low characteristic frequency, higher values are used for systems with a high characteristic frequency. Dither amplitudes are set for a range of 2% to 12% (related to current or set point).
Dither signals have an influence on the characteristic curve of the current caused by a physical dynamic correlation. In some cases, this has an effect on the linearity from U to I.

The programming of the parameter E 14 has an effect on both output stages.
Depending on operation mode, parameter E1.14 instead of E14 is available.
Then the effect works only on output stage A.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x506D	0	E 14	UINT16	rw	-	0….300	0

Value description

<E 14>	
Value	Description
0	Value == 0
100	Value == 100 Hz
300	Value == 300 Hz

Table 216: Possible values of parameter <E 14> (0x506D)

4.5.1.98 Object 0x506E: E 15, Selection set point S1.06 (U/I)

This object defines the value how S1.06/Analogue2 will be work.
This parameter is used in order to select the type of analogue set point. Either a voltage input (0 … □ 10 V) or a current input can be selected.
If current input is selected than the measuring resistance (250 Ω) is activated.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x506E	0	E 15	UINT16	rw	-	0…..8	1

Value description

<E 15>	
Value	Description
0	S1.06 is deactivated
1	S1.06 is activated as voltage input; range: 0….+/- 10V
2	S1.06 is activated as current input; range: 0….20mA, no cable fracture detection is possible
3	S1.06 is activated as current input; range: 10mA …..+/- .10mA, no cable fracture detection is possible
4	S1.06 is activated as current input; range: 4….20mA, no cable fracture detection is possible
5	S1.06 is activated as current input; range: 4….20mA, cable fracture detection is activated
6	S1.06 is activated as current input; range: 12…+/-8mA, no cable fracture detection is possible
7	S1.06 is activated as current input; range: 12…+/-8mA, cable fracture detection is activated
8	S1.06 is activated as voltage input; range: 5V….+/- 5V

Table 217: Possible values of parameter <E 15> (0x506E)

Mode description, refer to □ Chapter "4.3.1 Block diagram", page 46

<E 15>	
Operation Mode	Description
1	Always usable
3,4,6	Availability depends on setting of <E 17>(5070)

Table 218: Function of parameter referenced to block diagram <E 15> (0x506E)

4.5.1.99 Object 0x506F: E 16, Selection set point S1.05 (U/I)

This object defines the value how S1.05/Analogue1 will be work.
This parameter is used in order to select the type of analogue set point. Either a voltage input (0 … □ 10 V) or a current input can be selected.
If current input is selected than the measuring resistance (250 Ω) is activated.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x506F	0	E 16	UINT16	rw	-	0…..8	1

Value description

<E 16>	
Value	Description
0	S1.05 is deactivated
1	S1.05 is activated as voltage input; range: 0….+/- 10V
2	S1.05 is activated as current input; range: 0….20mA, no cable fracture detection is possible
3	S1.05 is activated as current input; range: 10mA …..+/- .10mA, no cable fracture detection is possible
4	S1.05 is activated as current input; range: 4….20mA, no cable fracture detection is possible
5	S1.05 is activated as current input; range: 4….20mA, cable fracture detection is activated
6	S1.05 is activated as current input; range: 12…+/-8mA, no cable fracture detection is possible
7	S1.05 is activated as current input; range: 12…+/-8mA, cable fracture detection is activated
8	S1.05 is activated as voltage input; range: 5V….+/- 5V

Table 219: Possible values of parameter <E 16> (0x506F)

Mode description, refer to □ Chapter "4.3.1 Block diagram", page 46

<E 16>	
Operation Mode	Description
1	Always usable
3,4,6	Availability depends on setting of <E 17>(5070)

Table 220: Function of parameter referenced to block diagram <E 16> (0x506F)

4.5.1.100 Object 0x5070: E 17, Set value activation mode

This object defines the value for which type of input the Analogue signals are used.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x5070	0	E 17	UINT16	rw	-	0….4	0

Value description

<E 17>	
Value	Description
0	Setpoint is given from CANopen, Analogue1 and Analogue2, (Feedbacksignal is given by Analogue3 – Operation Mode 3 and 4)
1	Setpoint is given from CANopen and Analogue1, Feedbacksignal is given by Analogue2
2	Setpoint is given from CANopen and Analogue2, Feedbacksignal is given by Analogue1
3	Setpoint is given from CANopen and Analogue1, Feedbacksignal is given by Analogue3 Feebacksignal2 is given by Analogue2
4	Setpoint is given from CANopen and Analogue2, Feedbacksignal is given by Analogue3 Feebacksignal2 is given by Analogue1

Table 221: Possible values of parameter <E 17> (0x5070)

Mode description, refer to □ Chapter "4.3.1 Block diagram", page 46

<E 17>	
Operation Mode	Description
1	Only Value == 0 possible
3,4	Value == 0 to 2 possible
6	Value == 3,4 possible

Table 222: Function of parameter referenced to block diagram <E 17> (0x5070)

4.5.1.101 Object 0x5071: E 18, Switchable universal output

This object defines the value how the universal output works.
The parameter controls the behavior, the interaction and the logic of this output.
With this output, the result of a comparison can be requested from an external control.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x5071	0	E 18	UINT16	rw	-	0….13	0

Value description

<E 18>	
Value	Description
0	Output always 24V (max.100mA)
1	On error, output high impedance
2	Comp_1 positive logic (Comparator1 in window => Output High)
3	Comp_1 negative logic(Comparator1 in window => Output Low)
4	Comp_2 positive logic (Comparator2 in window => Output High)
5	Comp_2 negative logic(Comparator2 in window => Output Low)
6	Dout_1 positive logic (LED “Dout_1” is lit => Output High)
7	Dout_1 negative logic (LED “Dout_1” is lit => Output Low)
8	Dout_2 positive logic (LED “Dout_2” is lit => Output High)
9	Dout_2 negative logic (LED “Dout_2” is lit => Output Low)
10	Comp_1 AND Comp_2 positive logic (Comparator1 and 2 in window => Output High)
1	Comp_1 AND Comp_2 negative logic (Comparator1 and 2 in window => Output Low)
12	Comp_1 OR Comp_2 positive logic (Comparator1 or 2 in window => Output High)
13	Comp_1 OR Comp_2 negative logic (Comparator1 or 2 in window => Output Low)

Table 223: Possible values of parameter <E 18> (0x5071)

In window means, the comparative value lies within the threshold values that have been defined with Cx.21 and Cx.22.

Mode description, refer to □ Chapter "4.3.1 Block diagram", page 46

<E 18>	
Operation Mode	Description
1	Only Value == 0,1 possible
3,4,6	Value == 0 to 13 possible

Table 224: Function of parameter referenced to block diagram <E 18> (0x5071)

4.5.1.102 Object 0x509B: E2.03, Solenoid selection B (Mode 2

This Parameter only in Mode 2 is active.
This object defines the value which set the nominal current through solenoid B at maximum setvalue.

The programming of the parameter E 2.03 has an effect only on output stage B.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x509B	0	E 2.03	UINT16	rw	-	1…..7	6

Value description

<E 2.03>	
Value	Description
1	150mA
2	150mA
3	150mA
4	240mA
5	500mA
6	630mA
7	800mA

Table 225: Possible values of parameter <E 2.03> (0x509B)

4.5.1.103 Object 0x509C: E2.04, P-Portion current controller energization B (Mode 2)

This Parameter only in Mode 2 is active.
This object defines the energization P-Portion value for the solenoid.

The programming of the parameter E 2.04 has an effect only on output stage B.
Default value of E 2.04 depends on setting of E 2.03.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x509C	0	E 2.04	UINT16	rw	-	0..9999	500

Value description

<E 2.04>	
Value	Description
0	Value == 0
2000	Value == 2000
9999	Value == 9999

Table 226: Possible values of parameter <E 2.04> (0x509C)

4.5.1.104 Object 0x509D: E2.05, I-Portion current controller energization B (Mode 2)

This Parameter only in Mode 2 is active.
This object defines the energization I-Portion value for the solenoid.

The programming of the parameter E 2.05 has an effect only on output stage B.
Default value of E 2.05 depends on setting of E 2.03.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x506D	0	E 2.05	UINT16	rw	-	0..9999	500

Value description

<E 2.05>	
Value	Description
0	Value == 0
2000	Value == 2000
9999	Value == 9999

Table 227: Possible values of parameter <E 2.05> (0x509D)

4.5.1.105 Object 0x509E: E2.06, P-Portion current controller de-energization B (Mode 2)

This Parameter only in Mode 2 is active.
This object defines the DE energization P-Portion value for the solenoid.

The programming of the parameter E 2.06 has an effect only on output stage B.
Default value of E 2.06 depends on setting of E 2.03.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x509E	0	E 2.06	UINT16	rw	-	0..9999	1300

Value description

<E 06>	
Value	Description
0	Value == 0
2000	Value == 2000
9999	Value == 9999

Table 228: Possible values of parameter <E 2.06> (0x509E)

4.5.1.106 Object 0x509F: E2.07, I-Portion current controller de-energization B (Mode 2)

This Parameter only in Mode 2 is active.
This object defines the DE energization I-Portion value for the solenoid.

The programming of the parameter E 2.07 has an effect only on output stage B.
Default value of E 2.07 depends on setting of E 2.03.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x509F	0	E 2.07	UINT16	rw	-	0..9999	500

Value description

<E 07>	
Value	Description
0	Value == 0
2000	Value == 2000
9999	Value == 9999

Table 229: Possible values of parameter <E 2.07> (0x509F)

4.5.1.107 Object 0x50A0: E2.10, Solenoid current adaptation B (Mode 2)

This Parameter only in Mode 2 is active.
This object defines the value to adjust the solenoid current.
This parameter allows a fine and variable adjustment and this also allows to adjust the already set maximum current.

The programming of the parameter E 2.10 has an effect only on output stage B.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x50A0	0	E 2.10	UINT16	rw	-	50…110	100

Value description

<E 2.10>	
Value	Description
50	Current is set to 50%
100	Current is set to 100%
110	Current is set to 110%t

Table 230: Possible values of parameter <E 2.10> (0x50A0)

4.5.1.108 Object 0x50A1: E2.13, Dither Amplitude B (Mode 2)

This Parameter only in Mode 2 is active.
This object defines the value of the dither amplitude.
The dither function can be matched to the valve or to the process with the parameters E2.13 (for the amplitude) and E2.14 (for the frequency). This is independent of the used operation modes and has an effect on both output stages.
The frequency of the signal is adjusted stepwise. The dither signal reduces the hysteresis of the valve or drive movement and improves the reaction of the system. This has positive effects on the precision and repeatability.
In general, low frequency signals are more effective, but they can result in noticeable disturbances (noise, oscillations). Values under 100 Hz are for systems with a low characteristic frequency, higher values are used for systems with a high characteristic frequency. Dither amplitudes are set for a range of 2% to 12% (related to current or set point).
Dither signals have an influence on the characteristic curve of the current caused by a physical dynamic correlation. In some cases, this has an effect on the linearity from U to I.

The programming of the parameter E 2.13 has an effect only on output stage B.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x50A1	0	E 2.13	UINT16	rw	-	0..3000	0

Value description

<E 2.13>	
Value	Description
0	Value == 0
1000	Value == 1.000V
3000	Value == 3.000V

Table 231: Possible values of parameter <E 2.13> (0x50A1)

4.5.1.109 Object 0x50A2: E2.14, Dither Frequency B (Mode 2)

This Parameter only in Mode 2 is active.
This object defines the value of the dither frequency.
The dither function can be matched to the valve or to the process with the parameters E2.13 (for the amplitude) and E2.14 (for the frequency). This is independent of the used operation modes and has an effect on both output stages.
The frequency of the signal is adjusted stepwise. The dither signal reduces the hysteresis of the valve or drive movement and improves the reaction of the system. This has positive effects on the precision and repeatability.

In general, low frequency signals are more effective, but they can result in noticeable disturbances (noise, oscillations). Values under 100 Hz are for systems with a low characteristic frequency, higher values are used for systems with a high characteristic frequency. Dither amplitudes are set for a range of 2% to 12% (related to current or set point).
Dither signals have an influence on the characteristic curve of the current caused by a physical dynamic correlation. In some cases, this has an effect on the linearity from U to I.

The programming of the parameter E 2.14 has an effect only on output stage B.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x50A2	0	E 2.14	UINT16	rw	-	0….300	0

Value description

<E 2.14>	
Value	Description
0	Value == 0
100	Value == 100 Hz
300	Value == 300 Hz

Table 232: Possible values of parameter <E 2.14> (0x50A2)

4.5.1.110 Object 0x50A4: C1.27, Hysteresis command A

This object defines the value of the hysteresis command.
This parameter is used in order to create a “artificial” dead band for the command inputs around “0”. When set than the command input will be ignored up to the adjusted values and will start with “0” from this point on. It can be used to avoid a too sensitive reaction (e.g. when using joy-stick as signal source).

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x50A4	0	C 1.27	UINT16	rw	-	0…9999	0

Value description

<C 1.27>	
Value	Description
0	Value == 0
100	Value == 0.1V
1000	Value == 1.000V

Table 233: Possible values of parameter <C 1.27> (0x50A4)

Mode description, refer to □ Chapter "4.3.1 Block diagram", page 46

<C1.27>	
Operation Mode	Description
1,3	Value of <d1.02>(5002) is processed with value of <C1.27>(50A4)
4	Output of Controller 1 is processed with value of <C1.27>(50A4)
6	Output of Controller 1 is processed with value of <C1.27>(50A4) under consideration of <d1.02>(5002)

Table 234: Function of parameter referenced to block diagram <C1.27> (0x50A4)

4.5.1.111 Object 0x50A5: C2.27, Hysteresis command B

This object defines the value of the hysteresis command.
This parameter is used in order to create a “artificial” dead band for the command inputs around “0”. When set than the command input will be ignored up to the adjusted values and will start with “0” from this point on. It can be used to avoid a too sensitive reaction (e.g. when using joy-stick as signal source).

