Contactors

C320 series
1 pole bi-directional DC NO contactors for 1,000 amps
Catalogue C320.en
C320 – 1 pole bi-directional DC NO contactors

Compact single-pole NO contactors for DC up to 1,800 volts rated insulation voltage. Making current up to 3,000 amps; conventional thermal current up to 1,000 amps; short-time current up to 4,500 amps.

The bidirectional DC contactors of the C320 series extend the application range of the successful C310 and C360 series. The compact devices switch even higher powers. With a rated short-circuit breaking capacity of up to 3,000 amps, the contactors are suitable for applications with high inrush currents. The devices can permanently conduct up to 1,000 amps – thanks to high contact forces with measurably less heating in the main contact system. In the event of a short circuit, as much as 4,500 amps may flow for one second without the contacts welding. This means that the contactor retains its full function in order to disconnect large powers when required, regardless of the direction of the current. This excellent breaking capacity is made possible by an efficient ceramic arc chamber with generously dimensioned air gaps.

Features

- **Compact dimensions – high rated insulation voltage $U_i$ up to 1,800 volts**
  All air clearances in the contact area are generously dimensioned. The rated insulation voltage is 1,800 volts. The C320K/1000 is specified for rated operational voltages up to 1,500 volts. The C320S/1000 is suitable for rated operational voltages up to 60 volts and is significantly more compact.

- **High thermal continuous current $I_{th}$ up to 1,000 amps**
  All versions of the C320 can carry up to 1,000 amps permanently. In addition, the series has a very high short-time current carrying capacity $I_{cw}$ up to a maximum of 4,500 amps. These values are achieved by optimised silver contacts, high contact forces and permanently extremely low contact resistances.

- **High making capacity $I_{cm}$ up to 4,000 amps and an excellent breaking capacity**
  The C320 can switch on a current of up to 3,000 amps. A PWM controller regulates the coil current, ensures low-bounce switch-on and low holding power. The C320K/1000 handles high short-circuit currents and can switch off a current of 800 amps at 1,500 volts, for example. An efficient ceramic arc chamber makes this very good breaking capacity possible.

- **Low energy consumption and low heating thanks to sophisticated coil saving circuit**
  A PWM controller regulates the pull-in and holding current. This ensures a low-bounce switch-on, limits the power consumption in holding mode and significantly reduces the heating of the coil. In addition to flexible and power-saving control, this also increases the service life.

- **Full bidirectionality – safe disconnection of high powers**
  All versions of the C320 can reliably disconnect high currents and voltages, irrespective of the current direction. In the C320K/1000, these properties are achieved by the special arrangement of the blowout magnets and arc chamber as well as generously dimensioned air clearances in the contact area.

- **Auxiliary switches with mirror contact function**
  The C320 contactors can be equipped with up to four auxiliary switches, of which a maximum of two auxiliary switches can have mirror contact function according to IEC 60947-4-1, Annex F. Mirror contacts are required for the feedback circuits in safety controls. The mirror contact function means that the NC contact of the auxiliary contact cannot and must not be closed at the same time as the NO main contact.

Standards

Contactors meet requirements for industrial applications to:
- IEC 60947-4-1 Low-voltage switchgear and controlgear – Part 4-1: Contactors and motor starters – Electromechanical contactors and motor starters.
- ISO 16750-3 Road vehicles – Environmental conditions and testing for electrical and electronic equipment – Part 3: Mechanical loads
- UL 60947-4-1 Low-Voltage Switchgear and Controlgear – Part 4-1: Contactors and Motor-Starters – Electromechanical Contactors and Motor-Starters.
- GB/T 14048.4 Low-Voltage Switchgear and Controlgear – Part 4-1: Contactors and Motor-Starters – Electromechanical Contactors and Motor-Starters.

