

igus® Motion Plastics®

dryve D1, ST- DC- EC/BLDC-Motor Control System

Manual V3.3



Sample Programs
www.igus.eu/Sample-program



Support Videos
www.igus.eu/dryveXP

Table of Contents

1	Safety Instructions, Protective Measures and Guidelines.....	7
1.1	Important Instructions.....	7
1.2	Qualified Personnel.....	7
1.3	Maintenance.....	7
1.4	Safety Instructions.....	8
1.4.1	Information Classification	8
1.5	Electromagnetic Compatibility	8
2	Product Overview.....	9
2.1	Operating Modes.....	9
2.2	Technical Data	10
2.2.1	General Data.....	10
2.2.2	Mechanical Data	10
2.2.3	Electrical Data	11
3	Installation	14
3.1	Mechanical Installation	14
3.2	Electrical Installation.....	15
3.2.1	General Electrical Installation Information	15
3.2.2	Grounding of motor and encoder cable	15
3.2.3	Cable Cross Sections.....	16
3.2.4	Power supply selection.....	16
3.2.5	Connection Overview	19
3.2.6	Pin Assignment	21
3.2.6.1	X1 Logic/Load Connector.....	21
3.2.6.2	X2 Digital Inputs Connector.....	21
3.2.6.3	X3 Digital Outputs Connector	22
3.2.6.4	X4 Analogue Inputs Connector	22
3.2.6.5	X5 Motor/Brake/Brake Resistor Connector	23
3.2.6.6	X6 Feedback Connector.....	25
3.2.7	CANopen Interface.....	27
3.2.8	Ethernet/Modbus TCP Gateway Interface.....	28
3.2.9	Status Display	28
3.3	“Enable” DI 7 - Integration in safety circuits.....	29
4	Initial Operation and User Interface.....	30
4.1	User Interface Connection Establishment	30
4.1.1	Connection Loss	31
4.2	User Interface Information.....	32
4.2.1	Overboost indicator	33
4.2.2	Entering Parameters	34
4.2.3	Parameterisation storage when using the bus systems	35
4.3	Start.....	36
4.3.1	Language	36
4.3.2	Measuring System.....	36
4.3.3	Movement Type	36
4.3.4	Time Units.....	36
4.3.5	Configuration.....	37

4.3.6	Firmware	38
4.3.6.1	Downloading the update file	38
4.3.6.2	Update process	38
4.3.6.3	Failed Update and display "Index Of..."	39
4.3.7	Password	40
4.4	Motor configuration.....	41
4.4.1	Motor	43
4.4.2	User-Defined Motor	45
4.4.3	Gear	45
4.4.4	Feedback	46
4.4.5	Impulse Check	47
4.4.5.1	Impulse Check with Physical Limitation.....	47
4.4.5.2	Impulse Check without Limit.....	48
4.4.6	Closed-Loop.....	49
4.4.7	Self-Tuning	50
4.4.8	Brake.....	50
4.4.9	Braking Resistor for EC/BLDC Motors	51
4.4.9.1	Braking Resistor selection for igus motors	51
4.4.9.2	Braking Resistor dimensioning for custom motors	52
4.4.9.3	Braking Voltage Setting.....	55
4.5	Axis Configuration	56
4.5.1	Axis	56
4.5.2	Software Limit Switch	56
4.5.3	Motion Limits	57
4.5.4	Limit Switch	59
4.5.4.1	Triggered Limit Switches	60
4.5.5	Homing.....	61
4.5.5.1	Offset.....	62
4.5.6	Analogue Absolute Feedback	63
4.6	Communication	64
4.6.1	Ethernet TCP/IP	64
4.6.2	Transmission Protocol.....	65
4.6.3	Bus Systems	66
4.6.3.1	CANopen.....	67
4.6.3.2	Modbus TCP Gateway	67
4.6.4	PROFINET	68
4.6.5	Ethernet MAC address	69
4.7	Inputs/Outputs.....	70
4.7.1	Digital Inputs	70
4.7.2	Operating Modes Digital Inputs	71
4.7.3	Digital Outputs.....	73
4.7.4	Digital Outputs Signal Characteristics	74
4.7.5	Analogue Inputs	76
4.7.6	Digital Input Switch Characteristics	76
4.8	Drive Profile.....	77
4.8.1	Drive Mode Selection	77
4.8.2	Available Movement Types	78
4.8.3	Movement Type Configuration	79
4.8.4	Test Function	82

4.8.5	Position Adoption	82
4.8.6	Binary	83
4.8.7	Tipp/Teach	83
4.8.8	Electronic Actuator	84
4.8.9	Modulo Positioning	84
4.9	Oscilloscope and Controller Data	85
4.9.1	Oscilloscope Settings	85
4.9.2	Controller Data	86
4.9.3	Controller Data Fine-Tuning	87
4.10	Feed Rate Specification	88
4.11	Absolute Feedback	90
4.12	Restore Factory Settings	91
4.12.1	Rest Opening Placement	91
5	External Signal Exchange	92
5.1	Binary	92
5.1.1	Requirements	92
5.1.2	Signal Sequence	94
5.1.2.1	Summary Binary Movement Selection	95
5.1.2.2	Movement looping	96
5.2	Tipp/Teach	96
5.2.1	Requirements	96
5.2.2	Usage of the inverting switches	97
5.2.3	Manual Positioning	97
5.2.4	Signal Sequence	97
5.2.5	Teaching	98
5.2.6	Overview Drive Profile Preselection	98
5.3	Step/Direction	99
5.3.1	Assignment of Step Mode to Motor Speeds	99
5.3.2	Requirements	100
5.4	Electronic Actuator	101
5.4.1	Requirements	101
5.5	Modulo Positioning	101
5.5.1	Requirements	102
5.5.2	Signal Sequence	103
5.6	CANopen	106
5.6.1	Special Features of SDO/PDO Communication	106
5.6.2	Telegram Structure	106
5.6.3	Network Management	108
5.6.4	PDO mapping	109
5.6.4.1	Standard PDO Mapping	110
5.6.4.2	EDS File	110
5.6.4.3	Customized PDO Mapping	111
5.6.5	Activation and Configuration 8 RX/TX PDOs	112
5.6.6	State Machine	113
5.6.7	State Machine Visualisation after Boot Up	114
5.6.8	Statusword	115
5.6.9	Controlword	116

5.6.10	Modes of Operation.....	117
5.6.10.1	Homing.....	117
5.6.10.2	Profile Position Mode	118
5.6.10.3	Profile Velocity Mode.....	119
5.6.10.4	Cyclic Synchronous Position Mode	119
5.6.11	Necessary User Interface Settings.....	120
5.6.12	Parameter Input	120
5.6.13	Saving Object Data	121
5.6.14	Error output and Reset.....	121
5.6.15	Abort Code SDO Communication	122
5.6.16	Object information	123
5.6.17	Overview of available Objects	124
5.6.18	Detailed description Motion Control Objects	125
5.7	Modbus TCP Gateway (Ethernet TCP/IP).....	187
5.7.1	Motion Control via Modbus TCP as Gateway.....	187
5.7.2	Necessary User Interface Settings.....	187
5.7.3	Conversion Decimal into Double Word Decimal.....	188
5.7.4	Communication Verification.....	188
5.7.5	Byte Assignment Modbus TCP Gateway Telegram	189
5.7.6	Configuration Read/Write Telegram	190
5.7.7	RX/TX Telegram Example.....	191
5.7.8	Error Output Modbus TCP Gateway.....	196
5.7.8.1	Motion Control Error.....	196
5.7.8.2	Data Telegram Error.....	196
5.8	PROFINET/PROFIdrive	197
5.8.1	GSDML File.....	197
5.8.2	Target Parameter Specifications	197
5.8.3	Cycle Times	197
5.8.4	Overview I/O-Parameter.....	198
5.8.5	Specifications from the User Interface.....	198
5.8.6	General State Diagram.....	199
5.8.6.1	Requirements.....	199
5.8.6.2	State Control	199
5.8.7	Supported Application Classes (AC)	200
5.8.8	Supported Standard Telegrams	200
5.8.9	Hardware-Configuration TIA Portal	200
5.8.10	Homing Parameter	201
5.8.11	Speed Control – Application Class 1 (AC1).....	202
5.8.11.1	I/O Data Standard Telegram 1	202
5.8.11.2	I/O Data Standard Telegram 2	202
5.8.12	Position Control – Application Class 3 (AC3)	203
5.8.12.1	Program Sub Mode - Standard Telegram 7	204
5.8.12.1.1	I/O Data Standard Telegram 7	204
5.8.12.1.2	Specific Data Standard Telegram 7	204
5.8.12.1.3	Specific Data Standard Telegram 7	205
5.8.12.2	MDI (Manual Data Input) – Standard Telegram 9	206
5.8.12.2.1	I/O Data Standard Telegram 9	206
5.8.12.2.2	Specific Data Standard Telegram 9	207
5.8.12.3	Function Bloc Standard Telegram 9.....	208
5.8.13	Controlword 1 (STW1).....	209

5.8.14	Statusword 1 (ZSW1)	210
5.8.15	PNU – Parameter User Data	211
5.8.16	Detailed description of the available Parameter User Data	211
5.8.16.1	Function Block FB 287	219
5.8.17	Error Codes PNU 947	219
6	Alerts and Errors	220
7	Troubleshooting	223
8	FAQs	225
9	Wiring Schemes Motor, Encoder and Brake	227
9.1	Stepper Motor und Special Stepper Motor	227
9.1.1	Motor Cable, Connector X5	227
9.1.2	Encoder Cable, Connector X6	232
9.2	DC-Protect Motor	234
9.3	DC-Motor wit Serration Gear	235
9.3.1	Motor, Connector X5	235
9.3.2	Hall, Connector X6	235
9.4	EC/BLDC-Motor	236
9.4.1	Motor, Connector X5	236
9.4.2	Hall/Encoder, Connector X6	237
10	Accessories	238
11	Abbreviations	238
12	Explanation of terminology	239
13	Overview Input/Output Values	241
13.1	Input Values	241
13.2	Value Entries	243
13.3	Output Values	243
14	Service	244

1 Safety Instructions, Protective Measures and Guidelines

1.1 Important Instructions

Read this manual carefully before operating the dryve D1 motor control system. Familiarise with the safety instructions and ensure that the required safety measures are followed.

This manual was created according to the best of our knowledge and belief. It is used for technical documentation and for assisting the user during the initial operation. The warnings, cautions and instructions issued by igus® regarding the dryve D1 motor control system must in any case be passed on to the end user if the dryve D1 motor control system is used as part of an overall system.

igus® undertakes warranties only for igus® products in accordance with the standards, norms and specifications given in this manual. The guarantee covers only the replacement or repair of a defective dryve D1 motor control system. There is no liability for consequential damage and consequential errors. The igus® GmbH does not take any responsibility for the integration of the dryve D1 motor control system into the overall system. The responsibility for it lies with the plant designer or the end user. Please observe the instructions under "**Qualified Personnel**". The company igus® assumes no liability for personal injury or damage to property resulting from misuse or unauthorised technical modification of the dryve D1 motor control system.

The igus® GmbH reserves the right to make changes and improvements to the product or the technical documentation at any time without prior notice.

The dryve D1 motor control system must only be used if:

- All information and safety instructions in this manual have been observed.
- The control system has been properly installed in a control cabinet in accordance with the instructions under [Electrical Installation](#) (p. 15)
- No changes have been made to the dryve D1 motor control system and it is in a technically flawless condition.
- The operating limits that are specified in [Technical Data](#) (p. 10) are complied with.

1.2 Qualified Personnel

The product may only be commissioned and operated by qualified specialist personnel..

- The personnel must have read and understood this manual and any other additional documentation that exists
- The personnel must be familiar with all relevant applicable standards, provisions and accident prevention regulations.
- The personnel must be able, due to their training, to anticipate or recognise any hazards that may arise when using the control system.
- The personnel must ensure the safety of persons and objects when using the motor control system in the overall system.

The operation of the product by personnel who are not qualified specialists is the responsibility of the company/institution carrying out the application planning and/or commissioning.

1.3 Maintenance

The dryve D1 is maintenance-free Apart from the connectors, the dryve D1 does not contain any components that the user can replace from the outside. Never open the motor control system. If hardware problems occur, please get in touch with [Customer service](#) (p. 244)

Opening the housing voids the warranty and the entitlement to receive technical support..

1.4 Safety Instructions

1.4.1 Information Classification

The degree and type of hazard are marked unambiguously. All safety instructions are assigned to one of the following classes.

	DANGER!
Safety instructions marked with DANGER indicate an imminently hazardous situation. A disregard of the notice inevitably leads to a serious or even fatal accident .	
	WARNING!
Safety instructions marked with WARNING indicate a potential hazardous situation. Failure to observe the instruction can possibly lead to a serious or even fatal accident or to equipment/property damage .	
	CAUTION!
Safety instructions marked with CAUTION indicate potential danger. Failure to comply with the notice may possibly result in an accident or property damage .	
	NOTE
Safety instructions marked with NOTE indicate a potential hazardous situation. Disregard of the notice may possibly result in property damage .	

1.5 Electromagnetic Compatibility

	WARNING!
Risk of injury due to interference with signals and devices Disturbed signals can cause unforeseen device reactions. Carry out the wiring in accordance with the EMC measures. Failure to follow these instructions can result in death, serious injury, or material damage	

	Measures for EMC	Effect
Device assembly	Use cable clamps for the shield support, connect metal parts over a large area.	Good conductivity due to surface contact.
	Switching devices such as contactors, relays or solenoid valves with interference suppression units or spark suppressors (e.g. diodes, varistors, RC elements).	Reduce mutual interference couplings.
Electric Wiring	Keep cables as short as possible.	Avoid capacitive and inductive interference.
	Do not place fieldbus cables and signal cables for direct and alternating voltage over 60 V together in a cable conduit.	Avoid reciprocal interference.
	The shields of power, control and signal cables must be grounded at both ends over a large area or via conductive connector housings.	Avoid interference on power, control and signal cables, reduce emissions.

2 Product Overview

Ready to use instantly

The igus® dryve D1 uses standard commercially available Ethernet technology and therefore can communicate directly with your network or a control unit (PC or PLC) via a standard Ethernet cable. The user interface is displayed in a browser of your choice, without having to install any additional software. This makes it possible to parameterise the igus® dryve D1 motor controller in an extremely short time.

Easy to control

You can use the simple intuitive user interface to parameterise positioning movements, accelerations and velocities of your linear axis without the need of having any prior knowledge. Programs for continuously recurring movements can be created in just a few seconds. A "Teach" function makes it possible to incorporate current actuator positions into the parameterisation with just one click of the mouse.

Industry standards

The standard communication protocols CANopen and Modbus TCP Gateway make it very easy to connect the system to industrial controllers such as the programmable logical controllers (PLC) as of Siemens or Beckhoff. The ten digital inputs, 5 of which are binary coded for the preselection of 32 positioning movements, and five digital outputs enable extremely easy communication with higher-level industrial controllers as well as with low-price open-source modules such as an Arduino or Raspberry Pi.

Powerful technology

The igus® dryve D1 supports stepper, DC and EC/BLDC-Motors in Open-Loop as with Closed-Loop technology. With the sinusoidally commutated Closed-Loop, a Stepper Motor can be operated as a servo motor. Due to the Closed-Loop, the Motor Current is controlled according to the load case, because of which the operating temperature of the dryve D1 and the connected motor can be lowered.

To optimally attune the igus® dryve D1 to a motor, current, velocity and position control parameters are able to be tuned. In addition an automatic Step Mode selection is available.

The system can be set to the "zero point" by different external and internal homing methods. Position monitoring with automatic Following Error correction and Closed-Loop control is available via different Feedback systems. The supported load voltage of up to 48 V ensures high motor velocities, whereby the high rated current of 7 A and peak currents of up to 21 A (depending on type of motor) enable powerful and dynamic movements.

I²T motor protection

To protect motors against thermal overload, the igus® dryve D1 is equipped with I²T protection for overload monitoring. I²T protection makes it possible to safely operate the motor for a certain time even if used with overload conditions.

2.1 Operating Modes

In the following section, the different operating modes of the dryve D1 motor control system are described. Due to the different operating modes, the arrangement of the electric wiring changes depending on the intended application.

Binary

The "Binary" operating mode offers up to 32 individual positioning movements parameterised with different motion types and movement data such as accelerations and velocities. It is possible to generate a simple programme sequence executed via the user interface or control it entirely with a higher-level control system via the Digital Inputs/Outputs

In addition, the target position of the command can be specified in the absolute reference system of the axis or relative to the current position. It is possible to execute manually controlled movements via the user interface.

A functional overview is available at [Binary](#) (p. 83).

Tipp/Teach

With the "Tipp/Teach" mode, positioning movements can be executed by external switches. The motor can be moved manually with these external switches in the desired direction at a pre-set acceleration and velocity.

Up to 8 individual positioning movements can be pre-set via the user interface. The target positions can be altered with the external switches without the user interface being used.

A functional overview is available at [Tipp/Teach](#) (p. 83)

Step/Direction

In the "Step/Direction" mode, a step frequency and a direction signal are applied to the dryve D1 motor control system by a master controller. The acceleration and the speed are fed to Digital Input 1 and the movement direction is fed to Digital Input 2.

A functional overview is available at [Step/Direction](#) (p. 99)

Electronic actuator

In the 'Electronic actuator' operating mode, 3 positions can be reached directly by setting a digital input without the need for an additional start signal at DI6 'Start'. The digital outputs indicate which of the 3 target positions the actuator is in.

Modulo positioning

In the 'Modulo positioning' operating mode (only available if the 'Rotary' movement mode is selected), the shortest distance between 2 points is always travelled at 360° during absolute positioning. Depending on the distance between the following target position and the current position, a positive or negative movement is executed to reach the target with the shortest distance.

BUS communication

The dryve D1 motor control system can be controlled by an external higher-level control system via the CANopen protocol, the Modbus TCP Gateway protocol or PROFINET/PROFIdrive.

A functional overview is available at [CANopen](#) (p. 101), at [Modbus TCP Gateway](#) (p. 187) and PROFINET/PROFIdrive (p.)

2.2 Technical Data

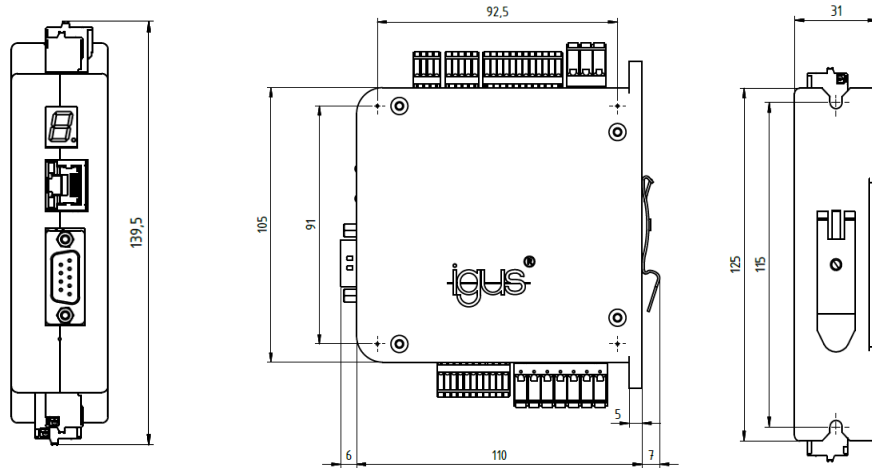
2.2.1 General Data

	WARNING!
- Danger of malfunction - Fire hazard - Explosion hazard - Danger of electric shock	
Never operate the dryve D1 motor control system in water or in an aggressive, flammable or explosive atmosphere.	

Ambient Temperature	Operation	-20 °C to +45 °C
	Transport	-40 °C to +60 °C
	Storage	-40 °C to +60 °C
Relative Humidity	≤ 90 %, non-condensing	
Protection Class	IP 30	
Degree of soiling according to EN 61010	1	
MTTF value @ 25°C	64,72 Years	
Category Requirement according to ISO EN 13849-1/2	3	
Diagnostic coverage (DC value)	90 %	
Power Loss	Min 2,5 W (idle)	
	Max.15 W (full load)	

2.2.2 Mechanical Data

D x W x H in millimetres, incl. connectors & mounting elements	124 x 31 x 139
Weight in grams	200 g
Material housing	Igumid NB V0
Weight housing (w/o metal parts)	91 g
Flammability rating	UL 94 V0



2.2.3 Electrical Data

	CAUTION!
Risk of destruction An operating voltage above the voltage indicated in the technical data will destroy the dryve D1 Select an operating voltage within the voltage range specified in the technical data. Induced voltages from other electrical loads and/or motors (generator operation, Back EMF) may result in a function interference. Allow corresponding safety reserves and countermeasures. Make sure that your voltage supply is energy feedback protected if the logic voltage and load voltage are supplied from the same power supply unit or from the same transformer.	

	CAUTION!
Danger of burning The housing of the dryve D1 motor control system as well as the driven motor may reach very high temperatures.	

Voltage Supply	Logic X1.3	Voltage	12 to 24 V, max. 26 V
		Current Drain	Min. 75 mA to 225 mA
	Load X1.1	Voltage	12 to 48 V, max. 50 V
		Current Drain	5 mA to 7 A, max 22 A (Boost)
	Digital I/O X2.11	Voltage	5 to 24 V, max. 26 V
		Current Drain	35 mA to 1,1 A
	Short Circuit Protected		
	Reverse polarity protection	X1.1 to X1.2	
		X1.3 to X1.2	
		X2.11 to X2.12	
Motor Types	ST	Type	2 Phase Stepper Motor, bipolar
		Step angle	0,72°, 0,9°, 1,8°, 7,5°, 15°, 18°
	DC		DC Motor
	EC/BLDC	Type	Electronically Commutated Motor
		Pole pairs	1 o 8
Continuous Motor Current	7 A @ 20°C ambient temperature		

Boost Current	Output Duration		Max. 2 s	
	ST		10.5 A	
	DC		14 A	
	EC/BLDC		21 A	
Load Power Output	Max. 340 W			
Peak Power Output	Max. 1000 W			
Temperature power stage	Max. 100°C			
Max. Velocity	Stepper		25,000 steps/s = 7500 rpm	
	DC		Motor dependent	
	EC/BLDC		Average speed 14,000 rpm	
Feedback	Permissible Feedback Types		Encoder (incremental), Hall-Sensor	
	Internal Voltage Source		5V ±10%	
			50 mA to 200 mA, Short Circuit Protected	
	Encoder	Type	Line Driver (RS422), Single Ended	
		Resolution	1 – 4096 increments	
		Average input frequency	Min. 300 kHz	
	Hall Sensor	Type	Open Collector	
		Resolution 2 Pole	1 – 4096	
		Average input frequency	Min 5 kHz	
Holding Brake	Voltage output		24 V	
	Current output		Max. 1 A	
	PWM at 48 V U _B at X 1.1		312 kHz	
Braking Resistor (EC/BLDC motors only)	External resistor between X5.4 and X5.5		24 V at X1.1	Min. 0,8 Ω
			48 V at X1.1	Min. 1,7 Ω
	Frequency		25 kHz	
	Overload protection shut off		After 1 s permanent trigger	
Motor and encoder cable lengths	< 30m (Encoder: Only incremental encoder as line driver)			
Digital Inputs	10 Digital Inputs			
	Short-Circuit Protected			
	Galvanically Separated by Optocoupler			
	U _{Low} 10% U _B X2.11			
	U _{High} 60% U _B X2.11			
	PNP		Pull-Down, internal	
	NPN		Pull-Up, internal	
	Maximum Frequency DI 1 and DI 2		25 kHz	
	Maximum Frequency DI 3 to DI 10		100 Hz	
	Debounce Filter DI 1 to DI 10 (not at Step/Direction Mode)		10 ms	
	Current Drain		5 V at X2.11	5 mA
			24 V at X2.11	8 mA

Digital Outputs	5 Digital Outputs	
	Short-Circuit Protected	
	Galvanically Separated by Optocoupler	
	PNP	Pull-Down, internal
	Output Current	Max. 200mA
	Supply Voltage	U_B at X2.11
	Output Voltage	U_B at X2.11
Analogue Inputs	2 Analogue Inputs	
	Voltage Interval	$\pm 10V$
	Input Resistance	50 k Ω
	Accuracy	$\pm 0.1 V$
	Signal Filter	16 ms, level dependent
	$\pm 10 V$ Signal	12 Bit
	0-10 V Signal	11 Bit
	Internal Voltage Supply	10 V $\pm 2\%$
		Max. 15 mA
		Regulated
		Short Circuit Protected
	External resistor between X4.1 and X4.4	1,5 k Ω to 50 k Ω

3 Installation

3.1 Mechanical Installation

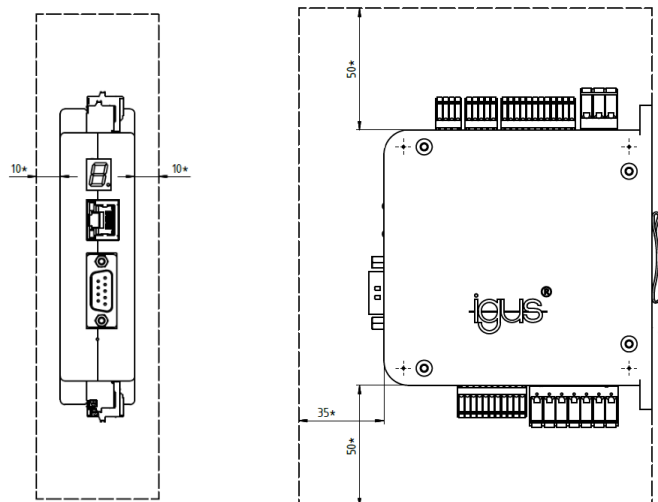
- Installation in a control cabinet by mounting it on a TS 35 supporting rail (EN 50022) or by removing the mounting clip and screwing the base of the housing directly onto a mounting plate.
- The device must be aligned vertically. For horizontal alignment, the maximum power must be reduced by 30% to prevent overheating
- The installation site must be free of extreme vibrations or shocks.
- Minimum free space above and underneath the device: 50 mm
- The ventilation openings are to be kept free
- 35 mm of space for plug-in connectors and cables must be kept free in front of the device.
- If several dryve D1 devices are placed next to each other, a space of 10 mm must be kept in between (applies for continuous operation)
- If several dryve D1 devices are placed without space in between, the maximum continuous current must be reduced to 5.5 A or an active cooling system must be used (applies for continuous operation)
- The heated air flow of other devices and components must not be led through the area of the dryve D1.



WARNING!

- Risk of malfunctions

No magnets or contactors/relays may be positioned in the immediate vicinity of the motor control unit, as their magnetic fields have a negative effect on the current measurement and can lead to incorrect movements.



3.2 Electrical Installation

	WARNING!
- Danger of electrical voltage - Danger of electric arcs Danger of injury and destruction of components. Always turn off the power before disconnecting or making electrical connections in the system. Secure the power supply against restart. After switching the device off, wait at least 5 minutes. Check for the absence of voltage before working on the system. Danger of electric arcs with improperly mounted electrical connections. Wires connected to the dryve D1 must not have exposed wire ends without insulation. Check all connections for being secured. In the event of a fault, the motor housing can carry high currents. Connect the motor housing to the ground conductor via the motor mounting components. In this regard, please observe the instructions in EN 60204-1.	

	CAUTION!
The maximum current of a Stepper Motor can be above the indicated rated current. The actual occurring current must be considered for installation. Any current setting are made at your own risk.	

	CAUTION !
The connection terminals are designed for single wires. A firm connection cannot be guaranteed due to improper multiple occupancy. There is a risk that wires may slip out of the terminals and cause short circuits. If several signals/wires have to be connected to one terminal, they must be brought together via an external terminal and connected from there with a single wire.	

	CAUTION !
The logic power connection does not supply energy to the motor. The motor will decelerate uncontrolled if the logic power supply collapses. In case of a vertical axis with an attached load it might result in an accelerated motion.	

NOTE
Follow the instructions regarding PELV wiring 21 and use suitable components for earthing.

NOTE
The dimension of a circuit breaker must be selected according to the actual current demand of the dryve D1. A sample calculation is available in the chapter Power supply selection (p. 16)

3.2.1 General Electrical Installation Information

The dryve D1 is designed for **DC voltages**.
All voltage specifications listed in this operating manual therefore are to be considered as DC voltage.

3.2.2 Grounding of motor and encoder cable

The D1 does not have dedicated contacts for connecting a potential equalisation to avoid interference via a shield in the motor or encoder cable. If these are required in the planned application, the cable shields must be connected via special potential equalisation contacts in the control cabinet.

3.2.3 Cable Cross Sections

Connector X1 and X5	mm ²	AWG
Min	0,2	24
Max	2,5	13

Connector X2 to X4 and X6	mm ²	AWG
Min	0,14	26
Max	0,5	20

3.2.4 Power supply selection

For the correct dimensioning of the power supplies to be used, various aspects must be considered

- Number of used motor controller per power supply
- Maximal current draw of each motor (consider the set Boost)
- Maximal current draw of used peripheral devices (e.g. sensors and other devices)
- Maximal current draw of the Logic

The current draw must be added voltage wise. This sum defines the minimal current supply capacity of the power supply.

NOTE	
If different power supplies are used for the load and logic voltage, the grounds of both power supplies must be connected to create a common potential.	

Example 1:

Common 24 V power supply for load, logic and digital inputs/outputs, no boost current

Current consumption load* ¹ :	4.2 A
Current consumption logic:	0.2 A
Current consumption digital inputs/outputs* ² :	0.8 A
Total current consumption, continuous:	5.2 A
Power supply selection incl. safety reserve:	approx. 6 A

*¹ Current consumption load corresponds to the set motor current

*² Value includes loads such as limit switches and/or relays

Example 2:

Common 24 V power supply for load, logic and digital inputs/outputs,
Boost current used (p. 40): 150%.

Current consumption load* ¹ , continuous:	4.2 A
Current consumption load* ¹ , short-term:	6.3 A
Current consumption logic:	0.2 A
Current consumption digital inputs/outputs* ² :	0.8 A
Total current consumption, continuous:	5.2 A
Total current consumption, short-term:	7.3 A
Power supply selection incl. safety reserve:	approx. 8 A

*¹ Current consumption load corresponds to the set motor current

*² Value includes loads such as limit switches and/or relays.

Example 3:

Common 24 V power supply for logic and digital inputs/outputs.
48 V power supply for load circuit.
Used [Boost Current](#) (p. 43): 150%.

24 V power supply

Current consumption logic:	0.2 A
Current consumption digital inputs/outputs*2:	0.8 A
Total current consumption:	1 A
Selection of power supply for logic and Digital inputs/outputs incl. safety reserve: approx.:	1.5 A

48 V power supply

Current consumption load*1, continuous:	7 A
Current consumption load*1, short-term:	10.5 A
Total current consumption, short term:	10,5 A
Selection of power supply incl. safety reserve:	approx. 11 A

*1 Current consumption load corresponds to the set motor current

*2 Value includes consumers such as limit switches and/or relays

Example 4:

2 dryve D1, 2 igus NEMA 23 Stepper Motor, common 24 V power supply for load, logic and digital inputs/outputs, no boost current

	Single	Combined
Current consumption load*1:	4,2 A	8,4 A
Current consumption logic:	0.2 A	0,4 A
Current consumption digital inputs/outputs*2:	0.8 A	1,6 A
Total current consumption, continuous:		10,4 A
Selection of power supply incl. safety reserve:		approx. 11 A

*1 Current consumption load corresponds to the set motor current

*2 Value includes consumers such as limit switches and/or relays

Example 5:

2 dryve D1, 1 igus NEMA 23 Stepper Motor, 1 NEMA 17 Stepper motor, common 24 V power supply for load, logic and digital inputs/outputs, no boost current

	Single	Combined
Current consumption load*1 D1 NEMA 23:	4,2 A	4,2 A
Current consumption load*1 D1 NEMA 17:	1,8 A	1,8 A
Current consumption logic:	0.2 A	0,4 A
Current consumption digital inputs/outputs*2:	0.8 A	1,6 A
Total current consumption, continuous:		8 A
Selection of power supply incl. safety reserve:		approx. 9 A

*1 Current consumption load corresponds to the set motor current

*2 Value includes consumers such as limit switches and/or relays

Example 6:

3 dryve D1, 2 igus NEMA 23 Stepper Motor, 1 NEMA 17 Stepper motor, common 24 V power supply for logic and digital inputs/outputs.

48 V power supply for load circuit.

Used [Boost Current](#) (p. 43): 150%.

24 V power supply

	Single	Combined
Current consumption logic:	0.2 A	0,6 A
Current consumption digital inputs/outputs*2:	0.8 A	2,4 A
Total current consumption:		3 A
Selection of power supply for logic and Digital inputs/outputs incl. safety reserve:		approx. 3 A

48 V power supply

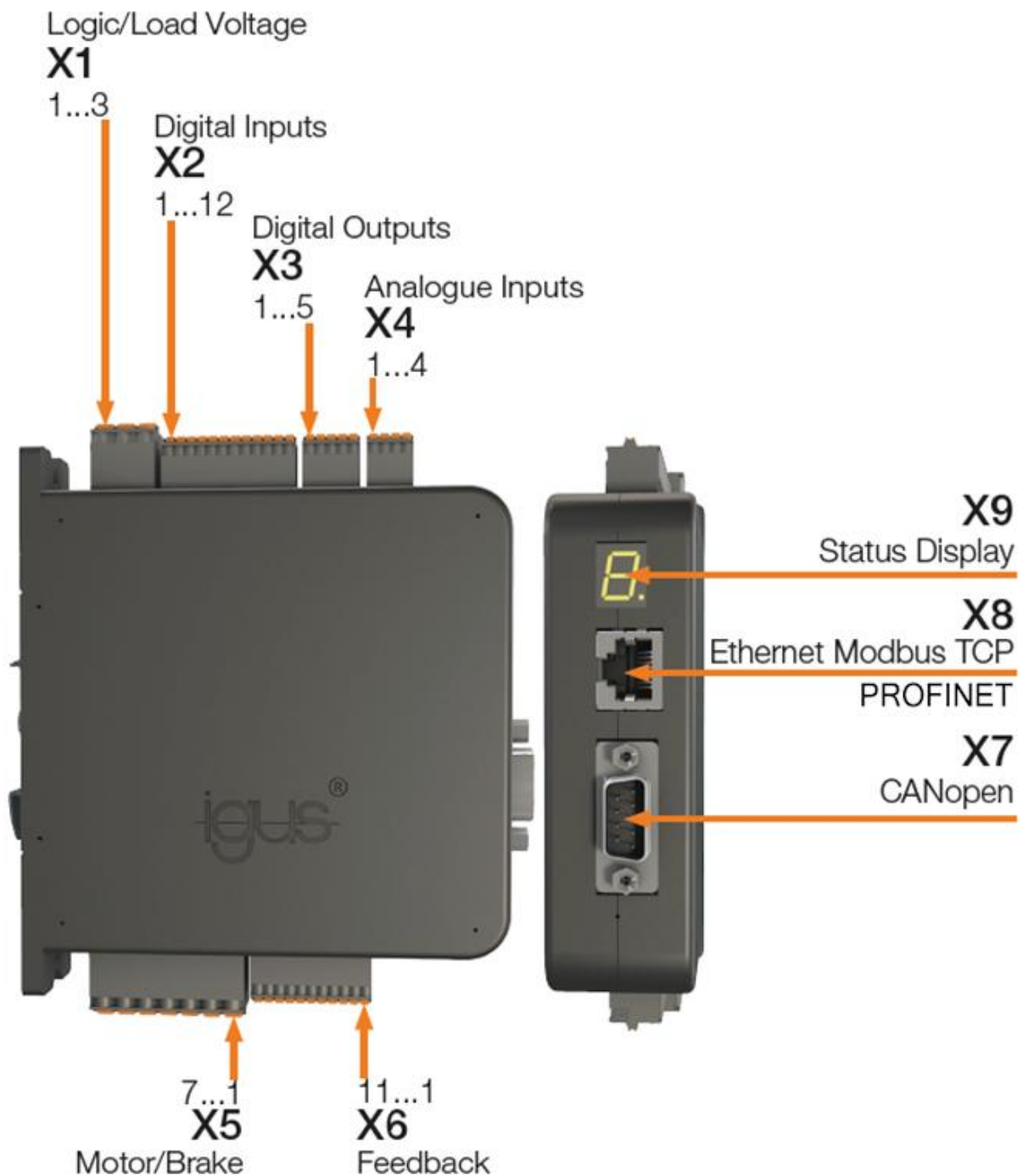
	Single	Combined
Current consumption load*1 D1 NEMA 23:	4,2 A	8,4 A
Current consumption load*1 D1 NEMA 17:	1,8 A	1,8 A
Current consumption load*1 D1 NEMA 23, short-term:	6,3 A	12,6 A
Current consumption load*1 D1 NEMA 17, short-term:	2,7 A	2,7 A
Total current consumption, short term:		15,3 A
Selection of power supply incl. safety reserve:		approx. 16 A

*1 Current consumption load corresponds to the set motor current

*2 Value includes consumers such as limit switches and/or relays

3.2.5 Connection Overview

Connector		Pin	Assignment	Description	
X1	Logic/Load-Voltage	1	12 - 48 V Load	Motor Voltage Supply	(necessary for operation)
		2	0 V / Ground Logic/Load	Common Ground	(necessary for operation)
		3	12 - 24 V Logic	Controller Voltage Supply	(necessary for operation)
X2	Digital Inputs			Binary, Modulo	Tipp/Teach Step/Direction Electronic Actuator
		1	Digital Input 1	Bit 0	Bit 0 Step Extend
		2	Digital Input 2	Bit 1	Bit 1 Direction Retract
		3	Digital Input 3	Bit 2	Bit 2 - Maintenance
		4	Digital Input 4	Bit 3	Jog left - -
		5	Digital Input 5	Bit 4	Jog right - -
		6	Digital Input 6	Start	Start/Teach - -
		7	Digital Input 7	Enable	Enable Enable Enable
		8	Digital Input 8	Limit Switch positive	
		9	Digital Input 9	Limit Switch negative	
		10	Digital Input 10	Stop/Reset	Stop/Reset Reset Stop/Reset
		11	5 - 24 V	External I/O Supply	necessary for operation
		12	0 V / Ground	External I/O Supply	(necessary for operation)
X3	Digital Outputs			Binary, Modulo, Tipp/Teach, Step/Direction	Electronic Actuator
		1	Digital Output 1	Ready	Ready
		2	Digital Output 2	Active	Extracted
		3	Digital Output 3	Referenced	Retracted
		4	Digital Output 4	Alert	Maintenance
X4	Analog Inputs	5	Digital Output 5	Error	Error
		1	10 V	Voltage supplied by controller	
		2	Signal 1	Velocity and position setpoint	
		3	Signal 2	Position feedback (only AAE (p. 61) or DC Motor Feedback)	
X5	Motor/Brake/ Braking Resistor	4	0 V / Ground	Ground supplied by controller	
		1	A (ST), U (EC/BLDC), + (DC)	Motor connection	
		2	A/ (ST), V (EC/BLDC), - (DC)	Motor connection	
		3	B (ST), W (EC/BLDC)	Motor connection	
		4	B/ (ST), R _{Brake} (EC/BLDC)	Motor and Braking Resistor connection	
		5	Ground, R _{Brake} (EC/BLDC)	Ground and Braking Resistor connection	
		6	24 V Holding Brake	Holding Brake connection, Voltage supply (constant)	
X6	Feedback	7	0 V / Ground Holding Brake	Holding Brake connection (switched)	
		1	5 V	Feedback	
		2	0 V	Feedback	
		3	A	Feedback	
		4	A/	Feedback	
		5	B	Feedback	
		6	B/	Feedback	
		7	N	Feedback	
		8	N/	Feedback	
		9	H 1/U (EC/BLDC), 1 (DC)	Feedback	
		10	H 2/V (EC/BLDC), 2 (DC)	Feedback	
		11	H 3/W (EC/BLDC)	Feedback	
X7	CANopen	1	-	NC	
		2	CAN_L	CAN Signal Low	
		3	CAN_GND	CAN Masse	
		4	-	NC	
		5	-	NC	
		6	-	NC	
		7	CAN_H	CAN Signal High	
		8	-	NC	
X8	Ethernet Modbus TCP Gateway PROFINET	8	-	NC	
X9	Status Display				



The arrow marks pin 1

3.2.6 Pin Assignment

The connectors must be wired according to your application. For this purpose, use the detailed illustrations below for each individual connector.

3.2.6.1 X1 Logic/Load Connector

If the dryve D1 is to be connected as a PELV wiring, the 0 V X1.2 terminal is to be connected to the earth potential of the overall application.



NOTE

For proper operation, it is necessary to ensure that the logic voltage supply can provide a minimum current of 75 mA. If this current can't be supplied, the user interface might still be accessed in individual cases, but it is not guaranteed that the dryve D1 will still function properly.

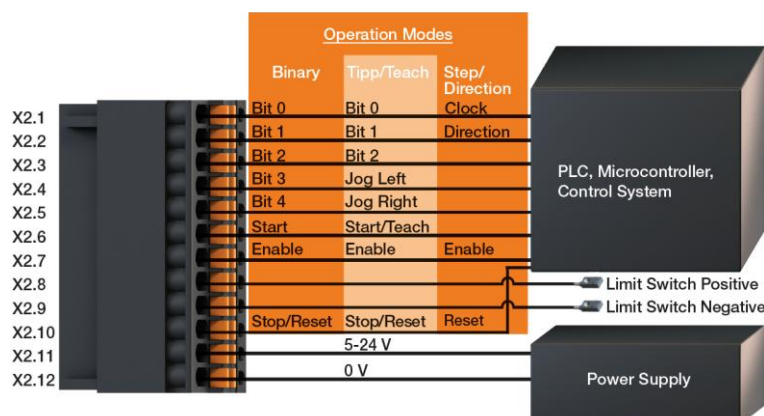
NOTE

If a logic voltage is applied to X1.3 without a load voltage being present at X1.1, the error E08 'Load voltage too low' is only output after a delay of 250 ms.

This serves to prevent incorrect error states after starting up the system when using powerful power supplies with a delayed voltage rise on the secondary side.

3.2.6.2 X2 Digital Inputs Connector

The wiring and function of each input depends on the [Operating Modes Digital Inputs](#) (p. 71).



To enable an operation of the dryve D1 motor control system, a voltage supply for the digital inputs must be connected to X2.11 and X2.12 (5-24 V). The same voltage source as that of the logic supply at X1.3 applicable. A connected PLC or microcontroller must be attached to the same electric potential as the dryve D1 to maintain a proper operation,

Applicable for the igus limit switches: The brown wire of the cable is connected to 24 V and the blue wire is connected to 0V. The black wire is connected to terminal X2.8 or X2.9 of dryve D1, depending on the position. The supply voltage (brown and blue wires of the limit position switch) is not provided by the D1. The wires must be connected to external terminals (e.g. in your control cabinet).

All inputs must be uniformly wired either as PNP or NPN. The type of wiring interconnection can be selected later via the user interface [Digital Input Switch Characteristics](#) (p. 76)

The Digital Inputs can be configured in such a way that they are activated in response to a high or low signal (NO contacts/NC contacts). Configuration at [Digital Inputs](#) (p. 70).

The motor controller is equipped with internal "Pull Up" and "Pull Down" resistors.

Connection of limit switches

If igus® limit switches are used, the brown wire (BN) of the cable must be connected to 24V and the blue wire (BU) to 0V. The black wire (BK) is connected to terminal X2.8 or X2.9 of dryve D1, depending on the position. The supply voltage (brown and blue wires of the limit position switch) is not provided by the D1. The wires must be connected to external terminals (e.g. in your switch cabinet) for the power supply.

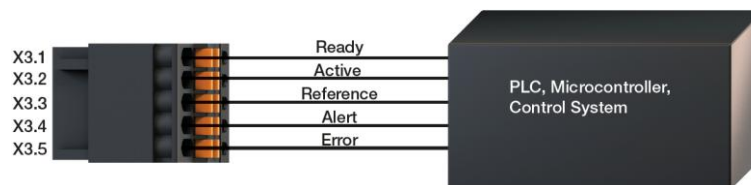
The motor control unit has 'Pull Down' (PNP) and 'Pull Up' (NPN) resistors. These do not need to be connected externally

NOTE

The internal 10 V power supply at connector X4 "Analogue inputs" (pin 1 and 4) must only be used for the operation of potentiometers at AI1 (pin 2) and AI2 (pin 3).

3.2.6.3 X3 Digital Outputs Connector

The output voltage of the digital outputs corresponds to the voltage across the X2.11 connector. The outputs have been permanently set to PNP and cannot be changed to NPN. Due to the internally installed pull-down resistors, micro-controllers that work with NPN logic can be used as well. The digital outputs can be configured in such a way that the emitted signals are inverted.

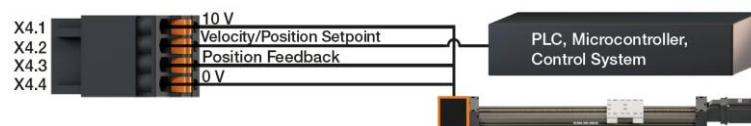


3.2.6.4 X4 Analogue Inputs Connector

With the Analogue Inputs it is possible to process position and velocity setpoints as well as position feedback with a 0 V to 10 V or ± 10 V signal. An analogue position setpoint potential can be supplied by an external master (i.e. a higher-level control system, whereby the external voltage supply must be connected to the X4.4 ground contact) to X4.2 as well as voltage-changing components (e.g. potentiometer, temperature-dependent resistors, etc.).

For analogue position feedback, an axis mounted absolute value feedback (e.g. a precision multiturn potentiometer) can be connected to X4.3.

The dryve D1 has got an build in 10 V voltage supply. It can be used to directly supply connectable components for the stipulation of position setpoints and for feedback as well.



NOTE

The internal 10 V power supply at connector X4 "Analogue inputs" (pin 1 and 4) must only be used for the operation of potentiometers at AI1 (pin 2) and AI2 (pin 3) and must not be used for other purposes (e.g. as a power supply for digital inputs/outputs on X2.11 and 12).

NOTE

An external voltage applied to X4.1 "Voltage Supply Output" may result in non-reversible damage of the controller.

Pin	Assignment	Designation
X4.1	10 V	Voltage Supply Output
X4.2	AI 1	Velocity or Position Setpoint Input
X4.3	AI 2	Position Feedback input
X4.4	0 V / Ground	Voltage Supply Output

3.2.6.5 X5 Motor/Brake/Brake Resistor Connector

Motor

The dryve D1 can control either a Stepper Motor, a DC Motor or an EC Motor. The following wiring diagrams demonstrate the connection for a Stepper Motor (X5.1 to X5.4), DC-Motor (X5.1 to X5.2) and EC/BLDC-Motor (X5.1 to X5.3).

Brake Resistor

In case an EC/BLDC motor is being used an additional Brake Resistor might be attached to X5.4 and X5.5 to dissipate the generated excessive energy.

Wiring schemes available at chapter [Wiring Schemes Motor, Encoder and Brake](#) (p. 226)



WARNING!

- Danger of malfunction
- Fire hazard

Use the dryve D1 motor control system only to control Stepper, DC or EC Motors that are compatible with technical connectivity and technical performance of the dryve D1 motor control system.

NOTE

Only one motor at a time is to be connected!

NOTE

The connector X5.5 is directly connected to the shared ground of the Logic and Load Supply at X1.2 and is not intended for the connection of external earthing wires.

NOTE

If the case of uncertainties or connection of a Stepper Motor with 6 or 8 connecting wires, please consult the motor data sheet and connect the wires according to the instructions.

NOTE

When using EC/BLDC motors variants that only use Hall sensors for commutation, uneven movements can occur at low rotor speeds - speed < 300 rpm.

At standstill, a target position between 2 detectable positions can also lead to a pendulum movement/oscillation.

Holding Brake



DANGER!

- Danger of falling load

The motor holding brake is not suitable for slowing down the load on a vertical axis.

Never work under unsecured vertical axes and loads.

Secure the axis or load against falling by a mechanical safety device or other approved safety method.

The following illustrations show how to connect a holding brake to X5.6 and X5.7.

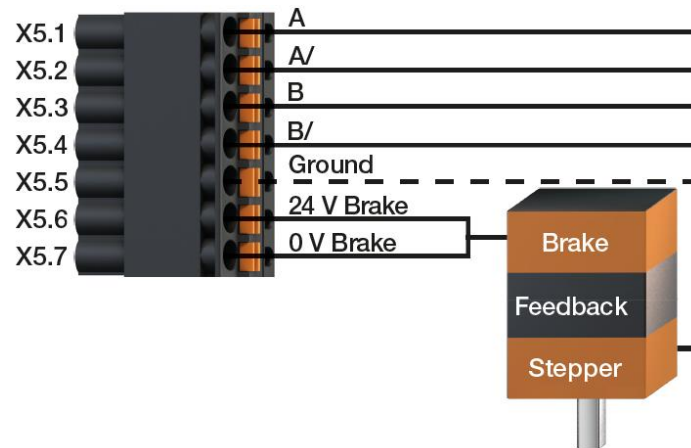
If the dryve D1 motor control system is operated with a load voltage of 24 V at X1.1, the voltage is directly passed on to the X5.6 brake output. In the case of a load voltage of 48 V at X1.1, the brake output voltage is lowered by a [PWM](#) (p. 239) with 312 kHz to 24 V.

In case of a necessary motor potential equalisation this is to be achieved via X5.5.

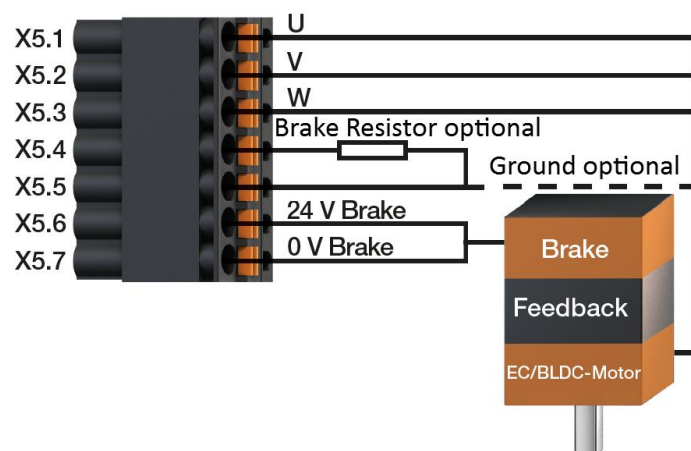
NOTE

If the load voltage X1.1 is supplied with 48 V and the brake output voltage is measured (X5.6 to X5.7), a voltage of 48 V is measured when using a high-impedance multimeter. The brake output voltage is only reduced to 24 V when a load is detected.

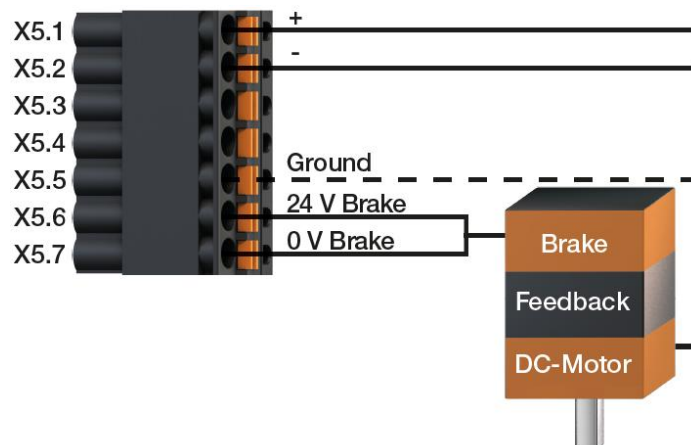
Stepper Motor



EC/BLDC Motor



DC Motor



3.2.6.6 X6 Feedback Connector

The drive D1 supports Incremental Feedback (Encoder) and Hall Sensors for position determination with a supply voltage of 5 V. These can be single-ended or line-driver (Encoder) or 2-pole or 3-pole Hall Sensors. If an encoder has an index channel, one homing pulse per motor revolution can be processed.

The following table shows the connection assignment.

Feedback Type	Compatibility	Connection Options
Line Driver Encoder	Stepper Motor DC-Motor EC/BLDC-Motor	• 5 V • 0 V • A • A/ • B • B/ • N (optional) • N/ (optional)
Single Ended Encoder	Stepper Motor DC-Motor EC/BLDC-Motor	• 5 V • 0 V • A • B • N (optional)
Hall Sensor 2-pole	DC-Motor	• 5 V • 0 V • Hall 1 DC • Hall 2 DC
Hall Sensor 3-pole	• EC/BLDC-Motor • For an EC/BLDC-Motor operation, the 3-pole Hall Sensor is required • The 3-pole Hall Sensor is only intended for the EC/BLDC-Motor and cannot be selected separately • If the EC/BLDC-Motor is selected, 3-pole Hall Sensor is activated automatically • A encoder line driver or as single-ended might be connected additionally	• 5 V • 0 V • Hall 1/U EC/BLDC • Hall 2/V EC/BLDC • Hall 3/W EC/BLDC

NOTE

If there is a need to process the encoder signals additionally at a higher-level control system, they can be accessed in parallel at connector X6.

Please note that the internal voltage supply can source a maximum of 120 mA.

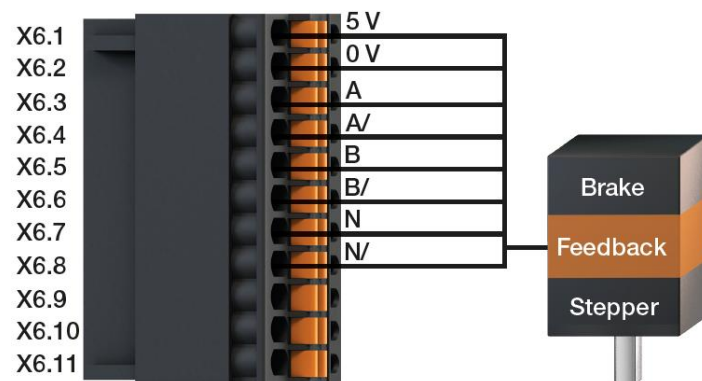
NOTE

Please use the corresponding feedback data sheets for additional information supplied by the manufacturer.

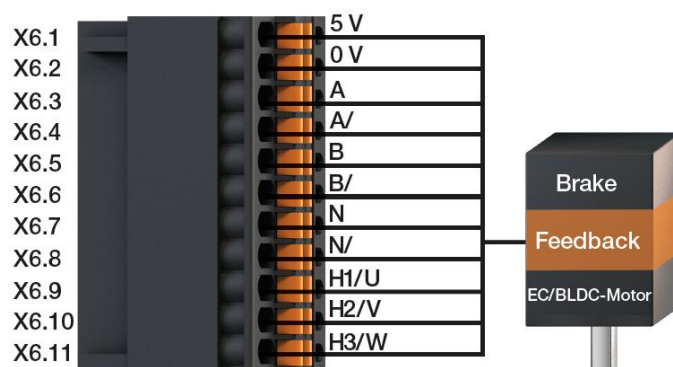
NOTE

External voltages applied to X6 may result in non-reversible damage of the controller.

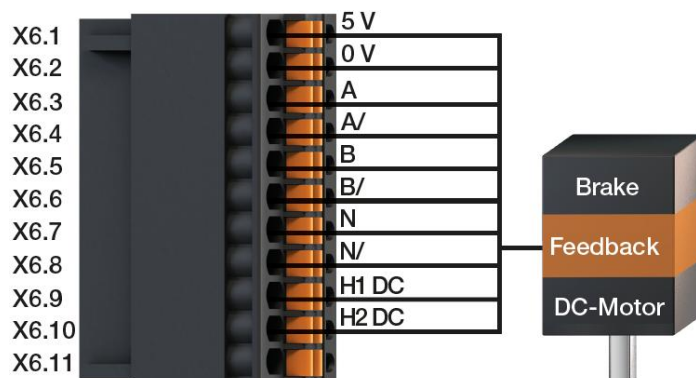
Stepper Motor



EC/BLDC-Motor



DC-Motor

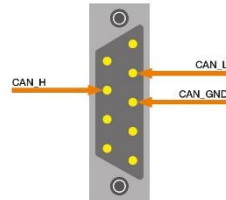


3.2.7 CANopen Interface

X7 CANopen Port

The dryve D1 may be controlled with the CANopen communication protocol. For this purpose, the dryve D1 will be connected to the bus and the master via the CANopen port. The standard pin assignment in accordance with CiA 301 is illustrated in the table.

CAN Port Pin Assignment



Top view of CANopen port

Pin	Layout	Designation
X7.1	-----	Not assigned
X7.2	CAN_L	CAN Signal Low
X7.3	CAN_GND	CAN ground
X7.4	-----	Not assigned
X7.5	-----	Not assigned
X7.6	-----	Not assigned
X7.7	CAN_H	CAN Signal High
X7.8	-----	Not assigned
X7.9	-----	Not assigned

Transmission Speeds

Possible transmission speeds are dependent on the used cable lengths. The dryve D1 supports [Baud Rates](#) of 10 Kbit/s up to 1 Mbit/s.

Baud Rate	Length
10kbit/s	6,700m
20kbit/s	3,300m
50kbit/s	1,000m
125kbit/s	500m
250kbit/s	250m
500kbit/s	125m
1Mbit/s	25m

Termination Resistors

At each end of the bus cable, the CAN bus needs a termination resistor with 120 Ω between the CAN high channel and the CAN low channel. These resistors are needed for defined difference-signal evaluation of the CAN low and CAN high channels.

3.2.8 Ethernet/Modbus TCP Gateway Interface

X8 Ethernet Port



The assignment of the X8 Ethernet port corresponds to the standard assignment according to TIA-568A/B.

Ethernet

To configure the drive D1, the Ethernet Port must be connected to a network or directly to a computer via a patch cable. Communication is based on the TCP/IP protocol.

Modbus TCP Gateway

If the communication shall be executed via the Modbus TCP Gateway protocol, the Ethernet Port must be connected to a network or directly to a computer via a patch cable. Communication is based on the Ethernet TCP/IP protocol.

PROFINET

If communication via PROFINET is required, the Ethernet port is connected to a PROFINET network. A standard patch cable can also be used here. Special PROFINET network cables can also be used if there are special requirements for the network HW.

3.2.9 Status Display

X9 Status Display



The IP address is shown on the status display after an Ethernet connection has been established.

If the network cable is plugged in anew or the interfaces on the master control/PC are deactivated/activated, the IP address is output again.

In addition, the error codes are output via the status display in case of a alert or an error – [Alerts and Errors](#) (p. 211). The output will repeat cyclical until the alert or error is resolved.

Special feature PROFINET

When the PROFINET DCP signal test is carried out, the entire display flashes to identify the subscriber.

Example:

Alert	A 10	Driver stage temperature above 85°C.
Error	E 10	Driver stage overheated - An emergency stop is executed

3.3 “Enable” DI 7 - Integration in safety circuits

The ‘Enable’ signal at digital input 7 is required to energise the motor continuously.

If this signal drops out, the motor is decelerated to a standstill using the value specified as Quick Stop (p. 53). Once standstill has been reached, the motor current is switched off.

There are 3 different options for integrating the motor control into safety circuits

1. Switching off the “Enable” at DI 7
Active delay of the executed movement with the “Quick Stop” delay until standstill.
2. Switching off the load voltage at X1.1
Passive deceleration (coasting) of the motor to a standstill.
3. Switching off the “Enable” at DI 7 and time-delayed switching off of the load voltage at X1.1
Active delay of the executed movement with the “Quick Stop” delay until standstill. Once this is reached, the load voltage is switched off via a relay or contactor.

If a certified safety shutdown is to be achieved for variants 2 and 3, appropriately certified components must be used.

The ‘Enable’ signal at digital input 7 is required to energise the motor permanently.

If this signal drops out, the motor is decelerated to a standstill using the value specified as [Quick Stop](#) (p. 56). Once standstill has been reached, the motor current is switched off.

NOTE
It is recommended that the enable signal is always integrated into the EMERGENCY OFF circuit of the overall application. This enables a ‘worst-case’ analysis to determine the maximum stopping distance or the maximum time until the motor is no longer energised

4 Initial Operation and User Interface

In the following, initial operation and the user interface of the dryve D1 is described.
This section explain all functions to be used to parameterise the control system for your application.

	WARNING!
- Danger of entanglement Danger of hair and clothing getting entangled into rotating components. Do not wear your long hair open, do not wear loose clothing, jewellery, ties, scarves or gloves.	

	WARNING!
- Risk of injury due to moving parts - Risk of crushing Never put your hand into moving components and never touch any driven/rotating components. Make sure that even unexpected movements of the driven components cannot cause personal injury or damage to equipment/hardware. Make sure that an emergency shutdown can be performed at any time.	

4.1 User Interface Connection Establishment

To establish a connection to the dryve D1 web server, the IP address assigned to the dryve D1 must be entered in the browser. The assignment is done automatically in the case of dryve D1's with factory settings.

Proceed as follows:

1. Start an Internet browser (Google Chrome, Mozilla Firefox, Microsoft Edge etc., no Internet connection necessary).
2. Using an Ethernet cable, connect the dryve D1 to the PC
3. Switch the voltage supply of the dryve D1 on
4. Type in the IP address shown on the status display of the dryve D1 (e.g. 169.254.1.0 or 192.168.0.100, individually assigned) into the address bar of your browser and press Enter
5. You will now be automatically taken to the user interface of the dryve D1

If the dryve D1 has already been used and an IP address is shown to which you cannot gain access, it may be necessary to adapt the network adapter setting in accordance with the IP address. If you cannot configure the computer, a reset to factory settings must be executed – [Restore Factory Settings](#) (p. 91).

NOTE
The IP address is displayed anew after the ethernet connector is plugged out and in again

NOTE
If you receive the error message "Address not available" (or similar) in the browser when attempting to establish a connection to dryve D1, please check the following aspects: - Does the set address range of the PC match the displayed IP address on the dryve D1? IP dryve D1: 192.168.1.1, IP range PC 169.254.1.1:- Address range not compatible! Despite a manually set PC IP address, it usually only assigns addresses in the 169.254.XXX.XXX range. - Are Ethernet and WIFI allowed to be active at the same time and establish connections? - Are the firewall settings too restrictive? In case of further issues, please contact your IT department.

NOTE

In some cases, a password may be requested even though none has been assigned. In this case, the browser tries to access outdated data from the browser cache.

Please check whether the IP address of dryve D1 has changed. If there is a discrepancy, enter it again into your browser.

If the IP address has not changed, please have the browser reset the browser cache with the key combination "CTRL + F5" and reload the user interface.

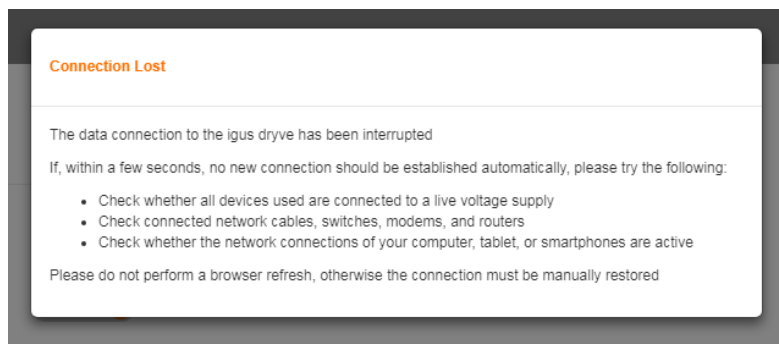
If a connection is still not possible, please restart your computer and dryve D1.

NOTE

In rare cases, programs running on the PC connected to the dryve D1 can prevent the IP address from being assigned automatically. After closing all programmes, the IP address can be output again and the connection to the user interface can be established. If the IP address has been assigned, all programmes can be opened again.

