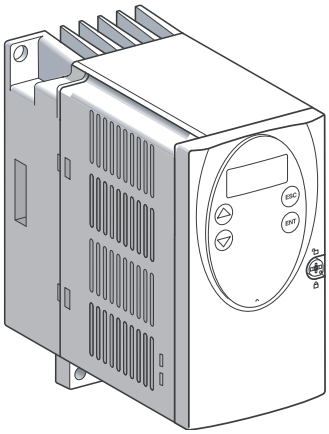
BERGER LAHR

Technical Documentation



Product manual for the AC servo drive system

CPD 170

Order no. ACC1MDADM00EN

Edition: V1.00, 01.2005

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

a company of Schneider Electric

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.

For more information see the chapter on safety.

Not all product types are available in all countries. Please see the current catalogue for the availability of products.

We reserve the right to make technical changes.

All information refers to specifications and not to assured properties.

Most product designations are registered trademarks of their proprietors, even when not specifically noted.

ACC1MDADM00EN, V1.00, 01.2005

Table of Contents

ACC1MDADM00EN, V1.00, 01.2005

ACC1MDADM00EN, V1.00, 01.2005

7 Commissioning

8 Operation

ACC1MDADM00EN, V1.00, 01.2005

ACC1MDADM00EN, V1.00, 01.2005

ACC1MDADM00EN, V1.00, 01.2005

ACC1MDADM00EN, V1.00, 01.2005

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.

Parameter display

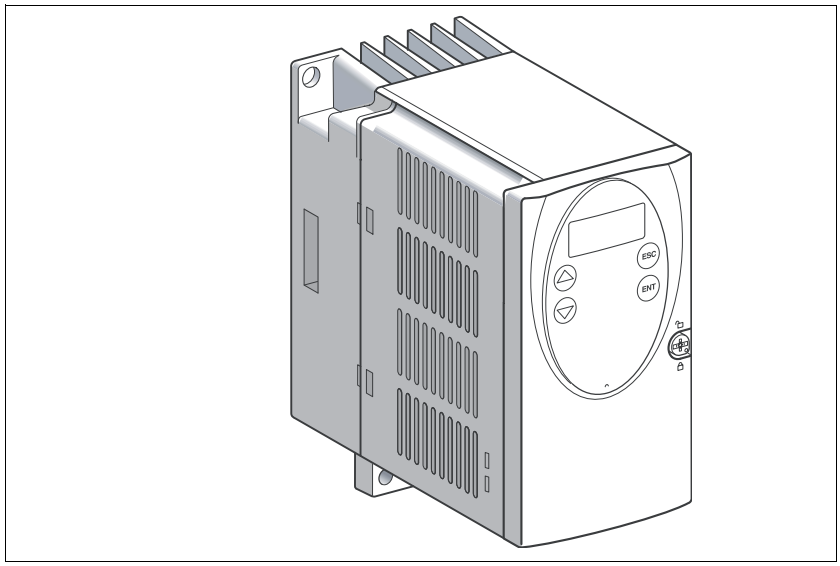
The parameters are shown in the text with parameter name and HMI code, e.g. n_max (nMAX). The tabular view is explained in the parameters chapter. The parameter list is alphabetically arranged by code.

ACC1MDADM00EN, V1.00, 01.2005

ACC1MDADM00EN, V1.00, 01.2005

1 Introduction

1.1 Unit overview



Drive system

The CPD17 is a universally applicable servo drive for brushless servomotors.

The servo drive CPD17 receives its default settings from a PLC or a Berger Lahr Motion Controller, e.g. TLC6, TLCC, TLM2.

It offers a very compact and powerful drive system in combination with the proven SER servomotors from Berger Lahr.

An input panel (HMI) with display and keypad is installed in the front panel for ease of setting parameters.
Because of different power levels there are four different case sizes. The functions are identical for all sizes.

Setpoint entry

Reference values can be preset alternatively by:

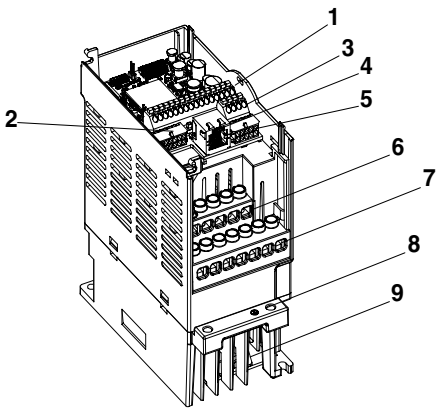
- Field bus: Modbus or CANopen for profile position movements, speed control and torque/speed regulation
- ±10 V analogue signals for torque regulation or speed control . Positional feedback of the actual motor position is accomplished by A/B encoder signals
- Pulse/direction signals or A/B encoder signals for implementing an electronic gearbox

Safety function

The integrated safety function "Safe Standstill" enables a stop of category 0 or 1 as per EN60204-1 without external power protection. This reduces the system costs and response times.

ACC1MDADM00EN, V1.00, 01.2005

1.2 Components and interfaces



(1) CN1, I/O signal connection (spring-loaded terminals)

- Two ±10 V analogue setpoint inputs in the speed control and current control operating modes (torque regulation)
- Eight digital inputs/outputs. The assignment depends on the selected operating mode
- CANopen for field bus control

(2) CN2, 12-pin Molex socket for motor encoder (SinCos Hiperface® sensor)

(3) CN3, terminal for 24 V power supply

(4) CN4, RJ45 socket for connecting

- Field bus: Modbus or CANopen
- PC with "Power Suite 2" software
- Peripheral control terminal

(5) CN5, 10-pin Molex socket for

- Output of actual motor position via A/B encoder signals in speed control and current control operating modes for position feedback for a higher level position controller (e.g. PLC with motion-control card).
- Input of pulse/direction or A/B encoder signals in electronic gearbox mode

(6) Screw terminals for connecting the mains power

(7) Screw terminals for connecting the motor and external brake resistors

(8) Bracket for EMC mounting plate

(9) Heat sink and ventilator on sizes 2 and 3

ACC1MDADM00EN, V1.00, 01.2005

1.3 Model Selection Chart

Example	CPD 1	7	x	x	x	x	x	x
Product designation:CPD 1	**CPD 1**	7	x	x	x	x	x	x
Product type 7 - AC-Servo drive for one axle	CPD 1	**7**	x	x	x	x	x	x
Interfaces 0 - universal drive: analogue, pulse direction and field bus (CANopen and Modbus) P - Profibus	CPD 1	7	**x**	x	x	x	x	x
Power amplifier supply voltage [V_{AC}] 1 - 115$V_{AC\ 1\sim}$ 2 - 230$V_{AC\ 1\sim}$ 3 - 230$V_{AC\ 3\sim}$ 4 - 480$V_{AC\ 3\sim}$	CPD 1	7	x	**x**	x	x	x	x
Mains filter F - mains filter fitted N - no mains filter fitted	CPD 1	7	x	x	**x**	x	x	x
Peak current (Peak value $\hat{I}$ [A_{peak}]) 10 - 10A_{peak} 14 - 14A_{peak} 17 - 17A_{peak} 28 - 28A_{peak} 34 - 34A_{peak} 42 - 42A_{peak} 57 - 57A_{peak}	CPD 1	7	x	x	x	**x**	x	x
Degree of protection S - Standard (IP20 Front, IP30 Side, IP40 Top) P - Protected(IP55)	CPD 1	7	x	x	x	x	**x**	x
Size [mm] 1 - W:72 H:130 D:140 2 - W:105 H:130 D:150 3 - W:140 H:170 D:150 4 - W:180 H:220 D:170	CPD 1	7	x	x	x	x	x	**x**

1.4 Documentation and literature references

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

- **device manual**, describes the technical data, installation, commissioning and all operating modes and operating functions of the power controller.
- **Field bus manuals**, essential descriptions for linking the drive system into a field bus , e.g. CANopen, Modbus, Profibus.
- **Motor manual**, describes the technical properties of the motors, including correct installation and commissioning.

The ordering numbers for the above documentation can be found in the a"ccessories and spare parts" section on page 12-1.

The entire documentation is also available on CD

Additional literature

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

No recommendation

ACC1MDADM00EN, V1.00, 01.2005

1.5 Directives and standards

CE mark

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. The drive systems described here can be used anywhere in the world.

EC Machine Directive

The drive systems described here are not machines as defined by the EC Machine Directive (89/392/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.

The manufacturer must certify that the complete system conforms to the machine directive with the CE mark.

EC EMC Directive

The EC Electromagnetic Compatibility Directives (89/336/EEC) applies to products that cause electromagnetic interference or whose operation may be be adversely affected by electromagnetic interference.

Conformity with the EMC Directive can only be expected of our 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.

EC Low-Voltage Directive

The EC Low-Voltage Directive (73/23/EEC) lays down safety requirements for 'electrical apparatus' as protection against the risks that can originate in such devices and can be created in response to external influences.

The drive systems described here comply with the EN 50178 Standard as per the Low-Voltage Directive.

Declaration of conformity

The declaration of conformity certifies that the drive system complies with the specific EC directive.

Standards for safe operation

DIN EN 60204-1: 1998-11 Electrical equipment of machines, General requirements

DIN VDE 0100, Regulations regarding the installation of high-voltage systems with voltages up to 1000 V

DIN VDE 0106-100: 1983-03 Protection against electric shock; layout of actuation elements in the vicinity of equipment in danger of contact

DIN EN 60529: 2000-09 IP degrees of protection

DIN EN 954-1: 1997-03 Safety of machines, Safety of components of control devices, Part 1: General design requirements

IEC61508 ”Functional safety of safety-related electric, electronic and programmable electronic systems”

Standards applicable to retaining the EMC limit values

DIN EN 61000-4-1: 2001-06 Measuring and test procedures, overview

DIN EN 61800-3: 2001-02: Variable-speed electrical drives

ACC1MDADM00EN, V1.00, 01.2005

1.6 Declaration of conformity

EC Declaration of Conformity
Year 2005

BERGER LAHR

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

☒ according to EC Directive Low Voltage 73/23/EEC; changed by CE Marking Directive 93/68/EEC
☒ according to EC Directive on Machinery 98/37/EEC
☒ according to EC Directive EMC 2004/108/EEC

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:	Motor Control Electronics
Type:	CPD170xxxxxx
Product number:	00637x170xxxx
Applied harmonized standards, especially:	EN ISO 13849-1:2004, Performance Level "d" EN 61508:2002, SIL 2 EN 50178:1998 EN 61800-3:2001, second environment according to Berger Lahr EMC test conditions
Applied national standards and technical specifications, especially:	UL 508C Berger Lahr EMC test conditions 200.47-01 EN Product documentation
Company stamp:	Berger Lahr GmbH & Co. KG Postfach 11 80 · D-77901 Lahr Breslauer Str. 7 · D-77933 Lahr
Date/ Signature:	19 January 2005
Name/ Department:	Wolfgang Brandstätter/R & D GMC Motors & Drives

ACC1MDADM00EN, V1.00, 01.2005

1.7 TÜV certificate for functional safety

Certificate

The Certification Body RWTÜV Systems GmbH of
Product Safety and Medical Devices hereby certify

Berger Lahr GmbH & Co. KG
Breslauer Str. 7

77933 Lahr
Germany

for the realisation of the function "Safe Standstill" and Emergency Stop" in the servo drive
Type: CPD17xxx
the compliance of the below mentioned requirements:

- IEC 61508: 2000; Part 1 to Part 7; Functional safety of electrical/electronic/programmable electronic safety-related systems; Type B; SIL 2
- pr IEC 62061:2003; SIL 2; Safety of machinery; Safety-related parts of control systems. Part 1: General principles for design
- pr DIN EN ISO 13849-1:2004; Performance-Level „d“ (Category 3); Safety of machinery; Safety-related parts of control systems; Part 1: General principles for design

Based on the report No.: 701-045/2003CPD in the valid version
this certificate entitles the owner to use the mark

IEC 61508/ SIL 2
pr IEC 62061/SIL 2
pr EN 13849
p-level “d” (Cat.3)
PFH = 2.85*10^{-9}
Lifetime:
20 years
SAS-0078/04
Safety Approved

Validation of TÜViT GmbH in cooperation with RWTÜV Systems GmbH

Certificate-Register-No.: SAS-0078/05 Essen, 2005-01-13
File reference: 2.4-4014/04
Valid to: 2010-01-13

Michael Eck Dr. Ulrich Adolph

RWTÜV Systems GmbH
Postfach 10 32 61 - 45032 Essen

ACC1MDADM00EN, V1.00, 01.2005

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 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 systems may be commissioned and operated only after installation in accordance with EMC requirements and the product-specific specifications.

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).

ACC1MDADM00EN, V1.00, 01.2005

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.

ACC1MDADM00EN, V1.00, 01.2005

2.4 General safety instructions

DANGER!

Electric shock, fire or explosion

- Only qualified personnel 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.
- Before working on the drive system:
  - Switch off power to all terminals.
  - Place a sign "DO NOT SWITCH ON" on the switch and lock to prevent switching on.
  - **Wait 6 minutes** (for discharge of DC bus capacitors).
  - Measure voltage between DC+ and DC- and check for <48V. (The DC bus LED is not a safe indication for absence of the DC bus voltage).
- Do not short-circuit DC bus or touch unshielded components or screws of the terminals with voltage present.
- Install all covers and close the housing doors before applying power.
- The motor generates voltage when the shaft is rotated. Lock the shaft of the motor to prevent rotation before starting work on the drive system.
- The system manufacturer is responsible for compliance with all applicable regulations relevant to earthing the drive system.
- Do not reach into the drive system (e.g. no pointed objects).

DANGER!

Danger of injury by complex system!

When starting field bus operation the attached controllers are generally out of view of the operator and cannot be directly monitored.

- Start the system only if there are no persons within the actuation zone of the moving system components and the system can be operated safely.

ACC1MDADM00EN, V1.00, 01.2005

WARNING!

Danger of injury and damage to system components by loss of control!

- Observe the accident prevention regulations.
- The system manufacturer must consider the possible errors that could occur with the signals and in particular the critical functions to ensure a safe status during and after errors. Examples for these are: emergency stop, final position limit, power failure and restart.
- Consideration of possible errors must also include unexpected delay and failure of signals or functions.
- Separate redundant controller paths must be provided for dangerous functions.
- Verify the effictiveness of the measures.

2.5 Safety functions

Using the safety functions integrated in this product requires careful planning. For more information see 5.3 ""Safe Standstill safety function"" on page 5-2.

2.6 Monitoring functions

The monitoring functions in the drive protect the system and reduce the risk in the event of system malfunction. The monitoring functions are not designed for personal safety. The following faults and limit values can be monitored:

Monitoring	Task	Protective function
Data connection	Error response to connection break	Functional safety and system protection
Limit switch signals	Monitoring the allowable traverse range	System protection
Following error	Monitoring deviation from motor position to setpoint position	Functional safety
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 limitation	Power limitation at overload	Device protection

Table 2.1 Monitoring functions

For the description of the monitoring function see 8.6.1 “Monitoring functions“ from page 8-43.

ACC1MDADM00EN, V1.00, 01.2005

3 Technical Data

This chapter contains information on the required environmental conditions and on the mechanical and electrical properties of the unit family and the accessories.

3.1 Environmental conditions

3.1.1 Temperature, humidity, installation height

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 permissible ambient 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.

Temperature [1]	[°C]	0 to +50

1) no icing

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.

Temperature	[°C]	-25 to +70

Relative humidity

The relative humidity is allowed as follows:

rel. air humidity	conforming to IEC60721-3-3, Class 3K3, 5% to 85%, no condensation permitted

Installation height

Installation height above mean sea level for 100% power	[m]	<1000
Max. ambient temperature 40°C, no protective foil and side distance >50 mm	[m]	<2000 m

3.1.2 Oscillation and shock loading

The strength during oscillation stress on the units corresponds to EN 50178 Section 9.4.3.2 and EN 61131 Section 6.3.5.1.

Oscillation and vibration	10Hz to 57Hz: 0.075mm amplitude 57Hz to 150Hz: 1g
Shock loading	according to EN 61131 Sect. 6.3.5.2

ACC1MDADM00EN, V1.00, 01.2005

3.1.3 Degree of protection as per EN60529

Degree of protection when using "Safe Stop"

The "Safe Stop" function must only be operated under environmental conditions corresponding to degree of protection IP54. This can be done by using units with degree of protection IP54, or the unit must be installed in a switch cabinet with the corresponding degree of protection. This is essential to prevent short circuits caused by foreign bodies contacting the safety-relevant circuit components.

Units with degree of protection standard "S"

The units with the "S" degree of protection in the type code have the overall degree of protection IP20, in which degree of protection IP40 is maintained for the top of the case so long as the safety cover on top of the unit has not been removed. If the safety cover must be removed because of the ambient temperature or the unit clearances, see page 6-6

3.2 Mechanical data

Sizes of the standard units

The standard units are available in sizes 1 to 4. The last number of the order description denotes the size. A unit with the identification xxx17xxxxxS2 is a standard unit of size 2.

Standard unit		Size 1	Size 2	Size 3	Size 4
Dimensions (W*H*D)	[mm]	72 * 145* 140	105 * 143* 150	140 * 184* 150	180 * 232* 170
Weight with filter / without filter	[kg]	1.1 / 1.1	1.4 / 1.3	2.0 / 2.0	x / x
Type of cooling		Convection >1 m/s	Fan	Fan	Fan
Degree of protection		IP20 (IP40) 1)	IP20 (IP40) 1)	IP20 (IP40) 1)	IP20 (IP40) 1)

1) IP40 restricted, only from above without removal of safety cover.

3.2.1 Dimensional drawings

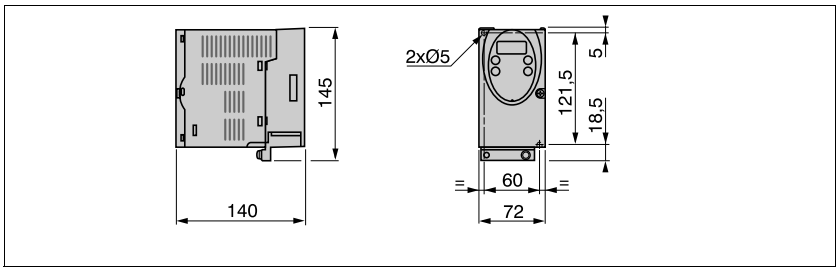


Figure 3.1 Dimensional drawing Size 1

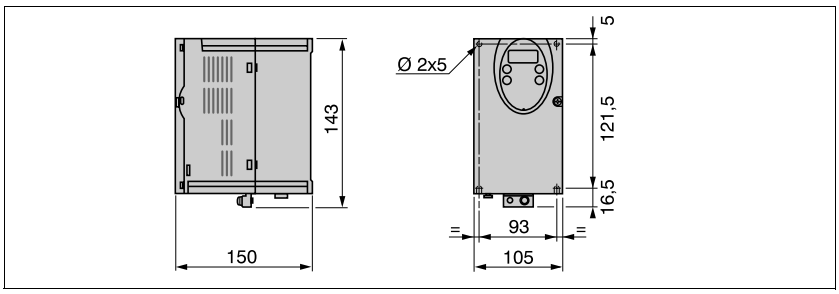


Figure 3.2 Dimensional drawing Size 2

ACC1MDADM00EN, V1.00, 01.2005

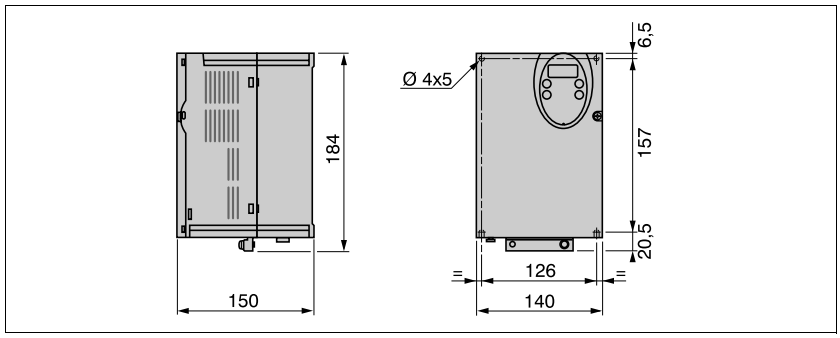


Figure 3.3 Dimensional drawing Size 3

3.3 Electrical Data

3.3.1 Performance data for power amplifier

Mains voltage: range and tolerance

$115V_{AC}$	[V]	100V -15% to 120V +10%
$230V_{AC}$	[V]	200V -15% to 240V +10%
$400V_{AC}$	[V]	380V -15% to 480V +10%
Frequency	[Hz]	50Hz-5% to 60 Hz +5%

transient overvoltages	overvoltage category III

Switch-on current and leakage current

Starting current	[A]	<60
Leakage current (as per IEC 60990, Figure 3)	[mA]	<30 [1)]

1) measured on networks with earthed neutral point, with no external mains filter. When using residual-current devices make sure that a 30 mA residual-current device can trigger at 15 mA. A high-frequency leakage current also flows, which is not considered in the measurement. Residual current devices respond differently to this.

Power consumption and impedance of mains power

The specified power consumption refers to a network with the specified reference voltage and the assumed short-circuit impedance at nominal power output. The power consumption depends strongly on the impedance of the supply network. This is specified by a possible short-circuit current. If the actual network deviates from this, line reactors must be installed upstream.

Monitoring the continuous output current

The continuous output current at 4kHz and 8kHz is monitored by the unit. If the value is continuously exceeded, the output current is reduced by the unit. The internal overtemperature monitoring does not respond at the specified values so long as the ambient temperature remains below 40°C and no heat is generated at the internal ballast resistor.

Peak output current for 3 seconds

The peak output current at 4kHz and 8kHz can be output by the unit for 3 seconds. If the peak current flows at motor standstill, the higher heat build-up enables the current limiting of the unit earlier that when the motor is rotating.

Continuous and peak currents are lower at 8kHz because of higher losses. This is particularly clear in units with higher DC link voltage ($400V_{AC}$). Therefore, the units with $400V_{AC}$ are factory-set to 4kHz and all others to 8kHz.

Voltage compared to PE (rated insulation voltage)

The insulation of the units is designed for a rated voltage of 480 VAC (or 240 VAC for size 1 units). The voltage against earth must not exceed these values.

Approved motors

For an overview of the approved motors that can be attached to this unit see the product catalogue. When making the selection consider the type and amount of the mains voltage.

ACC1MDADM00EN, V1.00, 01.2005

Overview of single-phase units

		1F10S1	1F17S2	1F28S3	2F10S1	2F17S2	2F28S3
		115V, size 1	115V, size 2	115V, size 3	230V, size 1	230V, size 2	230V, size 3
Power consumption at rated voltage	[A_{rms}]	7.3	11	21.6	7	11	20
Nominal voltage	[V]	115	115	115	230	230	230
max. permissible short circuit current of network	[kA]	1	1	1	1	1	1
rated power (motor power output)	[kW]	0.4	0.65	0.85	0.75	1.2	2.5
continuous output current at 4kHz	[A_{rms}]	4	8	15	4	8	15
peak output current at 4kHz	[A_{rms}]	7	12	20	7	12	20
continuous output current at 8kHz	[A_{rms}]	3.2	7	13	3.2	7	13
peak output current at 8kHz	[A_{rms}]	6	11	20	6	11	20
Primary fuse [1)]	[A]	10	15/16	25	10	15/16	25

1) Fuses: UL-approved class CC or J fusible links, alternatively circuit breakers with B-characteristic. Specification 15/16 A: circuit breakers are available with 16A nominal current, UL fuses with 15A.

Overview of three-phase units

		3N10S1 [1)]	3N17S2 [1)]	3N42S3 [1)]	4F14S2	4F34S3	4F57S4
		230V, size 1	230V, size 2	230V, size 3	400V, size 2	400V, size 3	400V, size 4
Power consumption at rated voltage	[A_{eff}]	4.5	7.75	16.5	4	9.2	x
Nominal voltage	[V]	200	200	200	400	400	400
max. permissible short circuit current of network	kA	5	5	5	5	5	x
rated power (motor power output)	[kW]	0.75	1.4	3.2	1.4	3.0	x
continuous output current at 4kHz	[$A]_{eff}$]	4	8	17	6	15	x
peak output current at 4kHz	[A]	7	12	30	10	24	x
continuous output current at 8kHz	[A_{eff}]	3.2	7	15	5	11	x
peak output current at 8kHz	[A_{rms}]	6	11	30	7.5	18	x
Primary fuse [2)]	[A]	10	10	25	10	15/16	x

1) Unit without integrated mains filter
2) Fuses: UL-approved class CC or J fusible links, alternatively circuit breakers with B-characteristic. Specification 15/16 A: circuit breakers are available with 16A nominal current, UL fuses with 15A.

Three-phase units with an operating voltage of 3*230V and designation xxx3Nxx do not have integrated mains filters. Use an external filter to comply with the EMC regulations. For information on mains filters see the chapter on accessories, page 12-2

ACC1MDADM00EN, V1.00, 01.2005

3.3.2 24VDC controller power supply

CN1 and CN3 spring-loaded terminals

The CN1 and CN3 connections are spring-loaded terminals with a maximum current carrying capacity of 2A.

24 V power supply

The 24V supply voltage must meet the requirements of IEC 61131-2 (PELV standard power supply):

Input voltage	[V]	24V -15% / +20%
Input current (without load)	[A]	≤1
Ripple voltage		<5%

3.3.3 Signals

Signal inputs are reverse polarity protected, outputs are resistant to short-circuit. There is an electrical connection to `0VDC`.

24V input signals

When configured for positive logic, the input levels correspond to EN 61132-2, type 1

Logic 1 (V_{high})	[V]	+15 to +30
Logic 0 (V_{low})	[V]	-3 bis +5
Debounced, debounce time	[ms]	4
Debounce time - Safe Stop	[ms]	>1

24V output signals

The 24V output signals correspond to IEC 61131-2.

Output voltage	[V]	≤30
max. switching current	[mA]	≤50
voltage drop at 50 mA load	[V]	≤1

Analogue input signals

Differential input voltage range	[V]	-10 to +10
Input resistance	[kΩ]	≥10
Resolution`ANA1`	[Bit]	14
Resolution`ANA2`	[Bit]	12
Sampling time `ANA1`	[ms]	0.25
Sampling time `ANA2`	[ms]	1

Pulse/direction, A/B input signals

The pulse/direction and A/B signals conform to the RS422 interface specifications

Symmetrical		conforming to RS422
Asymmetrical	[V]	-7 to +12
Input resistance	[kΩ]	5
Input frequency, pulse/direction	[kHz]	≤200
Input frequency, A/B	[kHz]	≤400

ESIM output signals

The ESIM signal complies with the RS422 interface specifications

ACC1MDADM00EN, V1.00, 01.2005

Logic level		corresponding to RS422
Output frequency	[kHz]	≤450

CAN bus signals

The CAN bus signals comply with the CAN standard and are short-circuit resistant.

Sensor signals

Output voltage for encoder		+10V / 100mA
SIN/COS input signalVoltage range		$1V_{SS}$ with 2.5V offset, $0.5V_{SS}$ at 100kHz
Input resistance	[Ω]	120

The output voltage is short-circuit resistant and overload resistant. The transmission protocol is asynchronous half-duplex in compliance with RS485.

3.3.4 Safety functions

Data for maintenance schedule and safety calculations

Use the following data for your maintenance schedule and safety calculations:

Service life corresponding to safety life cycle (IEC 61508)	20 years
SFF (Safe Failure Fraction) (IEC61508)	70%
Probability of failure (PFH) (IEC 61508	$2.1*10^{-8}$ 1/h
Response time (until shutdown of power amplifier)	<10ms

ACC1MDADM00EN, V1.00, 01.2005

3.3.5 Internal ballast resistor

The unit has an internal ballast resistor. If this is insufficient, it will be necessary to use one or more external ballast resistors - see also Chapter 6.3.5, "Connecting ballast resistors", page 6-206.3.5 “Connection of ballast resistor“ 6-20. For an overview of the available external ballast resistors see the chapter on accessories on page 12-1

Unit [1]	Energy consumption of internal capacitors E_{var}	resistance internal	Continuous rating P_{PR}	Peak energy E_{CR}	Switch-on voltage
	[Ws]	[Ω]	[W]	[Ws]	[V]
Size 1, 115V, 1~	10.8	40	20	200	250
Size 1, 230V, 1~	17.7	40	20	900	430
Size 1, 230V, 3~	17.7	40	20	900	430
Size 2, 115V, 1~	16.2	40	40	200	250
Size 2, 230V, 1~	26.6	40	40	900	430
Size 2, 230V, 3~	26.6	40	40	900	430
Size 2, 400V, 3~	26.0 [2]	40	40	1000	770
Size 3, 115V, 1~	26.0	20	60	1000	250
Size 3, 230 V, 1~	43.0	20	60	1600	430
Size 3, 230 V, 3~	43.0	30	60	1600	430
Size 3, 400 V, 3~	52.0 [3]	30	60	1600	770

1) For allocation of size, voltage and phase number see also type code on page 1-3
2) at 480 V: 6.0 Ws
3) at 480 V: 12.0 Ws

Table 3.1 Values for internal ballast resistors

ACC1MDADM00EN, V1.00, 01.2005

3.3.6 Internal line filter

The EMC standards differentiate between various application cases:

EN 61800-3:2001-02; IEC 61800-3, Ed.2	Description
first environment, general availability; category C1	operation in living areas, e.g. sale by hardware supplier
first environment, restricted availability; category C2	operation in living areas, sale through dealers only
second environment; category C3	operation in industrial networks

This drive system meets the EMC requirements for the second environment under the IEC 61800-3 standard if the measures described for the installation are taken into account. When operating outside this application area note the following:

WARNING!

This is a product with restricted availability under IEC 61800-3. This product may cause interference in living areas; in this case the operator may be required to take appropriate action.

Better values can be achieved depending on the unit and the application and also the structure, e.g. on installation in an enclosed switch cabinet. If the limit values for the first environment (public networks, category C2) are required, external line filters must be connected in series.

You can determine whether the your unit has an integrated mains filter from the name plate and selection chart, or from the specifications. Units with an integrated mains filter have an “F” in the identification, e.g. ...2**F**10S1, units without an integrated filter have an “N” at this part of the identification, e.g. ...3**N**17S2.

The following limiting values for wiring related fault disturbances are met by EMC compatible designs:

Units with internal mains filter (xFxxxx)	second environment (industrial, category C3) up to 10m motor cable length

An external line filter is required when using a unit without an integrated line filter or with long motor lines. The operator must ensure that the EMC directives are observed in this case. For order data for external line filters see the chapter on accessories on page 12-2

3.4 Technical Data accessories

3.4.1 External ballast resistors

The unit has an internal ballast resistor. If this is not sufficient, one or more external ballast resistors must be used. The following minimum resistance values must be met and the internal resistance must be deactivated, see also the chapter on commissioning, page 6-21. For an overview of the available external ballast resistors see the chapter on accessories on page 12-1

Unit [1)]	External ballast resistor		Switch-on voltage
	min [Ω]	max [Ω]	[V]
Size 1, 115V, 1~	27	45	250
Size 1, 230V, 1~	50	75	430
Size 1, 230V, 3~	50	75	430
Size 2, 115V, 1~	20	27	250
Size 2, 230V, 1~	27	45	430
Size 2, 230V, 3~	27	45	430
Size 2, 400 V / 480 V, 3~	60	80	770
Size 3, 115 V, 1~	10	20	250
Size 2, 230V, 1~	16	27	430
Size 2, 230V, 3~	10	20	430
Size 2, 400 V / 480 V, 3~	25	36	770

1) For allocation of size, voltage and phase number see also type code on page 1-3

Table 3.2 Values for external ballast resistors

3.4.2 External line filter

The EMC standards differentiate between various application cases; see Chapter 3.3.6 “Internal line filter“, page 3-9.

Better values can be achieved depending on the unit and the application and also the structure, e.g. on installation in an enclosed switch cabinet. If the limit values for the first environment (public networks, category C2) are required, external line filters must be connected in series.

The following limiting values for wiring related fault disturbances are met by EMC compatible designs:

All units with an external mains filter	first environment, restricted availability (public network, category C2) up 20m motor cable length, unit installed in an enclosed control cabinet with 15 dB attenuation.
second environment (industrial, category C3) up to 40m motor cable length (100m with 8kHz switching frequency)	

An external line filter is required when using a unit without an integrated line filter or with long motor lines. The operator must ensure that the

ACC1MDADM00EN, V1.00, 01.2005

EMC directives are observed in this case. For order data for external line filters see the chapter on accessories on page 12-2

3.4.3 Line reactor

Line reactor

If the mains power does not correspond to the requirements described for impedance, line reactors may need to be installed, see also the chapter on installation. For order data see the chapter on accessories on page 12-1

3.4.4 Holding brake controller

For motors with holding brake we recommend appropriate control logic (HBC) that releases the brake when the motor is powered and locks the motor axis at the correct moment before the power amplifier supply voltage is switched off and optionally reduces the braking voltage.

Dimensions of holding brake controller HBC

Dimensions (H * B * D)	[mm]	99 * 22.5 * 114.5
Installation on top-hat rail		

Electrical data of holding brake controller HBC

Input		
Supply voltage	[V]	19.2 to 30
Input current	[A]	0.5 + braking current
Output, brake		
DC voltage before voltage reduction	[V]	23 to 25
Maximum output current	[A]	2.1
Nominal time to voltage reduction	[ms]	1000
DC voltage with voltage reduction	[V]	17 to 19

The HBC holding brake controller has a safe electrical isolation between the 24 V input, control input and brake output. For more information see page 6-31, 7-25, 8-62 and 12-1.

3.4.5 Cable

Motor and encoder cable

The motor cable and encoder cables are suitable for trailing and are available in various lengths. Various motor cable cross sections are also available. For the corresponding types see the accessories section on page 12-1.

Permissible voltage	[VAC]	600 (UL and CSA)
Shield		Shield braiding
Sheath		Oil-resistant PUR
Temperature range	[°C]	-40 to +90 (fixed) -20 to +80 (movable)
Minimum bending radius		4 x diameter (fixed) 7.5 x diameter (moving)

ACC1MDADM00EN, V1.00, 01.2005

ACC1MDADM00EN, V1.00, 01.2005

4 Basics

4.1 Safety functions

Automation and safety engineering are two areas that were completely separate in the past but more recently have become more and more integrated. Planning and installation of complex automation solutions are greatly simplified by integrating safety functions. Safety-oriented functions are taken into consideration when planning automation and risks can be minimised more easily.

In general the safety engineering requirements depend on the application. The degree of the requirements is oriented to the risk and the hazard potential arising from the specific application.

Working with IEC61508

IEC61508 standard

The IEC61508 standard "Functional safety of safety-related electric, electronic and programmable electronic systems" covers the relevant safety-relevant function. This means that it is not only one single component but always a complete function chain (e.g. from the sensor through the logical processing unit to the actuator) that is considered as one single unit. The function chain must meet the requirements of the specific safety level as a whole. The standard establishes a basic standard that is virtually application-independent. Systems and components that can be used in various applications for safety tasks with comparable risk can be developed in this base.

SIL, Safety Integrity Level

The comparable risk is defined by the maximum achievable safety level SIL, which can be at level 1 to level 4 (maximum safety). This is based on an assessment of the hazard potential derived from the hazard and risk analysis. This is used to decide whether the relevant function chain requires a safety function and which hazard potential it must cover.

PFH, Probability of a dangerous failure per hour

To maintain the safety function the IEC61508 standard, depending on the required SIL, requires staged fault-control and fault-prevention measures. All components of a safety function must be subjected to a probability analysis to assess the effectiveness of the fault-control measures that were taken. This assessment determines the dangerous probability of failure PFH (probability of a dangerous failure per hour) for protective systems. This is the probability per hour that a protective system fails in a hazardous manner and the protective function cannot be correctly executed. The PFH must not exceed the values calculated for the complete protective system depending on the SIL. The individual PFH of a chain must be calculated together, the total of the PFH must not exceed the maximum value specified in the standard.

SIL	PFH at high requirement rate or continuous requirement
4	$>10^{-9}$ to $<10^{-8}$
3	$>10^{-8}$ to $<10^{-7}$
2	$>10^{-7}$ to $<10^{-6}$
1	$>10^{-6}$ to $<10^{-5}$

ACC1MDADM00EN, V1.00, 01.2005

HFT and SFF

The standard also requires a specific hardware fault tolerance HFT for the safety system depending on the SIL in connection with a specific proportion of safe failures SFF (safe failure fraction). The hardware fault tolerance is the property of a system that enables it to execute the desired safety function in spite of the presence of one or more hardware faults. The SFF of a system is defined as the ratio of the rate of safe failures to the total failure rate of the system. Under IEC61508 the maximum achievable SIL of a system is determined by the hardware fault tolerance HFT and the safe failure fraction SFF of the system.

SFF	**HFT type A subsystem**		
	0	**1**	**2**
<60%	SIL1	SIL2	SIL3
60%- <90%	SIL2	SIL3	SIL4
90%- < 99%	SIL3	SIL4	SIL4
> 99%	SIL3	SIL4	SIL4

Fault-prevention measures

Systematic faults in the specifications, in the hardware and the software, usage faults and maintenance faults of the safety system must be avoided as much as possible. IEC61508 specifies a series of fault-prevention measures that must be implemented depending on the required SIL. The fault-prevention measures must accompany the complete life cycle of the safety system, i.e. from design to decommissioning of the system.

ACC1MDADM00EN, V1.00, 01.2005

5 Engineering

This chapter contains basic information on options for use of the unit, which are essential for planning. Assistance is given indicating which settings are required for the specific operational case and how this influences the wiring.

5.1 Adjustable signal logic

This product can switch the 24V inputs and outputs as follows depending on the setting:

logic	active status
positive logic	current flows to the input output sends current
negative logic	current flows from the input output absorbs current

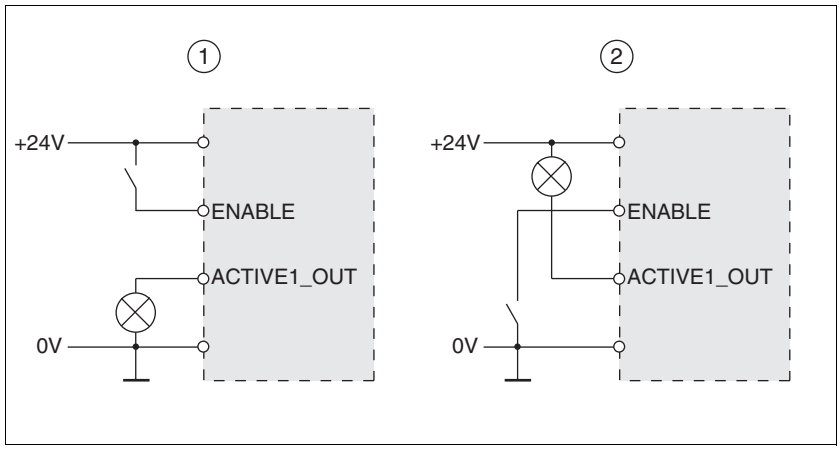


Figure 5.1 Positive logic (left) and Negative logic (right)

It is specified by "First Setup" with the parameter `IOLogicLevel`. This setting affects the wiring and the control of sensors and must be thoroughly clarified during planning with regard to the application.

The use of negative logic requires special care, because earth fault and wire breakage will be detected as ON status (z.B. start signal). With positive logic a short circuit to earth and wire break will be interpreted as OFF status. See also EN61131-2 for specific information on the properties of negative logic

Special case: Safety function $\overline{\texttt{SAFE\_DISABLE}}$

The inputs for the safety function "Safe Stop" (inputs $\overline{\texttt{SAFE\_DISABLE\_A}}$ and $\overline{\texttt{SAFE\_DISABLE\_B}}$) are **always** executed in positive logic regardless of the setting!

5.2 Specification of the con troller type

Control mode: local or field bus

The basic specification of whether the system should be controlled locally or over the field bus must be made when the product is started for

the first time. This specification can only be modified by restoring the factory setting, see page 8-67.

The availability of operating modes of the product also depends on this setting.

Local control mode With a local control mode the movement is preset with analogue signals (±10V) or with RS422 signals (e.g. pulse/direction).

Limit switches and reference switches cannot be connected with the control mode.

Field bus control mode In the field bus control mode all communications are made via field bus commands.

5.3 "Safe Standstill safety function"

For some general information on the application of IEC 61508 see page 4-1.

5.3.1 Definitions

Safe Standstill The Safe Standstill safely shuts down the motor torque. There is no monitoring at standstill.

Category 0 stop (EN60204-1) Stopping by immediate removal of power to the machine actuators (i.e. an uncontrolled stop).

Category 1 stop (EN60204-1) A controlled stop with power available to the machine actuators to achieve the stop and then removal of power when the stop is achieved;

5.3.2 Function

The "Safe Stop" safety function integrated into the product can be used to implement the control function "Standstill in Emergency" (EN 60204-1) for Stop Category 0 and Stop Category 1. In addition, this safety function prevents the drive from restarting unexpectedly.

The following safety stages are implemented in accordance with the standards for functional safety:

- IEC 61508 SIL 2
- EN 954-1 category 3
- EN 13849-1 PL d (Performance Level d)

Function The Safe Stop safety function can be triggered with the two redundant inputs SAFE_DISABLE_A and SAFE_DISABLE_B. The circuits of the two inputs must be separate from each other to retain the two channels. The switching process must be simultaneous for both inputs.
The power amplifier is without power and an error message is sent as soon as one of the two inputs is shut down. Then the motor cannot generate torque and runs down without braking. A restart is only possible after resetting the error message.

ACC1MDADM00EN, V1.00, 01.2005

5.3.3 Requirements for safe application

DANGER!

Electric shock caused by incorrect use!

The "Safe Standstill " function does not effect any electrical disconnection. The inter circuit voltage is still present.

- Turn off the mains voltage using an appropriate switch to achieve a voltage-free condition.

WARNING!

Danger of injury by incorrect usage!

Incorrect usage may cause a safety hazard by loss of the safety function.

- Observe the requirements for the safety function.

Stop of category 0

In a stop of category 0 the drive runs down uncontrolled. If access to the machine while it is running down is a hazard (result of hazard and risk analysis), suitable measures must be taken.

Stop of category 1

For a stop of category 1 a controlled standstill can be requested with the signal $\overline{\texttt{HALT}}$ or over the field bus. The standstill is not monitored by the drive system and is not guaranteed if power fails or in the event of an error. The final shutdown is ensured by shutting down the inputs $\overline{\texttt{SAFE\_DISABLE\_A}}$ and $\overline{\texttt{SAFE\_DISABLE\_B}}$. This is generally controlled by a standard EMERGENCY STOP module with safe time delay.

Vertical axes, external forces

If external forces act on the drive (vertical axis) and an unwanted movement, for example caused by gravity, could cause a hazard, the drive must not be operated without additional measures for drop protection corresponding to the required safety.

Prevention of unexpected restart

To prevent unexpected restart after restoration of power (e.g. after power failure), the parameter `IO_AutoEnable` must be set to "off". Note that a higher level controller must not trigger a dangerous restart.

Degree of protection when using "Safe Stop"

The "Safe Stop" function must only be operated under environmental conditions corresponding to degree of protection IP54. This can be done by using units with degree of protection IP54, or the unit must be installed in a switch cabinet with the corresponding degree of protection. This is essential to prevent short circuits caused by foreign bodies contacting the safety-relevant circuit components.

Protected line layout

If short circuits and cross connections are possible with the lines for the signals $\overline{\texttt{SAFE\_DISABLE\_A}}$ and $\overline{\texttt{SAFE\_DISABLE\_B}}$ and this cannot be detected by upstream devices, a protected layout is required. A protected layout prevents short circuits and cross connections.

Data for maintenance schedule and safety calculations

Use the following data for your maintenance schedule and safety calculations:

Service life corresponding to safety life cycle (IEC 61508)	20 years

ACC1MDADM00EN, V1.00, 01.2005

SFF (Safe Failure Fraction) (IEC61508)	70%
Probability of failure (PFH) (IEC 61508	$2.1*10^{-8}$ 1/h
Response time (until shutdown of power amplifier)	<10ms

Hazard and risk analysis

As a system manufacturer you must conduct a hazard and risk analysis (e.g. as per EN 1050) of the system. The results should be taken into account when using the "Safe Standstill" safety function.

The circuit resulting from the analysis may deviate from the following application examples. Additional safety components may be required. The results of the hazard and risk analysis always have priority.

5.3.4 Application examples

Stop category 0

Circuit without EMERGENCY STOP module, Stop category 0.

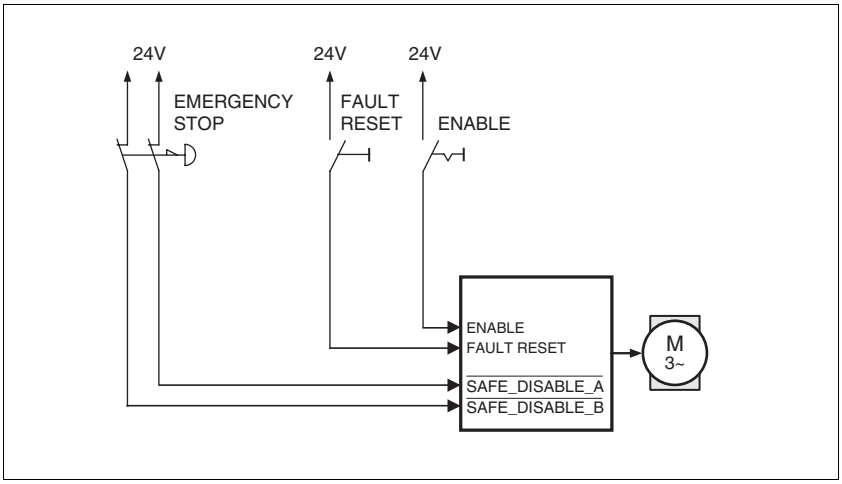


Figure 5.2 Example Stop category 0

Please note:

- When the EMERGENCY STOP switch is tripped it initiates a stop of category 0

Example: Stop category 1

Circuit with EMERGENCY STOP module, Stop category 1,

ACC1MDADM00EN, V1.00, 01.2005

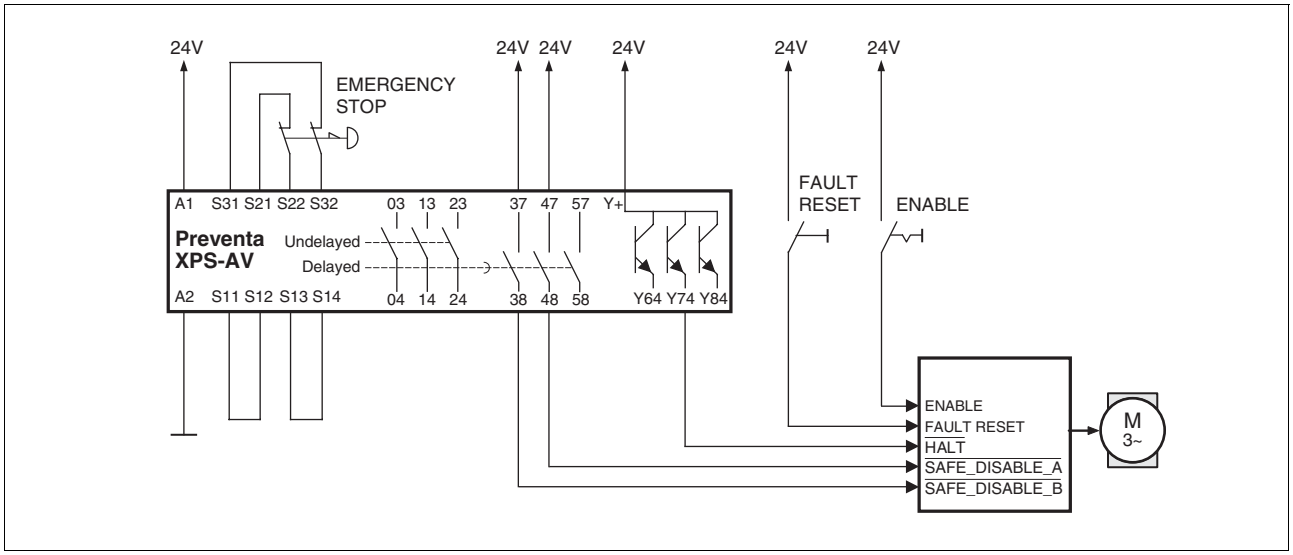


Figure 5.3 Example: Stop category 1

Please note:

- A "Halt" is initiated without delay via the $\overline{\text{HALT}}$ input .
- The $\overline{\text{SAFE\_DISABLE\_A}}$ and $\overline{\text{SAFE\_DISABLE\_B}}$ inputs are switched off after the delay period specified by the EMERGENCY STOP module. If the drive has not yet stopped at this time, it runs down without control (uncontrolled standstill).
- The specified minimum relay current must be maintained in the relay output circuits in the EMERGENCY STOP module.

ACC1MDADM00EN, V1.00, 01.2005

ACC1MDADM00EN, V1.00, 01.2005

6 Installation

WARNING!

Danger of injury and damage to system components by loss of control!

- Observe the accident prevention regulations.
- The system manufacturer must consider the possible errors that could occur with the signals and in particular the critical functions to ensure a safe status during and after errors. Examples for these are: emergency stop, final position limit, power failure and restart.
- Consideration of possible errors must also include unexpected delay and failure of signals or functions.
- Separate redundant controller paths must be provided for dangerous functions.
- Verify the effictiveness of the measures.

6.1 Electromagnetic compatibility, EMC

WARNING!

Interference with signals and devices may cause injury

Distorted signals can cause unexpected 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.

This drive system meets the EMC requirements for the second environment under the IEC 61800-3 standard if the measures described for the installation are taken into account. When operating outside this application area note the following:

WARNING!

This is a product with restricted availability under IEC 61800-3. This product may cause interference in living areas; in this case the operator may be required to take appropriate action.

An EMC-compliant design is required to maintain the specified limit values. Depending in the case better results can be achieved with the following measures:

- Upstream mains reactors. Information on current distortions can be obtained on request.
- Upstream external mains filters, particularly to maintain limit values for the first environment (living area, category C2)

ACC1MDADM00EN, V1.00, 01.2005

- Particularly EMC-compliant design, e.g. in an enclosed switch cabinet with 15dB damping of radiated interference

EMC scope of delivery and accessories

The scope of delivery includes earth clamps and an EMC plate.

For information on the prefabricated wiring see page 12-2.

Control cabinet setup

EMC measures	Effect
Use EMC plate (included) or galvanised/chromed mounting plates, connect metal parts over wide area, remove coatings on contact surfaces.	Good conductivity due to two-dimensional contacts
Earth the control cabinet, door and EMC plate with metal tapes or cables with a cross section area greater than 10 mm^2.	Reduction of emissions.
Fit switching devices such as contactors, relays or solenoids with interference suppressors or spark suppressors (e.g.diodes, varistors, RC elements)	Reduction of mutual interference
Install power and control components separately.	Reduction of mutual interference

Cabling

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
Use cable clamps to connect a large surface area of the shield of all shielded cables to the mounting plate at the control cabinet entry.	Reduction of emissions.
Field bus lines and signal lines must not be laid in the same conduit with lines for DC and AC voltage over 60 V. (Field bus lines can be laid in the same conduit with signal and analogue lines) Recommendation: lay in separate conduits at least 20 cm apart.	Prevention of mutual interference
Connect large surface areas of cable shields, use cable clamps and tapes	Reduction of emissions.
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
Use bonding conductors in system with – wide-area installation – different voltage infeed – networking between different buildings	Protection of wiring, reduction of emissions.
Use fine-core bonding conductors	Deflect even high-frequency interference currents
Earth shield on analogue signal lines directly at the unit (signal input), and earth the shield at the other end of the wire via a capacitor, e.g. 10 nF/100V MKT.	Preventing ripple loops due to low-frequency interference
Use only shielded motor cables with copper braiding and at least 85% covering, ground a large surface area of the shield at each end.	Controlled discharge of interference currents, reduction of emissions
If motor and machine are not conductively connected, e.g. by an insulated flange or a non-flat connection, earth the motor with an earth wire >10 mm^2 (>6 AWG) or ground strap.	Reduction of emissions, increase in resistance to interference

ACC1MDADM00EN, V1.00, 01.2005

EMC measures	Effect
Lay connections of the 24 V_{DC} supply voltage as “twisted pair”.	Preventing interference on control cables, reduction of emissions
Use shielded cables for the signal lines with IP54 products.	Reduction of EMC emissions

Power supply

EMC measures	Effect
Operate drive system only on a system with an earthed star point. Do not operate on systems with earthed phase or on a non-earthed system (IT system).	Line filter is only effective on system with an earthed star point.
Connect the negative output of the 24V power supply to PE.	Reduction of EMC emissions, safety
Circuit breaker if there is danger of overvoltage or lightning strike	Protection against damage by overvoltage

EMC requirement:motor and motor sensor wiring

Motor leads and motor sensor cables are especially critical signal lines. Use the cables recommended by your local representative. They must be tested for EMC safety and must be suitable for trailing cables.

The motor wiring and the motor sensor wiring on the drive solution must be laid out over a wide area with low resistance on the unit, the switch cabinet output and on the motor.

- Lay out motor and motor sensor wiring without interruption (do not install switch components) from the motor and sensor to the unit. If a line has to be interrupted, shielded connections and metal casing must be used to prevent interference.
- Lay the motor wiring at least 20 cm from the signal wiring. If the distance is less than this, the motor cable and signal cables must be separated by grounded screening plates.
- For long lines bonding conductors with a suitable cross section must be used

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 cross section of 16 mm^2 is sufficient, for greater lengths a cable cross section of 20 mm^2 is required.

ACC1MDADM00EN, V1.00, 01.2005

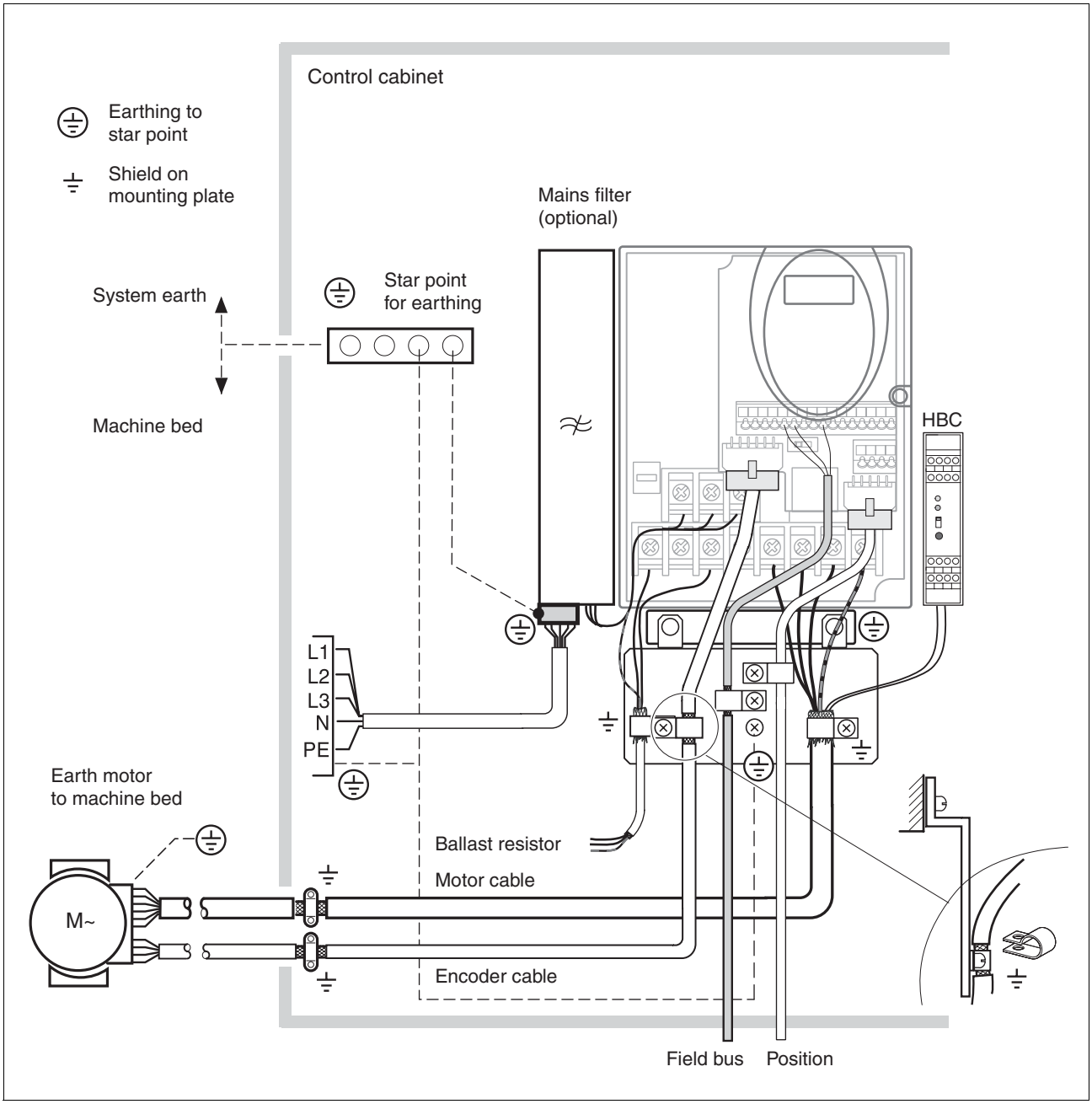


Figure 6.1 EMC measures, using a Size 2 unit as example

6.1.1 Operation in an IT network

An IT network is characterised by a neutral conductor that is isolated or earthed through a high impedance . If you use a permanent isolation monitor, it must be suited for non-linear loads. If, despite perfect wiring, a fault is indicated, you can, in the case of products with integrated mains filters, disconnect the earth connection to the Y- capacitors (deactivate the Y- capacitors). With all other networks, the earth connection via the Y- capacitors must be maintained.

If the earth connection to the Y- capacitors is removed, the specifications for the transmission of electromagnetic interference will no longer be maintained (specific categories see chapter 3.3.6 “Internal line filter“

ACC1MDADM00EN, V1.00, 01.2005

page 3-9)! Separate measures are required to comply with national regulations and standards.

IT network, Sizes 1-3

Isolation monitoring faults in units sizes 1 to 3: Units with an integrated line filter have a switch on the left side of the earth terminal.
Only open the switch for operation in IT networks and when isolation monitoring faults still arise despite perfect wiring. The position of the switch is different in the different models (see also Figure 6.7)

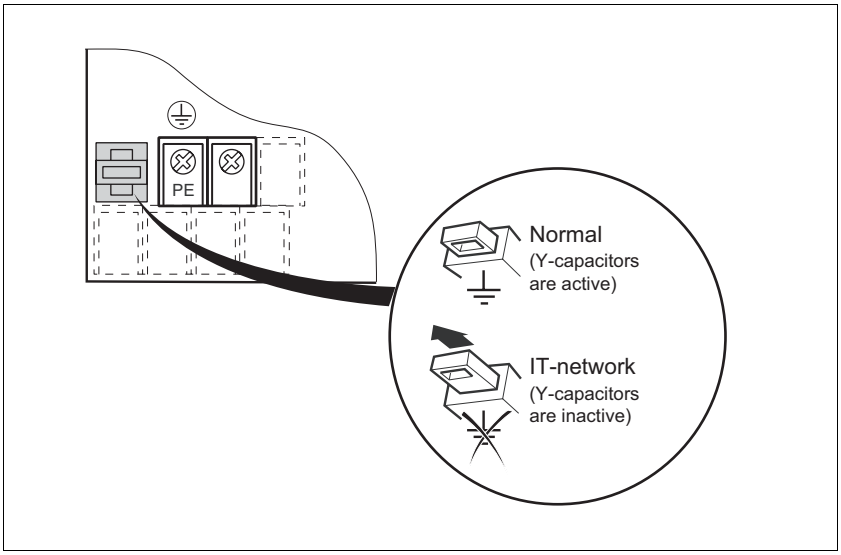


Figure 6.2 Y-Capacitors for the internal filter operative (standard), or deactivated for IT networks.

IT network, Size 4

Isolation monitoring faults in Size 4 units: In units with integrated line filters, if the isolation monitor fault still arises even with perfect wiring, you will need to connect the wires with cable connectors located above the power terminals in accordance with the illustration shown below, for operation in an IT network,.

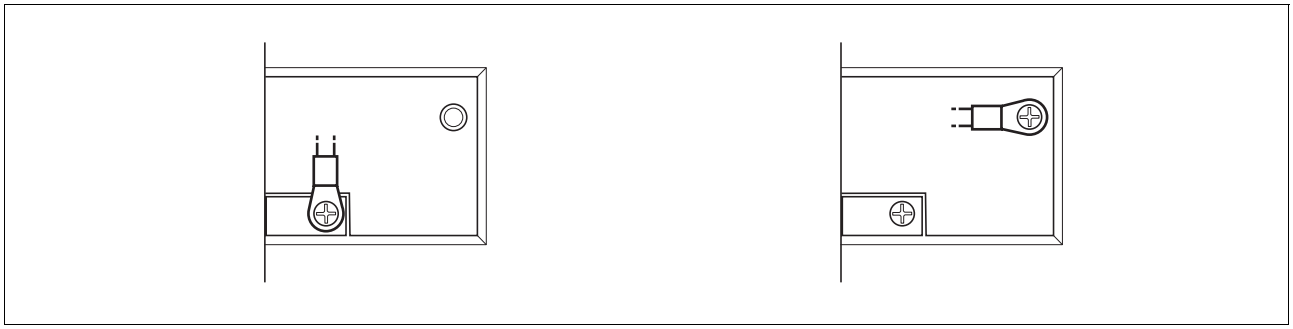


Figure 6.3 left: Y-Capacitors for the internal filter operative (standard): Y-Capacitors for the internal filter deactivated for IT networks

6.2 Mechanical installation

DANGER!

Electric shock from foreign bodies or damage.

Conductive foreign bodies in the product or serious damage can cause accidental energisation.

- Do not use damaged products.
- Prevent foreign bodies such as chips, screws or wire clippings from entering the product.
- Do not use products that contain foreign bodies.

WARNING!

Danger of injury by loss of safety function!

The safety function may fail because of conductive foreign bodies, liquids or dust. The "Safe Stop" safety function must only be used when the degree of protection IP54 is assured.

- Ensure degree of protection IP54.

CAUTION!

Hot surfaces can cause burns and damage to system components!

The heat sink on the product may heat up to over 100°C depending on the operating mode.

- Prevent contact with the hot heat sink.
- Do not install flammable or heat-sensitive components in the immediate vicinity.
- Follow the actions described for heat dissipation.

6.2.1 Installing the unit

control cabinet

The switch cabinet must be dimensioned so all units and accessories can be fixed in place and wired to meet EMC standards. The components include a holding brake controller or ballast resistors.

The switch cabinet ventilation must be capable of extracting the heat generated by all devices and components installed in the switch cabinet.

Installation spacing;ventilation

Size 1 units do not have ventilators and are ventilated by air circulation from bottom to top. Units of size 2, 3 and 4 are fitted with an integrated ventilator.

When selecting the position of the unit in the control cabinet, note the following instructions regarding temperature and degree of protection.

- Adequate cooling of the unit must be ensured by complying with the minimum installation distances.

ACC1MDADM00EN, V1.00, 01.2005

- 'Hot spots' must be prevented.
- The unit must not be installed close to heat sources.
- The unit must not be installed on flammable materials.
- The warm airflow from other units and components, such as an external ballast resistor, must not heat the air used for cooling the unit.
- The drive will switch off as a result of overtemperature when operated above the thermal limits.
- If degree of protection IP20 is sufficient, we recommend removing the protective foil (see page 6-8) on completion of installation.

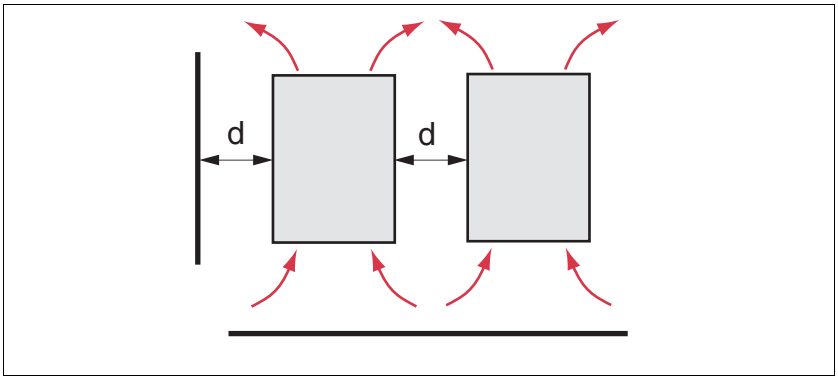


Figure 6.4 Installation spacing and air circulation

Temperature	Distance	Actions required if IP20 is possible	Actions required if IP40 is required
-10°C to +40°C	d > 50mm	None	None
d < <50mm	Removing the protective foil (page 6-8).	d > 10 mm	
+40°C to +50°C	d > 50mm	Removing the protective foil (page 6-8).	Reduce nominal current and continuous current by 2.2% per °C above 40°C
d < <50mm	Removing protective foil (page 6-8), reduce nominal current and continuous current by 2.2% per °C above 40°C	not possible	

Table 6.1 Installation spacing, actions

At least 10mm of free space is required in front of the unit.
At least 50 mm of free space is required above the unit.
The connecting cables come out of the bottom of the case. At least 200mm free space under the unit is required to ensure that wiring can be installed without excessive bending.