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x50A5	0	C 2.27	UINT16	rw	-	0…9999	0

Value description

<C 2.27>	
Value	Description
0	Value == 0
100	Value == 0.1V
1000	Value == 1.000V

Table 235: Possible values of parameter <C 2.27> (0x50A5)

Mode description, refer to □ Chapter "4.3.1 Block diagram", page 46

<C2.27>	
Operation Mode	Description
1,3,4	Not applicable
6	Value of <d2.02>(500F) is processed with value of <C2.27>(50A5)

Table 236: Function of parameter referenced to block diagram <C2.27> (0x50A5)

4.5.1.112 Object 0x50B3: C1.33, I-Portion output value limitation (loop 1)

This object defines the value of the I-Portion limitation.
This parameter is used to avoid an overdrive or saturation of the controller output by C 1.17.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x50B3	0	C 1.33	UINT16	rw	-	0…9999	9999

Value description

<C 1.33>	
Value	Description
0	Value == 0
100	Value == 0.1V
1000	Value == 1.000V

Table 237: Possible values of parameter <C 1.33> (0x50B3)

Mode description, refer to □ Chapter "4.3.1 Block diagram", page 46

<C1.33>	
Operation Mode	Description
1	Not applicable
3,4,6	Limitation of maximum value of <C1.17>(503A)

Table 238: Function of parameter referenced to block diagram <C1.33> (0x50B3)

4.5.1.113 Object 0x50B4: C2.33, I-Portion output value limitation (loop 2)

This object defines the value of the I-Portion limitation.
This parameter is used to avoid an overdrive or saturation of the controller output by C 2.17.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x50B4	0	C 2.33	UINT16	rw	-	0…9999	9999

Value description

<C 2.33>	
Value	Description
0	Value == 0
100	Value == 0.1V
1000	Value == 1.000V

Table 239: Possible values of parameter <C 2.33> (0x50B4)

Mode description, refer to □ Chapter "4.3.1 Block diagram", page 46

<C2.33>	
Operation Mode	Description
1,3,4	Not applicable
6	Limitation of maximum value of <C2.17>(5055)

Table 240: Function of parameter referenced to block diagram <C2.33> (0x50B4)

4.5.1.114 Object 0x50BC: C1.36, Sensor signal correction factor for values < 0 (related to C1.10)

This object defines the value how to adapt negative feedback values.
This parameter has only effects to negative values. Positive values do not consider this parameter.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x50BC	0	C 1.36	INT16	rw	-	-100..-..+100	0

Value description

<C 1.36>	
Value	Description
-100	Decrease feedback value of 100%
0	Feedback value unchanged
50	Increase feedback value of 50%

Table 241: Possible values of parameter <C 1.36> (0x50BC)

Mode description, refer to □ Chapter "4.3.1 Block diagram", page 46

<C1.36>	
Operation Mode	Description
1	Not applicable
3,4,6	Adapt value of feedback1

Table 242: Function of parameter referenced to block diagram <C1.36> (0x50BC)

4.5.1.115 Object 0x50BD: E 24, CANopen Node-ID (if Node-ID=0 CAN is deactivated)

This object defines the value of the Node-ID which is needed to address the single modules.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x50BD	0	E 24	INT16	rw	-	-1..-..+127	127

Value description

<E 24>	
Value	Description
-1	Module is not configured
0	CAN-Bus is deactivated
50	Node-ID is set to 50

Table 243: Possible values of parameter <E 24> (0x50BD)

4.5.1.116 Object 0x50BE: E 25, CANopen baud rate

This object defines the value of the CANopen baud rate.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x50BE	0	E 25	UINT16	rw	-	1.....7	3

Value description

<E 25>	
Value	Description
1	20 KBit/s
2	50 KBit/s
3	125 KBit/s
4	250 KBit/s
5	500 KBit/s
6	800 KBit/s
7	1 MBit/s

Table 244: Possible values of parameter <E 25> (0x50BE)

4.5.1.117 Object 0x50C3: C2.36, Sensor signal correction factor for values < 0 (related to C2.10)

This object defines the value how to adapt negative feedback values.
This parameter has only effects to negative values. Positive values do not consider this parameter.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x50C3	0	C 2.36	INT16	rw	-	-100..-.+100	0

Value description

<C 2.36>	
Value	Description
-100	Decrease feedback value of 100%
0	Feedback value unchanged
50	Increase feedback value of 50%

Table 245: Possible values of parameter <C 2.36> (0x50C3)

Mode description, refer to □ Chapter "4.3.1 Block diagram", page 46

<C2.36>	
Operation Mode	Description
1,3,4	Not applicable
6	Adapt value of feedback2

Table 246: Function of parameter referenced to block diagram <C2.36> (0x50C3)

4.5.1.118 Object 0x50C4; C1.37, Spool overlap compensation A

This object defines the value which is used to compensate a possible spool overlap for solenoid A.
The compensation works as an additional set point that is activated as soon as the polarity of the set point changes to positive. Overlaps of valve are empirically around 10 % to 15 % of full stroke (depending on manufacturer and valve type!). The setting has a decisive effect on the quality (precision and speed) when positioning the axis drives.
The amplification in the small signal range is essentially determined by this function.
The pre-set value is directly applied as a current on the solenoids. The programming is standardized in volt, 9.999 V equals the maximum set current.
Remark: Applicable for pilot operated valves in order to compensate the death band in the pilot stage.
See table “Mode description” for more info.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x50C4	0	C1.37	UINT16	rw	-	0….9999	0

Value description

<C1.37>	
Value	Description
0	No additional current is given, set value is not changed
1000	set value is increased by 1.000V

Table 247: Possible values of parameter <C1.37> (0x50C4)

Mode description, refer to □ Chapter "4.3.1 Block diagram", page 46

<C1.37>	
Operation Mode	Description
1,4	Not applicable
3,6	Output of controller1 processed with value of <C1.37> (50C4)

Table 248: Function of parameter referenced to block diagram <C1.37> (0x50C4)

4.5.1.119 Object 0x50C5: C1.38, Spool overlap compensation B

This object defines the value which is used to compensate a possible spool overlap for solenoid B.
The compensation works as an additional set point that is activated as soon as the polarity of the set point changes to positive. Overlaps of valve are empirically around 10 % to 15 % of full stroke (depending on manufacturer and valve type!). The setting has a decisive effect on the quality (precision and speed) when positioning the axis drives.
The amplification in the small signal range is essentially determined by this function.
The pre-set value is directly applied as a current on the solenoids. The programming is standardized in volt, 9.999 V equals the maximum set current.
See table “Mode description” for more info.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x50C5	0	C1.38	UINT16	rw	-	0....9999	0

Value description

<C1.38>	
Value	Description
0	No additional current is given, set value is not changed
1000	set value is increased by 1.000V

Table 249: Possible values of parameter <C1.38> (0x50C5)

Mode description, refer to □ Chapter "4.3.1 Block diagram", page 46

<C1.38>	
Operation Mode	Description
1,3,4,6	Value of <d1.04>(5004) processed with value of <C1.38> (5031)

Table 250: Function of parameter referenced to block diagram <C1.38> (0x50C5)

4.5.1.120 L1: Linearization curve 1

The following objects define the values which are used to generate a user defined linearization curve.
Those parameters affect the curve only if C1.02 is set to “6”.

Every value along the curve must be equal or bigger than its predecessor

4.5.1.120.1 Object 0x50C6: L1.x0 Linearization curve [0,0]

This object defines the value for the first input value in the curve. This value is always fixed to zero and can’t be changed.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x50C6	0	L1.x0	UINT16	rw	-	0….0	0

Value description

<L1.x0>	
Value	Description
0	Value == 0.000V

Table 251: Possible values of parameter <L1.x0> (0x50C6)

4.5.1.120.2 Object 0x50C7: L1.y0 Linearization curve [0,0]

This object defines the value for the first output value in the curve. It describes the output depending on defined input signal at L1.x0.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x50C7	0	L1.y0	UINT16	rw	-	0….9999	0

Value description

<L1.y0>	
Value	Description
0	Value == 0.000V
1000	Value == 1.000V

Table 252: Possible values of parameter <L1.y0> (0x50C7)

4.5.1.120.3 Object 0x50C8: L1.x1 Linearization curve [1,1]

This object defines the value for the second input value in the curve.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x50C8	0	L1.x1	UINT16	rw	-	0….9999	1250

Value description

<L1.x1>	
Value	Description
0	Value == 0.000V
1000	Value == 1.000V

Table 253: Possible values of parameter <L1.x1> (0x50C8)

4.5.1.120.4 Object 0x50C9: L1.y1 Linearization curve [1,1]

This object defines the value for the second output value in the curve. It describes the output depending on defined input signal at L1.x1.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x50C9	0	L1.y1	UINT16	rw	-	0….9999	1250

Value description

<L1.y1>	
Value	Description
0	Value == 0.000V
1000	Value == 1.000V

Table 254: Possible values of parameter <L1.y1> (0x50C9)

4.5.1.120.5 Object 0x50CA: L1.x2 Linearization curve [2,2]

This object defines the value for the third input value in the curve.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x50CA	0	L1.x2	UINT16	rw	-	0….9999	2500

Value description

<L1.x2>	
Value	Description
0	Value == 0.000V
1000	Value == 1.000V

Table 255: Possible values of parameter <L1.x2> (0x50CA)

4.5.1.120.6 Object 0x50CB: L1.y2 Linearization curve [2,2]

This object defines the value for the third output value in the curve. It describes the output depending on defined input signal at L1.x2.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x50CB	0	L1.y2	UINT16	rw	-	0….9999	2500

Value description

<L1.y2>	
Value	Description
0	Value == 0.000V
1000	Value == 1.000V

Table 256: Possible values of parameter <L1.y2> (0x50CB)

4.5.1.120.7 Object 0x50CC: L1.x3 Linearization curve [3,3]

This object defines the value for the 4th input value in the curve.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x50CC	0	L1.x3	UINT16	rw	-	0….9999	3750

Value description

<L1.x3>	
Value	Description
0	Value == 0.000V
1000	Value == 1.000V

Table 257: Possible values of parameter <L1.x3> (0x50CC)

4.5.1.120.8 Object 0x50CD: L1.y3 Linearization curve [3,3]

This object defines the value for the 4th output value in the curve. It describes the output depending on defined input signal at L1.x3.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x50CD	0	L1.y3	UINT16	rw	-	0….9999	3750

Value description

<L1.y3>	
Value	Description
0	Value == 0.000V
1000	Value == 1.000V

Table 258: Possible values of parameter <L1.y3> (0x50CD)

4.5.1.120.9 Object 0x50CE: L1.x4 Linearization curve [4,4]

This object defines the value for the 5th input value in the curve.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x50CE	0	L1.x4	UINT16	rw	-	0….9999	5000

Value description

<L1.x4>	
Value	Description
0	Value == 0.000V
1000	Value == 1.000V

Table 259: Possible values of parameter <L1.x4> (0x50CE)

4.5.1.120.10 Object 0x50CF: L1.y4 Linearization curve [4,4]

This object defines the value for the 5th output value in the curve. It describes the output depending on defined input signal at L1.x4.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x50CF	0	L1.y4	UINT16	rw	-	0….9999	5000

Value description

<L1.y4>	
Value	Description
0	Value == 0.000V
1000	Value == 1.000V

Table 260: Possible values of parameter <L1.y4> (0x50CF)

4.5.1.120.11 Object 0x50D0: L1.x5 Linearization curve [5,5]

This object defines the value for the 6th input value in the curve.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x50D0	0	L1.x5	UINT16	rw	-	0….9999	6250

Value description

<L1.x5>	
Value	Description
0	Value == 0.000V
1000	Value == 1.000V

Table 261: Possible values of parameter <L1.x5> (0x50D0)

4.5.1.120.12 Object 0x50D1: L1.y5 Linearization curve [5,5]

This object defines the value for the 6th output value in the curve. It describes the output depending on defined input signal at L1.x5.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x50D1	0	L1.y5	UINT16	rw	-	0….9999	6250

Value description

<L1.y5>	
Value	Description
0	Value == 0.000V
1000	Value == 1.000V

Table 262: Possible values of parameter <L1.y5> (0x50D1)

4.5.1.120.13 Object 0x50D2: L1.x6 Linearization curve [6,6]

This object defines the value for the 7th input value in the curve.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x50D2	0	L1.x6	UINT16	rw	-	0….9999	7500

Value description

<L1.x6>	
Value	Description
0	Value == 0.000V
1000	Value == 1.000V

Table 263: Possible values of parameter <L1.x6> (0x50D2)

4.5.1.120.14 Object 0x50D3: L1.y6 Linearization curve [6,6]

This object defines the value for the 7th output value in the curve. It describes the output depending on defined input signal at L1.x6.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x50D3	0	L1.y6	UINT16	rw	-	0….9999	7500

Value description

<L1.y6>	
Value	Description
0	Value == 0.000V
1000	Value == 1.000V

Table 264: Possible values of parameter <L1.y6> (0x50D3)

4.5.1.120.15 Object 0x50D4: L1.x7 Linearization curve [7,7]

This object defines the value for the 8th input value in the curve.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x50D4	0	L1.x7	UINT16	rw	-	0….9999	8750

Value description

<L1.x7>	
Value	Description
0	Value == 0.000V
1000	Value == 1.000V

Table 265: Possible values of parameter <L1.x7> (0x50D4)

4.5.1.120.16 Object 0x50D5: L1.y7 Linearization curve [7,7]

This object defines the value for the 8th output value in the curve. It describes the output depending on defined input signal at L1.x7.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x50D5	0	L1.y7	UINT16	rw	-	0….9999	8750

Value description

<L1.y7>	
Value	Description
0	Value == 0.000V
1000	Value == 1.000V

Table 266: Possible values of parameter <L1.y7> (0x50D5)

4.5.1.120.17 Object 0x50D6: L1.x8 Linearization curve [8,8]

This object defines the value for the 9th input value in the curve. This value is always fixed to 9.999 and can’t be changed.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x50D6	0	L1.x8	UINT16	rw	-	9999	9999

Value description

<L1.x8>	
Value	Description
9999	Value == 9.999V

Table 267: Possible values of parameter <L1.x8> (0x50D6)

4.5.1.120.18 Object 0x50D7: L1.y8 Linearization curve [8,8]

This object defines the value for the 9th output value in the curve. It describes the output depending on defined input signal at L1.x8.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x50D7	0	L1.y8	UINT16	rw	-	0….9999	9999

Value description

<L1.y8>	
Value	Description
0	Value == 0.000V
1000	Value == 1.000V

Table 268: Possible values of parameter <L1.y8> (0x50D7)

4.5.1.121 Linearization curve 2

The following objects defines the values which are used to generate a user defined linearization curve.
Those parameters affect the curve only if C2.02 is set to “6”.

Every value along the curve must be equal or bigger than its predecessor

See table “Mode description” for more info.

