

# GETRIEBEBAU NORD

Member of the NORD DRIVESYSTEMS Group



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## 1 Introduction

Frequency inverters of the series

- NORDAC *BASE* (SK 1x0E)
- NORDAC *FLEX* (SK 2xxE)
- NORDAC *ON* (SK 3xxP)
- NORDAC *PRO* (SK 5xxE)
- NORDAC *PRO* (SK 5xxP)

are subject to special requirements when used in mobile applications with detachable electrical connection to the power supply (mains plug).

## 2 Definition of mains plug

For the purpose of this documentation, mains plugs are understood to be the following plugs according to IEC 60309.



**CEE alternating current plug**  
16 A, 230 V, L+N+PE, 6h, IP44



**CEE three-phase plug**  
16 A, 400 V, 3L+N+PE, 6h, IP44

The use of so-called protected contact plug connectors (“Schuko plug”) is not permissible.

Industrial plug connectors (e.g. “Harting”) are not subject to the requirements listed in this documentation.

Technical Information / Datasheet	Pluggable mains connection with NORD products			
Electronics	TI 80_0037	V 1.0	2923	en

### 3 Installation information

The mains connections must be carried out via a multi-wired cable. The protective conductor must be part of the mains cable and have a minimum cross-section of 2.5 mm<sup>2</sup> (Cu) if no additional protective conductor is connected to the frequency inverter. (Please observe the TI 80-0019 “Dimensioning of the protective conductor” for further details)

#### **WARNING**

##### **Electric shock**

Dangerous voltages may be present at the plug contacts for the power connections (e.g. mains cable, motor cable) even when the device is not in operation.

- Before starting work, check that all relevant components (voltage source, connection cables) are free of voltage using suitable measuring equipment.
- Use insulated tools (e.g. screwdrivers).
- Earth devices.

#### 3.1 Residual voltages at mains plug contacts

The above-mentioned mains plugs have accessible contacts when they are unplugged and therefore do not meet the protection class with additional contact guards IPxxB (IEC/EN 60529) as required in EN 61800-5-1.

Frequency inverters typically have integrated filter circuits on the mains side to comply with EMC requirements. These filter circuits in turn contain capacitors.

These capacitors, also called filter capacitors, charge up to the instantaneous values of the mains voltage as soon as there is a connection of the frequency inverter to the mains supply. It is irrelevant in which operating state (standby, load or idling mode) the frequency inverter is.

After disconnecting the frequency inverter from the mains supply by pulling out the mains plug, the charge is initially stored in the filter capacitors. If no disconnecting or discharging device is installed between mains plug and frequency inverter, the residual voltage of the filter capacitors is applied to the contacts of the mains plug. Touching these contacts may lead to an electric shock.

To prevent this hazard, the EN 61800-5-1 and the Machinery Directive, among others, require that the capacitors are discharged to a residual voltage < 60 V or to a residual charge of less than 50 µC within 1 s. If neither the discharge time of 1 s nor a protection of at least IPxxB can be achieved, it is necessary to use additional operating materials for disconnection or an appropriate warning device. For example, a mains contactor with self-retaining function can be used between the mains plug and the frequency converter to implement an isolating device.

For some frequency inverters, NORD DRIVESYSTEMS Group offers a solution in the form of an optional discharge module.

These modules are designed exclusively for discharging the line filter capacitors installed in the frequency inverter. **They are not suitable for discharging any additional external line filters present in the circuit!**

- Power discharger for NORDAC *FLEX*:
  - SK CU4-PD1    Material number: 275271025
  - SK CU4-PD1-C    Material number: 275271525
- Power discharger for NORDAC *BASE*:
  - SK CU4-PD2    (Material number: 275271026)
  - SK CU4-PD2-C    (Material number: 275271526)

### 3.2 Device overview

The following list provides an overview of the assignments to the frequency inverters.

#### NORDAC BASE

Device type	Additional isolation by mains contactor required?	Type of the power discharger to be used	
		SK CU4-PD1(-C)	SK CU4-PD2(-C)
SK 1x0E-250-x23-A	No	Not permissible	Required
SK 1x0E-370-x23-A	No	Not permissible	Required
SK 1x0E-550-x23-A	No	Not permissible	Required
SK 1x0E-750-x23-A	No	Not permissible	Required
SK 1x0E-111-x23-A	No	Not permissible	Required
SK 1x0E-151-323-A	No	Not permissible	Required
SK 1x0E-250-340-A <sup>1</sup>	No	Not permissible	Required <sup>1</sup>
SK 1x0E-370-340-A <sup>1</sup>	No	Not permissible	Required <sup>1</sup>
SK 1x0E-550-340-A <sup>1</sup>	No	Not permissible	Required <sup>1</sup>
SK 1x0E-750-340-A <sup>1</sup>	No	Not permissible	Required <sup>1</sup>
SK 1x0E-111-340-A <sup>1</sup>	No	Not permissible	Required <sup>1</sup>
SK 1x0E-151-340-A	No	Not permissible	Required
SK 1x0E-221-340-A	No	Not permissible	Required

1) Frequency inverter not in standard version but in special version SK 1x0E-xxx-340-A-PD2(-C) required.

