SCHALTBAU

DC Power Under Control

3

Contactors

C193, C294 series

Single- and double pole
NO contactors

Installation and maintenance
instructions

Manual B193-B294-M.en

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1. Important basic information

1.1 Legal notes

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Schaltbau GmbH cannot be held liable for damage caused by not observing (or only partly observing) the manual.

1.2 Conventions for this manual

This manual describes the installation and maintenance of the contactors.
Cross references are presented in bold italics.
To highlight particularly important safety instructions and other information, the following symbols are used in this instructions:

DANGER

Indicates a hazardous situation with a high level of risk which, if not avoided, will result in death or serious injury.

WARNING

Indicates a hazardous situation with a medium level of risk which, if not avoided, could result in death or serious injury.

CAUTION

Indicates a hazardous situation with a low level of risk which, if not avoided, may result in minor or moderate injury.

NOTICE

Indicates a hazardous situation which, if not avoided, may result in property damage, such as service interruption or damage to equipment or other materials.

Refers to technical features and methods aimed at facilitating work or to particularly important information.

This manual refers to NO contactors of the following types:

- C193 (single pole), C294 (double pole).
- This manual describes only stock items of the above mentioned contactor types. If you need a special variant feel free to contact us.

2. General and security information

The contactors dealt with in this document are intended for use with high-voltage systems for special installations. They are designed and tested in compliance with the generally recognised state of the art. However, improper use, operation, handling, maintenance of or tampering with electric equipment can cause serious or fatal injury to the user or others, and the appliance or other property can be damaged.
The operation, maintenance and installation instructions for the contactors must therefore be strictly followed.
Any uncertainties must be clari ed and all queries must include details of the type of device and the serial number.
Only authorized and trained personnel are allowed to plan and carry out all mechanical and electrical installations, transport, commissioning, as well as maintenance and repair work. This applies to the observation of the general installation and safety regulations for high-voltage systems as well as the proper use of tools approved for this purpose. Electric equipment requires protection from moisture and dust during installation and storage.

2.1 Observing the instructions

- All sta must read and understand the instructions in this manual and adhere to them when working with the device.
- Always carefully observe all safety warnings!

2.2 User obligations

- Observe all applicable national provisions, all safety, accident prevention and environmental regulations as well as the recognized technical rules for safe and proper working.
- Carry out regular inspections of all protection and safety devices to see if they work properly.
- Work on electric equipment may only be performed by an expert or trained personnel working under the direction and supervision of an expert according to the applicable rules of electrical engineering.
- An expert is a person who can judge and recognise the possible dangers of the jobs commended to him based on his training, knowledge and experience and by knowledge of the appropriate regulations.
- Work on the contactors must only be carried out by sta who meets the requirements set out in this manual.
- Sta must be informed clearly about who is responsible for the maintenance of the contactors.
- After each installation work and/or after any other modi cations, alterations or maintenance works, always perform complete checks according to these standards:
  - IEC 60077-2
  - IEC 60947-4-1

2.3 Intended use

- The contactors have been designed and tested according to national and international standards. Due to their unique features they can also be used in a variety of applications.
- The contactors must only be used under operating conditions according to the technical speci cation and the instructions in this manual.
- None of the operating conditions de ned in the corresponding data sheets and in our catalogues B193and B294 in section “Speci cations“, such as voltages, currents, ambient conditions, etc. may be changed. Thecatalogues are available under: https://www.schaltbau.com/en/media-library/
- The contactors may only be used when all protective devices are present, have been installed properly and are fully operational.
- Contactors may not be used without further protective measures in potentially explosive atmospheres and/or in aggressive media.
- Coil suppression for reducing surges when the coil is switched o is optimally attuned to the contactor‘s switching behaviour. The existing opening characteristic must not be negatively in uenced by parallel connection with an external diode.
- Do not use the contactor without properly mounted arc chute cover.
- The contactor has unprotected live parts
- The required clearance of live parts to earth and other parts of the contactor is to be observed as well as the safety regulations of the applicable standards.
- Switching at maximum breaking capacity might require larger clearance! Do not hesitate to ask our advice for dimensioning.
- Improper handling of the contactors, e.g. when hitting the oor with some impact, can result in breakage, cracks and deformation. Always handle the contactors with care.
- Use the contactor only according to its intended use. Replace or repair damaged parts exclusively with original parts. Any other usage of or tampering with the contactors is considered contrary to its intended use. No liability is assumed for damages and accidents caused due to non-compliance with the instructions in this manual or improper use of the contactors.

2.4 Ambient conditions

NOTICE

The contactors are constructed for speci c ambient conditions.

- Operate the contactors only according to the ambient conditions, like temperature ranges, pollution degree, etc., as de ned in the corresponding data sheets and in our catalogues B193 and B294. The catalogues are available under: https://www.schaltbau.com/en/media-library/

3. Dangers and security measures

3.1 Electrical dangers

DANGER

The contactors are used to switch voltage. The touching of electrically conducting parts may result in serious injuries or even death!
Energized parts are all metal parts belonging directly to one of the circuits or wires leading there. All other visible metal parts and wires may also be energized in the case of a failure.
Before beginning any work on the contactors, always observe the following safety regulations:

- Disconnect on all sides
- Ensure that it is not possible to reconnect unintentionally
- Clearly mark your work area
- Make sure that there is no voltage present
- Earth and short circuit the installation; this also includes the discharging of any capacitors in the main circuit
- Besides the main electric circuit, also disconnect additional and auxiliary circuits
- Cover or insulate adjacent energized parts
- Only an electrically skilled person may determine if there is no voltage present
- When the work has been concluded, proceed the other way round.

