

Manual

NORDAC SK 1xxE Series

- SK 140E → Electronic motor starter**
- SK 150E → Electronic soft starter**
- SK 160E → Electronic reversing starter**



BU 0100 GB

Getriebebau NORD

GmbH & Co. KG



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1 General description

The product series NORDAC SK 1xxE constitutes a motor or wall-mounted electronic component that can be used to handle simple drive or switching functions. The following types are part of this product series:

SK 140E	Electronic motor starter (Startup in one direction)
SK 150E	Electronic soft starter (Soft startup and run-down with adjustment of time and torque)
SK 160E	Electronic reversing starter (Startup possible in both directions)

The electronics of this motor starter series are integrated into the motor's terminal box. They can be directly mounted on top of the motor (motor-integrated) or on the wall (proximity of motor). Each starter possesses an assessment of a thermal protector (temperature probe or control) and an optional brake rectifier. A red or a green LED visible from the outside through a transparent screw plug, indicating the devices status.

The **NORDAC SK 140E** enables a switching operation of a three-phase asynchronous motor in one direction. This allows for cost-efficient switching directly at the drive.

The **NORDAC SK 150E** enables a soft start-up and run-down of three-phase asynchronous motors. This allows for starting and stopping of the drive smoothly. With the soft starter, both torque and times can be set separately for the startup and rundown of a drive.

The **NORDAC SK 160E** enables the switching operation of a three-phase asynchronous motor in both directions. 2 rotary dip code switches are used to set a locking time to protect the installation against damage caused by too quick a reversal.

The entire power range of the motor starter series is covered by one component size. The power range of the **SK 140E** reaches from **0.12 kW to 3.0 kW**, that of the **SK 150E** and **SK 160E** cover a range from **0.12 to 4.0 kW**. Motor sizes 80 to 112 (with the SK 140E up to size 100) allow for direct mounting; sizes 63 to 71 require a simple adapter plate (Mat. No. 11015410).

The number of poles of a motor is immaterial; the only determining variable for the motor starter are the power consumption and the motor size.

The control electronics require 24 VDC (15 ...30 VDC, ≈ 50 mA) supply voltage, e.g., from a PLC or another power supply.

Optionally, each SK 1xxE is available with an integrated fast acting rectifier (BSG2). The electromechanical brake can then be directly connected to the device; no additional supply voltage is required for the brake.

A bus access is possible for all electronic starters of the SK 1xxE series by means of an optional AS interface (AS1).

With the option (MS) there is the possibility of realising the power input or motor output of the starter by means of a system plug of the Harting HAN 10E type.

All devices of the **SK150E/160E** series in the versions with and without integrated brake rectifiers fulfil the requirements for explosion protection (**ATEX**) in **Zone 22** according to the currently valid standards according to EN 50281 (Guideline 94/9/EG). However, this only applies if no further add-on options (AS interface, plug connectors) are included.

The most current information and documentation can be downloaded free of charge from the homepage of Getriebbau NORD at www.nord.com.



SAFETY NOTES

Safe operation of the device requires that it is mounted and made operational by qualified personnel according to the instructions provided in this manual.

Qualified personnel paying special attention to the safety and warning notes may only make adjustments.

Special attention must be paid to the general and regional installation and safety regulations for work on high-voltage installations (e.g., EN, VDE) as well as to the directions for the proper use of tools and the utilization of personal protection devices.

The motor connection terminals may carry dangerous voltage even at standstill of the motor (e.g., through electronic lock [RUN] or blocked drive). A motor standstill is not equivalent to electrical disconnection from system power.

ATTENTION: Touching open or exposed terminals can lead to serious injuries or death! Always use insulated screw drivers on these terminal panels. Make sure that the input voltage source is without voltage before you make connections to the unit or prior to altering them.

ATTENTION: The drive may start running immediately after applying system voltage.

1.1 Delivery

Inspect the device **immediately** after receipt/unpacking for transport damages such as deformed or loose parts.

In case of damage, contact the freight carrier without delay; initiate a careful fact-finding measure.

Important! This also applies if the packaging is not damaged.

1.2 European EMV (EMC) guideline.

If a NORDAC SK 1xxE is installed according to the recommendations of this manual, it will meet all requirements of the EMC guideline being in conformity with the EMC product standard EN60947-4-2 for low voltage switching devices, semiconductor control devices and starters for alternating current..



2 Electronic Motor Starter SK 140E

2.1 Principle of function

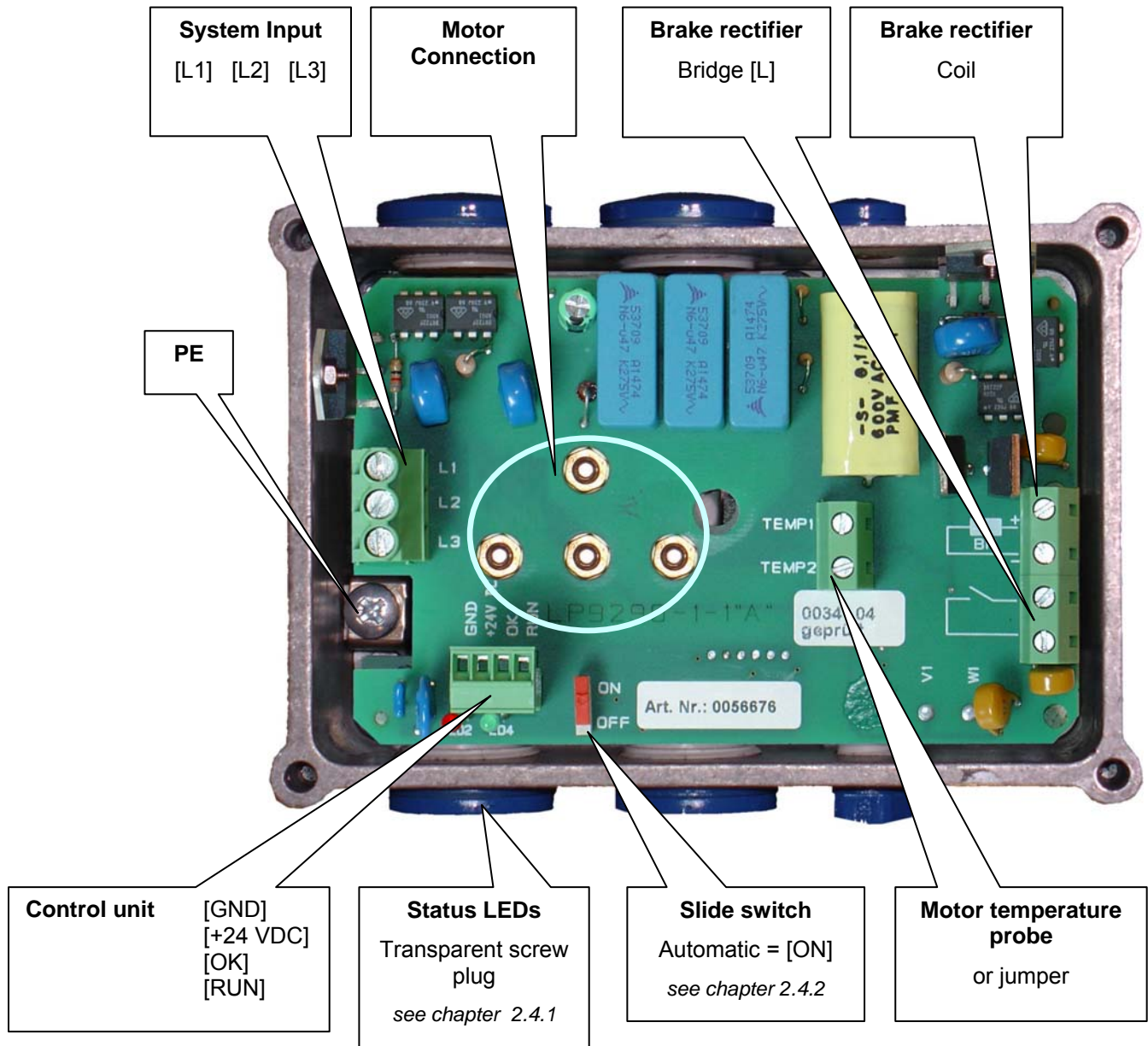
The SK 140E enables a simple motor startup in one direction. The switching process takes place through 2 wear-free power switches. The activation or release of the drive occurs through a 24 VDC control signal. The integrated temperature monitoring can be done via a temperature probe or control. A design with a rectifier - integrated or separately installed in the terminal box – is available for the control of a brake.



Features:

- The SK 140E contains an **electronic power switch** that switches the supply voltage to the motor windings via a 24 VDC control signal [RUN].
- At the same time, the electromechanical brake (if present) is released through the **integrated brake rectifier** (option).
- If the control signal is canceled, the supply of the motor windings is interrupted and the brake (if present) is applied again.
- During the entire operation, the motor can be thermally monitored through temperature probes acting as overload cutout. There are 2 monitoring modes that can be selected by means of a **slide switch**. During automatic operation (slide switch set to [ON], the SK 140E switches the motor off automatically and reports the excess temperature by removing the OK message (fault signal, signal [OK] changes to low). If the automatic operation has not been selected (slide switch set to [OFF]), then only the OK message is removed and the drive continues to run. The inputs must be connected with a jumper if temperature monitoring is not desired.
- In automatic operation, the motor **does not automatically start** even after cooling. To restart, the control signal [RUN] must first be switched off and then on again. Alternatively, the internal slide switch can be switched [OFF] and [ON] again. **Caution**, the drive starts **immediately!**
- The **basic direction** is predetermined by the system input phases. This can be altered by exchanging 2 phases. For the correct phase sequence, [RUN] corresponds to a clockwise motor direction.
- The **current status** of the SK 140E is shown through **2 LEDs**. These are visible from the outside through a transparent screw plug.

2.2 Device design



2.2.1 SK 140E-1-O

The SK 140E-1-O (Mat. No. 275101400) is a motor starter without permanently integrated rectifier. However, it is possible to install any rectifier by Getriebekbau NORD. This can be utilized in case of retrofitting or at system voltages of < 380 V. Spacer bolts are used for the assembly of the rectifiers. (→ See also chapter 5.1)

