ABB industrial drives

Hardware manual
ACS880-07XT drives (400 to 1200 kW)



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List of related manuals

Drive hardware manuals and guides	Code (English)
ACS880-04XT (500 to 1200 kW) hardware manual	*3AXD50000025169*
ACS-AP-X assistant control panels user's manual	*3AUA0000085685*
Drive firmware manuals and guides	
ACS880 primary control program firmware manual	*3AUA0000085967*
Quick start-up guide for ACS880 drives with primary control program	*3AUA0000098062*

Hardware manual

ACS880-07XT drives
(400 to 1200 kW)

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1

Safety instructions

Contents of this chapter

This chapter contains the safety instructions which you must obey when you install and operate the drive and do maintenance on the drive. If you ignore the safety instructions, injury, death or damage can occur.

Use of warnings and notes

Warnings tell you about conditions which can cause injury or death, or damage to the equipment. They also tell you how to prevent the danger. Notes draw attention to a particular condition or fact, or give information on a subject.

The manual uses these warning symbols:

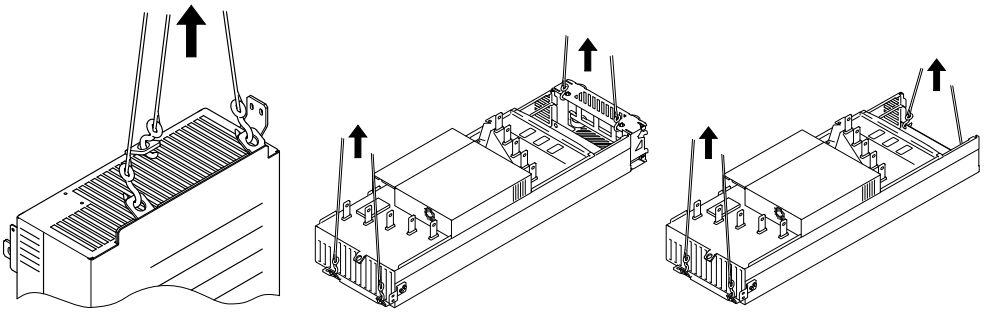
	**Electricity warning** tells about hazards from electricity which can cause injury or death, or damage to the equipment.
	**General warning** tells about conditions, other than those caused by electricity, which can cause injury or death, or damage to the equipment.
	**Electrostatic sensitive devices warning** tells you about the risk of electrostatic discharge which can cause damage to the equipment.

General safety in installation, start-up and maintenance

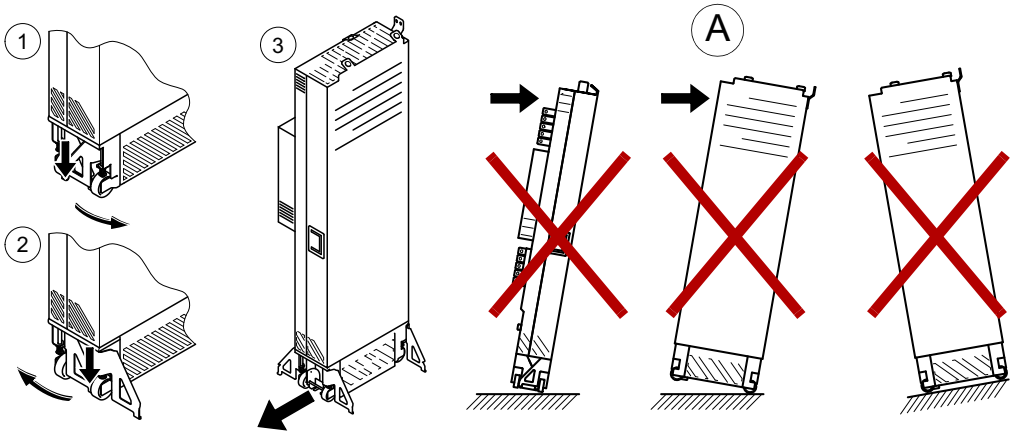
These instructions are for all personnel that install the drive module and do maintenance work on it.

WARNING! Obey these instructions. If you ignore them, injury or death, or damage to the equipment can occur.

- Use protective gloves when working on the drive module.
- Handle the drive module carefully:
  - Use safety shoes with a metal toe cap to prevent foot injury.
  - Lift the drive module only by the lifting lugs.



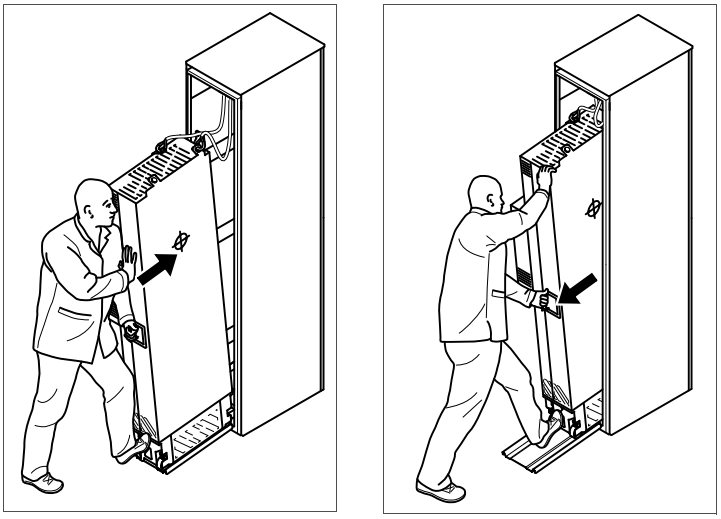
  - Make sure that the module does not topple over when you move it on the floor: Open the support legs by pressing each leg a little down (1, 2) and turning it aside. Whenever possible secure the module also with chains.
  - Do not tilt the drive module (A). It is **heavy** and its **center of gravity is high.** The module overturns from a sideways tilt of 5 degrees. Do not leave the module unattended on a sloping floor.



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  - Do not use the module installation ramp with plinth heights which exceed the maximum height marked on the ramp. (The maximum plinth height is 50 mm [1.97 in] when the telescopic ramp is fully retracted and 150 mm [5.91 in] when the ramp is fully extended.)
  - Attach the module installation ramp carefully.

- To prevent the drive module from falling, attach its top lifting lugs with chains to the cabinet frame before you push the module into the cabinet and pull it from the cabinet. Work carefully preferably with help from another person as shown below. Keep a constant pressure with one foot on the base of the module to prevent the module from falling on its back



3AUA0000088632

- Beware of hot surfaces. Some parts, such as heatsinks of power semiconductors, remain hot for a while after disconnection of the electrical supply.
- Make sure that debris from borings and grindings does not enter the drive during the installation. Electrically conductive debris inside the drive may cause damage or malfunction.
- Make sure that there is sufficient cooling.
- Before you connect voltage to the drive, make sure that the cabinet doors are closed. Keep the doors closed during the operation. Obey the panel builder's instructions.
- Before you adjust the drive operation limits, make sure that the motor and all driven equipment can operate throughout the set operation limits.
- Before you activate the automatic fault reset or automatic restart functions of the drive control program, make sure that no dangerous situations can occur. These functions reset the drive automatically and continue operation after a fault or supply break.
- The maximum number of drive power-ups is five in ten minutes. Too frequent power-ups can damage the charging circuit of the DC capacitors.
- Make sure that any safety circuits (for example, emergency stop and Safe torque off) are validated in start-up. See chapter *Start-up* for reference of the validation instructions.

Note:

- If you select an external source for start command and it is on, the drive will start immediately after fault reset unless you configure the drive for pulse start. See the firmware manual.
- When the control location is not set to Local, the stop key on the control panel will not stop the drive.

Electrical safety in installation, start-up and maintenance

Precautions before electrical work

These warnings are for all personnel that do work on the drive, motor cable or motor.



WARNING! Obey these instructions. If you ignore them, injury or death, or damage to the equipment can occur. If you are not a qualified electrician, do not do installation or maintenance work. Go through these steps before you begin any installation or maintenance work.

1. Clearly identify the work location.
2. Disconnect all possible voltage sources.
   - Open the main disconnector of the drive.
   - Open the disconnector of the supply transformer as the main disconnector of the drive does not remove the voltage from the input busbars of the drive.
   - Make sure that reconnection is not possible. Lock the disconnectors to open position and attach a warning notice to them.
   - Disconnect any external power sources from the control circuits before you do work on the control cables.
   - After you disconnect the drive, always wait for 5 minutes to let the intermediate circuit capacitors discharge before you continue.
3. Protect any other energized parts in the work location against contact.
4. Take special precautions when close to bare conductors.
5. Measure that the installation is de-energized.
   - Use a multimeter with an impedance of at least 1 Mohm.
   - Make sure that the voltage between the drive module input power terminals (L1/U1, L2/V1, L3/W1) and the grounding (PE) busbar is close to 0 V.
   - Make sure that the voltage between the drive module UDC+ and UDC- terminals and the grounding (PE) busbar is close to 0 V.
6. Install temporary grounding as required by the local regulations.
7. Ask for a permit to work from the person in control of the electrical installation work.

Additional instructions and notes



WARNING! Obey these instructions. If you ignore them, injury or death, or damage to the equipment can occur.

- If you are not a qualified electrician, do not do installation or maintenance work.
- Do not install a drive with EMC filter option +E200 or ARFI-10 on an ungrounded power system or a high resistance-grounded (over 30 ohms) power system.
- Do not connect the drive to a voltage higher than what is on the type designation label. If you do, the brake chopper starts to operate which causes the overheating of the brake resistor (if present). Overvoltage can also cause the motor to rush to its maximum speed.
- We do not recommend that you secure the cabinet by arc welding.
- Do not do insulation or voltage withstand tests on the drive or drive modules.

Note:

- The motor cable terminals of the drive are at a dangerous voltage when the input power is on, regardless of whether the motor is running or not.
- The DC bus and brake resistor terminals (UDC+, UDC-, R+ and R-) are at a dangerous voltage.
- External wiring can supply dangerous voltages to the terminals of relay outputs (XRO1, XRO2 and XRO3).
- The Safe torque off function does not remove the voltage from the main and auxiliary circuits. The function is not effective against deliberate sabotage or misuse.



WARNING! Use a grounding wrist band when you handle the printed circuit boards. Do not touch the boards unnecessarily. The boards contain components sensitive to electrostatic discharge.



WARNING! Obey these instructions. If you ignore them, equipment malfunction and damage to the fiber optic cables can occur.

- Handle the fiber optic cables with care.
- When you unplug the cables, always hold the connector, not the cable itself.
- Do not touch the ends of the fibers with bare hands as the ends are extremely sensitive to dirt.
- Do not bend the fiber optic cables too tightly. The minimum allowed bend radius is 35 mm (1.4 in).

Grounding

These instructions are for all personnel who are responsible for the grounding of the drive.



WARNING! Obey these instructions. If you ignore them, injury or death, or equipment malfunction can occur, and electromagnetic interference can increase.

- If you are not a qualified electrician, do not do grounding work.
- Always ground the drive, the motor and adjoining equipment. This is necessary for the personnel safety. Proper grounding also reduces electromagnetic emission and interference.
- Make sure that the conductivity of the grounding conductors is sufficient. See section *Selecting the power cables* on page *71*. Obey the local regulations.
- Connect the power cable shields to protective earth (PE) of the drive to make sure of personnel safety.
- Make a 360° grounding of the power and control cable shields at the cable entries to suppress electromagnetic disturbances.
- In a multiple-drive installation, connect each drive separately to the protective earth (PE) busbar of the switch board or the transformer.



Note:

- You can use power cable shields as grounding conductors only when their conductivity is sufficient.
- As the normal touch current of the drive is higher than 3.5 mA AC or 10 mA DC, you must use a fixed protective earth connection. See standard EN 61800-5-1, 4.3.5.5.2.

Additional instructions for permanent magnet motor drives

Safety in installation, start-up and maintenance

These are additional warnings concerning permanent magnet motor drives. The other safety instructions in this chapter are also valid.



WARNING! Obey these instructions. If you ignore them, injury or death and equipment malfunction can occur.

- Do not do work on the drive when the permanent magnet motor is rotating. A rotating permanent magnet motor energizes the drive including its input power terminals.

Before installation, start-up and maintenance work on the drive:

- Stop the motor.
- Disconnect the motor from the drive with a safety switch or by other means.
- If you cannot disconnect the motor, make sure that the motor cannot rotate during work. Make sure that no other system, like hydraulic crawling drives, can rotate the motor directly or through any mechanical connection like felt, nip, rope, etc.
- Measure that the installation is de-energized.
  - Use a multimeter with an impedance of at least 1 Mohm.
  - Make sure that the voltage between the drive output terminals (T1/U2, T2/V2, T3/W2) and the grounding (PE) busbar is close to 0 V.
  - Make sure that the voltage between the drive input power terminals (L1/U1, L2/V1, L3/W1) and the grounding (PE) busbar is close to 0 V.
  - Make sure that the voltage between the drive module UDC+ and UDC- terminals and the grounding (PE) busbar is close to 0 V.
- Install temporary grounding to the drive output terminals (T1/U2, T2/V2, T3/W2). Connect the output terminals together as well as to the PE.
- Make sure that the operator cannot run the motor over the rated speed. Motor overspeed causes overvoltage can damage or explode the capacitors in the intermediate circuit of the drive.



2

Introduction to the manual

Contents of this chapter

This chapter describes the manual. It contains a flowchart of steps in checking the delivery, installing and starting up the drive. The flowchart refers to chapters/sections in this manual and to other manuals.

Target audience

This manual is intended for people who plan the installation, install, start up, use and service the drive. Read the manual before working on the drive. You are expected to know the fundamentals of electricity, wiring, electrical components and electrical schematic symbols.

The manual is written for readers worldwide. Both SI and imperial units are shown.

Contents of the manual

This manual contains the instructions and information for the basic drive configuration. The chapters of the manual are briefly described below.

Safety instructions gives safety instructions for the installation, start-up, operation and maintenance of the drive.

Introduction to the manual gives an introduction to this manual.

Operation principle and hardware description describes the operation principle and construction of the drive.

Mechanical installation describes how to install the drive mechanically.

Guidelines for planning the electrical installation contains instructions for the motor and cable selection, protections and cable routing.

Electrical installation gives instructions on wiring the drive.

Control units of the drive contains the default I/O connection diagrams, descriptions of the terminals and technical data for the control units of both the supply and inverter units.

Installation checklist contains a list for checking the mechanical and electrical installation of the drive.

Start-up describes the start-up procedure of the drive.

Fault tracing describes the fault tracing possibilities of the drive.

Maintenance contains preventive maintenance instructions.

Technical data contains the technical specifications of the drive, eg. the ratings, sizes and technical requirements, provisions for fulfilling the requirements for CE and other markings.

Dimensions contains example dimension drawings of the drive.

Safe torque off function describes the Safe torque off function of the drive and gives instructions on its implementation.

Resistor braking describes selection, protection and wiring of optional brake choppers and resistors. The chapter also contains technical data.

Related manuals

See *List of related manuals* on the inside of the front cover.

Categorization by frame size and option code

Some instructions, technical data and dimension drawings which concern only certain frame sizes are marked with the symbol of the frame size. The instructions, technical data and dimension drawings which concern only certain drive.

Frame sizes are marked with the symbol of the frame size (R10 or R11). The frame size is marked on the type designation label.