3.2 Other dangers

WARNING

Exclusively use the contactors for purposes as indicated in the specications and data sheets.
A wrong application can cause accidents and severe damages to persons!

- The manufacturer doesn‘t take the responsibility for accidents which were caused by improper use of the product.

CAUTION

During continuous operation the contactors may become hot. Risk of burns!

- Before beginning any checks or maintenance work on the contactors make sure that the heat ed components have cooled down.

CAUTION

The contactors contain sharp-edged parts. Risk of injury!

- Use appropriate tools for installation and maintenance works on the contactors.
- Wear protective gloves when working with sharp-edged components.

3.3 Measures for avoiding damages and malfunctions

NOTICE

Aggressive uids may damage the contactors.

- Make sure that the contactors are not exposed to aggressive uids.

NOTICE

Improper handling of the contactors, e.g. when hitting the oor with some impact, can result in breakage, cracks and deformation.

- Make sure that the contactors are always used properly.
- Do not throw the contactors to the oor.
- Regularly sight-check the contactors for potential damages.
- Immediately replace damaged components.

NOTICE

Depending on the product type, contactors can contain strong (permanent) magnets. These magnets can attract ferromagnetic particles and may damage the contactors.

- Make sure that the contactors are installed at a location, where no ferromagnetic particles can be attracted.

NOTICE

Depending on the product type, contactors can contain strong (permanent) magnets. These magnets can de stroy data on credit cards or similar cards.

- Keep credit cards or similar cards away from the contactors..

NOTICE

During the switching o , strong electromagnetic elds are generated in the surroundings of the contactors. These may in uence other components close to the contactors.

- Make sure that the contactors are installed at a location, where no other components can be a ected.

NOTICE

In the case of damage, wear and tear and/or soiling of the contactor components - in the form of a partial break, sharp edges and discoloured surfaces - the functional safety of the contactors is no longer guaranteed.

- Carry out regular visual checks to detect wear and tear and dirt.
- Immediately replace damaged parts.
- Immediately remove dirt without leaving any residues.
- Immediately replace parts with stubborn dirt.

NOTICE

Detent-edged rings and detent-edged washers have a limited life time. After 3 times opening of screws secured with detent-edged rings or detent-edged washers, the rings or washers must be replaced by new ones.

- Record the frequency of screw opening in the work log.
- After 3 times opening of screws, replace detent-edged rings or detent-edged washers by new ones..

4. Product information

4.1 Contactors of the C193 and C294 series

Single and double pole high-voltage contactors of compact design:
Notwithstanding its small size, the contactors feature an extraordinary switching capacity.
The C193 series contactor is suitable for DC applications up to 1,000 V.
The C294 series contactor is suitable for DC applications up to 1,000 V per contact system or 1,500 V when main contacts connected in series.
Best suited for the harsh environment of public transport, both contactor series have been proven to be transportation system components of high reliability which have an electrical life that is above average.

4.2 Special features

- Suitable for years of continuous duty
- Intended for high ambient temperatures
- Compact design
- Double-break contacts
- DC versions with blowout magnets for arc quenching
- Only for C193 series:
  - Versions for AC and DC operation available
  - DIN rail mount option

4.3 Applications

Typical applications are to be found in tra c engineering equipment, particularly in heating circuits, air conditioning equipment and conversion
engineering of complex power supplies.

4.4 Technical information and material speci cation

For technical information and material speci cations, refer to the corresponding data sheets and to our catalogues B193 and B294.
The catalogues are available under:
https://www.schaltbau.com/en/media-library/

4.5 Survey of the C193 and C294 series (stock items)

C193 series (single pole NO contactors)