Installing the unit

For the dimensions of the fastening holes see 3.2.1 “Dimensional drawings“ from page 3-2.

ACC1MDADM00EN, V1.00, 01.2005

- ▶ Install the unit in a vertical position (±10°). This is particularly important for cooling the unit.
- ▶ Attach the supplied EMC plate at the bottom of the unit, see also Figure 6.1, or use alternative attaching elements (comb bars, shield clamps, busbars).

Attach plate with safety instructions

- ▶ Attach the plate with safety instructions included with the unit in a visible position on the front panel as specified by the national regulations.

As an alternative to fastening the unit directly to the control cabinet mounting plate, mounting plates for snap-mounting to top-hat rails are available as accessories for units sizes 1 and 2, see page 12-1. In this case mains filters cannot be attached directly beside or behind the unit.

Painted surfaces have an insulating effect. Remove the paint from the attachment points over a wide area (bright metal) before attaching the unit to a painted mounting plate.

Removing protective foil

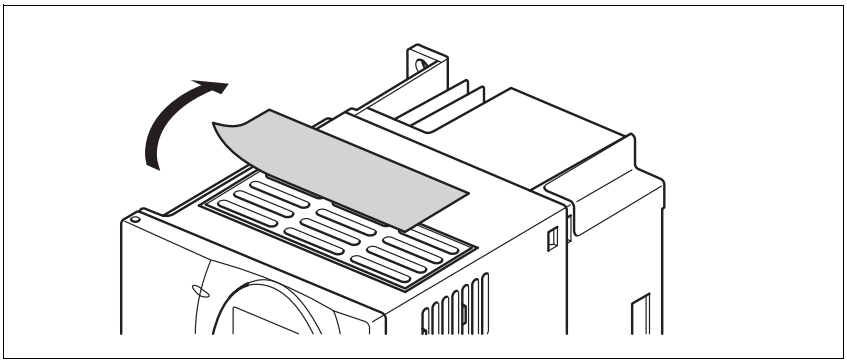


Figure 6.5 Removing protective foil

If degree of protection IP20 is sufficient, we recommend removal of the protective foil.

The protective foil must be removed if required by the thermal conditions. When doing so note the reduction of the degree of protection from IP40 to IP20.

Do not remove the protective foil until all installation work is completed to prevent external influences that may occur during the installation.

ACC1MDADM00EN, V1.00, 01.2005

6.2.2 Installing mains filter, mains reactor and ballast resistor

External line filter

You can see whether the your unit has an integrated line filter by the type code and the specifications (see page 3-1).

An external line filter is required when using a unit without an integrated line filter or with long motor lines. The operator must ensure that the EMC directives are observed in this case.

For specifications of external mains filters see page 3-9.
For directions on electrical installation see power supply from page 6-26.

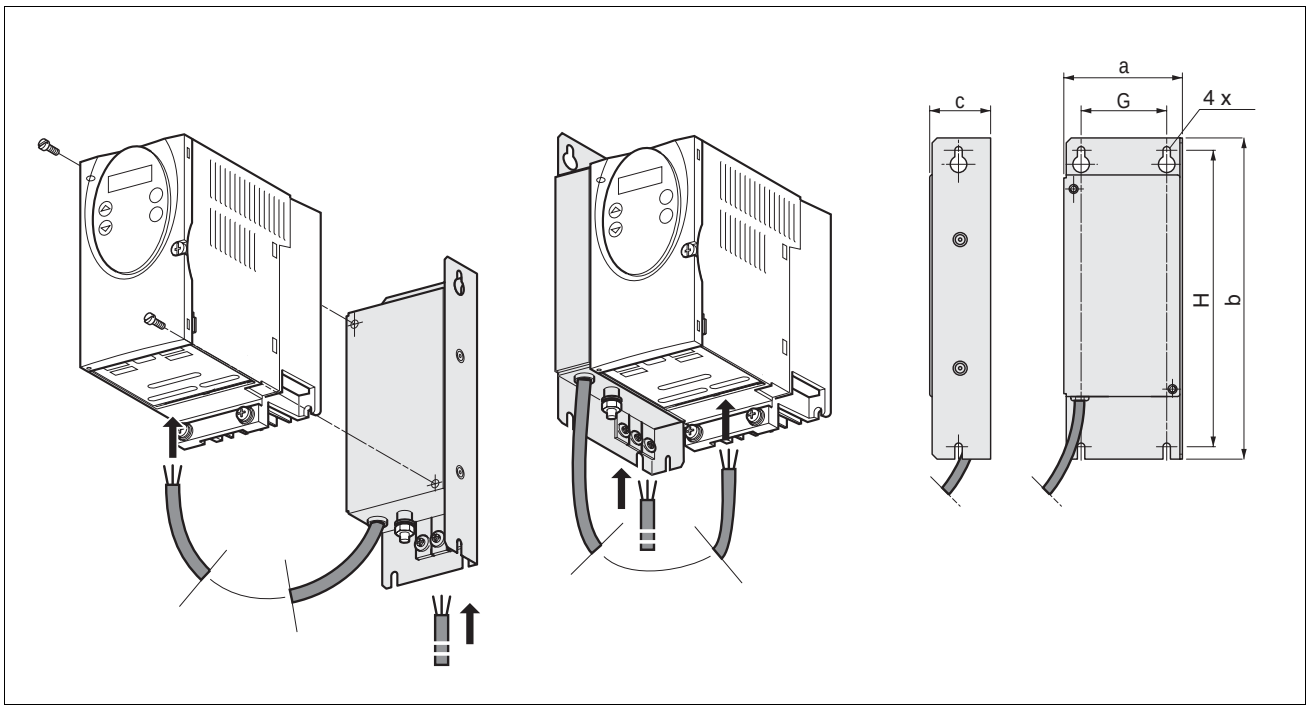


Figure 6.6 Installing mains filters

▶ Install the mains filter at the rear or the left side of the unit.

If the line filter is mounted behind the unit, the line filter terminals will not be accessible after installation of the EMC plate.

If you are using the top-hat rail mounting plates, the line filter cannot be mounted directly beside or behind the unit.

Line reactor

A line reactor must be used under the following conditions:

- operation on power supply networks with low impedance (maximum possible short circuit current of the network greater than specified in the Technical Data), see Technical Data from page 3-4
- at high average output power that is greater than half the rated power
- where there are special requirements for the service life of the unit (24h operation)
- operation on networks with reactive-current compensation systems

ACC1MDADM00EN, V1.00, 01.2005

- for improvement of the power factor at the network input and to reduce the network feedback
- if overvoltages greater than overvoltage category III could occur

Multiple units can be operated with one line reactor. The rated current of the reactor must be considered.

In the case of a network impedance that allows a short-circuit current greater than 1 kA the inductivity of the reactor must be greater than 0.8 mH.

Supplementary current harmonics place a heavy load on the DC bus capacitors. This has a substantial influence on the service life of the unit. For appropriate line reactors see accessories from page 12-1.

The information sheet included with the line reactor contains additional information on the installation. For directions on the electrical installation see power supply from page 6-26.

External ballast resistor

WARNING!

Hot surfaces can cause burns, fire and damage to system components.

The ballast resistor may heat up to over 250°C depending on the operating mode.

- Prevent contact with the hot ballast resistor.
- Do not place flammable or heat-sensitive components in the immediate vicinity of the ballast resistor.
- Ensure good heat dissipation.
- Check the temperature of the ballast resistor by conducting a test run under the most critical conditions.

The ballast resistors recommended in accessories from page 12-1 comply with degree of protection IP65. They can be installed outside a control cabinet in an environment with this degree of protection.

The information sheet included with the external ballast resistor contains additional information for the installation.

For information on the function and the electrical installation see page 6-20.

ACC1MDADM00EN, V1.00, 01.2005

6.3 Electrical installation

DANGER!

Electric shock, fire or explosion

- Only qualified personnel 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.
- Before working on the drive system:
  - Switch off power to all terminals.
  - Place a sign "DO NOT SWITCH ON" on the switch and lock to prevent switching on.
  - **Wait 6 minutes** (for discharge of DC bus capacitors).
  - Measure voltage between DC+ and DC- and check for <48V. (The DC bus LED is not a safe indication for absence of the DC bus voltage).
- Do not short-circuit DC bus or touch unshielded components or screws of the terminals with voltage present.
- Install all covers and close the housing doors before applying power.
- The motor generates voltage when the shaft is rotated. Lock the shaft of the motor to prevent rotation before starting work on the drive system.
- The system manufacturer is responsible for compliance with all applicable regulations relevant to earthing the drive system.
- Do not reach into the drive system (e.g. no pointed objects).

DANGER!

Electric shock from foreign bodies or damage.

Conductive foreign bodies in the product or serious damage can cause accidental energisation.

- Do not use damaged products.
- Prevent foreign bodies such as chips, screws or wire clippings from entering the product.
- Do not use products that contain foreign bodies.

ACC1MDADM00EN, V1.00, 01.2005

DANGER!

Electric shock because of insufficient earthing.

With insufficent earthing these is hazard of electric shock.

- Earth the drive system before applying power.
- Use cross-sections of the protective earth conductor that comply with the applicable codes.
- Earth the cable shields on both ends, but do not regard the shields as protective earth.

WARNING!

Interference with signals and devices may cause injury

Distorted signals can cause unexpected 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.

WARNING!

This product can cause a d.c. current in the protective conductor!

- Where a residual-current-operated protective device (RCD) is used for protection in case of direct or indirect contact, only an RCD of Type B is allowed on the supply side of this product.
- Otherwise, another protective measure shall be applied, such as separation from the environment by double or reinforced insulation, or isolation from the supply system by a transformer.

Suitability of wiring

Cables must not be twisted, stretched, crushed or kinked. Use only cables that comply with the cable specification. For example, make sure that it is suitable for:

- Use as a trailing cable
- Temperature range
- Chemical resistance
- Layout outdoors
- Layout underground

ACC1MDADM00EN, V1.00, 01.2005

6.3.1 Overview of procedure

▶ Observe the basic settings described in 5 “Engineering“ from page 5-1. The selected settings influence the complete installation:

- 5.1 “Adjustable signal logic“ Chapter from page 5-1
- 5.2 “Specification of the con troller type“ Chapter from page 5-1
- 5.3 “"Safe Standstill safety function"“ Chapter from page 5-2

▶ Unlock the front panel of the unit and open it.

▶ Connect the earth terminal of the unit or the EMC plate to the earthing star point of the system.

▶ Connect the required terminal, following the sequence in Table 6.2. If a different connection sequence is followed, terminals may be covered by other lines.

Follow the EMC requirements, see page 6-1.

▶ Then lock the front panel.

Connection from	Connection to	from page
Motor phases		6-16
External ballast resistor		6-20
Mains power supply		6-26
Motor rotary encoder	CN2	6-28
Holding brake controller (HBC)	CN1 and CN3	6-31
24V controller supply voltage	CN3	6-33
Encoder A, B, I	CN5	6-35
Pulse direction, PULSE	CN5	6-36
Encoder simulation, ESIM	CN5	6-39
Field bus CANopen	CN1 or CN4	6-41
Field bus Modbus	CN4	6-43
Analogue inputs	CN1	6-45
Digital inputs/outputs	CN1	6-43
PC or peripheral operating terminal	CN4	6-47

Table 6.2 Installation overview

ACC1MDADM00EN, V1.00, 01.2005

6.3.2 Overview of all connections

Power connections

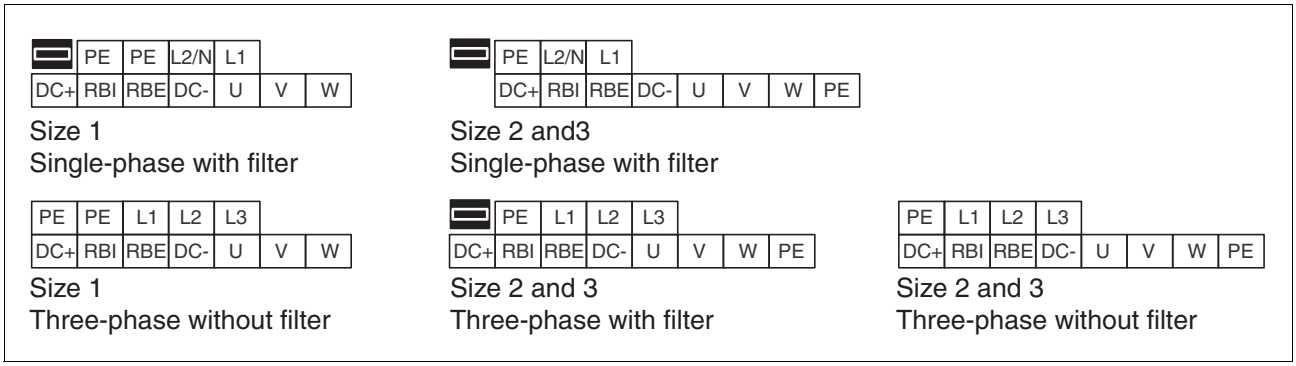


Figure 6.7 Overview of power connections for all unit types

Power connections	Description
PE	Earth connection (protective earth)
L1, L2/N	Mains connection, single phase units
L1, L2, L3	Mains connection, 3-phase units
DC+	DC bus
RBI	Internal ballast
RBE	External ballast
DC-	DC bus
U,V,W	Motor connections

Table 6.3 Designations of the power connections

Switch setting for units with integrated line filters.

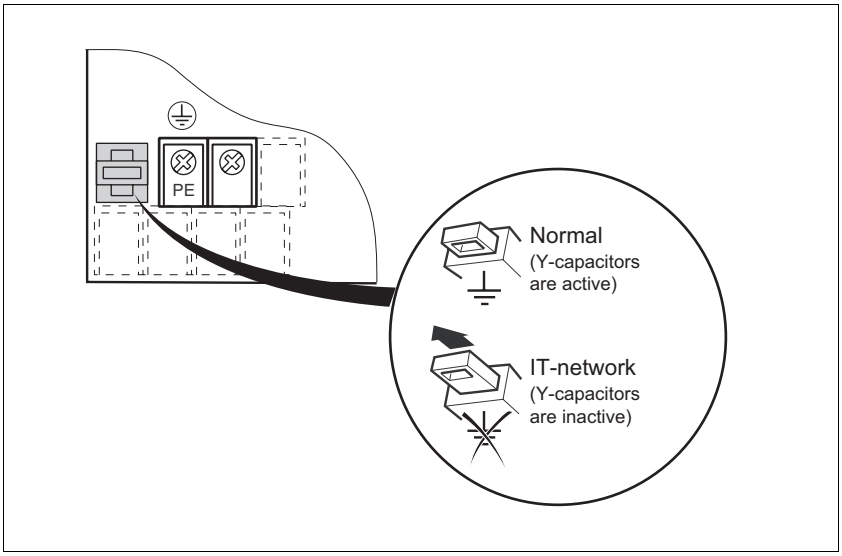


Figure 6.8 Y-Capacitors for the internal filter for units sizes 1 to 3 operative (standard), or deactivated for IT networks.

ACC1MDADM00EN, V1.00, 01.2005

In the case of units sizes 1-3 with integrated line filters, there is a switch to allow disconnection of the earth connections of the Y-capacitors in the IT network.

▶ Check the correct switch position for units with internal filter, see page6-4.

Signal connections

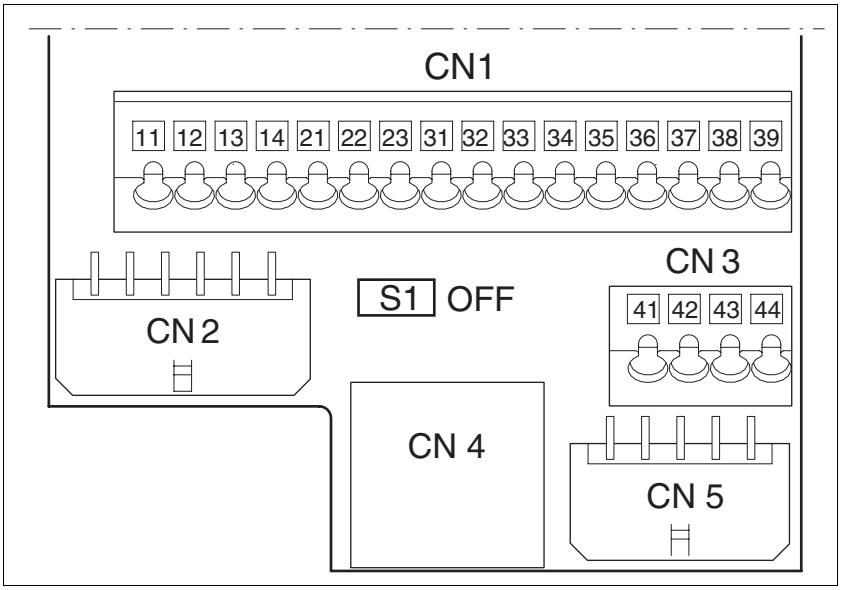


Figure 6.9 Overview of the signal connections

Connection/ switch	Assignments
CN1	Analogue inputs ±10V, pin 11 to 14
CANopen, pin 21-23	
Digital inputs/ outputs, pin 31-39	
CN2	Motor encoder (Hiperface Sensor)
CN3	24V controller supply voltage
CN4	PC, peripheral operating terminal, Modbus, CANopen;(RJ45)
CN5	ESIM (A/B/I out), PULS/DIR in, sensor signals A/B/I in [1)]
S1	Switch for CANopen terminating resistor

1) depending on the “First Setup”

Table 6.4 Assignment of the signal connections

6.3.3 Reference value signals and limits

External limits can be specified for the external reference value signals for operation. Table 6.5 shows the assignment options depending on the operating modes.

Operating mode	External reference value	Terminal	External limit	Terminal
Current control	ANA_IN1 (current)	CN1, Pin 11, 12 [1]	None	
ANA_IN1 (current)	CN1, Pin 11, 12 [1]	ANA_IN2 (current)	CN1, Pin 13, 14	
ANA_IN1 (current)	CN1, Pin 11, 12 [1]	ANA_IN2 (rpm)	CN1, Pin 13, 14	
Speed control	ANA_IN1 (rpm)	CN1, Pin 11, 12 [1]	None	
ANA_IN1 (rpm)	CN1, Pin 11, 12 [1]	ANA_IN2 (current)	CN1, Pin 13, 14	
ANA_IN1 (rpm)	CN1, Pin 11, 12 [1]	ANA_IN2 (rpm)	CN1, Pin 13, 14	
electronic gearbox	PULSE/DIR Signal	CN5	None	
A/B Signal	CN5	None		
Profile position	None, generated by profile generator	CN4 [2]	$\overline{\text{LIMP}}$, $\overline{\text{LIMN}}$	CN1, Pin 34, 35
Profile velocity	None, generated by profile generator	CN4 [2]	$\overline{\text{LIMP}}$, $\overline{\text{LIMN}}$	CN1, Pin 34, 35
Homing	None, generated by profile generator	CN4 [2]	$\overline{\text{LIMP}}$, $\overline{\text{LIMN}}$	CN1, Pin 34, 35
Jog	None, generated by profile generator		Local: None Field bus: $\overline{\text{LIMP}}$, $\overline{\text{LIMN}}$	- CN1, Pin 34, 35

1) CN1, pin 11,12 = analogue input 14-bit; with field bus control mode alternatively via parameter value
2) CN4 = CANopen, Modbus connection

Table 6.5 Reference value signals and limits

6.3.4 Motor phase connections

DANGER!

Electric shock

High voltages can occur unexpectedly at the motor connection.

- The motor generates voltage when the shaft is rotated. Lock the shaft of the motor to prevent rotation before starting work on the drive system.
- AC voltages may jump over unused wires in the motor cable. Isolate unused wires at both ends of the motor cable.
- The system manufacturer is responsible for compliance with all applicable regulations relevant to earthing the drive system. Extend the earth through the motor cable with an additional earth at the motor housing.

ACC1MDADM00EN, V1.00, 01.2005

WARNING!

Unexpected motion may cause injury and damage to the system

Drives can make unexpected movements if incorrectly connected or because of other faults.

- Operate the unit with approved motors only. Even if motors are similar, different adjustment of the sensor system may be a source of danger.
- Check the wiring. Compatibility is not ensured even with matching connectors on power connection and sensor system.

Cable specifications

- Shielded cable
- Minimum cross section of wires: see table
- Earthing of the screen at both ends
- Maximum cable length: depends on required limit values for cable-related malfunctions, see Chapter 3.3.6 “Internal line filter“ page 3-9 and Chapter 3.4.2 “External line filter“ page 3-10.
- For more information see 3.4.5 “Cable“ on page 3-11.

Specifications	Module 1	Module 2	Module 3	Module 4
Connection cross-section [mm^2]	0.75 - 1.5	1.5-4	1.5-4	
AWG connection cross section	14-20	10-16	10-16	
Tightening torque for terminal screws [Nm]	0.5 - 0.6	1.2-1.5	1.2-1.5	

The wiring must have a sufficiently large cross section to ensure that the fuse at the mains connection can be triggered in the event of a fault.

▶ Use prefabricated cables to minimise the risk of a wiring fault (from page 12-2).

Preparing cables

Note the dimensions specified when fabricating cables.

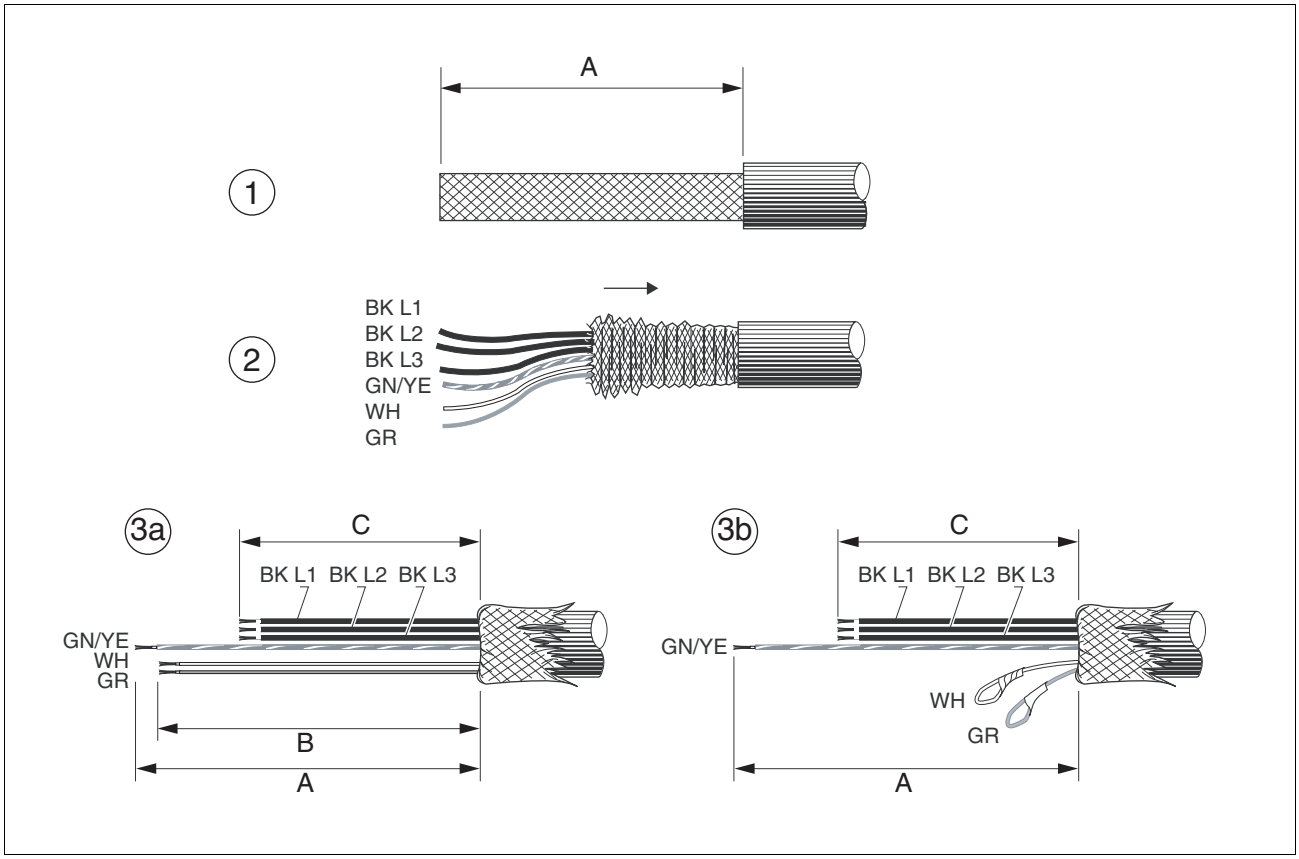


Figure 6.10 Steps (1-3) for fabrication of the motor cable

Length	Module 1	Module 2	Module 3	Module 4
A [mm]	130	130	130	
B [mm]	120	120	120	
C [mm]	75	85	90	

- ▶ (1) Remove the cable sheath, length A depends on the unit, see the table above.
- ▶ (2) Slide the screen braiding back over the cable sheath and store the screen braiding. Note that during installation the screen braiding must be positioned flat on the EMC plate.
- ▶ (3) Shorten the wires for the holding brake to length B and the three motor lines L1, L2 and L3 to length C. The protective conductor has length A.
  (3a) The two brake connection lines must have length B for units with a holding brake.
  (3b) The two brake connection lines must be separately isolated as shown for units without a holding brake.

Use fork-type cable lugs or wire end ferrules. The lead must fill the sleeve for its entire length to ensure maximum current carrying capacity and vibration resistance.

Monitoring The motor lines are monitored for:

- short circuit between the motor phases

ACC1MDADM00EN, V1.00, 01.2005

- short circuit between the motor phases and PE

A short circuit between the motor phases against DC+, DC- and RBI is not monitored.

Connecting the motor cable

- ▶ Follow the EMC requirements for motor cables, see page 6-3.
- ▶ Isolate unused wires at both ends and individually, see Figure 6.11, item 1.
- ▶ Connect the motor leads and protective conductor to terminals U, V, W and PE. The cable assignment at the motor and unit sides must match.
- ▶ Fix the cable sleeving flat on the EMV plate.

Wiring diagram

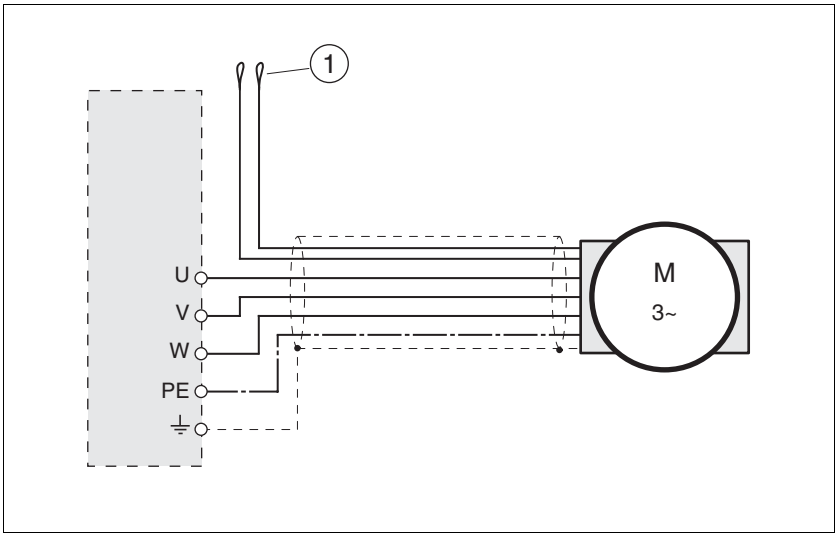


Figure 6.11 Motor wiring diagram, here without holding brake

Terminal	Description	Colour
U	Motor lead	black L1 (BK)
V	Motor lead	black L2 (BK)
W	Motor lead	black L3 (BK)
PE	Protective conductor	green/yellow (GN/YE)
(1)	Holding brake connection cable For motors with holding brake see page 6-31	white (WH), grey (GR)

ACC1MDADM00EN, V1.00, 01.2005

6.3.5 Connection of ballast resistor

WARNING!

Risk of injury and damage to system components by unbraked motor.

An insufficient ballast resistor causes overvoltage on the DC bus and switches off the power amplifier. The motor is no longer actively braked.

- Make sure that the ballast resistor is sufficiently dimensioned.
- Check the setting of the parameter for the ballast.
- Check the temperature of the ballast resistor by conducting a test run under the most critical conditions.
- During the test make sure that at higher mains voltage there is less reserve in the capacitors on the DC bus.

6.3.5.1 Internal ballast resistor

A ballast resistor is integrated in the unit to absorb braking energy. If the DC bus voltage exceeds a specified value, this ballast resistor is switched on. The returned energy is converted to heat by the resistance. See also dimensioning assistance, page 6-22.

The internal resistance is not effective if the DC+ and RBI connections are bridged (delivery status).

The internal ballast resistor is at the back of the unit.

6.3.5.2 External ballast resistor

An external ballast resistor is required for applications in which the motor is heavily braked and the internal ballast resistor can no longer dissipate the excess braking energy. Two or more ballast resistors can also be connected.

Monitoring

The unit monitors the power of the ballast resistor. The load on the resistance can be read out.
The connection of the external resistance is protected against short circuit. A short circuit between DC+ and RBE is detected and reported as an error.

Selection of the external ballast resistor

The size of an external ballast resistor is specified by the required peaks and the continuous output at which the ballast resistor can be operated. If applicable, see the section on dimensioning assistance, page 6-22.

The resistance value R [Ω] is derived from the required peak power and the DC bus voltage.

$$R = U^2 / P_{max}$$

U :	Switching threshold [V]
P_{max} :	Peek power [W]
R:	Resistance [Ohm]

Figure 6.12 Calculating the resistance R of an external ballast resistor

ACC1MDADM00EN, V1.00, 01.2005

It two or more resistances are connected, not the following criteria:

- The resistors must be wired in parallel or in series so the required resistance is reached.
- The resistance value of the external resistance must not fall below a bottom limit, see Table 3.1.
- The total continuous output of the individual resistors must yield the required continuous output.

For suitable ballast resistors, see accessories on page 12-1.

Cable specifications

- Shielded wires
- Minimum cross section: as in mains supply, see page 6-26. The wiring must have a sufficiently large cross section to ensure that the fuse at the mains connection can be triggered in the event of a fault.
- Earthing of the screen at both ends
- Maximum cable length: 3 m

The ballast resistors recommended in accessories have a 3-wire, temperature-resistant cable with a length of 0.75 m to 3 m.

Use fork-type cable lugs or wire end ferrules. The lead must fill the sleeve for its entire length to ensure maximum current carrying capacity and vibration resistance.

Connecting external ballast resistor

▶ Observe the safety instructions for the electrical installation.

▶ Before opening the unit disconnect it from the supply voltage.

▶ Remove the bridge between DC+ and RBI.

If the bridge is not removed, the internal ballast resistor may be destroyed during operation.

▶ Earth the PE connection of the ballast resistor.

▶ Connect the ballast resistor to the DC+ and RBE terminals of the unit.

▶ Spread the shielding of the cables out flat on the EMC plate.

Test the function of the ballast resistor under realistic conditions during commissioning (page 7-16).

Wiring diagram

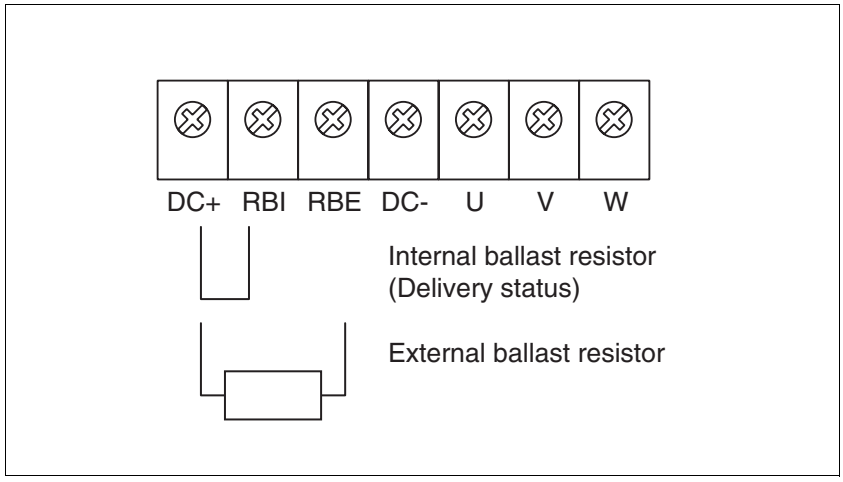


Figure 6.13 Wiring diagram, ballast resistor

6.3.5.3 Rating guide

The elements contributing towards the absorption of braking energy are calculated to assist in specification. This is used to calculate the size of the ballast resistor.

An external ballast resistor is required when the kinetic energy W_{kin} to be absorbed exceeds the sum of the internal shares, including the internal ballast resistor.

Kinetic energy W_{kin}

The kinetic energy is calculated from the kinetic or rotational energy of the drive.

Internal energy absorption

Braking energy is absorbed internally by the following mechanisms:

- DC bus capacitor W_{ZW}
- Internal ballast resistor W_{IN}
- Electrical losses in the drive W_E
- Mechanical losses in the drive W_M

The energy W_{ZW} depends in a square-law function on the difference between the voltage before the braking operation and the response threshold.

The voltage before the braking operation depends on the line voltage. The energy absorption by the DC bus capacitors is lowest when the line voltage is highest. Use the values for the highest line voltage.

Energy absorption of the internal ballast resistor

Two key values relating to the internal ballast resistor determine its energy absorption.

- The continuous output P_{AV} shows how much energy can be continuously dissipated without overloading the ballast resistor.
- The maximum energy W_{peak} limits the higher heat loss which can be dissipated in the short term.

If the continuous output is exceeded for a specified time, the ballast resistors remain unloaded for a correspondingly period. This ensures that the ballast resistor is not destroyed.

The characteristic values P_{AV} and W_{peak} of the internal ballast resistor can be found from page 3-8.

Electrical losses WE

The electrical losses W_E in the drive can be estimated from the peak power of the drive. The maximum power loss is around 10% of peak power for a typical efficiency factor of 90%. If the current on braking is lower, the power loss will be reduced accordingly.

Mechanical losses W_M

The mechanical losses result from absorption by friction, which occurs when the system is running. Mechanical losses can be ignored if the system requires a much longer time to coast to a stop than the time required to stop the system under braking. The mechanical losses can be calculated from the load torque and the speed from which the motor is to stop.

Example

Braking of a motor with the following data (AC IN equal to $400V_{AC}$):

- Initial speed: $n = 4000\ min^{-1}$
- Rotor inertia: $J_R = 4\ kgcm^2$
- Load inertia: $J_L = 6\ kgcm^2$.

ACC1MDADM00EN, V1.00, 01.2005

The energy to be absorbed is given by:

$W_B = 1/2 * J * (2*\pi*n)^2$

to 88 Ws

Electrical and mechanical losses are ignored.

23 Ws are absorbed in the DC bus capacitors at a power supply of 400 V.

The internal ballast resistor must absorb the residual 65 Ws. It can absorb a pulse of 80 Ws. The internal ballast resistor is sufficient if the load is stopped once under braking.

If the braking process is repeated cyclically, the continuous output must be considered. If the cycle time is longer than the ratio of the energy to be absorbed W_B and the continuous power P_{AV}, the internal ballast resistor is sufficient. If braking takes place more frequently, the internal ballast resistor will not be sufficient.

In the example the ratio W_B/P_{AV} is 1.3 s. An external ballast resistor is required with a shorter cycle time.

Dimensioning the external ballast resistor

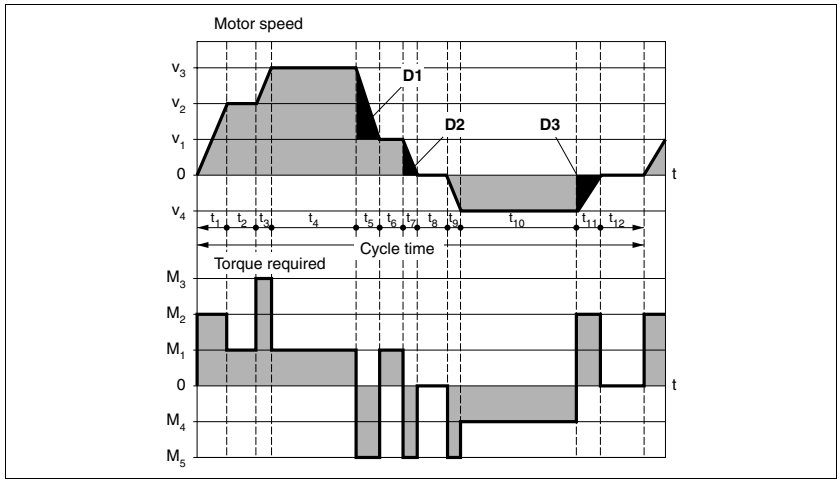


Figure 6.14 Characteristics for rating the ballast resistor

These two characteristics are also used for the rating the motor. The segments of the characteristic under consideration, in which the motor brakes, are designated (D_i).

Calculation of the energy at constant runout:

For this we need to know the total inertia (J_t).

J_t is given by:

$J_t = J_m + J_c$

J_m: Motor inertia with and without brake

J_c: Load inertia

The energy for each runout segment is calculated as follows:

$$E_i = \frac{1}{2} J_t \cdot \omega_i^2 = \frac{1}{2} J_t \cdot \left(\frac{2\pi v_i}{60}\right)^2$$

This yields the following for segments (D_1) … (D_3):

$$E_1 = \frac{1}{2} J_t \cdot \left(\frac{2\pi[v_3 - v_1]}{60}\right)^2$$

$$E_2 = \frac{1}{2} J_t \cdot \left(\frac{2\pi v_1}{60}\right)^2$$

Units: E_i in Joules, J_t in kg/m², w in rad and v_i in r.p.m.

The table shown below gives the energy uptake capacity, Evar, for the individual drive regulators (without regard to an internal or external ballast resistor).

When continuing with the calculation, take into account only those segments Di whose energy Ei exceeds the uptake capacity shown in the table. These excess energies E_{Di} should be removed via the ballast resistors (internal or external).

The calculation of E_{Di} is accomplished using the formula:

$E_{Di} = E_i - E_{var}$ (in Joules)

The continuous power P_c is calculated for each machine cycle

$$P_c = \frac{\sum E_{Di}}{\text{Zykluszeit}}$$

Units: P_c in [W], E_{Di} in [J] and cycle time T in [s]

Selection takes place in two steps:

- The maximum energy during the braking process must be less than the peak energy that the ballast resistor can accommodate: $(E_{Di})<(E_{Cr})$. In addition, the continuous power rating of the internal ballast resistor must not be exceeded: $(P_C)<(P_{Pr})$. If these conditions are met, then the internal ballast resistor is adequate.
- If any one of the conditions is not met, it is necessary to use an external ballast resistor. The resistance should be chosen such that the conditions are met. The value of the resistance must be between the specified minimum and maximum values, since otherwise the load can no longer be safely braked or the product could be destroyed.

For the order data for the external resistors see the accessories section from page 12-1.

Unit [1]	Energy consumption of internal capacitors E_{var}	resistance internal	Continuous rating P_{PR}	Peak energy E_{CR}	Switch-on voltage
	[Ws]	[Ω]	[W]	[Ws]	[V]
Size 1, 115V, 1~	10.8	40	20	200	250
Size 1, 230V, 1~	17.7	40	20	900	430
Size 1, 230V, 3~	17.7	40	20	900	430
Size 2, 115V, 1~	16.2	40	40	200	250
Size 2, 230V, 1~	26.6	40	40	900	430
Size 2, 230V, 3~	26.6	40	40	900	430
Size 2, 400V, 3~	26.0 [2]	40	40	1000	770
Size 3, 115V, 1~	26.0	20	60	1000	250
Size 3, 230 V, 1~	43.0	20	60	1600	430

ACC1MDADM00EN, V1.00, 01.2005

Unit [1]	Energy consumption of internal capacitors E_{var}	resistance internal	Continuous rating P_{PR}	Peak energy E_{CR}	Switch-on voltage
	[Ws]	[Ω]	[W]	[Ws]	[V]
Size 3, 230 V, 3~	43.0	30	60	1600	430
Size 3, 400 V, 3~	52.0 [3]	30	60	1600	770

1) For allocation of size, voltage and phase number see also type code on page 1-3
2) at 480 V: 6.0 Ws
3) at 480 V: 12.0 Ws

Table 6.6 Values for internal ballast resistors

Unit [1]	External ballast resistor		Switch-on voltage
	min [Ω]	max [Ω]	[V]
Size 1, 115V, 1~	27	45	250
Size 1, 230V, 1~	50	75	430
Size 1, 230V, 3~	50	75	430
Size 2, 115V, 1~	20	27	250
Size 2, 230V, 1~	27	45	430
Size 2, 230V, 3~	27	45	430
Size 2, 400 V / 480 V, 3~	60	80	770
Size 3, 115 V, 1~	10	20	250
Size 2, 230V, 1~	16	27	430
Size 2, 230V, 3~	10	20	430
Size 2, 400 V / 480 V, 3~	25	36	770

1) For allocation of size, voltage and phase number see also type code on page 1-3

Table 6.7 Values for external ballast resistors

ACC1MDADM00EN, V1.00, 01.2005

6.3.6 Connection of mains power to power amplifier

DANGER!

Electric shock because of insufficient earthing.

These drive systems have increased leakage current > 3.5 mA. A second protective conductor must always be connected.

- Connect a second protective conductor with a minimum cross section in accordance with IEC 60364-5-54 at the separate earth terminal.

Cable specifications

The wiring must have a sufficiently large cross section to ensure that the fuse at the mains connection can be triggered in the event of a fault.

In addition, note the suitability of the wiring, see page 6-12 and the EMC-compliant connection, see page 6-2.

Specifications	Module 1	Module 2	Module 3	Module 4
Connection cross-section [mm^2]	0.75 to 1.5	1.5 to 4	1.5 to 4	
AWG	14 to 20	10 to 16	10 to 16	
Tightening torque for terminal screws [Nm]	0.5 to 0.6	1.2 to 1.5	1.2 to 1.5	

Preparing cables

Use fork-type cable lugs or wire end ferrules. The lead must fill the sleeve for its entire length to ensure maximum current carrying capacity and vibration resistance.

Connecting mains power

Observe the following instructions at all times:

- 3-phase units must only be connected and operated on 3-phase.
- With units without an integrated line filter the power cable must be shielded and earthed at both ends between the external line filter and the unit when the cable is over 200 mm in length.
- Observe the EMC requirements. If necessary, use overvoltage arrestors, line filters and line reactors, see page 6-9.
- Follow the requirements for design of corresponding UL, see page 3-1.
- The PE connection on the case must be connected to the mounting plate because of the high leakage currents.

Wiring diagram of 1-phase unit

Figure 6.15 shows the connection of the mains power supply for a single phase unit. The diagram also shows the wiring of the optional external mains filter and mains reactor .

ACC1MDADM00EN, V1.00, 01.2005

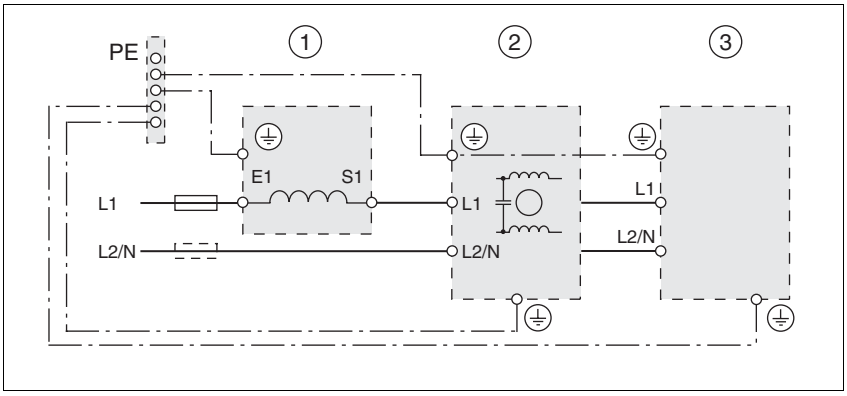


Figure 6.15 Wiring diagram:mains power for a single phase unit

(1) Mains reactor (optional)
(2) Mains filter (optional)
(3) Product

The second fuse is only required when phase L2 is connected. It is not necessary when wiring with neutral conductor N

▶ Connect the power cables to the screw terminals PE, L2/N and L1. Note the exact terminal assignment of your unit as per Figure 6.7 on page 6-14.

Wiring diagram of 3-phase unit

Figure 6.16 shows the connection of the mains power supply for a 3-phase unit. The diagram also shows the wiring of the optional external mains filter and mains reactor .

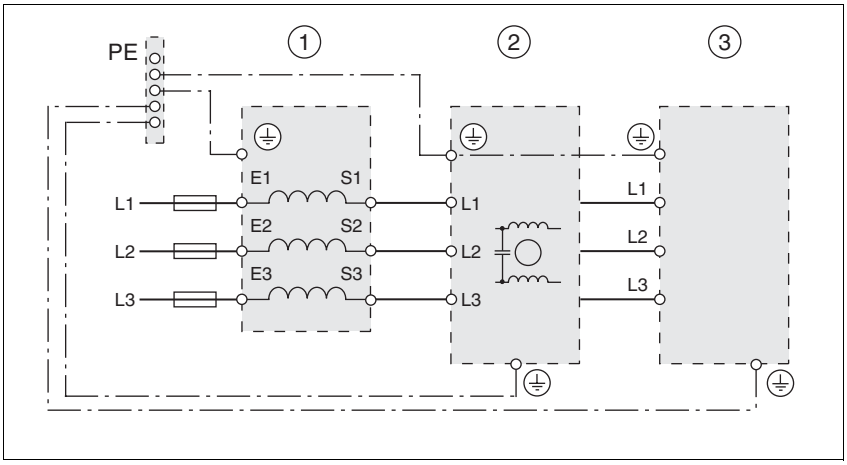


Figure 6.16 Wiring diagram:mains power for 3-phase unit

(1) Mains reactor (optional)
(2) Mains filter (optional)
(3) Product

▶ Connect the power cables to PE, L1, L2 and L3. Note the exact terminal assignment of your unit as per Figure 6.7 on page 6-14.

ACC1MDADM00EN, V1.00, 01.2005

6.3.7 Connection for parallel operation

CAUTION!

Destruction of the drive system by incorrect parallel operation.

Operation with a non-approved parallel circuit on the DC bus may destroy the drive systems immediately or after a delay.

- Find out the general conditions and requirements for parallel circuits on the DC bus from your local representative.

6.3.8 Connection of motor sensor (CN2)

Function and sensor type

The motor sensor is a Hiperface sensor (SinCos sensor) integrated into the motor. It captures the rotor position of the motor and sends the motor position to the unit both analogue and digitally.

Cable specifications

- Shielded cable
- Twisted-pair conductors
- Minimum cross section of signal wires: 0.25 mm^2
- Earthing of the screen at both ends
- maximum cable length 100m
- For more information see 3.4.5 “Cable“ on page 3-11.

Preparing cables

▶ Use prefabricated cables to minimise the risk of a wiring fault (from page 12-2). Step 5 in Figure 6.17 must be carried out even with prefabricated cable. The dimensions for positioning the shield on the case are applicable when the included EMC plate is used.

▶ If you are not using prefabricated wiring, follow the procedure and the dimensions in Figure 6.17.

ACC1MDADM00EN, V1.00, 01.2005

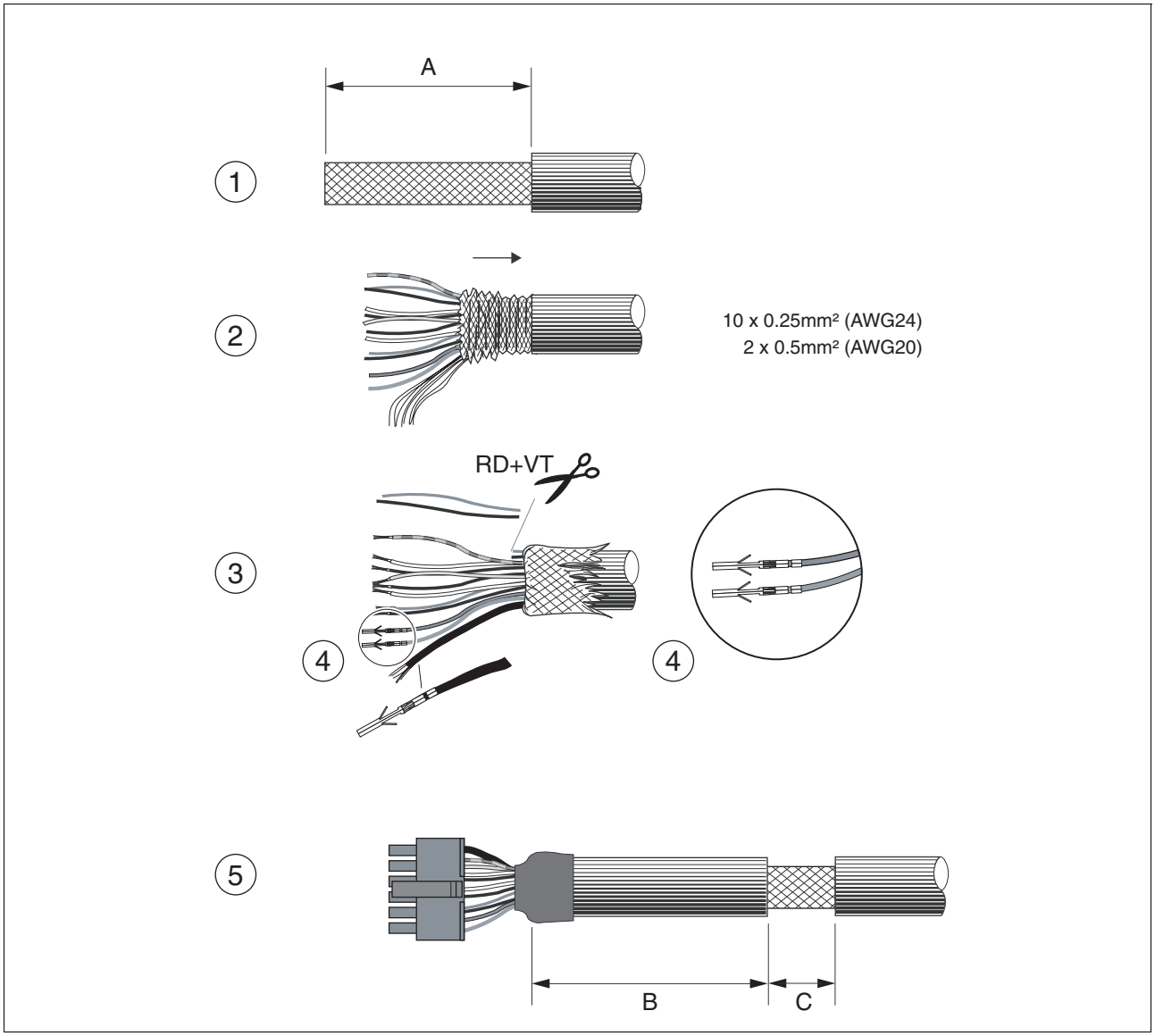


Figure 6.17 Steps (1-5) for fabrication of the sensor cable

Length	Module 1	Module 2	Module 3	Module 4
A [mm]	25	25	25	25
B [mm]	90	100	130	
C [mm]	15	15	15	15

- (1) Remove the cable sheath, length A depends on the unit, see the table above.
- (2) Slide the braiding back over the cable sheath. The shield braided filler wire is required as the connection.
- (3) The red and the violet lead is not required and can be cut off. Isolate the shield lead with shrink wrap.
- (4) Crimp the plug contacts on the remaining leads and on the isolated shield lead. Isolate the shield braiding with shrink wrap. Plug the

crimp contacts into the Molex plug housing, for the pin assignment see Figure 6.18.

▶ (5) Sheath the cable to length C on the position shown, the cable is fastened there at the EMC plate with a clamp (shield-earth connection).

Connection diagram

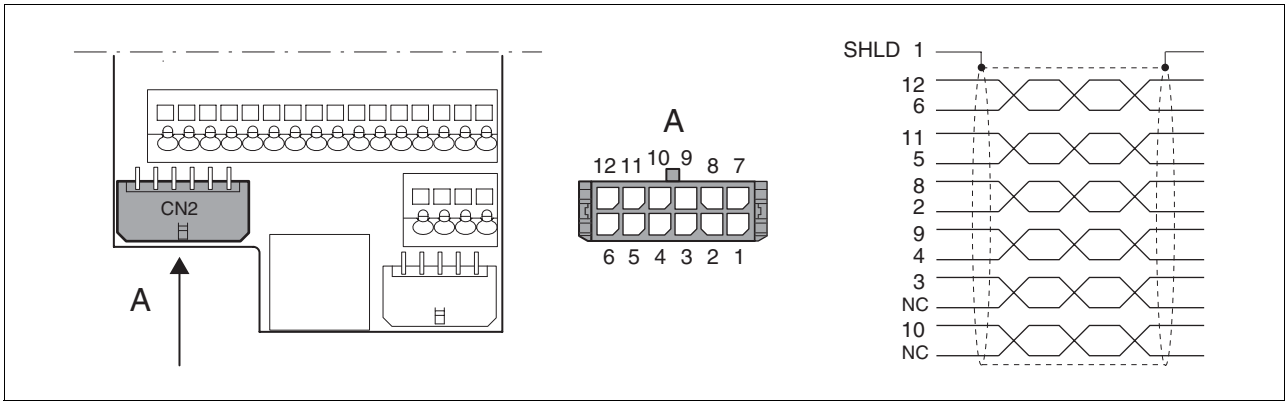


Figure 6.18 Motor sensor connection diagram

Pin	Signal	Motor, pin	Colour [1)]	Pair	Description	I/O
1	Shielding braid				Shielding braid	
12	SIN	8	white	1	Sine signal	I
6	REFSIN	4	brown	1	Reference for sine signal, 2.5 V	O
11	COS	9	green	2	Cosine signal	I
5	REFCOS	5	yellow	2	Reference for cosine signal, 2.5V	O
8	Data	6	grey	3	Receive and send data	I/O
2	$\overline{\text{Data}}$	7	pink	3	Receive and send data, inverted	I/O
10	ENC_0V	11	blue	4	sensor reference potential (encoder) (0.5mm²)	O
			red	4	not assigned (0.5mm²)	
3	TMOT_0V	1	black	5	Reference potential for T_MOT	-
			purple	5	not assigned	
9	T_MOT	2	grey/pink	6	temperature sensor PTC	O
4	ENC+10V_OUT	10	red/blue	6	10 V_{DC} power supply for sensor, max. 150 mA	I
7	n.c.				not assigned	

1) Colour data refer to the supplied cable

Connecting motor sensor

▶ Make sure that the wiring, the cables and the connected interfaces meet the requirements for PELV.

▶ Note the EMC specification for motor sensor wiring from page 6-3, and ensure the equipotential bonding over equipotential bonding lines.

▶ Connect the Molex plug to CN2.

▶ Fasten the cable to the EMC plate and make sure that the cable shielding is spread over a wide area.

ACC1MDADM00EN, V1.00, 01.2005

6.3.9 Connection of holding brake controller (HBC)

CAUTION!

Destruction of the drive system.

The terminals for the brake from the motor cable must not be directly connected to the drive amplifier

- Connect the brake to a holding brake control system.

DANGER!

Electric shock

High voltages can occur unexpectedly at the motor connection.

- The motor generates voltage when the shaft is rotated. Lock the shaft of the motor to prevent rotation before starting work on the drive system.
- AC voltages may jump over unused wires in the motor cable. Isolate unused wires at both ends of the motor cable.
- The system manufacturer is responsible for compliance with all applicable regulations relevant to earthing the drive system. Extend the earth through the motor cable with an additional earth at the motor housing.

Selection and dimensioning

For a motor with holding brake, we recommend an appropriate start-up logic (HBC) which releases the brake when current is supplied to the motor and which fixes the motor axle quickly when the motor is stopped.

Delay times for ventilation and the application of the brake can be set by parameters on the unit, see page 8-62. For order data for the HBC see accessories from page 12-1.

Note the power requirement of the HBC. It depends on the switching current for the holding brake and is calculated by the following:
input current HBC [A] = 0.5 A + switching current [A]

Under certain conditions you can omit the control logic system. If the holding brake start-up system is omitted, however, it is imperative that the following points are taken into account:

- You will need a separate voltage supply with the specified tolerances.
- The controller supply voltage and the supply for the brake must be electrically isolated.
- The drive power of many motors is reduced if the current reduction to the brake is omitted.
- The unshielded section of the brake wire must not exceed 12 cm because of possible EMC interference.

Cable specifications and fabrication

see motor cable, from page 6-2.

The unshielded section of the brake wire must not exceed 12 cm because of possible EMC interference.

ACC1MDADM00EN, V1.00, 01.2005

Wiring diagram HBC

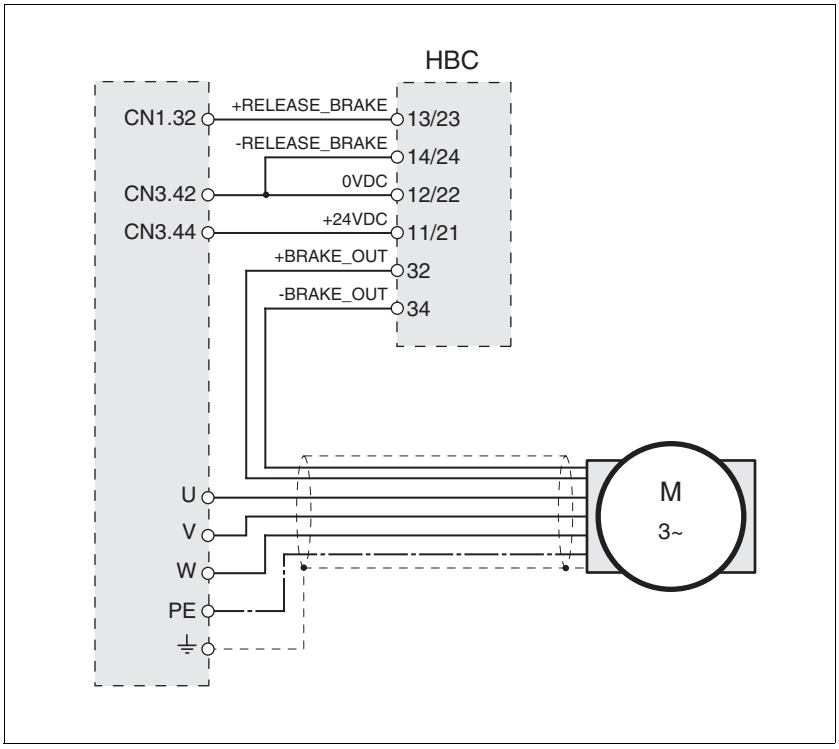


Figure 6.19 Wiring diagram, motor with holding brake and HBC

HBC terminal	HBC connection	Description	Colour
32	+BRAKE_OUT	Brake wire	white (WH)
34	-BRAKE_OUT	Brake wire	grey (GR)
13/23	+RELEASE_BRAKE	Control line ACTIVE1_OUT	
14/24	-RELEASE_BRAKE	Reference potential to ACTIVE1_OUT	
11/21	+24VDC	Supply voltage	
12/22	0VDC	Reference potential for supply voltage	

Connecting HBC

- ▶ Attach the holding brake controller to the right of the unit as shown in the wiring diagram. In units of size 3 and 4 the holding brake controller must be mounted flush with the bottom of the unit.
- ▶ Isolate unused leads individually.

The power supply to the holding brake must be isolated from that of the PELV circuit of the unit. The isolation is internal in the HBC described in the accessories chapter.

For further information on HBC see page 3-11, 7-25, 12-1

ACC1MDADM00EN, V1.00, 01.2005

6.3.10 Connection of controller supply voltage (24 V at CN3)

DANGER!

Electric shock from incorrect power supply.

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

- Use a power supply that meets the requirements for PELV (Protective Extra Low Voltage)
- Connect the negative output of the power supply to PE.
- Do not interrupt the negative connection between power supply and load with a fuse or switch

CAUTION!

Destruction of contacts.

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

CAUTION!

Destruction of system components and loss of control monitoring!

Interrupting the negative connection of the control supply can cause excessive voltages at the signal connections.

- Never switch the negative connection of the control supply.
- Check for correct connection before switching on.
- Never connect the control supply or change its wiring while there is supply voltage present.

Wiring diagram

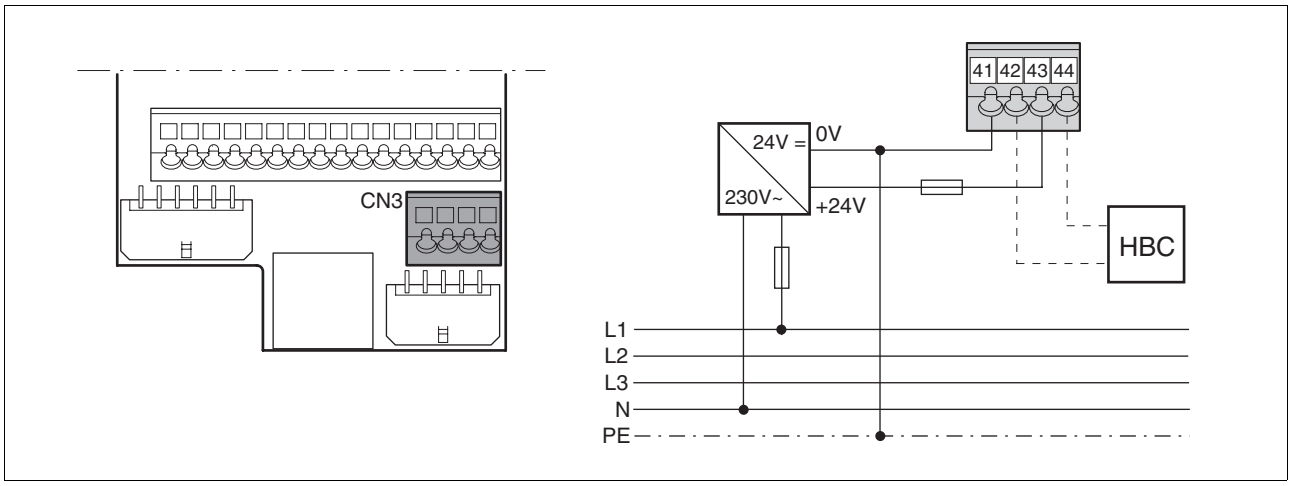


Figure 6.20 Controller supply voltage wiring diagram

Pin	Signal	Description
41	0VDC	Reference potential for 24V voltage
42	0VDC	Reference potential for 24V voltage
43	+24VDC	24V controller supply voltage
44	+24VDC	24V controller supply voltage

Connecting the controller supply voltage

- ▶ Make sure that the wiring, the cables and the connected interfaces meet the requirements for PELV.
- ▶ Feed the controller supply voltage from a power supply (PELV) to the unit.
- ▶ Earth the negative output at the power supply

Dimensioning

- Terminal CN3, pin 42 and 44 (see Figure 6.20) can be used as a 0V/24V terminal for additional consumers. Note the maximum terminal current, see Technical Data, from page 3-1.
- As long as the controller supply voltage is switched on, the position of the motor will remain the same, even if the power amplifier supply voltage is switched off.

ACC1MDADM00EN, V1.00, 01.2005

6.3.11 Connecting encoder signals A, B, I (CN5)

Function

At CN5 the setpoint value preset can be made via externally fed A/B signals and index pulse (I) in electronic gear operating mode.

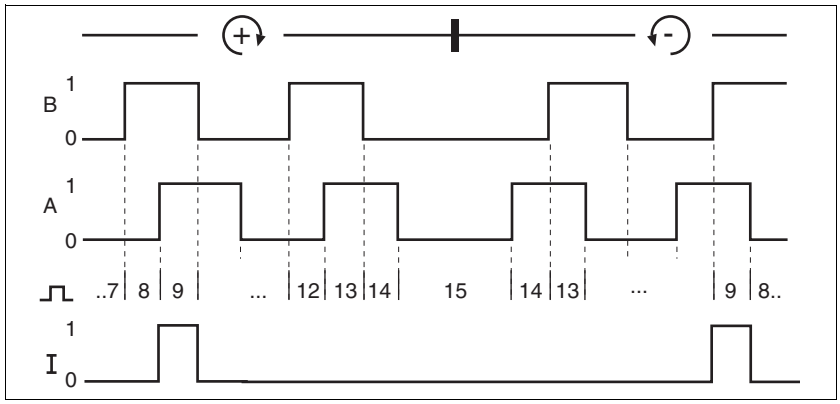


Figure 6.21 Timing diagram with A, B and index pulse signal, counting forwards and backwards

Cable specifications

- Shielded cable
- Twisted-pair conductors
- Minimum cross section of the signal wires 0.25 mm^2
- Earthing of the screen at both ends
- Maximum cable length 100m

▶ Use equipotential bonding lines, see page 6-3.

