

Hardware description

**NORDAC SK 1000E**

Servo controller

SK 1000E-101-340-A ... SK 1000E-102-340-A



T.-Nr. 0604 1192

**BU 1100 GB**  
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**Getriebebau NORD**  
GmbH & Co. KG





## Safety and operating instructions for the drive power converter

(as per: Low voltage guideline 73/23/EEC)

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### 1. General information

During operation, drive power converters may have, depending on their protection class, live, bare, moving or rotating parts or hot surfaces.

There is a risk of serious injury to persons and/or damage to equipment resulting from unpermitted removal of covers, incorrect use, installation or operation.

#### Further information can be found in this documentation.

All transport, installation and commissioning work, and maintenance, must be carried out by qualified personnel (comply with IEC 364, CENELEC HD 384, DIN VDE 0100, IEC 664 and DIN VDE 0110, and national accident prevention regulations).

Qualified personnel in the sense of these basic safety instructions are persons who are familiar with the erection, mounting, commission and operation of this product and who have the relevant qualifications for their activities.

### 2. Intended use

Drive power converters are components intended for installation in electrical systems or machines.

When being installed in machines, the drive power converter cannot be commissioned (i.e. implementation of the intended use) until it has been ensured that the machine meets the provisions of the EC guideline 89/392/EEC (machine guideline); EN 60204 must also be complied with.

Commissioning (i.e. implementation of the intended use) is only permitted when the EMC guideline (89/336/EEC) is complied with.

The drive power converters meet the requirements of the low voltage guideline 73/23/EEC. The harmonised standards in prEN 50178/DIN VDE 0160, together with EN 60439-1/VDE 0660 Part 500 and EN 60146/VDE 0558 were applied for the drive power converter.

Technical data and information for connection conditions can be found on the rating plate and in the documentation, and must be complied with.

### 3. Transport, storage

Information regarding transport, storage and correct handling must be complied with.

### 4. Erection

The erection and cooling of the equipment must be implemented as per the regulations in the corresponding documentation.

The drive power converter must be protected against unpermitted loads. During transport and handling in particular, components must not be deformed and/or insulation distances must not be changed. Touching of electronic components and contacts must be avoided.

Drive power converters have electrostatically sensitive components that can be easily damaged by incorrect handling. Electrical components must not be mechanically damaged or destroyed (this may cause a health hazard!).

### 5. Electrical connections

When working on live drive power converters, the applicable national accident prevention regulations must be complied with (e.g. VBG 4).

The electrical installation must be implemented as per the applicable regulations (e.g. cable cross-section, fuses, ground lead connections). Further instructions can be found in the documentation.

Information about EMC-compliant installation – such as shielding, earthing, location of filters and installation of cables – can be found in the drive power converter documentation. These instructions must be complied with even with CE marked drive power converters. Compliance with the limit values specified in the EMC regulations is the responsibility of the manufacturer of the system or machine.

### 6. Operation

Systems where drive power converters are installed must be equipped, where necessary, with additional monitoring and protective equipment as per the applicable safety requirements, e.g. legislation concerning technical equipment, accident prevention regulations, etc. Modifications to the drive power converter using the operating software are permitted.

After the drive power converter is disconnected from the power supply, live equipment components and power connections should not be touched immediately because of possible charged capacitors. Comply with the applicable information signs located on the drive power converter.

All covers must be kept closed during operation.

### 7. Maintenance and repairs

The manufacturer documentation must be complied with.

**These safety instructions must be kept in a safe place!**

## Special safety and operating instructions for the SK 1000E



NORDAC SK 1000E servo controllers are equipment for use in industrial high voltage systems and are operated at voltages that could lead to severe injuries or death if they are touched.

- The equipment continues to carry hazardous voltages for up to 5 minutes after being switched off at the mains. The equipment may only be opened or the cover or control element removed 5 minutes after the equipment has been disconnected from the power supply. All covers must be put back in place before the line voltage is switched back on again.
- Even during motor standstill (e.g. caused by a release block, blocked drive or output terminal short circuit), the line connection terminals, motor terminals and braking resistor terminals may still conduct hazardous voltages. A motor standstill is not identical to galvanic isolation from the mains.
- **Warning:** even parts of the control card and, in particular, the connection plug for FlashJTAG program programming can conduct hazardous voltages. When programming the DSP via the JTAG plug, a specially available opto-isolator must be used. The external control terminals are line potential-free. The JTAG interface is a non-proprietary standardised programming interface for DSP and controller for which several companies, e.g. Spectrum Digital, offer suitable connection adapters. The internal safety covers on these items must not be removed.
- **Warning,** under certain settings the servo controller can start automatically after the mains are switched on.
- The circuit boards contain highly-sensitive MOS semiconductor components that are particularly sensitive to static electricity. Avoid touching circuit tracks and components with the hand or metallic objects. Only the terminal strip screws may be touched with insulated screwdrivers when connecting the cables.
- The servo controllers are only intended for permanent connection and may not be operated without effective earthing connections that comply with local regulations regarding large leak currents (> 3.5 mA). VDE 0160 requires the installation of a second earthing conductor or an earthing conductor cross section of at least 10 mm<sup>2</sup>.
- Normal FI circuit breakers are generally not suitable as the sole protection in servo controllers when the local regulations do not permit a possible DC proportion in the faulty current. The standard FI circuit breaker must comply with the new design as per VDE 0664.
- NORDAC SK 1000E servo controllers are maintenance-free when used correctly. The cooling surfaces must be regularly cleaned with compressed air if the ambient air is dusty.

### **ATTENTION! DANGER TO LIFE!**

The power unit can continue to carry voltages for up to 5 minutes after being switched off at the mains. Terminals, motor cables and motor terminals may be live! Touching open or free terminals, cables and equipment components can lead to severe injury or death!



### **CAUTION**

- Children and the general public must be kept away from the equipment!
- The equipment may only be used for the purpose intended by the manufacturer. Unpermitted modifications and the use of spare parts and additional equipment that has not been bought from or recommended by the equipment manufacturer can lead to fire, electric shock and injury.
- Keep these operating instructions in an accessible location and ensure that every operator uses them!

### **European EMC guideline**

When the NORDAC SK 1000E is installed according to the instructions in this manual, it will meet all requirements in the EMC guideline, as per the EMC product standard for motor-operated systems EN 61800-3 (see also the chapter Electromagnetic compatibility [EMC]).



### **Utilisation in North America, UL and CSA authorisation**

*“Suitable for use on a circuit capable of delivering not more than 5000 rms symmetrical amperes, up to 460 Volts (three phase)” and “when protected by J class fuses.” as indicated.*

In preparation



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## 1 General information

### 1.1 NORDAC SK 1000E Servo Controller

#### The NORD dynamic intelligence

The NORDAC SK 1000E is the best choice where rapid acceleration, fast movement and high standstill moment, coupled with high speed and positioning precision, are essential. Combined with the integrated PLC, technical functions and CANopen field bus connection, it is the solution for demanding drive problems.

Rated current: 3.5-20Aeff, 3 AC380-460V 50-60Hz  
 Speed range: Servo controller with resolver +/- 22500 rpm,  
 Servo controller with incremental encoder is proportionally resolution dependent, e.g. at 4096 increments +/- 18500 rpm (**Attention:** note the limit frequency of the encoder, this is often only 250 kHz! )

NORDAC SK 1000E servo controllers are designed using fully digital signal processor technology (DSP) with field bus connections for torque, speed and positioning regulation of synchronous and asynchronous motors.