Quick installation, commissioning and operation flowchart

Task	See
Plan the electrical installation and acquire the accessories needed (cables, fuses, etc.). Check the ratings, required cooling air flow, input power connection, compatibility of the motor, motor connection, and other technical data.	*Guidelines for planning the electrical installation* (page *73*) *Technical data* (page *133*)
↓	
Check the installation site.	*Ambient conditions* (page *140*)
↓	
Unpack and check the drive (only intact units may be started up). Make sure that all necessary optional modules and equipment are present and correct. Mount the drive.	*Mechanical installation* (page *43*) If the drive has been non-operational for more than one year, the DC link capacitors need to be reformed (page *129*)
↓	
Route the cables.	*Routing the cables* (page *85*)
↓	
Check the insulation of the supply cable, the motor and the motor cable.	*Checking the insulation of the assembly* (page *75*)
↓	
If the drive is about to be connected to an IT (ungrounded) system, check that the drive is not equipped with EMC filter +E200.	*Checking the compatibility with IT (ungrounded) systems* (page *76*)
↓	
Connect the power cables. Connect the control cables.	*Connecting the input power cables* (page *87*), *Connecting the control cables* (page *77*),
↓	
Check the installation.	*Installation checklist* (page *105*)
↓	
Start the drive up.	*Start-up* (page *107*)
↓	
Operate the drive: start, stop, speed control etc.	ACS880 quick start-up guide, firmware manual

Terms and abbreviations

Term/ Abbreviation	Explanation
BCU	Drive control unit. The drive contains two BCU control units. One controls the supply unit, the other controls the inverter unit. As standard, the external I/O control signals are connected to the control unit, or optional I/O extensions mounted on it.
Drive	Frequency converter for controlling AC motors. In this manual, the term refers to the ACS880-07XT as a whole.
EMC	Electromagnetic compatibility
EMI	Electromagnetic interference
EMT	Electrical metallic tubing
FAIO-01	Optional analog I/O extension module
FCAN-01	Optional FCAN-01 CANopen adapter module
FCNA-01	Optional ControlNet™ adapter module
FDCO-01	Optional DDCS communication module with two pairs of 10 Mbit/s DDCS channels
FDNA-01	Optional DeviceNet™ adapter module
FECA-01	Optional EtherCAT adapter module
FEN-01	Optional TTL incremental encoder interface module
FEN-11	Optional TTL absolute encoder interface module
FEN-21	Optional resolver interface module
FEN-31	Optional HTL incremental encoder interface module
FENA-11	Optional Ethernet adapter module for EtherNet/IP™, Modbus TCP and PROFINET IO protocols
FENA-21	Optional Ethernet adapter module for EtherNet/IP™, Modbus TCP and PROFINET IO protocols, 2-port
FEPL-01	Optional Ethernet POWERLINK adapter module
FIO-01	Optional digital I/O extension module
FIO-11	Optional analog I/O extension module
FLON-01	Optional LonWorks® adapter module
FPBA-01	Optional PROFIBUS DP adapter module
Frame (size)	Relates to the construction type of the component in question. For example, several drive types with different power ratings may have the same basic construction, and a frame size is used in reference to all those drive types. To determine the frame size of a drive type, see the rating tables in chapter *Technical data*.
FSO-12, FSO-21	Optional functional safety modules
IGBT	Insulated gate bipolar transistor; a voltage-controlled semiconductor type widely used in drives due to their easy controllability and high switching frequency.
I/O	Input/Output
Power module	Supply module or inverter module. See also *Frame (size)*.
RFI	Radio-frequency interference
SAR	Safe acceleration range
SBC	Safe brake control
SLS	Safely-limited speed without encoder
SS1	Safe stop 1
SSE	Safe stop emergency
SSM	Safe speed monitor without encoder
STO	Safe torque off

Safety data (SIL, PL)

Abbr.	Reference	Description
Cat.	EN ISO 13849-1	Classification of the safety-related parts of a control system in respect of their resistance to faults and their subsequent behavior in the fault condition, and which is achieved by the structural arrangement of the parts, fault detection and/or by their reliability. The categories are: B, 1, 2, 3 and 4.
CCF	EN ISO 13849-1	Common cause failure (%)
DC	EN ISO 13849-1	Diagnostic coverage
FIT	IEC 61508	Failure in time: 1E-9 hours
HFT	IEC 61508	Hardware fault tolerance
$MTTF_d$	EN ISO 13849-1	Mean time to dangerous failure: (The total number of life units) / (the number of dangerous, undetected failures) during a particular measurement interval under stated conditions
PFD	IEC 61508	Probability of failure on demand
PFH_D	IEC 61508	Probability of dangerous failures per hour
PL	EN ISO 13849-1	Performance level. Levels a…e correspond to SIL
SC	IEC 61508	Systematic capability
SFF	IEC 61508	Safe failure fraction (%)
SIL	IEC 61508	Safety integrity level (1…3)
SILCL	IEC/EN 62061	Maximum SIL (level 1…3) that can be claimed for a safety function or subsystem
SS1	IEC/EN 61800-5-2	Safe stop 1
STO	IEC/EN 61800-5-2	Safe torque off
T1	IEC 61508	Proof test interval. T1 is a parameter used to define the probabilistic failure rate (PFH or PFD) for the safety function or subsystem. Performing a proof test at a maximum interval of T1 is required to keep the SIL capability valid. The same interval must be followed to keep the PL capability (EN ISO 13849) valid. Note that any T1 values given cannot be regarded as a guarantee or warranty. See also section *Maintenance* (page *258*).

3

Operation principle and hardware description

Contents of this chapter

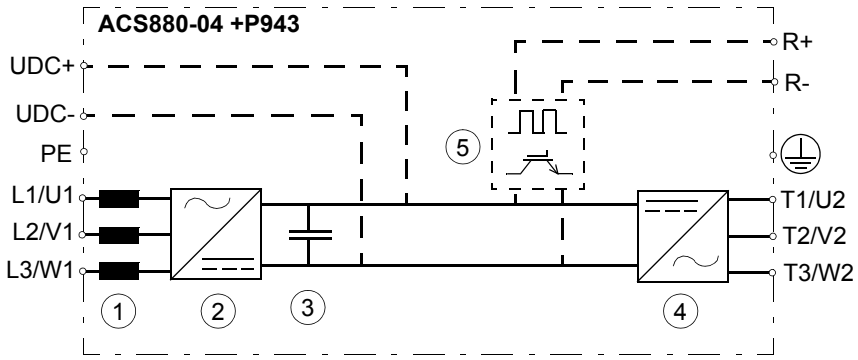
This chapter briefly describes the operation principle and construction of the drive.

Product overview

The ACS880-07XT is an air-cooled cabinet-installed drive for controlling asynchronous AC induction motors, permanent magnet synchronous motors and AC induction servomotors.

The drive consists of two drive modules (ACS880-04 +P943) and a separate control unit.

Overview circuit diagram of the drive



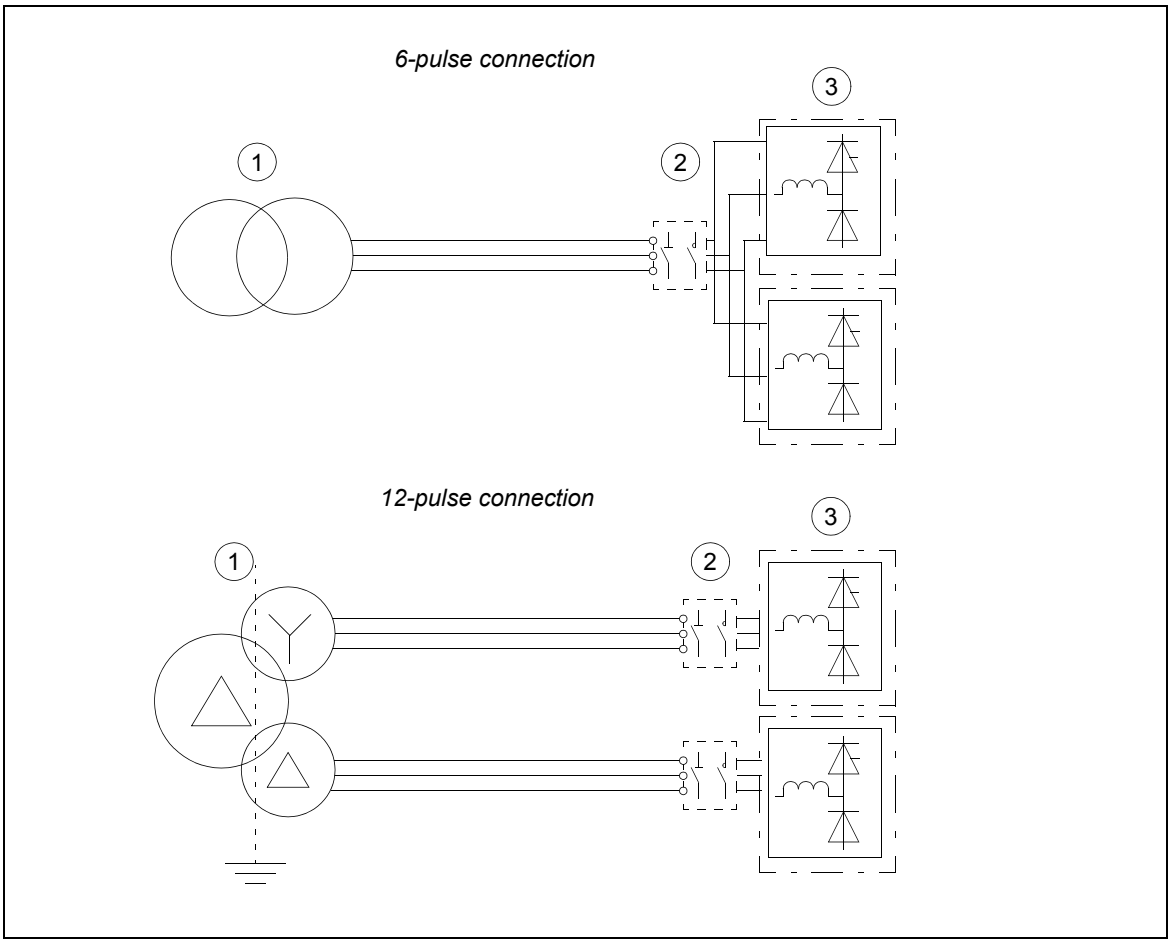
1	AC choke
2	Rectifier. Converts alternating current and voltage to direct current and voltage.
3	DC link. DC circuit between rectifier and inverter
4	Inverter. Converts direct current and voltage to alternating current and voltage.
5	Brake chopper (option +D150). Conducts the surplus energy from the intermediate circuit of the drive to the brake resistor when necessary. The chopper operates when the DC link voltage exceeds a certain maximum limit. The voltage rise is typically caused by deceleration (braking) of a high inertia motor.

12-pulse connection (option +A004)

The figure below illustrates the difference between 6-pulse and 12-pulse AC supply connections. 6-pulse connection is standard. If the drive has an even number of supply modules, you can order it as a 12-pulse version (option +A004).

12-pulse supply connection eliminates the fifth and seventh harmonics, which remarkably reduces the harmonic distortion of the line current and the conducted emissions.

12-pulse connection requires a three-winding transformer, or two separate transformers. There is a 30-degree phase shift between the two 6-pulse supply lines, which are connected to different supply modules through electrically separate switching equipment.



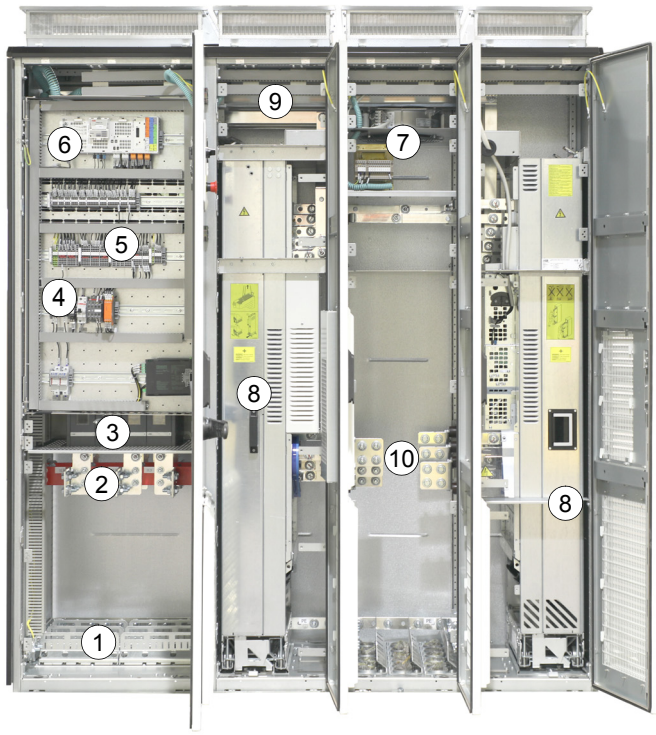
No.	Description
1.	Supply transformer. See section *Electrical power network specification* (page *139*) for transformer requirements.
2.	Switching equipment
3.	Diode supply modules

Cabinet line-up and layout examples

Example(Frame R11)



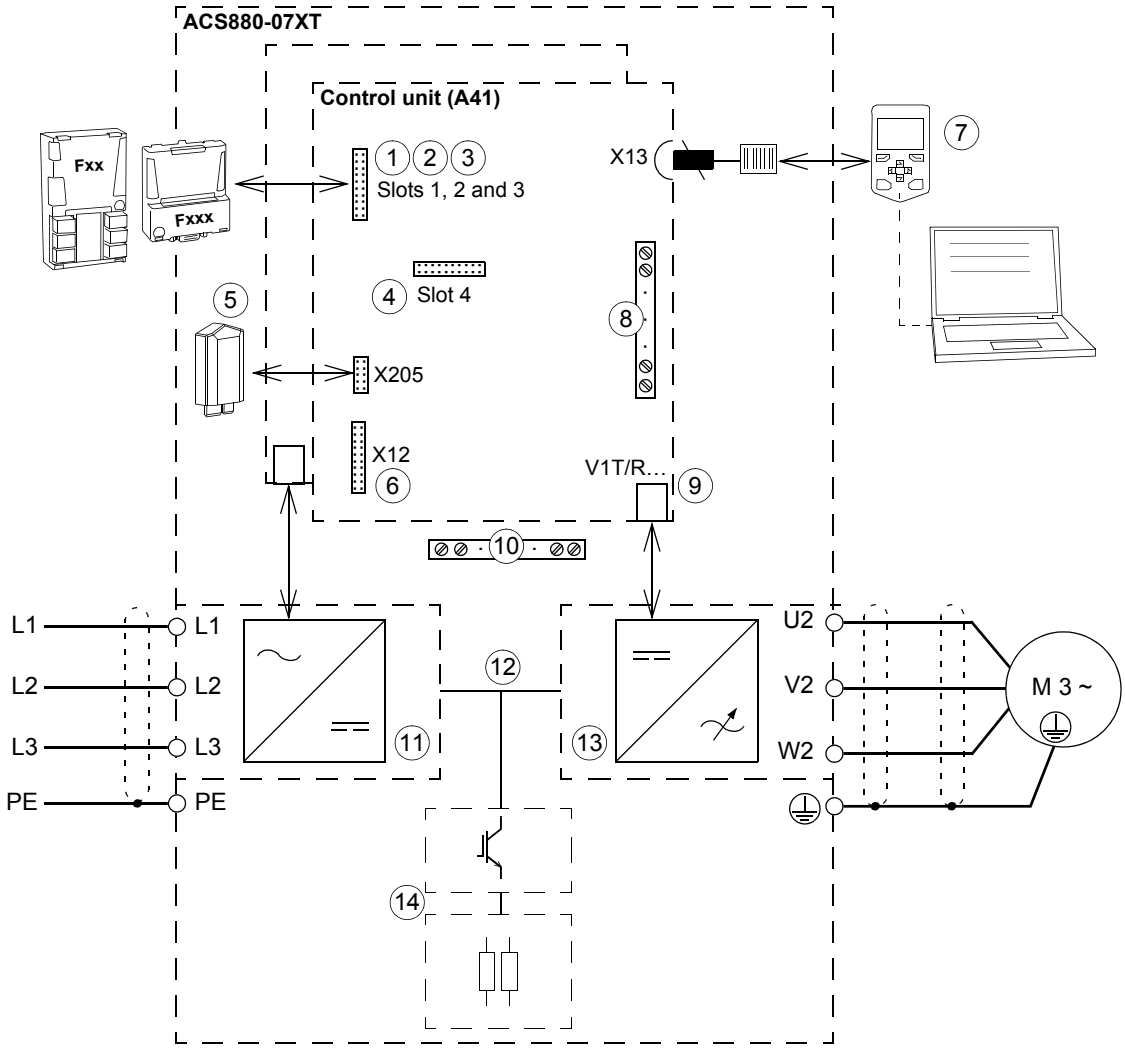
Cabinet line-up example	
A	Incoming and Auxiliary control cubicle (ICU). Contains control electronics, customer I/O connections, the power input cable terminals and switchgear.
B	Module cubicle. Contains the R11 module.
C	Output cubicle. Contains the du/dt (option) and output ternimals for motor.
D	Module cubicle. Contains the R11 module.
1	Main switch-disconnector (Q1.1)
2	Door switches and lights
3	Drive control panel



Cabinet layout example	
1	Input cable lead-throughs, PE busbar (behind grid)
2	Input terminals (behind grid)
3	Main switch-disconnector (Q1.1)
4	AC fuses (behind swing-out door)
5	Main contactor (Q2.1) (optional, behind swing door)
6	Control unit, BCU-02
7	Output cubicle cooling fan
8	Module
9	Bus bar
10	Output terminals

Overview of power and control connections

The diagram shows the power connections and control interfaces of the drive.