▶ Use prefabricated cables to minimise the risk of a wiring fault (from page 12-2).

Connect the encoder

▶ Connect the Molex plug to CN5. If you are not using prefabricated wiring, make sure the pin assignment is correct.

▶ Make the appropriate settings during commissioning. See "First Setup", page 7-10

Wiring diagram

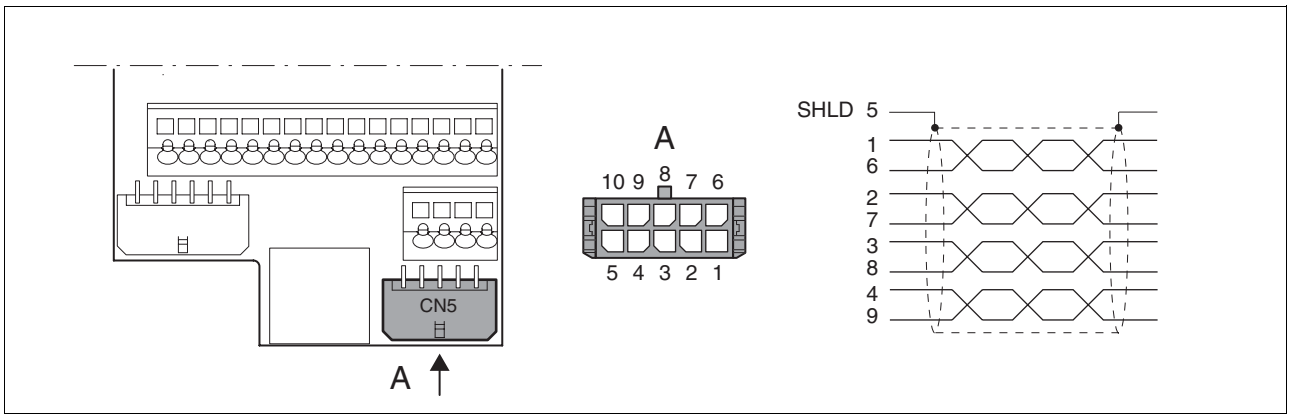


Figure 6.22 Wiring diagram, Encoder to CN5

Pin	Signal	Colour [1)]	Description	Type (I/O)
1	ENC_A	white	Encoder signal channel A	RS422 input signal

Pin	Signal	Colour [1)]	Description	Type (I/O)
6	$\overline{\text{ENC\_A}}$	brown	Channel A, inverted	RS422 input signal
2	ENC_B	green	Encoder signal channel B	RS422 input signal
7	$\overline{\text{ENC\_B}}$	yellow	Channel B, inverted	RS422 input signal
3	ENC_I	grey	Channel index pulse	RS422 input signal
8	$\overline{\text{ENC\_I}}$	pink	Channel index pulse, inverted	RS422 input signal
4	$\overline{\text{ACTIVE2\_OUT}}$	red	Drive ready	Open collector
9	POS_0V	blue	Reference potential	
5	Shield			
10	nc		not assigned	

1) Information on colour refers to the wires available as accessories.

6.3.12 PULSE (CN5) connection

WARNING!

Unexpected motion may cause injury and damage to the system.

Incorrect or faulty signals as reference position can trigger unexpected movements.

- Use shielded cables with twisted-pair.
- Operate the interface with push-pull signals.
- Do not use signals without push-pull in critical applications or in an environment subject to interference.
- Do not use signals without push-pull with cable lengths over 3 m and limit the frequency to 50 kHz

CAUTION!

Destruction of the product and loss of control monitoring!

The PULSE, DIR and ENABLE inputs on this connection are only rated for 5V. Excessive voltage can cause destruction of the product either immediately or at a later time.

- Check the correct connection before switching on.

Function

The unit is suitable for setpoint value default via externally fed pulse/direction signals. For example, they are required for electronic gear operating mode.

Pulse-direction signals are used as reference signals for positioning the motor and as a control signal for power amplifier enable. Drive ready for operation and a possible operating fault are reported.

PULSE/DIR

The motor executes an angular step on the leading edge of the PULSE signal PULSE. The direction of rotation is controlled by the DIR signal.

ACC1MDADM00EN, V1.00, 01.2005

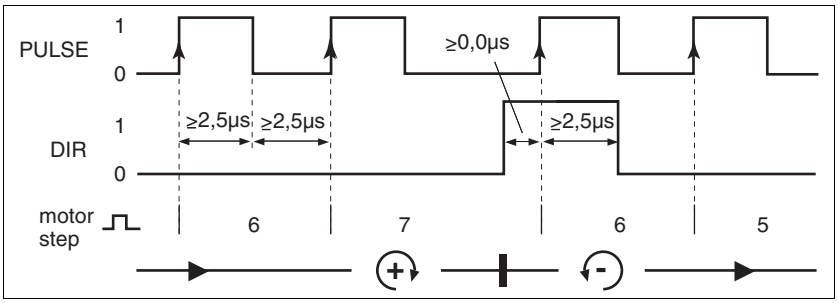


Figure 6.23 Pulse direction signal

Pin	Signal	Value	Function
1	PULSE	0 -> 1	Motor step
2	DIR	0 / open	Clockwise direction of rotation

The maximum frequency of PULSE and DIR is 200 kHz.

ENABLE If the case of local controller operating mode the ENABLE signal can also be used to enable the output stage.

If there is no operating fault, the $\overline{\text{ACTIVE2\_OUT}}$ output indicates ready for operation for about 100 ms after the power amplifier is enabled.

$\overline{\text{ACTIVE2\_OUT}}$ $\overline{\text{ACTIVE2\_OUT}}$ is an open collector output and switches against 0 V. The output shows that the unit is ready for operation.

Circuit of the signal inputs

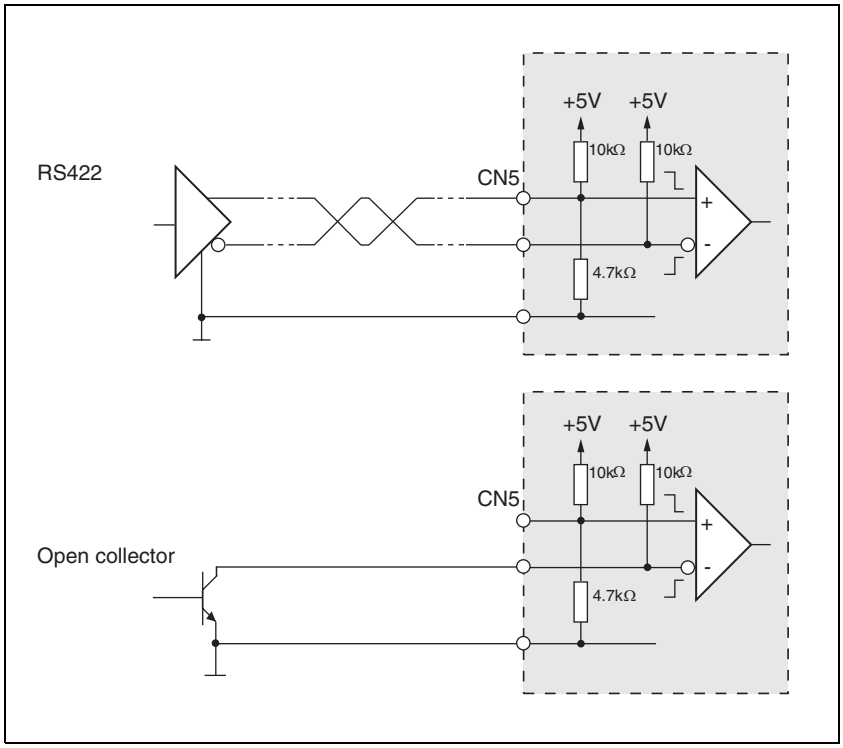


Figure 6.24 Circuit of the PULSE, DIR and ENABLE signal inputs

Cable specifications

- Shielded cable

- Twisted-pair conductors
- Minimum cross section of the signal wires 0.14 mm^2
- Earthing of the screen at both ends
- Maximum length 100 m

▶ Use equipotential bonding lines, see page 6-3.

▶ Use prefabricated cables to minimise the risk of a wiring fault (from page 12-1).

Connecting PULSE

▶ Connect the Molex plug to CN5. If you are not using prefabricated wiring, make sure the pin assignment is correct.

▶ Make the appropriate settings during commissioning. See "First Setup", page 7-10

Connection diagram

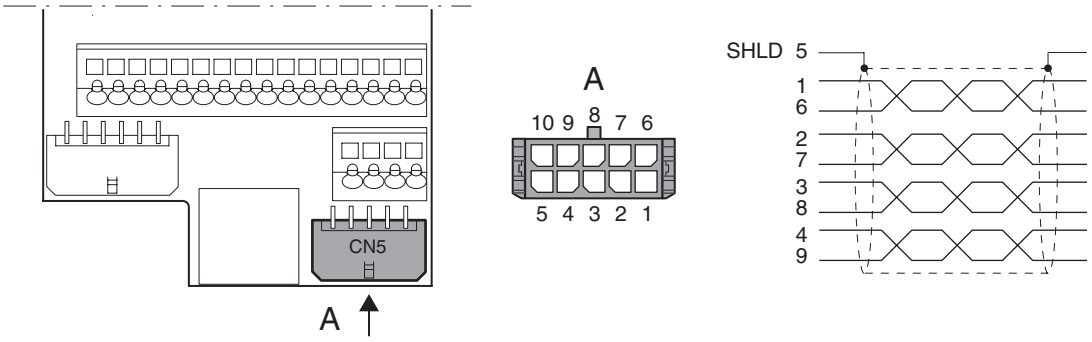


Figure 6.25 Connection diagram PULSE

Pin	Signal	Colour [1)]	Meaning	I/O
1	PULSE	white	Motor step "Pulse"	RS422 input signal
6	$\overline{\text{PULSE}}$	brown	Motor step "Pulse", inverted	RS422 input signal
2	DIR	green	direction of rotation "DIR"	RS422 input signal
7	$\overline{\text{DIR}}$	yellow	direction of rotation "Dir", inverted	RS422 input signal
3	ENABLE	grey	Enable signal	RS422 input signal
8	$\overline{\text{ENABLE}}$	pink	Enable signal, inverted	RS422 input signal
4	$\overline{\text{ACTIVE2\_OUT}}$	red	Drive ready	Open collector
9	POS_0V	blue	Reference potential	-
5	Shield line			
10	nc		not assigned	

1) Information on the colour refers to the cables available as accessories.

ACC1MDADM00EN, V1.00, 01.2005

6.3.13 ESIM (CN5) connection

Function The unit is suitable for encoder simulation (ESIM). Signals for output of the actual position cab be led out at CN5. They are two out-of-phase signals A and B. The A/B signals are sent by the motor-encoder module.

Resolution The basic resolution of the encoder simulation at 4x resolution is 4096 increments per revolution.

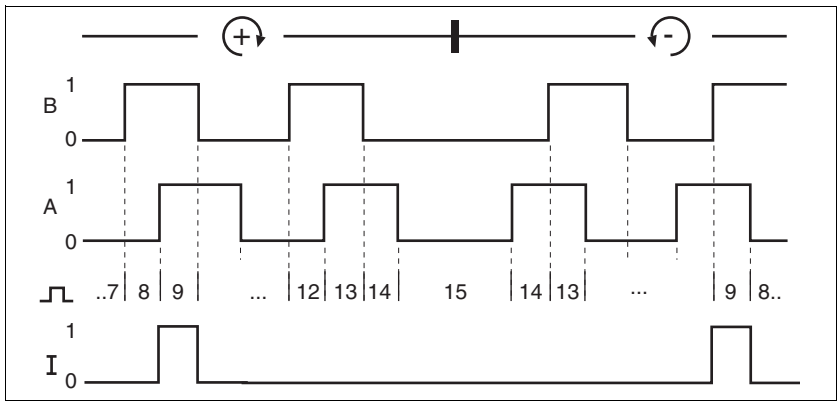


Figure 6.26 Timing diagram with A, B and index pulse signal, counting forwards and backwards

Cable specification

- Shielded cable
- Twisted-pair conductors
- Minimum cross section of the signal wires 0.14 mm^2
- Earthing of the screen at both ends
- Maximum length 100 m
- ▶ Use equipotential bonding lines, see page 6-3.
- ▶ Use prefabricated cables to minimise the risk of a wiring fault (from page 12-2).

Connecting ESIM

- ▶ Connect the Molex plug to CN5. If you are not using prefabricated wiring, make sure the pin assignment is correct.
- ▶ Make the appropriate settings during commissioning. See "First Setup", page 7-10

Connection diagram

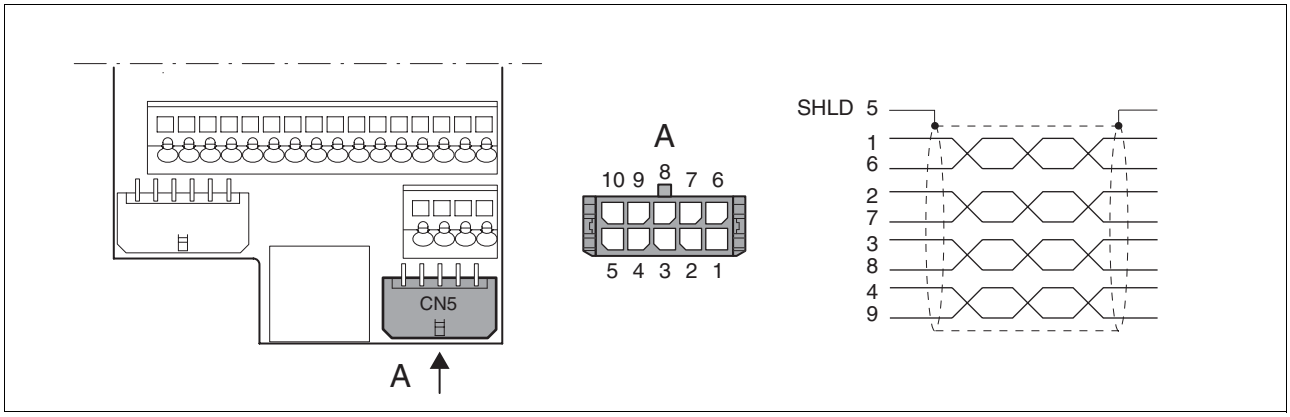


Figure 6.27 ESIM connection diagram

Pin	Signal	Colour [1)]	Meaning	I/O
1	ESIM_A	white	Channel A	RS422 output signal
6	$\overline{\text{ESIM\_A}}$	brown	Channel A, negated	RS422 output signal
2	ESIM_B	green	Channel B	RS422 output signal
7	$\overline{\text{ESIM\_B}}$	yellow	Channel B, negated	RS422 output signal
3	ESIM_I	grey	Index pulse	RS422 output signal
8	$\overline{\text{ESIM\_I}}$	pink	index pulse, negated	RS422 output signal
4	$\overline{\text{ACTIVE2\_OUT}}$	red	Drive ready	Open collector
9	POS_0V	blue	Reference potential	-
5	Shield line			
10	nc		not assigned	

1) Information on the colour refers to the cables available as accessories.

6.3.14 CANopen connection (CN1 or CN4)

Function

The unit is suitable for connection to CANopen.

In CAN bus multiple network devices can be connected over one bus cable. Up to 32 devices can be addressed in one CAN bus network branch and up to 127 devices in the extended network.

Every network device must be configured before operation on the network. It is given a unique, 7-bit node address (node-ID) between 1 (01_h) and 127 ($7F_h$).

The baud rate must be the same for all units in the field bus.

Address and baud rate are set during commissioning. See "First Setup", page 7-10

For additional information see the CANopen manual, order number, see page 12-3.

Cable specifications

- Shielded cable
- Twisted-pair conductors
- Minimum cross section of the signal wires 0.14 mm^2
- Earthing of the screen at both ends
- Maximum length depends on the number of devices, the baud rate and signal run times. The higher the baud rates the shorter the bus cable must be.

▶ Use equipotential bonding lines, see page 6-3.

▶ Use prefabricated cables to minimise the risk of a wiring fault (from page 12-3).

▶ Make sure that the wiring, the cables and the connected interfaces meet the requirements for PELV.

Maximum bus length

The maximum bus length depends on the selected baud rate. The following table shows the maximum recommended bus lengths for the overall length.

baud rate [kbit/s]	maximum bus length with CANopen [m]
20	2500
125	500
250	250
500	100
800	25
1000	4

At a baud rate of 1 Mbit the spur lines are limited to 0.3m.

Terminating resistors

The units at the two ends of a bus cable string must be terminated. This can be achieved with CAN by the using terminating resistances of 120Ω between CAN_L and CAN_H

A terminating resistor that is enabled with the S1 switch is integrated into the unit.

ACC1MDADM00EN, V1.00, 01.2005

▶ If the unit is at the end of the network, slide the S1 switch for the terminating resistor to the left.

Wiring diagram

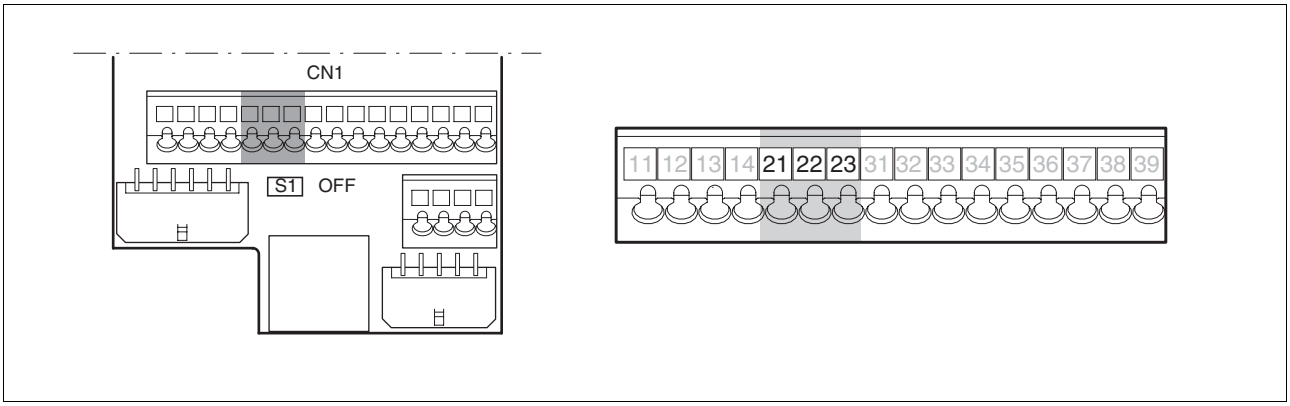


Figure 6.28 Wiring diagram, CANopen at CN1

Pin	Signal	Description	Type (I/O)
21	CAN_0V	CAN reference potential	
22	CAN_L	data wire, inverted	CAN level
23	CAN_H	data wire	CAN level

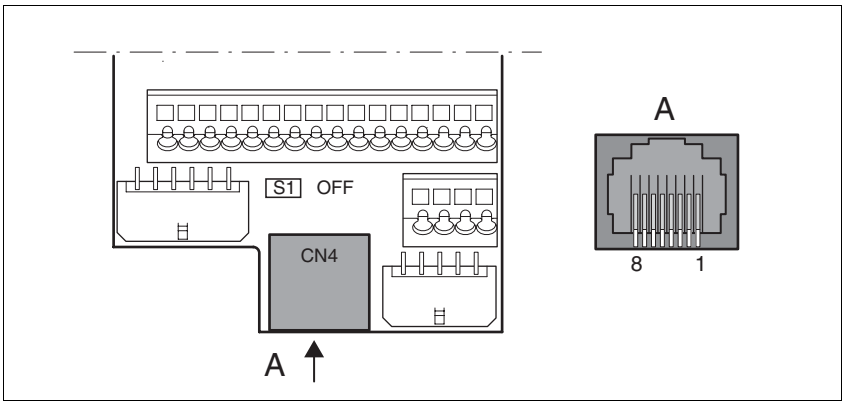


Figure 6.29 CANopen wiring diagram at CN4

Pin	Signal	Description	Type (I/O)
1	CAN_H	data wire	CAN level
2	CAN_L	data wire, inverted	CAN level
7	MOD+10V_OUT	10V power supply (different assignment from CANopen)	Output
8	MOD_0V	Reference potential forMOD+10V_OUT	Output

Connecting CANopen

▶ Connect the CANopen cable to CN1, pin 21, 22 and 23 or to CN4 (pin 1, 2 and 8) with an RJ45 plug.

ACC1MDADM00EN, V1.00, 01.2005

6.3.15 Modbus connection (CN4)

Function

The unit is designed for connection to the Modbus

With Modbus, multiple network devices are interconnected by bus cable. Every network device must be configured before operation on the network. Each is given a unique node address.

The baud rate must be the same for all units in the field bus.

Address and baud rate are set during commissioning. See "First Setup", page 7-10

For additional in formation see the Modbus manual, order number, see page 12-4.

Cable specifications

The cables used must conform to the following properties:

- Shielded cable
- Twisted-pair conductors
- Minimum cross section of the signal wires 0.14 mm^2
- Earthing of the screen at both ends
- maximum length 400 m.

▶ Use equipotential bonding lines, see page 6-3.

▶ Use prefabricated cables to minimise the risk of a wiring fault (from page 12-4).

Connection diagram

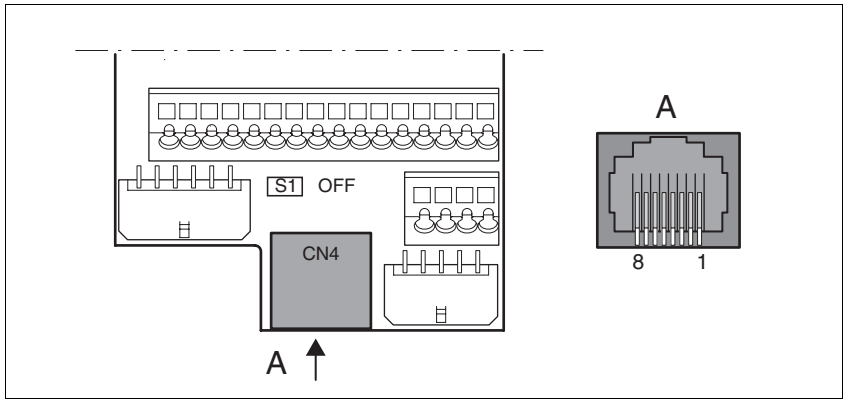


Figure 6.30 Connection diagram:MODBUS

Pin	Signal	Description	
4	MOD_D1	Bidirectional send/receive signal	RS485 level
5	MOD_D0	Bidirectional send/receive signal, inverted	RS485 level
7	MOD+10V_OUT	10 V power supply, max. 150 mA)	Output
8	MOD_0V	Reference potential forMOD+10V_OUT	Output

Connecting Modbus

▶ Connect the Modbus cable to CN4 with an RJ45 plug.

6.3.16 Connection of analogue inputs (CN1)

Cable specifications

- Shielded cable

- Twisted-pair conductors
- Minimum cross section of signal wires 0.14 mm^2, max. cross section 1.5 mm^2
- maximum length 10 m

Connecting analogue inputs

▶ Attach the cable to the EMC plate, the shield must be attached to the earth potential over a wide area. A capacitor, e.g. 10 nF/100 V MKT, must be installed at the other end of the cable between the shield and the earth to prevent HF interference.

Wiring diagram

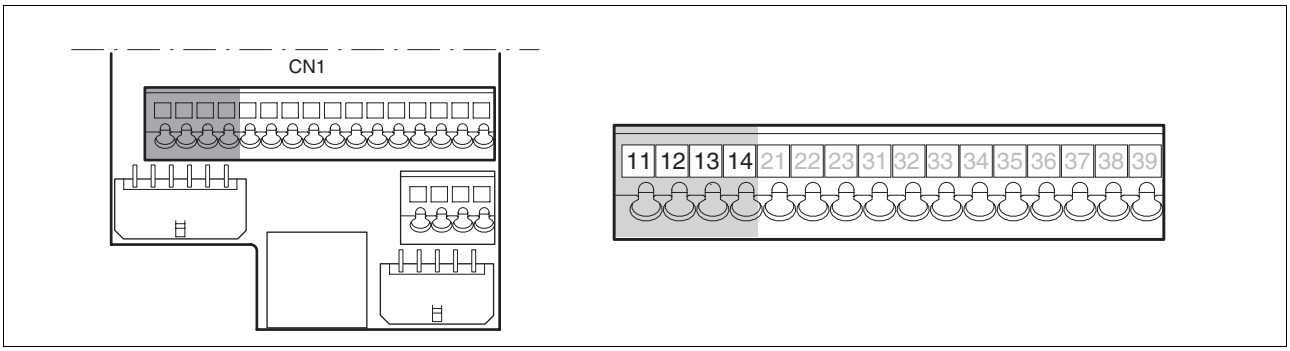


Figure 6.31 Wiring diagram, analogue inputs

Pin	Signal	Type (I/O)
11	ANA1+	Analogue input signal, ±10V, e.g. for current or rotation speed setpoint; Processing: 14 bits
12	ANA1-	Reference potential forANA1+, pin 11
13	ANA2+	Analogue input signal, ±10V, e.g. for current or rotation speed limit; Processing: 12 bits
14	ANA2-	Reference potential forANA2+, pin 13

Reference values and limits

The ±10V scaling of the analogue reference values and analogue limits can be specified for operation, see page 7-21.

ACC1MDADM00EN, V1.00, 01.2005

6.3.17 Connection of digital inputs/outputs (CN1)

CAUTION!

Loss of control monitoring.

The use of $\overline{\text{LIMP}}$ and $\overline{\text{LIMN}}$ can offer some protection against hazards (e.g. impact on mechanical stop caused by incorrect motion defaults).

- Use $\overline{\text{LIMP}}$ and $\overline{\text{LIMN}}$ where possible.
- Check that the external sensors or switches are correctly connected.
- Check the correct functional installation of the limit switches The limit switches must be mounted in a position far enough away from the mechanical stop to allow an adequate braking distance.
- The functions must be enabled to use $\overline{\text{LIMP}}$ and $\overline{\text{LIMN}}$.
- This function cannot provide protection against faulty functioning of the product or the sensors.

Cable specifications

- minimum cross-section 0.14 mm^2, max. cross-section 1.5 mm^2
- Maximum length at minimum cross section 15 m..

Minimum connection assignment

The following signals must always be connected.

Pin	Signal	Remarks
33	$\overline{\text{REF}}$	with field bus control mode only
34	$\overline{\text{LIMN}}$	with field bus control mode only
35	$\overline{\text{LIMP}}$	with field bus control mode only
36	$\overline{\text{HALT}}$	
37,38	$\overline{\text{SAFE\_DISABLE\_B}}$ $\overline{\text{SAFE\_DISABLE\_A}}$	Two-channel connection, signals are not managed with parameters.

Table 6.8 Minimum connection assignment

If the signals listed in the table are not used, they must be wired with +24VDC. $\overline{\text{HALT}}$, $\overline{\text{LIMP}}$, $\overline{\text{LIMN}}$ and $\overline{\text{REF}}$ can also be disabled with the corresponding parameters.

Terminal assignment for Safe Standstill function

WARNING!

Danger of injury by incorrect usage!

Incorrect usage may cause a safety hazard by loss of the safety function.

- Observe the requirements for the safety function.

Information on the safety signals SAFE_DISABLE_A and SAFE_DISABLE_B can also be found in 5.3 ""Safe Standstill safety function"" from page 5-2 and in 3.3.4 “Safety functions“ on page 3-7

Connecting digital inputs/outputs

- ▶ Wire the digital connections to CN1.
  The following functions are defined for pin 33, 34 and 35 depending on the controller type (local or field bus) (see Table 6.9). The controller type is specified during commissioning with parameters.
- ▶ Connect the limit switch that limits the working range in the positive direction of rotation to LIMP. Connect the switch for the negative direction of rotation to LIMN.
- ▶ Earth the shield with low resistance and over a wide area at both ends of the cable.

Wiring diagram

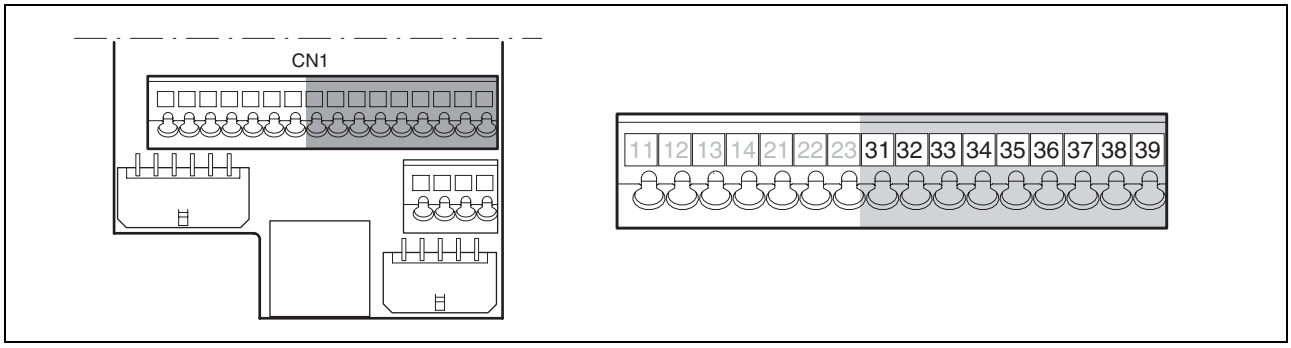


Figure 6.32 Wiring diagram, digital inputs/outputs

Pin	Signal with local control mode	Meaning with local control mode	Signal with field bus control mode	Meaning with field bus control mode	Type (I/O)
31	NO_FAULT_OUT		NO_FAULT_OUT		24V, A
32	ACTIVE1_OUT	0: motor is unpowered 1: motor is powered, control signal for HBC holding brake controller, output max. 400 mA	ACTIVE1_OUT	0: motor is unpowered 1: motor is powered, control signal for HBC holding brake controller, output max. 400 mA	24V, A
33	-	-	REF	Reference switch signal (factory setting: disable)	24V, E
34	FAULT_RESET	Reset error	LIMN	Limit switch signal negative	24V, E
35	ENABLE	Enable power amplifier	LIMP	Limit switch signal positive	24V, E
36	HALT	"Function Stop"	HALT	"Function Stop"	24V, E
37	SAFE_DISABLE_B	Safety function	SAFE_DISABLE_B	Safety function	24V, E
38	SAFE_DISABLE_A	Safety function	SAFE_DISABLE_A	Safety function	24V, E
39	24VDC	if a safety function is not required, at bridge on pin 37 and 38	24VDC	if a safety function is not required, at bridge on pin 37 and 38	-

Table 6.9 Digital signals, connection assignment

ACC1MDADM00EN, V1.00, 01.2005

6.3.18 Connection to PC or peripheral control terminal (CN4)

CAUTION!

Damage to PC!

If the interface connector on the product is directly connected to a Gigabit Ethernet plug on the PC, the interface on the PC may be destroyed.

- Never connect an Ethernet interface directly to this product.

Function of the control terminal

The peripheral control terminal with LCD display and keypad can be connected directly to CN4 with the supplied RJ-45 cable, see accessories from page 12-1. This allows the unit to be operated at a distance from the system. The functions and display of the control terminal are identical to those of the HMI.

Cable specifications

- Shielded cable
- Twisted-pair conductors
- Minimum cross section of the signal wires 0.14 mm^2
- Earthing of the screen at both ends
- maximum length 400 m

PC connection

An RS485 to RS232 converter is required for the PC, see accessories from page 12-1. The converter is powered by the unit.

Connection diagram

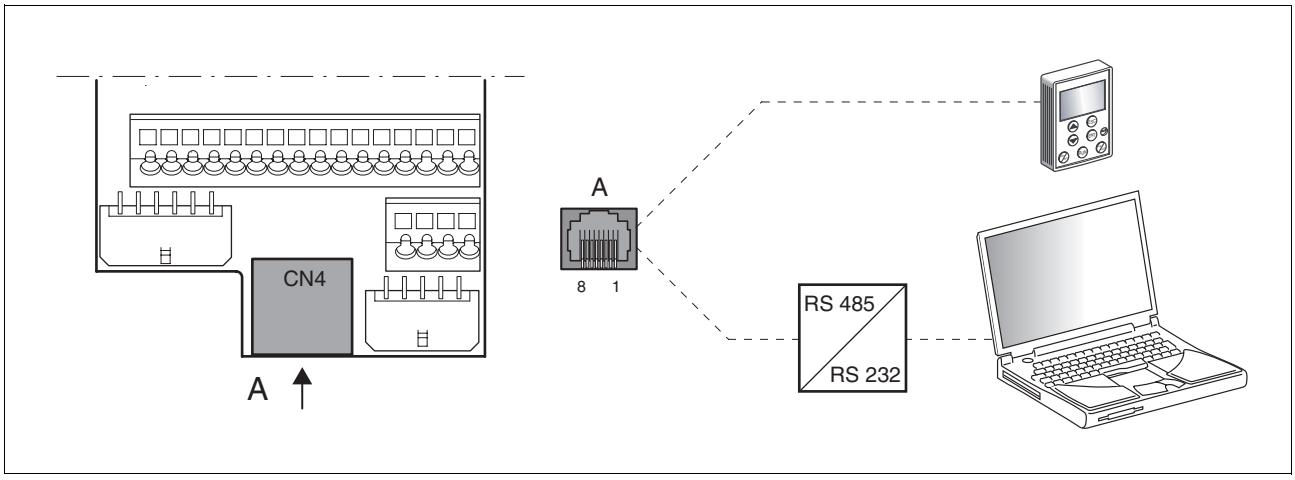


Figure 6.33 Connection of PC or decentralised operating terminal

Pin	Signal	Meaning	
4	MOD_D1	Bidirectional send/receive signal, inverted	RS485 level
5	MOD_D0	Bidirectional send/receive signal	RS485 level
7	MOD+10V_OUT	10 V power supply, max. 150 mA)	Output
8	MOD_0V	Reference potential to MOD+10V_OUT	Output

6.3.19 Reference signal adapter

Reference signal adapter RVA

Reference signals of a master device can be sent simultaneously to up to five units using the RVA (Reference Value Adapter) reference signal adapter. This adapter also supplies the supply voltage (5V, monitored with sense wires) for the motor sensor. The correct power supply is shown by a "5VSE" LED.

An external rotary encoder (A/B signals) or an encoder simulation (ESIM) can be used as a master device. Pulse/direction signals can also be sent from a higher level controller.

Connecting RVA reference signal adapter

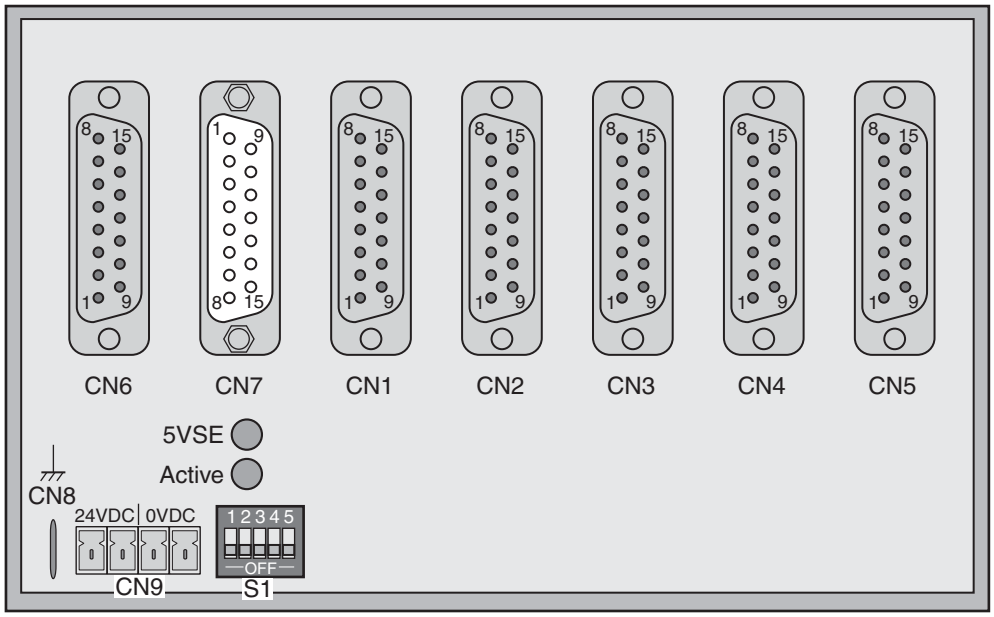
▶ Make sure that the wiring, the cables and the connected interfaces meet the requirements for PELV.

The RVA reference signal adapter is powered by 24 V at the CN9 terminals. A higher level controller (pulse/direction) can be connected to CN6. An external rotary encoder or an ESIM signal can be applied to CN7.

Up to five units for evaluating the specified reference signals can be connected to CN1 to CN5.

▶ Set switch S1 according to the assignment of CN1-CN5 For example, if units are only connected to CN1, CN3 and CN4, S1-1, S1-3 and S1-4 must be set to "off" and S1-2 and S1-5 to "on".

◁ The "active" LED shows that $\overline{\texttt{ACTIVE2\_OUT}}$ has been set on all connected units and the number of connected units complies with the setting.



Pin	Signal	Description
1	PULSE / A / ESIM_A	Pulse+, channel A, ESIM_A
9	$\overline{\texttt{PULSE}}$ / $\overline{\texttt{A}}$ / $\overline{\texttt{ESIM\_A}}$	Pulse-, channel A inverted, ESIM_A inverted
2	DIR / B / ESIM_B	Direction+, channel B, ESIM_B
10	$\overline{\texttt{DIR}}$ / $\overline{\texttt{B}}$ / $\overline{\texttt{ESIM\_B}}$	Direction-, channel B inverted, ESIM_A inverted

ACC1MDADM00EN, V1.00, 01.2005

Pin	Signal	Description
3	ENABLE / I / ESIM_I	ENABLE+, index pulse, ESIM_I
11	$\overline{\text{ENABLE}}$ / $\overline{\text{I}}$ / $\overline{\text{ESIM\_I}}$	ENABLE-, index pulse inverted, ESIM_I inverted
8	$\overline{\text{ACTIVE2\_OUT}}$ / $\overline{\text{READY}}$	Drive ready
15	GND	Reference potential
4, 5, 6, 7, 12, 13, 14	nc	not assigned

Table 6.10 CN1-CN6 connection assignment

Pin	Signal	Description
1	A	Channel A
9	$\overline{\text{A}}$	Channel A inverted
12	B	Channel B
5	$\overline{\text{B}}$	Channel B inverted
13	I	Index pulse
6	$\overline{\text{I}}$	index pulse inverted
10	SENSE+	Monitoring motor sensor power supply
11	SENSE-	Reference potential to motor sensor monitor
2	5VDC	5V motor sensor power supply
3	GND	Reference potential to 5V motor sensor power supply
4, 7, 8, 14, 15	nc	not assigned

Table 6.11 CN7 connection assignment

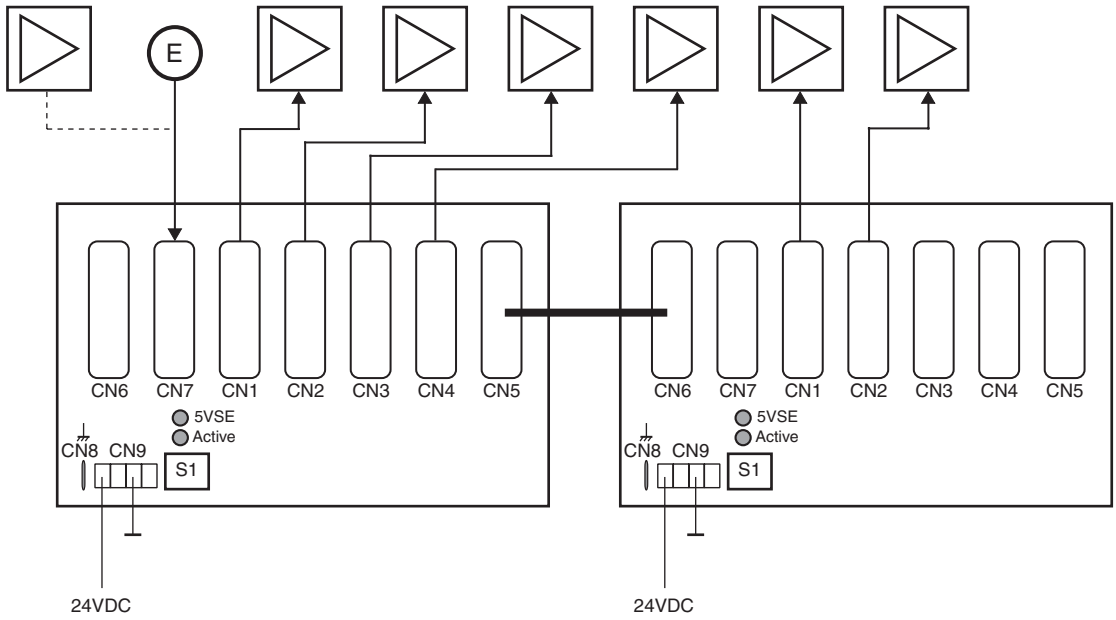


Figure 6.34 Wiring example: encoder signals A/B/I (at CN7) are sent to six units via two cascaded reference value adapter

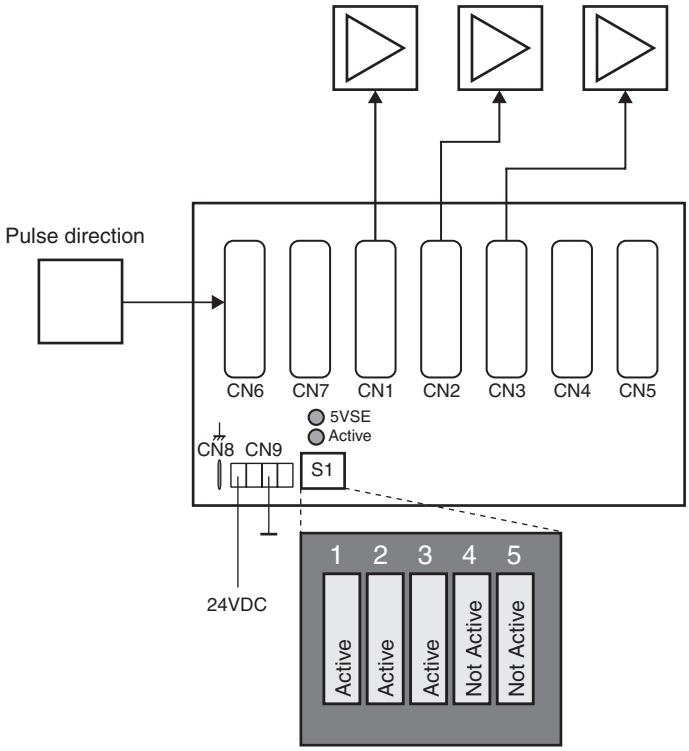


Figure 6.35 Wiring example: pulse direction signals (at CN6) are sent to three units.

ACC1MDADM00EN, V1.00, 01.2005

6.4 Checking installation

After completion of all steps we recommend checking the installation to prevent any errors before operation of the system.

▶ Make sure the drive system is correctly installed and wired up. Check in particular basic connections such as mains power and 24V power supply.

▶ Check in detail:

- Are all protective conductors connected?
- Are all fuses correct?
- Are any live cable ends exposed?
- Are all cables and connectors safely installed and connected?
- Are the control lines connected correctly?
- Have all EMC measures been taken?

▶ Check that all seals are fitted and that degree of protection IP54 is complied with (only when using the "Safe Standstill" function)

▶ Remove the protective foil as required in accordance with the specifications in Table 6.1.

ACC1MDADM00EN, V1.00, 01.2005

ACC1MDADM00EN, V1.00, 01.2005

7 Commissioning

7.1 General safety instructions

DANGER!

Electric shock, fire or explosion

- Only qualified personnel 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.
- Before working on the drive system:
  - Switch off power to all terminals.
  - Place a sign "DO NOT SWITCH ON" on the switch and lock to prevent switching on.
  - **Wait 6 minutes** (for discharge of DC bus capacitors).
  - Measure voltage between DC+ and DC- and check for <48V. (The DC bus LED is not a safe indication for absence of the DC bus voltage).
- Do not short-circuit DC bus or touch unshielded components or screws of the terminals with voltage present.
- Install all covers and close the housing doors before applying power.
- The motor generates voltage when the shaft is rotated. Lock the shaft of the motor to prevent rotation before starting work on the drive system.
- The system manufacturer is responsible for compliance with all applicable regulations relevant to earthing the drive system.
- Do not reach into the drive system (e.g. no pointed objects).

DANGER!

Electric shock caused by incorrect use!

The "Safe Standstill " function does not effect any electrical disconnection. The inter circuit voltage is still present.

- Turn off the mains voltage using an appropriate switch to achieve a voltage-free condition.

ACC1MDADM00EN, V1.00, 01.2005

WARNING!

Unexpected responses may cause injury and damage to the system.

The behaviour of the drive system is governed by numerous saved data. Unsuitable data may cause unexpected motions or responses to signals.

- Do not operate a unit with unknown data.
- Check the saved data.
- When commissioning carefully run tests for all operating states and fault cases.
- Check the functions after replacing a unit and also after changes to the saved data.
- Start the system only if there are no persons or materials in the danger zone and the system can be operated safely.

WARNING!

Danger of injury and damage to system components by loss of control!

- Observe the accident prevention regulations.
- The system manufacturer must consider the possible errors that could occur with the signals and in particular the critical functions to ensure a safe status during and after errors. Examples for these are: emergency stop, final position limit, power failure and restart.
- Consideration of possible errors must also include unexpected delay and failure of signals or functions.
- Separate redundant controller paths must be provided for dangerous functions.
- Verify the effictiveness of the measures.

WARNING!

Danger of injury and damage to system components by unbraked motor!

Loss of power or faults that result in switching off the power amplifier mean that the motor is no longer actively braked and may run against a mechanical stop at high speed.

- Check the mechanical conditions.
- If necessary, use an absorbent mechanical stop or a suitable brake.

ACC1MDADM00EN, V1.00, 01.2005

WARNING!

Unexpected motion may cause injury and damage to the system

When the drive is operated for the first time there is a high risk of unexpected motion because of possible wiring faults 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 motion before starting the function.

CAUTION!

Hot surfaces can cause burns and damage to system components!

The heat sink on the product may heat up to over 100°C depending on the operating mode.

- Prevent contact with the hot heat sink.
- Do not install flammable or heat-sensitive components in the immediate vicinity.
- Follow the actions described for heat dissipation.

7.2 Overview

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

What must be done

What you need to do...	Info
Checking installation	Page 6-51
Making "Initial Setup"	Page 7-10
Check and set critical device parameters	Page 7-16
Define ESIM resolution, if used	Page 7-20
Setting, scaling, testing analogue signals	Page 7-21
Set, test digital signals	Page 7-22
Limit switch function, tests the signals $\overline{\texttt{LIMP}}$, $\overline{\texttt{LIMN}}$	Page 7-23
Check signals $\overline{\texttt{SAFE\_DISABLE}}$, even if the “Safe Standstill” function is not used	Page 7-24

ACC1MDADM00EN, V1.00, 01.2005

What you need to do...	Info
Check the functioning of the holding brake controller if it is wired for that	Page 7-25
Checking motor direction of rotation	Page 7-26
Run autotuning	Page 7-29
Optimise controller settings manually - speed controller - position controller	Page 7-33 Page 7-34 Page 7-38
Back up all parameter settings as a file (using the commissioning software)	Page 8-67

ACC1MDADM00EN, V1.00, 01.2005

7.3 Tools for commissioning

7.3.1 Overview

Commissioning and setting parameters and also diagnostic tasks can be carried out with the following tools:

- Integrated HMI
- Peripherical control terminal
- Commissioning software
- Field bus

Access to the complete list of parameters is only possible with the commissioning software or via field bus.

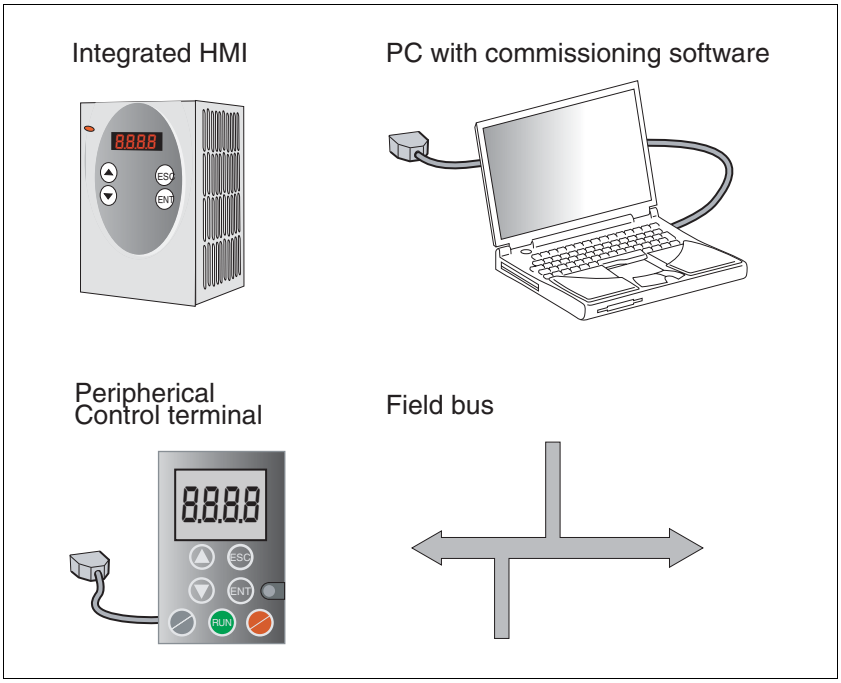


Figure 7.1 Commissioning tools

7.3.2 HMI: Human-Machine Interface

Function

The unit has the option of editing parameters with the integrated control panel (HMI). Displays for diagnosis are also possible. The sections on commissioning and operation include information on whether a function can be carried out with the HMI or whether the commissioning software must be used.

A brief introduction to the HMI structure and the operation is given below.

Control panel

Figure 7.2 shows the HMI (left) and the decentralised control terminal (right).

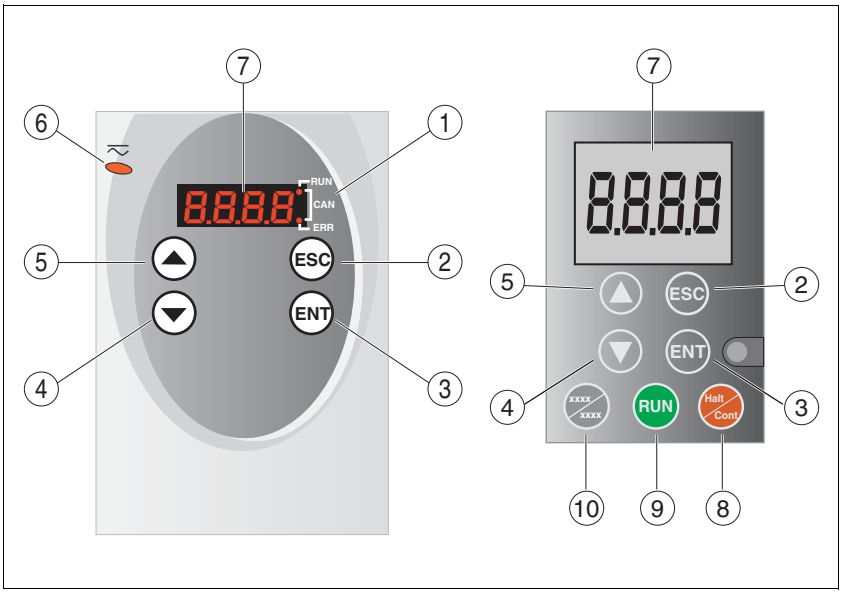


Figure 7.2 HMI and decentralised control terminal

(1) LEDs for CANopen
(2) ESC:
- exit a menu or parameter
- return from the displayed to the last saved value
(3) ENT:
- call a menu or parameter
- save the displayed value to EEPROM
(4) Down arrow:
- switch to next menu or parameter
- reduce the displayed value
(5) Up arrow:
- switch to previous menu or parameter
- increase the displayed value
(6) Red LED on: DC bus under voltage
(7) Status display
(8) Quick Stop (Software Stop)
(9) Fault Reset (Continue)
(10) No function

LEDs for CANopen

2 LEDs show the status of the CANopen state machine as per the CANopen standard DR 303-3.

ACC1MDADM00EN, V1.00, 01.2005

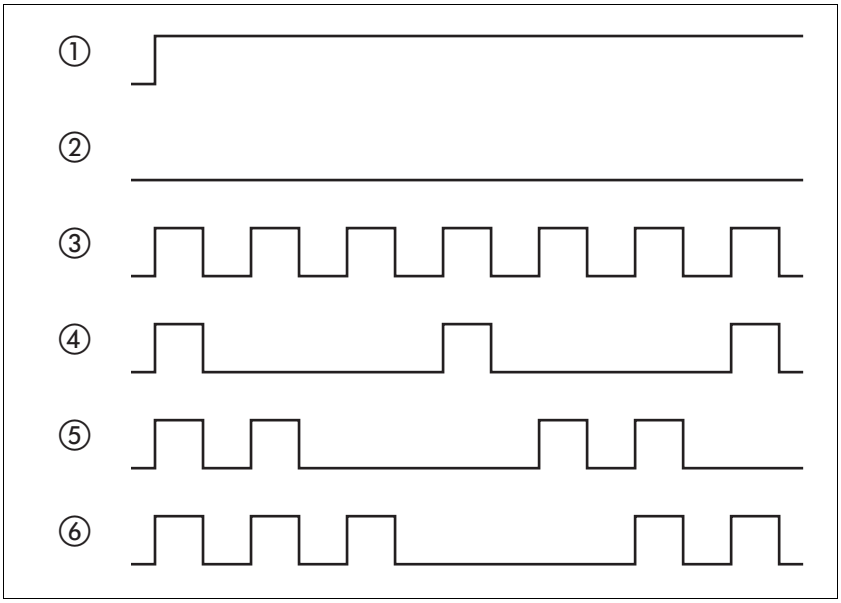


Figure 7.3 Meaning of the LED signals

"CAN RUN" LED

(1) Unit is in the NMT state OPERATIONAL
(3) Unit is in the NMT state PRE-OPERATIONAL
(4) Unit is in the NMT state STOPPED

"CAN ERR LED"

(1) CAN is BUS-OFF, e.g. after 32 failed transmission attempts.
(2) Unit is operating
(4) Warning limit reached e.g. after 16 failed transmission attempts
(5) Monitoring result (node guarding) has occurred
(6) SYNC message was not received within the configured period

Font on HMI display

Table 7.1 shows the assignment of the letters and numbers on the HMI display for the parameter view. Upper and lower case are only distinguished for C.

O	B	C	D	I	F	G	H	I	J	K	L	M	N	O	P	Q	R
A	b	cC	d	E	F	G	h	ı	J	H	L	n	n	o	P	q	r

S	T	U	V	W	X	Y	Z	1	2	3	4	5	6	7	8	9	0
5	t	u:	U	b	H	y	2	1	2	3	4	5	6	7	8	9	0

Table 7.1 HMI, available letters and numbers

Menu structure

The HMI is menu-driven. Figure 7.4 andTable 7.2 show the top level of the menu structure

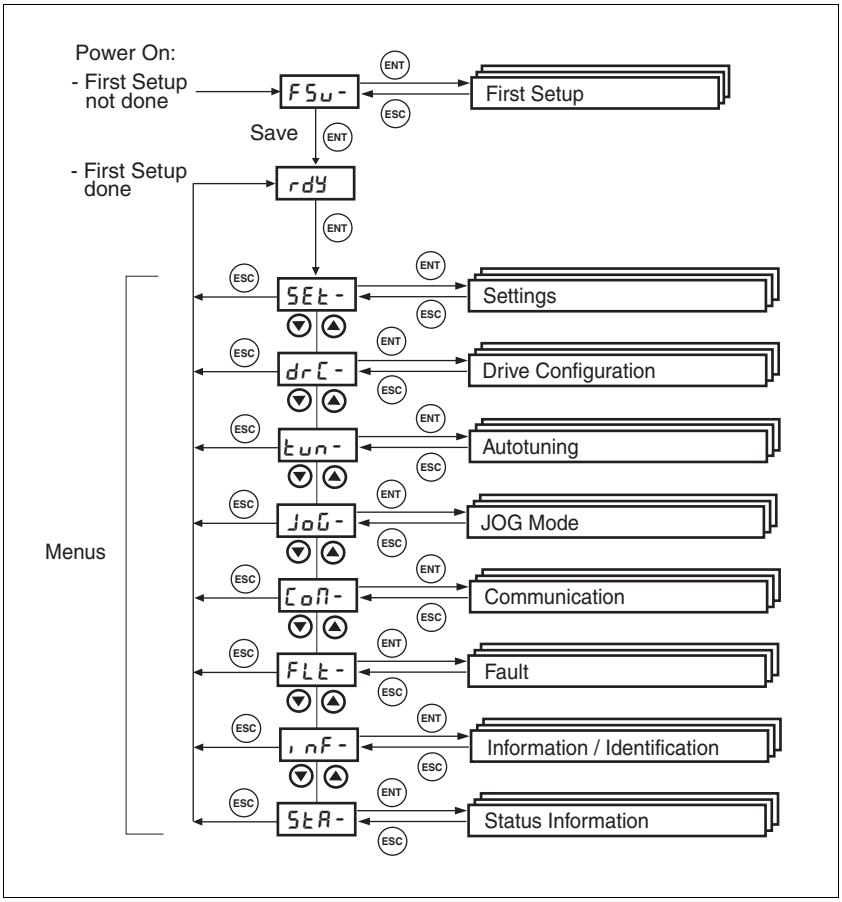


Figure 7.4 HMI menu structure

Menu	HMI code	Meaning
FSU-	FSu-	First Setup (**F**irst **S**et**U**p)
SET-	SEt-	Unit settings (**SET**tings)
DRC-	drC-	Unit configuration (**DR**ive **C**onfiguration)
TUN-	tun-	Autotuning (Auto**TUN**ing)
JOG-	JoG-	Manual movement(**JOG** Mode)
COM-	CoM-	Communication(**COM**munication)
FLT-	FLt-	Error display(**F**au**LT**)
INF-	inF-	Information/identification (**INF**ormation / Identification)
STA-	StA-	Observation/monitoring of unit, motor and movement data (**STA**tus Information)

Table 7.2 HMI, meaning of the menus

Status displays such as rdy- (Ready) can be found from page 7-15.

Calling parameters via HMI

The parameters belonging to a specific menu item are in the first level below the top menu level for that item. In order to give a better orientation, the table of parameters also shows the overall menu path, e.g. SEt- / A inS.

Figure 7.5 shows an example of calling a parameter (second level) and input or selection of a parameter value (third level).

ACC1MDADM00EN, V1.00, 01.2005

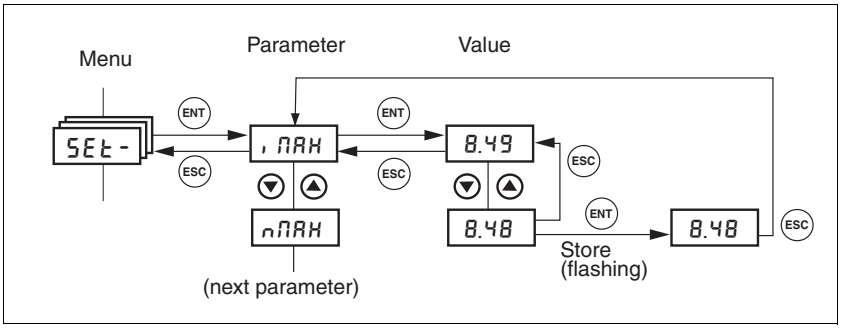


Figure 7.5 HMI, example of parameter setting

The two arrow keys allow setting of the numerical values within the permitted range of values, alpha-numeric values are selected from lists.

When you press ENT, the selected value is accepted. Confirmation is indicated by the display flashing once. The modified value is saved in the EEPROM immediately.

If you press ESC, the display jumps back to the original value.

Status display The status display in its default setting shows the current operating status, see page 8-4. You can specify the following with the menu item drC- / SuPU:

- StAt shows the current operating status by default
- nAct shows the current motor speed by default
- , Act shows the current motor current by default

A change is only imported with the power amplifier disabled.

7.3.3 PS2 commissioning software (Power Suite 2)

Features The Windows-based commissioning software simplifies commissioning, setting parameters, simulation and diagnosis.

Compared to the HMI the commissioning software offers further options such as:

- Setting the controller parameters in a graphic interface
- 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
- Interactive optimisation of controller behaviour
- Archiving all device settings and recordings with export functions for data processing

System requirements You will need a PC or laptop with a free serial port and an operating system with Windows 2000 or newer.

To connect the PC to the unit see page 6-47.

Online help The commissioning software offers comprehensive help functions, which can be accessed via "? - Help Topics" or by pressing F1.

ACC1MDADM00EN, V1.00, 01.2005

7.4 Commissioning procedure

WARNING!

Unsuitable parameters may cause injury and damage to the system.

If unsuitable parameters are used, safety functions may fail, unexpected motions or responses to signals may occur.

- Prepare a list with the parameters required for the functions in use.
- Check the parameters before operation.
- Start the system only if there are no persons or materials in the danger zone and the system can be operated safely.

7.4.1 "Initial Setup"

"Initial Setup" must be made when the controller supply voltage is switched on for the first time or when the factory settings have been loaded.

Preparation

■ A PC with the commissioning software must be connected to the unit unless the commissioning is conducted exclusively through the HMI.

▶ During commissioning disconnect the connection to the field bus to avoid conflicts caused by simultaneous access.

▶ Switch on the controller power supply.

Automatic read-in of the motor data set

When the unit is switched on for the first time with the motor connected, the unit reads the motor data set automatically from the Hiperface sensor (motor sensor). The data set is checked for completeness and saved in the EEPROM.

The motor data set contains technical information about the motor such as the nominal and peak torque, the nominal current and speed and the pole-pair number. It cannot be modified by the user. The unit cannot be switched ready for operation without this information

"First Setup" via HMI

The following diagram shows the sequence using HMI.

ACC1MDADM00EN, V1.00, 01.2005

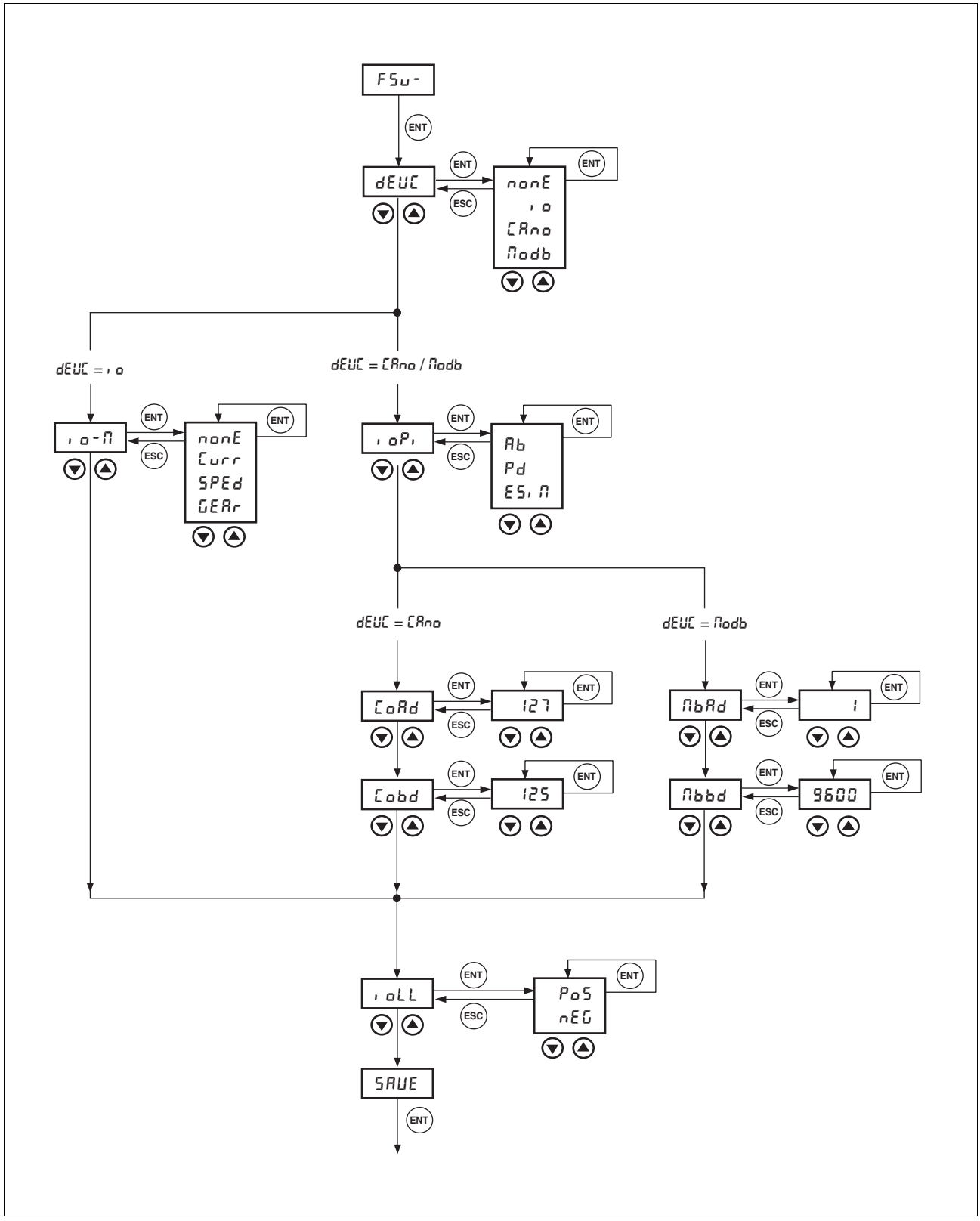


Figure 7.6 "First Setup" via HMI

Unit controller

▶ Specify how the unit will be controlled with the parameter `DEV-cmdinterf` (*dEUC*).