The field-orientated control concept with current, speed, position control and speed profile depiction in just 50µs sampling time means that this system has extremely high dynamics and full motor movement even when at standstill. Extremely high, load-independent speed and positioning accuracy is achieved by the rotor position feedback. Demanding drive tasks can therefore be resolved. Implemented technical functions underline customer benefits.

An integrated PLC rounds off the function spectrum of this controller.

The controller is commissioned with the operating software running under Windows 95/95, 2000, NT and XP. Commissioning is facilitated by the supplied motor/controller database, oscilloscope and numerous test functions, while the assistant means that anyone can commission the controller.

**Some specifications are currently in preparation. Technical developments means that this product description continuously undergoes changes and these changes are collected and the product description is updated with the latest developments as and when necessary.**

### 1.2 Variants and options

Variant	Description	Data
R = resolver	Feedback = Resolver	12 bit resolution
E = encoder	Feedback = incremental encoder Hall supplement recommended	from 500 increment resolution, freely selectable increment number
RS	Resolver with option: 1 MBaud CAN and absolute value encoder, no stepper motor interface	
ES	Encoder with option: 1 MBaud CAN and absolute value encoder, no stepper motor interface	
RT	Resolver with option: technical functions	See Nord applications publication
ET	Encoder with option: technical functions	See Nord applications publication
RST	Resolver with option: 1 MBaud CAN and absolute value encoder, no stepper motor interface, with technical functions option	
EST	Encoder with option: 1 MBaud CAN and absolute value encoder, no stepper motor interface, with technical functions option	

All servo controllers can operate synchronous and asynchronous motors. During commissioning, the connected motor data record simply has to be loaded from the database.

### 1.3 Equipment properties

- Operation of synchronous and asynchronous motors
- High dynamics, motors can be operated with up to 0.5 ms electrical and mechanical time constants.
- Full torque at standstill
- Sinusoidal commutation
- Fully digital control concept
- Integrated line filter A
- Integrated brake chopper with external brake resistor
- Torque, speed and positioning control – all in a control cycle time of 50µs
- Ramp generator / speed profile generator
- New positions, travel speeds and ramps can be set at any time during the procedure in the positioning control.
- Stepper motor interface with up to 5 MHz input frequency
- Technical functions, e.g. electronic gears, flying saws, winders  
Note -> you can obtain the publication: NORD applications for this purpose
- Encoder, resolver or absolute value encoder (SSI)
- Incremental encoder emulation output
- CAN field bus (up to 1 MBit/s), RS 232 and RS 485 (up to 56000 Bit/s)
- CAN- Open Protocol DS301V4.01&DS402V1.1, EDS configuration file provided
- Variable PDO mapping
- ±10 V analog setpoint interface
- 6 freely programmable inputs
- 6 freely programmable short-circuit proof outputs
- 1 freely programmable relay, e.g. for integrated brake control
- Integrated PLC with input assistant for particularly easy intuitive operation
- Logic and arithmetic operations can be implemented with variables and constants
- Integrated reference switch logic
- Integrated limit switch monitoring
- Comfortable and rapid commissioning via operating software with database functions and oscilloscope function
- Can be mounted adjacent to each other without spacing required
- Permissible ambient temperature up to 40°C
- Suitable for high speeds (encoder-dependent)

## 1.4 Delivery

Check the equipment **immediately** after delivery/unpacking for transport damage such as deformation or loose parts. If there is any damage, contact the carrier immediately and implement a thorough assessment.

**Important! This also applies even if the packaging is undamaged.**

The place before the decimal point on the firmware version (can be found under NORD SERV: equipment/controller info) and that of the operating program version of NORD SERV (displayed top left in NORD SERV) must coincide otherwise they will not be compatible.

Order version: Mounting unit IP 20 with resolver **or** encoder design  
 1MbaudCAN and SSI input **or** 500kbaudCAN and stepper motor input  
 with **or** without technical functions

Standard design	Integrated brake chopper Integrated line filter for limit curve A as per EN 55011 Integrated shield angle CAN Bus, RS232/RS485, 2.Resolver/ Encoder input/output PLC and programmable 6 inputs and 6 outputs +/- 10 V input, reference and limit switch inputs Motor temperature and motor brake logic Internal logic and power supply PC operating program with integrated online help (NORD SERV) Operating instructions
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Available accessories	Substructure brake resistors IP 20, various outputs Substructure line filter for limit curve B, as per EN 55011, IP 20 Line choke, IP 00 Interface converter RS 232 → RS 485 Cable set (see description in NORD cable documentation)
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## 2 Mounting and installation

### 2.1 Installation

NORDAC SK 1000E servo controllers are available in three sizes depending on the output. The equipment variants have different widths and installation depths.

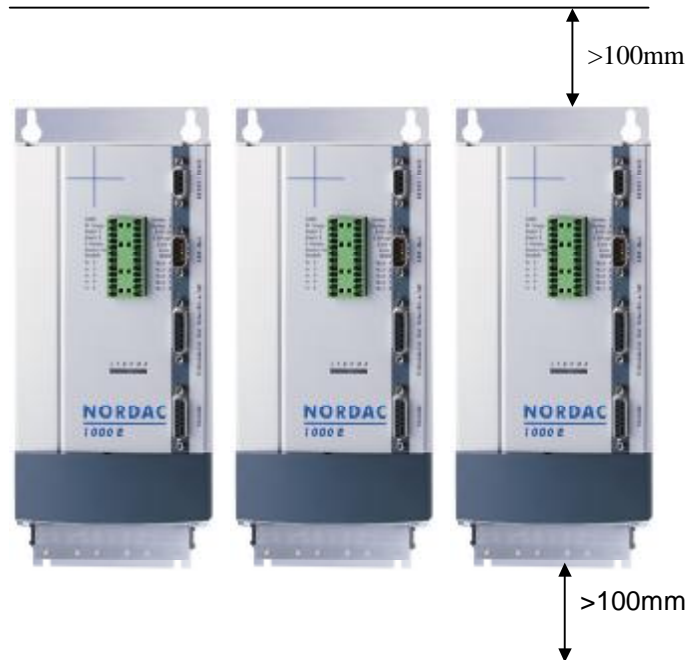
The equipment requires sufficient ventilation to protect against overheating. Guide values apply here for above and below the servo controller up to the limits of the control cabinet (above > 100 mm, below > 100 mm).

Electrical components (e.g. cable ducts, contactors, etc.) can be located within these limits. There is a height-dependent minimum distance from the servo controller for these objects. This distance must be minimum 2/3 the object height. (Example: cable duct height 60 mm high ->  $2.3 * 60 \text{ mm} = 40 \text{ mm}$  distance)

Additional distances at the sides are not required. Mounting can be implemented directly next to each other, e.g. on DIN rails. The installation position is normally vertical.