1 2 3 4	Option modules can be inserted into slots 1, 2, 3 and 4 as follows: **Module type** — **Slots** Analog and digital I/O extension modules — 1, 2, 3 Feedback interface modules — 1, 2, 3 Fieldbus communication modules — 1, 2, 3 RDCO-xx DDCS communication option module (standard equipment). As standard, a fiber optic link connects the supply and inverter control units. — 4
5	Memory unit (see page *130*)
6	Connection for FSO-xx safety functions module
7	See section *Control panel* (page *36*)
8	Terminal blocks on the inverter control unit. See page *79*, and *Control units of the drive* (page *95*). These terminals are optionally wired to terminal block X504 in the auxiliary control cabinet of the drive.
9	Fiber optic link to each inverter module. Similarly, each supply module is connected to the supply control unit by fiber optic cables.
10	Terminal blocks for customer connections installed in the drive cabinet. For the locations,
11	Rectifier

12	Bus bar link
13	Inverter
14	Optional brake chopper (+D150) and resistors (+D151)

Door switches and lights



	Label in English	Label in local language	Description
1	READY	-	Ready light (option +G327)
2	RUN	-	Run light (option+G328)
3	FAULT	-	Fault light (option +G329)
4	RUN/ENBL OFF 	-	Run enable signal switch for the supply unit OFF: Run enable signal off (starting the supply unit not allowed) ON: Run enable signal on (starting the supply unit allowed). Close the main contactor if present.
5	E-STOP RESET	-	Emergency stop reset push button with options +Q951,+Q952, +Q963 and +Q964
6	EARTH FAULT	-	Ground (earth) fault light with option +Q954
7	-	-	Reserved for application-engineered equipment
8	EMERGENCY STOP	-	Emergency stop push button with options +Q951,+Q952, +Q963 and +Q964

The layout depends on the options selected.

Main disconnecting device (Q1.1)

Depending on the configuration of the drive, the main disconnecting device of the drive is either a switch-disconnector or a main circuit breaker.

The main disconnecting device switches the main supply to the drive on and off. To disconnect the main supply, turn the switch-disconnector to the 0 (OFF) position, or rack out the main breaker (whichever device is installed).



WARNING! The main disconnecting device does not isolate the input power terminals, AC voltage meters, or the auxiliary voltage circuit from the power line. To isolate the auxiliary voltage circuit, open the auxiliary voltage switch (Q21). To isolate the input power terminals and AC voltage meters, open the main breaker of the supply transformer.

To close the main disconnecting device, auxiliary voltage must be switched on, and the grounding switch (if present) must be open.

Control panel

The ACS-AP-I is the user interface of the drive. It provides the essential controls such as Start/Stop/Direction/Reset/Reference, and the parameter settings for the inverter control program.

The control panel can be removed by pulling it forward from the top edge and reinstalled in reverse order. For the use of the control panel, see *ACS-AP assistant control panel user's manual* (3AUA0000085685 [English]) and the firmware manual.







Control by PC tools

There is a USB connector on the front of the panel that can be used to connect a PC to the drive. When a PC is connected to the control panel, the control panel keypad is disabled.

Descriptions of cabinet options

Note: All options are not available for all drive types, do not coexist with certain other options, or may require additional engineering. Check actual availability with ABB.

Degree of protection

Definitions

According to IEC/EN 60529, the degree of protection is indicated by an IP code where the first numeral means protection against ingress of solid foreign objects, and the second numeral protection against ingress of water. The IP codes of the standard cabinet and options covered in this manual are defined below.

IP code	The equipment is protected …	
	First numeral	Second numeral
IP22	against ingress of solid foreign objects ≥ 12.5 mm diameter *	against dripping (15° tilting) water
IP42	against ingress of solid foreign objects ≥ 1 mm	against dripping (15° tilting) water
IP54	dust-protected	against splashing water

* meaning for protection of persons: against access to hazardous parts with finger

IP22 (standard)

The degree of protection of the standard drive cabinet is IP22. The air outlets at the top of the cabinet are covered with a brass grating. The air inlet gratings are covered with plastic gratings. With doors open, the degree of protection of the standard cabinet and all cabinet options is IP20. The live parts inside the cabinet are protected against contact with clear plastic shrouds or metallic gratings.

IP42 (option +B054)

This option provides the degree of protection of IP42. The air inlet gratings are covered with a metallic mesh between the inner metallic grating and the outer plastic grating.

IP54 (pending)

This option provides the degree of protection of IP54. It provides the cabinet air inlets with filter housings containing folded board air filter mats between the inner metallic grating and the outer plastic grating. An additional fan on the cabinet roof is included.

Cabinet heater with external supply (option +G300)

The option contains:

- heating elements in the cubicles
- load switch for providing electrical isolation during service
- miniature circuit breaker for overcurrent protection
- terminal block for external power supply.

The heater prevents humidity condensation inside the cabinet when the drive is not running. The power output of the semiconductor-type heating elements depends on the environmental temperature. The customer must switch the heating off when it is not needed by cutting the supply voltage off.

The customer must supply the heater from an external 110…240 V AC power source.

See also
- *Powering the heating(options +G300)*
- circuit diagrams delivered with drive for the actual wiring.

Terminals for external control voltage (option +G307)

The option provides terminals for connecting external uninterruptible control voltage to the control unit and control devices when the drive is not powered.

See also
- *Supplying power for the auxiliary circuits* on page *90*
- *Connecting a 230/115 V AC auxiliary voltage supply (UPS, option +G307)* on page *80*
- circuit diagrams delivered with drive for the actual wiring.

Additional terminal block X504 (option +L504)

The standard terminal blocks of the drive control unit are wired to the additional terminal block at the factory for customer control wiring. The terminals are spring loaded.

Cables accepted by the terminals:
- solid wire 0.08 to 4 mm^2
- stranded wire with ferrule 0.14 to 2.5 mm^2
- stranded wire without ferrule 0.08 to 2.5 mm^2 (28 to 12 AWG).

Stripping length: 10 mm.

Note: The optional modules inserted in the slots of the control unit are not wired to the additional terminal block. The customer must connect the optional module control wires directly to the modules.

Thermistor relays (options +L505, +2L505)

The thermistor relay is used for the overtemperature supervision of motors equipped with PTC thermistors. When the motor temperature rises to the thermistor wake-up level, the thermistor resistance increases sharply. The relay detects the change and indicates motor overtemperature through its auxiliary contacts.

Option +L505 provides a thermistor relay and an auxiliary relay and connection terminals for one measuring circuit (one PTC thermistor) and for one normally open contact. The relay can be reset locally or from a remote reset switch wired to the relay.

Option +2L505 provides two thermistor relays and auxiliary relays and connection terminals for two measuring circuit (one PTC thermistor in each) and for two normally open contacts. The relays can be reset locally or from a remote reset switch wired to the relay.

The customer connects PTC sensors to the thermistor relay, and the terminals of the auxiliary relay of the normally open contact, for example, to
- main breaker control circuit of the drive for opening the breaker in case of motor overtemperature or
- appropriate digital input of the drive for tripping the drive and generating a fault message in case of motor overtemperature or
- customer control circuit.

See also

- firmware manual for parameter settings
- *Wiring the thermistor relay(s) (options +L505 and +2L505)* on page *81*
- circuit diagrams delivered with the drive for the actual wiring.

Pt100 relays (options +2L506, +3L506, +5L506, +8L506)

What the option contains

The standard Pt100 relay option includes two (+2L506), three (+3L506), five (+5L506) or eight (+8L506) Pt100 temperature monitoring relays and an auxiliary relay wired to a terminal block. Other numbers of Pt100 relays must be ordered as application engineered.

Description

A Pt100 relay is used for overtemperature supervision of motors equipped with Pt100 sensors. For example, three sensors measure the temperature of the motor windings and two sensors the temperature of the bearings. The sensor resistance increases linearly as the temperature rises. The relay releases at an adjustable wake-up level and indicates motor overtemperature through its change-over contact.

The relay provides connection terminals for one Pt100 temperature sensor and terminals of one normally open and one normally closed contact.

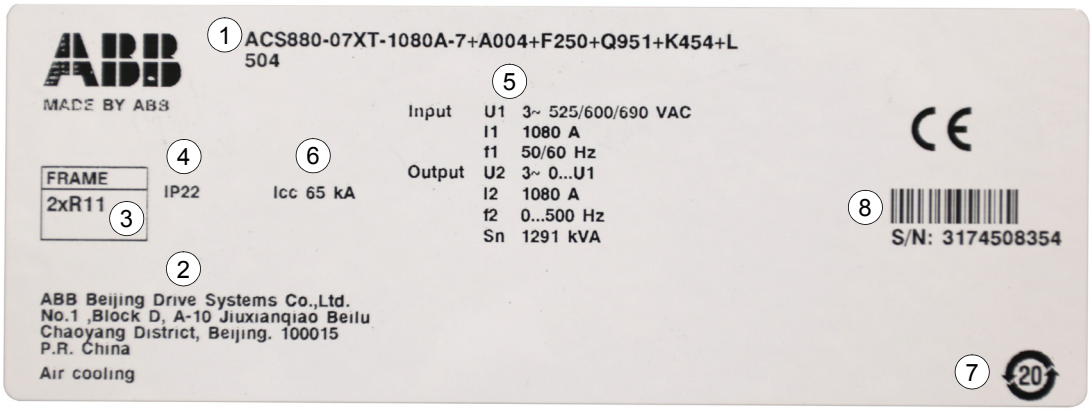
The customer connects Pt100 sensors to the Pt100 relays (one sensor per relay) and the auxiliary relays of the normally open contacts of the Pt100 relays, for example, to

- main breaker control circuit of the drive for opening the breaker in case of motor overtemperature or
- appropriate digital input of the drive for tripping the drive and generating a fault message in case of motor overtemperature or
- customer control circuit.

Type designation label

The type designation label includes ratings, appropriate markings, a type designation and a serial number, which allow identification of each unit. A sample label is shown below.

Quote the complete type designation and serial number when contacting technical support.



No.	Description
1	Type designation, see section *Type designation key* on page *40*.
2	Manufacturing address
3	Frame size
4	Degree of protection
5	Ratings. See section *Ratings* on page *133*, section *Electrical power network specification* on page *139* and section *Motor connection data* on page *139*.
6	Short-circuit withstand strength, section *Electrical power network specification* on page *139*.
7	Valid markings
8	Serial number. The first digit of the serial number refers to the manufacturing plant. The next four digits refer to the unit's manufacturing year and week, respectively. The remaining digits complete the serial number so that there are no two units with the same number.

Type designation key

The type designation contains information on the specifications and configuration of the drive. The first digits from left express the basic configuration (eg, ACS880-07-1580A-5). The optional selections are given thereafter, separated by plus signs, eg, +E202. The main selections are described below. Not all selections are available for all types. For more information, refer to *ACS880 07XT Ordering Information*.

CODE	DESCRIPTION
Basic codes	
ACS880	Product series
07XT	When no options are selected: cabinet-installed drive, IP22 (UL Type 1), main switch-disconnector, aR fuses, ACS-AP-I assistant control panel, build-in input choke, no EMC filter, common mode filter, ACS880 primary control program, Safe torque off function, coated circuit boards, bottom entry and exit of cables with lead-through-type entries, USB memory stick containing circuit diagrams, dimension drawings and manuals.
Size	
xxxxx	Refer to the rating tables (*see technical data)*
Voltage range	

CODE	DESCRIPTION
3	380…415 V AC. This is indicated in the type designation label as typical input voltage level (3~ 400 V AC)
5	380…500 V AC. This is indicated in the type designation label as typical input voltage levels (3~ 400/480/500 V AC)
7	525…690 V AC. This is indicated in the type designation label as typical input voltage levels (3~ 525/600/690 V AC)
Option codes (plus codes)	
Supply connection	
A004	12-pulse supply connection
Degree of protection	
B054	IP42 (UL Type 1)
B055	IP54 (UL Type 12), pending
Resistor braking	
D150	Brake choppers
Filters	
E200	EMC filter for second environment TN (grounded) system, category C3. Available for ACS880-04XT-xxxx-7 types only
E201	EMC filter for second environment IT (ungrounded)) system, category C3. Available for ACS880-04XT-xxxx-7 types only
E210	EMC filter for second environment TN (grounded) and IT (ungrounded)) systems, category C3. Available for ACS880-04XT-xxxx-3 and -5 types only
E205	du/dt output filter
Line options	
F250	Line contactor
Cabinet equipment	
G300	Cabinet and module heating elements (external supply)
G307	Terminals for connecting external control voltage (230 V AC or 115 V AC, eg. UPS)
Motor cable options	
H366	Common output for motor (need selecting +E205)
Fieldbus adapters	
K451	FDNA-01 DeviceNet™ adapter module
K454	FPBA-01 PROFIBUS DP adapter module
K457	FCAN-01 CANopen adapter module
K458	FSCA-01 RS-485 adapter module
K462	FCNA-01 ControlNet™ adapter module
K469	FECA-01 EtherCat adapter module
K470	FEPL-02 EtherPOWERLINK adapter module
K473	FENA-11 Ethernet adapter module for EtherNet/IP™, Modbus TCP and PROFINET IO protocols
K475	FENA-21 Ethernet adapter module for EtherNet/IP™, Modbus TCP and PROFINET IO protocols, 2-port
I/O extensions and feedback interfaces	
L500	FIO-11 analog I/O extension module
L501	FIO-01 digital I/O extension module
L502	FEN-31 HTL incremental encoder interface module
L504	Additional I/O terminal block
L505	Thermistor relay (1 or 2 pcs)
L506	Pt100 relay (2, 3, 5 or 8 pcs)

CODE	DESCRIPTION
L509	RDCO-04 optical fiber communication interface module
L516	FEN-21 resolver interface module
L517	FEN-01 TTL pulse encoder interface module
L518	FEN-11 absolute pulse encoder interface module
Starter for auxiliary motor fan	
M602	Trip limit setting range: 2.5 … 4 A
M603	Trip limit setting range: 4 … 6.3 A
M604	Trip limit setting range: 6.3 … 10 A
M605	Trip limit setting range: 10…16 A
M606	Trip limit setting range: 16…20 A
M610	Trip limit setting range: 20…25 A
Control program	
N5050	Crane control firmmare
N8010	IEC 61131-3 application programmability
Specialties	
P902	Customized
P904	Extended warranty
P912	Seaworthy packaging
P913	Special color
P929	Container packaging
Safety functions	
Q954	Earth fault monitoring, unearthed mains
Q951	Emergency stop (category 0) with safety relays, by opening the main breaker/contactor
Q952	Emergency stop (category 1) with safety relays, by opening the main breaker/contactor
Q963	Emergency stop (category 0) with safety relays, by activating the Safe torque off function
Q964	Emergency stop (category 1) with safety relays, by activating the Safe torque off function
Full set of printed manuals in the selected language **Note:** The delivery may include manuals in English if the requested language is not available.	
R700	English
R712	Chinese

4

Mechanical installation

Contents of this chapter

This chapter describes the mechanical installation procedure of the drive.

Examining the installation site

Examine the installation site:

- The installation site is sufficiently ventilated or cooled to transfer away the drive losses. [1)]
- The ambient conditions of the drive meet the specifications. [1)]
- The wall behind the unit is of non-flammable material.
- There is enough free space above the drive to enable cooling air flow, service and maintenance.
- The floor that the unit is installed on is of non-flammable material, as smooth as possible, and strong enough to support the weight of the unit. Check the floor flatness with a spirit level. The maximum allowed deviation from the surface level is 5 mm in every 3 meters. Level the installation site, if necessary, as the cabinet is not equipped with adjustable feet.

[1)] The heat losses and ambient conditions are specified in chapter *Technical data*.

Note: The module extraction/installation ramp included with the drive is only suitable for a height difference of 50 mm maximum (ie. the standard plinth height of the drive).