4.1.1 Connection Loss

If the Ethernet connection to the dryve D1 is interrupted, the dryve D1 automatically attempts to re-establish it. In such a case, a dialogue window is displayed on the user interface in which help topics are listed.



Once the connection has been re-established and communication is possible, the dryve D1 automatically reconnects itself to the user interface, the dialogue window closes automatically and the parameterisation can be continued in the same tab.

If the power supply for the dryve D1 is switched off and on again while there is an active connection to the user interface, the browser page must be loaded manually. If the IP address is assigned automatically, please check if the IP Address has changed.

The user interface will always return to the "Start" page.

NOTE

If HTTP is used for communication, the password is transmitted unsecured. This can lead to many and/or periodic connection losses in combination with certain anti-virus and firewall software. This issue can be solved by adopting/configure said software.

NOTE

If the Modbus TCP gateway connection is closed during operation, but the user interface is still accessible, the configured Modbus TCP gateway port has been closed.

This can be due to the following reasons:

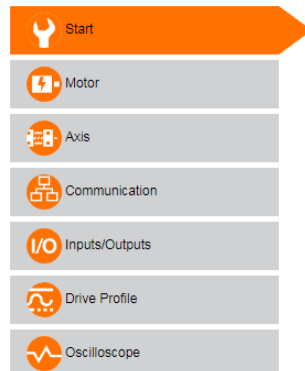
1. Faulty telegram structure - less or more data byte sent than specified in configuration.
Refer to [Byte Assignment Modbus TCP Gateway Telegram](#) (p. 189)
2. Automatic "heart beat" signal is not sent 3 times by the master or not forwarded by the network
3. The master itself closes the communication port

The motor controller can only close the port in case of error 1. or 2. A termination of the port due to a time without active communication between motor control and master controller is not implemented.

4.2 User Interface Information

Navigation Menu

The desired page will be displayed by clicking on the corresponding tab in the grey navigation menu at the left-hand edge of the screen. The page currently being shown is highlighted in orange.



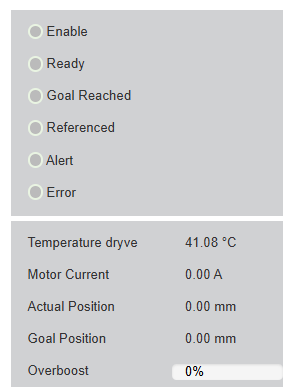
Switches

The status of the individual ON/OFF switches and Either-Or switches can be changed by clicking on them.



Status Area

The status area is located underneath the navigation menu. The current action status as well as warnings and error messages are shown in the upper part. In the lower part, the controller temperature, the Motor Current, the actual-and the set-position are shown.



4.2.1 Overboost indicator

The Overboost indicator is used to visualize whether the system is operating within its optimal state.

Four states are distinguished:

Green – up to 70% load:	The application is operating within the optimal range. Even under highly fluctuating application parameters (e.g., load, wear, or ambient temperature), no failures or performance losses are expected. A long-term stable operation is ensured.
Yellow – up to 80% load:	The application is operating within the extended range. No failures or performance losses are expected under moderately fluctuating application parameters. To ensure long-term operational reliability, the system load should be monitored regularly.
Orange – up to 90% load:	The system load is within a near-critical range. Fluctuations in application parameters may significantly impact performance. It is recommended to review the operating conditions and make adjustments if necessary to maintain the system stability and avoid potential failures. It is advisable to evaluate and, if necessary, adjust the operating parameters and mechanical configuration, including the driving profile.
Red – up to 100 % load:	The application is operating at maximum load and is already in the critical range. Even minor fluctuations in application parameters may lead to failures. Continuous operation in this range might indicate significant wear or a suboptimal mechanical design. It is strongly recommended to review and adjust the operating parameters and mechanical configuration, including the driving profile.

Help Buttons

Detailed information to the corresponding functions are available for display via the Help Buttons.



NOTE
A response or execution time of control commands and feedback requests cannot be guaranteed. The provision of information and response times are dependent on the used Ethernet network. There is no guaranteed response time or execution time for control of the dryve D1 motor control system via the user interface in the browser. For this reason, use the user interface in the browser only for initial operation or diagnosis.

4.2.2 Entering Parameters

The parameters entered are transferred directly, i.e. "live", to the control system. Additional confirmation, advance deactivation of the "Enable" signal or a reboot of the control system is only necessary for parameters that are critical for operation. Before the drive D1 is rebooted, a period of 5 seconds must elapse before altered parameters are permanently saved.

Confirmation after Parameter entry

- Motor Article Number
- Motor Current
- Boost Current
- Holding Current
- Step Mode

Deactivation of "Enable"

- Loading a configuration
- Execute FW update
- Motor Type
- Step Angle
- Pole Pairs
- Gearbox Activation
- Gearbox Ratio
- Feedback Activation
- Feedback Type
- Feedback Impulses
- Executing "Impulse Check"
- Closed Loop
- Executing "Self Tuning"
- Brake Activation
- Analogue Position Feedback Voltage Level AI2
- Controller "Reboot"
- Drive Profile selection

Controller Reboot

- "Automatic IP" or "Manual IP" Setting
- IP Address
- Subnetwork Mask
- Standard Gateway
- Host Name
- "HTTPS" or "HTTP" Setting
- PROFINET activation

The minimum and maximum values for each user interface parameter is found in the chapter [Input Values](#) (p,241)

	NOTE
	All movement relevant parameter won't be changeable via the user Interface if one of both Bus Systems is activated. Every parameter change must be done via the activated and set dominant system.

4.2.3 Parameterisation storage when using the bus systems

The parameterisation of the drive D1 can be performed in three different methods when used via the bus systems.

- Parameterisation via the user interface
If the configuration is performed via the pages of the user interface, all basic parameters, such as the [Feed Constant](#) (p. 56), are stored in the bus system [objects](#) (p.101) and permanently transferred to the non-volatile memory after a period of 5 seconds.
- Parameterisation via the bus systems
If all parameters are set exclusively via the bus systems, they must be transferred manually to the non-volatile memory via object [1010h Store Parameters](#)(p. 129).
- Parameterisation via predefined configuration file
If a configuration file is imported, the movement parameters are adopted. These parameters are permanently transferred to the non-volatile memory after 5 seconds. CANopen PDO mapping parameters must be written separately by the master and stored manually via object [1010h Store Parameters](#)(p. 129).

NOTE
It is not possible to save communication parameters in object range 1XXXh, e.g. PDO mapping settings, permanently in the non-volatile memory. These parameters must always be written and set after a restart of the motor control unit.

4.3 Start

4.3.1 Language

The following languages are available for operation of the dryve D1:

- German,
- English,
- Spanish
- French, Italian
- Italian, French
- Polish
- Portuguese
- Dutch (simplified)
- Chinese (simplified)
- Japanese
- Turkish

The user can select a language by clicking on the respective national flag.

Language



4.3.2 Measuring System

The user can choose between the metric and imperial measurement systems. Meters and millimetres are available with the metric and feet and inches with the imperial system. If changed, all previously entered values are automatically converted into the new measurement system.

Measuring System



Metric



Imperial

Meters



Millimetres

4.3.3 Movement Type

A linear or rotational movement can be selected. Accordingly, positions are displayed with the selected length or degree symbol (e.g. mm or °). . If changed, all previously entered values are automatically converted into the new measurement system.

Movement Type



Linear



Rotary

When the [Bus Systems](#) (p. 66) are activated, parameterisation only possible via the dominant system and not via the user interface.

4.3.4 Time Units

It is possible to display velocities and accelerations in seconds or minutes (e.g. mm/s or mm/min).

Time Units



Seconds



Minutes

4.3.5 Configuration

The whole parametrisation, as well as the Drive Profile can be saved and reloaded as a configuration file.

When the [Bus Systems](#) (p. 66) are activated, parameterisation only possible via the dominant system and not via the user interface.

Configuration

?

Load

Save

Configuration Name Assignment

1. Click in the blank text field and enter the desired configuration name. 40 characters are available.
2. Leave the field by clicking somewhere outside the text field
3. The new Configuration Name is now set and displayed on top of the user interface

Save

1. Click on "Save"
2. The current configuration is downloaded as a .txt file and is placed in the standard download directory of your computer

NOTE	
To save a configuration the configuration name must be set first. If the name is not set the "Save" button will be greyed out and not usable.	

Load

1. Deactivate the dryve D1 via disabling the Digital Input 7 "Enable" (external signal or use of the switch on "Inputs/Outputs" page
2. Click on "Load"
3. The file manager of the browser opens automatically
4. Navigate to the storage location of your configuration
5. Select it and click on "Open"
6. The desired configuration is now loaded into the dryve D1 and is active immediately

4.3.6 Firmware

If necessary, the Firmware of the dryve D1 can be updated with a build in routine. The currently installed version is shown under "Version".

Firmware



Version

dryve-D1-1-XXX

Search

Update

4.3.6.1 Downloading the update file

To download a new Firmware the used computer must be connected to the Internet. The update file (dryve-D1-1-XXXXXXX.cpio) can be found in a ZIP directory together with the release notes.

1. Click on "Search".
2. Your browser is downloading the update directory automatically
3. The update file is placed in your download folder
4. Unpack the ZIP file in a folder of your choice

You can also download the update file manually from the dryve motor controllers download page. Additionally, available are 2D and 3D drawings as well as certificates.

www.igus.eu/D1

4.3.6.2 Update process

1. Deactivate the dryve D1 via disabling the Digital Input 7 "Enable" (external signal or use of the switch on "Inputs/Outputs" page)
2. Click on "Update"
3. The file manager of the browser opens automatically
4. Navigate to the storage location of the firmware file (dryve-D1-1-XXXXXXX.cpio)
5. Select it and click on "Open"
6. The update now starts automatically. If the function for automatic IP Address Assignment is used, a new address may be shown in the Status Display after the update.

NOTE

Please follow the specific update instructions in the update file.

NOTE

Please note that if the FW version installed on your device is older than 2020, an update to a version from 2020 must first be performed before an update to the latest version can be executed.

If you require a 2020 FW version for this purpose, please contact dryve support:

de-dryve@igus.net

NOTE

To execute a FW update the digital input DI 7 "Enable" must be low/0

NOTE

It is recommended to reduce the Ethernet communication to a minimum while the update is executed.

It is advised not to use the browser for additional activities, don't execute programmes which need to communicate via the Ethernet and don't start or at least pause big data movements.

4.3.6.3 Failed Update and display "Index Of..."

If a connection is lost during the update (e.g. accidental disconnection of the Ethernet connection), the user interface may no longer be accessible and "Index Of" will be shown.

Please proceed as follows to restore the functionality of the motor control unit.

1. Enter the assigned IP address plus "/update".
2. Password request
 - a. Newly started motor control unit after the cancelled update without previously assigned admin password
Username: 'admin' Password: 'empty' - no entry Click on 'Login'.
 - b. Newly started engine control unit after the cancelled update with previously assigned admin password
Username: 'admin' Password: Your assigned password Click on 'Login'.
 - c. If no password has been assigned and the engine control unit has not been restarted, the update dialogue page is loaded automatically.
3. Click on 'Erase flash'.
4. After 'Erase flash ... done' is displayed, click on the 'Back' button of the browser.
5. Select the firmware file by clicking on 'Select file'. A dialogue window opens to navigate to the storage location of the previously downloaded firmware file.
6. Select the file and click on 'Open'.
7. Click on 'Upload'.
8. Display of the uploaded firmware components.
9. Click on 'Reboot' - do not switch off the motor control unit during the process!
10. Automatic call-up of the user interface
 - a. If the user interface is not displayed, please check the IP address.

4.3.7 Password

Available are "Admin" (administrator) and "Guest". Users can be activated or deactivated with the respective switches. If both users have been deactivated, the user interface is entered as the "Admin" without a previous password entry. The "Guest" can only be activated if the "Admin" has been previously activated.

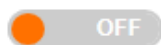
1. Activate the corresponding switch
2. Click on "Change"
3. Enter your password (maximum 30 characters) and repeat it
4. Confirm the password by clicking on "OK"

User	Access Rights
Admin	Read/Write rights
Guest	Read rights

Password



Admin



Change

Guest



Change

NOTE
It is not possible to reset/restore a forgotten password without deleting the entire configuration → Restore factory settings (p. 91). The configuration must then be reloaded from a configuration file or re-configured.

4.4 Motor configuration

The drive D1 can control Stepper, DC and EC/BLDC-Motors. Basic information is provided in the following chart.

Stepper Motor (ST)	
Parameters	Description
Motor Current	Indicates the maximum permissible continuous current of the motor.
Boost Current	The Boost Current indicates the increase of the Motor Current during acceleration and deceleration phases. An increase of the Motor Current to the value of the Boost Current is possible for a maximum of 2 s and may be set up to 150%. Activation of the Boost Current depends on the frequency of movement.
Holding Current	The Holding Current sets the current applied to the motor if it is at a standstill (only in the case of Stepper Motors in Open-Loop circuit, otherwise greyed out).
Step Mode	The "Step Mode" can be used to influence the positioning accuracy and smoothness of the movement. The smaller the step, the more precise the positioning movement, the better the motion steadiness and the less noise is emitted, Available are Auto, 1/1 Full Step, 1/2 Step, 1/4 Step, 1/8 Step, 1/16 Step, 1/32 Step und 1/64 Step. When using 'Auto', the motor control unit automatically selects the step mode according to the speed. Selecting the step mode results in the following maximum speeds: - Auto - 0 to 7500 rpm - 1/1 - 0 to 7500 rpm - 1/2 - 0 to 3750 rpm - 1/4 - 0 to 1875 rpm - 1/8 - 0 to 937 rpm - 1/16 - 0 to 468 rpm - 1/32 - 0 to 234 rpm - 1/64 - 0 to 117 rpm (only available with Stepper Motors, otherwise greyed out).
Step Angle	The Step Angle indicates the size of a step (0,72°, 0,9°, 1,8° etc.) and set the needed steps per revolution (1,8° correspond to 200 steps per revolution).

Direct Current Motor (DC)	
Parameters	Description
Motor Current	Indicates the maximum permissible continuous current of the motor.
Boost Current	The Boost Current indicates the increase of the Motor Current during acceleration and deceleration phases. An increase of the Motor Current to the value of the Boost Current is possible for a maximum of 2 s may be set up to 200%. Activation of the Boost Current depends on the frequency of movement.
Holding Current	The Holding Current is not used if a DC Motor is selected. The corresponding field has been greyed out.
Pole Pairs/Step Angle	The Pole Pairs/Step Angle value is not used if a DC Motor is selected. The corresponding field has been greyed out.

Electronically Commutated Motor (EC/BLDC)	
Parameters	Description
Motor Current	Indicates the maximum permissible continuous current of the motor.
Boost Current	The Boost Current indicates the increase of the Motor Current during acceleration and deceleration phases. An increase of the Motor Current to the value of the Boost Current is possible for a maximum of 2 s may be set up to 300%. Activation of the Boost Current depends on the frequency of movement.
Holding Current	The Holding Current is not used if an EC/BLDC-Motor is selected. The corresponding field has been greyed out.
Pole Pairs	The pole pairs indicate the arrangement and number of motor coils. A pole pair consists of 2 poles (magnetic north and south pole). 1 to 8 pole pairs are available for selection. The number of pole pairs also determines the positioning accuracy of the motor.
Note	In the case of the EC/BLDC-Motor, a 3-pole Hall Sensor is required for commutation. It is therefore possible to select an additional encoder in order to increase positioning accuracy.

	NOTE
The Step/Direction mode is only available for stepper motors.	

4.4.1 Motor

NOTE

A motor type change is only possible after DI 7 "Enable" has been revoked.

NOTE

The "Auto" mode adapts the Step Mode in relation to the motor's shaft speed. At low rotating speeds, the 1/64 Step Mode is preselected and, when the rotating speed increases, it is successively changed until 1/1 Full Step Mode is reached

NOTE

The maximum of 25.000 steps/seconds must not be exceeded if a fixed step mode is being used (steps per revolution divided by selected step mode)

NOTE

If the motor is used in the "[Step/Direction \(p.74\)](#)" operating mode, please select a Step Mode corresponding to your application. If one shaft revolution corresponds to 200 steps in the case of a 1.8° motor, please select 1/1 Full Step. If one shaft revolution corresponds to 12,800 steps with the same motor, please select 1/64 Step.

The "Auto" Step Mode is not available with Step/Direction

When the [Bus Systems](#) (p. 66) are activated, parameterisation only possible via the dominant system and not via the user interface.

Commissioning of the dryve D1 with the example of a stepper motor

1. Deactivate the dryve D1 by revoking the DI 7 "Enable" signal (external signal or switch on the "Inputs/Outputs" page)
2. Change to the "Motor" page
3. Select the used motor type. A selection must be made from the following:
 - a. ST (Stepper Motor)
 - b. DC (Direct Current Motor)
 - c. EC (Brush-Less DC-Motor)

Motor

Motor Type	Please Choose ▼
Article Number	ST (Stepper Motor)
Motor Current (A)	DC (Direct Current Motor)
Boost Current (A)	EC (Brush-Less DC Motor)
Holding Current (A)	0
Step Mode	Please Choose ▼
Pole Pairs	Please Choose ▼
Apply Changes	



- Select the igus® article number which is shown on the motor label

NOTE

If the igus® motor you are using cannot be found in the list, this indicates that the firmware is out of date. Please update the firmware (p. 38).

Motor

Motor Type	ST (Stepper Motor) ▼
Article Number	Please Choose ▼
Motor Current (A)	Custom article
Boost Current (A)	MOT-AD-S-060-017-056-M-A-AAK
Holding Current (A)	MOT-AD-S-060-017-056-M-C-AAAL
Step Mode	MOT-AN-S-060-001-028-L-A-AAAA
Step Angle	MOT-AN-S-060-001-028-L-C-AAAC
	MOT-AN-S-060-005-042-L-A-AAAA
	MOT-AN-S-060-005-042-M-A-AAAA
	MOT-AN-S-060-005-042-M-C-AAAC
	MOT-AN-S-060-005-042-M-D-AAAD
	MOT-AN-S-060-020-056-L-A-AAAA
	MOT-AN-S-060-020-056-M-A-AAAA
	MOT-AN-S-060-020-056-M-C-AAAC
	MOT-AN-S-060-020-056-M-D-AAAD
	MOT-AN-S-060-035-060-L-A-AAAA
	MOT-AN-S-060-035-060-M-A-AAAA
	MOT-AN-S-060-035-060-M-C-AAAC
	MOT-AN-S-060-035-060-M-D-AAAD
	MOT-AN-S-060-059-086-M-A-AAAA
	MOT-AN-S-060-059-086-M-C-AAAC
	MOT-AN-S-060-059-086-M-D-AAAD

- The parameters "Motor Current", "Boost Current", "Holding Current", "Step Angle" and "Pole pairs" are automatically filled with Default Values.

The predefined igus® motor currents have been reduced by 25% compared to the datasheet values

NOTE

The preset motor current has been reduced by approx. 25 to 30 % (depending on the motor type) to prevent the motor from overheating during continuous operation (within the valid ambient conditions (p. 12)).

- Installed peripheral devices such as motor-mounted gearboxes or feedback systems, including the necessary parameters, are automatically set and activated.

Please do not alter these settings as the system might not be operational afterwards

- Motor-specific control parameters are entered automatically on the "Oscilloscope" page
- Select the Step Mode needed
- Click on "Apply"

Motor

Motor Type	ST (Stepper Motor) ▼
Article Number	MOT-AN-S-060-005-042-M-C-AAAC ▼
Motor Current (A)	1,1
Boost Current (A)	1,1
Holding Current (A)	0,55
Step Mode	Please Choose ▼
Step Angle	1.8° ▼
	Apply Changes

4.4.2 User-Defined Motor

If no igus® motor is used, select "Custom Article" at "Article Number" and enter the parameter manually. If needed, use the help information provided in the manual or on the user interface. In addition, the "Controller Data" parameters for current, speed and position loop need to be entered on the "Oscilloscope" page. For Stepper Motors in Open Loop, only the current Controller Data is needed.

The necessary current controller settings can be obtained automatically via the [Self-Tuning](#) (P. 50) button on the "Motor" page.

When the [Bus Systems](#) (p. 66) are activated, parameterisation only possible via the dominant system and not via the user interface.

4.4.3 Gear

For igus® motors with motor-mounted gearboxes, all the necessary configurations have already been set.

If you have selected a "Custom article" at "Article Number" or if you want to use a gearbox that matches an igus® motor, please configure the gearbox manually. For this purpose, use the Help information provided in the manual or on the user interface.

Gear  

Gear Ratio

1. Deactivate the drive D1 by revoking the DI 7 "Enable" signal (external signal or switch on the "Inputs/Outputs" page)
2. Activate the gearbox by setting the switch to "ON"
3. Insert the gear transmission ratio in the "Gear Ratio" field. Please obtain the necessary information from the gearbox data sheet

NOTE
If a gearbox is set, all movement parameters such as speeds and positions are related to the output side.

4.4.4 Feedback

With a feedback sensor, a position change during a movement can be measured. As a result, it is possible to increase positioning accuracy and compensate for incorrect positioning (step loss). Motor-mounted encoders have already been configured for igus® motors. If an axis-mounted feedback sensor or a user-defined motor with a feedback sensor is used, please configure it manually.

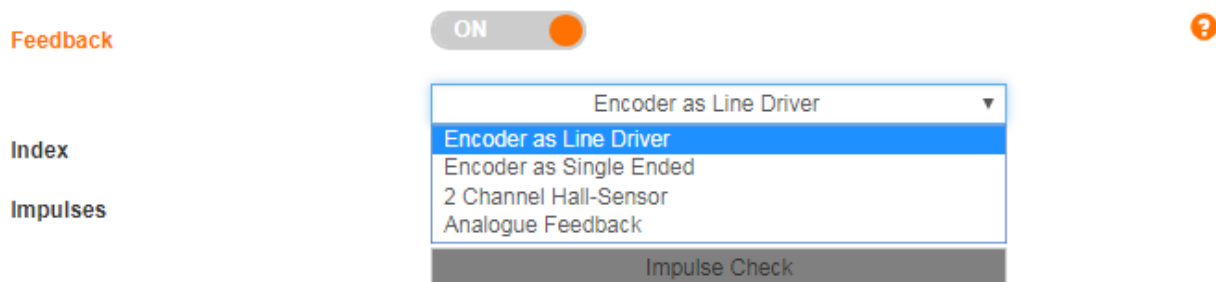
When the [Bus Systems](#) (p. 66) are activated, parameterisation is only possible via the dominant system and not via the user interface.

Feedback	Description
Encoder as Line Driver	A Line Driver Encoder uses a differential data transmission. This signal transmission type is more resistant to interferences. Standard RS422 Data transfer takes place on channels A, A/, B and B/. As an option, an index signal can be transmitted via N and N/. The index signal is emitted once per motor revolution.
Encoder as Single Ended	If a single ended encoder is used, the signals of the angular encoder are transmitted along channels A and B. As an option, an index signal can be transmitted via N. The index signal is output once per motor revolution.
Hall 2-Pole	The signals of 2 Hall Sensors are evaluated for position monitoring.
Analogue feedback	If analogue feedback is used, the position is monitored by analogue position feedback sensor connected to AI2. Carry out the further steps and then follow the instructions under Absolute Value Feedback (p.67) .
EC/BLDC motor specific property	
Hall 3-Pole	The signals of 3 Hall Sensors are evaluated for commutation. They are located at 120° from each other. To operate an EC/BLDC-Motor, the 3 Hall Sensors must be connected. The Hall Sensors are activated automatically and can't be selected separately.

The following configurations are available

Feedback	Stepper Motor	DC-Motor	EC/BLDC-Motor
Without Feedback	Yes	ROT, ARO, ADR only	Yes, 3 pole Hall Sensor required*
Encoder as Line Driver (p. 239)	Yes	Yes	Yes
Encoder as Single Ended (p. 239)	Yes	Yes	Yes
2 channel Hall Sensor (p. 239)	Not supported	Yes	Not supported
Analogue Feedback (p. 239)	Not supported	Yes	Not supported

*The Hall 3-pole Sensor will be activated as soon as an EC/BLDC motor is selected



1. Deactivate the dryve D1 by revoking the DI 7 "Enable" signal (external signal or switch on the "Inputs/Outputs" page)
2. Activate a "Feedback" by setting the switch to "ON"
3. Select the used Feedback from the dropdown menu

Feedback ON ?

Index ON

Impulses

Impulse Check

4. If an index channel is available, it can be activated. The associated data sheet will give you the information whether your encoder has an index channel
 - a. The index channel is activated by setting the switch to "ON"
5. Enter the impulses per shaft revolution into the "Impulses" field
 - a. If the Feedback impulse count is not known, a "Impulse Check" can be used to obtain the information.

	NOTE
	If, after using the pulse check, a resolution other than that specified in the encoder's data sheet is displayed, please execute it again. If the deviation persists, there is a possibility that the encoder is defective.

4.4.5 Impulse Check

If you use a user-defined motor with an encoder including an index and the impulse count per motor revolution is not known, a "Impulse Check" can be executed to determine the value. When using the "Impulse Check", a distinction must be made as to whether the motor has already been installed and therefore a physical limitation is present or whether the motor can rotate without limitation.

When the [Bus Systems](#) (p. 66) are activated, parameterisation only possible via the dominant system and not via the user interface.

Index ON

Impulses

Impulse Check

4.4.5.1 Impulse Check with Physical Limitation

1. Set the DI 7 "Enable" signal (external signal or switch on the "Inputs/Outputs" page)
2. Go to the "Drive Profile" page and use the "Position Adoption" buttons to move to the negative end of the axis
3. Make sure that the motor can execute 2 complete rotations → If this is not possible, the motor must be removed from the axis. After removal, continue with "Impulse Check without Limit"
4. Revoke the DI 7 "Enable" signal (external signal or switch on the "Inputs/Outputs" page)
5. Go to the "Motor" page and click on the "Pulse Check" button under "Feedback"
6. The dryve D1 will execute 2 motor rotations, determine the impulse count and automatically enter the value

4.4.5.2 Impulse Check without Limit

1. Revoke the DI 7 "Enable" signal (external signal or switch on the "Inputs/Outputs" page)
2. Go to the "Motor" page and click on the "Pulse Check" button under "Feedback"
3. The drive D1 will control the motor to execute 2 rotations, determine the impulse count and automatically enter the value

Note
If an unplausible resolution is displayed after using the impulse check several times (most encoders have even resolutions (e.g. 100, 500 or 1000) or resolutions of the power of 2 (e.g. 128, 512 or 1024), please contact the encoder manufacturer to check the problem. It is likely that the encoder is defective.

4.4.6 Closed-Loop

 WARNING!
- Risk of injury due to moving parts - Risk of crushing Incorrect initial alignment of the motor rotating field to the encoder after switching on the motor controller or activation of the closed loop, e.g. due to a blocked motor shaft at the time of switch-on, can result in unpredictable movements. Never reach into the travel path and do not touch any driven/rotating components. Ensure that even unexpected movements of the driven components cannot cause personal injury or material damage. Ensure that an emergency shutdown can be performed at any time.

The Closed-Loop control is able to reduce the motor's power consumption and its operating temperature significantly. Due to a continuous position monitoring, step losses are not possible.

Open Loop - Closed Loop Comparison

	Open Loop	Closed Loop
Motor Current	Constant current level	Load-dependent
Boost Current	Constant current level, output during acceleration/deceleration phases, max. 2 seconds	Load-dependent, output during acceleration/deceleration phases, max. 2 seconds
Holding Current	Load dependent	No separate parameter, current level Load-dependent, max. boost current for 2 seconds, then max. motor current
Commutation	Block	Sinus
Error Correction	Direct correction during phases with constant velocity, Step loss possible during deceleration phases, correction during subsequent movement	Continuous, no step loss possible
Motor Speeds	Higher than in closed loop, regulated by load voltage supply and load to be moved	Lower than in open loop, regulated by load voltage supply, load to be moved and control algorithm
Temperature D1 and Motor	Higher due to higher current values	Lower due to lower average current values

When the [Bus Systems](#) (p. 66) are activated, parameterisation only possible via the dominant system and not via the user interface.

1. Deactivate the drive D1 motor control by removing the 'Enable' at DI 7 (external signal or actuation of the switch on the 'Inputs/Outputs' tab).
2. Activate the 'closed loop' by setting the switch to 'ON'.
3. Ensure that the rotor of the motor can move at least 1.8° to align the rotating field with the encoder.
4. Activate the drive D1 motor control by setting the 'Enable' on DI 7 (external signal or actuation of the switch on the 'Inputs/Outputs' tab).

Closed Loop

ON



Self-Tuning

NOTE

Closed-loop control is only possible for stepper motors with connected encoders. Closed-loop control is always active for EC/BLDC motors and DC motors with encoders.

NOTE

When the maximum speed limit range of stepper motors in the closed loop is reached, the speed can no longer be kept constant and a whining noise can be heard from the motor.

This can be remedied by reducing the speed, increasing the load supply voltage at X1.1 to 48 V or using the open loop.

NOTE

When using the closed loop, there is a requirement for a minimum speed. This is determined by the mass moment of inertia of the motor and the resolution of the encoder

If this speed band is passed through quickly, there is no impairment of the control performance.

4.4.7 Self-Tuning

The Self-Tuning function determines the optimal motor current "Controller Data" and stores them automatically on the "Oscilloscope" page. These values are directly live.

When the [Bus Systems](#) (p. 66) are activated, parameterisation only possible via the dominant system and not via the user interface.

4.4.8 Brake

If a load is to be held in position without any Motor Current applied, the drive D1 can control a holding brake.

When the [Bus Systems](#) (p. 66) are activated, parameterisation only possible via the dominant system and not via the user interface.

Setting	Description
Standard Mode	The brake is energised and thus released after "Enable" is set at DI7. The brake is not applied again until the signal is revoked, an Error (p. 211) occurs or the load voltage is removed
Eco-Mode	Function which causes the brake to be applied and the Holding Current to be switched off whenever a movement is stopped. This can reduce the thermal load on the motor and save electrical energy.
ECO Delay	Indicates the delay in milliseconds which must pass until the ECO-Mode is activated
Switching Delay	Indicates the time in milliseconds during which the motor is still supplied with current and the brake has already been engaged. This function is needed to reliably achieve the holding torque of the motor and brake.

**WARNING!**

If a holding brake is mounted but not activated, malfunctions or component damage might occur

NOTE

The igus® motors with built-in brakes are designed as holding brakes. These brakes are only designed for holding the load in position at a standstill and are not used to decelerate loads during a movement.

NOTE

The "ECO mode" is only available for motors with encoders.

Brake	☒ ON	
Eco-Mode	☒ ON	
Eco Delay (ms)	100	
Switching Delay (ms)	100	

1. Deactivate the dryve D1 by revoking the DI 7 "Enable" signal (external signal or switch on the "Inputs/Outputs" page)
2. Activate the "Brake" by setting the switch to "ON"
3. If desired, the "Eco-Mode" can be activated by setting the switch to "ON"
4. Enter different "Off/On Delay" times if needed

4.4.9 Braking Resistor for EC/BLDC Motors

While reducing the motor speed the motor will change into the generator operation state. This produces a counter-voltage peaks which might be higher as the applied load voltage and might cause the destruction of the dryve D1 controller. If an application requires high decelerations a Braking Resistor must be used to dissipate the generated excessive energy.

Each used dryve D1 controller driving an EC/BLDC motor must be equipped with it's own Braking Resistor.

	Danger!
- Fire Hazard! An incorrectly dimensioned Brake Resistor might cause a thermal overload and lead to an acute fire hazard.	

	WARNING!
- Burn Hazard! The surface temperature of the resistor can reach temperatures of above 250°C. Consider necessary component mounting distances and ensure an adequate resistor and switching cabinet cooling.	

	WARNING!
- Risk of destruction! Using a multi axis system containing several dryve D1 controller with EC/BLDC motors and connecting all these controllers motor connector X5 wise to one single Braking Resistor may lead to a destruction of all connected controllers due to high current flow in-between.	

NOTE
The Braking Resistor is only available for EC/BLDC motors.

4.4.9.1 Braking Resistor selection for igus motors

The stated resistor values were determined from different application scenarios and are meant as a guideline to select an appropriate resistor.

The corresponding part number is stated at the [Accessories](#) (p. 226).

If the application requires a detailed determination, please proceed at "Braking Resistor Dimensioning for Custom Motors".

Motor	Resistance Value with 48 V Load Voltage	Power
MOT-EC-42-XXX	18 Ω	15 W – 35 W
MOT-EC-56-XXX	4,7 Ω	25 W – 65 W
MOT-EC-60-XXX	3,3 Ω	50 W – 85 W
MOT-EC-86-XXX	2,7 Ω	50 W – 100 W

Wire Cross-Section

Cable length	Min Cross-Section
Max. 3m	0,34 mm ²

4.4.9.2 Braking Resistor dimensioning for custom motors

The Braking Resistor value and power rating are determined according to the following formulas.

NOTE
The minimal resistance with 48 V at X1.1 is 1,7 Ω and 0,8 Ω with 24 V. If a lower resistance is used the error E02 "Motor Overcurrent" will be executed right after DI 7 "Enable" is set.

Resistance**Basic value to determine the Braking Resistor**

$$P_{\max \text{ brake}} = \frac{n_{\max} * M_{\max}}{9,55}$$

$P_{\max \text{ brake}}$	Maximal produced motor braking power in watt [W]
$n_{\max}$	Maximal motor speed in revolutions per minute [min ⁻¹] (dependent on Load Voltage at X1.1)
$M_{\max}$	Maximal motor torque (M_{peak}) in newton meter [Nm]
9,55	Constant to determine the mechanical power from corresponding numerical value equation divided by 1000

Example:

$$P_{\text{Motor max}} = \frac{3000 \text{ min}^{-1} * 3 \text{ Nm}}{9,55} = 942,4 \text{ W}$$

Determination Resistance Value

$$R_{\text{Brake}} = \frac{U_{\text{Brake Voltage}}^2}{P_{\max \text{ brake}}}$$

R_{Brake}	Optimal Brake Resistor value in Ohm [Ω]
$U_{\text{Brake Voltage}}$	Braking Voltage threshold to activate the Braking Resistor in volt [V] – see Braking Voltage Setting (p. 55)
$P_{\text{Motor max}}$	Maximal produced motor braking power in watt [W]

Example:

$$R_{\text{Brake}} = \frac{51 \text{ V}^2}{942,4 \text{ W}} = 2,76 \text{ Ω}$$

In case of a result not fitting to a Default Value it's recommended to use the very next smaller or bigger resistance with the smallest value delta. With a result of 2,76 Ω the next smaller and bigger available Default Values are 2,7 Ω and 3,3 Ω. In this case the recommended value is 2,7 Ω.

Power**Basic value to determine the needed power dissipation (if not mentioned in data sheet)**

$$P_{\text{nom brake}} = \frac{n_{\max} * M_{\text{nom}}}{9,55}$$

$P_{\text{nom brake}}$	Nominal produced motor braking power in watt [W] (typically identical to nominal motor power)
$n_{\max}$	Maximal motor speed in revolutions per minute [min ⁻¹] (dependent on Load Voltage at X1.1)
M_{nom}	Nominal motor torque (M_{rated}) in newton meter [Nm]
9,55	Constant to determine the mechanical power from corresponding numerical value equation divided by 1000

Example:

$$P_{\text{nom brake}} = \frac{3000 \text{ min}^{-1} * 1 \text{ Nm}}{9,55} = 314,1 \text{ W}$$

Power dissipation value

Horizontal application



$$P_{brake\ \varnothing} = P_{nom\ brake} \sqrt{\frac{T_{Brake}}{3 * (T_{Cycle} + T_{Pause} + T_{Brake})}}$$

P _{brake ∅}	Average motor braking power produced at a single movement cycle in watt [W]
P _{max brake}	Maximal produced motor braking power in watt [W]
T _{Brake}	Dwell time of the motor in the generator operation state in seconds [s] (see “Determination generator operation dwell time”)
T _{Cycle}	Total duration single movement cycle in seconds [s]
T _{Pause}	Pause time after single movement cycle in seconds [s]

Determination generator operation dwell time

Generator operation state only at deceleration phase.



Example:

$$P_{brake\ \varnothing} = 314,1\ W \sqrt{\frac{0,3\ s}{3 * (1,3\ s + 1\ s + 0,3\ s)}} = 61,6\ W$$

To avoid a thermal overload, it's recommended to always use a resistor with the next bigger power rating then the calculated value. At a value of 61,6 W a power rating of minimal 62 W is recommended.

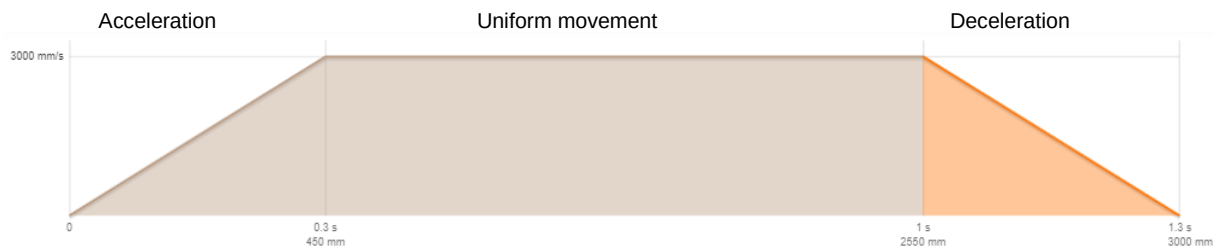
NOTE
Please consider the power derating curves of the resistor supplied by the manufacturer

Vertical application:

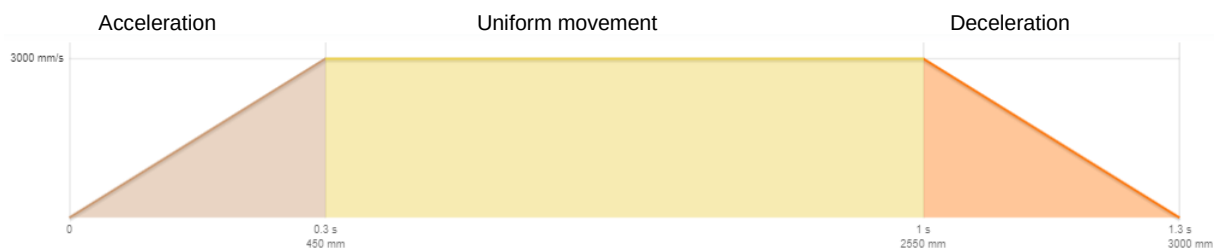
$$P_{brake \emptyset} = P_{nom brake} \frac{\left(\sqrt{\frac{T_{Brake} + \frac{T_{Move down}}{4}}{3 * (T_{Cycle} + T_{Pause} + T_{Brake})}} + \sqrt{\frac{T_{Brake}}{3 * (T_{Cycle} + T_{Pause} + T_{Brake})}} \right)}{2}$$

Determination generator operation dwell time upward movement

Generator operation state only at deceleration phase.

**Determination generator operation dwell time downward movement**

Generator operation state at deceleration and at the uniform movement with reduced intensity.



Example:

$$P_{brake \emptyset} = 314,1 W \frac{\left(\sqrt{\frac{0,3 s + \frac{0,7 s}{4}}{3 * (1,3 s + 1 s + 0,3 s)}} + \sqrt{\frac{0,3}{3 * (1,3 s + 1 s + 0,3 s)}} \right)}{2} = 69,56 W$$

To avoid a thermal overload, it's recommended to always use a resistor with the next bigger power rating then the calculated value. At a value of 69.56 W a power rating of minimal 70 W is recommended.

NOTE

Please consider the power derating curves of the resistor supplied by the manufacturer

4.4.9.3 Braking Voltage Setting

	WARNING !
- Fire Hazard! There is a risk of fire if the braking voltage is set incorrectly! If the voltage is set to a value below the value of the load supply voltage, the resistor value has also been set incorrectly and an insufficiently dimensioned power supply is used, an emergency shutdown of the braking resistor after one second of continuous operation is not possible.	

f

Braking Resistor



Braking Voltage (V)

The Braking Voltage sets the threshold to activate the Brake Resistor and dissipate the excessive energy. To ensure a safe operation the Braking Voltage is equipped with a ON/OFF hysteresis of 1 V. To dissipate energy the counter-voltage must rise above the set threshold plus 1 V. To stop the dissipation the voltage must sink below 50 V.

When the [Bus Systems](#) (p. 66) are activated, parameterisation only possible via the dominant system and not via the user interface.

1. Deactivate the drive D1 via disabling the Digital Input 7 "Enable" (external signal or use of the switch on "Inputs/Outputs" page)
2. Enter the desired Braking Voltage
3. Activate the drive D1 via enabling the Digital Input 7 "Enable" (external signal or use of the switch on "Inputs/Outputs" page)

NOTE
Setting the Braking Voltage to high might cause dissipating too less energy resulting in the error E09 Load Supply High (p. 221).

4.5 Axis Configuration

Available settings for linear or rotational axis configuration are described in the following.

4.5.1 Axis

Necessary basic settings for exact positioning.

When the [Bus Systems](#) (p. 66) are activated, parameterisation only possible via the dominant system and not via the user interface.

Settings	Description
Available Stroke	Specifying the movement window for "ABS" mode (Absolute Positioning). All other modes remain unaffected by this restriction. This window starts at the zero-point set after a homing run and ends at the entered value. Only movements within this window are permitted in the "Absolute Positioning" mode. Specification of a negative window is not possible.
Feed Rate	The feed rate indicates the resulting traversing movement per drive shaft rotation If a rotational axis is used, the value 360° must be entered for the feed rate.

Axis



Available Stroke (mm)

Feed Rate (mm)

1. Enter the desired maximum distance
2. Enter the "Feed rate"

NOTE

If no value is entered in the available stroke, it is not possible to execute an absolute positioning in the operation mode [Binary](#) (p. 83) [Tipp/Teach](#) (p.83). Relative movements as well as a manual movement via the [Position Adoption](#) (p. 82) are still possible.

NOTE

When using the bus systems, the objects [6092h Feed Constant](#) (p. 178) and [60A8h SI Unit Position](#) (p.181) must be set according to the respective description.

4.5.2 Software Limit Switch

The available stroke is limited by setting the 'Minimum stroke' and 'Maximum stroke'. The software limit switch positions refer to the axis zero point defined by the homing. It is not possible to move past these positions for relative and absolute movements. Relative movements are executed but are interrupted at the point of the 'Minimum stroke' or 'Maximum stroke' and the alarm 'A 22 - Invalid motion parameters' is set. If no referencing has been performed, a relative movement can also be executed beyond the software end position.

If the target position of an absolute movement command is outside the software limit switch range, the movement command is not executed and the alarm 'A 22 - Invalid movement parameters' is directly set. Homing is a basic requirement for executing absolute movements.

4.5.3 Motion Limits

It is recommended to set movement limits. They ensure a safe and reliable operation and avoid damage and malfunctions due to incorrect entries.

When the [Bus Systems](#) (p. 66) are activated, parameterisation only possible via the dominant system and not via the user interface.

Setting	Description						
Max. Velocity	Maximum motor, carriage or rotation arm velocity. Used to avoid errors due to accidental entries of excessively high values in the Drive Profile. The maximum velocity that can be achieved depends on the combination of the load voltage applied to X1.1, the motor used, the feed rate/pitch of the linear axis, the load to be moved and the required acceleration. These values can be found in the mechanical design of the application.						
Jog Velocity	Velocity of the linear axis, the rotation axis or the motor in Tipp/Teach mode and the position adaption function. The entered velocity must be lower than the "Max. Velocity"						
Max. Acceleration	Maximum motor, carriage or rotation arm acceleration. Used as the acceleration with the Tipp/Teach mode and the position adaption function.						
S-Curve	Selection between speed optimized trapezoidal or jerk reduce sinusoidal acceleration and deceleration ramps. Trapezoidal ramps are usually used with 1 axis applications without special requirements regarding a jerk forming at transitions between acceleration or deceleration phases to a constant velocity phase. Sinusoidal ramps are used if jerk sensitive goods are transported or several axes must interact (e.g. Delta Robot) <u>When using S-Curve, the average acceleration or deceleration is specified!</u> At the inflection point of the sine function, the maximum acceleration reaches a value that is up to twice as high as the value entered under "Drive Profile".						
Quick-stop	Deceleration rate when a movement is stopped in an emergency. To stop a movement in time to avoid an accident, it is recommended that the "Quick Stop" deceleration rate is set higher than the "Max. Acceleration" (recommendation: factor 10). It is important to ensure, that the increased deceleration rate is appropriate for the intended application and cannot destroy the mechanical structure. A "Quick-Stop" is executed if the "Quick-Stop" button (Test functions, p. 82) is used, the "Enable" signal at DI 7 is revoked.						
Following Error	Permissible deviation of the actual position from the desired position. If 50% of the permissible Following Error is reached, a warning is displayed. If the permissible Following Error is exceeded, the movement is stopped and an error message will be displayed. If a movement is to be executed at high accelerations and velocities, a higher Following Error value must be set. If the Following Error value has been set to 0, monitoring is activated.						
Positioning Window	Specification of a position range in a positive and negative direction around the target point. Example: <table> <tr> <td>Target</td><td>100 mm</td></tr> <tr> <td>Positioning Window</td><td>10 mm</td></tr> <tr> <td>Positioning interval</td><td>90 mm to 110 mm</td></tr> </table> If the interval is reached by the Actual Position, the Positioning Time is lapsed and the Position Setpoint as well, the movement can be assessed as being finished despite a mechanical blocking of the axis/motor. As a result, a "Ready" signal is set at DO1. If a 0 (zero) is entered in the window, the Positioning Window and the Positioning Time are deactivated. The Positioning Window is only available if Feedback sensors are used.	Target	100 mm	Positioning Window	10 mm	Positioning interval	90 mm to 110 mm
Target	100 mm						
Positioning Window	10 mm						
Positioning interval	90 mm to 110 mm						
Positioning Time	Specification of the retention time, the actual position must be placed in the Positioning Window interval before a movement can be assessed as having finished. The value is entered in milliseconds. The Positioning Time is only available Feedback sensors are used.						

Please enter the maximum permitted limits for your application.

Motion Limits

Max. Velocity (mm/s)	10
Jog Velocity (mm/s)	10
Max. Acceleration (mm/s ²)	100
S-Curve (%)	0
Quick-Stop (mm/s ²)	1000
Following Error (mm)	10
Positioning Window (mm)	0
Positioning Time (ms)	0

4.5.4 Limit Switch

Specification of the position and number of limit switches used.

The switched signal of the limit switch must be connected to the corresponding input (DI8 "Limit switch positive" or DI9 "Limit switch negative").

The information about which wire carries the switched signal can be found in the [data sheet](#) of the igus® limit switches.

Further information about the connection of the limit switches in the [FAQ](#) (p. 225).

The setting for whether the limit position switches work as " normally closed " or " normally open " can be found under [Digital Inputs](#) (p. 70).

Please note that the power supply of the limit position switch must be the same as that connected to X2.11 and X2.12.

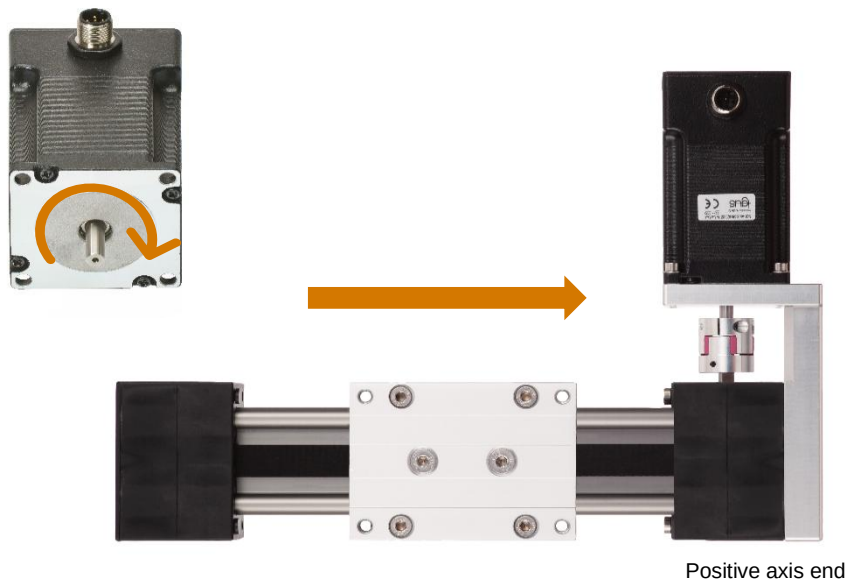
When the [Bus Systems](#) (p. 66) are activated, parameterisation only possible via the dominant system and not via the user interface.

Setting	Description
None	No limit switch installed on the axis
Negative	Limit switch placed at the negative end of the axis
Positive	Limit switch placed at the positive end of the axis
Negative and Positive	Limit switches placed at the positive and negative ends of the axis

NOTE
Even if "None" limit switches have been selected, referencing to one of the two limit switches is possible.

Position specification and selection of limit switches

1. View from drive shaft onto motor block
2. Clockwise motor rotation
3. End position of the movement corresponds to the positive limit switch position



Please refer to the corresponding limit switch datasheet for a correct connection.

Limit Switch



Position

Please Choose ▼

None
extern negative
extern positive
extern negative and positive

Selection Limit Switch

1. Select the limit switches installed at the axis in the "Position" drop-down menu.

4.5.4.1 Triggered Limit Switches

If an activated limit switch is triggered, the "E12 Limit Switch" error is shown and the movement is stopped. A retracting movement in the opposite direction is possible after the error has been acknowledged.

If no position feedback is used, a triggered Limit Switch causes the "Referenced" status signal to be revoked. With ABS in "Binary" and "Tipp/Teach", and a revoked "Referenced" signal, an automated movement can only be performed after the homing procedure was executed. A manual movement is possible with the "Left" and "Right" "Position Adoption" buttons (requirement for homing run after a Limit Switch was triggered: The set Limit Switch mustn't be overrun and the Limit Switch signal must be applied continuously to Digital Inputs DI 8 or DI 9).

In the case of "Tipp/Teach", movement off the Limit Switch is also possible via Digital Inputs DI 4 or DI 5.

NOTE	
If an activated limit switch is reached/set, this is always evaluated as a range violation and the error "E12 Limit switch" is output. If a limit switch evaluation shall only be performed during the reference run, "None" must be selected under "Position".	

1. Limit Switch triggered
2. Movement sequence is stopped
3. Error message "E12 Limit Switch" is displayed
4. Without feedback: Loss of the "Referenced" status signal
5. Error reset: Setting DI 10 "Stop" or pressing the reset button on the user interface
6. Movement off the limit switch
 - a. Binary
 - i. ABS
 1. A) Manual movement by hand: Motor moved after DI 7 "Enable" has been revoked.
B) Automated movement in the opposite direction with the clockwise/anticlockwise buttons of the "Position Adaption" function
 2. Repeated homing run
 - ii. All other travelling modes
 1. A) Manual movement by hand: Motor moved after DI 7 "Enable" has been revoked.
B) Automated movement in the opposite direction with the clockwise/anticlockwise buttons of the "Position Adaption" function
 2. Start of a movement in the opposite direction
 3. Repeated homing run

b. Tipp/Teach

i. ABS

1. A) Manual movement by hand: Motor moved after DI 7 "Enable" has been revoked.
B) Automated movement in the opposite direction with the clockwise/anticlockwise buttons of the "Position Adaption" function
C) Automated movement in the opposite direction with Digital Input DI 4 and DI 5
2. Repeated homing run

4.5.5 Homing

Selection of the preferred homing method and specification of a position offset.

When the [Bus Systems](#) (p. 66) are activated, parameterisation only possible via the dominant system and not via the user interface.

Methods	Description
SCP Set Current Position	Homing takes place at the current position
LSN Limit Switch Negative	Homing takes place at the negative limit switch
LSP Limit Switch Positive	Homing takes place at the positive limit switch
IEN Index Encoder Negative	Homing to the encoder index pulse in negative searching direction
IEP Index Encoder Positive	Homing to the encoder index pulse in positive searching direction
AAF Analogue Absolute Value Feedback	Homing takes place by means of an analogue absolute value encoder.

The zero-position of the coordinate system is set when referencing to a limit switch or an encoder index signal is executed when the respective signal is set low/0.

Behaviour when referencing to a limit switch

1. Search for the preselected limit switch position with configured acceleration and speed
2. Movement stop after reaching the limit switch with configured deceleration
3. After standstill, start of movement in the opposite direction
4. Set zero-position ion when reference signal is set low/0 and initiate movement stop with configured deceleration
5. Standstill after deceleration phase at the resulting position, e.g. 0.5 mm or 0.12°

Behaviour when referencing to an encoder index signal

1. Search for the index signal in preselected direction with configured acceleration and speed
2. Setting of the zero-position and initiation of movement stop after detection of the falling index signal with configured deceleration
3. Standstill after deceleration phase at the resulting position in the previous direction of rotation, e.g. 0.5 mm or 0.12°

A movement back to the 0-position is possible at any time

NOTE
Referencing to limit switches or index is also possible if limit switches or encoders are deactivated in the user interface.

NOTE
It is recommended to use an acceleration value 5 to 10 times higher than the velocity value when referencing

NOTE
If no position feedback is available the reference signal will be reset every time the controller is disabled via DI7 "Enable" or an error occurs.

Reference



Method

Offset (mm)

Please Choose ▼
SCP (Set Current Position)
LSN (Negative Limit Switch)
LSP (Positive Limit Switch)
IEN (Index Encoder Negative)
IEP (Index Encoder Positive)
AAF (Analogue Feedback)

Absolute Feedback



1. Select the desired homing method for determination of the mechanical zero point
2. Enter a desired position offset in the blank field

4.5.5.1 Offset

The offset specifies the distance by which the coordinate system is shifted after the homing has been completed. The position physically reached during homing is retained, but the distance specified at Offset is added to the zero position.

When the [Bus Systems](#) (p. 66) are activated, parameterisation only possible via the dominant system and not via the user interface.

Reference



Method

Offset (mm)

SCP (Set Current Position) ▼
0

Example:

If the homing is to be executed to the positive limit switch, and the set [Available Stroke](#) (p. 56) is 200 mm, the Offset must be set to the same value. This overwrites the zero-position set during homing with the position of 200 mm and thus shifts the zero point to the negative side of the axis.

NOTE

If referenced to the positive limit switch - [Homing Method](#) (p. 61) and using absolute positioning ([ABS](#), p. 83), the offset must be set to the value of the [Available Stroke](#) (p. 56)

4.5.6 Analogue Absolute Feedback

Configuration of the analogue Target Position value and the analogue Current Position value.
The [Available Stroke](#) (p. 56) will be integrated with these voltages.

When the [Bus Systems](#) (p. 66) are activated, parameterisation only possible via the dominant system and not via the user interface.

Example:

If the Available Stroke is set to 100 mm and the set voltage interval at Analogue Input AI 1 is from 1 V up to 9 V, these 100 mm will be mapped on the available 8 V (100 mm / 8V = 12,5 mm per 1 V at Analogue Input AI 1).

Setting	Description
AI 1 Target Value Min. (V)	Minimum voltage setting as target zero value at Analogue Input AI 1. Enter 1V if the minimal stroke of 0 mm shall be reached at 1 V instead of 0 V. Set this value to -10 V or higher if a ± 10 V source is being used.
AI 1 Target Value Max. (V)	Maximum voltage setting as target value at the Analogue Input AI 1. Enter 9 V if the maximum stroke of e.g. 100 mm shall be reached at 9 V instead of 10 V. Set this value to 10 V or lower.
AI 1 Dead Band Zero Value(V)	Adjustment of a window placed symmetrically around the 0 V set point signal of Analogue Input AI 1. The dead band can be used to minimize unwanted motor movements during standstill caused by a higher set point signal ripple or other interferences. ARO ± 10 V: -10 V 0-10 V: 0 V ADR ± 10 V: 0 V 0-10 V: 5V) APS ± 10 V: -10 V 0-10 V: 0 V The value is inserted in 0,001 V steps.
AI 1 Dead Band Input Signal	Adjustment of a window placed symmetrically around the input signal of Analogue Input AI 1. The dead band can be used to minimize unwanted motor movements during standstill as well as inconsistent movements and velocities caused by interferences as well as a signal source with a high ripple. The value is inserted in 0,001 V steps.
AI 1 Filter (ms)	Interval used to determine the signal average. Used to filter signal surges to prevent movement inconsistencies. Low values result in a quickly responding system with a higher proneness to disturbances. High values are resulting in a more stable system but with less agility.
AI 2 Absolute Value Min (V)	Minimum voltage of the axis mounted analogue absolute feedback system as a zero-point connected to Analogue Input AI 2.
AI 2 Absolute Value Max (V)	Maximum voltage of the axis mounted analogue absolute feedback system as an end-point connected to Analogue Input AI 2.

Further settings must be made to use an analogue absolute feedback sensor.

First, complete all other settings .Afterwards change to chapter [Absolute Feedback](#) (p. 63) and follow the instructions.

Absolute Feedback



AI 1 Target Value Min. (V)	0		
AI 1 Target Value Max. (V)	10		
AI 1 Dead Band Zero Value (V)	0,1		
AI 1 Dead Band Input Signal (V)	0,01		
AI 1 Filter (ms)	10		
AI 2 Absolute Value Min. (V)	1.5062	→	0
AI 2 Absolute Value Max. (V)	1.5062	→	10

4.6 Communication

Configuration of the different communication forms with a web browser and higher-level automation controllers.

4.6.1 Ethernet TCP/IP

Configuration of Ethernet TCP/IP communication.

The IP address can be assigned automatically or manually.

The following methods are available for automatic assignment of the IP address.

- Zeroconf method (direct connection of a laptop to the dryve)
- DHCP (connection of PC to the dryve via router)

If the IP address is assigned manually, you must specify an IP address, subnet mask and a standard gateway that match your network.

"Automatic IP" has been preselected as the standard

Setting	Description
Automatic IP / Manual IP	Selection of IP address assignment method
IP Address	Specification of the manual IP Address, e.g. 169.254.0.10
Subnetwork Mask	Specification of the subnet mask, e.g. 255.255.255.0
Standard Gateway	Specification of the standard gateway, e.g. 169.254.0.1
Host Name	Specification of the plain-text designation of the dryve D1 control system. Used as an alternative to the IP Address (a router with DNS server required).
Ethernet Settings Adoption	A reboot causes the made Ethernet Communication changes to be activated. For this purpose, it is necessary that DI 7 "Enable" has been revoked. In the case of "Automatic IP", an address change can occur. This depends on the connected PC or router.

NOTE

In the case of automatic IP address assignment, it is possible that another IP address will be specified for the dryve whenever the dryve is restarted or a new connection with a network is established.

This is due to the settings of your computer or your router/network.

The automatic change of the IP address can be prevented by setting a Manual IP address.

NOTE

A reboot of the dryve D1 is only possible if DI 7 "Enable" has been revoked.

NOTE

The IP address is displayed anew after the ethernet connector is plugged out and in again

NOTE

If you encounter any problems when configuring the Ethernet TCP/IP settings, please contact your network administrator to clarify whether the configuration used by you is compatible with the available networks.

NOTE

If HTTP is used for communication, the password is transmitted unsecured. This can lead to many and/or periodic connection losses in combination with certain anti-virus and firewall software. This issue can be solved by adopting/configure said software.

Ethernet TCP/IP



Automatic IP	☒	Manual IP	☐
IP-Address	192.168.0.10		
Subnet Mask	255.255.255.0		
Gateway	192.168.0.1		
Hostname	igus-dryve-D1-030c		
Apply Ethernet Settings	Reboot		

Preferred IP Address Assignment Method Selection

1. Select "Automatic IP" or "Manual IP"
2. *In the case of "Automatic IP", no further settings must be made
Please go straight to point 6*
3. Entry of the desired "IP Address"
4. Entry of the desired "Subnet Mask"
5. Entry of the desired "Standard Gateway"
6. Possible entry of the desired "Host Name"
7. Application of the TCP/IP settings via the "Reboot" button

4.6.2 Transmission Protocol

Selection of whether an unencrypted or encrypted connection to the web server of the dryve D1 motor control system is to be used.

"http" is set as the standard communication method.

Setting	Description
HTTP	The Hypertext Transfer Protocol is used to transfer data between the browser and the dryve D1 motor control system without encryption.
HTTPS	The Hypertext Transfer Protocol Secure performs the same task as "http", but encrypted. This enables the establishment of an <u>encrypted</u> connection between the dryve D1 motor control system and the browser. The "HTTPS" method is used by all normal browsers and therefore does not have to be installed separately. If HTTPS has been activated „https://" must be entered in front of the IP address to establish a connection to the dryve D1.
HTTPS Certificate	The use of "HTTPS" requires a digital certificate that uniquely identifies the server (dryve) and the client (browser). If there are special guidelines regarding the setting-up of a "HTTPS" connection, please consult your IT department.
External HTTPS Certificate	A certificate that has been especially issued for the dryve D1 by an official or non-official certification authority (CA).
Self-Signed HTTPS Certificate	A "HTTPS" certificate is generated for the IP address assigned to the dryve D1 at this time and is automatically stored in the browser. If an encrypted connection is established via "HTTPS", it is recommended that a fixed IP address (p.65) is set before the certificate generation.

Selection of the preferred Transmission Protocol

Transmission Protocol

https	☒	http
External HTTPS Certificate	Upload to dryve	
Self Signed HTTPS Certificate	Generate	

1. Select "HTTPS" or "HTTP"
 - a. If you choose "HTTP", no further settings must be made
 - b. Please go straight to point 3
2. Selection of the certificate type
 - a. "Self-signed HTTPS certificate"
 - i. Click on "Generate"
 - b. External "HTTPS" certificate
 - i. Selection of the desired certificate file via the dialogue box that opens
 - ii. Click on "Upload to the dryve"
3. Restart of the dryve D1 control system with a click on "Reboot" (Apply Ethernet Settings)

Bypass of a "HTTPS" Warning

If you use a self-signed certificate or an external certificate created by a non-official certification authority (CA) on the dryve D1 or in the browser, a warning indicating of an insecure "HTTPS" connection will be displayed when the dryve D1 IP Address is called up.

This warning must be shown as the browser cannot confirm whether this certificate is trustworthy.

There are two ways of avoiding this.

1. Use of a certificate that has been issued by an official certification authority
2. Manual installation of a certificate in the central "HTTPS" database of the respective computer

4.6.3 Bus Systems

Selection if the communication and control of the dryve D1 takes place via the user interface and the Digital Inputs/Outputs or whether it is controlled by CANopen or Modbus TCP Gateway.

	NOTE
	If one of the two bus systems has been activated, all essential movement control settings can only be changed via the dominant bus system – Drive Mode Selection (p.77). Settings via the user interface are only possible after the bus systems have been switched off.

	NOTE
	If no bus system is selected as the travel profile, objects can be read via CANopen or Modbus TCP as a gateway, but not written to

4.6.3.1 CANopen

Setting	Description
CANopen	Activation of communication complying to the CiA 402 standard.
Node ID	Value for explicit identification of the dryve D1 in a Node. The range is between 1 to 127. Must only be assigned once per Node.
Baud Rate	Transmission rates have been predefined in the user interface and can be selected with a drop-down menu. The baud rate of all connected devices must be identical. The maximum transfer speed depends on the total bus length and the transmission rate of the slowest device.

Bus Systems



CANopen ☐ OFF

Node ID

Baud rate

Modbus TCP ☐ OFF

Port

Unit Identifier

Activation of CANopen communication

1. Enter the "Node ID" intended for the dryve D1 in the text field
2. Select the Node transmission rate from the dropdown menu
3. Activate CANopen communication with the switch

After activation, it is possible to send and receive CANopen data to and from the dryve D1.