**The heated air must be vented!**

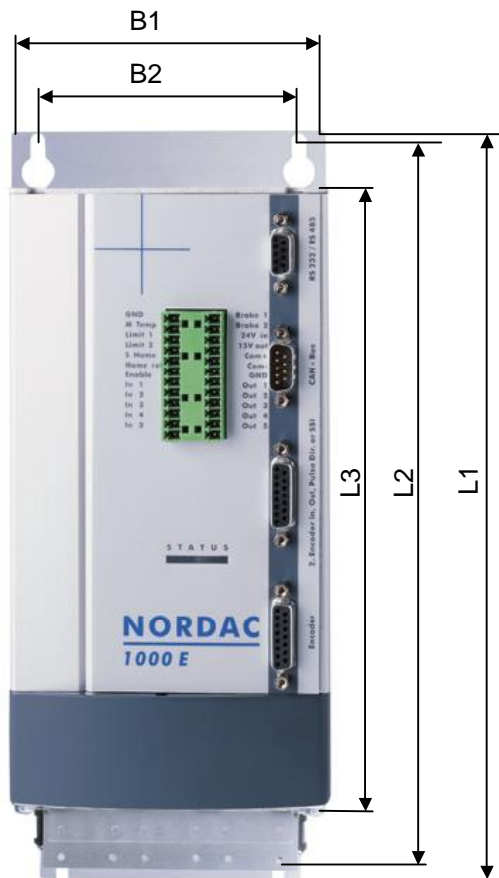


If several servo controllers are arranged above each other, ensure that the air entry temperature limits are not under or overshoot. In this case, it is recommended that any “obstacles” (e.g. a cable duct) are mounted between the servo controllers so that the air flow (rising warm air) is not hindered.



## 2.2 Dimensions

Size	Equipment type	L1	B1	Equipment depth D	Detail: Attachment			Weight ca.
					L2	B2	L3	
1	SK 1000E-101-340-A to SK 1000E-301-340-A	281	121	217	267	100	222	4 kg
2	SK 1000E-401-340-A to SK 1000E-501-340-A	331	121	217	310	100	272	5 kg
3	SK 1000E-801-340-A to SK 1000E-102-340-A	381	163	250	367	140	344	10 kg
Equipment depth without front plug				All measurements in mm				



## 2.3 Wiring guidelines


The servo controller is developed for operation in industrial environments where high values of electromagnetic interference are expected. In general, correct installation ensures safe and problem-free operation. If limit values exceeding the EMC guidelines are probable, the following information may be useful.

- (1) Ensure that all equipment in the cabinet is securely earthed using short earthing cables that have large cross-sections and which are connected to a common earthing point or earthing rail. It is very important that every connected controller (e.g. an automation device) is connected, using a short cable with large cross-section, to the same earthing point as the servo controller itself. Flat conductors (e.g. metal brackets) are preferable as they have low impedance at higher frequencies.


The PE lead of the motor controlled by the servo controller must be connected as directly as possible to the earth connection of the cooling element together with the PE of the relevant servo controller electrical system. The presence of a central earthing rail in the control cabinet and the bringing together of all PE conductors to this rail normally ensures safe operation. (See also the chapters: Line and motor connections, EMC)

- (2) Where possible, shielded cables must be used for the control circuits. Carefully terminate cable ends and ensure that the wires do not run over longer sections unshielded. The shields of analog setpoint cables should only be earthed on one side on the servo controller.
- (3) The control cables must be kept distant from load cables by using separate cable ducts, etc. If cables intersect, then an angle of 90° should be used where possible.
- (4) Ensure that the contactors in the cabinet are interference protected, either by RC circuits in the case of DC contactors or by free-wheeling diodes for AC contactors, **whereby the interference traps must be positioned on the contactor coils**. Varistors for over-voltage limitation are also effective. This interference suppression is particularly important when the contactors are controlled by the servo controller.
- (5) Shielded or armoured cables must be used for the load connections between motor and brake resistor. These must be applied to as much surface as possible on the shield angles directly on the servo controller with the supplied earthing clamps.
- (6) When the drive is to operate in an environment sensitive to electromagnetic interference, it is recommended that noise suppression filters are used to restrict the cable-dependent and radiated interference from the servo controller. In this case, the filter must be mounted as closely as possible to the servo controller and fully earthed. In addition, the servo controller must be installed, together with the line filter, in an EMC-proof enclosure with EMC-proof cabling.

**The safety regulations must be complied with under all circumstances when installing the servo controller!**

	<b>Note</b>
<p>The control cables, line cables and motor cables must be laid separately. In no case should they be laid in the same protective pipes/installation ducts. The test equipment for high voltage insulations must not be used on cables that are connected to the servo controller.</p>	

## 2.4 Line and motor connections

	<p><b>WARNING</b></p> <p>THIS EQUIPMENT MUST BE EARTHED.</p> <p>Safe operation of the equipment presupposes that qualified personnel mount and operate it in compliance with the instructions provided in these operating instructions.</p> <p>In particular, the general and regional mounting and safety regulations for work on high voltage systems (e.g. VDE) must be complied with as must the regulations concerning professional use of tools and the use of personal protection equipment.</p> <p>Dangerous voltages can be present at the line input and the motor connection terminals even when the servo controller is switched off. Always use insulated screwdrivers on these terminal fields!</p> <p>Ensure that the input voltage source is dead before setting up or changing connections to the unit.</p> <p><b>Ensure that the correct supply voltage is set up for the servo controller and motor.</b></p>
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The line, motor and brake resistor connections are located on the base of the unit. They can be accessed from the front by removing the plastic cover. All covers must be put back in place before switching on the supply voltage!

In general, the line, motor and brake resistor cables are connected first as their terminals are located on the bottom circuit board. The cable inlet gland is the slit opening on the bottom enclosure grid.

The following must be noted:

1. Ensure that the power source provides the correct voltage and is set up for the required current (see the chapter on technical data)! Ensure that suitable circuit breakers with the specified current range are switched between the voltage source and the servo controller!
2. Connect the line voltage directly to the line terminals  $L_1$  -  $L_2$  -  $L_3$  and the earth (PE)! For the cable cross-section of each wire, refer to the chapter on technical data!
3. A four-wire shielded cable must be used to connect the motor. The cable must be connected to the motor terminals U - V - W and the PE. **It is urgently recommended that the ready to use motor cables from NORD are used.** They are described in the NORD cable documentation.
4. The cable shield must be applied to as much surface as possible on the shield support angle with the supplied clamps. The clamps are also used as a strain relief.
 

**Note:** The use of shielded cables is essential in order to maintain the specified noise suppression level.
5. The motor cables can have a **total length of maximum 20 m.**
6. The switching cycle, the time between switching the mains on/off, must be greater than **1 minute** due to the integrated intermediate circuit capacitor charge. At least one minute must pass before the unit can be switched back on again!
7. The optional brake resistor must also be shielded when connected. When using the NORD substructure resistors, the cables are so short that shielding is not required.

The connection assignment U/V/W/PE is marked on the terminals. The power cables must be secured with the supplied shielded terminals (Phoenix SK 14).