#### NORDAC FLEX

Device type	Additional isolation by mains contactor required?	Type of the power discharger to be used	
		SK CU4-PD1(-C)	SK CU4-PD2(-C)
SK 2xxE-250-x23-A	No	Required	Not permissible
SK 2xxE-370-x23-A	No	Required	Not permissible
SK 2xxE-550-x23-A	No	Required	Not permissible
SK 2xxE-750-x23-A	No	Required	Not permissible
SK 2xxE-111-x23-A	No	Required	Not permissible
SK 2xxE-151-323-A	No	Required	Not permissible
SK 2xxE-221-323-A	No	Required	Not permissible
SK 2xxE-301-323-A	No	Required	Not permissible
SK 2xxE-401-323-A	No	Required	Not permissible
SK 2xxE-551-323-A	No	Required	Not permissible
SK 2xxE-751-323-A	No	Required	Not permissible
SK 2xxE-550-340-A	No	Required	Not permissible
SK 2xxE-750-340-A	No	Required	Not permissible
SK 2xxE-111-340-A	No	Required	Not permissible
SK 2xxE-151-340-A	No	Required	Not permissible
SK 2xxE-221-340-A	No	Required	Not permissible
SK 2xxE-301-340-A	No	Required	Not permissible
SK 2xxE-401-340-A	No	Required	Not permissible
SK 2xxE-551-340-A	No	Required	Not permissible
SK 2xxE-751-340-A	No	Required	Not permissible

Device type	Additional isolation by mains contactor required?	Type of the power discharger to be used	
		SK CU4-PD1(-C)	SK CU4-PD2(-C)
SK 2xxE-112-340-A	Yes	Not permissible	Not permissible
SK 2xxE-152-340-A	Yes	Not permissible	Not permissible
SK 2xxE-182-340-A	Yes	Not permissible	Not permissible
SK 2xxE-222-340-A	Yes	Not permissible	Not permissible

## NORDAC ON

Device type	Additional isolation by mains contactor required?	Type of the power discharger to be used	
		SK CU4-PD1(-C)	SK CU4-PD2(-C)
SK 3xxP-360-340-A	Yes	Not permissible	Not permissible
SK 3xxP-370-340-A	Yes	Not permissible	Not permissible
SK 3xxP-450-340-A	Yes	Not permissible	Not permissible
SK 3xxP-750-340-A	Yes	Not permissible	Not permissible
SK 3xxP-950-340-A	Yes	Not permissible	Not permissible
SK 3xxP-111-340-A	Yes	Not permissible	Not permissible
SK 3xxP-151-340-A	Yes	Not permissible	Not permissible
SK 3xxP-191-340-A	Yes	Not permissible	Not permissible
SK 3xxP-221-340-A	Yes	Not permissible	Not permissible
SK 3xxP-301-340-A	Yes	Not permissible	Not permissible

## NORDAC PRO

Device type	Additional isolation by mains contactor required?	Type of the power discharger to be used	
		SK CU4-PD1(-C)	SK CU4-PD2(-C)
SK 5xxE-250-x23-A	No	Not permissible	Not permissible
SK 5xxE-370-x23-A	No	Not permissible	Not permissible
SK 5xxE-550-x23-A	No	Not permissible	Not permissible
SK 5xxE-750-x23-A	No	Not permissible	Not permissible
SK 5xxE-111-x23-A	No	Not permissible	Not permissible
SK 5xxE-151-x23-A	No	Not permissible	Not permissible
SK 5xxE-221-x23-A	No	Not permissible	Not permissible
SK 5xxE-301-323-A	No	Not permissible	Not permissible
SK 5xxE-401-323-A	No	Not permissible	Not permissible
SK 5xxE-551-323-A	Yes <sup>1</sup>	Not permissible	Not permissible
SK 5xxE-751-323-A	Yes <sup>1</sup>	Not permissible	Not permissible
SK 5xxE-112-323-A	Yes <sup>1</sup>	Not permissible	Not permissible
SK 5xxE-152-323-A	Yes <sup>1</sup>	Not permissible	Not permissible
SK 5xxE-182-323-A	Yes <sup>1</sup>	Not permissible	Not permissible
SK 5xxE-550-340-A	No	Not permissible	Not permissible
SK 5xxE-750-340-A	No	Not permissible	Not permissible
SK 5xxE-111-340-A	No	Not permissible	Not permissible