Movement commands, however, cannot be processed until dominance has been set on the Drive Profile page - [Drive Mode Selection](#) (p.77).

NOTE
If CANopen communication has been activated, it is no longer possible to select the Drive Mode Selection (p.77). To change this, the CANopen communication must first be switched off.

4.6.3.2 Modbus TCP Gateway

Setting	Description
Modbus TCP Gateway	Activation of communication.
Port	Selection of an Ethernet communication port. The standard is port 502. Port 80 and 443 are reserved by the motor controller and are not available for Modbus TCP gateway communication
Unit Identifier	Only required when using a separate gateway to connect to other Modbus protocols or multiple networks. If networks with the same IP address ranges are connected via gateways, this is used to differentiate between the individual motor controllers. Value for unique identification in the range between 1 and 255. May only be assigned once in the bus segment. When using the igus® function block for communication from Siemens PLC to dryve motor controllers via Modbus TCP gateway, this value must match the value set in the function block..

NOTE
When using Modbus TCP Gateway, a manual IP address is required in most cases. If the network has a router with a configured DHCP server, automatic IP address assignment can also be used.

Activation of Modbus TCP Gateway communication.

1. If another port than 502 is needed, enter the specific port for your Modbus TCP Gateway communication
2. Activate Modbus TCP Gateway communication with the switch

After activation, it is possible to send and receive data to and from the drive D1 with Modbus TCP Gateway. Movement commands, however, cannot be processed until dominance has been set on the Drive Profile page - [Drive Mode Selection](#) (p.77).

NOTE	
If Modbus TCP gateway-communication has been activated, it is no longer possible to select the Drive Mode Selection (p. 77). To change this, the Modbus TCP gateway communication must first be switched off.	

If you use a gateway for translation into another Modbus protocols, the following configuration steps must be taken.

3. If another port than 502 is needed, enter the specific port for your Modbus TCP Gateway communication
4. Enter the "Unit Identifier" intended for the drive D1
5. Activate Modbus TCP Gateway communication with the switch

NOTE	
If the Modbus TCP gateway connection is closed during operation, but the user interface is still accessible, the configured Modbus TCP gateway port has been closed. This can be due to the following reasons: 1. Faulty telegram structure - less or more data byte sent than specified in configuration. Refer to Byte Assignment Modbus TCP Gateway Telegram (p. 189) 2. Automatic "heart beat" signal is not sent 3 times by the master or not forwarded by the network 3. The master itself closes the communication port The motor controller can only close the port in case of error 1. or 2. A termination of the port due to a time without active communication between motor control and master controller is not implemented.	

4.6.4 PROFINET

Setting	Description
PROFINET	Activation of communication

Note	
When using PROFINET, the IP address is assigned via the PLC after activation and restart of the motor control unit and the setting on the user interface is overridden.	

Activation of PROFINET communication

1. Activate PROFINET communication with the switch.
2. Restart the motor control unit to activate PROFINET
This can be carried out using the 'Reboot' button (for Ethernet TCP/IP) or by switching off the logic voltage at X1.3.

Bus Systems

CANopen ☐ OFF
 Node ID
 Baud rate
 Modbus TCP Gateway ☐ OFF
 Port
 Unit Identifier
 PROFINET ☒ ON Please reboot the controller to activate PROFINET

3. Select the PROFINET/PROFIdrive operating mode on the Drive Profile page

Note

If PROFINET communication has been activated, it is no longer possible to select the operating mode (p. 76). To change this, PROFINET communication must first be switched off.

Deactivating PROFINET communication

1. deactivate PROFINET communication with the switch.
 2. restart the motor control unit to deactivate PROFINET
- This can be done using the 'Reboot' button (for Ethernet TCP/IP) or by switching off the logic voltage at X1.3.

4.6.5 Ethernet MAC address

Hardware address display of the dryve D1 motor control system. Explicit identification of the dryve D1 in a network.

Example display user interface:

MAC-Address: 84.11.C2.A0.25.03

Example of information on the back of the housing:



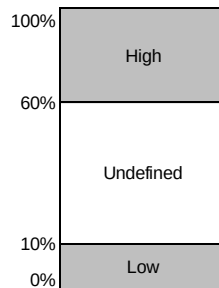
4.7 Inputs/Outputs

The digital inputs and outputs respectively receive and send signals for communication purposes "High" signals (H) or "Low" signals (L).

4.7.1 Digital Inputs

Signals under 10% of the voltage applied at X2.11 are evaluated as "Low". Signal over 60% as "High"

Input level percentage DI to voltage at X2.11



The functions of the Digital Inputs depend on the selected [Drive Mode Selection](#) (p.77). The respective functions for the "Binary", "Tipp/Teach" and "Pulse/Direction" operating modes are shown in the corresponding tables below.

1. Select the "Drive Profiles" page in the Navigation menu
2. Select your desired operating mode in the drop-down menu
3. Return to "Inputs/Outputs"

An input set to "H" will be set in the case of a "High" signal.
NO contacts (NO = Normally Open) must therefore be set for "H".

An input set to "L" will be set in the case of a "Low" signal.
NC contacts (NC = Normally Closed) must therefore be set for "L".

The Digital Inputs can be configured for PNP and NPN by changing a switch.
Pull-down (PNP) and Pull-Up (NPN) resistors for explicit signals in the not set state have already been installed in the drive D1.

When the [Bus Systems](#) (p. 66) are activated, parameterisation only possible via the dominant system and not via the user interface.

Further information regarding the exchange of signals via the Digital Inputs/Outputs, available at [Signal exchange](#). (p. 92)
Operating Modes

	NOTE
	In the operating modes Binary and Tipp/Teach, DI10 "Stop/Reset" is dominant. If this input is permanently set "high/1", no movement can be executed.

4.7.2 Operating Modes Digital Inputs

Binary

Digital Inputs



DI 1	Bit 0	☐	H
DI 2	Bit 1	☐	H
DI 3	Bit 2	☐	H
DI 4	Bit 3	☐	H
DI 5	Bit 4	☐	H
DI 6	Start	☐	H
DI 7	Enable	☐	H
DI 8	Limit Switch Positive	☐	H
DI 9	Limit Switch Negative	☐	H
DI 10	Stop/Reset	☐	H

Input	Function	Description
DI 1	Bit 0	Bit for binary coding
DI 2	Bit 1	Bit for binary coding
DI 3	Bit 2	Bit for binary coding
DI 4	Bit 3	Bit for binary coding
DI 5	Bit 4	Bit for binary coding
DI 6	Start	Start signal for the selected movement – positive edge
DI 7	Enable	Supply of electric current to the motor
DI 8	Limit Switch Positive	Limit switch at positive end of axis
DI 9	Limit Switch Negative	Limit switch at negative end of axis
DI 10	Stop / Reset	Stop of movement/ Acknowledgement of errors

Tipp/Teach

Digital Inputs



DI 1	Bit 0	☐	H
DI 2	Bit 1	☐	H
DI 3	Bit 2	☐	H
DI 4	Jog Left	☐	H
DI 5	Jog Right	☐	H
DI 6	Start/Teach	☐	H
DI 7	Enable	☐	H
DI 8	Limit Switch Positive	☐	H
DI 9	Limit Switch Negative	☐	H
DI 10	Stop/Reset	☐	H

Input	Function	Description
DI 1	Bit 0	Bit for binary coding
DI 2	Bit 1	Bit for binary coding
DI 3	Bit 2	Bit for binary coding
DI 4	Jog Left	Negative traversing with jog velocity
DI 5	Jog Right	Positive traversing with jog velocity
DI 6	Start/Teach	Start signal movement - Negative edge Teach target position - Continuous signal for 5 seconds
DI 7	Enable	Supply of electric current to the motor
DI 8	Limit Switch Positive	Limit switch at positive end of axis
DI 9	Limit Switch Negative	Limit switch at negative end of axis
DI 10	Stop / Reset	Stop of movement/ Acknowledgement of errors

Pulse/Direction**Digital Inputs**

DI 1	Clock	☒ H
DI 2	Direction	☒ H
DI 3	-	☒ H
DI 4	-	☒ H
DI 5	-	☒ H
DI 6	-	☒ H
DI 7	Release	☒ H
DI 8	Limit Switch Positive	☒ H
DI 9	Limit Switch Negative	☒ H
DI 10	-	☒ H

Input	Function	Description
DI 1	Clock	Pulse signal for frequency control
DI 2	Direction	Direction information
DI 3	Not used	-
DI 4	Not used	-
DI 5	Not used	-
DI 6	Not used	-
DI 7	Enable	Supply of electric current to the motor
DI 8	Limit Switch Positive	Limit switch at positive end of axis
DI 9	Limit Switch Negative	Limit switch at negative end of axis
DI 10	Reset	Acknowledgement of errors

NOTE

The inversion of the input signals at DI1 and DI2 has no functionality when using Step/Direction.

CANopen and Modbus TCP Gateway

When using the bus systems, the digital inputs DI1 to DI6 and DI10 have no function and can be used as an interface for communication between external switches, sensors or devices to the bus master.

The function of the digital inputs DI7 "Enable", DI8 "Limit switch positive" and DI9 "Limit switch negative" are kept.

If the [Limit Switch](#) (p. 59) are deactivated and the referencing is not executed via limit switches, DI8 and DI9 can also be used for the interface function.

4.7.3 Digital Outputs

The dryve D1 outputs status messages via the five Digital Outputs.

These can be evaluated by a master control unit (PLC, etc.) or can be used for information display via an external signal hardware.

When the [Bus Systems](#) (p. 66) are activated, parameterisation only possible via the dominant system and not via the user interface.

Configuration Binary, Tipp/Teach. Step/Direction, Modulo

Input	Function	Description
DO 1	Ready	Positioning commands can be accepted
DO 2	Active	A positioning command is being executed
DO 3	Reference	The system has been referenced
DO 4	Alert	Warning
DO 5	Error	Error

Configuration Electronic Actuator

Input	Function	Description
DO 1	Ready	Positioning commands can be accepted
DO 2	Extended	The extended target position has been reached.
DO 3	Retracted	The retracted target position has been reached.
DO 4	Maintenance	The maintenance position has been reached.
DO 5	Error	Error

An output set to "H" sends a "High" signal to indicate that it has been activated.

An output set to "L" sends a "Low" signal to indicate that it has been activated.

NOTE
The digital inputs have been permanently set to PNP. Micro-controllers with inputs set to NPN can communicate with the dryve D1 despite the different characteristics due to the built-in "pull-down" resistors.

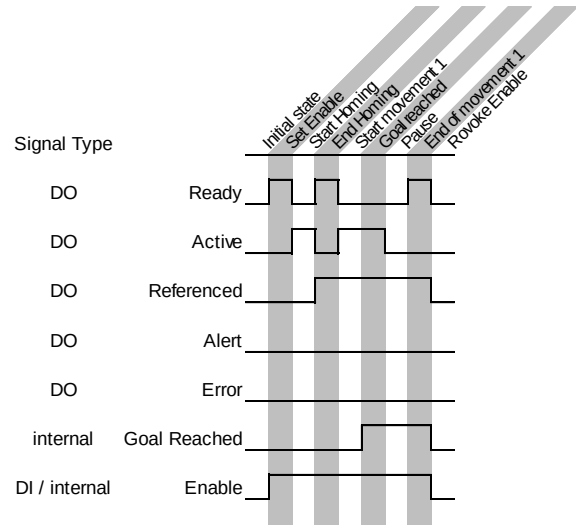
Digital Outputs



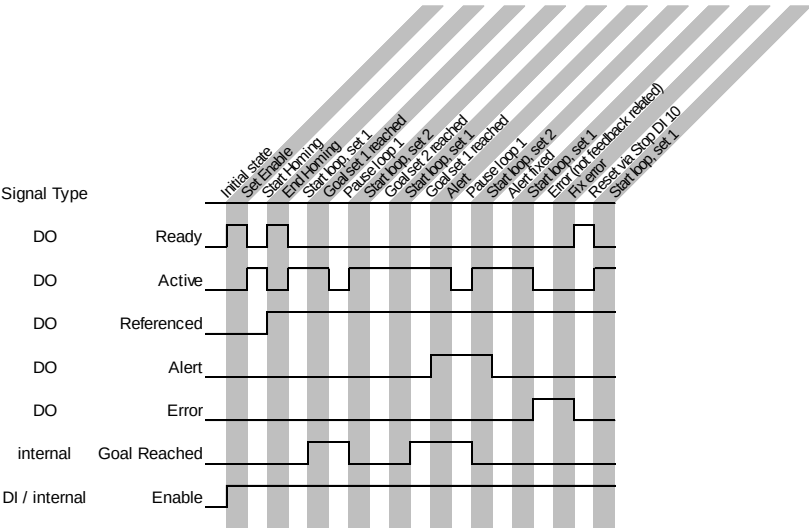
DO 1	Ready	
DO 2	Active	
DO 3	Reference	
DO 4	Alert	
DO 5	Error	

4.7.4 Digital Outputs Signal Characteristics

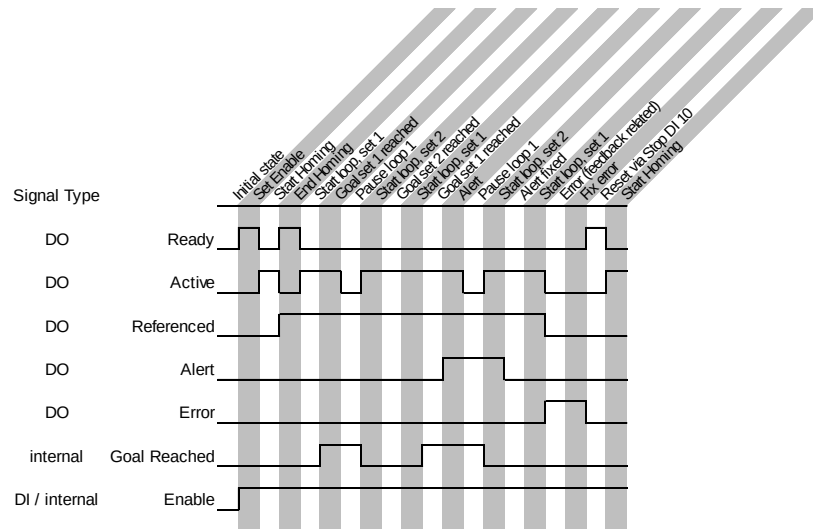
Example: Simple Positioning Movement



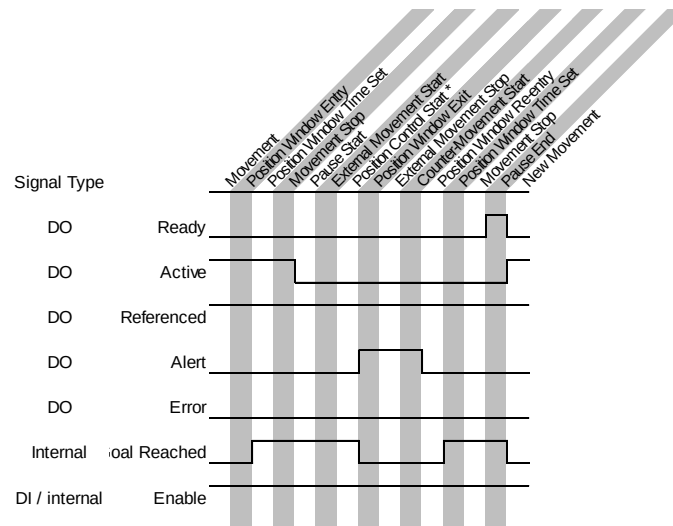
Example: I/O Movement with Error



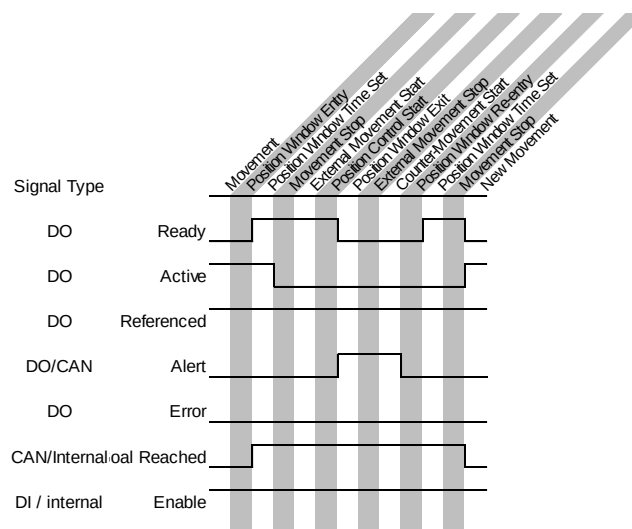
Example: I/O Movement with Feedback Error



Example: I/O Movement with Pause, Closed Loop and active Positioning Window



Example: Bus operation with Closed Loop and active Positioning Window



4.7.5 Analogue Inputs

0 V to 10 V and ± 10 V signals can be converted into setpoints and position feedback via the analogue inputs.

Setting	Operating Mode
AI 1	Velocity or position setpoint.
AI 2	Position Feedback from analogue sensor.

Analogue Inputs



AI 1	0-10 VDC		± 10 VDC
AI 2	0-10 VDC		± 10 VDC

1. Specify if the analogue inputs shall process 0 to 10 V signals with a resolution of 11 bit or a ± 10 V signal with a resolution of 12 bit
2. If ± 10 V signals are used, the lower value of the [Analogue Absolute Feedback](#) (p. 63) must be set to the minimum voltage value used

4.7.6 Digital Input Switch Characteristics

When the [Bus Systems](#) (p. 66) are activated, parameterisation only possible via the dominant system and not via the user interface.

Digital Input Switching



PNP ▼

Setting	Description
PNP	In the set state, the input is raised to U_B (voltage being applied to X2.11). In the non-connected state, the signal is pulled to ground due to a "pull-down" resistor In the case of PNP, the flow of current is from the output of the higher-level control system to the input of the dryve D1.
NPN	In the set state, the input is pulled to ground. In the non-connected state, the signal is raised to U_B (voltage being applied to X2.11) due to a "pull-up" resistor In the case of NPN, the current flows from the input of the dryve D1 to the output of the higher-level control system.

NOTE
The switching type of the higher-level control unit and the dryve D1 must match.

4.8 Drive Profile

4.8.1 Drive Mode Selection

The selection will set the corresponding drive mode dominant and is now entitled to execute movements.

Available for selection are:

- [Binary](#) (p. 83) – Use of the digital/analogue inputs and digital outputs to preselect motion profiles
- [Tipp/Teach](#) (p. 83) – Preselection of single movements with external manual motion controll
- [Step/Direction](#) (p. 99)– Movement conversion from square-wave frequency signals with dedicated directional preset
- [CANopen](#) (p. 106)– Movement control via CANopen communication protocol
- [Modbus TCP Gateway](#) (p. 187)– Movement control via Modbus TCP Gateway communication protocol
- [Electronic Actuator](#) (p. 101)– Direct execution of 3 predefined movements if a signal is applied to digital inputs 1 to 3
- [Modulo Positioning](#) (p. 101)– Absolute positioning with target reference to 360° and execution of a movement with the shortest distance in each direction
- [PROFINET/PROFIdrive](#) (p. 197)– Movement control via PROFINET/PROFIdrive communication protocol

Only "Binary", "Tipp/Teach", "Electronic Actuator" and "Modulo Positioning" require further settings.

For [Step/Direction](#) (p. 99), [CANopen](#) (p. 101) and [Modbus TCP Gateway](#) (p.187) please continue in the respective chapter. To visualize movements and tune them, please continue at the [Oscilloscope](#) (p. 85).

NOTE

When the [Bus Systems](#) (p. 66) are activated, parameterisation only possible via the dominant system and not via the user interface.

NOTE

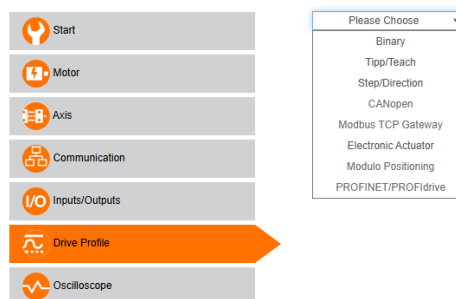
The maximal values for "Position", "Acceleration" ("Deceleration") and "Velocity" are set on the Axis page under [Motion Limits](#) (p. 56)

NOTE

It is not possible to change the operating mode when "Enable" is set at digital input DI7.

Creating Movements

To create a movement, fill in the cells of a row from left to right. The movement type must be specified in the "Mode" column. The functions of the other cells in a row depend on the selected mode.



Parameterising Table

Each row of the table represents a positioning movement

Binary							
	Mode	Position (mm)	Acceleration (mm/s²)	Velocity (mm/s)	Deceleration (mm/s²)	Pause (ms)	Next
1	HOM	SCP				0	2
2	ABS	10	5	5	5	1000	3
3	REL	-10	5	5	5	1000	2
4							

4.8.2 Available Movement Types

Mode	Description
HOM	Homing run With absolute positioning (ABS), a homing run must be executed to define an explicit zero position. The homing method must be specified on the "Axis" page. If a Homing is necessary it must be executed after every restart of the drive D1 control system, after the controller is disabled and no position feedback is used, an error caused by position feedback hardware or a change of the motor type, peripheral motor devices or the axis parameters. If an analogue absolute feedback is used, the result of homing is permanently retained after the initial position comparison is executed.
ABS	Absolute Positioning Movement with an absolute relation to the home point. A successful homing run is a requirement for using absolute positioning. Example: Start is 0 mm Desired position 1 equals to 100 mm, entered target is 100, moved distance +100 mm Desired position 2 equals to 50 mm, entered target is 50, moved distance -50 mm Desired position 3 equals to 150 mm, entered target is 150, moved distance +100 mm Desired position 4 equals to -25 mm, entered target is -25, moved distance +125 mm Desired position 5 equals to 75 mm, entered target is 75, moved distance +100 mm
REL	Relative Positioning Movement with a relation to the actual position. Example: Start is 0 mm Desired position 1 equals 100 mm entered target is 100, moved distance +100 mm Desired position 2 equals 50 mm entered target is -50 (minus 50), moved distance -50 mm Desired position 3 equals 150, entered target is 100, moved distance 100 mm
ROT	Rotation Rotary movement with a set motor rotation direction, acceleration and velocity. The rotary movement is executed continuously. It is only stopped in the event of a "Stop", Quick Stop", cancellation of the enabled status or an error occurrence.
ARO	Analogue Rotation Rotary movement with a set motor rotation direction, acceleration and maximum velocity. The rotation velocity setpoint is set via the signal at Analogue Input "AI 1". The signal can be supplied manually or by a higher-level control system. If a voltage interval of 0 V to 10 V has been selected, the maximum speed can be reached at 10 V. If an interval of -10 V to 10 V has been chosen, the maximum speed can be reached at 10 V. The rotary movement is executed continuously at a certain velocity after the setpoint has been set. The movement is only stopped because of one of the following actions/commands: - The value of the analogue setpoint is set to a standstill - A "Stop" command - A "Quick Stop" command - DI 7 "Enable" is revoked - An "Error" occurs
ADR	Analogue Rotation with Direction Definition Rotary movement with a set acceleration and maximum velocity. The rotation direction and the rotation velocity setpoint is set via Analogue Input "AI 1". The signal can be supplied manually or by a higher-level control system. Voltage interval of 0 V to 10 V - 0 V to 5 V motor rotating anti-clockwise - 5 V to 10 V motor rotating clockwise Maximum velocity at 0 V or 10 V - 0 V to +10 V motor rotating clockwise Maximum velocity at -10 V or +10 V

Mode	Description
ADR	Voltage interval of -10 V to +10 V - -10 V to 0 V motor rotating anti-clockwise The rotary movement is executed continuously at a certain velocity after the setpoint has been set. The movement is only stopped because of one of the following actions/commands: - The value of the analogue setpoint is set to a standstill - A "Stop" command - A "Quick Stop" command - DI 7 "Enable" is revoked - An "Error" occurs
APS	Analogue Positioning Movement with a set acceleration and maximum velocity. The position is defined by the "Min. Available Stroke" and "Max. Available Stroke", the voltage applied to Analogue Input "AI 1" and the selected voltage interval. The signal can be supplied manually or by a higher-level control system. Voltage interval of 0 V to 10 V - Minimum position at 0 V - Maximum position at 10 V Voltage interval of -10 V to 10 V - Minimum position at -10 V - Maximum position at 10 V After the target position is reached nor "Ready" signal at Digital Output DO1 will be emitted with Analogue Positioning. In this case the "Target Reached" information can be obtained with the negative edge of Digital Output DO2 "Active" instead. A successful homing run is a requirement for using absolute positioning. Theoretically, a positioning accuracy of 0.488 mm is available with the 11-bit resolution and a travel distance of, for example, 1000 mm. In comparison, a positioning accuracy of 0.0488 mm is available for a travel distance of 100 mm. This accuracy is, however, reduced when real circumstances are considered due to interference and other occurrences. As a result, deviations may occur depending on the environment and the used linear axis. It is also important to consider the situation to which this accuracy is applied. If a new position is to be approached in the immediate vicinity, the configurable dead bands and filter times of the analogue input play a role (Analogue Absolute Feedback, p. 63). Thus, it may not be possible to reach a target position from a too near distance from the actual position. If, however, the same target position is approached from a greater distance, it is quite possible to reach it.

4.8.3 Movement Type Configuration

In the following chapter the configuration steps for each mode are explained.

HOM

1. Select "HOM" in the "Mode" drop-down menu.
If "SCP" has been selected as homing type on the "Axis" page, go straight to point 4
2. The "Position" value automatically corresponds to the homing type selected on the "Axis" page
3. Enter the desired values for "Acceleration", "Velocity" and "Deceleration". If no value or a 0 (zero) is entered at "Deceleration", the value from "Acceleration" is used
4. If a delay is needed, enter the desired time in milliseconds (ms) under "Pause"
5. Enter the row number of the movement that is to be executed subsequently in "Next".
If no automatic subsequent movement shall be executed, type in a 0

ABS

1. Select "ABS" in the "Mode" drop-down menu
2. Specify the target position. There are various ways available:
 - a. Enter the desired target position in relation to the home point at "Position"
 - b. Use of the user interface for teaching
 - i. Mark the desired position by selecting the number field of the row
 - ii. Move to the desired target position with the "Position Adoption" buttons.
For this purpose, the motor must have been enabled via "DI 7"
 - iii. Click on the "Teach" button
3. Enter the desired values for "Acceleration", "Velocity" and "Deceleration". If no value or a 0 (zero) is entered at "Deceleration", the value from "Acceleration" is used.
4. If a delay is needed, enter the desired time in milliseconds (ms) under "Pause"
5. Enter the row number of the movement that is to be executed subsequently in "Next"
If no automatic subsequent movement shall be executed, type in a 0

REL

1. Select "REL" in the "Mode" drop-down menu
2. Enter the desired target position in relation to the actual position at "Position"
3. Enter the desired values for "Acceleration", "Velocity" and "Deceleration". If no value or a 0 (zero) is entered at "Deceleration", the value from "Acceleration" is used
4. If a delay is needed, enter the desired time in milliseconds (ms) under "Pause"
5. Enter the row number of the movement that is to be executed subsequently in "Next".
If no automatic subsequent movement shall be executed, type in a 0

ROT

1. Select "ROT" in the "Mode" drop-down menu
2. Select the desired motor rotation direction at "Position"
3. Enter the desired "Acceleration" and "Velocity values"

ARO

1. Select "ARO" in the "Mode" drop-down menu
2. Select the desired motor rotation direction at "Position"
3. Enter the desired values for "Acceleration" and "Deceleration". If no value or a 0 (zero) is entered at "Deceleration", the value from "Acceleration" is used
4. The final setup of the "ARO" positioning mode is described at [Signal Exchange, Binary](#)

ADR

1. Select "ADR" in the "Mode" drop-down menu
2. Enter the desired values for "Acceleration" and "Deceleration". If no value or a 0 (zero) is entered at "Deceleration", the value from "Acceleration" is used
3. The final setup of the "ADR" positioning mode is described at [Signal Exchange, Binary \(p.69\)](#)

APS

1. Select "APS" in the "Mode" drop-down menu
2. Enter the desired values for "Acceleration", "Velocity" and "Deceleration". If no value or a 0 (zero) is entered at "Deceleration", the value from "Acceleration" is used
3. The final setup of the "APS" positioning mode is described at [Signal Exchange, Binary \(p.69\)](#)

CANopen and Modbus TCP Gateway

If CANopen or Modbus TCP Gateway has been selected, it is possible to display all available objects live on the drive profile page.

Writeable objects can also be edited via this page. Values entered are automatically transferred to the corresponding parameters on the user interface.

As a pre-condition, the [Bus Systems](#) (p. 66) must be deactivated and the "enable" at DI7 must be deactivated for specific objects - see [Entering Parameters](#) (p. 34).

Start

Motor

Axis

Communication

I/O Inputs/Outputs

Drive Profile

Oscilloscope

Enable

Ready

Goal Reached

Referenced

Alert

Error

Temperature drye 38.96 °C

Motor Current 0.04 A

Actual Position 0.00 mm

Goal Position 0.00 mm

CANopen

CANopen communication to master controller set dominant
CANopen must bet set to On on communication page

Statusword

Controlword

Frequently Used Objects

00 Ready to Switch On

01 Switched On

02 Operation Enabled

03 Fault

04 Voltage Enable

05 Quick-Stop

06 Switch On Disabled

07 Warning

08 Not Assigned

09 Remote/Enable DI7

10 Target Reached

11 Internal Limit Active

12 Operation Mode Specific

13 Not Assigned

14 Not Assigned

15 Not Assigned

00 Switch On

01 Voltage Enable

02 Quick-Stop

03 Enable Operation

04 Operation Mode Specific

05 Operation Mode Specific

06 Operation Mode Specific

07 Fault Reset

08 Halt

09 Operation Mode Specific

10 Reserved

11 Not Assigned

12 Not Assigned

13 Not Assigned

14 Not Assigned

15 Not Assigned

6040.0 Controlword

6041.0 Statusword

2014.0 Status flags

6092.1 Feed

6092.2 Shaft revolutions

6091.1 Gear ratio Motor shaft

6091.2 Gear ratio Driving shaft

60C5.0 Max acceleration

6085.0 Quick stop deceleration

6064.0 Position actual value

606C.0 Velocity actual value

60F4.0 Following error actual value

2000.1 Motor current actual value

6061.0 Modes of operation display

6098.0 Homing method

609A.0 Homing acceleration

6099.1 Search Velocity for switch

6099.2 Search Velocity for zero

607C.0 Home offset

607F.0 Max profile velocity

607A.0 Target position

6083.0 Profile acceleration

6081.0 Profile velocity

6084.0 Profile deceleration

60FF.0 Target velocity

200E.1 Analog input value AI1

200E.2 Analog input value AI2

HEX

DEC

1f 00 00 00

27 16 00 00

01 00 00 00

70 17 00 00

01 00 00 00

30 f2 00 00

e8 03 00 00

a0 86 01 00

a0 86 01 00

00 00 00 00

00 00 00 00

00 00 00 00

26 00 00 00

06 00 00 00

25 00 00 00

00 00 00 00

00 00 00 00

00 00 00 00

00 00 00 00

00 00 00 00

80 a1 c0 3f

80 ef c0 3f

31

5671

1

6000

1

62000

1000

100000

100000

0

0

0

38

6

37

0

0

0

0

0

1.505

1.507

PROFINET/PROFIdrive

If PROFINET/PROFIdrive has been selected it is possible to control the motor controller via the PROFIdrive Standard-Telegrams.

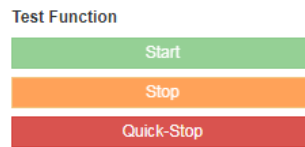
- Telegram 1
Speed setpoint 16 Bit
- Telegram 2
Speed setpoint 32 Bit
- Telegram 7
Single positioner with choice of traverse set
- Telegram 9
Single positioner with Manuel Data Input (MDI)

Example Telegram 7

	Modus	Ziel (mm)	Beschleunigung (mm/s²)	Geschwindigkeit (mm/s)	Verzögerung (mm/s²)
1	HCM	LSP	100	15	0
2	ABS	500	500	450	0
3	REL	-200	50	220	0
4					
5					
6					

4.8.4 Test Function

Created commands can be tested with the help of the "Start", "Stop" and "Quick-Stop" buttons. This feature is only available with "Binary" and "Tipp/Teach"



1. Select the "Inputs/Output" tab in the Navigation menu
2. Set DI 7 "Enable"
3. Select the "Drive Profile" tab in the Navigation menu
4. Mark the row to be executed by clicking in the number field in front of it
5. Click on "Start" to execute the movement
6. Click on "Stop" to stop the movement with a pre-set rate of deceleration
7. Click on "Quick Stop" to stop the movement with the rate of deceleration previously set at "Motion Limits" on the "Axis" page.

4.8.5 Position Adoption

The buttons under the parameterising table on the right-hand side of the screen can be used to manually move the motor clockwise or anti-clockwise with the Jog Velocity specified under "Motion Limits".



With the "Teach" button, manually reached positions are adopted as the target position in a previously marked row of the [Parameterising Table](#) (p. 77).

Rotation Direction Determination

1. View from drive shaft onto motor block
2. Click on "Clockwise" movement button
3. Clockwise motor rotation



4.8.6 Binary

The following parameters are set on the page [Drive Profile](#) (p. 82).

Delays specified at "Pause" are not started until the positioning movement has ended. The row link "Next" is executed when the pause time is lapsed.

Execution of the created motion sequences is explained under [Signal Exchange, Binary](#) (P. 92).

The "Binary" mode is available for the following encoder/motor combinations.

Feedback	Stepper Motor	DC-Motor	EC/BLDC-Motor
Without Feedback	Yes	ROT, ARO, ADR only	Yes, 3 pole Hall Sensor required
Encoder as Line Driver (p. 239)	Yes	Yes	Yes
Encoder as Single Ended (p. 239)	Yes	Yes	Yes
2 channel Hall Sensor (p. 239)	Not supported	Yes	Not supported
Analogue Feedback (p. 239)	Not supported	Yes	Not supported

NOTE
It is <u>not</u> possible to change the operating mode when "Enable" is set at digital input DI7.

The following command modes are available in the "Binary" operating mode:

Mode	Description
HOM	Homing run
ABS	Absolute Positioning
REL	Relative Positioning
ROT	Rotation
ARO	Analogue Rotation
ADR	Analogue Rotation with Direction Definition
APS	Analogue Positioning

4.8.7 Tipp/Teach

The following parameters are set on the page [Drive Profile](#) (p. 82).

Delays specified at "Pause" are not started until the positioning movement has ended. The row link "Next" is executed when the pause time is lapsed.

Execution of the created motion sequences is explained under [Signal Exchange, Tipp/Teach](#) (p. 96)

The "Tipp/Teach" mode is available for the following encoder/motor combinations

Feedback	Stepper Motor	DC-Motor	EC/BLDC-Motor
Without Feedback	Yes	Not supported	Yes, 3 pole Hall Sensor required
Encoder as Line Driver (p. 239)	Yes	Yes	Yes
Encoder as Single Ended (p. 239)	Yes	Yes	Yes
2 channel Hall Sensor (p. 239)	Not supported	Yes	Not supported
Analogue Feedback (p. 239)	Not supported	Yes	Not supported

NOTE
It is <u>not</u> possible to change the operating mode when "Enable" is set at digital input DI7.

The following command modes are available in the "Binary" operating modes

Mode	Description
HOM	Homing run
ABS	Absolute Positioning

4.8.8 Electronic Actuator

The following parameters are set on the page [Drive Profile](#) (p. 82).

NOTE
It is <u>not</u> possible to change the operating mode when "Enable" is set at digital input DI7.

The "Electronic Actuator" mode is available for the following encoder/motor combinations

Feedback	Stepper Motor	DC-Motor	EC/BLDC-Motor
Without Feedback	Yes	ROT, ARO, ADR only	Yes, 3 pole Hall Sensor required
Encoder as Line Driver (p. 239)	Yes	Yes	Yes
Encoder as Single Ended (p. 239)	Yes	Yes	Yes
2 channel Hall Sensor (p. 239)	Not supported	Yes	Not supported
Analogue Feedback (p. 239)	Not supported	Yes	Not supported

The following command modes are available in the "Electronic Actuator" operating modes

Mode	Description
HOM	Homing run
ABS	Absolute Positioning

4.8.9 Modulo Positioning

The following parameters are set on the page [Drive Profile](#) (p. 82).

 WARNING!
If a different operating mode (page 75) should be selected after using modulo positioning, it is essential to restart the motor control unit to avoid incorrect positioning and possible accidents!

NOTE
Modulo positioning is only available under the "Rotary" movement type ("Start" page). The feed must be set to 360°. The minimum available stroke is automatically set to "0°" and the maximum available stroke is set to "360°" and cannot be changed.

NOTE
It is <u>not</u> possible to change the operating mode when "Enable" is set at digital input DI7.

The "Modulo Positioning" mode is available for the following encoder/motor combinations

Feedback	Stepper Motor	DC-Motor	EC/BLDC-Motor
Without Feedback	Yes	ROT, ARO, ADR only	Yes, 3 pole Hall Sensor required
Encoder as Line Driver (p. 239)	Yes	Yes	Yes
Encoder as Single Ended (p. 239)	Yes	Yes	Yes
2 channel Hall Sensor (p. 239)	Not supported	Yes	Not supported
Analogue Feedback (p. 239)	Not supported	Yes	Not supported

The following command modes are available in the "Modulo Positioning" operating modes

Mode	Description
HOM	Homing run
ABS	Absolute Positioning
REL	Relative Positioning
ROT	Rotation
ARO	Analogue Rotation
ADR	Analogue Rotation with Direction Definition
APS	Analogue Positioning

4.9 Oscilloscope and Controller Data

4.9.1 Oscilloscope Settings

The internal oscilloscope enables simultaneous observation of 4 channels over a period of 5 seconds. Each channel can transfer one of eight different values.

Oscilloscope Settings



Channel 1: 	Please Choose ▼
Channel 2: 	Please Choose ▼
Channel 3: 	Please Choose ▼
Channel 4: 	Please Choose ▼

- Actual current (A)
- Following Error
- Speed (rpm)
- Actual position
- Desired position
- Digital inputs
- Analogue input 1
- Analogue input 2

Start
Stop
Save

1. Select the desired value with a drop-down menu
2. Click on "Start" to start the oscilloscope
3. Click on "Stop" to stop the recording
4. Click on "Save" to download the data (in the form of a *.csv file) recorded by the oscilloscope. The file will automatically be stored in the download folder of your browser

The axes corresponding to the respective channels are located at the left and right of the oscilloscope and are scaled automatically. The Y axes are scalable manually by scrolling with the mouse wheel. All Y axes are scaled simultaneously with the same factor. The automatic scaling is reactivated with a double click.

4.9.2 Controller Data

The dryve D1 can control the motor current, the velocity and the rotor position.

PI controllers are used for current control and velocity control whereas a P controller is used for rotor position control. Alteration of the individual parameters enables adaptation of the dryve D1 to the requirements of very different applications.

For igus® motors, universal parameters have already been set.

In applications with high velocities or with heavy loads or special attention to noise minimisation , it might be necessary to fine-tune the Control Data settings.

When the [Bus Systems](#) (p. 66) are activated, parameterisation only possible via the dominant system and not via the user interface.

Current control parameters

Stepper Motors: Silent operation can be achieved by lowering the P and I parameters. However, this is at the expense of dynamic responsiveness and the maximum torque generation.

EC/BLDC-Motor: Dynamic operation with a high torque can be achieved by raising the P parameter and lowering the I parameter.

DC-Motor: Dynamic operation with a high torque can be achieved by increasing the P parameter and I parameter.

Speed control parameters

All motor types: If the inertia of the overall application is low, the P parameter can be reduced for a rough harmonisation. The I parameter must be adapted for fine-tuning.

Position control parameters

All motor types: If the inertia of the application is low, the P parameter can be reduced.

Controller Data



Current

Amplification (P)	15
Time Constant (I)	8000

Velocity

Amplification (P)	0,2
Time Constant (I)	18

Position

Amplification (P)	100
-------------------	----------------------------------

4.9.3 Controller Data Fine-Tuning

If you want to manually parameterise motors not supplied by igus®, observe the following instructions.

	CAUTION!
A current controller with incorrect settings may damage the drive D1 or the connected motor! Excessively high currents might be supplied to the motor!	

	CAUTION!
Inappropriate Control Data tuning may lead to unforeseeable movements and vibrations. This may result in an accident or equipment damage. The Controller Data must be altered must small steps only!	

NOTE
If a Stepper Motor or DC-Motor is operated in Open-loop (p. 238) only the current control parameters needs to be set

1. Select comparable motor from the igus® product catalogue. Check whether the motor has a mounted encoder and/or brake
2. Select the motor on the "Motor" page and click "Apply"
3. Go to the "Oscilloscope" page and make a note of the "Controller Data"
4. Go back to the "Motor" page and select "Custom article"
5. Enter the specific currents for the non- igus® motor and confirm by clicking on "Apply"
6. Return to the "Oscilloscope" page
7. Enter the "Controller Data" previously noted
8. Go to the "Drive Profile" page and enter parameters leading to a [oscillating movement](#) (p. 238) with the maximum acceleration, velocity and deceleration as used in your application
9. Set "Enable" on the "Inputs/Outputs" page or by an external signal to DI 7
10. Go to the "Drive Profile" page and start the oscillating movement
11. Go to the "Oscilloscope" page and fine-tune the "Controller Data" while the motor is moving

NOTE
Until a feel of how to correctly fine-tune the combination of drive D1, motor and linear or rotary axis in your application is gained, modifications should be done following magnitudes only. Current Amplification $P \leq 1$ Current Time Constant $I \leq 10$ Velocity Amplification $P \leq 0.1$ Velocity Time Constant $I \leq 0.1$ Position Amplification $P \leq 10$

12. Make a note of the "Controller Data" found
13. Stop the movement and repeat the procedure for medium and slow rates of acceleration, velocity and deceleration
14. Once again, make a note of the "Controller Data" found
15. Fine-tune the "Controller Data" at a motor standstill with "Enable" being set
16. Once again, make a note of the "Controller Data" found
17. Compare all the "Controller Data" found and calculate the averages of the individual parameters
18. Enter the average value in the respective field of the "Controller Data"

4.10 Feed Rate Specification

If the "Feed rate" is not known, It can be easily determined with a measuring instrument such as a steel ruler. This procedure is described with reference to an example.

NOTE

Do not carry out a homing run before specifying the feed rate.

Choose a moderate speed to avoid accidents

Go to the "Axis" page

1. Enter "70" as the "Feed Rate" value

Motion Limits

Max. Velocity (mm/s)	5
Jog Velocity (mm/s)	2
Max. Acceleration (mm/s ²)	1000
Quick-stop (mm/s ²)	1000
Following Error (mm)	10
Positioning Window (mm)	0
Positioning Time (ms)	0

2. Set the following movement limits.
3. Set "Enable" on the "Inputs/Outputs" page or by an external signal to DI 7
4. Go to the "Drive Profile" page and select "Binary" from the drop-down menu
5. Make a note of the actual position shown in the status area

This value is called XS1.

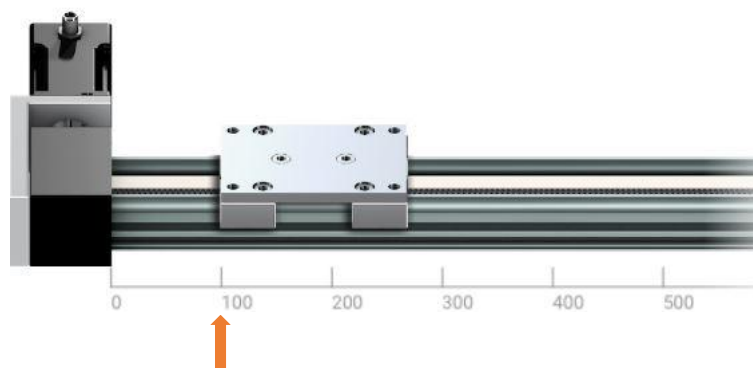
(In this example: XS1 = 80 mm)

Temperature dryve	55.10 °C
Motor Current	0.03 A
Actual Position	80.00 mm
Goal Position	80.00 mm

6. Measure the distance of the carriage to one end of the axis.

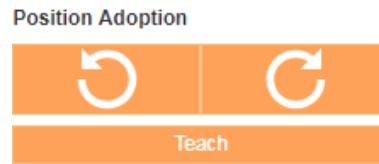
This value is called XM1

(In this example: XM1 = 100 mm).



7. Use the "Position Adaption" buttons to execute short movements to check whether the set "Jog Velocity" is set for a safe operation.

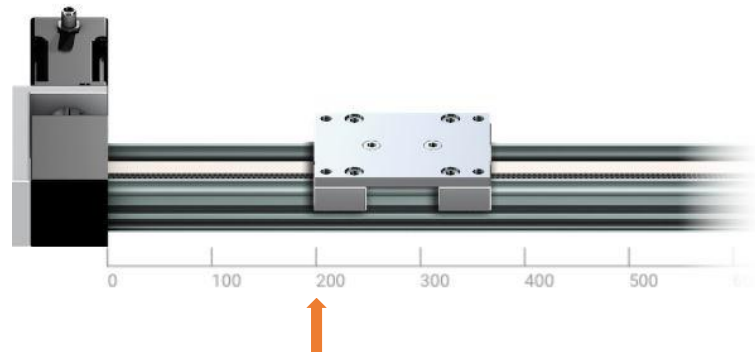
If the carriage moves very slowly or hardly at all, gradually increase the "Jog Velocity" on the "Axis" page, until a movement is clearly visible. If the carriage moves too quickly, reduce the "Jog Velocity"



8. Use the Position Adaption buttons to move the carriage as far as possible. Measure the distance of the carriage to one end of the axis again.

This value is called XM2.

(In this example: XM2 = 200 mm)



Read the new "Actual Position" in the status window.

This value is called XS2.

(In this example XS2 = 160 mm)

Temperature drive	56.87 °C
Motor Current	0.03 A
Actual Position	160.00 mm
Goal Position	160.00 mm

9. Now calculate the correct "Feed Rate" with the following formula:

$$\text{Feed Rate} = \frac{|XM2 - XM1|}{|XS2 - XS1|} * 70 \text{ [mm]}$$

In this example:

$$\text{Feed Rate} = \frac{|200 - 100|}{|160 - 80|} * 70 \text{ [mm]} = 87,50 \text{ [mm]}$$

10. Enter the new "Feed Rate" at "Axis".

4.11 Absolute Feedback

Absolute Feedback



AI 1 Target Value Min. (V)	0		
AI 1 Target Value Max. (V)	10		
AI 1 Dead Band Zero Value (V)	0,1		
AI 1 Dead Band Input Signal (V)	0,01		
AI 1 Filter (ms)	10		
AI 2 Absolute Value Min. (V)	1.5062	→	0
AI 2 Absolute Value Max. (V)	1.5062	→	10

Analogue Setpoints Configuration (APS, ARO, ADR)

1. Enter the voltage for the minimum stroke in "AI 1 Stroke Min".
2. Enter the voltage for maximum stroke in "AI 1 Stroke Max".

Absolute Feedback Configuration

1. Activate the "Feedback" on the "Motor" page
2. Select "Analogue Feedback" in the drop-down menu
3. Select the "AAF" method (Analogue Absolute Feedback) at "Homing" on the "Axis" page
4. Set the DI 7 "Enable" signal (external signal or switch on the "Inputs/Outputs" page)
5. Go to the "Drive Profile" page and use the "Position Adoption" buttons to move to the negative end of the axis or to the maximum negative position corresponding to your application
6. Go to "Absolute Feedback" on the "Axis" page
7. Click on the orange arrow next to "AI 2 Absolute Value min. (V)" to automatically transfer the actual voltage value to the field on the right
8. Go back to the "Drive Profile" page
9. Use the "Position Adoption" buttons to move to the positive end of the axis or to the maximum positive position corresponding to your application
10. Go back to "Analogue Feedback"
11. Click on the orange arrow next to "AI 2 Absolute Value max. (V)" to automatically transfer the actual voltage value to the field on the right

The "Absolute Feedback" has now been configured and is ready for use.

4.12 Restore Factory Settings

A reset button, located inside the dryve D1, enables a restoration of the factory settings. The opening, located under the product label, is covered to prevent accidental activation. The opening diameter is 1 mm.

Actuation Period	Function
3 to 9 seconds	Reset of the network settings (IP addresses assigned automatically)
More than 10 seconds	Reset to factory settings, incl. deletion of all entered parameters

1. Pierce the product label on the right-hand side of the left-hand "u" arc of the igus® logo
2. Insert a long thin object, e.g. a straightened paper clip, into the opening
3. Press and hold the button down either for 3 or 10 seconds, depending on which reset you want to perform
4. Remove the used object
5. The dryve D1 will now reboot
6. Check whether the IP address has changed. If yes, make a note of it
7. Enter the IP Address in your browser to open the user interface again

4.12.1 Rest Opening Placement



Note

In rare cases, the opening may not be fully present – in such instances, please contact support at: de-dryve@igus.net

5 External Signal Exchange

5.1 Binary

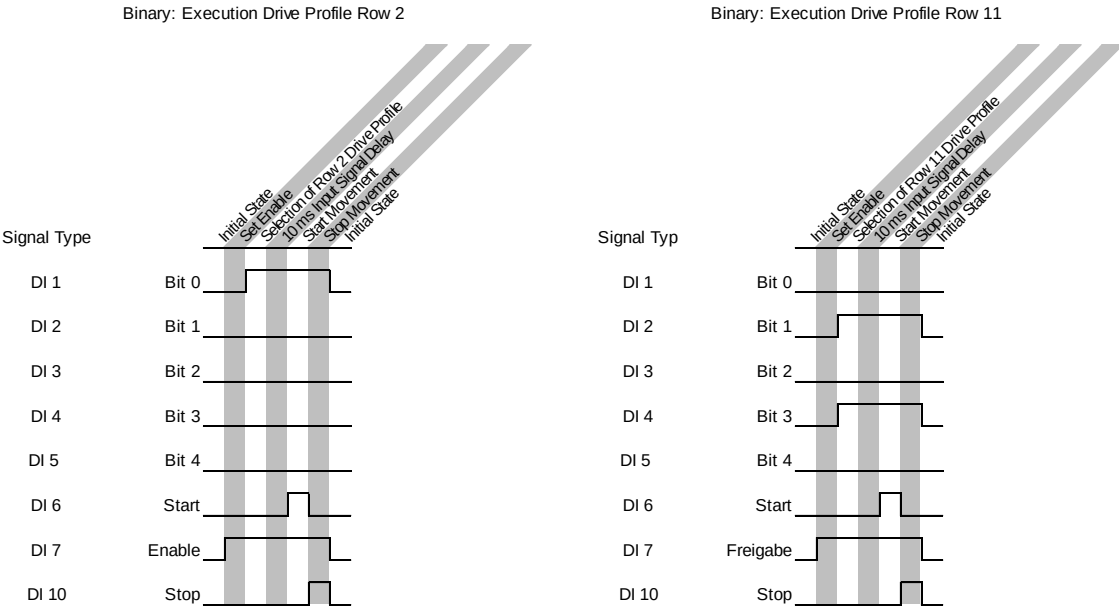
Positioning movements created with the [Drive Profile](#) (p. 77) can be started as well from a higher-level control system. The Digital In/Outputs are used for communication.

Certain requirements must be complied before parameterised positioning movements are executed. These requirements depend on the chosen mode.

5.1.1 Requirements

The signal/s for selecting the movement to be executed, must be applied to DI 1 to DI 5 for at least 10 ms before a “Start” signal is set via DI 6.

Note
A traversing movement in "Binary" mode requires the positive edge of digital input DI 6



Usage of the inverting switches

If the inputs with a PNP connection are used, the respective signal must be switched from "Low Level" to "High Level" so that the signal is processed in the drive D1.

In the case of an NPN connection, the respective signal must accordingly be switched from "High Level" to "Low Level".

To execute a movement, it must be complied to the following requirements

HOM

- [Homing Method](#) (p. 61) selection
- Feed Rate
- Max Velocity
- Jog Velocity ($\leq$ Max. Velocity)
- Max. Acceleration
- Set DI 7 "Enable"
- "Ready" signal at DO 1
- No "Active" signal at DO 2
- No "Error" signal at DO 5

REL, ARO, ADR, ROT

- Feed Rate
- Max Velocity
- Jog Velocity ($\leq$ Max. Velocity)
- Max. Acceleration
- Set DI 7 "Enable"
- "Ready" signal at DO 1
- No "Active" signal at DO 2
- No "Error" signal at DO 5

ABS, APS

- Available Stroke
- Feed Rate
- Max Velocity
- Jog Velocity ($\leq$ Max. Velocity)
- Max. Acceleration
- Set DI 7 "Enable"
- "Ready" signal at DO 1
- No "Active" signal at DO 2
- No "Error" signal at DO 5

5.1.2 Signal Sequence

HOM, REL, ABS, ROT

1. Set the DI 7 "Enable" signal (external signal or switch on the "Inputs/Outputs" page)
2. Select the desired positioning movement by setting the Digital Inputs in accordance with the "Summary Binary Movement Selection" table
3. Start the positioning movement by setting DI 6 "Start"

You can stop the movement by setting DI 10 "Stop" or revoking DI 7 "Enable".

ARO, ADR

1. Set the DI 7 "Enable" signal (external signal or switch on the "Inputs/Outputs" page)
2. Select the desired positioning movement by switching the Digital Inputs in accordance with the "Summary Binary Movement Selection" table
3. Apply a voltage to AI 2. Ensure that the set voltage does not trigger any movement as soon as DI 6 "Start" is set
4. Start the positioning movement by setting DI 6 "Start"
5. Control the velocity and direction (ADR only) by varying the voltage applied to AI 2. Follow the instructions at [Drive Profile Binary](#) (p. 83)

You can stop the movement by setting DI 10 "Stop" or revoking DI 7 "Enable".

APS

1. Set the DI 7 "Enable" signal (external signal or switch on the "Inputs/Outputs" page)
2. Select the desired positioning movement by switching the Digital Inputs in accordance with the "Summary Binary Movement Selection" table
3. Apply a voltage to AI 1. Ensure that the set voltage does not trigger any movement as soon as DI 6 "Start" is set
4. Start the positioning movement by setting DI 6 "Start"
5. Control the position by varying the voltage applied to AI 1. Follow the instructions at [Drive Profile Binary](#) (p. 83)

You can stop the movement by setting DI 10 "Stop" or revoking DI 7 "Enable".

5.1.2.1 Summary Binary Movement Selection

The table shows which Digital Inputs must be switched to select the desired positioning movement.

If you use the Inverting function (switch for the respective input changed from "H" (High) to "L" (Low) on the "Inputs/Outputs" page), this input will be interpreted as active if it is pulled to ground.

Movement No.	DI 5	DI 4	DI 3	DI 2	DI 1
1	0	0	0	0	0
2	0	0	0	0	1
3	0	0	0	1	0
4	0	0	0	1	1
5	0	0	1	0	0
6	0	0	1	0	1
7	0	0	1	1	0
8	0	0	1	1	1
9	0	1	0	0	0
10	0	1	0	0	1
11	0	1	0	1	0
12	0	1	0	1	1
13	0	1	1	0	0
14	0	1	1	0	1
15	0	1	1	1	0
16	0	1	1	1	1
17	1	0	0	0	0
18	1	0	0	0	1
19	1	0	0	1	0
20	1	0	0	1	1
21	1	0	1	0	0
22	1	0	1	0	1
23	1	0	1	1	0
24	1	0	1	1	1
25	1	1	0	0	0
26	1	1	0	0	1
27	1	1	0	1	0
28	1	1	0	1	1
29	1	1	1	0	0
30	1	1	1	0	1
31	1	1	1	1	0
32	1	1	1	1	1

A "1" corresponds to a voltage between 5 and 24 V. A "0" corresponds to 0 V (ground).

If automated motion sequences have been set at the "Drive Profile", they are executed after the positioning has been completed.

Example: Usage positioning pre-selection via DI 1 to DI5

- Valid for PNP [Digital Input Switch Characteristics](#) (p. 76)
- [Binary Mode Requirements](#) (p. 92) applied

Configured Drive Profile:

Command	Purpose	Mode	Required Digital Inputs					
			Position pre-selection + 10ms					Start
1	Homing	HOM	-	-	-	-	-	DI 6
2	Movement Goal 0 mm, Wait position	ABS	DI1	-	-	-	-	DI 6
3	Movement Goal 75 mm, Pick up component	ABS	-	DI2	-	-	-	DI 6
4	Movement Goal 200 mm, Discard component	ABS	DI1	DI2	-	-	-	DI 6
32	Movement Goal 50 mm, Maintenance position	ABS	DI1	DI2	DI3	DI4	DI5	DI 6

5.1.2.2 Movement looping

If another movement with different movement parameters shall be started during an active movement before the target position has been reached, this can be achieved by pre-selecting a new line via digital inputs DI1 to DI5 and then setting digital input DI6 "Start" to high/1.

5.2 Tipp/Teach

Besides manual positioning, parameterised positioning movements as created under [Drive Profile](#) (p. 77) can be executed by a [higher-level control system](#) (p. 238) as well. The Digital In/Outputs are used for communication.

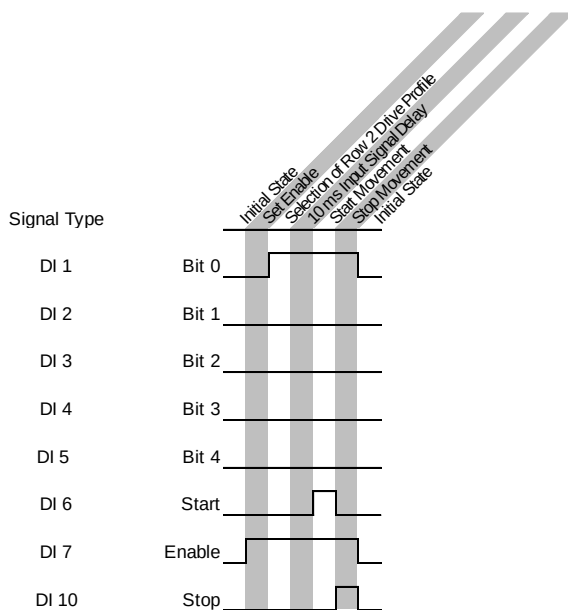
Certain requirements must be complied before parameterised positioning movements are executed. These requirements depend on the chosen mode.

5.2.1 Requirements

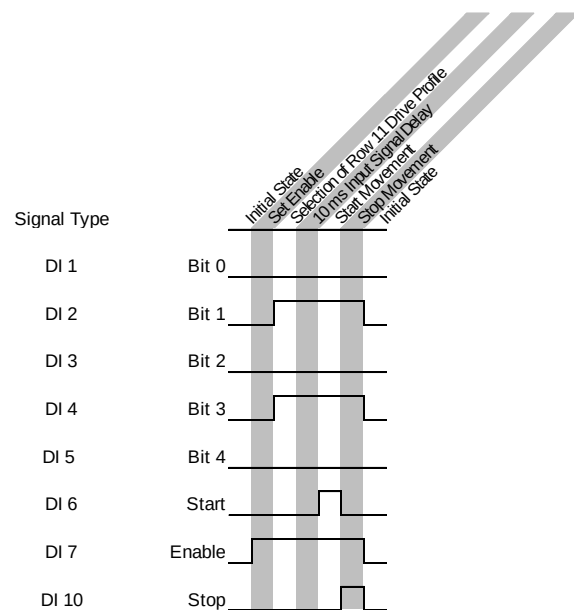
The signal/s for selecting the movement to be executed, must be applied to DI 1 to DI 5 for at least 10 ms before a "Start" signal is set via DI 6.

Note	
A traversing movement in "Tipp/Teach" mode requires the negative edge of digital input DI 6	

Binary: Execution Drive Profile Row 2



Binary: Execution Drive Profile Row 11



5.2.2 Usage of the inverting switches

If the inputs with a PNP connection are used, the respective signal must be switched from "Low Level" to "High Level" so that the signal is processed in the drive D1.

In the case of an NPN connection, the respective signal must accordingly be switched from "High Level" to "Low Level".

5.2.3 Manual Positioning

The following conditions must be fulfilled to execute movements:

- Feed Rate
- Max Velocity
- Jog Velocity ($\leq$ Max. Velocity)
- Max. Acceleration
- Set DI 7 "Enable"
- "Ready" signal at DO 1
- No "Active" signal at DO 2
- No "Error" signal at DO 5
- Trigger of a movement signal via DI 4 "Jog Left" or DI 5 "Jog Right"

HOM

Requirements for a "Homing" execution:

- [Homing Method](#) (p. 61) selection
- Feed Rate
- Max Velocity
- Jog Velocity ($\leq$ Max. Velocity)
- Max. Acceleration
- Set DI 7 "Enable"
- "Ready" signal at DO 1
- No "Active" signal at DO 2
- No "Error" signal at DO 5

ABS

Requirements for execution of a movement with an absolute position relation to the zero point:

- Available Stroke
- Feed Rate
- Max Velocity
- Jog Velocity ($\leq$ Max. Velocity)
- Max. Acceleration
- Set DI 7 "Enable"
- "Ready" signal at DO 1
- No "Active" signal at DO 2
- No "Error" signal at DO 5

5.2.4 Signal Sequence

Manual positioning

1. Set the DI 7 "Enable" signal (external signal or switch on the "Inputs/Outputs" page)
2. Use the control hardware connected to DI 4 "Jog Left" and DI 5 "Jog Right" to move the connected linear axis, rotary axis or motor to the desired position at the pre-set [Jog Velocity \(p.42\)](#)

HOM, ABS

1. Set the DI 7 "Enable" signal (external signal or switch on the "Inputs/Outputs" page)
2. Select the desired positioning movement by setting the Digital Inputs in accordance with the "Summary Tipp/Teach Movement Selection" table
3. Start the positioning movement by setting DI 6 "Start"

You can stop the movement by setting DI 10 "Stop" or revoking DI 7 "Enable".

5.2.5 Teaching

In the "Tipp/Teach" operating mode, it is possible to modify the goal position of already existing movements without using the user interface.

1. Set the DI 7 "Enable" signal (external signal or switch on the "Inputs/Outputs" page)
2. Use the control hardware connected to DI 4 "Jog Left" and DI 5 "Jog Right" to move the connected linear axis, rotary axis or motor to the desired position at the pre-set [Jog Velocity](#) (p. 56)
3. Select the desired positioning movement by setting the Digital Inputs in accordance with the "Summary Tipp/Teach Movement Selection" table
4. Set the control hardware connected to DI 6 "Start/Teach" for at least 5 seconds
5. The actual position will be adopted as the new goal position of the selected positioning movement

5.2.6 Overview Drive Profile Preselection

The table shows which Digital Inputs must be switched to select the desired positioning movement .

If you use the Inverting function (switch for the respective input changed from "H" (High) to "L" (Low) on the "Inputs/Outputs" page), this input will be interpreted as active if it is pulled to ground.

Movement No.	DI 3	DI 2	DI 1
1	0	0	0
2	0	0	1
3	0	1	0
4	0	1	1
5	1	0	0
6	1	0	1
7	1	1	0
8	1	1	1

A "1" corresponds to a voltage between 5 and 24 V. A "0" corresponds to 0 V (ground).