Mode description, refer to □ Chapter "4.3.1 Block diagram", page 46

<L2>	
Operation Mode	Description
1,3,4	Not applicable
6	User defined linearization curve

Table 269: Function of parameter referenced to block diagram <L2> (0x50DA) – (0x50EB)

4.5.1.121.1 Object 0x50DA: L2.x0 Linearization curve [0,0]

This object defines the value for the first input value in the curve. This value is always fixed to zero and can’t be changed.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x50DA	0	L2.x0	UINT16	rw	-	0….0	0

Value description

<L2.x0>	
Value	Description
0	Value == 0.000V

Table 270: Possible values of parameter <L2.x0> (0x50DA)

4.5.1.121.2 Object 0x50DB: L2.y0 Linearization curve [0,0]

This object defines the value for the first output value in the curve. It describes the output depending on defined input signal at L2.x0.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x50DB	0	L2.y0	UINT16	rw	-	0….9999	0

Value description

<L2.y0>	
Value	Description
0	Value == 0.000V
1000	Value == 1.000V

Table 271: Possible values of parameter <L2.y0> (0x50DB)

4.5.1.121.3 Object 0x50DC: L2.x1 Linearization curve [1,1]

This object defines the value for the second input value in the curve.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x50DC	0	L2.x1	UINT16	rw	-	0....9999	1250

Value description

<L2.x1>	
Value	Description
0	Value == 0.000V
1000	Value == 1.000V

Table 272: Possible values of parameter <L2.x1> (0x50DC)

4.5.1.121.4 Object 0x50DD: L2.y1 Linearization curve [1,1]

This object defines the value for the second output value in the curve. It describes the output depending on defined input signal at L2.x1.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x50DD	0	L2.y1	UINT16	rw	-	0....9999	1250

Value description

<L2.y1>	
Value	Description
0	Value == 0.000V
1000	Value == 1.000V

Table 273: Possible values of parameter <L2.y1> (0x50DD)

4.5.1.121.5 Object 0x50DE: L2.x2 Linearization curve [2,2]

This object defines the value for the third input value in the curve.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x50DE	0	L2.x2	UINT16	rw	-	0....9999	2500

Value description

<L2.x2>	
Value	Description
0	Value == 0.000V
1000	Value == 1.000V

Table 274: Possible values of parameter <L2.x2> (0x50DE)

4.5.1.121.6 Object 0x50DF: L2.y2 Linearization curve [2,2]

This object defines the value for the third output value in the curve. It describes the output depending on defined input signal at L2.x2.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x50DF	0	L2.y2	UINT16	rw	-	0....9999	2500

Value description

<L2.y2>	
Value	Description
0	Value == 0.000V
1000	Value == 1.000V

Table 275: Possible values of parameter <L2.y2> (0x50DF)

4.5.1.121.7 Object 0x50E0: L2.x3 Linearization curve [3,3]

This object defines the value for the 4th input value in the curve.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x50E0	0	L2.x3	UINT16	rw	-	0....9999	3750

Value description

<L2.x3>	
Value	Description
0	Value == 0.000V
1000	Value == 1.000V

Table 276: Possible values of parameter <L2.x3> (0x50E0)

4.5.1.121.8 Object 0x50E1: L2.y3 Linearization curve [3,3]

This object defines the value for the 4th output value in the curve. It describes the output depending on defined input signal at L2.x3.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x50E1	0	L2.y3	UINT16	rw	-	0....9999	3750

Value description

<L2.y3>	
Value	Description
0	Value == 0.000V
1000	Value == 1.000V

Table 277: Possible values of parameter <L2.y3> (0x50E1)

4.5.1.121.9 Object 0x50E2: L2.x4 Linearization curve [4,4]

This object defines the value for the 5th input value in the curve.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x50E2	0	L2.x4	UINT16	rw	-	0....9999	5000

Value description

<L2.x4>	
Value	Description
0	Value == 0.000V
1000	Value == 1.000V

Table 278: Possible values of parameter <L2.x4> (0x50E2)

4.5.1.121.10 Object 0x50E3: L2.y4 Linearization curve [4,4]

This object defines the value for the 5th output value in the curve. It describes the output depending on defined input signal at L2.x4.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x50E3	0	L2.y4	UINT16	rw	-	0....9999	5000

Value description

<L2.y4>	
Value	Description
0	Value == 0.000V
1000	Value == 1.000V

Table 279: Possible values of parameter <L2.y4> (0x50E3)

4.5.1.121.11 Object 0x50E4: L2.x5 Linearization curve [5,5]

This object defines the value for the 6th input value in the curve.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x50E4	0	L2.x5	UINT16	rw	-	0....9999	6250

Value description

<L2.x5>	
Value	Description
0	Value == 0.000V
1000	Value == 1.000V

Table 280: Possible values of parameter <L2.x5> (0x50E4)

4.5.1.121.12 Object 0x50E5: L2.y5 Linearization curve [5,5]

This object defines the value for the 6th output value in the curve. It describes the output depending on defined input signal at L2.x5.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x50E5	0	L2.y5	UINT16	rw	-	0....9999	6250

Value description

<L2.y5>	
Value	Description
0	Value == 0.000V
1000	Value == 1.000V

Table 281: Possible values of parameter <L2.y5> (0x50E5)

4.5.1.121.13 Object 0x50E6: L2.x6 Linearization curve [6,6]

This object defines the value for the 7th input value in the curve.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x50E6	0	L2.x6	UINT16	rw	-	0....9999	7500

Value description

<L2.x6>	
Value	Description
0	Value == 0.000V
1000	Value == 1.000V

Table 282: Possible values of parameter <L2.x6> (0x50E6)

4.5.1.121.14 Object 0x50E7: L2.y6 Linearization curve [6,6]

This object defines the value for the 7th output value in the curve. It describes the output depending on defined input signal at L2.x6.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x50E7	0	L2.y6	UINT16	rw	-	0....9999	7500

Value description

<L2.y6>	
Value	Description
0	Value == 0.000V
1000	Value == 1.000V

Table 283: Possible values of parameter <L2.y6> (0x50E7)

4.5.1.121.15 Object 0x50E8: L2.x7 Linearization curve [7,7]

This object defines the value for the 8th input value in the curve.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x50E8	0	L2.x7	UINT16	rw	-	0....9999	8750

Value description

<L2.x7>	
Value	Description
0	Value == 0.000V
1000	Value == 1.000V

Table 284: Possible values of parameter <L2.x7> (0x50E8)

4.5.1.121.16 Object 0x50E9: L2.y7 Linearization curve [7,7]

This object defines the value for the 8th output value in the curve. It describes the output depending on defined input signal at L2.x7.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x50E9	0	L2.y7	UINT16	rw	-	0….9999	8750

Value description

<L2.y7>	
Value	Description
0	Value == 0.000V
1000	Value == 1.000V

Table 285: Possible values of parameter <L2.y7> (0x50E9)

4.5.1.121.17 Object 0x50EA: L2.x8 Linearization curve [8,8]

This object defines the value for the 9th input value in the curve. This value is always fixed to 9.999 and can't be changed.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x50EA	0	L2.x8	UINT16	rw	-	0....9999	9999

Value description

<L2.x8>	
Value	Description
9999	Value == 9.999V

Table 286: Possible values of parameter <L2.x8> (0x50EA)

4.5.1.121.18 Object 0x50EB: L2.y8 Linearization curve [8,8]

This object defines the value for the 9th output value in the curve. It describes the output depending on defined input signal at L2.x8.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x50EB	0	L2.y8	UINT16	rw	-	0….9999	9999

Value description

<L2.y8>	
Value	Description
0	Value == 0.000V
1000	Value == 1.000V

Table 287: Possible values of parameter <L1.y8> (0x50EB)

4.5.1.122 Object 0x50EC: C1.39, Semi-automatic calibration of the FB1 sensor

This object defines the value to activate the semiautomatic calibration of the feedback sensor.
It is only working if C1.09 == 21,22,23,24,25,26., C1.00 == 0 , C1.26 == off
This calibration can only do via “HCS Tool”. Write access is intended only for “HCS-Tool”.
See table “Mode description” for more info.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x50EC	0	C1.39	UINT16	rw	-	0....10	0

Value description

<C1.39>	
Value	Description
any	Internal value. Do not enter any own values

Table 288: Possible values of parameter <C1.39> (0x50EC)

Mode description, refer to □ Chapter "4.3.1 Block diagram", page 46

<C1.39>	
Operation Mode	Description
1	Not applicable
3,4,6	Managing the calibration of feedback sensor 1

Table 289: Function of parameter referenced to block diagram <C1.39> (0x50EC)

4.5.1.123 Object 0x50ED: C1.40, Stored data of sensor type of the semi-automatic calibration

This object defines the value to indicate which sensor is last time calibrated.
See table “Mode description” for more info.

CANopen							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x50ED	0	C1.40	UINT16	ro	-	0....26	0

Value description

<C1.40>	
Value	Description
0	No sensor calibrated
21	Bipolar voltage calibration
22	Unipolar voltage calibration
23	Unipolar voltage calibration with only positive controller output
24	Bipolar current calibration
25	Unipolar current calibration
26	Unipolar current calibration with only positive controller output

Table 290: Possible values of parameter <C1.40> (0x50ED)

Mode description, refer to □ Chapter "4.3.1 Block diagram", page 46

<C1.40>	
Operation Mode	Description
1	Not applicable
3,4,6	Display last time calibrated sensor with <C1.39>(0x50EC)

Table 291: Function of parameter referenced to block diagram <C1.40> (0x50ED)

4.5.2 Additional parameter information

4.5.2.1 Detailed Information about C1.13, C1.14, C1.15, C1.16

When programming the parameters C1.13 and C1.16 then also the setting of parameter C1.00 (controller setting) is of importance. When C1.00 = 3 or C1.00 = 4 (dff controller), than C1.13 is the amplification of the dff controller and C1.16 is the P-amplification of the remaining PT1-I-DT1 controllers. C1.15 will be without effect in these cases.

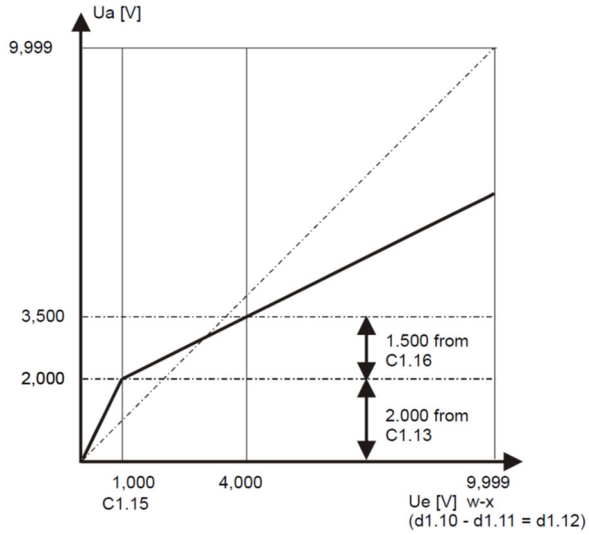
If C1.00 = 1 or 2 (P-PT1-I-DT1 controller):

- C1.13 is the P-amplification (KP1) for minor control deviations (proportional controller)
- C1.14 cooperates with C1.16 and forms therefore a PT1 term
- C1.15 is the threshold to control the operation of C1.13 (KP1) or C1.16 (KP2)
- C1.16 is the P-amplification (KP2) for major control deviations, results with C1.14 as a PT1 part

Description of the threshold function C1.15 and the resulting effect of C1.13 and C1.16:

- Case 1, the control deviation is smaller than the threshold (|w-x| <C1.15): only the P-portion KP1 is activated (w-x* KP1).
- Case 2, the control deviation is larger than the threshold (|w-x|> C1.15): from the threshold C1.15 on, the P-portion KP1 is activated with the value (w-x* KP1). The other P-portion KP2 only functions with the value (((w-x) – C1.15) * KP2). The complete portion of both controllers is an addition of these values. See the following graph for an explanation:

Example:
C1.15 = 1,000, C1.13 = 2,000, C1.16 = 0,500
d1.12 = 4,000 V (lag error w-x)



The division into two individually adjustable amplifications allows a more stable adjusting of the controller in non-linear systems (which is often the case for hydraulic applications), even if the control deviations are large. The possibility to suppress (attenuate) C1.16 (KP2) with a time relay supports this effect and results in adjustable moderate (smooth) PT1-characteristics.

If C1.00 = 3 or 4 (dff controller):

- C1.13 is the P-amplification with direct feed forward (proportional controller)
- C1.14 cooperates with C1.16 and therefore forms a PT1 term
- C1.15 is not taken into consideration
- C1.16 is the P-amplification of the remaining PT1-I-DT1 controller

4.5.2.2 Detailed Information about C2.13, C2.14, C2.15, C2.16

When programming the parameters C2.13 and C2.16, please note:
Check the setting of parameter C2.00 (controller setting) at the same time.
If C2.00 = 3 or C2.00 = 4 (dff controller), than C2.13 is the amplification of the dff controller and C2.16 is the P-amplification of the remaining PT1-I-DT1 controllers. C2.15 will be without effect in these cases.

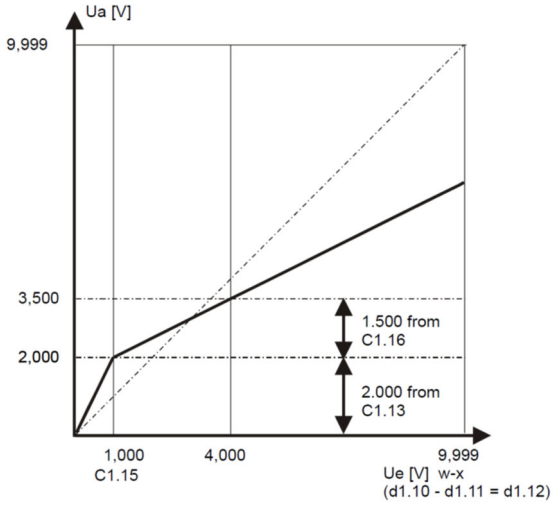
If C2.00 = 1 or 2 (P-PT1-I-DT1 controller):

- C2.13 is the P-amplification (KP1) for minor control deviations (proportional controller)
- C2.14 cooperates with C2.16 and forms therefore a PT1 term
- C2.15 is the threshold to control the operation of C2.13 (KP1) or C2.16 (KP2)
- C2.16 is the P-amplification (KP2) for major control deviations, results with C2.14 as a PT1 part

Description of the threshold function C2.15 and the resulting effect of C2.13 and C2.16:

- Case 1, the control deviation is smaller than the threshold (|w-x| <C2.15): only the P-portion KP1 is activated (w-x* KP1).
- Case 2, the control deviation is larger than the threshold (|w-x|> C2.15): from the threshold C2.15 on, the P-portion KP1 is activated with the value (w-x* KP1). The other P-portion KP2 only functions with the value (((w-x) – C2.15) * KP2). The complete portion of both controllers is an addition of these values. See the following graph for an explanation:

Example:
C1.15 = 1,000, C1.13 = 2,000, C1.16 = 0,500
d1.12 = 4,000 V (lag error w-x)

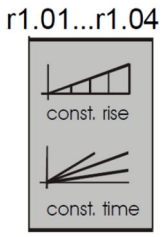


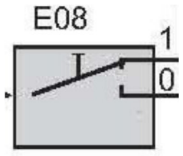
The division into two individually adjustable amplifications allows a more stable adjusting of the controller in non-linear systems (which is often the case for hydraulic applications), even if the control deviations are large. The possibility to suppress (attenuate) C2.16 (KP2) with a time relay supports this effect and results in adjustable moderate (smooth) PT1-characteristics.