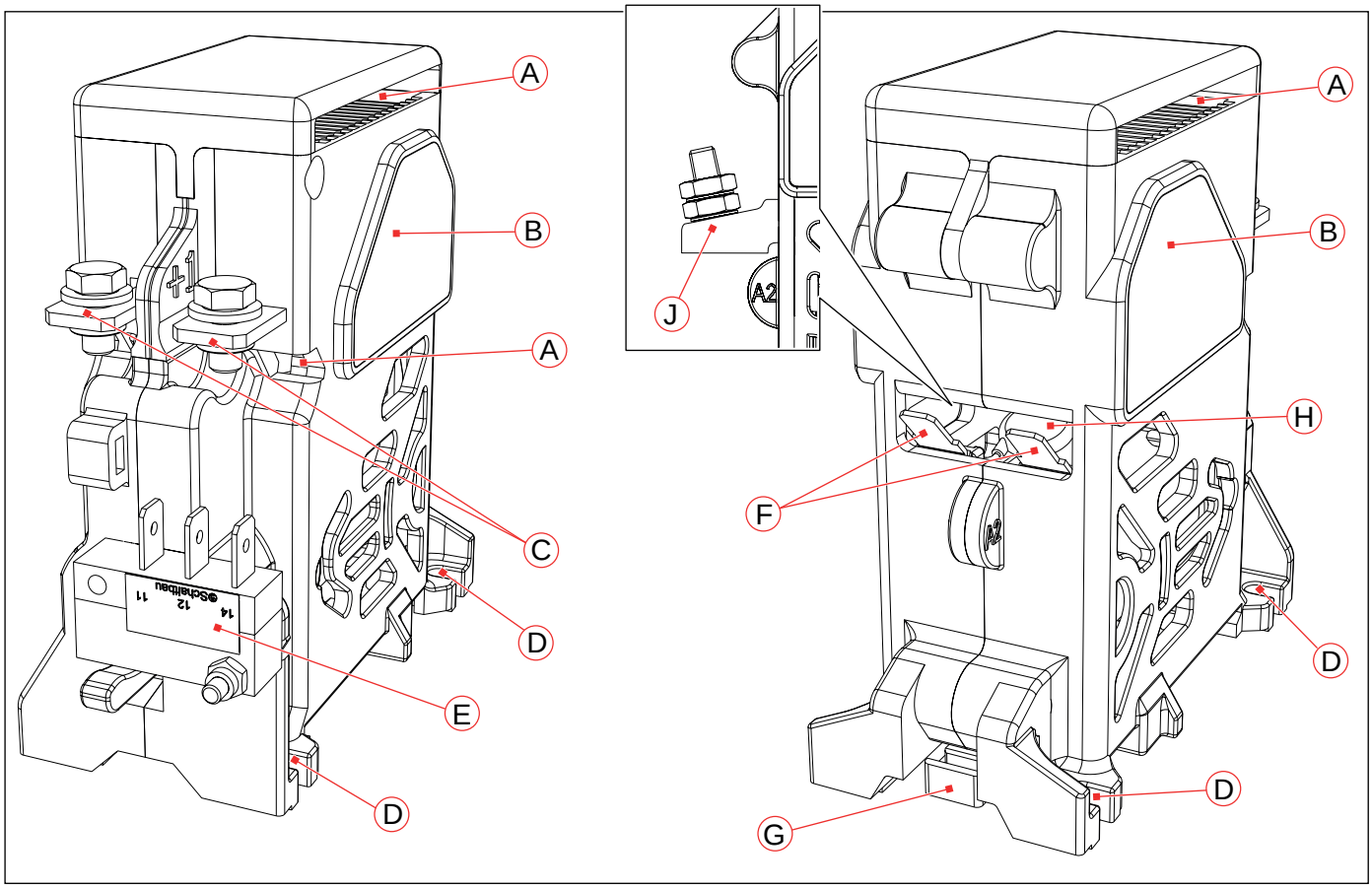

Fig. 1: C193 series (left: front view, right: rear view)

A Plasma exits
B Permanent magnets (behind cover)
C Main contacts, terminals hexagon head bolts M5 + load washers, tightening torque: 3 Nm max. Alternative version: main contact terminals with hexagon head bolts, inch thread 10-24UNC x 3/8“ + load washers
D Mounting holes for screws M4, Tightening torque: 2 Nm max.
E Auxiliary contact (S870), Terminals: Flat tabs 6.3 x 0.8 mm
F Coil terminals A1 and A2, Flat tabs 6.3 x 0.8 mm
G Slider for DIN rail mounting (DIN rail 35 mm)
H Varistor (suppressor diode optional)
J Alternative version: Coil terminals with hexagon head bolts, inch thread 10-24UNC x 5/8“, each with 2 hexagon nuts 10-24UNC + load washers

C294 series (double pole NO contactors)