Example: Usage positioning pre-selection via DI 1 to DI5

- Valid for PNP [Digital Input Switch Characteristics](#) (S.76)
- [Tipp/Teach Requirements](#)(S.96) applied

Configured Drive Profile:

Command	Purpose	Mode	Required Digital Inputs			
			Position pre-selection + 10ms			Start
1	Homing	HOM	-	-	-	DI 6
2	Movement Goal 15 mm, Product seize 1	ABS	DI1	-	-	DI 6
3	Movement Goal 20 mm, Product seize 2	ABS	-	DI2	-	DI 6
4	Movement Goal 25 mm, Product seize 3	ABS	DI1	DI2	-	DI 6
5	Movement Goal 45 mm, Product seize 4	ABS	-	-	DI3	DI 6
6	Movement Goal 47 mm, Product seize 5	ABS	DI1	-	DI3	DI 6
7	Movement Goal 65 mm, Product seize 6	ABS	-	DI2	DI3	DI 6
8	Movement Goal 78 mm, Product seize 7	ABS	DI1	DI2	DI3	DI 6

Movement looping

If another movement with different movement parameters shall be started during an active movement before the target position has been reached, this can be achieved by pre-selecting a new line via digital inputs DI1 to DI5 and then setting digital input DI6 "Start" to high/1.

5.3 Step/Direction

Each positive edge of a square wave signal corresponds to a step movement. The acceleration and velocity is varied with the applied signal frequency. The amount of counted positive edges determines the goal position.

NOTE

Step/Direction mode is momentarily available for Stepper Motors only.

Example

With a Step Mode of 1/1, a Step Angle of 1.8° and a frequency of 200 Hz, the motor executes one revolution per second, i.e. 60 revolutions per minute.

NOTE

For correct positioning, the step mode in the motor controller and the master controller must be identical.

NOTE

If a gearbox is set on the "Motor" page, the "Actual position" displayed on the user interface is calculated accordingly
--

5.3.1 Assignment of Step Mode to Motor Speeds

Step Mode	Steps per Revolution	Max Motor Speed
1/1 Full Step	200	7500 rpm
1/2 Step	400	3750 rpm
1/4 Step	800	1875 rpm
1/8 Step	1600	937 rpm
1/16 Step	3200	468 rpm
1/32 Step	6400	234 rpm
1/64 Step	12800	117 rpm

5.3.2 Requirements

To control the motor in the "Step/Direction" mode, proceed as follows:

1. Set the "Step mode" to the desired value on the "Motor" page
2. Set the values for "Max. Velocity", "Jog Velocity" on the "Axis" page under "Movement limits" to 100.000 and "Max. Acceleration" to 1.000.000
3. Set the DI 7 "Enable" signal (external signal or switch on the "Inputs/Outputs" page)
4. Set the movement direction by setting DI 2 "Direction"

Digital Input 2	Voltage	Direction
0	0 V	Anti-Clockwise
1	5 V to 24 V	Clockwise

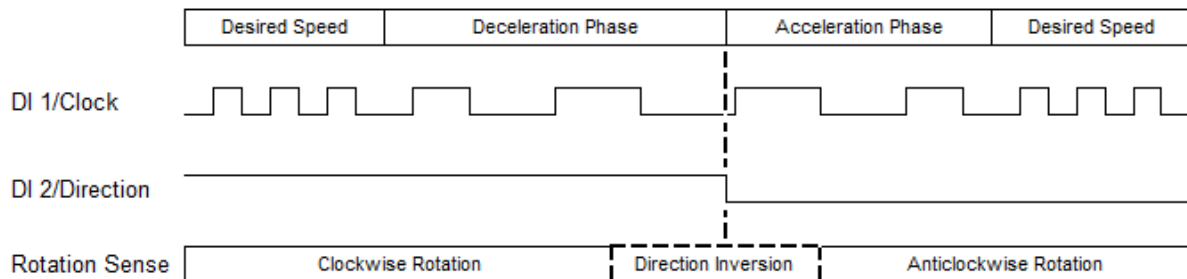
4. Apply the square wave signal frequency at DI 1 "Clock"

Voltage	Max. frequency	Minimum Period
5 V to 24 V	25 kHz	40 μ s

The movement can be stopped by ceasing the signal frequency at DI 1 "Clock" or revoking DI 7 "Enable".

If a rotation direction change is to be executed, DI 2 "Direction" must be changed after the last negative edge of the "Clock" signal. The "Direction" signal must be set at least 10 μ s after the last negative edge and at least 10 μ s before the first positive edge of the "Clock" signal and must be applied continuously. To ensure that all impulses are counted, it is required to change the "Direction" signal only when the level of the "Clock" signal is 0.

Timing Step/Direction



5.4 Electronic Actuator

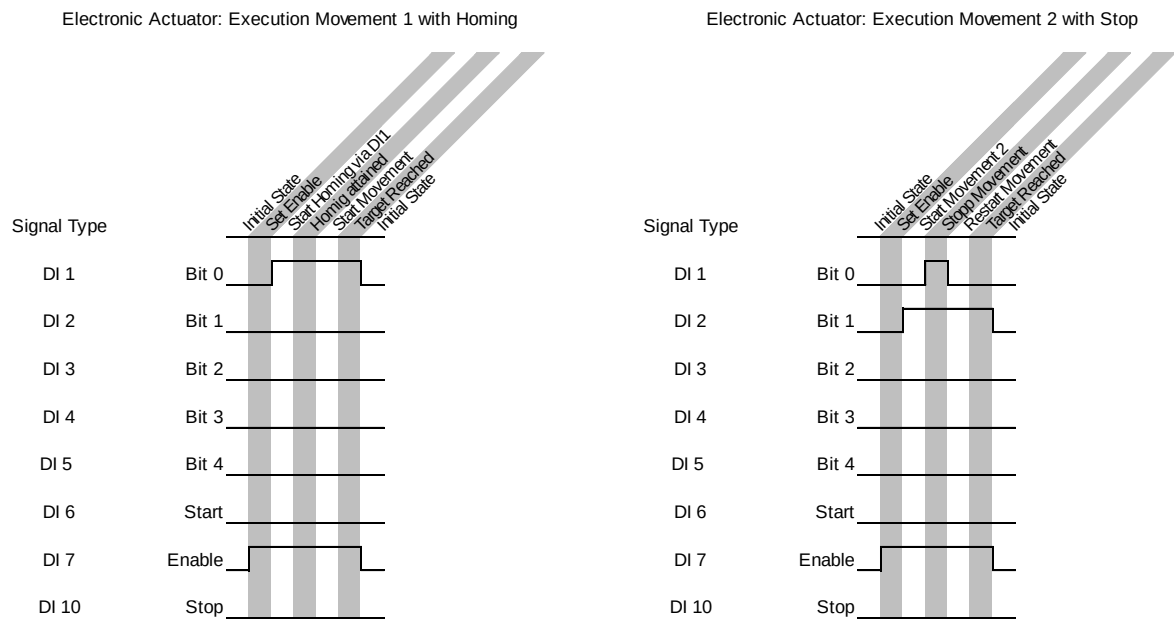
Positioning movements that were created under travel profiles (p. 75) can then also be started by a higher-level control system. The inputs/outputs are used for communication. There are prerequisites that must be met in order to execute the parameterised positioning movements. These requirements depend on the mode of the respective positioning movement.

5.4.1 Requirements

Movements are executed directly when a signal is set at digital input 1, 2 or 3. If referencing has not yet been carried out, this is automatically carried out before the desired movement and the set target position is approached directly after successful execution of the referencing.

NOTE

If more than one digital input of digital inputs 1 to 3 is set at the same time, no movement can be started or an active movement is stopped until only one input is set.
The input that is still active determines the target position of the following movement.



5.5 Modulo Positioning

Positioning movements that were created under travel profiles (p. 75) can then also be started by a higher-level control system. The inputs/outputs are used for communication. There are prerequisites that must be met in order to execute the parameterised positioning movements. These requirements depend on the mode of the respective positioning movement.

WARNING!
If a different operating mode (page 75) should be selected after using modulo positioning, it is essential to restart the motor control unit to avoid incorrect positioning and possible accidents!

NOTE

Modulo positioning is only available under the 'Rotary' movement type ("Star" page).
The feed should be set to 360° and should not be changed.
The minimum available stroke is automatically set to "0°" and the maximum available stroke is set to 360°.

5.5.1 Requirements

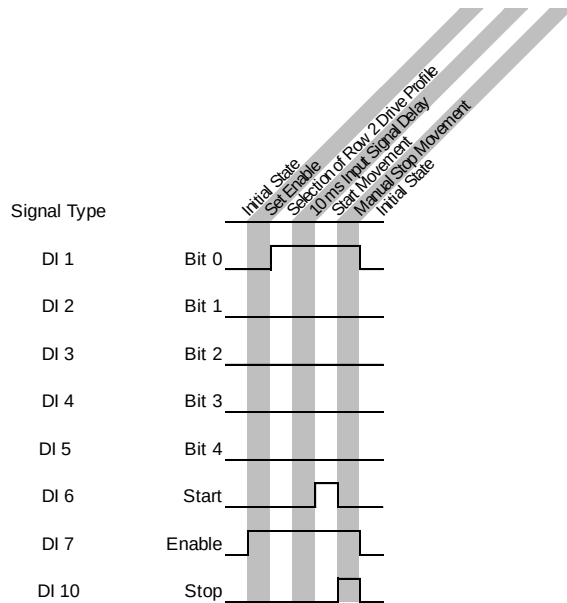
To select the travel profile, the "Movement Type" 'Rotative' must be selected on the "Start" page.

As a general rule, when using binary coding, the respective signal for the preselection of a movement at DI 1 to DI 5 must be applied to the respective digital input for at least 10 ms before a start signal can be set via DI 6.

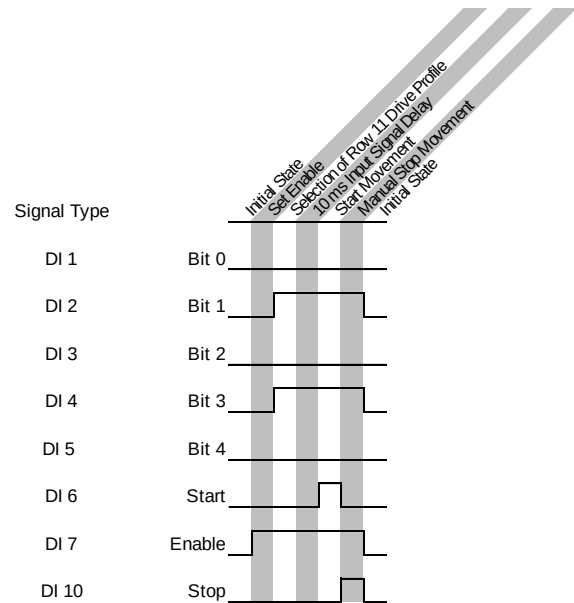
NOTE

The positive edge of the signal at digital input DI 6 is required to execute a movement in "Modulo positioning" mode.

Modulo-Positioning: Execution Drive Profile Row 2



Modulo-Positioning: Execution Drive Profile Row 11



To execute a movement, it must be complied to the following requirements

HOM

- [Homing Method](#) (p. 61) selection
- Feed Rate
- Max Velocity
- Jog Velocity ($\leq$ Max. Velocity)
- Max. Acceleration
- Set DI 7 "Enable"
- "Ready" signal at DO 1
- No "Active" signal at DO 2
- No "Error" signal at DO 5

REL, ARO, ADR, ROT

- Feed Rate
- Max Velocity
- Jog Velocity ($\leq$ Max. Velocity)
- Max. Acceleration
- Set DI 7 "Enable"
- "Ready" signal at DO 1
- No "Active" signal at DO 2
- No "Error" signal at DO 5

ABS, APS

- Available Stroke
- Feed Rate
- Max Velocity
- Jog Velocity ($\leq$ Max. Velocity)

- Max. Acceleration
- Set DI 7 "Enable"
- "Ready" signal at DO 1
- No "Active" signal at DO 2
- No "Error" signal at DO 5

5.5.2 Signal Sequence

HOM, REL, ABS, ROT

5. Set the DI 7 "Enable" signal (external signal or switch on the "Inputs/Outputs" page)
6. Select the desired positioning movement by setting the Digital Inputs in accordance with the "Summary Binary Movement Selection" table
7. Start the positioning movement by setting DI 6 "Start"

You can stop the movement by setting DI 10 "Stop" or revoking DI 7 "Enable".

ARO, ADR

8. Set the DI 7 "Enable" signal (external signal or switch on the "Inputs/Outputs" page)
9. Select the desired positioning movement by switching the Digital Inputs in accordance with the "Summary Binary Movement Selection" table
10. Apply a voltage to AI 2. Ensure that the set voltage does not trigger any movement as soon as DI 6 "Start" is set
11. Start the positioning movement by setting DI 6 "Start"
12. Control the velocity and direction (ADR only) by varying the voltage applied to AI 2. Follow the instructions at [Drive Profile Binary](#) (p. 83)

You can stop the movement by setting DI 10 "Stop" or revoking DI 7 "Enable".

APS

13. Set the DI 7 "Enable" signal (external signal or switch on the "Inputs/Outputs" page)
14. Select the desired positioning movement by switching the Digital Inputs in accordance with the "Summary Binary Movement Selection" table
15. Apply a voltage to AI 1. Ensure that the set voltage does not trigger any movement as soon as DI 6 "Start" is set
16. Start the positioning movement by setting DI 6 "Start"
17. Control the position by varying the voltage applied to AI 1. Follow the instructions at [Drive Profile Binary](#) (p. 83)

You can stop the movement by setting DI 10 "Stop" or revoking DI 7 "Enable".

Summary Binary Movement Selection

The table shows which Digital Inputs must be switched to select the desired positioning movement.

If you use the Inverting function (switch for the respective input changed from "H" (High) to "L" (Low) on the "Inputs/Outputs" page), this input will be interpreted as active if it is pulled to ground.

Movement No.	DI 5	DI 4	DI 3	DI 2	DI 1
1	0	0	0	0	0
2	0	0	0	0	1
3	0	0	0	1	0
4	0	0	0	1	1
5	0	0	1	0	0
6	0	0	1	0	1
7	0	0	1	1	0
8	0	0	1	1	1
9	0	1	0	0	0
10	0	1	0	0	1
11	0	1	0	1	0
12	0	1	0	1	1
13	0	1	1	0	0
14	0	1	1	0	1
15	0	1	1	1	0
16	0	1	1	1	1
17	1	0	0	0	0
18	1	0	0	0	1
19	1	0	0	1	0
20	1	0	0	1	1
21	1	0	1	0	0
22	1	0	1	0	1
23	1	0	1	1	0
24	1	0	1	1	1
25	1	1	0	0	0
26	1	1	0	0	1
27	1	1	0	1	0
28	1	1	0	1	1
29	1	1	1	0	0
30	1	1	1	0	1
31	1	1	1	1	0
32	1	1	1	1	1

A "1" corresponds to a voltage between 5 and 24 V. A "0" corresponds to 0 V (ground).

If automated motion sequences have been set at the "Drive Profile", they are executed after the positioning has been completed.

Example: Usage positioning pre-selection via DI 1 to DI5

- Valid for PNP [Digital Input Switch Characteristics](#) (p. 76)
- [Binary Mode Requirements](#) (p. 92) applied

Configured Drive Profile:

Command	Purpose	Mode	Required Digital Inputs					
			Position pre-selection + 10ms					Start
1	Homing	HOM	-	-	-	-	-	DI 6
2	Movement Goal 0 mm, Wait position	ABS	DI1	-	-	-	-	DI 6
3	Movement Goal 75 mm, Pick up component	ABS	-	DI2	-	-	-	DI 6
4	Movement Goal 200 mm, Discard component	ABS	DI1	DI2	-	-	-	DI 6
32	Movement Goal 50 mm, Maintenance position	ABS	DI1	DI2	DI3	DI4	DI5	DI 6

Movement looping

Movement Looping is not possible with Modulo Positioning.

5.6 CANopen

In the following chapter, the CANopen interface is explained.

The implementation is according to CiA301 and CiA402 (CiA402-3 servo drives).

Motion parameter are stored in the corresponding [objects](#) (p. 124)

5.6.1 Special Features of SDO/PDO Communication

SDO

SDO communication is used first for the initial parameterisation of object entries during commissioning. Each writing or reading of an individual object requires the sending of a dedicated telegram, which is confirmed by an acknowledgement telegram.

PDO

PDO communication is used for the transport of process data.

Several data records can be transmitted per telegram. The telegrams can be sent acyclically/cyclically synchronously or asynchronously via trigger events.

In the as-delivered state, 4 Receive (RX) and Transmit (TX) PDOs are available for communication. 4 more are available after configuration [Activation and Configuration 8 RX/TX PDOs](#) (p.112).

The overview of which communication type is available in which state is described in [Network Management](#) (p. 108).

5.6.2 Telegram Structure

To accomplish a successful communication, a read/write telegram must correspond to the following scheme.

For example, a telegram for reading the object 6041h Statusword and the response telegram of the drive D1 in "Operation Enabled" status ([State Machine Visualisation](#), p. 114) In this case, the drive D1 has the "Node-ID 1".

In later sections, we will only refer to Bytes 1 to 7.

Telegram Structure

COB-ID	DLC	Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
CAN identifier + Node ID	Amount of send data	Write/Read Command	Object Index part 2 e.g., 6092h	Object Index part 1 e.g., 6092h	Object Sub-Index e.g. 6092h:01	LSB MSB Data range - specification of the "Least Significant Bit (LSB)" in byte 4 and the "Most Significant Bit (MSB)" in byte 7			
600 + 1	0 bis 8	40h	92h	60h	01h	00h	00h	00h	00h

Write/Read Commands

Request SDO Client	Response SDO Server	Description
22h	60h	Write data, seize not specified
23h	60h	Write data, seize 4 Byte
27h	60h	Write data, seize 3 Byte
2Bh	60h	Write data, seize 2 Byte
2Fh	60h	Write data, seize 1 Byte
40h	42h	Read data, seize not specified
40h	43h	Read data, seize 4 Byte valid in response
40h	47h	Read data, seize 3 Byte valid in response
40h	4Bh	Read data, seize 2 Byte valid in response
40h	4Fh	Read data, seize 1 Byte valid in response

NOTE
The data range seize for read/write commands is predefined by the used object

Example Telegrams

Read 6041h „Statusword“ – Status Request

COB-ID	DLC	Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
601h	8h	40h	41h	60h	00h	00h	00h	00h	00h

Example Acknowledgement-Telegram 6041h „Statusword“

COB-ID	DLC	Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
581h	8h	4Bh	41h	60h	00h	27h	06h	00h	00h

Write 6040h „Controlword“ – Command: Enable Operation

COB-ID	DLC	Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
601h	8h	2Bh	40h	60h	00h	0Fh	00h	00h	00h

Example Acknowledgement-Telegram 6040h „Controlword“

COB-ID	DLC	Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
581h	8h	60h	40h	60h	00h	00h	00h	00h	00h

Write 607Ah „Target Position“ –Target Position: 1000,00 mm, this corresponds to an input value of 100000

COB-ID	DLC	Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
601h	8h	23h	7Ah	60h	00h	A0h	86h	01h	00h

Example Acknowledgement-Telegram 607Ah „Target Position“

COB-ID	DLC	Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
581h	8h	60h	40h	60h	00h	00h	00h	00h	00h

Read 6064h „Position Actual Value“

COB-ID	DLC	Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
601h	8h	40h	64h	60h	00h	00h	00h	00h	00h

Example Acknowledgement-Telegram 6064h „Position Actual Value“

Current Position: 503,87 mm, this corresponds to an output value of 50387

COB-ID	DLC	Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
581h	8h	43h	64h	60h	00h	D3h	C4h	00h	00h

Write 6092h: Sub 2 „Feed Rate“ – Feed Rate: 60 mm, this corresponds to an input value of 6.000

COB-ID	DLC	Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
601h	8h	23h	92h	60h	02h	70h	17h	00h	00h

Example Acknowledgement-Telegram 6092h: Sub 2 „Feed Rate“

COB-ID	DLC	Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
581h	8h	60h	92h	60h	02h	00h	00h	00h	00h

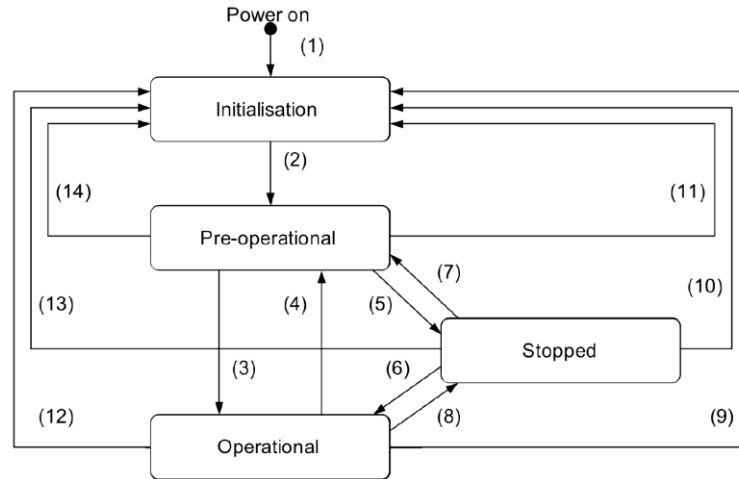
5.6.3 Network Management

An initialisation process must be completed before the drive D1 can be controlled by the master.

This initialisation process is performed by the D1 automatically.

Available are SDO and the synchronous and asynchronous PDO data transmission.

The asynchronous data transmission is available with and without event timer. If no event timer is used the PDO must include the "Statusword". The data is only transmitted if the "Statusword" is changed.



Transition	Description
1	Automatic start of the initialisation process after the system has been started.
2	Automatic transition to pre-operational state after NMT initialisation Boot-up message is sent.
3	Transition to the operational state set by bus control or local control. PDO communication active.
4, 7	Transition to pre-operational state. PDO communication stopped, SDO communication still active.
5, 8	Externally determined transition to stop. SDO and PDO communication stopped.
6	Transition to the operational state set by bus control. PDO communication active.
9, 10, 11	Total reset of the control system. All objects are reset to Default Values.
12, 13, 14	Reset of communication. Objects 1000h to 1FFFh are reset to Default Values.

Control Commands

Telegrams with the COB-ID 000 (highest available priority) are sent to control the network management.

These telegrams contain the control command for the transition to the respective status.

Command - Byte 0	Description
01h	Switch to the "Operational" state - activation of PDO communication.
02h	Switch to the "Stop" state.
80h	Switch to the "Pre-Operational" state.
81h	Reset Node + Reboot Controller
82h	Reset Communication.

Address – Byte 1	Description
00h	Addressing all devices in the network.
XXh	Addressing on specific Node.

Example Control Telegrams

Activation of PDO communication on node 1 by switching to „Operational“.

COB-ID	DLC	Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
000	2h	01h	01h	Not used	Not used	Not used	Not used	Not used	Not used

Activation of PDO communication on all nodes registered in the network by switching to „Operational“.

COB-ID	DLC	Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
000	2h	01h	00h	Not used	Not used	Not used	Not used	Not used	Not used

5.6.4 PDO mapping

PDO mapping allows data from several objects to be transmitted simultaneously within one telegram.

Instead of the information on COB-ID, DLC, command, object and subindex as well as data contained in an SDO telegram, the PDO telegram consists purely of data which can be found at predefined positions in the telegram.

Transmission and reception can be triggered automatically by various trigger events, such as after a defined time interval has elapsed (synchronous), by the transmission/reception of individual objects or by the change of values in individual objects (asynchronous).

By manually configuring the PDO mapping, up to 40 subindices with 64 bits of data each can be transmitted per RX/TX PDO.

The PDO mapping corresponds to the standard configuration according to CiA 301 in the state of delivery.

Settings of the PDOs to be received are executed in the following objects

Settings for the trigger events:

[1400h Receive PDO Communication Parameter 1](#) (p. 133) to
[1407h Receive PDO Communication Parameter 8](#) (p. 140)

Settings for the data positions:

[1600h Receive PDO Mapping Parameter 1](#) (p. 141) to
[1607h Receive PDO Mapping Parameter 8](#) (p. 145)

Settings of the PDOs to be sent are executed in the following objects

Settings for the trigger events:

[1800h Transmit PDO Communication Parameter 1](#) (p. 146) to
[1807h Transmit PDO Communication Parameter 8](#) (p. 154)

Settings for the data positions:

[1A00h Transmit PDO Mapping Parameter 1](#) (p. 155) to
[1A07h Transmit PDO Mapping Parameter 8](#) (p. 160)

5.6.4.1 Standard PDO Mapping

By default, the PDO mapping corresponds to the standard configuration in accordance with CiA 301.

Configuration Transmit PDOs „1800h – Communication Parameter“.

Further information in the property descriptions – [1800h Transmit PDO Communication Parameter 1](#) (S. 146) and following.

1800h – TPDO 1

Subindex	Name	Value	Description
1	Cob-ID	181h	Identifier with which PDO 1 is sent via the bus.
2	Transmission Type	FFh	Data transmit via Event Trigger.
3	Inhibit Time	0h	Send delay from trigger time to dispatch time.
5	Event Timer	0h	Manually adjustable event trigger, 0h - Deactivated.

1801h – TPDO 2

Subindex	Name	Value	Description
1	Cob-ID	281h	Identifier with which PDO 2 is sent via the bus.
2	Transmission Type	FFh	Data transmit via Event Trigger.
3	Inhibit Time	0h	Send delay from trigger time to dispatch time.
5	Event Timer	0h	Manually adjustable event trigger, 0h - Deactivated.

1802h – TPDO 3

Subindex	Name	Value	Description
1	Cob-ID	381h	Identifier with which PDO 3 is sent via the bus.
2	Transmission Type	FFh	Data transmit via Event Trigger.
3	Inhibit Time	0h	Send delay from trigger time to dispatch time.
5	Event Timer	0h	Manually adjustable event trigger, 0h - Deactivated.

1803h – TPDO 4

Subindex	Name	Value	Description
1	Cob-ID	481h	Identifier with which PDO 4 is sent via the bus.
2	Transmission Type	FFh	Data transmit via Event Trigger.
3	Inhibit Time	0h	Send delay from trigger time to dispatch time.
5	Event Timer	0h	Manually adjustable event trigger, 0h - Deactivated.

5.6.4.2 EDS File

The EDS file (Electronic Data Sheet) is a standardised digital template of the Object Dictionary of a CANopen device and specifies the supported objects of the device 1.

The EDS file contains information on:

- Communication-specific objects according to CiA 301
- Device/interface-specific objects in accordance with CiA 402
- Manufacturer specific objects

The ESD file can be loaded by CANopen master controllers, software and API tools to configure devices, manage networks and interpret CANopen data traffic.

The file is available at www.igus.eu/D1.

Configuration Transmit PDOs „1A00h – Transmit PDO Mapping Parameter 1“.

Further information in the property descriptions [1A00h Transmit PDO Mapping Parameter 1](#) (S.155) and following.

1A00h – TPDO 1

Subindex	Transmit Object	Used Bit	Reserved Position	Free Bit after Subindex
1	6041h - Statusword	16	Bit 0 bis 15	48

1A02h – TPDO 2

Subindex	Transmit Object	Used Bit	Reserved Position	Free Bit after Subindex
1	6041h - Statusword	16	Bit 0 bis 15	48
2	6064h Current Position	32	Bit 16 bis 47	16

1A03h – TPDO 3

Subindex	Transmit Object	Used Bit	Reserved Position	Free Bit after Subindex
1	6041h - Statusword	16	Bit 0 bis 15	48
2	606Ch Current Velocity	32	Bit 16 bis 47	16

1A04h – TPDO 4

Subindex	Transmit Object	Used Bit	Reserved Position	Free Bit after Subindex
1	6041h - Statusword	16	Bit 0 bis 15	48

5.6.4.3 Customized PDO Mapping

If a user-defined PDO configuration is to be used for communication, the corresponding objects (1800h following and 1A00h following) must be adapted for the respective purpose.

As these objects cannot be saved permanently, they must be reset each time the motor control unit is restarted.

To change the PDOs, the following procedure must be followed - example based on Transmit PDO 1, Node-ID 1:

1. Deactivation of object [1800h Transmit PDO Communication Parameter 1](#) (S. 146) via setting Bit 31 „high/1“ in Subindex 1 „Cob-ID“.

COB-ID	DLC	Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
601h	8h	23h	00h	18h	01h	81h	01h	00h	08h

2. Deactivation of object [1A00h Transmit PDO Mapping Parameter 1](#) (S.155) via writing the value 00h in Subindex 0 „Number of Entries“.

COB-ID	DLC	Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
601h	8h	2Fh	00h	1Ah	00h	00h	00h	00h	00h

3. Configuration of the transmission type to be used, 01h (cyclic synchronous, sent on arrival of each SYNC telegram) in subindex 2.
– see short description [1800h Transmit PDO Communication Parameter 1](#) (S. 146).

COB-ID	DLC	Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
601h	8h	23h	00h	18h	02h	01h	00h	00h	00h

4. Configuration of the data to be transmitted in the required subindices 1 to 8 - see brief description [1A00h Transmit PDO Mapping Parameter 1](#) (S. 155).

In this example, the current motor current is to be transferred from sub-index 1 of object 2000h Motor Current.

COB-ID	DLC	Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
601h	8h	2Fh	00h	1Ah	01h	20h	01h	00h	20h

6. Activate/confirm object [1A00h Transmit PDO Mapping Parameter 1](#) (S.155) Subindex 0 „Number of Entries“ by writing the value equal to the number of configured subindices.

COB-ID	DLC	Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
601h	8h	2Fh	00h	1Ah	00h	01h	00h	00h	00h

7. Activate/confirm object [1800h Transmit PDO Communication Parameter 1](#) (S. 146) via setting Bit 31 „low/0“ in Subindex 1 „Cob-ID“.

COB-ID	DLC	Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
601h	8h	23h	00h	18h	01h	81h	00h	00h	00h

Note
A setting of the PDOs that differs from the standard PDO configuration cannot be saved without voltage and must be carried out again after each restart of the motor control unit. For this purpose, it is recommended to create a corresponding restart routine in the master control system.

5.6.5 Activation and Configuration 8 RX/TX PDOs

To use the 8 possible Receive (RX) and Transmit (TX) PDOs the 4 additional PDOs must be activated separately.

For this purpose, it is necessary to configure the relevant RX/TX PDO communication parameters 5 to 8 and Receive/Transmit PDO mapping parameters 5 to 8.

Example of activation and configuration based on RX/TX PDO 5 when using the EDS file for 4 PDO

1. Invalidate object [1804h Transmit PDO Communication Parameter 5](#) (p.151) by setting bit 31 "high/1" in sub-index 1 "Cob-ID"
2. Invalidate object [1A04h Transmit PDO Mapping Parameter 5](#) (p. 158) by writing the value 00h in subindex 0 "Number of Entries"
3. Configuration of the data to be transmitted in the required sub-indices 1 to 8 - see short description [1A04h Transmit PDO Mapping Parameter 5](#) (p. 158)
4. Activate/validate object [1A04h Transmit PDO Mapping Parameter 5](#) (p. 158) subindex 0 "Number of Entries" by writing the value equal to the number of configured sub indices
5. Activate/validate object [1804h Transmit PDO Communication Parameter 5](#) (p.151) by setting bit 31 "low/0" in sub-index 1 "Cob-ID"

The "COB-ID" in Subindex 1 must be set according to the PDO number.

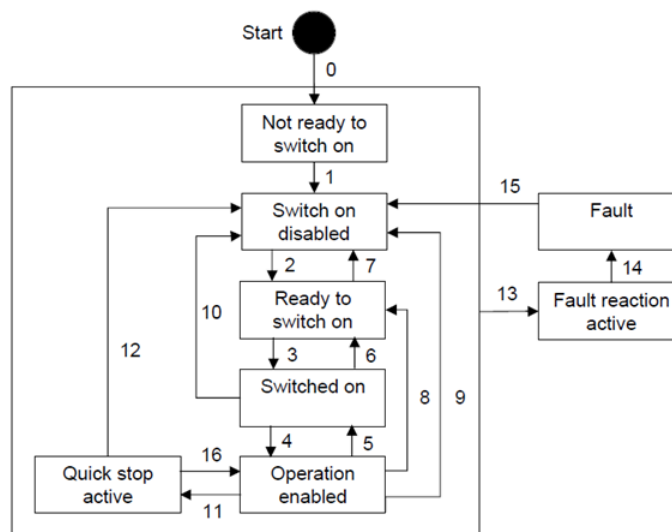
- TPDO 5 580 + Node-ID
- TPDO 6 680 + Node-ID
- TPDO 7 780 + Node-ID
- TPDO 8 880 + Node-ID

The configuration of the additional RX/TX PDOs starts with step 3 when using the EDS file for 8 PDOs, as these are already set to Invalid by default.

Note
A setting of the PDOs that differs from the standard PDO configuration cannot be saved without voltage and must be carried out again after each restart of the motor control unit. For this purpose, it is recommended to create a corresponding restart routine in the master control system.

5.6.6 State Machine

The states are controlled by reading and processing different bits of the Statusword 6041h and Controlword 6040h. The dryve D1 is controlled by the Controlword. The Statusword is used to display feedback. The states must be set by the user (master control system).



To go through the State Machine the Bits 0, 1, 2 and 3 must be set permanently after being set the first time.

Command	Bit assignment, Controlword 6040h					Transitions
	Bit 7	Bit 3	Bit 2	Bit 1	Bit 0	
Shutdown	0	X	1	1	0	2, 6, 8
Switch On	0	0	1	1	1	3
Switch On and Enable Operation1	0	1	1	1	1	3, 4
Disable Voltage	0	X	X	0	X	7, 9, 10, 12
Quick Stop	0	X	0	1	X	7, 10, 11
Disable Operation	0	0	1	1	1	5
Enable Operation	0	1	1	1	1	4, 16
Fault Reset	1	X	X	X	X	15

¹Automatic transition to Enable Operation after Switch On has been set

Note

A high/1 signal at digital input 7 “Enable” (“Remote” Bit 9 6041h Statusword) is mandatory for the state machine to run.

Note

After passing through the State Machine successfully and obtaining the state "Operation enabled" the Bits 0, 1, 2 and 3 must be sent with each Controlword telegram to maintain the state "Operation enabled"

Note

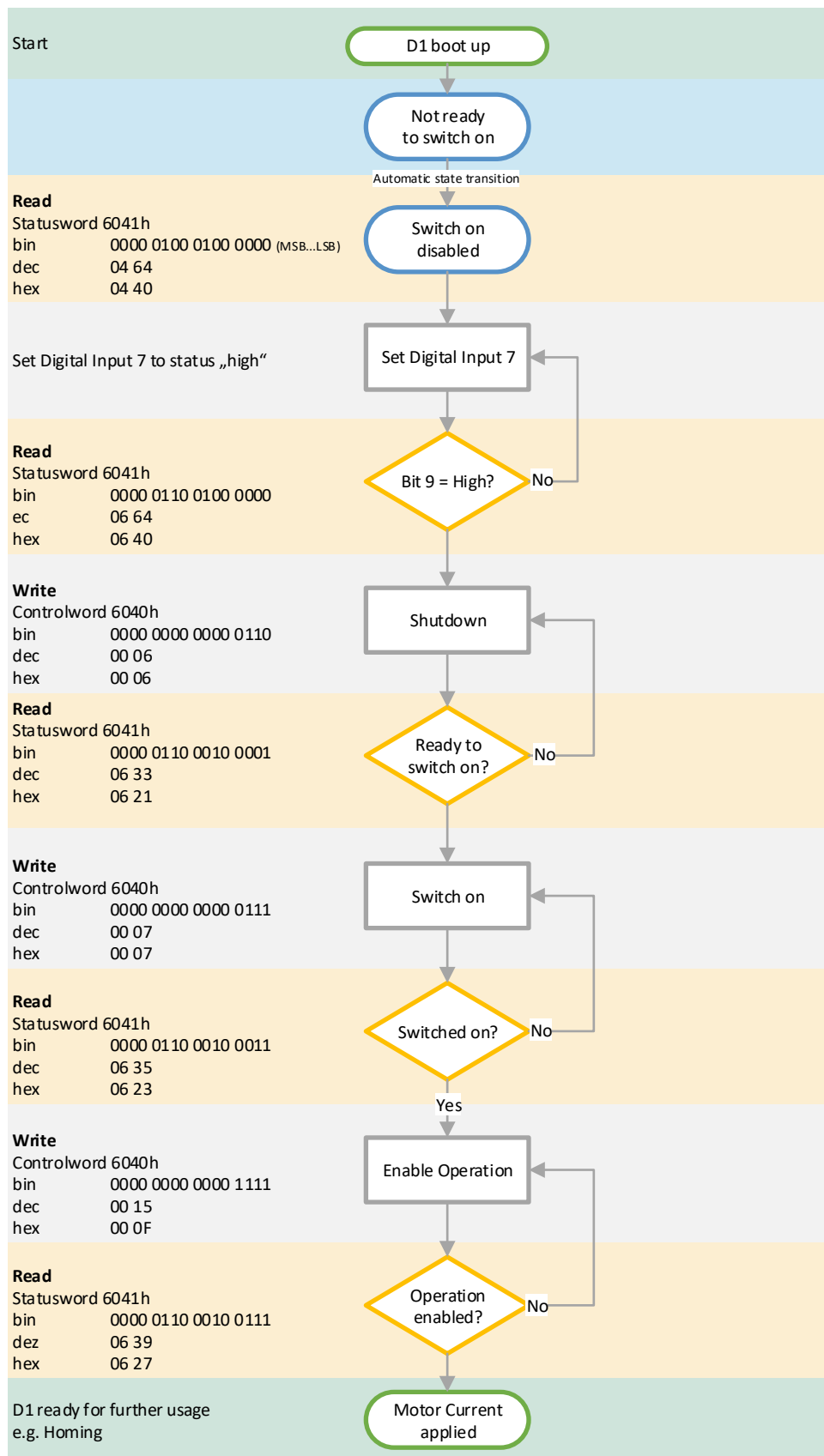
The "Quick stop" status is assumed when Bit 2 of object 6040h "Controlword" is set from 1/high to 0/low. This is functionally equivalent to an emergency stop - only an emergency stop function, no safety relevance.

Note

If it is not possible to run through the State Machine and the hexadecimal value "27 04" is output when the 6041h "Statusword" is read, the motor control unit has been transferred to an invalid state due to previous use in the "Binary", "Jog/Teach", "Clock/Direction", "Electronic Actuator" or "Modulo Positioning" operating mode.

Please restart the motor controller.

5.6.7 State Machine Visualisation after Boot Up



5.6.8 Statusword

The Statusword provides general operating state information of the drive D1.

Bit assignment of Statusword 6041h

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
<i>ms</i>		<i>oms</i>		<i>ila</i>	<i>tr</i>	<i>rm</i>	<i>ms</i>	<i>w</i>	<i>sod</i>	<i>qs</i>	<i>ve</i>	<i>f</i>	<i>oe</i>	<i>so</i>	<i>rtso</i>
MSB															LSB

Bit	Description	Different meaning "Mode Specific"		
		Homing	Profile Position	Profile Velocity
0	Ready to Switch On	-	-	-
1	Switched On	-	-	-
2	Operation Enabled	-	-	-
3	Fault	-	-	-
4	Voltage Enable	-	-	-
5	Quick Stop	-	-	-
6	Switch On Disabled	-	-	-
7	Warning	-	-	-
8	Manufacturer Specific	-	-	-
9	Remote	0: DI 7 logical 0	0: DI 7 logical 0	0: DI 7 logical 0
		1: DI 7 logical 1	1: DI 7 logical 1	1: DI 7 logical 1
10	Target Reached	Refer to Homing (p. 117)	0: Target not reached	0: Velocity not reached
		Refer to Homing (p. 117)	1: Target reached	1: Velocity reached
11	Internal Limit Active	-	-	-
12	Operation mode specific	Refer to Homing (p. 117)	0: Wait for new setpoint	0: Speed ≠0
		Refer to Homing (p. 117)	1: Setpoint applied	1: Speed =0
13	Operation mode specific	Refer to Homing (p. 117)	-	-
		Refer to Homing (p. 117)	-	-
14	Manufacturer Specific	-	-	-
15	Manufacturer Specific	-	-	-

Bit assignment, Statusword 6041h, data package	Meaning
Bit 15 → Bit 0	
xxxx xxxx x0xx 0000b	Not Ready to Switch On
xxxx xx1x x1xx 0000b	Switch On Disabled
xxxx xx1x x01x 0001b	Ready to Switch On
xxxx xx1x x01x 0011b	Switched On
xxxx xx1x x01x 0111b	Operation Enabled
xxxx xx1x x00x 0111b	Quick Stop Active
xxxx xx1x x0xx 1111b	Fault Reaction Active
xxxx xx1x x0xx 1000b	Fault

Note
The Status Word should always be evaluated "bit by bit."

5.6.9 Controlword

The Controlword can be used to trigger changes to the drive D1.

Bit assignment Controlword 6040h

15		11	10	9	8	7	6		4	3	2	1	0
<i>ms</i>				<i>r</i>	<i>oms</i>	<i>h</i>	<i>fr</i>	<i>oms</i>	<i>eo</i>	<i>qs</i>	<i>ev</i>	<i>so</i>	
MSB												LSB	

Bit	Description	Different meaning "Mode Specific"		
		Homing	Profile Position	Profile Velocity
0	Switch On	-	-	-
1	Enable Voltage	-	-	-
2	Quick Stop	-	-	-
3	Enable Operation	-	-	-
4	Mode Specific	0: Homing Blocked	0: No Start Signal	-
		1: Homing Start 	1: Start of Movement 	-
5	Mode Specific	-	-	-
		-	1: Instant new parameter adoption	-
6	Mode Specific	-	0: Absolute Positioning	-
		-	1: Relative Positioning	-
7	Fault Reset	-	-	-
		1: Error Reset 	1: Error Reset 	1: Error Reset 
8	Halt	0: Enable Bit 4	0: Movement Enabled	-
		1: Not enabled/Stop	1: Not enabled/Stop	-
9	Mode Specific	-	0: Point to point movement	-
		-	1: Movement Transition (p. 118)	-
10	Reserved	-	-	-
11	Manufacturer Specific	-	-	-
12	Manufacturer Specific	-	-	-
13	Manufacturer Specific	-	-	-
14	Manufacturer Specific	-	-	-
15	Manufacturer Specific	-	-	-

Note

After passing through the State Machine successfully and obtaining the state "Operation enabled" the Bits 0, 1, 2 and 3 must be sent with each Controlword telegram to maintain the state "Operation enabled"

Note

The start command via Bit 4 (positive edge) must not be set before all required objects are configured

5.6.10 Modes of Operation

The object 6060h „Modes of Operation“ controls the operating mode in which the motor controller is located.

- 06h Homing – Execute referencing to determine the zero point.
- 01h Profile Position Mode – Mode for executing positioning.
- 03h Profile Velocity Mode – Mode for controlling speed setpoints.
- 08h Cyclic Synchronous Position Mode – Positioning mode with complete control of all movement parameters.

To ensure that the operation mode has been changed, object 6061h “Modes of Operation Display” must display the same value as object 6060h.

5.6.10.1 Homing

Homing is used to reach a homing (reference) point and thus specify the zero point of the axis.
For this mode to be used, the value 6 must be entered in object **6060h "Modes of Operation"**.

Homing Execution

Requirements

- CANopen communication set active [Bus Systems](#) (P. 66)
- CANopen communication set dominant [Drive Mode Selection](#) (P. 77)
- Chapter [Necessary User Interface Settings](#) (p. 109)
- Digital Input DI 7 „Enable“ set high
- Pass through the „State Machine“ till „Operation Enabled“

The following objects are to be parameterised (minimal requirement)

Object	Name	Description
6060h	Modes of Operation	Mode selection – Target value: 6
6092h:01h	Feed_constant_Feed	Shaft federate
6092h:02h	Feed_constant_Shaft_revolutions	Shaft revolutions I
6099h:01h	Switch Search VEL	Switch Search Speed
6099h:02h	Zero Search VEL	Zero Search Speed
609Ah	Homing ACC	Acceleration/deceleration for homing run
6098h	Homing Method	Referencing method
607Ch	Home Offset	Home Point Offset (optional in user interface)
6040h	Controlword	Start Command via Bit 4 – positive edge

Before the Bit 4 start command can be set in Controlword 6040h, one system cycle (waiting for the masters response telegram) should be planned as a delay to ensure a reliable data adoption. An indication/assessment that the homing run has been completed positively is possible with Statusword Bit 10 and Bit 12. If these two bits have been set to 1, homing is regarded as been completed positively.

The information whether a referencing was successfully completed or still remains is stored in object [2014h Status Flags](#) (p. 169) in Bit 1.

In addition, the indicator "Referenced" and the Digital Output DO 3 "Referenced" will be set to 1 on the dryve D1 user interface.

Note
It is recommended to set the value 609Ah Homing Acceleration (p. 180) 5 to 10 times higher than the value 6099h Homing Speeds (p. 180) to search for the limit switch. If accelerations are set too low, the limit position switch can be overrun and the axis can be destroyed by driving into a block.

Homing specific explanation Bit 10, 12 and 13 Statusword 6041h

Bit 13	Bit 12	Bit 10	Description
Homing Error	Homing Attained	Target Reached	
0	0	0	Homing is being executed.
0	0	1	Homing is interrupted or not yet started.
0	1	0	Homing is executed but the target is not yet reached.
0	1	1	Homing is executed successfully.
1	0	0	An Error occurred, velocity ≠ 0
1	0	1	An Error occurred, velocity = 0
1	1	X	Reserved

5.6.10.2 Profile Position Mode

The Profile Position Mode (PP) is used for the execution of positioning movements. To perform positioning movements, the parameters for position, velocity, acceleration and deceleration must be entered.

The value 1 must be set in object **6060h "Modes of Operation"** so that this mode can be used.

Positioning movement Execution

Requirements

- CANopen communication set active [Bus Systems](#) (P. 66)
- CANopen communication set dominant [Drive Mode Selection](#) (P. 77)
- Chapter [Necessary User Interface Settings](#) (p. 109)
- Digital Input DI 7 „Enable“ set high
- Pass through the „State Machine“ till „Operation Enabled“
- Successful execution of a reference movement (Homing) – only with „Absolut“ positioning (Bit 6 „Controlword“ „0“)
- No negative values in object [607Ah Target Position](#) when using absolute positioning

The following objects must be parameterized (minimal requirement)

Object	Name	Description
6060h	Modes of Operation	Mode selection – Target value: 1
6092h:01h	Feed_constant_Feed	Shaft federate
6092h:02h	Feed_constant_Shaft_revolutions	Shaft revolutions l
607Ah	Target Position	Indication of the New Target Position
6081h	Profile Velocity	Speed
6083h	Profile Acceleration	Acceleration
6084h	Profile Deceleration	Deceleration (optional)
6040h	Controlword	Start Command via Bit 4 – positive edge

If “Absolut Positioning” (Controlword 6041h, Bit 6 not set) is used a previous homing is strictly necessary (Statusword 6041h, Bit 10 and 12 set). While using “Relative Positioning” (Controlword 6041h, Bit 6 set) a previous “Homing” is not necessary.

Before the Bit 4 start command can be set in Controlword 6040h, a delay period of one system cycle (write telegram sent and answer telegram received) should be planned to ensure a reliable adoption of the data .

After Bit 4 “Start” has been set in Controlword 6040h, Bit 10 “Target Reached” is reset in Statusword 6041h by the D1 and Bit 12 (New Setpoint) is set. The Start command Bit 4 in the Controlword should be reset now.

The D1 resets Bit 12 (New Setpoint) in the Statusword automatically. If Bit10 is then set in the Statusword, the movement has been executed successfully.

For display and evaluation of the actual position, object 6064h “Position Actual Value” can be used and object 606Ch “Velocity Actual Value” can be used for the actual velocity.

Bit 9 Controlword: Movement Transition

If a movement shall move directly to an alternative target position before reaching the original target position and setting the “Target Reached” Bit high , the new target position must be written into object 607Ah “Target Position” and Bit 5 “ Instant new parameter adoption ” must be set high/1 before the Start command (Bit 4) has been issued.

If other acceleration, velocity or deceleration values are to be used for the movement execution of the new target position, these must be written into the respective objects before the new movement is started.

5.6.10.3 Profile Velocity Mode

The Velocity Mode is used to set a motor target velocity. A Homing is not necessary. The value 3 must be set in object 6060h "Modes of Operation" so that this mode can be used.

Movement Execution

Requirements

- CANopen communication set active [Bus Systems](#) (P. 66)
- CANopen communication set dominant [Drive Mode Selection](#) (P. 77)
- Chapter [Necessary User Interface Settings](#) (p. 109)
- Digital Input DI 7 „Enable“ set high
- Pass through the „State Machine“ till „Operation Enabled“

The following objects must be parameterized (minimal requirement)

Object	Name	Description
6060h	Modes of Operation	Mode selection – Target value: 3
6092h:01h	Feed_constant_Feed	Shaft federate
6092h:02h	Feed_constant_Shaft_revolutions	Shaft revolutions l
6083h	Profile Acceleration	Acceleration
6084h	Profile Deceleration	Deceleration (optional)
60FFh	Target Velocity	Target Speed set point

If an acceleration value has been entered in object 6083h "Profile Acceleration" the movement is started immediately after setting the "Target Velocity" in object 60FFh. The movement is stopped by entering the value 0 (zero) in Object 60FFh. Positive values result in clockwise movements, negative values result in counterclockwise movements - [Rotation direction determination](#) (p. 82).

Object 6064h "Position Actual Value" or Object 606Ch "Velocity Actual Value" can be used to display and evaluate the current position or the current speed.

5.6.10.4 Cyclic Synchronous Position Mode

The Cyclic Synchronous Position Mode (CSP) is used to implement motion control by specifying many individual position points. This mode is particularly suitable for circular movements or for a synchronization of several axes. Accelerations and velocities are generated internally according to the next Target Position command. The trajectory must be generated in a higher-level control system.

To use this mode, the value 8 must be set in object **6060h "Modes of Operation"**

Requirements:

- CANopen communication set active [Bus Systems](#) (P. 66)
- CANopen communication set dominant [Drive Mode Selection](#) (P. 77)
- Chapter [Necessary User Interface Settings](#) (p. 109)
- Digital Input DI 7 „Enable“ set high
- Pass through the „State Machine“ till „Operation Enabled“
- Successful execution of a reference movement (Homing)
- No negative values in object [607Ah Target Position](#) when using absolute positioning

The following objects must be parameterized

Object	Name	Description
6060h	Modes of Operation	Mode selection – Target value: 8
6092h:01h	Feed_constant_Feed	Shaft federate
6092h:02h	Feed_constant_Shaft_revolutions	Shaft revolutions l
607Ah	Target Position	Indication of the New Target Speed
60C2h	Interpolation Time Period	Minimum cycle time for adopting new position set points

If the value in object 6060h "Modes of Operation" was set to 8, the CSP mode is directly active. If values are now written into object 607Ah "Target Position", position changes are executed directly

Note
If a fault shutdown during a traversing movement had to be executed, e.g. Following Error (P. 239) and the movement shall be restarted again, a new trajectory generation must be created from the current position. If a too large Actual Position to Target Position deviation is being used for restarting the movement (e.g. destination or initial starting position), a new following error can immediately arise.

The object 6064h "Position Actual Value" can be used to display and evaluate the current position or the object 606Ch "Velocity Actual Value" for the current speed.

5.6.11 Necessary User Interface Settings

The following objects/parameters must be set in the user interface of the drive D1.

“Motor” page

All parameters relevant to the motor must be set in the user interface.

“Communication” page

Parameterization and activation of the CANopen communication interface [Bus Systems](#) (p.66).

“Drive Profile” page

Setting the dominance via the dropdown menu to allow the CANopen master to execute movements.

Note
Only after the selection on the Drive Profile page is the CANopen master authorised to execute move commands.

5.6.12 Parameter Input

All parameters are to be entered without dimensions. Parameters that require a dimension due to their nature are dealt with in detail in the respective object descriptions.

The target position specification for a "relative movement" (Bit 6 Controlword 6040h set to 1) is specified in object 607Ah "Target Position" by positive and negative values.

The target position input for an "absolute movement" cannot use negative target values.

If the values entered in the movement parameters are greater than the values entered at [Motion Limits](#) (p. 56), no movement can be executed.

Decimal Value	Hexadezimal Value (Little Endian)			
	Byte 22	Byte 21	Byte 20	Byte 19
100	0	0	0	64
255	0	0	0	FF
256	0	0	1	0
2.000	0	0	7	D0
6.000	0	0	17	70
30.000	0	0	75	30
150.000	0	2	49	F0
101.253.137	6	9	0	11
-100	FF	FF	FF	156
-255	FF	FF	FF	1
-256	FF	FF	FF	0
-2.000	FF	FF	F8	30
-6.000	FF	FF	E8	90
-30.000	FF	FF	8A	D0
-150.000	FF	FD	B6	10
-101.253.137	F9	F6	FF	EF

5.6.13 Saving Object Data

The values entered in the objects can be saved in 2 ways.

1. Automatic saving during parameterisation via the user interface.
If the user interface is used for commissioning, all values entered via this interface are automatically transferred to the non-volatile memory of the motor controller after 5 seconds and are permanently saved – even after switching off/loss of the logic voltage.
2. Manual saving when parameterising via bus systems
If commissioning is executed via the bus systems, parameterisation must be initiated manually via object [1010h Store Parameters](#) (p. 129). Only with this command all values are transferred to the non-volatile memory of the motor control

HINWEIS

Only objects from the object ranges 2000h and 6000h can be saved permanently.

5.6.14 Error output and Reset

If an error is detected by the drive D1, Bit 3 "Fault" in the [6041h Statusword](#) (p. 171) is set high/1.

In addition, in object [1001h Error Register](#) (p. 125), the information to which error group this is assigned is stored by setting the respective Bit high/1.

Object [1003h Pre-defined Error Field](#) (p. 125) serves as an error memory for up to 8 errors. These are filled in the sub-indices 1 to 8 with the respective error code from object [603Fh Error Code](#) (p. 169).

Errors can be reset by setting Bit 7 "Fault Reset" in the Controlword (DI 7 "Enable"/Bit 9 "Remote" in the Statusword must be high/1), by using the reset button on the graphical user interface or by setting DI 10 to high/1. In addition, descriptions and remedies are provided for all errors.

HINWEIS

If an error has occurred during a movement and this has been reset, the movement can only be restarted after bit 8 'Halt' has been set high/1 via the Controlword and the state machine has been run through again to the 'Operation Enabled' status.

5.6.15 Abort Code SDO Communication

If invalid SDO telegrams are sent, an "Abort Code" specific to the cause is returned via the response telegram. This is indicated by an 80h in [Byte 0](#) (p. 106) of the response telegram.

Table of Abort Codes

Description				
Byte 4	Byte 5	Byte 6	Byte 7	
00	00	03	05	Toggle bit not alternated.
00	00	04	05	SDO protocol timed out.
01	00	04	05	Client/server command specifier not valid or unknown.
00	00	01	06	Unsupported access to an object.
01	00	01	06	Attempt to read a write only object.
02	00	01	06	Attempt to write a read only object.
00	00	02	06	Object does not exist in the object dictionary.
41	00	04	06	Object cannot be mapped to the PDO.
42	00	04	06	The number and length of the objects to be mapped would exceed PDO length.
43	00	04	06	General parameter incompatibility reason.
47	00	04	06	General internal incompatibility in the device.
00	00	06	06	Access failed due to a hardware error.
10	00	07	06	Data type does not match
12	00	07	06	Data type does not match
13	00	07	06	Data type does not match
11	00	09	06	Sub-index does not exist.
30	00	09	06	Invalid value for parameter (download only).
31	00	09	06	Value of parameter written too high (download only).
32	00	09	06	Value of parameter written too low (download only).
36	00	09	06	Maximum value is less than minimum value.
23	00	0A	06	Resource not available: SDO connection
00	00	00	08	General error
20	00	00	08	Data cannot be transferred or stored to the application
21	00	00	08	Data cannot be transferred or stored to the application because of local control
22	00	00	08	Data cannot be transferred or stored to the application because of the present device state
23	00	00	08	Object dictionary is generated from file and generation fails because of an file error)

5.6.16 Object information

Variable

Information in an object without sub index structures

Array

Information indicated in an object with sub index structures

Visible String

Information indicated in an object in the ASCII format.

Indication of the length always in sub index 0, information from sub index 1 onwards

Unsigned 8 to 32

Type of data for integral values with 8 to 32 Bit (1 to 4 Byte) in the positive value range

Integer 8 to 32

Type of data for integral values with 8 to 32 Bit (1 to 4 Byte) in the same distribution in the negative and positive value range

RO

Objects with this attribute can only be read

RW

Objects with this attribute can be read and written.

RWW

Objects with this attribute can be read and written. If an object is written with this attribute, the process result is affected immediately. (CiA DSP 306 V 1.2: CANopen electronic data sheet (EDS) specification for CANopen)

5.6.17 Overview of available Objects

1000h	Device Type	1802h	3 rd TPDO Com Parameter	6040h	Controlword
1001h	Error Register	1803h	4 th TPDO Com Parameter	6041h	Statusword
1003h	Pre-Defined Error Field	1804h	5 th TPDO Com Parameter	6060h	Modes of Operation
1005h	COB-ID SYNC	1805h	6 th TPDO Com Parameter	6061h	Modes of Operation Display
1006h	Communication Cycle Period	1806h	7 th TPDO Com Parameter	6064h	Position Actual Value
1007h	Synchronous Window Length	1807h	8 th TPDO Com Parameter	6065h	Following Error Window
1008h	Manufacturer Device Name	1A00h	1 st TPDO Mapping Parameter	6066h	Following Error Time Out
1009h	Manufacturer Hardware Version	1A01h	2 nd TPDO Mapping Parameter	6067h	Position Window
100Ah	Manufacturer Software Version	1A02h	3 rd TPDO Mapping Parameter	6068h	Position Window Time
100Ch	Guard Time	1A03h	4 th TPDO Mapping Parameter	606Ch	Velocity Actual Value
100Dh	Life Time Factor	1A04h	5 th TPDO Mapping Parameter	6073h	Max Current
1014h	COB-ID EMCY	1A05h	6 th TPDO Mapping Parameter	6075h	Motor Rated Current
1015h	Inhibit Time EMCY	1A06h	7 th TPDO Mapping Parameter	6078h	Current Actual Value
1016h	Consumer Heartbeat Time	1A07h	8 th TPDO Mapping Parameter	607Ah	Target Position
1017h	Producer Heartbeat Time	2000h	Motor Current	607Bh	Position Range Limit
1018h	Identity Object	2001h	Step Mode	607Ch	Home Offset
1010h	Store Parameters	2002h	Motor pole Pairs	607Fh	Max Profile Velocity
1200h	SDO Server Parameter	2003h	Encoder	6081h	Profile Velocity
1400h	1 st RPDO Com Parameter	2004h	Closed loop enabled	6083h	Profile Acceleration
1401h	2 nd RPDO Com Parameter	2005h	Brake	6084h	Profile Deceleration
1402h	3 rd RPDO Com Parameter	2006h	Brake Resistor Voltage	6085h	Quick Stop Deceleration
1403h	4 th RPDO Com Parameter	2007h	S Curve Ratio	608Fh	Position Encoder Resolution
1404h	5 th RPDO Com Parameter	2008h	Limit Switch Position	6091h	Gear Ratio
1405h	6 th RPDO Com Parameter	2009h	Analog Input Min	6092h	Feed Constant
1406h	7 th RPDO Com Parameter	200Ah	Analog Input Max	6098h	Homing Method
1407h	8 th RPDO Com Parameter	200Bh	Analog Input Dead Band	6099h	Homing Speeds
1600h	1 st RPDO Mapping Parameter	200Ch	Analog Input Hysteresis	609Ah	Homing Acceleration
1601h	2 nd RPDO Mapping Parameter	200Dh	Analog Input Filter	60A8h	SI Unit Position
1602h	3 rd RPDO Mapping Parameter	200Eh	Analog Input Value	60C2h	Interpolation Time Period
1603h	4 th RPDO Mapping Parameter	200Fh	Digital Input Type	60C5h	Max Acceleration
1604h	5 th RPDO Mapping Parameter	2010h	Digital Input Polarity	60F4h	Following Error Actual Value
1605h	6 th RPDO Mapping Parameter	2011h	Digital Output Polarity	60FDh	Digital Inputs
1606h	7 th RPDO Mapping Parameter	2012h	Controller Parameters	60FEh	Digital Outputs
1607h	8 th RPDO Mapping Parameter	2013h	Controller Temperature	60FFh	Target Velocity
1800h	1 st TPDO Com Parameter	2014h	Status Flags	6402h	Motor Type
1801h	2 nd TPDO Com Parameter	603Fh	Error Code	6502h	Supported Drive Modes

5.6.18 Detailed description Motion Control Objects

1000h Device Type

Short description

Information about the device type to identify all similar devices in one Node.

Parameter Name	Device_Type		
Object Type	VAR	0x7	
Data Type	UNSIGNED32	0x0007	4 Byte
Access	RO		
Default Value	0x420192		
PDO Mapping	No		

1001h Error Register

Short description

When switching to an error state, general error information is entered in this object by setting the respective bit. Bit 0 is always set in the event of an error.

If the error has been resolved, the object value is automatically reset to 0 without an actively executed reset.

Parameter Name	Error_Register		
Object Type	VAR	0x7	
Data Type	UNSIGNED8	0x0005	1 Byte
Access	RO		
Default Value	0x420192		
PDO Mapping	No		

Bit Assignment

0	Generic Error
1	Current
2	Voltage
3	Temperature
5	Device Profile Specific
7	Manufacturer Specific

1003h Pre-defined Error Field

Short description

Sub-index 0 shows how many errors have occurred so far. A maximum of 8 errors can be logged. The first error is entered in sub-index 1. When another error occurs, this information moves to sub-index 2 and successively to sub-index 8.

If the 9th error occurs, the oldest entry is deleted and overwritten by the second oldest.

The error codes from [603Fh Error Code](#) (p. 169) are entered in the subindices. These correspond to the error codes of the user interface.

If no error has occurred yet, subindex 0 has the value 00h.

The subindices 1 to 8 are not readable and are acknowledged with an

[Abort Code SDO Communication](#) (p. 122)" 11 00 09 06h".

Parameter Name	Pre-defined_Error_Field	
Object Type	ARRAY	0x8
Subindex Number	9	

1003h sub 0 Number of entries

Parameter Name	Number_of_Errors		
Object Type	VAR	0x7	
Data Type	UNSIGNED8	0x0005	1 Byte
Access	RW		
Default Value	0x0		
PDO Mapping	No		

1003h sub1 Standard Error Field

Parameter Name	Standard_Error_Field		
Object Type	VAR	0x7	
Data Type	UNSIGNED32	0x0007	4 Byte
Access	RO		
PDO Mapping	No		

1003h sub2 Standard Error Field

Parameter Name	Standard_Error_Field		
Object Type	VAR	0x7	
Data Type	UNSIGNED32	0x0007	4 Byte
Access	RO		
PDO Mapping	No		

[Back to object overview](#)

1003h sub3 Standard Error Field

Parameter Name	Standard_Error_Field		
Object Type	VAR	0x7	
Data Type	UNSIGNED32	0x0007	4 Byte
Access	RO		
PDO Mapping	No		

1003h sub4 Standard Error Field

Parameter Name	Standard_Error_Field		
Object Type	VAR	0x7	
Data Type	UNSIGNED32	0x0007	4 Byte
Access	RO		
PDO Mapping	No		

1003h sub5 Standard Error Field

Parameter Name	Standard_Error_Field		
Object Type	VAR	0x7	
Data Type	UNSIGNED32	0x0007	4 Byte
Access	RO		
PDO Mapping	No		

1003h sub6 Standard Error Field

Parameter Name	Standard_Error_Field		
Object Type	VAR	0x7	
Data Type	UNSIGNED32	0x0007	4 Byte
Access	RO		
PDO Mapping	No		

1003h sub7 Standard Error Field

Parameter Name	Standard_Error_Field		
Object Type	VAR	0x7	
Data Type	UNSIGNED32	0x0007	4 Byte
Access	RO		
PDO Mapping	No		

1003h sub8 Standard Error Field

Parameter Name	Standard_Error_Field		
Object Type	VAR	0x7	
Data Type	UNSIGNED32	0x0007	4 Byte
Access	RO		
PDO Mapping	No		

1005h Cob-ID Sync**Short description**

Setting of the SYNC telegram COB-ID of the SYNC protocol.

