

Technical Documentation



Product manual

Intelligent Compact Drive

IclA N065

Document: 0098441113268

Edition: V1.10, 07.2007

Berger Lahr GmbH & Co. KG
Breslauer Str. 7
D-77933 Lahr

Important information

The drive systems described here are products for general use that conform to the state of the art in technology and are designed to prevent any dangers. However, drives and drive controllers that are not specifically designed for safety functions are not approved for applications where the functioning of the drive could endanger persons. The possibility of unexpected or unbraked movements can never be totally excluded without additional safety equipment. For this reason personnel must never be in the danger zone of the drives unless additional suitable safety equipment prevents any personal danger. This applies to operation of the machine during production and also to all service and maintenance work on drives and the machine. The machine design must ensure personal safety. Suitable measures for prevention of property damage are also required.

See safety section for additional critical instructions.

Not all product variants are available in all countries.

Please consult the current catalogue for information on the availability of product variants.

We reserve the right to make changes during the course of technical developments.

All details provided are technical data and not promised characteristics.

In general, product names must be considered to be trademarks of the respective owners, even if not specifically identified as such.

Table of Contents

Important information	2
Table of Contents	3
Writing conventions and symbols	7
1 Introduction	9
1.1 About this manual	9
1.2 Scope of supply	9
1.3 Unit overview	10
1.4 Components and interfaces	11
1.4.1 Components	11
1.4.2 gear	12
1.4.3 Interfaces	14
1.4.4 Parameters and operating mode	14
1.5 Type code	15
1.6 Documentation and literature references	16
1.7 Directives and standards	17
1.8 Declaration of conformity	18
2 Safety	19
2.1 Qualification of personnel	19
2.2 Intended use	19
2.3 Hazard categories	20
2.4 General safety instructions	21
2.5 Monitoring functions	22
3 Technical Data	23
3.1 Environmental conditions	23
3.2 Electrical and mechanical data	24
3.2.1 Degree of protection	24
3.2.2 Service life	24
3.2.3 IcIA N065 DC024	25
3.2.4 IcIA N065 V - with spur wheel gearing	28
3.2.5 IcIA N065 1- with planetary gear	33
3.2.6 IcIA N065 G- with angled planetary gears	37
3.2.7 IcIA N065 U- with angled wormgear	41
3.2.8 Electrical terminals	45
4 Installation	47
4.1 Electromagnetic compatibility, EMC	47

4.2	Mechanical installation	49
4.2.1	Mounting	49
4.3	Electrical installation	51
4.3.1	Overview of all connections	51
4.3.2	Equipotential bonding connection	52
4.3.3	Overview signal interface	53
4.3.4	Supply voltage connection 24VDC	54
4.3.5	Connection control inputs	56
4.3.6	Connection Enable	57
4.3.7	Fieldbus connection	58
4.3.8	Connection Braking Resistor Controller	60
4.3.9	Checks	61
5	Commissioning	63
5.1	General safety instructions	63
5.2	Commissioning procedure	65
5.3	Commissioning software ICCT	66
5.3.1	Firmware update over fieldbus	66
5.4	Difference between the controller objects of D065 and N065	67
6	Operation	69
6.1	Operating modes	69
6.2	Functions	70
6.3	Protection and monitoring functions	71
6.3.1	Enable function	71
6.3.2	Monitoring functions of the motor controller	72
7	Diagnostics and troubleshooting	77
7.1	Fieldbus communication error diagnosis	77
7.2	Error diagnosis over fieldbus	78
7.2.1	Message objects	78
7.2.2	Messages on the device status	79
7.3	Error code table	84
8	Accessories and spare parts	87
8.1	Accessories	87
9	Service, maintenance and disposal	89
9.1	Service address	89
9.2	Maintenance	89
9.3	Replacing units	90
9.4	Shipping, storage, disposal	91

10 Glossary	93
10.1 Units and conversion tables	93
10.1.1 Length	93
10.1.2 Mass	93
10.1.3 Force	93
10.1.4 Power	93
10.1.5 Rotation	94
10.1.6 Torque	94
10.1.7 Moment of inertia	94
10.1.8 Temperature	94
10.1.9 Conductor cross section	94
10.2 Terms and Abbreviations	95
11 Index	97

Writing conventions and symbols

Work steps If work steps must be carried out in sequence, they are shown as follows:

- Special prerequisites for the following work steps
- Step 1
- ◁ Important response to this work step
- Step 2

If a response to a work step is specified, this will inform you that the step has been carried out correctly.

Unless otherwise stated, the individual instruction steps must be carried in the given sequence.

Lists Lists can be sorted alphanumerically or by priority. Lists are structured as follows:

- Point 1
- Point 2
 - Subpoint to 2
 - Subpoint to 2
- Point 3

Making work easier Information on making work easier can be found at this symbol:



*This offers supplementary information on making work easier.
See the chapter on safety for an explanation of the safety instructions.*

Parameters Parameters are shown as follows:

Group.Name Index:Subindex

1 Introduction

1.1 About this manual

This manual is applicable for all N065 standard models.

1.2 Scope of supply

- Check the parts supplied to make sure they are complete.
- Keep the original packaging in case it is necessary to return the compact drive to the manufacturer for repair.

Scope of supply

The scope of supply includes:

Item	Quan- tity	Designation
1	1	Compact drive IclA
For the exact unit type see the type code		

1.3 Unit overview

Intelligent compact drives IcIA

The IcIA N065 DC024 intelligent compact drives are servo drives based on an electronically commutated three-phase synchronous motor, referred to as a brushless DC motor and a block-commutated positioning controller. Power and control electronics with fieldbus terminal, motor, position sensor and gearing are integrated in the compact unit.

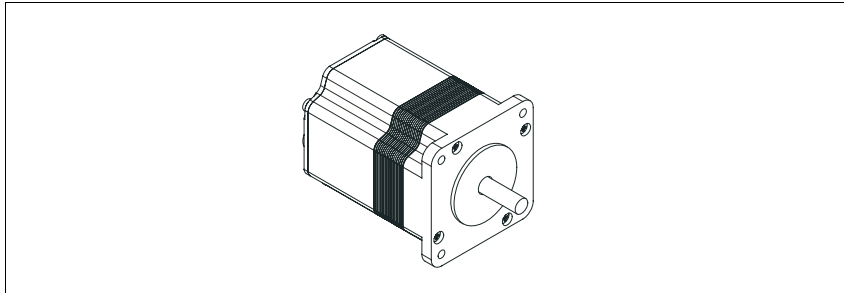


Figure 1.1 Unit overview

Area of application

The compact drives are primarily designed for automatic positioning of format axes during setup of production machines or for profile positioning of handling systems. The speed control operating mode is another area of application. This makes it easy to implement transport and metering functions on production machines.

Special features

The name IcIA stands for Integrated closed loop Actuator; actual and reference values are prepared in a closed control loop. Features of the compact drives are:

- compact construction
- low wiring requirements
- excellent reliability
- integrated positioning and speed control functions
- fieldbus communications interface
- high power density

1.4 Components and interfaces

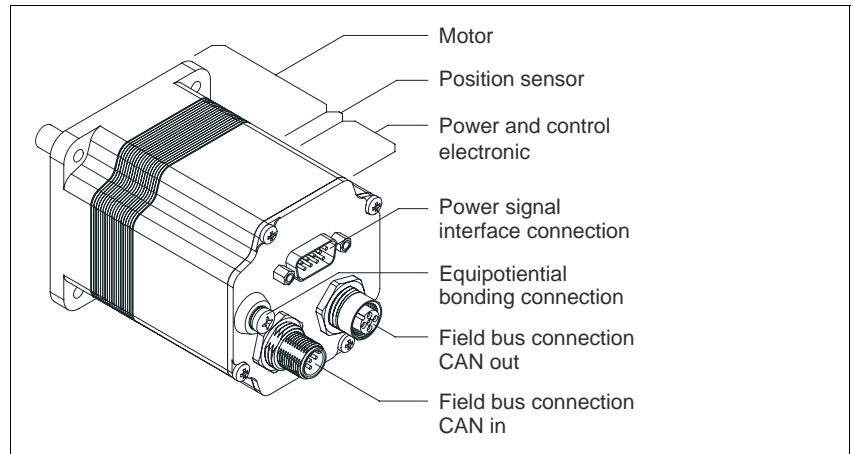


Figure 1.2 Components and interfaces

The intelligent compact drive has the following in compact design:

- Brushless DC motor
- Position sensor
- Power and control electronics
- Interfaces for fieldbus communications, enable signal, manual mode and supply voltage.
- Gearing (optional)

1.4.1 Components

Motor The electronically commutated three-phase synchronous motor in combination with the rare-earth magnets offers outstanding power density and thus very high efficiency.

The motors have a high detent torque. This means that often the use of a holding brake can be dispensed with. Motors with 2 pole pairs have a higher detent torque and an internal resolution of 12 increments per revolution. The model with 4 pole pairs offers a lower detent torque and the internal resolution is 24 increments per revolution.

Position sensor The position sensor and controller electronics form a quasi-absolute value sensor. 5 hall sensors capture the actual position of the rotor where the number of pole pairs $p = 2$ with an absolute resolution per revolution of 12 increments and 24 increments with $p = 4$ pole pairs. A position counter converts the actual position to a 32-bit absolute value. After positioning and before switching off the compact drive, the rotor position and absolute value are saved in the internal memory. When the compact drive is switched on again, the quasi-absolute value sensor detects whether the motor axis has been mechanically shifted within a revolution and reports this as "Drive not referenced".

power electronics The power electronics converts the speed or position instructions from the control electronics for motor control. Monitoring functions continuously monitor for overvoltage and undervoltage and protect the compact drive from overload. The power electronics must be hardware-isolated via a second channel in parallel to the microcontroller. To ensure minimum energy requirements, the electronics switch the power electronics off when the motor is at a standstill, the motor generates its detent torque from the permanent magnet field of the rotor.

1.4.2 gear

The case of the IcIA N065 compact drives offers a selection of different types of gearing. Spur wheel gears, planetary gears, angled planetary gears and spur wheel angled wormgears are available

Spur wheel gears The IcIA N065 V- compact drive has a 2, 3 or 4-ratio spur wheel gear. The gear teeth are metal and fitted with needle bearings. An important feature is the high power density, the low torsional backlash and the compact length of the drive with spur wheel gear.

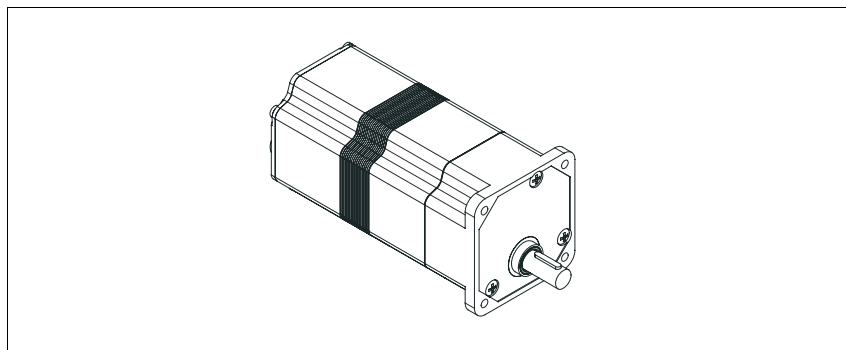


Figure 1.3 Intelligent compact drive with spur wheel gear

Planetary gear The IcIA N065 1- compact drive is fitted with a 2 or 3-ratio planetary gear. The drives with a planetary gear have minimum torsional backlash and very high output torque with very high efficiency.

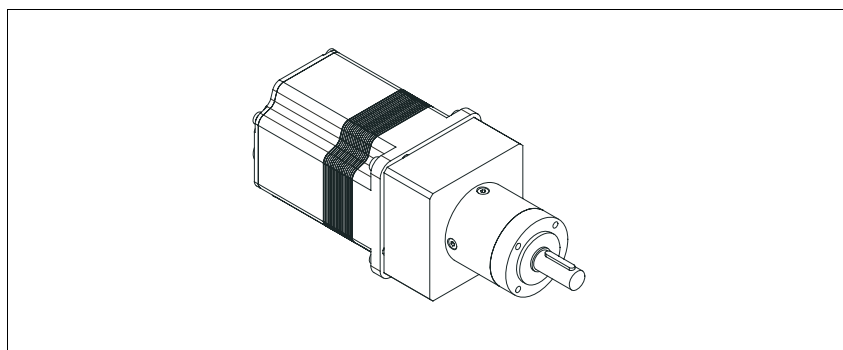


Figure 1.4 Intelligent compact drive with planetary gear

Angled planetary gear

The IcIA N065 G- compact drive is fitted with a 2 or 3 ratio planetary gear with an additional bevel gear ratio. The drives with angled planetary gears have minimum torsional backlash and very high output torque with very high efficiency. This type of gearing often proves suitable for implementation of compact and complex installation situations.

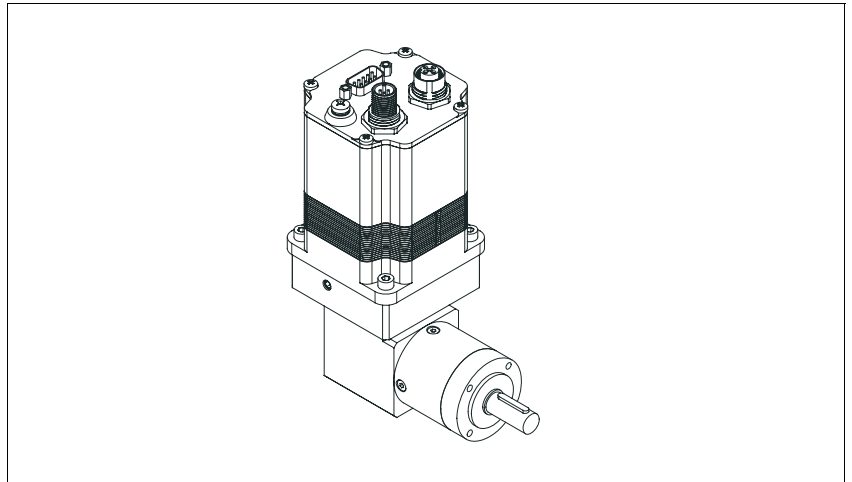


Figure 1.5 Intelligent compact drive with angled planetary gears

Angled spur wheel wormgears

The compact drive IcIA N065 U- is equipped with a 1 or 2 speed spur wheel gear and a wormgear. The drives with angled spur wheel wormgears have minimum torsional backlash and very high output torque. The variation of spur wheel and worm reduction can be set according to the application for high efficiency values up to self-locking. This type of gearing often proves suitable for implementation of compact and complex installation situations.

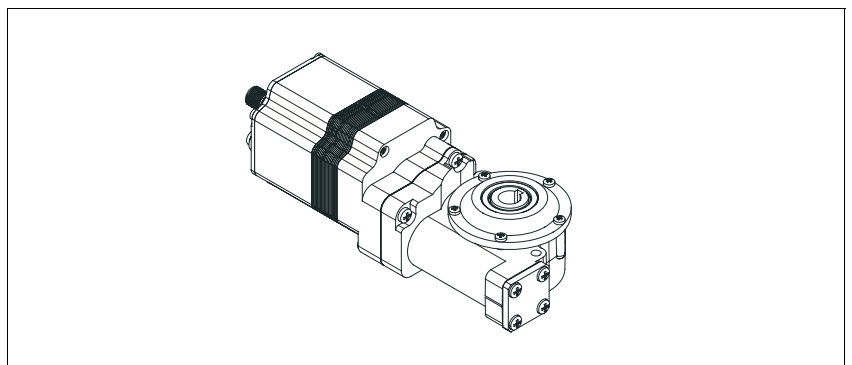


Figure 1.6 Intelligent compact drive with angled wormgear

1.4.3 Interfaces

<i>Power/signal interface</i>	<p>The compact drive is supplied with the operating voltage via the power interface.</p> <p>The signal interface can be used in 2 different ways.</p> <ul style="list-style-type: none"> • The "Standard Interface" type offers the option of manually traversing the compact drive with the aid of configurable jog inputs. • The "Sensor Interface" type makes homing of the drive easy with the evaluation of a reference switch and processing of two limit switches. <p>This also allows factory application-specific types to be generated, for which three signals are available as inputs or outputs.</p>
<i>Enable input</i>	<p>The enable signal input works in parallel to the microcontroller and offers a signal path to activate the integrated enable function.</p>
<i>Connection for manual operation</i>	<p>The compact drive can be moved manually in both directions with the input signals.</p> <p>The compact drive must be referenced before manual operation.</p>
<i>Fieldbus connection</i>	<p>The fieldbus interface is used for parameterisation and controlling the drive. This enables the drive to be integrated into a fieldbus network and controlled by a PLC.</p>
<i>Equipotential bonding connection</i>	<p>We recommend connecting the compact drive and machine conductively with the equipotential bonding connection to improve the EMC behaviour.</p>

1.4.4 Parameters and operating mode

<i>Electronic Data Sheet</i>	<p>The compact drive stores configuration and parameter data for gearbox, motor and power electronics in the electronic data sheet. The values are permanently stored in the drive when it delivered and be read out via the fieldbus.</p>
<i>Electronic log-books</i>	<p>2 electronic log-books record data from the movement mode. The following are stored:</p> <ul style="list-style-type: none"> • operating time of the drive • total time of drive in positioning mode • number of positionings. <p>When the drive power is shut off the positioning controller uses the voltage of the internal charging capacitors to transfer the movement data to a log-book. Every eight hours of total positioning time the data are also saved to the second log-book.</p>
<i>Application parameters</i>	<p>Travel parameters and settings for the operating modes and functions of the compact drive are saved in a non-volatile data range and can be read and adjusted via the fieldbus. The compact drive is delivered with a factory setting. This setting remains saved in the event of power failure and can be reactivated by a fieldbus command.</p>

1.5 Type code

Example:		IcIA	N06	5	/	2	DC024	V-007	K	CAN	00
Product family Intelligent Compact Drive IcIA		IcIA	N06	5	/	2	DC024	V-007	K	CAN	00
Size (flange) N06 = 66 mm		IcIA	N06	5	/	2	DC024	V-007	K	CAN	00
Motor package length 5 = 18 mm		IcIA	N06	5	/	2	DC024	V-007	K	CAN	00
Number of pole pairs 2 = 2 pair of poles 4 = 4 pair of poles ¹⁾		IcIA	N06	5	/	2	DC024	V-007	K	CAN	00
Supply voltage DC024 = 24VDC		IcIA	N06	5	/	2	DC024	V-007	K	CAN	00
Gearing type	Step-up gear	IcIA	N06	5	/	2	DC024	V-007	K	CAN	00
O- without gearing	O-000										
V - with spur wheel gears	430:63 160:9 75:2 490:9 3675:32										
	V-007 V-018 V-038 V-054 V-118										
1 - with planetary gears	16:1 40:1 60:1 120:1										
	1-016 1-040 1-060 1-120										
G - with angled planetary gear	16:1 40:1 60:1 120:1										
	G-016 G-040 G-060 G-120										
U - with angled wormgear	525:22 1715:32 735:8 3675:32										
	U-024 U-054 U-092 U-115										
Shaft type R = round, smooth shaft (gearing type O and V only) K = parallel key (gearing type V, 1 and G only) F = D-shaped shaft (gearing type V only) H = hollow shaft (gearing type U only)		IcIA	N06	5	/	2	DC024	V-007	K	CAN	00
Communication interface CAN = CANopen		IcIA	N06	5	/	2	DC024	V-007	K	CAN	00
Reserve 00		IcIA	N06	5	/	2	DC024	V-007	K	CAN	00

1) Type on enquiry

1.6 Documentation and literature references

The following User's manuals are supplied with this drive system:

- **Product manual**, describes the technical data, installation, commissioning and all operating modes and operating functions.
- **Fieldbus manual**, important description of integrating the product into a fieldbus.

Source product manuals The current product manuals are available for download from the Internet.
<http://www.berger-lahr.com/download>



Additional literature We recommend the following literature for more in-depth information:

- Ellis, George: Control System Design Guide. Academic Press
- Kuo, Benjamin; Golnaraghi, Farid: Automatic Control Systems. John Wiley & Sons

1.7 Directives and standards

<i>CE mark</i>	With the declaration of conformity and the CE mark on the product the manufacturer certifies that the product complies with the requirements of all relevant EC directives.
<i>EC Machine Directive</i>	<p>The drive systems described here are not machines as defined by the EC Machine Directive (98/37/EEC) but components for installation in machines. They do not have moving parts designed for specific purposes. However, they can be components of a machine or system.</p> <p>The manufacturer must certify that the complete system conforms to the machine directive with the CE mark.</p>
<i>EC EMC Directive</i>	<p>The EC Electromagnetic Compatibility Directives (89/336/EEC) applies to products that cause electromagnetic interference or whose operation may be adversely affected by electromagnetic interference.</p> <p>Conformity with the EMC Directive can only be expected of drive systems after correct installation in the machine. The information on ensuring electromagnetic compatibility given in the chapter on "Installation" must be followed to ensure that the drive system in the machine or system is EMC-compatible and that the product can legally be operated.</p>
<i>EC Low-Voltage Directive</i>	The EC Low Voltage Directive (73/23/EEC) is not applicable to the compact drive, because it is operated with CD current under 50 V.
<i>Declaration of conformity</i>	The declaration of conformity certifies that the drive system complies with the specific EC directive.
<i>Standards for safe operation</i>	<p>EN 50178: Fitting power systems with electronic equipment</p> <p>IEC 60204-1: Electrical equipment of machines, General requirements</p> <p>IEC 60034-ff: Rotating electrical machines</p> <p>IEC 61800-1: Variable-speed electrical drives</p>
<i>Standards for compliance with environmental conditions</i>	IEC 60068-2-ff: Environmental tests
<i>Standards for compliance with EMC limit values</i>	IEC 61800-3: Variable-speed electrical drives

1.8 Declaration of conformity

<u>EC Declaration of Conformity</u> <u>Year 2007</u>		
BERGER LAHR GmbH & Co.KG Breslauer Str. 7 D-77933 Lahr		
<input type="checkbox"/> according to EC Directive Low Voltage 73/23/EEC, changed by CE Marking Directive 93/68/EEC <input type="checkbox"/> according to EC Directive on Machinery 98/37/EC <input checked="" type="checkbox"/> according to EC Directive EMC 2004/108/EC		
We declare that the products listed below meet the requirements of the mentioned EC Directives with respect to design, construction and version distributed by us. This declaration becomes invalid with any modification on the products not authorized by us.		
Designation :		Intelligent Compact Drive
Type:		IcIA N065
Product number:		00180012xxxxx
Applied harmonized standards, especially:	EN 61800-3:2001, second environment according to Berger Lahr EMC test conditions	
Applied national standards and technical specifications, especially:	Berger Lahr EMC test conditions 200.47-01 EN Product documentation	
<div style="display: flex; justify-content: space-between;"> <div> Company stamp: Berger Lahr GmbH & Co. KG Postfach 11 80 · D-77901 Lahr Breslauer Str. 7 · D-77933 Lahr </div> <div style="text-align: center;">  </div> </div>		
Date/ Signature:		20 July 2007
Name/ Department:		Wolfgang Brandstätter/R & D

2 Safety

2.1 Qualification of personnel

Only technicians who are familiar with and understand the contents of this manual and the other relevant manuals are authorised to work on and with this drive system. The technicians must be able to detect potential dangers that may be caused by setting parameters, changing parameter values and generally by the mechanical, electrical and electronic equipment.