If C2.00 = 3 or 4 (dff controller):

- C2.13 is the P-amplification with direct feed forward (proportional controller)
- C2.14 cooperates with C2.16 and therefore forms a PT1 term
- C2.15 is not taken into consideration
- C2.16 is the P-amplification of the remaining PT1-I-DT1 controller

4.5.2.3 Detailed Information about r1.01 to r1.04 and E08



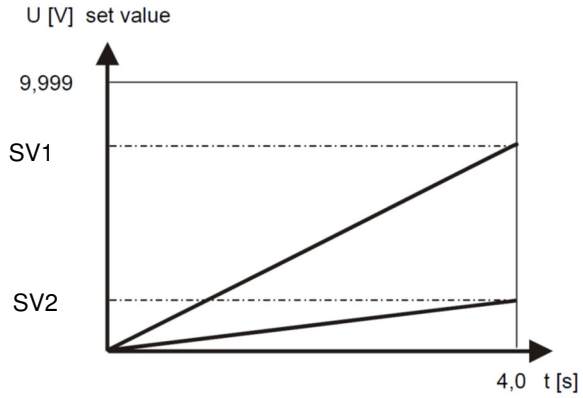


Digital set points are integrated accordingly to the ramp function generator.
For each change of direction, the ramp time can be set independently.
Times from 0 to 39.5 s can be set. The resolution is 0.01s. The ramp characteristic is assigned as follows:
r1.01 ramp from 0 to negative values r1.03 ramp from 0 to positive values
r1.02 ramp from negative values to 0 r1.04 ramp from positive values to 0

E08 = 0 effects only digital set points, constant time base and linear
E08 = 1 effects all set points, constant rise rate and linear

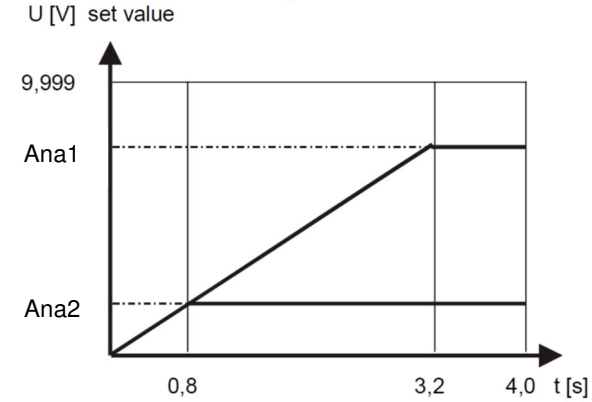
The following examples explains the ramp function:

Example 1:
E08 = 0, ramp with constant time base
Setvalue1 = 8.00 V; Setvalue2 = 2.00 V; r1.03 = 4.00 sec



Each set value reaches the full effect after 4sec.

Example 2:
E08 = 1, ramp with constant rise rate
Analogue1= 8.00 V; Analogue2 = 2.00 V; r1.03 = 4.00 sec



Time for reaching maximum set value is selected with 4 sec so every set value reaches the full effect with this formula:

$$full\ effect = \frac{setvalue}{9.999V} ramptime$$

So Analogue2 reaches 2 Volts after 0,8 sec and Analogue1 reach 8 Volts after 3,2 sec.

The ramp influences the digital set points as well as the analogue set point.

4.5.3 Device profile area

4.6 Diagnostics

4.6.1 Fault reaction

If a malfunction occurs, the amplifier software throws a fault. The corresponding fault is set in the fault state <FaultStatus> (0x4300). The fault reaction is described in the fault reaction chart.
At least an emergency message is sent and the <Error-Register> (0x1001) parameter will be set according to the error group of the fault code. Then the fault code and the error code are saved in an array <StandardErrorField> (0x1003) which holds the last four thrown faults.
If the configured fault reaction of the actual thrown fault requests a change of the device state, the corresponding transition of the device state machine will be forced.

4.6.1.1 Fault reaction flow chart

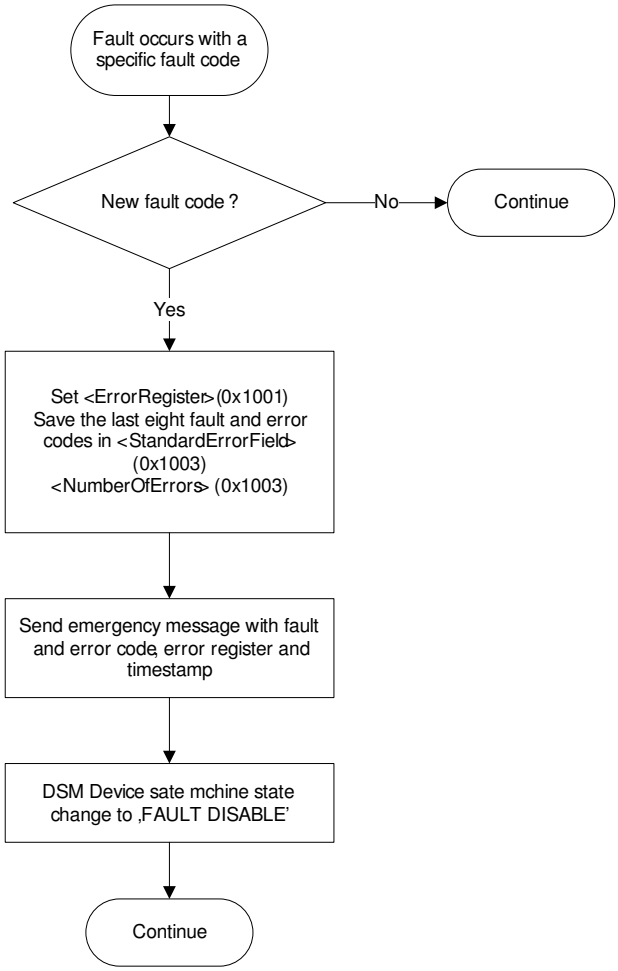


Figure 18: Fault reaction flow chart

4.6.1.2 Possible fault codes

The possible fault codes are shown in the following table. The possible error code is depending on the operation mode of the device.
The fault code 0 means that no fault is pending.

Fault code		Description
Dec.	Hex.	
0	0x00	Error reset or no error
1	0x01	reserved
2	0x02	Wire break set value (Input analogue 2)
3	0x03	Short circuit at the output stages
4	0x04	Wire break sensor 1 (Input analogue 3)
5	0x05	Overload of current >22mA (Input analogue 2)
6	0x06	Overload of current >22mA (Input analogue 1)
7	0x07	CAN error, no connection to other devices
8	0x08	Wire break at the output stages
9	0x09	Wire break Set value (Input analogue 1)
10	0x0A	CAN error, Receiving error
11	0x0B	reserved
12	0x0C	CAN connection error, no connection to CAN master
13	0x0D	CAN timeout error
14	0x0E	Wire break feedback input (Input analogue 1)
15	0x0F	Wire break feedback input (Input analogue 2)
16..22	0x10..16	reserved
23	0x17	Feedback Semi calibration Error
24..31	0x18..1D	reserved
30	0x1E	Lifeguard or heartbeat error
31	0x1F	reserved
32	0x20	CANopen error: Transmit of data causing error
33..63	0x21..3F	reserved
64	0x40	CANopen error: Receiving data causing error
65..91	0x41..5B	reserved
92	0x5C	CANopen error: Data transmission error
93..127	0x5D..7F	reserved
128	0x80	CANopen error: General error
129	0x81	CANopen error: Transmit PDO mapping error
130	0x82	CANopen error: Receive PDO mapping error
131	0x83	CANopen error: General mapping error
132..255	0x84..FF	reserved

Table 292: Possible fault codes

4.6.1.3 Error codes depending on fault codes

The following table combines the HCS specific fault codes with the error codes, send with an emergency message. (CiA profile defined codes)

HCS fault code	Profile error code	Error description	Error register value
23	0x5230	Feedback semi calibration error	0xFF
6,9,14	0x5231	Analogue input 1 circuit failure	0xFF
2,5,15	0x5232	Analogue input 2 circuit failure	0xFF
4	0x5233	Analogue input 3 circuit failure	0xFF
128,129,130,131	0x6000	CANopen device software generic	0x20
32,64	0x8100	Communication generic	0x10
3,8	0xFF00	Error on the output stages	0xFF
rest	0x1000	Generic error	0x01

Table 293: Possible error codes depending on fault codes

4.6.1.4 Object 0x4300: Fault status

The fault status indicates which faults are currently reported for the device

Device							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x4300	0	FaultStatus	UINT8	ro	-	UINT8	None

Value description, see □ Chapter "0 Object 0x1018: Identity object", page 121

4.6.1.5 Object 0x1001: Error register

This object shall provide error information. The CANopen device maps internal errors into this object. This information is also sent with the emergency object.

Device							
Index	Sub-Index	Parameter name	Data type	Access	non-volatile	Range	Default
0x1001	0	ErrorRegister	UINT8	ro	-	UINT8	None

Value description

<ErrorRegister> Bit	Error description	Value in Hex
0	Generic error (any error)	0x01
1	Current error	0x02
2	Voltage error	0x04
3	Temperature error	0x08
4	Communication error	0x10
5	Device profile specific	0x20
6	Reserved	0x40
7	Manufacture specific	0x80

Table 294: Possible values of parameter <ErrorRegister> (0x1001)

If a specific error occurs, the corresponding bit shall be set to 1b. The bits are cleared automatically when the error is gone.

4.6.1.6 Object 0x1003: Predefined error field

Every time a fault occured which triggered a fault reaction, information about the fault is stored to the <StandardErrorField> (0x1003) parameter array. The <StandardErrorField> (0x1003) parameter array contains a list of up to 4 entries. This error code provides information about the reason of the error. The parameter <NumberOfErrors> (0x1003) holds information about the number of errors currently recorded. Every new error is stored in the first element of the parameter array <StandardErrorField> (0x1003), the older ones move down in the list. If the maximum number of entries is reached and a new fault occurred the oldest fault information will be deleted. Writing the value 0 to the object <NumberOfErrors> (0x1003), sub-index 0, deletes the entire error code entries
Note: if no error is present the value of sub-Index 0 is zero and a read access to sub-index 1 is responded with an SDO abort message.

Device							
Index	Sub-Index	Parameter name	Data type	Access	Non-volatile	Range	Default
0x1003	0	NumberOfErrors	UINT8	rw	-	0..4	0
0x1003	1..4	StandardErrorField	UINT32	ro	-	UINT32	None

Value description

Parameter	Description
<NumberOfErrors>	Number of actual recorded errors.
<StandardErrorField>	Array of recorded errors.

Table 295: Possible values of parameter <PreDefinedErrorField> (0x1003)

StandardErrorField				
Byte	3	2	1	0
Description	Reserved	Fault code (HCS)	Error code	

- Description of Value Byte 2, see □ Chapter "4.6.1.2 Possible fault codes", page 121
- Description of Value Byte 0,1, see □ Chapter "4.6.1.3 Error codes depending on fault codes", page 122

4.6.1.7 EMCY Emergency message

Every time a configured error occurs on the amplifier, it sends an emergency message with error register, error code and timestamp to the master. The emergency message will also be sent if all errors has disappeared. In this case the fault code 0x00 (Error reset or no error) will be sent.
The CAN identifier of the emergency message is stored in the device object dictionary under object 0x1014
□ Chapter "3.9.2.1 Object 0x1014: EMCY protocol COB-ID configuration", page 27
□ Chapter "4.6.1.2 Possible fault codes", page 121
□ Chapter "4.6.1.3 Error codes depending on fault codes", page 122

The coding of the emergency message is as follows:

Byte	7	6	5	4	3	2	1	0
Description	HCS specific					CiA specific		
	Power on time in minutes				Fault code (HCS)	Error register	Error code	

The displayed byte order of the transmitted emergency message is depending on the field bus master.

Example:
In the example below a simple reproducible fault is described. The fault code 0x03 (short circuit at the output stages) is pending. The corresponding error code is 0xFF00 and the <ErrorRegister> (0x1001) is set to 0x80. The time since power on of the amplifier until the fault occurred is 1000 or in hex 0x03E8 minutes.

Byte	7	6	5	4	3	2	1	0
Content	0x00	0x00	0x03	0xE8	0x03	0x80	0xFF	0x00
Result	0x000003E80380FF00							

4.6.2 Fault disappears

If all faults have disappeared the <ErrorRegister> (0x1001) are set to zero. To confirm that no faults are present, the error code 0x00 (Error reset or no error) will be sent via an emergency message to the field bus master. If the device state machine (DSM) is in the state 'FAULT_HOLD','FAULT_DISABLED' or 'NOT_READY', the DSM must be set to 'ACTIVE' again. This can be done by the #ControlWord# or the enable signal (digital input enable).
□ Chapter "4.6.3 Fault acknowledgement", page 124

4.6.3 Fault acknowledgement

Depending on the configured fault reaction an emergency message is send out by the device and changes the device state machine to the corresponding fault state.
□ Chapter "4.6.1 Fault reaction", page 121

In order to leave the fault state the fault must be acknowledged. This can be achieved by:

- Sending the #ControlWord# to the amplifier with the bit 3 (fault reset) is set.
  □ Chapter "4.2.3 Device state machine (DSM)", page 41
- Toggling the enable signal (digital input enable).
- Reset the application, by send the NMI command „Reset node“.
  □ Chapter "3.10.5 Reset node command (COB-ID:0, CS:129)", page 34

4.6.4 Abort SDO Transfer Protocol

The Service Data Object (SDO) is used to transmit / receive parameter values to / from the valve. If the SDO upload or download is not successful, the amplifier will send an Abort SDO (0x80 command) Transfer Protocol. The error description is coded in the data bytes.
step

SDO Abort Code	Description
0x05000000	General SDO protocol error detected.
0x05030000	Toggle bit not alternated.
0x05040000	SDO protocol timeout.
0x05040001	Client/server command specifier not valid or unknown.
0x05040002	Invalid block size (block mode only).
0x05040003	Invalid sequence (block mode only).
0x05040004	CRC error (block mode only).
0x05040005	Out of memory.
0x06010000	Unsupported access to an object.
0x06010001	Attempt to read a write only object.
0x06010002	Attempt to write a read only object.
0x06020000	Object does not exist in the object dictionary.
0x06040041	Object cannot be mapped PDO.
0x06040042	The number and length of the objects to be mapped would exceed PDO length.
0x06040043	General parameter incompatibility reason.
0x06040047	General internal incompatibility in the device.
0x06060000	Access failed due to hardware error.
0x06070010	Data type / length of service data does not match.
0x06070012	Data type does not match / length of service data too high.
0x06070013	Data type does not match / length of service data too low.
0x06090011	Sub index doesn't exist.
0x06090030	Invalid value for parameter (download only).
0x06090031	Value of parameter written too high (download only).
0x06090032	Value of parameter written too low (download only).
0x06090036	Maximum value is less than minimum value.
0x08000000	General error.
0x08000020	Data cannot be transferred or stored to the application.
0x08000021	Data cannot be transferred or stored to the application because of local control.
0x08000022	Data cannot be transferred or stored to the application because of the present device state.
0x08000023	Object dictionary dynamic generation fails or no object dictionary is present.
0x08000024	No data available.

Table 296: SDO Abort Codes

4.7 Digital inputs

The ODC has one digital input

Figure 19: Digital inputs

4.7.1 Digital input 0 (enable signal)

The digital enable signal incorporates the following functions:

- Control the device state machine (DSM).

□ Chapter "4.2.3.2.2 DSM state transitions caused by the enable signal", page 43

- Fault confirmation by generating a rising edge on the digital enable signal.