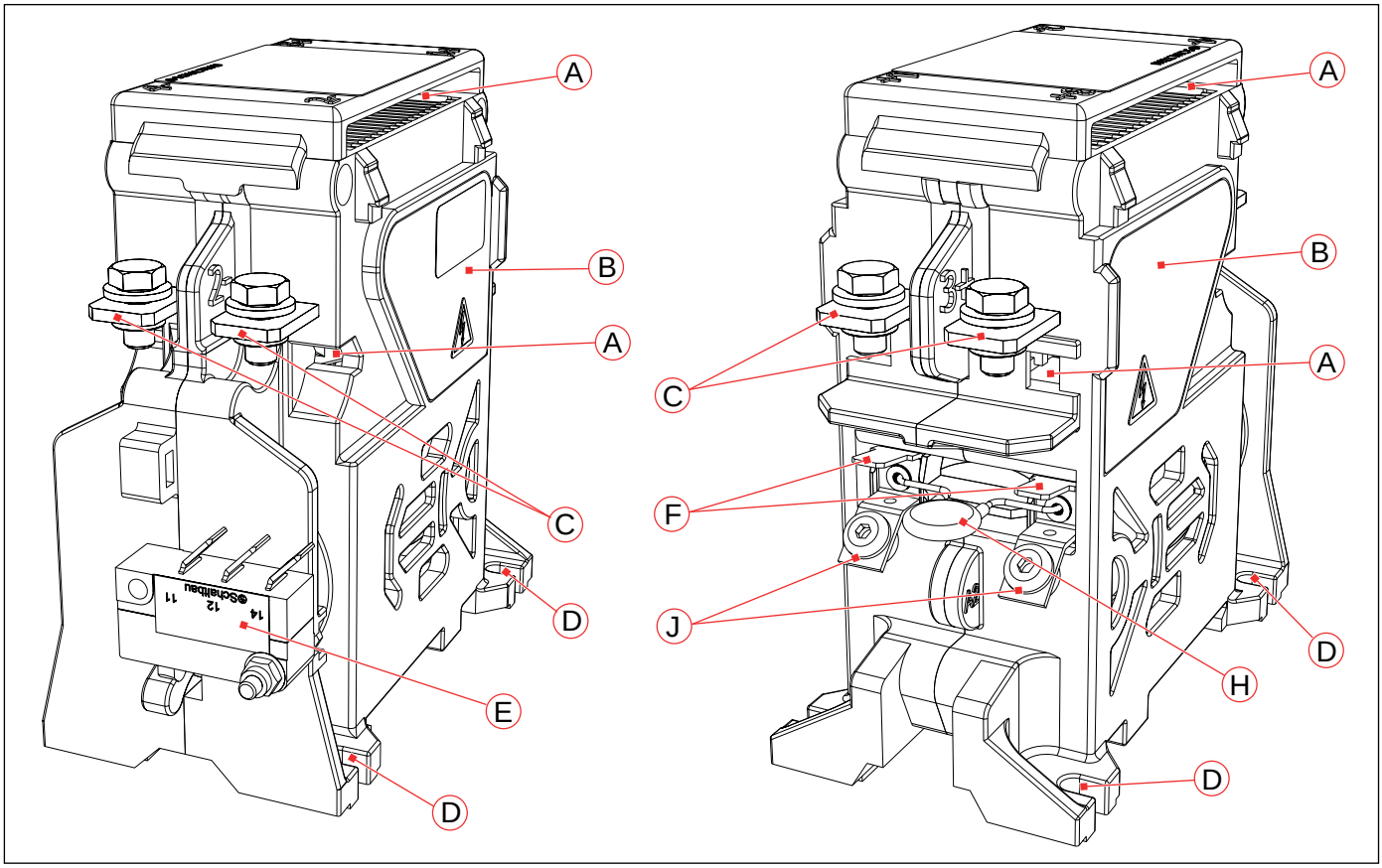

Fig. 2: C294 series (left: front view, right: rear view)

A Plasma exits
B Permanent magnets (behind cover)
C Main contacts, terminals hexagon head bolts M5 + load washers, tightening torque: 3 Nm max. Alternative version: main contact terminals with hexagon head bolts, inch thread 10-24UNC x 3/8“ + load washers
D Mounting holes for screws M4, Tightening torque: 2 Nm max.
E Auxiliary contact (S870), Terminals: Flat tabs 6.3 x 0.8 mm
F Coil terminals A1 and A2, Flat tabs 6.3 x 0.8 mm
H Varistor
J Alternative version: Coil terminals with phillips screws, inch thread 8-32UNC x 1/4“ + lock washers

5. Storage

NOTICE

Moisture and dust can damage the contactor. If the device is to be stored for a prolonged period of time,

- store it in its original packaging,
- store it in a dry and dust-free location.

Return shipments

Schaltbau recommends to keep the original packing box for any return shipments. If no original packing box is available care must be taken to pack the contactor in a way that prevents damage during shipment.

6. Unpacking

6.1 Unpack the device

- Before opening the packaging, perform a visual inspection for any signs that could indicate damage having occurred during transport (impacts, bumps, falling etc.).
- If any signs indicate that the contactor has been subject to excessive shock in uence do not install the contactor.

6.2 Check parts for transport damage

NOTICE

If parts are damaged, the functional reliability of the contactor is no longer given.

- Before installing, check all parts for any possible transport damage.
- Do not install a damaged contactor.

7. Installation

7.1 Mechanical installation

Dimensions and further technical speci cations

The dimensions and further technical speci cations are given in the respective data sheets or in our catalogues. Refer to our catalogues B193 and B294.
The catalogues are available under:
https://www.schaltbau.com/en/media-library/

Preliminaries

- For the fastening of the contactors an appropriate mounting plate with 4 mounting holes according to Fig. 3 or Fig. 4 has to be provided.