Necessary tools

The tools required for moving the unit to its final position, fastening it to the floor and wall and tightening the connections are listed below:

- crane, fork-lift or pallet truck (check load capacity!), slate/spud bar, jack and rollers
- Pozidriv and Torx screwdrivers
- torque wrench
- set of wrenches or sockets.

Checking the delivery

The drive delivery contains:

- drive cabinet line-up
- optional modules (if ordered) installed onto the control unit at the factory
- appropriate drive and optional module manuals
- delivery documents.

Check that there are no signs of damage. Before attempting installation and operation, check the information on the type designation labels of the drive to verify that the delivery is of the correct type. See section *Type designation key* on page *40*.

Moving and unpacking the drive

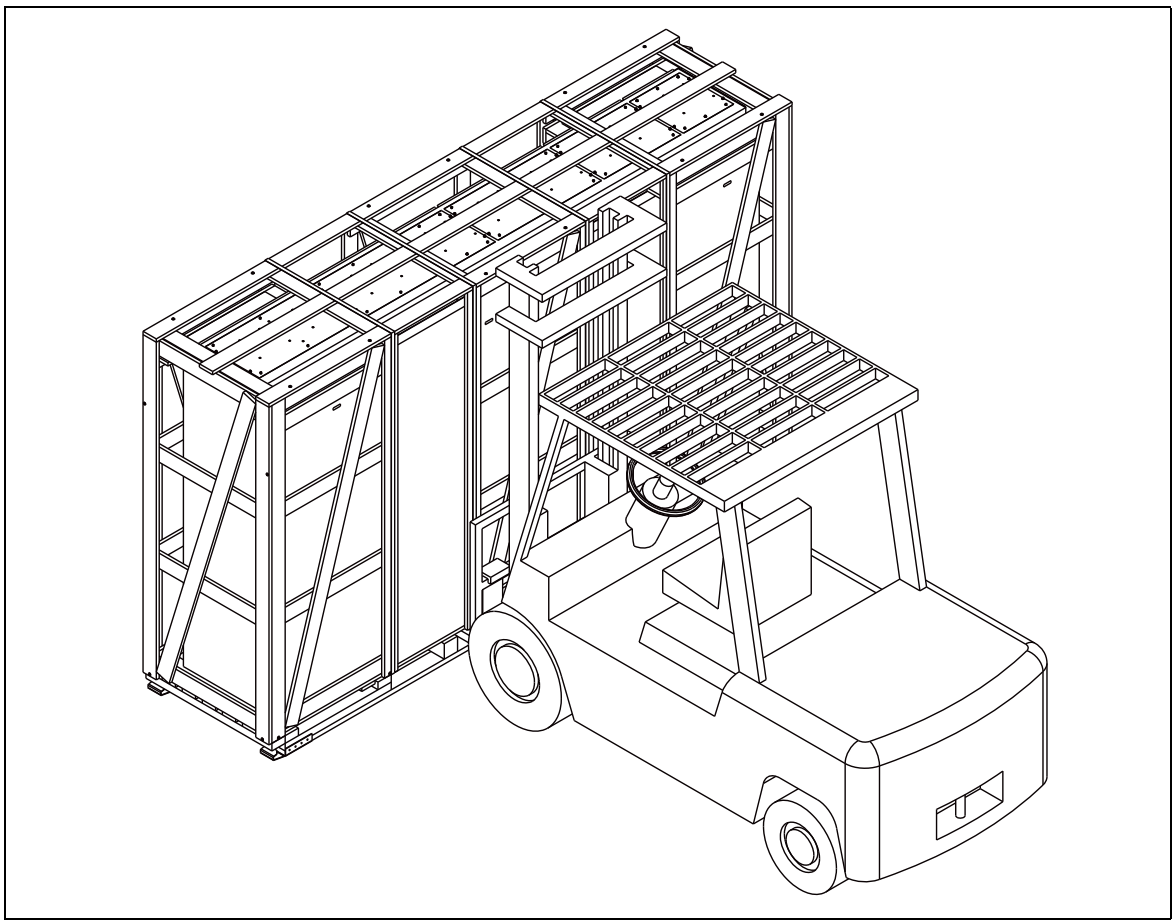
Move the drive in its original packaging to the installation site as shown below to avoid damaging the cabinet surfaces and door devices. When you are using a pallet truck, check its load capacity before you move the drive.

The drive cabinet is to be moved in the upright position.

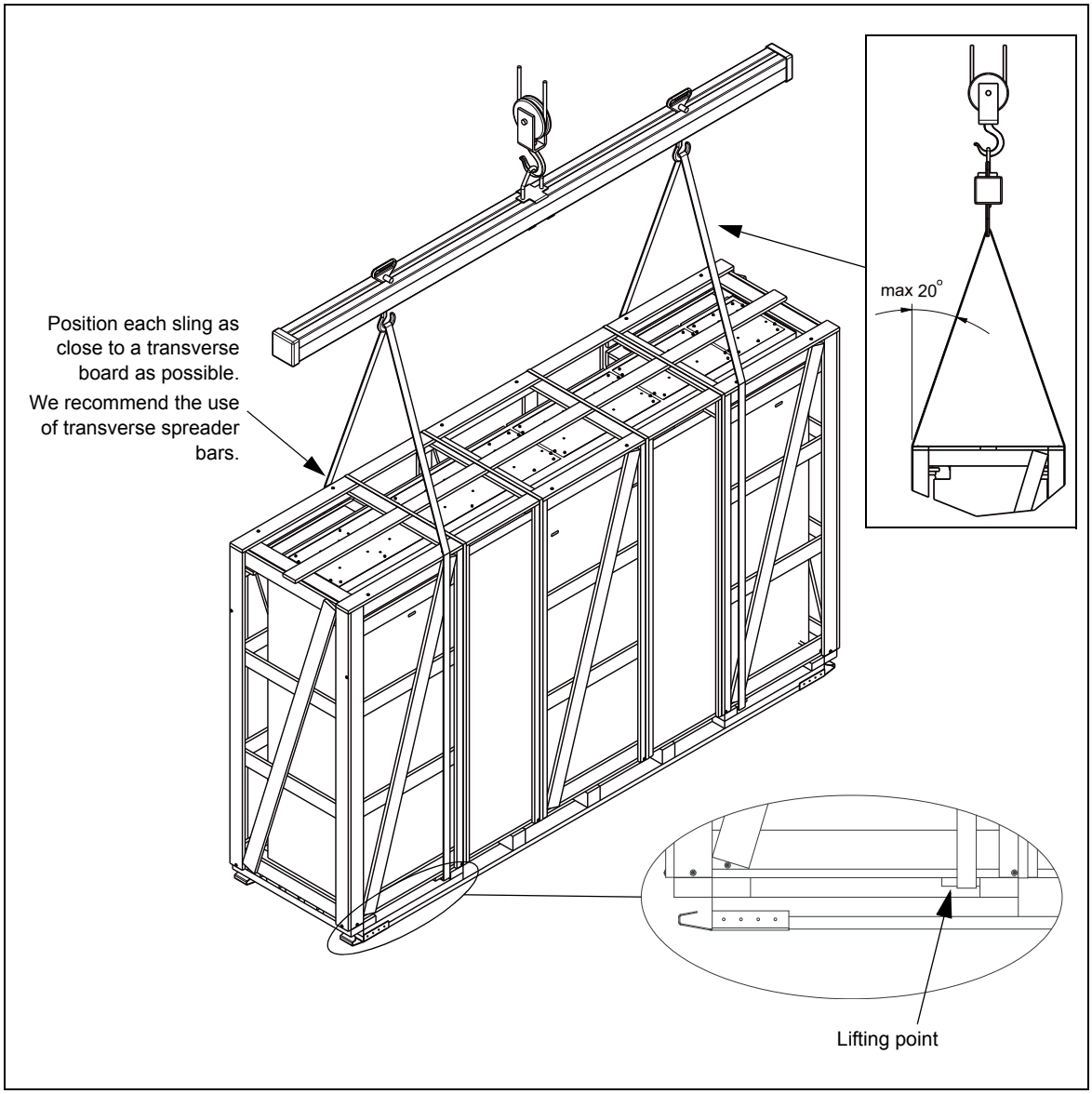
The center of gravity of the cabinet is high. Be therefore careful when moving the unit. Avoid tilting.

Moving the drive in its packaging

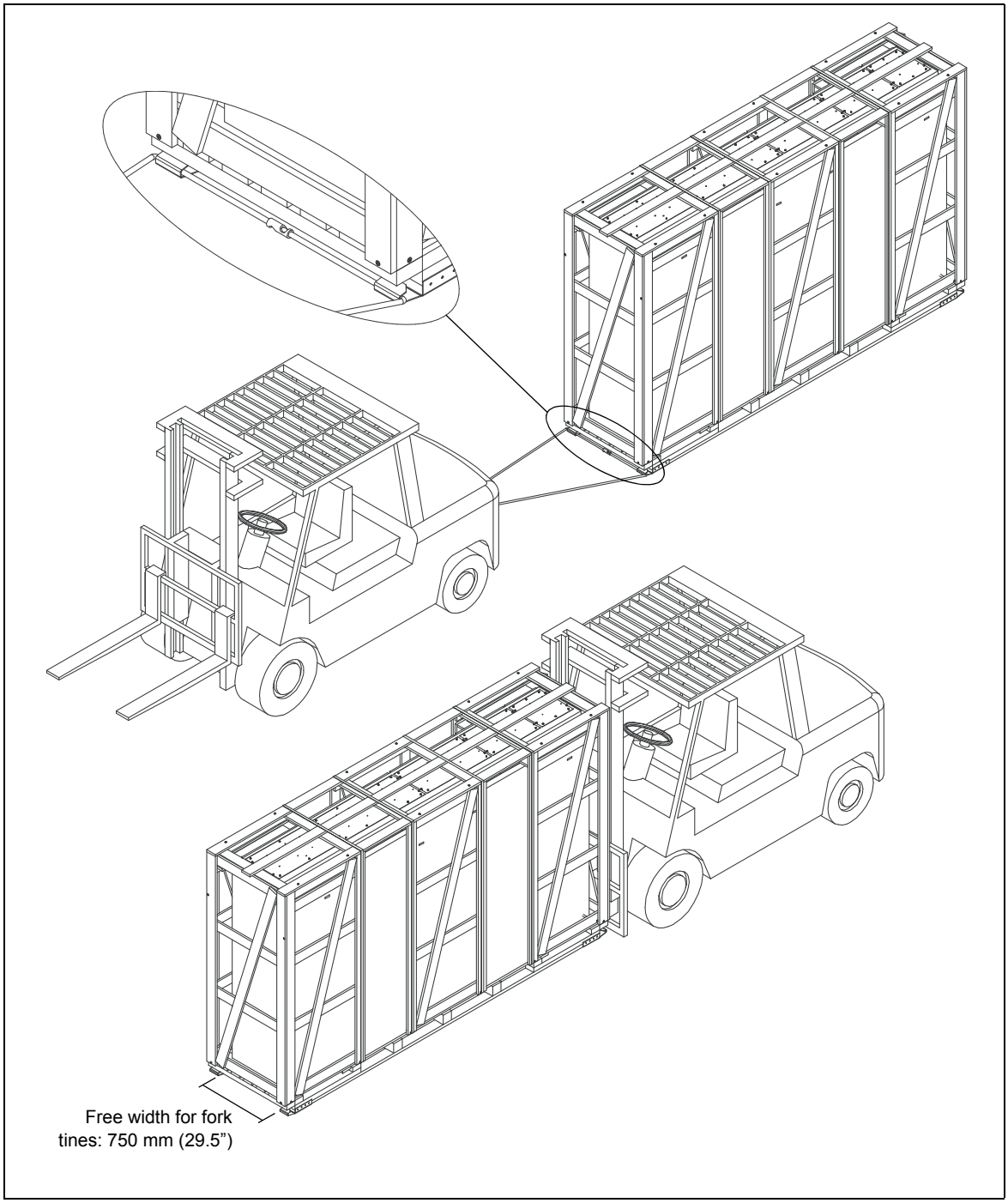
Lifting the crate with a forklift



Lifting the crate with a crane



Moving the crate with a forklift



Removing the transport package

Remove the transport package as follows:

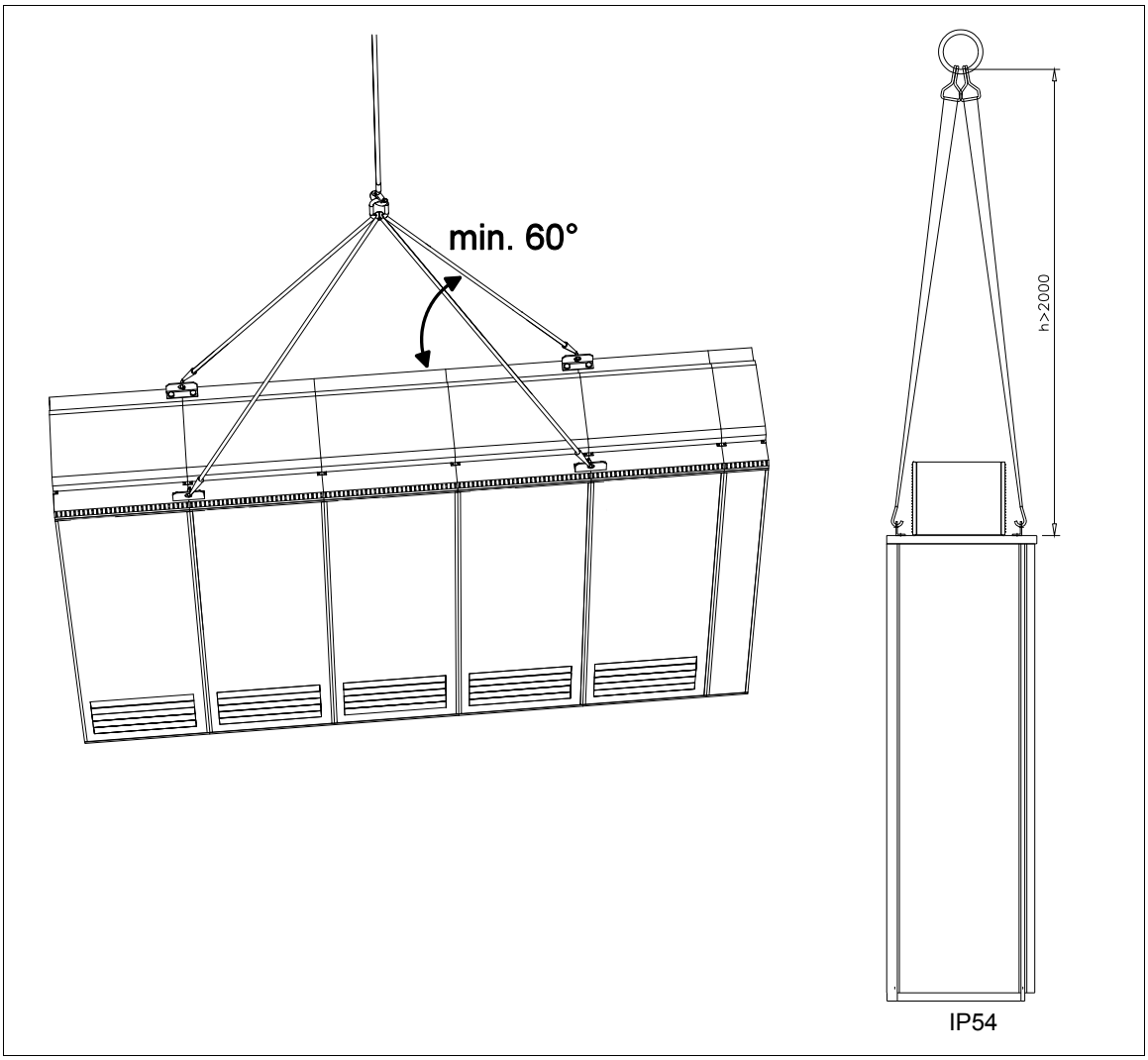
1. Undo the screws that attach the wooden parts of the transport crate together.
2. Remove the wooden parts.
3. Remove the clamps with which the drive cabinet is mounted onto the transport pallet by undoing the fastening screws.
4. Remove the plastic wrapping.