If a value other than the standard 80h shall be used, it must be ensured that no assigned or reserved COB-IDs are used.

Parameter Name	Cob-ID_Sync		
Object Type	VAR	0x7	
Data Type	UNSIGNED32	0x0007	4 Byte
Access	RW		
Default Value	0x80		
PDO Mapping	No		

1006h Communication Cycle Period**Short description**

Configuration of the cycle times between 2 PDO SYNC telegrams. Specification of the values in μ s.
If the value is set to 0, the transmission of SYNC telegram is deactivated.

Parameter Name	Communication_Cycle_Period		
Object Type	VAR	0x7	
Data Type	UNSIGNED32	0x0007	4 Byte
Access	RW		
Default Value	0x0		
PDO Mapping	No		

1007h Synchronous Window Length**Short description**

Configuration of the time frame for synchronous PDOs.
Within the time frame, the TX PDO must have been sent by the motor controller and the RX PDO must have been received by the master. If this frame is exceeded, all synchronous TX-PDOs are discarded and an EMCY message is transmitted.
Synchronous RX-PDO processing is resumed with the next SYNC telegram.
Specification of the values in μ s.
If the value is set to 0, the time window is deactivated.

Parameter Name	Synchronous_Window_Length		
Object Type	VAR	0x7	
Data Type	UNSIGNED32	0x0007	4 Byte
Access	RW		
Default Value	0x0		
PDO Mapping	No		

1008h Manufacturer Device Name**Short description**

Device name stated as number sequence

Parameter Name	Manufacturer_Device_Name		
Object Type	VAR	0x7	
Data Type	VISIBLE_STRING	0x0009	Size not defined
Access	CONST		
PDO Mapping	No		

1009h Manufacturer Hardware Version**Short description**

Hardware version stated as number sequence

Parameter Name	Manufacturer_Hardware_Version		
Object Type	VAR	0x7	
Data Type	VISIBLE_STRING	0x0009	Size not defined
Access	CONST		
PDO Mapping	No		

100Ah Manufacturer Software Version**Short description**

Software version stated as number sequence

Parameter Name	Manufacturer_Software_Version		
Object Type	VAR	0x7	
Data Type	VISIBLE_STRING	0x0009	Size not defined
Access	CONST		
PDO Mapping	No		

[Back to object overview](#)

100Ch Guard Time**Short description**

Configuration of the time window between 2 remote frame telegrams of the "Nodeguarding" functionality.
Specification of the values in ms.
If the value is set to 0, "Nodeguarding" is deactivated.

The use of nodeguarding/remote frame telegrams cannot be recommended due to the high error rate.
Compare: "CiA Application Note AN802 - CAN remote frames: Avoiding of usage".

Parameter Name	Guard_Time		
Object Type	VAR	0x7	
Data Type	UNSIGNED16	0x0006	2 Byte
Access	RW		
Default Value	0x0		
PDO Mapping	No		

100Dh Life Time Factor**Short description**

Configuration of the factor for determining the time period until the end of which a new remote frame telegram must have been received by the dryve D1.
The factor is multiplied by the value from the object 100Ch "Guard Time".
If the value is set to 0, "Nodeguarding" is deactivated.

The use of nodeguarding/remote frame telegrams is not recommended due to the high error rate.
Compare: "CiA Application Note AN802 - CAN remote frames: Avoiding of usage".

Parameter Name	Life_Time_Factor		
Object Type	VAR	0x7	
Data Type	UNSIGNED8	0x0005	1 Byte
Access	RW		
Default Value	0x0		
PDO Mapping	No		

1010h Store Parameters**Short description**

One-time saving of the parameters in the non-volatile memory.

In order to save the parameters, the following values must be transmitted in the telegram data range during the respective saving process.

Subindex 01: Save All Parameters

Permanent storage of all available parameters

Subindex 03: Save Application Parameters

Permanent saving of the parameters in the objects 6000h to 9FFFh

Data range of the sub-indices	Byte 0	Byte 1	Byte 2	Byte 3
	LSB			MSB
ISO8859 coding	S	A	V	E
Numerical values	73h	61h	76h	65h

Example:

Save All Parameters

COB-ID	DLC	Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
601h	8h	23h	10h	10h	01h	73h	61h	76h	65h

Parameter Name Store_Parameters
Object Type ARRAY 0x8
Subindex Number 4

1010h sub 0 Number of entries

Parameter Name Number_of_entries
Object Type VAR 0x7
Data Type UNSIGNED8 0x0005 1 Byte
Access Const
Default Value 0x3
PDO Mapping No

1010h sub1 Save All Parameters

Parameter Name Save_All_Parameters
Object Type VAR 0x7
Data Type UNSIGNED32 0x0007 4 Byte
Access RW
PDO Mapping No

1010h sub3 Save Application Parameters

Parameter Name Save_Application_Parameters
Object Type VAR 0x7
Data Type UNSIGNED32 0x0007 4 Byte
Access RW
PDO Mapping No

1014h COB-ID EMCY**Short description**

COB ID of the emergency service.

Bits 0 to 30 are set automatically according to the node ID.

The emergency service is deactivated by manually setting bit 31.

Parameter Name COB-ID EMCY
Object Type VAR 0x7
Data Type UNSIGNED32 0x0007 4 Byte
Access RW
Default Value \$NODEID+0x80
PDO Mapping No

[Back to object overview](#)

1015h Inhibit Time EMCY**Short description**

Configuration of the time delay until an EMCY telegram is sent again.

Specify the value in multiples of 100 µs.

If the value is set to 0, the EMCY telegram is sent once.

Parameter Name	Inhibit_Time_EMCY		
Object Type	VAR	0x7	
Data Type	UNSIGNED8	0x0005	1 Byte
Access	RW		
PDO Mapping	No		

1016h Consumer Heartbeat Time**Short description**

Configuration of the consumer heartbeat cycle time.

The consumer heartbeat is used to monitor whether the configured device (subindex 1, master or slave) continues to send the producer heartbeat as an NMT telegram (1017h Producer Heartbeat Time) at regular intervals.

If the cycle time is exceeded, an EMCY telegram is sent.

Monitoring is only started after receipt of the first producer heartbeat telegram.

Specification of the values in ms.

Parameter Name	Consumer_Heartbeat_Time	
Object Type	ARRAY	0x8
Subindex Number	2	

1016h sub 0 Number of entries

Parameter Name	Number_of_entries		
Object Type	VAR	0x7	1 Byte
Data Type	UNSIGNED8	0x0005	
Access	Const		
Default Value	0x1		
PDO Mapping	No		

1016h sub1 Consumer Heartbeat Time

Parameter Name	Consumer_Heartbeat_Time		
Object Type	VAR	0x7	
Data Type	UNSIGNED32	0x0007	4 Byte
Access	RW		
Default Value	0x0		
PDO Mapping	Yes		

Bit Assignment

0 to 15	Configuration cycle time
16 to 23	Configuration of monitored Node-ID
24 to 31	Reserved

If the value in Bit 0 to 16 is set to 0, the consumer heartbeat monitoring is deactivated

1017h Producer Heartbeat Time**Short description**

Configuration of the Producer Heartbeat cycle time.

The producer heartbeat periodically sends NMT telegrams to indicate the online status of the dryve D1.

Specification of the values in ms.

If the value is set to 0, the producer heartbeat monitoring is deactivated.

Parameter Name	Producer_Heartbeat_Time		
Object Type	VAR	0x7	
Data Type	UNSIGNED16	0x0006	2 Byte
Access	RW		
Default Value	0x0		
PDO Mapping	No		

Value Definition NMT-Status

7F	Pre-Operational
05	Operational

1018h Identity Object**Short description**

Information about the device manufacturer, the product code, the revision number and the serial number

Parameter Name	Identity_Object		
Object Type	VISIBLE_STRING	0x9	
Subindex Number	5		

1018h sub 0 Number of entries

Parameter Name	Number_of_entries		
Object Type	VAR	0x7	
Data Type	UNSIGNED8	0x0005	1 Byte
Access	Const		
Default Value	0x4		
PDO Mapping	No		

1018h sub1 Vendor-Id

Parameter Name	Vendor-Id		
Object Type	VAR	0x7	
Data Type	UNSIGNED32	0x007	4 Byte
Access	RO		
Default Value	0x3FE		
PDO Mapping	No		

1018h sub2 Product Code

Parameter Name	Product_Code		
Object Type	VAR	0x7	
Data Type	UNSIGNED32	0x0007	4 Byte
Access	RO		
PDO Mapping	No		

1018h sub3 Revision Number

Parameter Name	Revision_Number		
Object Type	VAR	0x7	
Data Type	UNSIGNED32	0x0007	4 Byte
Access	RO		
PDO Mapping	No		

1018h sub4 Serial Number

Parameter Name	Serial_Number		
Object Type	VAR	0x7	
Data Type	UNSIGNED32	0x0007	4 Byte
Access	RW		
PDO Mapping	No		

1200h SDO Server Parameter**Short description**

COB-ID configuration for SDO communication.

Parameter Name	Identity_Object	
Object Type	VISIBLE_STRING	0x9
Subindex Number	3	

1200h sub 0 Number of entries

Parameter Name	Number_of_entries		
Object Type	VAR	0x7	
Data Type	UNSIGNED8	0x0005	1 Byte
Access	Const		
Default Value	2		
PDO Mapping	No		

1200h sub1 COB-ID Client->Server (rx)

Parameter Name	COB-ID_Client->Server_(rx)		
Object Type	VAR	0x7	
Data Type	UNSIGNED32	0x007	4 Byte
Access	CONST		
Default Value	\$NODEID+0x600		
PDO Mapping	No		

1200h sub2 COB-ID Server->Client (tx)

Parameter Name	COB-ID_Server->Client_(tx)		
Object Type	VAR	0x7	
Data Type	UNSIGNED32	0x0007	4 Byte
Access	RO		
Default Value	\$NODEID+0x580		
PDO Mapping	No		

1400h Receive PDO Communication Parameter 1**Short description**

Receive PDO communication parameter configuration

Transmission Type

Parameterisation of when synchronous or asynchronous ("event triggered") transmitted data is considered "valid" and processed.

00h to F0h	Synchronous data transfer
F1h to FDh	Reserved
FEh	Asynchronous data transfer – User specific Trigger-Event
FFh	Asynchronous data transfer –Trigger-Event defined by device and application profile

Inhibit Time

Setting of the cycle time with which the synchronous PDO telegram is sent.
Specify the value in multiples of 100 µs. The value 0 deactivates the inhibit time.
Configuration only possible while Bit 31 of the COB-ID is set to 0.

Event Timer

Configuration of the time window in which the PDO must be received again.
The function is active as soon as a value has been entered in the subindex and the first PDO has been received.

Parameter Name	Receive_PDO_Communication_Parameter_1		
Object Type	VISIBLE_STRING	0x9	
Subindex Number	5		

1400h sub 0 Number of entries

Parameter Name	Number_of_entries		
Object Type	VAR	0x7	
Data Type	UNSIGNED8	0x0005	1 Byte
Access	RO		
Default Value	5		
PDO Mapping	No		
Low Limit	0x2		
High Limit	0x5		

1400h sub1 COB ID

Parameter Name	COB_ID		
Object Type	VAR	0x7	
Data Type	UNSIGNED32	0x0007	4 Byte
Access	RW		
Default Value	\$NODEID+0x200		
PDO Mapping	No		

1400h sub2 Transmission Type

Parameter Name	Transmission_Type		
Object Type	VAR	0x7	
Data Type	UNSIGNED8	0x0005	1 Byte
Access	RW		
Default Value	0xFF		
PDO Mapping	No		

1400h sub3 Inhibit Time

Parameter Name	Inhibit_Time		
Object Type	VAR	0x7	
Data Type	UNSIGNED16	0x0006	2 Byte
Access	RW		
Default Value	0x0000		
PDO Mapping	No		

1400h sub5 Event Timer

Parameter Name	Event_Timer		
Object Type	VAR	0x7	
Data Type	UNSIGNED16	0x0006	2 Byte
Access	RW		
Default Value	0x0		
PDO Mapping	No		

[Back to object overview](#)

1401h Receive PDO Communication Parameter 2**Short description**See short description [1400h Receive PDO Communication Parameter 1](#) (p. 133)

Parameter Name	Receive_PDO_Communication_Parameter_2
Object Type	VISIBLE_STRING 0x9
Subindex Number	5

1401h sub 0 Number of entries

Parameter Name	Number_of_entries		
Object Type	VAR	0x7	
Data Type	UNSIGNED8	0x0005	1 Byte
Access	RO		
Default Value	5		
PDO Mapping	No		
Low Limit	0x2		
High Limit	0x5		

1401h sub1 COB ID

Parameter Name	COB_ID		
Object Type	VAR	0x7	
Data Type	UNSIGNED32	0x0007	4 Byte
Access	RW		
Default Value	\$NODEID+0x300		
PDO Mapping	No		

1401h sub2 Transmission Type

Parameter Name	Transmission_Type		
Object Type	VAR	0x7	
Data Type	UNSIGNED8	0x0005	1 Byte
Access	RW		
Default Value	0xFF		
PDO Mapping	No		

1401h sub3 Inhibit Time

Parameter Name	Inhibit_Time		
Object Type	VAR	0x7	
Data Type	UNSIGNED16	0x0006	2 Byte
Access	RW		
Default Value	0x0		
PDO Mapping	No		

1401h sub5 Event Timer

Parameter Name	Event_Timer		
Object Type	VAR	0x7	
Data Type	UNSIGNED16	0x0006	2 Byte
Access	RW		
Default Value	0x0		
PDO Mapping	No		

[Back to object overview](#)

1402h Receive PDO Communication Parameter 3**Short description**See short description [1400h Receive PDO Communication Parameter 1](#) (p. 133)

Parameter Name	Receive_PDO_Communication_Parameter_3
Object Type	VISIBLE_STRING 0x9
Subindex Number	5

1402h sub 0 Number of entries

Parameter Name	Number_of_entries		
Object Type	VAR	0x7	
Data Type	UNSIGNED8	0x0005	1 Byte
Access	RO		
Default Value	5		
PDO Mapping	No		
Low Limit	0x2		
High Limit	0x5		

1402h sub1 COB ID

Parameter Name	COB_ID		
Object Type	VAR	0x7	
Data Type	UNSIGNED32	0x0007	4 Byte
Access	RW		
Default Value	\$NODEID+0x400		
PDO Mapping	No		

1402h sub2 Transmission Type

Parameter Name	Transmission_Type		
Object Type	VAR	0x7	
Data Type	UNSIGNED8	0x0005	1 Byte
Access	RW		
Default Value	0xFF		
PDO Mapping	No		

1402h sub3 Inhibit Time

Parameter Name	Inhibit_Time		
Object Type	VAR	0x7	
Data Type	UNSIGNED16	0x0006	2 Byte
Access	RW		
Default Value	0x0		
PDO Mapping	No		

1402h sub5 Event Timer

Parameter Name	Event_Timer		
Object Type	VAR	0x7	
Data Type	UNSIGNED16	0x0006	2 Byte
Access	RW		
Default Value	0x0		
PDO Mapping	No		

[Back to object overview](#)

1403h Receive PDO Communication Parameter 4**Short description**See short description [1400h Receive PDO Communication Parameter 1](#) (p. 133)

Parameter Name	Receive_PDO_Communication_Parameter_4
Object Type	VISIBLE_STRING 0x9
Subindex Number	5

1403h sub 0 Number of entries

Parameter Name	Number_of_entries		
Object Type	VAR	0x7	
Data Type	UNSIGNED8	0x0005	1 Byte
Access	RO		
Default Value	5		
PDO Mapping	No		
Low Limit	0x2		
High Limit	0x5		

1403h sub1 COB ID

Parameter Name	COB_ID		
Object Type	VAR	0x7	
Data Type	UNSIGNED32	0x0007	4 Byte
Access	RW		
Default Value	\$NODEID+0x500		
PDO Mapping	No		

1403h sub2 Transmission Type

Parameter Name	Transmission_Type		
Object Type	VAR	0x7	
Data Type	UNSIGNED8	0x0005	1 Byte
Access	RW		
Default Value	0xFF		
PDO Mapping	No		

1403h sub3 Inhibit Time

Parameter Name	Inhibit_Time		
Object Type	VAR	0x7	
Data Type	UNSIGNED16	0x0006	2 Byte
Access	RW		
Default Value	0x0		
PDO Mapping	No		

1403h sub5 Event Timer

Parameter Name	Event_Timer		
Object Type	VAR	0x7	
Data Type	UNSIGNED16	0x0006	2 Byte
Access	RW		
Default Value	0x0		
PDO Mapping	No		

[Back to object overview](#)

1404h Receive PDO Communication Parameter 5**Short description**

Configuration of the additional Receive PDO 5.
Deactivated by default.
Activation by setting the parameters in subindex 1 COB-ID.
See [Activation and Configuration 8 RX/TX PDOs](#) (p. 112)

Further configuration see short description [1400h Receive PDO Communication Parameter 1](#) (p. 133)

Parameter Name	Receive_PDO_Communication_Parameter_5
Object Type	VISIBLE_STRING 0x9
Subindex Number	5

1404h sub 0 Number of entries

Parameter Name	Number_of_entries		
Object Type	VAR	0x7	
Data Type	UNSIGNED8	0x0005	1 Byte
Access	RO		
Default Value	5		
PDO Mapping	No		
Low Limit	0x2		
High Limit	0x5		

1404h sub1 COB ID

Parameter Name	COB_ID		
Object Type	VAR	0x7	
Data Type	UNSIGNED32	0x0007	4 Byte
Access	RW		
Default Value	0x80000000		
PDO Mapping	No		

1404h sub2 Transmission Type

Parameter Name	Transmission_Type		
Object Type	VAR	0x7	
Data Type	UNSIGNED8	0x0005	1 Byte
Access	RW		
Default Value	0xFF		
PDO Mapping	No		

1404h sub3 Inhibit Time

Parameter Name	Inhibit_Time		
Object Type	VAR	0x7	
Data Type	UNSIGNED16	0x0006	2 Byte
Access	RW		
Default Value	0x0		
PDO Mapping	No		

1404h sub5 Event Timer

Parameter Name	Event_Timer		
Object Type	VAR	0x7	
Data Type	UNSIGNED16	0x0006	2 Byte
Access	RW		
Default Value	0x0		
PDO Mapping	No		

1405h Receive PDO Communication Parameter 6**Short description**

Configuration of the additional Receive PDO 6.
Deactivated by default.
Activation by setting the parameters in subindex 1 COB-ID.
See [Activation and Configuration 8 RX/TX PDOs](#) (p. 112)

Further configuration see short description [1400h Receive PDO Communication Parameter 1](#) (p. 133)

Parameter Name	Receive_PDO_Communication_Parameter_6
Object Type	VISIBLE_STRING 0x9
Subindex Number	5

1405h sub 0 Number of entries

Parameter Name	Number_of_entries		
Object Type	VAR	0x7	
Data Type	UNSIGNED8	0x0005	1 Byte
Access	RO		
Default Value	5		
PDO Mapping	No		
Low Limit	0x2		
High Limit	0x5		

1405h sub1 COB ID

Parameter Name	COB_ID		
Object Type	VAR	0x7	
Data Type	UNSIGNED32	0x0007	4 Byte
Access	RW		
Default Value	0x80000000		
PDO Mapping	No		

1405h sub2 Transmission Type

Parameter Name	Transmission_Type		
Object Type	VAR	0x7	
Data Type	UNSIGNED8	0x0005	1 Byte
Access	RW		
Default Value	0xFF		
PDO Mapping	No		

1405h sub3 Inhibit Time

Parameter Name	Inhibit_Time		
Object Type	VAR	0x7	
Data Type	UNSIGNED16	0x0006	2 Byte
Access	RW		
Default Value	0x0		
PDO Mapping	No		

1405h sub5 Event Timer

Parameter Name	Event_Timer		
Object Type	VAR	0x7	
Data Type	UNSIGNED16	0x0006	2 Byte
Access	RW		
Default Value	0x0		
PDO Mapping	No		

[Back to object overview](#)

1406h Receive PDO Communication Parameter 7**Short description**

Configuration of the additional Receive PDO 7.
Deactivated by default.
Activation by setting the parameters in subindex 1 COB-ID.
See [Activation and Configuration 8 RX/TX PDOs](#) (p. 112)

Further configuration see short description [1400h Receive PDO Communication Parameter 1](#) (p. 133)

Parameter Name	Receive_PDO_Communication_Parameter 7
Object Type	VISIBLE_STRING 0x9
Subindex Number	5

1406h sub 0 Number of entries

Parameter Name	Number_of_entries		
Object Type	VAR	0x7	
Data Type	UNSIGNED8	0x0005	1 Byte
Access	RO		
Default Value	5		
PDO Mapping	No		
Low Limit	0x2		
High Limit	0x5		

1406h sub1 COB ID

Parameter Name	COB_ID		
Object Type	VAR	0x7	
Data Type	UNSIGNED32	0x0007	4 Byte
Access	RW		
Default Value	0x80000000		
PDO Mapping	No		

1406h sub2 Transmission Type

Parameter Name	Transmission_Type		
Object Type	VAR	0x7	
Data Type	UNSIGNED8	0x0005	1 Byte
Access	RW		
Default Value	0xFF		
PDO Mapping	No		

1406h sub3 Inhibit Time

Parameter Name	Inhibit_Time		
Object Type	VAR	0x7	
Data Type	UNSIGNED16	0x0006	2 Byte
Access	RW		
Default Value	0x0		
PDO Mapping	No		

1406h sub5 Event Timer

Parameter Name	Event_Timer		
Object Type	VAR	0x7	
Data Type	UNSIGNED16	0x0006	2 Byte
Access	RW		
Default Value	0x0		
PDO Mapping	No		

1407h Receive PDO Communication Parameter 8**Short description**

Configuration of the additional Receive PDO 8.
Deactivated by default.
Activation by setting the parameters in subindex 1 COB-ID.
See [Activation and Configuration 8 RX/TX PDOs](#) (p. 112)

Further configuration see short description [1400h Receive PDO Communication Parameter 1](#) (p. 133)

Parameter Name	Receive_PDO_Communication_Parameter_8
Object Type	VISIBLE_STRING 0x9
Subindex Number	5

1407h sub 0 Number of entries

Parameter Name	Number_of_entries		
Object Type	VAR	0x7	
Data Type	UNSIGNED8	0x0005	1 Byte
Access	RO		
Default Value	5		
PDO Mapping	No		
Low Limit	0x2		
High Limit	0x5		

1407h sub1 COB ID

Parameter Name	COB_ID		
Object Type	VAR	0x7	
Data Type	UNSIGNED32	0x0007	4 Byte
Access	RW		
Default Value	0x80000000		
PDO Mapping	No		

1407h sub2 Transmission Type

Parameter Name	Transmission_Type		
Object Type	VAR	0x7	
Data Type	UNSIGNED8	0x0005	1 Byte
Access	RW		
Default Value	0xFF		
PDO Mapping	No		

1407h sub3 Inhibit Time

Parameter Name	Inhibit_Time		
Object Type	VAR	0x7	
Data Type	UNSIGNED16	0x0006	2 Byte
Access	RW		
Default Value	0x0		
PDO Mapping	No		

1407h sub5 Event Timer

Parameter Name	Event_Timer		
Object Type	VAR	0x7	
Data Type	UNSIGNED16	0x0006	2 Byte
Access	RW		
Default Value	0x0		
PDO Mapping	No		

[Back to object overview](#)

1600h Receive PDO Mapping Parameter 1**Short description**

Definition where certain data is stored in the Receive PDO telegram.

The number of subindices declares the number of objects to be transmitted per PDO.

Example 1:

Value Subindex 1	60400010h
Object Assignment	6040h → Controlword
Subindex Assignment	00h
Available Bit	40h → 64 Bit
Reserved Bit	10h → 16 Bit
Reserved Telegram Position	Bit 0 to 16
Unused Bit	30h → 48 Bit

Example 2:

Value Subindex 1	60400010h
Object Assignment	6040h → Controlword
Subindex Assignment	00h
Available Bit	40h → 64 Bit
Reserved Bit	10h → 16 Bit
Reserved Telegram Position	Bit 0 to 15
Unused Bit	30h → 48 Bit
Value Subindex 2	607A0020h
Object Assignment	607Ah → Target Position
Subindex Assignment	00h
Available Bit	30h → 48 Bit
Reserved Bit	20h → 32 Bit
Reserved Telegram Position	Bit 16 to 47
Unused Bit	10h → 16 Bit

Parameter Name	Receive_PDO_Mapping_Parameter_2
Object Type	VISIBLE_STRING 0x9
Subindex Number	2

1600h sub 0 Number of entries

Parameter Name	Number_of_entries		
Object Type	VAR	0x7	
Data Type	UNSIGNED8	0x0005	1 Byte
Access	RW		
Default Value	0x1		
PDO Mapping	No		
Low Limit	0x0		

1600h sub1 PDO Mapping Entry

Parameter Name	PDO_Mapping_Entry		
Object Type	VAR	0x7	
Data Type	UNSIGNED32	0x0007	4 Byte
Access	RW		
Default Value	0x60400010		
PDO Mapping	No		

1601h Receive PDO Mapping Parameter 2**Short description**See short description [1600h Receive PDO Mapping Parameter 1](#) (p. 141)

Parameter Name	Receive_PDO_Mapping_Parameter_2
Object Type	VISIBLE_STRING 0x9
Subindex Number	3

1601h sub 0 Number of entries

Parameter Name	Number_of_entries		
Object Type	VAR	0x7	
Data Type	UNSIGNED8	0x0005	1 Byte
Access	RW		
Default Value	0x2		
PDO Mapping	No		
Low Limit	0x0		

1601h sub1 PDO Mapping Entry

Parameter Name	PDO_Mapping_Entry		
Object Type	VAR	0x7	
Data Type	UNSIGNED32	0x0007	4 Byte
Access	RW		
Default Value	0x60400010		
PDO Mapping	No		

1601h sub2 PDO Mapping Entry

Parameter Name	PDO_Mapping_Entry		
Object Type	VAR	0x7	
Data Type	UNSIGNED32	0x0007	4 Byte
Access	RW		
Default Value	0x607A0020		
PDO Mapping	No		

1602h Receive PDO Mapping Parameter 3**Short description**See short description [1600h Receive PDO Mapping Parameter 1](#) (p. 141)

Parameter Name	Receive_PDO_Mapping_Parameter_3
Object Type	VISIBLE_STRING 0x9
Subindex Number	3

1602h sub 0 Number of entries

Parameter Name	Number_of_entries		
Object Type	VAR	0x7	
Data Type	UNSIGNED8	0x0005	1 Byte
Access	RW		
Default Value	0x2		
PDO Mapping	No		
Low Limit	0x0		

1602h sub1 PDO Mapping Entry

Parameter Name	PDO_Mapping_Entry		
Object Type	VAR	0x7	
Data Type	UNSIGNED32	0x0007	4 Byte
Access	RW		
Default Value	0x60400010		
PDO Mapping	No		

1602h sub2 PDO Mapping Entry

Parameter Name	PDO_Mapping_Entry		
Object Type	VAR	0x7	
Data Type	UNSIGNED32	0x0007	4 Byte
Access	RW		
Default Value	0x60FF0020		
PDO Mapping	No		

[Back to object overview](#)

1603h Receive PDO Mapping Parameter 4**Short description**

See short description [1600h Receive PDO Mapping Parameter 1](#) (p. 141)

Parameter Name	Receive_PDO_Mapping_Parameter_4
Object Type	VISIBLE_STRING 0x9
Subindex Number	2

1603h sub 0 Number of entries

Parameter Name	Number_of_entries		
Object Type	VAR	0x7	
Data Type	UNSIGNED8	0x0005	1 Byte
Access	RW		
Default Value	0x1		
PDO Mapping	No		
Low Limit	0x0		

1603h sub1 PDO Mapping Entry

Parameter Name	PDO_Mapping_Entry		
Object Type	VAR	0x7	
Data Type	UNSIGNED32	0x0007	4 Byte
Access	RW		
Default Value	0x60400010		
PDO Mapping	No		

1604h Receive PDO Mapping Parameter 5**Short description**

Object only available in object [1404h Receive PDO Communication Parameter 5](#) (p. 137) has been activated in advance.

See short description [1600h Receive PDO Mapping Parameter 1](#) (p. 141)

Parameter Name	Receive_PDO_Mapping_Parameter_5
Object Type	VISIBLE_STRING 0x9
Subindex Number	2

1604h sub 0 Number of entries

Parameter Name	Number_of_entries		
Object Type	VAR	0x7	
Data Type	UNSIGNED8	0x0005	1 Byte
Access	RW		
Default Value	0x1		
PDO Mapping	No		
Low Limit	0x0		

1604h sub1 PDO Mapping Entry

Parameter Name	PDO_Mapping_Entry		
Object Type	VAR	0x7	
Data Type	UNSIGNED32	0x0007	4 Byte
Access	RW		
Default Value	0x0		
PDO Mapping	No		

[Back to object overview](#)

1605h Receive PDO Mapping Parameter 6**Short description**

Object only available in object [1404h Receive PDO Communication Parameter 5](#) (p. 137) has been activated in advance.
See short description [1600h Receive PDO Mapping Parameter 1](#) (p. 141)

Parameter Name	Receive_PDO_Mapping_Parameter_6
Object Type	VISIBLE_STRING 0x9
Subindex Number	2

1605h sub 0 Number of entries

Parameter Name	Number_of_entries		
Object Type	VAR	0x7	
Data Type	UNSIGNED8	0x0005	1 Byte
Access	RW		
Default Value	0x1		
PDO Mapping	No		
Low Limit	0x0		

1605h sub1 PDO Mapping Entry

Parameter Name	PDO_Mapping_Entry		
Object Type	VAR	0x7	
Data Type	UNSIGNED32	0x0007	4 Byte
Access	RW		
Default Value	0x0		
PDO Mapping	No		

1606h Receive PDO Mapping Parameter 7**Short description**

Object only available in object [1404h Receive PDO Communication Parameter 5](#) (p. 137) has been activated in advance.
See short description [1600h Receive PDO Mapping Parameter 1](#) (p. 141)

Parameter Name	Receive_PDO_Mapping_Parameter_7
Object Type	VISIBLE_STRING 0x9
Subindex Number	2

1606h sub 0 Number of entries

Parameter Name	Number_of_entries		
Object Type	VAR	0x7	
Data Type	UNSIGNED8	0x0005	1 Byte
Access	RW		
Default Value	0x1		
PDO Mapping	No		
Low Limit	0x0		

1606h sub1 PDO Mapping Entry

Parameter Name	PDO_Mapping_Entry		
Object Type	VAR	0x7	
Data Type	UNSIGNED32	0x0007	4 Byte
Access	RW		
Default Value	0x0		
PDO Mapping	No		

1607h Receive PDO Mapping Parameter 8**Short description**

Object only available in object [1404h Receive PDO Communication Parameter 5](#) (p. 137) has been activated in advance.
See short description [1600h Receive PDO Mapping Parameter 1](#) (p. 141)

Parameter Name	Receive_PDO_Mapping_Parameter_8
Object Type	VISIBLE_STRING 0x9
Subindex Number	2

1607h sub 0 Number of entries

Parameter Name	Number_of_entries		
Object Type	VAR	0x7	
Data Type	UNSIGNED8	0x0005	1 Byte
Access	RW		
Default Value	0x1		
PDO Mapping	No		
Low Limit	0x0		

1607h sub1 PDO Mapping Entry

Parameter Name	PDO_Mapping_Entry		
Object Type	VAR	0x7	
Data Type	UNSIGNED32	0x0007	4 Byte
Access	RW		
Default Value	0x0		
PDO Mapping	No		

1800h Transmit PDO Communication Parameter 1**Short description**

Transmit PDO communication parameter configuration

Transmission Type

Configuration of when to send preconfigured data with a certain PDO.

00h	Acyclic synchronous: Data is transferred to the PDO when the SYNC telegram 1006h Communication Cycle Period (p. 105) arrives but is only sent when a trigger event occurs.
01h to F0h	Cyclic synchronous: Data is copied into the PDO when the SYNC telegram arrives and is transmitted directly. If the value 1 is set, the data is transmitted with every SYNC telegram. received. With the value 2, the PDO is sent with every second SYNC telegram. Up to 240.
H1h to FBh	Reserved
FCh	RTR Synchron: Data is transferred to the PDO with each SYNC telegram but is only sent after the arrival of a remote frame telegram.
FDh	RTR Event Trigger: After the arrival of a Remote Frame Telegram, the data is directly transferred into the PDO and sent
FFh und FFh	Asynchronous (event-controlled) The data is transferred and sent directly to the PDO when a trigger event occurs. Only affects TxPDOs that contain the status word (0x6041). If its value changes, this PDO is sent. This transmission type has no effect on all other PDOs (i.e. in which the status word is not contained). However, sending can be forced via the event timer.
Possible Trigger-Events	- Reaching the "State Machine" state "Operation Enabled" - The data in the object to be transmitted has changed - The event timer from subindex 5 is elapsed

Inhibit Time

Configuration of the cycle time with which asynchronous PDO telegrams are sent.

Specify the value in multiples of 100 µs. The value 0 deactivates the inhibit time.

Configuration only possible while Bit 31 of the COB-ID is set to 0.

Event Timer

Configuration of the cycle when a trigger event is triggered. Specification of the value in multiples of 1 ms. The value 0

deactivates the event timer. If transmission type 255 (FFh) is set, the setting of the 'Event

Timer' (subindex 5) of the PDO is also taken into account. The event timer specifies the maximum time

for sending TxPDOs. If the time specified in the event timer has elapsed since the TxPDO was last sent, the PDO is sent

automatically. This ensures that the master constantly receives information from objects, even if these are not mapped together with the status word. The value of the event timer is specified in milliseconds.

The adjustable time span is 5 to 65,000 ms.

Only available if:

- NMT status: Operational.
- Event timer ≥ 5 ms.
- Transmission type: FFh (asynchronous).
- The event timers always start simultaneously.

Parameter Name	Transmit_PDO_Communication_Parameter_1		
Object Type	VISIBLE_STRING	0x9	
Subindex Number	5		
1800h sub 0 Number of entries			
Parameter Name	Number_of_entries		
Object Type	VAR	0x7	
Data Type	UNSIGNED8	0x0005	1 Byte
Access	RO		
Default Value	0x5		
PDO Mapping	No		
Low Limit	0x2		
High Limit	0x5		
1800h sub1 COB ID			
Parameter Name	COB_ID		
Object Type	VAR	0x7	
Data Type	UNSIGNED32	0x0007	4 Byte
Access	RW		
Default Value	\$NODEID+0x40000180		
PDO Mapping	No		

1800h sub2 Transmission Type

Parameter Name	Transmission_Type		
Object Type	VAR	0x7	
Data Type	UNSIGNED8	0x0005	1 Byte
Access	RW		
Default Value	0xFF		
PDO Mapping	No		

1800h sub3 Inhibit Time

Parameter Name	Inhibit_Time		
Object Type	VAR	0x7	
Data Type	UNSIGNED16	0x0006	2 Byte
Access	RW		
Default Value	0x0		
PDO Mapping	No		

1800h sub5 Event Timer

Parameter Name	Event_Timer		
Object Type	VAR	0x7	
Data Type	UNSIGNED16	0x0006	
Access	RW		
Default Value	0x0		
PDO Mapping	No		

1801h Transmit PDO Communication Parameter 2**Short description**See short description [1800h Transmit PDO Communication Parameter 1](#) (p. 146)

Parameter Name	Transmit_PDO_Communication_Parameter_2		
Object Type	VISIBLE_STRING	0x9	
Subindex Number	5		

1801h sub 0 Number of entries

Parameter Name	Number_of_entries		
Object Type	VAR	0x7	
Data Type	UNSIGNED8	0x0005	1 Byte
Access	RO		
Default Value	0x5		
PDO Mapping	No		
Low Limit	0x2		
High Limit	0x5		

1801h sub1 COB ID

Parameter Name	COB_ID		
Object Type	VAR	0x7	
Data Type	UNSIGNED32	0x0007	4 Byte
Access	RW		
Default Value	\$NODEID+0x40000280		
PDO Mapping	No		

1801h sub2 Transmission Type

Parameter Name	Transmission_Type		
Object Type	VAR	0x7	
Data Type	UNSIGNED8	0x0005	1 Byte
Access	RW		
Default Value	0xFF		
PDO Mapping	No		

1801h sub3 Inhibit Time

Parameter Name	Inhibit_Time		
Object Type	VAR	0x7	
Data Type	UNSIGNED16	0x0006	2 Byte
Access	RW		
Default Value	0x0		
PDO Mapping	No		

1801h sub5 Event Timer

Parameter Name	Event_Timer		
Object Type	VAR	0x7	
Data Type	UNSIGNED16	0x0006	2 Byte
Access	RW		
Default Value	0x0		
PDO Mapping	No		

[Back to object overview](#)

1802h Transmit PDO Communication Parameter 3**Short description**See short description [1800h Transmit PDO Communication Parameter 1](#) (p. 146)

Parameter Name	Transmit_PDO_Communication_Parameter_3		
Object Type	VISIBLE_STRING	0x9	
Subindex Number	5		

1802h sub 0 Number of entries

Parameter Name	Number_of_entries		
Object Type	VAR	0x7	
Data Type	UNSIGNED8	0x0005	1 Byte
Access	RO		
Default Value	0x5		
PDO Mapping	No		
Low Limit	0x2		
High Limit	0x5		

1802h sub1 COB ID

Parameter Name	COB_ID		
Object Type	VAR	0x7	
Data Type	UNSIGNED32	0x0007	4 Byte
Access	RW		
Default Value	\$NODEID+0x40000380		
PDO Mapping	No		

1802h sub2 Transmission Type

Parameter Name	Transmission_Type		
Object Type	VAR	0x7	
Data Type	UNSIGNED8	0x0005	1 Byte
Access	RW		
Default Value	0xFF		
PDO Mapping	No		

1802h sub3 Inhibit Time

Parameter Name	Inhibit_Time		
Object Type	VAR	0x7	
Data Type	UNSIGNED16	0x0006	2 Byte
Access	RW		
Default Value	0x0		
PDO Mapping	No		

1802h sub5 Event Timer

Parameter Name	Event_Timer		
Object Type	VAR	0x7	
Data Type	UNSIGNED16	0x0006	2 Byte
Access	RW		
Default Value	0x0		
PDO Mapping	No		

[Back to object overview](#)

1803h Transmit PDO Communication Parameter 4**Short description**See short description [1800h Transmit PDO Communication Parameter 1](#) (p. 146)

Parameter Name	Transmit_PDO_Communication_Parameter_4		
Object Type	VISIBLE_STRING	0x9	
Subindex Number	5		

1803h sub 0 Number of entries

Parameter Name	Number_of_entries		
Object Type	VAR	0x7	
Data Type	UNSIGNED8	0x0005	1 Byte
Access	RO		
Default Value	0x5		
PDO Mapping	No		
Low Limit	0x2		
High Limit	0x5		

1803h sub1 COB ID

Parameter Name	COB_ID		
Object Type	VAR	0x7	
Data Type	UNSIGNED32	0x0007	4 Byte
Access	RW		
Default Value	\$NODEID+0x40000480		
PDO Mapping	No		

1803h sub2 Transmission Type

Parameter Name	Transmission_Type		
Object Type	VAR	0x7	
Data Type	UNSIGNED8	0x0005	1 Byte
Access	RW		
Default Value	0xFF		
PDO Mapping	No		

1803h sub3 Inhibit Time

Parameter Name	Inhibit_Time		
Object Type	VAR	0x7	
Data Type	UNSIGNED16	0x0006	2 Byte
Access	RW		
Default Value	0x0		
PDO Mapping	No		

1803h sub5 Event Timer

Parameter Name	Event_Timer		
Object Type	VAR	0x7	
Data Type	UNSIGNED16	0x0006	2 Byte
Access	RW		
Default Value	0x0		
PDO Mapping	No		

[Back to object overview](#)

1804h Transmit PDO Communication Parameter 5**Short description**

Configuration of the additional Transmit PDO 5.

Deactivated by default.

Activation by setting the parameters in subindex 1 COB-ID.

See [Activation and Configuration 8 RX/TX PDOs](#) (p. 112):

Further configuration see short description [1800h Transmit PDO Communication Parameter 1](#) (p. 146)

Parameter Name	Transmit_PDO_Communication_Parameter_5
Object Type	VISIBLE_STRING
Subindex Number	5

1804h sub 0 Number of entries

Parameter Name	Number_of_entries		
Object Type	VAR	0x7	
Data Type	UNSIGNED8	0x0005	1 Byte
Access	RO		
Default Value	0x5		
PDO Mapping	No		
Low Limit	0x02		
High Limit	0x05		

1804h sub1 COB ID

Parameter Name	COB_ID		
Object Type	VAR	0x7	
Data Type	UNSIGNED32	0x0007	4 Byte
Access	RW		
Default Value	\$NODEID+0x40000480		
PDO Mapping	No		

1804h sub2 Transmission Type

Parameter Name	Transmission_Type		
Object Type	VAR	0x7	
Data Type	UNSIGNED8	0x0005	1 Byte
Access	RW		
Default Value	0xFF		
PDO Mapping	No		

1804h sub3 Inhibit Time

Parameter Name	Inhibit_Time		
Object Type	VAR	0x7	
Data Type	UNSIGNED16	0x0006	2 Byte
Access	RW		
Default Value	0x0		
PDO Mapping	No		

1804h sub5 Event Timer

Parameter Name	Event_Timer		
Object Type	VAR	0x7	
Data Type	UNSIGNED16	0x0006	2 Byte
Access	RW		
Default Value	0x0		
PDO Mapping	No		

[Back to object overview](#)

1805h Transmit PDO Communication Parameter 6**Short description**

Configuration of the additional Transmit PDO 6.

Deactivated by default.

Activation by setting the parameters in subindex 1 COB-ID.

See [Activation and Configuration 8 RX/TX PDOs](#) (p. 112):

Further configuration see short description [1800h Transmit PDO Communication Parameter 1](#) (p. 146)

Parameter Name	Transmit_PDO_Communication_Parameter_6
Object Type	VISIBLE_STRING 0x9
Subindex Number	5

1805h sub 0 Number of entries

Parameter Name	Number_of_entries		
Object Type	VAR	0x7	
Data Type	UNSIGNED8	0x0005	1 Byte
Access	RO		
Default Value	0x5		
PDO Mapping	No		
Low Limit	0x02		
High Limit	0x05		

1805h sub1 COB ID

Parameter Name	COB_ID		
Object Type	VAR	0x7	
Data Type	UNSIGNED32	0x0007	4 Byte
Access	RW		
Default Value	\$NODEID+0x40000480		
PDO Mapping	No		

1805h sub2 Transmission Type

Parameter Name	Transmission_Type		
Object Type	VAR	0x7	
Data Type	UNSIGNED8	0x0005	1 Byte
Access	RW		
Default Value	0xFF		
PDO Mapping	No		

1805h sub3 Inhibit Time

Parameter Name	Inhibit_Time		
Object Type	VAR	0x7	
Data Type	UNSIGNED16	0x0006	2 Byte
Access	RW		
Default Value	0x0		
PDO Mapping	No		

1805h sub5 Event Timer

Parameter Name	Event_Timer		
Object Type	VAR	0x7	
Data Type	UNSIGNED16	0x0006	2 Byte
Access	RW		
Default Value	0x0		
PDO Mapping	No		

[Back to object overview](#)

1806h Transmit PDO Communication Parameter 7**Short description**

Configuration of the additional Transmit PDO 7.

Deactivated by default.

Activation by setting the parameters in subindex 1 COB-ID.

See [Activation and Configuration 8 RX/TX PDOs](#) (p. 112):

Further configuration see short description [1800h Transmit PDO Communication Parameter 1](#) (p. 146)

Parameter Name	Transmit_PDO_Communication_Parameter_7
Object Type	VISIBLE_STRING
Subindex Number	5

1806h sub 0 Number of entries

Parameter Name	Number_of_entries		
Object Type	VAR	0x7	
Data Type	UNSIGNED8	0x0005	1 Byte
Access	RO		
Default Value	0x5		
PDO Mapping	No		
Low Limit	0x02		
High Limit	0x05		

1806h sub1 COB ID

Parameter Name	COB_ID		
Object Type	VAR	0x7	
Data Type	UNSIGNED32	0x0007	4 Byte
Access	RW		
Default Value	\$NODEID+0x40000480		
PDO Mapping	No		

1806h sub2 Transmission Type

Parameter Name	Transmission_Type		
Object Type	VAR	0x7	
Data Type	UNSIGNED8	0x0005	1 Byte
Access	RW		
Default Value	0xFF		
PDO Mapping	No		

1806h sub3 Inhibit Time

Parameter Name	Inhibit_Time		
Object Type	VAR	0x7	
Data Type	UNSIGNED16	0x0006	2 Byte
Access	RW		
Default Value	0x0		
PDO Mapping	No		

1806h sub5 Event Timer

Parameter Name	Event_Timer		
Object Type	VAR	0x7	
Data Type	UNSIGNED16	0x0006	2 Byte
Access	RW		
Default Value	0x0		
PDO Mapping	No		

[Back to object overview](#)

1807h Transmit PDO Communication Parameter 8**Short description**

Configuration of the additional Transmit PDO 8.

Deactivated by default.

Activation by setting the parameters in subindex 1 COB-ID.

See [Activation and Configuration 8 RX/TX PDOs](#) (p. 112):

Further configuration see short description [1800h Transmit PDO Communication Parameter 1](#) (p. 146)

Parameter Name	Transmit_PDO_Communication_Parameter_8
Object Type	VISIBLE_STRING 0x9
Subindex Number	5

1807h sub 0 Number of entries

Parameter Name	Number_of_entries		
Object Type	VAR	0x7	
Data Type	UNSIGNED8	0x0005	1 Byte
Access	RO		
Default Value	0x5		
PDO Mapping	No		
Low Limit	0x02		
High Limit	0x05		

1807h sub1 COB ID

Parameter Name	COB_ID		
Object Type	VAR	0x7	
Data Type	UNSIGNED32	0x0007	4 Byte
Access	RW		
Default Value	\$NODEID+0x40000480		
PDO Mapping	No		

1807h sub2 Transmission Type

Parameter Name	Transmission_Type		
Object Type	VAR	0x7	
Data Type	UNSIGNED8	0x0005	1 Byte
Access	RW		
Default Value	0xFF		
PDO Mapping	No		

1807h sub3 Inhibit Time

Parameter Name	Inhibit_Time		
Object Type	VAR	0x7	
Data Type	UNSIGNED16	0x0006	2 Byte
Access	RW		
Default Value	0x0		
PDO Mapping	No		

1807h sub5 Event Timer

Parameter Name	Event_Timer		
Object Type	VAR	0x7	
Data Type	UNSIGNED16	0x0006	2 Byte
Access	RW		
Default Value	0x0		
PDO Mapping	No		

[Back to object overview](#)

1A00h Transmit PDO Mapping Parameter 1**Short description**

Defines the data storage position in the Transmit PDO telegram.
The number of subindices declares the number of objects to be transmitted per PDO.

Example 1:

Value Subindex 1	60410010h
Object Assignment	6041h → Statusword
Subindex Assignment	00h
Available Bit	40h → 64Bit
Reserved Bit	10h → 16 Bit
Reserved Telegram Position	Bit 0 to 16
Unused Bit	30h → 48 Bit

Example 2:

Value Subindex 1	60410010h
Object Assignment	6041h → Statusword
Subindex Assignment	00h
Available Bit	40h → 64Bit
Reserved Bit	10h → 16 Bit
Reserved Telegram Position	Bit 0 to 15
Unused Bit	30h → 48 Bit
Value Subindex 2	60640020h
Object Assignment	6064h → Actual Position
Subindex Assignment	00h
Available Bit	30h → 48 Bit
Reserved Bit	20h → 32 Bit
Reserved Telegram Position	Bit 16 to 47
Unused Bit	10h → 16 Bit

Parameter Name	Transmit_PDO_Mapping_Parameter_1
Object Type	VISIBLE_STRING 0x9
Subindex Number	2

1A00h sub 0 Number of entries

Parameter Name	Number_of_entries		
Object Type	VAR	0x7	
Data Type	UNSIGNED8	0x0005	1 Byte
Access	RW		
Default Value	0x1		
PDO Mapping	No		
Low Limit	0x0		

1A00h sub1 PDO Mapping Entry

Parameter Name	PDO_Mapping_Entry		
Object Type	VAR	0x7	
Data Type	UNSIGNED32	0x0007	4 Byte
Access	RW		
Default Value	0x60400010		
PDO Mapping	No		

1A00h sub2 PDO Mapping Entry to sub8 PDO Mapping Entry

Parameter Name	PDO_Mapping_Entry		
Object Type	VAR	0x7	
Data Type	UNSIGNED32	0x0007	4 Byte
Access	RW		
Default Value	0x0		
PDO Mapping	No		

[Back to object overview](#)

1A01h Transmit PDO Mapping Parameter 2**Short description**See short description [1A00h Transmit PDO Mapping Parameter 1](#) (p.155)

Parameter Name	Transmit_PDO_Mapping_Parameter_2
Object Type	VISIBLE_STRING 0x9
Subindex Number	3

1A01h sub 0 Number of entries

Parameter Name	Number_of_entries		
Object Type	VAR	0x7	
Data Type	UNSIGNED8	0x0005	1 Byte
Access	RW		
Default Value	0x2		
PDO Mapping	No		
Low Limit	0x0		

1A01h sub1 PDO Mapping Entry

Parameter Name	PDO_Mapping_Entry		
Object Type	VAR	0x7	
Data Type	UNSIGNED32	0x0007	4 Byte
Access	RW		
Default Value	0x60410010		
PDO Mapping	No		

1A01h sub2 PDO Mapping Entry

Parameter Name	PDO_Mapping_Entry		
Object Type	VAR	0x7	
Data Type	UNSIGNED32	0x0007	4 Byte
Access	RW		
Default Value	0x60640020		
PDO Mapping	No		

1A01h sub3 PDO Mapping Entry to sub8 PDO Mapping Entry

Parameter Name	PDO_Mapping_Entry		
Object Type	VAR	0x7	
Data Type	UNSIGNED32	0x0007	4 Byte
Access	RW		
Default Value	0x0		
PDO Mapping	No		

[Back to object overview](#)

1A02h Transmit PDO Mapping Parameter 3**Short description**See short description [1A00h Transmit PDO Mapping Parameter 1](#) (p.155)

Parameter Name	Transmit_PDO_Mapping_Parameter_3
Object Type	VISIBLE_STRING 0x9
Subindex Number	3

1A02h sub 0 Number of entries

Parameter Name	Number_of_entries		
Object Type	VAR	0x7	
Data Type	UNSIGNED8	0x0005	1 Byte
Access	RW		
Default Value	0x2		
PDO Mapping	No		
Low Limit	0x0		

1A02h sub1 PDO Mapping Entry

Parameter Name	PDO_Mapping_Entry		
Object Type	VAR	0x7	
Data Type	UNSIGNED32	0x0007	4 Byte
Access	RW		
Default Value	0x60410010		
PDO Mapping	No		

1A02h sub2 PDO Mapping Entry

Parameter Name	PDO_Mapping_Entry		
Object Type	VAR	0x7	
Data Type	UNSIGNED32	0x0007	4 Byte
Access	RW		
Default Value	0x606C0020		
PDO Mapping	No		

1A02h sub3 PDO Mapping Entry to sub8 PDO Mapping Entry

Parameter Name	PDO_Mapping_Entry		
Object Type	VAR	0x7	
Data Type	UNSIGNED32	0x0007	4 Byte
Access	RW		
Default Value	0x0		
PDO Mapping	No		

[Back to object overview](#)

1A03h Transmit PDO Mapping Parameter 4**Short description**

See short description [1A00h Transmit PDO Mapping Parameter 1](#) (p.155)

Parameter Name	Transmit_PDO_Mapping_Parameter_4
Object Type	VISIBLE_STRING 0x9
Subindex Number	2

1A03h sub 0 Number of entries

Parameter Name	Number_of_entries		
Object Type	VAR	0x7	
Data Type	UNSIGNED8	0x0005	1 Byte
Access	RW		
Default Value	0x1		
PDO Mapping	No		
Low Limit	0x0		

1A03h sub2 PDO Mapping Entry

Parameter Name	PDO_Mapping_Entry		
Object Type	VAR	0x7	
Data Type	UNSIGNED32	0x0007	4 Byte
Access	RW		
Default Value	0x60410010		
PDO Mapping	No		

1A03h sub2 PDO Mapping Entry to sub8 PDO Mapping Entry

Parameter Name	PDO_Mapping_Entry		
Object Type	VAR	0x7	
Data Type	UNSIGNED32	0x0007	4 Byte
Access	RW		
Default Value	0x0		
PDO Mapping	No		

1A04h Transmit PDO Mapping Parameter 5**Short description**

Object only available in object [1804h Transmit PDO Communication Parameter 5](#) (p. 151) has been activated in advance.

See short description [1A00h Transmit PDO Mapping Parameter 1](#) (p.155)

Parameter Name	Transmit_PDO_Mapping_Parameter_5
Object Type	VISIBLE_STRING 0x9
Subindex Number	2

1A04h sub 0 Number of entries

Parameter Name	Number_of_entries		
Object Type	VAR	0x7	
Data Type	UNSIGNED8	0x0005	1 Byte
Access	RW		
Default Value	0x1		
PDO Mapping	No		
Low Limit	0x0		

1A04h sub1 PDO Mapping Entry to sub8 PDO Mapping Entry

Parameter Name	PDO_Mapping_Entry		
Object Type	VAR	0x7	
Data Type	UNSIGNED32	0x0007	4 Byte
Access	RW		
Default Value	0x0		
PDO Mapping	No		

[Back to object overview](#)

1A05h Transmit PDO Mapping Parameter 6**Short description**

Object only available in object [.1804h Transmit PDO Communication Parameter 6](#) (p. 151) has been activated in advance.
See short description [1A00h Transmit PDO Mapping Parameter 1](#) (p.155)

Parameter Name	Transmit_PDO_Mapping_Parameter_6
Object Type	VISIBLE_STRING 0x9
Subindex Number	2

1A05h sub 0 Number of entries

Parameter Name	Number_of_entries		
Object Type	VAR	0x7	
Data Type	UNSIGNED8	0x0005	1 Byte
Access	RW		
Default Value	0x1		
PDO Mapping	No		
Low Limit	0x0		

1A05h sub1 PDO Mapping Entry to sub8 PDO Mapping Entry

Parameter Name	PDO_Mapping_Entry		
Object Type	VAR	0x7	
Data Type	UNSIGNED32	0x0007	4 Byte
Access	RW		
Default Value	0x0		
PDO Mapping	No		

1A06h Transmit PDO Mapping Parameter 7**Short description**

Object only available in object [.1804h Transmit PDO Communication Parameter 7](#) (p. 151) has been activated in advance.
See short description [1A00h Transmit PDO Mapping Parameter 1](#) (p.155)

Parameter Name	Transmit_PDO_Mapping_Parameter_7
Object Type	VISIBLE_STRING 0x9
Subindex Number	2

1A06h sub 0 Number of entries

Parameter Name	Number_of_entries		
Object Type	VAR	0x7	
Data Type	UNSIGNED8	0x0005	1 Byte
Access	RW		
Default Value	0x1		
PDO Mapping	No		
Low Limit	0x0		

1A06h sub1 PDO Mapping Entry to sub8 PDO Mapping Entry

Parameter Name	PDO_Mapping_Entry		
Object Type	VAR	0x7	
Data Type	UNSIGNED32	0x0007	4 Byte
Access	RW		
Default Value	0x0		
PDO Mapping	No		

[Back to object overview](#)

1A07h Transmit PDO Mapping Parameter 8**Short description**

Object only available in object [.1804h Transmit PDO Communication Parameter 8](#) (p. 151) has been activated in advance.
See short description [1A00h Transmit PDO Mapping Parameter 1](#) (p.155)

Parameter Name	Transmit_PDO_Mapping_Parameter_8
Object Type	VISIBLE_STRING 0x9
Subindex Number	2

1A07h sub 0 Number of entries

Parameter Name	Number_of_entries		
Object Type	VAR	0x7	
Data Type	UNSIGNED8	0x0005	1 Byte
Access	RW		
Default Value	0x1		
PDO Mapping	No		
Low Limit	0x0		

1A07h sub1 PDO Mapping Entry to sub8 PDO Mapping Entry

Parameter Name	PDO_Mapping_Entry		
Object Type	VAR	0x7	
Data Type	UNSIGNED32	0x0007	4 Byte
Access	RW		
Default Value	0x0		
PDO Mapping	No		

2000h Motor Current**Short description**

Output of the "live" motor current and setting of the various motor currents.
All values in mA

Parameter Name	Motor_Current	
Object Type	ARRAY	0x8
Subindex Number	4	

2000h sub 0 Number of entries

Parameter Name	Number_of_entries		
Object Type	VAR	0x7	
Data Type	UNSIGNED8	0x0005	1 Byte
Access	Const		
Default Value	0x3		
PDO Mapping	No		

2000h sub1 Motor Current Actual value

Parameter Name	Motor_Current_Actual_value		
Object Type	VAR	0x7	
Data Type	UNSIGNED16	0x0006	2 Byte
Access	RO		
PDO Mapping	Yes		

2000h sub2 Boost current

Parameter Name	Boost_current		
Object Type	VAR	0x7	
Data Type	UNSIGNED16	0x0006	2 Byte
Access	RWW		
Default Value	0x0		
PDO Mapping	No		

2000h sub3 Hold current

Parameter Name	Hold_current		
Object Type	VAR	0x7	
Data Type	UNSIGNED16	0x0006	2 Byte
Access	RW		
Default Value	0x0		
PDO Mapping	No		

[Back to object overview](#)

2001h Step Mode**Short description**

Step Mode settings for Stepper motors

Parameter Name	Step_mode		
Object Type	VAR	0x7	
Data Type	UNSIGNED8	0x0005	1 Byte
Access	RW		
PDO Mapping	No		

Value Assignment

1	Auto	Auto
2	1/1 Full Step	200 steps per revolution
3	1/2 Step	400 steps per revolution
4	1/4 Step	800 steps per revolution
5	1/8 Step	1600 steps per revolution
6	1/16 Step	3200 steps per revolution
7	1/32 Step	6400 steps per revolution
8	1/64 Step	12800 steps per revolution

2002h Motor Pole Pairs**Short description**

Specification of pole pairs for stepper and EC/BLDC motors.

For stepper motors, the physical number of steps per revolution must be divided by 4.

If the controller has been enabled before, DI7 "Enable" must be toggled after settings were changed to adopt new parametrisation

Parameter Name	Motor:pole_pairs		
Object Type	VAR	0x7	
Data Type	UNSIGNED8	0x0005	1 Byte
Access	RW		
PDO Mapping	No		

2003h Encoder**Short description**

Feedback settings see [Feedback](#) (p. 46)

If the controller has been enabled before, DI7 "Enable" must be toggled after settings were changed to adopt new parametrisation

Parameter Name	Motor_Current		
Object Type	ARRAY	0x8	
Subindex Number	4		

2003h sub 0 Number of entries

Parameter Name	Number_of_entries		
Object Type	VAR	0x7	
Data Type	UNSIGNED8	0x0005	1 Byte
Access	Const		
Default Value	0x3		
PDO Mapping	No		

2003h sub1 Encoder Enabled

Parameter Name	Encoder_Enabled		
Object Type	VAR	0x7	
Data Type	UNSIGNED8	0x0005	1 Byte
Access	RW		
Default Value	0x0		
PDO Mapping	No		
High Limit	0x1		

2003h sub2 Encoder Type

Parameter Name	Encoder_Type		
Object Type	VAR	0x7	
Data Type	UNSIGNED8	0x0005	1 Byte
Access	RW		
Default Value	0x0		
PDO Mapping	No		

2003h sub3 Encoder Index

Parameter Name	Encoder_Index		
Object Type	VAR	0x7	
Data Type	UNSIGNED8	0x0005	1 Byte
Access	RW		
Default Value	0x0		
PDO Mapping	No		
High Limit	0x1		

Value Assignment Subindex 2

1	Line Driver
2	Single Ended
3	Hall-Sensor
4	Analogue Feedback

2004h Closed loop enabled**Short description**

Activating the [Closed-Loop](#) (p. 49)

If the controller has been enabled before, DI7 "Enable" must be toggled after settings were changed to adopt new parametrisation

Parameter Name	Closed_loop_enabled		
Object Type	VAR	0x7	
Data Type	BOOLEAN	0x0001	1 Bit
Access	RW		
PDO Mapping	No		

2005h Brake**Short description**

Settings related to the [Brake](#) (p. 50). Delay time specification in ms. If the controller has been enabled before, DI7 "Enable" must be toggled after settings were changed to adopt new parametrisation

Parameter Name	Motor_Current		
Object Type	ARRAY	0x8	
Subindex Number	5		

2005h sub 0 Number of entries

Parameter Name	Number_of_entries		
Object Type	VAR	0x7	
Data Type	UNSIGNED8	0x0005	1 Byte
Access	Const		
Default Value	0x4		
PDO Mapping	No		

2005h sub1 Brake Enabled

Parameter Name	Brake_Enabled		
Object Type	VAR	0x7	
Data Type	UNSIGNED16	0x0006	2 Byte
Access	RW		
Default Value	0x0		
PDO Mapping	No		
High Limit	0x1		

2005h sub2 Brake Eco mode

Parameter Name	Brake_Eco_mode		
Object Type	VAR	0x7	
Data Type	UNSIGNED16	0x0006	2 Byte
Access	RW		
Default Value	0x0		
PDO Mapping	No		
High Limit	0x1		

2005h sub3 Brake Eco delay

Parameter Name	Brake_Eco_delay		
Object Type	VAR	0x7	
Data Type	UNSIGNED16	0x0006	2 Byte
Access	RW		
Default Value	0x3E8		
PDO Mapping	No		
High Limit	0x2710		

2005h sub4 Brake Mechanical delay

Parameter Name	Brake_Mechanical_delay		
Object Type	VAR	0x7	
Data Type	UNSIGNED16	0x0006	2 Byte
Access	RW		
Default Value	0x64		
PDO Mapping	No		
High Limit	0x3E8		

2006h Brake Resistor Voltage**Short description**

Setting from which load voltage level the braking resistor is switched on during operation of EC/BLDC motors.

[Braking Voltage Setting](#) (p. 55)

Value specification in V with three decimal digits

Parameter Name	Brake_Resistor_Voltage		
Object Type	VAR	0x7	
Data Type	REAL32	0x0008	4 Byte
Access	RW		
Default Value	0x424C0000		
PDO Mapping	No		
High Limit	0x424C0000		

[Back to object overview](#)

2007h S Curve Ratio**Short description**

Adjustment of the acceleration ramp type. [Motion Limits](#) (p. 56)
Specifying the value integer from 0 to 100

Parameter Name	S_Curve_Ratio		
Object Type	VAR	0x7	
Data Type	UNSIGNED8	0x0005	1 Byte
Access	RW		
Default Value	0x0		
PDO Mapping	No		
High Limit	0x64		

2008h Limit Switch Position**Short description**

Selection of the used limit switches.