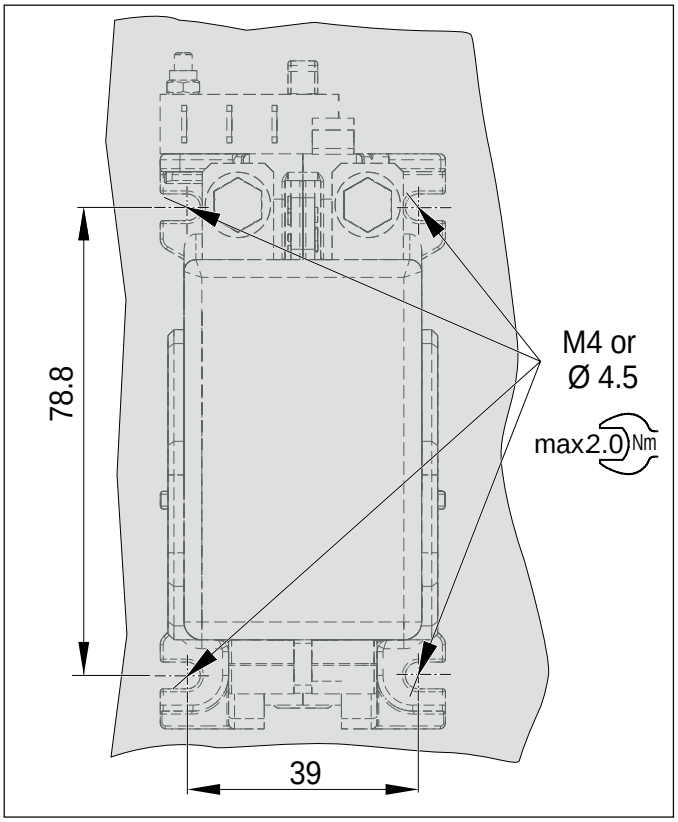

Fig. 3: C193 series: Dimensions (in mm) and arrangement of the mounting holes

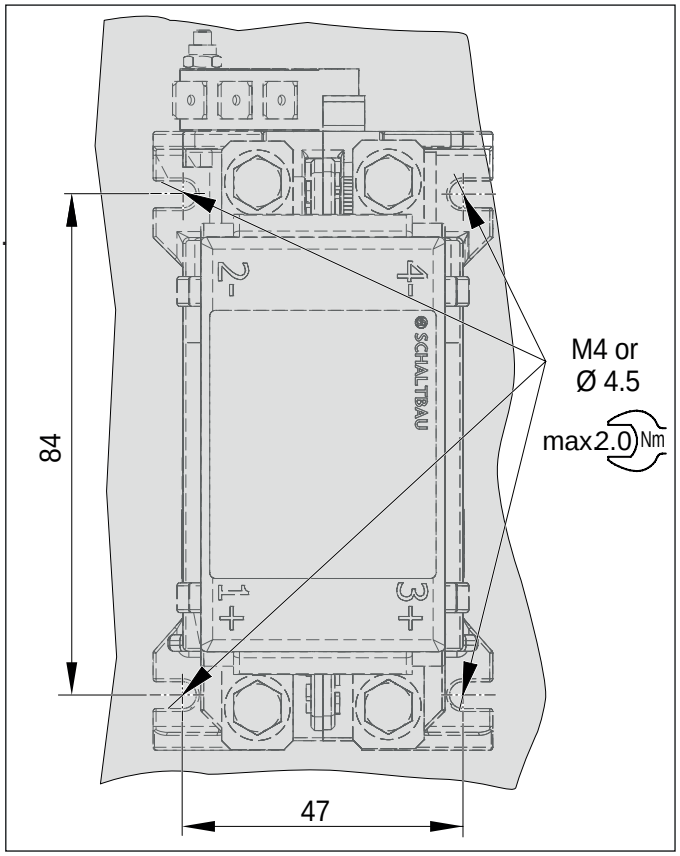

Fig. 4: C294 series: Dimensions (in mm) and arrangement of the mounting holes

- The mounting holes can either be
  - threaded holes (for threaded screws)
  - or through holes (for threaded screws and nuts).
- The length of the xing screws has to be deter mined according to the constructional conditions.
- In order to secure the mounting screws against self-loosening, appropriate screw locking ele ments have to be provided. Schaltbau strongly recommends Schnorr-Washers (or similar) to- se cure the screws.
- As an alternative, contactors of the C193 series can also be installed by means of DIN rail mounting. See section “DIN rail mounting (only C193 series)“.

Correct mounting positions

The contactors are designed for horizontal or vertical mounting positions.

Examples for intended mounting positions are shown in Fig. 5/(A) and Fig. 6/(A).

The following mounting positions are not permissible:

- for the C294 series: do not mount upside down, so that mounting plate points upwards or coil terminals point downwards as shown in Fig. 5/(B).
- for the C193 series: do not mount upside down, so that mounting plate points upwards as shown in Fig. 6/(B)

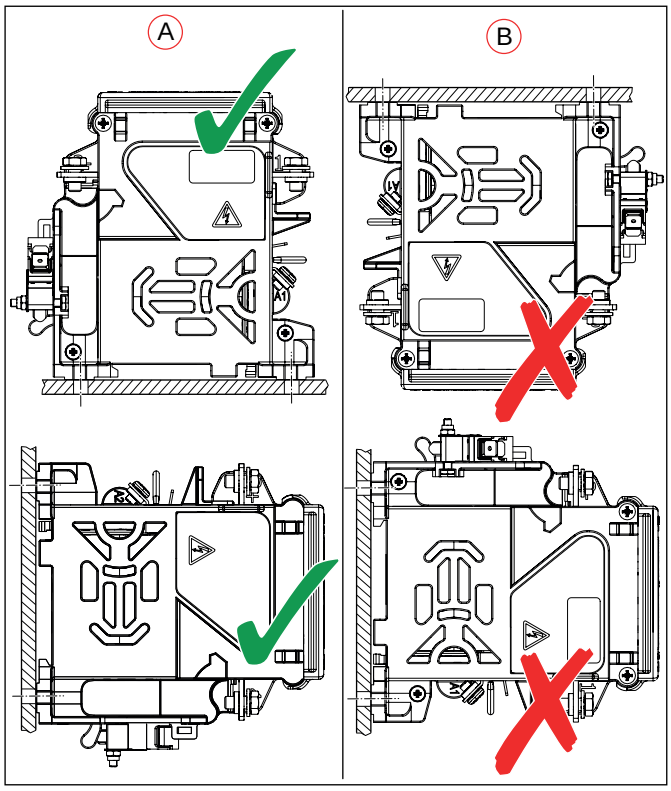

Fig. 5: C294 series - examples for intended mounting positions (A) and non-permissible mounting positions (B)