The technicians must have sufficient technical training, knowledge and experience to recognise and avoid dangers.

The technicians must be familiar with the relevant standards, regulations and safety regulations that must be observed when working on the drive system.

2.2 Intended use

The compact drive is a variable speed drive with a permanent-field electronically commutated motor, integrated control electronics and optional integrated gearing.

The drive is an OEM component and should be used in machines and systems in the configuration described.

The drive systems described here are products for general use that conform to the state of the art in technology and are designed to prevent any dangers. However, drives and drive controllers that are not specifically designed for safety functions are not approved for applications where the functioning of the drive could endanger persons. The possibility of unexpected or unbraked movements can never be totally excluded without additional safety equipment. For this reason personnel must never be in the danger zone of the drives unless additional suitable safety equipment prevents any personal danger. This applies to operation of the machine during production and also to all service and maintenance work on drives and the machine. The machine design must ensure personal safety. Suitable measures for prevention of property damage are also required.

In the system configuration described the drive systems must be used in industrial applications only and must have a fixed connection only.

In all cases the applicable safety regulations and the specified operating conditions, such as environmental conditions and specified technical data, must be observed.

The drive system must not be commissioned and operated until completion of installation in accordance with the EMC regulations and the specifications in this manual.

To prevent personal injury and damage to property damaged drive systems must not be installed or operated.

Changes and modifications of the drive systems are not permitted and if made all no warranty and liability will be accepted.

The drive system must be operated only with the specified wiring and approved accessories. In general, use only original accessories and spare parts.

The drive systems must not be operated in an environment subject to explosion hazard (ex area).

2.3 Hazard categories

Safety notes and general information are indicated by hazard messages in the manual. In addition there are symbols and instructions affixed to the product that warn of possible hazards and help to operate the product safely.

Depending on the seriousness of the hazard, the messages are divided into three hazard categories.

DANGER

DANGER indicates an imminently hazardous situation, which, if not avoided, **will result** in death, serious injury, or equipment damage.

WARNING

WARNING indicates a potentially hazardous situation, which, if not avoided, **can result** in death, serious injury, or equipment damage.

CAUTION

CAUTION indicates a potentially hazardous situation, which, if not avoided, **can result** in injury or equipment damage.

2.4 General safety instructions

DANGER

Motor out of view

When the system is started the drives are generally out of the operator's view and cannot be visually monitored.

- Only start the system if there are no persons in the operating zone of the moving components and the system can be operated safely.

Failure to follow these instructions will result in death or serious injury.

WARNING

Loss of control

- Observe the accident prevention regulations. (For USA see also NEMA ICS1.1 and NEMA ICS7.1)
- The system manufacturer must take the potential error possibilities of the signals and the critical functions into account to ensure a safe status during and after errors. Some examples are: emergency stop, final position limitation, power failure and restart.
- The assessment of error possibilities must also include unexpected delays and the failure of signals or functions.
- Suitable redundant control paths must be in place for dangerous functions.
- Check that measures taken are effective.

Failure to follow these instructions can result in death or serious injury.

2.5 Monitoring functions

The monitoring functions in the product protect the system and reduce the risks involved in a system malfunction. These monitoring functions are not sufficient for personal protection.

The following errors and limit values can be monitored:

Monitoring	Task	Protective function
Data link	Error response in event of connection break	Functional safety and system protection
Limit switch signals	Monitoring of permissible area of travel	System protection
Motor overload	Monitoring for excessively high current in the motor phases	Functional safety and device protection
Overvoltage and undervoltage	Monitoring for overvoltage and undervoltage of the power supply	Functional safety and device protection
Overtemperature	Monitoring device for overtemperature	Device protection
I^2t Limit	Power limitation in event of overloading	Device protection

3 Technical Data

3.1 Environmental conditions

When considering the ambient temperature a distinction is made between the permissible temperatures during operation and the permissible storage and transport temperature.

ambient operating temperature

The maximum permissible ambient air temperature during operation depends on the clearance between the units and the required output. The relevant requirements in the chapter on installation are also very important.

Ambient temperature without power reduction	[°C]	+5 ... +40 class 3K3, DIN EN 60721-3-3
---	------	---

Ambient climate for transport and storage

The environment during transport and storage must be dry and dust-free. The maximum oscillation and shock stress must be within the specified limits. The bearing and transport temperature must remain within the specified range.

Storage temperature	[°C]	-25 ... +55 class 1K4, DIN EN 60721-3-1
---------------------	------	--

Transport temperature	[°C]	-25 ... +70 class 2K3, DIN EN 60721-3-2
-----------------------	------	--

Relative humidity

The relative humidity is allowed as follows:

Operation	[%]	5 ... 85 class 3K3, DIN EN 60721-3-3
-----------	-----	---

Storage	[%]	5 ... 95 class 1K3, DIN EN 60721-3-1
---------	-----	---

Installation height

Installation height without power reduction	[m]	< 1000 m above sea level
---	-----	--------------------------

Oscillations and shocks

Oscillations, sinusoidal	in accordance with IEC/EN 60068-2-6 0.35 mm (from 10Hz ... 60Hz) 50 m/s ² (from 60Hz ... 300Hz)	
Shocks, semisinusoidal	in accordance with IEC/EN 60068-2-27 300 m/s ² (for 18 ms)	

3.2 Electrical and mechanical data

3.2.1 Degree of protection

IP degree of protection Degree of protection according to IEC 60034-5.

	In total, without shaft exit	Shaft exit
without gearing	IP65	IP41
with spur wheel gears	IP65	IP54
with planetary gears	IP65	IP43
with angled planetary gears	IP65	IP43
with angled wormgear	IP65	-

Overview of IP protection

First digit	Second digit
Protection against foreign bodies	Protection against water
0 no protection	0 no protection
1 foreign body > 50mm	1 vertically falling drops
2 foreign body > 12mm	2 diagonally falling drops (75° ... 90°)
3 foreign body > 2.5mm	3 spray water
4 foreign body > 1mm	4 splashing water
5 dust-protected	5 jet water
6 dust-proof	6 heavy sea
	7 immersion
	8 continuous immersion

3.2.2 Service life

max. on-time	%	20
Service life at: 40°C ambient temperature operation with nominal current 20% on-time ¹⁾	h	3000
Service life at: 40°C ambient temperature operation in StandBy	h	80000

1) ca. 2 minute cycle time

3.2.3 IcIA N065 DC024

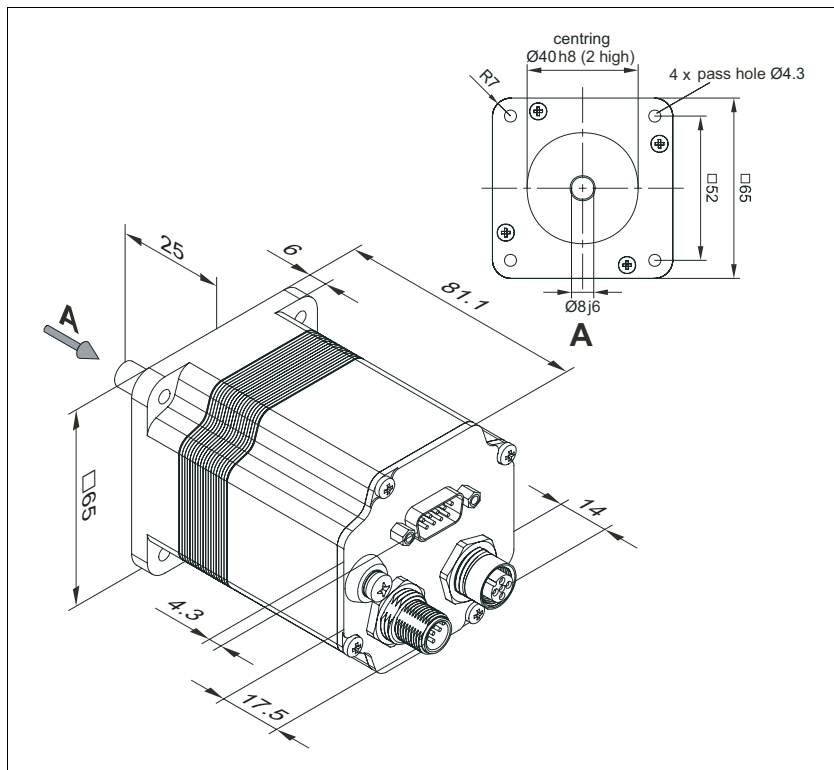
Dimensions

Figure 3.1 Dimensions without gearing

Design data

	Size	Unit		
Nominal voltage	U_{DC}	V	24	
Number of pole pairs	P		2	4
Rated speed	n_N	rpm	4350	
Nominal current	I_{NDC}	A	3.79	
Ready-for-operation current	I_0	A	0.09	
max. Phase current	\hat{i}	A	6.0	
Torque constant	k_M	Nm/A	0.036	
Nominal output	P_N	W	71	
Nominal motor torque	M_N	Nm	0.155	
Starting torque	M_{max}	Nm	0.22	
Detent torque	M_S	Nm	0.08	0.015
Moment of inertia	J_R	g cm ²	151	
Min. speed ¹⁾	n_{min}	inc./s 1/min	60 300	30 75
max. Speed	n_{max}	1/min	5000	
Positioning resolution		Inc./rev	12	24
Positioning resolution		°	30	15
Positioning accuracy		Inc.	±1	
Mass	m	kg	0.8	

1) from software version V1.015

Shaft load

max. radial force ¹⁾	N	80
max. axial force pull	N	30
Nominal bearing lifetime L_{10h} ²⁾	h	20000

1) point of attack of radial shaft load: 12.5 mm distance from flange

2) operating hours at a probability of failure of 10%

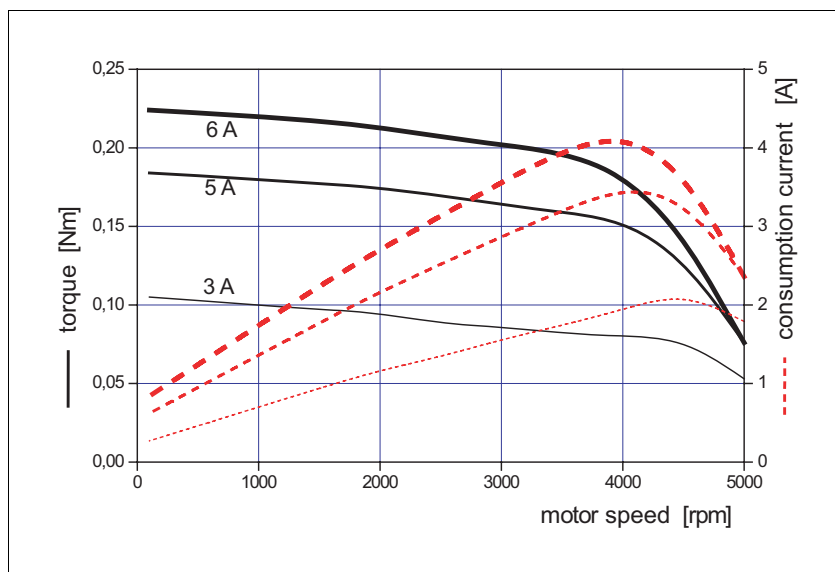
Characteristic curves

Figure 3.2 Torque and flow characteristics IcIA N065 DC024

Dimensions

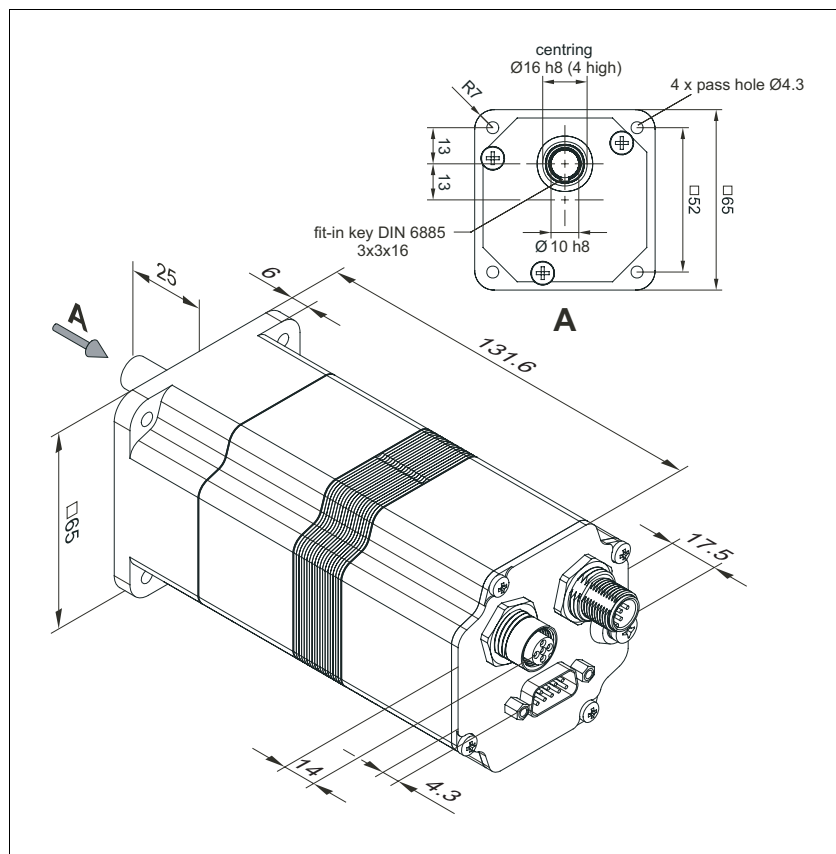


Figure 3.3 Dimensions with spur wheel gear

Design data

	Size	Unit	V-007	V-018	V-038	V-054	V-115
Nominal voltage	U _{DC}	V	24	24	24	24	24
Gear speeds	n _G		2	3	3	4	4
Ratio	I		430: 63	160: 9	75: 2	490: 9	3675: 32
Number of pole pairs	P		2 4	2 4	2 4	2 4	2 4
Nominal speed ¹⁾	n _N	rpm	4000	4000	4000	4000	4000
Nominal current	I _{N DC}	A	4.43	4.43	4.43	4.43	3.16
Ready-for-operation current	I ₀	A	0.09	0.09	0.09	0.09	0.09
max. Phase current	î	A	6.0	6.0	6.0	6.0	4.5
Torque constant ¹⁾	k _M	Nm/A	0.036	0.036	0.036	0.036	0.036
Gear efficiency	η _G		0.90	0.86	0.86	0.81	0.81
Nominal output	P _N	W	68	64	64	61	45
Nominal output torque ²⁾	M _N	Nm	1.1	2.7	5.8	7.9	12.3
Starting torque ²⁾	M _{max}	Nm	1.3	3.3	6.9	9.6	15.2
Nominal output speed ²⁾	n _N	rpm	586	225	107	73	35
Detent torque	M _S	Nm	0.5 0.1	1.3 0.3	2.8 0.6	4.1 0.8	8.6 1.7
Moment of inertia ¹⁾	J _R	g cm ²	151	151	151	151	151
Moment of inertia ²⁾	J _R	kg m ²	0.0007	0.0048	0.0212	0.0448	0.1992
Min. speed ^{2) 3)}	n _{min}	1/min	44 11	16.9 4.2	8 2	5.5 1.4	2.6 0.7
max. Speed ²⁾	n _{max}	1/min	733	281	133	92	44
Torsional play ²⁾		°	≤ 1.5	≤ 1.0	≤ 1.0	≤ 1.0	≤ 1.0
Positioning resolution ¹⁾		Inc./rev	12 24	12 24	12 24	12 24	12 24
Positioning resolution ²⁾		°	4.40 2.20	1.69 0.84	0.80 0.40	0.55 0.28	0.26 0.13
Positioning accuracy ¹⁾		Inc.	±1	±1	±1	±1	±1
Mass	m	kg	1.1	1.2	1.2	1.2	1.2

1) with reference to motor shaft

2) with reference to gearing output shaft

3) From software version V1.015

	V-007	V-018	V-038	V-054	V-115
Shaft load (short-time operation)					
max. radial force ¹⁾	N	200	200	200	200
max. axial force	N	80	80	80	80
Nominal service life L _{10h} ²⁾	h	2500	2500	2500	2500
Shaft load (continuous operation)					
max. radial force ¹⁾	N	200	200	200	200
max. axial force	N	10	10	10	10
Nominal service life L _{10h} ²⁾	h	15000	15000	15000	15000