Device type	Additional isolation by mains contactor required?	Type of the power discharger to be used	
		SK CU4-PD1(-C)	SK CU4-PD2(-C)
SK 5xxE-151-340-A	No	Not permissible	Not permissible
SK 5xxE-221-340-A	No	Not permissible	Not permissible
SK 5xxE-301-340-A	No	Not permissible	Not permissible
SK 5xxE-401-340-A	No	Not permissible	Not permissible
SK 5xxE-551-340-A	No	Not permissible	Not permissible
SK 5xxE-751-340-A	No	Not permissible	Not permissible
SK 5xxE-112-340-A	Yes <sup>1</sup>	Not permissible	Not permissible
SK 5xxE-152-340-A	Yes <sup>1</sup>	Not permissible	Not permissible
SK 5xxE-182-340-A	Yes <sup>1</sup>	Not permissible	Not permissible
SK 5xxE-222-340-A	Yes <sup>1</sup>	Not permissible	Not permissible

1) Installation without mains contactor isolation is possible if the particular case is checked and approved by NORD DRIVESYSTEMS.

### NORDAC PRO

Device type	Additional isolation by mains contactor required?	Type of the power discharger to be used	
		SK CU4-PD1(-C)	SK CU4-PD2(-C)
SK 5xxP-250-123-A	Yes	Not permissible	Not permissible
SK 5xxP-370-123-A	Yes	Not permissible	Not permissible
SK 5xxP-550-123-A	Yes	Not permissible	Not permissible
SK 5xxP-750-123-A	Yes	Not permissible	Not permissible
SK 5xxP-111-123-A	Yes	Not permissible	Not permissible
SK 5xxP-151-123-A	Yes	Not permissible	Not permissible
SK 5xxP-221-123-A	Yes	Not permissible	Not permissible
SK 5xxP-250-340-A	Yes	Not permissible	Not permissible
SK 5xxP-370-340-A	Yes	Not permissible	Not permissible
SK 5xxP-550-340-A	Yes	Not permissible	Not permissible
SK 5xxP-750-340-A	Yes	Not permissible	Not permissible
SK 5xxP-111-340-A	Yes	Not permissible	Not permissible
SK 5xxP-151-340-A	Yes	Not permissible	Not permissible
SK 5xxP-221-340-A	Yes	Not permissible	Not permissible
SK 5xxP-301-340-A	Yes	Not permissible	Not permissible
SK 5xxP-401-340-A	Yes	Not permissible	Not permissible
SK 5xxP-551-340-A	Yes	Not permissible	Not permissible
SK 5xxP-751-340-A	Yes	Not permissible	Not permissible
SK 5xxP-112-340-A	Yes	Not permissible	Not permissible
SK 5xxP-152-340-A	Yes	Not permissible	Not permissible
SK 5xxP-182-340-A	Yes	Not permissible	Not permissible
SK 5xxP-222-340-A	Yes	Not permissible	Not permissible

### 3.3 EMC

According to EN 61800-3 and EN 55011, frequency inverters must comply with EMC Category C1 (limit class B) when used as a plug-in device and/or in mobile equipment.

Frequency inverters of the **NORDAC BASE** series comply with EMC Category C1 when the motor is mounted and the EMC filter is switched on.

Frequency inverters of the **NORDAC FLEX**, **NORDAC ON** and **NORDAC PRO** series comply with Category C2 or C3 depending on the series and motor cable length. Therefore, these devices require additional measures to comply with the required Category C1. A suitable measure for this is the integration of an appropriately dimensioned external line filter.

Please refer to the respective instruction manual of the frequency inverter for detailed EMC information.

## **WARNING**

### **Electric shock**

If other capacitive devices or components are integrated in the circuit of the frequency inverter, dangerous voltages may be present at the plug contacts for the mains connection even when a SK CU4-PD... power discharger is used.

- Before starting work, check that all relevant components (voltage source, connection cables) are free of voltage using suitable measuring equipment.
  - Use insulated tools (e.g. screwdrivers).
  - Earth devices.
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**Note:** A possibly installed power discharger of type SK CU4-PD... is not able to discharge the capacitors of an external mains line with sufficient speed.

### **3.3.1 Connection to the public low-voltage network**

In principle, a frequency inverter generates harmonic currents on the mains side. Compliance of the limit values according to EN 61000-3-2 for connection to the public low-voltage network cannot be guaranteed for frequency inverters with a power <1 kW. Professionally used devices according to EN 61000-3-2 with a power <1 kW can be connected to the low-voltage network and operated if the installer or operator obtains prior approval from the responsible power supply company.

EN 61000-3-2 does not define limit values for professionally used devices with a power >1 kW and a rated input current <16 A. These devices can be connected to the public low-voltage network without consultation with the responsible power supply company.

**Note:** The technical connection conditions of the local mains operator may specify requirements that exceed the standard requirements described in this document.

### **3.3.2 Leakage current**

Plug-in devices are typically operated on mains connections with residual current operated circuit breakers.

Handling of the frequency inverters for operation on the residual current operated circuit breaker is described in the TI800\_000000003 “Residual currents and residual current protective devices”.