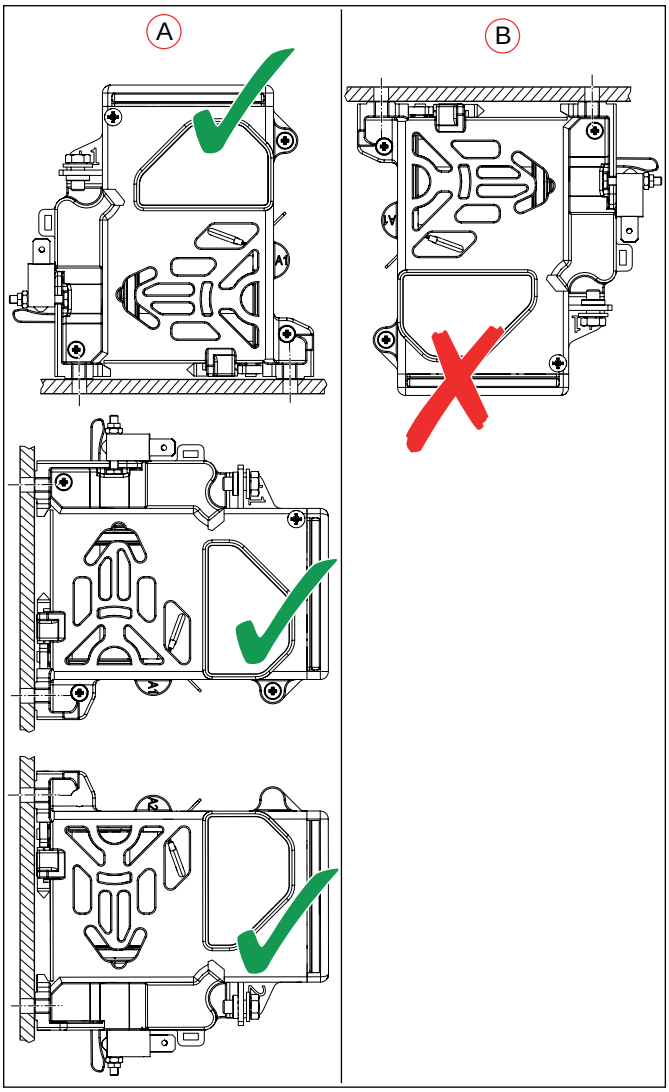

Fig. 6: C193 series - examples for intended mounting positions (A) and non-permissible mounting positions (B)

Required minimum clearance

NOTICE

Switching electrical currents at high voltages will produce arcing and plasma may exit out of the arc chute. It is essential to observe the minimum clear ance towards earthed and live parts to avoid the risk of a ash-over.

- Observe the minimum clearance towards earthed and live parts to plasma exits! Refer to the dimension drawings in our catalogues B193 and B294 minimum clearance upwards and to all sides. The catalogues are available under: https://www.schaltbau.com/en/media-library/

Ventilation requirements

- Ensure su cient ventilation, especially in the case of heavy arc switching. Allow the exchange of sur rounding atmosphere to avoid the risk of ash-overs and excessive corrosion.

Safety

- The installation has to be carried out by quali ed trained personnel.

NOTICE

During installation, ensure that dirt caused by sur rounding construction activities does not get into the contactor.

NOTICE

Detent-edged rings and detent-edged washers have a limited life time. After 3 times opening of screws secured with detent-edged rings or detent-edged washers, the rings or washers must be replaced by new ones.

- Record the frequency of screw opening in the work log.
- After 3 times opening of screws, replace detent-edged rings or detent-edged washers by new ones.

Required tools and auxiliaries

- Socket wrench set, hexagon nuts
- Hexagon socket wrench set
- Torque wrench

Install the contactor

- Make sure, that the mounting surfaces of mount ing plate (5) and contactor (3) are free from dirt and other contamination (e. g. metal cuttings).
- Place the contactor (3) on the mounting plate (5) with the prepared mounting holes.
- Screw the contactor (3) with four screws (4) on the mounting plate (5).
  - When using threaded holes: Screw the screws with appropriate screw locking elements direct ly in the threaded holes.
  - When using through holes: Fasten the screws with appropriate screw locking elements and nuts.
- Then tighten the four screws (4) with the required torque of 2 Nm max.

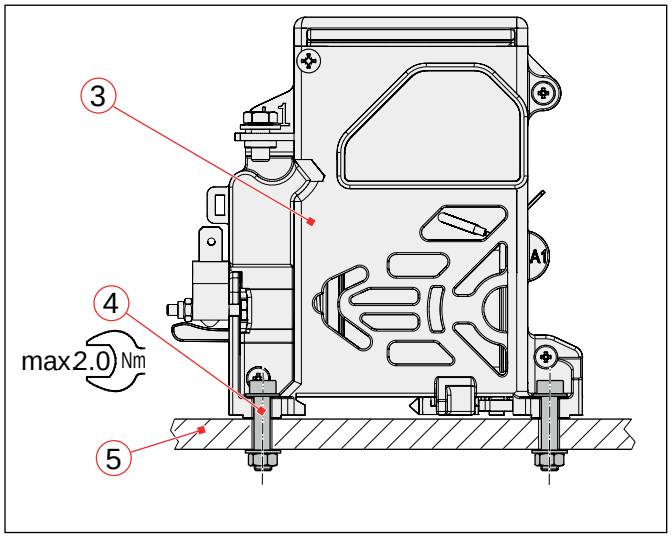

Fig. 7: Install the contactor to the mounting plate (the gure shows the C193 series, the procedure for the C294 series is the same)

DIN rail mounting (only C193 series)

As an alternative, contactors of the C193 series can also be installed by means of DIN rail mounting. The contactors are prepared accordingly and can be attached and removed to 35 mm DIN rails by using the slider at the bottom of the contactor.

- Pull and hold the DIN rail slider (8).
- Attach the contactor with the clamping groove (6) to the DIN rail (7) or slide it laterally to the rail.
- Press on the contactor gently and release the DIN rail slider (8).
- Check if the contactor is rmly locked to the DIN rail (7).

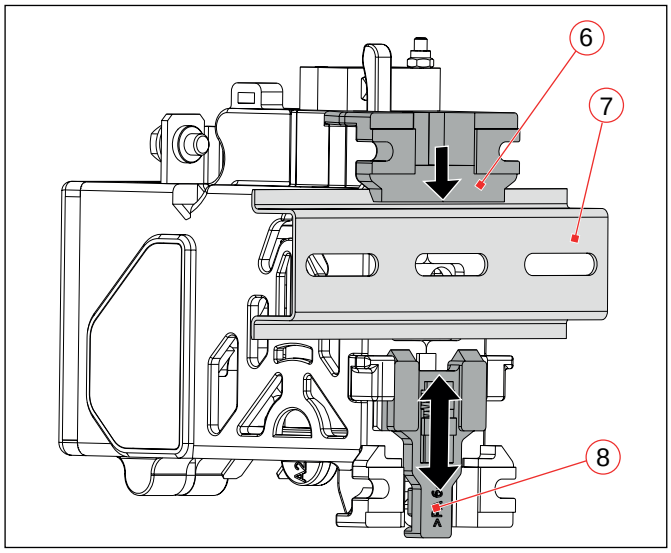

Fig. 8: DIN rail mounting (only C193 series)