1) point of attack of radial shaft load: 12.5 mm distance from flange

2) operating hours at a probability of failure of 10%

Characteristic curves

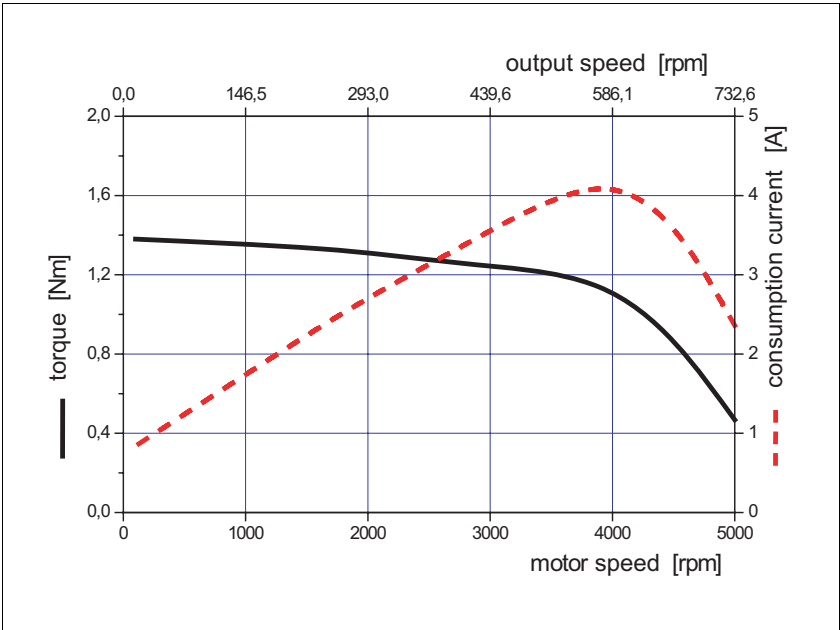


Figure 3.4 Torque and flow characteristics IcIA N065 DC024 V-007

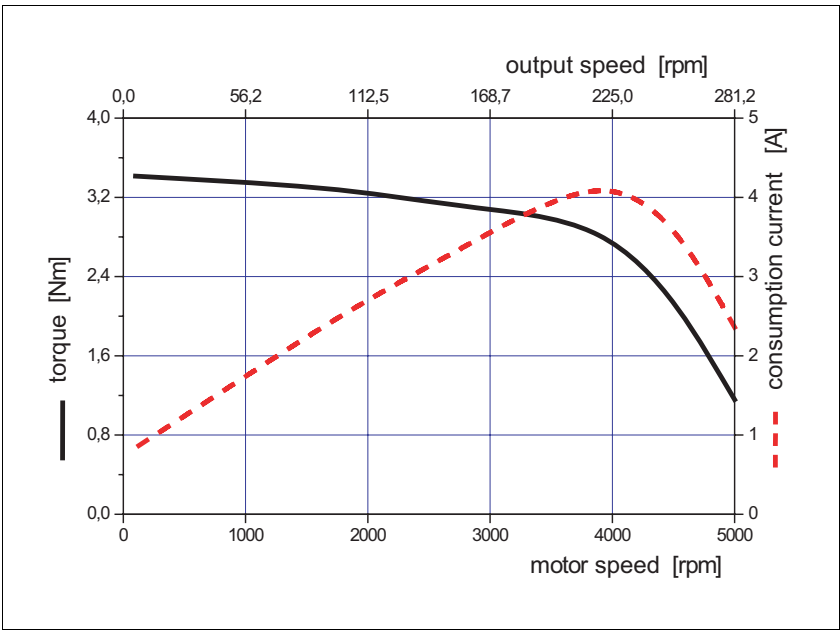


Figure 3.5 Torque and flow characteristics IcIA N065 DC024 V-018

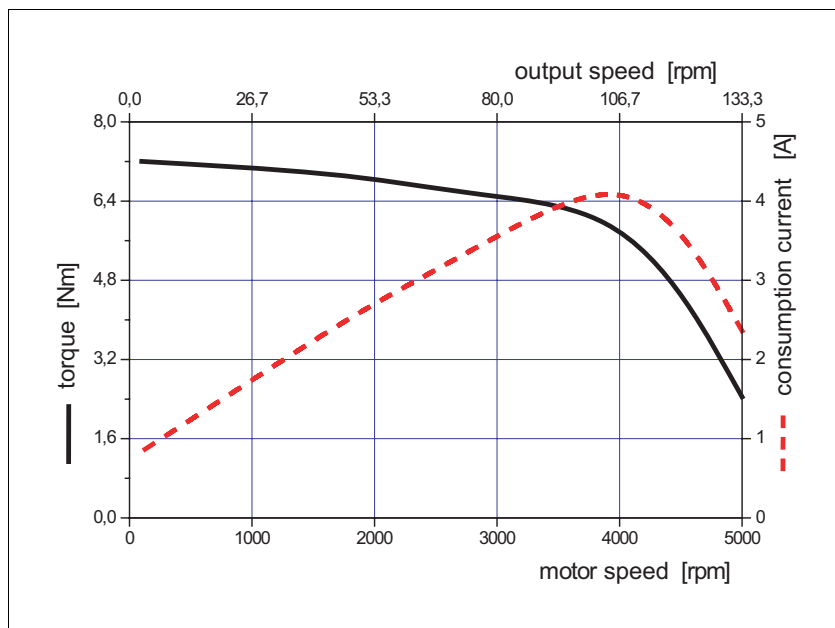


Figure 3.6 Torque and flow characteristics IcIA N065 DC024 V-038

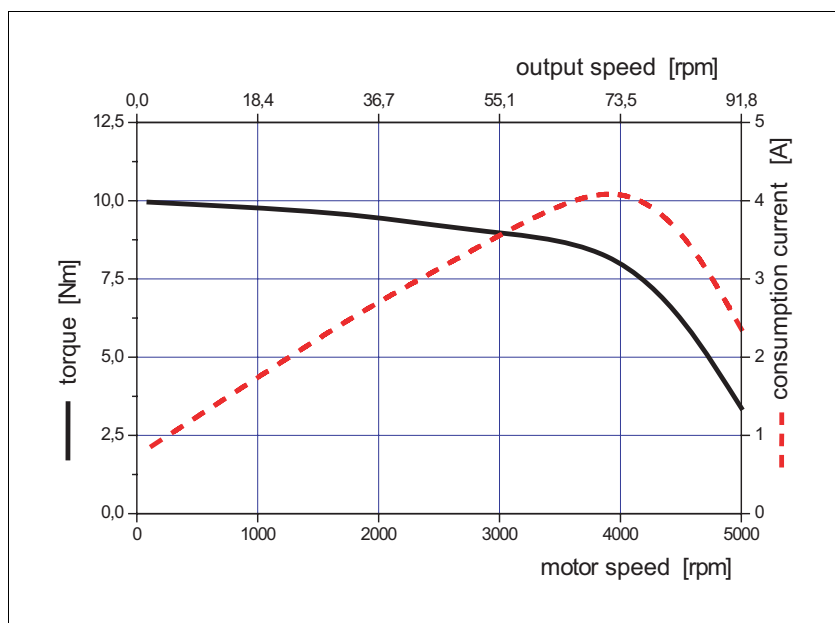


Figure 3.7 Torque and flow characteristics IcIA N065 DC024 V-054

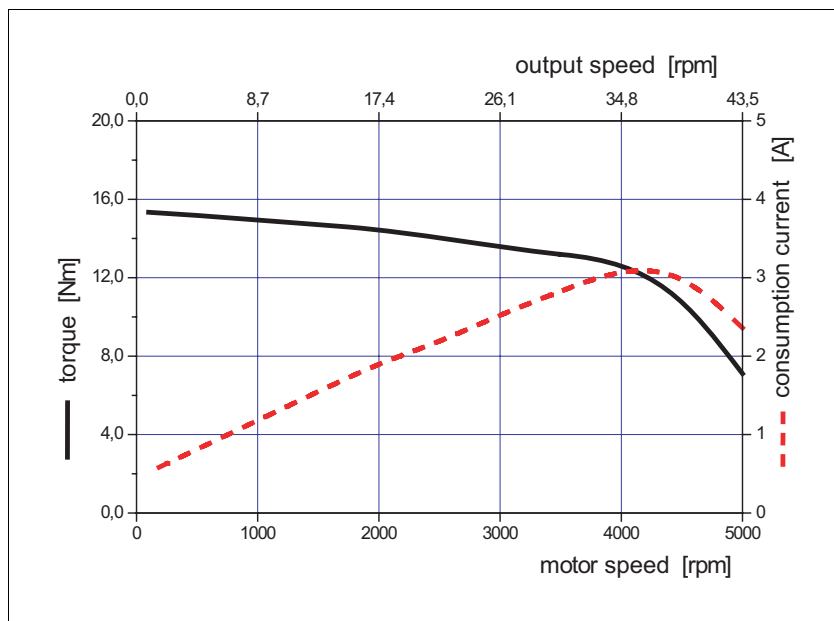


Figure 3.8 Torque and flow characteristics IcIA N065 DC024 V-115

3.2.5 IcIA N065 1- with planetary gear

Dimensions

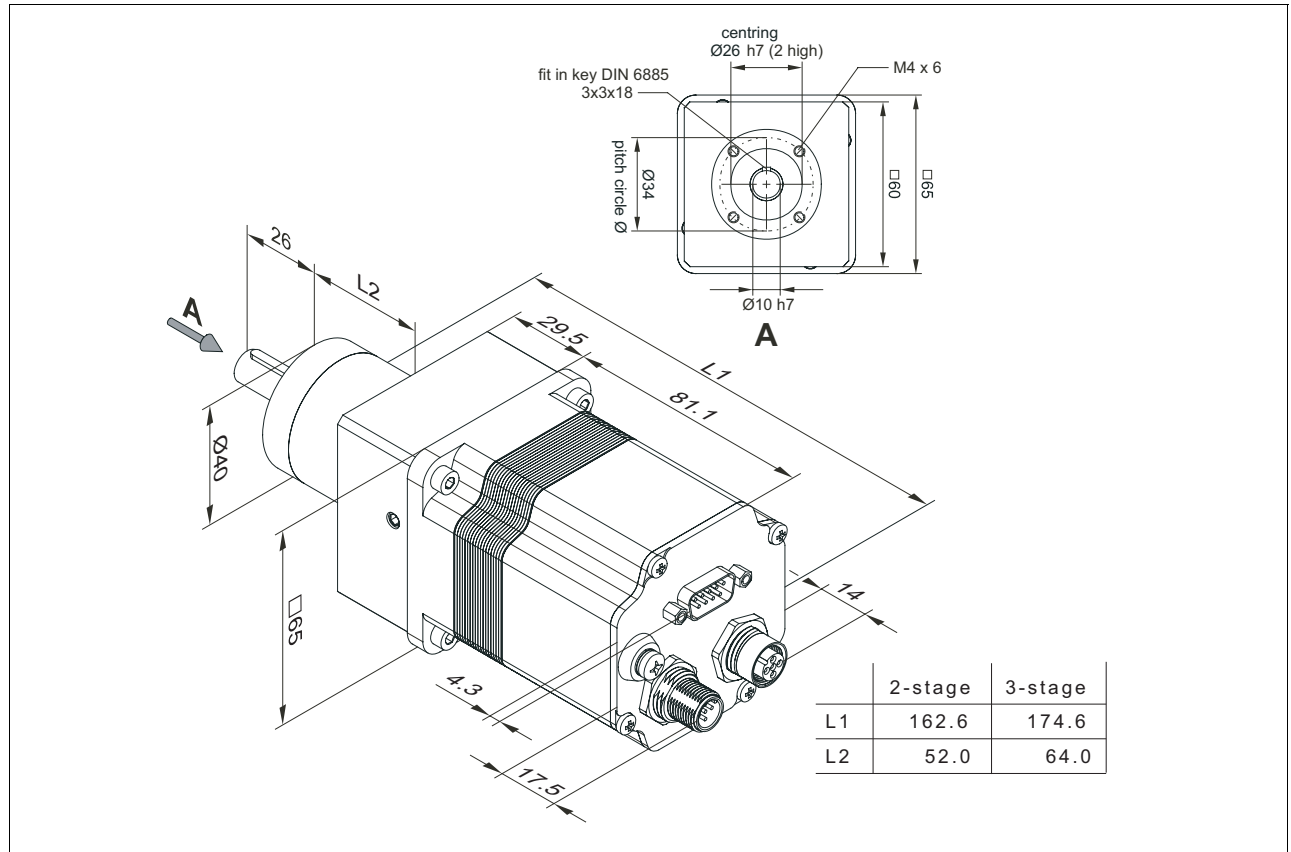


Figure 3.9 Dimensions with planetary gear

Design data

	Size	Unit	1-016		1-040		1-060		1-120	
Nominal voltage	U_{DC}	V	24		24		24		24	
Gear speeds	n_G		2		2		3		3	
Ratio	i		16:1		40:1		60:1		120:1	
Number of pole pairs	P		2	4	2	4	2	4	2	4
Nominal speed ¹⁾	n_N	rpm	4000		4000		4000		4000	
Nominal current	$I_{N DC}$	A	4.43		4.43		4.43		3.85	
Ready-for-operation current	I_0	A	0.09		0.09		0.09		0.09	
max. Phase current	\hat{i}	A	6.0		6.0		6.0		5.4	
Torque constant ¹⁾	k_M	Nm/A	0.036		0.036		0.036		0.036	
Gear efficiency	η_G		0.94		0.94		0.90		0.90	
Nominal output	P_N	W	71		71		67		63	
Nominal output torque ²⁾	M_N	Nm	2.7		6.8		9.7		18.0	
Starting torque ²⁾	M_{max}	Nm	3.3		8.1		11.6		21.0	
Nominal output speed ²⁾	n_N	rpm	250		100		67		33	
Detent torque	M_S	Nm	1.2	0.2	3.0	0.6	4.5	0.9	9.0	1.8
Moment of inertia ¹⁾	J_R	g cm ²	151		151		151		151	
Moment of inertia ²⁾	J_R	kg m ²	0.0039		0.0242		0.0544		0.2174	
Min. speed ^{2) 3)}	n_{min}	1/min	18.8	4.7	7.5	1.9	5	1.3	2.5	0.6
max. Speed ²⁾	n_{max}	1/min	313		125		83		42	
Torsional play ²⁾		°	≤ 0.58		≤ 0.58		≤ 0.67		≤ 0.67	
Positioning resolution ¹⁾		Inc./rev	12	24	12	24	12	24	12	24
Positioning resolution ²⁾		°	1.88	0.94	0.75	0.38	0.50	0.25	0.25	0.13
Positioning accuracy ¹⁾		Inc.	±1		±1		±1		±1	
Mass	m	kg	1.4		1.4		1.5		1.5	

1) with reference to motor shaft

2) with reference to gear output shaft

3) from software version V1.015

Shaft load		1-016	1-040	1-060	1-120
max. radial force ¹⁾	N	200	200	200	200
max. axial force	N	200	200	200	200
Nominal service life L_{10h} ²⁾	h	10000	10000	10000	10000

1) measured at the centre of the output shaft

2) operating hours at a probability of failure of 10%

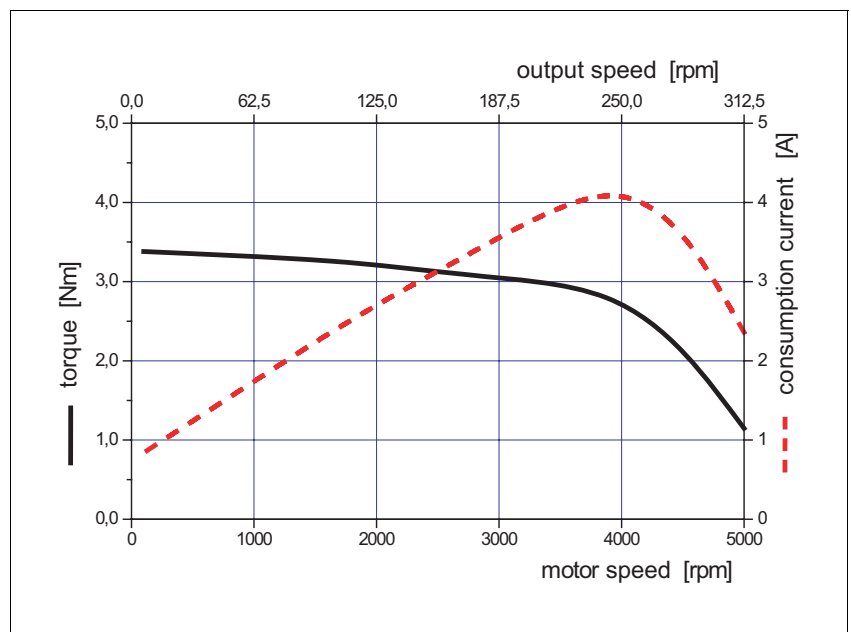
Characteristic curves

Figure 3.10 Torque and flow characteristics IcIA N065 DC024 1-016

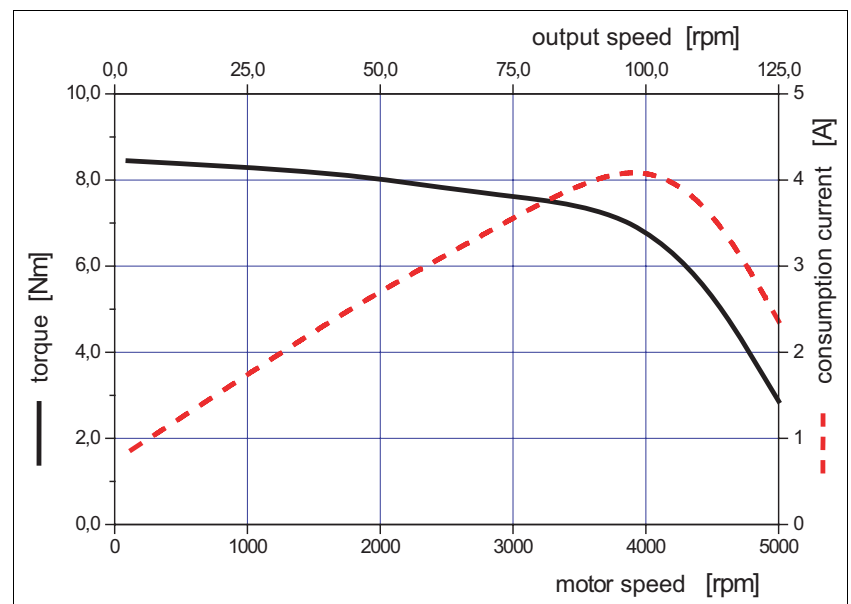


Figure 3.11 Torque and flow characteristics IcIA N065 DC024 1-040

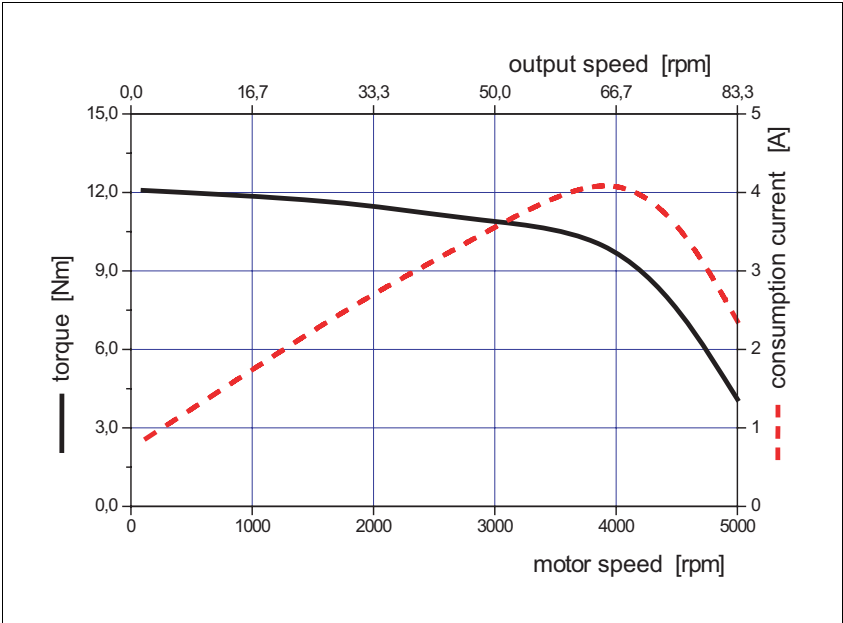


Figure 3.12 Torque and flow characteristics IcIA N065 DC024 1-060

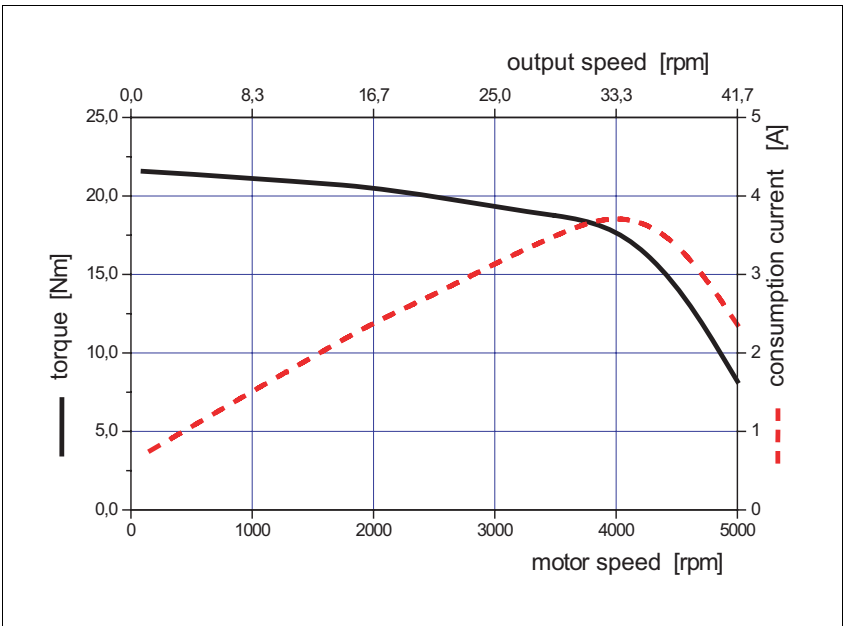


Figure 3.13 Torque and flow characteristics IcIA N065 DC024 1-120

3.2.6 IcIA N065 G- with angled planetary gears

Dimensions

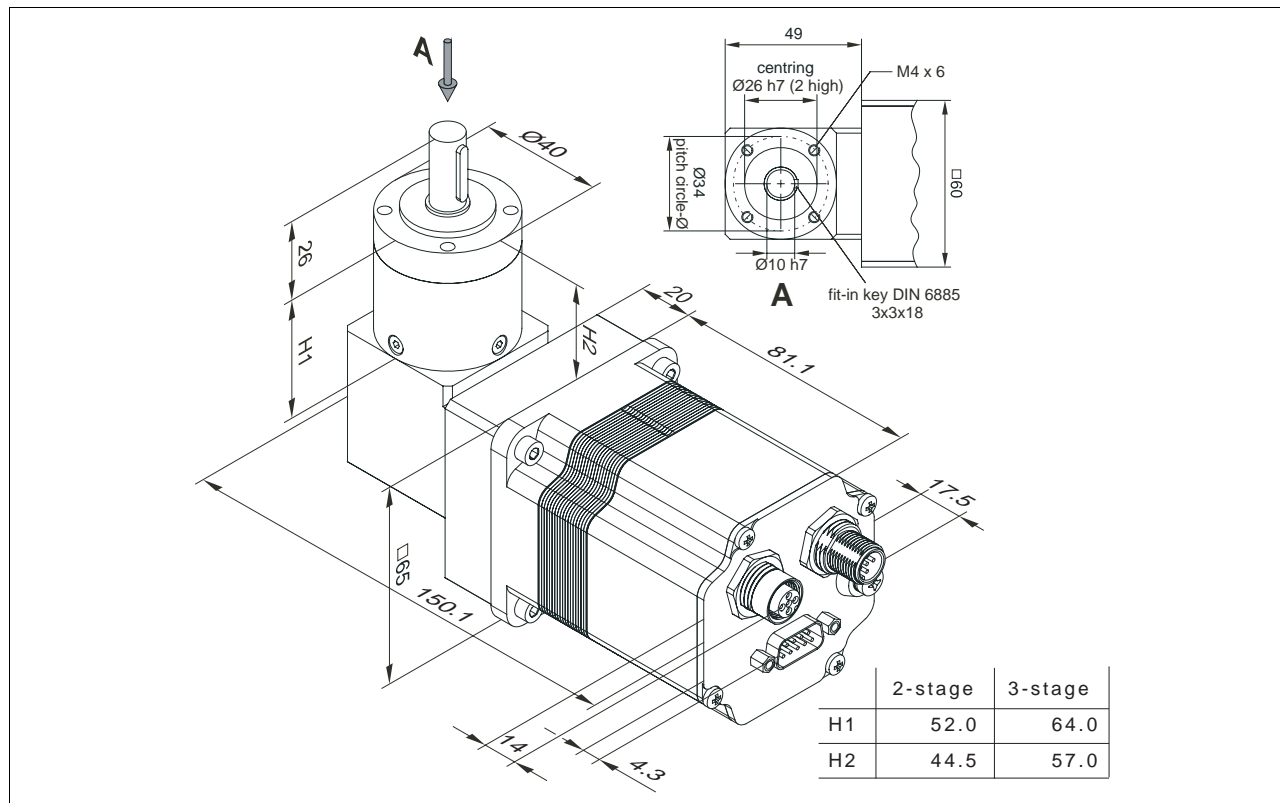


Figure 3.14 Dimensions angled planetary gears

Design data

	Size	Unit	G-016		G-040		G-060		G-120	
Nominal voltage	U_{DC}	V	24		24		24		24	
Gear speeds	n_G		2		2		3		3	
Ratio	i		16:1		40:1		60:1		120:1	
Number of pole pairs	P		2	4	2	4	2	4	2	4
Nominal speed ¹⁾	n_N	rpm	4000		4000		4000		4000	
Nominal current	$I_{N DC}$	A	4.43		4.43		4.43		3.95	
Ready-for-operation current	I_0	A	0.09		0.09		0.09		0.09	
max. Phase current	\hat{i}	A	6.0		6.0		6.0		5.5	
Torque constant ¹⁾	k_M	Nm/A	0.036		0.036		0.036		0.036	
Gear efficiency	η_G		0.92		0.92		0.88		0.88	
Nominal output	P_N	W	69		69		66		63	
Nominal output torque ²⁾	M_N	Nm	2.6		6.6		9.5		18.0	
Starting torque ²⁾	M_{max}	Nm	3.2		8.0		11.5		21.0	
Nominal output speed ²⁾	n_N	rpm	250		100		67		33	
Detent torque	M_S	Nm	1.2	0.2	3.0	0.6	4.5	0.9	9.0	1.8
Moment of inertia ¹⁾	J_R	g cm ²	151		151		151		151	
Moment of inertia ²⁾	J_R	kg m ²	0.0039		0.0242		0.0544		0.2174	
Min. speed ^{2) 3)}	n_{min}	1/min	18.8	4.7	7.5	1.9	5	1.3	2.5	0.6
max. Speed ²⁾	n_{max}	1/min	313		125		83		42	
Torsional play ²⁾		°	≤ 0.75		≤ 0.75		≤ 0.83		≤ 0.83	
Positioning resolution ¹⁾		Inc./rev	12	24	12	24	12	24	12	24
Positioning resolution ²⁾		°	1.88	0.94	0.75	0.38	0.50	0.25	0.25	0.13
Positioning accuracy ¹⁾		Inc.	±1		±1		±1		±1	
Mass	m	kg	1.6		1.6		1.7		1.7	