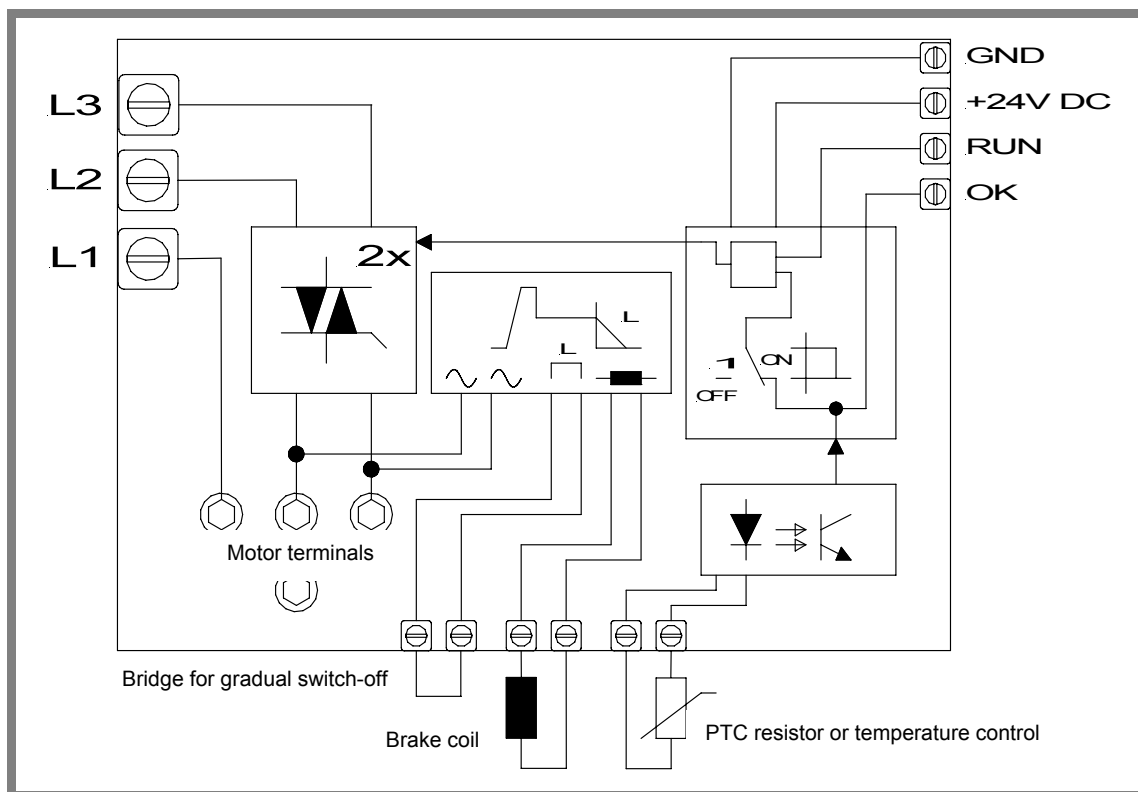
2.2.2 SK 140E-1-BSG2

The design with integrated fast acting brake rectifier has the designation SK 140E-1-BSG2 (Mat. No. 275101405). With this device design, a fast acting brake rectifier has been added to the basic function to directly control a brake mounted to the motor. Consequently, the brake voltage supplied equals supply voltage x 0.45. The jumper [L] can be used to affect a gradual switch-off by shorting the integrated DC switch. (→ See also chapter 5.1)

2.3 Electrical connection

- Power cable: The system connection shall be performed with a cable of sufficient cross-section (max. 4 mm²)
- Control unit: 4-pole plug with screw terminals 1.5 mm²
(*electrically separated from the system potential*)
- PTC resistor/brake: 3 x 2-pole screw terminals with 1.5 mm² (*on system potential*)
- Cable entry: The following are available: 1 x M25 and 1 x M12 and 1 x M16. If applicable, 1 x M12 may already be reserved by the brake connection. Other screw connections are available, but cannot be freely allocated.

Principle circuit diagram:



	Terminal	Function	Data
Power unit (System potential)	L1, L2, L3	System connection	4mm ² , (200) 380 ...480V, 50...60Hz
	PE	Housing ground	4 mm ²
	[L]	Bridge L	1.5 mm ²
	[BR-]	Brake coil	1,5mm ² , (105) 180V DC ... 205V DC, max. 0,5A
	[BR+]	Brake coil	1,5mm ² , (105) 180V DC ... 205V DC, max. 0,5A
	[38] Temp1	PTC resistor	1.5 mm ²
	[39] Temp2	PTC resistor	1.5 mm ²
Control unit (electrically separated)	[46] GND	Reference potential	1.5 mm ² , 0 V
	[45] +24 VDC	Supply voltage 24 V	1.5 mm ² , 15...30 V, 50 mA
	[22] RUN	Release signal	1.5 mm ² , 15...30 V, ca. 2 mA
	[B1] OK	Feedback, operational	1.5 mm ² , 15...30 V, max. 50 mA

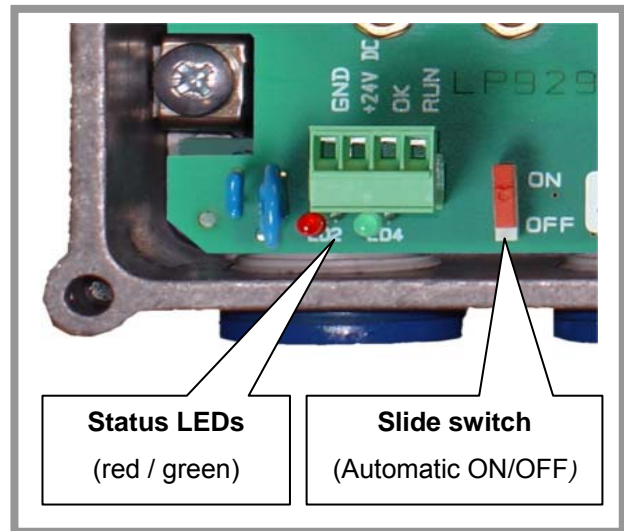
2.4 Display and settings

The following controls are available for the SK 140E:



Transparent screw plug

To permit viewing of status LEDs from outside



Status LEDs (red / green)

Slide switch (Automatic ON/OFF)

2.4.1 Status LEDs

These LEDs are visible through a lateral **transparent** screw plug.

red LED:	OFF		no fault present
green LED:	Blinking briefly	Long pause	Operational (<i>Standby</i>), System voltage and temperature are OK
	Permanently on	---	Electronic switch is active (ON, motor turns)

red LED:	ON		a fault is present
green LED:	Blinking 1 x	Pause	[RUN] was already active before applying the 24 VDC
	Blinking 2 x	Pause	Automatic feature is OFF and the system voltage is absent or the motor temperature is too high
	Blinking 3 x	Pause	Automatic feature is ON and the system voltage is absent or the motor temperature is too high

2.4.2 Slide switch for automatic operation

The slide switch is used to switch the automatic operation on or off. This refers to the characteristics of switching on again after the motor starter has cut off because of excess motor temperature.

[ON]

Switching off: OK message (signal OK at low) is removed in case of excess temperature. The motor is automatically switched off by SK 140E.

Switching on again: The drive will not start automatically if excess temperature is no longer present. The control signal [RUN] must first be switched off and then on again or, alternatively, the slide switch is pushed to [OFF] and again to [ON]. *Attention:* The drive starts immediately!

[OFF]

Switching off: OK message (signal OK at low) is removed in case of excess temperature. The motor is not switched off by SK 140E.

Switching on again: The OK message is switched high again when the excess temperature is no longer present. The motor would start up even in case of excess temperature!

3 Electronic Soft Starter SK 150E

3.1 Principle of function

The SK 150E allows a soft start-up and run-down of a three-phase asynchronous motor by a gradual rise or reduction of the torque to be defined. A smooth start-up is thereby achieved, preventing damage to the drive elements by a suddenly applied torque. A 2-phase control process realizes the drive properties. The selection or release of the drive occurs through a 24 VDC control signal. Depending on the operating mode chosen, the start-up and braking torque as well as the associated time can be adjusted with potentiometers. 4 slide switches define the operating mode. The integrated temperature can be monitored via a temperature probe or control. For the activation of a brake, a design with a rectifier - integrated or separately installed in the terminal box – is available.



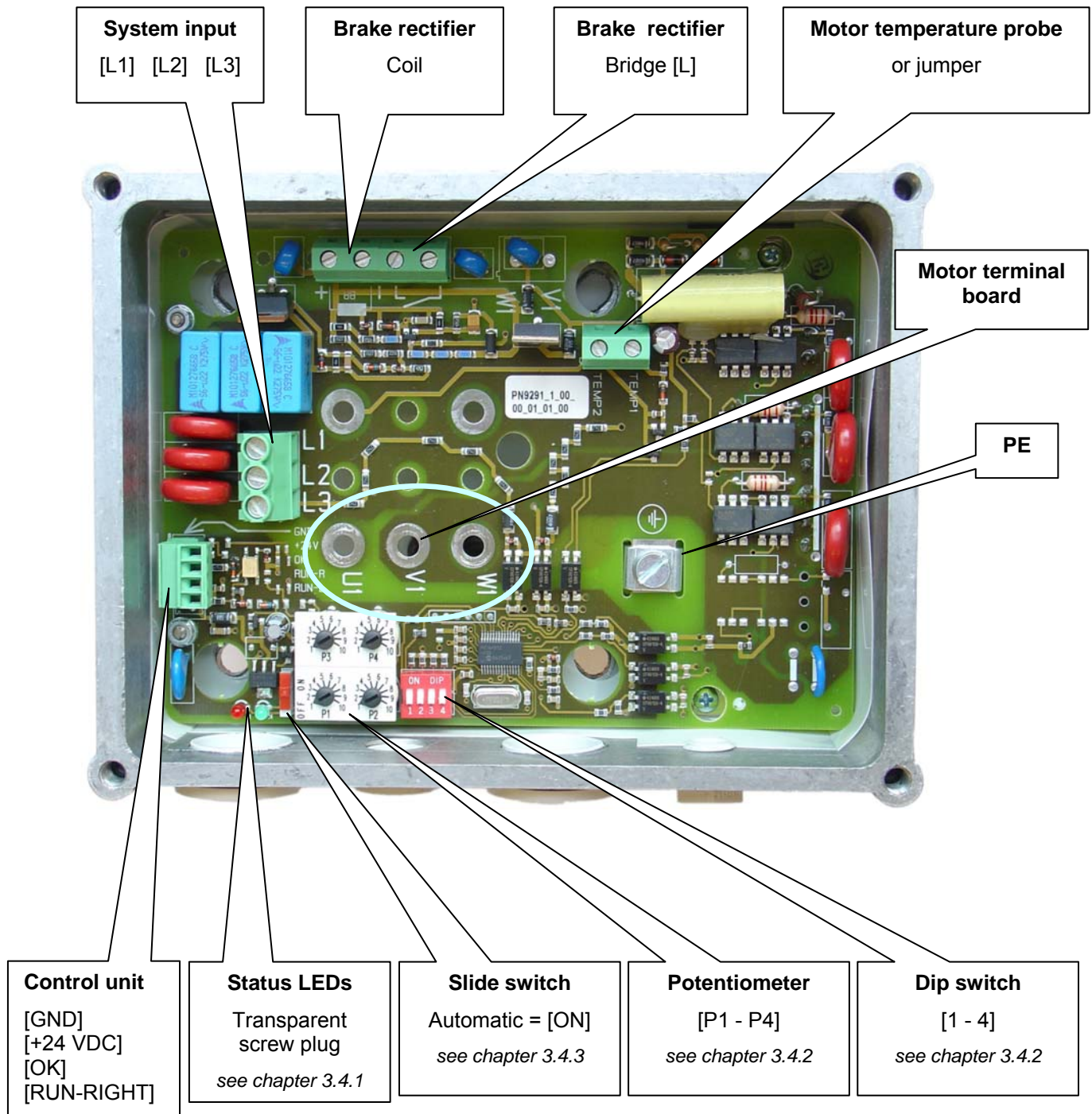
Features:

- A **24 V voltage** supplies the **control electronics** externally. The control logic is potential-separated from the system voltage.
- With the release of the drive via a 24 V control signal, the motor is supplied with voltage through a **phase control process**. If an integrated brake rectifier is included, then it is connected to the system voltage through electronic power switches and the electromechanical brake is thereby released.
- During the entire operation, the motor can be thermally monitored through **temperature probes** (PTC resistor or temperature control) thereby acting like an **overload cut-out**. There are 2 monitoring modes that can be selected by a **slide switch**. During automatic operation (**slide switch set to [ON]**), the SK 150E switches the motor off automatically and reports the excess temperature by removing the OK message (fault signal, signal [OK] changes to low). If the automatic operation has not been selected (slide switch set to [OFF]), then only the OK message is removed and the drive continues to run. The inputs must be connected with a jumper if temperature monitoring is not desired.