7.2 Electrical installation

Electrical data and further technical speci cations

For the power consumption of the magnetic drive system and electrical data of the auxiliary switches refer to the respective data sheets and to our catalogues B193 and B294.
The catalogues are available under:
https://www.schaltbau.com/en/media-library/

Preliminaries

- The connection of the main current circuit can be done with wires or busbars.
- If wires are used, the wire gauges must be selected in coordination with their insulation class and the operating conditions.
- The minimum gauges of the wires/busbars must be observed. For the required cross sections of wires/busbars refer to our catalogues B193 and B294.
  The catalogues are available under:
  https://www.schaltbau.com/en/media-library//
- The wires of the main current circuit must be t-ted with appropriate ring cable lugs (for terminal screws M5).
- The main contact terminals are provided with press nuts M5.
- Schaltbau recommends Schnorr-Washers (or similar) to secure the terminal screws against self-loosening.
  The terminal screws must be tightened with the required torque of max. 3 Nm.
- The terminals of the coil and the auxiliary contact are designed as at tabs. Therefore the control wires must be tted with appropriate at receptacles for tabs. Depending on the series, the table shows the type of at receptacles.

Series	Auxiliary contact terminals: at receptacles for tabs	Coil terminals: at receptacles for tabs
C193	6.3 x 0.8 mm	
C294	6.3 x 0.8 mm	

- The maximum permissible cross section of the auxiliary contact control cables is 1 mm² / AWG 18 stranded wire.

Safety

DANGER

The contactors are used to switch voltage. The touching of electrically conducting parts may result in serious injuries or even death!
Energized parts are all metal parts belonging directly to one of the circuits or wires leading there. All other visible metal parts and wires may also be energized in the case of a failure.
Before beginning any work on the contactors, always observe the following safety regulations:

- Disconnect on all sides
- Ensure that it is not possible to reconnect unintentionally
- Clearly mark your work area
- Make sure that there is no voltage present
- Earth and short circuit the installation; this also includes the discharging of any capacitors in the main circuit
- Besides the main electric circuit, also disconnect additional and auxiliary circuits
- Cover or insulate adjacent energized parts
- Only an electrically skilled person may determine if there is no voltage present
- When the work has been concluded, proceed the other way round.

NOTICE

Detent-edged rings and detent-edged washers have a limited life time. After 3 times opening of screws secured with detent-edged rings or detent-edged washers, the rings or washers must be replaced by new ones.

- Record the frequency of screw opening in the work log.
- After 3 times opening of screws, replace detent-edged rings or detent-edged washers by new ones.

Required tools and auxiliaries

- Socket wrench set, hexagon nuts
- Open-end wrench set
- Torque wrench
- Continuity tester
- Cable ties

Connect the auxiliary contact

The control wires for the auxiliary contact must be- t ted with appropriate at receptacles (6.3 x 0.8 mm).

NOTICE

The maximum permissible cross section of the auxiliary contact control wires is 1 mm² / AWG 18 stranded wire.

- Bending of the auxiliary contact terminals is not permissible!
- Move and lay the control wires and at recep tacles only in plugging direction, see Fig. 9 and Fig. 10.
- Attach the control wires mechanically, in order to minimize retroactivities (e. g. shock, vibra- tions) from the wires to the terminals.

- Plug the prepared control wires with the at re ceptacles (1) to the terminals (2) of the auxiliary contact.
- Bundle the control wires with cable ties and x them to the grommet (3) provided for this pur pose.

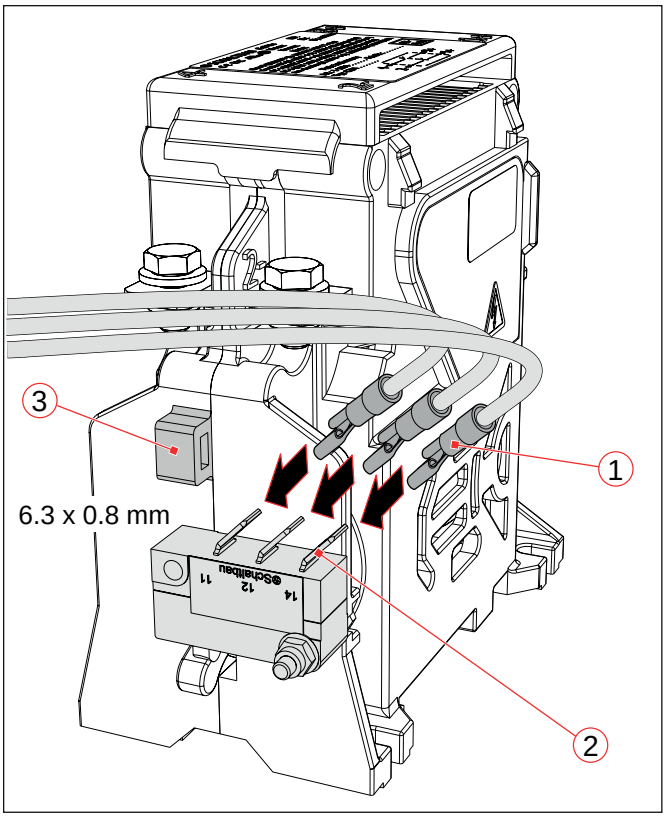

Fig. 10: C294 series: Connect the auxiliary contact (S870)