**For sizes 1 and 2:**

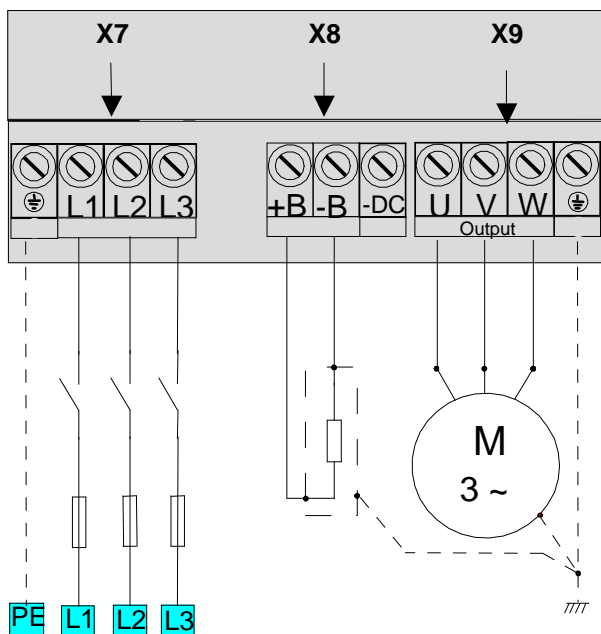
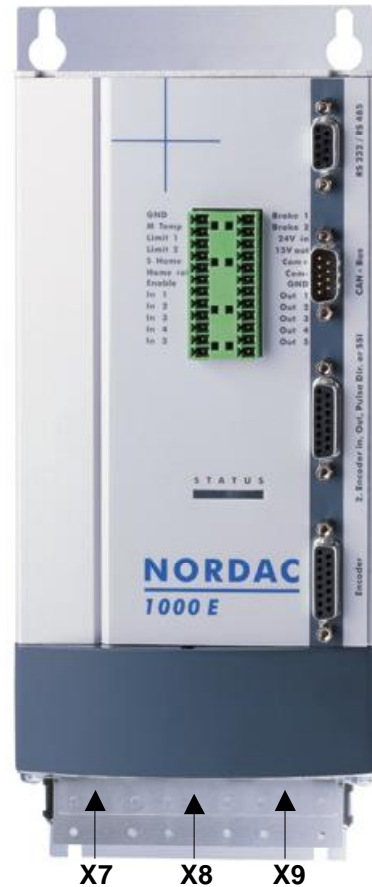
The connections terminals are suitable for a maximum cable cross-section of **2.5mm<sup>2</sup>**. When using certain wire sleeves, the maximum cable cross-section can be reduced to 1.5mm<sup>2</sup>.

The total external diameter of the power cable can be max. 10.5 mm, otherwise the supplied shield and strain relief clamps cannot be fastened.

**For size 3:**

The connections terminals are suitable for a maximum cable cross-section of **4mm<sup>2</sup>**. When using certain wire sleeves, the maximum cable cross-section can be reduced to 2.5mm<sup>2</sup>.

The total external diameter of the power cable can be max. 15.5mm, otherwise the supplied shield and strain relief clamps cannot be fastened.



Brake resistor  
Optional  
(see accessories)

Line connection 3 ~ 380V - 460V

## 2.5 Controller connections

### 2.5.1 24V I/O

- Connection terminals: - Standard screw terminal blocks.  
 Max. connection cross-section: - 1mm<sup>2</sup>  
 Cable: - Lay and shield **separately** from the line/motor cables  
 Control voltages: - For inputs = 15V to 30V, min. 10 mA (0... 7V low, 8... 30V high)  
 - Digital outputs up to 25 mA (short-circuit proof)  
 - 15V for internal power supply through the servo controller, 24V through external PSU  
 - Analog input ± 10V, max. 5mA, as analog setpoint

Note the switch-off delay of the servo controller outputs based on the input resistance of the control unit! This also applies to the servo controller inputs, a driver output of min. 10 mA through the machine controller is necessary for optimal switching behaviour.



Control voltages are based on a common reference potential (GND)!

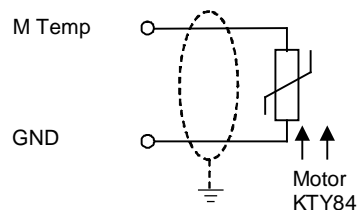
When using the 15V voltage output of the servo controller to power its outputs, a bridge must be inserted from the 15V output to the 24V input on the servo controller terminals. The servo controller internal I/O logic can then use the 15V produced internally by the servo controller and an external power supply unit is not required. Up to 150 mA can be used from the 15V output outside the servo controller for other purposes. This 15V output is unregulated and is short-circuit proof.

### 2.5.2 Connection terminals (left side X5)

(see front panels photo)

Terminal	Function
GND	Common (filtered) ground
M Temp	Motor temperature sensor (KTY84)

A temperature sensor can be connected to protect the motor from overheating.



Limit 1 and 2	Limit switch
Home ref	Reference switch input
Enable	When the enable signal is removed, the final stage is shut down. If operated with a motor brake, a quick stop occurs first. The servo controller motor terminals will still be carrying line potential!
6x In	Freely-programmable inputs can also be sampled via the integrated PLC with the assistance of NORD SERV

### 2.5.3 Connection terminals (right side X5)

(See front panels photo)

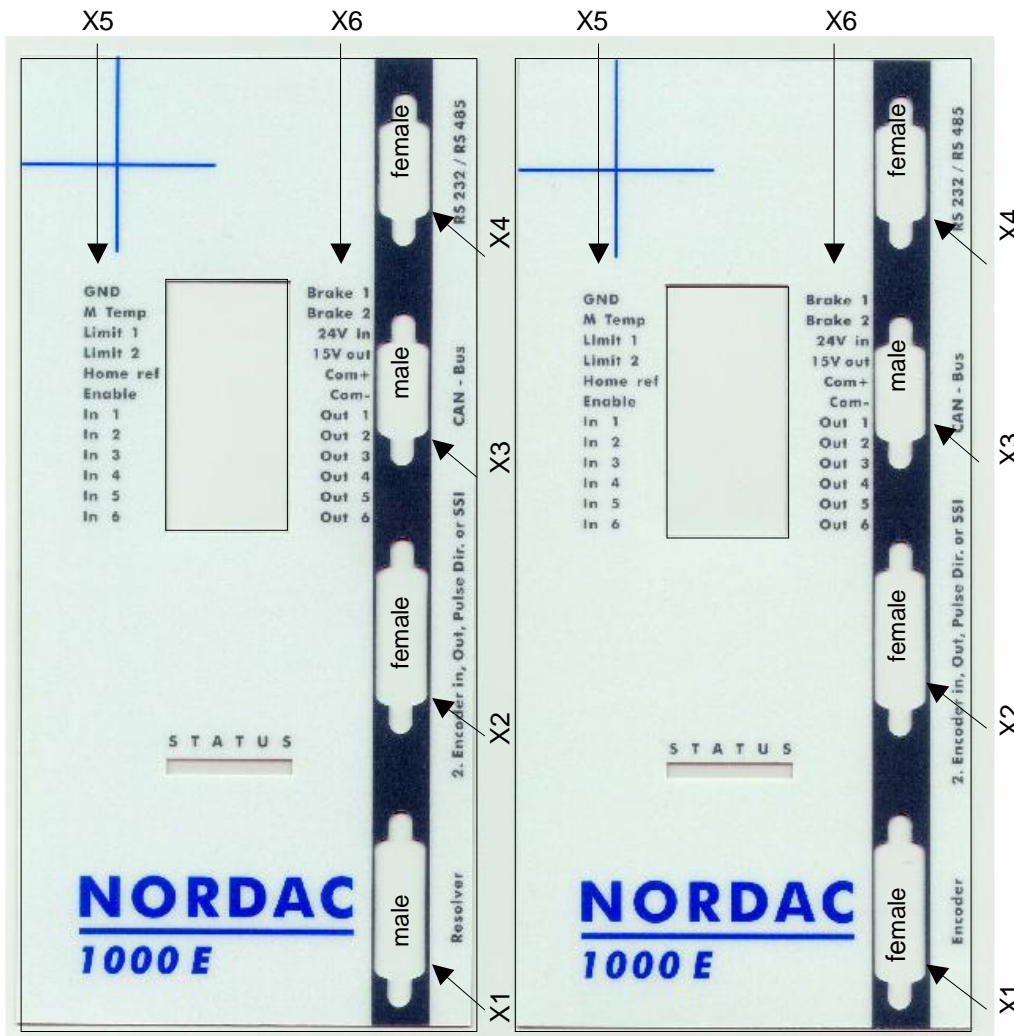
Terminal	Function
Brake1/ Brake2	Monopolar floating relay contact for the motor brake Relay limit value: 30V / 4A (The 15V output of the servo controller is not suitable for controlling a motor brake)
24Vin	Input for 24V / 300 mA, smoothed for brake 3A, from external PSU
15Vout	without external PSU, this voltage is available in the servo controller's own I/O circuits
Com+ Com-	Differential input for +/-10V analog control voltage
6 Out	Freely-programmable outputs, standard functions such as "Position OK", "Enable", etc. can be activated via the PLC with the assistance of the NORD SERV