Contactors meet requirements for railway applications to:
- IEC 60077-2 Railway applications – Electric equipment for rolling stock – Part 2: Electrotechnical components; General rules
- IEC 61373 Railway applications – Rolling stock equipment – Shock and vibration tests
- IEC 61373 Railway applications – Rolling stock equipment – Shock and vibration tests
- IEC 62497-1 Railway applications – Insulation coordination – Part 1: Basic requirements – Clearances and creepage distances for all electrical and electronic equipment
Depending on the application, high demands are placed on electro-mechanical components. The new DC contactors are highly resistant to shock and vibration loads and meet the high requirements of ISO 16750-3 as well as those of IEC 61373.

Contactors of the C320 series are designed for continuous currents of 1,000 amps. The switchgear has both high making and breaking capacities, and a high short-time withstand current. This ensures high operational safety. An integrated electronic coil control ensures constantly reliable switching behaviour independent of the ambient temperature. In addition, the energy consumption and associated heat development is noticeably reduced when switched on.

**Ordering key**

<table>
<thead>
<tr>
<th>Series, contact configuration</th>
<th>C320</th>
<th>1 pole NO contactor, DC bi-directional</th>
</tr>
</thead>
<tbody>
<tr>
<td>Version</td>
<td>K</td>
<td>1,500 V DC</td>
</tr>
<tr>
<td></td>
<td>S</td>
<td>60 V DC</td>
</tr>
<tr>
<td>Conv. thermal current</td>
<td>1000</td>
<td>( I_{th} = 1,000 , \text{A} )</td>
</tr>
<tr>
<td>Coil voltage</td>
<td>24</td>
<td>( U_s = 24 , \text{V DC} )</td>
</tr>
</tbody>
</table>

Example: C320K/1000 24E-BBBB

**Auxiliary switches, number / type**

Position (see page 6)

- 1
- 2
- 3
- 4

Snap-action switches

<table>
<thead>
<tr>
<th>Position</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>S870 W1D1 t</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- B B B B
- B B 0 0
- 0 0 B B
- 0 0 0 0

Coil design

- Monostable with integrated PWM module
- E

**Applications**

Thanks to many years of experience and competence in developing electromechanical switchgear and the mastering DC arcs, Schaltbau has developed an innovative solution with new DC contactors that significantly simplifies applications with DC switching technology. Since the C320 series safely controls both current directions, the contactors are ideal for all applications involving energy recovery.

**Battery energy storage systems**

- Grid stabilization and battery energy storages
- Regenerative systems in industrial plants
- Battery management systems
- Industrial energy storage systems

**E-mobility**

- Electrical vehicles, hybrid vehicles and trolley busses
- DC charging station
- Battery test system

**Rail vehicles**

- Traction contactors for battery or hybrid vehicles
- Contactors for auxiliary converters for battery or hybrid vehicles
- Isolating contactors in battery circuits

**Photovoltaics**

- DC switching in central inverters
- Electrical cabinet (combiner boxes)
- Industrial energy storage systems

**Typical applications**

E-mobility

- Electrical vehicles, hybrid vehicles and trolley busses
- DC charging station
- Battery test system

Rail vehicles

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### Specifications C320K/1000 for $U_e = 1,500$ V DC, C320S/1000 for $U_e = 60$ V DC