1) with reference to motor shaft

2) with reference to gear output shaft

3) from software version V1.015

Shaft load		G-016	G-040	G-060	G-120
max. radial force ¹⁾	N	200	200	200	200
max. axial force	N	200	200	200	200
Nominal service life L_{10h} ²⁾	h	10000	10000	10000	10000

1) measured at the centre of the output shaft

2) operating hours at a probability of failure of 10%

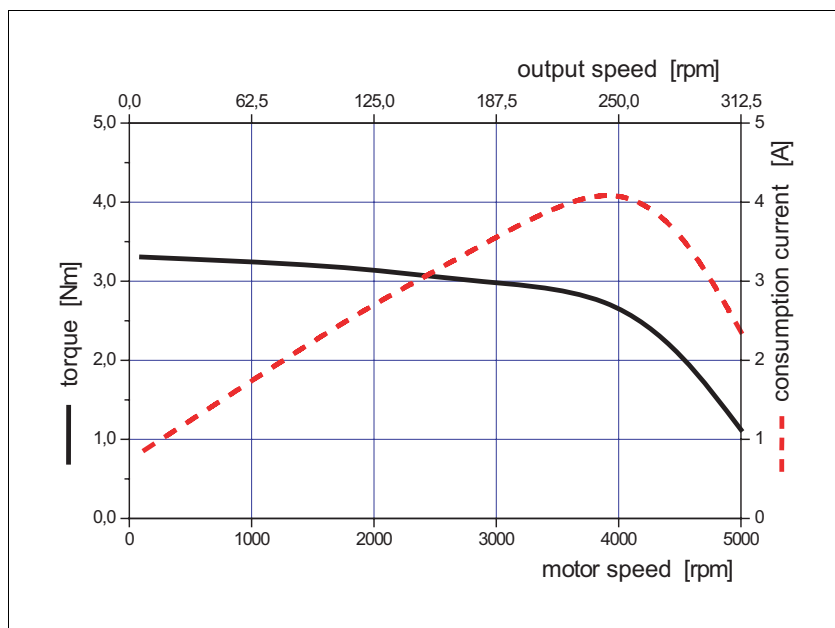
Characteristic curves

Figure 3.15 Torque and flow characteristics IcIA N065 DC024 G-016

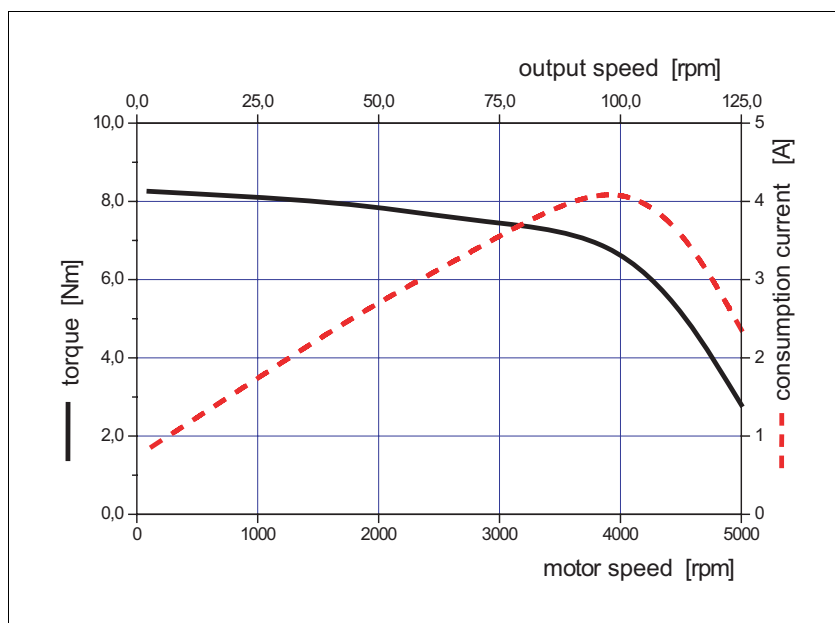


Figure 3.16 Torque and flow characteristics IcIA N065 DC024 G-040

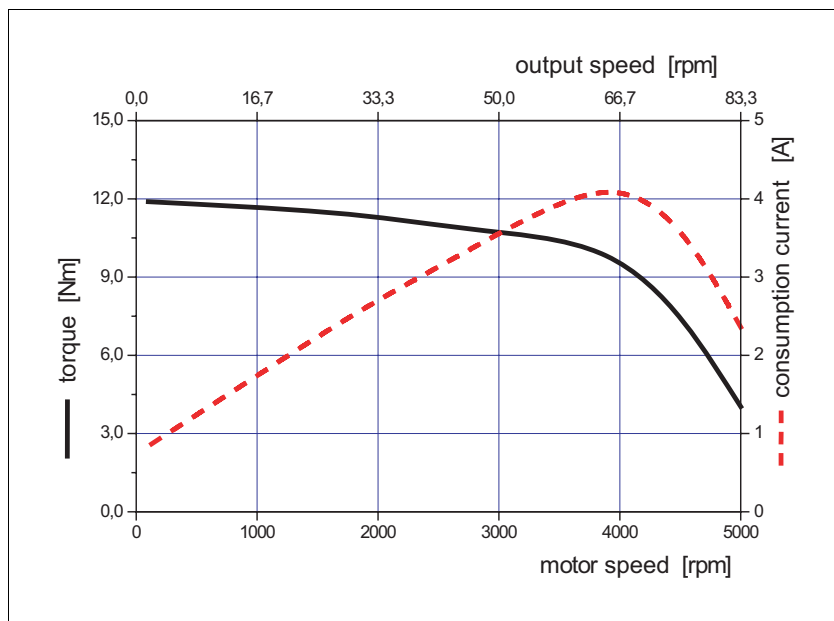


Figure 3.17 Torque and flow characteristics IcIA N065 DC024 G-060

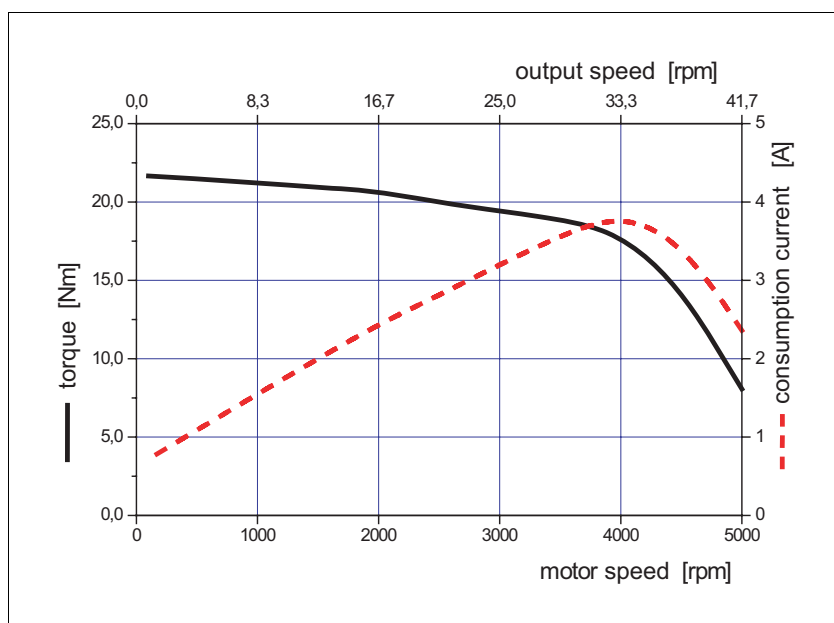


Figure 3.18 Torque and flow characteristics IcIA N065 DC024 G-120

3.2.7 IcIA N065 U- with angled wormgear

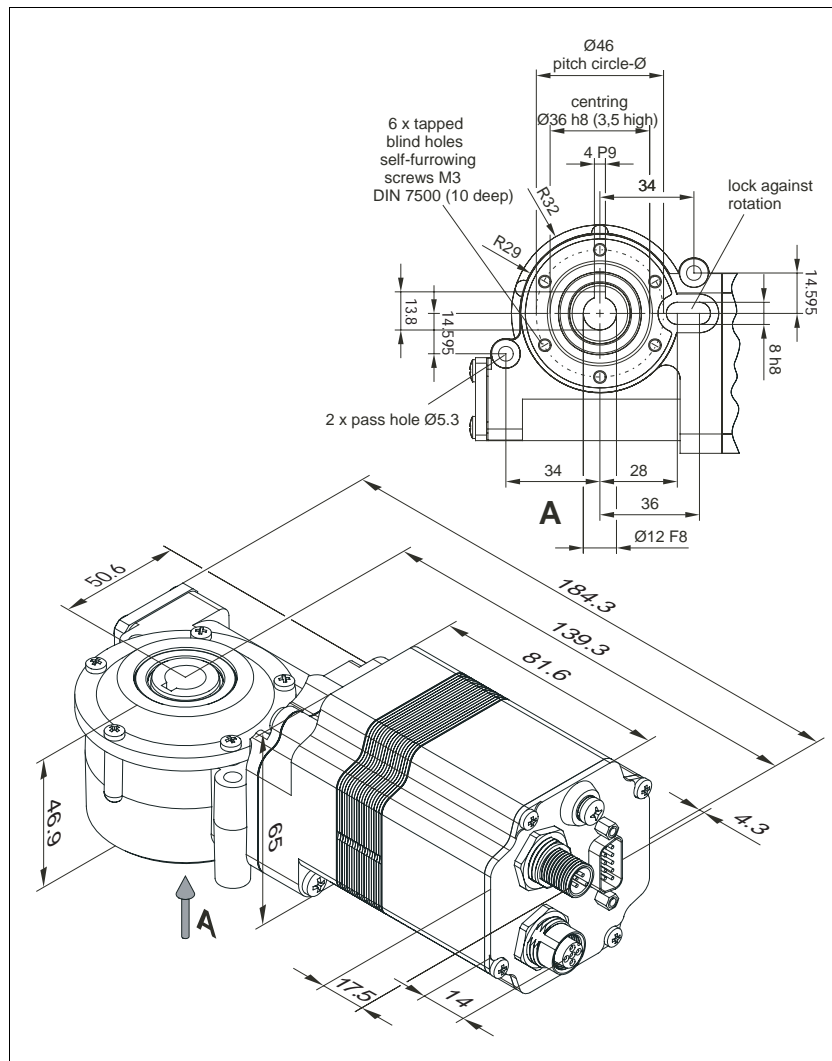
Dimensions

Figure 3.19 Dimensions with angled wormgear

Design data

	Size	Unit	U-024		U-054		U-092		U-115	
Nominal voltage	U_{DC}	V	24		24		24		24	
Gear speeds	n_G		2		3		3		3	
Ratio	i		525: 22		1715: 32		735: 8		3675: 32	
Number of pole pairs	P		2	4	2	4	2	4	2	4
Nominal speed ¹⁾	n_N	rpm	4000		4000		4000		4000	
Nominal current	$I_{N DC}$	A	4.43		4.43		4.43		4.43	
Ready-for-operation current	I_0	A	0.09		0.09		0.09		0.09	
max. Phase current	\hat{i}	A	6.0		6.0		6.0		6.0	
Torque constant ¹⁾	k_M	Nm/A	0.036		0.036		0.036		0.036	
Gear efficiency	η_G		0.61		0.62		0.56		0.51	
Nominal output	P_N	W	46		47		42		39	
Nominal output torque ²⁾	M_N	Nm	2.6		6.0		9.2		10.6	
Starting torque ²⁾	M_{max}	Nm	2.2		5.0		7.8		8.9	
Nominal output speed ²⁾	n_N	rpm	168		75		44		35	
Detent torque	M_S	Nm	2.9	0.6	6.5	1.3	12.3	2.5	16.7	3.3
Moment of inertia ¹⁾	J_R	g cm ²	165		150		150		150	
Moment of inertia ²⁾	J_R	kg m ²	0.009		0.043		0.127		0.198	
Min. speed ^{2) 3)}	n_{max}	1/min	12.6	3.1	5.6	1.4	3.3	0.8	2.6	0.7
max. Speed ²⁾	n_{max}	1/min	189		93		54		44	
Torsional play ²⁾		°	≤ 1.5		≤ 1.0		≤ 1.0		≤ 1.0	
Positioning resolution ¹⁾		Inc./rev	12	24	12	24	12	24	12	24
Positioning resolution ²⁾		°	1.26	0.63	0.56	0.28	0.33	0.16	0.26	0.13
Positioning accuracy ¹⁾		Inc.	±1		±1		±1		±1	
Mass	m	kg	1.7		1.7		1.7		1.7	

1) with reference to motor shaft

2) with reference to gear output shaft

3) from software version V1.015

Shaft load		U-024	U-054	U-092	U-115
max. radial force	N	200	200	200	200
max. axial force	N	80	80	80	80
Nominal service life L_{10h} ¹⁾	h	9000	6000	6000	3000

1) operating hours at a probability of failure of 10%

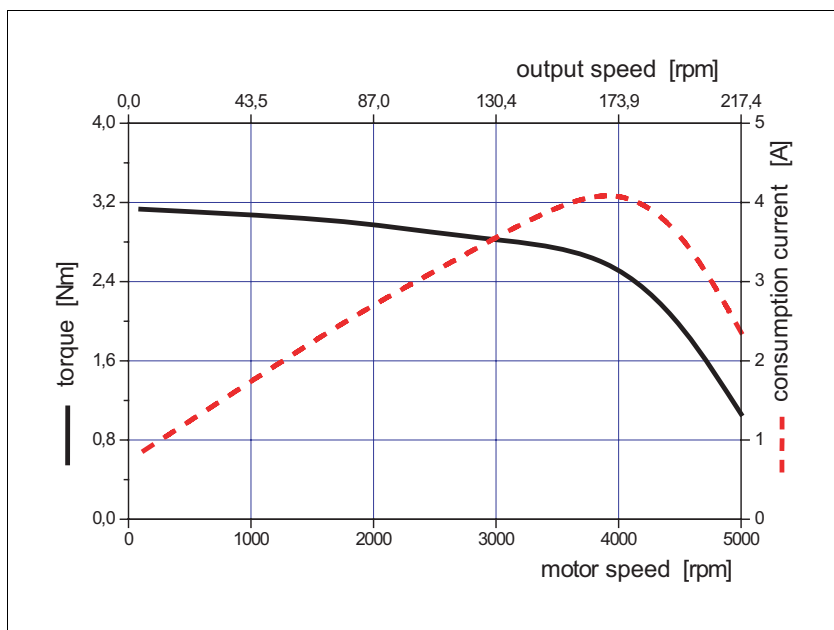
Characteristic curves

Figure 3.20 Torque and flow characteristics IcIA N065 DC024 U-024

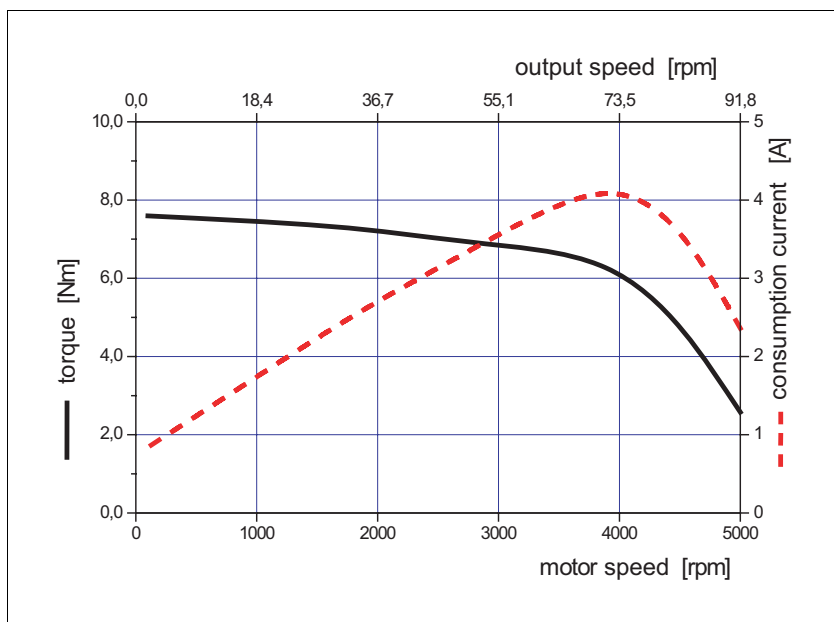


Figure 3.21 Torque and flow characteristics IcIA N065 DC024 U-054

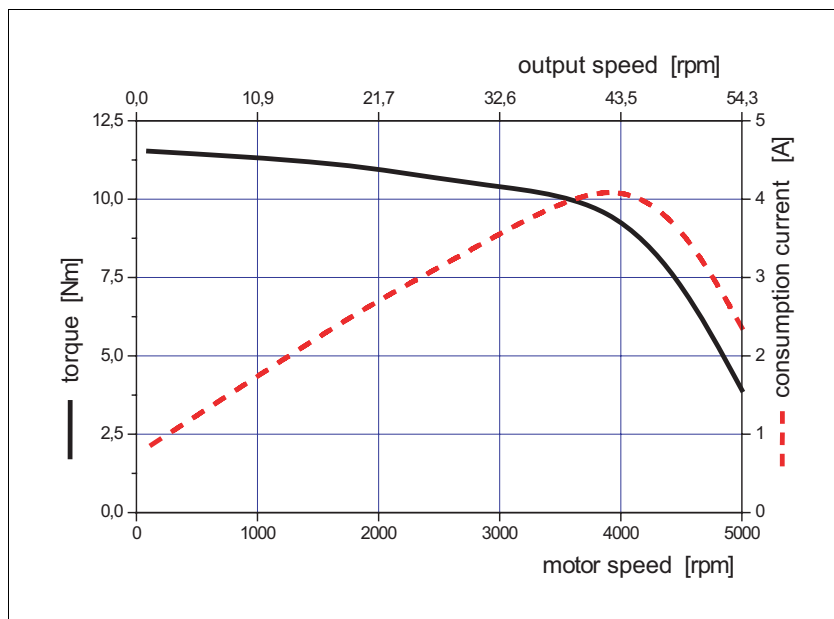


Figure 3.22 Torque and flow characteristics IcIA N065 DC024 U-092

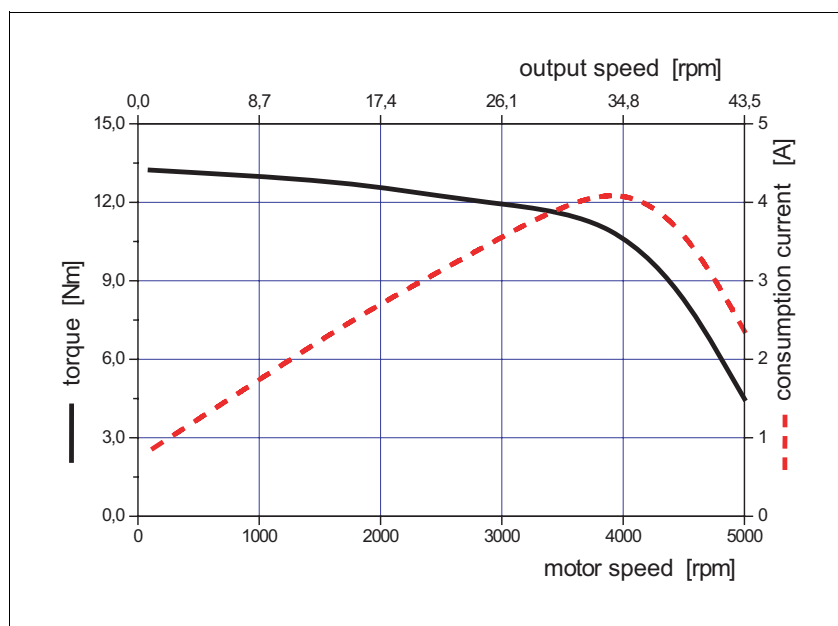


Figure 3.23 Torque and flow characteristics IcIA N065 DC024 U-115

3.2.8 Electrical terminals

Power supply

reverse-polarity-protected

Nominal power supply range	Vdc	19.2... 28.8 (permissible operating range)
Ripple at nominal voltage	V	≤ 3.6
Inrush current	A	Load current for DC bus capacity (500 µF)

24V signal interface

4 signal inputs, 0VDC internally connected with 0VDC supply voltage, reverse-polarity-protected

Permissible low level	V / mA	≤4.5 / ≤0.7
Permissible high level	V / mA	≥15 / ≥2
Admissible voltage range	V	0...30
Debounce time of signal inputs	ms	50 (in manual operation) Without debounce (reference movement switch and limit position sensors)

CAN fieldbus interface

CANIn/CANOut - topology

Signal inputs/outputs		according to ISO 11898, no galvanic isolation
Transmission rate	kBaud	10, 20, 50, 100, 125, 250, 500, 800, 1000
Transmission protocol	CANopen	Communication profile: DS301 V4.02 Device Profile: DSP 402 V2.0

4 Installation

4.1 Electromagnetic compatibility, EMC

⚠ WARNING

Interference with signals and devices

Distorted signals can cause unpredictable device responses.