### 2.5.4 Front panels

The figure below shows the front panels, connections are clearly marked on the front panels. The front panel designs shown differ only in the encoder input. When ordering, customers must ensure they select the correct design, retrofitting is not possible.

Resolver type:

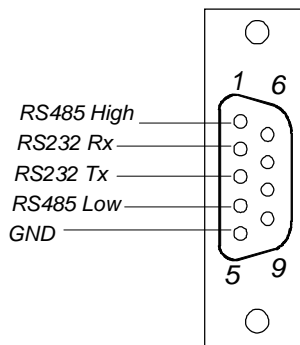
Encoder type:



### 2.5.5 RS 232 and RS 485 (X4)

The RS 232 interface enables the NORDAC SK 1000E servo controller to be easily connected to a PC with a serial interface and the supplied NORD SERV parameterisation and operating software. The connected servo controller can be controlled and parameterised via this interface. This permits a function test of the servo controller. Following parameterisation, the data record can be stored as a file both on the PC and in the servo controller.

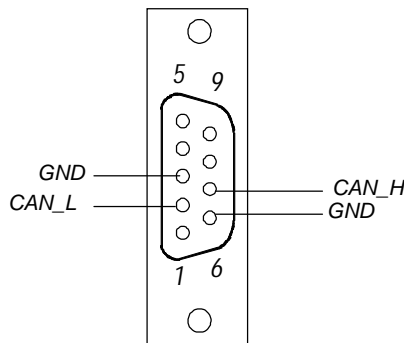
The RS485 interface enables up to 16 servo controllers to be connected in parallel if a converter is used which is also available from NORD on request. NORD also offers corresponding ready to use RS 483 cables (see accessories). Operation of several servo controllers via the RS485 bus requires that the same baud rate is used by all of the units and a different address is set on each unit. The terminating resistor integrated in the servo controller must also be connected to the end of the bus. This is explained in the following “Can bus” section.



RS232 and RS485 pin assignment, 9 pole SUB-D female with UMC/ inch thread

### 2.5.6 CAN Bus (X3)

The CAN bus interface is compatible with the ISO 11898 standard. The pin assignment of the SUB-D connector is compatible with the CANopen standard.

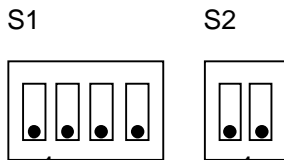


Pin assignment, 9 pole SUB-D male with UMC/ inch thread

The use of an external CAN bus nodal connector with 2 screw terminal connections is recommended (see Accessories chapter).

The CAN bus is electrically isolated from the power supply and coupled with the terminal grounds

Up to 16 different addresses can be selected via the servo controller DIP switches, these addresses are only read in when the power supply for the servo controller is switched on. Terminating resistors are integrated and can be set or switched on like the address preselection via the DIP switches. These switches are located under the opened plastic cover on the front panel of the servo controller. The quadruple DIP switch (S1) sets the address pre-selection and the twin DIP switch (S2) enables/disables the terminating resistor.



Arrangement of DIP switches on the servo controller, all switches are by default in the "OFF" position.

S1

Switch 4	Switch 3	Switch 2	Switch 1	Set value	CAN node address
OFF	OFF	OFF	OFF	0	1
OFF	OFF	OFF	ON	1	2
OFF	OFF	ON	OFF	2	3
OFF	OFF	ON	ON	3	4
OFF	ON	OFF	OFF	4	5
OFF	ON	OFF	ON	5	6
OFF	ON	ON	OFF	6	7
OFF	ON	ON	ON	7	8
ON	OFF	OFF	OFF	8	9
ON	OFF	OFF	ON	9	10
ON	OFF	ON	OFF	10	11
ON	OFF	ON	ON	11	12
ON	ON	OFF	OFF	12	13
ON	ON	OFF	ON	13	14
ON	ON	ON	OFF	14	15
ON	ON	ON	ON	15	16

Address settings for the bus on the quadruple DIP switch

The addresses for CAN nodes are increased by 1 in the servo controller, i.e., when 0 is set as an address with the DIP switch, the servo controller will have the CAN node address "1".

The baud rate can be set to 10K, 20k, 50k, 125k, 250k, 500kBaund and 1MBaud. The default rate is 500kBaund, an optional variant is available with 1MBaud. The settings are made via the supplied NORD SERV operating software.

S2

Switch 1	Switch 2	Function
ON	---	Terminating resistor for RS 485 switched on with 120Ω
---	ON	Terminating resistor for CAN bus switched on with 120Ω