Parameter Name Code HMI menu, Code	Meaning	Unit Minimum value Default value Maximum value	Data type R/W per Expert	Parameter address via field bus
DEVcmdinterf DEVC NONE*dEUC*	Specification of the control mode() **0 / none**: undefined (default) **1 / IODevice / IO**: local control mode **2 / CANopenDevice / CanO**: CANopen **3 / ModbusDevice / Modb**: Modbus **4**: reserved CAUTION: a change in the setting is not enabled until the next start (exception: change of the value 0", at "Initial Setup"").	 0 0 4	UINT16 R/W per. -	CANopen 3005:1$_h$ Modbus 1282

Default operating mode

- `DEVcmdinerf` = `IODevice` (*dEUC* = *, o*)

▶ Specify the operating mode in which the unit will start by default every time it is switched on with the parameter `IOdefaultMode` (*, o-M*).

The operating modes are described from page 8-11.

Parameter Name Code HMI menu, Code	Meaning	Unit Minimum value Default value Maximum value	Data type R/W per Expert	Parameter address via field bus
IOdefaultMode IO-M DRC-*, o-M*	Start-up of operating mode for 'local control mode'() **0 / none / none** : none (default) **1 / CurrentControl / Curr**: current controller (reference value of ANA1) **2 / SpeedControl / Sped**: speed controller (reference value of ANA1) **3 / GearMode / Gear**: electronic gear The operating mode is automatically enabled when the drive switches to the 'OperationEnable' status and "I/O Device / I/O" is set in DEVcmdinterf.""	 0 0 3	UINT16 R/W per. -	CANopen 3005:3$_h$ Modbus 1286

Function of the RS422 interface

- `DEVcmdinerf` = `CANopenDevice` / `ModbusDevice` (*dEUC* = *CAno* / *Modb*)

▶ Determine the assignment for the `IOposInterfac` RS422 interfaces using the (*, oP,*) parameters.

ACC1MDADM00EN, V1.00, 01.2005

Parameter Name Code HMI menu, Code	Meaning	Unit Minimum value Default value Maximum value	Data type R/W per Expert	Parameter address via field bus
IOposInterfac IOPI DRC-, oP,	Logic level of the digital inputs/outputs() RS422 I/O interface (Pos) as: **0 / ABinput / AB**: input ENC_A, ENC_B, ENC_I (index pulse) 4x evaluation **1 / PDinput /PD**: input PULSE, DIR, ENABLE2 **2 / ESIMoutput / ESIM**: output: ESIM_A, ESIM_B, ESIM_I	0 0 2	UINT16 R/W per. -	CANopen 3005:2$_h$ Modbus 1284

Field bus CANopen

- DEVcmdinerf = CANopenDevice (dEUC = CAno)

▶ Specify the node address with the parameter CANadr (CoAd) and the baud rate with the parameter CANbaud (Cobd).

Every unit must have its own unique node address, which must be assigned only once in the network.

Parameter Name Code HMI menu, Code	Meaning	Unit Minimum value Default value Maximum value	Data type R/W per Expert	Parameter address via field bus
CANadr COAD COM-CoAd	CANopen address (node number)() valid addresses (node numbers): 1 to 127	1 127 127	UINT16 R/W per. -	
CANbaud COBD COM-Cobd	CANopen baud rate() valid baud rates in kbps: 50 125 250 500 1000	kbps 50 125 1000	UINT16 R/W per. -	

Field bus MODBUS

- DEVcmdinerf = ModbusDevice (dEUC = Modb)

▶ Specify the node address with the parameter MBadr (MbAd) and the baud rate with the parameter MBbaud (Mbbd).

Parameter Name Code HMI menu, Code	Meaning	Unit Minimum value Default value Maximum value	Data type R/W per Expert	Parameter address via field bus
MBadr MBAD COM-MbAd	Modbus address() valid addresses 1 to 247	1 1 247	UINT16 R/W per. -	

ACC1MDADM00EN, V1.00, 01.2005

Parameter Name Code HMI menu, Code	Meaning	Unit Minimum value Default value Maximum value	Data type R/W per Expert	Parameter address via field bus
MBbaud MBBD COM-ñbbd	Modbus baud rate() Allowable baud rates: 9600 19200 38400	Baud 0 19200 38400	UINT16 R/W per. -	

Select logic level

▶ Specify whether the unit will operate in positive or negative logic with the parameter IOLogicLevel (ı oLL), see also the chapter on planning from page 5-1.

Parameter Name Code HMI menu, Code	Meaning	Unit Minimum value Default value Maximum value	Data type R/W per Expert	Parameter address via field bus
IOLogicLevel IOLL DRC-ı oLL	Logic level of the digital inputs/outputs() **0 / positive / pos**: positive logic (default) **1 / negative / neg**: negative logic CAUTION: a change of the setting is not enabled until the next start.	0 0 1	UINT16 R/W per. -	CANopen 3005:4$_h$ Modbus 1288

Data back-up

▶ Back up all inputs on completion.
HMI: save your settings for the commissioning software with SAVE: save them with "Configuration - In EEPROM" Save your settings

◁ The unit saves all set values in the EEPROM and displays the status nrdY, rdY or dı S on the HMI.

A restart of the unit is required to allow the changes to be accepted.

Further steps

▶ Stick a label on the unit with all important information required in case of service,e.g. field bus type, address and baud rate.

▶ Make the settings described below for commissioning.

Note that you can only return to the "Initial Setup" by restoring the factory settings, see 8.6.10.2 “Restore factory settings“ page 8-67.

ACC1MDADM00EN, V1.00, 01.2005

7.4.2 Operating state (state diagram)

After switching on and at the start of an operating mode, a sequence of operating states is progressed through.

The relationship between the operating states and the state transitions is shown in the state diagram (state machine).

The operating states are internally monitored and influenced by monitoring and system functions, such as temperature and current monitoring

Graphic representation

The state diagram is shown graphically as a flow chart.

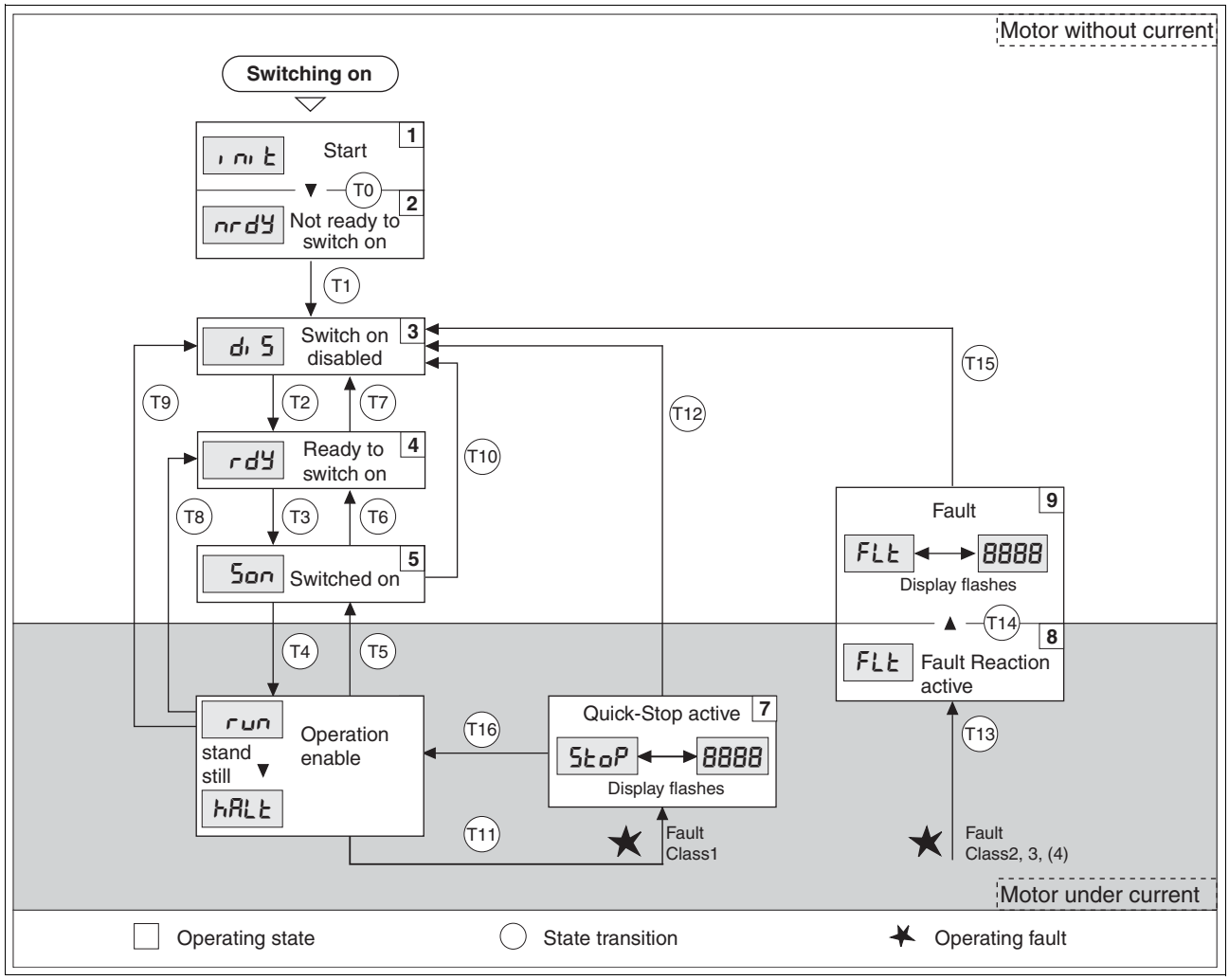


Figure 7.7 State diagram

Operating states and mode transitions

For detailed information on operating states and mode transitions see page 8-4.

7.4.3 Setting basic parameters and limit values

WARNING!

Unsuitable parameters may cause injury and damage to the system.

If unsuitable parameters are used, safety functions may fail, unexpected motions or responses to signals may occur.

- Prepare a list with the parameters required for the functions in use.
- Check the parameters before operation.
- Start the system only if there are no persons or materials in the danger zone and the system can be operated safely.

Setting thresholds

Suitable thresholds must be calculated from the system configuration and motor characteristics. So long as you are running the motor without external loads you will not need to change the default settings.

The maximum motor current must for example be reduced as a determining factor of the torque if the permissible torque of a system component will otherwise be exceeded.

Current limiting

To protect the drive system, the maximum current flowing can be modified with the `CTRL_I_max` parameter. The maximum current for the "Quick Stop" function can be limited with the `LIM_I_maxQSTP` parameter and for the "Halt" function with the `LIM_I_maxHalt` parameter.

Acceleration and deceleration are limited with ramp functions in the point-to-point , speed profile and referencing modes.

▶ Specify the maximum motor current with the `CTRL_I_max` parameter.

▶ Specify the maximum current for "Quick Stop" with the `LIM_I_maxQSTP` parameter.

▶ Specify the maximum current for "Halt" with the `LIM_I_maxHalt` parameter.

Parameter Name **Code** **HMI menu, Code**	**Meaning**	**Unit** **Minimum value** **Default value** **Maximum value**	**Data type** **R/W** **per** **Expert**	**Parameter address via field bus**
CTRL_I_max IMAX SET-, MAX	Current limiting() Must not exceed max. permissible current of motor or power amplifier. Default is the smallest value of M_I_nom and PA_I_nom	A_{pk} 0.00 0.00 299.99 **Field bus** 0 29999	UINT16 R/W per. -	CANopen 3012:1$_h$ Modbus 4610

ACC1MDADM00EN, V1.00, 01.2005

Parameter Name Code HMI menu, Code	Meaning	Unit Minimum value Default value Maximum value	Data type R/W per Expert	Parameter address via field bus
LIM_I_maxQSTP LIQS SET-LI, 95	Current limiting for Quick Stop() Max. current during braking via torque ramp resulting from an error with error class 1 or 2, and when a software stop is triggered Maximum and default value setting depend on the motor and power amplifier	A_{pk} - - -	UINT16 R/W per. -	CANopen 3011:5$_h$ Modbus 4362
LIM_I_maxHalt LIHA SET-LI, hA	Current limiting for Halt() Max. current during braking after Halt or termination of an operating mode. Maximum and default value setting depend on motor and power amplifier	A_{pk} - - -	UINT16 R/W per. -	CANopen 3011:6$_h$ Modbus 4364

Speed limitation

The maximum speed can be limited with the parameter CTRL_n_max to protect the drive system.

- Specify the maximum motor speed with the parameter CTRL_n_max.

Parameter Name Code HMI menu, Code	Meaning	Unit Minimum value Default value Maximum value	Data type R/W per Expert	Parameter address via field bus
CTRL_n_max NMAX SET-nMAX	Speed limiter() Must not exceed max. rpm of motor Default is M_n_max	rpm 0 13200	UINT16 R/W per. -	CANopen 3012:2$_h$ Modbus 4612

Limitations via analogue input

A current or speed limit can be activated via the analogue input ANA2.

- Specify the limit type with the parameter ANA2LimMode.
- Specify the scaling of the limit at +10V with the parameter ANA2_I_max or ANA2_n_max.

Parameter Name Code HMI menu, Code	Meaning	Unit Minimum value Default value Maximum value	Data type R/W per Expert	Parameter address via field bus
ANA2LimMode A2MO DRC-A2Mo	Selection of limit by ANA2() **0 / none**: no limit **1 / Current Limitation / CURR**: limit current setpoint at current controller (limit value at 10 V in ANA2_I_max) **2 / Speed Limitation / SPED**: limit of setpoint speed value at speed controller (limit value at 10V in ANA2_n_max)	0 0 2	UINT16 R/W per. -	CANopen 3012:B$_h$ Modbus 4630

Parameter Name Code HMI menu, Code	Meaning	Unit Minimum value Default value Maximum value	Data type R/W per Expert	Parameter address via field bus
ANA2_I_max A2IM DRC-A2, M	Scaling for current limiting by ANA2 at +10V() Default value is lower value from ImaxM or ImaxPA	A_{pk} 0.00 0.00 300.00 **Field bus** 0 30000	UINT16 R/W per. -	CANopen 3012:C_h Modbus 4632
ANA2_n_max A2NM DRC-A2nM	Scaling for speed limiting by ANA2 at +10V() Default value is maximum motor speed M_n_max.	rpm 500 30000	UINT16 R/W per. -	CANopen 3012:D_h Modbus 4634

Chopper frequency

The factory setting for the chopper frequency in 400V units is 4kHz, in 115V and 230V units 8kHz.

The 24 V power supply must be switched off and on again for the chopper frequency settings to be effective.

▶ Specify the chopper frequency with the parameter `PWM_fChop`.

When changing the factory setting, note that with the higher chopper frequency the nominal current and the maximum current are reduced.

Parameter Name Code HMI menu, Code	Meaning	Unit Minimum value Default value Maximum value	Data type R/W per Expert	Parameter address via field bus
PWM_fChop -	Switching frequency of power amplifier() Switching frequency of power amplifier **0 / 4kHz**: 4 kHz **1 / 8kHz**: 8 kHz Factory setting: 400 V units: 4 kHz all others: 8 kHz	 0 1	UINT16 R/W per. expert	CANopen 3005:E_h Modbus 1308

ACC1MDADM00EN, V1.00, 01.2005

Ballast resistor

WARNING!

Risk of injury and damage to system components by unbraked motor.

An insufficient ballast resistor causes overvoltage on the DC bus and switches off the power amplifier. The motor is no longer actively braked.

- Make sure that the ballast resistor is sufficiently dimensioned.
- Check the setting of the parameter for the ballast.
- Check the temperature of the ballast resistor by conducting a test run under the most critical conditions.
- During the test make sure that at higher mains voltage there is less reserve in the capacitors on the DC bus.

If an external ballast resistor is connected, the parameter `BALint_ext` must be set to "external".

The maximum permissible ballast output must be set with the `BALext_P` parameter. The resistance value must be set with the parameter `BALext_R`.

If the actual ballast output exceeds the maximum allowable ballast output, the unit will output an error message and the power amplifier will be switched off.

WARNING!

Hot surfaces can cause burns, fire and damage to system components.

The ballast resistor may heat up to over 250°C depending on the operating mode.

- Prevent contact with the hot ballast resistor.
- Do not place flammable or heat-sensitive components in the immediate vicinity of the ballast resistor.
- Ensure good heat dissipation.
- Check the temperature of the ballast resistor by conducting a test run under the most critical conditions.

▶ Test the function of the ballast resistor under realistic conditions.

Parameter Name Code HMI menu, Code	Meaning	Unit Minimum value Default value Maximum value	Data type R/W per Expert	Parameter address via field bus
BALint_ext	Ballast control() **0 / internal**: internal ballast resistor **1 / external**: external ballast resistor	 0 0 1	UINT16 R/W per. -	CANopen 3005:9$_h$ Modbus 1298
-				

Parameter Name Code HMI menu, Code	Meaning	Unit Minimum value Default value Maximum value	Data type R/W per Expert	Parameter address via field bus
BALext_P -	Rated power of external ballast resistor()	W 1 30 32767	UINT16 R/W per. -	CANopen 3005:12$_h$ Modbus 1316
BALext_R -	Resistance value of external ballast resistor()	Ω 0.01 47.00 327.67 **Field bus** 1 4700 32767	UINT16 R/W per. -	CANopen 3005:13$_h$ Modbus 1318

Define ESIM resolution

The default resolution can be scaled with the parameter `ESIMscale`.

- The ESIM functionality is only active if the parameter `IOposInterfac` is set to "ESIM".

▶ Specify the resolution with the parameter `ESIMscale`.

Parameter Name Code HMI menu, Code	Meaning	Unit Minimum value Default value Maximum value	Data type R/W per Expert	Parameter address via field bus
ESIMscale ESSC DRC-ESSC	Encoder simulation - setting the resolution() The following resolutions can be adjusted: 128 256 512 1024 2048 4096	Inc 8 4096 65535	UINT16 R/W per. -	CANopen 3005:15$_h$ Modbus 1322

7.4.4 Analogue inputs

- Power amplifier power is switched off.
  Controller power supply is switched on.

▶ At the analogue input ANA1or ANA2 apply a voltage in the range of $\pm 10V_{DC}$.

▶ Check the applied voltage with the parameter ANA1_act or ANA2_act.

Parameter Name Code HMI menu, Code	Meaning	Unit Minimum value Default value Maximum value	Data type R/W per Expert	Parameter address via field bus
ANA1_act A1AC STA-A IRC	Voltage value analogue input ANA1()	mV -10000 10000	INT16 R/- - -	CANopen 3009:1_h Modbus 2306
ANA2_act A2AC STA-A2RC	Voltage value analogue input ANA2()	mV -10000 10000	INT16 R/- - -	CANopen 3009:5_h Modbus 2314

Zero voltage window For the ±10V input, parameters for a zero voltage window can be set using ANA1_win . An input voltage within this window is interpreted as 0V.

Parameter Name Code HMI menu, Code	Meaning	Unit Minimum value Default value Maximum value	Data type R/W per Expert	Parameter address via field bus
ANA1_win A1WN SET-A iLn	Zero voltage window on analogue input ANA1() Absolute value up to which an input voltage value is interpreted as 0 V Example: setting 20 mV ->range of -20 .. +20mV is interpreted as 0mV	mV 0 0 1000	UINT16 R/W per. -	CANopen 3009:9_h Modbus 2322

7.4.5 Digital inputs/outputs

The switching states of the digital inputs and outputs can be displayed on the HMI and displayed and modified using the commissioning software or the field bus.

HMI The signal states can be displayed with the HMI, but they cannot be modified.

▶ Call up the menu point StA / ,oAc.

◁ You will see the digital inputs (Bit 0-7) bit-coded.

▶ Press the "up arrow".

◁ You will see the digital inputs (Bit 8,9) bit-coded.

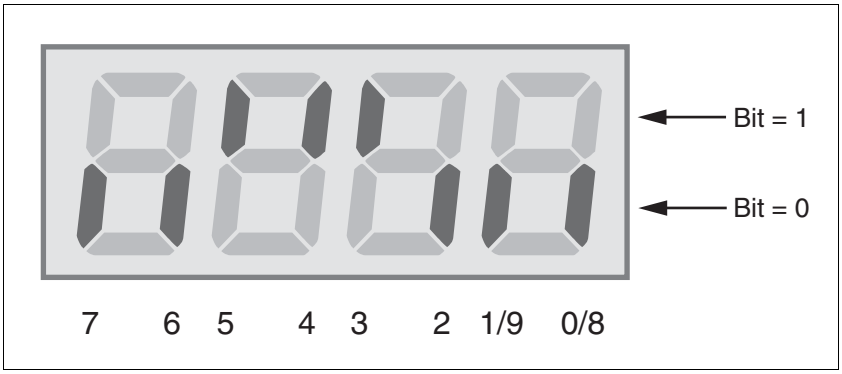


Figure 7.8 HMI, status display of the digital inputs/outputs

Bit	Local controller operating mode	Field bus controller operating mode	Type
0	-	$\overline{\text{REF}}$	I
1	FAULT_RES	$\overline{\text{LIMN}}$	I
2	ENABLE	$\overline{\text{LIMP}}$	I
3	$\overline{\text{HALT}}$	$\overline{\text{HALT}}$	I
4	$\overline{\text{SAFE\_DISABLE B}}$	$\overline{\text{SAFE\_DISABLE B}}$	I
5	$\overline{\text{SAFE\_DISABLE A}}$	$\overline{\text{SAFE\_DISABLE A}}$	I
6	ENABLE2 [1)]	-	I
7	-	-	I
8	NO_FAULT	NO_FAULT	O
9	ACTIVE1_OUT	ACTIVE1_OUT	O

1) only with IOposInterfac = PDinput

Field bus The current switching states are displayed bit-coded in the parameter _IO_act. The values 1 and 0 indicate whether an input or output is active.

ACC1MDADM00EN, V1.00, 01.2005

Parameter Name Code HMI menu, Code	Meaning	Unit Minimum value Default value Maximum value	Data type R/W per Expert	Parameter address via field bus
_IO_act IOAC STA-ı oRC	Status of digital inputs and outputs() Assignment 24 V inputs: bit x: 'local control mode'/ 'field bus control mode') bit 0: - / REF Bit 1: FAULT_RESET / LIMN Bit 2: ENABLE / LIMP Bit 3: HALT Bit 4: STANDSTILL_B Bit 5: STANDSTILL_A Bit 6: ENABLE2 / - Bit 7: reserved Bit 6 represents the ENABLE under the following conditions only: DEVcmdinterf = IODevice and IOposInterfac = PDinput Assignment 24 V outputs: Bit 8: NO_FAULT Bit 9: ACTIVE	0 65535	UINT16 R/- - -	CANopen 3008:1$_h$ Modbus 2050

7.4.6 Testing limit switches signals in field bus units

CAUTION!

Loss of control monitoring.

The use of $\overline{\text{LIMP}}$ and $\overline{\text{LIMN}}$ can offer some protection against hazards (e.g. impact on mechanical stop caused by incorrect motion defaults).

- Use $\overline{\text{LIMP}}$ and $\overline{\text{LIMN}}$ where possible.
- Check that the external sensors or switches are correctly connected.
- Check the correct functional installation of the limit switches The limit switches must be mounted in a position far enough away from the mechanical stop to allow an adequate braking distance.
- The functions must be enabled to use $\overline{\text{LIMP}}$ and $\overline{\text{LIMN}}$.
- This function cannot provide protection against faulty functioning of the product or the sensors.

▶ Set up the limit switches so the drive cannot traverse through the limit switch.

▶ Trigger the limit switches manually.

◁ The HMI shows an error message, see Diagnostics from page 10-3

The input signals $\overline{\text{LIMP}}$, $\overline{\text{LIMN}}$ and $\overline{\text{REF}}$ and the evaluation to active Low or High can be changed with the parameters of the same name, see page 8-43.

7.4.7 Testing safety functions

Operation with "Safe Stop"

Carry out the following steps to use the "Safe Stop" function:

- Power amplifier power is switched off.
  Controller power is switched off.
- ▶ Check that the inputs SAFE_DISABLE_A and SAFE_DISABLE_B are isolated from each other. The two signals must not be connected.
- Power amplifier power is switched on.
  Controller power is switched on.
- ▶ Start the manual movement operating mode (without motor movement).
  (see page 8-14)
- ▶ Trigger the safety disconnection. SAFE_DISABLE_A and SAFE_DISABLE_B must be disconnected simultaneously.
- ◁ The power amplifier is switched off and error message 1300 is displayed. (CAUTION: error message 1301 displays a wiring fault.)
- ▶ Check that the parameter IO_AutoEnable is set to "off" to prevent unwanted restart.
- ▶ Check the behaviour of the drive in error states.
- ▶ Record all tests of the safety function in the acceptance record.

Operation without "Safe Stop"

If you do not want to use the safety function:

- ▶ Check that the inputs SAFE_DISABLE_A and SAFE_DISABLE_B are connected to +24VDC.

ACC1MDADM00EN, V1.00, 01.2005

7.4.8 Checking holding brake

WARNING!

Unexpected motion may cause injury and damage to the system

For example, if the brake is released with vertical axes an unexpected motion may be triggered in the system.

- Make sure that no damage will be caused by the load dropping.
- Run the test only if there are no persons or materials in the danger zone of the moving system components.

Testing from HBC to brake

■ Supply voltage is present at HBC, LED '"24 V on"' is lit up.

▶ Switch off the power amplifier supply voltage.

◁ The unit switches to the operating status "Switch on disabled"

▶ Press the "Release brake" button on the HBC several times to release and close the brake alternately.

◁ The LED '"Brake released"' on the HBC flashes if there is brake voltage present and the brake is released by the button.

▶ Test that the axle can be moved manually with the brake lifted (take gearbox into account, if applicable).

Testing from brake to HBC

■ The unit is in operating status "Ready to switch on"

▶ Start manual movement operating mode (HMI: JoG- / Strt)

◁ The HMI displays JG. The brake is lifted. The LED "Brake released" on the HBC is lit up if there is brake voltage present and the brake is released.

For further information on HBC see page 3-11, 6-31, 12-1

ACC1MDADM00EN, V1.00, 01.2005

7.4.9 Check direction of rotation

Direction of rotation

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.

▶ Start jog operating mode
(HMI: JoG- / Strt

◁ The HMI displays JG.

▶ Start a movement with clockwise direction of rotation
(HMI: "up arrow")

◁ The motor rotates in the positive direction of rotation. The HMI shows
JG-

▶ Start a movement with anticlockwise direction of rotation
(HMI: "down arrow")

◁ The motor rotates in anticlockwise direction of rotation. The HMI shows
-JG

WARNING!

Unexpected movement if motor phases are reversed!

Reversal of the motor phases can cause unexpected movements at high acceleration.

- Use the parameter `POSdirOfRotat` to reverse the direction of rotation, if required.
- Do not reverse the motor phases.

▶ If the arrow and direction of rotation do not match, correct this with the parameter `POSdirOfRotat`, see 8.6.8 “Reversal of direction of rotation“ page 8-64.

ACC1MDADM00EN, V1.00, 01.2005

7.4.10 Setting device parameters for rotary encoder

When starting up the unit reads the absolute position of the motor from the encoder and sets the internal actual position. The current absolute position can be shown with the parameter _p_absENCusr.

Information for setting the absolute position

The value can be transferred both in disable status and in enable status.

- Transfer the new absolute position value only when the motor is stopped.
- Make sure that the position displacement is valid only after the restart (switch 24 V controller supply voltage off and on). Wait 5 seconds after programming before shutting off the unit.

Position processing with SinCos single turn SRS

With the SinCos Singleturn the position of the index pulse can be moved by setting a new absolute position (see 8.5.7.3 “Reference movement with index pulse“ page 8-39). The parameter ENC_pabsusr is available to set a new absolute position.

Position processing with SinCos Multiturn SRM

If the motor is moved anticlockwise from the absolute position 0, the SinCos multiturn receives an underrun of its absolute position. In contrast, the internal actual position counts mathematically forward and sends a negative position value.

After switching off and on the internal actual position would no longer show the anticlockwise position value but the absolute position of the SinCos multiturn.

To prevent these jumps caused by underrun or overrun - i.e. unsteady positions in the area of travel, the absolute position in the sensor must be set so the mechanical limits are within the continuous range of the sensor.

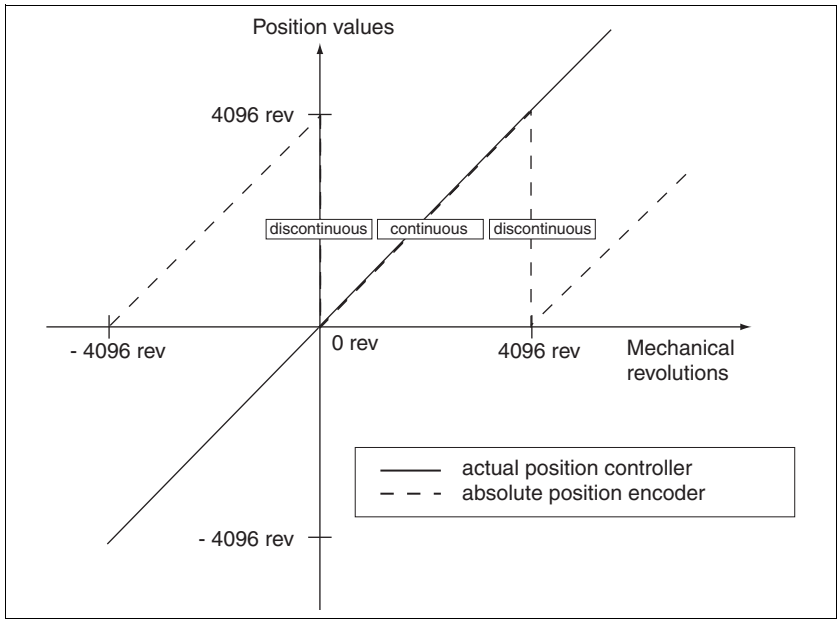


Figure 7.9 Positioning values without direction of rotation reversal

▶ Enter a position value >0. This ensures that when the drive is moved within the mechanical limits of the system the resulting sensor position is always within the continuous range of the sensor.

▶ Note that the absolute position is stored in the SinCos multiturn, so the settings remain when the unit is replaced.

Parameter Name Code HMI menu, Code	Description	Unit Minimum value Default value Maximum value	Data type R/W per Expert	Parameter address via field bus
_p_absENCusr -	Absolute position based on motor sensor working range in user-defined units() Value range is set by sensor type With Singleturn motor sensors the value is set with reference to one motor revolution, with multiturn motor sensors with reference to the total working range of the sensor (e.g. 4096 revs.)	usr	UINT32 R/- - -	
ENC_pabsusr -	Setting position of the motor sensor directly() Value range depends on the sensor type. SRS: Sincos Singleturn: 0..max_pos_usr/rev. - 1 SRM: Sincos Multiturn: 0 .. (4096 * max_pos_usr/rev.) -1 max_pos_usr/rev.: maximum user position for a motor revolution, at default position scaling this value is 16384. Important: values are enabled only next time the controller is started. Changing the value also changes the position of the virtual index pulse.	usr 0 2147483647	UINT32 R/W - -	

ACC1MDADM00EN, V1.00, 01.2005

7.4.11 Run autotuning

Autotuning determines the friction torque, an ever present load torque, and considers it in the calculation of the moment of inertia of the total system.

External factors, such as a load on the motor, are taken into account. Autotuning optimises the parameters for the controller settings.

Autotuning is not permissible for vertical axles!

WARNING!

Unexpected motion may cause injury and damage to the system.

Autotuning moves the motor to set the drive regulation. If incorrect parameters are input unexpected movements may occur or monitoring functions may be disabled.

- Check the parameters AT_dir and AT_dismax. The path for the braking ramp in cases of error must also be taken into account.
- Check that the parameter LIM_I_maxQSTP for Quick-Stop is correctly set.
- If possible, use the limit switches $\overline{\text{LIMN}}$ and $\overline{\text{LIMP}}$.
- Make sure that a functioning button for EMERGENCY STOP is within reach.
- Make sure that the system is free and ready for the motion before starting the function.

▶ Select the setting for the AT_mechanics parameter corresponding to your mechanical system. In case of doubt preferably select a softer coupling.

▶ Start the autotuning with the parameter AT_start (tun- / Strt).

If the autotuning is interrupted with an error message, change the mechanical position and start the autotuning again. If you want to check the plausibility of the calculated values, they can be displayed, see also 7.4.12 “Extended settings for autotuning“ from page 7-30.

ACC1MDADM00EN, V1.00, 01.2005

Parameter Name Code HMI menu, Code	Meaning	Unit Minimum value Default value Maximum value	Data type R/W per Expert	Parameter address via field bus
AT_dir DIR TUN-dir	Direction of rotation autotuning() **1 / pos-neg-home / pnh**: clockwise direction only then negative direction with return to initial position **2 / neg-pos-home / nph**: first anticlockwise direction then clockwise direction with return to initial position **3 / pos-home / p-h**: clockwise direction only with return to initial position **4 / pos / p--**: clockwise direction only without return to initial position **5 / neg-home / n-h**: anticlockwise direction only with return **6 / neg / n--**: anticlockwise direction without return to initial position	 1 1 6	UINT16 R/W - -	CANopen 302F:4_h Modbus 12040
AT_dismax DIST TUN-dist	Movement range autotuning() Range in which the automatic optimisation processes of the controller parameters are run. The range is input relative to the current position. Default value = 1 motor revolution. Values from 0.1 to 0.9 are not permissible. CAUTION: value 0 switches monitoring off.	U 0.0 1.0 999.9 **Field bus** 0 10 9999	UINT32 R/W - -	CANopen 302F:3_h Modbus 12038
AT_mechanics MECH TUN-MECH	System coupling type() 1: direct coupling (J ext. to J motor <<3:1) 2: flexible coupling () 3: flexible coupling (short toothed belt) 4: flexible coupling () 5: high-flexibility coupling (J ext. to J motor >10:1, linear axis)	 1 1 5	UINT16 R/W - -	CANopen 302F:E_h Modbus 12060
AT_start -	Start Autotuning() 0: Stop 1: Enable	 0 0 1	UINT16 R/W - -	CANopen 302F:1_h Modbus 12034

7.4.12 Extended settings for autotuning

For most applications the procedure described is sufficient for autotuning. The following parameters can be used to monitor or even influence the autotuning.

The parameters `AT_state` and `AT_progress` can be used to monitor the status of the autotuning and the percentage progress during the autotuning process.

Parameter Name Code HMI menu, Code	Meaning	Unit Minimum value Default value Maximum value	Data type R/W per Expert	Parameter address via field bus
AT_state	Autotuning status() Bit 15: auto_tune_err Bit 14: auto_tune_end Bit 13: auto_tune_process Bit 10..0: last processing step	 0 65535	UINT16 R/- - -	CANopen 302F:2_h Modbus 12036
AT_progress	Autotuning progress()	% 0 0 100	UINT16 R/- - -	CANopen 302F:B_h Modbus 12054

If you are conducting a test operation and want to check how a harder or softer setting affects the control parameters on your system, you can change the settings found during autotuning by writing the parameter AT_gain. A value of 100% is generally not possible, because this value is at the stability limit. The available value is typically 70%-80%.
The parameter AT_J can be used to read out the moment of inertia of the entire system calculated during the autotuning.

Parameter Name Code HMI menu, Code	Meaning	Unit Minimum value Default value Maximum value	Data type R/W per Expert	Parameter address via field bus
AT_gain GAIN TUN-GAIN	Adapting controller parameters (tighter/looser)() Measure of the degree of tightness of the regulation. The value 100 represents the theoretical optimum. Values larger than 100 mean that the regulation is tighter and smaller values mean that the regulation is looser.	%	UINT16 R/W - -	CANopen 302F:A_h Modbus 12052
AT_J	Inertia of the entire system() is calculated automatically during the autotuning process	kg cm^2 0.0 0.0 0.0	UINT16 R/W per. -	CANopen 302F:C_h Modbus 12056

The parameter AT_wait can be changed to set a wait time between the single steps during the autotuning process. It only makes sense to specify a wait time with a very flexible coupling if the change of hardness has already been made (=next step with autotuning), while the system is still oscillating.

Parameter Name Code HMI menu, Code	Meaning	Unit Minimum value Default value Maximum value	Data type R/W per Expert	Parameter address via field bus
AT_wait WAIT TUN-tWAIt	Waiting time between autotuning steps()	ms 300 1200 10000	UINT16 R/W - -	CANopen 302F:9_h Modbus 12050

7.5 Controller optimisation with step response

7.5.1 Controller structure

The controller structure in the controller corresponds to the classical cascade control of a position control loop with current controller, speed controller and position controller. The reference value of the speed controller can also be smoothed by an upstream filter.

The controllers are set one after the other from the 'inside' to the 'outside' in the sequence current, speed, and position controller. The higher-level control loop in each case stays switched out.

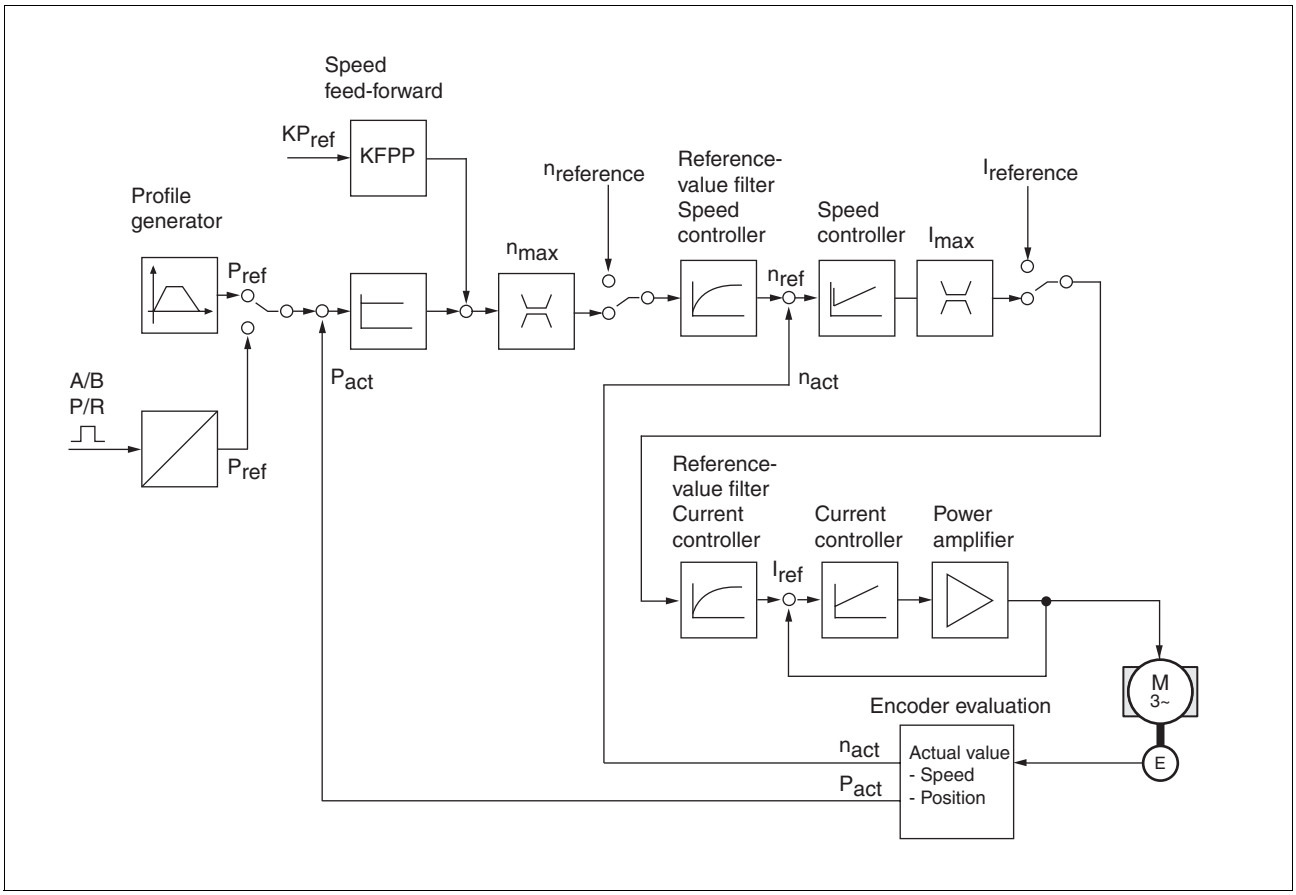


Figure 7.10 Controller structure for encoder evaluation via CN2

Current controller The motor's drive torque is determined by the current controller. The current controller has been optimised automatically using the stored motor data.

Speed controller The speed controller maintains the required motor speed by varying the output motor torque depending on the load situation. It exerts a decisive influence on the speed with which the drive reacts. The dynamics of the speed controller depend on

- the moments of inertia of the drive and the control distance
- the torque of the motor
- the stiffness and elasticity of the components in the power flow
- the play of the mechanical drive components

ACC1MDADM00EN, V1.00, 01.2005

- the friction

Position controller

The position controller reduces the difference between setpoint position and actual motor position (following error) to a minimum. At motor standstill the following error is virtually zero with a well-adjusted position controller. In movement mode a speed-dependent following error occurs. The setpoint position for the position control loop with field bus controller type is generated by the travel profile generator and with a local controller type by the A/B or P/R input signals or manual mode.

A requirement for good gain of the position controller is an optimised speed control loop.

7.5.2 Optimisation

The drive optimisation function matches the unit to the operating conditions. The following options are available:

- Selecting control loops. Higher level control loops are automatically disconnected.
- Defining reference signal: signal form, height, frequency and starting point
- Testing control response with the signal generator.
- Recording and assessing the control behaviour on the monitor with the commissioning software.

Setting reference signals

▶ Start the operating mode "Manual Optimisation" in the commissioning software.

The window shows a graphic display of the signal paths of the reference signal and the responses of the controller. Multiple response signals can be transmitted and displayed simultaneously.

▶ Set the following values for the reference signal:

- Signal form: "positive jump"
- Amplitude: 100 rpm
- Period duration: 100 ms
- Number of repetitions: 1

The total dynamic behaviour of a control loop can be only understood with the signal forms 'Jump' and 'Square wave'. Refer to the manual for all signal paths for the signal form 'Jump'.

Setting recording signals

Select the signals that should be displayed as the step response of the control loop:

- - actual speed of motor `_n_act`
  - setpoint speed of the speed controller `_n_ref`
  - setpoint current of the current controller `_Iq_ref`
- Input 1 ms in the "Time base" field
- Select the speed controller as type. The speed controller is optimised first.

ACC1MDADM00EN, V1.00, 01.2005

Inputting controller values

Control parameters must also be input for the individual optimisation steps described over the following pages. These parameters must be tested by initiating a jump function.

A jump function is triggered as soon as a recording is started in the commissioning software tool bar with the “Start” button (arrow icon).

You can enter controller values for optimisation in the parameters window in the "Control" group.

7.5.3 Optimising the speed controller

The optimum setting for complex mechanical control systems requires practical experience with setting and adjustment procedures for control equipment. This includes the ability to calculate control parameters and to apply identification procedures.

Less complex mechanical systems can generally be successfully optimised with the experimental adjustment procedure using the aperiodic limiting case method. Here the following two parameters are set:

Parameter Name **Code** **HMI menu, Code**	**Meaning**	**Unit** **Minimum value** **Default value** **Maximum value**	**Data type** **R/W** **per** **Expert**	**Parameter address via field bus**
CTRL_KPn -	Speed controller P-factor() Default value is calculated from motor parameters	Amin/rev 0.0010 0.0000 1.2700 **Field bus** 10 12700	UINT16 R/W per. -	CANopen 3012:3_h Modbus 4614
CTRL_TNn -	Speed controller correction time()	ms 0.00 9.00 327.67 **Field bus** 0 900 32767	UINT16 R/W per. -	CANopen 3012:4_h Modbus 4616

Check and optimise the calculated values in a second step, as described from page 7-37.

Determining the mechanics of the system

Decide which one of the following two systems fits the mechanics of your set-up to assess and optimise its response behaviour.

- System with rigid mechanism
- System with less rigid mechanism

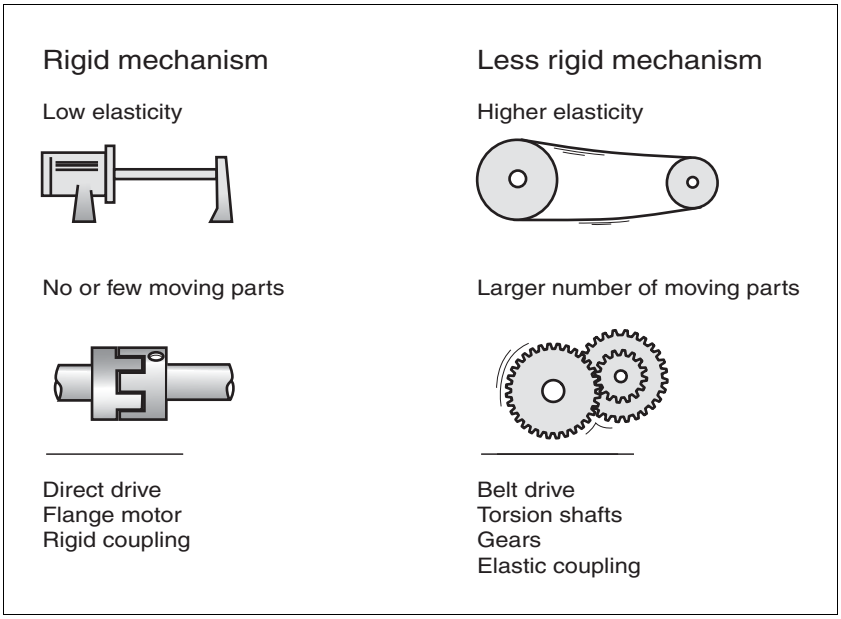


Figure 7.11 Mechanical systems with rigid and less rigid mechanisms

▶ Connect the motor to your system's mechanism.

■ Only in the field bus control mode

▶ Carry out a function check of the limit switches once the motor has been installed.

Switch off reference value filter of speed controller

With the reference variable filter you can improve the response behaviour under optimised speed control. The reference value filter must be switched off when setting the speed controller for the first time.

▶ Disable the reference value filter of the speed controller. Set the parameter `CTRL_TAUnref` to the bottom limit value "0".

Parameter Name Code HMI menu, Code	Meaning	Unit Minimum value Default value Maximum value	Data type R/W per Expert	Parameter address via field bus
CTRL_TAUnref -	Filter time constant reference value filter of the reference speed value()	ms 0.00 9.00 327.67 **Field bus** 0 900 32767	UINT16 R/W per. -	CANopen 3012:9_h Modbus 4626

The procedure for optimisation of the settings described is only a suggested setting. It is responsibility of the user to decide whether the method is suitable for the actual application.

Determining controller values with rigid mechanics

Requirements for setting the control response as per the table are:

- a known and constant inertia of load and motor
- a rigid mechanism

The P-factor CTRL_KPn and the correction time CTRL_TNn depend on:

- J_L: Mass moment of inertia of the load
- J_M Mass moment of inertia of the motor

▶ Determine the controller values based on Table 7.3:

	$J_L=J_M$		$J_L=5 * J_M$		$J_L=10 * J_M$	
J_L[kgcm^2]	KPn	TNn	KPn	TNn	KPn	TNn
1	0.0125	8	0.008	12	0.007	16
2	0.0250	8	0.015	12	0.014	16
5	0.0625	8	0.038	12	0.034	16
10	0.125	8	0.075	12	0.069	16
20	0.250	8	0.150	12	0.138	16

Table 7.3 Determining controller values

Determining controller values with less rigid mechanics

For optimisation purposes the P-factor of the speed controller at which the controller adjusts the speed _n_act as quickly as possible without overshooting is determined.

▶ Set the correction time CTRL_TNn to infinite.
CTRL_TNn= 0 ms.

If a load torque is acting on the stationary motor, the correction time must be set just high enough to prevent an uncontrolled change of the motor position.

In drive systems in which the motor is loaded while stationary, e.g. with vertical axis operation, the correction time "infinite" may result in unwanted position deviations, thereby requiring the value to be reduced. However, this can adversely affect optimisation results.

WARNING!

Unexpected motion may cause injury and damage to the system

The jump function moves the motor in speed mode at constant speed until the specified time has expired.

- Check that the selected values for speed and time do not exceed the available distance.
- If possible, use limit switches or stop as well.
- Make sure that a functioning button for EMERGENCY STOP is within reach.
- Make sure that the system is free and ready for motion before starting the function.

▶ Initiate a jump function.

▶ After the first test check the maximum amplitude for the current set-point _Iq_ref.

ACC1MDADM00EN, V1.00, 01.2005

Set the amplitude of the reference value – default was 100 rpm – just high enough so the current setpoint _Iq_ref remains below the maximum value CTRL_I_max. On the other hand, the value selected should not be too low, otherwise friction effects of the mechanism will determine control loop response.

- Trigger a jump function again if you need to modify _n_ref and check the amplitude of _Iq_ref.
- Increase or decrease the P-factor in small steps until _n_act adjusts as fast as possible. The following diagram shows the adjustment response required on the left. Overshooting - as shown on the right - is reduced by reducing CTRL_KPn.

Deviations from _n_ref and _n_act result from setting CTRL_TNn to "infinite".

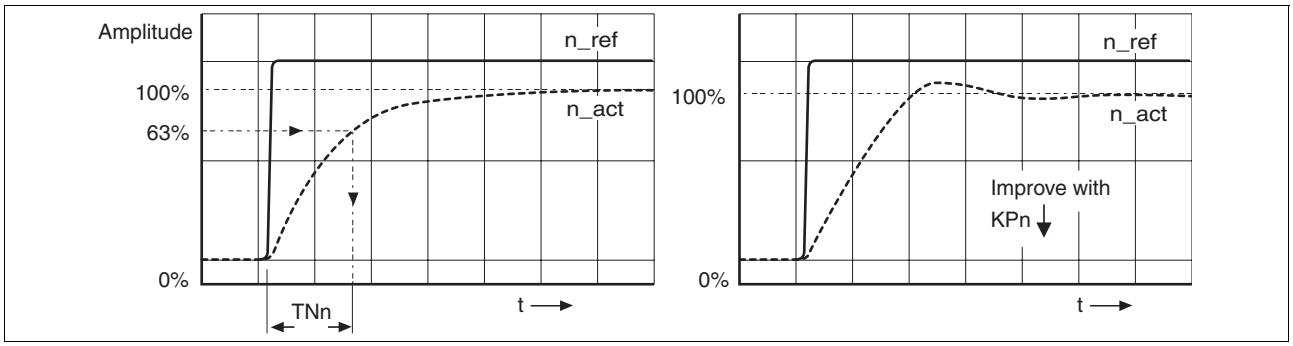


Figure 7.12 Determining 'TNn' in the aperiodic limiting case

For drive systems in which oscillations occur before the aperiodic limiting case is reached, the P-factor "KPn" must be reduced to the exact point where oscillations can no longer be detected. This occurs frequently with linear axes with a toothed belt drive.

Graphical calculation of the 63% value

Determine graphically the point at which the actual speed _n_act reaches 63% of the final value. The correction time CTRL_TNn is then shown as a value on the time axis. The commissioning software will help you with the evaluation:

7.5.4 Checking and optimising default settings

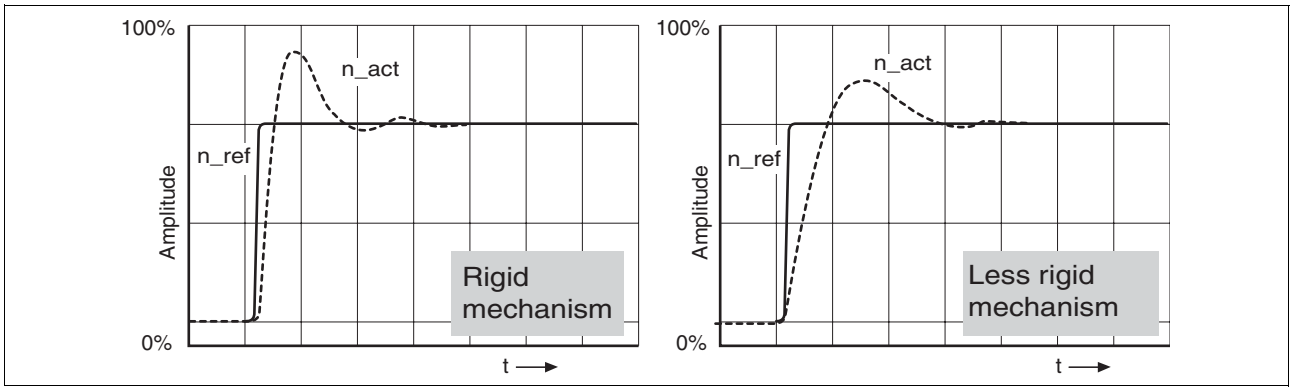


Figure 7.13 Step responses with good controller characteristics

The controller is properly set when the jump response is approximately identical to the signal path shown. Good control response can be recognised by

- Fast adjustment
- Overshooting up to a maximum of 40% - 20% is recommended.

If the control response does not correspond to the curve shown, change CTRL_KPn´ in steps of about 10% and then initiate a jump function once again:

- If the controller is too slow: select CTRL_KPn greater.
- If the controller tends to oscillate: select CTRL_KPn smaller.

You can recognise an oscillation by the motor continuously accelerating and decelerating.

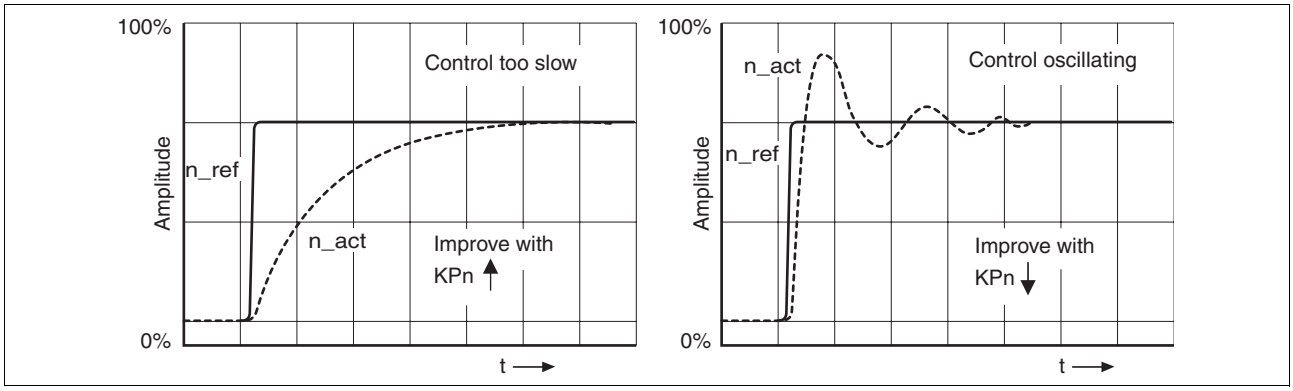


Figure 7.14 Optimise inadequate settings of the speed regulator

If you cannot achieve sufficiently satisfactory controller properties in spite of optimisation, contact your local dealer.

7.5.5 Optimising the position controller

Optimisation requires a good control response in the lower-ranking speed control circuit.

When setting the position control the P-factor of the position controller CTRL_KPp must be optimised in two limits:

- CTRL_KPp too great: overshooting of the mechanism, instability of the controller
- CTRL_KPp too small: Large following error

ACC1MDADM00EN, V1.00, 01.2005

Parameter Name Code HMI menu, Code	Meaning	Unit Minimum value Default value Maximum value	Data type R/W per Expert	Parameter address via field bus
CTRL_KPp -	Position controller P-factor()	1/s 2.0 0.0 495.0 **Field bus** 20 4950	UINT16 R/W per. -	CANopen 3012:6_h Modbus 4620

WARNING!

Unexpected motion may cause injury and damage to the system

The jump function moves the motor in speed mode at constant speed until the specified time has expired.

- Check that the selected values for speed and time do not exceed the available distance.
- If possible, use limit switches or stop as well.
- Make sure that a functioning button for EMERGENCY STOP is within reach.
- Make sure that the system is free and ready for motion before starting the function.

Setting reference signal

▶ Select the position controller reference value in the commissioning software.

▶ Set the reference signal:

- Signal form: 'Jump'
- Set amplitude for about 1/10 motor revolution.

Selecting recording signals

▶ Select the values in General Recording Parameters:

- setpoint position of position controller `_p_ref`
- actual position of position controller `_p_act`
- actual speed `_n_act`
- current motor current `_Iq_ref`

Controller values for the position controller can be changed in the same parameter group used for the speed controller.

Optimising the position control value

▶ Start a jump function with the default controller values.

▶ After the first test check the achieved values `_n_act` and `_Iq_ref` for current and speed regulation. The values must not cross into the range of current and speed limiting.

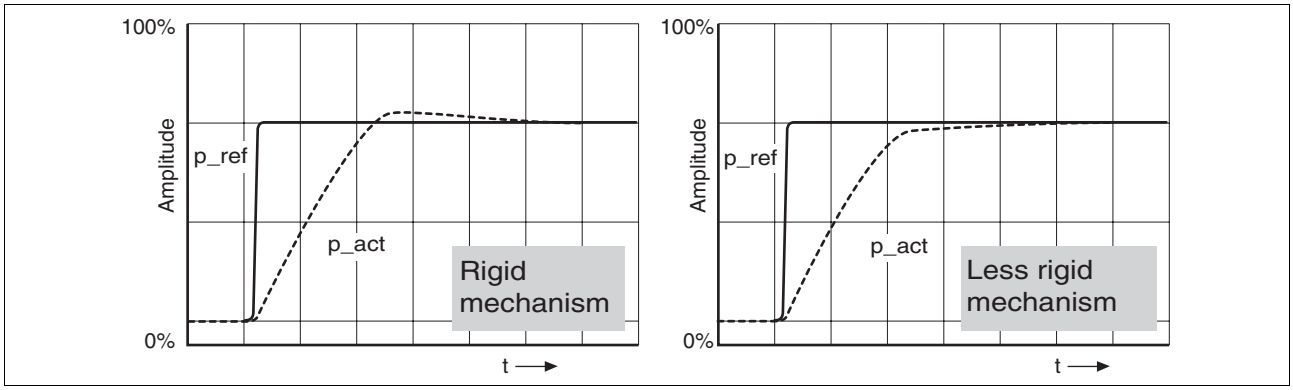


Figure 7.15 Jump responses of a position controller with a good control response

The proportional factor CTRL_KPp is at its optimum setting when the motor reaches its target position rapidly and with little or no overshooting.

If the control response does not correspond to the curve shown, change the P-factor CTRL_KPp in steps of about 10% and then initiate a jump function once again.

- If the controller tends to oscillate: select CTRL_KPp smaller.
- If the actual value is too slow following the setpoint value: select CTRL_KPp greater.

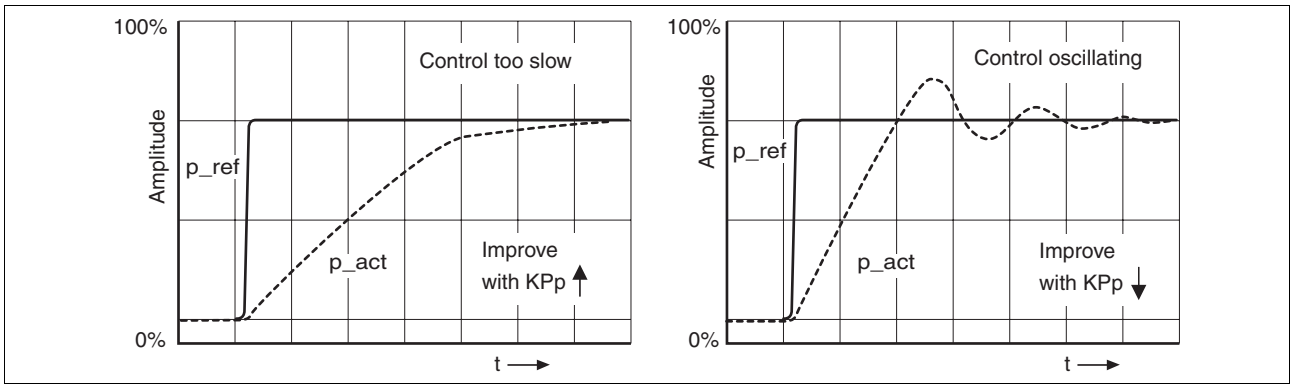


Figure 7.16 Optimising improper settings of the position controller

ACC1MDADM00EN, V1.00, 01.2005

8 Operation

The "Operation" section describes the basic operating states, operating modes and functions of the unit.

8.1 control mode and operating mode handling

During initial commissioning, you will have determined during "First Setup", amongst other things, whether the unit is to be operated under local control mode or via field bus control mode. This determination cannot be altered in running operation.

The operating modes can be changed at any time during operation. The choice of operating modes is dependent upon the "First Setup".

Setpoint entry

The following table shows the type of set value preselection based upon the set control mode.

Operating mode	in local control mode	in field bus control mode.	Description
Jog	HMI	Field bus commands or HMI	Page8-14
Current control	ANA_IN1	Field bus command or ANA_IN1	Page8-16
Speed control	ANA_IN1	Field bus command or ANA_IN1	Page8-19
Electronic gear	P/D or A/B	P/D or A/B	Page8-22
Profile position	-	Field bus commands	Page8-26
Profile velocity	-	Field bus commands	Page8-29
Homing	-	Field bus commands	Page8-31

In the case of local control mode, the motion can be initiated using analogue signals (±10V) or with RS422 signals (pulse/direction or A/B)

In the case of field bus control mode, the motion can be initiated using analogue signals (±10V) or with field bus commands.

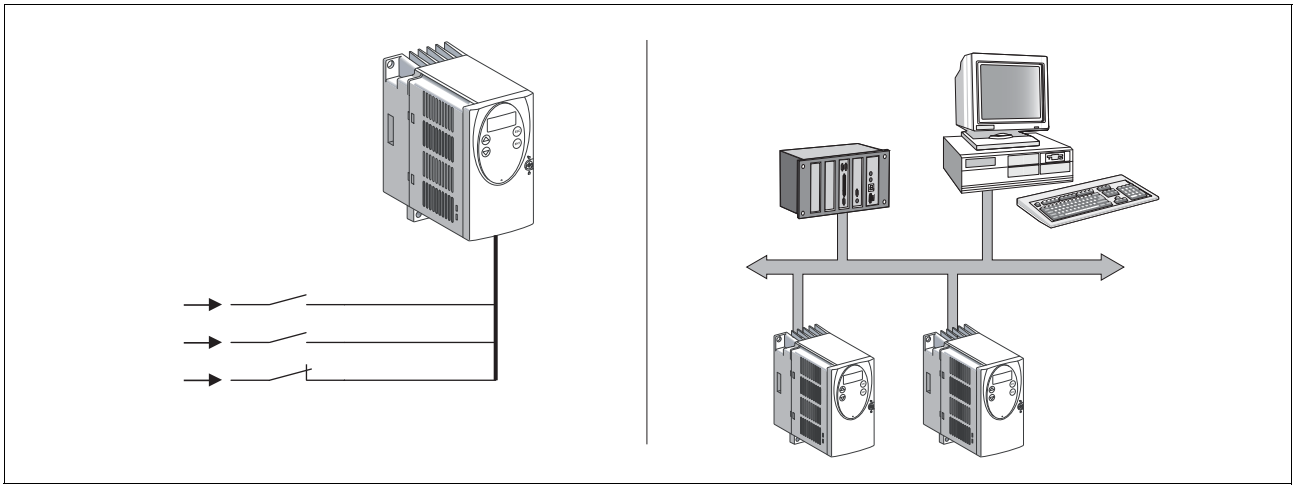


Figure 8.1 Local control mode and field bus control mode

8.2 Access monitor

8.2.1 via HMI

The HMI receives the access monitoring when starting the jog operating mode or when starting auto-tuning. Control via the commissioning software or by the field bus is then not possible.