#### C320 series

<table>
<thead>
<tr>
<th>Series</th>
<th>I</th>
<th>C320K/1000</th>
<th>C320S/1000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type of voltage</td>
<td></td>
<td>DC, bi-direktional</td>
<td>1x NO</td>
</tr>
<tr>
<td>Main contacts, configuration</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electrical data according to IEC/UL 60947-4-1, GB/T 14048.4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rated operational voltage $U_e$</td>
<td>$1,500$ V</td>
<td>$60$ V</td>
<td></td>
</tr>
<tr>
<td>Rated insulation voltage $U_i$</td>
<td>$1,800$ V</td>
<td>$1,800$ V</td>
<td></td>
</tr>
<tr>
<td>Rated impulse withstand voltage $U_{imp}$</td>
<td>$10$ kV</td>
<td>$10$ kV</td>
<td></td>
</tr>
<tr>
<td>Pollution degree / Overvoltage category</td>
<td></td>
<td>PD3 / OV3</td>
<td></td>
</tr>
<tr>
<td>Conventional free air thermal current $I_{th}$, $T_a = 60°$ C (cross section)</td>
<td>$1,000$ A</td>
<td>$1,000$ A</td>
<td></td>
</tr>
<tr>
<td>Power dissipation per pole $I_{pp}$, typ.</td>
<td>$50$ W</td>
<td>$50$ W</td>
<td></td>
</tr>
<tr>
<td>Pole impedance</td>
<td>typ.</td>
<td>$50$ $\mu$Ω</td>
<td>$50$ $\mu$Ω</td>
</tr>
<tr>
<td>Utilization category DC-1</td>
<td>IEC 60947-4-1, GB/T 14048.4</td>
<td>$150$ A @ $U_e = 1,500$ V DC</td>
<td>$330$ A @ $U_e = 48$ V DC</td>
</tr>
<tr>
<td>Utilization category DC-1 / DC general use</td>
<td>UL 60947-4-1</td>
<td>$80$ A @ $U_e = 1,500$ V DC</td>
<td>$330$ A @ $U_e = 48$ V DC</td>
</tr>
<tr>
<td>Frequency of operation (operations per hour) $I_e$</td>
<td>DC-1</td>
<td>$180$ h$^{-1}$</td>
<td>$360$ h$^{-1}$</td>
</tr>
<tr>
<td>Rated short-time withstand current $I_{cw}$, $t = 100$ ms</td>
<td></td>
<td>$4,500$ A</td>
<td></td>
</tr>
<tr>
<td>Additional electrical ratings of main circuit</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Conventional free air thermal current $I_{th}$, $T_a = 60°$ C (cross section)</td>
<td></td>
<td>$1,000$ A (600 mm$^2$)</td>
<td></td>
</tr>
<tr>
<td>Terminal heating</td>
<td></td>
<td>$55$ K</td>
<td></td>
</tr>
<tr>
<td>Rated short-circuit making capacity $I_{sw}$, $(L/R = 0$ ms)</td>
<td></td>
<td>$3,000$ A</td>
<td></td>
</tr>
<tr>
<td>Breaking capacity</td>
<td>$U_e = 1,500$ V / $I_e = 800$ A / $L/R = 0.15$ ms</td>
<td>$30$ operations</td>
<td>---</td>
</tr>
<tr>
<td>$U_e = 1,500$ V / $I_e = 450$ A / $L/R = 1$ ms</td>
<td>$30$ operations</td>
<td>---</td>
<td></td>
</tr>
<tr>
<td>$U_e = 1,000$ V / $I_e = 1,600$ A / $L/R = 0.2$ ms</td>
<td>$30$ operations</td>
<td>---</td>
<td></td>
</tr>
<tr>
<td>$U_e = 1,000$ V / $I_e = 1,300$ A / $L/R = 1$ ms</td>
<td>$30$ operations</td>
<td>---</td>
<td></td>
</tr>
<tr>
<td>$U_e = 60$ V / $I_e = 2,200$ A / $L/R = 1$ ms</td>
<td>---</td>
<td>$30$ operations</td>
<td></td>
</tr>
<tr>
<td>Electrical endurance</td>
<td>$U_e = 1,250$ V DC / $I_e = 120$ A / $L/R = 1$ ms</td>
<td>$6,000$ operations</td>
<td>---</td>
</tr>
<tr>