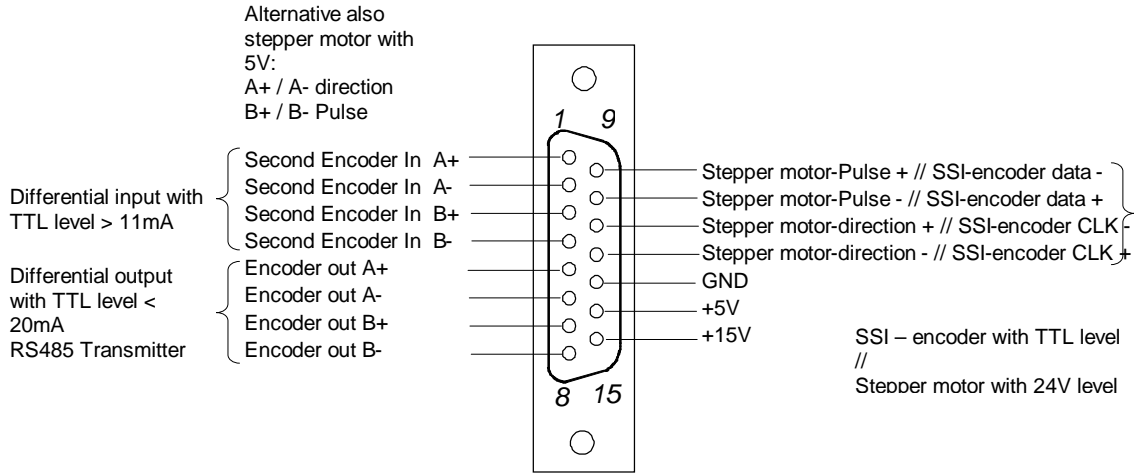
Function of twin DIP switch



### 2.5.7 Second encoder in, Out, Pulse Dir. / SS1 (X2)

Pin assignment, 15 pole female SUB-D with UMC/ inch thread

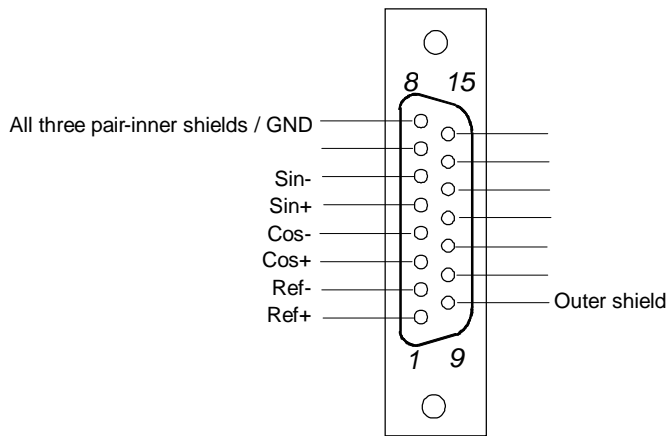
Depending on the type, pins 9 to 12 can have various input/output signals. Differential inputs for "Pulse and Direction" (stepper motor interface) or a differential input for SSI Data and a differential output for SSI clock pulse. (SSI -> Synchronous Serial Interface). SSI absolute value encoders 10-30V, 12Bit (4096 / rpm, Gray-Code coded) are available from NORD.



### 2.5.8 Resolver or encoder unit (X1)

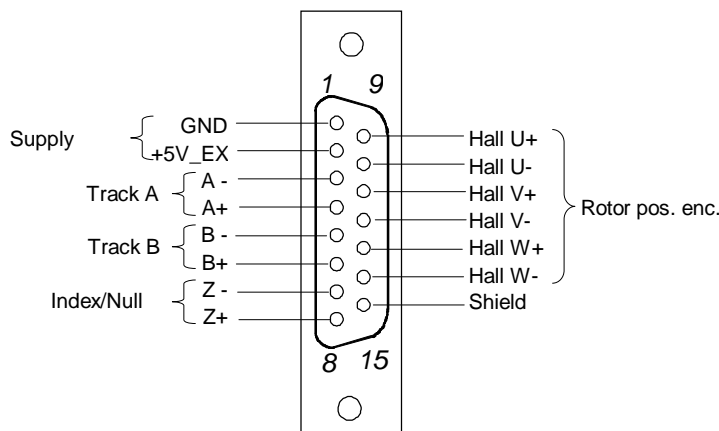
The unit type must be selected by the customer when ordering. The servo controller is equipped with the corresponding feedback system during manufacture and cannot be retrofitted. NORD synchronous motors are normally equipped with output and feedback connectors on the motor.

Resolver pin assignment, 15 pole male SUB-D with UMC/ inch thread



or

5V TTL encoder with Hall or commutation tracks, pin assignment 15 pole female SUB-D with UMC/ inch thread



## 2.5.9 Asynchronous motor cable connections

### Feedback:

NORD asynchronous motors come with a 1.5 m encoder cable permanently connected to the motor as standard. The customer can connect a SUB-D connector to the free wire ends with the following assignment for the servo. As the 1.5 m cable length is normally not sufficient to reach the servo controller, a NORD encoder extension cable (see NORD cable documentation) can be connected to this SUB-D connector.

Assignment SUB-D connector servo-side:

PIN	Wire colours	Signal
1	White/green	0V
2	Brown/green	5V
3	Green	A-
4	Brown	A+
5	Pink	B-
6	Grey	B+
7	Black	Z-
8	Red	Z+

### Power:

A terminal box is located on NORD asynchronous motors for the power connection. The customer can implement the connection to the servo controller with the screw terminals using a ready-to-use cable available from NORD (see NORD cable documentation). The terminals are labelled in the terminal box. It is highly recommended to select the asynchronous motor equipped with temperature sensors for servo applications. Only then can the servo controller take over the temperature protection of the motor. The NORD power cable for asynchronous motors also includes the wires for the temperature sensor and for any motor brake present. The relevant connections are identified, conforming to standards, in the terminal box. Polarity can be ignored for the temperature sensor and brake.

## 2.5.10 CAN connector (optional accessories)

Various screw terminal connectors are available for the connection to the CAN Open socket in addition to other additional NORD accessories. The customer can cut CAN cables, also available from NORD, to the length required and connect them by these means to the screw terminals. The terminals come with two connections so that the servo controller can be looped through. In addition, the terminals come with optional terminating resistors which are not required when the terminating resistor on the DIP switch is already switched on in the servo controller itself. A terminating resistor should be switched on for each end unit (not the looped units!). NORD ready-to-use CAN cables are also available. The NORD cable documentation also describes various other cables.

### Recommended CAN screw terminal connector:

1. **Erbic CAN bus node, straight, without programming connection, ERNI, article No.: 154039 (metal enclosure) -> this is usually the best choice!**
2. Bus connector, angled CAN bus, Sangel, Order No.: 101-690-0BA11
3. Erbic CAN bus node, angled, with programming connection, ERNI, article No.: 103662
4. T-adapter for CAN bus, PEAK-System Technik, No.: IPEK- 003003  
+2x hexagonal bolts (UNC) +Gender Changer 10 pole (male/male)
5. CAN cable without terminating resistor, PEAK-System Technik, No.: IPEK- 003000
6. Bus connector, CAN bus, Helmholz, without connection socket, Order No.: 700-690-0BA11

## 2.6 Display

The base unit NORDAC SK 1000E is delivered with a status LED (bi-colour green, red). The line voltage and operational readiness of the servo controller is signalled by a green LED. The red LED lights up if there is a malfunction. In operation, the colour displayed roughly indicates the motor current or the required motor torque. Green -> no current, red -> maximum current, orange -> average current.

## 2.7 Rated / peak current

The servo controller automatically protects itself against overload. It is designed thermally for the rated current. This rated or nominal current can be permanently supplied by the servo controller. The servo controller can supply a peak current for brief accelerations, it is electrically designed for this purpose. The time in which peak current can be supplied is 60s. If the servo controller is subject to this load, it must be given the same amount of time for cooling during which it can only supply the rated current. This function is dynamic and therefore depends on the actual applicable relationships of the overcurrent in the overload and cooling phases. The cooling phase can extend into "disable" times that can possibly be included. The cooling phase is brought to this reduced value through the rated current limited by the motor parameters so that the motor is also thermally protected.

## 2.8 Brake

The servo controller has a parameterisable brake control system. The application time and ventilating time parameters can be set in NORD SERV (parameter dialog "Motor"). A relay is integrated in the servo controller to directly switch the motor brake. 24 V must be supplied on the secondary side as the servo controller only has a floating contact. The relay is controlled by the status machine of the servo controller.