If the controller has been enabled before, DI7 "Enable" must be toggled after settings were changed to adopt new parametrisation

Parameter Name	Limit_Switch_Position		
Object Type	VAR	0x7	
Data Type	UNSIGNED8	0x0005	1 Byte
Access	RW		
Default Value	0x0		
PDO Mapping	No		
High Limit	0x4		

Value Assignment

- | | |
|---|------------------------------------|
| 1 | No limit switch |
| 2 | Negative limit switch |
| 3 | Positive limit switch |
| 4 | Negative and positive limit switch |
-

2009h Analog Input Min**Short description**

Specification of the minimum values for the evaluation of the analogue inputs

Value specification in V with three decimal digits.

If the controller has been enabled before, DI7 "Enable" must be toggled after settings were changed to adopt new parametrisation

Parameter Name	Analog Input Min		
Object Type	ARRAY	0x8	
Subindex Number	3		

2009h sub 0 Number of entries

Parameter Name	Number_of_entries		
Object Type	VAR	0x7	
Data Type	UNSIGNED8	0x0005	1 Byte
Access	Const		
Default Value	0x2		
PDO Mapping	No		

2009h sub1 Analog Input Min AI1

Parameter Name	Analog_Input_Min_AI1		
Object Type	VAR	0x7	
Data Type	REAL32	0x0008	4 Byte
Access	RW		
Default Value	0x0		
PDO Mapping	No		
High Limit	0x41200000		

2009h sub2 Analog Input Min AI2

Parameter Name	Analog_Input_Min_AI2		
Object Type	VAR	0x7	
Data Type	REAL32	0x0008	4 Byte
Access	RW		
Default Value	0x0		
PDO Mapping	No		
High Limit	0x41200000		

[Back to object overview](#)

200Ah Analog Input Max**Short description**

Specification of the maximal values for the evaluation of the analogue inputs

Value specification in V with three decimal digits.

If the controller has been enabled before, DI7 "Enable" must be toggled after settings were changed to adopt new parametrisation

Parameter Name	Analog Input Max		
Object Type	ARRAY	0x8	
Subindex Number	3		

200Ah sub 0 Number of entries

Parameter Name	Number_of_entries		
Object Type	VAR	0x7	
Data Type	UNSIGNED8	0x0005	1 Byte
Access	Const		
Default Value	0x2		
PDO Mapping	No		

200Ah sub1 Analog Input Max AI1

Parameter Name	Analog_Input_Max_AI1		
Object Type	VAR	0x7	
Data Type	REAL32	0x0008	4 Byte
Access	RW		
Default Value	0x41200000		
PDO Mapping	No		
High Limit	0x41200000		

200Ah sub2 Analog Input Max AI2

Parameter Name	Analog_Input_Max_AI2		
Object Type	VAR	0x7	
Data Type	REAL32	0x0008	4 Byte
Access	RW		
Default Value	0x41200000		
PDO Mapping	No		
High Limit	0x41200000		

200Bh Analog Input Dead Band**Short description**

Configuration of the zero-value dead band of the corresponding analogue input. Specification of the values in V

Parameter Name	Analog_Input_Deadband		
Object Type	ARRAY	0x8	
Subindex Number	3		

200Bh sub 0 Number of entries

Parameter Name	Number_of_entries		
Object Type	VAR	0x7	
Data Type	UNSIGNED8	0x0005	1 Byte
Access	Const		
Default Value	0x2		
PDO Mapping	No		

200Bh sub1 Analog input dead band AI1

Parameter Name	Analog_input_dead_band_AI1		
Object Type	VAR	0x7	
Data Type	REAL32	0x0008	4 Byte
Access	RW		
Default Value	0x3DCCCCCD		
PDO Mapping	No		
High Limit	0x3F800000		

200Bh sub2 Analog input dead band AI2

Parameter Name	Analog_input_dead_band_AI2		
Object Type	VAR	0x7	
Data Type	REAL32	0x0008	4 Byte
Access	RW		
Default Value	0x0		
PDO Mapping	No		
High Limit	0x3F800000		

200Ch Analog Input Hysteresis**Short description**

Configuration of the dead band hysteresis around the input signal of the corresponding analogue input. Specification of the values in V with three decimal digits.

Parameter Name	Analog_Input_Hysteresis		
Object Type	ARRAY	0x8	
Subindex Number	3		
200Ch sub 0 Number of entries			
Parameter Name	Number_of_entries		
Object Type	VAR	0x7	
Data Type	UNSIGNED8	0x0005	1 Byte
Access	Const		
Default Value	0x2		
PDO Mapping	No		
200Ch sub1 Analog Input Hysteresis AI1			
Parameter Name	Analog_Input_Hysteresis_AI1		
Object Type	VAR	0x7	
Data Type	REAL32	0x0008	4 Byte
Access	RW		
Default Value	0x3C23D70A		
PDO Mapping	No		
High Limit	0x3F800000		
200Ch sub2 Analog Input Hysteresis AI2			
Parameter Name	Analog_Input_Hysteresis_AI2		
Object Type	VAR	0x7	
Data Type	REAL32	0x0008	4 Byte
Access	RW		
Default Value	0x0		
PDO Mapping	No		
High Limit	0x3F800000		

200Dh Analog Input Filter**Short description**

Configuration of the filter time for calculating an average value of the corresponding analogue input. Specification of the values in ms

Parameter Name	Analog_Input_Filter		
Object Type	ARRAY	0x8	
Subindex Number	3		
200Dh sub 0 Number of entries			
Parameter Name	Number_of_entries		
Object Type	VAR	0x7	
Data Type	UNSIGNED8	0x0005	1 Byte
Access	Const		
Default Value	0x2		
PDO Mapping	No		
200Dh sub1 Analog Input Filter AI1			
Parameter Name	Analog_Input_Filter_AI1		
Object Type	VAR	0x7	
Data Type	REAL32	0x0008	4 Byte
Access	RW		
Default Value	0xA		
PDO Mapping	No		
High Limit	0x3E8		
200Dh sub2 Analog Input Filter AI2			
Parameter Name	Analog_Input_Filter_AI2		
Object Type	VAR	0x7	
Data Type	REAL32	0x0008	4 Byte
Access	RW		
Default Value	0x0		
PDO Mapping	No		
High Limit	0x3E8		

[Back to object overview](#)

200Eh Analog Input Value**Short description**

Output of the corresponding analogue input value (live) in V

Parameter Name	Analog_Input_Value		
Object Type	ARRAY	0x8	
Subindex Number	3		

200Eh sub 0 Number of entries

Parameter Name	Number_of_entries		
Object Type	VAR	0x7	
Data Type	UNSIGNED8	0x0005	1 Byte
Access	Const		
Default Value	0x2		
PDO Mapping	No		

200Eh sub1 Analog Input Value AI1

Parameter Name	Analog_Input_Value_AI1		
Object Type	VAR	0x7	
Data Type	REAL32	0x0008	4 Byte
Access	RO		
PDO Mapping	Yes		

200Eh sub2 Analog Input Value AI2

Parameter Name	Analog_Input_Value_AI2		
Object Type	VAR	0x7	
Data Type	REAL32	0x0008	4 Byte
Access	RO		
PDO Mapping	Yes		

200Fh Digital Input Type**Short description**

Selection if the Digital Inputs are used in PNP or NPN configuration

Parameter Name	Digital_Input_Type		
Object Type	VAR	0x7	
Data Type	UNSIGNED8	0x0005	1 Byte
Access	RW		
Default Value	0x0		
PDO Mapping	No		
High Limit	0x1		

Value Assignment

0	PNP
1	NPN

2010h Digital Input Polarity**Short description**

Selection which [Digital Input](#) (p. 70) signal shall be inverted.
The preselection is binary coded.

Example:

Object-value 66h (102dec) correspond to an active inversion of Digital Input DI2, DI3, DI6 and DI7

Parameter Name	Digital_Input_Polarity		
Object Type	VAR	0x7	
Data Type	UNSIGNED32	0x0007	4 Byte
Access	RW		
Default Value	0x0		
PDO Mapping	No		
High Limit	0x3FF		

[Back to object overview](#)

2011h Digital Output Polarity**Short description**

Selection which [Digital Output](#) (p. 73) signal shall be inverted. The preselection is binary coded.

Example: Object-value 1Ah (26dec) correspond to an active inversion of Digital Output DO2, DO4 and DO5

Parameter Name	Digital_Output_Polarity		
Object Type	VAR	0x7	
Data Type	UNSIGNED32	0x0007	4 Byte
Access	RW		
Default Value	0x0		
PDO Mapping	No		
High Limit	0x1F		

2012h Controller Parameters**Short description**

Adjustment of the control parameters – further information in chapter [Controller Data](#) (p. 86)

Name	Controller_Parameters		
Object Type	ARRAY	0x8	
Subindex Number	6		

2012h sub 0 Number of entries

Parameter Name	Number_of_entries		
Object Type	VAR	0x7	
Data Type	UNSIGNED8	0x0005	1 Byte
Access	Const		
Default Value	0x5		
PDO Mapping	No		

2012h sub1 Current Proportional Gain

Parameter Name	Current_Proportional_Gain		
Object Type	VAR	0x7	
Data Type	REAL32	0x0008	4 Byte
Access	RW		
Default Value	0x0		
PDO Mapping	No		
High Limit	0x461C4000		

2012h sub2 Current Integral Gain

Parameter Name	Current_Integral_Gain		
Object Type	VAR	0x7	
Data Type	REAL32	0x0008	4 Byte
Access	RW		
Default Value	0x0		
PDO Mapping	No		
High Limit	0x49742400		

2012h sub3 Velocity Proportional Gain

Parameter Name	Velocity_Proportional_Gain		
Object Type	VAR	0x7	
Data Type	REAL32	0x0008	4 Byte
Access	RW		
Default Value	0x0		
PDO Mapping	No		
High Limit	0x461C4000		

2012h sub4 Velocity Integral Gain

Parameter Name	Velocity_Integral_Gain		
Object Type	VAR	0x7	
Data Type	REAL32	0x0008	4 Byte
Access	RW		
Default Value	0x0		
PDO Mapping	No		
High Limit	0x49742400		

2012h sub5 Position Gain

Parameter Name	Position_Gain		
Object Type	VAR	0x7	
Data Type	REAL32	0x0008	4 Byte
Access	RW		
Default Value	0x0		
PDO Mapping	No		
High Limit	0x461C4000		

[Back to object overview](#)

2013h Controller Temperature**Short description**

Output of the controller temperature (driver stage) in °C

Parameter Name	Controller_Temperature		
Object Type	VAR	0x7	
Data Type	REAL32	0x0008	4 Byte
Access	RO		
PDO Mapping	Yes		

2014h Status Flags**Short description**

Output of general status information

Parameter Name	Status_Flags		
Object Type	VAR	0x7	
Data Type	UNSIGNED32	0x0007	4 Byte
Access	RO		
PDO Mapping	Yes		

Bit Assignment

0	0	Not referenced
	1	Referenced

Bit 1 to 31 not assigned

603Fh Error Code**Short description**

Assignment of the available errors emitted on the user interface to the CANopen error codes.

If an error occurs, these are inserted into the subindices of [1003h Pre-defined Error Field](#) (p. 125).

The Error Code telegram will be transmitted with a COB-ID of 80h + Node ID e.g. 81h if the error is occurring in Node 1.

Parameter Name	Status_Flags		
Object Type	VAR	0x7	
Data Type	UNSIGNED16	0x0006	2 Byte
Access	RO		
PDO Mapping	Yes		

Value Assignment

		MSB to LSB	Displayed in telegram (HEX, LSB to MSB)
-----	No Error	0000h	00 00
E01	Error Configuration	6320h	20 63
E02	Motor Over-Current	2320h	20 23
E03	Encoder Over-Current	2311h	11 23
E04	10 V Output Over Current	2312h	12 23
E05	I/O Supply Low	5114h	14 51
E06	Logic Supply Low	3222h	22 32
E07	Logic Supply High	3212h	12 32
E08	Load Supply Low	3221h	21 32
E09	Load Supply High	3211h	11 32
E10	Temperature High	4310h	10 43
E11	Following Error	8611h	11 86
E12	Limit Switch	FF00h	00 FF
E13	Hall Sensor	7306h	06 73
E14	Encoder	7305h	05 73
E15	Encoder Channel A	FF01h	01 FF
E16	Encoder Channel B	FF02h	02 FF
E17	Encoder Channel I	FF03h	03 FF
E21	Braking Resistor Overload	7110h	10 71
E22	Invalid Motion Parameter	FF04h	04 FF
E23	Bus connection Lost	FF05h	05 FF

[Back to object overview](#)

6040h Controlword**Short description**

Object for controlling the drive D1

Further information at [Controlword](#) (p. 116).

Parameter Name	Controlword		
Object Type	VAR	0x7	
Data Type	UNSIGNED16	0x0006	2 Byte
Access	RWW		
PDO Mapping	Yes		

Bit Assignment

0	Switch On
1	Enable Voltage
2	Quick-Stop
3	Enable Operation
4	Mode Specific
5	Mode Specific
6	Mode Specific
7	Fault Reset
8	Halt
9	Mode Specific
10	Reserved
11	Manufacturer Specific
12	Manufacturer Specific
13	Manufacturer Specific
14	Manufacturer Specific
15	Manufacturer Specific

Example

Write "Controlword" – Command "Shutdown"

CANopen

COB-ID	DLC	Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
601h	8h	2Bh	40h	60h	00h	6h	00h	00h	00h

Modbus TCP as Gateway

Byte													
	0 - 4	5	6	7	8	9	10 - 11	12	13	14 - 17	18	19	20 - 22
bin	0000 0000	0000 1110	0000 0000	0010 1011	0000 1101	0000 0001	0000 0000	0110 0000	0100 0000	0000 0000	0000 0001	0000 0110	not send
hex	0h	0Eh	0h	2Bh	0Dh	1h	0h	60h	40h	0h	1h	6h	not send
dec	0	14	0	43	13	1	0	96	64	0	1	6	not send

6041h Statusword**Short description**

Feedback of status information from the drive D1
Further information at [Statusword](#) (p. 115).

Parameter Name	Statusword		
Object Type	VAR	0x7	
Data Type	UNSIGNED16	0x0006	2 Byte
Access	RO		
PDO Mapping	Yes		

Bit Assignment

0	Ready to Switch On
1	Switched On
2	Operation Enabled
3	Fault
4	Voltage Enable
5	Quick-Stop
6	Switch On Disabled
7	Warning
8	Manufacturer Specific
9	Remote
10	Target Reached
11	Internal Limit Active
12	Mode Specific
13	Mode Specific
14	Manufacturer Specific
15	Manufacturer Specific

Example

Read "Statusword"

CANopen

COB-ID	DLC	Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
601h	8h	40h	41h	60h	00h	00h	00h	00h	00h

Modbus TCP as Gateway

Byte											
	0 - 4	5	6	7	8	9 - 11	12	13	14 - 17	18	19 - 22
bin	0000 0000	0000 1101	0000 0000	0010 1011	0000 1101	0000 0000	0110 0000	0100 0001	0000 0000	0000 0010	not send
hex	0h	0Dh	0h	2Bh	0Dh	0h	60h	41h	0h	2h	not send
dec	0	13	0	43	13	0	96	65	0	2	not send

6060h Modes of Operation**Short description**

Operation mode pre-selection

Parameter Name	Modes_of_operation		
Object Type	VAR	0x7	
Data Type	INTEGER8	0x0002	1 Byte
Access	RWW		
Default Value	0x1		
PDO Mapping	Yes		

Value Assignment

0	No mode change / no mode assigned
1	Profile Position mode
2	Not implemented
3	Profile Velocity mode
4	Not implemented
5	reserved
6	homing mode
7	Not implemented
8	Cyclic Synchronous Position mode

Entry 9-128 Not assigned

6061h Modes of Operation Display**Short description**

Object for feedback of current operating mode

Parameter Name	Modes_of_operation_display		
Object Type	VAR	0x7	
Data Type	INTEGER8	0x0002	1 Byte
Access	RO		
PDO Mapping	Yes		

Value Assignment

0	No mode change / no mode assigned
1	Profile Position mode
2	Not implemented
3	Profile Velocity mode
4	Not implemented
5	reserved
6	homing mode
7	Not implemented
8	Cyclic Synchronous Position mode

Entry 9-128 Not assigned

6064h Position Actual Value**Short description**Output of the actual position. Value dimension dependent on object [60A8h SI Unit Position](#) (p. 181).

Parameter Name	Position_actual_value		
Object Type	VAR	0x7	
Data Type	INTEGER32	0x0004	4 Byte
Access	RO		
PDO Mapping	Yes		

6067h Position Window**Short description**Entry of a symmetrical area around the target position.
If this area is reached, the target position is considered to be reached.

Parameter Name	Position_window		
Object Type	VAR	0x7	
Data Type	INTEGER32	0x0004	4 Byte
Access	RO		
PDO Mapping	Yes		

[Back to object overview](#)

6065h Following Error Window**Short description**

Configuration of the tolerable position deviation
Value dimension dependent on object [60A8h SI Unit Position](#) (p. 181).
If the value is set to FFFF FFFFh, monitoring is deactivated.

Parameter Name	Following_Error_Window		
Object Type	VAR	0x7	
Data Type	UNSIGNED32	0x0007	4 Byte
Access	RWW		
PDO Mapping	Yes		

6066h Following Error Time Out**Short description**

Configuration of the dwell time which must have lapsed before a position deviation greater than the interval specified in object 6065h Following Error Window causes an error message.

Parameter Name	Following_Error_Time_Out		
Object Type	VAR	0x7	
Data Type	UNSIGNED16	0x0006	2 Byte
Access	RWW		
PDO Mapping	Yes		

6068h Position Window Time**Short description**

Specification of a delay time that must elapse before a "Target Reached" signal can be emitted.
The time starts counting when the Position Window (6067h) is reached.

Parameter Name	Position_window_time		
Object Type	VAR	0x7	
Data Type	UNSIGNED16	0x0006	2 Byte
Access	RO		
PDO Mapping	Yes		

606Ch Velocity Actual Value**Short description**

Output of current Velocity.
Value dimension dependent on object [60A8h SI Unit Position](#) (p. 181).

Parameter Name	Velocity_actual_value		
Object Type	VAR	0x7	
Data Type	INTEGER32	0x0004	4 Byte
Access	RO		
PDO Mapping	Yes		

6073h Max Current**Short description**

Setting the motor boost current as a per mil value of the motor rated current in object [6075h Motor Rated Current](#) (p. 174)

Parameter Name	Max_Current		
Object Type	VAR	0x7	
Data Type	UNSIGNED16	0x0006	2 Byte
Access	RWW		
PDO Mapping	Yes		

Example

Value 6075h Motor Rated Current	= 1000	-> 1A
Value 6073h Max Current	= 2000	-> 2A Boost current during acceleration and deceleration phases

[Back to object overview](#)

6075h Motor Rated Current**Short description**

Setting of the rated motor current in mA

Parameter Name	Max_Current		
Object Type	VAR	0x7	
Data Type	UNSIGNED32	0x0007	4 Byte
Access	RW		
PDO Mapping	No		

6078h Current Actual Value**Short description**

Display of the actual motor current in % of the value set in object 6075 Motor Rated Current

Parameter Name	Current_Actual_Value		
Object Type	VAR	0x7	
Data Type	UNSIGNED32	0x0007	4 Byte
Access	RW		
PDO Mapping	No		

607Ah Target Position**Short description**

Entry of the target position

Value dimension dependent on object [60A8h SI Unit Position](#) (p. 181).

Parameter Name	Target_position		
Object Type	VAR	0x7	
Data Type	INTEGER32	0x0004	4 Byte
Access	RWW		
PDO Mapping	Yes		

607Bh Position Range Limit**Short description**

Entry of the minimum and maximum value of the target position. Sub-index 2 corresponds to the [Available Stroke](#) (p. 56).

If these values in object [607Ah Target Position](#) (p. 174) are exceeded or not reached, no movement is executed.

The value 0 must be entered in sub-index 1.

Value dimension dependent on object [60A8h SI Unit Position](#) (p. 181). If the controller has been enabled before, DI7 "Enable" must be toggled after settings were changed to adopt new parametrisation

Parameter Name	Position_Range_Limit	
Object Type	ARRAY	0x8
Subindex Number	3	

607Bh sub 0 Number of entries

Parameter Name	Number_of_entries		
Object Type	VAR	0x7	
Data Type	UNSIGNED8	0x0005	1 Byte
Access	Const		
Default Value	0x2		
PDO Mapping	No		

607Bh sub1 Position Range Limit Min

Parameter Name	Position_Range_Limit_Min		
Object Type	VAR	0x7	
Data Type	INTEGER32	0x0004	4 Byte
Access	RWW		
Default Value	0x0		
PDO Mapping	Yes		

607Bh sub2 Position Range Limit Max

Parameter Name	Position_Range_Limit_Max		
Object Type	VAR	0x7	
Data Type	INTEGER32	0x0004	4 Byte
Access	RWW		
Default Value	0x0		
PDO Mapping	Yes		
High Limit	0x989680		

[Back to object overview](#)

607Ch Home Offset**Short description**

Specification of the difference between application and machine reference point

Value dimension dependent on object [60A8h SI Unit Position](#) (p. 181).

If the controller has been enabled before, DI7 "Enable" must be toggled after settings were changed to adopt new parametrisation

Parameter Name	Home_offset		
Object Type	VAR	0x7	
Data Type	INTEGER32	0x0004	4 Byte
Access	RWW		
Default Value	0x0		
PDO Mapping	Yes		

607Fh Max Profile Velocity**Short description**

Entry of maximal velocity in Profile Position Mode

Value dimension dependent on object [60A8h SI Unit Position](#) (p. 181).

Parameter Name	Max_Profile_Velocity		
Object Type	VAR	0x7	
Data Type	UNSIGNED32	0x0007	4 Byte
Access	RWW		
PDO Mapping	Yes		

6081h Profile Velocity**Short description**

Entry of goal velocity

Value dimension dependent on object [60A8h SI Unit Position](#) (p. 181).

Parameter Name	Profile_velocity		
Object Type	VAR	0x7	
Data Type	UNSIGNED32	0x0007	4 Byte
Access	RWW		
PDO Mapping	Yes		

6083h Profile Acceleration**Short description**

Entry of acceleration

Value dimension dependent on object [60A8h SI Unit Position](#) (p. 181).

Parameter Name	Profile_acceleration		
Object Type	VAR	0x7	
Data Type	UNSIGNED32	0x0007	4 Byte
Access	RWW		
PDO Mapping	Yes		

6084h Profile Deceleration**Short description**

Entry of deceleration

Value dimension dependent on object [60A8h SI Unit Position](#) (p. 181).

Parameter Name	Profile_deceleration		
Object Type	VAR	0x7	
Data Type	UNSIGNED32	0x0007	4 Byte
Access	RWW		
PDO Mapping	Yes		

[Back to object overview](#)

6085h Quick Stop Deceleration**Short description**

Specification of the deceleration with which a movement is stopped in the event of an error or if the signal at DI7 "Enable" is set low/0.

Value dimension dependent on object [60A8h SI Unit Position](#) (p. 181).

Parameter Name	Quick_Stop_Deceleration		
Object Type	VAR	0x7	
Data Type	UNSIGNED32	0x0007	4 Byte
Access	RWW		
PDO Mapping	Yes		

608Fh Position Encoder Resolution**Short description**

Specification of the increment count per shaft revolution of the encoder.

If the controller has been enabled before, DI7 "Enable" must be toggled after settings were changed to adopt new parametrisation

Parameter Name	Position_Encoder_Resolution		
Object Type	ARRAY	0x8	
Subindex Number	3		

608Fh sub 0 Number of entries

Parameter Name	Number_of_entries		
Object Type	VAR	0x7	
Data Type	UNSIGNED8	0x0005	1 Byte
Access	Const		
Default Value	0x2		
PDO Mapping	No		

608Fh sub1 Position Range Limit Min

Parameter Name	Position_Encoder_Resolution_Encoder_Increments		
Object Type	VAR	0x7	
Data Type	UNSIGNED32	0x0007	4 Byte
Access	RWW		
Default Value	0x1		
PDO Mapping	Yes		

608Fh sub2 Position Range Limit Max

Parameter Name	Position_Encoder_Resolution_Motor_Revolutions		
Object Type	VAR	0x7	
Data Type	UNSIGNED32	0x0007	4 Byte
Access	RWW		
Default Value	0x1		
PDO Mapping	Yes		

6091h Gear Ratio**Short description**

Entry of the gear ratio

$$6091h \text{ Gear Ratio} = \frac{6091h:01 \text{ Motor Shaft Revolutions}}{6091h:02 \text{ Driving Shaft Revolutions}}$$

If the controller has been enabled before, DI7 "Enable" must be toggled after settings were changed to adopt new parametrisation

Example 1:

Gear with a transmission ratio of 5:1

$$6091h:01 \text{ Motor Shaft Revolutions} = 5$$

$$6091h:02 \text{ Driving Shaft Revolutions} = 1$$

Example 2:

Gear with a transmission ratio of 2,467:1

$$6091h:01 \text{ Motor Shaft Revolutions} = 2467$$

$$6091h:02 \text{ Driving Shaft Revolutions} = 1000$$

Example 3:

Gear with a transmission ratio of 2,467:1,25

$$6091h:01 \text{ Motor Shaft Revolutions} = 2467$$

$$6091h:02 \text{ Driving Shaft Revolutions} = 1250$$

Parameter Name	Gear_Ratio		
Object Type	ARRAY	0x8	
Subindex Number	3		
6091h sub0 Number of Entries			
Parameter Name	Number_of_entries		
Object Type	VAR	0x7	
Data Type	UNSIGNED8	0x0005	1 Byte
Access	RO		
Default Value	0x2		
PDO Mapping	No		
6091h sub1 Gear Ratio Motor Shaft Revolutions			
Parameter Name	Gear_Ratio_Motor_Shift_Revolutions		
Object Type	VAR	0x7	
Data Type	UNSIGNED32	0x0007	4 Byte
Access	RWW		
Default Value	0x1		
PDO Mapping	Yes		
6091h sub2 Gear Ratio Driving Shaft Revolutions			
Parameter Name	Gear_Ratio_Driving_Shift_Revolutions		
Object Type	VAR	0x7	
Data Type	UNSIGNED32	0x0007	4 Byte
Access	RWW		
Default Value	0x1		
PDO Mapping	Yes		

6092h Feed Constant**Short description**

Specification of the feed constant. The Feed Constant defines the distance, e.g. in millimetres, which a linear axis travels per one drive shaft revolution. This value is also referred to as the spindle pitch for spindle drives.

The Feed Constant value is defined by specifying the Feed (6092h:01), the number of Shaft Revolutions (6092h:02) and the separate object [60A8h SI Unit Position](#) (p. 181).

For positioning in the 100th scale, in this example 0.01mm, the [60A8h SI Unit Position](#) (p. 181) must be set to the value 00 00 01 FBh (default value with "Linear" of the [Movement Type](#) (p. 36)). This setting results in a factor with the value 100. All objects with acceleration, speed and position information must now be multiplied by this factor of 100.

$$6092h \text{ Feed Constant} = \frac{6092h:01 \text{ Feed} \times 60A8h \text{ SI Unit Position}}{6092h:02 \text{ Shaft Revolutions}}$$

**CAUTION!**

- Execution of unpredictable movements

If new feed constant values are to be applied and the motor controller has already been activated via DI7 "Enable", the digital input DI7 must be toggled (switched off and on) to apply the new feed constant values.

If DI7 "Enable" is not toggled, the previous feed value is retained. If position values are now to be executed on the basis of the new feed, however, they will be executed on the basis of the old value.

Example:

Setting 6092h:01 to 6000 and [607Ah Target Position](#) (p. 174) to 6000, activation of DI 7 and start signal-> execution of one revolution of the motor shaft.

Change 6092h:01 to 7000 without subsequent toggle of DI 7, set [607Ah Target Position](#) (p. 174) to 7000, start signal-> execution of 1.16 revolutions of the motor shaft.

Example 1:

[Movement Type](#) (p. 36): Linear

Positioning in 0,01 mm scale,

Tooth belt axis with 70 mm travel per drive shaft revolution

[60A8h SI Unit Position](#) (p. 181): Default Value

$$60A8h \text{ SI Unit Position (Value from Byte 3, Linear)} = \text{Meter} \times 10^{-5} \equiv \text{Milimeter} \times 10^{-2} \equiv \text{Factor 100}$$

$$6092h:01 \text{ Feed} = 70 \times 100 = 7000$$

$$6092h:02 \text{ Shaft Revolutions} = 1$$

Example 2:

[Movement Type](#) (p. 36): Linear

Positioning in 0,01 mm scale,

Spindle drive axis with 4 mm travel per drive shaft revolution

[60A8h SI Unit Position](#) (p. 181): Default Value

$$60A8h \text{ SI Unit Position (Value from Byte 3, Linear)} = \text{Meter} \times 10^{-5} \equiv \text{Milimeter} \times 10^{-2} \equiv \text{Factor 100}$$

$$6092h:01 \text{ Feed} = 4 \times 100 = 400$$

$$6092h:02 \text{ Shaft Revolutions} = 1$$

Example 3:

[Movement Type](#) (p. 36): Rotary

Positioning in 0,01° scale,

Rotating axis with 360°

[60A8h SI Unit Position](#) (p. 181): Default Value

$$60A8h \text{ SI Unit Position (Value from Byte 3, Rotativ)} = \text{Grad} \times 10^{-2} \equiv \text{Factor 100}$$

$$6092h:01 \text{ Feed} = 360 \times 100 = 36000$$

$$6092h:02 \text{ Shaft Revolutions} = 1$$

[Back to object overview](#)

Parameter Name	Feed_constant	
Object Type	ARRAY	0x8
Subindex Number	3	

6092h sub0 Number of Entries

Parameter Name	Feed_constant_number_of_entries		
Object Type	VAR	0x7	
Data Type	UNSIGNED8	0x0005	1 Byte
Access	RO		
Default Value	0x2		
PDO Mapping	No		

6092h sub1 Feed

Parameter Name	Feed_constant_Feed		
Object Type	VAR	0x7	
Data Type	UNSIGNED32	0x0007	4 Byte
Access	RWW		
Default Value	0x1		
PDO Mapping	Yes		

6092h sub2 Shaft Revolutions

Parameter Name	Feed_constant_Shaft_revolutions		
Object Type	VAR	0x7	
Data Type	UNSIGNED32	0x0007	4 Byte
Access	RWW		
Default Value	0x1		
PDO Mapping	Yes		

6098h Homing Method**Short description**

Reference method selection.

If the controller has been enabled before, DI7 "Enable" must be toggled after settings were changed to adopt new parametrisation

Parameter Name	Homing_method		
Object Type	VAR	0x7	
Data Type	INTEGER8	0x0002	1 Byte
Access	RO		
PDO Mapping	Yes		

Value Assignment

17	LSN Limit Switch Negativ
18	LSP Limit Switch Positiv
33	IEN Index Encoder Negativ
34	IEP Index Encoder Positiv
37	SCP Set Current Position
255	AAF Analog Absolute Feedback

6099h Homing Speeds**Short description**

Entry of the corresponding velocities during a reference run.

Value dimension dependent on object [60A8h SI Unit Position](#) (p. 181).

Sub-index 1 defines the maximum velocity during the search movement for the selected limit switch or encoder index signal.

Subindex 2 defines the maximum velocity that is used when the limit switch was found and the reference point is set.

Subindex 2 is not used when the encoder index is used to determine the zero-position.

Parameter Name	Homing_speeds	
Object Type	ARRAY	0x8
Subindex Number	3	

6099h sub0 Number of Entries

Parameter Name	Homing_speeds_number_of_entries		
Object Type	VAR	0x7	
Data Type	UNSIGNED8	0x0005	1 Byte
Access	RO		
Default Value	0x2		
PDO Mapping	No		

6099h sub1 Search Velocity for Switch

Parameter Name	Homing_speeds_Search_Velocity_for_Switch		
Object Type	VAR	0x7	
Data Type	UNSIGNED32	0x0007	4 Byte
Access	RWW		
Default Value	0x0		
PDO Mapping	Yes		

6099h sub2 Search Velocity for Zero

Parameter Name	Homing_speeds_Search_Velocity_for_Zero		
Object Type	VAR	0x7	
Data Type	UNSIGNED32	0x0007	4 Byte
Access	RWW		
Default Value	0x0		
PDO Mapping	Yes		

609Ah Homing Acceleration**Short description**

Entry of the acceleration used during homing runs.

Value dimension dependent on object [60A8h SI Unit Position](#) (p. 181).

Parameter Name	Homing_acceleration		
Object Type	VAR	0x7	
Data Type	UNSIGNED32	0x0007	4 Byte
Access	RWW		
PDO Mapping	Yes		

[Back to object overview](#)

60A8h SI Unit Position**Short description**

Configuration of the multiplying factor for object [6092h Feed Constant](#) (p. 178) and all objects with acceleration, velocity and position values.

This factor is needed to be able to transfer the input values correctly from the data objects to the user interface and back again. The factor can be changed via the object within the given range

Standard object values when using the "Movement Type" switch on the "Start" page

Movement Type	Byte 0	Byte 1	Byte 2	Byte 3
Linear	00h	00h	01h	FBh
Rotary	00h	00h	41h	FEh

Preselection Movement Type

Movement Type	Value Byte 2	Basic Unit
Linear	01h	Meter
Rotary	41h	Degree

Preselection Exponent

Value Byte 3	Resulting Exponent	Multiplying Factor Linear	Multiplying Factor Rotary
02h	10^2	0,00001	0,01
01h	10^1	0,0001	0,1
00h	10^0	0,001	1
FFh	10^{-1}	0,01	10
FEh	10^{-2}	0,1	100 (Standard)
FDh	10^{-3}	1	1.000
FCh	10^{-4}	10	10.000
FBh	10^{-5}	100 (Standard)	100.000
FAh	10^{-6}	1.000	1.000.000

Parameter Name	SI Init Position		
Object Type	VAR	0x7	
Data Type	UNSIGNED32	0x0007	4 Byte
Access	RW		
PDO Mapping	No		

60C2h Interpolation Time Period**Short description**

Specifies the time interval with which a new position set point is adopted from object 607Ah "Target Position".

If, for example, the value 5 is set in sub-index 01 and the value "-3" in sub-index 02, a new position support point is generated every 5 ms.

$$\text{Time interval} = \text{Subindex 01} * 10^{\text{Subindex 02}_S}$$

Example:

$$\text{Time interval} = 5 * 10^{-3} = 5\text{ms}$$

Parameter Name	Interpolation time period	
Object Type	ARRAY	0x8
Subindex Number	3	

60C2h sub0 Number of Entries

Parameter Name	Homing_speeds_number_of_entries		
Object Type	VAR	0x7	
Data Type	UNSIGNED8	0x0005	1 Byte
Access	RO		
Default Value	0x2		
PDO Mapping	No		

60C2h sub1 Interpolation time period value

Parameter Name	Interpolation_time_period_value		
Object Type	VAR	0x7	
Data Type	UNSIGNED8	0x0005	1 Byte
Access	RWW		
Default Value	0x1		
PDO Mapping	Yes		

60C2h sub2 Interpolation time index

Parameter Name	Interpolation_time_index		
Object Type	VAR	0x7	
Data Type	UNSIGNED32	0x0007	4 Byte
Access	RWW		
Default Value	0xFD		
PDO Mapping	Yes		

60C5h Max Acceleration**Short description**

Entry of maximal acceleration

Value dimension dependent on object [60A8h SI Unit Position](#) (p. 181).

Parameter Name	Max_Acceleration		
Object Type	VAR	0x7	
Data Type	UNSIGNED32	0x0007	4 Byte
Access	RWW		
Default Value	0x0		
PDO Mapping	Yes		

60F4h Following Error Actual Value**Short description**

Output of the actual Following Error value.

Value dimension dependent on object [60A8h SI Unit Position](#) (p. 181).

Parameter Name	Max_Acceleration		
Object Type	VAR	0x7	
Data Type	UNSIGNED32	0x0007	4 Byte
Access	RWW		
Default Value	0x0		
PDO Mapping	Yes		

60FDh Digital Inputs**Short description**

Status display of the Digital Inputs.

Bits 0, 1 und 3 are redundant to Bit 22, 23 und 24

Parameter Name	Digital_inputs		
Object Type	VAR	0x7	
Data Type	UNSIGNED32	0x0007	4 Byte
Access	RO		
Default Value	0x0		
PDO Mapping	Yes		

Bit Assignment

0	0	DI 9 Negative Limit Switch off
	1	DI 9 Negative Limit Switch on
1	0	DI 8 Positive Limit Switch off
	1	DI 8 Positive Limit Switch on
2		Not Assigned
3		Enable
4		Reserved
5		Reserved
6		Reserved
7		Reserved
8		Reserved
9		Reserved
10		Reserved
11		Reserved
12		Reserved
13		Reserved
14		Reserved
15		Reserved
16	0	DI 1 off
	1	DI 1 on
17	0	DI 2 off
	1	DI 2 on
18	0	DI 3 off
	1	DI 3 on
19	0	DI 4 off
	1	DI 4 on
20	0	DI 5 off
	1	DI 5 on
21	0	DI 6 off
	1	DI 6 on
22	0	DI 7 off
	1	DI 7 on
23	0	DI 8 off
	1	DI 8 on
24	0	DI 9 off
	1	DI 9 on
25	0	DI 10 off
	1	DI 10 on
26		Not Assigned
27		Not Assigned
28		Not Assigned
29		Not Assigned
30		Not Assigned
31		Not Assigned

60FEh Digital Outputs

Short description

Automatic and manual setting of the Digital Outputs.

For manual Digital Output control the following steps must be followed.

1. The corresponding Bit of the Digital Output to be set manually must be set at the sub-index 2 "Digital Outputs Bitmask" high and keep this state permanently
To ensure a safe operation it's recommended to set one send/receive cycle as a delay before proceeding
2. Set the desired Bit at Subindex 1 „Digital Outputs Physical Outputs" to high/1

Example:

If DO1 "Ready" and DO2 "Active" shall be set manually the Bits 16 and 17 at Subindex 2 must be set high/1 permanently.
Afterwards the Bits 16 and 17 at Subindex 1 must be set high/1.

The brake output Bit 0 is controlled exclusively by the dryve D1.

Live values of the Digital Outputs DO 1 to 5 are emitted at Bit 24 to 28 of the Subindex 1. These Bits always mirror the current status of the Digital Outputs.

Parameter Name	Digital_outputs	
Object Type	ARRAY	0x8
Subindex Number	3	

60FEh sub0 Number of Entries

Parameter Name	Digital_outputs_number_of_entries		
Object Type	VAR	0x7	
Data Type	UNSIGNED8	0x0005	1 Byte
Access	RO		
Default Value	0x2		
PDO Mapping	No		

60FEh sub1 Digital Outputs Physical Outputs

Parameter Name	Digital_outputs_Physical_outputs		
Object Type	VAR	0x7	
Data Type	UNSIGNED32	0x0007	4 Byte
Access	RWW		
Default Value	0x0		
PDO Mapping	Yes		

The Bit Assignment is situated at the following page

Bit Assignment 60FEh Digital Outputs

0	0	Brake off
	1	Brake on
1		Reserved
2		Reserved
3		Reserved
4		Reserved
5		Reserved
6		Reserved
7		Reserved
8		Reserved
9		Reserved
10		Reserved
11		Reserved
12		Reserved
13		Reserved
14		Reserved
15		Reserved
16	0	DO 1 off
	1	DO 1 on
17	0	DO 2 off
	1	DO 2 on
18	0	DO 3 off
	1	DO 3 on
19	0	DO 4 off
	1	DO 4 on
20	0	DO 5 off
	1	DO 5 on
21		Not Assigned
22		Not Assigned
23		Not Assigned
24		Live Value DO1
25		Live Value DO2
26		Live Value DO3
27		Live Value DO4
28		Live Value DO5
29		Not Assigned
30		Not Assigned
31		Not Assigned

60FEh sub2 Digital Outputs Bitmask

Parameter Name	Digital_outputs_Bitmask		
Object Type	VAR	0x7	
Data Type	UNSIGNED32	0x0007	4 Byte
Access	RWW		
Default Value	0x0		
PDO Mapping	Yes		

60FFh Target Velocity**Short description**

Entry of the goal velocity in Profile Velocity Mode

Parameter Name	Target_velocity		
Object Type	VAR	0x7	
Data Type	INTEGER32	0x0004	4 Byte
Access	RWW		
PDO Mapping	Yes		

[Back to object overview](#)

6402h Motor Type**Short description**

Selection of the used motor type.

If the controller has been enabled before, DI7 "Enable" must be toggled after settings were changed to adopt new parametrisation

Parameter Name	Motor_Type		
Object Type	VAR	0x7	
Data Type	UNSIGNED16	0x0006	2 Byte
Access	RW		
PDO Mapping	Yes		

Value Assignment

Typ	Wert HEX	Wert DEC
Stepper Motor	09	9
EC/BLDC Motor	0A	10
DC Motor	0D	13

6502h Supported Drive Modes**Short description**

Display of the supported control modes

Parameter Name	Supported_drive_modes		
Object Type	VAR	0x7	
Data Type	UNSIGNED32	0x0007	4 Byte
Access	RO		
PDO Mapping	Yes		

Bit Assignment

0	Profile Position Mode	1
1	Velocity Mode	0
2	Profile Velocity Mode	1
3	Profile Torque Mode	0
4	Reserved	0
5	Homing Mode	1
6	Interpolated Position Mode	0
7	Cyclic Synchronous Position Mode	1
8	Cyclic Synchronous Velocity Mode	0
9	Cyclic Synchronous Torque Mode	0

Bit 10 to 15 „Reserved“.

Bit 16 to 31 „Manufacturer Specific“

A mode is available if the respect bit has been set with a 1.

If a 0 has been entered, this mode is not supported.

5.7 Modbus TCP Gateway (Ethernet TCP/IP)

The Modbus TCP Gateway communication is implemented as a gateway from Ethernet TCP/IP to CANopen and is solely used for data telegram transmissions. It is based on the CAN in Automation (CiA) specification "Access from other networks" part 1 "General principles and services" and part 2 "Modbus/TCP mapping".

In the following chapter the data telegram read and write functions as well as the response telegrams are explained. The customer must implement the read and write telegram communication in the master control on their own behalf.

5.7.1 Motion Control via Modbus TCP as Gateway

Internally the motion control is implemented with [CANopen](#) (p. 101). All read/write commands and behaviours are the same as those described in the CANopen. Instead of the CAN-Bus the Ethernet TCP/IP protocol is used to transfer data telegrams.

Only SDO communication is available. PDO communication is not supported. Predefined read/write coils via function code 11 and 12 or 22 and 23 (and others), as used in the Modbus TCP communication without a gateway function, are not supported.

The Modbus TCP as Gateway protocol cannot initiate an automatic data transmission of values such as the status word, the current position, etc.. A read telegram must always be sent for each information transmission.

If values greater than those set under [Motion Limits](#) (p. 56) are entered as motion parameters, no motion can be executed.

Information about [Homing](#) (p. 117), [Positioning](#) (p. 118), [Velocity Control](#) (p. 119) and [Synchronous Position Control](#) (p. 119) can be found in the respective CANopen chapters.

Note
The response time between sending a read/write telegram from the master and processing it in the drive D1 and sending the response telegram is approx. 0.6 ms on average with a "lean" connection (master and few slaves). In connection with PLC systems, this communication time can increase to 20 ms and more due to internal speed restrictions of the communication.

5.7.2 Necessary User Interface Settings

The following objects/parameters must be set in the user interface of the drive D1.

"Motor" page

All parameters relevant to the motor must be set in the user interface.

"Communication" page

Parameterization and activation of the Modbus TCP as Gateway communication interface [Bus Systems](#) (p.66).

"Drive Profile" page

Setting the dominance via the dropdown menu to allow the Modbus TCP as Gateway master to execute movements.

Only by selecting this option the Modbus TCP Gateway Master is allowed to execute move commands.

5.7.3 Conversion Decimal into Double Word Decimal

Integer	Binary	Integer as double word			
		Byte 22	Byte 21	Byte 20	Byte 19
100	0000.0000.0000.0000.0000.0000.0110.0100	0	0	0	100
255	0000.0000.0000.0000.0000.0000.1111.1111	0	0	0	255
256	0000.0000.0000.0000.0000.0001.0000.0000	0	0	1	0
2.000	0000.0000.0000.0000.0000.0111.1101.0000	0	0	7	208
6.000	0000.0000.0000.0000.0001.0111.0111.0000	0	0	23	112
30.000	0000.0000.0000.0000.0111.0101.0011.0000	0	0	117	48
150.000	0000.0000.0000.0010.0100.1001.1111.0000	0	2	73	240
101.253.137	0000.0110.0000.1001.0000.0000.0001.0001	6	9	0	17
-100	1111.1111.1111.1111.1111.1111.1001.1100	255	255	255	156
-255	1111.1111.1111.1111.1111.1111.0000.0001	255	255	255	1
-256	1111.1111.1111.1111.1111.1111.0000.0000	255	255	255	0
-2.000	1111.1111.1111.1111.1111.1000.0011.0000	255	255	248	48
-6.000	1111.1111.1111.1111.1110.1000.1001.0000	255	255	232	144
-30.000	1111.1111.1111.1111.1000.1010.1101.0000	255	255	138	208
-150.000	1111.1111.1111.1101.1011.0110.0001.0000	255	253	182	16
-101.253.137	1111.1001.1111.0110.1111.1111.1110.1111	249	246	255	239

5.7.4 Communication Verification

1. Configuration of the dryve D1 according to the manual
2. Repowering the dryve D1 with "Enable" set – no further parameter changes during this test run
3. Sending telegram to read object 6041h "Statusword". Setting the value "15" in Byte 0 and 1 for communication control – [Byte Assignment Modbus TCP Gateway Telegram](#) (p. 189)
4. Receiving the answer telegram and control of Bytes 0, 1, 19 and 20
 Byte 0 and 1 Value: each 15 (F hex, 1111 bin)
 Byte 19 and 20 value: 1600 (640 hex, 0000 0110 0100 0000 bin – compare to [State Machine](#) (p. 113)
 If the answer telegrams differ from [RX/TX Telegram Example](#) (p. 191) please check the program of your master controller and redo these steps.
5. Continue going through the [State Machine](#) (p. 113) with the goal "Operation enabled"
6. Writing the object 607Ah "Target Position" (value different to 0 or 1) and reading it subsequently to ensure the value has been adopted correctly

If the previously written value has been sent back the communication can be considered as operational. If the answer telegrams differ, please check the program of your master controller and redo these steps.

5.7.5 Byte Assignment Modbus TCP Gateway Telegram

Byte	Endianness	Field	Value	Description
Byte 0	Big Endian	Transaction Identifier	0	Identification of Modbus telegram (allocation of a response to a command telegram). The master will set a value, e.g. 1, in the command telegram. The drive D1 will adopt the value 1 to the response telegram and will send it back to the master. If the Transaction Identifier value is the same in the command and the response telegram, both telegrams are interrelated. If this function is not used, a 0 should be set.
Byte 1			0	
Byte 2		Protocol Identifier	0	0 = Modbus Protocol
Byte 3			0	0 = Modbus Protocol
Byte 4		Length	0	Byte not used but must be send.
Byte 5			13 - 17	Information of how many bytes will be send in a telegram after byte number 5. The value is 13 (0Dh) if a read telegram is sent by the master. A 1-byte long SDO write telegram does have the value 14 (0Eh). A 4-byte long telegram has the value 17 (11h).
Byte 6		Unit Identifier	0	Byte not used but must be send.
Byte 7		Function code	43 (2Bh)	Modbus TCP Gateway (CANopen) = 43 (2Bh) Exception Codes Modbus TCP Gateway (p. 196)
Byte 8		MEI type	13 (0Dh)	Modbus TCP Gateway (CANopen) = 13 (0Dh) Exception Codes Modbus TCP Gateway (p. 196)
Byte 9		Protocol option fields / Protocol control	0 = read 1 = write	The value is a 0 for a read and a 1 for a write telegram.
Byte 10		Protocol option fields / Reserve	0	Byte not used but must be send.
Byte 11		Node ID	0	Byte not used but must be send.
Byte 12		Object Index	SDO Object	Controlword SDO Object e.g. 96 (60h) for Controlword (p. 116)
Byte 13			SDO Object	Controlword SDO Object e.g. 64 (40h) for Controlword (p. 116)
Byte 14		Sub Index	SDO Object / Sub Index	Objects Sub Index
Byte 15		Starting Address	0	Byte not used but must be send.
Byte 16			0	Byte not used but must be send.
Byte 17		SDO Object	0	Byte not used but must be send.
Byte 18		Byte count	1-4	Byte count detail depending on the SDO Object in Byte 12 and 13. For example the Controlword 6040h is 2 Byte long the value must be 2
Byte 19	Little Endian	Data Field	Data read/write	Information byte section. If the master sends a read telegram to the drive D1, it will respond with the requested information. The information will be transmitted in byte 19 to 22, depending on the SDO Object length. If only 1-byte shall be read the response telegram contains byte 19 only. If the information is 4-byte long, byte 19 to 22 will be send.
Byte 20			Data read/write	
Byte 21			Data read/write	
Byte 22			Data read/write	A write telegram must have the length of byte 19 to 22. 1-byte information will be set in byte 19, 2-byte information in byte 19 to 20 and so on.

5.7.6 Configuration Read/Write Telegram

Operation	Read/Write Data Length	Byte 5	Byte 18	Send data in: (zero is counted as data as well)			
				Byte 19	Byte 20	Byte 21	Byte 22
Read	1	0Dh	1h	The telegram has to stop after Byte 18 - No additional Bytes must be send in a reading operation			
Read	2	0Dh	2h				
Read	3	0Dh	3h				
Read	4	0Dh	4h				
Wirte	1	0Eh	1h	yes	-	-	-
Wirte	2	0Fh	2h	yes	yes	-	-
Wirte	3	10h	3h	yes	yes	yes	-
Wirte	4	11h	4h	yes	yes	yes	yes

5.7.7 RX/TX Telegram Example

The following examples show how Ethernet telegrams must be structured to ensure proper communication between the dryve D1 and a Modbus TCP Gateway Master.

Listed below are read/write telegrams with the respective response telegram from the dryve D1. The Bytes highlighted in green must be configured for the respective purpose (e.g. reading the Statusword 6041 or writing the Controlword 6040h).

The following telegrams describe the passage of the "State Machine", the execution of the "Homing" and a pendulum motion in "Profile Position" mode.

Telegram Type		Task/Information		Byte																								
				0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22		
1	Send Telegram (TX) Read Statusword 6041h	Status Request	bin	0000 1111	0000 1111	0000 0000	0000 0000	0000 0000	0000 1101	0000 0000	0010 1011	0000 1101	0000 0000	0000 0000	0000 0000	0110 0000	0100 0001	0000 0000	0000 0000	0000 0000	0000 0000	0000 0010	not send	not send	not send	not send		
			hex	Fh*	Fh*	0h	0h	0h	0Dh	0h	2Bh	0Dh	0h	0h	0h	0h	60h	41h	0h	0h	0h	0h	2h	not send	not send	not send	not send	
			dec	15*	15*	0	0	0	13	0	43	13	0	0	0	0	96	65	0	0	0	0	2	not send	not send	not send	not send	
2	Answer Telegram (RX) Switch On Disabled	Switch On Disabled	bin	0000 1111	0000 1111	0000 0000	0000 0000	0000 0000	0000 1111	0000 0000	0010 1011	0000 1101	0000 0000	0000 0000	0000 0000	0110 0000	0100 0001	0000 0000	0000 0000	0000 0000	0000 0000	0000 0010	0100 0000	0000 0100	not send	not send		
			hex	Fh*	Fh*	0h	0h	0h	0Fh	0h	2Bh	0Dh	0h	0h	0h	0h	60h	41h	0h	0h	0h	0h	2h	40h	4h	not send	not send	
			dec	15*	15*	0	0	0	15	0	43	13	0	0	0	0	96	65	0	0	0	0	2	64	4	not send	not send	
Digital Input DI 7 set "high" - Bit 9 "Remote" in Statusword 6041h *Only used to identify the response telegram in multi axis application																												
3	Send Telegram (TX) Read Statusword 6041h	Status Request	bin	0000 0000	0000 0000	0000 0000	0000 0000	0000 0000	0000 1101	0000 0000	0010 1011	0000 1101	0000 0000	0000 0000	0000 0000	0110 0000	0100 0001	0000 0000	0000 0000	0000 0000	0000 0000	0000 0010	not send	not send	not send	not send		
			hex	0h	0h	0h	0h	0h	0Dh	0h	2Bh	0Dh	0h	0h	0h	0h	60h	41h	0h	0h	0h	0h	2h	not send	not send	not send	not send	
			dec	0	0	0	0	0	13	0	43	13	0	0	0	0	96	65	0	0	0	0	2	not send	not send	not send	not send	
4	Answer Telegram (RX) Switch On Disabled	Switch On Disabled	bin	0000 0000	0000 0000	0000 0000	0000 0000	0000 0000	0000 1111	0000 0000	0010 1011	0000 1101	0000 0000	0000 0000	0000 0000	0110 0000	0100 0001	0000 0000	0000 0000	0000 0000	0000 0000	0000 0010	0100 0000	0000 0110	not send	not send		
			hex	0h	0h	0h	0h	0h	0Fh	0h	2Bh	0Dh	0h	0h	0h	0h	60h	41h	0h	0h	0h	0h	2h	40h	6h	not send	not send	
			dec	0	0	0	0	0	15	0	43	13	0	0	0	0	96	65	0	0	0	0	2	64	6	not send	not send	
5	Send Telegram (TX) Write Controlword 6040h	Command: Shutdown	bin	0000 0000	0000 0000	0000 0000	0000 0000	0000 0000	0000 1111	0000 0000	0010 1011	0000 1101	0000 0001	0000 0000	0000 0000	0110 0000	0100 0000	0000 0000	0000 0000	0000 0000	0000 0000	0000 0010	0000 0110	0000 0000	not send	not send		
			hex	0h	0h	0h	0h	0h	0Fh	0h	2Bh	0Dh	1h	0h	0h	0h	60h	40h	0h	0h	0h	0h	2h	6h	0h	not send	not send	
			dec	0	0	0	0	0	15	0	43	13	1	0	0	0	96	64	0	0	0	0	2	6	0	not send	not send	
6	Answer Telegram (RX) Handshake	Handshake	bin	0000 0000	0000 0000	0000 0000	0000 0000	0000 0000	0000 1101	0000 0000	0010 1011	0000 1101	0000 0001	0000 0000	0000 0000	0110 0000	0100 0000	0000 0000	0000 0000	0000 0000	0000 0000	0000 0000	not send	not send	not send	not send		
			hex	0h	0h	0h	0h	0h	0Dh	0h	2Bh	0Dh	1h	0h	0h	0h	60h	40h	0h	0h	0h	0h	0h	0h	not send	not send	not send	not send
			dec	0	0	0	0	0	13	0	43	13	1	0	0	0	96	64	0	0	0	0	0	0	not send	not send	not send	not send
7	Send Telegram (TX) Read Statusword 6041h	Status Request	bin	0000 0000	0000 0000	0000 0000	0000 0000	0000 0000	0000 1101	0000 0000	0010 1011	0000 1101	0000 0000	0000 0000	0000 0000	0110 0000	0100 0001	0000 0000	0000 0000	0000 0000	0000 0000	0000 0010	not send	not send	not send	not send		
			hex	0h	0h	0h	0h	0h	0Dh	0h	2Bh	0Dh	0h	0h	0h	0h	60h	41h	0h	0h	0h	0h	2h	not send	not send	not send	not send	
			dec	0	0	0	0	0	13	0	43	13	0	0	0	0	96	65	0	0	0	0	2	not send	not send	not send	not send	
8	Answer Telegram (RX) Ready To Switch On	Ready To Switch On	bin	0000 0000	0000 0000	0000 0000	0000 0000	0000 0000	0000 1111	0000 0000	0010 1011	0000 1101	0000 0000	0000 0000	0000 0000	0110 0000	0100 0001	0000 0000	0000 0000	0000 0000	0000 0000	0000 0010	0010 0001	0000 0110	not send	not send		
			hex	0h	0h	0h	0h	0h	0Fh	0h	2Bh	0Dh	0h	0h	0h	0h	60h	41h	0h	0h	0h	0h	2h	21h	6h	not send	not send	
			dec	0	0	0	0	0	15	0	43	13	0	0	0	0	96	65	0	0	0	0	2	33	6	not send	not send	
9	Send Telegram (TX) Write Controlword 6040h	Command: Switch on	bin	0000 0000	0000 0000	0000 0000	0000 0000	0000 0000	0000 1111	0000 0000	0010 1011	0000 1101	0000 0001	0000 0000	0000 0000	0110 0000	0100 0000	0000 0000	0000 0000	0000 0000	0000 0000	0000 0010	0000 0111	0000 0000	not send	not send		
			hex	0h	0h	0h	0h	0h	0Fh	0h	2Bh	0Dh	1h	0h	0h	0h	60h	40h	0h	0h	0h	0h	2h	7h	0h	not send	not send	
			dec	0	0	0	0	0	15	0	43	13	1	0	0	0	96	64	0	0	0	0	2	7	0	not send	not send	
10	Answer Telegram (RX) Handshake	Handshake	bin	0000 0000	0000 0000	0000 0000	0000 0000	0000 0000	0000 1101	0000 0000	0010 1011	0000 1101	0000 0001	0000 0000	0000 0000	0110 0000	0100 0000	0000 0000	0000 0000	0000 0000	0000 0000	0000 0000	not send	not send	not send	not send		
			hex	0h	0h	0h	0h	0h	0Dh	0h	2Bh	0Dh	1h	0h	0h	0h	60h	40h	0h	0h	0h	0h	0h	0h	not send	not send	not send	not send
			dec	0	0	0	0	0	13	0	43	13	1	0	0	0	96	64	0	0	0	0	0	0	not send	not send	not send	not send

External Signal Exchange

Telegram Type		Task/Information	Byte																								
			0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22		
11	Send Telegram (TX) Read Statusword 6041h	Status Request	bin	0000 0000	0000 0000	0000 0000	0000 0000	0000 0000	0000 1101	0000 0000	0010 1011	0000 1101	0000 0000	0000 0000	0000 0000	0110 0000	0100 0001	0000 0000	0000 0000	0000 0000	0000 0000	0000 0010	not send	not send	not send	not send	
			hex	0h	0h	0h	0h	0h	0Dh	0h	2Bh	0Dh	0h	0h	0h	0h	60h	41h	0h	0h	0h	0h	2h	not send	not send	not send	not send
			dec	0	0	0	0	0	13	0	43	13	0	0	0	0	96	65	0	0	0	0	2	not send	not send	not send	not send
12	Answer Telegram (RX) Switched On	Switched On	bin	0000 0000	0000 0000	0000 0000	0000 0000	0000 0000	0000 1111	0000 0000	0010 1011	0000 1101	0000 0000	0000 0000	0000 0000	0110 0000	0100 0001	0000 0000	0000 0000	0000 0000	0000 0000	0000 0010	0010 0011	0000 0110	not send	not send	
			hex	0h	0h	0h	0h	0h	0Fh	0h	2Bh	0Dh	0h	0h	0h	0h	60h	41h	0h	0h	0h	0h	2h	23h	6h	not send	not send
			dec	0	0	0	0	0	15	0	43	13	0	0	0	0	96	65	0	0	0	0	2	35	6	not send	not send
13	Send Telegram (TX) Write Controlword 6040h	Command: Enable Operation	bin	0000 0000	0000 0000	0000 0000	0000 0000	0000 0000	0000 1111	0000 0000	0010 1011	0000 1101	0000 0001	0000 0000	0000 0000	0110 0000	0100 0000	0000 0000	0000 0000	0000 0000	0000 0000	0000 0010	0000 1111	0000 0000	not send	not send	
			hex	0h	0h	0h	0h	0h	0Fh	0h	2Bh	0Dh	1h	0h	0h	0h	60h	40h	0h	0h	0h	0h	2h	Fh	0h	not send	not send
			dec	0	0	0	0	0	15	0	43	13	1	0	0	0	96	64	0	0	0	0	2	15	0	not send	not send
14	Answer Telegram (RX) Handshake	Handshake	bin	0000 0000	0000 0000	0000 0000	0000 0000	0000 0000	0000 1101	0000 0000	0010 1011	0000 1101	0000 0001	0000 0000	0000 0000	0110 0000	0100 0000	0000 0000	0000 0000	0000 0000	0000 0000	0000 0000	not send	not send	not send	not send	
			hex	0h	0h	0h	0h	0h	0Dh	0h	2Bh	0Dh	1h	0h	0h	0h	60h	40h	0h	0h	0h	0h	0h	not send	not send	not send	not send
			dec	0	0	0	0	0	13	0	43	13	1	0	0	0	96	64	0	0	0	0	0	not send	not send	not send	not send
15	Send Telegram (TX) Read Statusword 6041h	Status Request	bin	0000 0000	0000 0000	0000 0000	0000 0000	0000 0000	0000 1101	0000 0000	0010 1011	0000 1101	0000 0000	0000 0000	0000 0000	0110 0000	0100 0001	0000 0000	0000 0000	0000 0000	0000 0000	0000 0010	not send	not send	not send	not send	
			hex	0h	0h	0h	0h	0h	0Dh	0h	2Bh	0Dh	0h	0h	0h	0h	60h	41h	0h	0h	0h	0h	2h	not send	not send	not send	not send
			dec	0	0	0	0	0	13	0	43	13	0	0	0	0	96	65	0	0	0	0	2	not send	not send	not send	not send
16	Answer Telegram (RX) Operation enabled	Operation enabled	bin	0000 0000	0000 0000	0000 0000	0000 0000	0000 0000	0000 1111	0000 0000	0010 1011	0000 1101	0000 0000	0000 0000	0000 0000	0110 0000	0100 0001	0000 0000	0000 0000	0000 0000	0000 0000	0000 0010	0010 0111	0000 0110	not send	not send	
			hex	0h	0h	0h	0h	0h	0Fh	0h	2Bh	0Dh	0h	0h	0h	0h	60h	41h	0h	0h	0h	0h	2h	27h	6h	not send	not send
			dec	0	0	0	0	0	15	0	43	13	0	0	0	0	96	65	0	0	0	0	2	39	6	not send	not send
Motor current applied - Ready for desired taks																											
Homing Mode																											
17	Send Telegram (TX) Write Modes of OP 6060h	Write Value: 6 Homing	bin	0000 0000	0000 0000	0000 0000	0000 0000	0000 0000	0000 1110	0000 0000	0010 1011	0000 1101	0000 0001	0000 0000	0000 0000	0110 0000	0110 0000	0000 0000	0000 0000	0000 0000	0000 0000	0000 0001	0000 0110	not send	not send	not send	not send
			hex	0h	0h	0h	0h	0h	0Eh	0h	2Bh	0Dh	1h	0h	0h	0h	60h	60h	0h	0h	0h	0h	1h	6h	not send	not send	not send
			dec	0	0	0	0	0	14	0	43	13	1	0	0	0	96	96	0	0	0	0	1	6	not send	not send	not send
18	Answer Telegram (RX) Handshake	Handshake	bin	0000 0000	0000 0000	0000 0000	0000 0000	0000 0000	0000 1101	0000 0000	0010 1011	0000 1101	0000 0001	0000 0000	0000 0000	0110 0000	0110 0000	0000 0000	0000 0000	0000 0000	0000 0000	0000 0000	not send	not send	not send	not send	
			hex	0h	0h	0h	0h	0h	0Dh	0h	2Bh	0Dh	1h	0h	0h	0h	60h	60h	0h	0h	0h	0h	0h	not send	not send	not send	not send
			dec	0	0	0	0	0	13	0	43	13	1	0	0	0	96	96	0	0	0	0	0	not send	not send	not send	not send
19	Send Telegram (TX) Read Modes Display 6061h	Status Request	bin	0000 0000	0000 0000	0000 0000	0000 0000	0000 0000	0000 1101	0000 0000	0010 1011	0000 1101	0000 0000	0000 0000	0000 0000	0110 0000	0100 0001	0000 0000	0000 0000	0000 0000	0000 0000	0000 0001	not send	not send	not send	not send	
			hex	0h	0h	0h	0h	0h	0Dh	0h	2Bh	0Dh	0h	0h	0h	0h	60h	61h	0h	0h	0h	0h	1h	not send	not send	not send	not send
			dec	0	0	0	0	0	13	0	43	13	0	0	0	0	96	97	0	0	0	0	1	not send	not send	not send	not send
20	Answer Telegram (RX) Mode: 6 Homing	Mode: 6 Homing	bin	0000 0000	0000 0000	0000 0000	0000 0000	0000 0000	0000 1110	0000 0000	0010 1011	0000 1101	0000 0000	0000 0000	0000 0000	0110 0000	0110 0000	0000 0000	0000 0000	0000 0000	0000 0000	0000 0001	0000 0110	not send	not send	not send	
			hex	0h	0h	0h	0h	0h	0Eh	0h	2Bh	0Dh	0h	0h	0h	0h	60h	60h	0h	0h	0h	0h	1h	6h	not send	not send	not send
			dec	0	0	0	0	0	14	0	43	13	0	0	0	0	96	97	0	0	0	0	1	6	not send	not send	not send
21	Send Telegram (TX) Write Feed Rate 6092h:01	Write Value: 6000	bin	0000 0000	0000 0000	0000 0000	0000 0000	0000 0000	0001 0001	0000 0000	0010 1011	0000 1101	0000 0001	0000 0000	0000 0000	0110 0000	1001 0010	0000 0001	0000 0000	0000 0000	0000 0000	0000 0100	0111 0000	0001 0111	0000 0000	0000 0000	
			hex	0h	0h	0h	0h	0h	11h	0h	2Bh	0Dh	1h	0h	0h	0h	60h	92h	1h	0h	0h	0h	4h	70h	17h	0h	0h
			dec	0	0	0	0	0	17	0	43	13	1	0	0	0	96	146	1	0	0	0	4	112	23	0	0
22	Answer Telegram (RX) Handshake	Handshake	bin	0000 0000	0000 0000	0000 0000	0000 0000	0000 0000	0000 1101	0000 0000	0010 1011	0000 1101	0000 0001	0000 0000	0000 0000	0110 0000	1001 0010	0000 0001	0000 0000	0000 0000	0000 0000	0000 0000	not send	not send	not send	not send	
			hex	0h	0h	0h	0h	0h	0Dh	0h	2Bh	0Dh	1h	0h	0h	0h	60h	92h	1h	0h	0h	0h	0h	not send	not send	not send	not send
			dec	0	0	0	0	0	13	0	43	13	1	0	0	0	96	146	1	0	0	0	0	not send	not send	not send	not send