In addition, the HMI can be locked using the parameter `HMIprotectet` This means that control via the HMI is no longer possible.

Parameter Name Code HMI menu, Code	Meaning	Unit Minimum value Default value Maximum value	Data type R/W per Expert	Parameter address via field bus
HMIprotected -	HMI Interlock() 0: HMI interlock not enabled 1: HMI interlock enabled The following actions are not possible when interlocked: - modify parameter - manual mode (jog) - autotuning - FaultReset	 0 0 1	UINT16 R/W per. -	CANopen 303:1_h Modbus 14850

8.2.2 via field bus

Local control mode Access monitoring via field bus is not possible when in local control mode. It is, however, possible to enter parameters via the field bus.

Field bus control mode In the case of field bus control mode, the parameter `AccessLock` can be used to limit the access monitoring to the field bus.

Parameter Name Code HMI menu, Code	Meaning	Unit Minimum value Default value Maximum value	Data type R/W per Expert	Parameter address via field bus
AccessLock -	Blocking of other access channels() 0: enable other access channels 1: block other access channels The field bus can use this parameter to block active access to the unit for the following access channels: - commissioning tool - HMI - a second field bus Processing of the input signals (e.g. Halt input) cannot be blocked.	 0 0 1	UINT16 R/W - -	CANopen 3001:$1E_h$ Modbus 316

ACC1MDADM00EN, V1.00, 01.2005

8.2.3 via commissioning software

The commissioning software receives the access monitor via the Activate button."" Access via HMI or field bus is then not possible.

Access control via the commissioning software is not possible if the HMI or the field bus has the access monitor.

8.2.4 via hardware input signals

The digital input signals HALT, LIMN / FAULT_RESET, LIMP / ENABLE, REF, SAFE_DISABLE_A and SAFE_DISABLE_B are always operational, even if the HMI, the commissioning software or the field bus has the access monitor.

ACC1MDADM00EN, V1.00, 01.2005

8.3 Operating states

8.3.1 State diagram

After switching on and at the start of an operating mode, a sequence of operating states is progressed through.

The relationship between the operating states and the state transitions is shown in the state diagram (state machine).

The operating states are internally monitored and influenced by monitoring and system functions, such as temperature and current monitoring

Graphic representation The state diagram is shown graphically as a flow chart.

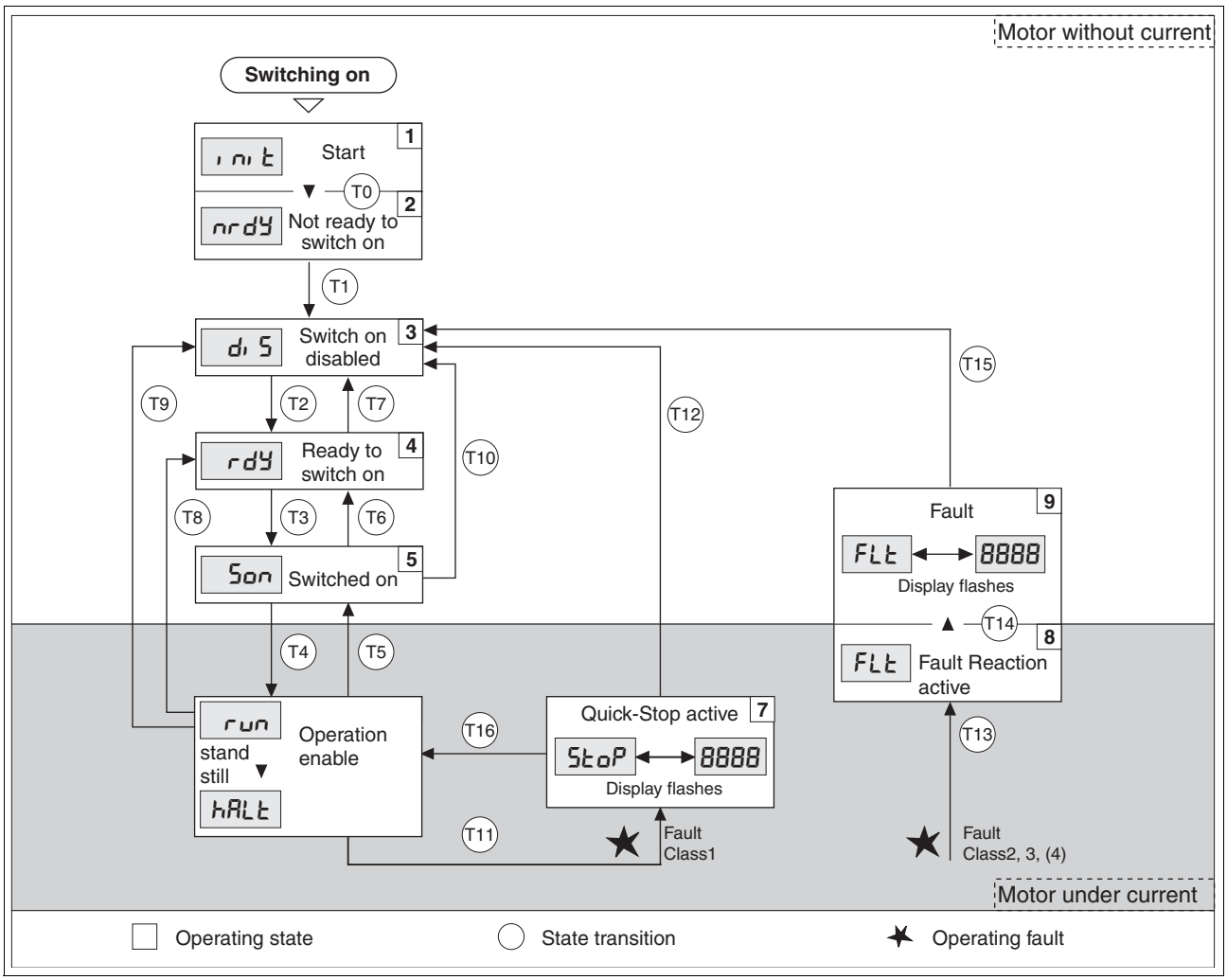


Figure 8.2 State diagram

Operating states The operating states are displayed as standard by the HMI and the commissioning software.

Display	Status	State description
init	**1** Start	Controller supply voltage, electronics is initialised
nrdy	**2**Not ready to switch on	The power amplifier is not ready to switch on
dis	**3**Switch on disabled	Switching on the power amplifier is disabled

ACC1MDADM00EN, V1.00, 01.2005

Display	Status	State description
rdy	**4**Ready to switch on	The power amplifier is ready to switch on
Son	**5**Switched on	Motor not under current Power amplifier ready No operating mode active
run hALt	**6**Operation enable	RUN: unit operates in the specified operating mode Halt: motor is stopped with power amplifier active
StoP	**7** Quick Stop active	"Quick Stop" is executed
FLt	**8** Fault Reaction active	Error detected, error response is enabled
FLt	**9**Fault	Unit is in fault condition

Error response

The state transition T13 initiates an error response as soon as an internal occurrence indicates an operation fault to which the unit must react. The description of the error classification can be seen in the diagnostics chapter.

Error class	Statusfrom -> to	Response
2	**x** -> **8**	Braking with "Quick Stop" Brake is closed Power amplifier is switched off
3.4 or$\overline{\text{SAFE_DISABLE}}$	**x** -> **8 -> 9**	No error response, power amplifier is switched off immediately, even if "Quick Stop" is still active.

Table 8.1 Error response at state transition T13

An operating error can be indicated by, for example, a temperature sensor. The unit interrupts the running task and carries out an error response e.g. braking and stopping with "Quick Stop" or switching off the power amplifier. Subsequently the operating state changes to "Fault".

In order to leave the Fault operating state, the cause of the fault must be resolved and a Fault Reset must be carried out with the input signal """"FAULT_RESET or the parameter DCOMcontrol

*In the case of a "Quick Stop" triggered by errors of class 1 (operating status **7**), a "Fault Reset" triggers a direct return to the operating status **6**.*

State transitions

Status transitions are triggered by an input signal, a field bus command (with field bus control mode only) or as a response to a monitoring signal.

Transition	Operating state	Condition / result [1]	Response
T0	**1** -> **2**	• Motor speed below switch-on limit • Unit electronics successfully initialised	Check motor encoder
T1	**2** -> **3**	• First commissioning is completed	-
T2	**3** -> **4**	• Motor encoder check successful, DC-BUS voltage active, $\overline{\text{SAFE\_DISABLE}}$ = +24V, field bus command: shutdown [2]	-

ACC1MDADM00EN, V1.00, 01.2005

Trans-ition	Operating state	Condition / result [1]	Response
T3	**4** -> **5**	• Field bus command: Switch On • Input signal: ENABLE 0 -> 1	
T4	**5** -> **6**	• Field bus command: Enable Operation	Switch on power amplifier. Motor phases, earthing, User parameters are checked Brake released
T5	**6** -> **5**	• Field bus command: Disable Operation • Input signal: ENABLE 1 -> 0	Interrupt task with "Hlt" Brake actuated Switch off power amplifier
T6	**5** -> **4**	• Field bus command: Shutdown	
T7	**4** -> **3**	• DC-BUS low voltage • $\overline{\text{SAFE\_DISABLE}}$ = 0V • Field bus command: Disable voltage	-
T8	**6** -> **4**	• Field bus command: Shutdown	Switch off power amplifier immediately
T9	**6** -> **3**	• Field bus command: Disable voltage	Switch off power amplifier immediately
T10	**5** -> **3**	• Field bus command: Disable voltage	
T11	**6** -> **7**	• Class 1 error • Field bus command: Quick Stop	Interrupt task with "Quick Stop"
T12	**7** -> **3**	• Field bus command: Disable voltage	Switch off power amplifier immediately, even if "Quick Stop" still active
T13	**x** -> **8**	• Errors Class 2, 3 or 4	Error response is carried out, see "error response"
T14	**8** -> **9**	• Error response completed • Errors Class , 3 or 4	
T15	**9** -> **3**	• Field bus command: Fault Reset [3] • Input signal: FAULT_RESET 0 -> 1 [3]	Fault is reset
T16	**7** -> **6**	• Field bus command: Fault Reset [3] • Field bus command: Enable Operation [4] • Input signal: FAULT_RESET 0 -> 1 [3]	Local control mode: specified operating mode is automatically continued

1) It is sufficient to fulfil one point to trigger the status transition
2) Only required with field bus control mode, field bus CANopen and parameter DCOMcompatib = 1
3) Cause of error must be corrected
4) Only possible if operating status was triggered via field bus

ACC1MDADM00EN, V1.00, 01.2005

8.3.2 Changing operating state

Local controller operating mode

In local controller operating mode, the change of operating state takes place either via the commissioning software, the signal inputs or automatically.

Input signal	State transitions	State change to
ENABLE 0 -> 1	T3, T4	**6**: Operation enable
ENABLE 1 -> 0	T5, T6	**4**: Ready to switch on
FAULT_RESET 0 -> 1	T15 T16	**4**: Ready to switch on **6**: Operation enable

field bus controller operating mode

In the case of field bus controller operating mode, the operating states are set either by the commissioning software or by the parameter `DCOMcontrol` Bits 0 to 3 and Bit 7 are relevant for a state change

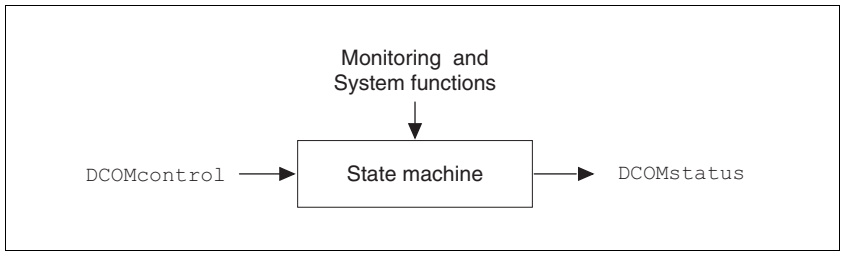


Figure 8.3 Changing and monitoring the operating states via parameters

Parameter Name Code HMI menu, Code	Meaning	Unit Minimum value Default value Maximum value	Data type R/W per Expert	Parameter address via field bus
DCOMcontrol -	Drivecom control word() Bit coding see Operation section, operating states 0: Switch on 1: Enable Voltage 2: Quick Stop 3: Enable Operation 4..6: op. Mode specific 7: Fault Reset 8: Halt 9..15: reserved		UINT16 R/W - -	CANopen 6040:0_h Modbus 6914

Bit 0 to 3 and 7

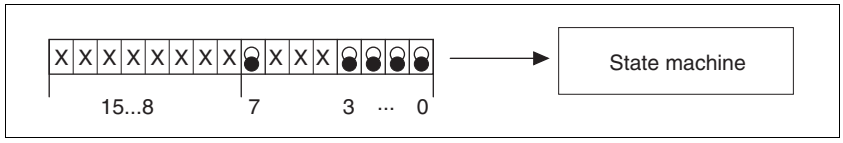


Figure 8.4 Changing the operating state

Field bus command	state transitions	Status change open	Bit 7, Reset Fault	Bit 3, Enable operation	Bit 2, Quick-Stop	Bit 1, Disable Voltage	Bit 0, Switch On
Shutdown	T2, T6, T8	**4**: Ready to switch on	X	X	1	1	0

Field bus command	state transitions	Status change open	Bit 7, Reset Fault	Bit 3, Enable operation	Bit 2, Quick-Stop	Bit 1, Disable Voltage	Bit 0, Switch On
Switch On	T3	**5**: Switched on	X	X	1	1	1
Disable Voltage	T7, T9, T10, T12	**3**: Switch on disabled	X	X	X	0	X
Quick Stop	T7, T10T11	**3**: Switch on disabled**7**: Quick Stop active	X	X	0	1	X
Disable Operation	T5	**5**: Switched on	X	0	1	1	1
Enable operation	T4, T16	**6**: Operation enable	X	1	1	1	1
Fault Reset	T15	**3**: Switch on disabled	0->1	X	X	X	X

The bit states in the fields marked with "X" have no meaning that particular status change.

Bit 4 to 6 Bits 4 to 6 are used for the operating mode specific settings. Details can be found in the description of the individual operating modes in this chapter.

Bit 8, Halt Bit 8=1 can initiate a "Halt".

Bit 9 to 15 reserved

ACC1MDADM00EN, V1.00, 01.2005

8.3.3 Displaying the operating states

Local controller operating mode

In local controller operating mode, the display of operating state takes place via the signal outputs, the HMI or the commissioning software.

Status	NO_FAULT_OUT	ACTIVE1_OUT
2: Not ready to switch on	0	0
3: Switch on disabled	0	0
4: Ready to switch on	1	0
5: Switched on	1	0
6: Operation enable	1	1
7: Quick Stop active	0	1
9: Fault	0	0

Field bus control mode

In field bus control mode the operating status is displayed via the signal inputs, the field bus, the HMI or the commissioning software.

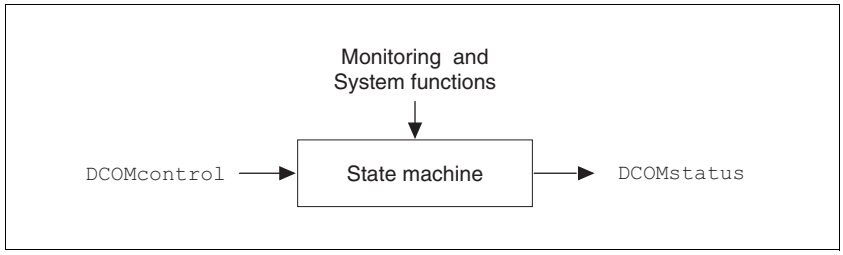


Figure 8.5 Changing and monitoring the operating state via parameters

Status information

The parameter `DCOMstatus` provides global information on the operating state of the unit and the processing state.

Parameter Name Code HMI menu, Code	Meaning	Unit Minimum value Default value Maximum value	Data type R/W per Expert	Parameter address via field bus
DCOMstatus -	Drivecom status word() Bit coding see Operation section, status machine 0-3,5,6: status bits 4: Voltage enabled 7: Warning 8: HALT request active 9: Remote 10: Target reached 11: reserved 12: Op. mode specific 13: x_err 14: x_end 15: ref_ok		UINT16 R/- - -	CANopen 6041:0_h Modbus 6916

Bit 0 to 3, 5 and 6

The status of the state diagram is displayed by bits 0 to 3, 5 and 6 of the parameter `DCOMstatus`.

ACC1MDADM00EN, V1.00, 01.2005

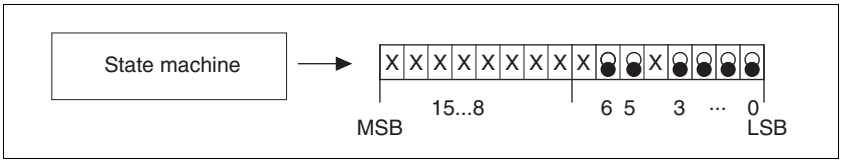


Figure 8.6 Display of operating state

Status	Bit 6,Switch Ondisable	Bit 5, Quick-Stop	Bit 3,Fault	Bit 2, OperationE-NABLE	Bit 1, Switch On	Bit 0, Ready toSwitch On
2: Not ready to switch on	0	X	0	0	0	0
3: Switch on disabled	1	X	0	0	0	0
4: Ready to switch on	0	1	0	0	0	1
5: Switched on	0	1	0	0	1	1
6: Operation enable	0	1	0	1	1	1
7: Quick Stop active	0	0	0	1	1	1
9: Fault	0	X	1	1	1	1

Bit 4, Voltage enabled Bit 4=1 indicates whether the DC-Bus voltage is correct. If the voltage is missing or is too low, then the unit does not change from state 3 to state 4.

Bit 7, Warning Bit 7=1 signals a fault message without interrupting the traverse operation.

Bit 8, Halt request active Bit 8=1 indicates that a "Halt"is active.

Bit 9, Remote If Bit 9 is set, then the unit carries out the commands via the field bus. If Bit 9 is set, then the unit is controlled from a different interface. The field bus then allows other parameters to be read and written.

Bit 10, Target reached Bit 10 only becomes "1“, if the operating mode is completed successfully and the motor stops. Bit 10 has the value “0”, as long as the motor is running, if the operating mode is interrupted by a "Halt"or discontinued because of a fault.

Bit 11 reserved

Bit 12 Bit 12 is used for the monitoring the current operating mode. Details can be found in the chapter for the individual operating mode.

Bit 13, x_err Bit 13 only becomes "1“, if there is a fault present, which needs to be rectified by the further processing. The unit responds corresponding to an error class, see page 10-1.

Bit 14, x_end Bit 14 changes to "0“, if an operating mode is started. When the process is complete or if the process is discontinued e.g. by a "Halt", Bit 14 changes back to "1" when the motor is at a standstill.
Bit 14's signal change to '1' is suppressed if one process is followed immediately by a new process in a different operating mode.

Bit 15, ref_ok Bit 15 is "1“, if a homing has been completed successfully.

ACC1MDADM00EN, V1.00, 01.2005

8.4 Starting and changing operating modes

WARNING!

Danger of personal injury and damage to system parts by uncontrolled system operation!

- Note that inputs to these parameters are executed by the drive controller immediately on receipt of the data set.
- Make sure that the system is free and ready for movement before changing these parameters

Requirements

To start an operating mode the unit must be ready to start and correctly initialised.

An operating mode cannot be carried out in parallel with another operating mode. If an operating mode is active, then you can only change to a different operating mode if the current operating mode is completed or is discontinued.

An operating mode is completed if the drive is at a standstill, e.g. if the target position of a positioning process is reached or if the drive is stopped by a "Quick Stop" or "Halt". If a fault occurs during the process which leads to the discontinuation of a current operating mode, then, after the cause of the fault has been removed, the traverse operation can be resumed, or you can change to a different operating mode.

8.4.1 Start operating mode

Local control mode

In the case of local control mode, after starting, the unit changes to the operating mode set using the parameter `IOdefaultMode`

The motor is placed under current by setting the input signal `ENABLE` and the set operating mode is started.

In addition, a "Jog"or "Auto-tuning" can be started using the HMI.

Field bus control mode

In the case of field bus control mode, the operating mode is started using the parameter `DCOMopmode` .

The following table shows the sequence of parameters for starting an operating mode with the example of the current control operating mode.

	Parameter	Description
1	CUR_I_target	Transmission of the reference value
2	CURreference	Setting the reference quantity
3	DCOMopmode	Calling up the operating mode (-3)

ACC1MDADM00EN, V1.00, 01.2005

Parameter Name Code HMI menu, Code	Meaning	Unit Minimum value Default value Maximum value	Data type R/W per Expert	Parameter address via field bus
CUR_I_target -	Setpoint current in current control operating mode(8-16) For this purpose, the operating mode current control must be activated by pre-setting on the parameter.	A_{pk} -300.00 0.00 300.00 **Field bus** -30000 0 30000	INT16 R/W - -	CANopen 3020:4_h Modbus 8200
CURreference -	Selection of setpoint source for current control operating mode(8-16) 0: none 1: reference value over +/-10 V interface ANA1 2: reference value over parameter CUR_I_target	 0 0 2	UINT16 R/W - -	CANopen 301B:10_h Modbus 6944
DCOMopmode -	Operating mode() DSP402 operating modes: 1 : profile position 3 : profile velocity 6 : homing --- manufacturer operating modes: -1 : jog -2 : electronic gear -3 : current control -4 : speed control	 -6 6	INT16 R/W - -	CANopen 6060:0_h Modbus 6918

In the case of the operating modes point-to-point ("Profile Position Mode") and referencing ("Homing Mode"), the unit receives the instruction to start the set operating mode by Bit 4 in the parameter `DCOMcontrol`.

For all other operating modes, the Bits 4 to 6 are not occupied.

ACC1MDADM00EN, V1.00, 01.2005

8.4.2 Change operating mode

Local control mode

When the drive is at a standstill, the default operating mode can be changed using the parameter `IOdefaultMode` . The operating modes cannot be changed whilst the operating mode is running.

field bus controller operating mode

The operating modes can be changed whilst the operation is in process. For this purpose, the current process must be completed or explicitly discontinued. The drive must be at a standstill. Proceed then as shown under "Calling-Up the Operating Mode".

Exceptions to this are the operating modes current regulation and speed regulation. The motor need not be at a standstill to change between these two operating modes

Two parameters are available for displaying the current operating mode and for switching the operating modes.

- Parameter for display: `_DCOMopmd_act`
- Parameter for change: `DCOMopmode`

Parameter Name Code HMI menu, Code	**Meaning**	**Unit Minimum value Default value Maximum value**	**Data type R/W per Expert**	**Parameter address via field bus**
_DCOMopmd_act -	active operating mode() DSP402 operating modes: 1 : profile position 3 : profile velocity 6 : homing ---------- manufacturer operating modes: -1 : jog -2 : electronic gear -3 : current control -4 : speed control	 -6 6	INT16 R/- - -	CANopen 6061:0_h Modbus 6920
DCOMopmode -	Operating mode() DSP402 operating modes: 1 : profile position 3 : profile velocity 6 : homing ---------- manufacturer operating modes: -1 : jog -2 : electronic gear -3 : current control -4 : speed control	 -6 6	INT16 R/W - -	CANopen 6060:0_h Modbus 6918

8.5 Operating modes

8.5.1 Jog operation mode

WARNING!

Danger of personal injury and damage to system parts by uncontrolled system operation!

- Note that inputs to these parameters are executed by the drive controller immediately on receipt of the data set.
- Make sure that the system is free and ready for movement before changing these parameters

Description

The motor traverses by one traverse unit or at constant speed in continuous running. The length of the traverse unit, the speed steps and the change-over time in continuous running can be adjusted.

The current axis position is the start position for the jog operating mode. Position and speed values are input in user-defined units.

Start operating mode

In local control mode the operating mode can be started with the HMI. The power amplifier becomes active and the motor is under current by calling up the JoG- / Strt. The motor runs by pushing the "up arrow"or "down arrow"buttons. You can change between slow and fast movement by simultaneously pushing the ENT-button.

In the case of field bus control mode, the operating mode must be set using the parameter DCOMopmode . The writing of the parameter value simultaneously causes the start of the operating mode. At the start signal for jog the motor first moves over a defined path JOGstepusr. If the start signal is still present after a specific time delay JOGtime the unit changes to continuous running until the start signal has been taken back.

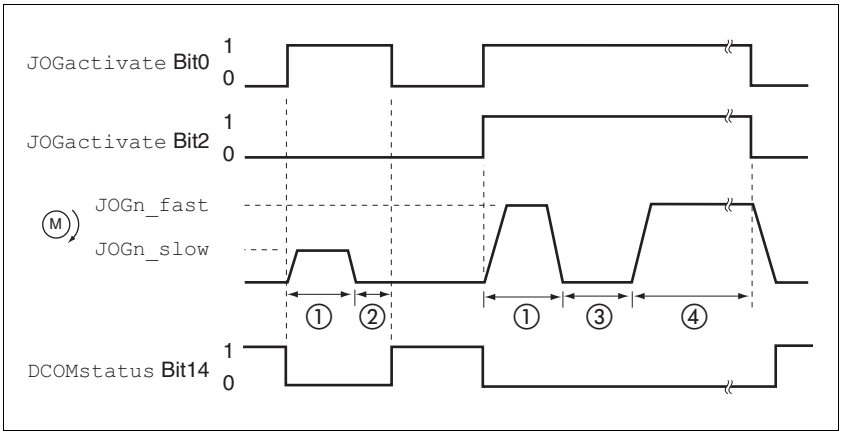


Figure 8.7 Jog, slow and fast

(1) JOGstepusr
(2) t < JOGtime
(3) t > JOGtime
(4) Continuous operation

ACC1MDADM00EN, V1.00, 01.2005

The inching distance, delay and jog speeds can be set. If the inching distance is zero, jog starts directly with continuous movement irrespective of the delay.

Parameter Name Code HMI menu, Code	Meaning	Unit Minimum value Default value Maximum value	Data type R/W per Expert	Parameter address via field bus
JOGactivate -	Activation of jog() Bit0 : clockwise direction of rotation Bit1 : anticlockwise direction of rotation Bit2 : 0=slow 1=fast	 0 0 7	UINT16 R/W - -	CANopen 301B:9$_h$ Modbus 6930
JOGn_slow NSLW JOG-nSLU	Speed for slow jog() The set value is internally limited to the current parameter setting in RAMPn_max.	r.p.m. 1 60 13200	UINT16 R/W per. -	CANopen 3029:4$_h$ Modbus 10504
JOGn_fast NFST JOG-nFSt	Speed for fast jog() The set value is internally limited to the current parameter setting in RAMPn_max.	r.p.m. 1 180 13200	UINT16 R/W per. -	CANopen 3029:5$_h$ Modbus 10506
JOGstepusr -	Inching movement before continuous running() 0: direct enable of continuous operation >0: positioning distance per jog cycle	usr 0 20	INT32 R/W per. -	CANopen 3029:7$_h$ Modbus 10510
JOGtime -	Waiting time before continuous running() Time is only effective if an inching section not equal to 0 has been set, otherwise direct transition to continuous running.	ms 1 500 32767	UINT16 R/W per. -	CANopen 3029:8$_h$ Modbus 10512

End operating mode Jog is finished when the motor has stopped and

- the directional signal is inactive.
- the operating mode has been interrupted by "Halt" or an error

Further possibilities For further setting possibilities and functions for the operating mode see from page 8-43.

8.5.2 Current control mode.

Overview of current control

In current control, the setpoint value of the motor current can be set either with parameters or the ±10V input of the signal interface.

The following overview shows the effectivity of the parameters which can be set for the operating mode.

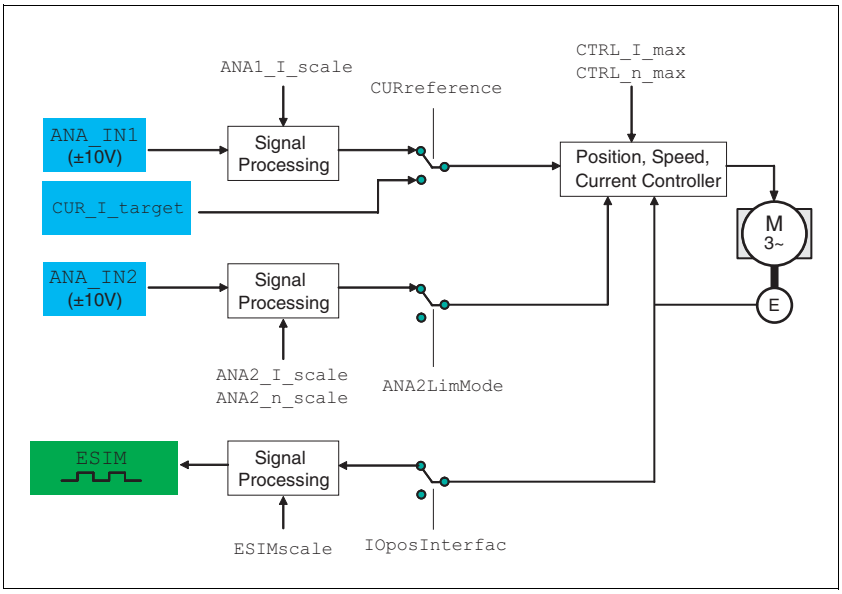


Figure 8.8 Operating mode current control, effects of settable parameters

Start operating mode

In the case of local controller operating mode, the operating mode must be set using the parameter `IOdefaultMode` . The output stage becomes active, the motor receives current and the inputs are evaluated in accordance with the setting by setting the input signal ENABLE.

In the case of field bus controller operating mode, the operating mode must be set using the parameter `DCOMopmode` . The writing of the parameter value simultaneously causes the start of the operating mode.

End operating mode

The processing in the operating mode is completed if the operating mode has been "deactivated" and the drive is at a standstill, or if the motor speed has taken the value = 0 as a result of a fault.

Setting thresholds

See page for the setting of current limitation and speed limitation7-16.

Setting to the set value

In the case of local controller operating mode, the analogue input ANA1 is automatically evaluated.

In the case of field bus controller operating mode, the parameter `CURreference` determines whether the analogue input ANA1 or the parameter `CUR_I_target` is to be evaluated.

ACC1MDADM00EN, V1.00, 01.2005

Parameter Name Code HMI menu, Code	Meaning	Unit Minimum value Default value Maximum value	Data type R/W per Expert	Parameter address via field bus
CURreference -	Selection of setpoint source for current control operating mode() 0: none 1: reference value over +/-10 V interface ANA1 2: reference value over parameter CUR_I_target	 0 0 2	UINT16 R/W - -	CANopen 301B:10$_h$ Modbus 6944
CUR_I_target -	Setpoint current in current control operating mode() For this purpose, the operating mode current control must be activated by pre-setting on the parameter.	A_{pk} -300.00 0.00 300.00 **Field bus** -30000 0 30000	INT16 R/W - -	CANopen 3020:4$_h$ Modbus 8200

Reference value at +10 V input signal

The progress of the reference value in relation to the ±10V input value can be altered:

- Setting the reference value at +10V
- Setting parameters for a zero voltage window

The unit calculates a current value, with which the motor accelerates to a speed which is limited by the load moment, from the ±10V analogue value preset. Without a load the motor therefore accelerates to the variable speed limit.

The reference value of a voltage value of +10V can be set by the scaling value `ANA1_I_scale`.

WARNING!

Unexpected acceleration may cause injury and damage to the system.

The drive in current regulation mode can reach extreme speeds when operated without limits or load.

- Check the configured speed limiter.

Parameter Name Code HMI menu, Code	Meaning	Unit Minimum value Default value Maximum value	Data type R/W per Expert	Parameter address via field bus
ANA1_I_scale A1IS SET-R i 5	Scaling ANA1 for set current at +10V(8-16) Default value is the lesser value from ImaxM or ImaxPA With a neg. sign an inversion of the evaluation of the analogue signal can be conducted	A_{pk} -300.00 3.00 300.00 **Field bus** -30000 300 30000	INT16 R/W per. -	CANopen 3020:3$_h$ Modbus 8198

Zero voltage window

For the ±10V input, parameters for a zero voltage window can be set using `ANA1_win` . An input voltage within this window is interpreted as 0V.

Parameter Name Code HMI menu, Code	Meaning	Unit Minimum value Default value Maximum value	Data type R/W per Expert	Parameter address via field bus
ANA1_win A1WN SET-A in	Zero voltage window on analogue input ANA1() Absolute value up to which an input voltage value is interpreted as 0 V Example: setting 20 mV ->range of -20 .. +20mV is interpreted as 0mV	mV 0 0 1000	UINT16 R/W per. -	CANopen 3009:9$_h$ Modbus 2322

Example local controller operating mode

An example of setting by parameters in the case of local controller operating mode can be found on page 9-2.

ACC1MDADM00EN, V1.00, 01.2005

8.5.3 Speed control operating mode

Description

In the operating mode speed regulation, the set value of the motor speed is provided either by parameter or via the ±10V analogue input.

Transitions between two speeds can only take place in relation to the set regulation parameters. Compare this to the operating mode speed profile, where the transitions are defined by a profile generator.

The following overview shows the effectivity of the parameters which can be set for the operating mode.

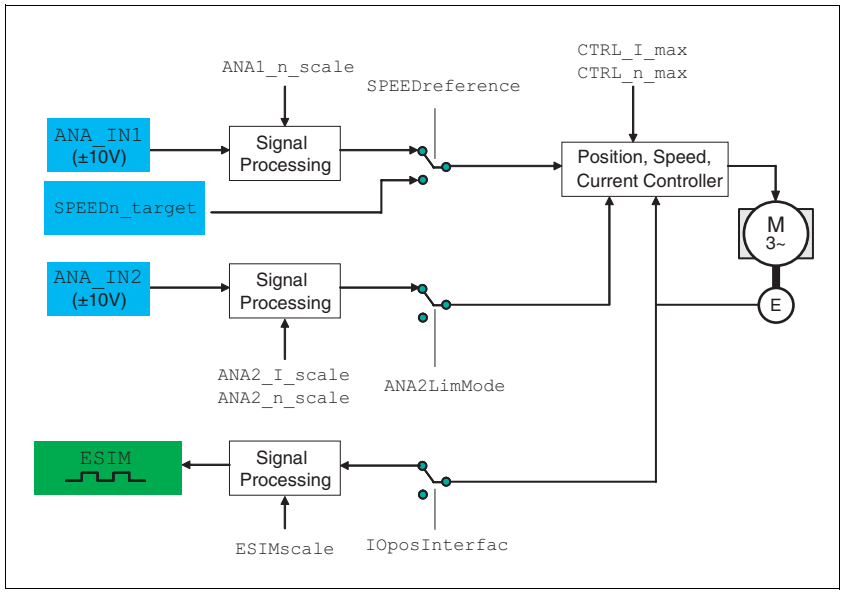


Figure 8.9 Operating mode speed control , effect of settable parameters

Start operating mode

In the case of local controller operating mode, the operating mode must be set using the parameter `IOdefaultMode` . The output stage becomes active, the motor receives current and the inputs are evaluated in accordance with the setting by setting the input signal ENABLE.

In the case of field bus controller operating mode, the operating mode must be set using the parameter `DCOMopmode` . The writing of the parameter value simultaneously causes the start of the operating mode.

End operating mode

The processing in the operating mode is completed if the operating mode has been "deactivated" and the drive is at a standstill, or if the motor speed has taken the value = 0 as a result of a fault.

Setting thresholds

See page for the setting of current limitation and speed limitation7-16.

Setting to the set value

In the case of local controller operating mode, the analogue input ANA1 is automatically evaluated.

In the case of field bus controller operating mode, the parameter `SPEEDreference` determines whether the analogue input ANA1 or the parameter `SPEEDn_target` is to be evaluated.

ACC1MDADM00EN, V1.00, 01.2005

Parameter Name Code HMI menu, Code	Meaning	Unit Minimum value Default value Maximum value	Data type R/W per Expert	Parameter address via field bus
SPEEDreference -	Selection of reference source for speed control operating mode() 0: none 1: reference value over +/-10V interface ANA1 2: reference value over parameter SPEEDn_target	 0 0 2	UINT16 R/W - -	CANopen 301B:11$_h$ Modbus 6946
SPEEDn_target -	Reference speed in speed control operating mode() For this purpose, the operating mode speed control must be activated by pre-setting on the parameter. The internal maximum speed is limited by the current setting in CTRL_n_max	r.p.m. -30000 0 30000	INT16 R/W - -	CANopen 3021:4$_h$ Modbus 8456

Reference value at +10V input signal

The progress of the reference value in relation to the ±10V input value can be altered:

- Setting the reference value at +10V
- Setting parameters for a zero voltage window

The reference value of a voltage value of +10V can be set by the scaling value `ANA1_n_scale`.

Parameter Name Code HMI menu, Code	Meaning	Unit Minimum value Default value Maximum value	Data type R/W per Expert	Parameter address via field bus
ANA1_n_scale A1NS SET-R in5	Scaling ANA1 for reference speed at +10V(8-19) The internal max. speed is limited to the current setting in CTRL_n_max With neg. sign an inversion of the evaluation of the analogue signal can be conducted	r.p.m. -30000 3000 30000	INT16 R/W per. -	CANopen 3021:3$_h$ Modbus 8454

Zero voltage window

For the ±10V input, parameters for a zero voltage window can be set using `ANA1_win` . An input voltage within this window is interpreted as 0V.

Parameter Name Code HMI menu, Code	Meaning	Unit Minimum value Default value Maximum value	Data type R/W per Expert	Parameter address via field bus
ANA1_win A1WN SET-R iUn	Zero voltage window on analogue input ANA1() Absolute value up to which an input voltage value is interpreted as 0 V Example: setting 20 mV ->range of -20 .. +20mV is interpreted as 0mV	mV 0 0 1000	UINT16 R/W per. -	CANopen 3009:9$_h$ Modbus 2322

ACC1MDADM00EN, V1.00, 01.2005

Example local controller operating mode

An example of setting by parameters in the case of local controller operating mode can be found on page 9-2.

ACC1MDADM00EN, V1.00, 01.2005

8.5.4 Electronic gear operation mode

WARNING!

Danger of personal injury and damage to system parts by uncontrolled system operation!

- Note that inputs to these parameters are executed by the drive controller immediately on receipt of the data set.
- Make sure that the system is free and ready for movement before changing these parameters

Description In the electronic gear operating mode reference signals are fed in as A/B signals or as pulse/direction signals, see Chapter 7.4.1 ""Initial Setup"" page 7-10. They are offset to a new position preset with an adjustable gear ratio.

Example An NC control provides reference signals to two units. The motors execute different, proportional positioning movements in accordance with the gear ratios.

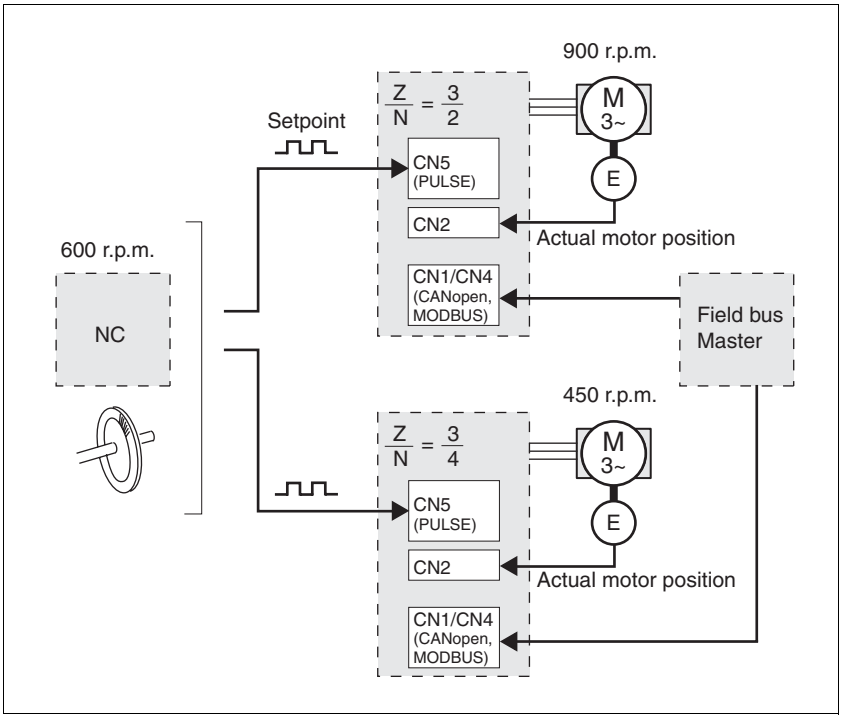


Figure 8.10 Preset default via NC controller

Start operating mode In the case of local controller operating mode, the operating mode must be set using the parameter `IOdefaultMode` . The output stage becomes active, the motor receives current and the inputs are evaluated in accordance with the setting by setting the input signal `ENABLE`.

In the case of field bus controller operating mode, the operating mode must be set using the parameter `DCOMopmode` . The writing of the parameter value simultaneously causes the start of the operating mode.

The type of synchronisation is set and the gear processing is started by a write command on the parameter `GEARreference` . If positioning

ACC1MDADM00EN, V1.00, 01.2005

changes at the reference signals are stored, then the unit computes these with the gear factor and positions the motor to the new set position.

Positioning values are given in internal units. The unit performs the changes immediately.

End operating mode

The processing is complete when the operating mode is deactivated and the motor is at a standstill, or if the motor is at a standstill because of a "Halt"or a fault.

8.5.4.1 Setting parameters

Example local controller operating mode

An example of setting by parameters in the case of local controller operating mode can be found on page 9-2.

Overview

The following overview shows the effectiveness of the parameters which can be set for the operating mode electronic gear.

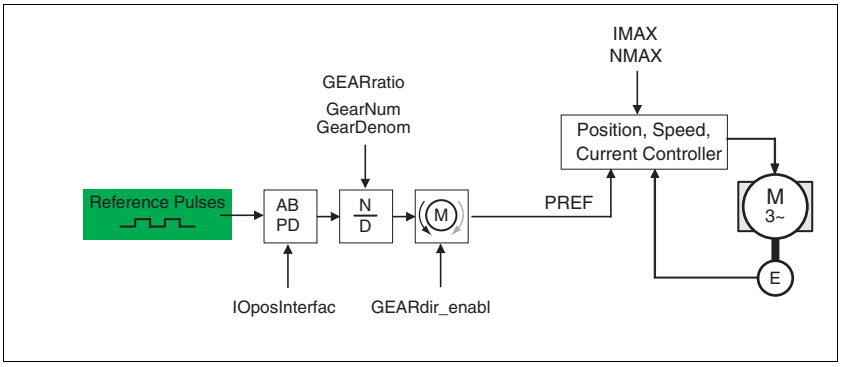


Figure 8.11 Operating mode electronic gear, effect of settable parameters

The resulting positioning movement is dependent upon the current motor resolution. It amounts to 131072 motor increments per revolution.

The setting values for the electronic gear, independent of the type of synchronisation, are:

- Gear factor (predefined value or intrinsic gear factor)
- size of following error
- Release of the direction of rotation

Setting thresholds

See page for the setting of current limitation and speed limitation7-16.

Synchronisation

In the case of the operating mode electronic gear, the unit operates synchronously in a gear train e.g. with other drives. If the unit leaves the gear processing for a short period of time, then the synchronous run with other drives is lost.

- In the case of local control mode, the positioning changes at the reference signals which arise during the interruption are not evaluated. When the gear processing is resumed, the unit follows the positioning changes from that point in time when the gear processing is reactivated.
- In the case of field bus control mode, the positioning changes at the reference signals which arise during the interruption continue to be counted internally. The parameter `GEARreference` allows setting whether these positioning changes are to be processed or ignored when the gear processing is resumed.

ACC1MDADM00EN, V1.00, 01.2005

Parameter Name Code HMI menu, Code	Meaning	Unit Minimum value Default value Maximum value	Data type R/W per Expert	Parameter address via field bus
GEARreference -	Electronic gear processing operating mode() 0: disabled 1: real-time synchronisation 2: synchronisation with compensation movement	 0 0 2	UINT16 R/W - -	CANopen 301B:12$_h$ Modbus 6948

Gear factor

The gear factor is the relationship between the motor increments and the externally inputted guide increments for the movement of the motor.

$$\text{Gear factor} = \frac{\text{Motor increments}}{\text{Reference increments}} = \frac{\text{Gear factor numerator}}{\text{Gear factor denominator}}$$

The parameter `GEARratio` serves to set the predefined gear factor. Alternatively, an intrinsic gear factor can be selected.

The intrinsic gear factor is determined with the parameters count and name. A negative numerator value reverses the motor's direction of rotation. The gear ratio is preset to 1:1.

Example

At a setting of 1000 reference increments the motor should rotate 2000 motor increments. This yields a gear factor of 2.

Parameter Name Code HMI menu, Code	Meaning	Unit Minimum value Default value Maximum value	Data type R/W per Expert	Parameter address via field bus
GEARratio GFAC SET-GFAC	Selection of special gear ratios() 0 : use of the specified gear ratio from GEARnum/GEARdenom 1 : 200 2 : 400 3 : 500 4 : 1000 5 : 2000 6 : 4000 7 : 5000 8 : 10000 9 : 4096 10 : 8192 11 : 16384 Change of reference values by the specified value effects a motor revolution.	 0 0 11	UINT16 R/W per. -	CANopen 3026:6$_h$ Modbus 9740
GEARnum -	Numerator of the gear ratio() Gear ratio numerator gear ratio= ---------- gear ratio denominator The new gear ratio is enabled on transfer of the numerator value.	 -2147483648 1 2147483647	INT32 R/W per. -	CANopen 3026:4$_h$ Modbus 9736

ACC1MDADM00EN, V1.00, 01.2005

Parameter Name Code HMI menu, Code	Meaning	Unit Minimum value Default value Maximum value	Data type R/W per Expert	Parameter address via field bus
GEARdenom -	Denominator of gear ratio() see description GEARnum	 1 1 2147483647	INT32 R/W per. -	CANopen 3026:3$_h$ Modbus 9734

Direction enabling The direction enabling allows restriction of the movement to positive or negative direction of rotation. Direction enabling is set with the parameter `GEARdir_enabl`.

Parameter Name Code HMI menu, Code	Meaning	Unit Minimum value Default value Maximum value	Data type R/W per Expert	Parameter address via field bus
GEARdir_enabl -	Enable direction of rotation() **1 / positive** : clockwise direction **2 / negative**: anticlockwise direction **3 / both**: both directions (default) Set permissible direction of motion, a reverse interlock can be set during gear processing.	 1 3 3	UINT16 R/W per. -	CANopen 3026:5$_h$ Modbus 9738

Further possibilities For further setting possibilities and functions for the operating mode see from page 8-43.

8.5.5 Profile position operating mode

The operating mode can only be used with field bus control mode and can only be executed via field bus.

WARNING!

Danger of personal injury and damage to system parts by uncontrolled system operation!

- Note that inputs to these parameters are executed by the drive controller immediately on receipt of the data set.
- Make sure that the system is free and ready for movement before changing these parameters

In profile position operating mode a movement with an adjustable travel profile is run from a start position to a target position. The value of the target position can be given as either a relative or an absolute position.

A movement profile can be set with values for acceleration and deceleration ramps and final speed.

Relative and absolute positioning,

The positioning movement is given either relative to the momentary axial position, or absolute with reference to the zero point of the axis. A zero point must be defined with the homing operating mode before the first absolute positioning.

Relative positioning or absolute positioning is set using Bit 6 via the parameter `DCOMcontrol`.

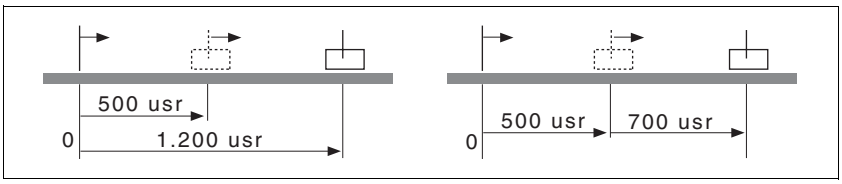


Figure 8.12 Absolute positioning (left) and relative positioning (right)

Requirements

The unit must be in the "Operation status" operating mode.

See chapter8.4 “Starting and changing operating modes“.

Trigger positioning

Parameter value	Description
Bit 4: New setpoint	0->1: start positioning or prepare following positioning
Bit 5: Change set immediately (applicable with new setpoint 0->1 only)	0: enable new target values when target position reached 1: enable new target values immediately
Bit 6: Absolute / relative	0: absolute positioning 1: relative positioning

Start positioning via Bit 4 in the parameter `DCOMcontrol`. The positioning can be triggered in 2 ways depending upon Bit 5.

- Bit 5=0:

  New positioning values are temporarily saved on leading edge of bit 4: `PPp_targetusr`, `PPn_target`, `RAMPacc` and `RAMPdecel`.

Only when the target position of the current positioning has been reached are the new positioning values carried out.

When new positioning values are transferred again, the intermediately stored positioning values are overwritten.

- Bit 5=1:

  As the flank of Bit 4 increases, new positioning values are carried out immediately. The drive moves to the new target position without intermediate stop.

  If a relative positioning is carried out with a positioning already running, the new positioning value is added to the positioning value of the positioning running at that moment. The new target position is moved to directly.

Status messages

The drive provides information concerning positioning via Bits 10 and 12 to 15 in the parameter `DCOMstatus`.

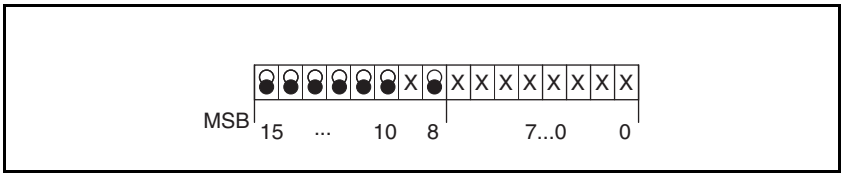


Figure 8.13 Status reports for operating mode

Parameter value	Description
Bit 10: target reached	0: target position not reached (also with "Halt" or error) 1: target position reached
Bit 12: setpoint acknowledge	0: new position can be imported 1: new target position imported
Bit 13: x_err	1: error occurred
Bit 14: x_end	1: positioning completed, motor at standstill
Bit 15: ref_ok	1: drive has valid reference point

Positioning finished

Bit 14 indicates whether positioning is complete. If this includes reaching the target position, then Bit 10 changes to 1. If the positioning has been interrupted by a "Halt" or a fault, Bit 10 remains at 0.

8.5.5.1 Setting parameters

The operating mode point - to - point can be set and carried out by parameters.

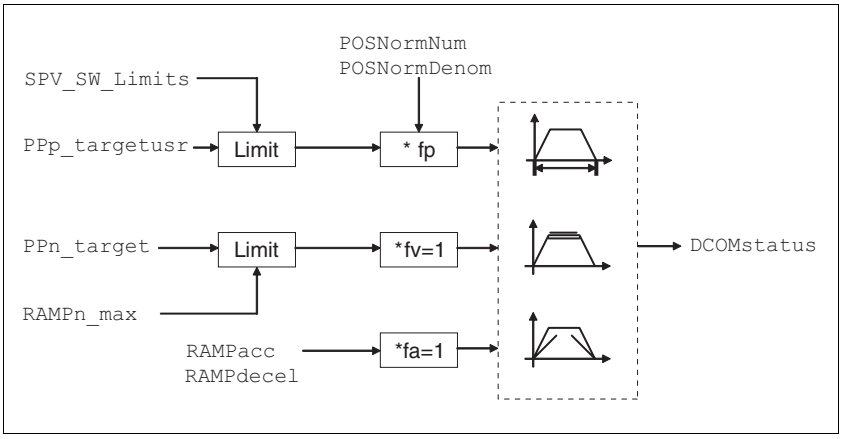


Figure 8.14 Operating mode point - to - point, effect of settable parameters

Target position A new positioning value is transferred with the parameter PPp_targetusr . The positioning movement is given either relative to the momentary axial position, or absolute with reference to the zero point of the axis.

Parameter Name Code HMI menu, Code	Meaning	Unit Minimum value Default value Maximum value	Data type R/W per Expert	Parameter address via field bus
PPp_targetusr -	Target position of profile position operating mode() Min/max values depend on: - scaling factor - software limit switch (if enabled)	usr	INT32 R/W - -	CANopen 607A:0$_h$ Modbus 6940

Current Position The current position is determined by using the 2 parameters _p_actusr and _p_actRAMPusr .

Parameter Name Code HMI menu, Code	Meaning	Unit Minimum value Default value Maximum value	Data type R/W per Expert	Parameter address via field bus
_p_actusr PACU STA-PACU	Actual position of the motor in user units()	usr	INT32 R/- - -	CANopen 6064:0$_h$ Modbus 7706
_p_actRAMPusr -	Actual position of the movement profile encoder()	usr	INT32 R/- - -	CANopen 301F:2$_h$ Modbus 7940

current limitation The maximum values for the acceleration and deceleration ramps are determined by the current limit, which can be set by the CTRL_I_max parameter.

There are separate deceleration ramps for the "Quick Stop" and "Halt" operating modes which can be set by the LIM_I_maxQSTP and LIM_I_maxHalt parameters.

ACC1MDADM00EN, V1.00, 01.2005

8.5.6 Operation mode Profile velocity

The operating mode can only be used with field bus control mode and can only be executed via field bus.

WARNING!

Danger of personal injury and damage to system parts by uncontrolled system operation!

- Note that inputs to these parameters are executed by the drive controller immediately on receipt of the data set.
- Make sure that the system is free and ready for movement before changing these parameters

In the profile velocity operating mode it is accelerated to an adjustable setpoint speed. A movement profile can be set with values for acceleration and deceleration.

Requirements The unit must be in the "Operation status" operating mode.

See chapter8.4 “Starting and changing operating modes“.

Velocity operation trigger If the type of operation, the operating state and the parameter values are set, the operating mode can be started by transfer of a set velocity in the parameter `PVn_target`.

Status messages The drive provides information concerning positioning via Bits 10 and 12 to 15 in the parameter `DCOMstatus`.

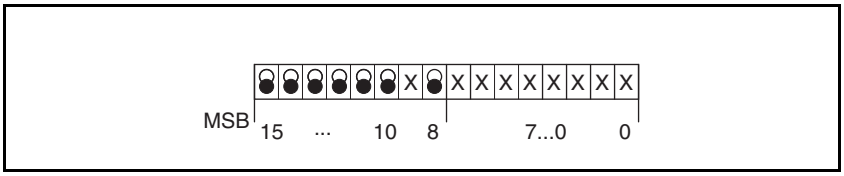


Figure 8.15 Status reports for operating mode

Parameter/ Signal	Description
Bit 10: target reached	0: set speed not reached 1: set speed reached (also at motor standstill by "Halt")
Bit 12: speed=0	0: motor moves 1: motor at standstill
Bit 13: x_err	1: error occurred
Bit 14: x_end	1: operating mode completed
Bit 15: ref_ok	1: drive has valid reference point

Operating mode finished The operating mode is completed on a motor standstill by "Halt", by an error or after a preset default = 0.

8.5.6.1 Setting parameters

Overview The following overview shows the effectivity of the parameters which can be set for the operating mode velocity profile.

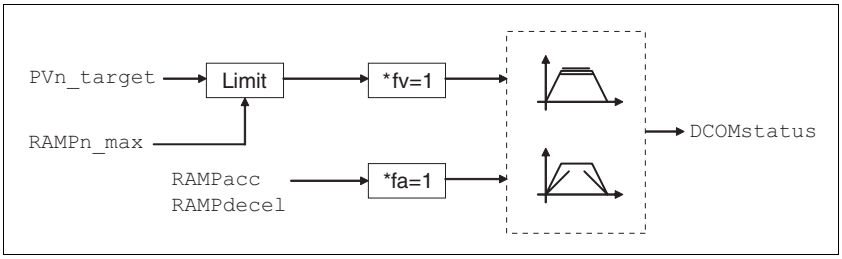


Figure 8.16 Operating mode velocity profile, effect of settable parameters

Setpoint speed

The set velocity is transferred via the parameter PVn_target in r.p.m. and can be changed during the movement. The operating mode is not limited by range limits of the positioning. New velocity values are accepted immediately during a running movement order.

Parameter Name Code HMI menu, Code	Meaning	Unit Minimum value Default value Maximum value	Data type R/W per Expert	Parameter address via field bus
PVn_target	Setpoint speed profile velocity operating mode(8-29)		INT32 R/W	CANopen 60FF:0_h Modbus 6938
-	Maximum value is limited to the current setting in CTRL_n_max.	0 rpm	- -	

Current speed

The current speed is determined by using the 2 parameters _n_act and _n_actRAMP .

Parameter Name Code HMI menu, Code	Meaning	Unit Minimum value Default value Maximum value	Data type R/W per Expert	Parameter address via field bus
_n_act NACT STA-nACt	Actual speed of the motor()	rpm	INT16 R/- - -	CANopen 606C:0_h Modbus 7696
_n_actRAMP	Actual speed of the movement profile encoder()	rpm	INT32 R/- - -	CANopen 606B:0_h Modbus 7948
-				

current limitation

The maximum values for the acceleration and deceleration ramps are determined by the current limit, which can be set by the CTRL_I_max parameter.

There are separate deceleration ramps for the "Quick Stop" and "Halt" operating modes which can be set by the LIM_I_maxQSTP and LIM_I_maxHalt parameters.

8.5.7 Operation mode Homing

The operating mode can only be used with field bus control mode and can only be executed via field bus.

WARNING!

Danger of personal injury and damage to system parts by uncontrolled system operation!

- Note that inputs to these parameters are executed by the drive controller immediately on receipt of the data set.
- Make sure that the system is free and ready for movement before changing these parameters

Overview of homing

In homing mode, an absolute scale reference of the motor position at a defined axis position is established. Referencing can be carried out by a homing movement or by dimension setting.

- A reference movement performs movement to a defined point, the reference point, on the axis, in order to create the absolute measurement reference of the motor position. The reference point simultaneously defines the zero point that is used for all subsequent absolute positionings as a reference point. Displacement of the zero point can be set by parameters.

  The reference movement must be carried out completely to ensure that the new zero point is valid. If it is interrupted, then the reference movement has to be started again. Unlike the other operating modes a reference movement must be completed before you can switch to a new operating mode.

  The signals $\overline{\texttt{LIMN}}$, $\overline{\texttt{LIMP}}$ and $\overline{\texttt{REF}}$ required for the reference movement must be wired. Monitoring signals that are not used should be deactivated.

  A homing is not required for motors with SinCos Multiturn encoders, because it sends a valid absolute position.

- Set dimensions provides the option of setting the current motor position to a desired position value to which the subsequent position specifications will refer.

Types of reference movements

4 standard reference movements are available

- Movement to negative limit switch $\overline{\texttt{LIMN}}$
- Movement to positive limit switch $\overline{\texttt{LIMP}}$
- Movement to reference switch $\overline{\texttt{REF}}$ with movement in negative direction of rotation
- Movement to reference switch $\overline{\texttt{REF}}$ with movement in positive direction of rotation

A reference movement can be conducted with or without index pulse.

- Reference movement without index pulse
  Movement from the edge of the switch to a distance set by parameters from the edge of the switch.
- Reference movement with index pulse (SinCos Singleturn encoder) movement from switch edge to the next motor index pulse. The cur-

rent motor position can be read out with the parameter _p_absENCusr. The index pulse is at position value 0.

Trigger homing Homing via Bit 4=1 in parameter DCOMcontrol is triggered.

Status messages The drive provides information concerning positioning via Bits 10 and 12 to 15 in the parameter DCOMstatus.

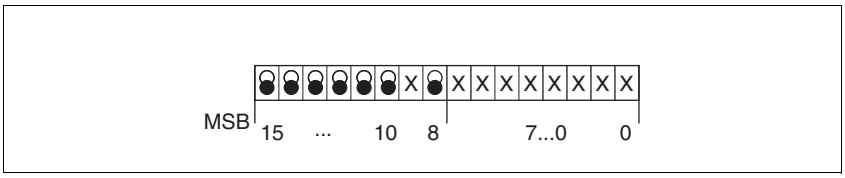


Figure 8.17 Status reports for operating mode

Parameter/ Signal	Description
Bit 10: target reached	0: homing not complete 1: homing complete (even with interruption by "Halt")
Bit 12: Homing attained	1: homing successfully executed
Bit 13: x_err	1: error occurred
Bit 14: x_end	1: homing completed, motor at standstill
Bit 15: ref_ok	1: drive has valid reference point

ACC1MDADM00EN, V1.00, 01.2005

8.5.7.1 Setting by parameters, general

There are various methods of homing which can be selected via the parameters HMmethod.

Parameter Name Code HMI menu, Code	Meaning	Unit Minimum value Default value Maximum value	Data type R/W per Expert	Parameter address via field bus
HMmethod -	Reference movement method() 1 : LIMN with index pulse 2 : LIMP with index pulse 7: REF+ with index pulse, inv., outside 8: REF+ with index pulse, inv., inside 9: REF+ with index pulse, not inv., inside 10: REF+ with index pulse, not inv., outside 11: REF- with index pulse, inv., outside 12: REF- with index pulse, inv., inside 13: REF- with index pulse, not inv., inside 14: REF- with index pulse, not inv., outside 17 : LIMN 18 : LIMP 23: REF+, inv., outside 24: REF+, inv., inside 25: REF+, not inv., inside 26: REF+, not inv., outside 27: REF-, inv., outside 28: REF-, inv., inside 29: REF-, not inv., inside 30: REF-, not inv., outside 35 : set dimensions data type with CANopen: INT8 explanation of abbreviations: REF+: search movement in pos. direction REF-: search movement in neg. direction inv.: reverse direction of rotation in switch not inv.: non-reverse direction of rotation in switch outside: index pulse/distance outside switch inside: index pulse/distance inside switch.	 1 18 35	INT16 R/W - -	CANopen 6098:0_h Modbus 6936

The level of the reference switch $\overline{\text{REF}}$ can be set on the parameter IOsigREF . A release of the switch is not required.

The level and the release for the limit switch are set with the parameter IOsigLimN and IOsigLimP.

Parameter Name Code HMI menu, Code	Meaning	Unit Minimum value Default value Maximum value	Data type R/W per Expert	Parameter address via field bus
IOsigRef -	Processing setting signal REF at reference movement to REF(8-43) **1 / normally closed**: normally closed contact **2 / normally open**: normally open contact The reference switch is only enabled during processing of the reference movement to REF.	 1 1 2	UINT16 R/W per. -	CANopen 3006:E_h Modbus 1564

Parameter Name Code HMI menu, Code	Meaning	Unit Minimum value Default value Maximum value	Data type R/W per Expert	Parameter address via field bus
IOsigLimN -	Processing setting signal LIMN(8-43) **0 / none**: inactive **1 / normally closed**: normally closed contact **2 / normally open**: normally open contact	 0 1 2	UINT16 R/W per. -	CANopen 3006:F_h Modbus 1566
IOsigLimP -	Processing setting signal LIMP(8-43) **0 / none**: inactive **1 / normally closed**: normally closed contact **2 / normally open**: normally open contact	 0 1 2	UINT16 R/W per. -	CANopen 3006:10_h Modbus 1568

The parameters `HMn` and `HMn_out` are used for setting the speeds for the reference movement.

Parameter Name Code HMI menu, Code	Meaning	Unit Minimum value Default value Maximum value	Data type R/W per Expert	Parameter address via field bus
HMn -	Reference speed for search for the switch() The set value is internally limited to the current parameter setting in RAMPn_max.	r.p.m. 1 60 13200	UINT16 R/W per. -	CANopen 6099:1_h Modbus 10248
HMn_out -	Reference speed for retraction from switch() The set value is internally limited to the current parameter setting in RAMPn_max.	r.p.m. 1 6 3000	UINT16 R/W per. -	CANopen 6099:2_h Modbus 10250

The parameter `HMp_homeusr` can be used to specify a desired position value, which is set at the reference point after a successful reference movement. This position value defines the current motor position at the reference point. This also defines the zero point.