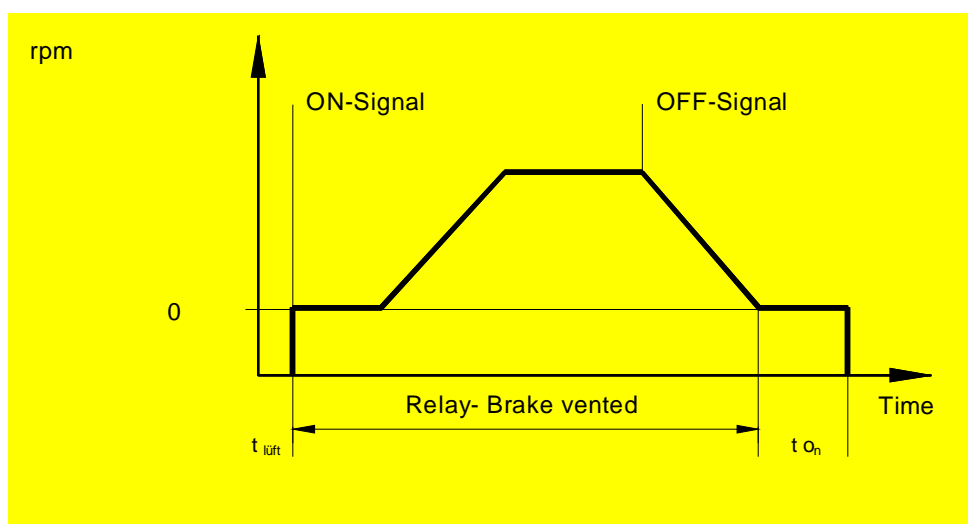
### Brake application time:

Electromagnetic brakes have a physically dependent delayed reaction time during application.

This application time can be taken into account in the settings in NORD SERV. During this adjustable application time, the servo controller internally supplies the speed setpoint Null and thereby prevents a load drop during vertical drive applications. Attention: If the time selected is too short, load drops will occur and this will lead to increased brake wear.

### Brake ventilation time:

Electromagnetic brakes have a physically dependent delayed reaction time during ventilation. This ventilation time can also be taken into account in the settings in NORD SERV. During the adjustable ventilation time, the servo controller supplies the speed Null and prevents contact with the brake. Attention: If the time selected is too short, brake wear will increase and this could eventually cause the servo controller to fail due to trailing or overcurrent faults.



## 2.9 Basic settings

To start-up, a data record suitable for the motor must be loaded into the corresponding controller using the supplied NORD SERV software.

**Initial test:** Check whether all cables, e.g. limit switches, are correctly connected and whether all relevant safety precautions have been complied with.  
Switch on the line voltage for the servo controller.  
Ensure that the motor can start-up without danger. Enable.  
Start the motor by increasing the speed, e.g. in the NORD SERV control window, check that the motor is turning in the required direction.



## 2.10 Commissioning

When the power supply for the servo controller is switched on, it is operational after a few seconds (green LED). It can then be set to the application requirements, i.e. parameterised. The motor can only be started with the enable signal after it has been successfully commissioned initially by qualified personnel.



The servo controller is not equipped with a line switch and is therefore always live when connected to the power supply.

When using the incremental encoder and the corresponding hall encoder commutation (rotor position encoder), only circa 60% of the peak torque is available for the first motor rotation after the power is switched on.

Check the maximum permissible speed of the encoder used and its limit frequency. The encoder used in NORD standard motors (2048 inc/rpm) has, up to 85°C, a limit frequency of 200kHz (6000 rpm) and up to 100°C just 100kHz (3000 rpm).

Long incremental encoder connection cables lead to a not insignificant voltage drop due to the ohmic resistance of the encoder supply circuits. The encoders used have an operating voltage tolerance of  $\pm 5\%$  (250mV). If this is undershot ( $< 4.75$  V at the encoder), the encoder will operate outside its specifications and correct function can no longer be guaranteed. The standard encoder cables from NORD permit a cable length of 20 m. If longer cables are required, the cables must have a larger cross-section or an external power supply must be used for the encoder. Non-compliance will lead to pulse losses and therefore to position deviations.

This power supply problem is not critical for resolver cables. However, analog resolver signals will then be evaluated by the servo controller. Therefore the balance quality will decrease continuously due to interference injections.

If the data record stored in the unit matches the application and, in particular, the motor, the axis will be immediately operational after connection. If the settings were not prepared, the axis must be made operational via the operating interface (see next manual section). The operating interface starts up with an assistant which can provide comprehensive help. Standard records can be baded for synchronous and asynchronous motors from the integrated databases.

### 3 Technical Data

3

#### 3.1 Electrical data

Unit type: SK 1000E...	-101-340-A	-201-340-A	-301-340-A	-401-340-A	-501-340-A	-801-340-A	-102-340-A
Power [kW]	1	2	3	4	5	8	10
Size	1		2		3		
Line voltage V	3 AC 380 – 460, -20%/+10%, 47 ... 63 Hz						
Rated current (eff.) (permanent open circuit current) [A]	3.6	4.8	6.3	8.4	10.8	15	20
Peak current for 60s (eff.) (open circuit current) [A]	5.1	6.7	8.8	11.7	15.1	21	28
Peak current for 60s (eff.) >3Hz [A]	7.2	9.5	12.4	16.6	21.4	30	40
Braking resistor	External (see 3.3.2)						
Line/emergency stop switching time	After unit is switched off, leave at least 1 minute without power!						
Ambient temperature	0°C ... +40°C continuous operation						
Cooling	Convection	Fan					

#### 3.2 Functions

Function	Specification
Feedback resolver or Feedback incremental encoder	Accuracy 10 Bit, resolution 12 Bit, rpm range +/-22500 rpm, 2 pole, 7Vrms From 500 increments, 5V supply <150mA, rpm range 4096 increments = +/-18500 rpm, over 500 any number of increments up to 4294967295 can be used (e.g. 500, 512, 1000, 1024, etc.). Please note the permissible output frequency of the encoder used. This is normally around 200 kHz, the given speed can be used to derive the permissible maximum increment number. NORD standard: 2048 inc/rpm, 85°C max. 200kHz (6000 rpm); 100°C max. 100 kHz (3000 rpm)
Protective measures against	Over-temperature of servo controller and motor Over and under-voltage Short-circuit, earth fault, overload
Regulation and control	Travelling profile, torque, speed and positioning control – all in a control cycle time of 50µs
Setpoint input analog	+/- 10 V resolution 12Bit
Speed calculation	16 bit
Motor temperature monitoring	KTY84
Control inputs	6 freely programmable inputs, 10-30 V, e.g. for the PLC + and - limit switches, enable, reference, motor temperature monitoring
Control outputs	1 relay 30V AC / DC 2A; 6 freely programmable short-circuit proof outputs 24 V / 25mA, e.g. for the PLC
Interfaces	RS 232 RS 485 CAN bus up to 500 kBit/s
Controller efficiency	Ca. 95%
Interface	Stepper motor interface 5 MHz (cannot be combined with SSI option regarding hardware, software cannot operate second incremental encoder simultaneously, but switching is possible with NORD SERV!) Second incremental encoder input 5 MHz, < 150 mA Required for gear functions (cannot be operated simultaneously with stepper motor interface through software, however switching is possible with NORD SERV!)
Ambient temperature	0°C ... +40°C continuous operation
Storage and transport temperature	-40°C ... +70°C
Protection class	IP20
Electrical isolation	Control terminals (digital and analog inputs)

### 3.3 Accessories

Accessories	Description	Data
Motor power cable	NORD factory standard Available on request	---
Resolver-encoder cable		---
Incremental encoder cable		---
RS 485 communication cable		---
CAN bus connection cable		---
RS 232 communication cable		---
Shaft electrical connection cable		---
RS232 / RS485 converter	For connecting a PC to the RS 485 bus	Automatic bit(s)-speed detection and read/write switching
External auxiliary filter	Filter class B	
External brake resistor	For applications with high generational recovered energy	100W, 300W, 400W, 600W

#### 3.3.1 Auxiliary line filter class B

An auxiliary external line filter (optional) can be looped into the line supply of the servo controller to maintain the increased noise suppression level (class B as per EN 55011),

When connecting the line filter, comply with the Chapters: "Wiring guidelines" and "EMC".