□ Chapter "4.2.3.2.4.2 Fault confirmation with the enable signal", page 44

The digital enable signal is assigned to connector terminal X101/2 and X102/2

□ Chapter "2.8.3 Power, Error, Enable (X102)", page 16

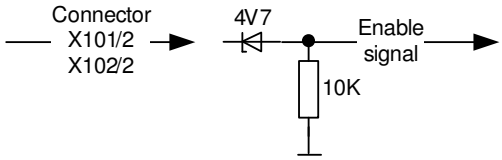


Figure 20: schematic of digital input 0

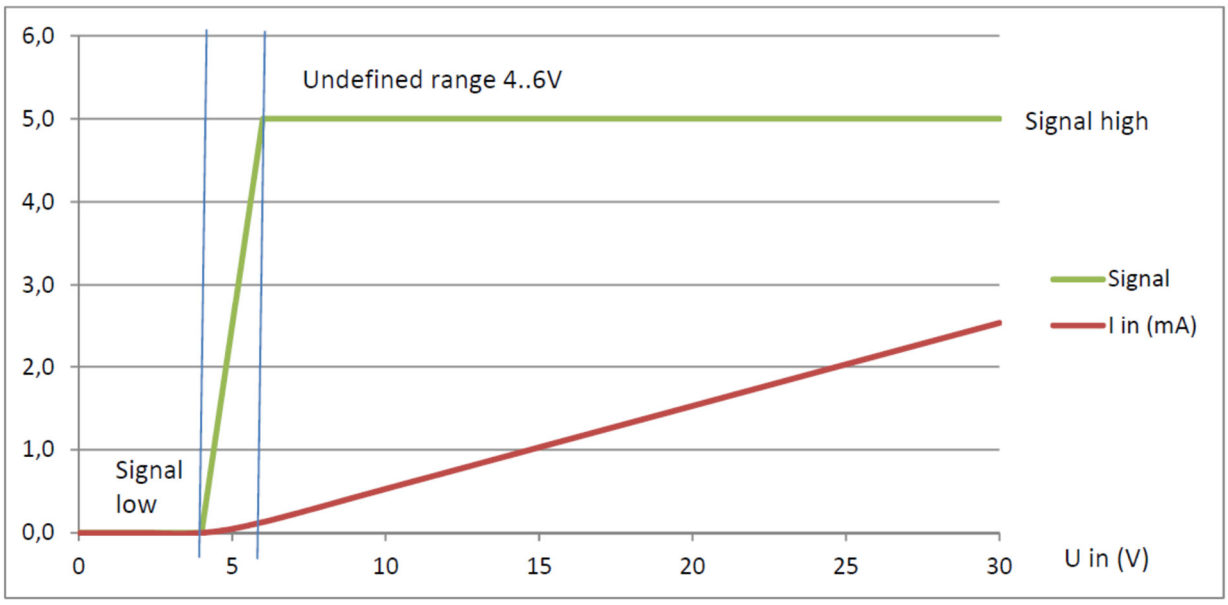


Figure 21: Input Signal curve

4.8 Digital outputs

The following digital outputs are available.

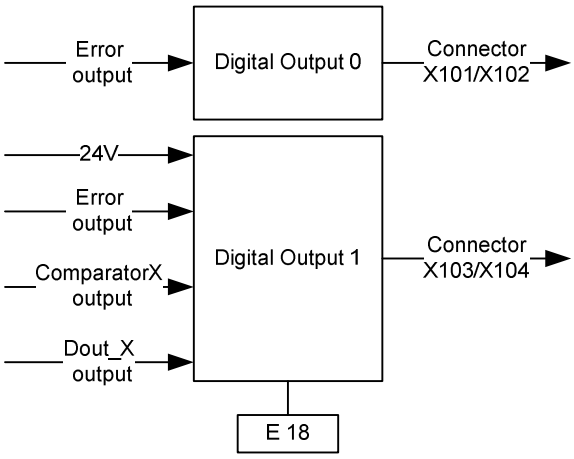


Figure 22: Digital outputs

4.8.1 Digital output 0 (error signal)

At the terminal X101/4 and X102/4 the error output is available.
If an error occurred, the output is low (negative logic).

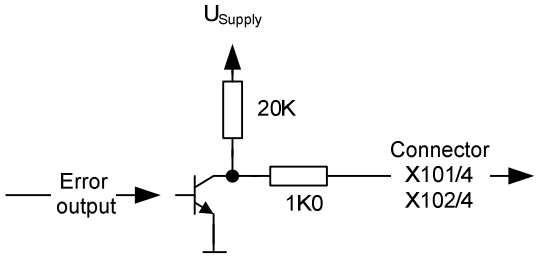


Figure 23: schematic of digital output 0

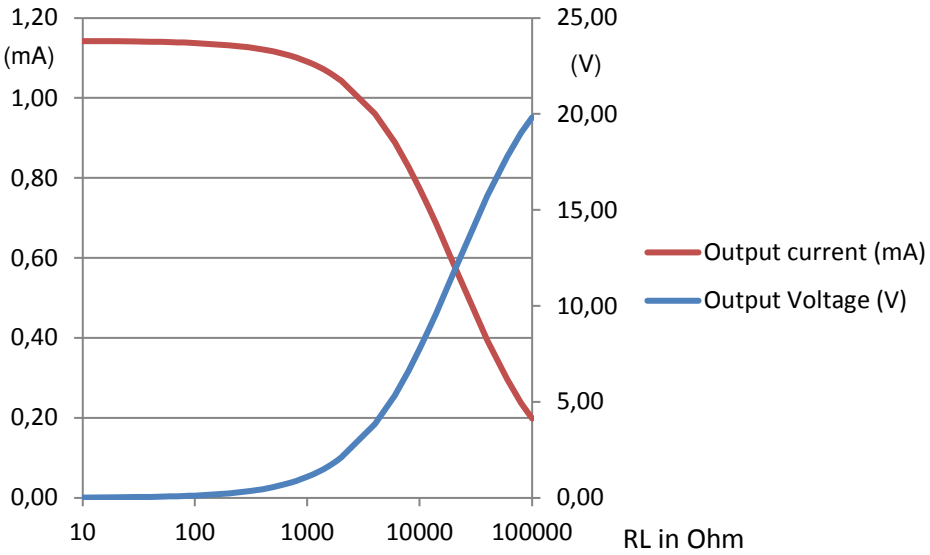


Figure 24: Output high, voltage and current curve at 24V supply

4.8.2 Digital output 1 (universal output)

On the output pin X103/5 the universal output is available. The behavior of the digital output 1 is parametrizable with the parameter E18 <UniversalOutput> 0x5071.

□ Chapter "4.5.1.101 Object 0x5071: E 18, Switchable universal output", page 99

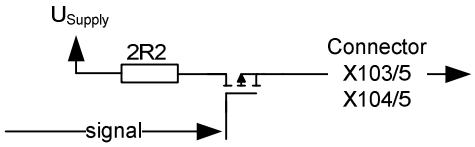


Figure 25: schematic of digital output 1

Output has an current limiting circuit (overload protection)
Maximal output current ≈ 120mA

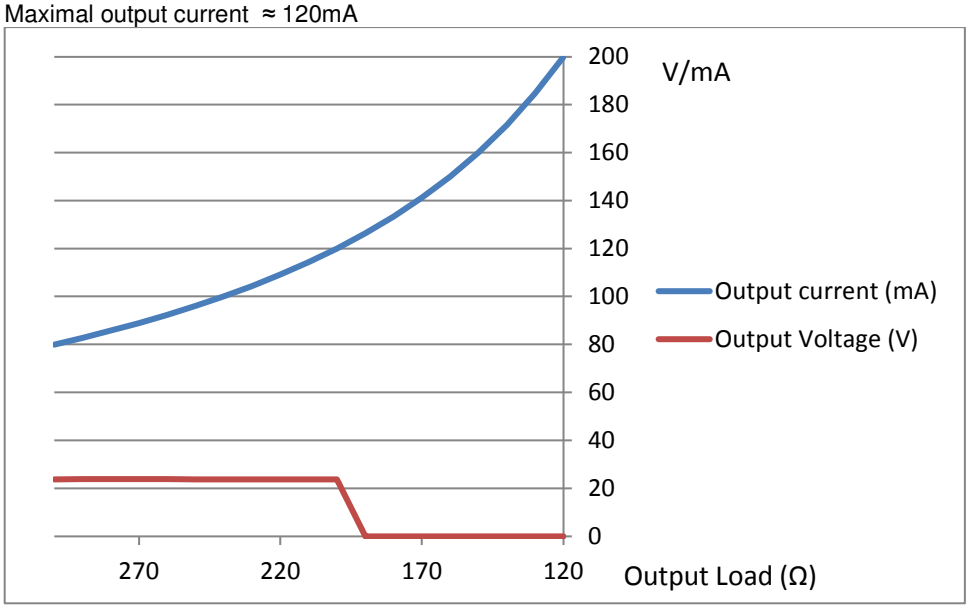


Figure 26: Diagram of output current/voltage versus resistance

4.9 Status display LEDs

The network and the amplifier states are indicated by multicolor light emitting diodes (status display LEDs) on the electronics housing.

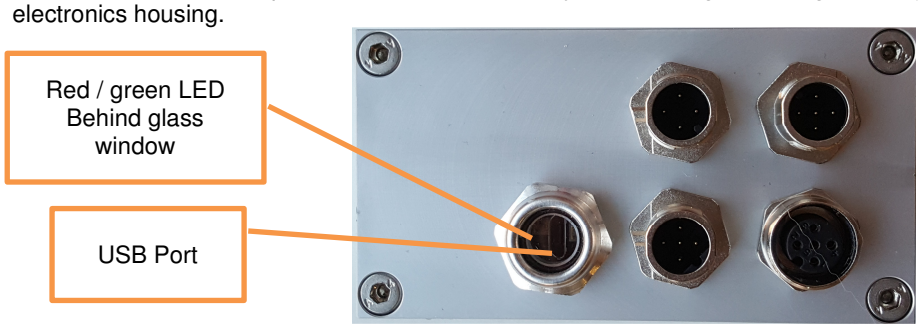


Figure 27: Top view, status LEDs and USB port

4.9.1 Lightening definition

LED	Definition
ON	constantly ON
OFF	constantly OFF
Blinking	equal ON and OFF times with a frequency of 1.0 Hz: ON = 500 ms, OFF = 500 ms.
Flashing	equal ON and OFF times with a frequency of 2.0 Hz: ON = 50 ms, OFF = 200 ms.
Flicker flash	equal ON and OFF times with a frequency of 1.0 Hz: ON = 100 ms, OFF = 400 ms.

4.9.2 LED status definition “NODE-ID == 0”

CanOpen is deactivated

□ Chapter “4.5.1.115 Object 0x50BD: E 24, CANopen Node-ID (if Node-ID=0 CAN is deactivated)“,page 105

Definition « Enable Signal » see □ Chapter “4.7.1 Digital input 0 (enable signal)“, page 126

DSM	Green LED	Red LED	Enable Signal	Description
---	OFF	OFF	---	No power is applied to the amplifier
---	ON 	OFF	OFF	The amplifier is active; The CANopen DSM is not applicable. CANopen address is set to zero. see description of parameter E 24
---	OFF	ON 	ON	Internal error occurred.

4.9.3 LED status definition “NODE-ID” is set

CanOpen is active

□ Chapter “4.5.1.115 Object 0x50BD: E 24, CANopen Node-ID (if Node-ID=0 CAN is deactivated)“,page 105

Definition « Enable Signal » see □ Chapter “4.7.1 Digital input 0 (enable signal)“, page 126

DSM	Green LED	Red LED	Enable Signal	Description
---	OFF	OFF	---	No power is applied to the amplifier
“INIT”, “DISABLED”, ”HOLD”, “ACTIVE”	Blinking 	OFF	OFF	The digital input 0 (enable) of the amplifier is lower than 4V
“INIT”, “DISABLED”	Blinking 	OFF	ON	The digital input 0 (enable) is applied to an voltage higher than 6V
”HOLD”	Flicker flash 	OFF	ON	The amplifier is in the “HOLD” state and the digital input 0 (enable) is applied to an voltage higher than 6V
”ACTIVE”	ON 	OFF	ON	The amplifier is in the “ACTIVE” state and the digital input 0 (enable) is applied to an voltage higher than 6V
“INIT”, “DISABLED”, ”HOLD”, “ACTIVE”	OFF	ON 	ON	Error occurred see description in □ Chapter “4.6.1.2 Possible fault codes“, page 122
“INIT”	OFF	Blinking 	ON	In the init phase, no CAN communication is possible, CAN TxD error.

5 Object dictionary

Index	Sub-Index	Parameter name	Data type	Access	Operation access:	non-volatile	Range	Default
0x1000	0	DeviceType	UINT32	ro		-	UINT32	408
0x1001	0	ErrorRegister	UINT8	ro		-	UINT8	None
0x1002	0	ManufacturerStatusRegister	UINT32	ro		-	UINT32	-
0x1003	0	NumberOfErrors	UINT32	ro		-	UINT32	None
0x1003	1..4	StandardErrorField	UINT32	ro		-	UINT32	None
0x1005	0	CobIdSyncMessage	UINT32	ro		-	0x80000080	0x80000080
0x1008	0	ManufacturerDeviceName	STRING	ro		-	None	-
0x1009	0	ManufacturerHardwareVersion	STRING	ro		-	None	-
0x100A	0	ManufacturerSoftwareVersion	STRING	ro		-	None	-
0x100C	0	GuardTime	UINT16	rw	ro	y	UINT16	0
0x100D	0	LifeTimeFactor	UINT8	rw	ro	y	UINT8	0
0x1014	0	CobIdEmergencyMessage	UINT32	rw		y	0x0080….0x00FF	0x0080+127
0x1016	0	Number of entries	UINT8	rw		n	UINT8	1
0x1016	1	ConsumerHeartbeatTime 1	UINT32	rw	ro	y	UINT32	0
0x1017	0	ProducerHeartbeatTime	UINT16	rw		y	UINT16	0
		ProducerHeartbeatTime, SW V2.8x*						0x3E8
0x1018	0	Number of entries	UINT8	ro		-	UINT8	4
0x1018	1	VendorId	UINT32	ro		-	UINT32	0x036C
0x1018	2	ProductCode	UINT32	ro		-	UINT32	-
0x1018	3	RevisionNumber	UINT32	ro		-	UINT32	-
0x1018	4	SerialNumber	UINT32	ro		-	UINT32	-
0x1200	0	Number of entries	UINT8	ro		-	UINT8	2
0x1200	1	CobIdClientServer	UINT32	ro		-	UINT32	0x0600+127
0x1200	2	CobIdClientClient	UINT32	ro		-	UINT32	0x0580+127
0x1400	0	Number of entries	UINT8	ro		-	UINT8	2
0x1400	1	RPdo1_CobIdUsedByPdo	UINT32	rw	ro	y	0x00000200…0x0000027F| 0x80000200…0x8000027F	0x0200+ Node-ID
0x1400	2	RPdo1_TransmissionType	UINT8	rw	ro	y	255	255
0x1600	0	RPdo1_NumberOfMappedApplicParaInPdo	UINT8	rw		y	0…8	2
0x1600	1	RPdo1_ApplicPara1	UINT32	rw	ro	y	UINT32	0x60400010
0x1600	2	RPdo1_ApplicPara2	UINT32	rw	ro	y	UINT32	0x63000110
0x1600	3	RPdo1_ApplicPara3	UINT32	rw	ro	y	UINT32	0x0
0x1600	4	RPdo1_ApplicPara4	UINT32	rw	ro	y	UINT32	0x0
0x1800	0	Number of entries	UINT8	ro		-	UINT8	5
0x1800	1	TPdo1_CobIdUsedByPdo	UINT32	rw	ro	y	0x40000180…0xC00001FF	0x0180+ NodeID
0x1800	2	TPdo1_TransmissionType	UINT8	rw	ro	y	UINT8	255
		TPdo1_TransmissionType, SW V2.8x*						1
0x1800	5	TPdo1_EventTimer	UINT16	rw	ro	y	UINT16	03E8
0x1A00	0	TPdo1_NumberOfMappedApplicParaInPdo	UINT8	rw		y	0…8	2
		TPdo1_NumberOfMappedApplicParaInPdo, SW V2.8x*						4
0x1A00	1	TPdo1_ApplicPara1	UINT32	rw	ro	y	UINT32	0x60410010
0x1A00	2	TPdo1_ApplicPara2	UINT32	rw	ro	y	UINT32	0x63010110
0x1A00	3	TPdo1_ApplicPara3	UINT32	rw	ro	y	UINT32	0
		TPdo1_ApplicPara3, SW V2.8x*						0x50130010
0x1A00	4	TPdo1_ApplicPara4	UINT32	rw	ro	y	UINT32	0
		TPdo1_ApplicPara4, SW V2.8x*						0x500F0010