Parameter Name Code HMI menu, Code	Meaning	Unit Minimum value Default value Maximum value	Data type R/W per Expert	Parameter address via field bus
HMp_homeusr -	Position on reference point() After successful reference movement this position value is automatically set at the reference point.	usr -2147483648 0 2147483647	INT32 R/W per. -	CANopen 3028:B_h Modbus 10262

The parameters `HMoutdisusr` and `HMsrchdisusr` can be used for activation of the monitoring of the switch function.

ACC1MDADM00EN, V1.00, 01.2005

Parameter Name Code HMI menu, Code	Meaning	Unit Minimum value Default value Maximum value	Data type R/W per Expert	Parameter address via field bus
HMoutdisusr -	Maximum run-off distance() 0: withdrawal control inactive >0: run-off in user-defined units position range within which it must be disabled again with the switch enabled.	usr 0 0 2147483647	INT32 R/W per. -	CANopen 3028:6_h Modbus 10252
HMsrchdisusr -	Maximum search distance after traversing over the switch() Positioning range within which, after traversing over the switch, this must be reactivated again. 0: search path processing inactive >0: search path in user-defined units	usr 0 0 2147483647	INT32 R/W per. -	CANopen 3028:D_h Modbus 10266

8.5.7.2 Reference movement without index pulse

Description A reference movement without index pulse can be set with the parameter `HMmethod` = 17 to 30, see page 8-33. The distance to the switching edge can be specified with the parameter `HMdisusr`.

Parameter Name Code HMI menu, Code	Meaning	Unit Minimum value Default value Maximum value	Data type R/W per Expert	Parameter address via field bus
HMdisusr -	Distance between the switching point and the reference point() After leaving the switch, the drive is still positioned in the working range for a defined path and this position is defined as a reference point. The parameters are only effective with reference movements without index pulse searching.	usr 1 200 2147483647	INT32 R/W per. -	CANopen 3028:7$_h$ Modbus 10254

Reference movement towards limit switch A reference movement to the negative limit switch is shown below with the distance to the switch edge (`HMmethod` = 17).

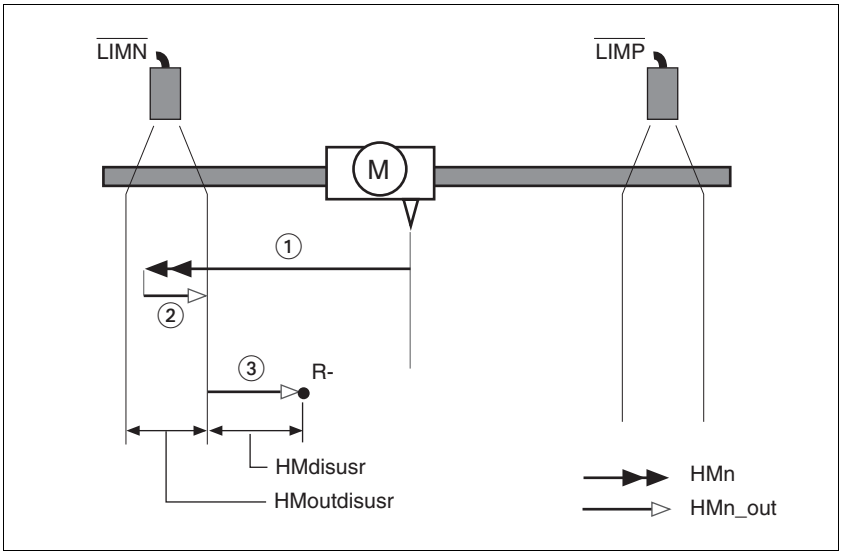


Figure 8.18 Reference movement to the negative limit switch

(1) Movement to limit switch at search speed
(2) Movement to switching point with release speed
(3) Movement at the distance to switching point with release speed

Reference movement to reference switch Reference movements to the reference switch with the distance to the switch edge are shown below (`HMmethod` = 27 to 30).

ACC1MDADM00EN, V1.00, 01.2005

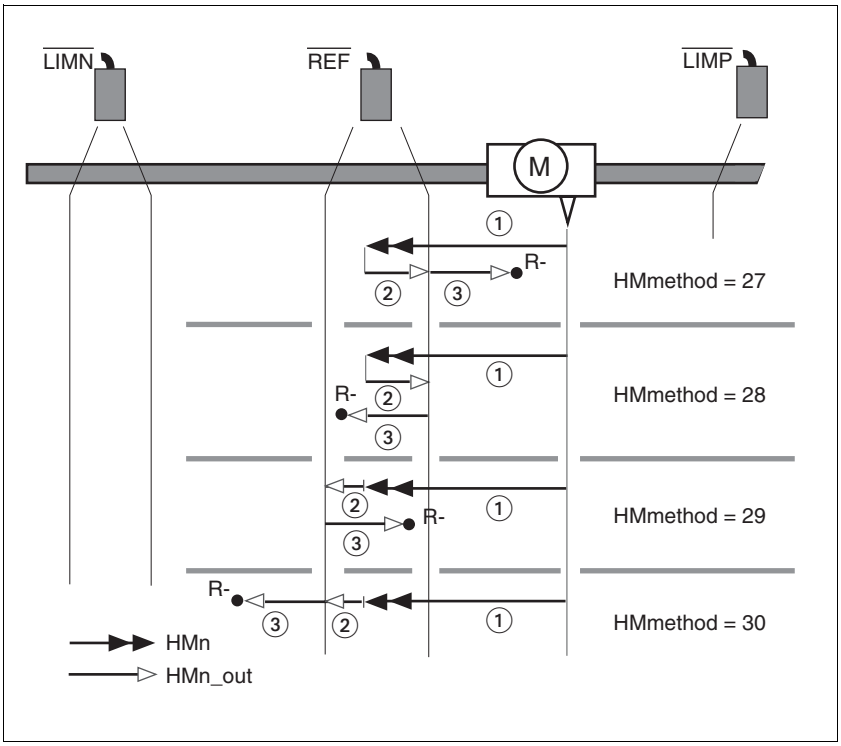


Figure 8.19 Reference movements to the reference switch

(1) Movement to reference switch at search speed
(2) Movement to switching point with release speed
(3) Movement at the distance to switching point with release speed

Examples Reference movements to the reference switch with the distance to the switch edge are shown below (`HMmethod` = 27). Various responses at different search speeds and start positions are shown.

- Movement to the reference switch with first movement in the negative direction, reference switch is once before (A1, A2) and once behind the start point (B1, B2).
- Additional movement when traversing through the switching window (A2, B2).

ACC1MDADM00EN, V1.00, 01.2005

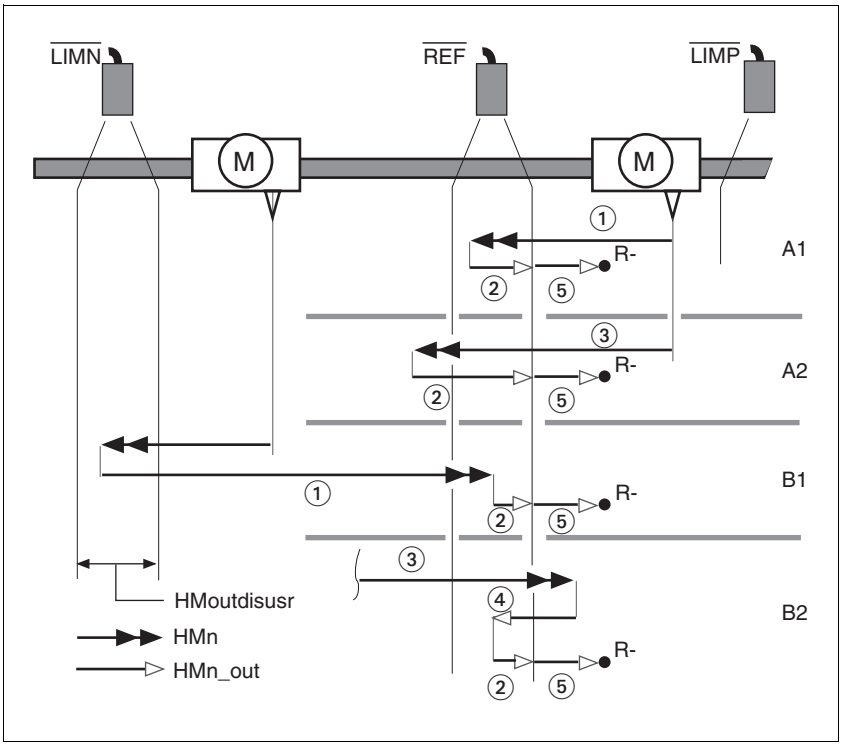


Figure 8.20 Reference movements to the reference switch

(1) Movement to reference switch at search speed
(2) Movement to switching point with release speed
(3) Excessively fast movement to reference switch with search speed
(4) Return movement to switch area at release speed
(5) Movement at the distance to switching point with release speed

ACC1MDADM00EN, V1.00, 01.2005

8.5.7.3 Reference movement with index pulse

Description A reference movement with index pulse can be set with the parameter `HMmethod` = 1 to 14, see page 8-33. First, the defined reference switch is approached and finally a search movement is made to the nearest index pulse.

Parameter possibilities The position distance between switching edge and index pulse can be calculated with the parameter `HMdisREFtoIDX`.
The value should be >0.05 revolutions.

If the index pulse is too close to the switching edge, the limit switch or reference switch can be moved mechanically. Otherwise the position of the index pulse can be moved with the parameter `ENC_pabsusr`, see Chapter 7.4.10 “Setting device parameters for rotary encoder“ page 7-27. This ensures that a reference movement with index pulse can be reproduced at any time.

Parameter Name Code HMI menu, Code	Meaning	Unit Minimum value Default value Maximum value	Data type R/W per Expert	Parameter address via field bus
HMdisREFtoIDX -	Distance of switch - index pulse after reference movement() Reading value provides the value of the difference between the index pulse position and the position on the switching flank of the limit or reference switch. Serves to monitor how far the index pulse is from the switching flank and serves to provide the criterion whether the reference movement with index pulse processing can be safely reproduced. Value input in 1/10000 U	U 0.0000 0.0000 0.0000	INT32 R/- - -	CANopen 3028:C_h Modbus 10264

Reference movement towards limit switch A reference movement to the positive limit switch with movement to the first index pulse is shown below (`HMmethod` = 2).

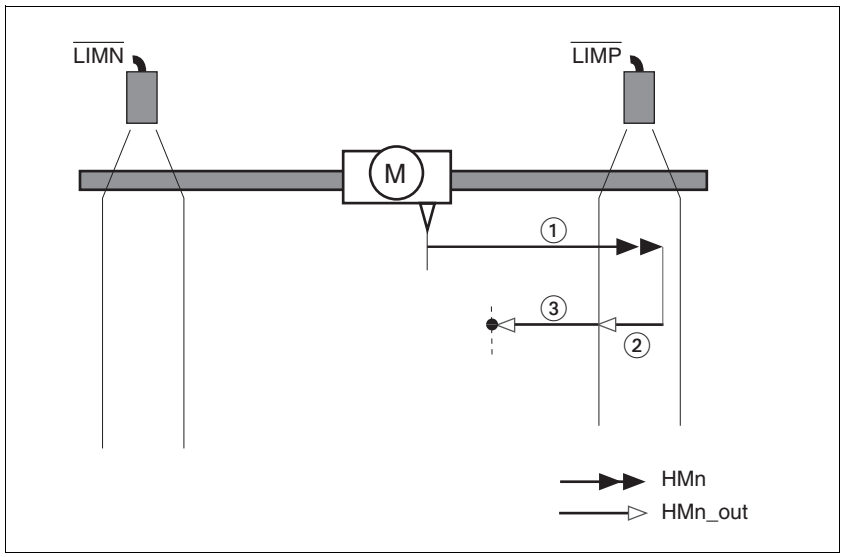


Figure 8.21 Reference movement to the positive limit switch

(1) Movement to limit switch at search speed

(2) Movement to switching point with release speed
(3) Movement to index pulse with release speed

Reference movement to reference switch

Reference movements to the reference switch with movement to the first index pulse are shown below (`HMmethod` = 11 to 14).

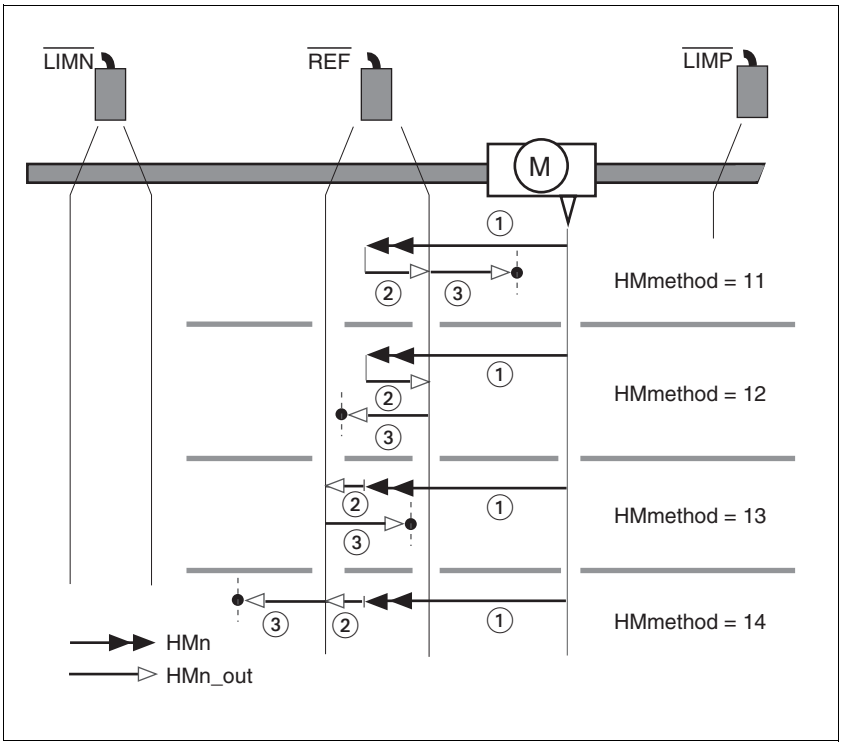


Figure 8.22 Reference movements to the reference switch

(1) Movement to reference switch at search speed
(2) Movement to switching point with release speed
(3) Movement to index pulse with release speed

Examples

Reference movements to the reference switch with movement to the first index pulse are shown below (`HMmethod` = 11). Various responses at different search speeds and start positions are shown.

- Movement to the reference switch with first movement in the negative direction, reference switch is once before (A1, A2) and once behind the start point (B1, B2).
- Additional movements when travelling through switching window (A2, B2).

ACC1MDADM00EN, V1.00, 01.2005

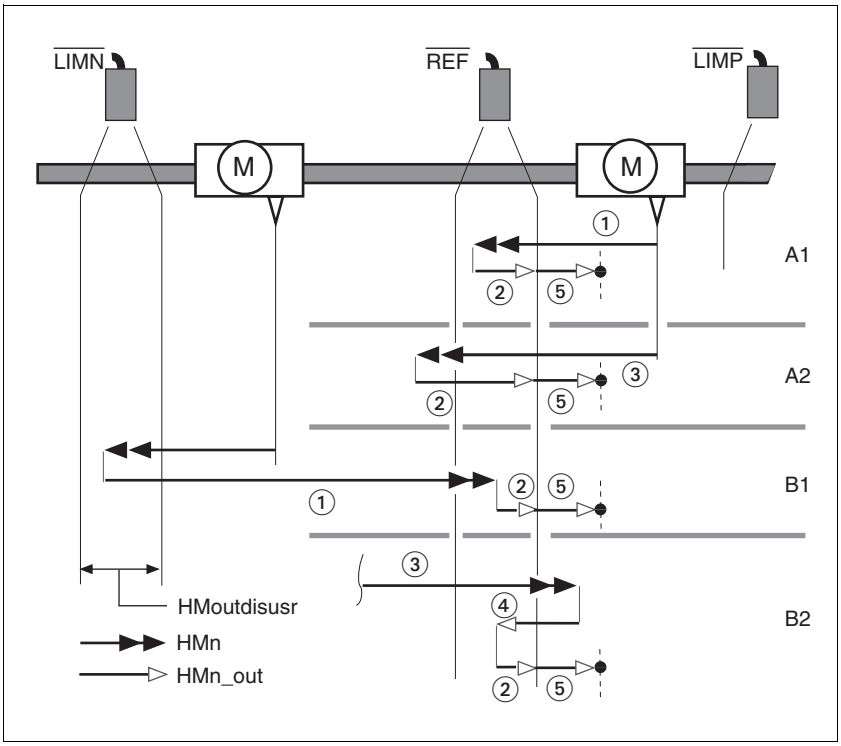


Figure 8.23 Reference movements to the reference switch

(1) Movement to reference switch at search speed
(2) Movement to switching point with release speed
(3) Excessively fast movement to reference switch with search speed
(4) Return movement to switch area at release speed
(5) Movement to index pulse with release speed

ACC1MDADM00EN, V1.00, 01.2005

8.5.7.4 Homing by dimension setting

A homing by set dimensions can be set with the parameter HMmethod = 35, see page 8-33. The current motor position is set at the position value in the parameter HMp_setpusr by set dimensions. This also defines the zero point.

Homing by dimension setting can only be carried out when the motor is at a standstill. Any active position deviation is retained and can still be compensated by the position controller after dimension setting has taken place.

Parameter Name Code HMI menu, Code	Meaning	Unit Minimum value Default value Maximum value	Data type R/W per Expert	Parameter address via field bus
HMp_setpusr	Position for measurement setting()		INT32 R/W	CANopen 301B:16$_h$ Modbus 6956
-	Measurement setting position for homing method 35	0 usr	- -	

Example Dimension setting can be used to carry out a continuous motor movement without exceeding positioning limits.

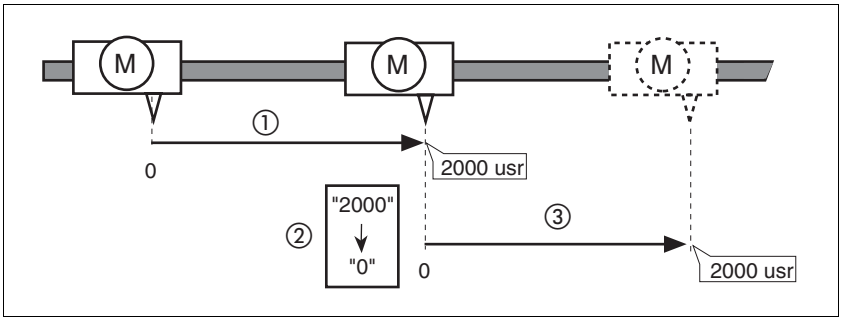


Figure 8.24 Positioning by 4000 usr units with measurement setting

(1) The motor is positioned by 2000 usr.
(2) By setting dimensions to 0 the current motor position is set to position value 0 and the new zero point is simultaneously defined.
(3) After triggering a new movement order of 2000 usr, the new target position is 2000 usr.

This method avoids crossing absolute position limits during a positioning operation because the zero point is continuously tracked.

The read out of the setpoint is by the parameter _p_refusr.

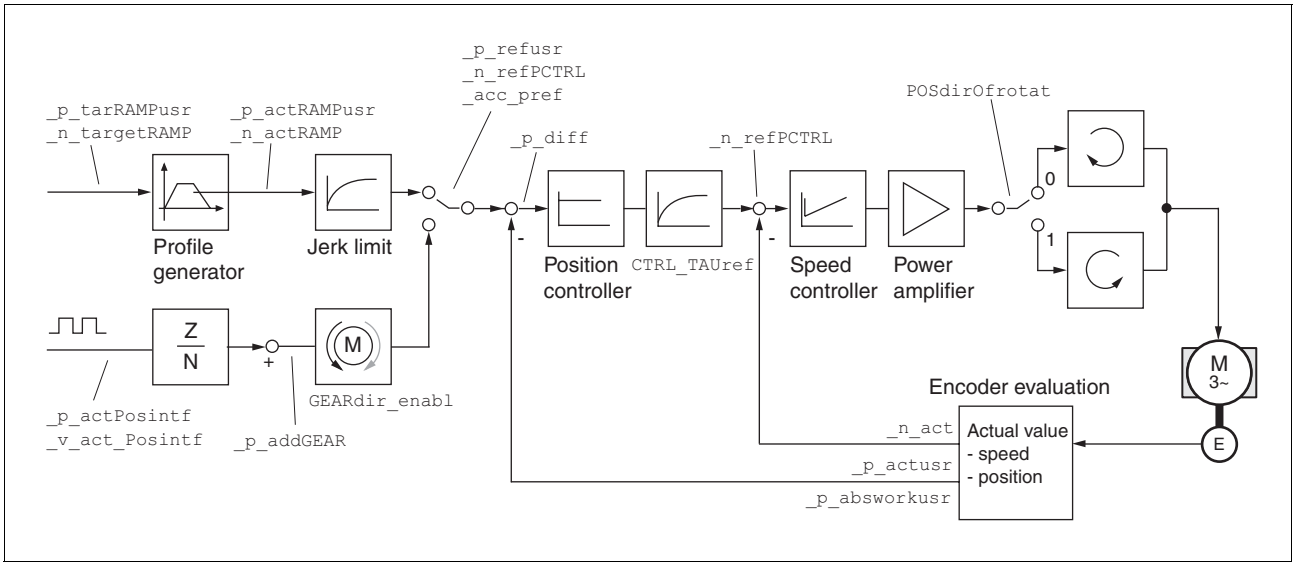
Parameter Name Code HMI menu, Code	Meaning	Unit Minimum value Default value Maximum value	Data type R/W per Expert	Parameter address via field bus
_p_refusr	Setpoint of the position regulator in user units()	usr	INT32 R/- -	CANopen 301:C$_h$ Modbus 7704
-			-	

ACC1MDADM00EN, V1.00, 01.2005

8.6 Functions

8.6.1 Monitoring functions

8.6.1.1 Status monitoring in movement mode



8.6.1.2 Positioning range

Positioning range (only field bus)

The motor can be moved to any point on the axis within the axis positioning range by specifying an absolute positioning process.

The current position of the motor can be read out using the parameter `_p_actusr`.

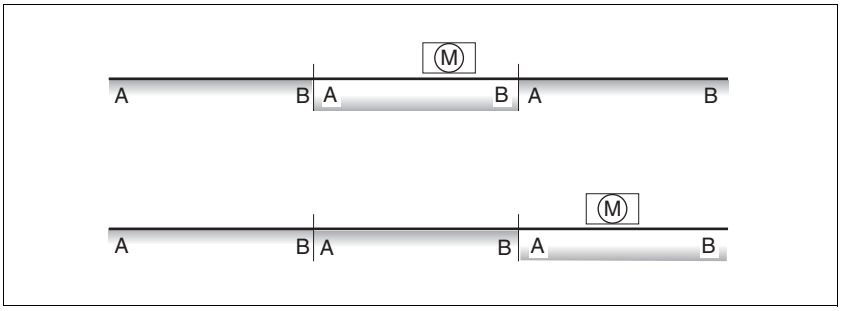


Figure 8.25 Positioning range

The positioning limits, with default scaling, are:

(A) -286435456 usr
(B) 286435455 usr

An overshoot of the positioning limits is possible in all operating modes, except during an absolute positioning in profile position mode.

Overshoot of motor at a positioning limit loses the reference point.

During a relative position in profile position mode a check of whether the absolute positioning limits will be overshot is made before starting the movement. If yes, an internal dimension setting to 0 is made before starting the movement. The reference point is lost (ref_ok = 1->0).

ACC1MDADM00EN, V1.00, 01.2005

Software limit switches

The positioning range can be limited by software limit switch. This is possible as soon as the drive has a valid zero point (ref_ok = 1). The positioning values are quoted relative to the zero point. The software limit switches are set using the parameters SPVswLimPusr and SPVswLimNusr are activated using SPV_SW_Limits .

The determining factor for position monitoring of the software limit switch range is the setpoint of the position controller. Depending on the controller setting, therefore, the motor can stop before it reaches the limit switch position. Bit 2 of parameter _SigLatched signals the triggering of a software limit switch

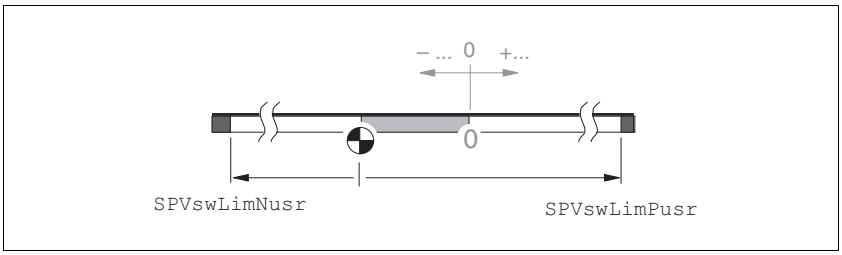


Figure 8.26 Software limit switches

Parameter Name Code HMI menu, Code	Meaning	Unit Minimum value Default value Maximum value	Data type R/W per Expert	Parameter address via field bus
SPVswLimPusr -	positive position limit for software limit switch()	 2147483647 usr	INT32 R/W per. -	CANopen 607D:2$_h$ Modbus 1544
SPVswLimNusr -	negative position limit for software limit switch()	 -2147483648 usr	INT32 R/W per. -	CANopen 607D:1$_h$ Modbus 1546
SPV_SW_Limits -	Monitoring the software limit switch() **0 / none**: none (default) **1 / SWLIMP**: activation of software limit switch pos. direction **2 / SWLIMN**: activation of software limit switch neg. direction **3 / SWLIMP+SWLIMN**: activation of software limit switch both directions The software limit switch is only monitored after a successful homing (ref_ok = 1)	 0 0 3	UINT16 R/W per. -	CANopen 3006:3$_h$ Modbus 1542

Parameter Name Code HMI menu, Code	Meaning	Unit Minimum value Default value Maximum value	Data type R/W per Expert	Parameter address via field bus
_SigLatched SIGS STA-S, GS	Stored state of the monitoring signals(8-46) Signal state: 0: not enabled 1: enabled Bit assignment: Bit0: general error Bit1: limit switch (LIMP/LIMN/REF) Bit2 software limit switch (SW-LIMP/ SW_LIMN) Bit3. Quick Stop via field bus Bit4. Inputs for safe standstill are 0 Bit6. Fault field bus RS485 Bit7. Fault field bus CAN Bit8. Fault field bus Profibus Bit9. Fault pulse input (frequency too high) Bit10. Fault in current operating mode Bit14. Low voltage DC bus Bit15. Excess voltage DC bus Bit16. Power amplifier supply voltage faulty (phase fault, earth fault) Bit17. Connection to motor faulty Bit18. Motor excess current/short circuit Bit19. Fault motor encoder or connection Bit20. Under voltage 24 Volt supply Bit21. Temperature too high (power amplifier, ballast, motor) Bit22. Lag error Bit23. Maximum speed exceeded Bit24. Inputs for safe standstill are different Bit29. Fault in EEPROM Bit30. Fault system run-up (hardware or parameter fault) Bit31. Internal system fault (e.g. Watchdog)		UINT32 R/- - -	CANopen 301C:8$_h$ Modbus 7184

Limit switch

CAUTION!

Loss of control monitoring.

The use of LIMP and LIMN can offer some protection against hazards (e.g. impact on mechanical stop caused by incorrect motion defaults).

- Use LIMP and LIMN where possible.
- Check that the external sensors or switches are correctly connected.
- Check the correct functional installation of the limit switches The limit switches must be mounted in a position far enough away from the mechanical stop to allow an adequate braking distance.
- The functions must be enabled to use LIMP and LIMN.
- This function cannot provide protection against faulty functioning of the product or the sensors.

During the movement the two limit switches are monitored with the input signals $\overline{\texttt{LIMP}}$ and $\overline{\texttt{LIMN}}$. If the drive moves to a limit switch, the motor stops. The triggering of the limit switch is signalled.

Release of the input signals $\overline{\texttt{LIMP}}$ and $\overline{\texttt{LIMN}}$ and the evaluation to active Low or active High can be changed using the parameters `IOsigLimP` and `IOsigLimN` .

Parameter Name Code HMI menu, Code	Meaning	Unit Minimum value Default value Maximum value	Data type R/W per Expert	Parameter address via field bus
IOsigLimP -	Processing setting signal LIMP() **0 / none**: inactive **1 / normally closed**: normally closed contact **2 / normally open**: normally open contact	 0 1 2	UINT16 R/W per. -	CANopen 3006:10_h Modbus 1568
IOsigLimN -	Processing setting signal LIMN() **0 / none**: inactive **1 / normally closed**: normally closed contact **2 / normally open**: normally open contact	 0 1 2	UINT16 R/W per. -	CANopen 3006:F_h Modbus 1566
IOsigRef -	Processing setting signal REF at reference movement to REF() **1 / normally closed**: normally closed contact **2 / normally open**: normally open contact The reference switch is only enabled during processing of the reference movement to REF.	1 1 2	UINT16 R/W per. -	CANopen 3006:E_h Modbus 1564

Moving drive out

The drive can be moved back from the limit switch area to the movement area by using manual movement.

If the drive does not go back to the movement area, check whether the manual drive is activated and that the correct direction of movement has been selected.

8.6.1.3 Monitoring internal signals

Monitoring systems protect the motor, the output stage and the ballast resistor from overheating and contribute to the functional and operational safety. A list of all the safety equipment can be seen from page 2-4.

Temperature monitoring

Sensors monitor the temperature of the motor, the output stage and the ballast resistor. All temperature limits are permanently set. If the temperature of a component approaches its permissible temperature limit, the unit creates a warning signal. If the temperature exceeds the limit value for more than 5 seconds, then the output stage and the regulation switches off. The unit signals a temperature fault.

ACC1MDADM00EN, V1.00, 01.2005

Parameter Name Code HMI menu, Code	Meaning	Unit Minimum value Default value Maximum value	Data type R/W per Expert	Parameter address via field bus
_Temp_act_DEV TDEV STA-tdEU	Unit temperature()	°C	INT16 R/- - -	CANopen 301C:12$_h$ Modbus 7204
_Temp_act_M -	Temperature motor()	°C	INT16 R/- - -	CANopen 301C:11$_h$ Modbus 7202
_Temp_act_PA TPA STA-tPR	Temperature of the power amplifier()	°C	INT16 R/- - -	CANopen 301C:10$_h$ Modbus 7200
PA_T_warn -	Temperature limit of the power amplifier()	°C	INT16 R/- per. -	CANopen 3010:6$_h$ Modbus 4108
PA_T_max -	maximum permissible temperature of the power amplifier()	°C	INT16 R/- per. -	CANopen 3010:7$_h$ Modbus 4110
M_T_max -	max. motor temperature()	°C	INT16 R/- per. -	CANopen 300D:10$_h$ Modbus 3360

I^2t monitoring

If the unit operates with high peak currents, then temperature monitoring with sensors can be too sluggish. With I^2t monitoring the closed-loop control anticipates a rise in temperature in time and if the I^2t threshold is exceeded, it reduces the motor, amplifier or ballast resistor current to their rated value.

If the limit value is not reached, the individual components can be taken to the output limit again.

Parameter Name Code HMI menu, Code	Meaning	Unit Minimum value Default value Maximum value	Data type R/W per Expert	Parameter address via field bus
_I2tI_act_BAL -	Overload load current()	%	INT16 R/- - -	CANopen 301C:13$_h$ Modbus 7206
_I2tI_mean_BAL I2TB STA-i2tb	Loading factor load()	%	INT16 R/- - -	CANopen 301C:14$_h$ Modbus 7208
_I2t_peak_BAL -	Overload load maximum value() Maximum overload ballast that has occurred in the last 10 sec.	%	INT16 R/- - -	CANopen 301C:15$_h$ Modbus 7210

Parameter Name Code HMI menu, Code	Meaning	Unit Minimum value Default value Maximum value	Data type R/W per Expert	Parameter address via field bus
_I2t_act_PA -	Overload power amplifier current()	%	INT16 R/- - -	CANopen 301C:16$_h$ Modbus 7212
_I2t_mean_PA I2TP STA-, 2tP	Loading factor power amplifier ()	%	INT16 R/- - -	CANopen 301C:17$_h$ Modbus 7214
_I2t_peak_PA -	Overload power amplifier maximum value() Maximum overload power amplifier that has occurred in the last 10 sec.	%	INT16 R/- - -	CANopen 301C:18$_h$ Modbus 7216
_I2t_act_M -	Overload motor current()	%	INT16 R/- - -	CANopen 301C:19$_h$ Modbus 7218
_I2t_mean_M I2TM STA-, 2tn	Loading factor motor()	%	INT16 R/- - -	CANopen 301C:1A$_h$ Modbus 7220
_I2t_peak_M -	Overload motor maximum value() Maximum overload motor that has occurred in the last 10 sec.	%	INT16 R/- - -	CANopen 301C:1B$_h$ Modbus 7222

Following error monitoring

If the reference value changes quickly, the drive cannot follow directly. There is a transient regulation discrepancy. If the setpoint and the actual position are widely different, the movement operation is discontinued by a lag error signal. In order to prevent this regulation discrepancy from switching off the power amplifier, you can set the lag error limiting value. The maximum permissible contouring error can be set with the parameter SPV_p_maxDiff.

The maximum control deviation occurring during operation can be determined with the parameter _p_DifPeakand compared with the maximum permissible contouring error.

The error class for a lag error can also be changed, see also8.6.1 “Monitoring functions“.

Parameter Name Code HMI menu, Code	Meaning	Unit Minimum value Default value Maximum value	Data type R/W per Expert	Parameter address via field bus
_p_DifPeak -	Value of max. reached lag errors of the position regulator() The lag error is the current position regulation offset minus the speed-dependent position regulation offset. Further information see SPV_p_maxDiff. A write operation resets the value again.	U 0.0000 0.0000 429496.7295 **Field bus** 0 0 4294967295	UINT32 R/W - -	CANopen 3011:F$_h$ Modbus 4382

ACC1MDADM00EN, V1.00, 01.2005

Parameter Name Code HMI menu, Code	Meaning	Unit Minimum value Default value Maximum value	Data type R/W per Expert	Parameter address via field bus
_p_dif PDIF STA-Pd, F	Current regulation variation of the position regulator() in 1/10000 revolutions. Actual rule deviation between setpoint and actual position, i.e. without consideration of any dynamic components. Note: different from SPV_p_maxDiff	U -214748.3648 0.0000 214748.3647 **Field bus** -2147483648 2147483647	INT32 R/- - -	CANopen 60F4:0$_h$ Modbus 7716
SPV_p_maxDiff - 	Max. permissible contouring error of position regulator() The lag error is the current position regulation offset minus the speed-dependent position regulation offset. Actually, only the position offset caused by the moment requirements is still referred to for lag error monitoring.	U 0.0001 1.0000 4.0000 **Field bus** 1 10000 40000	UINT32 R/W per. -	CANopen 6065:0$_h$ Modbus 4636

Monitoring parameters The unit and operating status can be monitored with various objects.

Parameter Name Code HMI menu, Code	Meaning	Unit Minimum value Default value Maximum value	Data type R/W per Expert	Parameter address via field bus
_SigActive - 	Current state of the monitoring signals() Meaning see _SigLatched		UINT32 R/- - -	CANopen 301C:7$_h$ Modbus 7182

Parameter Name Code HMI menu, Code	Meaning	Unit Minimum value Default value Maximum value	Data type R/W per Expert	Parameter address via field bus
_SigLatched SIGS STA-SiGS	Stored state of the monitoring signals() Signal state: 0: not enabled 1: enabled Bit assignment: Bit0: general error Bit1: limit switch (LIMP/LIMN/REF) Bit2 software limit switch (SW-LIMP/ SW_LIMN) Bit3. Quick Stop via field bus Bit4. Inputs for safe standstill are 0 Bit6. Fault field bus RS485 Bit7. Fault field bus CAN Bit8. Fault field bus Profibus Bit9. Fault pulse input (frequency too high) Bit10. Fault in current operating mode Bit14. Low voltage DC bus Bit15. Excess voltage DC bus Bit16. Power amplifier supply voltage faulty (phase fault, earth fault) Bit17. Connection to motor faulty Bit18. Motor excess current/short circuit Bit19. Fault motor encoder or connection Bit20. Under voltage 24 Volt supply Bit21. Temperature too high (power amplifier, ballast, motor) Bit22. Lag error Bit23. Maximum speed exceeded Bit24. Inputs for safe standstill are different Bit29. Fault in EEPROM Bit30. Fault system run-up (hardware or parameter fault) Bit31. Internal system fault (e.g. Watchdog)		UINT32 R/- - -	CANopen 301C:8_h Modbus 7184
_WarnActive -	Active warnings bit-coded() Meaning of Bits see _WarnLatched		UINT16 R/- - -	CANopen 301C:B_h Modbus 7190
_WarnLatched WRNS STA-WrnS	Stored warnings bit-coded() Stored warning bits are erased in the event of a FaultReset. Signal state: 0: not enabled 1: enabled Bit assignment: Bit 0: general warning Bit 1: temperature of power amplifier high Bit 2: temperature of motor high Bit 3: reserved Bit 4: power amplifier overloaded Bit 5: motor overloaded Bit 6: ballast resistor overloaded Bit 7: CAN warning Bit 8: motor encoder warning Bit 9: RS485 protocol warning Bit 10: SAFE_DISABLE_A and/or SAFE_DISABLE_B Bit 11: DC Bus undervoltage		UINT16 R/- - -	CANopen 301C:C_h Modbus 7192

Parameter Name Code HMI menu, Code	Meaning	Unit Minimum value Default value Maximum value	Data type R/W per Expert	Parameter address via field bus
_actionStatus -	Action word() Signal state: 0: not enabled 1: enabled Bit0: error class 0 Bit1: error class 1 Bit2: error class 2 Bit3: error class 3 Bit4: error class 4 Bit5: reserved Bit6: drive at standstill: actual speed _n_act < <9 rpm Bit7: drive rotating clockwise Bit8: drive rotating anticlockwise Bit9: drive inside position window (pwin) Bit10: reserved Bit11: profile generator stopped: setpoint speed is 0 Bit12: profile generator decelerating Bit13: profile generator accelerating Bit14: profile generator at constant speed Bit15: reserved		UINT16 R/- - -	CANopen 301C:4$_h$ Modbus 7176
_StopFault STPF FLT-StPF	Fault number of the last interruption cause()		UINT16 R/- - -	CANopen 603F:0$_h$ Modbus 7178

Set fault response

The response of the unit to a fault is classified into error classes, and can be set for certain monitoring functions. This allows the error response of the unit to be matched to the operational requirements.

Parameter Name Code HMI menu, Code	Meaning	Unit Minimum value Default value Maximum value	Data type R/W per Expert	Parameter address via field bus
SPV_Flt_pDiff -	Error response to contouring error() **1 / ErrorClass1**: error class 1 **2 / ErrorClass2**: error class 2 **3 / ErrorClass3**: error class 3	 1 3 3	UINT16 R/W per. -	CANopen 3005:B$_h$ Modbus 1302
SPV_Flt_AC -	Error response to failure of a phase() **1 / ErrorClass1**: error class 1 **2 / ErrorClass2**: error class 2 **3 / ErrorClass3**: error class 3	 1 2 3	UINT16 R/W per. -	CANopen 3005:A$_h$ Modbus 1300

8.6.1.4 Commutation monitoring

Functional principle

The unit continuously checks the plausibility of motor acceleration and effective motor moment, in order to recognise uncontrolled motor movements and to stop them if required. The monitoring function is referred to as commutation monitoring.

If the motor accelerates for a time period of more than 5 to 10ms, the commutation monitoring signals an uncontrolled motor movement, even though the drive regulation delays the motor with the set current value.

The unit shows flashing on HMI 5603 (error class 4)

Causes of error

Uncontrolled motor movements can be traced back to the following causes:

- The motor phases U, V, W are connected to the unit incorrectly, i.e. each offset by 120° , e.g. U with V, V with W, W with U.
- Faulty or interfered evaluation of the rotor position by a faulty position encoder on the motor, interfered sensor signals or defective position acquisition in the unit.

In addition, the unit can recognise a commutation error in the following cases, since the above-mentioned plausibility conditions could equally apply:

- The motor receives an external torque that is greater than the specified maximum torque. The external force causes it to accelerate.
- The motor is manually moved either in the direction of the motor moment or in the opposite direction, whilst the drive regulation is active.
- The motor is moved to a mechanical stop.
- Speed and position control loop are set to be extremely unstable.

Setting parameters

WARNING!

Danger of injury and damage to system components by unexpected movement!

Disabling monitoring functions increases the risk of an unexpected movement.

- Use the monitoring functions.

Parameter Name Code HMI menu, Code	Meaning	Unit Minimum value Default value Maximum value	Data type R/W per Expert	Parameter address via field bus
SPVcommutat -	Monitoring commutation() **0 / off**: off **1 / on**: on (default)	 0 1 1	UINT16 R/W per. -	CANopen 3005:5$_h$ Modbus 1290

8.6.1.5 Earth fault monitoring

Functional principle

The unit checks the motor phases for earth fault. An earth fault of one or more motor phases is detected. An earth fault of the DC bus or the ballast resistor is not detected.

Setting parameters

WARNING!

Danger of injury and damage to system components by unexpected movement!

Disabling monitoring functions increases the risk of an unexpected movement.

- Use the monitoring functions.

ACC1MDADM00EN, V1.00, 01.2005

Parameter Name Code HMI menu, Code	Meaning	Unit Minimum value Default value Maximum value	Data type R/W per Expert	Parameter address via field bus
SPV_EarthFlt -	Earth fault monitoring() **0 / off**: Off **1 / on**: On (default) In exceptional cases it may require disabling, e.g.: - parallel connection of multiple units - operation on an IT network - long motor lines Only disable the monitoring if it is triggered when not wanted	 0 1 1	UINT16 R/W per. expert	CANopen 3005:10_h Modbus 1312

8.6.1.6 Mains phase monitoring

Functional principle

The unit checks the mains phases for failure. The failure of a mains phase is detected with 3-phase units.

Setting parameters

WARNING!

Danger of injury and damage to system components by unexpected movement!

Disabling monitoring functions increases the risk of an unexpected movement.

- Use the monitoring functions.

Parameter Name Code HMI menu, Code	Meaning	Unit Minimum value Default value Maximum value	Data type R/W per Expert	Parameter address via field bus
SPV_MainsVolt -	Monitor mains phases() **0 / off**: Off **1 / on**: On (default) In exceptional cases it may require disabling, e.g.: - when powered via the DC bus	 0 1 1	UINT16 R/W per. expert	CANopen 3005:F_h Modbus 1310

8.6.2 Scaling

Description Scaling translates user units to internal units of the unit, and vice versa. The unit saves position values in user-defined units.

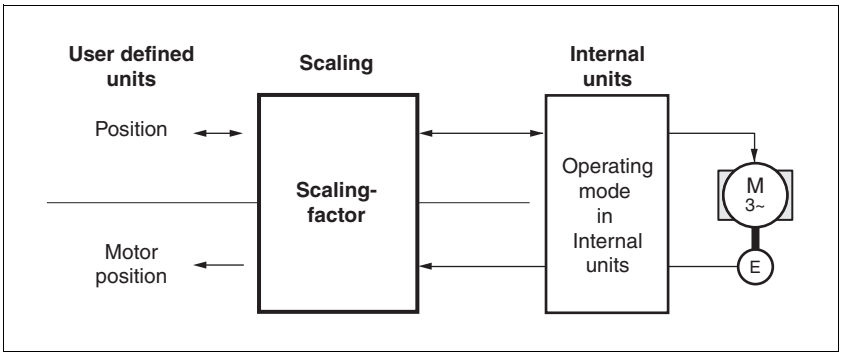


Figure 8.27 Scaling

Scaling factor The scaling factor creates the relationship between the number of motor rotations and the required user units [usr] needed for this. It is specified in [revs/usr].

$$\text{Scaling factor} = \frac{\text{Motor revolution [U]}}{\text{Change of the user position [usr]}}$$

Figure 8.28 Calculation of the scaling factor

WARNING!

Unexpected motion may cause injury and damage to the system

Changing the scaling changes the effect of the values in user-defined units. The same movement jobs can therefore cause different motions.

- Note that the scaling affects all relationships between the defaults and the drive motion.
- Check the corresponding usr parameters and defaults of the system in user-defined units.

The scaling factor is set using the parameters `POSscaleNum` and `POSscaleDenom` . A new scaling factor is activated by transfer of the count value.

When quoting the scaling factor, take care that the relationship can be completely represented by a fraction.

ACC1MDADM00EN, V1.00, 01.2005

Code HMI-Code Parameter Name	Description	Unit Minimum value Default value Maximum value	Data type R/W per Expert	Parameter address via field bus
POSscaleNum -	Numerator of the position scaling factor() Specification of scaling factor: motor revolutions [U] ---------- change of user position [usr] A new scaling is imported when the numerator value is transferred User-defined limit values may be reduced as a result of the calculation of an internal system factor	U 1 1 2147483647	INT32 R/W per. -	CANopen 3006:8_h Modbus 1552
POSscaleDenom -	Denominator of the position scaling factor() Description see count (POSscaleNum) Acceptance of a new scaling factor is by transfer of the numerator	usr 1 16384 2147483647	INT32 R/W per. -	CANopen 3006:7_h Modbus 1550

Value change of the scaling factor is only possible with inactive output stage. Value statements in user units are transformed to internal units when activating the output stage, simultaneously checking the value range.

Examples The minimal scaling is that which causes a change in the motor position of 1/131072 U when changing by 1 usr.

There are 3 cases for the setting of the user units.

- Scaling corresponds to default scaling
  1 U = 16384 user units

  => every 8th motor position can be approached.

- Scaling corresponds to default scaling
  1 U = 131072 user units

  => every motor position can be approached.

- Scaling is less than the default scaling
  1 U = 4096 user units

  => every 32nd motor position can be approached.

To retain the same positioning movement of the motor after changing the scaling factor, the following persistent parameters must be adapted in addition to the user-defined values: `HMoutdisusr`, `HMdisusr`, `HMp_homeusr`, `HMsrchdisusr`, `JOGstepusr`, `SPVswLimPusr` and `SPVswLimNusr`.

If the parameters are not adjusted, this can cause problems such an error during the reference movement, because the distance to the switching edge of the limit or reference switch is no longer sufficient for safely leaving the switching range.

If the existing unit is replaced by this unit, and if the same positioning orders are to be used, then the scaling is to be set in accordance with the settings used previously.

Example 1 Positioning of 1111 user-defined units is to correspond to 3 motor revolutions. This gives:

$$\text{Scaling factor} = \frac{3\ \text{U}}{1111\ \text{usr}}$$

If you carry out a relative positioning operation of 900 user-defined units now, the motor will move 900 usr * 3/1111 rev/usr = 2.4302 revolutions.

Example 2 Calculation of the scaling factor in length units: 1 motor revolution corresponds to a path of 100 mm. Every user-defined unit [usr] should correspond to one 0.01 mm step.

This gives: 1 usr = 0.01 mm * 1 rev/100 mm = 1/10000 rev.

$$\text{Scaling factor} = \frac{1\ \text{U}}{10000\ \text{usr}}$$

Example 3 Setting the positioning in 1/1000 rad
1rad = 1 U/(2*π)
π = 3,1416 (rounded)

User value = 1 usr

Unit value = 1/(2*π*1000) U

$$\text{Scaling factor} = \frac{1\ \text{U}}{2*3{,}1416*1000\ \text{usr}} = \frac{1\ \text{U}}{6283{,}2\ \text{usr}} = \frac{10\ \text{U}}{62832\ \text{usr}}$$

ACC1MDADM00EN, V1.00, 01.2005

8.6.3 Movement profile

Profile generator

Target position and final speed are input values to be entered by the user. The profile generator uses these values to calculate a motion profile dependent on the selected operating mode.

The initial values of the profile generator and the addable jolt limiting are transformed into a motor movement by the drive regulator.

The acceleration and deceleration behaviour of the motor can be described by the ramp function of the profile generator. The nominal sizes of the ramp functions are the ramp shape and the ramp steepness.

Ramp shape

A linear ramp for the acceleration and deceleration phases is available as the ramp shape. The profile settings are valid for both directions of movement of the drive.

Ramp gradient

The steepness of the ramp determines the speed changes of the motor per unit time. It can be set, for the acceleration ramp, by using the parameter `RAMPacc` and the deceleration ramp by using `RAMPdecel`.

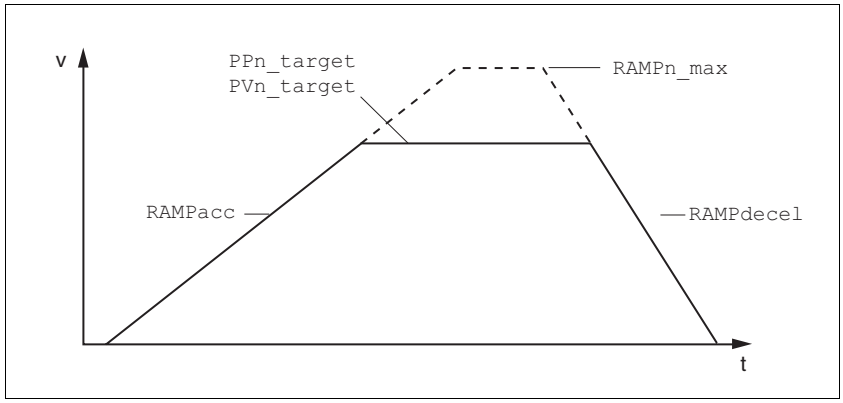


Figure 8.29 Acceleration and deceleration ramps

Parameter Name Code HMI menu, Code	Meaning	Unit Minimum value Default value Maximum value	Data type R/W per Expert	Parameter address via field bus
RAMPacc -	Profile generator acceleration()	r.p.m*s 30 600 3000000	UINT32 R/W per. -	CANopen 6083:0_h Modbus 1556
RAMPdecel -	Profile generator deceleration()	r.p.m*s 750 750 3000000	UINT32 R/W per. -	CANopen 6084:0_h Modbus 1558

Parameter Name Code HMI menu, Code	Meaning	Unit Minimum value Default value Maximum value	Data type R/W per Expert	Parameter address via field bus
RAMPn_max -	Profile generator deceleration() Parameters are effective in the following operating modes: - point-to-point - profile velocity - homing - jog If a higher setpoint speed is set on one of these operating modes it will be automatically limited to this value. This makes it simple to conduct a commissioning with limited speed.	r.p.m. 60 12000 13200	UINT16 R/W per. -	CANopen 607F:0_h Modbus 1554

8.6.4 Quick Stop

WARNING!

Risk of injury and damage to system components by unbraked motor.

An insufficient ballast resistor causes overvoltage on the DC bus and switches off the power amplifier. The motor is no longer actively braked.

- Make sure that the ballast resistor is sufficiently dimensioned.
- Check the setting of the parameter for the ballast.
- Check the temperature of the ballast resistor by conducting a test run under the most critical conditions.
- During the test make sure that at higher mains voltage there is less reserve in the capacitors on the DC bus.

"Quick Stop" is a fast braking function which stops the motor as a result of a fault of error class 1 and 2 or by a software stop.

In the event of a fault category 1 fault response, the power amplifier remains on. In the case of error class 2, the output stage switches off after the drive is at a standstill.

Maximum current

The unit absorbs the excess braking energy. If the DC bus voltage exceeds the permissible limit the output stage switches off and the unit signals "DC bus overvoltage". The motor runs down without braking.

The current for the moment ramp should be set so that the drive comes to a standstill with the required delay.

Parameter Name Code HMI menu, Code	Meaning	Unit Minimum value Default value Maximum value	Data type R/W per Expert	Parameter address via field bus
LIM_I_maxQSTP LIQS SET-L, 95	Current limiting for Quick Stop() Max. current during braking via torque ramp resulting from an error with error class 1 or 2, and when a software stop is triggered Maximum and default value setting depend on the motor and power amplifier	A_{pk} - - -	UINT16 R/W per. -	CANopen 3011:5$_h$ Modbus 4362

If the unit switches off frequently with "Quick Stop" with "DC bus overvoltage", then the maximum braking current should be reduced, the drive load should be reduced or an external ballast resistor should be installed.

Quick Stop reset

A "Quick Stop" must be acknowledged with the error confirmation.

If the "Quick Stop" is actuated by the limit switch signals $\overline{\text{LIMN}}$ or $\overline{\text{LIMP}}$, the drive can be moved back into the movement area by the jog operation, see page 8-14.

ACC1MDADM00EN, V1.00, 01.2005

8.6.5 Halt

The "Halt" function can be set from any source (commissioning software, field bus, input signal $\overline{\text{HALT}}$). This is independent of the control mode which has been set during the initial setup.""

The "Halt" function brakes the motor with a moment ramp The parameter `LIM_I_maxHalt` specifies the current for the moment ramp.

After drive standstill an internal position compensation is run, the position control is enabled and the motor is stopped with the power amplifier active.

The further processing takes place by the retraction of all set $\overline{\text{HALT}}$-signals and by activation of a new movement order.

Maximum current

The unit absorbs the excess braking energy. If the DC bus voltage exceeds the permissible limit the output stage switches off and the unit signals "DC bus overvoltage". The motor runs down without braking.

The current for the moment ramp should be set so that the drive comes to a standstill with the required delay.

Parameter Name **Code** **HMI menu, Code**	**Meaning**	**Unit** **Minimum value** **Default value** **Maximum value**	**Data type** **R/W** **per** **Expert**	**Parameter address via field bus**
LIM_I_maxHalt LIHA SET-L, hR	Current limiting for Halt() Max. current during braking after Halt or termination of an operating mode. Maximum and default value setting depend on motor and power amplifier	A_{pk} - - -	UINT16 R/W per. -	CANopen 3011:6_h Modbus 4364

8.6.6 Standstill window

The standstill window can be used to check whether the drive has reached the setpoint position.

If the control deviation _p_dif of the position controller remains in the standstill window after the end of the positioning for time STANDpwinTime, the unit reports the end of the process (x_end = 0->1).

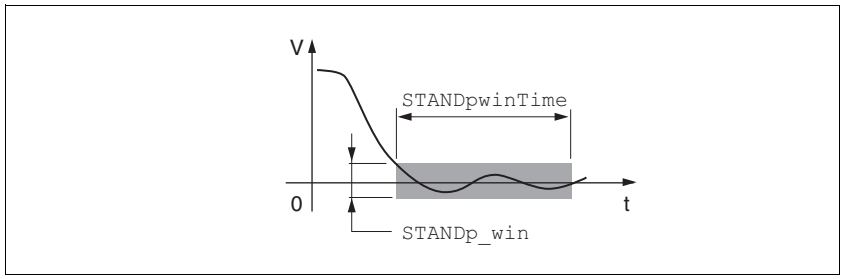


Figure 8.30 Standstill window

The parameters STANDp_win and STANDpwinTime define the size of the window.

The parameter STANDpwinTout can be used to set the period after which an error is reported if the standstill window was not reached.

Parameter Name Code HMI menu, Code	Description	Unit Minimum value Default value Maximum value	Data type R/W per Expert	Parameter address via field bus
STANDp_win -	Standstill window, permissible offset() The offset for the standstill window time must lie in this range of values to allow recognition of the standstill of the drive. Info: the processing of the standstill window must be activated via the 'STANDpwinTime' parameter.	U 0.0000 0.0010 3.2767 **Field bus** 0 10 32767	UINT16 R/W per. -	CANopen 6067:0_h Modbus 4370
STANDpwinTime -	Standstill window, time() 0 : monitoring of standstill window disabled >0 : time in ms within which the control deviation must be in the standstill window	ms 0 0 32767	UINT16 R/W per. -	CANopen 6068:0_h Modbus 4372
STANDpwinTout -	Timeout period for standstill window monitor() 0 : timeout monitoring disabled >0 : timeout period in ms The standstill window process is set with STANDp_win and STANDpwinTime The time monitoring starts at the moment the target position (setpoint position of position controller) is reached or the end of processing of the profile generator.	ms 0 0 16000	UINT16 R/W per. -	CANopen 3011:B_h Modbus 4374

8.6.7 Braking function with HBC

Inadvertent movement of the motor without current is prevented by the use of a holding brake motor. The holding brake requires a holding brake control system HBC, see chapter "Accessories"

Holding brake controller

The holding brake control HBC amplifies the digital output signal ACTIVE1_OUT of the unit and controls the brake in such a way to allow fast switching with a minimum of heat generation. In addition, the brake connection, which is located in a cable with the wiring connections to the motor, safely disconnects the signal connections on the unit in the event of a breakdown of the insulation of the motor cable.

The function of the HBC and the holding brake can be tested, see 7.4.8 “Checking holding brake“ page 7-25.

Settable parameters

ACTIVE1_OUT changes to 1 as soon as the output stage is released and the motor has a holding moment applied to it. A time delay for release (BRK_trelease) and application (BRK_tclose) can be set by parameters.

Signal	Function	Value
ACTIVE1_OUT	Brake is or will be released	1
Brake is or will be applied		0

Delayed release

When releasing the brake (opening) the parameter BRK_trelease effects a delayed response of the drive with respect to the enable command.

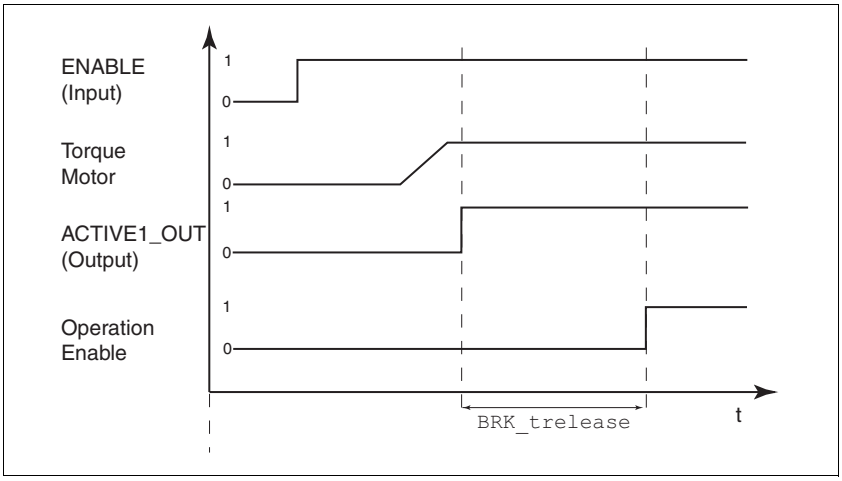


Figure 8.31 Releasing the holding brake

The setting of the parameter BRK_trelease depends on the motor type and can be found in the motor type plate.

ACC1MDADM00EN, V1.00, 01.2005

Parameter Name Code HMI menu, Code	Meaning	Unit Minimum value Default value Maximum value	Data type R/W per Expert	Parameter address via field bus
BRK_trelease BTRE DRC-btrE	Time delay when opening/release of brake()	ms 0 0 1000	UINT16 R/W per. -	CANopen 3005:7_h Modbus 1294

Delayed application

After removing the enable signal, the signal ACTIVE1_OUT changes to 0, the brake is applied. The motor remains under current, however, for the time set on the parameter BRK_tclose.

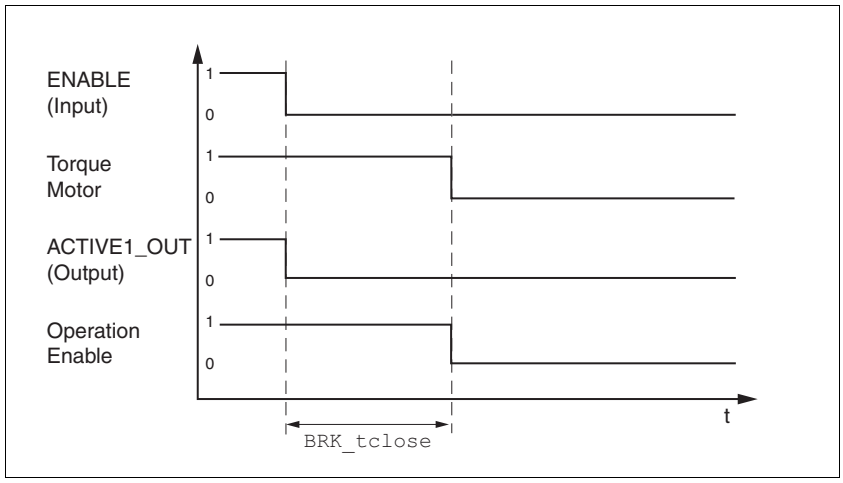


Figure 8.32 Applying the holding brake

The setting of the parameter BRK_tclose depends on the motor type and can be found in the motor type plate.

Parameter Name Code HMI menu, Code	Meaning	Unit Minimum value Default value Maximum value	Data type R/W per Expert	Parameter address via field bus
BRK_tclose BTCL DRC-btCL	Time delay when closing the brake()	ms 0 0 1000	UINT16 R/W per. -	CANopen 3005:8_h Modbus 1296

Voltage reduction

If the voltage reduction on the HBC is activated, the start-up voltage of the brake is reduced after a time delay.

The voltage reduction must be set via the "Voltage reduction" switch depending on the motor type:
on: voltage reduction on, e.g. for SER motors
off: voltage reduction off
Note the defaults in the motor documentation.

When switching on the supply voltage, the holding brake control and the function of the HBC button are reset. There is no voltage at the control terminals of the brake, the LED "Brake released" of the HBC is off.

ACC1MDADM00EN, V1.00, 01.2005

8.6.8 Reversal of direction of rotation

The parameter POSdirOfRotat can be used to reverse the direction of rotation of the motor.

The limit switch that limits the working range with positive direction of rotation must be connected to $\overline{\text{LIMP}}$. The limit switch that limits the working range with negative direction of rotation must be connected to $\overline{\text{LIMN}}$.

Parameter Name Code HMI menu, Code	Meaning	Unit Minimum value Default value Maximum value	Data type R/W per Expert	Parameter address via field bus
POSdirOfRotat PROT DRC-Prot	Definition of the direction of rotation() **0 / clockwise / clw**: clockwise **1 / counter clockwise / cclw**: anticlockwise Meaning: The drive rotates clockwise at positive speeds when the motor shaft is viewed at the flange. CAUTION: when using limit switches, after changing the setting the limit switch connections must be changed over. The limit switch which is actuated by moving in jog mode in a positive direction must be connected to the input LIMP, and vice versa.	 0 0 1	UINT16 R/W per. -	CANopen 3006:C_h Modbus 1560

If the direction of rotation of the motor must be reversed, all parameter values can be imported unchanged except for the parameters for position processing with SinCos Multiturn.

By reversing the direction of rotation, the absolute position of the motor _p_absworkusr changes, which is read from the rotary encoder, and also the set position evaluated by the unit _p_actusr.

The direction of rotation should therefore be set at commissioning to the state which will be required later for the operation of this motor.