- Install the wiring in accordance with the EMC requirements.
- Check compliance with the EMC requirements, particularly in an environment subject to strong interference.

Failure to follow these instructions can result in death, serious injury or equipment damage.

⚠ WARNING

Danger from interference with signals and devices

This is a product with restricted availability under IEC 61800-3. It may cause radio interference in the domestic environment.

- Check compliance with the EMC requirements, particularly in an environment subject to strong interference.

Failure to follow these instructions can result in death, serious injury or equipment damage.

The drive and the system are subject to electromagnetic interference. If suitable precautions are not taken, the interference will affect the signals from the control lines and system parts and adversely affect the operating reliability of the system.

Before operation the electromagnetic compatibility of the system must be checked and assured. The drive system conforms to the requirements of the EC directives on EMC immunity to interference under IEC 61800-3 for the second environment where the following actions are taken into account during installation.

To maintain the limit values for the EMC interference resistance and interference radiation the drive must be earthed. It can be grounded from the motor flange or the electronics housing. This is generally done by bolting the motor to an electrically conductive and earthed machine component for sufficient earthing of the drive.

EMC measures	Effect
Keep wiring as short as possible. Do not install "safety loops", short cables from the star point in the switch cabinet to outlying earth connection.	Avoidance of capacitive and inductive interference injection
The electronics case is electrically connected to the motor. Earthing drive through the motor flange. If this is not possible, provide additional earth wire connected to the plug cover lid or with a cable clip to the flange. Note that in this case the drive will not be earthed when the cover is removed.	Reduce emissions, increase interference resistance
Earth shields on digital signal lines over a wide area at both ends or via conductive plug housing.	Preventing interference on control cables, reduction of emissions
Connect large surface areas of cable shields, use cable clamps and tapes	Reduction of emissions.

Table 4.1 EMC measures

Equipotential bonding conductors

The shields are connected at both ends for fault protection. Potential differences can result in excessive currents on the shield and must be prevented by equipotential bonding conductor cables.

If lines over 100 m are approved, the following applies: up to 200 m length a cable cross section of 16 mm² is sufficient, for greater lengths a cable cross section of 20 mm² is required.

4.2 Mechanical installation

⚠ CAUTION

Failure of the drive by mechanical damage

If the maximum allowable forces on the shaft are exceeded, this will result in accelerated bearing wear or shaft breakage.

- Do not exceed the maximum allowable axial and radial forces.
- Protect the shaft against impact.
- Do not exceed the maximum allowable axial force even when pressing on output components.

Failure to follow these instructions can result in injury or equipment damage.

4.2.1 Mounting

- ▶ Check the drive for externally visible damage such as faulty terminal clamps or damage to the housing. Do not install damaged devices.

The compact drive must be fixed with four bolts.

- ▶ Install the drive on a flat horizontal surface to prevent transmission of mechanical tension to the housing.
- ▶ Tighten the flange bolts with spring washers to prevent twisting.

The compact drive becomes hot during operation. Do not enclose the drive in a heatproof enclosure.

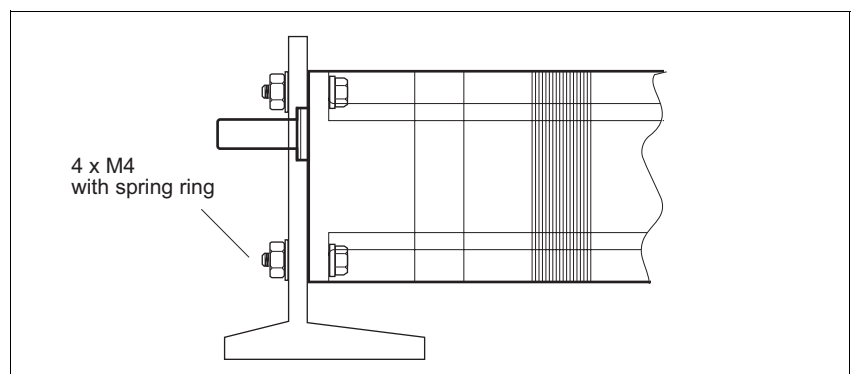


Figure 4.1 Mechanical load

Load Support a flanged spindle or shaft with suitable bearings if it is subject to high transverse or axial forces.

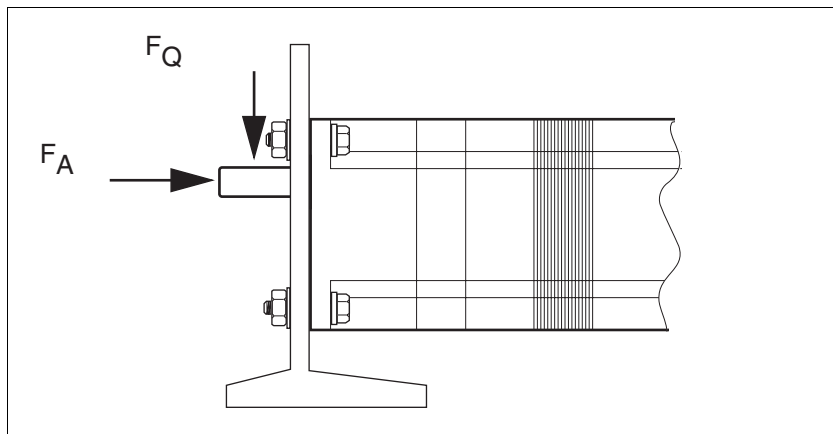


Figure 4.2 Mechanical load

The maximum permissible stress for the various unit types are listed in 3.2 "Electrical and mechanical data".

Differentiation by protection classes

If the shaft exit is dust and waterproof, the drive can be installed in an environment corresponding to IP65.

4.3 Electrical installation

⚠ WARNING

Interference with signals and devices

Distorted signals can cause unpredictable device responses.

- Install the wiring in accordance with the EMC requirements.
- Check compliance with the EMC requirements, particularly in an environment subject to strong interference.

Failure to follow these instructions can result in death, serious injury or equipment damage.

4.3.1 Overview of all connections

The following figure shows all connections in overview.

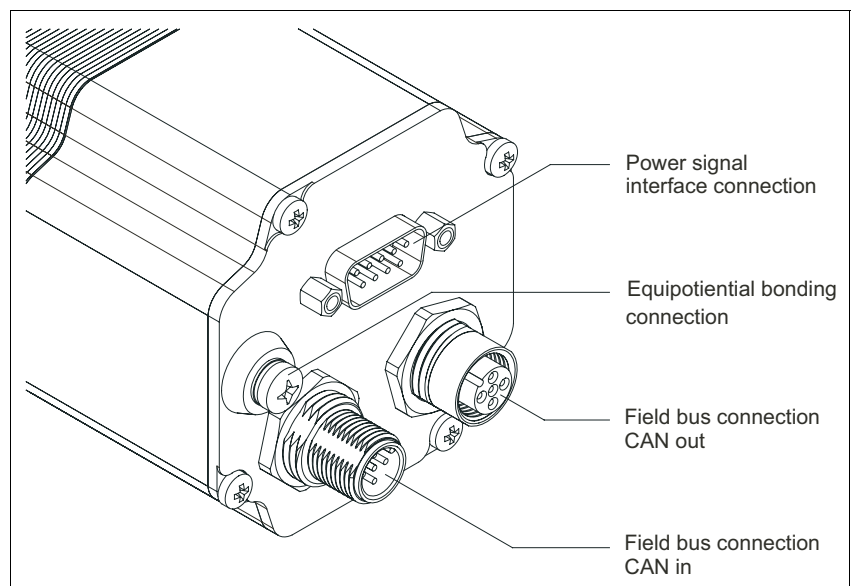


Figure 4.3 Unit connections

- Signal interface, connection for:
 - Supply voltage
 - Control signals (manual operation)
 - Limit switch signals (fieldbus operation)
 - Enable signal
 - Braking Resistor Controller
- Equipotential bonding for grounding via PE busbar
- CAN fieldbus interface

Connect prepared and tested cables only.

4.3.2 Equipotential bonding connection

The shields are connected at both ends for fault protection. Potential differences can result in excessive currents on the shield and must be prevented by equipotential bonding conductor cables.

The compact drive is connected to ground potential via equipotential bonding.

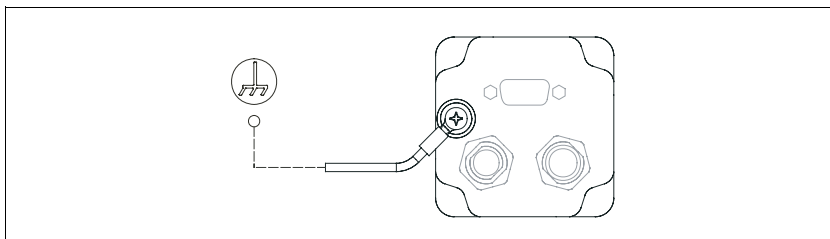


Figure 4.4 Equipotential bonding connection

Cable specifications If lines over 100 m are approved, the following applies: up to 200 m length a cable cross section of 16 mm² is sufficient, for greater lengths a cable cross section of 20 mm² is required.

Connecting cable ► Fasten the equipotential bonding cable to the equipotential bonding connection of the compact drive with the screw.

The included M4x6 fillister head screw is self-locking.

Use the safety contact cable with cable lug, Ø4.5 mm.

► Connect the bonding conductor to the central PE busbar or the central protective conductor terminal of the machine.

4.3.3 Overview signal interface

⚠ WARNING

Risk of injury or damage to the drive

With a short circuit of the signal **CHOPPER** against 0VDC the supply voltage is also short-circuited against 0VDC.

- Run the wiring as specified.

Failure to follow these instructions can result in death, serious injury or equipment damage.

The signal interface is a 9-pin Sub-D plug with UNC fasteners, degree of protection IP65.

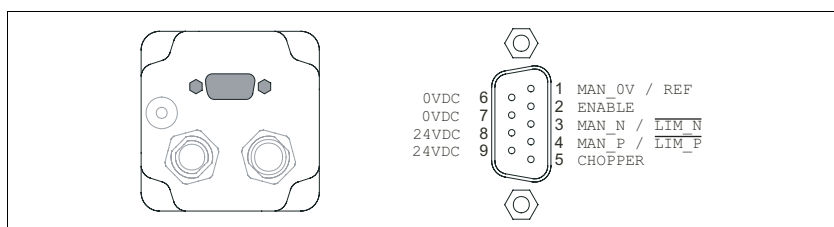


Figure 4.5 Sub-D connector

Pin	Signal	Description	I/O
1	MAN_0V REF	Reference potential at MAN_P and MAN_N Reference switch (normally open contact ¹⁾)	- I
2	ENABLE	Activating and deactivating the power amplifier	I
3	MAN_N LIM_N	Jog counterclockwise rotation Negative limit switch (normally closed contact ¹⁾)	I I
4	MAN_P LIM_P	Jog clockwise rotation Positive limit switch (normally closed contact ¹⁾)	I I
5	CHOPPER	Connection braking resistor controller	A
6	0VDC	Reference potential	-
7	0VDC	Reference potential	-
8	24VDC	Supply voltage 24VDC	-
9	24VDC	Supply voltage 24VDC	-

1) at factory setting

Connectors for manufacture of a connector cable for environmental conditions corresponding to IP65 can be found in the accessories list in chapter 8 "Accessories and spare parts".

4.3.4 Supply voltage connection 24VDC

⚠ DANGER**Electric shock from incorrect power supply unit**

The supply voltage 24VDC is connected with many accessible signals in the drive system.

- Use a power supply unit that meets the requirements for PELV (Protective Extra Low Voltage)
- Connect the negative output of the power supply unit to PE.

Failure to follow these instructions will result in death or serious injury.

⚠ CAUTION**Destruction of system components and loss of control monitoring**

Excessive currents can be created at the signal connections if the negative connection to the controller supply voltage is interrupted.

- Do not interrupt the negative connection between power supply unit and load with a fuse or switch
- Check for correct connection before switching on.
- Never connect the controller supply voltage or change its wiring while there is supply voltage present.

Failure to follow these instructions can result in injury or equipment damage.

CAUTION**Destruction of contacts**

The connection for the controller supply voltage at the drive system does not have a make current limit. If the voltage is switched on by switching contacts, the contacts may be destroyed or welded shut.

- Use a power supply unit that limits the peak value of the output current to a value permissible for the contact.
- Switch the line input of the power supply unit instead of the output voltage.

Failure to follow these instructions can result in equipment damage.

The compact drive is operated at a supply voltage of +24V direct voltage. The voltage is fed through the Sub-D plug connector.

A three-phase transformer with a three-phase rectifier can be used as a power source. A charging capacitor is not required.

A residual ripple of a maximum of 3.6V at the nominal voltage is required for operation of the drive.

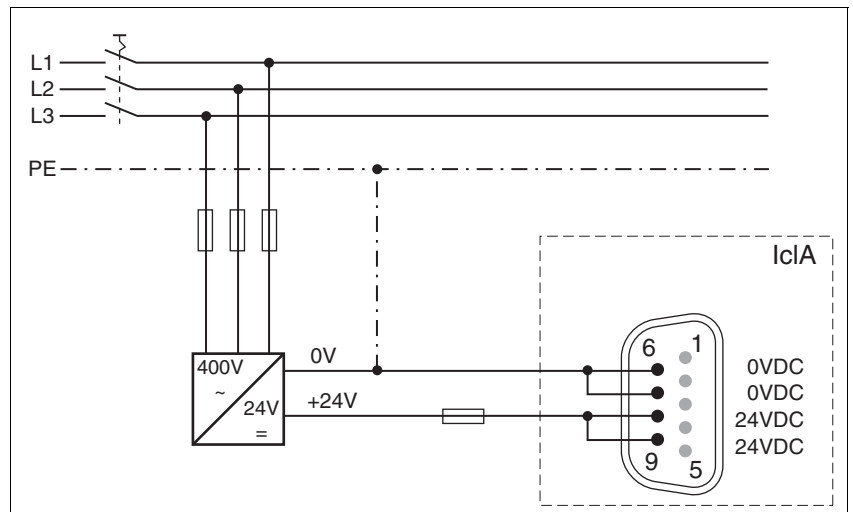


Figure 4.6 Power supply of the compact drive

Cable specifications

- Cross section 2 x 0.75 ... 1.5 mm²

Unshielded cables may be used for the 24VDC supply voltage. Twisted pair is not required.

- ▶ Use pre-assembled cables to minimise the risk of a wiring error.
- ▶ Make sure that the wiring, the cables and the connected interfaces meet the requirements for PELV.

Connecting cable

- ▶ Connect the connections of the Sub-D plug connector to the power supply:
- ▶ Connect the reference potential (0VGND) of the supply voltage to a point on PE.
- ▶ Fuse the 24VDC cable according to the selected cable cross-section, at least however with 6A.

If multiple drives are powered from one 24VDC power supply unit, take the following applications of the drives into account when dimensioning the power supply unit and the wiring. If multiple drives are operated simultaneously, this increases the terminal power required for the power supply unit.

Additional consumers must not be connected to pins 6, 7 and 8, 9. Cascade the drives using multi-terminal busbars.

Lay the 24VDC supply line at a distance of at least 20cm from other lines to ensure EMC protection. For wiring longer than 2m make a twisted pair of the 0V and 24VDC supply wires.

4.3.5 Connection control inputs

The signal interface can be configured as a "Standard Interface" or as a "Sensor Interface".

Connection "Standard Interface" Connecting pushbuttons with "Standard Interface".

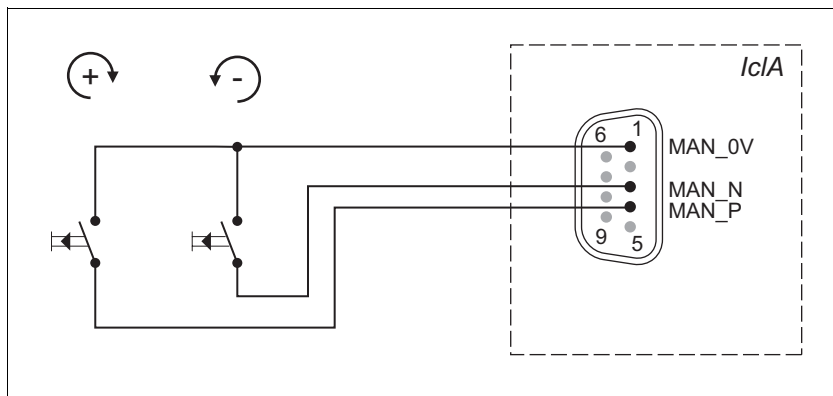


Figure 4.7 Connection "Standard Interface"

Connection "Sensor Interface" Connecting limit switches with "Sensor Interface".

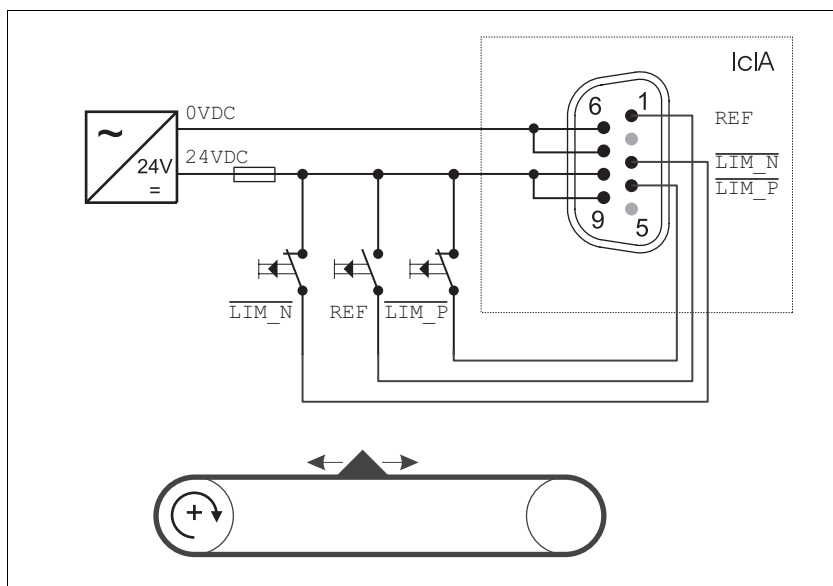


Figure 4.8 Connection "Sensor Interface"

Cable specifications Cross section 0.25mm^2 to 1.5mm^2
maximum length with minimum cross-section 15 m

Connecting cable ► Connect the connections of the signal interface to the buttons or limit switches respectively.



When commissioning you can use the commissioning software to switch between "Standard Interface" and "Sensor Interface" (parameter group "Drive data", parameter "Interface option type").

4.3.6 Connection Enable

If the enable signal voltage is interrupted, the Kompaktantrieb is shut down.

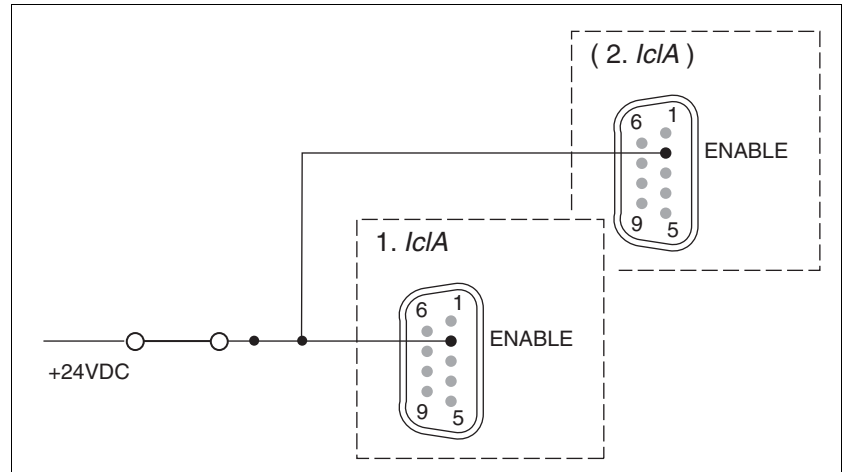


Figure 4.9 Enable connection

Cable specifications Cross section 0.25mm^2 to 1.5mm^2

maximum length with minimum cross-section 15 m

Connecting cable ► Connect the Sub-D plug and socket connection with the power supply and additional compact drives:

Pin 2 (ENABLE): Control signal +24VDC for enable function

Reference potential is PE

Pin 2 is decoupled with diode, no electrical isolation.

If the enable function is not required, connect pin 2 with pin 8 or 9 (24VDC).

4.3.7 Fieldbus connection

*circular plug-in connector,
assignment of input plugs*

The compact drive is connected to the CAN fieldbus with the circular plug-in connector, 5-pin model.