Index	Sub-Index	Parameter name	Data type	Access	Operation access:	non-volatile	Range	Default
0x1F80	0	NMT-Startup	UINT32	rw		y	UINT32	8
0x4200	0	ModuleIdentifier	UINT8	rw	ro	y	0..127	127
0x4201	0	Bitrate	UINT8	rw	ro	y	1..7	3
0x4211	0	TPdoTrigger	UINT8	rw		n	255	None
0x4212	0	RPdo1_Counter	UINT32	rw		n	UINT32	0
0x4300	0	FaultStatus	UINT8	ro		-	UINT8	None
0x5000	0	Vers	UINT16	ro		-	0..9999	-
0x5001	0	d1.01	INT16	ro		-	-9999. .+9999	-
0x5002	0	d1.02	INT16	ro		-	-9999. .+9999	-
0x5003	0	d1.03	INT16	ro		-	-9999. .+9999	-
0x5004	0	d1.04	INT16	ro		-	-9999. .+9999	-
0x5005	0	d1.05	INT16	ro		-	0. .9999	-
0x5006	0	d1.06	INT16	ro		-	0. .9999	-
0x5007	0	d1.07	INT16	ro		-	0. .9999	-
0x5008	0	d1.08	INT16	ro		-	0. .9999	-
0x5009	0	d1.09	INT16	ro		-	0. .9999	-
0x500A	0	d1.10	INT16	ro		-	-9999. .+9999	-
0x500B	0	d1.11	INT16	ro		-	-9999. .+9999	-
0x500C	0	d1.12	INT16	ro		-	-9999. .+9999	-
0x500D	0	d1.13	INT16	ro		-	-9999. .+9999	-
0x500E	0	d2.01	INT16	ro		-	-9999. .+9999	-
0x500F	0	d2.02	INT16	ro		-	-9999. .+9999	-
0x5010	0	d2.03	INT16	ro		-	-9999. .+9999	-
0x5011	0	d2.04	INT16	ro		-	-9999. .+9999	-
0x5012	0	d2.10	INT16	ro		-	-9999. .+9999	-
0x5013	0	d2.11	INT16	ro		-	-9999. .+9999	-
0x5014	0	d2.12	INT16	ro		-	-9999. .+9999	-
0x5015	0	d2.13	INT16	ro		-	-9999. .+9999	-
0x501A	0	S1.08	INT16	rw		Y	-9999..+9999	-
0x501B	0	r1.01	UINT16	rw		Y	0. .3950	0
0x501C	0	r1.02	UINT16	rw		Y	0. .3950	0
0x501D	0	r1.03	UINT16	rw		Y	0. .3950	0
0x501E	0	r1.04	UINT16	rw		Y	0. .3950	0
0x501F	0	A1.01	INT16	rw		-	-9999. .+9999	0
0x5020	0	A1.02	INT16	rw		-	-9999. .+9999	0
0x5027	0	A2.01	INT16	rw		-	-9999. .+9999	0
0x5028	0	A2.02	INT16	rw		-	-9999. .+9999	0
0x5029	0	C1.00	UINT16	rw		Y	0...4	0
0x502A	0	C1.01	UINT16	rw		Y	0...1	0
0x502B	0	C1.02	UINT16	rw		Y	0...6	0
0x502C	0	C1.03	UINT16	rw		Y	0 - 200	100
0x502D	0	C1.04	UINT16	rw		Y	0 - 200	100
0x502E	0	C1.05	INT16	rw		Y	-400… +400	100
0x502F	0	C1.06	INT16	rw		Y	-9999… +9999	0
0x5030	0	C1.07	UINT16	rw		Y	0….9999	0
0x5031	0	C1.08	UINT16	rw		Y	0....9999	0
0x5032	0	C1.09	UINT16	rw		Y	0....26	4
0x5033	0	C1.10	UINT16	rw		Y	0....400	100
0x5034	0	C1.11	INT16	rw		Y	-9999… +9999	0
0x5035	0	C1.12	INT16	rw		Y	-1… +1	1
0x5036	0	C1.13	UINT16	rw		Y	0… 400	0
0x5037	0	C1.14	UINT16	rw		Y	0…1000	0
0x5038	0	C1.15	UINT16	rw		Y	0…9999	9999

Index	Sub-Index	Parameter name	Data type	Access	Operation access:	non-volatile	Range	Default
0x5039	0	C1.16	UINT16	rw		Y	0… 400	0
0x503A	0	C1.17	UINT16	rw		Y	0….4000	0
0x503B	0	C1.18	UINT16	rw		Y	0….400	0
0x503C	0	C1.19	UINT16	rw		Y	0….400	0
0x503D	0	C1.20	UINT16	rw		Y	1….32	1
0x503E	0	C1.21	INT16	rw		Y	-9999 +9999	0
0x503F	0	C1.22	INT16	rw		Y	-9999 +9999	0
0x5040	0	C1.23	UINT16	rw		Y	0....9999	0
0x5041	0	C1.24	UINT16	rw		Y	0....9999	0
0x5042	0	C1.25	UINT16	rw		Y	0....3	0
0x5043	0	C1.26	UINT16	rw		Y	0....2	0
0x5044	0	C2.00	UINT16	rw		Y	0...4	0
0x5045	0	C2.01	UINT16	rw		Y	0...1	0
0x5046	0	C2.02	UINT16	rw		Y	0...6	0
0x5047	0	C2.03	UINT16	rw		Y	0 - 200	100
0x5048	0	C2.04	UINT16	rw		Y	0 - 200	100
0x5049	0	C2.05	INT16	rw		Y	-400… +400	100
0x504A	0	C2.06	INT16	rw		Y	-9999… +9999	0
0x504B	0	C2.07	UINT16	rw		Y	0….9999	0
0x504C	0	C2.08	UINT16	rw		Y	0....9999	0
0x504D	0	C2.09	UINT16	rw		Y	0....12	4
0x504E	0	C2.10	UINT16	rw		Y	0....400	100
0x504F	0	C2.11	INT16	rw		Y	-9999… +9999	0
0x5050	0	C2.12	INT16	rw		Y	-1… +1	1
0x5051	0	C2.13	UINT16	rw		Y	0… 400	0
0x5052	0	C2.14	UINT16	rw		Y	0…1000	0
0x5053	0	C2.15	UINT16	rw		Y	0…9999	9999
0x5054	0	C2.16	UINT16	rw		Y	0… 400	0
0x5055	0	C2.17	UINT16	rw		Y	0….4000	0
0x5056	0	C2.18	UINT16	rw		Y	0….400	0
0x5057	0	C2.19	UINT16	rw		Y	0….400	0
0x5058	0	C2.20	UINT16	rw		Y	1….32	1
0x5059	0	C2.21	INT16	rw		Y	-9999 +9999	0
0x505A	0	C2.22	INT16	rw		Y	-9999 +9999	0
0x505B	0	C2.23	UINT16	rw		Y	0....9999	0
0x505C	0	C2.24	UINT16	rw		Y	0....9999	0
0x505D	0	C2.25	UINT16	rw		Y	0....3	0
0x505E	0	C2.26	UINT16	rw		Y	0....2	0
0x505F	0	E 00	UINT16	rw		Y	1…..8	1
0x5061	0	E 02	UINT16	rw		Y	0….4	0
0x5062	0	E 03	UINT16	rw		Y	1…..7	6
0x5063	0	E 04	UINT16	rw		Y	0..9999	500
0x5064	0	E 05	UINT16	rw		Y	0..9999	500
0x5065	0	E 06	UINT16	rw		Y	0..9999	1300
0x5066	0	E 07	UINT16	rw		Y	0..9999	500
0x5067	0	E 08	UINT16	rw		Y	0..1	1
0x5068	0	E 09	UINT16	rw		Y	0..9999	0
0x5069	0	E 10	UINT16	rw		Y	50…110	100
0x506A	0	E 11	UINT16	rw		Y	0..9999	0
0x506B	0	E 12	UINT16	rw		Y	0..9999	0
0x506C	0	E 13	UINT16	rw		Y	0..3000	0
0x506D	0	E 14	UINT16	rw		Y	0….300	0
0x506E	0	E 15	UINT16	rw		Y	0…..8	1

Index	Sub-Index	Parameter name	Data type	Access	Operation access:	non-volatile	Range	Default
0x506F	0	E 16	UINT16	rw		Y	0…..8	1
0x5070	0	E 17	UINT16	rw		Y	0….4	0
0x5071	0	E 18	UINT16	rw		Y	0….13	0
0x509B	0	E 2.03	UINT16	rw		Y	1…..7	6
0x509C	0	E 2.04	UINT16	rw		Y	0..9999	500
0x506D	0	E 2.05	UINT16	rw		Y	0..9999	500
0x509E	0	E 2.06	UINT16	rw		Y	0..9999	1300
0x509F	0	E 2.07	UINT16	rw		Y	0..9999	500
0x50A0	0	E 2.10	UINT16	rw		Y	50…110	100
0x50A1	0	E 2.13	UINT16	rw		Y	0..3000	0
0x50A2	0	E 2.14	UINT16	rw		Y	0….300	0
0x50A4	0	C 1.27	UINT16	rw		Y	0…9999	0
0x50A5	0	C 2.27	UINT16	rw		Y	0…9999	0
0x50B3	0	C 1.33	UINT16	rw		Y	0…9999	9999
0x50B4	0	C 2.33	UINT16	rw		Y	0…9999	9999
0x50BC	0	C 1.36	INT16	rw		Y	-100..- .+100	0
0x50BD	0	E 24	INT16	rw		Y	-1..- ..+127	127
0x50BE	0	E 25	UINT16	rw		Y	1…..7	3
0x50C3	0	C 2.36	INT16	rw		Y	-100..- .+100	0
0x50C4	0	C1.37	UINT16	rw		Y	0….9999	0
0x50C5	0	C1.38	UINT16	rw		Y	0….9999	0
0x50C6	0	L1.x0	UINT16	rw		Y	0….0	0
0x50C7	0	L1.y0	UINT16	rw		Y	0….9999	0
0x50C8	0	L1.x1	UINT16	rw		Y	0….9999	1250
0x50C9	0	L1.y1	UINT16	rw		Y	0….9999	1250
0x50CA	0	L1.x2	UINT16	rw		Y	0….9999	2500
0x50CB	0	L1.y2	UINT16	rw		Y	0….9999	2500
0x50CC	0	L1.x3	UINT16	rw		Y	0….9999	3750
0x50CD	0	L1.y3	UINT16	rw		Y	0….9999	3750
0x50CE	0	L1.x4	UINT16	rw		Y	0….9999	5000
0x50CF	0	L1.y4	UINT16	rw		Y	0….9999	5000
0x50D0	0	L1.x5	UINT16	rw		Y	0….9999	6250
0x50D1	0	L1.y5	UINT16	rw		Y	0….9999	6250
0x50D2	0	L1.x6	UINT16	rw		Y	0….9999	7500
0x50D3	0	L1.y6	UINT16	rw		Y	0….9999	7500
0x50D4	0	L1.x7	UINT16	rw		Y	0….9999	8750
0x50D5	0	L1.y7	UINT16	rw		Y	0….9999	8750
0x50D6	0	L1.x8	UINT16	rw		Y	9999	9999
0x50D7	0	L1.y8	UINT16	rw		Y	0….9999	9999
0x50DA	0	L2.x0	UINT16	rw		Y	0….0	0
0x50DB	0	L2.y0	UINT16	rw		Y	0….9999	0
0x50DC	0	L2.x1	UINT16	rw		Y	0….9999	1250
0x50DD	0	L2.y1	UINT16	rw		Y	0….9999	1250
0x50DE	0	L2.x2	UINT16	rw		Y	0….9999	2500
0x50DF	0	L2.y2	UINT16	rw		Y	0….9999	2500
0x50E0	0	L2.x3	UINT16	rw		Y	0….9999	3750
0x50E1	0	L2.y3	UINT16	rw		Y	0….9999	3750
0x50E2	0	L2.x4	UINT16	rw		Y	0….9999	5000
0x50E3	0	L2.y4	UINT16	rw		Y	0….9999	5000
0x50E4	0	L2.x5	UINT16	rw		Y	0….9999	6250
0x50E5	0	L2.y5	UINT16	rw		Y	0….9999	6250
0x50E6	0	L2.x6	UINT16	rw		Y	0….9999	7500
0x50E7	0	L2.y6	UINT16	rw		Y	0….9999	7500

Index	Sub-Index	Parameter name	Data type	Access	Operation access:	non-volatile	Range	Default
0x50E8	0	L2.x7	UINT16	rw		Y	0....9999	8750
0x50E9	0	L2.y7	UINT16	rw		Y	0….9999	8750
0x50EA	0	L2.x8	UINT16	rw		Y	0....9999	9999
0x50EB	0	L2.y8	UINT16	rw		Y	0….9999	9999
0x50EC	0	C1.39	UINT16	rw		Y	0....10	0
0x50ED	0	C1.40	UINT16	ro		Y	0....26	0
0x6040	0	Control Word	UINT16	rw		-	UINT16	0
0x6041	0	Status Word	UINT16	ro		-	UINT16	-
0x6050	0	DeviceVersion	STRING	ro		-	None	“”
0x6052	0	SerialNumber	STRING	ro		-	None	“”
0x6055	0	ModelURL	STRING	ro		-	None	“www.h-c-s-gmbh.de“
0x605F	0	Capability	UINT32	ro		-		0x1F000000
0x6300	0	Number of entries	UINT8	ro		-	1	1
0x6300	1	Setpoint	INT16	wo		-	INT16	none
0x6301	0	Number of entries	UINT8	ro		-	1	1
0x6301	1	ActualValue	INT16	ro		-	INT16	-
0x6314	0	Number of entries	UINT8	ro		-	1	1
0x6314	1	HoldSetpoint	INT16	wo		-	INT16	S1.08
0x6330	0	Type	INT8	ro		-	3	3
0x6332	0	Number of entries	UINT8	ro		-	1	1
0x6332	1	AccelerationTimePositive	UINT16	rw	ro	Y	0..3950	0
0x6333	0	Number of entries	UINT8	ro		-	1	1
0x6333	1	AccelerationTimeNegative	UINT16	rw	ro	Y	0..3950	0
0x6335	0	Number of entries	UINT8	ro		-	1	1
0x6335	1	DecelerationTimePositive	UINT16	rw	ro	Y	0..3950	0
0x6336	0	Number of entries	UINT8	ro		-	1	1
0x6336	1	DecelerationTimeNegative	UINT16	rw	ro	Y	0..3950	0

Table 297: Object Dictionary

6 Reset the CANopen parameter to default values

6.1 Set the CANopen Communication parameter via HCSTool

By reset the CANopen parameter as described in the following section, the PDO COP-ID for transmit and receive will automatically set with den Node-ID of parameter E24.