<td>$U_e = 60$ V DC / $I_e = 500$ A / $L/R = 1$ ms</td>
<td>---</td>
<td>$6,000$ operations</td>
<td></td>
</tr>
<tr>
<td>Critical current range</td>
<td>None</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td>Main contacts</td>
<td>Contact material</td>
<td>AgSnO$_2$</td>
<td></td>
</tr>
<tr>
<td>Terminals</td>
<td>$2x$ M8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Torque</td>
<td>$6 ... 8$ Nm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Auxiliary contacts</td>
<td>Number, configuration / contact material</td>
<td>$4$ max. snap-action switches S870 W1D1 t / silver</td>
<td></td>
</tr>
<tr>
<td>Making / breaking capacity</td>
<td>Snap-action switch S870 AC-15: $230$ V A / $1.5$ A DC-13: $60$ V DC / $0.5$ A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minimum voltage / current</td>
<td>$24$ V / $5$ mA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Terminals</td>
<td>Flat tabs $6.3 \times 0.8$ mm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Magnetic drive (monostable)</td>
<td>Rated control supply voltage $U_s$ (Operating range)</td>
<td>$24$ V DC (16 ... $36$ V DC)</td>
<td></td>
</tr>
<tr>
<td>Pollution degree / Overvoltage category</td>
<td>PD3 / OV2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coil power dissipation, max. $(T_a = 20°$ C / $U_e)$</td>
<td>Pull-in $(0.2$ s) / Holding power</td>
<td>$95$ W $(24$ V) / $11$ W</td>
<td></td>
</tr>
<tr>
<td>Frequency of operation (operations per hour, no load)$T_a = 20°$ C / $60°$ C</td>
<td>$3,600$ h$^{-1}$ / $1,800$ h$^{-1}$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pull-in time $(T_a = 20°$ C / $U_e)$ / Drop-off time $(T_a = 20°$ C / $U_e)$ typ.</td>
<td>$&lt; 60$ ms$^*$ / $&lt; 10$ ms</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coil suppression</td>
<td>integrated</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coil terminals</td>
<td>2-pole screwless terminal block for solid and stranded conductors up to $2.5$ mm$^2$ max.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mounting position</td>
<td>vertical / horizontal (not upside-down, see page 6, 7)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Degree of protection</td>
<td>IEC 60529</td>
<td>IP00</td>
<td></td>
</tr>
<tr>
<td>Mechanical endurance</td>
<td></td>
<td>$1,000,000$ operations</td>
<td></td>
</tr>
<tr>
<td>Vibration</td>
<td>IEC 61373 / ISO 16750-3</td>
<td>Category 1, class B / profile VII</td>
<td></td>
</tr>
<tr>
<td>Shock</td>
<td>IEC 61373 / ISO 16750-3</td>
<td>Category 1, class B / $20$ g/6 ms</td>
<td></td>
</tr>
<tr>
<td>Temperatures</td>
<td>Operating temperature / Storage temperature</td>
<td>$-40°$ C ... $+60°$ C / $-40°$ C ... $+85°$ C</td>
<td></td>
</tr>
<tr>
<td>Attitude** / Humidity (IEC 62948-1)</td>
<td>$&lt; 5,000$ m above sea level / $&lt; 75$ % rel. humidity, annual average</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weight</td>
<td>$2.7$ kg</td>
<td>$2.0$ kg</td>
<td></td>
</tr>
</tbody>
</table>