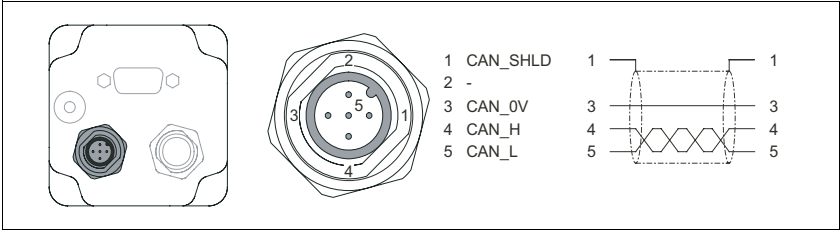


Figure 4.10 CAN fieldbus connection (input plug)

Pin	Signal	Description
1	CAN_SHLD	Shielding, PE connection
2	-	not assigned
3	CAN_0V	CAN ground
4	CAN_H	Data wire, dominant high
5	CAN_L	Data wire, dominant low

*Circular plug-in connector,
assignment of output socket*

The compact drive has a second circular plug-in connector, 5-pin model, for networking the CAN fieldbus. Additional network devices can be connected here.

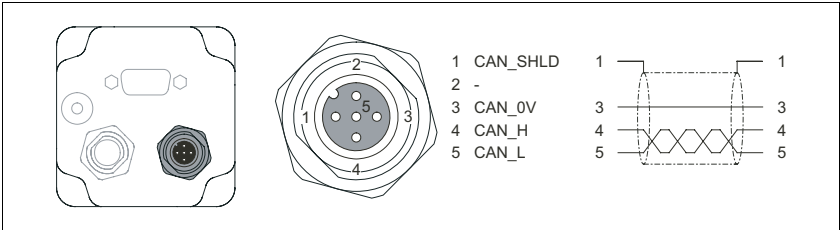


Figure 4.11 CAN fieldbus connection (output socket)

Pin	Signal	Description
1	CAN_SHLD	Shielding, PE connection
2	-	not assigned
3	CAN_0V	CAN ground
4	CAN_H	Data wire, dominant high
5	CAN_L	Data wire, dominant low

Accessories for networking

Cable connectors, terminal blocks and terminating resistors for the compact drive can be found in the accessories list in chapter 8 "Accessories and spare parts".

- Connecting cable*
- ▶ Connect the fieldbus cable to the circular plug-in connector (input connector) of the compact drive. If no other devices are to be connected, the second circular plug-in connector (output socket) must have a terminating resistor.
 - ▶ Otherwise a t-piece or a plug with two cable outputs can be connected to the input connector to connect adjacent fieldbus devices. The output socket must not be wired with a terminating resistor in this case.

Install the t-piece on the compact drive without a drop line.

The two open ends in the CAN fieldbus must be connected with a 120Ω resistor.

The maximum cable length of a CAN network depends on the baud rate at which the network is to be operated. The higher the baud rate, the shorter the bus cable needs to be.

Baud rate [Kbd]	Cable length [m]	Baud rate [Kbd]	Cable length [m]
1000	25	100	600
800	50	50	1000
500	100	20	2500
250	250	10	5000

The following example shows the networking of four compact drives with a PLC.

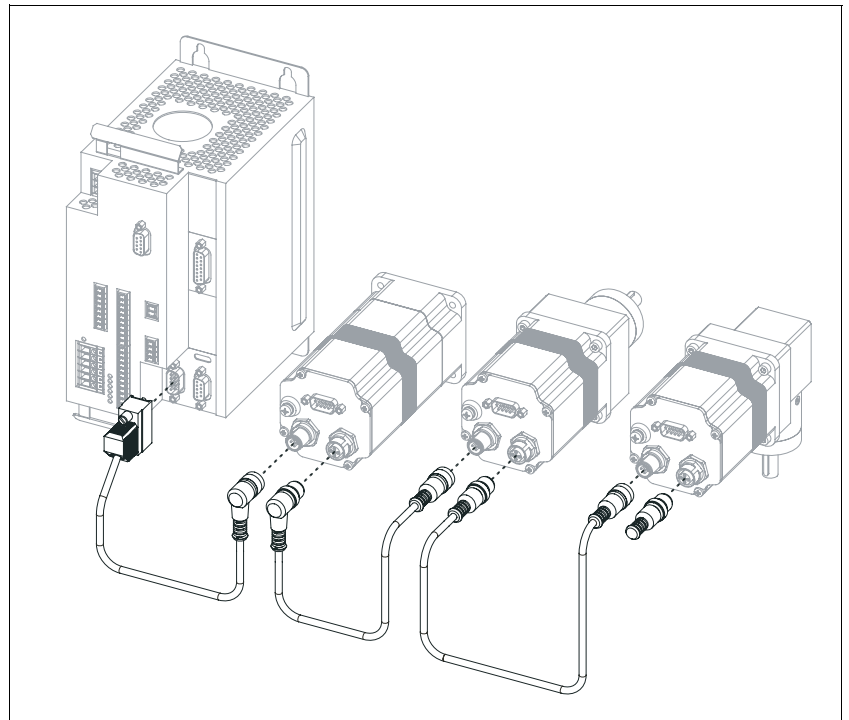


Figure 4.12 Networking of four compact drives with a PLC

4.3.8 Connection Braking Resistor Controller

A braking resistor controller can be connected to the signal **CHOPPER**. A braking resistor controller is required if the supply voltage gets too high due to reverse feeding.

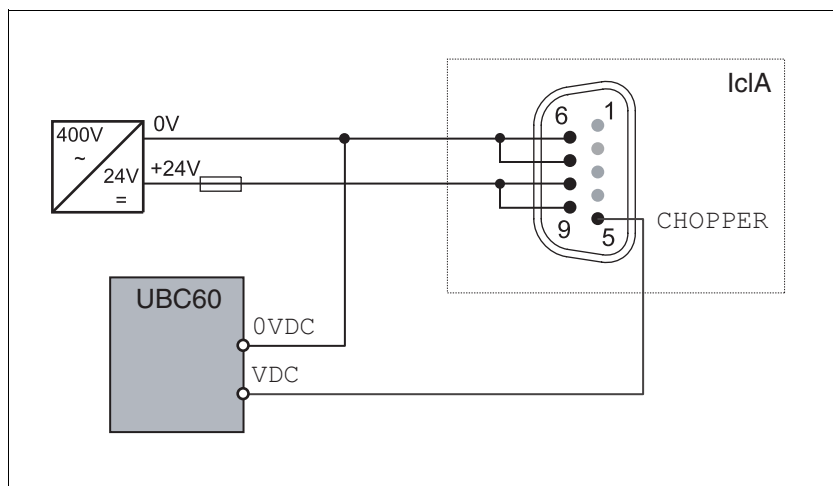


Figure 4.13 Connection Braking Resistor Controller

Cable specifications

- Cross section 0.75 ... 1.5 mm²

Connecting cable

- Connect the Sub-D connector to the input of the braking resistor controller.

IMPORTANT: The signal **CHOPPER** may only be connected directly to the input of the braking resistor controller.

Several compact drives can not be connected directly to a braking resistor controller.



*If you have any questions please contact your local dealer.
Your dealer will be happy to give you the name of a
customer service outlet in your area.*

4.3.9 Checks

⚠ WARNING

Unexpected movement

When the drive is operated for the first time there is a high risk of unexpected movements because of possible wiring errors or unsuitable parameters.

- If possible, run the first test movement without coupled loads.
- Make sure that a functioning button for EMERGENCY STOP is within reach.
- Also anticipate a movement in the incorrect direction or oscillation of the drive.
- Make sure that the system is free and ready for the movement before starting the function.

Failure to follow these instructions can result in death, serious injury or equipment damage.

System checks and test

- Carry out these checks:

Are all cables and connectors safely installed and connected?

Are any live cable ends exposed?

Are the control lines connected correctly?

For this test and the first stages of commissioning the motor should be run decoupled from the system. This prevents damage to motor and system if the motor starts unexpectedly or by incorrect referencing marks.

- Switch on the 24V_{DC} power supply. The drive runs a self-test and switches to manual operation mode.

Manual movement test

If the drive is referenced and the signal connections are wired for manual mode, the function of the drive can be tested in manual mode. The motor cannot move without valid reference values. The drive can only be referenced over the fieldbus.

- Switch the manual movement signals for clockwise and anti-clockwise rotation to low level.

If MAN_P is wired, the shaft rotates clockwise when viewed towards the face of the driven shaft. The supply voltage and manual movement signals are then correctly wired.

Testing fieldbus wiring

- With the power off measure the resistance between CAN_L and CAN_H.

If the measured value with both terminating resistors is 60Ω, the network is correctly wired and connected.

5 Commissioning

5.1 General safety instructions

⚠ CAUTION

Hot Surfaces

Depending on the operation the surface may heat up to more than 100°C (212°F).

- Prevent contact with the hot surfaces.
- Do not install flammable or heat-sensitive components in the immediate vicinity.
- Follow the actions described for heat dissipation.
- Check the temperature during the test run.

Failure to follow these instructions can result in injury or equipment damage.

⚠ WARNING

Unexpected movement

When the drive is operated for the first time there is a high risk of unexpected movements because of possible wiring errors or unsuitable parameters.

- If possible, run the first test movement without coupled loads.
- Make sure that a functioning button for EMERGENCY STOP is within reach.
- Also anticipate a movement in the incorrect direction or oscillation of the drive.
- Make sure that the system is free and ready for the movement before starting the function.

Failure to follow these instructions can result in death, serious injury or equipment damage.

⚠ WARNING**Unexpected behaviour**

The behaviour of the drive system is governed by numerous stored data or settings. Unsuitable settings or data may trigger unexpected movements or reactions to signals and disable monitoring functions.

- Do not operate a drive system with unknown settings or data.
- Check the stored data or settings.
- When commissioning carefully run tests for all operating statuses and fault cases.
- Check the functions after replacing the product and also after making changes to the settings or data.
- Only start the system if there are no persons or materials in the danger zone and the system can be operated safely.

Failure to follow these instructions can result in death, serious injury or equipment damage.

⚠ WARNING**Unbraked motor**

In the case of power failure and faults which cause the power amplifier to be switched off, the motor is no longer controlled by the brake and increases its speed even more until it comes to a mechanical stop.

- Check the mechanical situation.
- If necessary, use a cushioned mechanical stop or a suitable brake.

Failure to follow these instructions can result in death, serious injury or equipment damage.

⚠ WARNING**Rotating parts**

Rotating parts may cause injuries and may catch clothing or hair. Loose parts or parts that are unbalanced may be thrown clear.

- After mounting check all rotating parts (parallel keys, coupling, ..).
- Use a cover as protection against rotating parts.

Failure to follow these instructions can result in death, serious injury or equipment damage.

⚠ WARNING**Falling parts**

The motor may move as a result of the reaction torque, tip and fall.

- Fasten the motor securely to prevent it from breaking loose during strong acceleration.

Failure to follow these instructions can result in death, serious injury or equipment damage.



When commissioning you can use the commissioning software to switch between "Standard Interface" and "Sensor Interface" (parameter group "Drive data", parameter "Interface option type").

5.2 Commissioning procedure

The steps for commissioning and parameterising the operating modes and functions over the fieldbus are described in the fieldbus manual for the compact drive.



The following commissioning steps are also required if you are using a configured unit under changed operating conditions.

5.3 Commissioning software ICCT

Features The commissioning software simplifies commissioning, parameterisation, simulation and diagnostics.

It provides extensive options such as:

- Graphic interface for parameter setting and status display
- Extensive diagnostic tools for optimisation and maintenance
- Long-term recording as an aid to assessing operating behaviour
- Testing input and output signals
- Tracking signal sequences on the monitor
- Archiving all device settings and recordings with export functions for data processing

Requirements

- PC or laptop with Windows 2000 or later
- Converter for fieldbus connection to PC
- Product manual: Commissioning software ICCT

Converter You require a converter to connect the product to the PC. The following converters are recommended:

- "USB-to-CAN compact", www.ixxat.com
- "PCAN-USB", www.peak-system.com

Reference source of commissioning software The current commissioning software is available for download from the internet.

<http://www.berger-lahr.com/download>

5.3.1 Firmware update over fieldbus

⚠ CAUTION

Damage to the product from failure of the supply voltage

If the supply voltage fails during an update, the product will be damaged and must be sent in for repair.

- Never switch off supply voltage during the update.
- Always carry out the update with a reliable supply voltage.

Failure to follow these instructions can result in injury or equipment damage.

Finding the firmware version

The firmware number and the firmware version of your drive can be found with the commissioning software by opening the device information window.

5.4 Difference between the controller objects of D065 and N065

The controller objects of the D065 (Object 2010_hControl Parameter Set) are not compatible with the controller objects of N065. Thus 1 to 1 use is not possible.

The behaviour of the N065 when using the factory settings shows virtually identical behaviour to the D065 when using the factory settings. Respectively changed controller objects have to be reset for the N065.

The following objects have been replaced by new objects.

D065 Object (Index_h:Subindex_h)	N065 Object (Index_h:Subindex_h)
KP_Pos (2010:01)	no equivalent
KP_Rpm (2010:02)	Gain (60F9:01)
KP_Cmd (2010:03)	KP_Cmd (60F9:09)
RI_Lag (2010:04)	IntegrationTimeConstant (60F9:02S)
PositionWindow (2010:05)	PositionWindow (6067:00)
RpmWindow (2010:06)	VelocityWindow (606D:00)
RpmDeviationEvents (2010:07)	VelocityWindowTime (606E:00)
RpmStartTimeout (2010:08)	StartUpTimeout (60F9:03)
RpmStop (2010:09)	no equivalent
LP1_TimeConst (2010:0A)	LP1_TimeConstant (60F9:08)
HoldingTorqueTime (2010:0B)	HoldingTorqueTime (60FB:01)
MaxSteadyCurrent (2010:0C)	no equivalent
StartingCurrentFactor (2010:0D)	AccelerationCurrentFactor (60F9:05)
DeviationDelay (2010:0E)	ConstantDriveDelay (60F9:04)
CurrentDeviationEvents (2010:0F)	MaxCurrentEvents (60F9:06)
Current window (2010:10)	no equivalent
BlockDeceleration (2010:11)	BlockDeceleration (60F9:07)

Some of the new objects have a different scale.

The meaning of the individual objects is described in the relevant field-bus manual.

6 Operation

6.1 Operating modes

The compact drive operates with seven operating modes:

Operating modes	with fieldbus	without fieldbus
Manual operation via signal inputs MAN_N and MAN_P	x	x
Manual operation via CAN bus (simulated manual mode)	x	—
Homing	x	—
Positioning mode	x	—
Speed control mode	x	—
Configuration mode	x	—
Manufacturer-specific positioning mode (manufacturer-specific travel profile)	x	—

After switching on the supply voltage, the compact drive automatically switches to manual operation. The drive can be switched to fieldbus controller via the fieldbus.

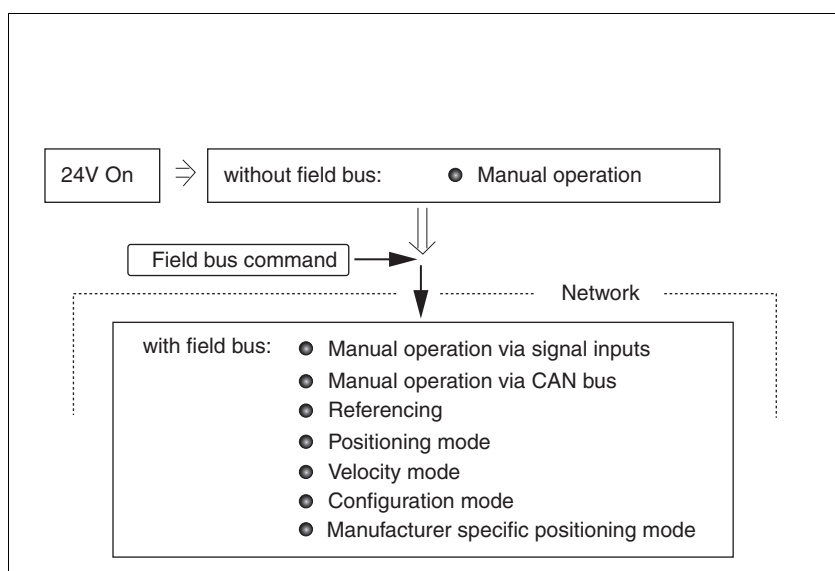


Figure 6.1 Operating modes of the Kompaktantriebs

Manual operation via signals

In manual operation the Kompaktantrieb moves at an adjustable speed within the referenced working range. The direction of movement and the jog operating mode or continuous operation are preset by two signal inputs.

Manual operation via fieldbus

In manual operation via fieldbus the Kompaktantrieb can also be moved clockwise or anticlockwise within the reference range. The direction of motion and the speed are specified over the fieldbus.

<i>Homing</i>	The compact drive must be referenced for manual or positioning mode. The homing specifies three limit switch points for every direction of motion. The drive monitors them continuously for overshoot. A homing is also retained after switching the compact drive off and on if they were not rotated when the power was off.
<i>Positioning mode</i>	In positioning mode the referenced drive can be moved from a point A to a point B. A trapeze profile is specified; application-specific trapeze profiles with values for final speed and acceleration and deceleration ramps can be saved in nine additional parameter sets.
<i>Speed control mode</i>	<p>In speed control mode movement commands are processed via the fieldbus. In this operating mode the drive requires homing if the software limit switches are used. The function of the software limit switches can be disabled by setting parameters of all software limit switches to the minimum or maximum range limits. The drive can then be moved in speed control mode without homing.</p> <p>The reference value of a movement command is the set speed of the drive movement. The acceleration and braking ramp is parameterised and can be adjusted for the specific application.</p>

6.2 Functions

<i>Communication configuration</i>	<p>Communication parameters of the compact drive can be set for data exchange over fieldbus.</p> <p>In the CANopen network the parameters baud rate and node number can be modified via the LSS service (layer setting services).</p>
<i>Configuration mode</i>	Parameter values of the compact drive can only be set via the fieldbus. The configuration mode offers the option of adjusting the compact drive for the operating conditions.

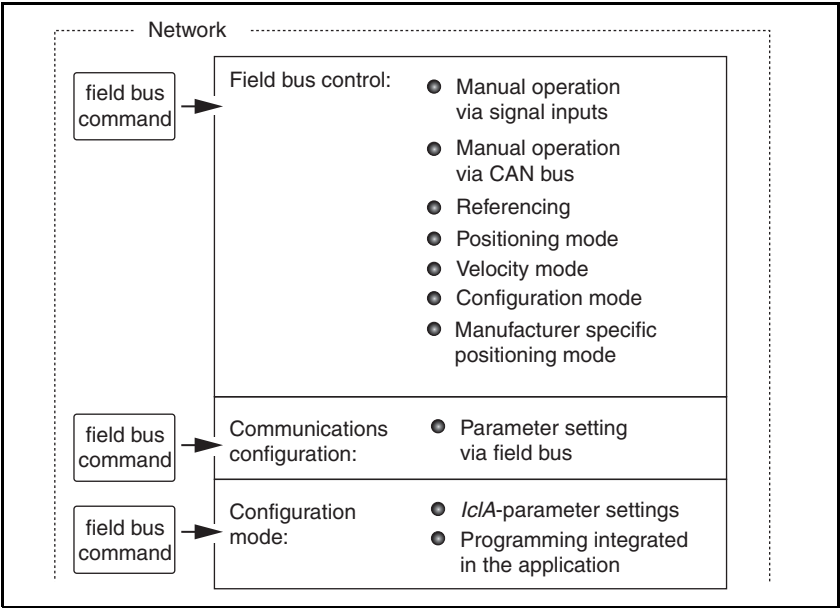


Figure 6.2 Communication configuration and configuration mode

0098441113268, V1.10, 07.2007

6.3 Protection and monitoring functions

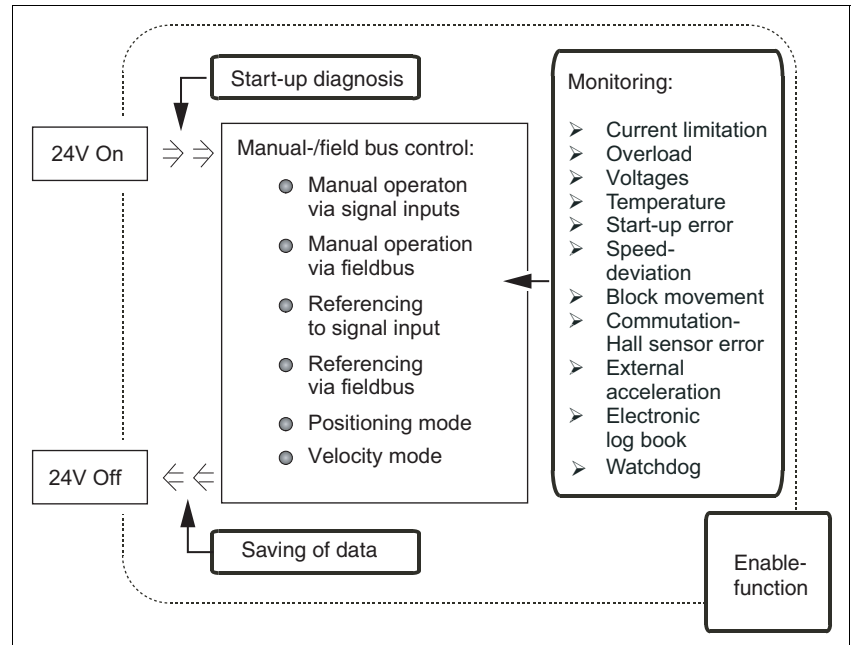


Figure 6.3 Enable function and monitoring function

6.3.1 Enable function

The enable function is triggered via a fieldbus command or alternatively by interrupting the enable control signal. The current travel command is cancelled in different ways.

In the case of the fieldbus command an error flag is set and the motor is brought to a standstill with the Quick Stop ramp.