With automatic operation, the motor **does not automatically start** even after cooling. To restart, the control signal [RUN-RIGHT] must first be switched off and then on again. Alternatively, the internal slide switch can be switched [OFF] and [ON] again. **Caution**, the drive starts **immediately!**

- The **basic direction** is predetermined by the system input phases. This can be altered by exchanging 2 phases on the motor terminal board. With the correct phase sequence (U1, V1, W1), [RUN] corresponds to a right motor direction.
- The **current status** of the SK 150E is shown through **2 LEDs**. These are visible from the outside through a transparent screw plug.
- Series SK 150E in the versions SK 150E-1-0 and SK 150E-1-BSG2 fulfils the requirements for explosion protection (**ATEX**) in **Zone 22** according to the currently valid standards according to EN 50281 (guideline 94/9/EG).

3.2 Device design



3.2.1 SK 150E-1-O-3D-T125

The SK 150E-1-0 (Mat. No. 275101500) is a soft starter without permanently integrated rectifier. However, it is possible to install a rectifier by Getriebebau NORD. This can be utilized in case of retrofitting or at system voltages of < 380 V. Spacer bolts are used for the assembly of the rectifiers. (→ See also chapter 5.1)

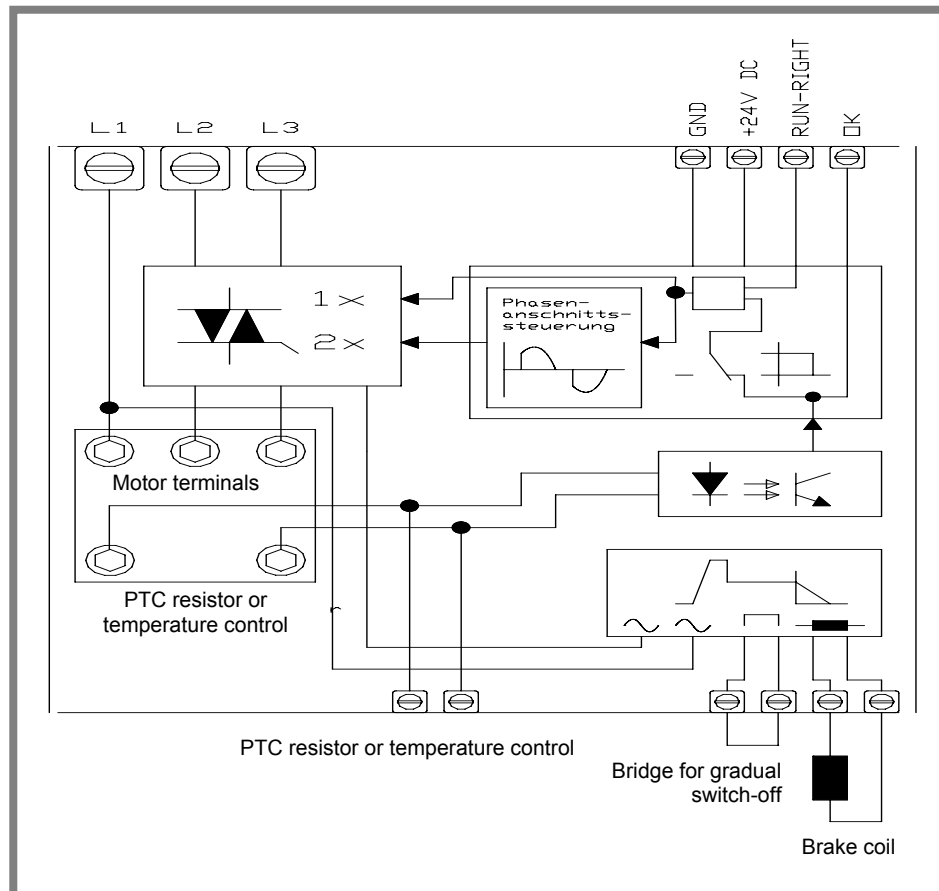
3.2.2 SK 150E-1-BSG2-3D-T125

The design with integrated fast acting brake rectifier has the designation SK 150E-1-BSG2 (Mat. No. 275101505). With this device design, a fast acting brake rectifier has been added to the basic function to directly control a brake mounted to the motor. Consequently, the brake voltage supplied equals supply voltage x 0.45. The jumper [L] can be used to affect a gradual switch off by shorting the integrated DC switch. (→ See also chapter 5.1)

3.3 Electrical connection

- Power cable: The system connection shall be performed with a cable of sufficient cross-section (max. 4 mm²).
- Control unit: 4-pole plug with screw terminals 1.5 mm² (*electrically separated from the system potential*)
- PTC resistor/brake: 3 x 2-pole screw terminals with 1.5 mm² (*on system potential*)
- Cable entry: The following are available: 1 x M25 and 1 x M16 and 1 x M12. The 1 x M12 screw plug may already be reserved by the brake connection and the M16 by the optional M12 plug.

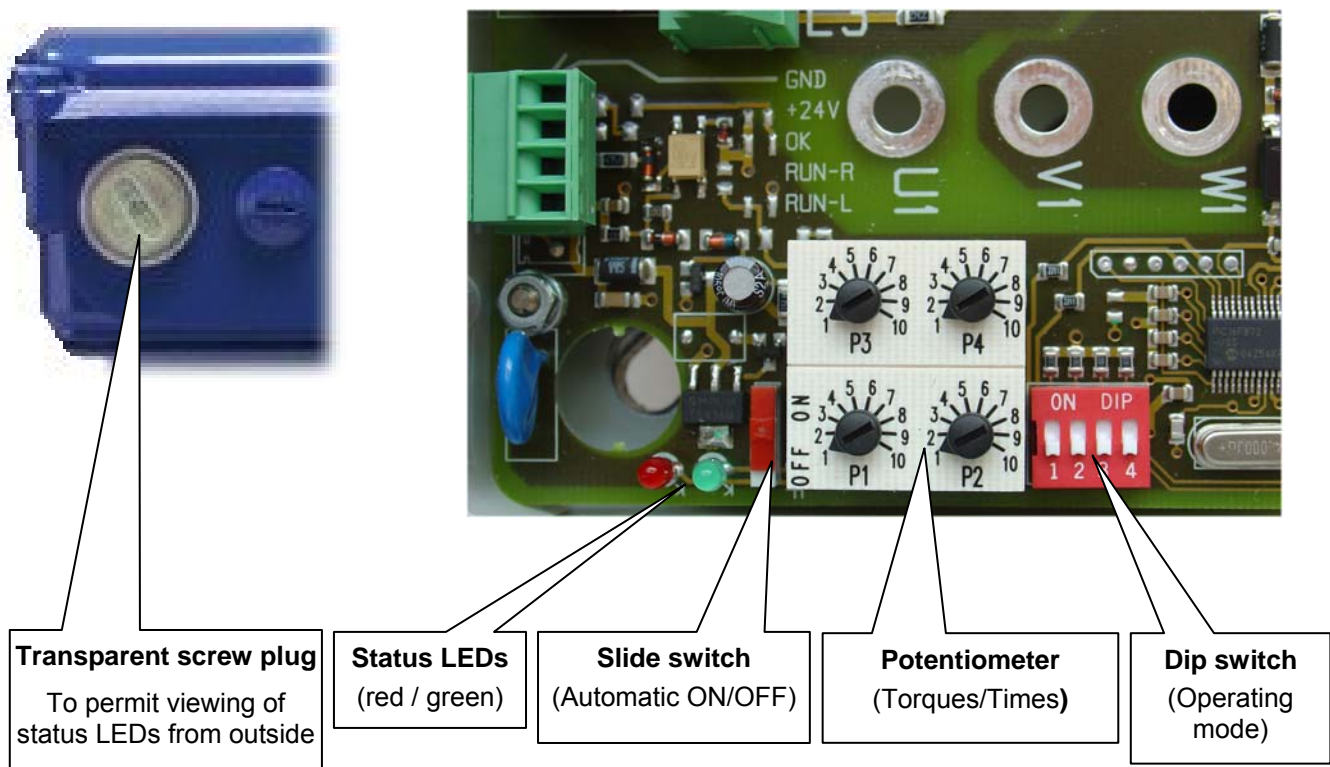
Principle circuit diagram:



	Terminal	Function	Data
Power unit (System potential)	L1, L2, L3	System connection	4 mm ² , (200) 380...480 V, 50...60 Hz
	PE	Housing ground	4 mm ²
	[L]	Bridge L	1.5 mm ²
	[BR-]	Brake coil	1.5mm ² , (105) 180V DC ... 205V DC, max. 0,5A
	[BR+]	Brake coil	1.5mm ² , (105) 180V DC ... 205V DC, max. 0,5A
	[38] Temp1	Temperature probe	1.5 mm ²
	[39] Temp2	Temperature probe	1.5 mm ²
Control unit (electrically separated)	[46] GND	Reference potential	1.5 mm ² , 0 V
	[45] +24 VDC	Supply voltage 24 V	1.5 mm ² , 15...30 V, 50 mA
	[B1] OK	Feedback, operational	1.5 mm ² , 15...30 V, max. 50 mA
	[22] RUN-R	Release signal - right	1.5 mm ² , 15...30 V, ca. 2 mA

3.4 Display and settings

The following controls are available for the SK 150E:



3.4.1 Status LEDs

These LEDs are visible through a lateral **transparent** screw plug.

red LED:	OFF		no fault present
green LED:	Blinking briefly	Long pause	Operational (<i>Standby</i>): System voltage and temperature are OK, no [RUN-R] release has been applied
	Blinking briefly	Short pause	Release [RUN-R] has been applied, phase angle is active
	Permanently on	---	Motor turns with maximum torque (Motor receives full voltage)

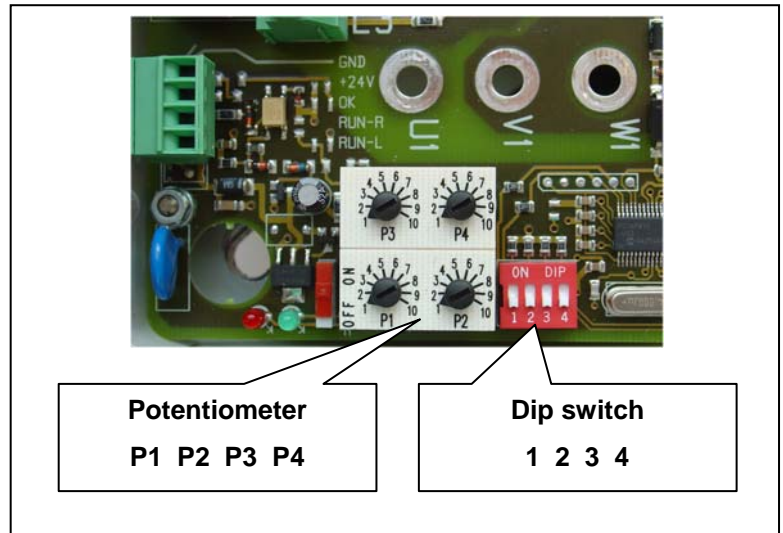
red LED:	ON		a fault is present
green LED:	Blinking 1 x	Pause	[RUN-RIGHT] was already active before applying the 24 VDC.
	Blinking 2 x	Pause	Automatic feature is OFF and the system voltage is absent or the motor temperature is too high
	Blinking 3 x	Pause	Automatic feature is ON and the system voltage is absent or the motor temperature is too high
	Blinking 5 x	Pause	One phase of the system voltage is missing.
	Blinking 7 x	Pause	Frequency deviates from 50/60 Hz by more than +/-2 Hz.

3.4.2 Setting the potentiometers and dip switches

With the electronic soft starter Sk 150E, the start-up and run-down behavior of the drive can be adapted to the respective application. The settings are made using 4 dip switches and 4 potentiometers.