Here an example of ODC with SW V2.81d

- Open the HCSTool Select the Interface COM port.

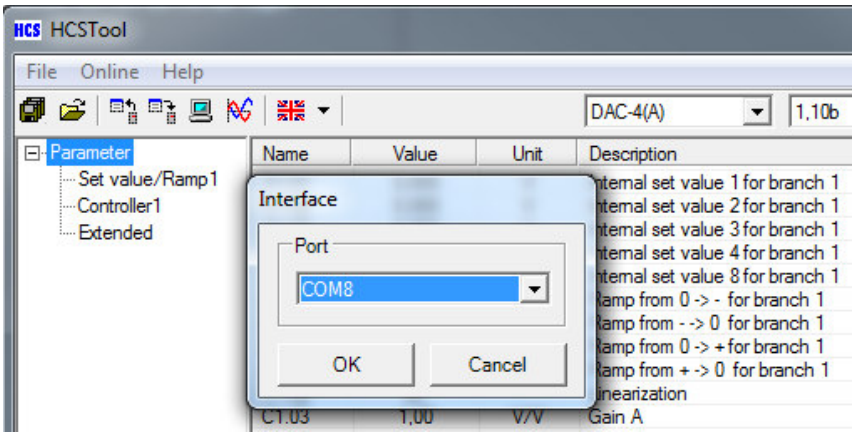


Figure 28: Set the COM port for the “HCSTool”

- Upload the parameter from the ODC.

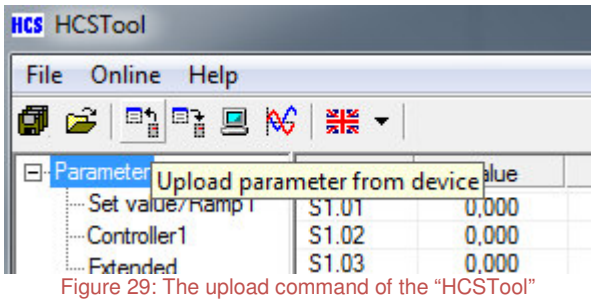


Figure 29: The upload command of the “HCSTool”

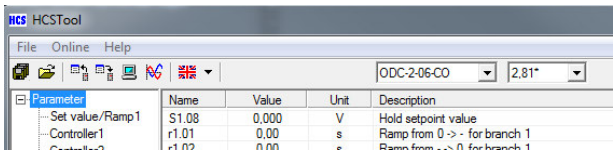


Figure 30: After upload, device type and SW version is shown

- setup the CAN speed and the Node-id of the ODC.

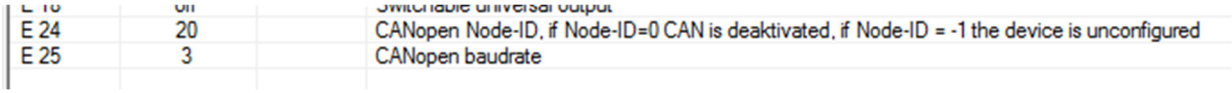


Figure 31: Extended parameter E24, E25

Attention !! If you change the Node-ID of the device, the COP ID of the TPDO, RPDO remains unchanged. If you set the COP-ID equal to the Node-ID, you need a CAN configuration tool or use the "rcan" command described in the following section.

6.2 Description, how to reset the CANopen default parameter

For doing this, a terminal program like “Tera Term” or “Hypertermial” is needed.
An installation for the “Tera Term” can be downloaded from our web-site also.

Here we describe the handling together with the “Tera Term”, the handling with the “Hypertermial” is equivalent.

- Disconnect the USB interface from the ODC, Power off/on the ODC. (The communication port of the ODC then will be set to default)
- Connect the USB interface of the ODC with the PC, If the HCSTool is open, please close it.
- Open the “Tera Term”

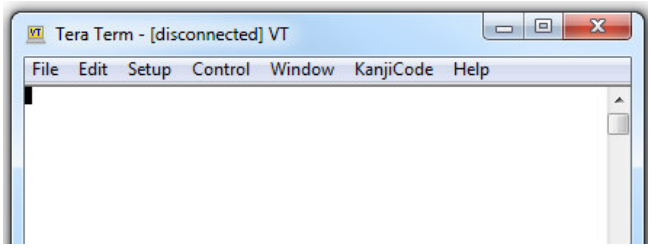


Figure 32: Disconnected “Tera Term”

- Select the correct serial COM port for the USB communication

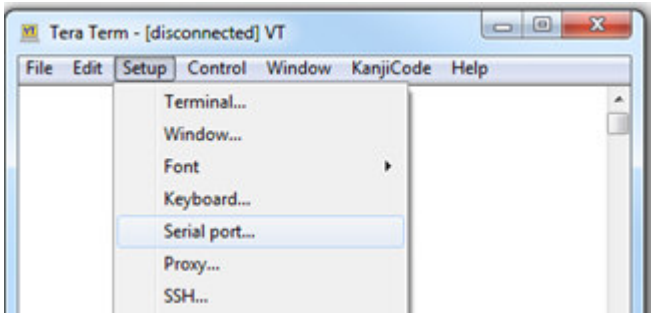


Figure 33: Setup of “Tera Term”

- In this example COM8 is used, you can see in the description of the driver “Device Friendly Name: Silicon Labs CP210x USB to UART Bridge (COM8)”
- Set the Speed to “19200” and press “New open

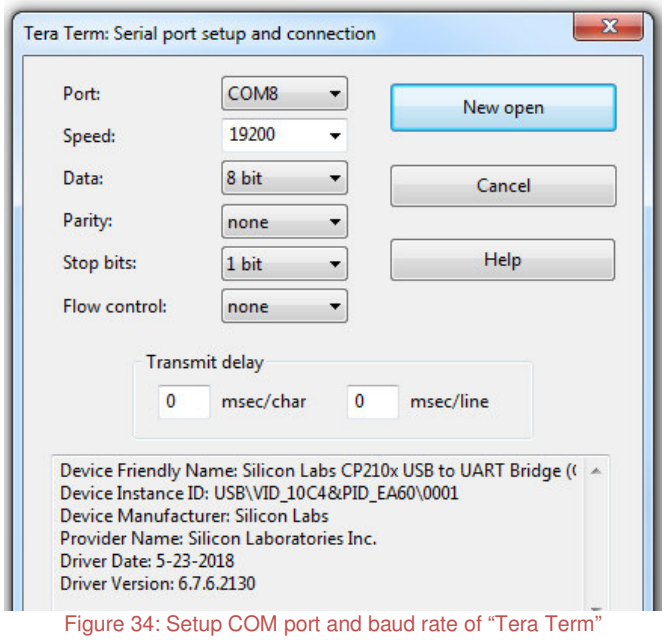


Figure 34: Setup COM port and baud rate of “Tera Term”

- If the ODC is connected, it will show “Vewrs = x.xx*” x.xx for the SW Version. If the SW version is not shown, then the ODC is in the HCSTool communication mode. By power off/on the ODC will start into the terminal mode by default.

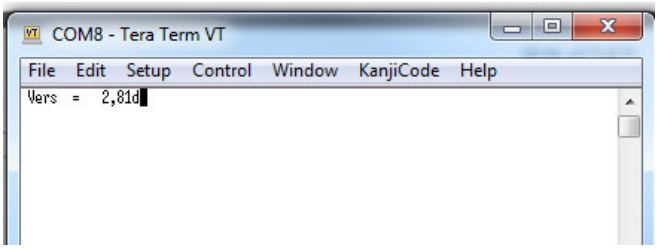


Figure 35: connected ODC

- In order to reset the CANopen parameters to the original value, the command "rcan" is used with the preceding character '@'. The subsequent question must be answered with a 'y' if this is actually desired. The COP-iID for TPDO and RPDO is automatically set to the current Node-id.

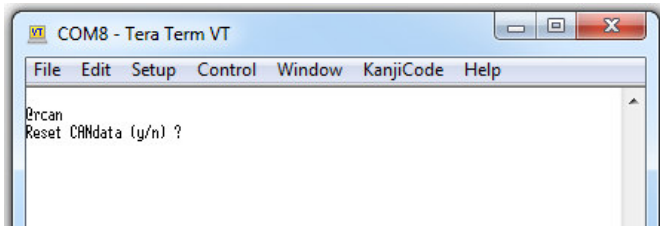


Figure 36: The reset CANopen command

The set baud rate of the CANopen ODC remains at the value set via the HCSTool.

7 Quick Setup – ODC

This chapter describes how to generate a signal at the output stages based on CANopen communication.

7.1 Setup HCSTool

HCSTool software is executed on WINDOWS based PC’s.
HCSTool is required if parameters or device changes shall be made without using the CAN interface.

HCSTool can be downloaded from www.h-c-s-gmbh.de/download.
The required driver for a HCS USB interface is included and will be installed as well.

7.2 Setting up the CAN interface at an PC

Use a CAN-Interface with its software driver.

The example explains this for a CAN interface provided by **IXXAT**:
USB-to-CAN-Interface. (www.ixxat.com)

Figure 37: CAN interface with USB connection

Needed drivers can be downloaded from IXXAT homepage
(https://www.ixxat.com/support/file-and-documents-download/drivers).

The driver also contains tool “Minimon”. This tool allows monitoring of communication between PC and device.

7.3 Connecting the USB interface

Connect the PC and the ODC with a micro USB cable.

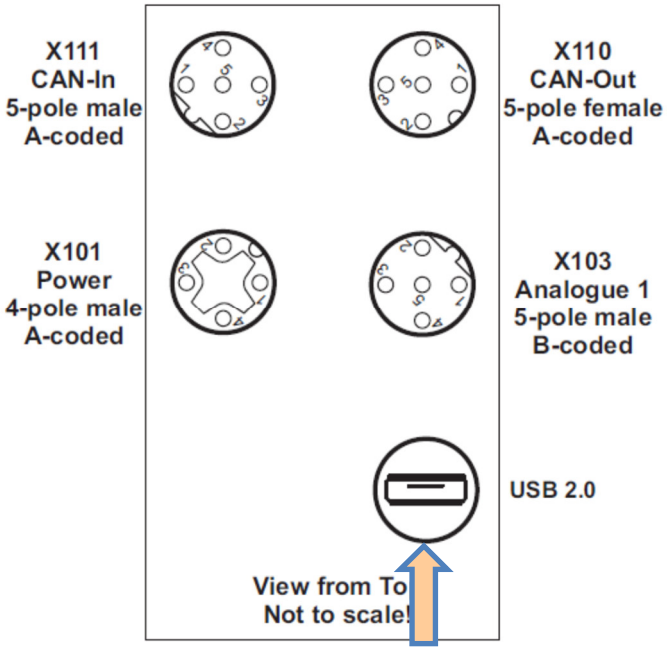


Figure 38: Connect the USB interface

7.4 Connecting the CAN network

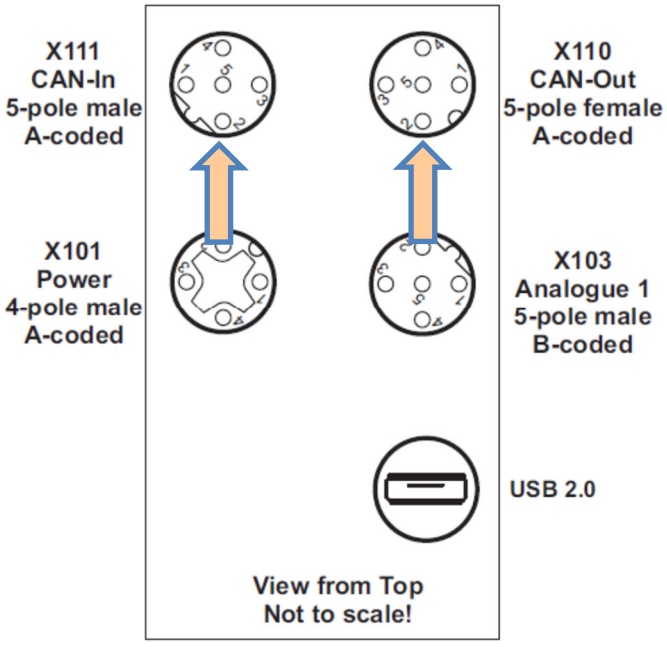


Figure 39: Connect the CAN interface

Signal definition of the CAN-Interface X110, X111;(terminal #:
4 = CAN High
5 = CAN Low

7.5 Connecting supply to the ODC

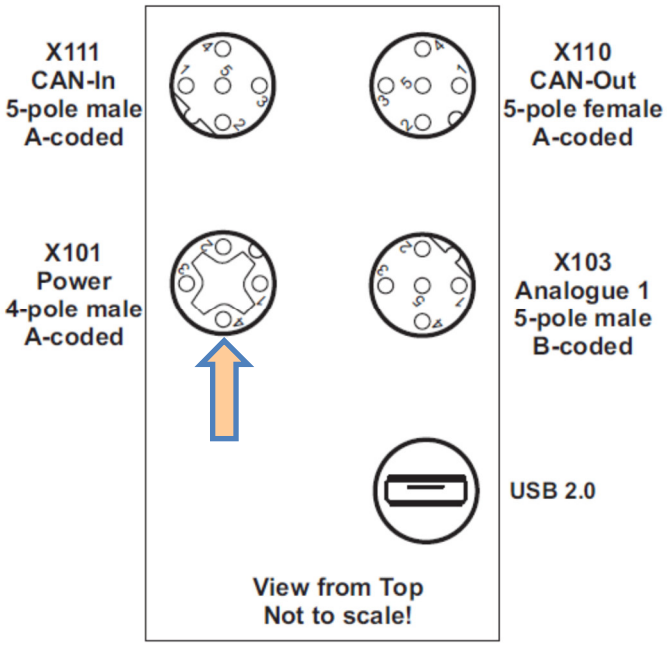
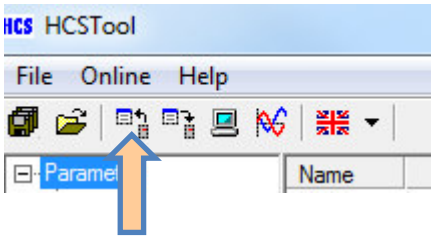


Figure 40: Connect the power to the ODC

Power and Enable input X101; terminal #:
1 = 24 V
2 = 0 V
3 = Enable input.