The interruption of the enable control signal triggers a time-delayed deactivation of the power electronics. The drive is braked at maximum power. After elapse of the delay time the power electronics are disabled. The error flag is set.



Moving loads are not permitted when using the enable function, e.g. with Z-axes, because the drive is actively braked for just one second after enabling the enable control signal. A continuing application with a moving load may result in unwanted drive movements.

The compact drive remains at a standstill until the external control resets the enable status.

6.3.2 Monitoring functions of the motor controller

Various operating functions provide protection against damage and malfunctions. This includes:

- Self-test at Power On (start diagnosis of the integrated electronics)
- Data backup when the supply voltage is switched off
- Current limiting
- Overload
- Voltages
- Temperature
- Starting error
- Deviation in rpm
- Block movement
- Commutation/Hall sensor error
- Outside acceleration
- Electronic log-book
- Watchdog (program process monitoring)

6.3.2.1 Self-test at Power On

After Power On the application program calls the initialisation routine of the motor management system, where a self-test of the following functions is run.

- Timer and oscillator
- Configuration memory (consistency of the non-volatile data in the EEPROM)
- Combination of the Hall sensors
- Motor current
- DC bus and auxiliary voltage
- Temperature of the power electronics
- Wire break (functional readiness of the Enable hardware)
- Check historical watchdog
- Test for dereferencing

With the error a corresponding error flag is set in the drive status register.

A distinction can be made between reversible and non-reversible (fatal) errors, which must be treated differently.

The fatal errors include EEPROM errors (loss of data and movement log-book), Enable self-test errors, watchdog errors and timer and oscillator errors. In these cases the system is held in an endless loop to prevent activation of an invalid operating status. After Power On the drive simply sends a BootUp message and the assigned error message. Otherwise the system shows no outside response. Only a manufacturer-specific host system can detect this status. The user should send drive systems with the error type described above in for closer examination.

In the case of the reversible self-test errors the system branches into the basic loop. The motor controller is not enabled; an error message is sent over the bus interface.

If the supply voltage fails the run-time data are written to the configuration memory (Power Fail Save). The primary data are the position of the drive in the position memory (position counter) and the current rotor position. The voltage monitor detects the Power Down, stops the motor and initialises the Power Fail Save sequence. The data are written to the configuration memory as soon as the drive is at a standstill in the event of a Power Down:

- Position counter (current position in the position memory)
- Hall combination (to detect mechanical displacement)
- Status register (controller status at Power Down)
- Log-book (operating hours, etc.)

A validity bit is set in the configuration memory at Power Down to test the validity of the run-time data. The validity bit is read from the configuration memory at the next Power On and reset there immediately, i.e. the run-time data in the configuration memory are flagged as invalid.

If the validity bit is not set at Power On, the last backup of the run-time data did not work. The run-time data in the configuration memory do not refer to the last Power Fail Save; this has the following consequences:

- the position counter is invalid: the drive must be referenced again,
- the Hall combination is invalid: the drive must be referenced again,
- the status registers are invalid: insignificant, because it is historical
- the log-book is invalid: the data must be reconstructed.

6.3.2.2 Current limiting

If the motor phase current reaches the maximum value that can be set by the user, it is limited by the electronics. The warning flag "current limiting" is set in the status register.

6.3.2.3 Overload

The overload is calculated by the I^2t method. If the calculated motor phase current exceeds the value of the permissible continuous current for a specified time, the drive is stopped and the error flag "overload" is set. The time until enabling the error depends on the height of the measured current.

6.3.2.4 Voltages

The three parameters power supply, DC bus and auxiliary voltage are continuously measured, filtered and compared with limit values. Various actions may follow depending on the type of voltage.

	Power supply	DC link	Auxiliary voltage
Overvoltage (>20%)	Warning flags are set in status word and status register, no error message (EMCY)	Warning flags are set in status word and status register, no error message (EMCY)	Warning flags are set in status word and status register, no error message (EMCY)
Overvoltage (illegal range e.g. by moving load)	-	Error flag, braking ramp is delayed, power electronics switch off, output of assigned error message (EMCY)	-
Undervoltage (<20%)	Warning flags are set in status word and status register, no error message (EMCY)	Warning flags are set in status word and status register, no error message (EMCY)	Warning flags are set in status word and status register, no error message (EMCY)
Undervoltage (Fail Safe)	Error flag, motor at maximum braking, data backup, output of assigned error message (EMCY)	Error flag, motor at maximum braking, data backup, output of assigned error message (EMCY)	-

The measured values can be read out over the field bus interface

6.3.2.5 Temperature

The temperature of the motor electronics are continuously measured and evaluated. If the warning threshold is exceeded the warning flag is set in the status register. If the shut-down threshold is exceeded the error flag is set, the motor is braked at the Quick-Stop ramp and the error message assigned to the overtemperature error is output. When the motor is at a standstill the power electronics are switched off.

If the temperature falls below the configured reset threshold, the motor controller can be enabled via the application program.

The temperature of the power electronics can be queried via the CAN bus.

The values for overtemperature and reset threshold are saved in the configuration memory of the drive and can be queried over the bus interface (electronic data sheet).

6.3.2.6 Starting error

If the motor does not start within a configurable time, the power electronics are switched off and an error flag is set. The system waits for a new movement command. The system continues to remain in the "ready" status and can process new movement commands.

6.3.2.7 Speed deviation

If the control deviation of the speed of rotation exceeds a defined limit value after completion of the acceleration phase in the range of constant setpoint speed, the speed deviation error flag is set. The speed deviation does not indicate an error in all cases; incorrect selections, such as excessively low current setpoints, could also be the cause.

6.3.2.8 Block movement

If the speed of rotation falls by a configurable value within a permanently defined period and the current limiting is active at the same time, a block movement is detected. It is displayed by a corresponding entry in the error flag.

6.3.2.9 Commutation/Hall sensor errors

The motor electronics check the measuring signals for determination of the rotor angle (Hall signals) for plausibility. If an error in a signal is detected, it is shown by an error flag.

6.3.2.10 Outside acceleration

Various functions protect the drive from damage resulting from outside acceleration.

Two different operating states must be distinguished.

- During a positioning process a moving load is applied to the output during braking. Because the drive is actively braking in this phase, a component of the braking energy is fed to the DC bus circuit, which increases the voltage.

The drive responds to rising voltage values in three stages: generation of a warning flag, reduction of the braking ramp and finally by switching off the power electronics, which is acknowledged by the error message "overvoltage" (see section 6.3.2.4 "Voltages").

- The drive is accelerated out of standstill by an outside force to displace is manually. If the drive is accelerated past the maximum permitted speed of rotation specified in the electronic data sheet, it may be damaged by the high induced voltage.
 - If the drive is connected to a power supply and there is no Enable signal, the drive is protected against overvoltage by a short-circuit braking. The short-circuit braking is tripped if the permissible maximum speed is exceeded by 25%.

If the Enable signal is active and the power electronics are disabled, the protective function is also disabled. The drive will then be damaged if the maximum speed is exceeded.
 - If the drive is not connected to a power supply, there is no protection against overload by an auxiliary drive.

6.3.2.11 Electronic log-book

The following data are recorded in the electronic log-book:

- Uptime of the drive
- Active time of the drive
- Number of positionings
- Number of reference losses
- Number of log-book losses

The log-book is continuously updated during the operating time and written to the configuration memory on Power Down.

Because a loss of run-time data and also the log-book cannot be completely prevented on Power Down, a second log-book is also maintained. It is periodically written to the configuration memory during operation. The log-book can be reconstructed from the second log-book after a loss of run-time data. The data error during the time counters is less than a backup period in this case.

6.3.2.12 Watchdog

The Watchdog timer is a monitoring mechanism for responding to hardware faults and "software hang-ups". The Watchdog timer is enabled at Power On and must be serviced cyclically by the software (Watchdog Servicing).

If the Watchdog Servicing fails, the microcontroller performs a Watchdog reset. The system runs the Power On self-test and the initialisation phase. The motor controller is not enabled. An error message is set via the bus interface.

This status can only be reset by a hardware reset (switching off the supply voltage). This is a non-reversible error. Drives with this error type should be sent in for closer examination.

7 Diagnostics and troubleshooting

7.1 Fieldbus communication error diagnosis

Field-mode must be functioning to be able to evaluate operational and error messages. The Kompaktantrieb can only exchange messages via the fieldbus.

Connections to field-bus mode

If the drive cannot be addressed over the field bus, first check the connections. Kompaktantriebcompact drive contains the technical data on the device and information on network and device installation. Check the following:

- 24V power supply
- Power connections to the device
- Fieldbus cable and wiring
- Network connection to the device

Function test on the fieldbus

If the Kompaktantrieb is connected up correctly then test field bus operation. This requires installation of a CAN monitor that displays CAN messages. Acknowledgement of the drive is captured by a boot-up message:

- ▶ Switch the drive power supply off and on again.
- ▶ Observe the network messages shortly after switching on the device. The Kompaktantrieb sends a 1-byte long boot-up message after bus initialisation: 1792 (700_h)+node ID.
- ▶ With the node address factory setting to "127" (7F_h), the boot-up message "2047" (77F_h) is sent over the bus. The drive can then be put into operation via LSS and NMT services.

If no boot-up message is received on the network after switching on the drive, first check whether the baud rate of the CAN monitor matches the set baud rate in the network.



If network operation cannot be started, the network function of the device must be checked by your local representative. Contact your local representative.

Baud rate and address

If a connection to a device cannot be made, check the baud rate and node address.

- The baud rate of all network devices must be set to the same value
- The node address of every device must be between 1 and 127 and must be different for every device.

The default baud rate is 20 kbps. The default address is 127.

The baud rate and node address for the Kompaktantrieb can be set with LSS services, see CANopen manual, "LSS services in the positioning drive".

7.2 Error diagnosis over fieldbus

7.2.1 Message objects

Several objects provide information on the operation and error status of the Kompaktantriebs:

- Object `Statusword` (6041_h)
operating statuses which are reported over the status word are described in the CANopen manual in the chapter "Operating statuses and operating modes".
- Object `EMCY`(80_h+ node-Id)
error message of a user with error status and fault code; see CANopen manual, chapter "Emergency service".
- Object `Manufacturer status register` (1002_h)
operation and error status of the device components, this is where the manufacturer-specific message on the Kompaktantrieb are stored. The object remains set after an error status until a new positioning order is executed or the original source of the malfunction is removed. Detailed information on this can be obtained from the following 7.2.2 "Messages on the device status" chapter.
- Object `Error register` (1001_h)
shows the error status of a device in bit-coded form. The exact cause of error must be determined with the error code table. Bit 0 is set as soon as an error occurs.

Bit	Message	Description
0	generic error	An error has occurred
1	current	The parameterised range limits of the maximum motor current or the I2t monitoring were exceeded
2	voltage	Detection of overvoltage or undervoltage for the internal auxiliary voltage (12V), supply voltage or DC bus voltage
3	temperature	The maximum permissible limit temperature was exceeded (internal measurement)
4	communication error	Error in the network communication
5	device profile-specific	Error during execution of the command according to device profile (e.g. block movement)
6	reserved	Reserved
7	manufacturer-specific	Manufacturer-specific error message (e.g. external torque)

- Object `Error code`(603F_h)
The error code is analysed by the object error code(603F_h), an object of the device profile DSP 402 and is issued as a 4-digit hexadecimal number. The error code shows the cause of the last interruption of movement. The meaning of the error code can also be found in the CANopen manual in the section on error diagnosis and troubleshooting.

- Object `Predefined error field (1003h)`
error memory contains the last five occurring errors as an error code in chronological order.
- Devices use the special SDO ABORT error message to report the failed message exchange via SDO (abort)

Validates transmitted LSS services "Transmitting acknowledgement information" or an error code. The meaning of the feedback message to each LSS service is described in the CANopen manual, chapter "Basics".

7.2.2 Messages on the device status

The 32 bit object "Manufacturer status register" (1002_h) of the engine operating programme is the central register of engine interface.

Bits 24 - 31 inform about the operating status of the engine control.

Bits 0 - 22 inform about the error status of the various monitoring functions.

Errors occurring can be analysed in detail via bits 0 - 23

Operation and error messages indicate the drive bitcoded.

For error analysis and handling purposes one differentiates between reversible and fatal errors as well as note messages.

Warning (Warn) A Warning (object 1002_h/Bit30) indicates that the drive is in a critical but not yet operation-endangering condition (value = 1). The exact origin of the problem is stored in bits 23 to 0 of the status register (object 1002_h).

The warning bit and the bit(s) which indicate the origin of the problem remain until a new travel command is discharged, that is possible origins of problems can also be called up after completing a travel command.

Reversible error (Rev) If the drive detects a reversible error, it sends an EMCY message over the fieldbus and stops the current movement operation. After the error has been corrected, the error message must be acknowledge via bit 7, `Reset fault` in the control word `Controlword (6040h)`.

In the event of a reversible error bit 7 in the object `Statusword (6041h)` and bit 30 in the object manufacturer status register (1002_h) are set.

Fatal error (fatal) A fatal error occurs when the internal device test detects hardware or software errors. The motor controller is blocked; the block can only be reset by switching the drive off and on again.

The drive sends an EMCY message.

Message The entry "Info" in the column ""Type of message"" indicates that a note was issued without interruption of the currently running movement mode.

The following table shows the bit values of the object `Manufacturer status register (1002h)`.

Bit	Designation	Possible cause for the message	Type of message	Remedy	EMCY message
0	Configuration error drive parameter	Reading/writing error or plausibility error when copying drive parameters (control parameter, communications parameter, application parameter or identification parameter) from the configuration memory (EEPROM).	Warning	Check user settings for plausibility and correct or go back to the factory setting. Bit 30 = 1!	No
			Fatal	There is an EEPROM memory error; the drive must be replaced and sent back to the manufacturer Bit 31 = 1!	Yes / EMCY code 6310 _h
1	Configuration error in drive data	Reading/writing error or plausibility error when copying drive data from the configuration memory (EEPROM).	Fatal	There is an EEPROM error in the memory area of the drive and motor data. The drive must be replaced and sent back to the manufacturer. Bit 31 = 1!	Yes / EMCY code 6310 _h
2	Self test error in Enable input circuit	Error during testing of the Enable hardware during the self test phase (occurs with every switching on of the power supply)	Fatal	Possible defect in the Enable hardware. The drive must be replaced and sent back to the manufacturer Bit 31 = 1! CAUTION: If the drive is turned during the initialisation and self test phase then this will result in an Enable self-test error!	Yes / EMCY code 5000 _h
3	Auxiliary voltage undervoltage (12VDC)	Going below the tolerance limit (10VDC) or going below the switch off limit (8.5VDC).	Warn/Rev	1) Going below the tolerance limit 10VDC: Bit3 in object 1002 _h is set. The full drive function continues to be accessible. Bit 30 = 1! 2) Going below the switch off limit 8.5VDC: Bit3 in object 1002 _h is set. The drive stores all run-time data and is put into initialisation status for a self-reset. Bit 31 = 1! Measure: In both cases check stability of the central power supply! If the error occurs again or is not removed after initialisation then the drive must be replaced and sent back to the manufacturer.	1) No 2) Yes / 5110 _h
4	DC bus overvoltage	Exceeding the tolerance limit (24VDC +20%) or the maximum switch off limit (about 39VDC)	Warn/Rev	1. Exceeding the tolerance limit of 24VDC +20%: Bit4 in object 1002 _h is set. The full drive function continues to be accessible. Bit 30 = 1! Exceeding the switch off limit of 39VDC: Bit4 in object 1002 _h is set. The drive stores all run-time data and is put into initialisation status for a self-reset. Bit 31 = 1! Measure: In both cases check stability of the central power supply! If the error occurs again or is not removed after initialisation then the drive must be replaced and sent back to the manufacturer.	1) No 2) Yes / 3210 _h

Bit	Designation	Possible cause for the message	Type of message	Remedy	EMCY message
5	DC bus undervoltage	Going below the tolerance limit (24VDC -20%) or the switch off limit (15VDC) of the DC bus voltage	Warn/Rev	1) Going below the tolerance limit of 24VDC -20%) Bit5 in object 1002 _h is set. The full drive function continues to be accessible. Bit 30 = 1! 2) Going below the switch off threshold of 15VDC: Bit5 in object 1002 _h is set. The drive stores all run-time data and is put into initialisation status for a self-reset. Bit 31 = 1! Measure: In both cases check stability of the central power supply! If the error occurs again or is not removed after initialisation then the drive must be replaced and sent back to the manufacturer.	1) No 2) Yes / 3220 _h
6	Supply voltage overvoltage	Exceeding the tolerance limit of the supply voltage 24VDC +20%	Warning	Exceeding the tolerance limit of 24VDC +20%: Bit6 in object 1002 _h is set. The full drive function continues to be accessible. Bit 30 = 1!	No
7	Supply voltage undervoltage	Going below the tolerance limit (24VDC -20%) or the switch off limit (12VDC) of the supply voltage	Warn/Rev	1 Going below the tolerance limit of 24VDC -20%) Bit7 in object 1002 _h is set. The full drive function continues to be accessible. Bit 30 = 1! 2. Going below the switch off threshold of 12VDC: Bit7 in object 1002 _h is set. The drive stores all run-time data and is put into initialisation status for a self-reset. Bit 31 = 1! Measure: In both cases check stability of the central power supply! If the error occurs again or is not removed after initialisation then the drive must be replaced and sent back to the manufacturer.	1) No 2) Yes / 3120 _h
8	Oscillator watchdog	An excessively high variation of the oscillator frequency or the oscillator does not reach the specified frequency.	Fatal	The drive must be replaced and sent back to the manufacturer. Bit 31 = 1!	Yes / 0x6000
9	Watchdog timer reset	Reset of the microcontroller by the watchdog timer	Fatal	The drive must be replaced and sent back to the manufacturer. Bit 31 = 1!	Yes / 0x6000
10	Class B hardware trap	Error message from an internal software monitoring function	Fatal	The drive must be replaced and sent back to the manufacturer. Bit 31 = 1!	Yes / 0x6000
11	Class B hardware trap	Error message from an internal hardware monitoring function	Fatal	The drive must be replaced and sent back to the manufacturer. Bit 31 = 1!	Yes / 0x6000
12	not assigned				
13	EEPROM error (storing run-time data)	Error in reading the run-time data previously stored in the EEPROM (logbook)	Fatal	The drive must be replaced and sent back to the manufacturer. Bit 31 = 1!	Yes / 0x5530

Bit	Designation	Possible cause for the message	Type of message	Remedy	EMCY message
14	ROM error (programme memory)	Not implemented on the IcIA N065			
15	RAM error (data memory)	Not implemented on the IcIA N065			
16	An unexpected Hall sensor combination	An undefinable Hall sensor combination occurs or a sequence occurs during the commutation sequence a number of times	Fatal	The drive must be replaced and sent back to the manufacturer. Bit 31 = 1!	Yes / 0x7122
17	Start up error on the motor	No Hall sensor signals after the start up phase, an excessively high start up torque, drive blocked	Warning	Reduce load, increase operating current or peak current, increase value of the acceleration ramp Bit 30 = 1!	Yes / 0x71AA
18	Deviation in rpm	An excessively high start up torque	Warning	Reduce load, increase operating current or peak current, increase value of the acceleration ramp, choose a low speed of rotation Bit 30 = 1!	Yes / 0x71BB
19	Current limiting	The motor current is limited by the parameterised maximum current (lowest maximum value from the motor or electronic parameters).	Warning	Reduce load Bit 30 = 1!	Yes / 0x2222
20	Block movement	Movement onto an obstacle leads to a drop in speed of rotation or stopping and to an over-current.	Rev	Remove the cause of the blockage (obstacle, dead stop, ...). In field bus operation: Perform FaultReset (Bit7/object 6040 _h). In manual mode: Remove power supply, remove the cause of the blockage, switch on again. Bit 31 = 1!	Yes / 0x7121
21	Overload (I ² t)	The measured motor current is above the permissible continuous engine current (calculation with the aid of the I ² t method, thermal motor monitoring)	Rev	Reduce load or increase operating current. The drive executes a rapid stop. Bit 31 = 1!	Yes / 0x2221
22	Excessively high temperature of the power electronics	Exceeding the parameterised temperature limit values	Warn/Rev	1. Exceeding the temperature warning threshold of 80°C: Bit22 in object 1002 _h is set. The full drive function continues to be accessible. Bit 30 = 1! 2. Exceeding the temperature switch off threshold of 90°C: Bit22 in object 1002 _h is set. The drive is stopped. Bit 31 = 1! Measure: The drive can be moved again when it has cooled down to below the temperature warning threshold.	1) No 2) Yes / 0x4310

Bit	Designation	Possible cause for the message	Type of message	Remedy	EMCY message
23	External torque	The drive is pulled out of its rest condition by an external torque. Activation of the message takes place depending on the presettings in object "Position window", 6067h.	Warn/Rev	Checking of the mechanical system. Bit 30 = 1!	Yes / 0xFF29
24	Drive referenced	1: Drive is referenced, which means that the commutation pattern and the co-recorded position concur.	----	No measure necessary.	
		0: The drive is not referenced! Cause: The drive was moved while not under power (effect of an external force). Bit 31= Bit 30, both are 0!		The drive must be newly referenced over the fieldbus (position adjustment).	Yes / 0xFF22
25	Move to position	1: The drive has reached the target position window after executing the travel command	Info	No measure necessary.	
26	Motor turns	1: Motor turns itself (Hall sensor signals change) 0: Motor stationary (Hall sensor signals static)	Info	No measure necessary.	
27	not assigned				
28	reserved				
29	Standstill demand by Enable signal	1: Enable signal = low (Standstill) - a drive stop was demanded. Neither Bit31 nor Bit30 are set!	----	If an emergency situation arose! In field bus mode: -Apply hardware Enable signal at potential of the supply voltage. -Execute "Reset fault" (Bit7/object 6040 _h). In manual mode without use of a fieldbus: -Remove supply voltage. -Apply hardware Enable signal on the potential of the supply voltage. -Apply supply voltage again. Bit30/Bit31 = 0!	Yes / 0xFF01
		0: Enable signal = high (Ready-for-operation) - The drive can be moved.			
30	WARNING/note	Drive is in a critical but not an operation-endangering condition. The drive functionality is still available in full for the moment. The cause of the WARNING can be taken from the status information about the object 1002 _h .	Info	The WARNING cannot be reset in a targetted manner. Bit30 is reset as soon as the event causing the WARNING has been removed and a movement of the drive could be executed without a renewed WARNING.	