The **dip switches** 1 and 2 are used to set 4 different operating modes. The dip switches 3 and 4 determine the time base for two potentiometers.

The **potentiometers** are used to set times and torques for drive characteristics. Depending on the operating mode set, potentiometers P1 and P3 are for the associated torques and potentiometers P2 and P4 for the corresponding times.



Operating modes

4 different operating modes, i.e., characteristics during start-up and run-down, can be selected with the electronic soft starter SK 150E. If a drive with SK 150E shall be started, then the operating mode must first be determined, followed by the setting of the associated torques and times. The principle of the phase control must always be observed, by which the variable torque is merely determined by the voltage applied to the motor. This does not allow ramp times and torques to be realized with the same quality as with a frequency inverter.

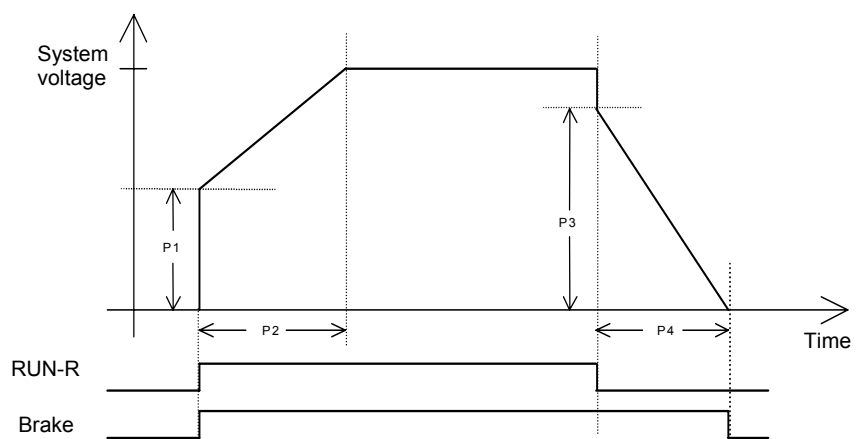
The 4 operating modes are described and explained below. The pertaining dip switch positions and adjustment ranges can be taken from the subsequent chapters. All information supplied on brake properties presuppose a brake motor as well as the SK 150E with integrated or separate rectifier.

Operating mode "00"

With this operating mode, the torque (voltage on motor, P1) and the time (P2) can be set for start-up and run-down.

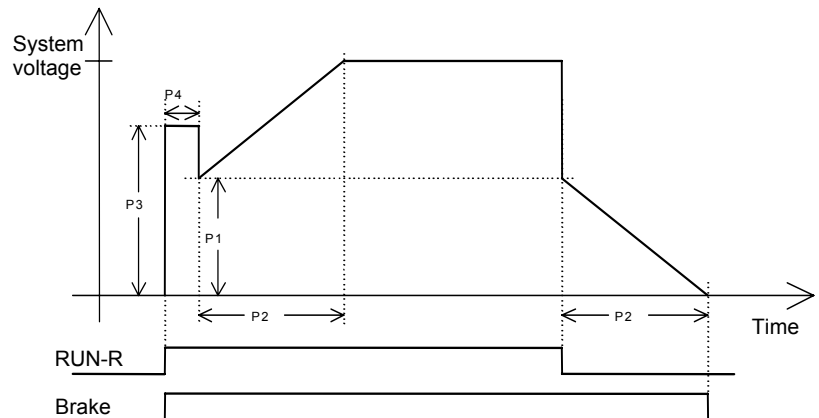
When applying the release [RUN-R], the drive starts up with the torque (voltage at motor) set at P1. The maximum torque (full voltage at motor) is reached after the time set at P2.

When removing the release signal [RUN-R], the torque (voltage at motor) is lowered immediately to the value set at P3. The torque is then reduced continuously in the time set at P4 until standstill. The brake applies after the run-down of the time set with P4.



Operating mode "01"

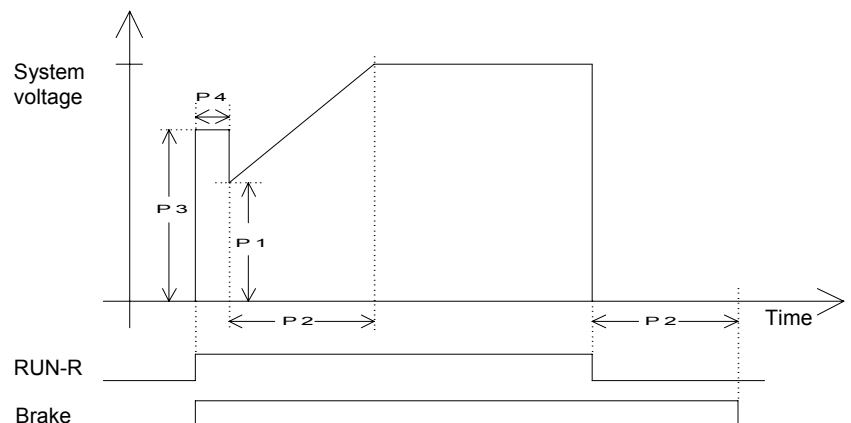
These and the subsequent operating modes work with an "increased initial breakaway torque" during start-up. That means, an increased (in some cases, possibly also a reduced) torque is realized during start-up at the motor for an adjustable time. The drive subsequently begins as starting ramp whose initial torque and time can again be set. For instance, an initial breakaway torque can be generated.



As can be seen in the graphic, a torque (or voltage) set with P3 can be realized at the motor immediately after release [RUN-R]. After the time set at P4, the torque (voltage at motor) is reduced to the value set at P1. The starting ramp begins here and reaches the maximum moment (full voltage at motor) after the time set in P2. This time also applies to the run-down ramp after removing the release [RUN-R].

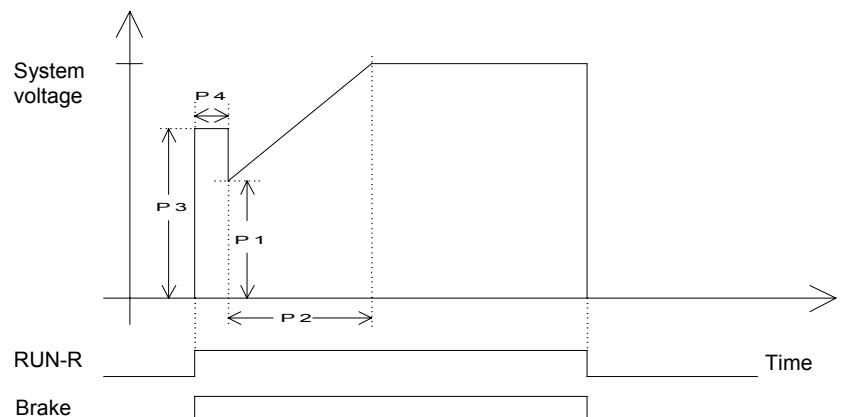
Operating mode "10"

This operating mode only differs from the previous "01" by the switch-off characteristics. After removing the release [RUN-R], the voltage is switched off at the motor causing the drive to coast to a stop. The brake applies only after the time set at P2 elapses.

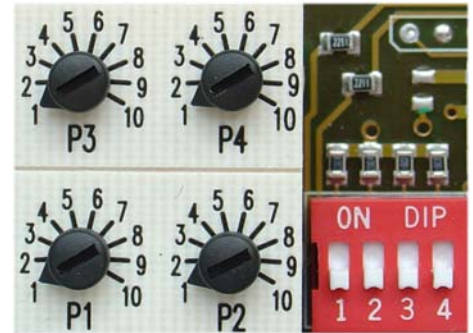


Operating mode "11"

Again, this operating mode differs from the previous "10" only in the point in time when the brake becomes active. If at "10" some time first elapses then here the brake applies immediately after removing the release [RUN-R]. The drive cannot coast to a stop.



The following table provides an overview of all dip switches and potentiometers as well as the corresponding description of the functionalities.



Switch	Function	Setting	Description
Dip switches 1 and 2	Operating modes	00	The drive starts with a predefined torque and start-up time. Torque and time can also be set for the run-down.
		01	An adjustable torque can generate an increased "initial breakaway moment" for a specified time. Start-up and run-down times can be set with the same values.
		10	Just as "01", but with an engagement time of the brake instead of the run-down time.
		11	Just as "01" and "10", but without run-down time or engagement time of the brake.
Dip switches 3 and 4	Time basis for potentiometers P2 and P4	00	This setting is used to determine which time range applies for the potentiometers P2 and P4. There are 4 time ranges: 0.05 – 1 s 0.25 – 6 s 0.5 – 10 s 2 – 60 s
		01	
		10	
		11	
Potentiometers P1 and P3	Torque according to operating mode	Start-up moment	Adjustable torque directly at start-up of the drive.
		Run-down moment	Adjustable torque directly after removal of the drive release.
		Initial breakaway moment	Increased torque for a specified time, e.g., to generate an initial breakaway moment.
Potentiometers P2 and P4	Time ranges	0.05 – 1 s	Time range for potentiometer P4 at operating modes with "increased initial breakaway moment".
		0.25 – 6 s	
		0.5 – 10 s	Time ranges for potentiometers P2 and P4 depending on the operating modes set.
		2 – 60 s	

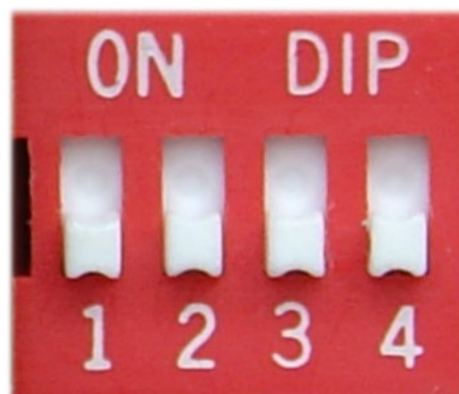
DIP switches





The 4 existing dip switches are used to set the operating mode and the adjustable time range of a potentiometer. The following table provides an overview for the setting of the operating mode as well as the corresponding assignment of individual functions, potentiometers and time ranges.

Switch position:

1 = ON

0 = OFF



Dip switch	
1	2
Operating mode	
(Binary code or switch position)	
0	0
P3 Run-down moment 	P4 Run-down time 
P1 Start-up moment 	P2 Start-up time 
0	1
P3 Initial breakaway moment	P4 Initial breakaway time
P1 Start-up/Run-down moment	P2 Start-up/Run-down time
1	0
P3 Initial breakaway moment	P4 Initial breakaway time
P1 Start-up moment	P2 Start-up time/ Engagement time of brake
1	1
P3 Initial breakaway moment	P4 Initial breakaway time
P1 Start-up moment	P2 Start-up time

Dip switch 3 → Time range P2:

1 [ON] = 2 – 60 s

0 [OFF] = 0.5 – 10 s

Dip switch 4 → Time range P4:

1 [ON] = 2 – 60s

(At "Increased initial breakaway moment": 0.2 – 6 s)

0 [OFF] = 0,5 - 10s

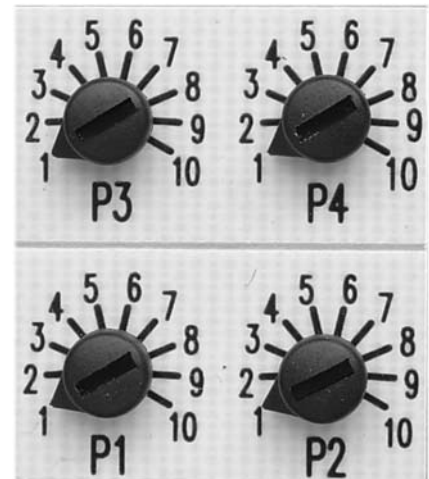
(At "Increased initial breakaway moment": 0,05 – 1 s)

Potentiometers

With the 4 potentiometers, the user can adjust the different times and torques infinitely variable, depending on the operating mode.