7.6 Setup parameter for CAN communication

- Power up the ODC
- Apply 24 V to the enable input
- Start HCSTool
- Upload actual parameter setting from ODC (Upload from device)



- Ensure valid CAN-ID is selected:
  Parameter E 24 defines the Node –ID of the device in the range 1..127.
  If E24 is set to “0” than the CAN interface is deactivated.
- Ensure a valid a baud rate is selected. Select the correct network baud rate with parameter E25.
  Default value is 125 kbit.

In this example:

- CAN-ID is set to 126 (parameter E24 = 126)
- Baud rate 125 kBit is selected (parameter E25 = 3)
- Operation mode E00 = 6 (mode 6)

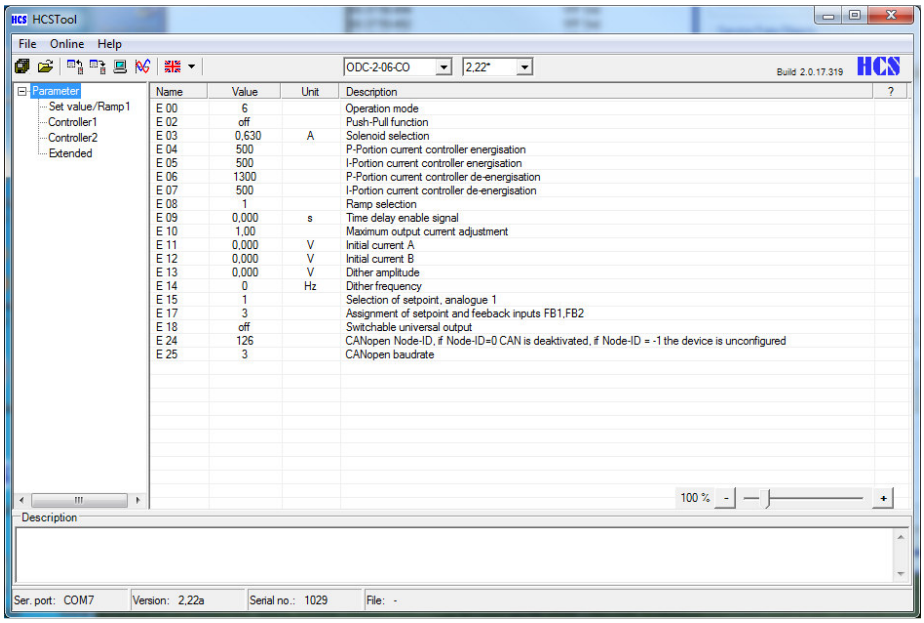


Figure 41: Parameter with HCSTool

7.7 Establishing CAN communication

After power up the ODC starts depending on Object 0x1F80: NMT-Startup,
(Refer to, □ Chapter "4.3.1

Object 0x1F80: NMT-Startup", page 35)

- If the default value of Object 0x1F80 is not changed, the ODC starts in the operational mode.
- If the transmit PDO is not active, please enable a transmit PDO first to see internal values via CAN. (Refer to, □ Chapter "3.9.3.4 TxPDO protocol configuration (COB-ID: 0x180)", page 29)
  Please use the default values for Object 0x1800, index 00..05 and Object 0x1A00, index 00..04

If the TPDO is enabled every second (value in index 0x1800-05) a message of CAN-Identifier (value in 0x1800-01) 0x1FF is transmitted. The mapped values are object 0x6041 (device status word) and 0x6301 (actual value).

Screen shot for this situation, :

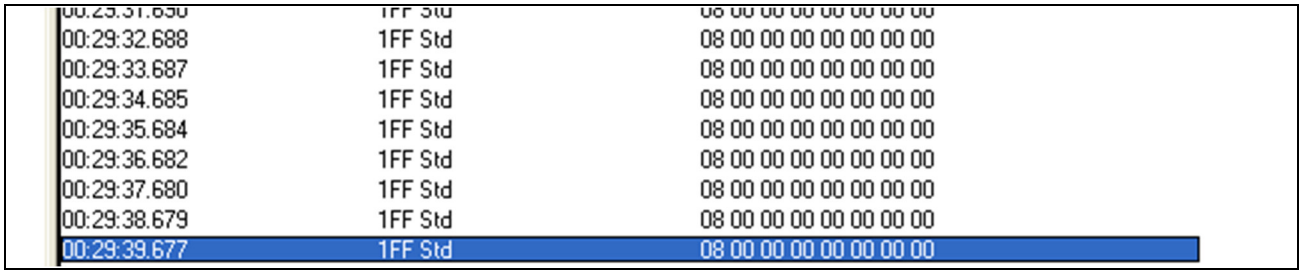


Figure 42: Logging the CAN data transmission, <StatusWord> shows ready

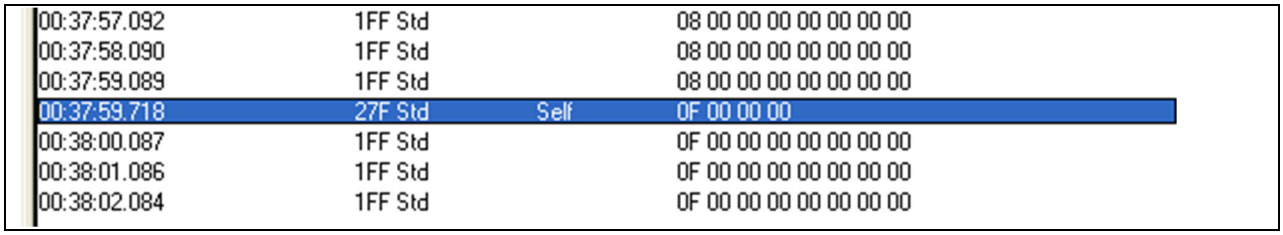


Figure 43: Logging the CAN data transmission, <StatusWord> from ready to active

7.8 If there is a communication error after starting the ODC

Every time a new device is connected to the bus, it will send a startup NMI control object.
Example for ODC with node 127:

Time (ms)	Identifier	Format	Flags	Data
00:11:52.094	77F	Std		00

Figure 44: startup NMI control object from node 127

The startup NMI control object is send.

- If any communication partner receives this object, the access to the bus is successful.
- If no communication participant is available, the CAN controller in the ODC tries to send the object until it receives an CAN acknowledgment.
  If the internal telegram error counter reaches a certain level, an internal communication error will be performed.
  The next send telegram will then recognize this error and display it as an active error.

00:10:48.305	1FF Std	08 00 00 00 00 00 00 00
00:10:48.306	FF Std	00 60 20 07 00 00 00 00
00:10:48.307	1FF Std	01 00 00 00 00 00 00 00

Figure 45: Emergency object after “next send”

After sending the “Emergency object” with Error ---7, the ODC is disabled and will show this NMI error as –7. Also, the red Error-Led is flashing.

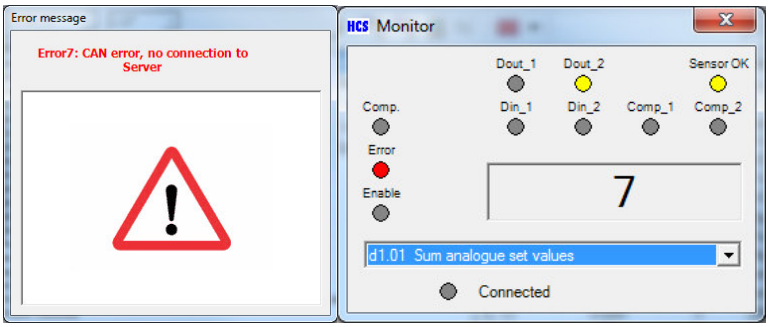


Figure 46: Error Message, no CAN communication

If the CAN master receives an "emergency telegram" with communication-related error codes, the master recognizes that there was a communication error.
The communication error disappears automatically after error-free receipt or transmission of **telegrams**.

Depending on the sort of the communication error, several “good” receipt or transmission telegrams are needed for automatically reset the internal error and clear the red error LED.

If the error does not disappear automatically, there is a cabling problem or a missing terminating resistor.

7.9 Startup, DSM “DISABLE”

Depending on the DSM the ODC is set to state “DISABLE” after power up.
Refer to □ Chapter “4.2.3 Device state machine (DSM), page 41”.

- If the enable signal at X101 is set to 24 V, the enable LED at the ODC is flashing
- All internal values - except the feedback value - are set to zero
- The output stages are deactivated.

It is also possible to be observed by using the “monitor” function within the HCSTool.
ODC is still disabled (Enable LED is off):

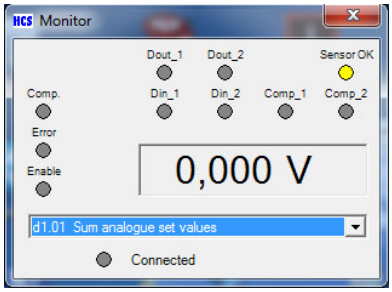


Figure 47: Monitor function of the HCSTool, Disable.

To set the DSM to “ACTIVE”, the following data must be sent by means of CAN Identifier 0x27F: 07 00 00 00
Explanation:

- 07 00 → sets the “Device Control Word” to active state
  DSM changes from “DISABLE” to “ACTIVE”
- 00 00 → set value = 0.00V

By sending a value by means of CAN Identifier 0x27F the “Device Status Word” (Object 0x6041) will be written and the “Device Control Word” of the device profile (Object 0x6040) is set.
Refer to
□ Chapter “4.2.2.1 Object 0x6040: Control word, page 40”.

When sending 0x27F with the value “0x07” the DSM will change to “ACTIVE”.
Remark: If using the CANopen manager the “Device Control Word” (Object 0x6040) of the device profile can be used to set the “Device Status Word”.

HCSTool is now showing the Enable LED as being lit. Signal value at d1.10 is also appearing in this example.

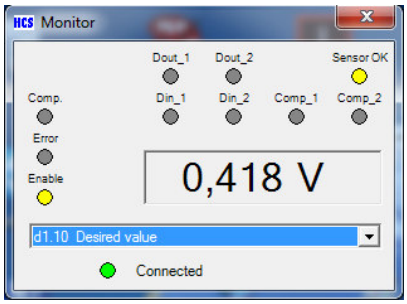


Figure 48: ODC “ACTIVE”, Analog input, E15 = +-10V

Generally it is to be noted that in CANopen data are transmitted according to the **"Little Endian"** rule and therefore according to the form for corresponding INTEL processors. This means that the low value byte is transmitted first.

7.10 Sending a set value to the ODC

When using CANopen it is necessary to switch off analogue signals if unused!
Using HCSTool and disable the analogue input by setting parameter E15 and E16 to “off”.

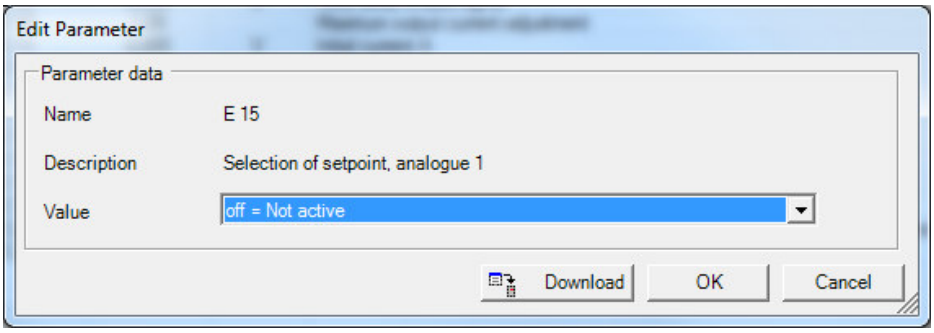


Figure 49: Disable the analog input

This will force the value at the analogue inputs to “0.00 V” - can be displayed by using the monitor function of the HCSTool showing d1.02:

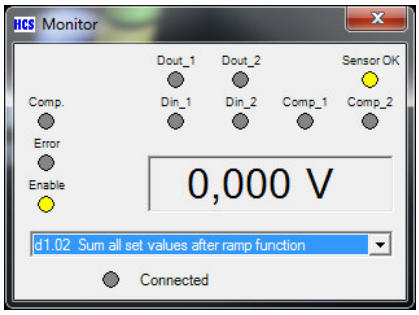


Figure 50: ODC Enabled, analog input = off

As a consequence now only digital values via CAN or digital command inputs will be executed.

Example: Set the digital set value to 1.00 V.
Sending to CAN object the following data: 07 00 E8 03
Explanation:

- 07 00 → set the “Device Control Word” to active state
- 03 E8 → set value = 1.00 V (intel format = bytes are reversed)
  (maximum value for 9.999 V is 0F 27).

Remark: If using the CANopen manager the “vpoc_set_point_Value” (Object 0x6300) of the device profile can be used to set the digital set value.
□ Chapter “4.4.1.1.1 Object 0x6300: Set point“,page 48

Now the value at d1.02 is 0.999 V

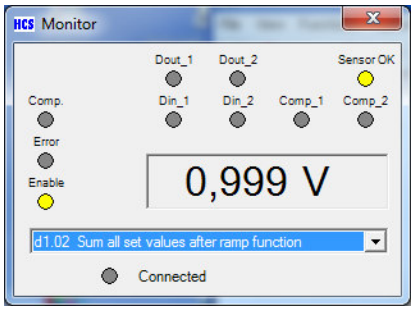


Figure 51: ODC Enabled, digital value set.

➔ Current at output stages will be accordingly but can also be influenced by other consecutive parameters.

8 Declaration of Conformity

EC Declaration of Conformity in accordance with EMC Directive 2004/108/EG

HCS Hydraulic Control Systems GmbH
Neuffener Str. 29
D-72636 Frickenhausen

hereby declares that the product described as follows complies in terms of its design, as well as in the version placed in the stream of commerce by us, with the relevant requirements of the directive. This declaration is void in the event of any changes to the product without our written agreement.

Product:	ODC – On Board Digital Amplifier and Controller
Intended use:	Automation systems (industrial, marine and offshore applications)
Model:	ODC-2
Rated voltage:	24 V DC; SELV
Rated power:	max. 25 W
Protection class:	III
Protection degree:	IP67 (IP67k on request)
Relevant EC Directive:	EMC Directive 2004/108/EG
Applicable EU Standards:	EN 61000-6-2: 2005 EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-4-16 EN 61000-6-3:2007 + A1:2011 EN 61000-6-4:2007 + A1:2011 Germanischer Lloyd VI-7-2 (EN 60945) on request IEC 60533: 11/2010 EMC, Civil ship (General Zone) Surge: 55V 30ms Isolation between housing and connector terminals > 10 MΩ (50V DC)

Date/manufacturer's signature

31.08.2022
Details of signatory: Dipl.-Ing. (FH) Peter Deuschle (General Manager)

9 Notes:

10 HCS distributors and partners

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www.h-c-s-gmbh.de

- End -