ACC1MDADM00EN, V1.00, 01.2005

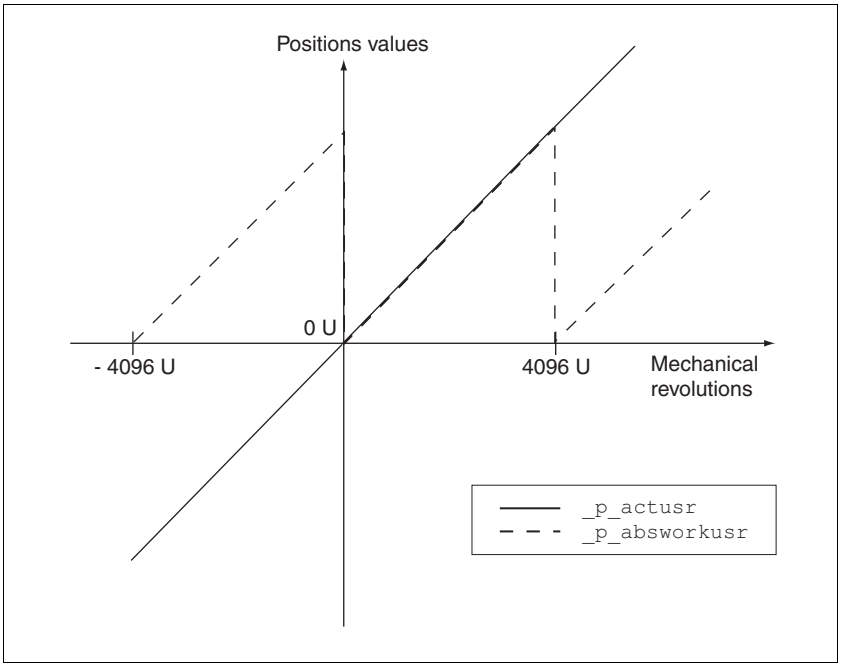


Figure 8.33 Positioning values without direction of rotation reversal

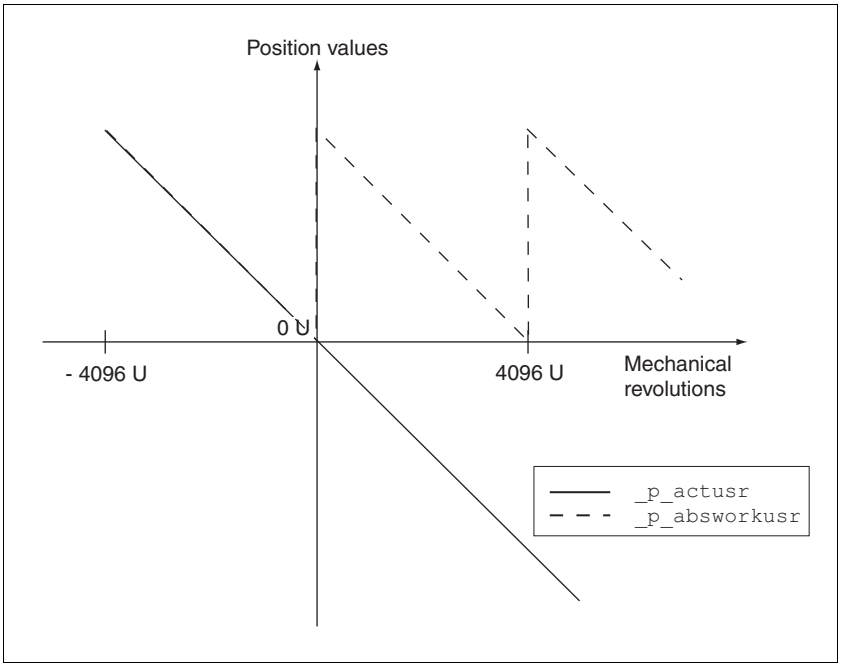


Figure 8.34 Positioning values with direction of reversal

ACC1MDADM00EN, V1.00, 01.2005

8.6.9 Analogue signals

Analog inputs The analogue inputs allow analogue input voltages between -10V and +10V to be read in. The current voltage value on ANA1+ can be read using the parameter ANA1_act

Parameter Name Code HMI menu, Code	Meaning	Unit Minimum value Default value Maximum value	Data type R/W per Expert	Parameter address via field bus
ANA1_act A1AC STA-AIAC	Voltage value analogue input ANA1()	mV -10000 10000	INT16 R/- - -	CANopen 3009:1$_h$ Modbus 2306
ANA1_I_scale A1IS SET-AI.S	Scaling ANA1 for set current at +10V() Default value is the lesser value from ImaxM or ImaxPA With a neg. sign an inversion of the evaluation of the analogue signal can be conducted	A_{pk} -300.00 3.00 300.00 **Field bus** -30000 300 30000	INT16 R/W per. -	CANopen 3020:3$_h$ Modbus 8198
ANA1_n_scale A1NS SET-AnS	Scaling ANA1 for reference speed at +10V() The internal max. speed is limited to the current setting in CTRL_n_max With neg. sign an inversion of the evaluation of the analogue signal can be conducted	r.p.m. -30000 3000 30000	INT16 R/W per. -	CANopen 3021:3$_h$ Modbus 8454
ANA1_win A1WN SET-AIWn	Zero voltage window on analogue input ANA1() Absolute value up to which an input voltage value is interpreted as 0 V Example: setting 20 mV ->range of -20 .. +20mV is interpreted as 0mV	mV 0 0 1000	UINT16 R/W per. -	CANopen 3009:9$_h$ Modbus 2322
ANA2_act A2AC STA-A2AC	Voltage value analogue input ANA2()	mV -10000 10000	INT16 R/- - -	CANopen 3009:5$_h$ Modbus 2314
ANA2LimMode A2MO DRC-A2Mo	Selection of limit by ANA2() **0 / none**: no limit **1 / Current Limitation / CURR**: limit current setpoint at current controller (limit value at 10 V in ANA2_I_max) **2 / Speed Limitation / SPED**: limit of setpoint speed value at speed controller (limit value at 10V in ANA2_n_max)	0 0 2	UINT16 R/W per. -	CANopen 3012:B$_h$ Modbus 4630
ANA2_I_max A2IM DRC-A2.M	Scaling for current limiting by ANA2 at +10V() Default value is lower value from ImaxM or ImaxPA	A_{pk} 0.00 0.00 300.00 **Field bus** 0 30000	UINT16 R/W per. -	CANopen 3012:C$_h$ Modbus 4632

ACC1MDADM00EN, V1.00, 01.2005

Parameter Name Code HMI menu, Code	Meaning	Unit Minimum value Default value Maximum value	Data type R/W per Expert	Parameter address via field bus
ANA2_n_max A2NM DRC-A2nM	Scaling for speed limiting by ANA2 at +10V() Default value is maximum motor speed M_n_max.	rpm 500 30000	UINT16 R/W per. -	CANopen 3012:D_h Modbus 4634

8.6.10 Restoring default values

8.6.10.1 Restore status after "Initial Setup"

The parameter PARuserReset is used to restore the status after "Initial Setup". All parameter values are reset to default values, with the exception of the communication parameters, the control mode and the logic level.

Parameter Name Code HMI menu, Code	Meaning	Unit Minimum value Default value Maximum value	Data type R/W per Expert	Parameter address via field bus
PARuserReset -	Resetting the user parameters() 1: set user parameters to default values. All parameters are reset except: - communications parameters - device control - logic level	 0 0 1	UINT16 R/W - -	CANopen 3004:8_h Modbus 1040

All the user set parameters will be lost if no back-up has been made onto the data carrier in the commissioning software.

8.6.10.2 Restore factory settings

The parameter PARfactorySet is used to restore the factory settings. All parameter values are reset to the default values.

▶ Remove the connection to the field bus in order to avoid conflicts by simultaneous intervention.

Parameter Name Code HMI menu, Code	Meaning	Unit Minimum value Default value Maximum value	Data type R/W per Expert	Parameter address via field bus

Factory setting via HMI

▶ Set drC and then FCS on the HMI and confirm your selection with YES.

All parameter values are reset to the default values. See "Initial Setup", page 7-10
The new settings only become effective after switching off and switching on the unit again.

Factory settings via commissioning software

The factory settings are set via the menu points Configuration => Factory Settings. All parameter values are reset to the default values. See "Initial Setup", page 7-10
The new settings only become effective after switching off and switching on the unit again.

All the user set parameters will be lost if no back-up has been made onto the data carrier in the commissioning software.

8.6.10.3 Store the settings on the data medium

The unit settings can be saved to a data medium with the commissioning software. Load the configuration of the unit into the commissioning software with "Action - Transfer". Highlight the configuration and select "File - Export".

This also gives you the option of uploading a stored configuration into a unit of the same type. To do this select "File - Import" and load the desired configuration. Highlight the configuration and select "Action - Configure".

ACC1MDADM00EN, V1.00, 01.2005

9 Examples

9.1 Wiring for field bus control

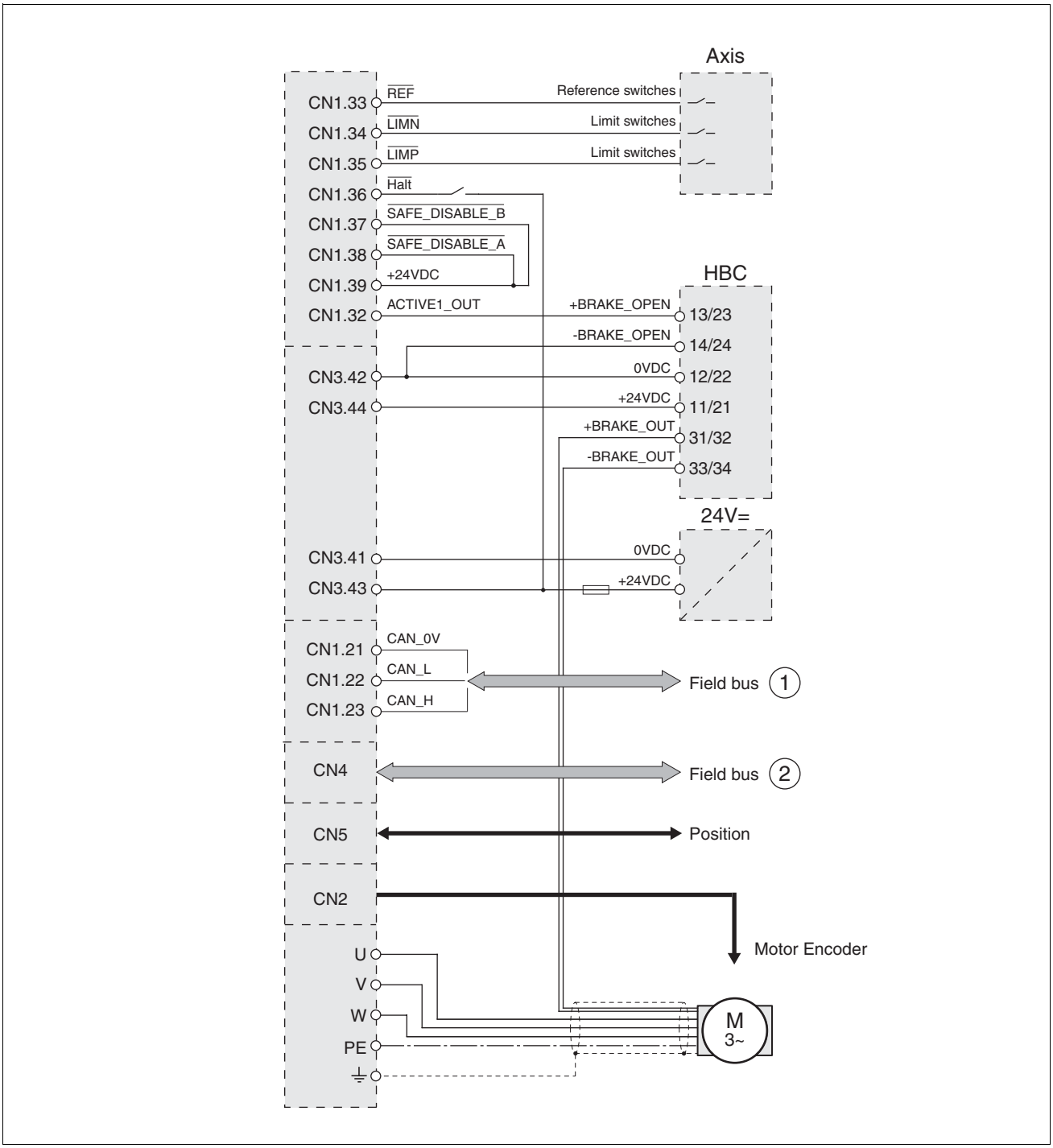


Figure 9.1 Wiring for field bus controller operating mode, no Safe Stop

Procedure

- ▶ Unlock the front panel of the unit and open it.
- ▶ Connect the earth terminal of the unit or the EMC plate to the earthing star point of the system.

▶ Connect the required terminal according to the sequence in Table 6.2 “Installation overview“. If a different connection sequence is followed terminals may be covered by other leads.

Follow the EMC requirements, see page 6-1.

▶ Then lock the front panel.

Connection from	Connection to	from page
Motor phases		6-16
Mains power supply		6-26
Motor position encoder	CN2	6-28
Holding brake controller (HBC)		6-31
24 VDC power supply	CN3	6-33
Encoder A, B, I	CN5	6-35
Field bus CANopen or MODBUS	CN4	6-41, 6-43
Digital inputs/outputs	CN1	6-45

Table 9.1 Procedure for the “Wiring for field bus control" example

9.2 Example of I/O parameter setting

The following examples show settings for the current control, speed control and electronic gearbox modes. The control is local (I/O Mode), the set value preselection via the analogue inputs.

The parameter setting is performed on the HMI in the following examples.

Requirements:

- The motor shaft should not yet be coupled with the system mechanism.
- The analogue inputs are already wired up.
- The "Initial Setup" and the settings for the basic parameters and limiting values have been carried out during commissioning.
- The power amplifier is ready to switch on, i.e the status display on the HMI shows rdY.

Example A: current control

▶ Set the default operating mode to current control. Under drC- / Mo- dE select the entry Curr.

▶ The set current should be preset to 200 mA at 10V using ANA1+ . Select under SEt- / A1 S the value 0.20.

▶ The motor speed should be limited using ANA2+ . Under drC- / A2Mo select the entry SPEd.

▶ The limit value of the motor speed should be 6000 rpm at 10 V. Under drC- / A2nM select the value 6000.

▶ Check the speed limiter.

Start the motor for this (input signal $\overline{\text{ENABLE}}$). Set ANA1+ to maximum and limit it using ANA2+. Read off the speed value under StA- / nACt.

ACC1MDADM00EN, V1.00, 01.2005

▶ Check the actual current value. Read off the value under StA- / I ACt.

Example B: speed control

▶ Set the default operating mode to speed control . Under drC- / I on select the entry SPEd.

▶ The motor speed should be preset to 1500 r.p.m. at 10V using ANA1+ . Select under SEt- / A In5 the value 1500.

▶ The motor current should be limited using ANA2+ . Under drC- / A2no select the entry Curr.

▶ The limit value of the motor current should be 0.5 A at 10 V. Under drC- / A2, n select the value 5.00.

▶ Check the current limiter

Start the motor for this (input signal $\overline{\text{ENABLE}}$). Set ANA1+ to maximum and limit it using ANA2+. Read off the current value under StA- / I ACt.

▶ Check the current speed. Read off the value under StA- / nACt.

Example C: electronic gear

▶ Set the default operating mode to electronic gear. Under drC- / I on select the entry GEAr

▶ The gear ratio should be selected from a list of presets and should be 2000. Under SEt- / GFAC select the value 2000.

▶ Check the current speed. Start the motor for this (input signal $\overline{\text{ENABLE}}$). Read off the value under StA- / nACt.

9.3 Wiring for “Safe Standstill”

Using the safety functions integrated in this product requires careful planning. For more information see 5.3 “"Safe Standstill safety function"“ on page 5-2.

ACC1MDADM00EN, V1.00, 01.2005

ACC1MDADM00EN, V1.00, 01.2005

10 Diagnostics and troubleshooting

DANGER!

Electric shock, fire or explosion

- Only qualified personnel 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.
- Before working on the drive system:
  - Switch off power to all terminals.
  - Place a sign "DO NOT SWITCH ON" on the switch and lock to prevent switching on.
  - **Wait 6 minutes** (for discharge of DC bus capacitors).
  - Measure voltage between DC+ and DC- and check for <48V. (The DC bus LED is not a safe indication for absence of the DC bus voltage).
- Do not short-circuit DC bus or touch unshielded components or screws of the terminals with voltage present.
- Install all covers and close the housing doors before applying power.
- The motor generates voltage when the shaft is rotated. Lock the shaft of the motor to prevent rotation before starting work on the drive system.
- The system manufacturer is responsible for compliance with all applicable regulations relevant to earthing the drive system.
- Do not reach into the drive system (e.g. no pointed objects).

10.1 Service

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

- Type, identification number and serial number of the product (type plate)
- Type of fault (possibly with 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.

10.2 Error responses and error classes

Error response The product triggers an error response in the event of a fault. Depending upon the gravity of the fault, the unit responds in accordance with one of the following error classes:

Error class	Response	Description
0	Warning	Message only, no interruption of movement mode.
1	Quick Stop	Motor stops with "Quick Stop", power amplifier and controller remain switched on and active.
2	Quick Stop with switch-off	Motor stops with "Quick Stop", power amplifier and controller switch off when at standstill.
3	Fatal error	Power amplifier and controller switch off immediately, without stopping the motor first.
4	Uncontrolled operation	Power amplifier and controller switch off immediately, without stopping the motor first. Error response can only be reset by switching the unit off.

The occurrence of an event is signalled by the unit as follows:

Event	Status	HMI-display	Entry for last interruption cause (_StopFault)	Entry in fault memory
Halt	Operation Enabled	HALt	-	-
Software-Stop	Quick Stop active	StoP A306	E A306	-
Hardware limit switch (e.g.$\overline{\text{LIMP}}$)	Quick Stop active	StoP A302	E A302	E A302
Error with error class 1, e.g. lag error with error class 1	Quick Stop active	StoP A320	E A320	E A320
Error with error class>1, e.g. contouring error with error class 3	Fault	FLt A320	E A320	E A320

HMI, commissioning software and field bus indicate whether the safety function has been triggered by $\overline{\text{SAFE\_DISABLE\_A}}$ or $\overline{\text{SAFE\_DISABLE\_B}}$. Neither signal can be configured via parameters.

ACC1MDADM00EN, V1.00, 01.2005

10.3 Error display

The last cause of interruption and the last 10 error messages are stored. The HMI allows the last cause of interruption to be displayed; the commissioning software and the field bus allow, in addition to the last cause of interruption, the last 10 error messages also to be displayed. A description of all the error numbers can be seen from page 10-13.

10.3.1 State diagram

After switching on and at the start of an operating mode, a sequence of operating states is progressed through.

The relationship between the operating states and the state transitions is shown in the state diagram (state machine).

The operating states are internally monitored and influenced by monitoring and system functions, such as temperature and current monitoring

Graphic representation The state diagram is shown graphically as a flow chart.

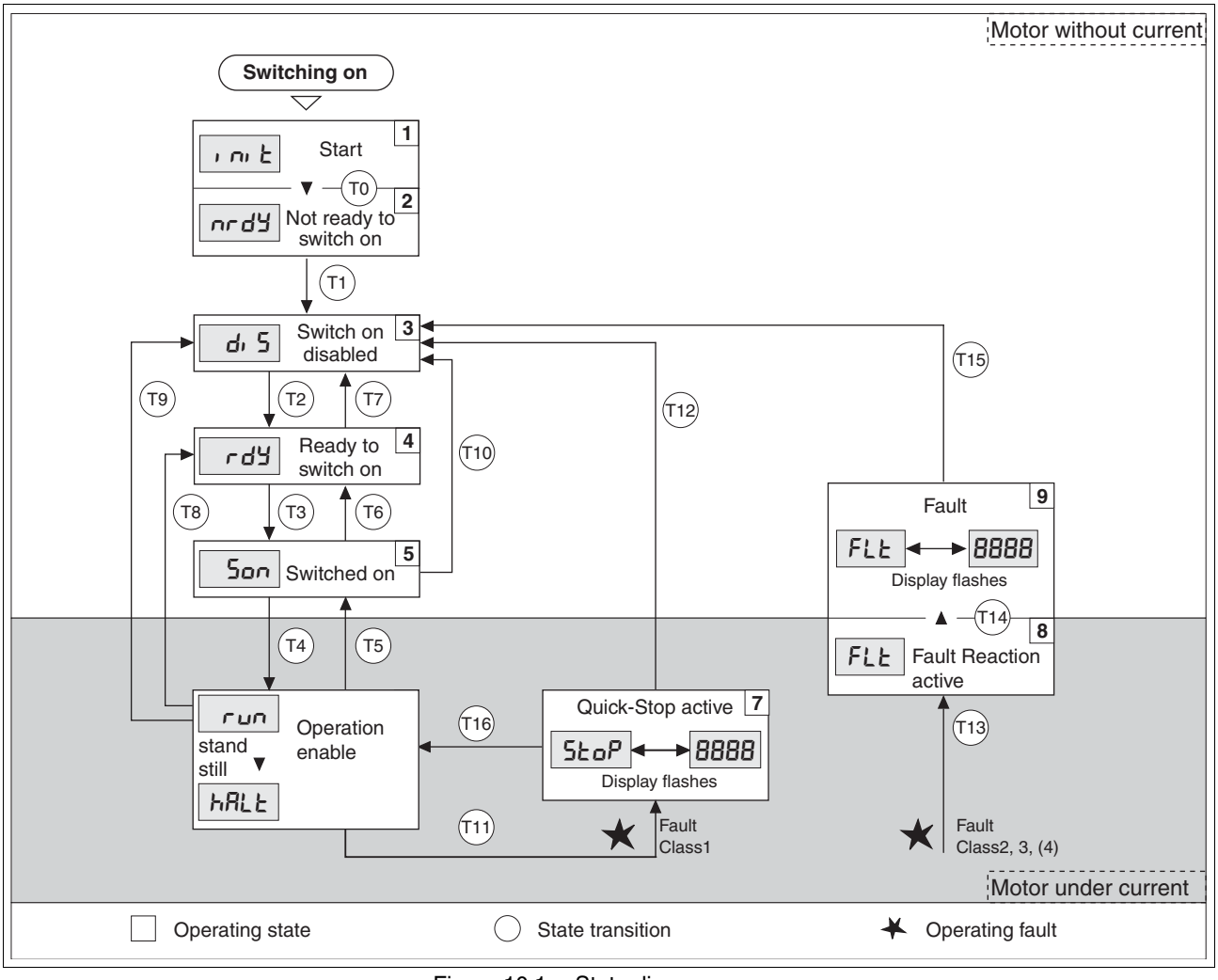


Figure 10.1 State diagram

Operating states The operating states are displayed as standard by the HMI and the commissioning software.

Display	Status	State description
init	**1** Start	Controller supply voltage, electronics is initialised
nrdy	**2**Not ready to switch on	The power amplifier is not ready to switch on
di S	**3**Switch on disabled	Switching on the power amplifier is disabled
rdy	**4**Ready to switch on	The power amplifier is ready to switch on
Son	**5**Switched on	Motor not under current Power amplifier ready No operating mode active
run hALt	**6**Operation enable	RUN: unit operates in the specified operating mode Halt: motor is stopped with power amplifier active
StoP	**7** Quick Stop active	"Quick Stop" is executed
FLt	**8** Fault Reaction active	Error detected, error response is enabled
FLt	**9**Fault	Unit is in fault condition

State transitions Status transitions are triggered by an input signal, a field bus command (with field bus control mode only) or as a response to a monitoring signal.

Transition	Operating state	Condition / result [1]	Response
T0	**1** -> **2**	• Motor speed below switch-on limit • Unit electronics successfully initialised	Check motor encoder
T1	**2** -> **3**	• First commissioning is completed	-
T2	**3** -> **4**	• Motor encoder check successful, DC-BUS voltage active, $\overline{\text{SAFE\_DISABLE}}$ = +24V, field bus command: shutdown [2]	-
T3	**4** -> **5**	• Field bus command: Switch On • Input signal: ENABLE 0 -> 1	
T4	**5** -> **6**	• Field bus command: Enable Operation	Switch on power amplifier. Motor phases, earthing, User parameters are checked Brake released
T5	**6** -> **5**	• Field bus command: Disable Operation • Input signal: ENABLE 1 -> 0	Interrupt task with "Hlt" Brake actuated Switch off power amplifier
T6	**5** -> **4**	• Field bus command: Shutdown	
T7	**4** -> **3**	• DC-BUS low voltage • $\overline{\text{SAFE\_DISABLE}}$ = 0V • Field bus command: Disable voltage	-
T8	**6** -> **4**	• Field bus command: Shutdown	Switch off power amplifier immediately
T9	**6** -> **3**	• Field bus command: Disable voltage	Switch off power amplifier immediately
T10	**5** -> **3**	• Field bus command: Disable voltage	
T11	**6** -> **7**	• Class 1 error • Field bus command: Quick Stop	Interrupt task with "Quick Stop"
T12	**7** -> **3**	• Field bus command: Disable voltage	Switch off power amplifier immediately, even if "Quick Stop" still active

ACC1MDADM00EN, V1.00, 01.2005

Trans-ition	Operating state	Condition / result [1]	Response
T13	**x** -> **8**	• Errors Class 2, 3 or 4	Error response is carried out, see "error response"
T14	**8** -> **9**	• Error response completed • Errors Class , 3 or 4	
T15	**9** -> **3**	• Field bus command: Fault Reset [3] • Input signal: FAULT_RESET 0 -> 1 [3]	Fault is reset
T16	**7** -> **6**	• Field bus command: Fault Reset [3] • Field bus command: Enable Operation [4] • Input signal: FAULT_RESET 0 -> 1 [3]	Local control mode: specified operating mode is automatically continued

1) It is sufficient to fulfil one point to trigger the status transition
2) Only required with field bus control mode, field bus CANopen and parameter DCOMcompatib = 1
3) Cause of error must be corrected
4) Only possible if operating status was triggered via field bus

10.3.2 Error display on HMI

State display uLoU The display shows uLoU (ULOW) when initialised. The voltage of the control supply is too low .

▶ Check the control supply.

State display nrdY The product persists in switch-on state nrdY (NRDY).

▶ After "First Setup", you need to switch the unit off and switch it on again.

▶ Check the installation.
If the installation is correct, then there is an internal fault. To diagnose, read the error memory using the commissioning software.
If you cannot resolve the fault yourself please contact your local sales partner.

State display di S If the product stops in state di S (DIS), the DC bus voltage is absent or the safety inputs SAFE_DISABLE_A and SAFE_DISABLE_B are not drawing current

▶ Check the following:

- Are the safety inputs SAFE_DISABLE_A and SAFE_DISABLE_B activated? If not required, these two inputs should be set to +24V.
- Check the installation of the analogue and digital signal connections. Pay particular attention to the minimum occupancy, see page 6.3.17 “Connection of digital inputs/outputs (CN1)“.
- Is the power supply to the power amplifier switched on and does the voltage correspond to the details in the technical data?

Special condition for units with CANopen field bus: Note the setting of the parameter DCOMcompatib in the case of units with field bus and CANopen controller mode. Depending upon the setting of this parameter, the unit remains in state di S after switching on.

State display FLt The display flashes alternately with FLt (FLT) and a 4 digit error number. The error number can also be found in the error memory list.

▶ Check especially:

- Is a suitable motor connected?
- Is the motor encoder cable correctly wired and connected? The unit cannot correctly start up the motor without a motor encoder signal.

Status display StoP The HMI displays StoP (STOP) when a "Quick Stop" has been triggered. This can be caused by a software stop, a hardware limit switch or by an error of error class 1.

▶ Remove the cause of the error and reset the error message.

STATE di SPLAY Udog The display shows Udog (WDOG) when initialised. The internal monitor has sensed a fault by means of the Watchdog.

▶ Contact the Technical Support of your local sales partner. Advise the peripheral conditions (operating mode, application event) when the fault occurs:

▶ The error can be reset by switching the unit off and on again.

Last cause of interruption Additional error information can be obtained from the menu points corresponding to the HMI codes in 11.2 “List of all parameters“ .

▶ Press the ENT button on the HMI to acknowledge the current error message.

▶ Change to the FLt menu. The last cause of interruption (Parameter _StopFault) is shown as an error number.

10.3.3 Error display with commissioning software

■ You will need a PC with the commissioning software and a functional connection to the product, see 6.3.18 “Connection to PC or peripheral control terminal (CN4)“ from page 6-47.

▶ Select “Diagnosis error memory“. A dialog box which displays the error messages appears.

ACC1MDADM00EN, V1.00, 01.2005

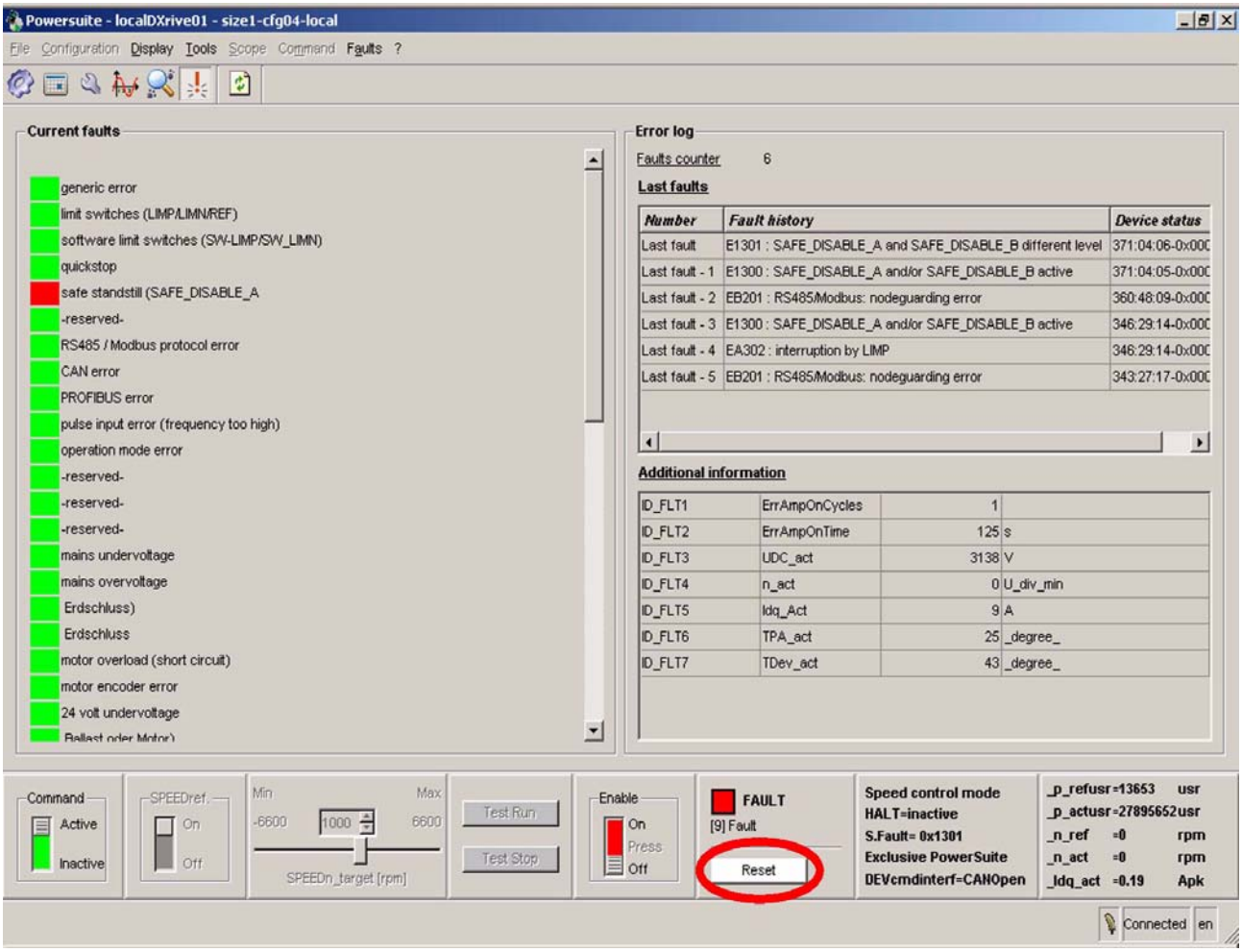


Figure 10.2 Error messages

The commissioning software shows a 4 digit error number in the list of the error memory with an "E" in front.

Error messages are displayed showing status, error class, time when error occurred and a short description. Under additional information you can verify the exact conditions when the "error occurred".

▶ Resolve the error and reset the current error message with the "reset" button in the command bar of the program.
In the case of class 4 errors, you will need to switch off the controller supply voltage and switch it on again.

10.3.4 Error display via field bus

Error display by status word

The error is first displayed via the parameter `DCOMstatus` . The display takes place by changing the operating state and setting the error bits Bit 13 x_err.

cause of last interruption

The parameter `_StopFault` allows read out of the error number and the last cause of interruption. As long as there is no error present, the value of this parameter will be 0. If an error occurs, the error, together with the further status information, is written to the error memory. In the case of subsequent errors, only the triggering cause of error is stored.

Error memory

The error memory is an error history of the last 10 errors and is maintained even if the unit is switched off. The following parameters allow the error memory to be controlled:

Parameter Name Code HMI menu, Code	Meaning	Unit Minimum value Default value Maximum value	Data type R/W per Expert	Parameter address via field bus
FLT_del_err -	Erase error memory() 1: delete all entries in the error memory The deletion process is completed when 0 is returned during reading.	 0 0 1	UINT16 R/W - -	CANopen 303B:4_h Modbus 15112
FLT_MemReset -	Reset the error memory read pointer() 1 : set error memory read indicator to oldest error entry.	 0 0 1	UINT16 R/W - -	CANopen 303B:5_h Modbus 15114

The error memory can only be read sequentially. The parameter `FLT_MemReset` must be used to reset the read pointer. Then the first error entry can be read. The read pointer is automatically moved on to the next entry, re-reading selects the next error entry. If the error number 0 is returned there is no error entry present.

Position of the entry	Description
1	1. error entry, oldest report
2	2. error entry, later report, if present
...	...
10	10. error entry. In the case of 10 error entries the most current error value is shown here

An individual error entry consists of several pieces of information which are read out using various parameters. When reading out an error entry, the error number must always be read out first with the parameter `FLT_err_num`.

Parameter Name Code HMI menu, Code	Meaning	Unit Minimum value Default value Maximum value	Data type R/W per Expert	Parameter address via field bus
FLT_err_num -	Error number() Reading this parameter brings the complete error entry (sub-index 1..11) into an intermediate memory from which all other sub-indices are subsequently read. In addition, the read indicator of the error memory is automatically switched forward to the next error entry.	 0 65535	UINT16 R/- - -	CANopen 303C:1_h Modbus 15362
FLT_class -	Error class() 0: warning (no response) 1: error (Quick Stop -> status 7) 2: error (Quick Stop -> status 8,9) 3: fatal error (status 9) 4: fatal error (status 9, cannot be acknowledged)	 0 4	UINT16 R/- - -	CANopen 303C:2_h Modbus 15364

ACC1MDADM00EN, V1.00, 01.2005

Parameter Name Code HMI menu, Code	Meaning	Unit Minimum value Default value Maximum value	Data type R/W per Expert	Parameter address via field bus
FLT_Time	Error time() referenced to the operating hours counter	s 0 536870911	UINT32 R/- - -	CANopen 303C:3_h Modbus 15366
FLT_Qual	Eror additional information() This entry contains additional information on the error depending on the error number Example: parameter address	0 65535	UINT16 R/- - -	CANopen 303C:4_h Modbus 15368

ACC1MDADM00EN, V1.00, 01.2005

10.4 Troubleshooting

10.4.1 Resolution of malfunctions

Malfunction	Cause	Correction
Motor not turning	Motor blocked by brake	Release brake, check wiring
Break in the motor cable	Check motor cable and connection. One or more motor phases are not connected.	
No torque	Set the parameters for max. current, max. speed to greater than zero	
Incorrect operating mode selected	Set the input signal and parameters for the operating mode you want	
Drive system switched off	Switch on drive system, generate release signal	
Analogue set value is missing	PLC program and wiring to be checked	
Motor phases reversed	Correct the sequence of the motor phases	
Motor mechanically blocked	Check ancillary units	
Current limit activated (analogue I/O or parameter)	Correct the current limit	
The motor jerks briefly	Motor phases reversed	Check motor cable and connection: connect motor phases U, V and W in the same way on the motor and unit sides
Motor vibrating	Amplification factor KP too high	reduce KP (speed controller)
Fault in the motor encoder system	Check motor encoder	
Reference potential for analogue signal missing	Connect reference potential of analogue signal to the set value source.	
Motor running too soft	Integration time TNn too high	Reduce Tn (speed controller)
Amplification factor KPn too low	Increase KPn (speed controller)	
Motor running too rough	Integration time TNn too low	Increase TNn (speed controller)
Amplification factor KPn too high	Reduce KPn (speed controller)	
Error message communication error	Drive system switched off	Switch on the drive system
Wiring fault	Check wiring	
Wrong PC interface selected	Select correct interface	

ACC1MDADM00EN, V1.00, 01.2005

10.4.2 Error resolution sorted by error bit

To provide improved visibility when troubleshooting, all error numbers are categorised with so-called error bits. The error bits can be read using the parameter `_SigLatched` . The signal state "1" marks an error or warning message.

Error bit	Description	Error class	Cause	Troubleshooting
0	General error	0		
1	Limit switch (LIMP/LIMN/ REF)	1	Limit switch is or was activated, wire interrupted	Traverse drive into movement zone, match positioning data to axis range, special message in error memory
2	Software limit switch (SW-LIMP/SW_LIMN)	1	Motor outside movement area	Check movement area, re-reference the drive
3	"Quick Stop" by field bus	1	field bus command	
4	Inputs for safe standstill are LOW.	3	Safe Standstill has been triggered	Check guard door, wiring
5	reserved			
6	Error in field bus RS485, modbus		Interruption of the field bus communication, only with RS485 e.g. modbus	Check communication cable, check field bus check communication parameters see also field bus manual
7	Error in field bus CANopen		Interruption in field bus communication, only with CANopen	Check communication cable, check field bus check communication parameters see also field bus manual
8	Fault in field bus Profibus	0	Interruption in field bus communication, only with Profibus	Check communication cable, check field bus check communication parameters see also field bus manual
9	Guide signals faulty (frequency too high)		frequency too high error	EMC measures, maintain maximum frequency (technical data)
10	Error in processing of the current operating mode	2	Processing error in electronic gearbox , reference movement or jog mode.	Detailed information see under additional information in the error memory
11..13	reserved			
14	DC-BUS low voltage	2	DC-Bus voltage under threshold value for "Quick Stop"	Check or increase mains voltage
		3	DC-Bus voltage under threshold for switch-off of the drive	Check for power failure
15	DC bus overvoltage	3	DC-Bus overvoltage, braking too fast	Extend braking, Apply external brake resistor
16	Power supply faulty (phase fault, earth fault)	par. [1)]	Short circuit or earth fault	Check fuse and installation
			Supply voltage connected incorrectly (e.g. 1-phase instead of 3-phase)	
17	Connection to motor (motor phase interrupted, earth fault, commutation)	3	Short circuit or earth fault in the motor wiring or encoder wiring.	Check connections, change motor cable or encoder cable.
			Motor faulty.	Change motor.
			External moment exceeds the motor moment (preset motor current too low).	Reduce external moment or increase the setting of the motor current.
18	Motor overload (phase current too high)	3	I^2t monitoring for motor	Reduce load, use a motor with a higher rated power

Error bit	Description	Error class	Cause	Troubleshooting
19	Encoder in motor signals error or connection to encoder faulty	3-4	No signal from the motor encoder, encoder faulty	Check encoder cable and encoder, replace cable
20	low voltage from controller supply		Controller supply voltage has fallen below the minimum value	Secure controller supply voltage. Check short-term voltage failures during load changes
21	Temperature too high (power amplifier, ballast, motor)	3	The power amplifier is overheating	Ventilator faulty or blocked, switch on time for peak current, reduce load or peak moment
			Motor is overheating Temperature sensor not connected	Allow motor to cool down, reduce load, use motor with greater nominal rating, temperature sensor faulty, check/change motor and encoder cables
22	Lag error	par. [1)] 1-3	Lag error	Reduce external load or acceleration, error response is adjustable via "Flt_pDiff“
23	Maximum speed exceeded		Exceeding the maximum motor speed during feed operations	Reduce vertical loading
24	Inputs for SAFE_DISABLE different	4	Interruption of the signal wiring	Signal cable/connection to be checked, check signal encoder or change
25..28	reserved			
29	error in EEPROM	3-4	Checksum in EEPROM incorrect	"Initial Setup" to be carried out, user parameters to be stored in the EEPROM, consult your local sales partner
30	system run-up faulty (hardware or parameter fault)	3-4	Cause of error in accordance with error display	Resolution dependent upon error display
31	Internal system fault (e.g. Watchdog)	4	Internal system error	Switch unit off and on, replace unit
			system error, e.g. division by 0 or time-out checks, inadequate EMC	Comply with EMC protective measures, switch unit off and on, contact your local service representative

1) par. = configurable

ACC1MDADM00EN, V1.00, 01.2005

10.5 Table of error numbers

The cause of error for each error message is coded as an error number and stored in the parameter FLT_err_num . The following table shows all the error numbers and their meaning If "par." is shown under the error class, then the error class is can be set as a parameter. Please note that in the HMI, the error number is shown without the preceding "E".

The error numbers are structured:

Error number	Error in area
E 1xxx	General error
E 2xxx	Excess current error
E 3xxx	Voltage error
E 4xxx	Temperature error
E 5xxx	Hardware error
E 6xxx	Software error
E 7xxx	Interface error, wiring fault
E 8xxx	Field bus error CANopen
E Axxx	Drive error, movement error
E Bxxx	Communication error

Information on error class can be found on page 10-1.
Information on error bits can be found on page 10-11.

Error number	Error class	Error bit	Meaning
E 1100	0	0	parameter out of permissible range
E 1101	0	0	parameter does not exist
E 1102	0	0	parameter does not exist
E 1103	0	0	parameter write not permissible (READ only)
E 1104	0	0	write access denied (no access authorisations)
E 1106	0	0	Command not allowed if output stage active
E 1107	0	0	Access via other interface blocked
E 1108	0	0	parameter not readable (Block Upload)
E 1109	0	0	power fail data invalid
E 110A	0	0	System error: boot loader not present
E 110B	3	30	Initialisation error (additional info=modbus-adr.)
E 1300	3	4	Safe Standstill triggered (SAFE_DISABLE_A, SAFE_DISABLE_B)
E 1301	4	24	SAFE_DISABLE_A and SAFE_DISABLE_B different level
E 1310	3	9	Guide signal frequency too high
E 1603	0	0	Capture memory occupied by other function
E 1606	0	0	Capture still active
E 1607	0	0	Trigger parameter for capture not defined
E 1608	0	0	Trigger option for trigger parameter not permitted
E 1609	0	0	No capture channel defined
E 160A	0	0	No capture data present

ACC1MDADM00EN, V1.00, 01.2005

Error number	Error class	Error bit	Meaning
E 160B	0	0	parameter not recordable
E 160C	1	0	Autotuning: moment of inertia outside permissible range
E 160E	1	0	Autotuning: Test movement could not be started
E 160F	1	0	Autotuning: Output stage cannot be activated
E 1610	1	0	Autotuning: Processing discontinued
E 1611	1	0	System error: Auto-Tuning internal write access
E 1612	1	0	System error: Auto-Tuning internal write access
E 1613	1	0	Autotuning: max. permissible positioning range exceeded
E 1614	0	0	Autotuning: already active
E 1617	1	0	Autotuning: Frictional or load moment too great
E 1618	1	0	Autotuning: optimisation aborted
E 1A00	0	0	System error: FIFO memory overflow
E 1A01	3	19	motor has been changed
E 1A02	3	19	motor has been changed
E 1B00	4	31	System error: Faulty parameter in motor or output stage
E 2300	3	18	power amplifier overcurrent
E 2301	3	18	ballast resistor overcurrent
E 3100	par.	16	mains power supply phase fault
E 3200	3	15	DC bus overvoltage
E 3201	3	14	DC bus low voltage (switch-off threshold)
E 3202	2	14	DC bus low voltage (Quick Stop threshold)
E 3203	4	19	Motor encoder supply voltage
E 3206	0	11	DC BUS low voltage (warning)
E 4100	3	21	Output stage excess temperature
E 4101	0	1	Power amplifier overtemperature warning
E 4102	0	4	Output stage overload (I^2t) warning
E 4200	3	21	Unit overtemperature
E 4300	3	21	Motor overtemperature
E 4301	0	2	Motor overtemperature warning
E 4302	0	5	Motor overload (I^2t) warning
E 4402	0	6	Ballast resistor overload (I^2t) warning
E 5200	4	19	No connection to the motor encoder
E 5201	4	19	errors in motor sensor communication
E 5202	4	19	Motor encoder is not supported
E 5203	4	19	No connection to the motor encoder
E 5204	3	19	Connection to motor encoder lost
E 5430	4	29	System error: EEPROM read error
E 5431	3	29	System error: EEPROM write error
E 5435	4	29	System error: EEPROM not formatted
E 5437	4	29	System error: EEPROM checksum error in manufacturer data

ACC1MDADM00EN, V1.00, 01.2005

Error number	Error class	Error bit	Meaning
E 5438	3	29	System error: EEPROM checksum error in user-defined parameter
E 5439	3	29	System error: EEPROM checksum error CAN parameter
E 543A	4	29	System error: EEPROM HardwareInfo invalid
E 543B	4	29	System error: EEPROM Manufacturer data invalid
E 543C	3	29	System error: EEPROM CAN-data invalid
E 543D	3	29	System error: EEPROM user parameter invalid
E 5600	3	17	motor connection phase error
E 5601	4	19	Interruption or faulty motor encoder signals
E 5602	4	19	Interruption or faulty motor encoder signals
E 5603	4	17	Commutation error
E 6107	0	0	Parameters outside value range (calculation error)
E 6108	0	0	Function not available
E 610D	0	0	Error in selection parameter
E 610F	4	30	System error: Internal time base failed (Timer0)
E 7120	4	19	Invalid motor data
E 7121	2	19	System error: errors in motor sensor communication
E 7122	4	30	Motor data not acceptable
E 7123	4	30	motor current offset outside permissible range
E 7124	4	19	System error: Motor encoder faulty
E 7200	4	30	System error: calibration of analogue/digital converter
E 7201	4	30	System error: motor sensor initialising (quadrant evaluation)
E 7327	4	19	System error: position sensor not ready
E 7328	4	19	Motor encoder sends: position capture errors
E 7329	0	8	Motor encoder sends: Warning
E 7330	4	19	System error: motor encoder (Hiperface)
E 7331	4	30	System error: Motor encoder initialisation
E 7333	4	30	System error: Discrepancy during calibration of analogue/digital converter
E 7334	3	30	System error: Analogue/digital converter offset too big
E 7335	0	8	Communication to motor encoder occupied
E 7400	0	31	System error: illegal interrupt (XINT2)
E 7500	0	9	RS485/Modbus: Overrun-error
E 7501	0	9	RS485/Modbus: Framing-error
E 7502	0	9	RS485/Modbus: Parity-error
E 7503	0	9	RS485/Modbus: Receive error
E 8110	0	7	CANopen: CAN overflow (message lost)
E 8120	0	7	CANopen: CAN Controller in Error Passive
E 8130	2	7	CANopen: Heartbeat or Life Guard error
E 8140	0	0	CANopen: CAN Controller was in Busoff, communication possible again
E 8141	2	7	CANopen: CAN Controller in Busoff
E 8201	0	7	CANopen: RxPdo1 could not be processed

ACC1MDADM00EN, V1.00, 01.2005

Error number	Error class	Error bit	Meaning
E 8202	0	7	CANopen: RxPdo2 could not be processed
E 8203	0	7	CANopen: RxPdo3 could not be processed
E 8204	0	7	CANopen: RxPdo4 could not be processed
E 8205	0	7	CANopen: TxPdo could not be processed
E 8206	0	7	CANopen: Internal queue overflow message lost
E A060	2	10	Calculation error with electronic gearbox
E A061	2	10	Change in reference value with electronic gearbox too great
E A300	0	0	Torque ramp with STOP current active
E A301	0	0	Drive in state 'QuickStopActive'
E A302	1	1	Interruption by LIMP
E A303	1	1	Interruption by LIMN
E A304	1	1	Interruption by REF
E A306	1	3	Interruption by user initiated software stop
E A307	0	0	Interruption by internal software stop
E A308	0	0	Drive in state 'Fault'
E A309	0	0	Drive not in state 'OperationEnable'
E A310	0	0	Power amplifier not active
E A312	0	0	Profile generation interrupted
E A313	0	0	Position over-run present (pos_over=1), thus reference point no longer defined (ref_ok=0)
E A314	0	0	No reference position
E A315	0	0	Referencing active
E A316	0	0	Overrun on acceleration calculation
E A317	0	0	Drive not at standstill
E A318	0	0	Operating mode active (x_end = 0)
E A319	1	2	Manual/Autotuning: distance range overflow
E A31A	0	0	Manual/Autotuning: amplitude/offset set too high
E A31B	0	0	STOP requested
E A31C	0	0	Illegal position setting with software limit switch
E A31D	0	0	Speed range exceeded (CTRL_n_max)
E A31E	1	2	Interruption by pos. software limit switch
E A31F	1	2	Interruption by neg. software limit switch
E A320	par.	22	position lag error
E A321	0	0	RS422 position interface not defined as input
E A324	1	10	Error when referencing (additional info = detailed error number)
E A325	1	10	Approach limit switch not activated
E A326	1	10	REF switch not found between LIMP and LIMN
E A327	1	10	Reference movement to REF without reversal of direction of rotation improper activation of limit switch LIM "
E A328	1	10	Reference movement to REF without reversal of direction of rotation, overrun of LIM or REF not permissible
E A329	1	10	More than one signal LIMP, LIMN, REF active

ACC1MDADM00EN, V1.00, 01.2005

Error number	Error class	Error bit	Meaning
E A32A	1	10	Ext. monitoring signal LIMP with neg. direction of rotation
E A32B	1	10	Ext. monitoring signal LIMN with pos. direction of rotation
E A32C	1	10	Reference movement error at REF (e.g. by impact)
E A32D	1	10	Reference movement error at LIMP (e.g. by impact)
E A32E	1	10	Reference movement error at LIMN (e.g. by impact)
E A32F	1	10	Index pulse not found
E A330	0	0	Reproducibility of the index pulse movement uncertain, index pulse too close to the switch
E A331	3	0	No run-up operating mode with local control selected
E A332	1	10	Error with manual movement (additional info = detailed error number)
E A334	2	0	Timeout at Standstill window monitor
E A335	1	10	Processing only possible in field bus operation
E B100	0	9	RS485/Modbus: unknown service
E B200	0	9	RS485/Modbus: Protocol error
E B201	2	6	RS485/Modbus: Nodeguard error
E B202	0	9	RS485/Modbus: Nodeguard Warning
E B203	0	9	RS485/Modbus: number of monitor objects incorrect
E B204	0	9	RS485/Modbus: service too long

ACC1MDADM00EN, V1.00, 01.2005

ACC1MDADM00EN, V1.00, 01.2005

11 Parameters

11.1 Representation of the parameters

The parameter display contains, on the one hand, information which is needed for positive identification of a parameter. On the other hand, the parameter display can also provide information on setting options, presets and parameter properties.

A parameter display has the following features:

Parameter Name **Code** **HMI menu, Code**	**Meaning**	**Unit** **Minimum value** **Default value** **Maximum value**	**Data type** **R/W** **per** **Expert**	**Parameter address via field bus**
Beispiel_Name BSPI NONE-bSPI	Example parameter (cross-reference) Details and selection values **1 / selection value1 / WRT1**: declaration 1 **2 / selection value2 / WRT2**: declaration 2	A_{pk} 0.00 3.00 300.00 **Field bus** 0 300 30000	UINT16 R/W per. -	CANopen 1234:5_h Modbus 1234

The most important terms in the heading line of a parameter table are explained in the following.

Parameter Name The parameter name is displayed with the commissioning software in the "Designation" column.

Code and HMI Code The Code is represented on a 7 segment display on the HMI (HMI-Code).

Default values Factory settings.

Data type The data type determines the valid range of values, especially when a parameter does not have explicit minimum and maximum values.

Data type	Byte	Min value	Max value
INT16	2 Byte / 16 Bit	-32768	32767
UINT16	2 Byte / 16 Bit	0	65535
INT32	4 Byte / 32 Bit	-2147483648	2147483647
UINT32	4 Byte / 32 Bit	0	4294967295

R/W Note on reading and writing the values
"R/-" values are read-only
"R/W" values are read and write.

per. Designation of whether the value of the parameter is persistent, i.e. after switching off the unit it is retained in the memory. When entering via HMI the unit stores the value of the parameter automatically at each change. When changing a value via commissioning software or field bus, the user must explicitly store the value change in the persistent memory.

Cross reference If there is more information available for these parameters you can find this under this cross-reference.

ACC1MDADM00EN, V1.00, 01.2005

Selection values

In the case of parameters which offer a selection of settings, the selection number and the designation of the value when inputting with commissioning software and HMI are quoted. Example:
1 / pos-neg-home / pnh: Explanation

Instructions on inputting values

The maximum value corresponds to the relatively smaller maximum value of output stage or motor. The unit automatically limits to the smaller value.

Use the details which are applicable to the type of control being used (local or field bus).

Setting parameters with	Specifications
Field bus	Parameter name
HMI	HMI code
Commissioning software	Code

Please note that the parameter values in the case of field bus controller operating mode are shown without decimal point, e.g.

- For local controller operating mode:
  Max. value = 327.67
- For field bus controller operating mode(=Fieldbus):
  Max. value = 32767

ACC1MDADM00EN, V1.00, 01.2005

11.2 List of all parameters

Parameter Name Code HMI menu, Code	Meaning	Unit Minimum value Default value Maximum value	Data type R/W per Expert	Parameter address via field bus
_acc_pref -	Acceleration of setpoint generation(8-43) Sign corresponding to the change in the speed quantity: increase in speed: pos. sign reduction in speed: neg. sign	rpm*s	INT32 R/- - -	
_AccessInfo -	Current access channels for action objects(8-2) Low byte : 0 : assigned by channel in high byte 1 : exclusively assigned by channel in high byte High byte: current assignment of access channel 0: reserved 1: IO 2: HMI 3: Modbus 4: CANopen 5: CANopen via second SDO channel		UINT16 R/- - -	CANopen 3001:C_h Modbus 280
_actionStatus -	Action word(8-46) Signal state: 0: not enabled 1: enabled Bit0: error class 0 Bit1: error class 1 Bit2: error class 2 Bit3: error class 3 Bit4: error class 4 Bit5: reserved Bit6: drive at standstill: actual speed _n_act < <9 rpm Bit7: drive rotating clockwise Bit8: drive rotating anticlockwise Bit9: drive inside position window (pwin) Bit10: reserved Bit11: profile generator stopped: setpoint speed is 0 Bit12: profile generator decelerating Bit13: profile generator accelerating Bit14: profile generator at constant speed Bit15: reserved		UINT16 R/- - -	CANopen 301C:4_h Modbus 7176
_DCOMopmd_act -	active operating mode() DSP402 operating modes: 1 : profile position 3 : profile velocity 6 : homing ---------- manufacturer operating modes: -1 : jog -2 : electronic gear -3 : current control -4 : speed control	-6 6	INT16 R/- - -	CANopen 6061:0_h Modbus 6920

Parameter Name Code HMI menu, Code	Meaning	Unit Minimum value Default value Maximum value	Data type R/W per Expert	Parameter address via field bus
_I2t_act_M -	Overload motor current(8-46)	% 	INT16 R/- - -	CANopen 301C:19$_h$ Modbus 7218
_I2t_act_PA -	Overload power amplifier current(8-46)	% 	INT16 R/- - -	CANopen 301C:16$_h$ Modbus 7212
_I2t_mean_M I2TM STA-, 2tM	Loading factor motor(8-46)	% 	INT16 R/- - -	CANopen 301C:1A$_h$ Modbus 7220
_I2t_mean_PA I2TP STA-, 2tP	Loading factor power amplifier (8-46)	% 	INT16 R/- - -	CANopen 301C:17$_h$ Modbus 7214
_I2t_peak_BAL -	Overload load maximum value(8-46) Maximum overload ballast that has occurred in the last 10 sec.	% 	INT16 R/- - -	CANopen 301C:15$_h$ Modbus 7210
_I2t_peak_M -	Overload motor maximum value(8-46) Maximum overload motor that has occurred in the last 10 sec.	% 	INT16 R/- - -	CANopen 301C:1B$_h$ Modbus 7222
_I2t_peak_PA -	Overload power amplifier maximum value(8-46) Maximum overload power amplifier that has occurred in the last 10 sec.	% 	INT16 R/- - -	CANopen 301C:18$_h$ Modbus 7216
_I2tl_act_BAL -	Overload load current(8-46)	% 	INT16 R/- - -	CANopen 301C:13$_h$ Modbus 7206
_I2tl_mean_BAL I2TB STA-, 2tb	Loading factor load(8-46)	% 	INT16 R/- - -	CANopen 301C:14$_h$ Modbus 7208
_Id_act -	current motor current d-components()	A_{pk} 0.00 0.00 0.00	INT16 R/- - -	CANopen 301E:2$_h$ Modbus 7684
_Id_ref -	Set motor current d component (field weakening)()	A_{pk} 0.00 0.00 0.00	INT16 R/- - -	CANopen 301E:11$_h$ Modbus 7714
_Idq_act IACT STA-, ACt	Total motor current (vector sum of d and q components() Total motor current (vector sum of d and q components	A_{pk} 0.00 0.00 0.00	INT16 R/- - -	CANopen 301E:3$_h$ Modbus 7686

ACC1MDADM00EN, V1.00, 01.2005

Parameter Name Code HMI menu, Code	Meaning	Unit Minimum value Default value Maximum value	Data type R/W per Expert	Parameter address via field bus
_IO_act IOAC STA-, oRC -	Status of digital inputs and outputs(7-22) Assignment 24 V inputs: bit x: 'local control mode'/ 'field bus control mode') bit 0: - / REF Bit 1: FAULT_RESET / LIMN Bit 2: ENABLE / LIMP Bit 3: HALT Bit 4: STANDSTILL_B Bit 5: STANDSTILL_A Bit 6: ENABLE2 / - Bit 7: reserved Bit 6 represents the ENABLE under the following conditions only: DEVcmdinterf = IODevice and IOposInterfac = PDinput Assignment 24 V outputs: Bit 8: NO_FAULT Bit 9: ACTIVE	0 65535	UINT16 R/- - -	CANopen 3008:1$_h$ Modbus 2050
_Iq_act - -	current motor current q-components()	A_{pk} 0.00 0.00 0.00	INT16 R/- - -	CANopen 301E:1$_h$ Modbus 7682
_Iq_ref IQRF STA-, 9rF -	Set motor current q component (torque-creating)()	A_{pk} 0.00 0.00 0.00	INT16 R/- - -	CANopen 301E:10$_h$ Modbus 7712
_LastWarning - -	Last warning as number() Number of the last warning generated. If the warning becomes inactive again, the number is retained until the next fault reset. Value 0: no warning occurred		UINT16 R/- - -	CANopen 301C:9$_h$ Modbus 7186
_n_act NACT STA-nRCt -	Actual speed of the motor(8-43)	rpm	INT16 R/- - -	CANopen 606C:0$_h$ Modbus 7696
_n_actRAMP - -	Actual speed of the movement profile encoder(8-43)	rpm	INT32 R/- - -	CANopen 606B:0$_h$ Modbus 7948
_n_pref - -	Speed of setpoint generation()	rpm	INT32 R/- - -	CANopen 301F:7$_h$ Modbus 7950
_n_ref - -	Reference speed of the speed controller(8-43)	rpm	INT16 R/- - -	CANopen 301E:7$_h$ Modbus 7694

Parameter Name Code HMI menu, Code	Meaning	Unit Minimum value Default value Maximum value	Data type R/W per Expert	Parameter address via field bus
_n_targetRAMP -	Target speed of the movement profile encoder(8-43)	rpm	INT32 R/- - -	CANopen 301F:5$_h$ Modbus 7946
_OpHours OPH STA-oPh	Operating hours counter()	s	UINT32 R/- - -	CANopen 301C:A$_h$ Modbus 7188
_p_absmodulo -	Absolute position referenced to one motor revolution()	Inc	UINT32 R/- - -	CANopen 301E:E$_h$ Modbus 7708
_p_act -	Actual motor position()	Inc	INT32 R/- - -	CANopen 6063:0$_h$ Modbus 7700
_p_actPosintf -	Actual position at position interface() Counted increments at pulse input. Requirement: IOposInterfac = Pdinput or Abinput	Inc -2147483648 2147483647	INT32 R/- - -	CANopen 3008:5$_h$ Modbus 2058
_p_actusr PACU STA-PRCu	Actual position of the motor in user units(8-43)	usr	INT32 R/- - -	CANopen 6064:0$_h$ Modbus 7706
_p_actRAMPusr -	Actual position of the movement profile encoder(8-43)	usr	INT32 R/- - -	CANopen 301F:2$_h$ Modbus 7940
_p_addGEAR -	Start position of electronic gearbox(8-22) With an inactive gearbox the setpoint position can be calculated here at the position controller that was set when the gearbox was enabled with the selection 'Synchronisation with compensation motion'.	Inc	INT32 R/- - -	CANopen 301F:3$_h$ Modbus 7942
_p_dif PDIF STA-Pd, F	Current regulation variation of the position regulator(8-43) in 1/10000 revolutions. Actual rule deviation between setpoint and actual position, i.e. without consideration of any dynamic components. Note: different from SPV_p_maxDiff	U -214748.3648 0.0000 214748.3647 **Field bus** -2147483648 2147483647	INT32 R/- - -	CANopen 60F4:0$_h$ Modbus 7716
_p_DifPeak -	Value of max. reached lag errors of the position regulator() The lag error is the current position regulation offset minus the speed-dependent position regulation offset. Further information see SPV_p_maxDiff. A write operation resets the value again.	U 0.0000 0.0000 429496.7295 **Field bus** 0 0 4294967295	UINT32 R/W - -	CANopen 3011:F$_h$ Modbus 4382

ACC1MDADM00EN, V1.00, 01.2005

Parameter Name Code HMI menu, Code	Meaning	Unit Minimum value Default value Maximum value	Data type R/W per Expert	Parameter address via field bus
_p_ref -	Setpoint of the position regulator()	Inc	INT32 R/- - -	CANopen 301E:9_h Modbus 7698
_p_refusr -	Setpoint of the position regulator in user units(8-43)	usr	INT32 R/- - -	CANopen 301:C_h Modbus 7704
_p_tarRAMPusr -	Target position of the movement profile generator(8-43) Absolute position value of the profile generator calculated from transferred relative and absolute position values.	usr	INT32 R/- - -	CANopen 301F:1_h Modbus 7938
_Power_act -	current output power()	W	INT16 R/- - -	CANopen 301C:D_h Modbus 7194
_Power_mean -	average output power()	W	INT16 R/- - -	CANopen 301C:E_h Modbus 7196
_prgNoDEV _PNR INF--Pnr	Firmware program number() Example: PR840.1 Value entered in decimal as: 8401	0.0 0.0 0.0	UINT16 R/W - -	CANopen 3001:1_h Modbus 258
_prgVerDEV _PVR INF--PVr	Firmware version() Example.: V4.201 Value is entered in decimal: 4201	0.000 0.000 0.000	UINT16 R/W - -	CANopen 3001:2_h Modbus 260
_serialNoDEV -	Unit serial number() Serial number: unique number for identification of the product	0 4294967295	UINT32 R/W per. -	CANopen 3001:17_h Modbus 302
_SigActive -	Current state of the monitoring signals(8-46) Meaning see _SigLatched		UINT32 R/- - -	CANopen 301C:7_h Modbus 7182

ACC1MDADM00EN, V1.00, 01.2005

Parameter Name Code HMI menu, Code	Meaning	Unit Minimum value Default value Maximum value	Data type R/W per Expert	Parameter address via field bus
_SigLatched SIGS STA-SI, GS	Stored state of the monitoring signals(8-46) Signal state: 0: not enabled 1: enabled Bit assignment: Bit0: general error Bit1: limit switch (LIMP/LIMN/REF) Bit2 software limit switch (SW-LIMP/ SW_LIMN) Bit3. Quick Stop via field bus Bit4. Inputs for safe standstill are 0 Bit6. Fault field bus RS485 Bit7. Fault field bus CAN Bit8. Fault field bus Profibus Bit9. Fault pulse input (frequency too high) Bit10. Fault in current operating mode Bit14. Low voltage DC bus Bit15. Excess voltage DC bus Bit16. Power amplifier supply voltage faulty (phase fault, earth fault) Bit17. Connection to motor faulty Bit18. Motor excess current/short circuit Bit19. Fault motor encoder or connection Bit20. Under voltage 24 Volt supply Bit21. Temperature too high (power amplifier, ballast, motor) Bit22. Lag error Bit23. Maximum speed exceeded Bit24. Inputs for safe standstill are different Bit29. Fault in EEPROM Bit30. Fault system run-up (hardware or parameter fault) Bit31. Internal system fault (e.g. Watchdog)		UINT32 R/- - -	CANopen 301C:8_h Modbus 7184
_StopFault STPF FLT-STPF	Fault number of the last interruption cause(10-3)		UINT16 R/- - -	CANopen 603F:0_h Modbus 7178
_Temp_act_DEV TDEV STA-TdEV	Unit temperature(8-46)	°C	INT16 R/- - -	CANopen 301C:12_h Modbus 7204
_Temp_act_M -	Temperature motor(8-46)	°C	INT16 R/- - -	CANopen 301C:11_h Modbus 7202
_Temp_act_PA TPA STA-TPA	Temperature of the power amplifier(8-46)	°C	INT16 R/- - -	CANopen 301C:10_h Modbus 7200
_Ud_ref -	Set motor voltage d-components()	V 0.0 0.0 0.0	INT16 R/- - -	CANopen 301E:5_h Modbus 7690