After the operating mode and the time range have been set with the dip switches, the following table can be used to set the respective function of the potentiometer and the pertaining time range.

Note: It must be observed that times and torques of a soft starter can only be adjusted under the load conditions of the application to be realized. Accordingly, the time ranges in seconds only apply under load. The scales serve as benchmarks and are not to be considered defined values in sec. and Nm.



3.4.3 Slide switch for automatic operation

The slide switch is used to switch the automatic operation on or off. It refers to the characteristics of switching on again after the motor starter has cut off because of excess temperature of the motor.

[ON]

Switching off: OK message (signal OK at low) is removed in case of excess temperature. The motor is automatically switched off by SK 150E.

Switching on again: The drive will not start automatically if excess temperature is no longer present. The control signal [RUN] must first be switched off and then on again or, alternatively, the slide switch is pushed to [OFF] and again to [ON]. *Attention:* The drive starts immediately!

[OFF]

Switching off: OK message (signal OK at low) is removed in case of excess temperature. The motor is not automatically switched off by SK 150E.

Switching on again: The OK message is switched high again when the excess temperature is no longer present. The motor would start-up even in case of excess temperature!

4 Electronic Reversing Starter SK 160E

4.1 Principle of function

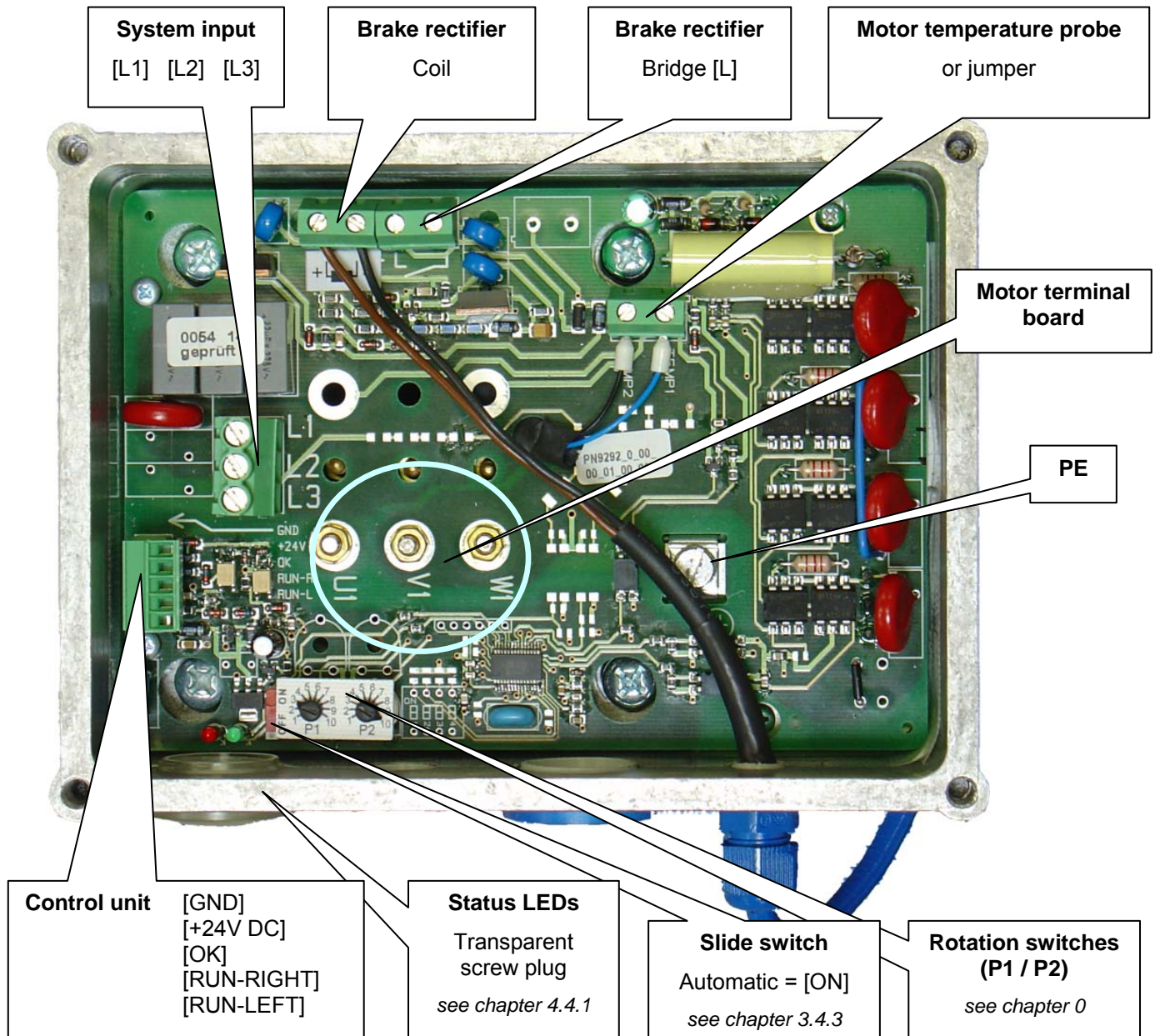
With the SK 160E, a motor can be switched in both directions. For protection purposes, there is a locking time for the immediate reversal that can be set with 2 rotary dip code switches. The selection or release of the drive occurs through a 24 VDC control signal. The integrated temperature can be monitored via a temperature probe or control. A design with a rectifier - integrated or separately installed in the terminal box – is available for the activation of a brake.



Features:

- The SK 160E contains power switches that are activated via a 24 VDC **control signal [RUN-RIGHT] or [RUN-LEFT]** and pass the system voltage to the motor windings.
(RUN-RIGHT = Right running (clockwise), RUN-LEFT = Left running (counterclockwise))
- 2 rotary dip code switches determine the locking time in case of direct direction reversal.
- At the same time, the electromechanical brake (if available) is released through the integrated brake rectifier (option).
- If the control signal is removed, the voltage supply of the motor windings is interrupted and the brake (if present) is applied again.
- During the entire operation, the motor can be thermally monitored through **temperature probes** acting like an **overload cut-out**. There are 2 monitoring modes that can be selected through a **slide switch**. During automatic operation (**slide switch set to [ON]**), the SK 160E switches the motor off automatically and reports the excess temperature by removing the OK message (fault signal, signal [OK] changes to low). If the automatic operation has not been selected (slide switch set to [OFF]), then only the OK message is removed and the drive continues to run. The inputs must be connected with a jumper if temperature monitoring is not desired.
- In automatic operation, the motor **does not automatically start** even after cooling. To restart, the control signal [RUN-RIGHT] or [RUN-LEFT] must first be switched off and then on again. Alternatively, the internal slide switch can be switched [OFF] and [ON] again. **Caution**, the drive starts **immediately!**
- The **basic direction** is predetermined by the system input phases. This can be altered by exchanging 2 phases. For the correct phase sequence, [RUN-RIGHT] corresponds to a clockwise motor direction.
- The **current status** of the SK 160E is shown through **2 LEDs**. These are visible from the outside through a transparent screw plug.
- Series SK 160E in the versions SK 160E-1-0 and SK 160E-1-BSG2 fulfil the requirements for explosion protection (**ATEX**) in **Zone 22** according to the currently valid standards according to EN 50281 (Guideline 94/9/EG).

4.2 Device design



The reverse starter SK 160E is available in the following versions according to customers' requirements.

	Name	Material number	Option		
			Brake rectifier	HAN 10E plug connector	AS interface
Protection class IP 55	SK 160E-1-O-3D-T125	275101600	without/external	without	without
	SK 160E-1-BSG2-3D-T125	275101605	with	without	without
	SK 160E-1-O-MS	275101610	without/external	with	without
	SK 160E-1-BSG2-MS	275101615	with	with	without
	SK 160E-AS1-O-MS	275101620	without/external	with*	with
	SK 160E-AS1-BSG2-MS	275101625	with	with*	with
Protection class IP 66	SK 160E-1-O-C-3D-T125	275151600	without/external	without	without
	SK 160E-1-BSG2-C-3D-T125	275151605	with	without	without
	SK 160E-1-O-C-MS	275151610	without/external	with	without
	SK 160E-1-BSG2-C-MS	275151615	with	with	without
	SK 160E-AS1-O-C-MS	275151620	without/external	with*	with
	SK 160E-AS1-BSG2-C-MS	275151625	with	with*	with

*Plug connection mounted flush left on the terminal box

4.2.1 SK 160E-1-O(-C)-3D-T125

The SK 160E-1-O(-C)-3D-T125 is motor reverse starter without a fixed integrated rectifier. However, there is the possibility of installing a rectifier from Getriebebau NORD. This can be used in case of an upgrade, or for mains voltages < 380V. Spacer bolts are provided for installing the rectifier. (→ See also Section. 5.1)

4.2.2 SK 160E-1-BSG2(-C)-3D-T125

The version with integrated rapid-switching brake rectifier has the designation SK 160E-1-BSG2(-C)-3D-T125. With this version of the device, a rapid switching brake rectifier is fitted in addition to the basic function, in order to directly control a brake which is mounted on the motor. The output braking voltage is then the mains voltage x 0.45. With the jumper [L], slow braking can be switched to by bypassing the integrated DC switch. (→ See also Section 5.1)

4.2.3 SK 160E-1-x(-C)-MS

The reverse starter can be equipped with a Harting HAN 10E plug connector. The configuration in the terminal box is described in Section 5.3). According to the version (without or with an integrated brake rectifier) the corresponding designation is SK 160E-1-O(-C)-MS or SK 160E-1-BSG2(-C)-MS.

4.2.4 SK 160E-AS1-x(-C)-MS

In the versions described under 4.2.1 to 4.2.3, the reverse starter SK 160E can be extended by the AS interface bus access (SK IU2-AS1) option, using an additional assembly integrated into the cover of the housing. (→ See also Section 5.5.1).

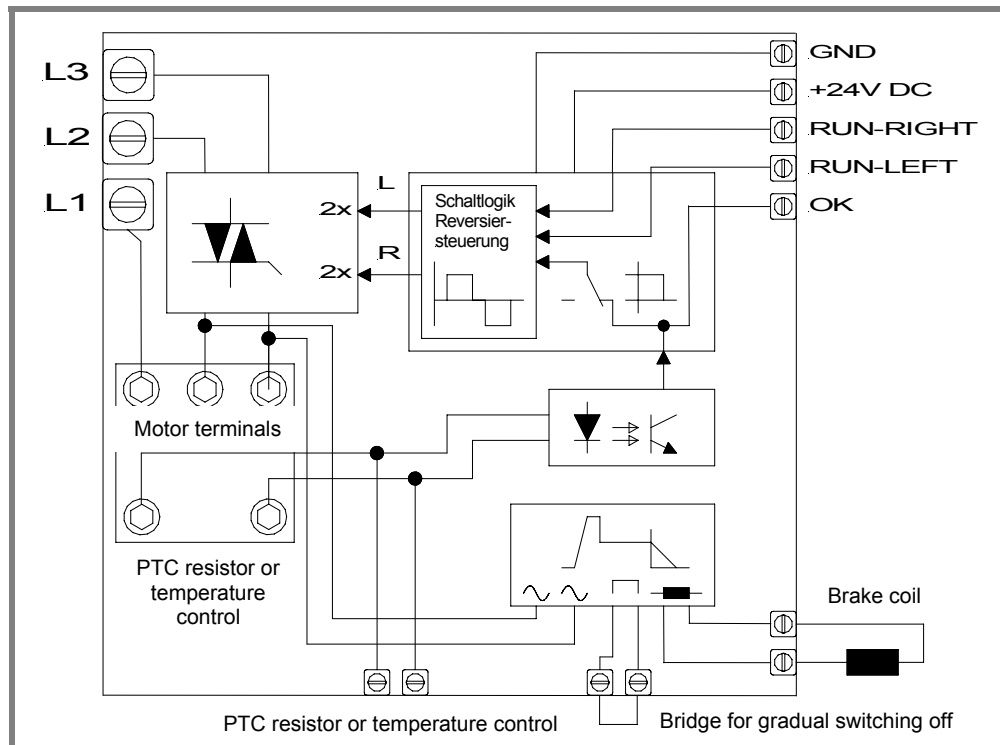
In combination with a HAN 10E system plug it is also possible to integrate the AS interface bus access into the SK 160 E by modifying the terminal box. With this version of the reverse starter the plug connector is mounted flush left on the terminal box and not in the centre. The feed-out of the connecting sockets of the AS interface is then carried out according to Section 5.5.2 next to the plug connector, and not via the cover of the terminal box.