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* Detection of the switching status via the auxiliary contacts from $120$ ms onwards

** Greater warming is possible for altitudes $\geq 2,000$ m a.s.l.
**Arc chamber main contact system**
Highly efficient ceramic arc chamber with permanent magnetic blowout

**Main contact terminals**
Holes for bolts M8, Tightening torque 6 ... 8 Nm

**Auxiliary switches**
2x or 4x snap-action switches S870, SPDT, flat tab 6.3 x 0.8 mm

**Electronic coil controller**
Permanently reliable switching behaviour regardless of ambient temperature, reduced energy consumption and less heat generation

**Coil terminal**
2 pole screwless terminal block for solid and stranded conductors up to 2.5 mm² max.

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**Dimension diagram C320K/1000:**

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**Dimension diagram C320S/1000:**

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**Dimension diagram C320K/1000:**

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**Dimension diagram C320S/1000:**

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*Subject to change / Dimensions in mm*
Minimum distances to magnetically active, live or earthed parts

- **C320K/1000**
  - Top edge arc chamber
  - Minimum distance at max. load current

- **C320S/1000**
  - Cover main contact system
  - Minimum distance depending on customer insulation coordination

Circuit diagram

- **C320K/1000**
  - Main contact 1
  - Aux. switch 1: S870 W1D1 t
  - Aux. switch 2: S870 W1D1 t
  - Main contact 2
  - Aux. switch 3: S870 W1D1 t
  - Aux. switch 4: S870 W1D1 t
  - Coil connection

- **C320S/1000**
  - Main contact 1
  - Aux. switch 1: S870 W1D1 t
  - Aux. switch 2: S870 W1D1 t
  - Main contact 2
  - Aux. switch 3: S870 W1D1 t
  - Aux. switch 4: S870 W1D1 t
  - Coil connection

**Circuit diagram**

- **C320K/1000**
  - Main contact system
  - Coil with PWM controller
  - A1 + 1 12 14 22 24 32 34 42 44
  - A2 - 2 11 21 31 41

- **C320S/1000**
  - Aux. switch 1: S870 W1D1 t
  - Aux. switch 2: S870 W1D1 t
  - Aux. switch 3: S870 W1D1 t
  - Aux. switch 4: S870 W1D1 t

**Mounting holes**

- **C320K/1000, C320S/1000**

  - Base plate, view from below

- **The contactors are mounted on a suitable mounting plate with four M5 screws.**
### Mounting instructions

**C320 series**

- **Permissible mounting orientations**

![Permissible mounting orientations](image)

- **Mounting holes**

![Mounting holes](image)

The contactors can be mounted horizontally or vertically on a prepared mounting plate. Mounting positions hanging upside down are not allowed.

### Maintenance and safety instructions

**C320 series**

**Maintenance:**

- C320 series contactors are basically maintenance free.
- Make regular in-depth visual inspections once or twice a year.

**Safety instructions:**

- The device must be used according to the intended purpose as specified in the technical documentation. You are obliged to observe all specifications depending on operating temperature, degree of pollution etc. that are relevant to your application.
- Without further safety measures the contactors are not suited for use in potentially explosive atmospheres.
- In case of malfunction of the device or uncertainties stop using it any longer and contact the manufacturer instantly.
- Tampering with the device can seriously affect the safety of people and equipment. This is not permitted and leads to an exclusion of liability and warranty.
- Coil suppression for reducing surges when the coil is switched off is optimally attuned to the contactors switching behaviour. The existing opening characteristic must not be negatively influenced by parallel connection with an external diode.

- Contactors running permanently may heat up. So make sure that the contactor has sufficiently cooled down before you start any inspection or maintenance work.
- When installing contactors with magnetic blowout make sure to do it in such a way that no magnetizable parts can be attracted by the permanent magnets that are also capable of destroying all data of swipe cards.
- In general, strong electromagnetic fields can be generated in the area around the contactors. These can influence other components in the area of the contactors.
- Improper handling of the contactor, e.g. when hitting the floor with some impact, can result in breakage, visible cracks and deformation.

**Warning:** Defective contactors or parts (e.g. arc chambers, auxiliary switches) must be replaced immediately!

For detailed maintenance, safety and mounting instructions please refer to our operating manuals [C320-M.en](#).
Electrical Components and Systems for Railway Engineering and Industrial Applications

Connectors
- Connectors manufactured to industry standards
- Connectors to suit the special requirements of communications engineering (MIL connectors)
- Charging connectors for battery-powered machines and systems
- Connectors for railway engineering, including UIC connectors
- Special connectors to suit customer requirements

Snap-action switches
- Snap-action switches with positive opening operation
- Snap-action switches with self-cleaning contacts
- Snap-action switch made of robust polyetherimide (PEI)
- Snap-action switch with two galvanically isolated contact bridges
- Special switches to suit customer requirements

Contactors
- Single and multi-pole DC contactors
- High-voltage AC/DC contactors
- Contactors for battery powered vehicles and power supplies
- Contactors for railway applications
- Terminal bolts and fuse holders
- DC emergency disconnect switches
- Special contactors to suit customer requirements

Electrics for rolling stock
- Equipment for driver’s cab
- Equipment for passenger use
- High-voltage switchgear
- High-voltage heaters
- High-voltage roof equipment
- Equipment for electric brakes
- Design and engineering of train electrics to customer requirements