External Signal Exchange

		Byte																									
Telegram Type		Task/Information		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	
23	Send Telegram (TX) Write Feed Rate 6092h:02	Write Value: 1	bin	0000 0000	0000 0000	0000 0000	0000 0000	0000 0000	0000 1110	0000 0000	0010 1011	0000 1101	0000 0001	0000 0000	0000 0000	0110 0000	1001 0010	0000 0010	0000 0000	0000 0000	0000 0000	0000 0001	0000 0001	not send	not send	not send	
			hex	0h	0h	0h	0h	0h	0Eh	0h	2Bh	0Dh	1h	0h	0h	0h	60h	92h	2h	0h	0h	0h	1h	1h	not send	not send	not send
			dec	0	0	0	0	0	14	0	43	13	1	0	0	0	96	146	2	0	0	0	1	1	not send	not send	not send
24	Answer Telegram (RX)	Handshake	bin	0000 0000	0000 0000	0000 0000	0000 0000	0000 0000	0000 1101	0000 0000	0010 1011	0000 1101	0000 0001	0000 0000	0000 0000	0110 0000	1001 0010	0000 0010	0000 0000	0000 0000	0000 0000	0000 0000	not send	not send	not send	not send	
			hex	0h	0h	0h	0h	0h	0Dh	0h	2Bh	0Dh	1h	0h	0h	0h	60h	92h	2h	0h	0h	0h	0h	not send	not send	not send	not send
			dec	0	0	0	0	0	13	0	43	13	1	0	0	0	96	146	2	0	0	0	0	not send	not send	not send	not send
25	Send Telegram (TX) Write Switch VEL 6099h:01	Write Value: 6000	bin	0000 0000	0000 0000	0000 0000	0000 0000	0000 0000	0001 0001	0000 0000	0010 1011	0000 1101	0000 0001	0000 0000	0000 0000	0110 0000	1001 1001	0000 0001	0000 0000	0000 0000	0000 0000	0000 0100	0000 1111	0000 0000	0000 0000	0000 0000	
			hex	0h	0h	0h	0h	0h	11h	0h	2Bh	0Dh	1h	0h	0h	0h	60h	99h	1h	0h	0h	0h	4h	70h	17h	0h	0h
			dec	0	0	0	0	0	17	0	43	13	1	0	0	0	96	153	1	0	0	0	4	112	23	0	0
26	Answer Telegram (RX)	Handshake	bin	0000 0000	0000 0000	0000 0000	0000 0000	0000 0000	0000 1101	0000 0000	0010 1011	0000 1101	0000 0001	0000 0000	0000 0000	0110 0000	1001 1001	0000 0001	0000 0000	0000 0000	0000 0000	0000 0000	not send	not send	not send	not send	
			hex	0h	0h	0h	0h	0h	0Dh	0h	2Bh	0Dh	1h	0h	0h	0h	60h	99h	1h	0h	0h	0h	0h	not send	not send	not send	not send
			dec	0	0	0	0	0	13	0	43	13	1	0	0	0	96	153	1	0	0	0	0	not send	not send	not send	not send
27	Send Telegram (TX) Write Zero VEL 6099h:02	Write Value: 6000	bin	0000 0000	0000 0000	0000 0000	0000 0000	0000 0000	0001 0001	0000 0000	0010 1011	0000 1101	0000 0001	0000 0000	0000 0000	0110 0000	1001 1001	0000 0010	0000 0000	0000 0000	0000 0000	0000 0100	0000 1111	0000 0000	0000 0000	0000 0000	
			hex	0h	0h	0h	0h	0h	11h	0h	2Bh	0Dh	1h	0h	0h	0h	60h	99h	2h	0h	0h	0h	4h	70h	17h	0h	0h
			dec	0	0	0	0	0	17	0	43	13	1	0	0	0	96	153	2	0	0	0	4	112	23	0	0
28	Answer Telegram (RX)	Handshake	bin	0000 0000	0000 0000	0000 0000	0000 0000	0000 0000	0000 1101	0000 0000	0010 1011	0000 1101	0000 0001	0000 0000	0000 0000	0110 0000	1001 1001	0000 0010	0000 0000	0000 0000	0000 0000	0000 0000	not send	not send	not send	not send	
			hex	0h	0h	0h	0h	0h	0Dh	0h	2Bh	0Dh	1h	0h	0h	0h	60h	99h	2h	0h	0h	0h	0h	not send	not send	not send	not send
			dec	0	0	0	0	0	13	0	43	13	1	0	0	0	96	153	2	0	0	0	0	not send	not send	not send	not send
29	Send Telegram (TX) Write Homing ACC 609Ah	Write Value: 50000	bin	0000 0000	0000 0000	0000 0000	0000 0000	0000 0000	0001 0001	0000 0000	0010 1011	0000 1101	0000 0001	0000 0000	0000 0000	0110 0000	1001 1010	0000 0000	0000 0000	0000 0000	0000 0000	0000 0100	0101 0000	1100 0011	0000 0000	0000 0000	
			hex	0h	0h	0h	0h	0h	11h	0h	2Bh	0Dh	1h	0h	0h	0h	60h	9Ah	0h	0h	0h	0h	4h	50h	C3h	0h	0h
			dec	0	0	0	0	0	17	0	43	13	1	0	0	0	96	154	0	0	0	0	4	80	195	0	0
30	Answer Telegram (RX)	Handshake	bin	0000 0000	0000 0000	0000 0000	0000 0000	0000 0000	0000 1101	0000 0000	0010 1011	0000 1101	0000 0001	0000 0000	0000 0000	0110 0000	1001 1010	0000 0000	0000 0000	0000 0000	0000 0000	0000 0000	not send	not send	not send	not send	
			hex	0h	0h	0h	0h	0h	0Dh	0h	2Bh	0Dh	1h	0h	0h	0h	60h	9Ah	0h	0h	0h	0h	0h	not send	not send	not send	not send
			dec	0	0	0	0	0	13	0	43	13	1	0	0	0	96	154	0	0	0	0	0	not send	not send	not send	not send
31	Send Telegram (TX) Write Controlword 6040h	Command: Start Movement	bin	0000 0000	0000 0000	0000 0000	0000 0000	0000 0000	0000 1111	0000 0000	0010 1011	0000 1101	0000 0001	0000 0000	0000 0000	0110 0000	0100 0000	0000 0000	0000 0000	0000 0000	0000 0000	0000 0010	0001 1111	0000 0000	not send	not send	
			hex	0h	0h	0h	0h	0h	0Fh	0h	2Bh	0Dh	1h	0h	0h	0h	60h	40h	0h	0h	0h	0h	2h	1Fh	0h	not send	not send
			dec	0	0	0	0	0	15	0	43	13	1	0	0	0	96	64	0	0	0	0	2	31	0	not send	not send
32	Answer Telegram (RX)	Handshake	bin	0000 0000	0000 0000	0000 0000	0000 0000	0000 0000	0000 1101	0000 0000	0010 1011	0000 1101	0000 0001	0000 0000	0000 0000	0110 0000	0100 0000	0000 0000	0000 0000	0000 0000	0000 0000	0000 0000	not send	not send	not send	not send	
			hex	0h	0h	0h	0h	0h	0Dh	0h	2Bh	0Dh	1h	0h	0h	0h	60h	40h	0h	0h	0h	0h	0h	not send	not send	not send	not send
			dec	0	0	0	0	0	13	0	43	13	1	0	0	0	96	64	0	0	0	0	0	not send	not send	not send	not send
33	Send Telegram (TX) Write Controlword 6040h	Command: Reset Start	bin	0000 0000	0000 0000	0000 0000	0000 0000	0000 0000	0000 1111	0000 0000	0010 1011	0000 1101	0000 0001	0000 0000	0000 0000	0110 0000	0100 0000	0000 0000	0000 0000	0000 0000	0000 0000	0000 0010	0000 1111	0000 0000	not send	not send	
			hex	0h	0h	0h	0h	0h	0Fh	0h	2Bh	0Dh	1h	0h	0h	0h	60h	40h	0h	0h	0h	0h	2h	Fh	0h	not send	not send
			dec	0	0	0	0	0	15	0	43	13	1	0	0	0	96	64	0	0	0	0	2	15	0	not send	not send
34	Answer Telegram (RX)	Handshake	bin	0000 0000	0000 0000	0000 0000	0000 0000	0000 0000	0000 1101	0000 0000	0010 1011	0000 1101	0000 0001	0000 0000	0000 0000	0110 0000	0100 0000	0000 0000	0000 0000	0000 0000	0000 0000	0000 0000	not send	not send	not send	not send	
			hex	0h	0h	0h	0h	0h	0Dh	0h	2Bh	0Dh	1h	0h	0h	0h	60h	40h	0h	0h	0h	0h	0h	not send	not send	not send	not send
			dec	0	0	0	0	0	13	0	43	13	1	0	0	0	96	64	0	0	0	0	0	not send	not send	not send	not send
35	Send Telegram (TX) Read Statusword 6041h	Status Request	bin	0000 0000	0000 0000	0000 0000	0000 0000	0000 0000	0000 1101	0000 0000	0010 1011	0000 1101	0000 0000	0000 0000	0000 0000	0110 0000	0100 0001	0000 0000	0000 0000	0000 0000	0000 0000	0000 0010	not send	not send	not send	not send	
			hex	0h	0h	0h	0h	0h	0Dh	0h	2Bh	0Dh	0h	0h	0h	0h	60h	41h	0h	0h	0h	0h	2h	not send	not send	not send	not send
			dec	0	0	0	0	0	13	0	43	13	0	0	0	0	96	65	0	0	0	0	2	not send	not send	not send	not send
36	Answer Telegram (RX)	Referenced	bin	0000 0000	0000 0000	0000 0000	0000 0000	0000 0000	0000 1111	0000 0000	0010 1011	0000 1101	0000 0000	0000 0000	0000 0000	0110 0000	0100 0001	0000 0000	0000 0000	0000 0000	0000 0000	0000 0010	0010 0111	0001 0110	not send	not send	
			hex	0h	0h	0h	0h	0h	0Fh	0h	2Bh	0Dh	0h	0h	0h	0h	60h	41h	0h	0h	0h	0h	2h	27h	16h	not send	not send
			dec	0	0	0	0	0	15	0	43	13	0	0	0	0	96	65	0	0	0	0	2	39	22	not send	not send

External Signal Exchange

Telegram Type		Task/Information	Byte																							
			0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	
Profile Position Mode																										
37	Send Telegram (TX) Write Modes of OP 6060h	Write Value: 1 (Profile Position)	bin hex dec	0000 0000 0h 0	0000 0000 0h 0	0000 0000 0h 0	0000 0000 0h 0	0000 0000 0h 0	0000 1110 0Eh 14	0000 0000 0h 0	0010 1011 28h 43	0000 1101 0Dh 13	0000 0001 1h 1	0000 0000 0h 0	0000 0000 0h 0	0110 0000 60h 96	0110 0000 60h 96	0000 0000 0h 0	0000 0000 0h 0	0000 0000 0h 0	0000 0000 0h 0	0000 0001 1h 1	0000 0001 1h 1	not send not send not send	not send not send not send	not send not send not send
38	Answer Telegram (RX)	Handshake	bin hex dec	0000 0000 0h 0	0000 0000 0h 0	0000 0000 0h 0	0000 0000 0h 0	0000 0000 0h 0	0000 1101 0Dh 13	0000 0000 0h 0	0010 1011 28h 43	0000 1101 0Dh 13	0000 0001 1h 1	0000 0000 0h 0	0000 0000 0h 0	0110 0000 60h 96	0110 0000 60h 96	0000 0000 0h 0	0000 0000 0h 0	0000 0000 0h 0	0000 0000 0h 0	0000 0000 0h 0	not send not send not send	not send not send not send	not send not send not send	
39	Send Telegram (TX) Read Modes Display 6061h	Status Request	bin hex dec	0000 0000 0h 0	0000 0000 0h 0	0000 0000 0h 0	0000 0000 0h 0	0000 0000 0h 0	0000 1101 0Dh 13	0000 0000 0h 0	0010 1011 28h 43	0000 1101 0Dh 13	0000 0000 0h 0	0000 0000 0h 0	0000 0000 0h 0	0110 0000 60h 96	0100 0001 61h 97	0000 0000 0h 0	0000 0000 0h 0	0000 0000 0h 0	0000 0000 0h 0	0000 0001 1h 1	not send not send not send	not send not send not send	not send not send not send	
40	Answer Telegram (RX)	Mode: 1 (Profile Position)	bin hex dec	0000 0000 0h 0	0000 0000 0h 0	0000 0000 0h 0	0000 0000 0h 0	0000 0000 0h 0	0000 1110 0Eh 14	0000 0000 0h 0	0010 1011 28h 43	0000 1101 0Dh 13	0000 0001 1h 1	0000 0000 0h 0	0000 0000 0h 0	0110 0000 60h 96	0110 0000 60h 97	0000 0000 0h 0	0000 0000 0h 0	0000 0000 0h 0	0000 0000 0h 0	0000 0001 1h 1	0000 0001 1h 1	not send not send not send	not send not send not send	not send not send not send
41	Send Telegram (TX) Write Profile VEL 6081h	Write Value: 6000	bin hex dec	0000 0000 0h 0	0000 0000 0h 0	0000 0000 0h 0	0000 0000 0h 0	0000 0000 0h 0	0001 0010 11h 17	0000 0000 0h 0	0010 1011 28h 43	0000 1101 0Dh 13	0000 0001 1h 1	0000 0000 0h 0	0000 0000 0h 0	0110 0000 60h 96	1000 0001 81h 129	0000 0000 0h 0	0000 0000 0h 0	0000 0000 0h 0	0000 0000 0h 0	0000 0100 4h 4	0000 1111 70h 112	0001 0111 23h 23	0000 0000 0h 0	0000 0000 0h 0
42	Answer Telegram (RX)	Handshake	bin hex dec	0000 0000 0h 0	0000 0000 0h 0	0000 0000 0h 0	0000 0000 0h 0	0000 0000 0h 0	0000 1101 0Dh 13	0000 0000 0h 0	0010 1011 28h 43	0000 1101 0Dh 13	0000 0001 1h 1	0000 0000 0h 0	0000 0000 0h 0	0110 0000 60h 96	1000 0001 81h 129	0000 0000 0h 0	0000 0000 0h 0	0000 0000 0h 0	0000 0000 0h 0	0000 0000 0h 0	not send not send not send	not send not send not send	not send not send not send	
43	Send Telegram (TX) Write Profile ACC 6083h	Write Value: 50000	bin hex dec	0000 0000 0h 0	0000 0000 0h 0	0000 0000 0h 0	0000 0000 0h 0	0000 0000 0h 0	0001 0010 11h 17	0000 0000 0h 0	0010 1011 28h 43	0000 1101 0Dh 13	0000 0001 1h 1	0000 0000 0h 0	0000 0000 0h 0	0110 0000 60h 96	1000 0011 83h 131	0000 0000 0h 0	0000 0000 0h 0	0000 0000 0h 0	0000 0000 0h 0	0000 0010 4h 4	0101 0000 50h 80	1100 0011 C3h 195	0000 0000 0h 0	0000 0000 0h 0
44	Answer Telegram (RX)	Handshake	bin hex dec	0000 0000 0h 0	0000 0000 0h 0	0000 0000 0h 0	0000 0000 0h 0	0000 0000 0h 0	0000 1101 0Dh 13	0000 0000 0h 0	0010 1011 28h 43	0000 1101 0Dh 13	0000 0001 1h 1	0000 0000 0h 0	0000 0000 0h 0	0110 0000 60h 96	1000 0011 83h 131	0000 0000 0h 0	0000 0000 0h 0	0000 0000 0h 0	0000 0000 0h 0	0000 0000 0h 0	not send not send not send	not send not send not send	not send not send not send	
45	Send Telegram (TX) Write Target Position 607Ah	Write Value: 6000	bin hex dec	0000 0000 0h 0	0000 0000 0h 0	0000 0000 0h 0	0000 0000 0h 0	0000 0000 0h 0	0001 0010 11h 17	0000 0000 0h 0	0010 1011 28h 43	0000 1101 0Dh 13	0000 0001 1h 1	0000 0000 0h 0	0000 0000 0h 0	0110 0000 60h 96	0111 1010 7Ah 122	0000 0000 0h 0	0000 0000 0h 0	0000 0000 0h 0	0000 0000 0h 0	0000 0010 4h 4	0000 1111 70h 112	0001 0111 23h 23	0000 0000 0h 0	0000 0000 0h 0
46	Answer Telegram (RX)	Handshake	bin hex dec	0000 0000 0h 0	0000 0000 0h 0	0000 0000 0h 0	0000 0000 0h 0	0000 0000 0h 0	0000 1101 0Dh 13	0000 0000 0h 0	0010 1011 28h 43	0000 1101 0Dh 13	0000 0001 1h 1	0000 0000 0h 0	0000 0000 0h 0	0110 0000 60h 96	0111 1010 7Ah 122	0000 0000 0h 0	0000 0000 0h 0	0000 0000 0h 0	0000 0000 0h 0	0000 0000 0h 0	not send not send not send	not send not send not send	not send not send not send	
47	Send Telegram (TX) Write Controlword 6040h	Command: Start Movement	bin hex dec	0000 0000 0h 0	0000 0000 0h 0	0000 0000 0h 0	0000 0000 0h 0	0000 0000 0h 0	0000 1111 0Fh 15	0000 0000 0h 0	0010 1011 28h 43	0000 1101 0Dh 13	0000 0001 1h 1	0000 0000 0h 0	0000 0000 0h 0	0110 0000 60h 96	0100 0000 40h 64	0000 0000 0h 0	0000 0000 0h 0	0000 0000 0h 0	0000 0000 0h 0	0000 0010 2h 2	0001 1111 1Fh 31	0000 0000 0h 0	not send not send not send	not send not send not send
48	Answer Telegram (RX)	Handshake	bin hex dec	0000 0000 0h 0	0000 0000 0h 0	0000 0000 0h 0	0000 0000 0h 0	0000 0000 0h 0	0000 1101 0Dh 13	0000 0000 0h 0	0010 1011 28h 43	0000 1101 0Dh 13	0000 0001 1h 1	0000 0000 0h 0	0000 0000 0h 0	0110 0000 60h 96	0100 0000 40h 64	0000 0000 0h 0	0000 0000 0h 0	0000 0000 0h 0	0000 0000 0h 0	0000 0000 0h 0	not send not send not send	not send not send not send	not send not send not send	
Movement will be executed																										

External Signal Exchange

Telegram Type		Task/Information		Byte																							
				0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	
49	Send Telegram (TX) Write Controlword 6040h	Command: Reset Start	bin	0000 0000	0000 0000	0000 0000	0000 0000	0000 0000	0000 1111	0000 0000	0010 1011	0000 1101	0000 0001	0000 0000	0000 0000	0110 0000	0100 0000	0000 0000	0000 0000	0000 0000	0000 0000	0000 0010	0000 1111	0000 0000	not send	not send	
			hex	0h	0h	0h	0h	0h	0Fh	0h	2Bh	0Dh	1h	0h	0h	60h	40h	0h	0h	0h	0h	2h	Fh	0h	not send	not send	
			dec	0	0	0	0	0	15	0	43	13	1	0	0	96	64	0	0	0	0	2	15	0	not send	not send	
50	Answer Telegram (RX)	Handshake	bin	0000 0000	0000 0000	0000 0000	0000 0000	0000 0000	0000 1101	0000 0000	0010 1011	0000 1101	0000 0001	0000 0000	0000 0000	0110 0000	0100 0000	0000 0000	0000 0000	0000 0000	0000 0000	0000 0010	0000 1111	0000 0000	not send	not send	
			hex	0h	0h	0h	0h	0h	0Dh	0h	2Bh	0Dh	1h	0h	0h	0h	60h	40h	0h	0h	0h	0h	2h	Fh	0h	not send	not send
			dec	0	0	0	0	0	13	0	43	13	1	0	0	0	96	64	0	0	0	0	2	15	0	not send	not send
Target Position reached and movement stopped																											
51	Send Telegram (TX) Read Statusword 6041h	Status Request	bin	0000 0000	0000 0000	0000 0000	0000 0000	0000 0000	0000 1101	0000 0000	0010 1011	0000 1101	0000 0000	0000 0000	0000 0000	0110 0000	0100 0001	0000 0000	0000 0000	0000 0000	0000 0000	0000 0010	not send	not send	not send	not send	
			hex	0h	0h	0h	0h	0h	0Dh	0h	2Bh	0Dh	0h	0h	0h	0h	60h	41h	0h	0h	0h	0h	2h	not send	not send	not send	not send
			dec	0	0	0	0	0	13	0	43	13	0	0	0	0	96	65	0	0	0	0	2	not send	not send	not send	not send
52	Answer Telegram (RX)	Setpoint Acknowledged, Target Reached	bin	0000 0000	0000 0000	0000 0000	0000 0000	0000 0000	0000 1111	0000 0000	0010 1011	0000 1101	0000 0000	0000 0000	0000 0000	0110 0000	0100 0001	0000 0000	0000 0000	0000 0000	0000 0000	0000 0010	0010 0111	0001 0110	not send	not send	
			hex	0h	0h	0h	0h	0h	0Fh	0h	2Bh	0Dh	0h	0h	0h	0h	60h	41h	0h	0h	0h	0h	2h	27h	16h	not send	not send
			dec	0	0	0	0	0	15	0	43	13	0	0	0	0	96	65	0	0	0	0	2	39	22	not send	not send
53	Send Telegram (TX) Write Target Position 607Ah	Write Value: 0	bin	0000 0000	0000 0000	0000 0000	0000 0000	0000 0000	0001 0001	0000 0000	0010 1011	0000 1101	0000 0001	0000 0000	0000 0000	0110 0000	0111 1010	0000 0000	0000 0000	0000 0000	0000 0000	0000 0010	0000 0000	0000 0000	0000 0000	0000 0000	
			hex	0h	0h	0h	0h	0h	11h	0h	2Bh	0Dh	1h	0h	0h	0h	60h	7Ah	0h	0h	0h	0h	2h	0h	0h	0h	0h
			dec	0	0	0	0	0	17	0	43	13	1	0	0	0	96	122	0	0	0	0	2	0	0	0	0
54	Answer Telegram (RX)	Handshake	bin	0000 0000	0000 0000	0000 0000	0000 0000	0000 0000	0000 1101	0000 0000	0010 1011	0000 1101	0000 0001	0000 0000	0000 0000	0110 0000	0111 1010	0000 0000	0000 0000	0000 0000	0000 0000	0000 0010	0000 0000	0000 0000	0000 0000	0000 0000	
			hex	0h	0h	0h	0h	0h	0Dh	0h	2Bh	0Dh	1h	0h	0h	0h	60h	7Ah	0h	0h	0h	0h	2h	0h	0h	0h	0h
			dec	0	0	0	0	0	13	0	43	13	1	0	0	0	96	122	0	0	0	0	2	0	0	0	0
55	Send Telegram (TX) Write Controlword 6040h	Command: Start Movement	bin	0000 0000	0000 0000	0000 0000	0000 0000	0000 0000	0000 1111	0000 0000	0010 1011	0000 1101	0000 0001	0000 0000	0000 0000	0110 0000	0100 0000	0000 0000	0000 0000	0000 0000	0000 0000	0000 0010	0001 1111	0000 0000	not send	not send	
			hex	0h	0h	0h	0h	0h	0Fh	0h	2Bh	0Dh	1h	0h	0h	0h	60h	40h	0h	0h	0h	0h	2h	1Fh	0h	not send	not send
			dec	0	0	0	0	0	15	0	43	13	1	0	0	0	96	64	0	0	0	0	2	31	0	not send	not send
56	Answer Telegram (RX)	Handshake	bin	0000 0000	0000 0000	0000 0000	0000 0000	0000 0000	0000 1101	0000 0000	0010 1011	0000 1101	0000 0001	0000 0000	0000 0000	0110 0000	0100 0000	0000 0000	0000 0000	0000 0000	0000 0000	0000 0010	not send	not send	not send	not send	
			hex	0h	0h	0h	0h	0h	0Dh	0h	2Bh	0Dh	1h	0h	0h	0h	60h	40h	0h	0h	0h	0h	2h	not send	not send	not send	not send
			dec	0	0	0	0	0	13	0	43	13	1	0	0	0	96	64	0	0	0	0	2	not send	not send	not send	not send
Movement will be executed																											
57	Send Telegram (TX) Write Controlword 6040h	Command: Movement Halt	bin	0000 0000	0000 0000	0000 0000	0000 0000	0000 0000	0000 1111	0000 0000	0010 1011	0000 1101	0000 0001	0000 0000	0000 0000	0110 0000	0100 0000	0000 0000	0000 0000	0000 0000	0000 0000	0000 0010	0001 1111	0000 0001	not send	not send	
			hex	0h	0h	0h	0h	0h	0Fh	0h	2Bh	0Dh	1h	0h	0h	0h	60h	40h	0h	0h	0h	0h	2h	1Fh	1h	not send	not send
			dec	0	0	0	0	0	15	0	43	13	1	0	0	0	96	64	0	0	0	0	2	31	1	not send	not send
58	Answer Telegram (RX)	Handshake	bin	0000 0000	0000 0000	0000 0000	0000 0000	0000 0000	0000 1101	0000 0000	0010 1011	0000 1101	0000 0001	0000 0000	0000 0000	0110 0000	0100 0000	0000 0000	0000 0000	0000 0000	0000 0000	0000 0010	not send	not send	not send	not send	
			hex	0h	0h	0h	0h	0h	0Dh	0h	2Bh	0Dh	1h	0h	0h	0h	60h	40h	0h	0h	0h	0h	2h	not send	not send	not send	not send
			dec	0	0	0	0	0	13	0	43	13	1	0	0	0	96	64	0	0	0	0	2	not send	not send	not send	not send
Movement will be stopped																											
59	Send Telegram (TX) Write Controlword 6040h	Command: Reset Start	bin	0000 0000	0000 0000	0000 0000	0000 0000	0000 0000	0000 1111	0000 0000	0010 1011	0000 1101	0000 0001	0000 0000	0000 0000	0110 0000	0100 0000	0000 0000	0000 0000	0000 0000	0000 0000	0000 0010	0000 1111	0000 0000	not send	not send	
			hex	0h	0h	0h	0h	0h	0Fh	0h	2Bh	0Dh	1h	0h	0h	0h	60h	40h	0h	0h	0h	0h	2h	Fh	0h	not send	not send
			dec	0	0	0	0	0	15	0	43	13	1	0	0	0	96	64	0	0	0	0	2	15	0	not send	not send
60	Answer Telegram (RX)	Handshake	bin	0000 0000	0000 0000	0000 0000	0000 0000	0000 0000	0000 1101	0000 0000	0010 1011	0000 1101	0000 0001	0000 0000	0000 0000	0110 0000	0100 0000	0000 0000	0000 0000	0000 0000	0000 0000	0000 0010	not send	not send	not send	not send	
			hex	0h	0h	0h	0h	0h	0Dh	0h	2Bh	0Dh	1h	0h	0h	0h	60h	40h	0h	0h	0h	0h	2h	not send	not send	not send	not send
			dec	0	0	0	0	0	13	0	43	13	1	0	0	0	96	64	0	0	0	0	2	not send	not send	not send	not send
Loop movement: Jump back to command # 45 and repeat the steps till # 60 Changing movements: Adjust telegrams starting at command # 41 and execute with command # 47																											

5.7.8 Error Output Modbus TCP Gateway

When using Modbus TCP as a gateway, the following two upper categories can be defined

5.7.8.1 Motion Control Error

The movement-specific error output is explained in detail in the CANopen chapter [Error output and Reset](#) (p 121).

5.7.8.2 Data Telegram Error

In the case of a telegram/protocol error the value 80h will be always added to Byte 7.

Example Value Byte 7: $2Bh + 80h = ABh$ ($43 + 128 = 171$)

The value of Byte 7 resend by the drive D1 is therefore ABh (171).

The error information is sent in Byte 8. The significance is available in the following table:

Exception Code	Code Name	Description
1 (1h)	Illegal Function Code	The used device does not permit the send function code.
2 (2h)	Illegal Data Address	The used device does not permit the send data address. The used register address is faulty.
3 (3h)	Illegal Data Value	The used data values are not allowable. This may indicate an error in Byte 5.
4 (4h)	Device Failure	An unrecoverable error occurred while the device was attempting to perform the requested action.
5 (5h)	Acknowledge	The device has accepted the request and is currently processing it, but a long processing time is required to execute the request. This response is sent, to prevent a network timeout error.
6 (6h)	Server Busy	The receiving device is engaged in processing a long-duration program command. The sending device should resend the telegram if the receiving device is available again.
255 (FFh)	Device-specific error	Abort Code SDO Communication (p. 122) -Information in Bit 7,6,5,4.

NOTE
If the Modbus TCP gateway connection is closed during operation, but the user interface is still accessible, the configured Modbus TCP gateway port has been closed. This can be due to the following reasons: 1. Faulty telegram structure - less or more data byte sent than specified in configuration. Refer to Byte Assignment Modbus TCP Gateway Telegram (p. 189) 2. Automatic "heart beat" signal is not sent 3 times by the master or not forwarded by the network 3. The master itself closes the communication port The motor controller can only close the port in case of error 1. or 2. A termination of the port due to a time without active communication between motor control and master controller is not implemented.

5.8 PROFINET/PROFIdrive

The following chapter explains how to use the motor control unit via the PROFINET/PROFIdrive interface.

The implementation was created according to version 4.2.

Further information can be found on the homepage of the PROFIBUS and PROFINET International user organisation (PI) – <https://www.profibus.com/>

Basic settings for PROFINET are described on the page [Communication](#) (S. 64).

5.8.1 GSDML File

The PROFINET GSDML file (General Station Description Markup Language) is an XML-based text file that describes the properties and capabilities of a PROFINET device.

This file is used to configure and integrate the device in an automation environment.

The GSDML file contains information such as

- Device identification
- Communication parameters
- Module and channel information
- Diagnostic options

These files are essential for integrating PROFINET devices into systems such as the Siemens TIA Portal.

The file is available for download at www.igus.eu/D1.

HINWEIS
Only the current version of the GSDML file may be present in a TIA project. Older versions must be actively deleted via the GSDML manager.

5.8.2 Target Parameter Specifications

Target Position

The target position is specified by Siemens as 'N4' scaled.

The input value (PLC, μ C, etc.) 1,073,741,824 dec (40,000,000 hex) corresponds to a 100 % value (motor control) of the value specified by the 'Maximum stroke' parameter - on the 'Axis' page.

This means that 0 % corresponds to the parameter specified under 'Minimum stroke' and 100 % corresponds to the parameter specified under 'Maximum stroke'. The resolution is 32 bits.

Acceleration

The acceleration is defined as 100 % of the value specified by the 'Max. acceleration' parameter - on the 'Axis' page.

Velocity

The speed is specified by Siemens as 'N4' scaled.

The input value (PLC, μ C, etc.) 1,073,741,824 dec (40,000,000 hex), corresponds to a 100 % value (motor control) of the value specified by the 'Max. speed' parameter - on the 'Axis' page.

5.8.3 Cycle Times

Cycle times between 8 ms and 16 ms can be achieved.

5.8.4 Overview I/O-Parameter

Name	Meaning	Length
STW1	Controlword 1 - Input parameter for status and motion control	2 Byte
ZSW1	Statusword 1 - output parameter for status and movement monitoring	2 Byte
STW2	Statusword 2 - not used	2 Byte
ZSW2	Statusword 2 - not used	2 Byte
NSOLL_A	Speed setpoint A	2 Byte
NIST_A	Current speed A	2 Byte
NSOLL_B	Speed setpoint B	4 Byte
NIST_B	Current speed B	4 Byte
G1_STW	Control word sensor 1	2 Byte
G1_ZSW	Status word sensor 1	2 Byte
G1_XIST1	Current position 1, sensor 1	4 Byte
G1_XIST2	Current position 2, sensor 1	4 Byte
SATZANW	Preselection parameter set	2 Byte
AKTSATZ	Active parameter set	2 Byte
MDI_TARPOS	Target position MDI input	4 Byte
MDI_VELOCITY	Speed MDI input	4 Byte
MDI_ACC	Acceleration MDI input	2 Byte
MDI_DEC	Deceleration MDI input	2 Byte
MDI_MOD	MDI mode	2 Byte

5.8.5 Specifications from the User Interface

The following parameters must be set in the dryve D1 user interface:

“Motor” page

All motor-relevant parameters must be set in the user interface.

“Axis” page

The limits set by the maximum parameters ‘Min. stroke’, ‘Max. stroke’, ‘Max. speed’ and ‘Max. acceleration’ must not be exceeded by the respective PROFINET/PROFIdrive parameters.

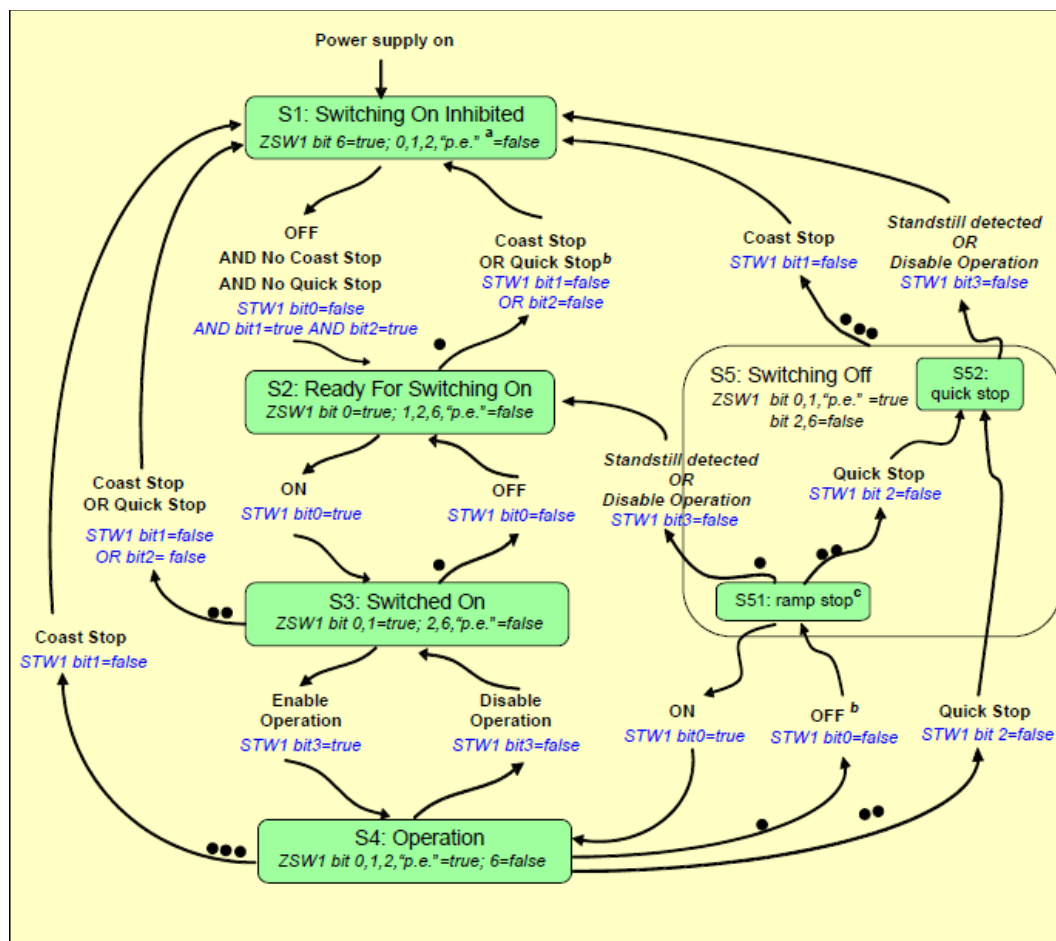
“Communication” page

Activation of the PROFINET communication at [Bus Systems](#) (p. 66) and an executed restart of the motor control unit.

“Drive Profile” page

Set the dominance by selecting ‘PROFINET/PROFIdrive’ in the drop-down menu.

5.8.6 General State Diagram



- **a** 'p.e.' = 'Pulse Enabled' - not used
- **b** The internal condition 'Fault with ramp stop' also activates this transition.
- **c** The deceleration rate at ramp stop is switched to maximum if STW1 bit 4 = false in speed control mode.
- Note 1
STW1 bit x,y =: These control word bits are set by the control system.
- Note 2
Standstill detected is an internal result of a stop process.
- Note 3
ZSW1 Bit x,y = These status word bits indicate the current status.

5.8.6.1 Requirements

To successfully pass through the general state from 'S1: Switching On Inhibited' to 'S4: Operation', it is necessary for input DI 7 'Enable' to remain permanently set.

5.8.6.2 State Control

State	Control word bit assignment STW1			
	Bit 3	Bit 2	Bit 1	Bit 0
S1: Switching On Inhibited	X	X	1	0
S2: Ready For Switching On	X	1	1	X
S3: Switched On	X	X	X	1
S4: Operation	1	X	X	X
S51: Ramp-Stop	X	X	X	0
S52: Quick-Stop	X	0	X	X

5.8.7 Supported Application Classes (AC)

- AC 1 - Standard drive (speed control)
In application class 1 (AC1), the drive is controlled by means of a main setpoint, such as a speed setpoint. The speed control is fully implemented in the motor controller.
The higher-level PLC contains all the technology functions required for the automation task. The process data (setpoint and actual values) is exchanged cyclically. The setpoint acceleration.
- AC 3 - Position control
In application class 3 (AC3), the positioning commands are sent from the higher-level PLC to the motor controller. The higher-level PLC controller only contains the technology functions required for the automation task.
The interpolation, position and speed control as well as all time-critical control algorithms are implemented directly in the motor controller.

5.8.8 Supported Standard Telegrams

- Telegram 1
Speed setpoint 16 Bit
- Telegram 2
Speed setpoint 32 Bit
- Telegram 7
Single positioner with choice of traverse set
- Telegram 9
Single positioner with Manuel Data Input (MDI)

5.8.9 Hardware-Configuration TIA Portal

1. Select the CPU you are using and import the current GSDML file via the GSDML Manager.
2. Drag and drop the motor controller into the HW configuration window of the TIA portal.
3. Connect the PROFINET port of the CPU to that of the motor controller.
4. Set the IP address to be used in the HW configuration window of the motor controller
5. The standard telegram to be used must then be dragged and dropped into the functionalities tree.

Note
It is recommended to boot up the PLC CPU before the motor control system, as otherwise the assignment of an IP address may no longer be possible

6. Open the I/O addresses tab and set the 'Input addresses' and 'Output addresses' to any value as the 'Start address'. The 'End address' value is automatically set by the PLC in relation to the selected standard telegram. The 'Organisation block' is set to 'Main'.

Example: Standard telegram 1, I/O addresses starting with 20

7. By assigning the 'PLC variables', the I/O addresses are assigned to the input and output variables used in the user programme.

Example: Standard telegram 1, I/O addresses starting with 20

PLC-Variablen									
	Name	Variablen-tabelle	Datentyp	Adresse	Rema...	Erreic...	Schrei...	Sichtb...	Kommentar
1	ZSW1_8	Standard-Variablen...	Bool	%I20.0	☐	☒	☒	☒	Schleppfehler
2	ZSW1_9	Standard-Variablen...	Bool	%I20.1	☐	☒	☒	☒	Steuerhoheit SPS
3	ZSW1_10	Standard-Variablen...	Bool	%I20.2	☐	☒	☒	☒	Ziel-Geschwindigkeit erreicht
4	ZSW1_11	Standard-Variablen...	Bool	%I20.3	☐	☒	☒	☒	
5	ZSW1_12	Standard-Variablen...	Bool	%I20.4	☐	☒	☒	☒	
6	ZSW1_13	Standard-Variablen...	Bool	%I20.5	☐	☒	☒	☒	
7	ZSW1_14	Standard-Variablen...	Bool	%I20.6	☐	☒	☒	☒	
8	ZSW1_15	Standard-Variablen...	Bool	%I20.7	☐	☒	☒	☒	
9	ZSW1_0	Standard-Variablen...	Bool	%I21.0	☐	☒	☒	☒	Einschaltbereit
10	ZSW1_1	Standard-Variablen...	Bool	%I21.1	☐	☒	☒	☒	Betriebsbereit
11	ZSW1_2	Standard-Variablen...	Bool	%I21.2	☐	☒	☒	☒	Bewegungsfreigabe
12	ZSW1_3	Standard-Variablen...	Bool	%I21.3	☐	☒	☒	☒	Fehler
13	ZSW1_4	Standard-Variablen...	Bool	%I21.4	☐	☒	☒	☒	Stop - Austrudeln
14	ZSW1_5	Standard-Variablen...	Bool	%I21.5	☐	☒	☒	☒	Stop - Quick Stop
15	ZSW1_6	Standard-Variablen...	Bool	%I21.6	☐	☒	☒	☒	Einschaltsperr
16	ZSW1_7	Standard-Variablen...	Bool	%I21.7	☐	☒	☒	☒	Warnung
17	NIST_A	Standard-Variablen...	Int	%IW22	☐	☒	☒	☒	Drehzahlwert 16 bit +/-
18	STW1_8	Standard-Variablen...	Bool	%Q20.0	☐	☒	☒	☒	Tippen 1
19	STW1_9	Standard-Variablen...	Bool	%Q20.1	☐	☒	☒	☒	Tippen 2
20	STW1_10	Standard-Variablen...	Bool	%Q20.2	☐	☒	☒	☒	Steuerhoheit SPS
21	STW1_11	Standard-Variablen...	Bool	%Q20.3	☐	☒	☒	☒	
22	STW1_12	Standard-Variablen...	Bool	%Q20.4	☐	☒	☒	☒	
23	STW1_13	Standard-Variablen...	Bool	%Q20.5	☐	☒	☒	☒	
24	STW1_14	Standard-Variablen...	Bool	%Q20.6	☐	☒	☒	☒	
25	STW1_15	Standard-Variablen...	Bool	%Q20.7	☐	☒	☒	☒	
26	STW1_0	Standard-Variablen...	Bool	%Q21.0	☐	☒	☒	☒	Ein/Aus
27	STW1_1	Standard-Variablen...	Bool	%Q21.1	☐	☒	☒	☒	Stop 1
28	STW1_2	Standard-Variablen...	Bool	%Q21.2	☐	☒	☒	☒	Stop 2
29	STW1_3	Standard-Variablen...	Bool	%Q21.3	☐	☒	☒	☒	Freigabe
30	STW1_4	Standard-Variablen...	Bool	%Q21.4	☐	☒	☒	☒	Berechnung Ramp e
31	STW1_5	Standard-Variablen...	Bool	%Q21.5	☐	☒	☒	☒	Rampenfreigabe
32	STW1_6	Standard-Variablen...	Bool	%Q21.6	☐	☒	☒	☒	Drehzahlollwert freigeben
33	STW1_7	Standard-Variablen...	Bool	%Q21.7	☐	☒	☒	☒	Fehler quittieren
34	NSOLL_A	Standard-Variab...	Int	%QW22	☐	☒	☒	☒	

5.8.10 Homing Parameter

The homing mode is selected on the Axis page at [Homing](#) (p. 61).

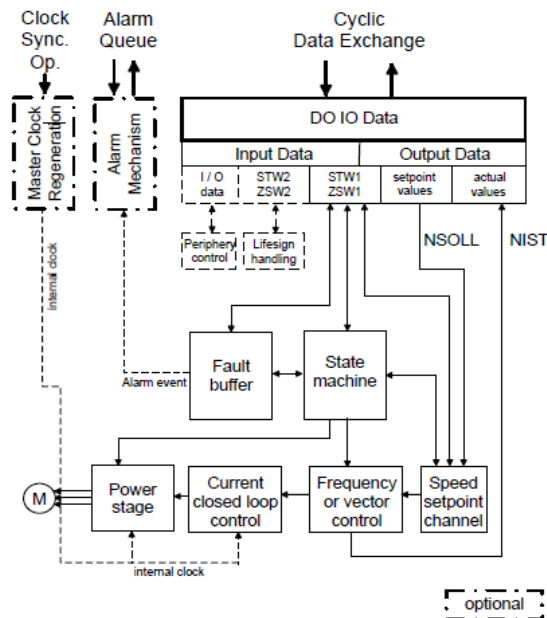
The homing velocity is set to $\frac{1}{8}$ of the value "Max Velocity" and the homing acceleration/deceleration is set to $\frac{3}{4}$ of the value "Max Acceleration" set at [Motion Limits](#) (p. 57) the "Axis" page.

5.8.11 Speed Control – Application Class 1 (AC1)

In application class 1 (AC1), the drive is controlled by means of a main setpoint, such as a speed setpoint. The speed control is fully implemented in the motor controller.

The higher-level PLC contains all the technology functions required for the automation task. The process data (setpoint and actual values) is exchanged cyclically. The setpoint acceleration

The standard telegrams 1 and 2 are available for operation of the speed setpoint interface.



5.8.11.1 I/O Data Standard Telegram 1

Speed specification with 16-bit setpoint value.

The target acceleration is defined via the 'Max acceleration' parameter on the 'Axis' page.

IO Data number	Setpoint	Actual value
1	STW1	ZSW1
2	NSOLL A	NIST A

5.8.11.2 I/O Data Standard Telegram 2

Speed specification with 32-bit setpoint value.

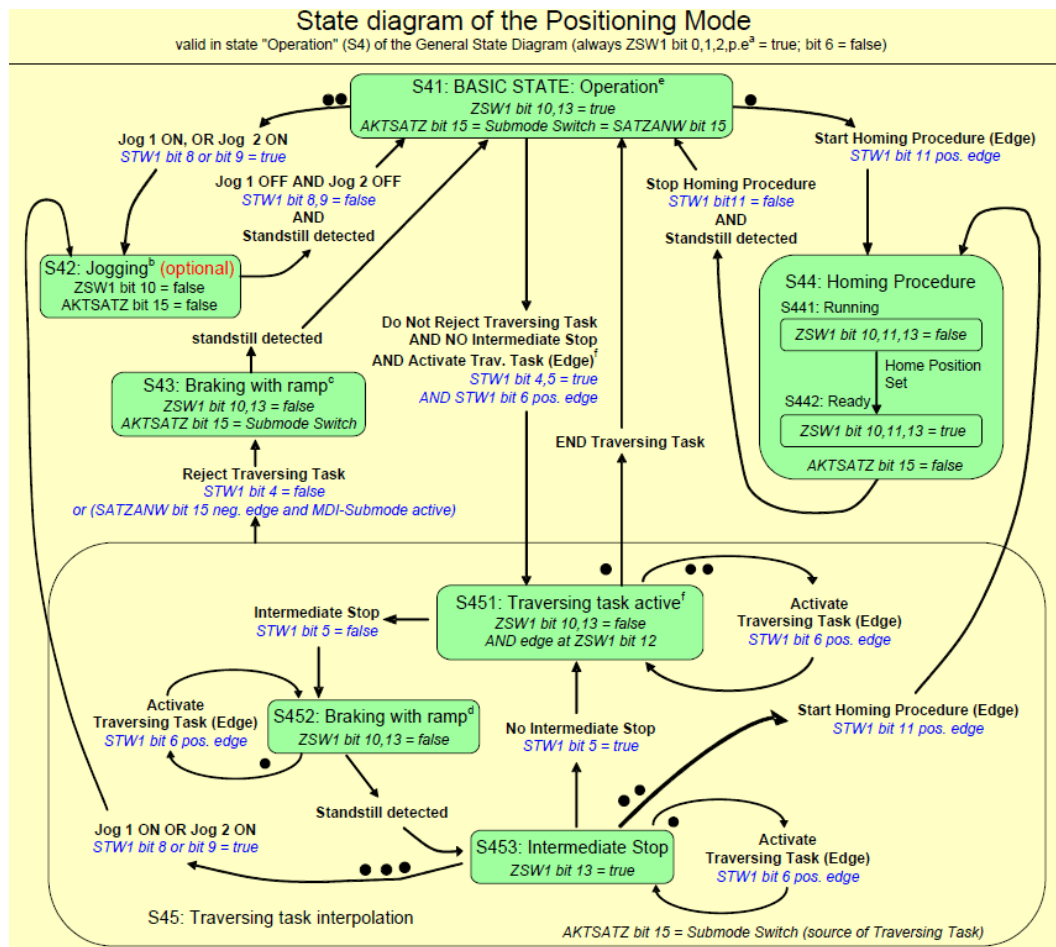
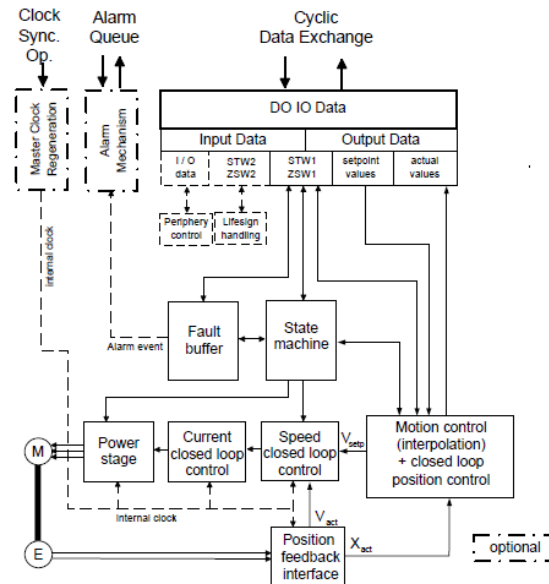
The target acceleration is defined via the 'Max acceleration' parameter on the 'Axis' page.

IO Data number	Setpoint	Actual value
1	STW1	ZSW1
2	NSOLL_B	NIST_B
3		
4	STW2 – not used	ZSW2 – not used

5.8.12 Position Control – Application Class 3 (AC3)

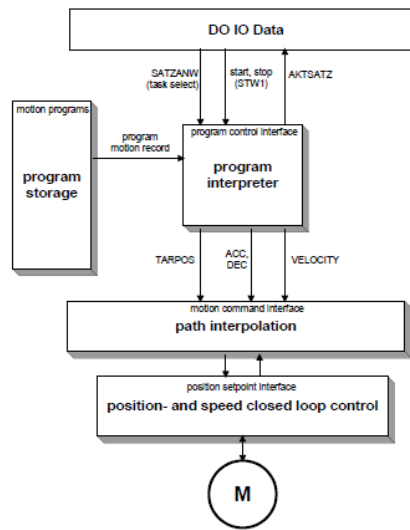
In application class 3 (AC3), the positioning commands are sent from the higher-level PLC to the motor controller. The higher-level PLC controller only contains the technology functions required for the automation task. The interpolation, position and speed control as well as all time-critical control algorithms are implemented directly in the motor controller.

The standard telegrams 7 and 9 are available for the operation of the position setpoint interface.



5.8.12.1 Program Sub Mode - Standard Telegram 7

Movements (target position, target acceleration, target speed, target deceleration) can be permanently pre-parameterised via the table on the travel profiles page and preselected and executed via standard telegram 7. It is not possible to adapt the target values to changing application parameters.



5.8.12.1.1 I/O Data Standard Telegram 7

IO Data number	Setpoint	Actual value
1	STW1	ZSW1
2	SATZANW (integer)	AKTSATZ

5.8.12.1.2 Specific Data Standard Telegram 7

Definition „SATZANW“

Bit	Meaning
0 to 9	Number of the motion record in the program storage intended to start. Value range: 0 to 31, bits 0 to 4, bits 5 to 9 are not used. Bits 0 to 9 are only relevant in Program submode.
10 to 14	Reserved for future use by PROFIdrive profile.
15	Control of submode switch for the selection of submodes (toggle of submode switch with change of motion command source only in S41): = 1 Activation of the MDI submode. If there is a program still running (extended state machine not in the state Basic State), the positioning interface will change to MDI Submode only after the program ends or is terminated (STW1 bit4). = 0 Deactivation of the MDI submode. If a MDI motion command is still being executed, the path interpolation shall stop and the MDI motion command shall be rejected.

Definition AKTSATZ

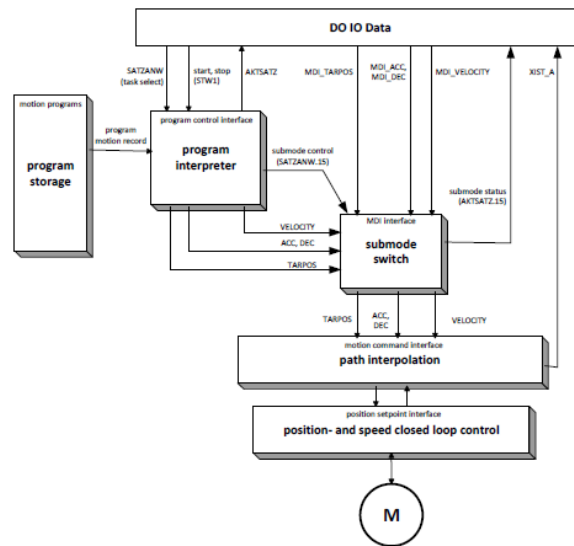
Bit	Meaning
0 to 9	Number of the motion record currently active (executed by the path interpolation). Value range: 0 to 31, bits 0 to 4, bits 5 to 9 are not used. Bits 0 to 9 are only relevant in Program submode (in MDI-submode and while no program is being executed the number should be 0).
10 to 14	Reserved for future use by PROFIdrive profile.
15	Status of submode switch and currently active submode (source of currently active Traversing Task): = 1 MDI submode active. The input values for the motion command will be taken from the signals TARPOS, VELOCITY_A, MDI_ACC and MDI_DEC. If a motion command is still executed in the path interpolation (S45, S43), the source of the motion command was MDI. = 0 Program submode active. The initial motion record for the start of a new motion program will be taken from bits 0 to 9 of SATZANW. If a motion command is still executed (S45, S43), the motion command is part of a motion program and the current motion record is posted in AKTSATZ bit 0 to 9.

5.8.12.1.3 Specific Data Standard Telegram 7

Motion Record Nr.	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	0	0	0	0	0
2	0	0	0	0	1
3	0	0	0	1	0
4	0	0	0	1	1
5	0	0	1	0	0
6	0	0	1	0	1
7	0	0	1	1	0
8	0	0	1	1	1
9	0	1	0	0	0
10	0	1	0	0	1
11	0	1	0	1	0
12	0	1	0	1	1
13	0	1	1	0	0
14	0	1	1	0	1
15	0	1	1	1	0
16	0	1	1	1	1
17	1	0	0	0	0
18	1	0	0	0	1
19	1	0	0	1	0
20	1	0	0	1	1
21	1	0	1	0	0
22	1	0	1	0	1
23	1	0	1	1	0
24	1	0	1	1	1
25	1	1	0	0	0
26	1	1	0	0	1
27	1	1	0	1	0
28	1	1	0	1	1
29	1	1	1	0	0
30	1	1	1	0	1
31	1	1	1	1	0
32	1	1	1	1	1

5.8.12.2 MDI (Manual Data Input) – Standard Telegram 9

When using MDI mode, the movement parameters of the target position, target acceleration, target speed and target deceleration are transferred directly from the PLC to the motor controller and executed via standard telegram 9. The target values can be adapted to changing application parameters at any time.



5.8.12.2.1 I/O Data Standard Telegram 9

IO Data number	Setpoint	Actual value
1	STW1	ZSW1
2	SATZANW	AKTSATZ
3	STW2 – not used	ZSW2 – not used
4	MDI_TARPOS	XIST_A
5		
6	MDI_VELOCITY	-
7		-
8	MDI_ACC	-
9	MDI_DEC	-
10	MDI_MOD	-

5.8.12.2.2 Specific Data Standard Telegram 9

Definition „SATZANW“

Bit	Meaning
0 to 9	Number of the motion record in the program storage intended to start (value range: 0 to 31) Bits 0 to 9 are only relevant in Program submode.
10 to 14	Reserved for future use by PROFIdrive profile.
15	Control of submode switch for the selection of submodes (toggle of submode switch with change of motion command source only in S41): = 1 Activation of the MDI submode. If there is a program still running (extended state machine not in the state Basic State), the positioning interface will change to MDI Submode only after the program ends or is terminated (STW1 bit4). = 0 Deactivation of the MDI submode. If a MDI motion command is still being executed, the path interpolation shall stop and the MDI motion command shall be rejected.

Definition AKTSATZ

Bit	Meaning
0 to 9	Number of the motion record currently active (executed by the path interpolation). Bits 0 to 9 are only relevant in Program submode (in MDI-submode and while no program is being executed the number should be 0).
10 to 14	Reserved for future use by PROFIdrive profile.
15	Status of submode switch and currently active submode (source of currently active Traversing Task): = 1 MDI submode active. The input values for the motion command will be taken from the signals TARPOS, VELOCITY_A, MDI_ACC and MDI_DEC. If a motion command is still executed in the path interpolation (S45, S43), the source of the motion command was MDI. = 0 Program submode active. The initial motion record for the start of a new motion program will be taken from bits 0 to 9 of SATZANW. If a motion command is still executed (S45, S43), the motion command is part of a motion program and the current motion record is posted in

Definition MDI_MOD

Bit	Meaning
0	Absolute/Relative positioning mode = 1 Absolute positioning. The target position in the signal TARPOS defines the absolute target position for the motion. = 0 Relative positioning. The target position in the signal TARPOS defines the relative target position for the motion related to the actual axis position.
1	Positive Modulo positioning direction (implementation optional). This command is only functional if the axis type is a rotating modulo axis and the absolute position mode is activated (MDI_MOD bit 0 = 1). = 1 For a modulo Axis, the absolute position shall be reached by a motion in the positive direction. If bit 1 and bit 2 are both 1, the target position of a modulo axis shall be reached by the shortest path. = 0 If bits 1 and 2 are both 0, the target position of a modulo axis shall be reached by the shortest path.
2	Negative Modulo positioning direction (implementation optional). This command is only functional if the axis type is a rotating modulo axis and the absolute position mode is activated (MDI_MOD bit 0 = 1). = 1 For a modulo Axis, the absolute position shall be reached by a motion in the negative direction. If bit 1 and bit 2 are both 1, the target position of a modulo axis shall be reached by the shortest path. = 0 If bits 1 and 2 are both 0, the target position of a modulo axis shall be reached by the shortest path.
3 to 15	Reserved for future use by PROFIdrive profile.

5.8.12.3 Function Bloc Standard Telegram 9

Siemens offers a predefined function block for MDI communication.

The function block 'Positioning a drive with standard telegram 9' and the corresponding instructions can be downloaded from the 'SiePortal' - account and login required.

	HINWEIS
	Special feature Siemens S7-1200 CPUs: This FB was developed for S7-1500 CPUs. When using an S7-1200 CPU, an error is permanently present at the FB output 'error'. At the same time, the 'status' output outputs the value 8600 (hex). This has no effect on the function of the block. It is therefore necessary to continuously evaluate the 'status' output to determine whether the displayed error is relevant for the function sequence. S7-1500 CPUs have a native error evaluation and do not require this manually added programme part.

5.8.13 Controlword 1 (STW1)

Bit	Velocity Mode	Position Mode
0	On/Off 1: Enable motor control  0: Stop active - movement is brought to a defined standstill with the last delay used and the power output stage is switched off	
1	Stop 1 –Coast Stop 1: Movement enabled 0: Coast Stop active – - movement approaches standstill in an undefined state	
2	Stop 2 – Quick-Stop 1: Movement enabled 0: Quick-Stop active – Movement is brought to a defined standstill via the Quick-Stop deceleration	
3	Enable 1: Operation Enabled 0: Operation Disabled	
4	Ramp Generator 1: Ramp generation enabled 0: Ramp generation disabled	Motion Stopped 1: Movement enabled 0: Stop
5	Enable Ramp 1: Start motion 0: Stop motion	Intermediate Halt 1: Movement enabled 0: Movement halted
6	Speed Setpoint 1: Accept setpoint 0: Reject setpoint	Movement Start 1: Start  0: Wait for Start
7	Fault Acknowledge 1: Reset Fault 	
8	Jog 1 1: Manual movement 1 is executed 0: No action	
9	Jog 2 1: Manual movement 2 is executed 0: No action	
10	PLC control authority 1: PLC has control rights - process data is sent and read 0: No control rights	
11	-	Homing 1: Start  0: No action
12	-	-
13	-	-
14	-	-
15	-	-

5.8.14 Statusword 1 (ZSW1)

Bit	Velocity Mode	Position Mode
0	Ready To Switch On 1: Ready 0: Disabled	
1	Ready To Operate 1: Ready 0: Disabled	
2	Operation Enabled 1: Ready 0: Disabled	
3	Fault 1: Fault present 0: Ready	
4	Stop – Coast Stop 1: Active 0: No action	
5	Stop – Quick-Stop 1: Active 0: No action	
6	Switch On Inhibited 1: Active 0: No action	
7	Warning 1: Warning present 0: Ready	
8	Following Error 1: Difference within tolerance 0: Difference outside tolerance	
9	PLC control authority 1: PLC has control rights - process data is sent and read 0: No control rights	
10	Target speed 1: Reached 0: Not reached	Target position 1: Reached 0: Not reached
11		Referencing 1: Obtained 0: Pending
12	-	Movement order - only in S4 'Operational' 1: Accepted  0: Waiting
13	-	Stop 1: Movement stopped 0: Movement enabled
14	-	-
15	-	-

5.8.15 PNU – Parameter User Data

The parameter user data can be used to read and write acyclic communication for reading the respective process data.