This version of the SK 160 E is available both with and without an integrated brake rectifier. The designation for these versions is accordingly SK 160E-AS1-BSG2(-C)-MS or SK 160E-AS1-O(-C)-MS.

4.3 Electrical connection

- Power cable: The system connection shall be performed with a cable of sufficient cross-section (max. 4 mm²).
- Control unit: 5-pole plug with screw terminals 1.5 mm² (*electrically separated from the system potential*)
- PTC resistor/brake: 3 x 2-pole screw terminals with 1.5 mm² (*on system potential*)
- Cable entry: The following are available: 1 x M25 and 1 x M16 and 1 x M12. The 1 x M12 screw plug may already be reserved by the brake connection and the M16 by the optional M12 plug.

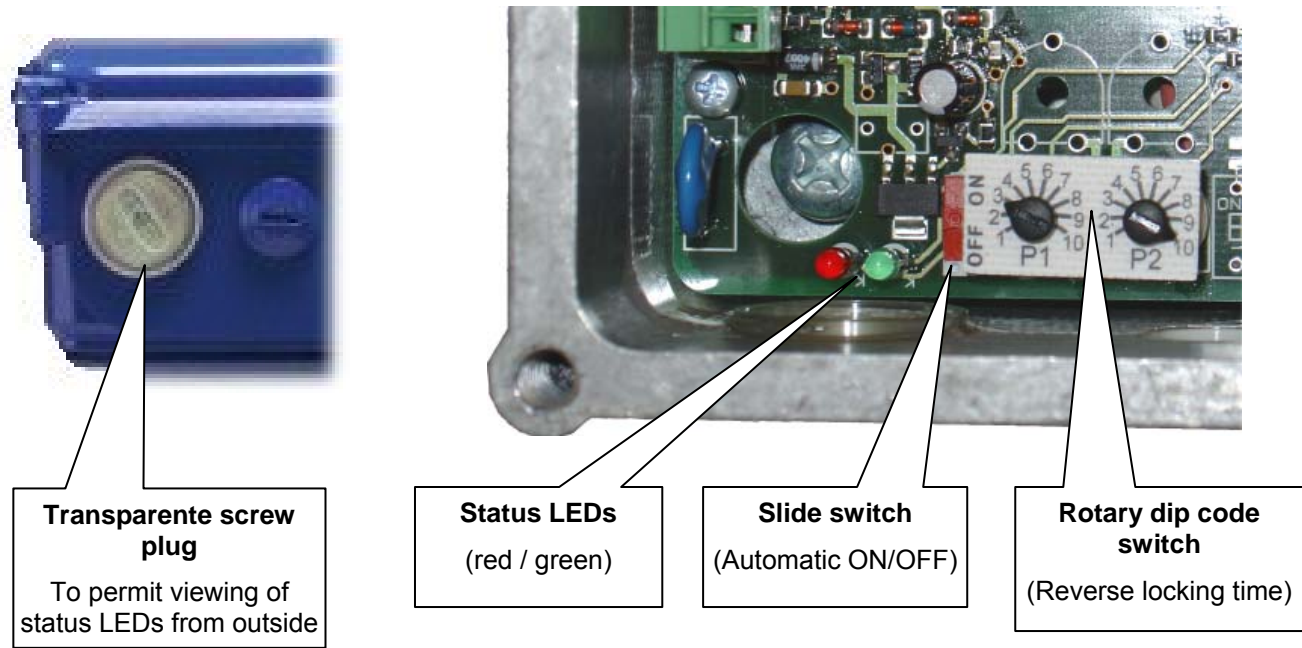
Principle circuit diagram:



	Terminal	Function	Data
Power unit (System potential)	L1, L2, L3	System connection	4 mm ² , (200) 380...480 V, 50...60 Hz
	PE	Housing ground	4 mm ²
	[L]	Bridge L	1.5 mm ²
	[BR-]	Brake coil	1.5mm ² , (105) 180V DC ... 205V DC, max. 0,5A
	[BR+]	Brake coil	1.5mm ² , (105) 180V DC ... 205V DC, max. 0,5A
	[38] Temp1	Temperature probe	1.5mm ²
	[39] Temp2	Temperature probe	1.5mm ²
Control unit (Electrically separated)	[46] GND	Reference potential	1.5 mm ² , 0 V
	[45] +24 VDC	Supply voltage 24 V	1.5 mm ² , 15...30V, 50 mA
	[B1] OK	Feedback, operational	1.5 mm ² , 15...30 V, max. 50 mA
	[22] RUN-R	Release signal - right	1.5 mm ² , 15...30 V, ca. 2 mA
	[23] RUN-L	Release signal - left	1.5 mm ² , 15...30 V, ca. 2 mA

4.4 Display and settings

The following controls are available for the SK 160E:



4.4.1 Status LEDs

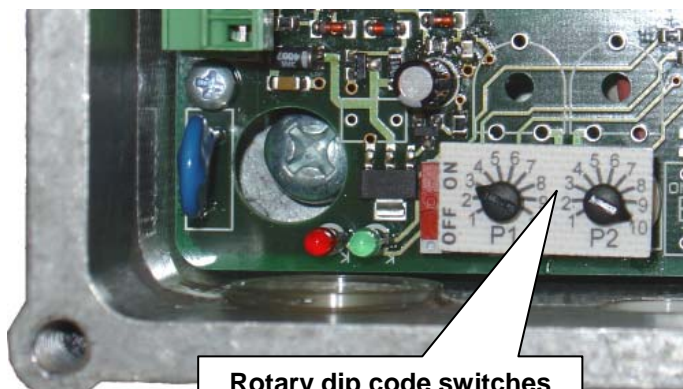
These LEDs are visible through a lateral **transparent** screw plug.

red LED:	OFF		no fault present
green LED:	Blinking briefly	Long pause	Operational (<i>Standby</i>), System voltage and temperature are OK
	Blinking briefly	Short pause	Locking time of the power switches is active (see chapter 0)
	Permanently on	---	Electronic switch is active (ON, motor turns)

red LED:	ON		a fault is present
green LED:	Blinking 1 x	Pause	[RUN-RIGHT] or [RUN-LEFT] was already active before applying the 24 VDC.
	Blinking 2 x	Pause	Automatic feature is OFF and the system voltage is absent or the motor temperature is too high
	Blinking 3 x	Pause	Automatic feature is ON and the system voltage is absent or the motor temperature is too high

4.4.2 Rotary dip code switches for locking time

With the help of two 10-step rotary dip code switches, the user can select the locking time for direct direction reversal. Both electronic power switches are locked for this time. The switch (P1) is used to select the desired time range. The switch (P2) allows a fine adjustment in 1/10 steps depending on the respective time range selected.



Step	1	2	3	4	5	6	7	8	9	10
P 1	0-0.2 s	0.2-0.5 s	0.5-1 s	1-2 s	2-5 s	5-10 s	10-15 s	15-30 s	30-60 s	60-120 s
P 2	1/10	2/10	3/10	4/10	5/10	6/10	7/10	8/10	9/10	10/10

Example 1:

Switch P1 on Step 1: Time range 0-200 ms
 Switch P2 on Step 1 = 20 ms, step 2 = 40 ms, step 3 = 60 ms,..., step 10 = 200 ms

Example 2:

Switch P1 on Step 5: Time range 2-5 s
 Switch P2 on Step 1 = 2.3 s, step 2 = 2.6 s, step 3 = 2.9 s,..., step 10 = 5 s

Because of the digital processing, the time accuracy is very high and can be exactly set again even if a device is replaced.

4.4.3 Slide switch for automatic operation

The slide switch is used to switch the automatic operation on or off. It refers to the behavior of switching on again after the motor starter has cut off because of excess temperature of the motor.

[ON]

Switching off: OK message (signal OK at low) is removed in case of excess temperature. The motor is automatically switched off by SK 160E.

Switching on again: The drive will not start automatically if excess temperature is no longer present. The control signal [RUN] must first be switched off and then on again or, alternatively, the slide switch is pushed to [OFF] and again to [ON]. *Attention:* The drive starts immediately!

[OFF]

Switching off: OK message (signal OK at low) is removed in case of excess temperature. The motor is not switched off by SK 160E.

Switching on again: The OK message is switched high again when the excess temperature is no longer present. The motor would start-up even in case of excess temperature!

5 Options / Accessories SK 1xxE

5.1 SK 1xxE on motor with electromechanical brake

When operating an SK 1xxE in conjunction with a brake motor, there are different options to generating the coil voltage of the brake. An SK 1xxE with integrated brake rectifier can be used or – e.g., in case of special voltages – an SK 1xxE with separately installed rectifier.

5.1.1 SK 1xxE with integrated brake rectifier

All SK 1xxE with integrated brake rectifier receive **–BSG2** (e.g., SK 140E-1-BSG2) as corresponding suffix in the type designation. A fast acting rectifier (BSG/brake control, half-wave rectifier) is integrated here in the electronics. The output brake coil voltage (terminals [Br-] and [Br+]) depends on the supply voltage of the drive.

Supply voltage 400 VAC → Brake voltage 180 VDC

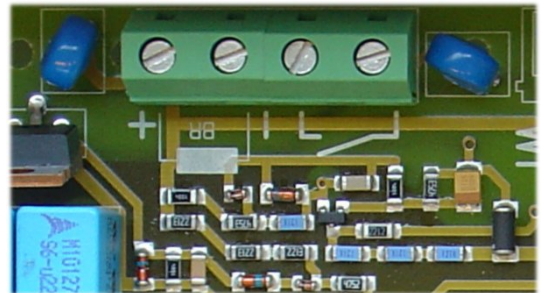
Supply voltage 480 VAC → Brake voltage 205 VDC

A separately installed brake rectifier must be used for supply voltages smaller than 380 V.

The bridge [L] allows conversion to a gradual switch-off.

Bridge [L] open → Direct current switch-off, quick cut-in

Bridge [L] closed → Alternating current switch-off, gradual cut-in



Type designation:

SK 140E-1-BSG2	Mat. No. 275101405
SK 150E-1-BSG2-3D-T125	Mat. No. . 275101505
SK 160E-1-BSG2-3D-T125	Mat. No. 275101605

5.1.2 SK 1xxE with separately installed brake rectifier

If a separate brake rectifier is contained in a SK 1xxE, the suffix **-O** (e.g. SK 140E-1-O) is included in the type designation. No terminals are available here for brake activation. If an electromechanical brake needs to be activated, a separate rectifier can be mounted on inserted spacers. This separate brake rectifier may be required for supply voltages smaller than 380 V or when a bridge rectifier is used.