Bit	Designation	Possible cause for the message	Type of message	Remedy	EMCY message
31	Error/mal-function	Error or malfunction in a monitoring function of the motor operating programme. The cause of the WARNING can be taken from the status information about the object 1002 _h .	Info	The possible source of the error can be determined by evaluation of bits 0-29 from object 1002 _h . If it is a reversible error (Rev), then the original source of error must be removed. The command "Reset fault" (change Bit7 in control word/object 6040 _h von 0 ->1) resets the drive into operating mode.	

Table 7.1 Messages about the device status

7.3 Error code table

The error code is evaluated with the object `Error code (603Fh)`, an object of the DSP 402 device profile, and output as a four-character hexadecimal number. The error code shows the cause of the last interruption of movement.

Code	Name	Description
0000 _h	no error	No error
1000 _h	generic error	General error coding
2221 _h	motor overload	Overload
2222 _h	motor current limitation	Current limiting
3110 _h	mains overvoltage	Supply voltage overvoltage
3120 _h	mains undervoltage	Supply voltage undervoltage
3210 _h	DC link overvoltage	Motor DC link overvoltage
3220 _h	DC bus undervoltage	Motor DC link undervoltage
4310 _h	excess temperature drive	Excessively high temperature of the power electronics
5000 _h	device hardware	Self-test errors hardware (here enable switching circuit)
5110 _h	supply undervoltage	Auxiliary voltage VDD undervoltage
5510 _h	data storage RAM	Self-test failure of the data memory
5530 _h	data storage EEPROM	Self-test failure of the configuration memory
6000 _h	device software	Microcontroller, internal processing or hardware error
6010 _h	software reset (watchdog)	Software reset by the watchdog timer (timeout in the software execution)
6310 _h	loss of parameters	Parameter loss in the non-volatile configuration data memory (motor/electronics parameter, identification parameter, application parameter, control parameter and communications parameter)
7121 _h	motor blocked	Block movement
7122 _h	motor error or commutation	Hall error
71AA _h	motor start failed	Start up error on the motor
71BB _h	motor rpm failed	Motor speed deviation
8110 _h	queue overrun	Overflow of the CAN message buffer. Possible cause of the error: Loss of the communication connection.
8210 _h	PDO not processed	PDO could not be discharged. Possible cause of the error: Receipt of a faulty PDO message.
FF00 _h	device specific	Additional drive/motor errors

Code	Name	Description
FF01h	emergency stop	Hardware enable signal = Low - drive has been stopped
FF03h	negative limit switch	Negative end position sensor run over
FF04h	positive limit switch	Positive end position sensor run over
FF10h	general application	Application: general error
FF11h	illegal mode application	Application: invalid operating mode
FF12h	illegal parameter application	Application: invalid parameter value
FF13h	position value application	Application: invalid position value
FF14h	usrerr poslim	Application: invalid position memory
FF15h	communication (NMT)	Communication error for NMT
FF20h	general drive controller	Motor control: general error
FF21 _h	power drive enabled	Motor control: controllers not ready
FF22 _h	no reference	Motor control: Drive is not referenced
FF23 _h	drive moves	Motor control: Drive not at standstill
FF24 _h	illegal mode drive controller	Motor control: invalid operating mode
FF25 _h	illegal parameter drive controller	Motor control: invalid parameter value
FF26 _h	parameter too low	Motor control: parameter value too low
FF27h	parameter too high	Motor control: parameter value too large
FF28h	position not accepted	Motor control: position not accepted/processed
FF29h	external force	Effect of an external force
FF2Ah	position overrun error	Drive has not reached its target position due to the effect of an external force
FF2Bh	velocity exceeded	Drive was accelerated to above its maximum rpm through the action of an external force
FF30 _h	illegal homing method	Illegal homing method
FF33 _h	negative limit switch active	Drive standing at the negative end position sensor
FF34 _h	positive limit switch active	Drive standing at the positive end position sensor
FF35 _h	negative limit switch disabled	Negative end position sensor disabled
FF36 _h	positive limit switch disabled	Positive end position sensor disabled
FF37h	home switch disabled	Reference sensor disabled
FF83 _h	drive at target position	Drive at setpoint

Table 7.2 Error codes

8 Accessories and spare parts

8.1 Accessories

Designation	Order number
Braking Resistor Controller UBC60	ACC3EA001

*Reference source of
commissioning software*

The current commissioning software is available for download from the internet.

<http://www.berger-lahr.com/download>

Cable

Supplier recommendations:

- Hans Turck GmbH & Co. KG
www.turck.com
- Franz Binder GmbH & Co. elektrische Bauelemente KG
www.binder-connector.de
- PHOENIX CONTACT GmbH & Co. KG
www.phoenixcontact.com
- Lumberg Automation
www.lumberg-automation.com

Signal interface

Supplier recommendations:

- FCT electronic GmbH
www.fct-electronic.de

Source product manuals

The current product manuals are available for download from the Internet.

<http://www.berger-lahr.com/download>.

9 Service, maintenance and disposal

▲ CAUTION

Destruction of system components and loss of control monitoring

Excessive currents can be created at the signal connections if the negative connection to the controller supply voltage is interrupted.

- Do not interrupt the negative connection between power supply unit and load with a fuse or switch
- Check for correct connection before switching on.
- Never connect the controller supply voltage or change its wiring while there is supply voltage present.

Failure to follow these instructions can result in injury or equipment damage.



You cannot carry out repairs yourself. The repair should only be carried out by a certified customer service organisation. No warranty or liability is accepted for repairs made by the customer.

9.1 Service address

If you cannot resolve the fault yourself please contact your appointed sales partner. Have the following details available:

- Type plate (Type, identification number, serial number, DOM, ...)
- Type of fault (possibly with flash code or fault number)
- Previous and concurrent conditions
- Your own ideas regarding the cause of the fault

Include this information if you return the product for inspection or repair.



If you have any questions please contact your local dealer. Your dealer will be happy to give you the name of a customer service outlet in your area.

9.2 Maintenance

The product is maintenance free.

9.3 Replacing units

⚠ WARNING

Unexpected behaviour

The behaviour of the drive system is governed by numerous stored data or settings. Unsuitable settings or data may trigger unexpected movements or reactions to signals and disable monitoring functions.

- Do not operate a drive system with unknown settings or data.
- Check the stored data or settings.
- When commissioning carefully run tests for all operating statuses and fault cases.
- Check the functions after replacing the product and also after making changes to the settings or data.
- Only start the system if there are no persons or materials in the danger zone and the system can be operated safely.

Failure to follow these instructions can result in death, serious injury or equipment damage.

Observe the following procedure when changing the devices.

- ▶ Store all parameter settings using the commissioning software on your PC.
- ▶ Switch off all supply voltages. Make sure that power is no longer connected (safety instructions).
- ▶ Label all connections and remove the product.
- ▶ Note the identification number and the serial number from the product nameplate for later identification.
- ▶ Install the new product as specified in chapter 4 "Installation"
- ▶ Carry out commissioning as described in Chapter 5 "Commissioning"

9.4 Shipping, storage, disposal

<i>Removal</i>	<p>Removal procedure:</p> <ul style="list-style-type: none">▶ Switch off the power supply.▶ Disconnect the power supply.▶ Pull out all plugs.▶ Remove the product from the system.
<i>Shipping</i>	<p>The product must be protected against shocks during transport. Use the original packaging for this purpose.</p>
<i>Storage</i>	<p>Store the product only under the specified, approved environmental conditions for room temperature and humidity. Protect the product against dust and dirt.</p>
<i>Disposal</i>	<p>The product consists of various materials that can be recycled and must be disposed of separately. Dispose of the product in accordance with local regulations.</p>

10 Glossary

10.1 Units and conversion tables

The value in the specified unit (left column) is calculated for the desired unit (top row) with the formula (in the field).

Example: conversion of 5 metres [m] to yards [yd]

5 m / 0.9144 = 5.468 yd

10.1.1 Length

	in	ft	yd	m	cm	mm
in	-	/ 12	/ 36	* 0.0254	* 2.54	* 25.4
ft	* 12	-	/ 3	* 0.30479	* 30.479	* 304.79
yd	* 36	* 3	-	* 0.9144	* 91.44	* 914.4
m	/ 0.0254	/ 0.30479	/ 0.9144	-	* 100	* 1000
cm	/ 2.54	/ 30.479	/ 91.44	/ 100	-	* 10
mm	/ 25.4	/ 304.79	/ 914.4	/ 1000	/ 10	-

10.1.2 Mass

	lb	oz	slug	kg	g
lb	-	* 16	* 0.03108095	* 0.4535924	* 453.5924
oz	/ 16	-	* 1.942559*10 ⁻³	* 0.02834952	* 28.34952
slug	/ 0.03108095	/ 1.942559*10 ⁻³	-	* 14.5939	* 14593.9
kg	/ 0.453592370	/ 0.02834952	/ 14.5939	-	* 1000
g	/ 453.592370	/ 28.34952	/ 14593.9	/ 1000	-

10.1.3 Force

	lb	oz	p	dyne	N
lb	-	* 16	* 453.55358	* 444822.2	* 4.448222
oz	/ 16	-	* 28.349524	* 27801	* 0.27801
p	/ 453.55358	/ 28.349524	-	* 980.7	* 9.807*10 ⁻³
dyne	/ 444822.2	/ 27801	/ 980.7	-	/ 100*10 ³
N	/ 4.448222	/ 0.27801	/ 9.807*10 ⁻³	* 100*10 ³	-

10.1.4 Power

	HP	W
HP	-	* 745.72218
W	/ 745.72218	-

10.1.5 Rotation

	1/min (RPM)	rad/s	deg./s
1/min (RPM) -		$\ast \pi / 30$	$\ast 6$
rad/s	$\ast 30 / \pi$	-	$\ast 57.295$
deg./s	/ 6	/ 57.295	-

10.1.6 Torque

	lb-in	lb-ft	oz-in	Nm	kp-m	kp-cm	dyne-cm
lb-in	-	/ 12	$\ast 16$	$\ast 0.112985$	$\ast 0.011521$	$\ast 1.1521$	$\ast 1.129 \ast 10^6$
lb-ft	$\ast 12$	-	$\ast 192$	$\ast 1.355822$	$\ast 0.138255$	$\ast 13.8255$	$\ast 13.558 \ast 10^6$
oz-in	/ 16	/ 192	-	$\ast 7.0616 \ast 10^{-3}$	$\ast 720.07 \ast 10^{-6}$	$\ast 72.007 \ast 10^{-3}$	$\ast 70615.5$
Nm	/ 0.112985	/ 1.355822	/ 7.0616 $\ast 10^{-3}$	-	$\ast 0.101972$	$\ast 10.1972$	$\ast 10 \ast 10^6$
kp-m	/ 0.011521	/ 0.138255	/ 720.07 $\ast 10^{-6}$	/ 0.101972	-	$\ast 100$	$\ast 98.066 \ast 10^6$
kp-cm	/ 1.1521	/ 13.8255	/ 72.007 $\ast 10^{-3}$	/ 10.1972	/ 100	-	$\ast 0.9806 \ast 10^6$
dyne-cm	/ 1.129 $\ast 10^6$	/ 13.558 $\ast 10^6$	/ 70615.5	/ 10 $\ast 10^6$	/ 98.066 $\ast 10^6$	/ 0.9806 $\ast 10^6$	-

10.1.7 Moment of inertia

	lb-in ²	lb-ft ²	kg-m ²	kg-cm ²	kp-cm-s ²	oz-in ²
lb-in ²	-	/ 144	/ 3417.16	/ 0.341716	/ 335.109	$\ast 16$
lb-ft ²	$\ast 144$	-	$\ast 0.04214$	$\ast 421.4$	$\ast 0.429711$	$\ast 2304$
kg-m ²	$\ast 3417.16$	/ 0.04214	-	$\ast 10 \ast 10^3$	$\ast 10.1972$	$\ast 54674$
kg-cm ²	$\ast 0.341716$	/ 421.4	/ 10 $\ast 10^3$	-	/ 980.665	$\ast 5.46$
kp-cm-s ²	$\ast 335.109$	/ 0.429711	/ 10.1972	$\ast 980.665$	-	$\ast 5361.74$
oz-in ²	/ 16	/ 2304	/ 54674	/ 5.46	/ 5361.74	-

10.1.8 Temperature

	°F	°C	K
°F	-	$(^{\circ}\text{F} - 32) \ast 5/9$	$(^{\circ}\text{F} - 32) \ast 5/9 + 273.15$
°C	$^{\circ}\text{C} \ast 9/5 + 32$	-	$^{\circ}\text{C} + 273,15$
K	$(\text{K} - 273.15) \ast 9/5 + 32$	$\text{K} - 273.15$	-

10.1.9 Conductor cross section

AWG	1	2	3	4	5	6	7	8	9	10	11	12	13
mm ²	42.4	33.6	26.7	21.2	16.8	13.3	10.5	8.4	6.6	5.3	4.2	3.3	2.6

AWG	14	15	16	17	18	19	20	21	22	23	24	25	26
mm ²	2.1	1.7	1.3	1.0	0.82	0.65	0.52	0.41	0.33	0.26	0.20	0.16	0.13

10.2 Terms and Abbreviations

<i>Actual position</i>	Current absolute or relative position of moving components in the drive system.
<i>Address</i>	Memory location which can be accessed by its unique number. See also Slave address.
<i>CAN</i>	(C ontroller A rea N etwork), standardized open Fieldbus over which the drives and other devices from different manufacturers communicate with one another.
<i>CANopen</i>	Device and manufacturer-independent description language for communication in the CAN bus
<i>DC</i>	Direct current
<i>DC bus</i>	Electric circuit that generates the direct current required to operate the motor and supplies the required energy to the power electronics. The DC bus acts as a buffer for energy fed back by the motor.
<i>Direction of rotation</i>	Rotation of the motor shaft in a positive or negative direction of rotation. A positive direction of rotation is defined as the motor shaft rotating clockwise as the observer faces the end of the protruding shaft.
<i>Drive system</i>	System consisting of controller, power electronics and motor.
<i>EC</i>	European Community
<i>EC motor</i>	Electronically commutated motor
<i>EDS</i>	Electronic Data Sheet Contains the technical data for the motor and gearbox and is loaded in the factory.
<i>EMC</i>	Electromagnetic compatibility.
<i>EU</i>	European Union
<i>Fieldbus</i>	A bus optimised for data transmission between field devices. A Fieldbus is "open", meaning that it is not proprietary (not supported by only one manufacturer). The parameter settings of the drive system can be called and modified via the Fieldbus, inputs can be monitored and outputs controlled and diagnosis and error monitoring functions enabled.
<i>Hall sensor</i>	Sensor for determining position
<i>Holding brake</i>	brake that only prevents the motor from rotating without power after it has stopped (e.g. a vertical-axis lowering). It must not be used as a service brake for braking motion.
<i>I/O</i>	Inputs/Outputs
<i>I²t-monitoring</i>	Predictive temperature monitoring. The expected temperature rise of unit components is calculated in advance on the basis of the motor current. If a limit value is exceeded, the drive system reduces the motor current.
<i>Idx</i>	Index value of a parameter
<i>Inc</i>	Increment
<i>Limit switch</i>	Switch that signals an overrun of the permissible travel range.
<i>LSS</i>	Layer setting services, setting services of the CAN application layers
<i>M</i>	Motor

<i>Master</i>	Active bus user that controls the data traffic in the network.
<i>Node Guarding</i>	Monitoring function with slave at an interface for cyclic communication.
<i>node ID</i>	Node address assigned to a device on the network.
<i>Parameter</i>	Device functions and values that can be set and called by the user.
<i>PC</i>	Personal Computer
<i>PDO</i>	Process Data Object
<i>PELV</i>	Protective Extra Low Voltage, functional low voltage with safe isolation.
<i>PLC</i>	Programmable Logic Controller
<i>power electronic system</i>	This is the unit that controls the motor. The power electronics generate currents for controlling the motor in accordance with the positioning signals from the control unit.
<i>Protection class</i>	The protection class is a standardised specification for electrical equipment that describes the protection against the ingress of foreign bodies and water (for example, IP20).
<i>Protocol</i>	Guideline that specifies the format required for transmitting data.
<i>Quick Stop</i>	Quick stop, function used to provide quick braking of the motor via a command or in the event of a fault.
<i>Register</i>	Memory range of specified size (generally 8, 16 or 32 bits) for temporary storage of data transmitted from one system unit to another.
<i>SDO</i>	Service Data Object
<i>Slave</i>	Passive bus device that receives control commands and provides data to the master.
<i>Slave address</i>	Targeted communications between master and slave is only possible with the assignment of unique addresses.
<i>Software limit switch</i>	Limitation of the movement range in both directions of motion, settings are determined specifically with the application. A positioning is possible only within the working range.
<i>Timeout</i>	Error caused by exceeding the maximum allowable time between query and response of devices.
<i>Watchdog</i>	Equipment that monitors cyclic basic functions in the drive system. Power electronics and outputs are switched off in the event of error.

11 Index

A

- Abbreviations 95
- ABORT 79
- Accessories 87
- Accessories and spare parts 87
- Accessories for networking 58
- Address
 - check 77

B

- Baud rate
 - check 77
- Block movement 75

C

- Cable specifications
 - control inputs for manual operation 56
 - Enable connection 57
 - equipotential bonding conductor connection 52
 - power supply 55, 60
- CE mark 17
- Characteristic curve
 - IclA N065 DC024 27
- Characteristic curves
 - IclA N065 1- with planetary gears 35
 - IclA N065 G- with angled planetary gear 39
 - IclA N065 U- with angled wormgear 43
 - IclA N065 V- with spur wheel gears 30
- Check
 - address 77
 - baud rate 77
- Circular plug-in connector
 - assignment of output socket 58
- circular plug-in connector
 - assignment of input plugs 58
- Commissioning 63
 - steps 65
- Commissioning software
 - features 66
 - requirements 66
- Communication configuration 70
- Commutation errors 75
- Components and interfaces 11
- Configuration mode (for setting parameters) 70
- Connection
 - control inputs for manual operation 56
 - equipotential bonding conductor connection 52
 - power supply 55
- Control inputs for manual operation
 - cable specifications 56
 - connection 56

Current limiting 73

D

Danger classes 20

Declaration of conformity 18

Design data

IcIA N065 1- with planetary gear 34

IcIA N065 DC024 26

IcIA N065 G- with angled planetary gears 38

IcIA N065 U- with angled wormgear 42

IcIA N065 V- with spur wheel gear 29

Diagnostics 77

Directives and standards 17

Disposal 89, 91

Documentation and literature references 16

E

Electrical installation 51

Electronic Data Sheet 14

Electronic log-book 14, 76

EMC 47

Enable connection

cable specifications 57

Enable function 71

Environmental conditions 23

Equipotential bonding conductor connection

cable specifications 52

equipotential bonding conductor connection

connection 52

Equipotential bonding conductors 48

Error code

table 84

Error diagnosis

connections to field-bus mode 77

function test on fieldbus 77

F

Fatal error (fatal) 79

Function test

on fieldbus 77

Functions 70

G

Glossary 93

H

Hall sensor errors 75

Homing 70

I

IcIA

special features 10

Installation

- electrical 51
- Function test 61
- mechanical installation 49
- Installation material
 - Field bus connection 58
- Installation, electrical
 - Connecting supply voltage 54
- Intended use 19
- Interruption of movement
 - cause 84
- Introduction 9

L

- LMT service 70

M

- Maintenance 89
- Manual movement test 61
- Manual operation via fieldbus 69
- Manual operation via signals 69
- manuals 16, 87
- Message 79
- Message objects 78
 - EMCY(80h+ node ID) 78
 - error code (603Fh) 78
 - error register (1001h) 78
 - status word (6041h) 78
- Messages on the device status 79
- Monitoring functions 22, 72
 - block movement 75
 - commutation/Hall sensor errors 75
 - current limiting 73
 - electronic log-book 76
 - outside acceleration 75
 - overload 73
 - self-test at Power On 72
 - speed deviation 75
 - starting error 74
 - temperature 74
 - voltages 74
 - watchdog 76

N

- Network messages
 - after switching on 77
- Network operation
 - not possible 77

O

- Operating functions
 - communication configuration 70
- Operating modes 69
 - homing 70
 - manual operation via fieldbus 69

- manual operation via signals 69
- positioning mode 70
- speed control mode 70
- Operation 69
- Outside acceleration 75
- Overload 73
- Overview
 - all connections 51

P

- Positioning mode 70
- Positioning mode, operating mode 70
- Power supply
 - cable specifications 55, 60
 - connection 55
- product manuals 16, 87
- Protection classes 50

Q

- Qualifications, personnel 19

R

- Reversible error (Rev) 79

S

- Scope of supply 9
- SDO
 - error message 79
- Self-test at Power On 72
- Service 89
- Service address 89
- Shipping 91
- Source
 - product manuals 16, 87
- Speed control mode 70
- Speed control mode, operating mode 70
- Speed deviation 75
- Starting error 74
- Storage 91
- Supply voltage
 - connecting 54
- System checks 61

T

- Technical data 23
- Temperature 74
- Terms 95
- Testing fieldbus wiring 61
- Troubleshooting 77
- Type code 15

U

- Unit overview 10

Units and conversion tables 93

V

Voltages 74

W

WARNING (Warn) 79

Watchdog 76