5.8.16 Detailed description of the available Parameter User Data

PNU 1 Motor Current Actual Value

Data Type: FLOATINGPOINT
Description: Mot I Act Val
Read only: true

PNU 2 Boost Current

Data Type: FLOATINGPOINT
Description: Mot I Boost
Read only: false

PNU 3 Hold Current

Data Type: FLOATINGPOINT
Description: Mot I Hold
Read only: false

PNU 4 Boost Current Percent

Data Type: FLOATINGPOINT
Description: Mot I Max %
Read only: false

PNU 5 Step Mode

Data Type: FLOATINGPOINT
Description: Step Mode
Read only: false
Min: 0
Max: 8

PNU 6 Motor Pole Pairs

Data Type: FLOATINGPOINT
Description: Mot Pole Pairs
Read only: false
Min: 0

PNU 7 Encoder Enable

Data Type: FLOATINGPOINT
Description: Encoder EN
Read only: false
Min: 0
Max: 1

PNU 8 Encoder Type

Data Type: FLOATINGPOINT
Description: Encoder Type
Read only: false
Min: NULL
Max: 4

- 1 Line Driver
- 2 Single Ended
- 3 Hall-Sensor
- 4 Analogue Feedback

PNU 9 Encoder Index

Data Type: FLOATINGPOINT
 Description: Encoder Index
 Read only: false
 Min: 0
 Max: 1

PNU 10 Closed Loop Enable

Data Type: FLOATINGPOINT
 Description: Closed Loop EN
 Read only: false
 Min: 0
 Max: 1

PNU 11 Brake Enable

Data Type: FLOATINGPOINT
 Description: Brake EN
 Read only: false
 Min: 0
 Max: 1

PNU 12 Brake Eco Enable

Data Type: FLOATINGPOINT
 Description: Brake Eco EN
 Read only: false
 Min: 0
 Max: 1

PNU 13 Eco Delay Enable

Data Type: FLOATINGPOINT
 Description: Eco Delay EN
 Read only: false
 Min: 0
 Max: 1

PNU 14 Switching Delay

Data Type: FLOATINGPOINT
 Description: Switching Delay
 Read only: false
 Min: 0
 Max: 10.000

PNU 15 Brake Resistor Voltage

Data Type: FLOATINGPOINT
 Description: Brake Resistor V
 Read only: false
 Min: 24
 Max: 51

PNU 16 S-Curve

Data Type: FLOATINGPOINT
 Description: S-Curve
 Read only: false
 Min: 0
 Max: 100

PNU 17**Limit Switch Position**

Data Type: FLOATINGPOINT
Description: LS Position
Read only: false
Min: NULL
Max : 4

1 No limit switches
2 Limit Switch Negative
3 Limit Switch Positive
4 Limit Switch Negative and Positive

PNU 18**Analog Input 1 Min: Stroke**

Data Type: FLOATINGPOINT
Description: AI 1 Goal Min
Read only: false
Min: 0
Max: 10

PNU 19**Analog Input 2 Min: Absolut**

Data Type: FLOATINGPOINT
Description: AI 2 Abs Min
Read only: false
Min: 0
Max: 10

PNU 20**Analog Input 1 Max Stroke**

Data Type: FLOATINGPOINT
Description: AI 1 Goal Max
Read only: false
Min: 0
Max: 10

PNU 21**Analog Input 2 Max Absolut**

Data Type: FLOATINGPOINT
Description: AI 2 Abs Max
Read only: false
Min: 0
Max: 10

PNU 22**Analog Input Deadband Zero Value**

Data Type: FLOATINGPOINT
Description: AI 1 DB 0 Val
Read only: false
Min: 0
Max: 5
Info: 0,001 increments

PNU 23**Analog Input Hysteresis**

Data Type: FLOATINGPOINT
Description: AI 1 DB In Sig
Read only: false
Min: 0
Max: 1
Info: 0,001 increments

PNU 24**Analog Input Filter**

Data Type: FLOATINGPOINT
Description: AI 1 Filter
Read only: false
Min: 0
Max: 1000

PNU 25 **Analog input 1 Value**
 Data Type: FLOATINGPOINT
 Description: AI 1 Act Val
 Read only: true

PNU 26 **Analog input 2 Value**
 Data Type: FLOATINGPOINT
 Description: AI 2 Act Val
 Read only: true

PNU 27 **Digital Input Type**
 Data Type: UNSIGNED8
 Description: DI Input Type
 Read only: false
 Min: 0
 Max: 1

0 PNP
 1 NPN

PNU 28 **Digital Input Polarity**
 Data Type: FLOATINGPOINT
 Description: DI Polarity
 Read only: false
 Min: 0
 Max: 1.023

PNU 29 **Digital Output Polarity**
 Data Type: FLOATINGPOINT
 Description: DO Polarity
 Read only: false
 Min: 0
 Max: 31

PNU 30 **Controller Parameter Current P**
 Data Type: FLOATINGPOINT
 Description: Ctrl Data CUR P
 Read only: false
 Min: 0
 Max: 10.000

PNU 31 **Controller Parameter Current I**
 Data Type: FLOATINGPOINT
 Description: Ctrl Data CUR I
 Read only: false
 Min: 0
 Max: 1.000.000

PNU 32 **Controller Parameter Velocity P**
 Data Type: FLOATINGPOINT
 Description: Ctrl Data VEL P
 Read only: false
 Min: 0
 Max: 10.000

PNU 33 **Controller Parameter Velocity I**
 Data Type: FLOATINGPOINT
 Description: Ctrl Data VEL I
 Read only: false
 Min: 0
 Max: 1.000.000

PNU 34 Controller Parameter Position P

Data Type: FLOATINGPOINT
Description: Ctrl Data POS P
Read only: false
Min: 0
Max: 10.000

PNU 35 Controller Temperature

Data Type: FLOATINGPOINT
Description: Temp dryve
Read only: true

PNU 36 Status Flags

Data Type: UNSIGNED32
Description: Status Flags
Read only: true

Bit assignment

0	0	Not Referenced
	1	Referenced

PNU 37 Position Actual Value

Data Type: FLOATINGPOINT
Description: POS Act Val
Read only: true

PNU 38 Following Error Window

Data Type: FLOATINGPOINT
Description: Following Error
Read only: false
Min: 0
Max: 100.000

The Value 4.294.967.295 deactivates the Following Error

PNU 39 Position Window

Data Type: FLOATINGPOINT
Description: POS Window
Read only: false
Min: 0
Max: 100.000

PNU 40 Position Window Time

Data Type: FLOATINGPOINT
Description: POS Time
Read only: false
Min: 0
Max: 65.535

PNU 41 Velocity Actual Value

Data Type: FLOATINGPOINT
Description: VEL Act Val
Read only: true

PNU 42 Max Current Factor

Data Type: FLOATINGPOINT
Description: Mot I Max F
Read only: false
Min: 1.000
Max: 3.000

PNU 43	Motor Rated Current
Data Type:	FLOATINGPOINT
Description:	Mot I Rated
Read only:	false
Min:	100
Max:	7.000
PNU 44	Motor Current Actual Value
Data Type:	FLOATINGPOINT
Description:	Mot I Act Val F
Read only:	true
PNU 45	Stroke Minimum
Data Type:	FLOATINGPOINT
Description:	Stroke Min
Read only:	false
PNU 46	Stroke Maximum
Data Type:	FLOATINGPOINT
Description:	Stroke Max
Read only:	false
PNU 47	Home Offset
Data Type:	FLOATINGPOINT
Description:	HOM Offset
Read only:	false
Min:	0
Max:	100.000
PNU 48	Max Profile Velocity
Data Type:	FLOATINGPOINT
Description:	VEL Max
Read only:	false
Min:	0
Max:	100.000
PNU 49	Quick Stop Deceleration
Data Type:	FLOATINGPOINT
Description:	Quick-Stop DEC
Read only:	false
Min:	0
Max:	100.000
PNU 50	Encoder Resolution
Data Type:	FLOATINGPOINT
Description:	Feedback RES
Read only:	false
Min:	1
Max:	4.096
PNU 51	Gear Ratio - Motor Shaft
Data Type:	FLOATINGPOINT
Description:	Gear Ratio 1
Read only:	false
Min:	1.000
Max:	4.294.967.295
PNU 52	Gear Ratio - Driving Shaft
Data Type:	FLOATINGPOINT
Description:	Gear Ratio 2
Read only:	false
Min:	1.000
Max:	4.294.967.295

PNU 53

Feed Rate 1

Data Type: FLOATINGPOINT
 Description: Feed Rate 1
 Read only: false
 Min: 0
 Max: 100.000

PNU 54

Feed Rate 2

Data Type: FLOATINGPOINT
 Description: Feed Rate 2
 Read only: false
 Min: 0
 Max: 100.000

PNU 55

Homing Method

Data Type: FLOATINGPOINT
 Description: HOM Method
 Read only: false
 Min: 0
 Max: 255

17 LSN Limit Switch negative
 18 LSP Limit Switch positive
 33 IEN Index Encoder negative
 34 IEP Index Encoder positive
 37 SCP Current Position
 255 AAF Analogue Absolut Value

PNU 56

Max Acceleration

Data Type: FLOATINGPOINT
 Description: ACC Max
 Read only: false
 Min: 0
 Max: 100.000

PNU 57

Following Error Actual Value

Data Type: FLOATINGPOINT
 Description: Following Err AV
 Read only: true

PNU 58

Motor Type

Data Type: FLOATINGPOINT
 Description: Mot Type
 Read only: false
 Min: 9
 Max: 13

9 Stepper Motor
 11 EC/BLDC Motor
 13 DC-Motor

PNU 59

Si Unit Position

Data Type: UNSIGNED32
 Description: Si Unit Position
 Read only: false

PNU 60

Positioning Option Code

Data Type: FLOATINGPOINT
 Description: Operation Mode 1
 Read only: false

PNU 922	Telegram Selection
Data Type:	UNSIGNED16
Description:	Telegram Select
Read only:	true
PNU 930	Operation Mode 2
Data Type:	UNSIGNED16
Description:	Operation Mode 2
Read only:	true
PNU 944	Fault Message Counter
Data Type:	UNSIGNED16
Description:	Fault Msg Count
Read only:	true
PNU 947	Fault Number
Data Type:	UNSIGNED16
Description:	Fault Number
Max subindex:	70
Read only:	true
PNU 964	Drive Unit Identification
Data Type:	UNSIGNED16
Description:	Drive Unit ID
Max subindex:	4
Read only:	true
PNU 965	Profile Identification Number
Data Type:	OCTETSTRING
Description:	Profile ID Nr
Max subindex:	1
Read only:	true
PNU 971	Transfer to Non-Volatile Memory
Data Type:	UNSIGNED16
Description:	Safe to NVM
Read only:	false
PNU 975	DO Identification
Data Type:	UNSIGNED16
Description:	DO ID
Max subindex:	7
Read only:	true
PNU 978	List of All DO-IDs
Data Type:	UNSIGNED8
Description:	DO ID List
Max subindex:	7
Read only:	true
PNU 980	Number List of Defined Parameter
Data Type:	UNSIGNED16
Description:	Param ID List
Max subindex:	71
Read only:	true
PNU 60000	Velocity Reference Value
Data Type:	FLOATINGPOINT
Description:	VEL Max Ref
Read only:	true

5.8.16.1 Function Block FB 287

Siemens offers a predefined function block for reading and writing data.

The instructions: 'FAQ-04EP6Z7Q_read_write_parameter_using_FB287_EN.pdf' can be downloaded from the 'SiePortal' – account and registration required.

FB287 is a function block for accessing a single parameter that internally calls the blocks for acyclic communication RDREC/SFB52 and WRREC/SFB53.

FB287 is integrated into the libraries of the TIA Portal software.

5.8.17 Error Codes PNU 947

PNU 947 outputs the faults/errors present in the motor control system.

E01	Error Configuration	6320h
E02	Motor Over-Current	2320h
E03	Encoder Over-Current	2311h
E04	10 V Output Over Current	2312h
E05	I/O Supply Low	5114h
E06	Logic Supply Low	3222h
E07	Logic Supply High	3212h
E08	Load Supply Low	3221h
E09	Load Supply High	3211h
E10	Temperature High	4310h
E11	Following Error	8611h
E12	Limit Switch	FF00h
E13	Hall Sensor	7306h
E14	Encoder	7305h
E15	Encoder Channel A	FF01h
E16	Encoder Channel B	FF02h
E17	Encoder Channel I	FF03h
E21	Braking Resistor Overload	7110h
E22	Invalid Motion Parameter	FF04H
E23	Bus connection Lost	FF05h

6 Alerts and Errors

Alerts

No.	Description
Alert 10	A10 Temperature too high The temperature of the power unit has risen above 85 °C. In the event of a further temperature rise, please increase the cooling air flow, lower the ambient temperature, reduce the acceleration or velocity or insert pauses between the movements.
Alert 11	A11 Following Error 50% of the allowed Following Error reached If value falls under 50% again the alert will be reset automatically after 1 minute. Please check the mechanical construction if executed correctly, decrease the acceleration, increase the "Motor Current", the "Boost Current" or reduce the load
Alert 18	A18 Position window The position window has been left before the Positioning Time has been lapsed. Please check the load, the forces applied to the motor or adopt the positioning window
Alert 22	A22 Incorrect movement parameters/target position outside defined stroke The movement parameters used are outside the defined ranges. Check the movement parameters on the Travel profiles page (red font) as well as the minimum and maximum stroke and the movement limits on the Axis page.
Alert 23	A23 Bus communication cancelled Bus communication has been restored Please check your programme to see whether it has an automatic recover function.

Errors

No.	Description
Error 1	E01 Configuration Please check the configuration. Incorrect parameter combination
Error 2	E02 Motor Over-current Possible short circuit of the motor phases or incorrect current control parameter If EC/BLDC with Brake Resistor is being used: Resistance value attached to X5.4 and X5.5 too low
Error 3	E03 Encoder Over-current Electric load at terminals X6:1 is too high Please check all electrical connections
Error 4	E04 10 V Output Over-current Electric load at terminal X4:1 is too high Please check all electrical connections
Error 5	E05 I/O Supply There is no or too little voltage at terminal X2:11-12 Please check if a permissible voltage from 5 to 24 V is applied to the terminal
Error 6	E06 Logic Supply Low Voltage at terminal X1:3-2 is too low Please check if a permissible voltage from 5 to 24 V is applied to the terminal
Error 7	E07 Logic Supply High Voltage at terminal X1:3-2 too high Please check if a permissible voltage from 5 to 24 V is applied to the terminal
Error 8	E08 Load Supply Low No or too little voltage at terminal X1:1-2 Please check if a permissible voltage from 5 to 24 V is applied to the terminal The error evaluation is activated 250 ms after the logic voltage is switched on.
Error 9	E09 Load Supply High Voltage at terminal X1:1-2 too high Please check if a permissible voltage from 5 to 24 V is applied to the terminal
Error 10	E10 Temperature Power unit is overheated – Temperature above 100°C Please increase the flow of cooling air, lower the ambient temperature and reduce speed or insert pauses between the movements. See E10 Temperature Error (p. 223)
Error 11	E11 Following Error Movement outside the target parameters (comparison of target position and actual position) If possible, increase the supply voltage or the Motor Current, lower the following error limit, reduce the load, lower acceleration or speed, or adapt the Controller Data See E11 Following Error (p. 223)

No.	Description
Error 12	E12 Limit Switch A limit switch has been tripped Please check the available stroke, the home position and the positions of the limit switches
Error 13	E13 Hall-Sensor Incorrect Hal sensor data Please check the Hall Sensor, the wiring and the signal sequence
Error 14	E14 Encoder Incorrect encoder data Please check the encoder, the wiring and the signal sequence
Error 15	E15 Encoder Error Channel A No or unplausible signal at encoder channel A Please check the connecting cable for wire breaks or a correct pin assignment of the terminal.
Error 16	E16 Encoder Error Channel B No or unplausible signal at encoder channel B Please check the connecting cable for wire breaks or a correct pin assignment of the terminal.
Error 17	E17 Encoder Error Channel I No or unplausible signal at encoder channel I Please check the connecting cable for wire breaks or a correct pin assignment of the terminal.
Error 21	E 21 Braking Resistor Overload Permanent Braking Resistor trigger. Please check the parameter Braking Voltage as well as the value of the Braking Resistor itself.
Error 22	E22 Incorrect movement parameters/target position outside defined stroke The movement parameters used are outside the defined ranges. Check the movement parameters on the Travel profiles page (red font) as well as the minimum and maximum stroke and the movement limits on the Axis page.
Error 23	E23 Bus communication lost Bus communication must be re-established. Please check your programme to see whether it has an automatic recover function

7 Troubleshooting

No IP address displayed

Description	Possible Cause	Possible Countermeasures
No IP address is shown on the display of the motor controller. The connection between the motor controller and the PC is established directly via an Ethernet cable, no switch or router is used. The green and orange LEDs on plug contact X8 (RJ45 socket) light up. The orange LED may flash occasionally.	The assignment of the IP address is prevented by special Ethernet settings, installed software or other connected devices.	- Close all open programmes on your PC - Reset the Ethernet settings to the factory standard - Establish the connection via an Ethernet switch - Test a separate PC without too restrictive firewall or virus scanner settings.

E03 Encoder Over Current – Not possible to reset error

Description	Possible Cause	Possible Countermeasures
The error message "E03 Encoder Over Current" cannot be reset via the "Reset" button on the user interface or by setting the digital input DI 10 "Stop/Reset" after eliminating the cause of the error or deactivating the encoder function and removing connector X6.	The previous error condition (e.g. external voltage applied to X6 connector) has destroyed the dryve D1 motor control.	Purchase of a replacement dryve D1 motor controller

E10 Temperature Error

Description	Possible Cause	Possible Countermeasures
After a certain operating time, the dryve D1 enters the "Stop" state and emits the error "E10 Temperature"	The power electronic is thermally overloaded due to excessively high Motor Current without any regeneration time. Inadequate temperature management at the installation location.	- Load reduction - Motor Current reduction - Increase of the pause times - Use of a motor with a higher torque at the same Motor Current - Improve heat dissipation

E11 Following Error

Description	Possible Cause	Possible Countermeasures
In the case of a periodic movement with acceleration and deceleration phases longer than the movement at uniform velocity, the dryve D1 enters the "Stop" state after a certain reproducible operating time and outputs the error "E11 Following Error".	The Boost Current (p. 41) used for the acceleration and deceleration phases is applied without sufficient regeneration time (current decreased to values below the	- Boost Current reduction - Same acceleration and deceleration at a lower Boost Current level - Shortened acceleration and deceleration phases with same Boost Current - Increase of pause times between the movements - Use of a motor with a higher torque at the same Motor Current - Load Reduction
During acceleration or deceleration phases or passages with an increasing load, the dryve D1 enters the "Stop" state and outputs the error "E11 Following Error "	The motor rotor can no longer follow the rotating field of the stator. The difference between the setpoint position and the actual position (slip) cannot be compensated within the specified parameters.	- Motor Current increase - Boost Current increase - Load reduction - Acceleration reduction - Velocity reduction
As soon as a movement is executed, the following error displayed in the oscilloscope increases continuously in proportion to the velocity until the error "Following error E11" is emitted.	The rotation directions of the motor and encoder do not match. Incorrect or missing signals from the encoder.	- Check for correct wiring of motor and encoder - Check encoder for correct function

E12 Limit Switch

Description	Possible Cause	Possible Countermeasures
During the reference run, the motor/linear axis triggers the limit switch and error E12 is output.	The motor rotates in the wrong direction. The limit switch is connected to the wrong digital input. The limit switch is configured incorrectly	- Check if the wiring of the motor has been done correctly - Check that the switched output of the limit switch is connected to the correct Digital Input - Check that the digital input for the connected limit switch has been configured correctly - normally closed/ normally open, PNP/NPN

Motor movement in random directions

Description	Possible Cause	Possible Countermeasures
A stepper motor is changing randomly the movement direction at the movement start although a constant direction is set. This direction will be kept till the movement is stopped. The motor noise is "rougher" as usual.	There is a broken wire in one of the 4 motor wires. One wire has no electrical contact.	Shorten or replace the damaged wire up to the broken section

Only manual movements possible

Description	Possible Cause	Possible Countermeasures
The motor can be moved via the rotation direction buttons of the Position Adoption (p. 82) but not via the configured drive profiles.	The Available Stroke (p. 56) of the axis has not been set correctly.	Set the Available Stroke to the value corresponding to the application

Motor noises while using Closed Loop

Description	Possible Cause	Possible Countermeasures
Above a certain motor rpm/velocity while using the closed loop, a "howling" noise can be heard and the following error fluctuates periodically.	The motor speed is above the maximum possible speed when using the Closed Loop	24 V load voltage Reduce the motor speed/velocity or increase the load voltage supply to 48 V. If the properties of the Closed-Loop (p. 49) are not required, the Open Loop could be used. 48 V load voltage Decrease the motor speed/velocity. If the properties of the closed loop are not required, the open loop could be used.

8 FAQs

If you have difficulties in commissioning your D1, we stated the most frequently asked questions here. Please always use the latest firmware of the D1. It is available at www.igus.eu/dryve.

[How do I determine the rotation direction of the motor?](#)

[How do I connect a limit switch?](#)

[How do I determine the position of a limit switch?](#)

[How do I connect the motor?](#)

[Is there anything special to consider when commissioning a brake?](#)

[Is the igus motor encoder an incremental or absolute encoder?](#)

[Is there a sample program demonstrating the communication of the D1 with a Siemens PLC?](#)

[Is there a sample program demonstrating the communication of the D1 via Modbus TCP/IP as a gateway?](#)

[The dryve D1 is controlled by a master via CANopen or Modbus TCP/IP as a gateway. The motor is energized but does not move after the start bit is set.](#)

Is your request not addressed in this list? Please send us a support request with your current configuration file of the D1 to de-dryve@igus.net

How do I determine the rotation direction of the motor?

Please read the chapter [Limit Switches](#) (p. 59). The determination of the rotation direction is illustrated in a picture.

How do I connect a limit switch?

The following applies to the igus limit switches: The brown wire is connected to 24V and the blue wire to 0V. Depending on the position, the black wire is connected to terminal X2.8 or X2.9 of the dryve D1. The supply voltage (brown and blue wire of the limit switch) is not provided by the D1. The cores must be connected to external terminals (e.g. in your switch cabinet).

How do I determine the position of the limit switches?

Please read the chapter [Limit Switches](#) (p. 59). There you will find a graphic illustration of the position determination.

How do I connect a motor?

Please refer to the chapter [Pin Assignment](#) (p.21). The motor connection is illustrated in a picture.

Is there anything special to consider when commissioning a brake?

During initial commissioning or after a longer standstill period of the brake, a grinding process must be performed. To execute it, please refer to the relevant motor data sheet and follow the instructions in the sub-section "Holding brake".

Is the igus motor encoder an incremental or absolute encoder?

igus motor encoder are incremental encoder. Please refer to the corresponding data sheet.

Is there a sample program demonstrating the communication of the D1 with a Siemens PLC?

Sample programs demonstrating the communication of the D1 with a Siemens PLC are available in different versions. Several different sample programs are available on our web page www.igus.eu/sample-program

Is there a sample program demonstrating the communication of the D1 via Modbus TCP/IP as Gateway?

A communication sample program for the D1 with a PC (laptop, Raspberry Pi or similar) via Modbus TCP/IP as Gateway is available in the form of a Python script.

Several different sample programs are available on our web page www.igus.eu/sample-program

The dryve D1 is controlled by a master via CANopen or Modbus TCP/IP as a gateway. The motor is energized but does not move after the start bit is set.

Please check first whether you have set all parameters of the user interface according to the chapter [Necessary User Interface Settings](#) (p. 109). These settings are absolutely necessary.

Furthermore, check whether you have set the respective communication mode (CANopen or Modbus TCP/IP) to active and therefore dominant [Drive Mode Selection](#) (p. 77).

If the problems persists, please write a Email to the dryve D1 Support – [Service](#) (p. 244)

How to calculate the torque of a motor at reduced current and speed

You can find the torque/speed curve in the motor's data sheet: <https://www.igus.de/product/MOT-AN-S-060-059-086-M-A-AAAA>

From this, you can approximate the current required per Nm:

$$\begin{aligned} 5.2 \text{ Nm} &= 6.36 \text{ A} \\ 1 \text{ Nm} &= 6.36 \text{ A} / 5.2 \text{ Nm} \\ 1 \text{ Nm} &= 1.223 \text{ A} \end{aligned}$$

Next, the resulting current can be calculated based on the torque at the respective speed (here, 100 rpm).

For 24 V:

$$1.223 \text{ A} * 4.2 \text{ Nm} = 5.14 \text{ A}$$

For 48 V:

$$1.223 \text{ A} * 4.9 \text{ Nm} = 5.99 \text{ A}$$

Please note that these are approximate values. They may vary due to tolerances and other factors.
If the motor current is set to 4.8 A, the above calculations must be adjusted accordingly.

9 Wiring Schemes Motor, Encoder and Brake

9.1 Stepper Motor und Special Stepper Motor

Article Code	Motor Type
MOT-AN-S-060-001-020-X-X-XXXX, MOT-ST-20-X-X-X	NEMA 8 (20)
MOT-AN-S-060-001-028-X-X-XXXX, MOT-ST-28-X-X-X	NEMA 11 (28)
MOT-AN-S-060-005-042-X-X-XXXX, MOT-ST-42-X-X-X	NEMA 14 (35)
MOT-AN-S-060-020-056-X-X-XXXX, MOT-ST-56-X-X-X	NEMA 17 (42)
MOT-AN-S-060-035-060-X-X-XXXX, MOT-ST-60-X-X-X	NEMA 23 (56)
MOT-AN-S-060-059-086-X-X-XXXX, MOT-ST-86-X-X-X	NEMA 24 (60)

9.1.1 Motor Cable, Connector X5

The following wiring diagrams only apply when using **igus cables**.

If NEMA 17, NEMA 23 and NEMA23XL motors with brake are used, the corresponding brake cable must be used in addition to the motor cable – [drylin E data sheets](#)

The motor connection cable of the NEMA 34 motor directly contains the necessary wires for connecting a brake.

Motors with the suffix "C-AAAC" also have an encoder. The necessary connection diagrams can be found at [Encoder Cable, Connector X6](#)(p. 232)

Motor Cable – Motors with Metric Connector
NEMA11, 17, 23, 24
Straight
DLE904121451-3
DLE904121451-5
DLE904121451-10
Angled
DLE904121452-3
DLE904121452-5
DLE904121452-10
NEMA34 – incl. Brake Connection
DLE904121457-3
DLE904121457-5
DLE904121457-10

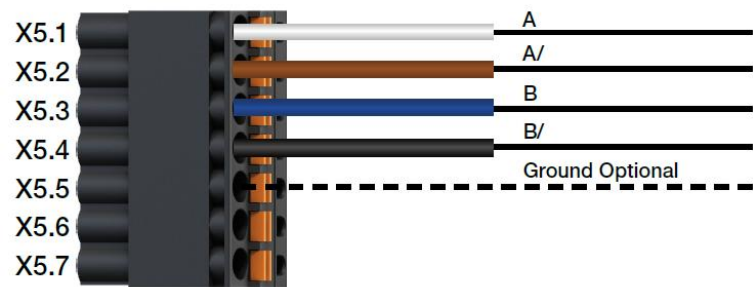
Motor Cable – Motors with Stranded Wires
NEMA8, 11, 14, 17, 23, 24
DLE904121461-3
DLE904121461-5
DLE904121461-10
NEMA34
DLE904161278-3
DLE904161278-5
DLE904161278-10

Brake Cable – Motors with Metric Connector
NEMA17, 23, 24
Straight
DLE904121453-3
DLE904121453-5
DLE904121453-10
Angled
DLE904121454-3
DLE904121454-5
DLE904121454-10

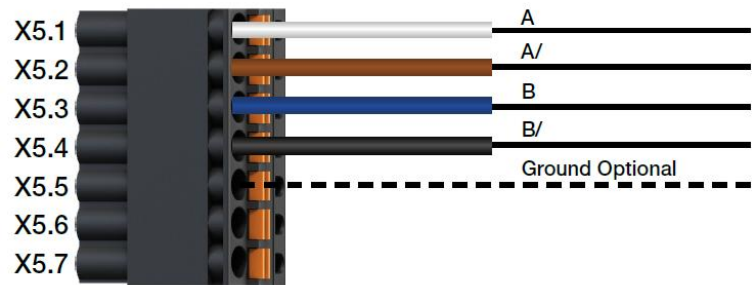
Brake Cable – Motors with Stranded Wires
NEMA14, 17, 23, 24, 34
DLE904172361-3
DLE904172361-5
DLE904172361-10

Overview Motor Connection

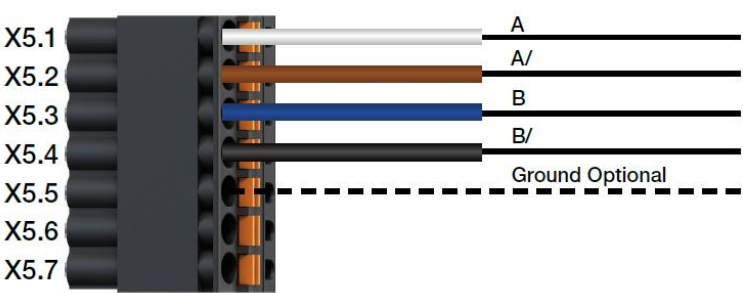
Type
MOT-AN-S-060-001-020-L-A-AAAO
MOT-AN-S-060-001-020-L-C-AAAO
MOT-AN-S-060-001-020-L-A-AAAO
MOT-AN-S-060-001-020-L-C-AAAO
MOT-AN-S-060-001-028-L-A-AAAA
MOT-AN-S-060-001-028-M-A-AAAA
MOT-AN-S-060-001-028-L-C-AAAC
MOT-AN-S-060-001-028-L-C-AAAO
MOT-AN-S-060-001-035-L-A-AAAO
MOT-AN-S-060-001-035-L-C-AAAO
MOT-AN-S-060-002-035-L-A-AAAA
MOT-AN-S-060-002-035-L-B-AAAA
MOT-AN-S-060-002-035-L-C-AAAC
MOT-AN-S-060-005-042-L-A-AAAA
MOT-AN-S-060-005-042-L-A-AAAB
MOT-AN-S-060-005-042-L-B-AAAA
MOT-AN-S-060-005-042-L-C-AAAC
MOT-AN-S-060-002-042-L-C-AAAO
MOT-AN-S-060-005-042-M-A-AAAA
MOT-AN-S-060-005-042-M-C-AAAC
MOT-AN-S-060-005-042-M-C-AAAS
MOT-AN-S-060-010-056-L-C-AAAO
MOT-AD-S-060-017-056-M-A-AAAK
MOT-AD-S-060-017-056-M-C-AAAL



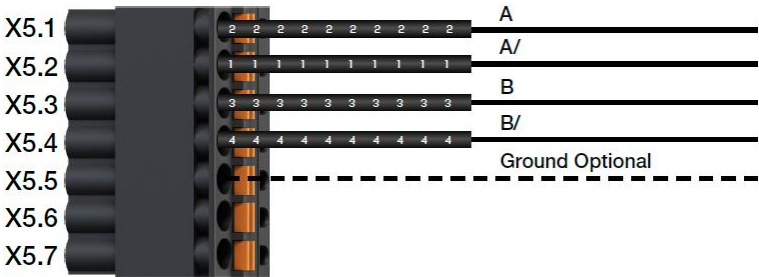
Type
MOT-AN-S-060-008-042-L-A-AAAA
MOT-AN-S-060-020-056-L-A-AAAA
MOT-AN-S-060-020-056-L-A-AAAB
MOT-AN-S-060-020-056-L-B-AAAA
MOT-AN-S-060-020-056-L-C-AAAC
MOT-AN-S-060-020-056-M-A-AAAA
MOT-AN-S-060-020-056-M-C-AAAC
MOT-AN-S-060-020-056-M-C-AAAS
MOT-AN-S-060-016-060-L-C-AAAO
MOT-AN-S-060-035-060-L-A-AAAA
MOT-AN-S-060-035-060-L-A-AAAB
MOT-AN-S-060-035-060-L-B-AAAA
MOT-AN-S-060-035-060-L-C-AAAC
MOT-AN-S-060-035-060-M-A-AAAA
MOT-AN-S-060-035-060-M-C-AAAC
MOT-AN-S-060-035-060-M-C-AAAS
MOT-AD-S-060-017-056-M-A-AAAK
MOT-AD-S-060-017-056-M-C-AAAL
MOT-AP-S-060-007-056-L-A-AAAJ
MOT-ST-20-L-A-A
MOT-ST-20-L-C-A
MOT-ST-20-L-A-B
MOT-ST-20-L-C-B
MOT-ST-28-L-A-A
MOT-ST-28-L-A-B
MOT-ST-28-L-C-A
MOT-ST-28-L-C-B
MOT-ST-35-L-A-A
MOT-ST-35-L-C-A
MOT-ST-35-L-A-B
MOT-ST-35-L-C-B
MOT-ST-42-L-A-A
MOT-ST-42-L-A-B
MOT-ST-42-L-C-A
MOT-ST-42-L-C-B
MOT-ST-42-L-C-O
MOT-ST-42-C-A-C
MOT-ST-42-C-C-C
MOT-ST-56-L-A-A
MOT-ST-56-L-A-B
MOT-ST-56-L-C-A
MOT-ST-56-L-C-B
MOT-ST-56-C-A-C
MOT-ST-56-C-C-C



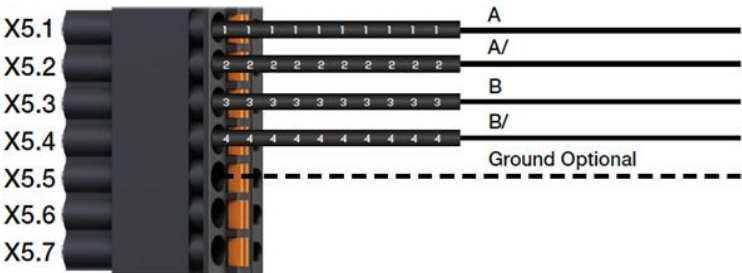
Type
MOT-ST-60-C-C-C
MOT-ST-86-C-A-C



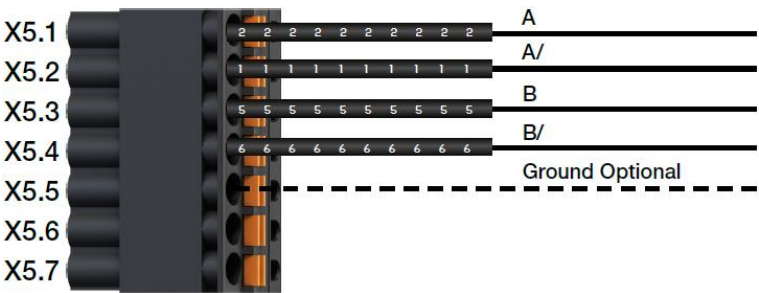
Typ
MOT-AN-S-060-059-086-M-A-AAAA
MOT-AN-S-060-059-086-M-C-AAAC
MOT-AP-S-060-013-056-K-C-AAAM
MOT-ST-86-C-C-C



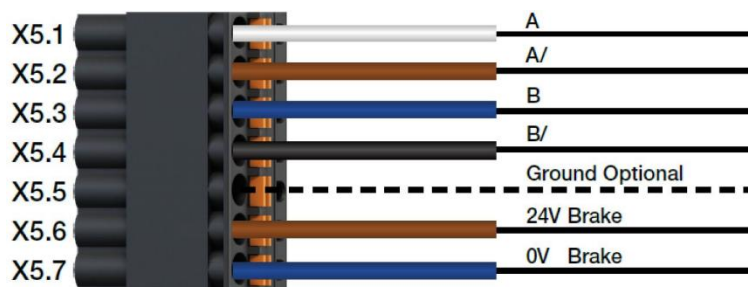
Typ
MOT-AN-S-060-059-086-L-A-AAAB
MOT-AN-S-060-059-086-L-B-AAAA
MOT-AN-S-060-059-086-L-C-AAAC
MOT-AN-S-060-112-086-L-A-AAAA
MOT-AN-S-060-112-086-L-C-AAAC



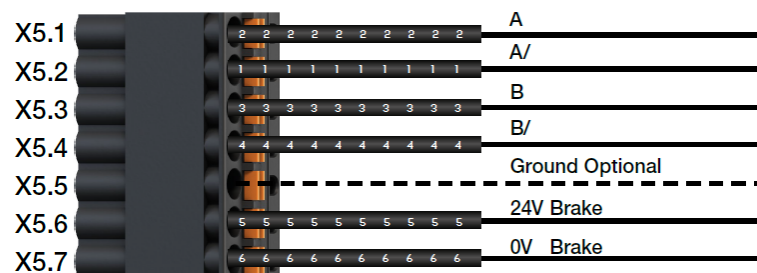
Type
MOT-AP-S-060-013-056-K-A-AAAI



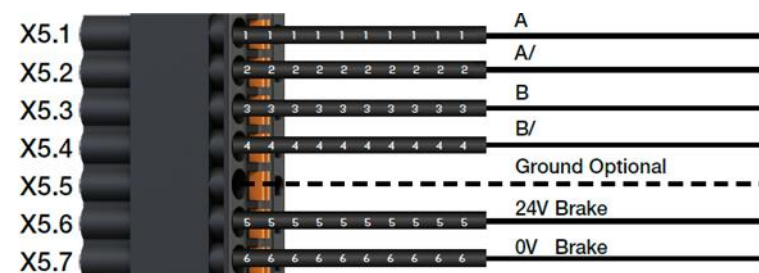
Type
MOT-AN-S-060-005-042-M-D-AAAD
MOT-AN-S-060-020-056-M-D-AAAD
MOT-AN-S-060-035-060-M-D-AAAD
MOT-AN-S-060-059-086-L-B-AAAA



Typ
MOT-AN-S-060-036-086-L-C-AAAO
MOT-AN-S-060-059-086-L-B-AAAA
MOT-AN-S-060-112-086-L-B-AAAA
MOT-AN-S-060-059-086-M-D-AAAD
MOT-AN-S-060-059-086-M-D-AAAS
MOT-ST-42-C-B-C
MOT-ST-56-C-B-C
MOT-ST-60-C-B-C
MOT-ST-86-C-B-C



Typ
MOT-AN-S-060-036-086-L-C-AAAC
MOT-AN-S-060-036-086-L-C-AAAO
MOT-AN-S-060-059-086-L-B-AAAA
MOT-AN-S-060-112-086-L-B-AAAA



9.1.2 Encoder Cable, Connector X6

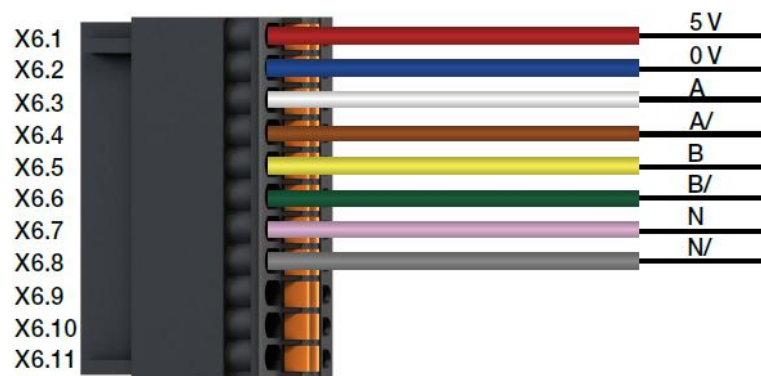
The following wiring diagrams only apply when using **igus cables**.

Motors with Metric Connector
NEMA11, 14, 17, 23, 24
Straight
DLE904121451-3
DLE904121451-5
DLE904121451-10
Angled
DLE904121452-3
DLE904121452-5
DLE904121452-10
NEMA34
Straight
DLE904121451-3
DLE904121451-5
DLE904121451-10
Angled
DLE904121452-3
DLE904121452-5
DLE904121452-10

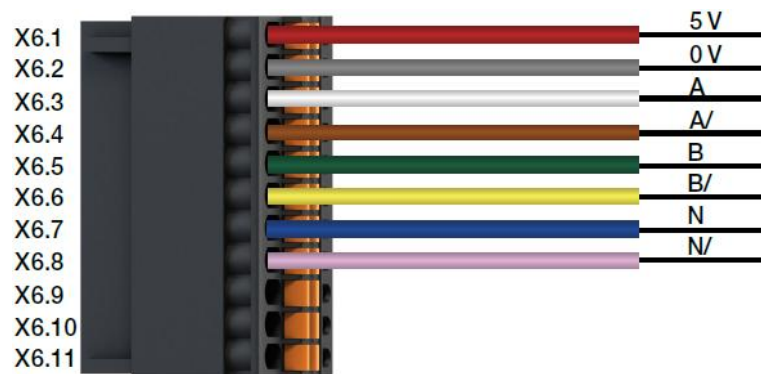
Motors with Stranded Wires
NEMA8, 11,
DLE904121459-3
DLE904121459-5
DLE904121459-10
NEMA 14, 17, 23, 24, 34
DLE904121460-3
DLE904121460-5
DLE904121460-10

Overview Encoder-Connection

Type
MOT-AN-S-060-001-028-L-C-AAAC
MOT-AN-S-060-005-042-L-C-AAAC
MOT-AN-S-060-020-056-L-C-AAAC
MOT-AN-S-060-035-060-L-C-AAAC
MOT-AN-S-060-036-086-L-C-AAAO
MOT-AN-S-060-059-086-L-B-AAAA
MOT-AN-S-060-059-086-L-C-AAAC
MOT-AN-S-060-112-086-L-B-AAAA
MOT-ST-28-L-C-A
MOT-ST-28-L-C-B
MOT-ST-42-L-C-A
MOT-ST-42-L-C-B
MOT-ST-56-L-C-A
MOT-ST-56-L-C-B



Type
MOT-AN-S-060-005-042-M-C-AAAC
MOT-AN-S-060-005-042-M-C-AAAS
MOT-AN-S-060-005-042-M-D-AAAD
MOT-AN-S-060-020-056-M-C-AAAC
MOT-AN-S-060-020-056-M-C-AAAS
MOT-AN-S-060-020-056-M-D-AAAD
MOT-AN-S-060-035-060-M-C-AAAC
MOT-AN-S-060-035-060-M-C-AAAS
MOT-AN-S-060-035-060-M-D-AAAD
MOT-AD-S-060-017-056-M-C-AAAL



Type
MOT-AN-S-060-059-086-M-C-AAAC
MOT-AN-S-060-059-086-M-D-AAAD

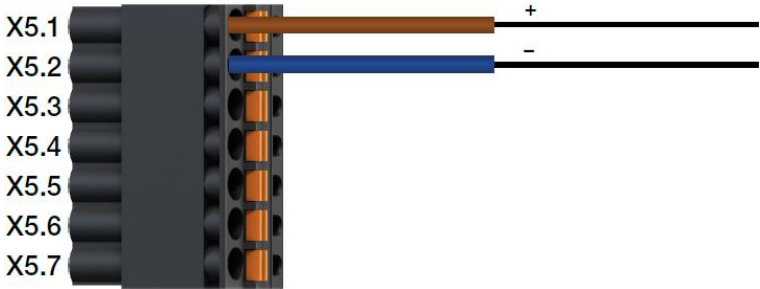


9.2 DC-Protect Motor

The following wiring diagrams only apply when using **igus cables**.

Motor Cable
Straight
DLE904121451-3
DLE904121451-5
DLE904121451-10
Angled
DLE904121452-3
DLE904121452-5
DLE904121452-10

Type
MOT-DC-37-M-A-A
MOT-DC-37-M-A-B
MOT-DC-36-M-A-D
MOT-DC-37-M-A-D
MOT-DC-42-M-A-D
MOT-DC-37-M-A-H
MOT-DC-42-M-A-F



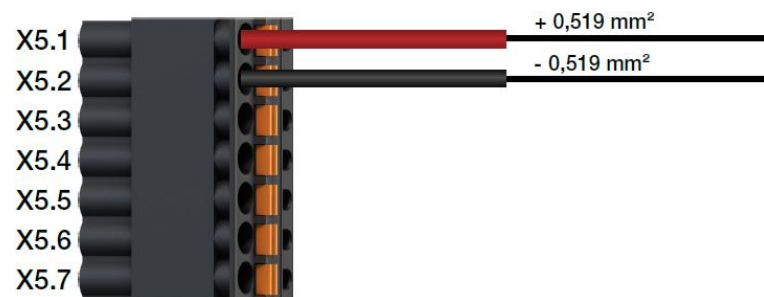
9.3 DC-Motor wit Serration Gear

The following wiring diagrams only apply when using **igus cables**.

Motor/Hall-Sensor Cable
Unshielded
DLE904121463-3
DLE904121463-5
DLE904121463-10
Shielded
DLE904121462-3
DLE904121462-5
DLE904121462-10

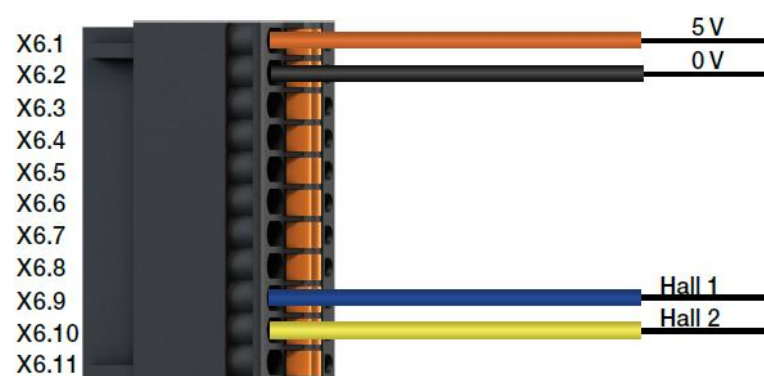
9.3.1 Motor, Connector X5

Type
MOT-DC-42-J-H-B
MOT-DC-42-J-H-D
MOT-DC-42-J-H-F
MOT-DC-42-J-H-H
MOT-DC-42-J-H-J
MOT-DC-42-J-H-L
MOT-DC-42-J-H-N
MOT-DC-42-J-H-P



9.3.2 Hall, Connector X6

Type
MOT-DC-42-J-H-B
MOT-DC-42-J-H-D
MOT-DC-42-J-H-F
MOT-DC-42-J-H-H
MOT-DC-42-J-H-J
MOT-DC-42-J-H-L
MOT-DC-42-J-H-N
MOT-DC-42-J-H-P



9.4 EC/BLDC-Motor

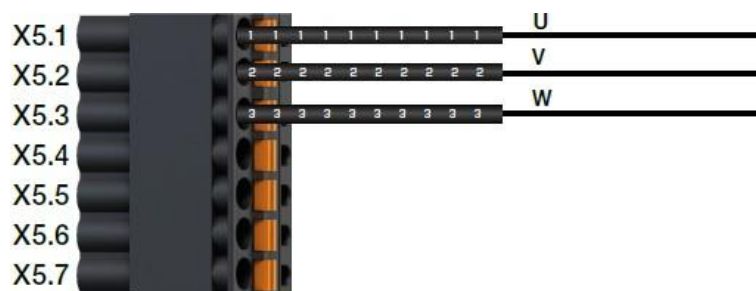
Article Code	Motor type
MOT-EC-42-X-X-X	NEMA 17
MOT-EC-56-X-X-X	NEMA 23
MOT-EC-60-X-X-X	NEMA 24
MOT-EC-86-X-X-X	NEMA 34

9.4.1 Motor, Connector X5

If motors with brakes are used, the corresponding brake cable must be used – [drylin E Data Sheets](#)

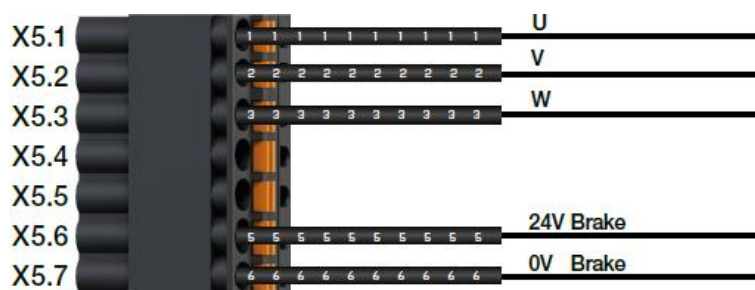
Motor Cable
DLE904172362-3
DLE904172362-5
DLE904172362-10

Type
MOT-EC-42-C-H-A
MOT-EC-56-C-H-A
MOT-EC-60-C-H-A
MOT-EC-86-C-H-A
MOT-EC-42-C-I-A
MOT-EC-56-C-I-A
MOT-EC-60-C-I-A
MOT-EC-86-C-I-A



Motor Cable with Brake
DLE904172363-3
DLE904172363-5
DLE904172363-10

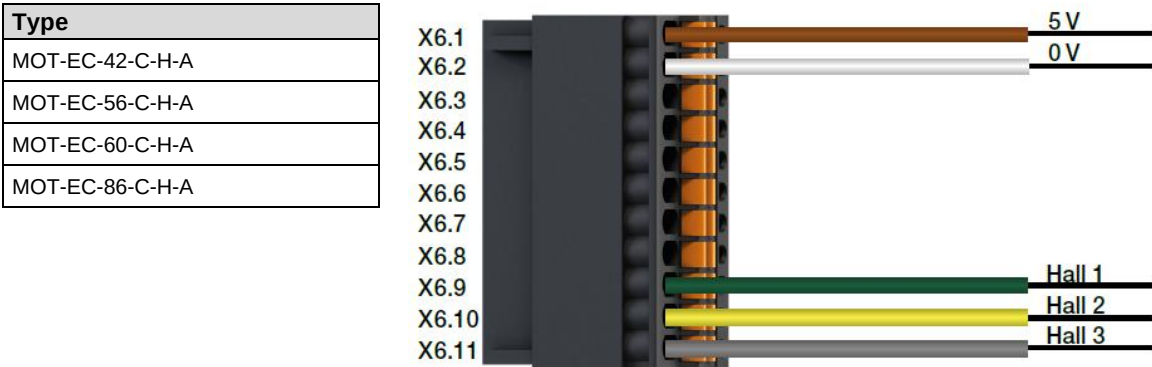
Type
MOT-EC-42-C-K-A
MOT-EC-56-C-K-A
MOT-EC-60-C-K-A
MOT-EC-86-C-K-A



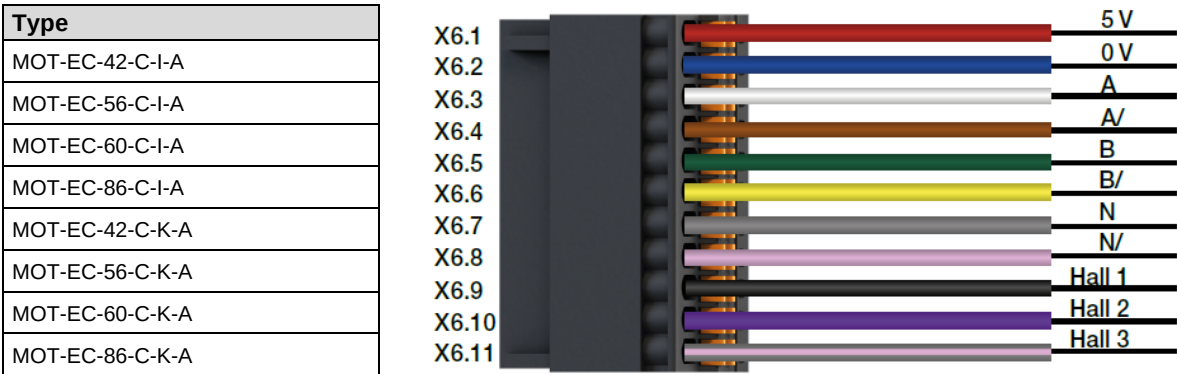
9.4.2 Hall/Encoder, Connector X6

The wiring diagrams show the connection of the wires coming directly from the motor.

Hall-Sensor Cable
DLE904172364-3
DLE904172364-5
DLE904172364-10



Encoder Cable
DLE904172365-3
DLE904172365-5
DLE904172365-10



10 Accessories

Connectors

D1-CONNECTOR-SET Connector replacement set for the dryve D1

Brake Resistor

DLE-BR-50-18R	Brake Resistor for Nema 17 BLDC Motors, 50 W, 18 Ω
DLE-BR-75-4R7	Brake Resistor for Nema 23 BLDC Motors, 75 W, 4,7 Ω ,
DLE-BR-100-3R3	Brake Resistor for Nema 24 BLDC Motors, 100 W, 3,3 Ω
DLE-BR-100-2R7	Brake Resistor for Nema 34 BLDC Motors, 100 W, 2,7 Ω

Mounting

Top-Hat-Rail Please contact the dryve support – de-dryve@igus.net

Marking

Sticker Pin Assignment Please contact the dryve support – de-dryve@igus.net

Control Units

DLE-CU-1	Control Unit „Binary“
DLE-CU-2	Control Unit „Tipp/Teach“
DLE-CU-3	Control Unit „Electronic Actuator“
DLE-CU-4	Control Unit „Analogue 10 turn“
DLE-CU-5	Control Unit „ Analogue 1 turn“
DLE-CU-6	Control Unit „Tipp and Jog“

Additional accessories as well as motors available at <http://www.igus.eu/drylinE>

11 Abbreviations

- AI	Analogue Input
- ABS	Absolute Positioning in relation to the zero point
- ADR	Rotational speed with direction set by an external analogue setpoint
- APS	Positioning with an external set analogue setpoint
- ARO	Rotational velocity with an external set analogue setpoint
- CL	Closed-Loop
- I/O	Input/Output
- DC-Motor	Direct Current Motor
- EC/BLDC-Motor	Electronically Commutated DC-Motor
- HOM	Homing mode
- OL	Open-Loop
- PWM	Pulse width modulation
- REL	Relative Positioning in relation to actual position
- ROT	Rotational Velocity
- ST	Stepper Motor

12 Explanation of terminology

Analogue Feedback

A sensor that is fitted to an axis and converts the rotary movement of the axis shaft into a 0 to 10 V or ± 10 V signal. An absolute position can be determined with this signal

Baud Rate

Uniform designation for transmission speeds

Brake ECO Mode

After completion of a positioning process, the time until the next start is monitored. If a new start command is not given within a set time, the brake output is deactivated, as a result the holding brake is applied and the motor holding current is set to 0 A. The controller and the output stage remain active. If a new positioning movement is started, the motor is supplied with current before the brake output is switched on again after a pre-set time and the brake is therefore released again. The ECO Mode can considerably reduce the thermal load on the motor.

Boost Current

The Boost Current is the increased Motor Current during phases of acceleration and deceleration. An increase of the Motor Current to the value of the Boost Current is possible for a maximum of 2 seconds and can [Motor type \(p.33\)](#) be up to 300%. Activation of the Boost Current depends on the frequency of movement.

Closed Loop

Field-oriented control with sinusoidally commutated current-vector control This effects that a Stepper Motor behaves like a servo motor and the Motor Current is controlled in relation to the load

DC-Motor

A DC-Motor consists of a stator (fixed part) and the rotor (moving part). Pole reversal of the magnetic field is necessary for rotary movement and is executed by the commutator on the rotor. Carbon brushes conduct the electric current through the commutator in a changing flow direction into the motor windings fitted on the rotor. As a result, a magnetic rotating field is generated that causes the rotor to rotate.

EC/BLDC-Motor

The Brushless Direct-Current Motor, abbreviated EC/BLDC-Motor (Electronically Commutated DC-Motor), can be understood as a type of Direct-Current Motor whereby the normally used commutator with carbon brushes for pole reversal of the magnetic field is replaced with an electronic circuit.

Encoder as Line Driver

An incremental encoder that is equipped with a difference signal generator as well as a signal amplifier stage. Channels A and A/, B and B/ as well as installed index channels I and I/ can be evaluated.

This encoder has greater interference resistance due to difference-signal evaluation. This encoder is therefore suitable for long cables.

Encoder as Single-Ended

An incremental encoder that can transmit signals via the A and B channels as well as the I channel, if the latter has been installed. The respective channel is measured against earth and is therefore susceptible to interference signals. This cost-effective encoder can be used if very short cables are used and interference signals are rare.

Limit Switch

Switch for electric feedback indicating that the mechanical limits of a linear or rotational axis have been reached. These switches can be in the form of mechanical or electrical proximity switches.

Hall-Sensor

An angular feedback based on the Hall effect. The Hall-Sensors are controlled by magnets mounted on the rotor shaft. Every time a Hall-Sensor is actuated, it outputs a signal that can be evaluated.

Incremental Encoder

An encoder consisting of a rotating disc on which a certain number of increments (impulses, lines) are placed. With adding and subtracting those increments, the motor position is exactly determinable.

Open Loop

An operating mode in which the motor is controlled. A direct position feedback is not available.

Open-loop with Error Correction

Operating mode in which the motor is controlled. If a difference between the desired value and an actual value is detected during a movement, this difference is compensated by an additional movement after the deceleration phase.

Oscillating movement

Two movements, one being from a starting point to an intermediate stop and the other one being movement back to the start.

PWM

Pulse width modulation A procedure whereby a DC voltage is converted into a lower voltage. The incoming DC voltage is converted into a square-wave voltage. This alternates between ground and the supply voltage with a predetermined basic frequency. The resulting output voltage is determined by the duty factor (average "On to Off" value).

Following Error

Comparison of the actual position to the setpoint position. If a Following Error is greater than the pre-set limit, an error message is emitted.

Stepper Motor

A Stepper Motor is a synchronous motor whereby the rotor can be turned through a minimum step (angle) by a controlled electromagnetic field of the stator coils. As the rotor exactly follows each stator step, a Stepper Motor can perform precise positioning without a feedback.

Step/Direction

In this operating mode, movements are generated from the signals of an incoming pulse frequency at Digital Input DI 1 in combination with a separate direction signal at Digital Input DI 2.

Teaching

Teaching is a procedure whereby the current position is adopted and stored in Drive Profile as a target point for a movement that is to be executed.

Jog

Jog enables a manually executed movement via the drive D1 user interface

Higher-level control system

A higher-level control system can be a PLC (programmable logic controller), a micro-controller or some other kind of control hardware.

13 Overview Input/Output Values

13.1 Input Values

Page	Group	Subitem 1	Subitem 2	Evaluated input
Start	Configuration			40 characters
	Password	Admin	Change	Min. 30 characters
		Observer	Change	Min. 30 characters
Motor	Motor	Motor Current	All motors	0 A to 7 A
		Boost Current	Stepper Motor	Min. Motor Current up to 10.5 A
			DC-Motor	Min. Motor Current up to 14 A
			EC/BLDC-Motor	Min. Motor Current up to 21 A
		Holding Current	Stepper Motor	0 A to 6.90 A
	Gear	Ratio		4,294,967,295 to 4,294,967,295
	Feedback	Impulses	All Feedbacks	1 to 4,096
	Brake	ECO Delay		0 ms to 10,000 ms
		Switching Delay		0 ms to 1,000 ms
	Brake Resistor	Brake Voltage		12 V to 51 V
Axis	Axis	Available Stroke		from 0 to 1,000,000
		Feed Rate		from 0 to 1,000,000
	Motion Limits	Max. Velocity		from 0 to 100,000
		Jog Velocity		from 0 to 100,000
		Max. Acceleration		from 0 to 1,000,000
		S-Curve		From 0 to 100
		Quick Stop		from 1000 to 1,000,000
		Following Error		from 0 to 1,000,000
		Positioning Window		from 0 to 1,000,000
		Positioning Time		from 0 to 65,535

Page	Group	Subitem 1	Subitem 2	Evaluated input
Axis	Homing	Offset	from 0 to 1,000,000	Homing
	Absolute Feedback	AI 1 Min. Target Value (V)		-10 V to 10 V
		AI 1 Max. Target Value (V)		-10 V to 10 V
		AI 1 Dead Band Zero Value		From 0 to 1 in 0,001 V steps
		AI 1 Dead Band Input Signal		From 0 to 1 in 0,001 V steps
		AI 1 Filter		from 0 to 65.535
		AI 2 Min. Absolute Value (V)		-10 V to 10 V
		AI 2 Max. Absolute Value (V)		-10 V to 10 V
Communication	Ethernet TCP/IP	IP Address		from 0.0.0.1 to 254.254.254.254
		Subnetwork Mask		from 0.0.0.1 to 254.254.254.254
		Standard Gateway		from 0.0.0.1 to 254.254.254.254
		Host Name		40 characters
	Bus Systems	CANopen	Node ID	from 1 to 127
		Modbus TCP Gateway	Port	from 0 to 65,535
			Unit Identifier	from 1 to 255
Drive Profile	Binary	Mode	ABS	0 to Motion Limit
			REL	from 0 to 1,000,000
			APS	0 to Motion Limit
		Acceleration		0 to Motion Limit
		Velocity		0 to Motion Limit
		Deceleration		0 to Motion Limit
		Pause		0 ms to 100,000,000 ms
		Next		from 0 to 32
	Tipp/Teach	Mode	ABS	0 to Motion Limit
		Acceleration		0 to Motion Limit
		Velocity		0 to Motion Limit
		Deceleration		0 to Motion Limit

Page	Group	Subitem 1	Subitem 2	Evaluated input
Oscilloscope	Controller Data	Current	Amplification (P)	from 0 to 10,000
			Time constant (I)	from 0 to 1,000,000
		Speed	Amplification (P)	from 0 to 10,000
			Time constant (I)	from 0 to 1,000,000
		Position	Amplification (P)	from 0 to 10,000

13.2 Value Entries

Input values are accepted by the dryve D1 with 6 significant places without 0 (zero).

Examples of correct input values

123456	123045	123456000
123.123	123.012	0.123456
0.102345	0.000123456	

13.3 Output Values

Group	Value	Min	Max
Status Field	Temperature dryve	-20 °C	105 °C (Error shutdown at 100°C)
	Motor Current	0 A	30 A
	Current-Position	-4,294,967,296	4,294,967,296
	Goal-Position	-4,294,967,296	4,294,967,296
	Boost Current	0 %	100 %

14 Service

Technical Support (After Sales)

DE-dryve@igus.net

+49 (0) 2203-9649-845

Technical support for igus® dryve motor control systems

Documentation/FW

www.igus.eu/D1

Ordering of additional motor controllers, download of manuals,
FW updates, certificates and the CANopen EDS file



Sample Programs

www.igus.eu/sample-program

Download sample programs for connecting the dryve D1 to higher-level controllers.
Examples for the integration of DI/Os, AIs, Step/Direction and bus systems

Videos/Tutorials

www.igus.eu/dryve/tutorial

Videos with tutorials on the range of functions of the dryve D1 and how to set it up for operation
Further videos on igus® products



Website D1 simulation

www.igus.eu/info/dryve-motorsteuerung

Simulation of the dryve D1 user interface
Detailed information on the dryve D1



Website drylin drive technology

www.igus.eu/drivetechnology

Download data sheets of the mechanical drive technology
Ordering of axes, linear robots and accessories

Contact

www.igus.eu

info@igus.eu

+49 (0) 2203-9649-0

Imprint

© 2025

All rights reserved:

igus® SE & Co. KG

Spicher Str. 1a

51147 Cologne, Germany

CANopen®, CiA®, PROFINET and PROFIdrive are registered trademarks of the respective trademark owner