More information on brake rectifiers on drives by NORD can be found in the electric motor catalog **M7000/3 DE**.

Type designation:

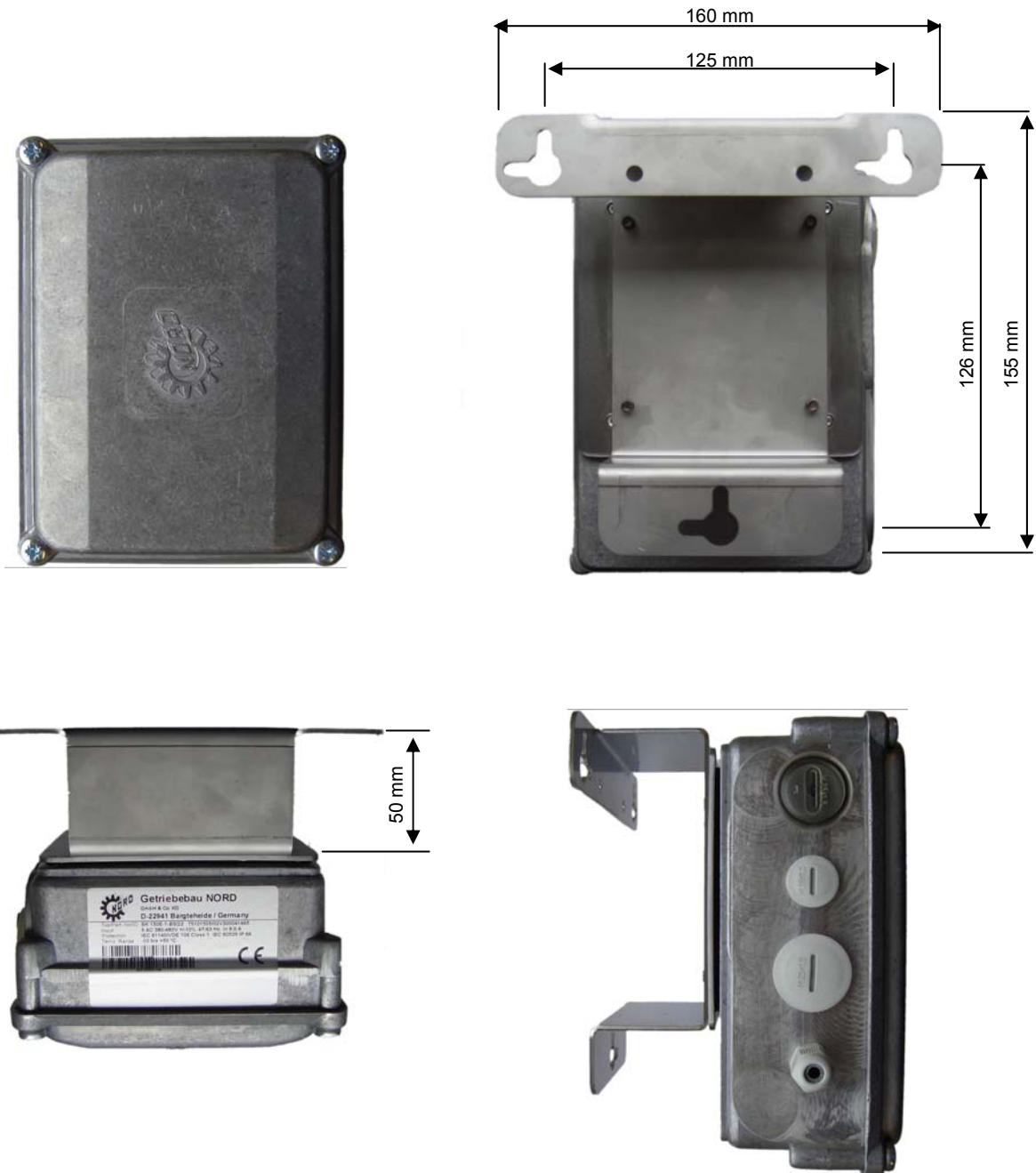
SK 140E-1-O	Mat. No. 275101400
SK 150E-1-O-3D-T125	Mat. No. 275101500
SK 160E-1-O-3D-T125	Mat. No. 275101600

5.2 Wall-mounting kit

An installation in close proximity to the motor is possible for all motor starters SK 1xxE, i.e., the control electronics with its terminal box is mounted in the immediate vicinity of the drive and is not attached directly to the motor. The optional **"Wall-mounting kit"** is required for this and contains the pertaining mounting plate for the respective SK 1xxE. This type of installation may be advantageous, e.g., for easier accessibility or quicker replacement.

Wall-mounting kit

Type: **SK WMK-DA1** (Mat. No. 275115100)



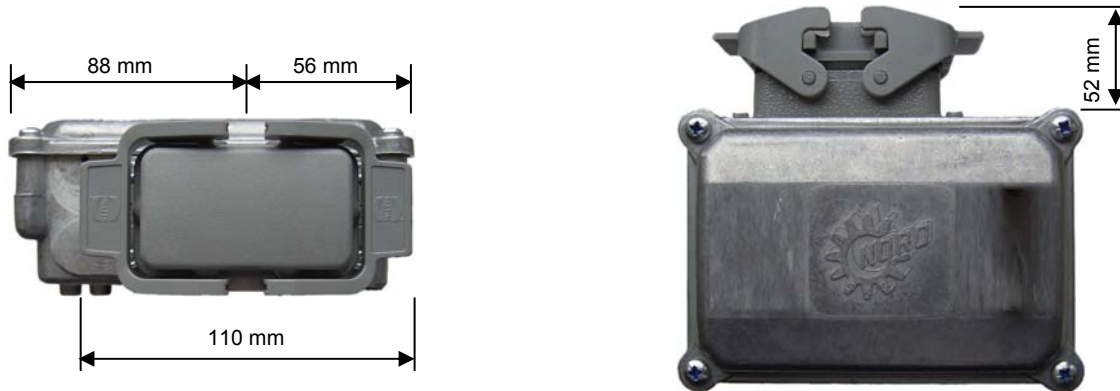
→ Illustrated example with SK 150E / SK 160E

5.3 System plug for power input or motor output

All series SK 1xxE motor starters can be equipped with a Harting HAN 10E system plug. (see illustration). The connector can serve as **power input** or **motor output**.

Harting plug for SK 140E :

The placement of the Harting plug is always on the opposite side of the screwed cable gland and status indicator. The approximate dimensions are listed below.



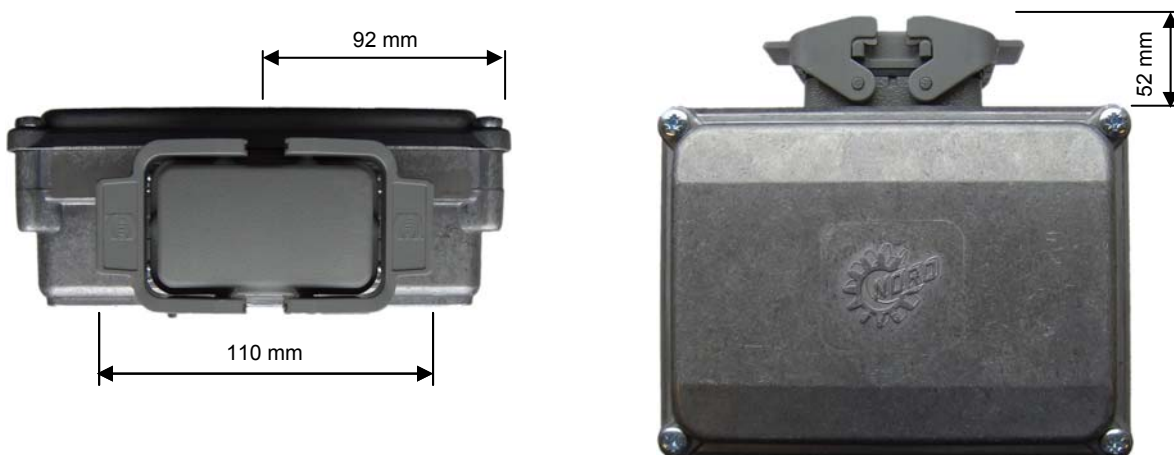
Type designation:

SK 140E-1-O-MS	Mat. No. 275101410
SK 140E-1-BSG2-MS	Mat. No. 275101415

Harting plug for SK 150E / SK 160E :

The placement of the Harting plug is always on the opposite side of the screwed cable gland and status indicator. The approximate dimensions are listed below.

In combination with an **AS interface** (as per 4.2.4), which is integrated into the terminal box, the plug connector is mounted flush left on the terminal box (→ See also Section 5.5.2).



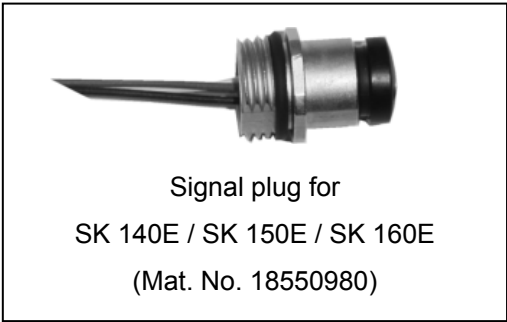
Type designation:

SK 150E-1-O-MS	Mat. No. 275101510
SK 150E-1-BSG2-MS	Mat. No. 275101515
SK 160E-1-O-MS	Mat. No. 275101610
SK 160E-1-BSG2-MS	Mat. No. 275101615

5.4 Signal plug M12 for control signals

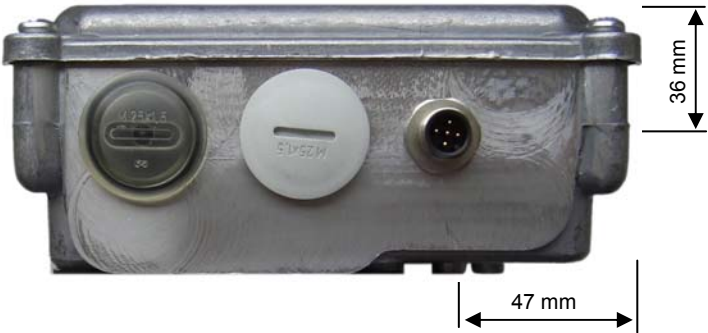
A signal plug M12 can be inserted for the supply of the 24 V control voltage as well as the connection of the signals RUN and OK. This plug-in connection facilitates a quick replacement of a drive without problems.

The signal plug M12 is inserted into the M16 screwed cable gland of the terminal box.

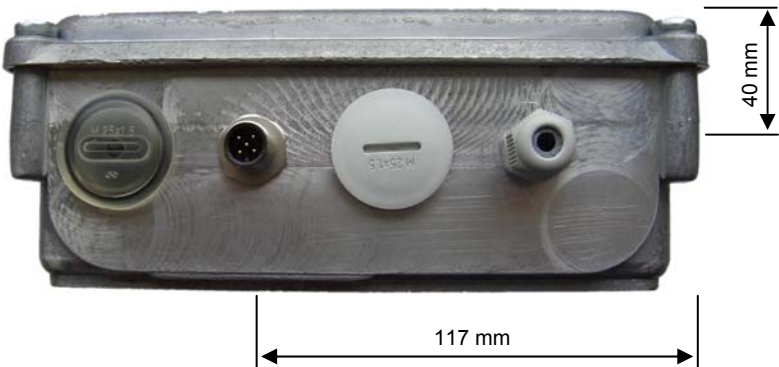


Pin	Color	Terminal	Function
1	brown	[43]	24V DC
2	white	[21]	RUN-RIGHT
3	blue	[40]	GND
4	black	[17]	OK
5	grey	[22]	RUN-LEFT

SK 140E



SK 150E / SK 160E



5.5 AS interface bus connection

The AS1 module (4 inputs / 4 outputs) corresponds to the requirements of the new AS interface according to specification 2.1. As with the control electronics of the SK 1xxE, this assembly is entirely powered by the AS interface. The inputs and outputs are resistant to short circuit and overload

A watchdog function has been integrated that switches the outputs current less if no communication takes place on the AS interface line.