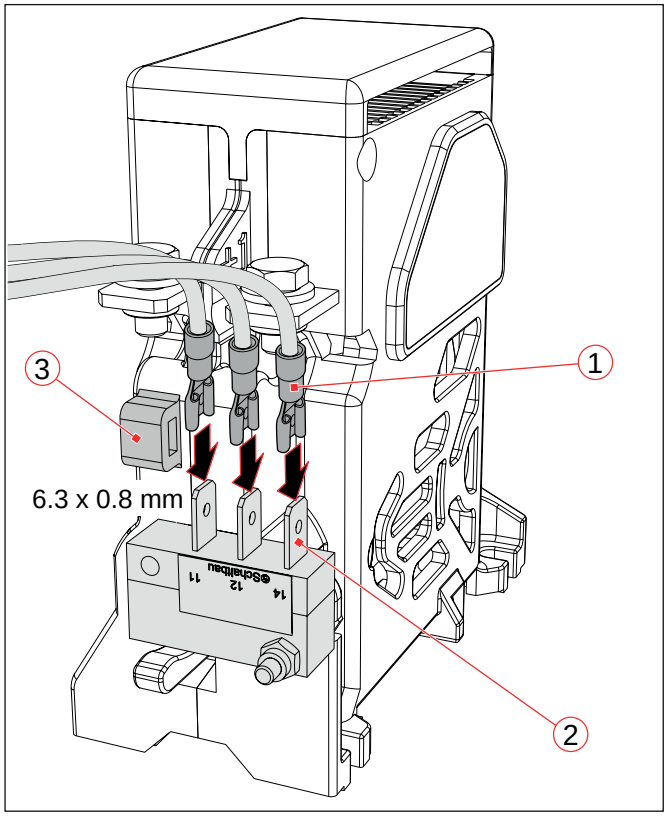

Fig. 9: C193 series: Connect the auxiliary contact (S870)

Connect the coil terminals

The control wires for the coil connection must be tted with appropriate at receptacles (6.3 x 0.8 mm).

NOTICE

Bending of the coil terminals is not permissible!

- Move and lay the control wires and at receptacles only in plugging direction, see Fig. 11 and Fig. 12.
- Attach the control wires mechanically, in order to minimize retroactivities (e. g. shock, vibrations) from the wires to the terminals.

- Plug the prepared control wires with the at receptacles (4) to both coil terminals A1 and A2 (5).

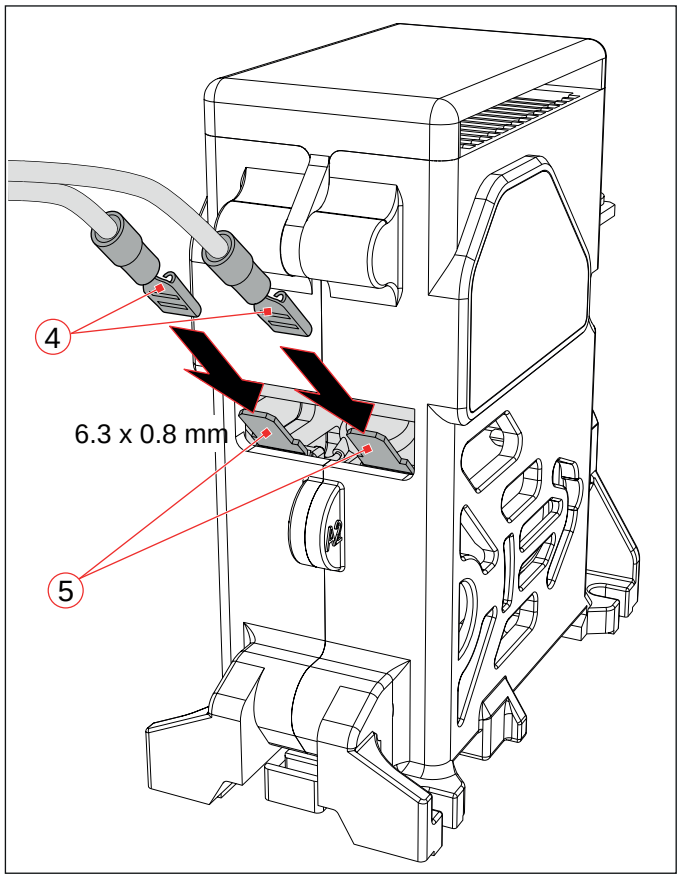
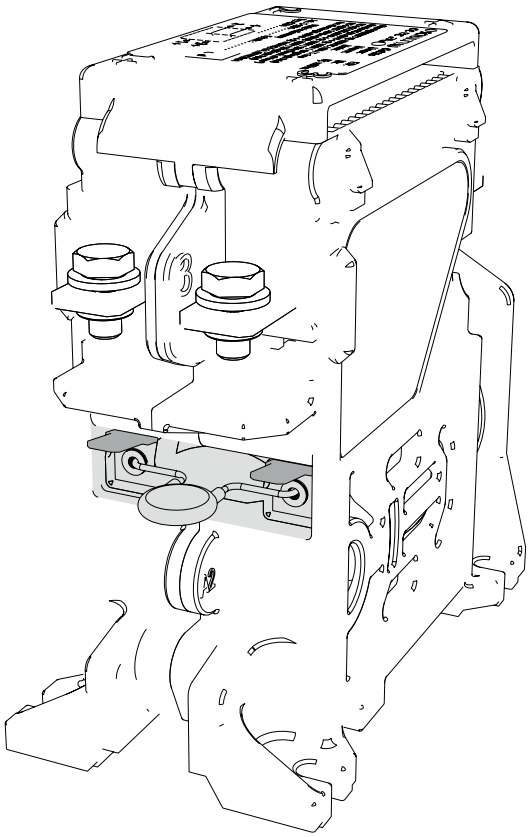
Fig. 11: C193 series: Connect the coil terminals