ACC1MDADM00EN, V1.00, 01.2005

Parameter Name Code HMI menu, Code	Meaning	Unit Minimum value Default value Maximum value	Data type R/W per Expert	Parameter address via field bus
_UDC_act UDCA STA-udCR	DC bus voltage of the power amplifier supply voltage()	V 0.0 0.0 0.0	UINT16 R/- - -	CANopen 301C:F_h Modbus 7198
_Udq_ref - -	Total motor current (vector sum of d and q components() Total motor current (vector sum of d and q components	V 0.0 0.0 0.0	INT16 R/- - -	
_Uq_ref - -	Set motor voltage q-components()	V 0.0 0.0 0.0	INT16 R/- - -	CANopen 301E:4_h Modbus 7688
_v_act_Posintf - -	Actual speed at position interface() Corresponds to frequency of the signal at the pulse input. Requirement: IOposInterfac = Pdinput or Abinput	Inc/s -2147483648 2147483647	INT32 R/- - -	CANopen 3008:6_h Modbus 2060
_WarnActive - -	Active warnings bit-coded(8-46) Meaning of Bits see _WarnLatched		UINT16 R/- - -	CANopen 301C:B_h Modbus 7190
_WarnLatched WRNS STA-WrnS	Stored warnings bit-coded(8-46) Stored warning bits are erased in the event of a FaultReset. Signal state: 0: not enabled 1: enabled Bit assignment: Bit 0: general warning Bit 1: temperature of power amplifier high Bit 2: temperature of motor high Bit 3: reserved Bit 4: power amplifier overloaded Bit 5: motor overloaded Bit 6: ballast resistor overloaded Bit 7: CAN warning Bit 8: motor encoder warning Bit 9: RS485 protocol warning Bit 10: SAFE_DISABLE_A and/or SAFE_DISABLE_B Bit 11: DC Bus undervoltage		UINT16 R/- - -	CANopen 301C:C_h Modbus 7192
AccessLock - -	Blocking of other access channels(8-2) 0: enable other access channels 1: block other access channels The field bus can use this parameter to block active access to the unit for the following access channels: - commissioning tool - HMI - a second field bus Processing of the input signals (e.g. Halt input) cannot be blocked.	0 0 1	UINT16 R/W - -	CANopen 3001:$1E_h$ Modbus 316

Parameter Name Code HMI menu, Code	Meaning	Unit Minimum value Default value Maximum value	Data type R/W per Expert	Parameter address via field bus
ANA1_act A1AC STA-R IRC	Voltage value analogue input ANA1(7-21)	mV -10000 10000	INT16 R/- - -	CANopen 3009:1$_h$ Modbus 2306
ANA1_I_scale A1IS SET-R I. S	Scaling ANA1 for set current at +10V(8-16) Default value is the lesser value from ImaxM or ImaxPA With a neg. sign an inversion of the evaluation of the analogue signal can be conducted	A_{pk} -300.00 3.00 300.00 **Field bus** -30000 300 30000	INT16 R/W per. -	CANopen 3020:3$_h$ Modbus 8198
ANA1_n_scale A1NS SET-R InS	Scaling ANA1 for reference speed at +10V(8-19) The internal max. speed is limited to the current setting in CTRL_n_max With neg. sign an inversion of the evaluation of the analogue signal can be conducted	r.p.m. -30000 3000 30000	INT16 R/W per. -	CANopen 3021:3$_h$ Modbus 8454
ANA1_win A1WN SET-R IWn	Zero voltage window on analogue input ANA1(7-21) Absolute value up to which an input voltage value is interpreted as 0 V Example: setting 20 mV ->range of -20 .. +20mV is interpreted as 0mV	mV 0 0 1000	UINT16 R/W per. -	CANopen 3009:9$_h$ Modbus 2322
ANA2_act A2AC STA-R2RC	Voltage value analogue input ANA2(7-21)	mV -10000 10000	INT16 R/- - -	CANopen 3009:5$_h$ Modbus 2314
ANA2_I_max A2IM DRC-R2. I	Scaling for current limiting by ANA2 at +10V(7-16) Default value is lower value from ImaxM or ImaxPA	A_{pk} 0.00 0.00 300.00 **Field bus** 0 30000	UINT16 R/W per. -	CANopen 3012:C$_h$ Modbus 4632
ANA2_n_max A2NM DRC-R2nM	Scaling for speed limiting by ANA2 at +10V(7-16) Default value is maximum motor speed M_n_max.	rpm 500 30000	UINT16 R/W per. -	CANopen 3012:D$_h$ Modbus 4634
ANA2LimMode A2MO DRC-R2Mo	Selection of limit by ANA2(7-16) **0 / none**: no limit **1 / Current Limitation / CURR**: limit current setpoint at current controller (limit value at 10 V in ANA2_I_max) **2 / Speed Limitation / SPED**: limit of setpoint speed value at speed controller (limit value at 10V in ANA2_n_max)	 0 0 2	UINT16 R/W per. -	CANopen 3012:B$_h$ Modbus 4630

ACC1MDADM00EN, V1.00, 01.2005

Parameter Name Code HMI menu, Code	Meaning	Unit Minimum value Default value Maximum value	Data type R/W per Expert	Parameter address via field bus
AT_dir DIR TUN-dir	Direction of rotation autotuning(7-29) **1 / pos-neg-home / pnh**: clockwise direction only then negative direction with return to initial position **2 / neg-pos-home / nph**: first anticlockwise direction then clockwise direction with return to initial position **3 / pos-home / p-h**: clockwise direction only with return to initial position **4 / pos / p--**: clockwise direction only without return to initial position **5 / neg-home / n-h**: anticlockwise direction only with return **6 / neg / n--**: anticlockwise direction without return to initial position	 1 1 6	UINT16 R/W - -	CANopen 302F:4_h Modbus 12040
AT_dismax DIST TUN-dist	Movement range autotuning(7-29) Range in which the automatic optimisation processes of the controller parameters are run. The range is input relative to the current position. Default value = 1 motor revolution. Values from 0.1 to 0.9 are not permissible. CAUTION: value 0 switches monitoring off.	U 0.0 1.0 999.9 **Field bus** 0 10 9999	UINT32 R/W - -	CANopen 302F:3_h Modbus 12038
AT_gain GAIN TUN-GAin	Adapting controller parameters (tighter/looser)(7-30) Measure of the degree of tightness of the regulation. The value 100 represents the theoretical optimum. Values larger than 100 mean that the regulation is tighter and smaller values mean that the regulation is looser.	%	UINT16 R/W - -	CANopen 302F:A_h Modbus 12052
AT_J -	Inertia of the entire system(7-30) is calculated automatically during the autotuning process	kg cm^2 0.0 0.0 0.0	UINT16 R/W per. -	CANopen 302F:C_h Modbus 12056
AT_mechanics MECH TUN-MECh	System coupling type(7-29) 1: direct coupling (J ext. to J motor <<3:1) 2: flexible coupling () 3: flexible coupling (short toothed belt) 4: flexible coupling () 5: high-flexibility coupling (J ext. to J motor >10:1, linear axis)	 1 1 5	UINT16 R/W - -	CANopen 302F:E_h Modbus 12060
AT_n_ref NREF TUN-nrEF	Speed when auto-tuning()	r.p.m. 10 100 1000	UINT16 R/W - -	CANopen 302F:6_h Modbus 12044
AT_progress -	Autotuning progress(7-30)	% 0 0 100	UINT16 R/- - -	CANopen 302F:B_h Modbus 12054

Parameter Name Code HMI menu, Code	Meaning	Unit Minimum value Default value Maximum value	Data type R/W per Expert	Parameter address via field bus
AT_start -	Start Autotuning(7-29) 0: Stop 1: Enable	 0 0 1	UINT16 R/W - -	CANopen 302F:1$_h$ Modbus 12034
AT_state -	Autotuning status(7-30) Bit 15: auto_tune_err Bit 14: auto_tune_end Bit 13: auto_tune_process Bit 10..0: last processing step	 0 65535	UINT16 R/- - -	CANopen 302F:2$_h$ Modbus 12036
AT_wait WAIT TUN-tAit	Waiting time between autotuning steps(7-30)	ms 300 1200 10000	UINT16 R/W - -	CANopen 302F:9$_h$ Modbus 12050
BALext_P -	Rated power of external ballast resistor(7-16)	W 1 30 32767	UINT16 R/W per. -	CANopen 3005:12$_h$ Modbus 1316
BALext_R -	Resistance value of external ballast resistor(7-16)	Ω 0.01 47.00 327.67 **Field bus** 1 4700 32767	UINT16 R/W per. -	CANopen 3005:13$_h$ Modbus 1318
BALext_ton -	max. permissible switch-in time for external ballast resistor()	ms 1 11 5000	UINT16 R/W per. -	CANopen 3005:11$_h$ Modbus 1314
BALint_ext -	Ballast control(7-16) **0 / internal**: internal ballast resistor **1 / external**: external ballast resistor	 0 0 1	UINT16 R/W per. -	CANopen 3005:9$_h$ Modbus 1298
BALint_P -	Rated power of internal ballast resistor()	W	UINT16 R/- per. -	CANopen 3010:9$_h$ Modbus 4114
BALint_R -	Internal ballast resistor() in 10 mOhm steps	Ω	UINT16 R/- per. -	CANopen 3010:8$_h$ Modbus 4112
BRK_trelease BTRE DRC-btrE	Time delay when opening/release of brake(8-62)	ms 0 0 1000	UINT16 R/W per. -	CANopen 3005:7$_h$ Modbus 1294
BRK_tclose BTCL DRC-btCL	Time delay when closing the brake(8-62)	ms 0 0 1000	UINT16 R/W per. -	CANopen 3005:8$_h$ Modbus 1296

ACC1MDADM00EN, V1.00, 01.2005

Parameter Name Code HMI menu, Code	Meaning	Unit Minimum value Default value Maximum value	Data type R/W per Expert	Parameter address via field bus
CANadr COAD COM-CoAd	CANopen address (node number)(7-10) valid addresses (node numbers): 1 to 127	 1 127 127	UINT16 R/W per. -	
CANbaud COBD COM-Cobd	CANopen baud rate(7-10) valid baud rates in kbps: 50 125 250 500 1000	kbps 50 125 1000	UINT16 R/W per. -	
CTRL_I_max IMAX SET-, MAX	Current limiting(7-16) Must not exceed max. permissible current of motor or power amplifier. Default is the smallest value of M_I_nom and PA_I_nom	A_{pk} 0.00 0.00 299.99 **Field bus** 0 29999	UINT16 R/W per. -	CANopen 3012:1$_h$ Modbus 4610
CTRL_KFDn - 	Speed regulator pre-control D factor() 	A s r.p.ms 0.0000000 0.0000000 0.0003175 **Field bus** 0 0 3175	UINT16 R/W per. expert	CANopen 3012:5$_h$ Modbus 4618
CTRL_KFPp - 	Speed pre-control position regulator() Over-control up to 110% possible. 	% 0.0 0.0 110.0 **Field bus** 0 0 1100	UINT16 R/W per. -	CANopen 3012:8$_h$ Modbus 4624
CTRL_KPid - 	Current controller longitudinal (d) P factor() Is calculated from motor parameters. 	V/A 0.0 0.5 1270.0 **Field bus** 5 12700	UINT16 R/W per. -	CANopen 3011:1$_h$ Modbus 4354
CTRL_KPiq - 	Current controller transverse (q) P factor() Is calculated from motor parameters. 	V/A 0.0 0.5 1270.0 **Field bus** 5 12700	UINT16 R/W per. -	CANopen 3011:3$_h$ Modbus 4358

Parameter Name Code HMI menu, Code	Meaning	Unit Minimum value Default value Maximum value	Data type R/W per Expert	Parameter address via field bus
CTRL_KPn -	Speed controller P-factor(7-34) Default value is calculated from motor parameters	Amin/rev 0.0010 0.0000 1.2700 **Field bus** 10 12700	UINT16 R/W per. -	CANopen 3012:3$_h$ Modbus 4614
CTRL_KPp -	Position controller P-factor(7-38)	1/s 2.0 0.0 495.0 **Field bus** 20 4950	UINT16 R/W per. -	CANopen 3012:6$_h$ Modbus 4620
CTRL_n_max NMAX SET-nMAX	Speed limiter(7-16) Must not exceed max. rpm of motor Default is M_n_max	rpm 0 13200	UINT16 R/W per. -	CANopen 3012:2$_h$ Modbus 4612
CTRL_TAUnref -	Filter time constant reference value filter of the reference speed value(7-34)	ms 0.00 9.00 327.67 **Field bus** 0 900 32767	UINT16 R/W per. -	CANopen 3012:9$_h$ Modbus 4626
CTRL_TNid -	Current controller longitudinal (d) setting time() Is calculated from motor parameters.	ms 0.13 0.00 327.67 **Field bus** 13 32767	UINT16 R/W per. -	CANopen 3011:2$_h$ Modbus 4356
CTRL_TNiq -	Current controller lateral (q) setting time() Is calculated from motor parameters.	ms 0.13 0.00 327.67 **Field bus** 13 32767	UINT16 R/W per. -	CANopen 3011:4$_h$ Modbus 4360
CTRL_TNn -	Speed controller correction time(7-34)	ms 0.00 9.00 327.67 **Field bus** 0 900 32767	UINT16 R/W per. -	CANopen 3012:4$_h$ Modbus 4616

ACC1MDADM00EN, V1.00, 01.2005

Parameter Name Code HMI menu, Code	Meaning	Unit Minimum value Default value Maximum value	Data type R/W per Expert	Parameter address via field bus
CUR_I_target -	Setpoint current in current control operating mode(8-16) For this purpose, the operating mode current control must be activated by pre-setting on the parameter.	A_{pk} -300.00 0.00 300.00 **Field bus** -30000 0 30000	INT16 R/W - -	CANopen 3020:4_h Modbus 8200
CURreference -	Selection of setpoint source for current control operating mode(8-16) 0: none 1: reference value over +/-10 V interface ANA1 2: reference value over parameter CUR_I_target	 0 0 2	UINT16 R/W - -	CANopen 301B:10_h Modbus 6944
DCOMcompatib -	DriveCom status machine: status transition 3->4(8-4) Determines the transition between the SwitchOnDisabled (3) and ReadyTo-SwitchOn (4) states in CANopen units. If not CANopen, this value is ignored! 0 = automatic (state transition takes place automatically) 1 = standard conform (state transition must be controlled by field bus)	 0 0 1	UINT16 R/W per. -	CANopen 301B:13_h Modbus 6950
DCOMcontrol -	Drivecom control word(8-4) Bit coding see Operation section, operating states 0: Switch on 1: Enable Voltage 2: Quick Stop 3: Enable Operation 4..6: op. Mode specific 7: Fault Reset 8: Halt 9..15: reserved		UINT16 R/W - -	CANopen 6040:0_h Modbus 6914
DCOMopmode -	Operating mode() DSP402 operating modes: 1 : profile position 3 : profile velocity 6 : homing --- manufacturer operating modes: -1 : jog -2 : electronic gear -3 : current control -4 : speed control	 -6 6	INT16 R/W - -	CANopen 6060:0_h Modbus 6918

Parameter Name Code HMI menu, Code	Meaning	Unit Minimum value Default value Maximum value	Data type R/W per Expert	Parameter address via field bus
DCOMstatus -	Drivecom status word(8-4) Bit coding see Operation section, status machine 0-3,5,6: status bits 4: Voltage enabled 7: Warning 8: HALT request active 9: Remote 10: Target reached 11: reserved 12: Op. mode specific 13: x_err 14: x_end 15: ref_ok		UINT16 R/- - -	CANopen 6041:0_h Modbus 6916
DEVcmdinterf DEVC NONE*dEUC*	Specification of the control mode(7-10) **0 / none**: undefined (default) **1 / IODevice / IO**: local control mode **2 / CANopenDevice / CanO**: CANopen **3 / ModbusDevice / Modb**: Modbus **4**: reserved CAUTION: a change in the setting is not enabled until the next start (exception: change of the value 0", at "Initial Setup"").	0 0 4	UINT16 R/W per. -	CANopen 3005:1_h Modbus 1282
ESIMscale ESSC DRC-*ESSC*	Encoder simulation - setting the resolution(7-16) The following resolutions can be adjusted: 128 256 512 1024 2048 4096	Inc 8 4096 65535	UINT16 R/W per. -	CANopen 3005:15_h Modbus 1322
FLT_AddInfo1 -	ENABLE cycles up to time of error() Number of power amplifier switch-on processes after switching on the power supply (control voltage) up to the appearance of the error		UINT16 R/- - -	CANopen 303C:5_h Modbus 15370
FLT_AddInfo2 -	Time error occurs after ENABLE()	s	UINT16 R/- - -	CANopen 303C:6_h Modbus 15372
FLT_AddInfo3 -	DC bus voltage at error time()	V 0.0 0.0 0.0	UINT16 R/- - -	CANopen 303C:7_h Modbus 15374
FLT_AddInfo4 -	Speed at error time()	rpm	INT16 R/- - -	CANopen 303C:8_h Modbus 15376

Parameter Name Code HMI menu, Code	Meaning	Unit Minimum value Default value Maximum value	Data type R/W per Expert	Parameter address via field bus
FLT_AddInfo5 -	Motor current at error time()	A 0.00 0.00 0.00	UINT16 R/- - -	CANopen 303C:9_h Modbus 15378
FLT_AddInfo6 -	Power amplifier temperature at error time()	°C	INT16 R/- - -	CANopen 303C:A_h Modbus 15380
FLT_AddInfo7 -	Unit temperature at error time()	°C	INT16 R/- - -	CANopen 303C:B_h Modbus 15382
FLT_class -	Error class() 0: warning (no response) 1: error (Quick Stop -> status 7) 2: error (Quick Stop -> status 8,9) 3: fatal error (status 9) 4: fatal error (status 9, cannot be acknowledged)	0 4	UINT16 R/- - -	CANopen 303C:2_h Modbus 15364
FLT_del_err - 	Erase error memory() 1: delete all entries in the error memory The deletion process is completed when 0 is returned during reading.	0 0 1	UINT16 R/W - -	CANopen 303B:4_h Modbus 15112
FLT_err_num -	Error number() Reading this parameter brings the complete error entry (sub-index 1..11) into an intermediate memory from which all other sub-indices are subsequently read. In addition, the read indicator of the error memory is automatically switched forward to the next error entry.	0 65535	UINT16 R/- - -	CANopen 303C:1_h Modbus 15362
FLT_MemReset -	Reset the error memory read pointer() 1 : set error memory read indicator to oldest error entry.	0 0 1	UINT16 R/W - -	CANopen 303B:5_h Modbus 15114
FLT_powerOn POWO INF-Pobo	Number of switch-on processes()	0 4294967295	UINT32 R/- - -	CANopen 303B:2_h Modbus 15108
FLT_Qual -	Eror additional information() This entry contains additional information on the error depending on the error number Example: parameter address	0 65535	UINT16 R/- - -	CANopen 303C:4_h Modbus 15368
FLT_Time -	Error time() referenced to the operating hours counter	s 0 536870911	UINT32 R/- - -	CANopen 303C:3_h Modbus 15366

Parameter Name Code HMI menu, Code	Meaning	Unit Minimum value Default value Maximum value	Data type R/W per Expert	Parameter address via field bus
GEARdenom -	Denominator of gear ratio(8-22) see description GEARnum	 1 1 2147483647	INT32 R/W per. -	CANopen 3026:3$_h$ Modbus 9734
GEARdir_enabl -	Enable direction of rotation(8-22) **1 / positive** : clockwise direction **2 / negative**: anticlockwise direction **3 / both**: both directions (default) Set permissible direction of motion, a reverse interlock can be set during gear processing.	 1 3 3	UINT16 R/W per. -	CANopen 3026:5$_h$ Modbus 9738
GEARnum -	Numerator of the gear ratio(8-22) Gear ratio numerator gear ratio= ---------- gear ratio denominator The new gear ratio is enabled on transfer of the numerator value.	 -2147483648 1 2147483647	INT32 R/W per. -	CANopen 3026:4$_h$ Modbus 9736
GEARratio GFAC SET-GFAC	Selection of special gear ratios(8-22) 0 : use of the specified gear ratio from GEARnum/GEARdenom 1 : 200 2 : 400 3 : 500 4 : 1000 5 : 2000 6 : 4000 7 : 5000 8 : 10000 9 : 4096 10 : 8192 11 : 16384 Change of reference values by the specified value effects a motor revolution.	 0 0 11	UINT16 R/W per. -	CANopen 3026:6$_h$ Modbus 9740
GEARreference -	Electronic gear processing operating mode(8-22) 0: disabled 1: real-time synchronisation 2: synchronisation with compensation movement	 0 0 2	UINT16 R/W - -	CANopen 301B:12$_h$ Modbus 6948
HMdisusr -	Distance between the switching point and the reference point(8-31) After leaving the switch, the drive is still positioned in the working range for a defined path and this position is defined as a reference point. The parameters are only effective with reference movements without index pulse searching.	usr 1 200 2147483647	INT32 R/W per. -	CANopen 3028:7$_h$ Modbus 10254

ACC1MDADM00EN, V1.00, 01.2005

Parameter Name Code HMI menu, Code	Meaning	Unit Minimum value Default value Maximum value	Data type R/W per Expert	Parameter address via field bus
HMoutdisusr -	Maximum run-off distance(8-31) 0: withdrawal control inactive >0: run-off in user-defined units position range within which it must be disabled again with the switch enabled.	usr 0 0 2147483647	INT32 R/W per. -	CANopen 3028:6_h Modbus 10252
HMdisREFtoIDX -	Distance of switch - index pulse after reference movement(8-31) Reading value provides the value of the difference between the index pulse position and the position on the switching flank of the limit or reference switch. Serves to monitor how far the index pulse is from the switching flank and serves to provide the criterion whether the reference movement with index pulse processing can be safely reproduced. Value input in 1/10000 U	U 0.0000 0.0000 0.0000	INT32 R/- - -	CANopen 3028:C_h Modbus 10264
HMIprotected -	HMI Interlock(8-31) 0: HMI interlock not enabled 1: HMI interlock enabled The following actions are not possible when interlocked: - modify parameter - manual mode (jog) - autotuning - FaultReset	0 0 1	UINT16 R/W per. -	CANopen 303:1_h Modbus 14850

Parameter Name Code HMI menu, Code	Meaning	Unit Minimum value Default value Maximum value	Data type R/W per Expert	Parameter address via field bus
HMmethod -	Reference movement method(8-31) 1 : LIMN with index pulse 2 : LIMP with index pulse 7: REF+ with index pulse, inv., outside 8: REF+ with index pulse, inv., inside 9: REF+ with index pulse, not inv., inside 10: REF+ with index pulse, not inv., outside 11: REF- with index pulse, inv., outside 12: REF- with index pulse, inv., inside 13: REF- with index pulse, not inv., inside 14: REF- with index pulse, not inv., outside 17 : LIMN 18 : LIMP 23: REF+, inv., outside 24: REF+, inv., inside 25: REF+, not inv., inside 26: REF+, not inv., outside 27: REF-, inv., outside 28: REF-, inv., inside 29: REF-, not inv., inside 30: REF-, not inv., outside 35 : set dimensions data type with CANopen: INT8 explanation of abbreviations: REF+: search movement in pos. direction REF-: search movement in neg. direction inv.: reverse direction of rotation in switch not inv.: non-reverse direction of rotation in switch outside: index pulse/distance outside switch inside: index pulse/distance inside switch.	 1 18 35	INT16 R/W - -	CANopen 6098:0_h Modbus 6936
HMn -	Reference speed for search for the switch(8-31) The set value is internally limited to the current parameter setting in RAMPn_max.	r.p.m. 1 60 13200	UINT16 R/W per. -	CANopen 6099:1_h Modbus 10248
HMn_out -	Reference speed for retraction from switch(8-31) The set value is internally limited to the current parameter setting in RAMPn_max.	r.p.m. 1 6 3000	UINT16 R/W per. -	CANopen 6099:2_h Modbus 10250
HMp_homeusr -	Position on reference point(8-31) After successful reference movement this position value is automatically set at the reference point.	usr -2147483648 0 2147483647	INT32 R/W per. -	CANopen 3028:B_h Modbus 10262
HMsrchdisusr -	Maximum search distance after traversing over the switch(8-31) Positioning range within which, after traversing over the switch, this must be reactivated again. 0: search path processing inactive >0: search path in user-defined units	usr 0 0 2147483647	INT32 R/W per. -	CANopen 3028:D_h Modbus 10266

ACC1MDADM00EN, V1.00, 01.2005

Parameter Name Code HMI menu, Code	Meaning	Unit Minimum value Default value Maximum value	Data type R/W per Expert	Parameter address via field bus
IO_AutoEnable IOAE DRC-, oRE	Automatic Enable at PowerOn, if ENABLE input is active(7-24) **0 / off**: active enable during PowerOn does not result in activation of power amplifier (default) **1 / on**: active enable during PowerOn results in activation of power amplifier	 0 0 1	UINT16 R/W per. -	CANopen 3005:6_h Modbus 1292
IOdefaultMode IO-M DRC-, o-M	Start-up of operating mode for 'local control mode'(7-10) **0 / none / none** : none (default) **1 / CurrentControl / Curr**: current controller (reference value of ANA1) **2 / SpeedControl / Sped**: speed controller (reference value of ANA1) **3 / GearMode / Gear**: electronic gear The operating mode is automatically enabled when the drive switches to the 'OperationEnable' status and "I/O Device / I/O" is set in DEVcmdinterf.""	 0 0 3	UINT16 R/W per. -	CANopen 3005:3_h Modbus 1286
IODirPosintf -	Count direction at the position interface() **0 / clockwise**: clockwise **1 / counter clockwise**: anticlockwise	 0 0 1	UINT16 R/W per. -	CANopen 3008:7_h Modbus 2062
IOLogicLevel IOLL DRC-, oLL	Logic level of the digital inputs/outputs(7-10) **0 / positive / pos**: positive logic (default) **1 / negative / neg**: negative logic CAUTION: a change of the setting is not enabled until the next start.	 0 0 1	UINT16 R/W per. -	CANopen 3005:4_h Modbus 1288
IOposInterfac IOPI DRC-, oP,	Logic level of the digital inputs/outputs(7-10) RS422 I/O interface (Pos) as: **0 / ABinput / AB**: input ENC_A, ENC_B, ENC_I (index pulse) 4x evaluation **1 / PDinput /PD**: input PULSE, DIR, ENABLE2 **2 / ESIMoutput / ESIM**: output: ESIM_A, ESIM_B, ESIM_I	 0 0 2	UINT16 R/W per. -	CANopen 3005:2_h Modbus 1284
IOsigLimN -	Processing setting signal LIMN(8-43) **0 / none**: inactive **1 / normally closed**: normally closed contact **2 / normally open**: normally open contact	 0 1 2	UINT16 R/W per. -	CANopen 3006:F_h Modbus 1566
IOsigLimP -	Processing setting signal LIMP(8-43) **0 / none**: inactive **1 / normally closed**: normally closed contact **2 / normally open**: normally open contact	 0 1 2	UINT16 R/W per. -	CANopen 3006:10_h Modbus 1568

Parameter Name Code HMI menu, Code	Meaning	Unit Minimum value Default value Maximum value	Data type R/W per Expert	Parameter address via field bus
IOsigRef -	Processing setting signal REF at reference movement to REF(8-43) **1 / normally closed**: normally closed contact **2 / normally open**: normally open contact The reference switch is only enabled during processing of the reference movement to REF.	 1 1 2	UINT16 R/W per. -	CANopen 3006:E_h Modbus 1564
JOGactivate -	Activation of jog(8-14) Bit0 : clockwise direction of rotation Bit1 : anticlockwise direction of rotation Bit2 : 0=slow 1=fast	 0 0 7	UINT16 R/W - -	CANopen 301B:9_h Modbus 6930
JOGn_fast NFST JOG-nFSt	Speed for fast jog(8-14) The set value is internally limited to the current parameter setting in RAMPn_max.	r.p.m. 1 180 13200	UINT16 R/W per. -	CANopen 3029:5_h Modbus 10506
JOGn_slow NSLW JOG-nSLL	Speed for slow jog(8-14) The set value is internally limited to the current parameter setting in RAMPn_max.	r.p.m. 1 60 13200	UINT16 R/W per. -	CANopen 3029:4_h Modbus 10504
JOGstepusr -	Inching movement before continuous running(8-14) 0: direct enable of continuous operation >0: positioning distance per jog cycle	usr 0 20	INT32 R/W per. -	CANopen 3029:7_h Modbus 10510
JOGtime -	Waiting time before continuous running(8-14) Time is only effective if an inching section not equal to 0 has been set, otherwise direct transition to continuous running.	ms 1 500 32767	UINT16 R/W per. -	CANopen 3029:8_h Modbus 10512
LIM_I_maxHalt LIHA SET-L, hA	Current limiting for Halt(8-60) Max. current during braking after Halt or termination of an operating mode. Maximum and default value setting depend on motor and power amplifier	A_{pk} - - -	UINT16 R/W per. -	CANopen 3011:6_h Modbus 4364
LIM_I_maxQSTP LIQS SET-L, 95	Current limiting for Quick Stop(8-59) Max. current during braking via torque ramp resulting from an error with error class 1 or 2, and when a software stop is triggered Maximum and default value setting depend on the motor and power amplifier	A_{pk} - - -	UINT16 R/W per. -	CANopen 3011:5_h Modbus 4362
M_I_0 -	Motor constant current at standstill()	A_{pk} - - -	UINT16 R/- - -	CANopen 300D:13_h Modbus 3366
M_I_max MIMA INF-n, nA	Motor maximum current() Current in 10 mA steps	A_{pk} - - -	UINT16 R/- - -	CANopen 300D:6_h Modbus 3340

ACC1MDADM00EN, V1.00, 01.2005

Parameter Name Code HMI menu, Code	Meaning	Unit Minimum value Default value Maximum value	Data type R/W per Expert	Parameter address via field bus
M_I_nom MINO INF-n_no	Motor nominal current() Current in 10 mA steps	A_{pk} - - -	UINT16 R/- - -	CANopen 300D:7_h Modbus 3342
M_I2t -	maximum permissible time for ImaxM()	ms - - -	UINT16 R/- - -	CANopen 300D:11_h Modbus 3362
M_Jrot -	Motor moment of inertia() in 0.1 kgcm^2 steps	kg cm^2 - - -	UINT16 R/- - -	CANopen 300D:C_h Modbus 3352
M_Ke -	Motor EMF constants Ke()	Vs - - -	UINT16 R/- per. -	CANopen 300D:B_h Modbus 3350
M_L_d -	Mtor inductance d-direction() in 0.01 mH steps	mH - - -	UINT16 R/- - -	CANopen 300D:F_h Modbus 3358
M_L_q -	Motor inductance q-direction() in 0.01 mH steps	mH - - -	UINT16 R/- - -	CANopen 300D:E_h Modbus 3356
M_M_max -	Motor peak torque()	N cm - - -	UINT16 R/- - -	CANopen 300D:9_h Modbus 3346
M_M_nom -	Motor nominal torque()	N cm - - -	UINT16 R/- - -	CANopen 300D:8_h Modbus 3344
M_n_max -	maximum permissible motor speed()	rpm	UINT16 R/- - -	CANopen 300D:4_h Modbus 3336
M_n_nom -	Nominal motor speed()	rpm	UINT16 R/- - -	CANopen 300D:5_h Modbus 3338
M_Polepair -	Number of motor pole pairs()	Pole pairs - - -	UINT16 R/- - -	CANopen 300D:14_h Modbus 3368
M_R_UV -	Motor termination resistance() in 10mOhm steps	Ω	UINT16 R/- - -	CANopen 300D:D_h Modbus 3354

ACC1MDADM00EN, V1.00, 01.2005

Parameter Name Code HMI menu, Code	Meaning	Unit Minimum value Default value Maximum value	Data type R/W per Expert	Parameter address via field bus
M_Sensor -	Motor encoder type() **0 / unknown**: unknown **1**: reserved **2**: reserved **3 / SRS**: SinCos 1024 lines Singleturn **4 / SRM**: SinCos 1024 lines Multiturn **5 / SCS**: SinCos 512 lines Singleturn **6 / SCM**: SinCos 512 lines Multiturn	- - -	UINT16 R/- per. -	CANopen 300D:3_h Modbus 3334
M_serialNo -	Motor serial number()	- - -	UINT32 R/- - -	
M_T_max -	max. motor temperature()	°C	INT16 R/- per. -	CANopen 300D:10_h Modbus 3360
M_T_warn -	Motor temperature warning threshold()	°C	INT16 R/- per. -	CANopen 300D:15_h Modbus 3370
M_TempType -	Type of temperature sensor() 0: PTC 1: NTC	- - -	UINT16 R/- per. -	CANopen 300D:12_h Modbus 3364
M_Type -	Motor type() 0: no motor selected >0: connected motor type	- - -	UINT32 R/- per. -	CANopen 300D:2_h Modbus 3332
M_U_nom -	Motor nominal voltage()	V - - -	UINT16 R/- - -	CANopen 300D:A_h Modbus 3348
MBadr MBAD COM-nbRd	Modbus address(7-10) valid addresses 1 to 247	1 1 247	UINT16 R/W per. -	
MBbaud MBBD COM-nbbd	Modbus baud rate(7-10) Allowable baud rates: 9600 19200 38400	Baud 0 19200 38400	UINT16 R/W per. -	
MBdword_order MBWO COM-nbLo	Modbus word sequence for double words (32 bit values)() (register swap) **0 / HighLow / HiLo**: HighWord-LowWord, big endian -> Modicon Quantum (default) **1 / LowHigh / LoHi** : LowWord-HighWord little endian -> Premium, HMI (Telemecanique)	0 0 1	UINT16 R/W per. -	

Parameter Name Code HMI menu, Code	Meaning	Unit Minimum value Default value Maximum value	Data type R/W per Expert	Parameter address via field bus
MBformat MBFO COM-MbFo	Modbus data format() **1 / 8Bit NoParity 1Stop / 8n1**: 8 bit, no parity bit, 1 stop bit **2 / 8Bit EvenParity 1Stop / 8e1**: 8 bit, even parity bit, 1 stop bit (default) **3 / 8Bit OddParity 1Stop / 8o1**: 8 Bit, odd parity bit, 1 stop bit **4 / 8Bit NoParity 2Stop / 8n2**: 8 bit, no parity bit, 2 stop bits	 1 2 4	UINT16 R/W per. -	
MBnode_guard -	Modbus Node Guard() Connection monitoring 0 : inactive (default) >0 : monitoring time	ms 0 0 10000	UINT16 R/W - -	
PA_f_DefChop -	Switching frequency of power amplifier() **0 / 4kHz**: 4 kHz **1 / 8kHz**: 8 kHz	 - - -	UINT16 R/- per. -	CANopen 3010:5$_h$ Modbus 4106
PA_I_max PIMA INF-PI MA	Maximum current of power amplifier() in 10 mA steps	A_{pk} - - -	UINT16 R/- per. -	CANopen 3010:2$_h$ Modbus 4100
PA_I_nom PINO INF-PI no	Nominal current of power amplifier() in 10 mA steps	A_{pk} - - -	UINT16 R/- per. -	CANopen 3010:1$_h$ Modbus 4098
PA_T_max -	maximum permissible temperature of the power amplifier()	°C	INT16 R/- per. -	CANopen 3010:7$_h$ Modbus 4110
PA_T_warn -	Temperature limit of the power amplifier()	°C	INT16 R/- per. -	CANopen 3010:6$_h$ Modbus 4108
PA_U_maxDC -	max. permissible DC bus voltage (DC bus)() in 0.1V steps	V - - -	UINT16 R/- per. -	CANopen 3010:3$_h$ Modbus 4102
PA_U_minDC -	DC bus low voltage threshold for drive switch-off() in 0.1V steps	V - - -	UINT16 R/- per. -	CANopen 3010:4$_h$ Modbus 4104
PA_U_minStopDC -	DC bus low voltage threshold for Quick Stop() At this threshold, the drive performs a Quick Stop	V - - -	UINT16 R/- per. -	CANopen 3010:A$_h$ Modbus 4116
PAR_CTRLreset RES TUN-rES	Reset controller parameter() 1: controller parameters of the speed and position controller are reset The current controller is automatically set for the connected motor.	 0 0 1	UINT16 R/W - -	CANopen 3004:7$_h$ Modbus 1038

Parameter Name Code HMI menu, Code	Meaning	Unit Minimum value Default value Maximum value	Data type R/W per Expert	Parameter address via field bus
PAReeprSave -	Back up the parameters in the EEPROM memory() Bit 0 = 1: run backup of user parameters. The current parameters are backed up in the non-volatile memory (EEPROM). The storing process is complete if a 0 is returned when reading the parameters.	 0 0 3	UINT16 R/W - -	
PARuserReset -	Resetting the user parameters(8-67) 1: set user parameters to default values. All parameters are reset except: - communications parameters - device control - logic level	 0 0 1	UINT16 R/W - -	CANopen 3004:8_h Modbus 1040
POSdirOfRotat PROT DRC-*Prot*	Definition of the direction of rotation(8-64) **0 / clockwise / clw**: clockwise **1 / counter clockwise / cclw**: anticlockwise Meaning: The drive rotates clockwise at positive speeds when the motor shaft is viewed at the flange. CAUTION: when using limit switches, after changing the setting the limit switch connections must be changed over. The limit switch which is actuated by moving in jog mode in a positive direction must be connected to the input LIMP, and vice versa.	 0 0 1	UINT16 R/W per. -	CANopen 3006:C_h Modbus 1560
POSscaleDenom -	Denominator of the position scaling factor(8-54) Description see count (POSscaleNum) Acceptance of a new scaling factor is by transfer of the numerator	usr 1 16384 2147483647	INT32 R/W per. -	CANopen 3006:7_h Modbus 1550
POSscaleNum -	Numerator of the position scaling factor(8-54) Specification of scaling factor: motor revolutions [U] ---------- change of user position [usr] A new scaling is imported when the numerator value is transferred User-defined limit values may be reduced as a result of the calculation of an internal system factor	U 1 1 2147483647	INT32 R/W per. -	CANopen 3006:8_h Modbus 1552
PPn_target -	Speed setpoint for profile position(8-26) Maximum value is limited to the current setting in CTRL_n_max.	rpm 0 60	UINT32 R/W - -	CANopen 6081:0_h Modbus 6942

ACC1MDADM00EN, V1.00, 01.2005

Parameter Name Code HMI menu, Code	Meaning	Unit Minimum value Default value Maximum value	Data type R/W per Expert	Parameter address via field bus
PPp_targetusr -	Target position of profile position operating mode(8-26) Min/max values depend on: - scaling factor - software limit switch (if enabled)	usr	INT32 R/W - -	CANopen 607A:0_h Modbus 6940
ProfileType -	Motion profile() 0 : Linear	 0 0 0	INT16 R/- - -	
PVn_target -	Setpoint speed profile velocity operating mode(8-29) Maximum value is limited to the current setting in CTRL_n_max.	 0 rpm	INT32 R/W - -	CANopen 60FF:0_h Modbus 6938
PWM_fChop -	Switching frequency of power amplifier(7-16) Switching frequency of power amplifier **0 / 4kHz**: 4 kHz **1 / 8kHz**: 8 kHz Factory setting: 400 V units: 4 kHz all others: 8 kHz	 0 1	UINT16 R/W per. expert	CANopen 3005:E_h Modbus 1308
RAMPacc -	Profile generator acceleration(8-57)	r.p.m*s 30 600 3000000	UINT32 R/W per. -	CANopen 6083:0_h Modbus 1556
RAMPdecel -	Profile generator deceleration(8-57)	r.p.m*s 750 750 3000000	UINT32 R/W per. -	CANopen 6084:0_h Modbus 1558
RAMPn_max -	Profile generator deceleration(8-57) Parameters are effective in the following operating modes: - point-to-point - profile velocity - homing - jog If a higher setpoint speed is set on one of these operating modes it will be automatically limited to this value. This makes it simple to conduct a commissioning with limited speed.	r.p.m. 60 12000 13200	UINT16 R/W per. -	CANopen 607F:0_h Modbus 1554
SPEEDn_target -	Reference speed in speed control operating mode(8-19) For this purpose, the operating mode speed control must be activated by pre-setting on the parameter. The internal maximum speed is limited by the current setting in CTRL_n_max	r.p.m. -30000 0 30000	INT16 R/W - -	CANopen 3021:4_h Modbus 8456

Parameter Name Code HMI menu, Code	Meaning	Unit Minimum value Default value Maximum value	Data type R/W per Expert	Parameter address via field bus
SPEEDreference -	Selection of reference source for speed control operating mode(8-19) 0: none 1: reference value over +/-10V interface ANA1 2: reference value over parameter SPEEDn_target	 0 0 2	UINT16 R/W - -	CANopen 301B:11_h Modbus 6946
SPV_Flt_AC -	Error response to failure of a phase(8-46) **1 / ErrorClass1**: error class 1 **2 / ErrorClass2**: error class 2 **3 / ErrorClass3**: error class 3	 1 2 3	UINT16 R/W per. -	CANopen 3005:A_h Modbus 1300
SPV_Flt_pDiff -	Error response to contouring error(8-46) **1 / ErrorClass1**: error class 1 **2 / ErrorClass2**: error class 2 **3 / ErrorClass3**: error class 3	 1 3 3	UINT16 R/W per. -	CANopen 3005:B_h Modbus 1302
SPV_EarthFlt -	Earth fault monitoring(8-52) **0 / off**: Off **1 / on**: On (default) In exceptional cases it may require disabling, e.g.: - parallel connection of multiple units - operation on an IT network - long motor lines Only disable the monitoring if it is triggered when not wanted	 0 1 1	UINT16 R/W per. expert	CANopen 3005:10_h Modbus 1312
SPV_MainsVolt -	Monitor mains phases(8-53) **0 / off**: Off **1 / on**: On (default) In exceptional cases it may require disabling, e.g.: - when powered via the DC bus	 0 1 1	UINT16 R/W per. expert	CANopen 3005:F_h Modbus 1310
SPV_p_maxDiff -	Max. permissible contouring error of position regulator(8-46) The lag error is the current position regulation offset minus the speed-dependent position regulation offset. Actually, only the position offset caused by the moment requirements is still referred to for lag error monitoring.	U 0.0001 1.0000 4.0000 **Field bus** 1 10000 40000	UINT32 R/W per. -	CANopen 6065:0_h Modbus 4636
SPV_SW_Limits -	Monitoring the software limit switch(8-43) **0 / none**: none (default) **1 / SWLIMP**: activation of software limit switch pos. direction **2 / SWLIMN**: activation of software limit switch neg. direction **3 / SWLIMP+SWLIMN**: activation of software limit switch both directions The software limit switch is only monitored after a successful homing (ref_ok = 1)	 0 0 3	UINT16 R/W per. -	CANopen 3006:3_h Modbus 1542

Parameter Name Code HMI menu, Code	Meaning	Unit Minimum value Default value Maximum value	Data type R/W per Expert	Parameter address via field bus
SPVswLimNusr -	negative position limit for software limit switch(8-43)	 -2147483648 usr	INT32 R/W per. -	CANopen 607D:1$_h$ Modbus 1546
SPVswLimPusr -	positive position limit for software limit switch(8-43)	 2147483647 usr	INT32 R/W per. -	CANopen 607D:2$_h$ Modbus 1544
SPVcommutat -	Monitoring commutation(8-51) **0 / off**: off **1 / on**: on (default)	 0 1 1	UINT16 R/W per. -	CANopen 3005:5$_h$ Modbus 1290
STANDp_win -	Standstill window, permissible offset(8-61) The offset for the standstill window time must lie in this range of values to allow recognition of the standstill of the drive. Info: the processing of the standstill window must be activated via the 'STANDpwinTime' parameter.	U 0.0000 0.0010 3.2767 **Field bus** 0 10 32767	UINT16 R/W per. -	CANopen 6067:0$_h$ Modbus 4370
STANDpwinTime -	Standstill window, time(8-61) 0 : monitoring of standstill window disabled >0 : time in ms within which the control deviation must be in the standstill window	ms 0 0 32767	UINT16 R/W per. -	CANopen 6068:0$_h$ Modbus 4372
STANDpwinTout -	Timeout period for standstill window monitor(8-61) 0 : timeout monitoring disabled >0 : timeout period in ms The standstill window process is set with STANDp_win and STANDpwinTime The time monitoring starts at the moment the target position (setpoint position of position controller) is reached or the end of processing of the profile generator.	ms 0 0 16000	UINT16 R/W per. -	CANopen 3011:B$_h$ Modbus 4374
StartUpMessage -	Start-up messages() Read : start-up messages Write: validation Read : Bit 0 = 1: First Setup Bit 1 = 1: motor replaced Bit 2 = 1: EEPROM data corrupt Bit 3 = 1: no motor connected Bit 4-15: reserved Write: Bit 0 = 1: validation First Setup Bit 1 = 1: validation motor replaced Bit 2..15: reserved		UINT32 R/W - -	CANopen 3001:1C$_h$ Modbus 312

ACC1MDADM00EN, V1.00, 01.2005

Parameter Name Code HMI menu, Code	Meaning	Unit Minimum value Default value Maximum value	Data type R/W per Expert	Parameter address via field bus
SuppDriveModes -	Supported operating modes as per DSP402() Bit 0: profile position Bit 1: reserved Bit 2: profile velocity Bit 3: reserved Bit 4: reserved Bit 5: homing Bit 16: jog Bit 17: electrical gearbox Bit 18: current control Bit 19: speed control Bit 20: reserved Bit 21: reserved		UINT32 R/- - -	CANopen 6502:0_h Modbus 6952

12 Accessories and spare parts

12.1 Optional accessories

Description	Ordering number
Peripheral control terminal	VW3A31101
Powersuite V2 CD-ROM (commissioning software)	VW3A8104
PC connection kit	VW3A8106
USIC (Universal Signal Interface Converter) for matching to RS422 standard	GEA3EC001
Reference value adapter RVA for distribution of A/B or pulse/direction signals on 6 units	GEA3EC002
HBC	GEA3EB001

12.2 Ballast resistors

Description	Ordering number
Ballast resistor IP54; 10 Ohm; 400W; 0.75m connection cable	GEA3ERA010C5A
Ballast resistor IP54; 10 Ohm; 400W; 2m connection cable	GEA3ERA010C52
Ballast resistor IP54; 10 Ohm; 400W; 3m connection cable	GEA3ERA010C53
Ballast resistor IP54; 27 Ohm; 100W; 0.75m connection cable	GEA3ERA027A5A
Ballast resistor IP54; 27 Ohm; 200W; 0.75m connection cable	GEA3ERA027B5A
Ballast resistor IP54; 27 Ohm; 200W; 3m connection cable	GEA3ERA027B53
Ballast resistor IP54; 27 Ohm; 400W; 0.75m connection cable	GEA3ERA027C5A
Ballast resistor IP54; 27 Ohm; 400W; 2m connection cable	GEA3ERA027C52
Ballast resistor IP54; 27 Ohm; 400W; 3m connection cable	GEA3ERA027C53
Ballast resistor IP54; 72 Ohm; 100W; 0.75m connection cable	GEA3ERA072A5A
Ballast resistor IP54; 72 Ohm; 100W; 2m connection cable	GEA3ERA072A52
Ballast resistor IP54; 72 Ohm; 200W; 0.75m connection cable	GEA3ERA072B5A
Ballast resistor IP54; 72 Ohm; 400W; 0.75m connection cable	GEA3ERA072C5A
Ballast resistor IP54; 72 Ohm; 400W; 2m connection cable	GEA3ERA072C52
Ballast resistor IP54; 72 Ohm; 400W; 3m connection cable	GEA3ERA072C53

12.3 Mains reactor s

Description	Ordering number
Line reactor 1~; 50-60Hz; 7A; 5mH; IP00	VZ1L007UM50
Line reactor 1~; 50-60Hz; 18A; 2mH; IP00	VZ1L018UM20
Line reactor 3~; 50-60Hz; 10A; 4mH; IP00	VW3A66502
Line reactor 3~; 50-60Hz; 16A; 2mH; IP00	VW3A66503
Line reactor 3~; 50-60Hz; 30A; 1mH; IP00	VW3A66504
Line reactor 3~; 50-60Hz; 60A; 0.5mH; IP00	VW3A66505

ACC1MDADM00EN, V1.00, 01.2005

12.4 Mains filters

Description	Ordering number
Single phase line filter for size 1 units with 115/230VAC	VW3A31401
Three phase line filter for size 1 units with 230VAC	VW3A31402
Single phase line filter for size 2 units with 115/230VAC	VW3A31403
Three phase line filter for size 2 units with 230/480VAC	VW3A31404
Single phase line filter for size 3 units with 115/230VAC	VW3A31405
Three phase line filter for size 3 units with 230/480VAC	VW3A31406
Three phase line filter for size 4 units with 230/480VAC	VW3A31407

12.5 Motor cables

Description	Ordering number
Motor cable 3m for Servomotor, 4*1.5mm² and 2*1.0mm² screened; Motor end 8-pole round plug, other cable end open	GEA2M0AAAA003
Motor cable 5m for Servomotor, 4*1.5mm² and 2*1.0mm² screened; Motor end 8-pole round plug, other cable end open	GEA2M0AAAA005
Motor cable 10m for Servomotor, 4*1.5mm² and 2*1.0mm² screened; Motor end 8-pole round plug, other cable end open	GEA2M0AAAA010
Motor cable 15m for Servomotor, 4*1.5mm² and 2*1.0mm² screened; Motor end 8-pole round plug, other cable end open	GEA2M0AAAA015
Motor cable 20m for Servomotor, 4*1.5mm² and 2*1.0mm² screened; Motor end 8-pole round plug, other cable end open	GEA2M0AAAA020
Motor cable 3m for Servomotor, 4*2.5mm² and 2*1.0mm² screened; Motor end 8-pole round plug, other cable end open	GEA2M0ABAA003
Motor cable 5m for Servomotor, 4*2.5mm² and 2*1.0mm² screened; Motor end 8-pole round plug, other cable end open	GEA2M0ABAA005
Motor cable 10m for Servomotor, 4*2.5mm² and 2*1.0mm² screened; Motor end 8-pole round plug, other cable end open	GEA2M0ABAA010
Motor cable 15m for Servomotor, 4*2.5mm² and 2*1.0mm² screened; Motor end 8-pole round plug, other cable end open	GEA2M0ABAA015
Motor cable 20m for Servomotor, 4*2.5mm² and 2*1.0mm² screened; Motor end 8-pole round plug, other cable end open	GEA2M0ABAA020

12.6 Encoder cables

Description	Ordering number
Encoder cable 3m for Servomotor, 5*(2*0.25mm²) and 1*(2*0.5mm²) screened; Motor end 12-pole round plug, unit end 12-pole Molex plug	GEA2EAAAAA003
Encoder cable 5m for Servomotor, 5*(2*0.25mm²) and 1*(2*0.5mm²) screened; Motor end 12-pole round plug, unit end 12-pole Molex plug	GEA2EAAAAA005
Encoder cable 10m for Servomotor, 5*(2*0.25mm²) and 1*(2*0.5mm²) screened; Motor end 12-pole round plug, unit end 12-pole Molex plug	GEA2EAAAAA010
Encoder cable 15m for Servomotor, 5*(2*0.25mm²) and 1*(2*0.5mm²) screened; Motor end 12-pole round plug, unit end 12-pole Molex plug	GEA2EAAAAA015

ACC1MDADM00EN, V1.00, 01.2005

Description	Ordering number
Encoder cable 20m for Servomotor, 5*(2*0.25mm²) and 1*(2*0.5mm²) screened; Motor end 12-pole round plug, unit end 12-pole Molex plug	GEA2EAAAAA020

12.7 RS 422

Description	Ordering number
Cable pulse/direction, ESIM, A/B, unit end 10 pole Molex, other end open, 0.5m	GEA2RAAABA005
Cable pulse/direction, ESIM, A/B, unit end 10 pole Molex, other end open, 1.5m	GEA2RAAABA015
Cable pulse/direction, ESIM, A/B, unit end 10 pole Molex, other end open, 3m	GEA2RAAABA030
Cable pulse/direction, ESIM, A/B, unit end 10 pole Molex, other end open, 5m	GEA2RAAABA050
Cable ESIM, A/B, for Master/Slave operation of units 2* 10-pole Molex, 0.5m	GEA2RBAABB005
Cable ESIM, A/B, for Master/Slave operation of units 2* 10-pole Molex, 1.5m	GEA2RBAABB015
Cable ESIM, A/B, for Master/Slave operation of units 2* 10-pole Molex, 3m	GEA2RBAABB030
Cable ESIM, A/B, for Master/Slave operation of units 2* 10-pole Molex, 5m	GEA2RBAABB050
Cable pulse/direction, ESIM, AB on Premium CAY, 0.5m, 10-pole Molex + 15-pole SubD	GEA2RBAABB005
Cable pulse/direction, ESIM, AB on Premium CAY, 1.5m, 10-pole Molex + 15-pole SubD	GEA2RBAABB015
Cable pulse/direction, ESIM, AB on Premium CAY, 3m, 10-pole Molex + 15-pole SubD	GEA2RBAABB030
Cable pulse/direction, ESIM, AB on Premium CAY, 5m, 10-pole Molex + 15-pole SubD	GEA2RBAABB050
Cable pulse/direction, ESIM, AB on Premium CAY, 0.5m, 10-pole Molex + 15-pole SubD	GEA2REAABC005
Cable pulse/direction, ESIM, AB on Premium CAY, 1.5m, 10-pole Molex + 15-pole SubD	GEA2REAABC015
Cable pulse/direction, ESIM, AB on Premium CAY, 3m, 10-pole Molex + 15-pole SubD	GEA2REAABC030
Cable pulse/direction, ESIM, AB on Premium CAY, 5m, 10-pole Molex + 15-pole SubD	GEA2REAABC050
Cable pulse/direction, ESIM, AB on Siemens S5 IP247, 3m, 10-pole Molex	GEA2RFAABE030
Cable pulse/direction, ESIM, AB on Siemens S5 IP247, 3m, 10-pole Molex	GEA2RGAABE030
Cable pulse/direction, ESIM, AB Siemens S7-300 FM353, 3m, 10-pole Molex	GEA2RHAABD030
Cable pulse/direction, ESIM, AB on RVA, USIC or WP/WPM311, 0.5m	GEA2RCAABD005
Cable pulse/direction, ESIM, AB on RVA, USIC or WP/WPM311, 1.5m	GEA2RCAABD015
Cable pulse/direction, ESIM, AB on RVA, USIC or WP/WPM311, 3m	GEA2RCAABD030
Cable pulse/direction, ESIM, AB on RVA, USIC or WP/WPM311, 5m	GEA2RCAABD050

12.8 CANopen

Description	Ordering number
CANopen documentation	ACC1MDACA01EN
CAN branching socket	VW3CANTAP2

ACC1MDADM00EN, V1.00, 01.2005

Description	Ordering number
CAN-cable, 0.3m, both ends RJ45-plug	VW3CANCARR03
CAN-cable, 1m, both ends RJ45-plug	VW3CANCARR1

12.9 MODBUS

Description	Ordering number
MODBUS documentation	ACC1MDAMB00EN
MODBUS branching socket, 3* screwed terminal rail, RC termination Connect with cable W3A8306D30.	TSXSCA50
MODBUS 2-way branching socket, 2*socket plug SubD 15-pole, 2* screwed terminal rail, RC termination Connect with cable W3A8306D30.	TSXSCA62
MODBUS connection module, 10*RJ45 plug and 1*screwed terminal rail	LU9GC3
MODBUS termination for RJ45 plug, 120 Ohm, 1nF	VW3A8306RC
MODBUS termination for RJ45 plug, 150 Ohm	VW3A8306R
MODBUS termination for screwed terminal rail, 120 Ohm, 1nF	VW3A8306DRC
MODBUS termination for screwed terminal rail, 150 Ohm	VW3A8306DR
MODBUS T-branching module with integral cable 0.3m	VW3A8306TF03
MODBUS T-branching module with integral cable 1m	VW3A8306TF10
MODBUS-cable, 3m, 1*RJ45 plug, other end insulated	VW3A8306D30
MODBUS-cable, 3m, 1*RJ45 plug, 1*SubD15pole plug, for TSXSCA62	VW3A8306
MODBUS-cable, 0.3m, 2*RJ45 plug	VW3A8306R03
MODBUS-cable, 1m, 2*RJ45 plug	VW3A8306R10
MODBUS-cable, 3m, 2*RJ45 plug	VW3A8306R30
MODBUS-cable, 100m, 4-core, screened and twisted	TSXCSA100
MODBUS-cable, 200m, 4-core, screened and twisted	TSXCSA200
MODBUS-cable, 500m, 4-core, screened and twisted	TSXCSA500

12.10 Installation material

Description	Ordering number
Adaptor plate for size . 1 for cap rail mounting	VW3A11851
Adaptor plate for size . 2 for cap rail mounting	VW3A31852

ACC1MDADM00EN, V1.00, 01.2005

14 Glossaries

14.1 Terms and Abbreviations

AC	Alternating Current
Actual position	Current absolute or relative position of moving components in the drive system.
CAN	(**C**ontroller **A**rea **N**etwork), standardized open Fieldbus over which the drives and other devices from different manufacturers communicate with one another.
DC	Direct current
Default values	Factory settings.
DIP switch	Small switches positioned side by side. They must be set during installation.
Direction of rotation	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.
Drive system	The drive system consists of the controller, power amplifier and motor.
Electronic gear	An input speed is recalculated by the drive system using the values of an adjustable gear factor to derive a new output speed for the motor movement.
EMC	Electromagnetic compatibility
Encoder	Sensor for recording the angular position of a rotating element. The encoder is mounted on the motor and signals the angular position of the rotor.
Error class	Classification of possible operating faults of the drive system that result in an error status.
EU	European Union
FI	Fault current
Holding brake	brake that only prevents the motor from rotating without power after it has stopped (e.g. a Z-axis lowering). It must not be used as a service brake for braking motion.
I^2t-monitoring	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.
Inc	Increment
Index pulse	Encoder signal for referencing the rotor position in the motor. The encoder sends one index pulse per revolution.
Internal units	Resolution of the power amplifier with which the motor is directed to the new setpoint. Internal units are given in increments.
I/O	Inputs/Outputs
IT network	Network in which all active components are isolated from earth or are earthed by a high impedance.IT: isolé terre (French), isolated earth

ACC1MDADM00EN, V1.00, 01.2005

Limit switch	Switch that signals an overrun of the permissible travel range.
Motor phase current	In a stepper motor the available torque is specified by the motor phase current. The higher the motor phase current, the higher the torque.
NMT	network management (NMT), component of the CANopen communications profile, tasks: initialising network and devices, starting, stopping, monitoring devices
Node-Guarding	Monitoring function with slave at an interface for cyclic communication.
NTC	resistance with negative temperature coefficient. Resistance value is reduced as the temperature rises.
Parameter	Device functions and values that can be set and called by the user.
PC	Personal Computer
PELV	Protective Extra Low Voltage, functional low voltage with safe isolation
per.	Designation of whether the value of the parameter is persistent, i.e. after switching off the unit it is retained in the memory. When entering via HMI the unit stores the value of the parameter automatically at each change. When changing a value via commissioning software or field bus, the user must explicitly store the value change in the persistent memory.
PLC	Programmable Logic Controller
Power amplifier	A device that generates current for controlling the motor in accordance with the positioning signals from the controller.
Protection class	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).
PS2	Abbreviation for Power Suite 2 commissioning software
PTC	resistance with positive temperature coefficient. Resistance value is increased as the temperature rises.
Pulse direction signals	Digital signals with variable pulse frequencies which signal changes in position and rotation direction via separate signal wires.
Quick Stop	Quick stop, function used to provide quick braking of the motor via a command or in the event of a fault.
rms	Effective value of a voltage (V_{rms}) or a current (A_{rms}); abbreviation of “Root Mean Square”.
Scaling factor	This factor gives the relationship between an internal unit and the user unit.
TT network, TN network	Earthed networks, distinguished by the PE conductor connection.
User-defined unit	Unit whose reference to motor rotation can be determined by the user via parameters.
Watchdog	Equipment that monitors cyclic basic functions in the drive system. Power amplifier and outputs are switched off in the event of error.

14.2 Product name

CPD17	Servo drive for brushless servomotors
Power Suite 2, PS2	Software for commissioning

ACC1MDADM00EN, V1.00, 01.2005

HBC	Holding brake controller
Peripheral control terminal	hand-held operating unit
USIC	(Universal Signal Interface Converter) adapter for RS422 standard
RVA	Reference value adapter for distribution of A/B or pulse/direction signals to 5 units

ACC1MDADM00EN, V1.00, 01.2005

ACC1MDADM00EN, V1.00, 01.2005

13 Service, maintenance and disposal

DANGER!

Electric shock, fire or explosion

- Only qualified personnel 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.
- Before working on the drive system:
  - Switch off power to all terminals.
  - Place a sign "DO NOT SWITCH ON" on the switch and lock to prevent switching on.
  - **Wait 6 minutes** (for discharge of DC bus capacitors).
  - Measure voltage between DC+ and DC- and check for <48V. (The DC bus LED is not a safe indication for absence of the DC bus voltage).
- Do not short-circuit DC bus or touch unshielded components or screws of the terminals with voltage present.
- Install all covers and close the housing doors before applying power.
- The motor generates voltage when the shaft is rotated. Lock the shaft of the motor to prevent rotation before starting work on the drive system.
- The system manufacturer is responsible for compliance with all applicable regulations relevant to earthing the drive system.
- Do not reach into the drive system (e.g. no pointed objects).

CAUTION!

Destruction of system components and loss of control monitoring!

Interrupting the negative connection of the control supply can cause excessive voltages at the signal connections.

- Never switch the negative connection of the control supply.
- Check for correct connection before switching on.
- Never connect the control supply or change its wiring while there is supply voltage present.

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.

ACC1MDADM00EN, V1.00, 01.2005

13.1 Service address

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

- Type, identification number and serial number of the product (type plate)
- Type of fault (possibly with 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.

13.2 Maintenance

The unit is maintenance free

13.2.1 Operational duration of safety function

The operating life for the Safe Standstill function is designed to be 20 years. After this period correct function is no longer ensured. The expiry date of the unit is determined by adding 20 years to the DOM shown on the type plate.

▶ This date must be included in the system maintenance schedule.

Example The name plate on the unit includes the DOM in the DD.MM.YY format, z.B. 31.12.06. (31 December 2006). This means that the safety function is guaranteed until 31 December 2026 (06 + 20 = 26).

ACC1MDADM00EN, V1.00, 01.2005

13.3 Replacing units

WARNING!

Unexpected responses may cause injury and damage to the system.

The behaviour of the drive system is governed by numerous saved data. Unsuitable data may cause unexpected motions or responses to signals.

- Do not operate a unit with unknown data.
- Check the saved data.
- When commissioning carefully run tests for all operating states and fault cases.
- Check the functions after replacing a unit and also after changes to the saved data.
- Start the system only if there are no persons or materials in the danger zone and the system can be operated safely.

Observe the following procedure when changing the units.

▶ Store all parameter settings in your PC with the commissioning software, see 8.6.10.3 “Store the settings on the data medium“ page 8-68.

▶ Switch off all power supplies. 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 type plate for later identification.

▶ Install the new product as specified in 6 “Installation“

▶ If the product that you are installing was previously used in a different part of the system, the factory settings must be reset before commissioning. See 8.6.10.2 “Restore factory settings“ from page 8-67.

▶ Carry out commissioning in accordance with chapter 7 “Commissioning“.

ACC1MDADM00EN, V1.00, 01.2005

13.4 Changing the motor

WARNING!

Unexpected motion may cause injury and damage to the system

Drives can make unexpected movements if incorrectly connected or because of other faults.

- Operate the unit with approved motors only. Even if motors are similar, different adjustment of the sensor system may be a source of danger.
- Check the wiring. Compatibility is not ensured even with matching connectors on power connection and sensor system.

▶ Switch off all power supplies. 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 type plate for later identification.

▶ Install the new product as specified in 6 “Installation“

If the original motor has been replaced with a different motor, the motor data set is read out again. If the unit recognises a different motor type, the regulation parameters are re-calculated and nOt is shown on the HMI.

Change motor type temporarily only

▶ Press ESC if you want to operate the new motor type temporarily on this unit.

◁ The newly calculated regulation parameters are not stored in the EEPROM. This means that the original motor can be put back into operation using the previously stored regulation parameters.

Change motor type permanently

▶ Press ENT if you wish to operate the new motor type permanently in this unit.

◁ The newly calculated regulation parameters are stored in the EEPROM.

13.5 Shipping, storage, disposal

Shipping The product must be protected against shocks during transport. Use the original packaging for this purpose.

Storage Store the product only under the specified, approved environmental conditions for room temperature and humidity.
Protect the product against dust and dirt.

Disposal The product consists of various materials which can be used again and must be disposed of separately. Dispose of the product in accordance with local regulations

ACC1MDADM00EN, V1.00, 01.2005

15 Index

Numerics

A

B

ACC1MDADM00EN, V1.00, 01.2005

C

ACC1MDADM00EN, V1.00, 01.2005

ACC1MDADM00EN, V1.00, 01.2005

D

E

ACC1MDADM00EN, V1.00, 01.2005

F

G

H

ACC1MDADM00EN, V1.00, 01.2005

I

J

L

M

ACC1MDADM00EN, V1.00, 01.2005

O

ACC1MDADM00EN, V1.00, 01.2005

P

Q

R

ACC1MDADM00EN, V1.00, 01.2005

S

ACC1MDADM00EN, V1.00, 01.2005

T

U

V

ACC1MDADM00EN, V1.00, 01.2005

W

Z

ACC1MDADM00EN, V1.00, 01.2005

ACC1MDADM00EN, V1.00, 01.2005