Up to 3 circuit elements can be queried with the inputs. A signal lamp can be activated by the output whereby the energy is supplied from the AS interface system. The assignment for the control signals of the SK 1xxE is included in the table below. Apart from the motor activation, up to 3 additional sensors can be connected to M12 sockets and read. Together, they may draw max. 130 mA current.

The AS1 Module 4E/4A has the following assignment:		
AS Interface	Input	Ausgang
Bit 0	[OK] Output	[RUN-RIGHT] Input
Bit 1	Probe 3	[RUN-LEFT] Input
Bit 2	Probe 1	-
Bit 3	Probe 2	-

AS1 Assignment of M12 socket for AS Interface		Probe assignment of the M12 sockets:	Probe connection 1	Probe connection 2
Pin 1	AS1 +	Pin 1	+24 VDC	+24 VDC
Pin 2	-	Pin 2	Probe input 3	---
Pin 3	AS1 -	Pin 3	GND	GND
Pin 4	-	Pin 4	Probe input 1	Probe input 2

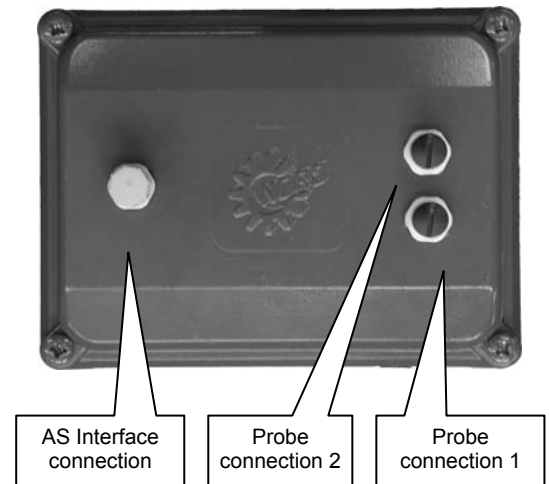
Technical data	
No-load current draw (Inputs = 0, Outputs = 0)	≤ 20 mA
Switching threshold of inputs	≤ 0.8 mA (low) ≥ 5 mA (high)
Voltage	20-30 VDC
Outputs	4, electronic
Load capacity	100 mA per output, 24 VDC (Sum of all outputs < 180 mA)
Length of power cable	E/A: max. 1.5m
Operating voltage	Via AS Interface
Operating current	< 200 mA
EMC compliance with	EN 50 081-2, EN 50 082-2

5.5.1 AS interface as additional assembly

An AS interface can be optionally integrated into the housing cover of a series SK 1xxE motor starter. In exchange for the standard closed terminal box cover, there is an assembly for the SK140E and for the SK 150E / SK 160E.

SK 140E Type: **SK IU1-AS1** (Mat. No.: 275101910)

SK 150E/ SK 160E Type: **SK IU2-AS1** (Mat. No.: 275101920)

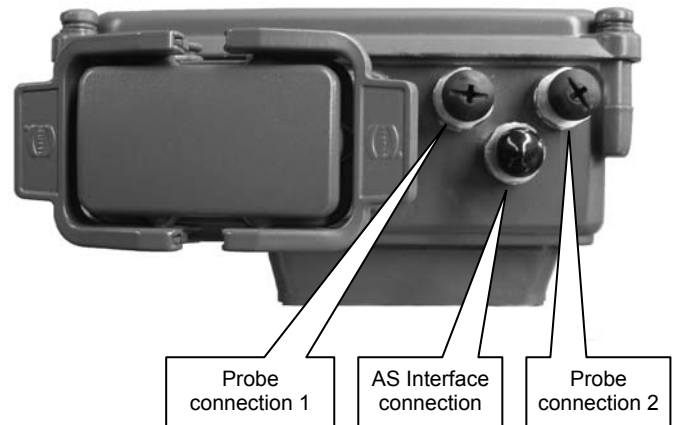


5.5.2 AS interface as additional optional assembly

For the SK 160E, with the use of the assembly –MS (Harting HAN 10E plug connector) there is alternatively the possibility of leading out the connections for the AS interface via the terminal box. For this, the plug connector is mounted flush left on the terminal box at the factory. The fitting of the connections for the AS interface is then next to the plug connector.

This version cannot be retro-fitted.

(→ See also Section 5.5.1).



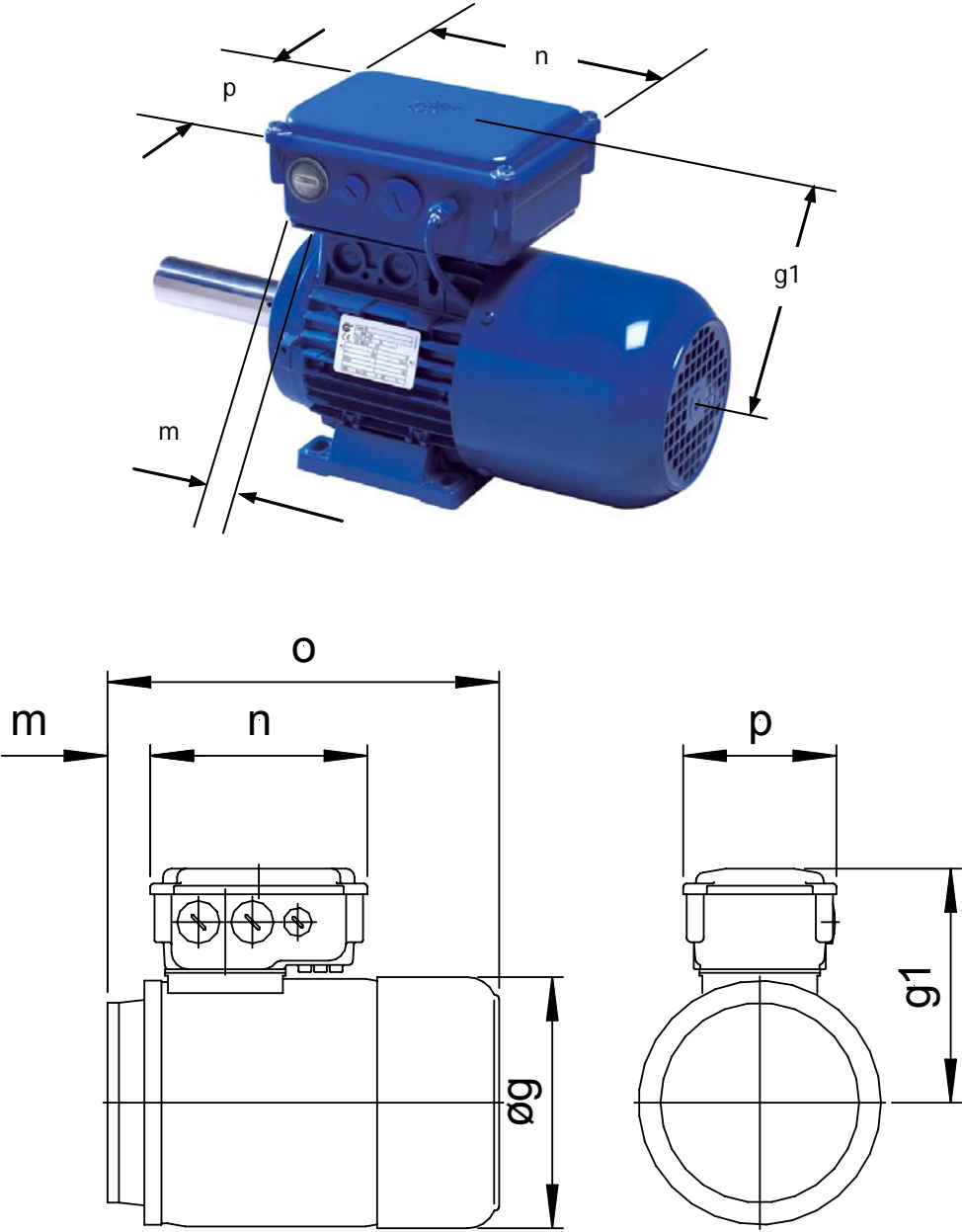
6 Technical data / Dimensions

Technical data

Function	Specification
System voltage	SK xxx-1- O 3~ 200...480 V, $\pm 10\%$, 47 ... 63 Hz without brake control
	SK xxx-1- BSG2 3~ 380...480 V, $\pm 10\%$, 47 ... 63 Hz with brake control
Operating current	0.5 ... 9 A
Motor rating	SK 140E: 0.12 ... 3 kW (at 400 V)
	SK 150E / SK 160E: 0.12 ... 4 kW (at 400 V)
Brake voltage	With integrated brake rectifier (Type „-BSG2“) depending on system voltage (180 VDC at 400 V~ / 205 VDC at 480 V~, max. 0.5A). Otherwise, according to brake rectifier used.
Ext. control voltage	24 VDC (15 ... 30 V), 50 mA (without AS interface Option)
Control input	15 ... 30 V, ca. 2 mA
Control output	15 ... 30 V, max. 50 mA, <i>short circuit-proof</i>
Motor temperature monitoring	PTC or bimetallic switch, assessment applied to system potential
Interface	24 VDC M12 plug (optional) AS Interface (optional)
Electrically separated	Control logic (digital input) against system voltage
Ambient temperature	-10 °C ... +50 °C, without condensation
Storage and transport temperature	-20°C ... +60/70°C
Protection class	IP55 / IP66 [-C- coated] (also dependent on the motor used)
Max. installation elevation above sea level	up to 1000 m: No output reduction
	1000 – 4000 m: 1%/ 100 m Output reduction (up to 2000 m overvolt. cat. 3)
	2000 – 4000 m: Only overvoltage cat. 2 is observed, an external overvoltage protection at the system input is required
Max. permitted connecting frequency	SK 140E / SK 160E: 1000 connections per hour, without heavy duty start-up
	SK 150E: 500 connections per hour, operation at normal rating
EMC	Interference suppression class A, suitable for industrial applications
Certifications	CE (UL, cUL → In preparation)

Dimensions

Motor size	SK 1xxE		SK 140E				SK 150E / SK 160E			
	g	o	g1	m	n	p	g1	m	n	p
BG 63	123	192	158	9	153	108	167	- 8	185	139
BG 71	138	214	167	17			176	0		
BG 80	156	236	159	26			169	9		
BG 90	176	276	164	30			174	14		
BG 100	194	306	175	36			185	19		
BG 112	218	326	-	-	-	-	195	32		
	all dimensions in [mm]						all dimensions in [mm]			



7 Maintenance and service notes

NORDAC SK 1xxE are maintenance-free if properly operated.

In case of repair, send the device to the following address:

Getriebebau NORD GmbH & Co. KG
Rudolf-Diesel-Str. 1
22941 Bargteheide

For questions regarding the repair, please contact:

Getriebebau NORD GmbH & Co. KG
Telephone: 04532 / 401 -515
Telefax: 04532 / 401 -555

If a NORDAC SK 1xxE is returned for repair, no guarantee can be assumed for possibly attached components such as power supply, connecting cable, etc.!

The most current information and documentation can be downloaded free of charge from the homepage of Getriebebau NORD at <http://www.nord.com>.

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9 Agencies and branch offices

<u>N O R D Branch offices worldwide:</u>		
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