Moving the unpacked drive cabinet

Lifting the cabinet with a crane

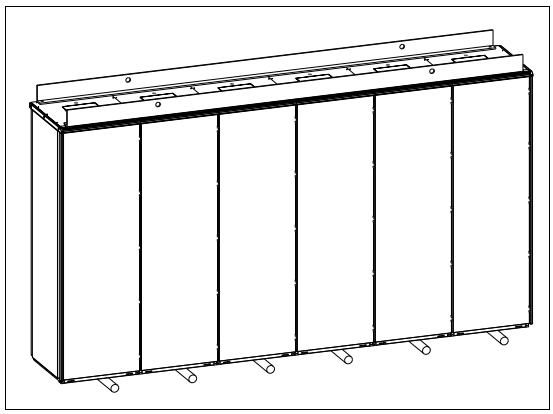
Lift the drive cabinet using its lifting eyes. The lifting eyes can be removed after the cabinet is in its final position, but their mounting holes must be blocked to retain the degree of protection.

Note: The minimum allowed height of the lifting slings with IP54 units is 2 meters (6’7”).



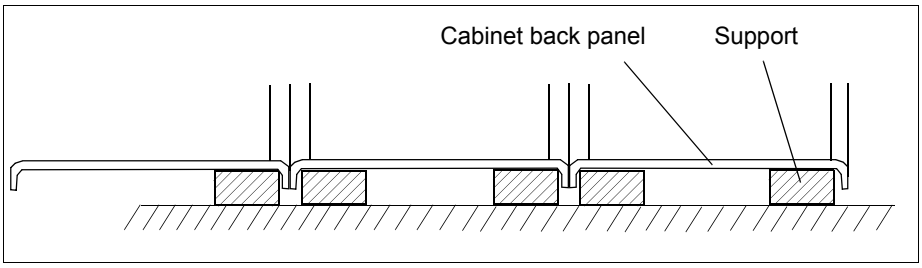
Moving the cabinet on rollers

Lay the cabinet on the rollers and move it carefully until close to its final location. Remove the rollers by lifting the unit with a crane, forklift, pallet truck or jack.



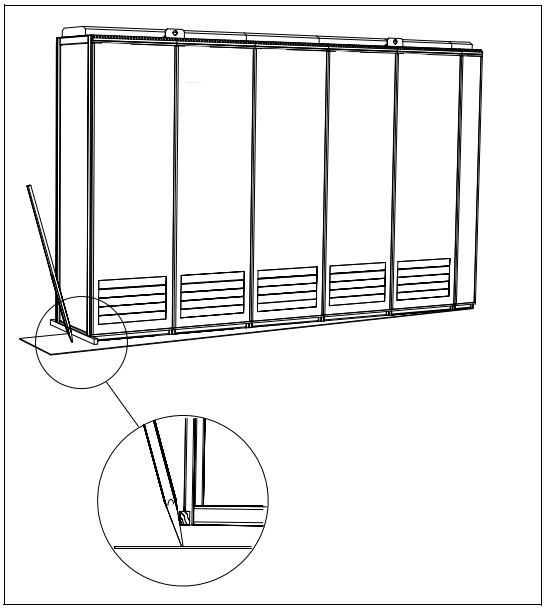
Moving the cabinet on its back

Support the cabinet from below alongside the cubicle seams.



Final placement of the cabinet

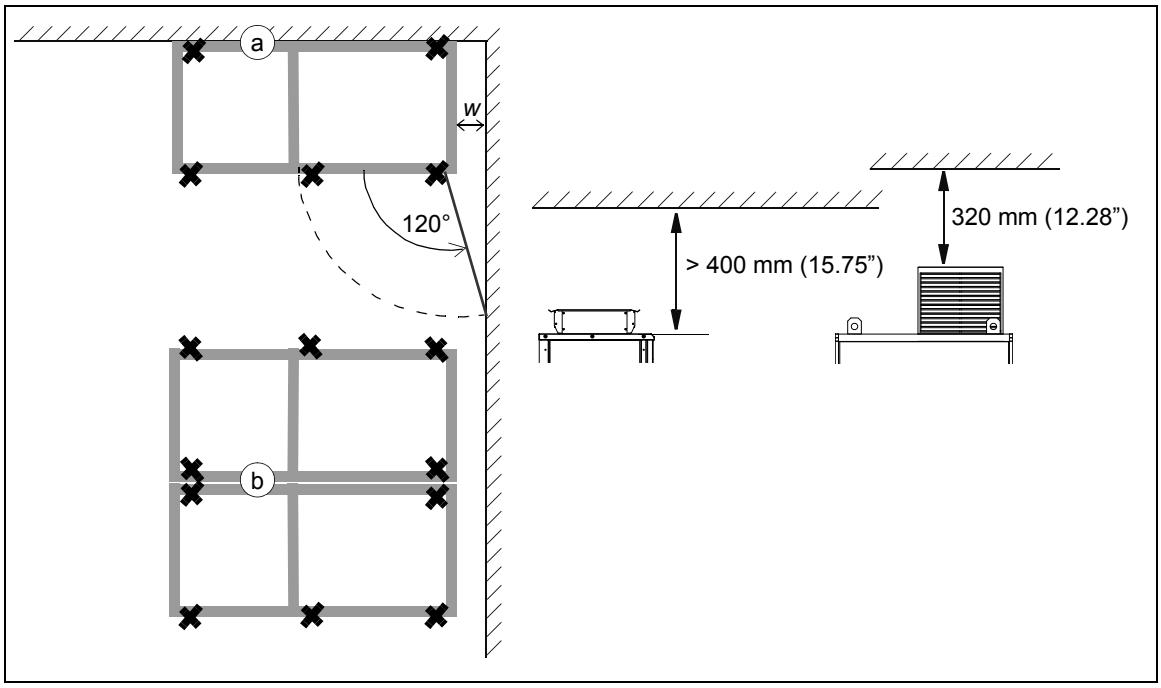
Move the cabinet into its final position with a slate bar (spud bar). Place a piece of wood between the edge of the cabinet and the bar to protect the cabinet frame.



Fastening the cabinet to the floor and wall or roof (non-marine units)

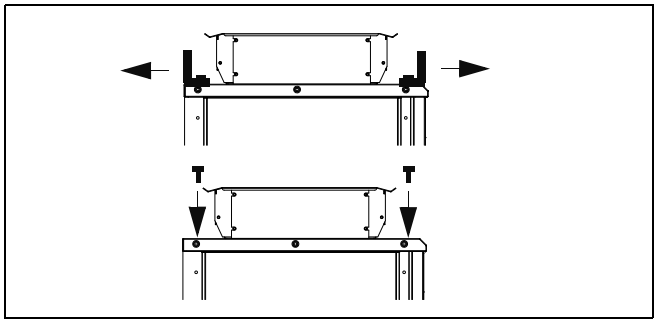
General rules

- The drive must be installed in an upright vertical position.
- The cabinet can be installed with its back against a wall (a), or back-to-back with another unit (b).
- Leave 400 mm (15.75”) of free space above the basic roof level of the cabinet for cooling. IP54 fan replacement requires 320 mm (12.28”) of free space above the filter compartment.
- Leave some space (w) at the side where the cabinet outmost hinges are to allow the doors to open sufficiently. The doors must open 120° to allow supply or inverter module replacement.



Note 1: Any height adjustment must be done before fastening the units or shipping splits together. Height adjustment can be done by using metal shims between the cabinet bottom and floor.

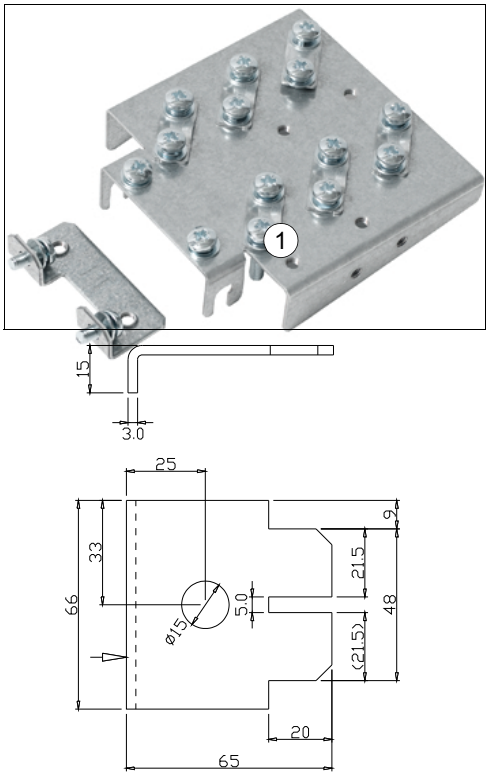
Note 2: If the lifting eyes are removed, refasten the bolts to retain the degree of protection of the cabinet.



Fastening methods

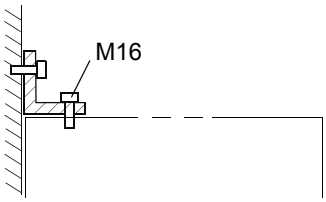
Fasten the cabinet to the floor by using the clamps included along the edge of the cabinet bottom, or by bolting the cabinet to the floor through the holes inside (if they are accessible).

Alternative 1 – Clamping

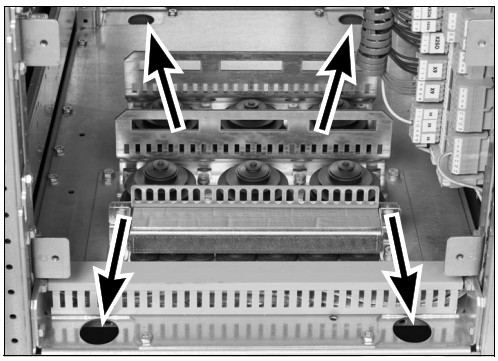


Clamp dimensions

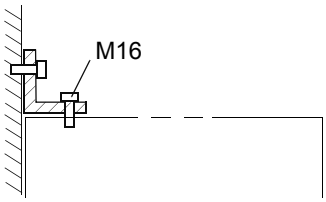
1. Insert the clamps into the twin slots along the front and rear edges of the cabinet frame body and fasten them to the floor with a bolt. The recommended maximum distance between the clamps in the front edge is 800 mm (31.5”).
2. If floor mounting at the back is not possible, fasten the top of the cabinet to the wall with L-brackets (not included in the delivery) bolted to the lifting bar fastening holes.



Alternative 2 – Using the holes inside the cabinet



1. Fasten the cabinet to the floor through the bottom fastening holes with M10 to M12 (3/8” to 1/2”) bolts. The recommended maximum distance between the front edge fastening points is 800 mm (31.5”).
2. If the back fastening holes are not accessible, fasten the cabinet at the top to wall with L-brackets (not included in the delivery) using the lifting bar fastening holes.



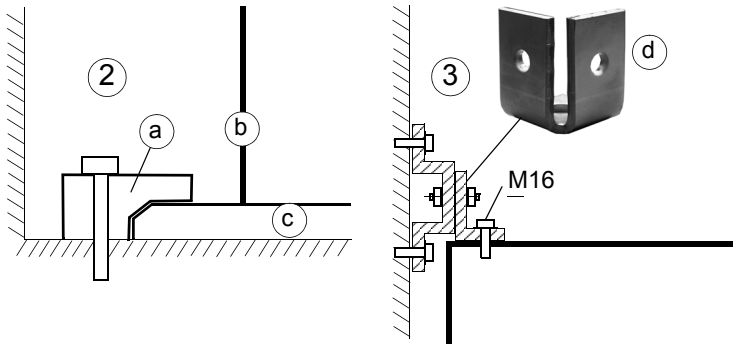
Fastening the cabinet to the floor and roof/wall (marine units)

Follow the general rules given in section *General rules*.

See the dimension drawing delivered with the drive for the locations of the fastening holes in the flat bars below the cabinet and for fastening points at the top of the cabinet. Top fastening brackets are included in the delivery.

Fasten the cabinet to the floor and roof (wall) as follows:

1. Bolt the unit to the floor through the holes in each flat bar at the base of the cabinet using M10 or M12 screws.
2. If there is not enough room behind the cabinet for installation, clamp the rear ends of the flat bars.
3. Remove the lifting lugs and bolt the fastening brackets into the lifting lug holes. Fasten the top of the cabinet to the rear wall and/or roof with brackets.



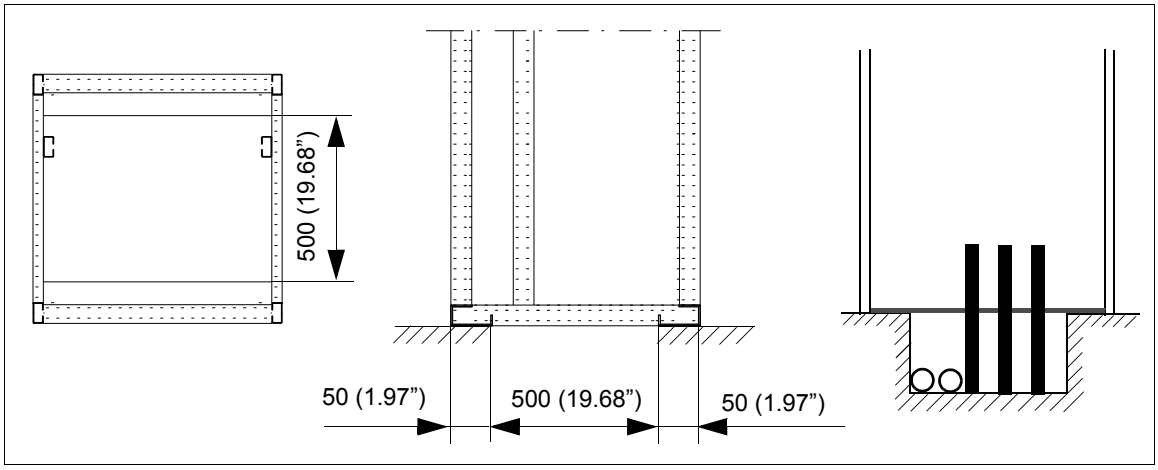
2. Clamping the cabinet to the floor at the back	
a	Clamp
b	Back panel of cabinet
c	Flat bars at base of cabinet
3. Fastening the cabinet at the top	
d	Fastening bracket

Miscellaneous

Cable duct in the floor below the cabinet

A cable duct can be constructed below the 500 mm wide middle part of the cabinet. The cabinet weight lies on the two 50 mm wide transverse sections which the floor must carry.

Prevent the cooling air flow from the cable duct to the cabinet by bottom plates. To ensure the degree of protection for the cabinet, use the original bottom plates delivered with the unit. With user-defined cable entries, take care of the degree of protection, fire protection and EMC compliance.





5

Guidelines for planning the electrical installation

Contents of this chapter

This chapter contains the instructions that you must obey when you select the motor, cables, protections, cable routing and way of operation for the drive system.

Limitation of liability

The installation must always be designed and made according to applicable local laws and regulations. ABB does not assume any liability whatsoever for any installation which breaches the local laws and/or other regulations. Furthermore, if the recommendations given by ABB are not obeyed, the drive can experience problems that the warranty does not cover.

Selecting the supply disconnecting device

Install a hand-operated input disconnecting device between the AC power source and the drive. The disconnecting device must be of a type that can be locked to the open position for installation and maintenance work.

European Union

To agree with the European Union Directives, according to standard EN 60204-1, *Safety of Machinery*, the disconnecting device must be one of the following types:

- switch-disconnector of utilization category AC-23B (EN 60947-3)
- disconnector that has an auxiliary contact that in all cases causes switching devices to break the load circuit before the opening of the main contacts of the disconnector (EN 60947-3)
- circuit breaker suitable for isolation in accordance with EN 60947-2.

Other regions

The disconnecting device must conform to the applicable safety regulations.

Selecting the main contactor

If a main contactor is used, its utilization category (number of operations under load) must be AC-1 according to IEC 60947-4, *Low-voltage switchgear and controlgear*. One main contactor for the drive unit, or contactors for both basic modules can be used if they are closed simultaneously. Select the contactor according to nominal voltage of the drive and the drive or basic module current.

Examining the compatibility of the motor and drive

Use an asynchronous AC induction motor, permanent magnet motor, AC induction servomotor or ABB synchronous reluctance motor (SynRM motor) with the drive. Several induction motors can be connected at a time.

Select the motor size and drive type from the rating tables in chapter *Technical data* on basis of the AC line voltage and motor load. Use the DriveSize PC tool if you need to tune the selection more in detail.

Make sure that the motor withstands the maximum peak voltage in the motor terminals, see the *Requirements table* on page *58*. For basics of protecting the motor insulation and bearings in drive systems, refer to section *Protecting the motor insulation and bearings* below.