Servo controller type	Filter type
SK1000E-101-340-A to 301-340-A	SK-LF1-460/14-F
SK 1000E-401-340-A to 501-340-A	SK-LF1-460/24-F
SK 1000E-801-340-A to 102-340-A	SK-LF1-460/45-F



## 4 Additional information

### 4.1 Electromagnetic compatibility (EMC)

All electrical equipment that have an intrinsic, independent function and are placed on the market as individual units for users must comply from January 1996 with the EEC directive EEC/89/336 . There are three different ways for manufacturers to display compliance with this directive:

1. *EC conformance declaration*

This is a declaration by the manufacturer that the requirements in the applicable European standards for the electrical environment of the equipment are met. Only those standards that are published in the Official Journal of the European Community can be cited in the manufacturer declaration.

2. *Technical documentation*

Technical documentation can be produced that describes the EMC behaviour of the equipment. This documentation must be authorised by one of the "Responsible bodies" named by the responsible European government. This makes it possible to use standards that are still under preparation.

3. *EC approval test certificate* This method only applies to radio transmitter equipment.

NORDAC servo controllers only have a function when they are connected to other equipment (e.g. with a motor). The base units cannot therefore carry the CE mark that would confirm compliance with the EMC directive. Precise details are therefore given below about the EMC behaviour of this product, based on the proviso that it is installed according to the guidelines and instructions described in this documentation.

#### **Class 1: General, for industrial environments**

Complies with the EMC standard for power drives EN 61800-3, for use in **secondary environments (industrial)** and when **not generally available**.

#### **Class 2: Interference suppressed for industrial environments (operation has own supply transformer)**

In this operating class, the manufacturer can certify that his equipment meets the requirements of the EMC directive for industrial environments with respect to their EMC behaviour in power drives. The limit values correspond to the basic standards EN 50081-2 and EN 50082-2 for radiation and interference resistance in industrial environments.

#### **Class 3: Interference suppressed for domestic, commercial and light industry environments**

In this operating class, the manufacturer can certify that his equipment meets the requirements of the EMC directive for domestic, commercial and light industry environments with respect to their EMC behaviour in power drives. The limit values correspond to the basic standards EN 50081-1 and EN 50082-1 for radiation and interference resistance.

**Note:** The NORDAC servo controllers are designed **solely for commercial applications**. They do not therefore meet the requirements of the standard EN 61000-3-2 for radiation of harmonics.



## 4.2 Limit value classes

Equipment type	without aux. line filter	with aux. line filter	with aux. line filter
SK 1000E-101-340-A to SK 1000E-102-340-A	Class 2 (A)	Class 2 (A)	Class 3 (B)
Max. length motor cable	7m	30m	20m

**NOTE:**

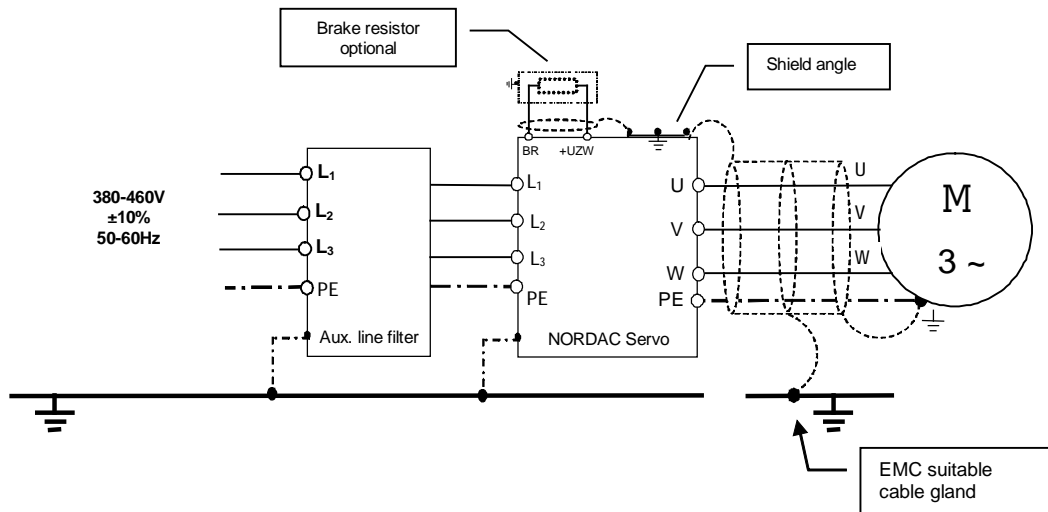
Please note that these limit value classes are only achieved when the length of the motor cable does not exceed the length given above. Shielded cables are required.

In addition, EMC compliant wiring is essential.

The shield of the shielded motor cable must be applied to the shield angle and, to comply with Class 3, also on the entry to the control cabinet (EMC screw connection).

<i>Overview of standards that, as per EN 61800-3 (product standard for FU), are based on EN 50081; 510082 and must be complied with</i>			
	<b>Standard</b>	<b>Limit value class</b>	
<b>Interference emission</b>			
Cable based interferences	EN55011	"A"	"B" with filter
Radiated interference	EN55011	"A"	"B" with filter
<b>Interference resistance</b>			
ESD	EN61000-4-2	8kV (AD&CD)	
Burst on control cables	EN61000-4-4	2kV	
Burst on line and motor cables	EN61000-4-4	4kV	
Surge (phase-phase / phase-ground)	EN61000-4-5	1kV / 2kV	
EMF	EN61000-4-3	10V/m; 26-1000MHz	
Voltage fluctuations and drops	EN61000-2-1	+10%, -15%; 90%	
Voltage dissymmetries and frequency changes	EN61000-2-4	3%; 2%	

#### 4.2.1 Wiring recommendations for compliance with Class 3 in 3 phase networks



### 5 Maintenance and service notes

NORDAC SK 1000E servo controllers are maintenance-free when used correctly.

If the servo controller is operated in dusty air, the cooling surfaces must be regularly cleaned with compressed air. If air filters are used in the control cabinet, these must also be cleaned or replaced regularly.

The equipment must be sent to the following address if it needs repairing:

Enercon NORD Electronic GmbH  
 Finkenburgweg 11  
 26603 Aurich  
 Germany

For queries about repairs, please contact:

Getriebebau NORD GmbH & Co.  
 Telephone: +49 4532 / 401 514 or 401 518  
 Fax: +49 4532 / 401 555

If a servo controller is sent in for repair, no liability can be accepted for any added components, e.g. such as line cables, potentiometer, external displays, etc.!

Please remove all non-original parts from the servo controller.

You can find the comprehensive manuals in German and in English on our Internet site.  
<http://www.nord.com/>

You can also obtain this manual from your local representative if necessary.

## 6 Representatives, branches

### Getriebbau NORD representatives, in Germany:

#### **North branch**

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TR - 81700 Tuzla – Istanbul

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Fax: +90 216 / 304 13 69

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