Note:

- Consult the motor manufacturer before you use a motor which nominal voltage differs from the AC line voltage connected to the drive input.
- The voltage peaks at the motor terminals are relative to the supply voltage of the drive, not the drive output voltage.
- If the motor and drive are not of the same size, consider the following operation limits of the drive control program:
  - motor nominal voltage range 1/2 ... 2 · U_N
  - motor nominal current range 1/6 ... 2 · I_N of the drive in DTC control and 0 ... 2 · I_N in scalar control. The control mode is selected by a drive parameter.

Protecting the motor insulation and bearings

The drive uses modern IGBT inverter technology. Regardless of frequency, the drive output has pulses of approximately the drive DC bus voltage with a very short rise time. Up to twice bus voltage can be at the motor terminals, depending on the attenuation and reflection properties of the motor cable and the terminals. The increased voltage can cause additional stress on the motor and motor cable insulation.

Modern variable speed drives with their fast rising voltage pulses and high switching frequencies can generate current pulses that flow through the motor bearings. This can gradually erode the bearing races and rolling elements.

Optional d*u*/d*t* filters protect motor insulation system and reduce bearing currents. Optional common mode filters mainly reduce bearing currents. Insulated N-end (non-drive end) bearings protect the motor bearings.

Requirements table

The following table shows how to select the motor insulation system and when optional ABB d*u*/d*t* filters, insulated N-end (non-drive end) motor bearings and ABB common mode filters are required. Failure of the motor to fulfill the following requirements or improper installation may shorten motor life or damage the motor bearings and voids the motor warranty.

Motor type	**Nominal AC supply voltage**	**Requirement for**		
		Motor insulation system	**ABB d*u*/d*t* and common mode filters, insulated N-end motor bearings**	
			100 kW ≤ P_N < 350 kW or IEC 315 ≤ frame size < IEC 400	**P_N ≥ 350 kW or frame size ≥ IEC 400**
			134 hp ≤ P_N < 469 hp or NEMA 500 ≤ frame size ≤ NEMA 580	**P_N ≥ 469 hp or frame size > NEMA 580**
ABB motors				
Random-wound M2_, M3_ and M4_	U_N ≤ 500 V	Standard	+ N	+ N + CMF [1)]
	500 V < U_N ≤ 600 V	Standard	+ N + d*u*/d*t*	+ N + d*u*/d*t* + CMF
		or		
		Reinforced	+ N	+ N + CMF [1)]
	600 V < U_N ≤ 690 V (cable length ≤ 150 m)	Reinforced	+ N + d*u*/d*t*	+ N + d*u*/d*t* + CMF
	600 V < U_N ≤ 690 V (cable length > 150 m)	Reinforced	+ N	+ N + CMF [1)]
Form-wound HX_ and AM_	380 V < U_N ≤ 690 V	Standard	+ N + CMF	P_N < 500 kW: +N + CMF [1)]
				P_N ≥ 500 kW +N + d*u*/d*t* + CMF
Old* form-wound HX_ and modular	380 V < U_N ≤ 690 V	Check with the motor manufacturer.	+ N + d*u*/d*t* with voltages over 500 V + CMF	
Random-wound HX_ and AM_ **	0 V < U_N ≤ 500 V	Enamelled wire with fiber glass taping	+ N + CMF [1)]	
	500 V < U_N ≤ 690 V		+ N + d*u*/d*t* + CMF	
HDP	Consult the motor manufacturer.			

* manufactured before 1.1.1998

** For motors manufactured before 1.1.1998, check for additional instructions with the motor manufacturer.

1) also d*u*/d*t* filter is required at the output of the basic drive modules if the motor cable length is less than 20 meters before connecting the motor cables together

Motor type	Nominal AC supply voltage	Requirement for		
		Motor insulation system	ABB d*u*/d*t* and common mode filters, insulated N-end motor bearings	
			100 kW ≤ P_N < 350 kW or IEC 315 ≤ frame size < IEC 400	**P_N ≥ 350 kW or frame size ≥ IEC 400**
			134 hp ≤ P_N < 469 hp or NEMA 500 ≤ frame size ≤ NEMA 580	**P_N ≥ 469 hp or frame size > NEMA 580**
Non-ABB motors				
Random-wound and form-wound	U_N ≤ 420 V	Standard: $\hat{U}_{LL}$ = 1300 V	+ N or CMF	+ N + CMF [1)]
	420 V < U_N ≤ 500 V	Standard: $\hat{U}_{LL}$ = 1300 V	+ d*u*/d*t* + (N or CMF)	+ N + d*u*/d*t* + CMF
		or		
		Reinforced: $\hat{U}_{LL}$ = 1600 V, 0.2 microsecond rise time	+ N or CMF	+ N + CMF [1)]
	500 V < U_N ≤ 600 V	Reinforced: $\hat{U}_{LL}$ = 1600 V	+ d*u*/d*t* + (N or CMF)	+ N + d*u*/d*t* + CMF
		or		
		Reinforced: $\hat{U}_{LL}$ = 1800 V	+ N or CMF	+ N + CMF [1)]
	600 V < U_N ≤ 690 V	Reinforced: $\hat{U}_{LL}$ = 1800 V	+ d*u*/d*t* + N	+ N + d*u*/d*t* + CMF
		Reinforced: $\hat{U}_{LL}$ = 2000 V, 0.3 microsecond rise time ***	N + CMF	+ N + CMF [1)]

*** If the intermediate DC circuit voltage of the drive is increased from the nominal level by resistor braking, check with the motor manufacturer if additional output filters are needed in the applied drive operation range.

1) also d*u*/d*t* filter is required at the output of the basic drive modules if the motor cable length is less than 20 meters before connecting the motor cables together

The abbreviations used in the table are defined below.

Abbreviation	Definition
U_N	Nominal AC line voltage
$\hat{U}_{LL}$	Peak line-to-line voltage at motor terminals which the motor insulation must withstand
P_N	Motor nominal power
d*u*/d*t*	d*u*/d*t* filter at the output of the drive
CMF	Common mode filter (option +E208)
N	N-end bearing (Insulated motor non-drive end bearing)
n.a.	Motors of this power range are not available as standard units. Consult the motor manufacturer.

Additional requirements for explosion-safe (EX) motors

If you use an explosion-safe (EX) motor, obey the rules in the requirements table above. In addition, consult the motor manufacturer for any further requirements.

Additional requirements for ABB motors of types other than M2_, M3_, M4_, HX_ and AM_

Use the selection criteria given for non-ABB motors.

Additional requirements for the braking applications

When the motor brakes the machinery, the intermediate circuit DC voltage of the drive increases, the effect being similar to increasing the motor supply voltage by up to 20 percent. Consider this voltage increase when you specify the motor insulation requirements if the motor is braking a large part of its operation time.

Example: Motor insulation requirement for a 400 V AC line voltage application must be selected as if the drive were supplied with 480 V.

Additional requirements for ABB high-output and IP23 motors

The rated output power of high output motors is higher than what is stated for the particular frame size in EN 50347:2001. This table shows the requirements for ABB random-wound motor series (for example, M3AA, M3AP and M3BP).

Nominal AC supply voltage	**Requirement for**		
	Motor insulation system	**ABB du/dt and common mode filters, insulated N-end motor bearings**	
		100 kW ≤ P_N < 200 kW	**P_N ≥ 200 kW**
		140 hp ≤ P_N < 268 hp	**P_N ≥ 268 hp**
$U_N \leq 500$ V	Standard	+ N	+ N + CMF [1)]
500 V < $U_N \leq 600$ V	Standard	+ d*u*/d*t* + N	+ d*u*/d*t* + N + CMF
	or		
	Reinforced	+ N	+ N + CMF [1)]
600 V < $U_N \leq 690$ V	Reinforced	+ d*u*/d*t* + N	+ d*u*/d*t* + N + CMF

1) also d*u*/d*t* filter is required at the output of the basic drive modules if the motor cable length is less than 20 meters before connecting the motor cables together

Additional requirements for non-ABB high-output and IP23 motors

The rated output power of high output motors is higher than what is stated for the particular frame size in EN 50347:2001. The table below shows the requirements for random-wound and form-wound non-ABB motors with nominal power smaller than 350 kW. For bigger motors, consult the motor manufacturer.

Nominal AC supply voltage	**Requirement for**	
	Motor insulation system	**ABB d*u*/d*t* filter, insulated N-end bearing and ABB common mode filter**
		100 kW ≤ P_N < 350 kW or IEC 315 ≤ frame size < IEC 400
		134 hp ≤ P_N < 469 hp or NEMA 500 ≤ frame size ≤ NEMA 580
$U_N \leq 420$ V	Standard: $\hat{U}_{LL}$ = 1300 V	+ N + CMF [1]
420 V < $U_N \leq 500$ V	Standard: $\hat{U}_{LL}$ = 1300 V	+ N + d*u*/d*t* + CMF
	or	
	Reinforced: $\hat{U}_{LL}$ = 1600 V, 0.2 microsecond rise time	+ N + CMF [1]
500 V < $U_N \leq 600$ V	Reinforced: $\hat{U}_{LL}$ = 1600 V	+ d*u*/d*t* + N + CMF
	or	
	Reinforced: $\hat{U}_{LL}$ = 1800 V	+ N + CMF [1]
600 V < $U_N \leq 690$ V	Reinforced: $\hat{U}_{LL}$ = 1800 V	+ N + d*u*/d*t* + CMF
	Reinforced: $\hat{U}_{LL}$ = 2000 V, 0.3 microsecond rise time ***	N + CMF [1]

*** If the intermediate DC circuit voltage of the drive is increased from the nominal level by resistor braking, check with the motor manufacturer if additional output filters are needed in the applied drive operation range.

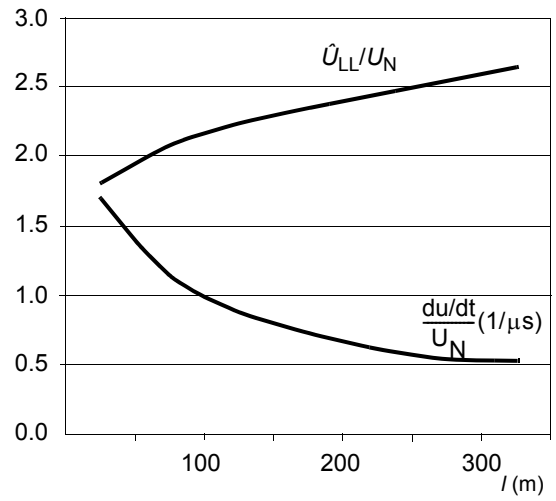
1) also d*u*/d*t* filter is required at the output of the basic drive modules if the motor cable length is less than 20 meters before connecting the motor cables together

Additional data for calculating the rise time and the peak line-to-line voltage

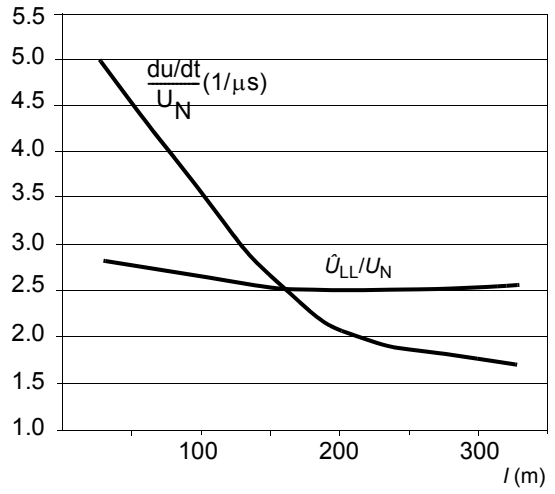
The diagrams below show the relative peak line-to-line voltage and rate of change of voltage as a function of the motor cable length with and without a d*u*/d*t* filter in use.

To calculate the actual peak voltage for a certain cable length read the relative $\hat{U}_{LL}/U_N$ value from the appropriate diagram and multiply it by the nominal supply voltage (U_N).

To calculate the actual voltage rise time for a certain cable length read the relative values $\hat{U}_{LL}/U_N$ and (d*u*/d*t*)/U_N from the appropriate diagram. Multiply the values by the nominal supply voltage (U_N) and substitute into equation $t = 0.8 \cdot \hat{U}_{LL}/(du/dt)$.



Drive with d*u*/d*t* filter



Drive without d*u*/d*t* filter

l	Motor cable length
$\hat{U}_{LL}/U_N$	Relative peak line-to-line voltage
d*u*/d*t* /U_N	Relative d*u*/d*t* value

Note: ÛLL and du/dt values are approximately 20% higher with resistor braking.

Additional note for sine filters

Sine filters protect the motor insulation system. Therefore, the d*u*/d*t* filter can be replaced with a sine filter. The peak phase-to-phase voltage with the sine filter is approximately $1.5 \cdot U_N$.

Additional note for common mode filters

Common mode filter is included in the standard drive module delivery.

Selecting the power cables

General rules

Select the input power and motor cables according to local regulations:

- Select a cable capable of carrying the drive nominal current.
- Select a cable rated for at least 70 °C (158 °F) maximum permissible temperature of conductor in continuous use.
- The inductance and impedance of the PE conductor/cable (grounding wire) must be rated according to permissible touch voltage appearing under fault conditions (so that the fault point voltage will not rise excessively when a ground fault occurs).
- 600 V AC cable is accepted for up to 500 V AC. 750 V AC cable is accepted for up to 600 V AC. For 690 V AC rated equipment, the rated voltage between the conductors of the cable should be at least 1 kV.

Use symmetrical shielded motor cables. Ground motor cable shields 360° at both ends. Keep the motor cable and its PE pigtail (twisted shield) as short as possible to reduce high-frequency electromagnetic emissions.

Note: When continuous metal conduit is employed, shielded cable is not required. The conduit must have bonding at both ends.

A four-conductor system is allowed for input cabling, but shielded symmetrical cable is recommended.

Compared to a four-conductor system, the use of symmetrical shielded cable reduces electromagnetic emission of the whole drive system as well as the stress on motor insulation, bearing currents and wear.

The protective conductor must always have an adequate conductivity. The table below shows the minimum cross-sectional area related to the phase conductor size according to IEC 61439-1 when the phase conductor and the protective conductor are made of the same metal.

Cross-sectional area of the phase conductors **S (mm^2)**	**Minimum cross-sectional area of the corresponding protective conductor** **S_p (mm^2)**
$S \leq 16$	S
$16 < S \leq 35$	16
$35 < S \leq 400$	S/2
$400 < S \leq 800$	200

Typical power cable sizes

The tables below give copper and aluminum cable types with concentric copper shield for the drive modules with nominal current.

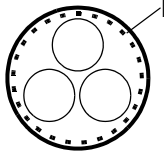
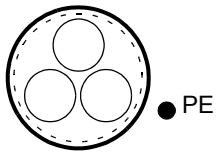
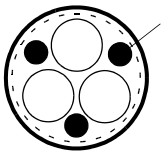
Drive type ACS880-07XT-	IEC[1] input and motor cabling			
	Cabling per basic module		Common cabling for the basic modules	
	Cu cable type	Al cable type	Cu cable type	Al cable type
	mm^2	mm^2	mm^2	mm^2
U_N = 400 V				
1010A-3	3 × (3 × 120)	3 × (3 × 185)	4 × (3 × 185)	5 × (3 × 240)
1190A-3	3 × (3 × 150)	3 × (3 × 240)	4 × (3 × 240)	6 × (3 × 240)
1330A-3	3 × (3 × 185)	4 × (3 × 185)	5 × (3 × 240)	6 × (3 × 240)
1610A-3	3 × (3 × 240)	4 × (3 × 240)	6 × (3 × 240)	7 × (3 × 240)
U_N = 500 V				
1010A-5	3 × (3 × 120)	3 × (3 × 185)	4 × (3 × 185)	5 × (3 × 240)
1160A-5	3 × (3 × 150)	3 × (3 × 240)	4 × (3 × 240)	6 × (3 × 240)
1310A-5	3 × (3 × 185)	4 × (3 × 185)	5 × (3 × 240)	6 × (3 × 240)
1610A-5	3 × (3 × 240)	4 × (3 × 240)	6 × (3 × 240)	7 × (3 × 240)
U_N = 690 V				
0810A-7	3 × (3 × 95)	3 × (3 × 120)	4 × (3 × 150)	4 × (3 × 240)
0960A-7	3 × (3 × 120)	3 × (3 × 185)	4 × (3 × 185)	5 × (3 × 185)
1080A-7	3 × (3 × 150)	3 × (3 × 185)	4 × (3 × 240)	5 × (3 × 240)
1320A-7	3 × (3 × 185)	4 × (3 × 185)	5 × (3 × 240)	6 × (3 × 240)

1) The cable sizing is based on max. 9 cables laid on a cable ladder side by side, three ladder type trays one on top of the other, ambient temperature 30 °C (86 °F) PVC insulation, surface temperature 70 °C (158 °F) (EN 60204-1 and IEC 60364-5-52). For other conditions, dimension the cables according to local safety regulations, appropriate input voltage and the load current of the drive.

Alternative power cable types

The recommended and not allowed power cable types to be used with the drive are presented below.

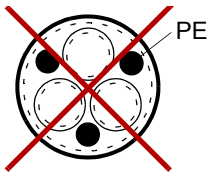
Recommended power cable types

	Symmetrical shielded cable with three phase conductors and a concentric PE conductor as shield. The shield must agree with the requirements of IEC 61439-1. Check with local / state / country electrical codes for allowance.
	Symmetrical shielded cable with three phase conductors and a concentric PE conductor as shield. A separate PE conductor is required if the shield does not agree with the requirements of IEC 61439-1.
	Symmetrical shielded cable with three phase conductors and symmetrically constructed PE conductor, and a shield. The PE conductor must agree with the requirements of IEC 61439-1.

Power cable types for restricted use

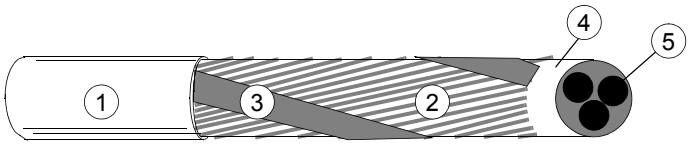
	A four-conductor system (three phase conductors and a protective conductor on a cable tray) is **not allowed for motor cabling** (allowed for input cabling).

Not allowed power cable types

	Symmetrical shielded cable with individual shields for each phase conductor is not allowed on any cable size for input and motor cabling.

Motor cable shield

If the motor cable shield is used as the sole protective earth conductor of the motor, make sure that the conductivity of the shield is sufficient. See subsection *General rules* above, or IEC 61439-1. To effectively suppress radiated and conducted radio-frequency emissions, the cable shield conductivity must be at least 1/10 of the phase conductor conductivity. The requirements are easily met with a copper or aluminum shield. The minimum requirement of the motor cable shield of the drive is shown below. It consists of a concentric layer of copper wires with an open helix of copper tape or copper wire. The better and tighter the shield, the lower the emission level and bearing currents.



1	Insulation jacket
2	Copper wire screen
3	Helix of copper tape or copper wire
4	Inner insulation
5	Cable core

Armored cable / shielded power cable

Six conductor (3 phases and 3 ground) type MC continuous corrugated aluminum armor cable with symmetrical grounds is available from the following suppliers (trade names in parentheses):

- Anixter Wire & Cable (Philsheath)
- BICC General Corp (Philsheath)
- Rockbestos Co. (Gardex)
- Oaknite (CLX).

Shielded power cables are available from Belden, LAPPKABEL (ÖLFLEX) and Pirelli.

Planning the braking system

See chapter *Resistor braking*.

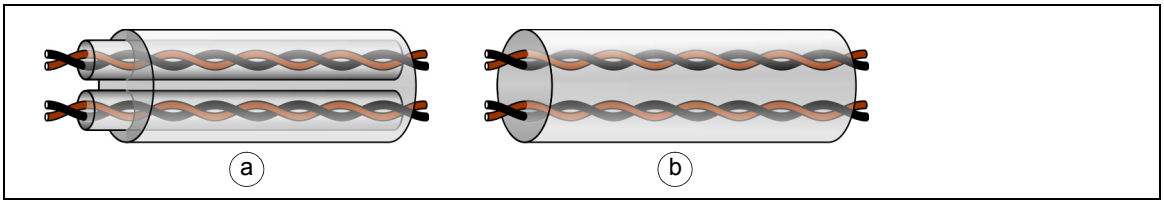
Selecting the control cables

Shielding

All control cables must be shielded.

Use a double-shielded twisted pair cable for analog signals. We recommend this type of cable for the pulse encoder signals also. Employ one individually shielded pair for each signal. Do not use common return for different analog signals.

A double-shielded cable (figure a below) is the best alternative for low-voltage digital signals but single-shielded (b) twisted pair cable is also acceptable.



Signals in separate cables

Run analog and digital signals in separate, shielded cables. Never mix 24 V DC and 115/230 V AC signals in the same cable.

Signals allowed to be run in the same cable

Relay-controlled signals, providing their voltage does not exceed 48 V, can be run in the same cables as digital input signals. The relay-controlled signals should be run as twisted pairs.

Relay cable type

The cable type with braided metallic screen (for example ÖLFLEX by LAPPKABEL, Germany) has been tested and approved by ABB.

Control panel cable length and type

In remote use, the cable connecting the control panel to the drive must not exceed three meters (10 ft). Cable type: shielded CAT 5e or better Ethernet patch cable with RJ-45 ends.

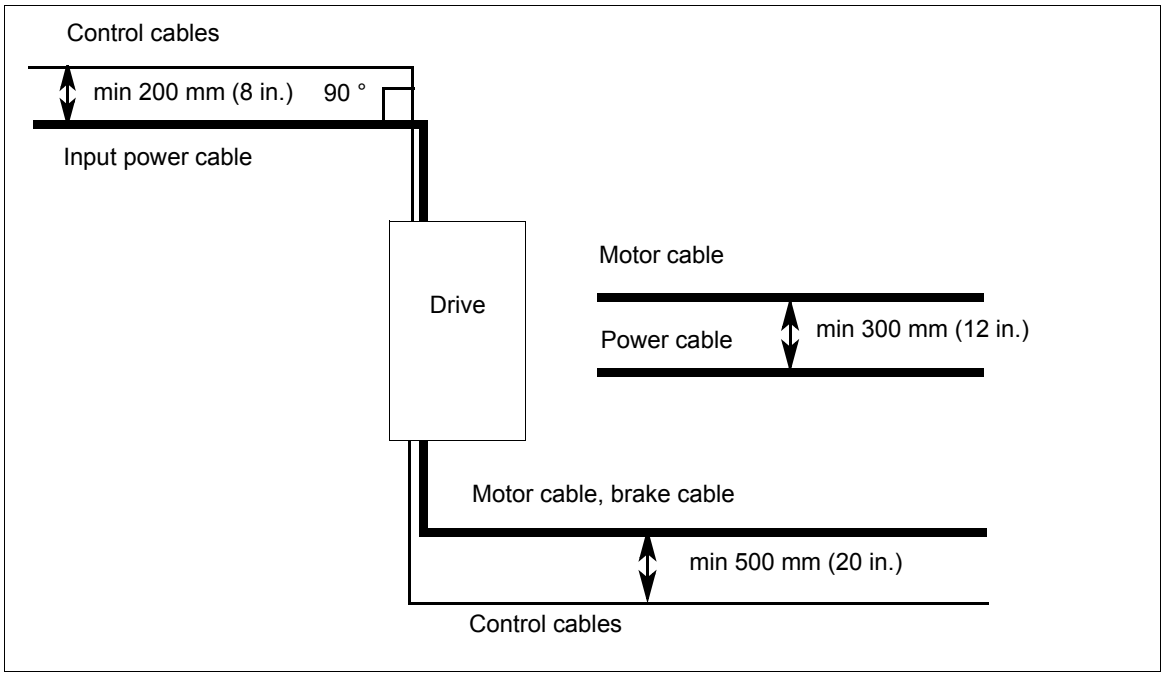
Routing the cables

Route the motor cable away from other cable routes. Motor cables of several drives can be run in parallel when installed next to each other. The motor cable, input power cable and control cables should be installed on separate trays. Avoid long parallel runs of motor cables with other cables in order to decrease electromagnetic interference caused by the rapid changes in the drive output voltage.

Where control cables must cross power cables, make sure they are arranged at an angle as near to 90 degrees as possible. Do not install extra cables through the drive.

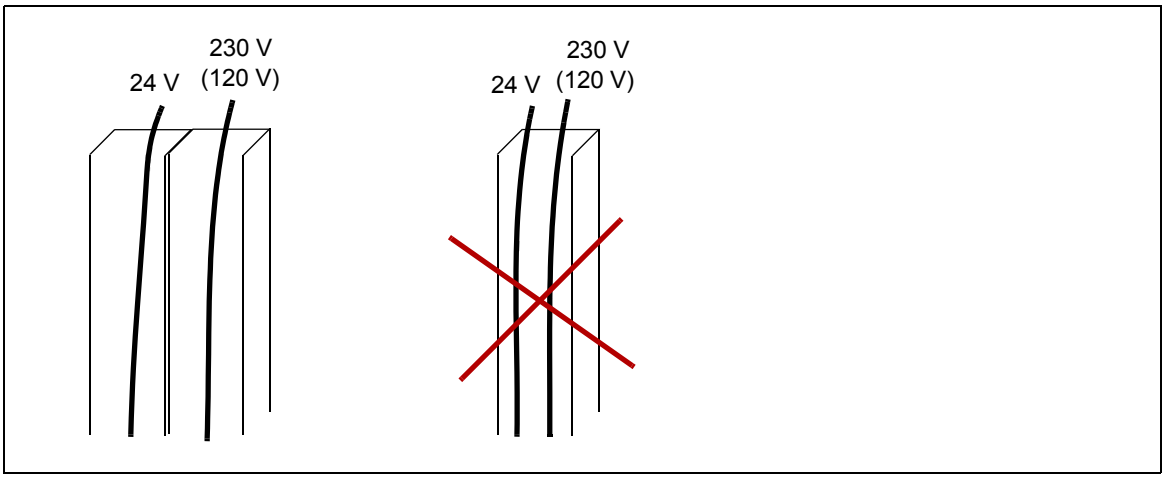
The cable trays must have good electrical bonding to each other and to the grounding electrodes. Aluminum tray systems can be used to improve local equalizing of potential

A diagram of the cable routing is shown below.



Separate control cable ducts

Lead 24 V and 230 V (120 V) control cables in separate ducts unless the 24 V cable is insulated for 230 V (120 V) or insulated with an insulation sleeving for 230 V (120 V).



Continuous motor cable shield or enclosure for equipment in the motor cable

To minimize the emission level when safety switches, contactors, connection boxes or similar equipment are installed on the motor cable between the drive and the motor:

- European Union: Install the equipment in a metal enclosure with 360 degree grounding for the shields of both the incoming and outgoing cable, or connect the shields of the cables otherwise together.

Implementing thermal overload and short-circuit protection

Protecting the drive and input power cable in short-circuits

Protect the drive with fuses and the input cable with fuses or a circuit breaker with current restriction.

Equip the fuses with blown fuse indicators for stopping the drive.

Size the fuses or the circuit breaker according to local regulations for the input cable protection. Select the fuses for the drive according to the instructions given in chapter *Technical data*. The fuses for the drive protection will restrict drive damage and prevent damage to adjoining equipment in case of a short-circuit inside the drive.

Circuit breakers

The protective characteristics of circuit breakers depend on the type, construction and settings of the breakers. There are also limitations pertaining to the short-circuit capacity of the supply network. Your local ABB representative can help you in selecting the breaker type when the supply network characteristics are known.



WARNING! Due to the inherent operating principle and construction of circuit breakers, independent of the manufacturer, hot ionized gases can escape from the breaker enclosure in case of a short-circuit. To ensure safe use, pay special attention to the installation and placement of the breakers. Obey the manufacturer's instructions.

Protecting the motor and motor cable in short-circuits

The drive protects the motor cable and motor in a short-circuit situation when the motor cable is dimensioned according to the nominal current of the drive. No additional protection devices are needed.

Protecting the drive and the input power and motor cables against thermal overload

The drive protects itself and the motor cables against thermal overload when the cables are dimensioned according to the nominal current of the drive. No additional thermal protection devices are needed.

In 6-pulse connection with a common main circuit breaker, the drive protects the input cables against thermal overload when the cables are dimensioned according to the nominal current of the drive.

For 12-pulse connection and 6-pulse connection with individual circuit breakers, use gG fuses with blown fuse indicators for the thermal protection of the input cables. Wire the indicators to stop the drive in case of a blown fuse.

WARNING! If the drive is connected to multiple motors, use a separate circuit breaker or fuses for protecting each motor cable and motor against overload. The drive overload protection is tuned for the total motor load. It may not trip due to an overload in one motor circuit only.

Protecting the motor against thermal overload

According to regulations, the motor must be protected against thermal overload and the current must be switched off when overload is detected. The drive includes a motor thermal protection function that protects the motor and switches off the current when necessary. Depending on a drive parameter value, the function either monitors a calculated temperature value (based on a motor thermal model) or an actual temperature indication given by motor temperature sensors. The user can tune the thermal model further by feeding in additional motor and load data.

The most common temperature sensors are:

- motor sizes IEC 180…225: thermal switch, eg, Klixon
- motor sizes IEC 200…250 and larger: PTC or Pt100.

See the firmware manual for more information on the motor thermal protection, and the connection and use of the temperature sensors.

Protecting the drive against ground faults

The drive is equipped with an internal ground fault protective function to protect the drive against ground faults in the motor and motor cable in TN (grounded) networks. This is not a personal safety or a fire protection feature. The ground fault protective function can be disabled with a parameter, refer to the firmware manual.

Measures for protection in case of direct or indirect contact, such as separation from the environment by double or reinforced insulation or isolation from the supply system by a transformer, can be applied.

Residual current device compatibility

The drive is suitable to be used with residual current devices of Type B.

Note: The EMC filter of the drive includes capacitors connected between the main circuit and the frame. These capacitors and long motor cables increase the ground leakage current and can cause fault current circuit breakers to function.

Implementing the Emergency stop function

For safety reasons, install the emergency stop devices at each operator control station and at other operating stations where emergency stop may be needed. You can implement the emergency stop function using the Safe torque off function of the drive module Design the emergency stop according to relevant standards.

Note: Pressing the stop key ⏚ on the control panel of the drive does not generate an emergency stop of the motor or separate the drive from dangerous potential.

IImplementing the Power loss ride-through function

Implement the power loss ride-through function as follows:

1. Check that the power-loss ride-through function of the drive is enabled with parameter **30.31 Undervoltage control** in the ACS880 primary control program.
2. If the installation is equipped with a main contactor, prevent its tripping at the input power break. For example, use a time delay relay (hold) in the contactor control circuit.



WARNING! Make sure that the flying restart of the motor will not cause any danger. If you are in doubt, do not implement the power-loss ride-through function.

Using power factor compensation capacitors with the drive

Power factor compensation is not needed with AC drives. However, if a drive is to be connected in a system with compensation capacitors installed, note the following restrictions.



WARNING! Do not connect power factor compensation capacitors or harmonic filters to the motor cables (between the drive and the motor). They are not meant to be used with AC drives and can cause permanent damage to the drive or themselves.

If there are power factor compensation capacitors in parallel with the three phase input of the drive:

1. Do not connect a high-power capacitor to the power line while the drive is connected. The connection will cause voltage transients that may trip or even damage the drive.
2. If capacitor load is increased/decreased step by step when the AC drive is connected to the power line, ensure that the connection steps are low enough not to cause voltage transients that would trip the drive.
3. Check that the power factor compensation unit is suitable for use in systems with AC drives, ie, harmonic generating loads. In such systems, the compensation unit should typically be equipped with a blocking reactor or harmonic filter.

Implementing a safety switch between the drive and the motor

We recommended that you install a safety switch between the permanent magnet motor and the drive output. The switch is needed to isolate the motor during any maintenance work on the drive.

Using a contactor between the drive and the motor

Implementing the control of the output contactor depends on how you select the drive to operate.

When you have selected to use DTC motor control mode and motor ramp stop, open the contactor as follows:

1. Give a stop command to the drive.
2. Wait until the drive decelerates the motor to zero speed.
3. Open the contactor.

When you have selected to use DTC motor control mode and motor coast stop, or scalar control mode, open the contactor as follows:

1. Give a stop command to the drive.
2. Open the contactor.



WARNING! When the DTC motor control mode is in use, never open the output contactor while the drive controls the motor. The DTC motor control operates extremely fast, much faster than it takes for the contactor to open its contacts. When the contactor starts opening while the drive controls the motor, the DTC control will try to maintain the load current by immediately increasing the drive output voltage to the maximum. This will damage, or even burn the contactor completely.

Implementing a bypass connection

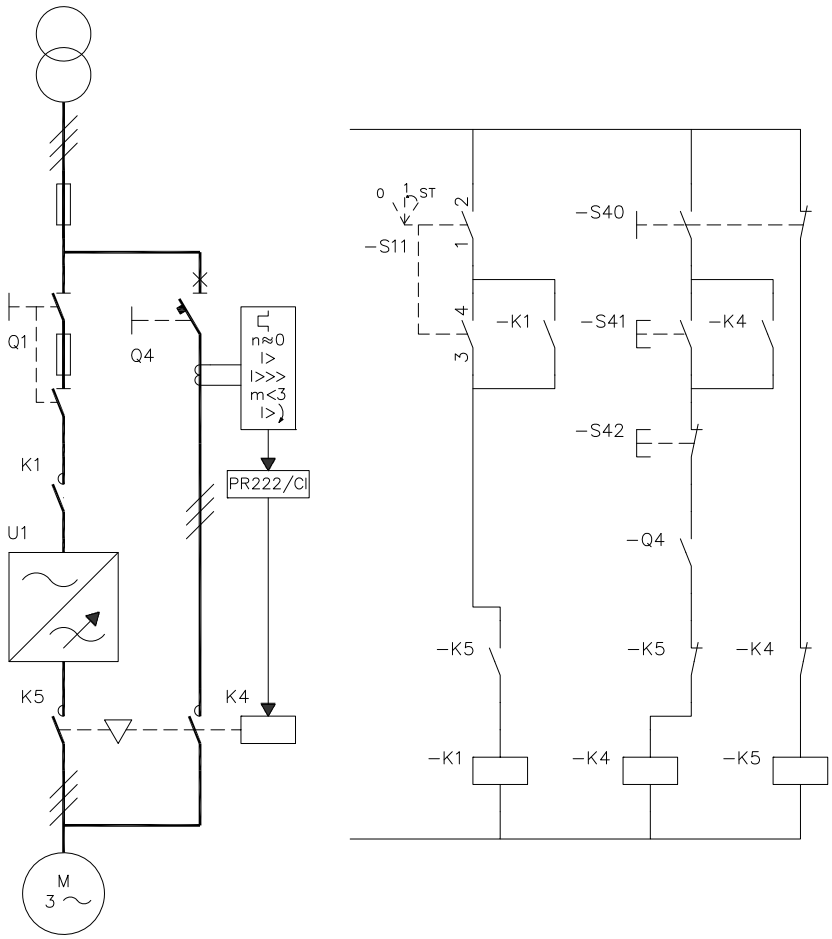
If bypassing is required, employ mechanically or electrically interlocked contactors between the motor and the drive and between the motor and the power line. Ensure with interlocking that the contactors cannot be closed simultaneously.



WARNING! Never connect the drive output to the electrical power network. The connection may damage the drive.

Example bypass connection

An example bypass connection is shown below.



Q1	Drive main switch
Q4	Bypass circuit breaker
K1	Drive main contactor
K4	Bypass contactor
K5	Drive output contactor
S11	Drive main contactor on/off control
S40	Motor power supply selection (drive or direct-on-line)
S41	Start when motor is connected direct-on-line
S42	Stop when motor is connected direct-on-line

Switching the motor power supply from drive to direct-on-line

1. Stop the drive and the motor with the drive control panel (drive in the local control mode) or the external stop signal (drive in the remote control mode).
2. Open the main contactor of the drive with S11.
3. Switch the motor power supply from the drive to direct-on-line with S40.
4. Wait for 10 seconds to allow the motor magnetization to die away.
5. Start the motor with S41.

Switching the motor power supply from direct-on-line to drive

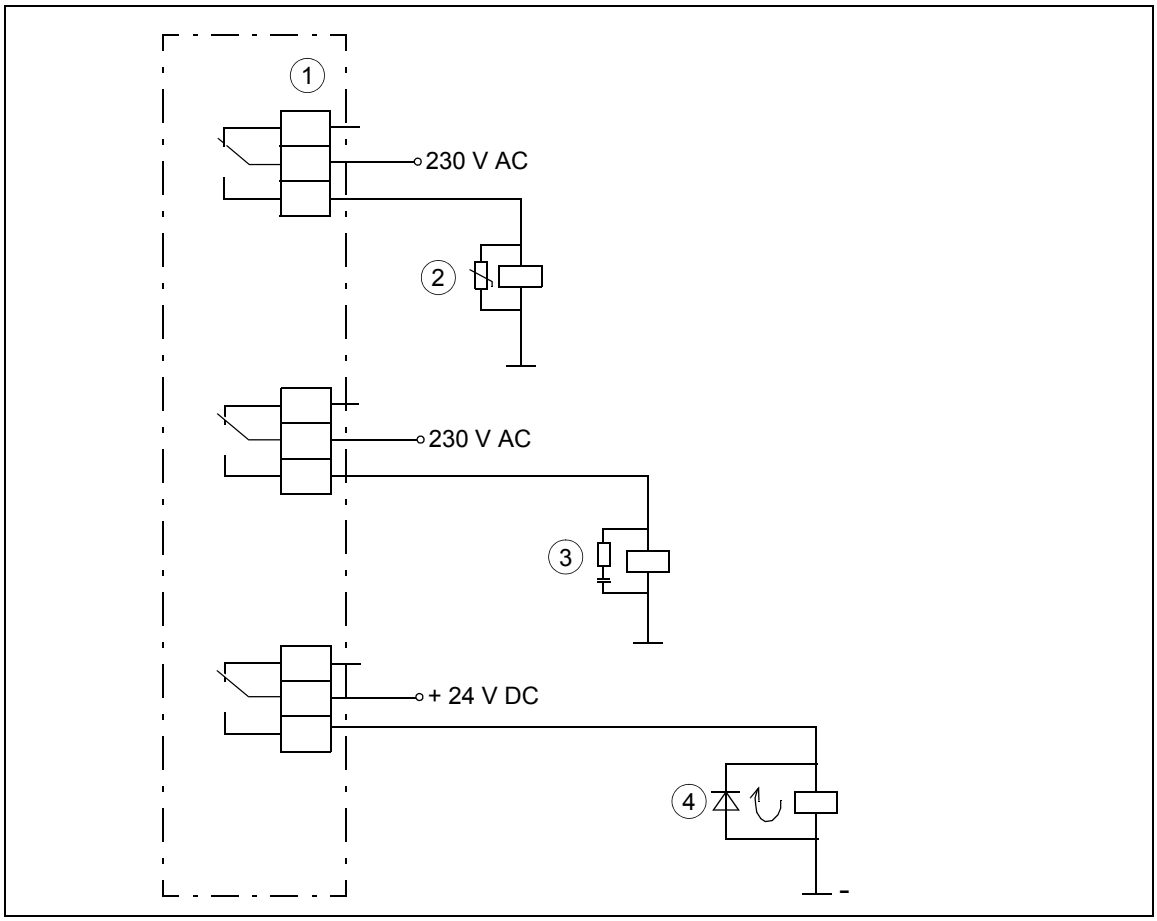
1. Stop the motor with S42.
2. Switch the motor power supply from direct-on-line to the drive with S40.
3. Close the main contactor of the drive with switch S11 (-> turn to position ST for two seconds and leave to position 1).
4. Start the drive and the motor with the drive control panel (drive in the local control mode) or the external start signal (drive in the remote control mode).

Protecting the contacts of relay outputs

Inductive loads (relays, contactors, motors) cause voltage transients when switched off.

The relay contacts on the drive control unit are protected with varistors (250 V) against overvoltage peaks. In spite of this, it is highly recommended that inductive loads are equipped with noise attenuating circuits (varistors, RC filters [AC] or diodes [DC]) in order to minimize the EMC emission at switch-off. If not suppressed, the disturbances may connect capacitively or inductively to other conductors in the control cable and form a risk of malfunction in other parts of the system.

Install the protective component as close to the inductive load as possible. Do not install protective components at the relay outputs.



1) Relay outputs; 2) Varistor; 3) RC filter; 4) diode

6

Electrical installation

Contents of this chapter

This chapter gives instructions on the wiring the drive.

Warnings



WARNING! Only qualified electricians are allowed to carry out the work described in this chapter. Follow the *Safety instructions* on the first pages of this manual. Ignoring the safety instructions can cause injury or death.

Checking the insulation of the assembly

Drive

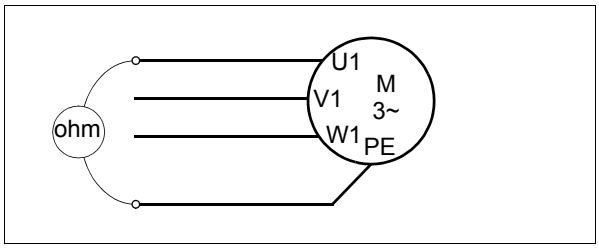
Do not make any voltage tolerance or insulation resistance tests on any part of the drive as testing can damage the drive. Every drive has been tested for insulation between the main circuit and the chassis at the factory. Also, there are voltage-limiting circuits inside the drive which cut down the testing voltage automatically.

Input cable

Check the insulation of the input cable according to local regulations before connecting it to the drive.

Motor and motor cable

1. Check that the motor cable is disconnected from the drive output terminals U2, V2 and W2.
2. Measure the insulation resistance between each phase conductor and the Protective Earth conductor using a measuring voltage of 1000 V DC. The insulation resistance of an ABB motor must exceed 100 Mohm (reference value at 25 °C or 77 °F). For the insulation resistance of other motors, consult the manufacturer's instructions. **Note**: Moisture inside the motor casing will reduce the insulation resistance. If moisture is suspected, dry the motor and repeat the measurement.



Checking the compatibility with IT (ungrounded) systems

EMC filter +E201 is not suitable for use in an IT (ungrounded) system. If the drive is equipped with filter +E201, it can not be used in an IT (ungrounded) system.

WARNING! If a drive with EMC filter +E201 is installed on an IT system (an ungrounded power system or a high resistance-grounded [over 30 ohm] power system), the system will be connected to earth potential through the EMC filter capacitors of the drive. This may cause danger, or damage the unit.

Connecting the control cables

The default I/O connections can be different with some hardware options, see the circuit diagrams delivered with the drive for the actual wiring. For other control programs, see their firmware manuals.

Control cable connection procedure

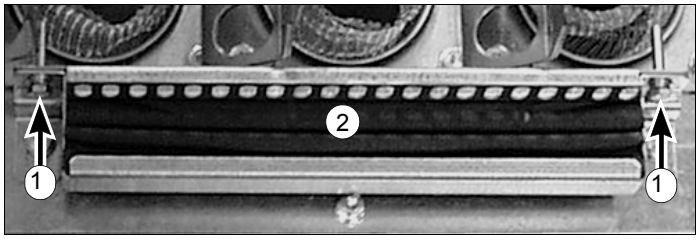
WARNING! Obey the instructions in chapter *Safety instructions*. If you ignore them, injury or death, or damage to the equipment can occur.

1. Stop the drive (if running) and do the steps in section *Precautions before electrical work* before you start the work.
2. Run the control cables into the auxiliary control cubicle (ACU) as described in section *Grounding the outer shields of the control cables at the cabinet lead-through* below.
3. Route the control cables as described in section *Routing the control cables inside the cabinet*.
4. Connect the control cables as described starting.

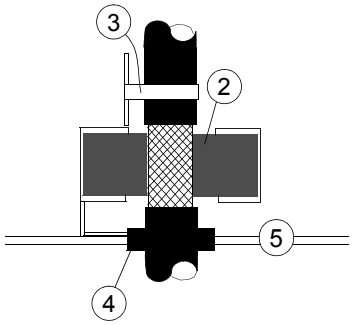
Grounding the outer shields of the control cables at the cabinet lead-through

Ground the outer shields of all control cables 360 degrees at the EMI conductive cushions as follows:

1. Loosen the tightening screws of the EMI conductive cushions and pull the cushions apart.
2. Cut adequate holes to the rubber grommets in the lead-through plate and lead the cables through the grommets and the cushions into the cabinet.
3. Strip off the cable plastic sheath above the lead-through plate just enough to ensure proper connection of the bare shield and the EMI conductive cushions.
4. Tighten the two tightening screws so that the EMI conductive cushions press tightly round the bare shield.



View from above

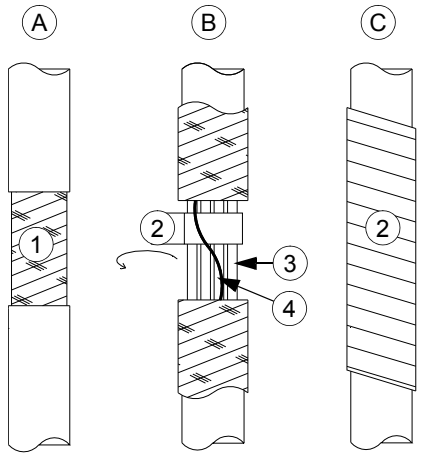


1	Tightening screw
2	EMI conductive cushion
3	Strain relief
4	Grommet
5	Lead-through plate

Note 1: Keep the shields continuous as close to the connection terminals as possible. Secure the cables mechanically at the lead-through strain relief.

Note 2: If the outer surface of the shield is non-conductive:

- Cut the shield at the midpoint of the bare part. Be careful not to cut the conductors or the grounding wire (if present).
- Turn the shield inside out to expose its conductive surface.
- Cover the turned shield and the stripped cable with copper foil to keep the shielding continuous.



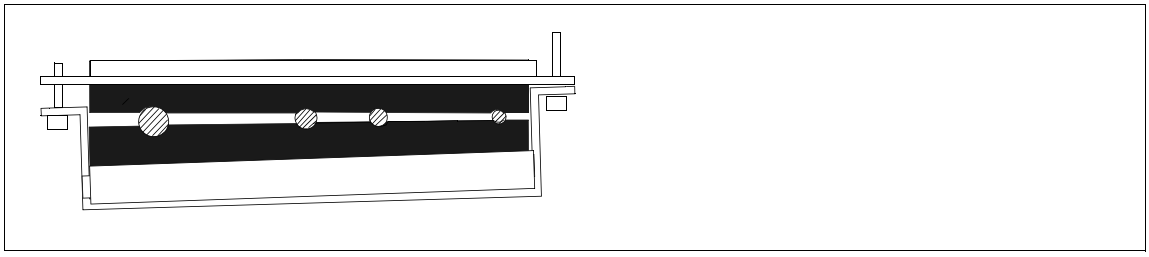
A	Stripped cable
B	Conductive surface of the shield exposed
C	Stripped part covered with copper foil
1	Cable shield
2	Copper foil
3	Shielded twisted pair
4	Grounding wire

Note for top entry of cables: When each cable has its own rubber grommet, sufficient IP and EMC protection can be achieved. However, if very many control cables come to one cabinet, plan the installation beforehand as follows:

1. Make a list of the cables coming to the cabinet.
2. Sort the cables going to the left into one group and the cables going to the right into another group to avoid unnecessary crossing of cables inside the cabinet.
3. Sort the cables in each group according to size.
4. Group the cables for each grommet as follows ensuring that each cable has a proper contact to the cushions on both sides.

Cable diameter in mm	Max. number of cables per grommet
≤ 13	4
≤ 17	3
< 25	2
≥ 25	1

5. Arrange the bunches according to size from thickest to the thinnest between the EMI conductive cushions.



6. If more than one cable go through a grommet, seal the grommet by applying Loctite 5221 (catalogue number 25551) inside the grommet.

Routing the control cables inside the cabinet

Use the existing trunking in the cabinet wherever possible. Use sleeving if cables are laid against sharp edges. When running cables to or from the swing-out frame, leave enough slack at the hinge to allow the frame to open fully.

Connecting to the control unit (A41)

Connect the conductors to the appropriate terminals of the control unit or terminal block X504 (option +L504).

Connect the inner twisted pair shields and all separate grounding wires to the grounding clamps below the control unit.

The drawing below represents a drive with additional I/O terminal block (option +L504). Without the block, the grounding is made the same way.

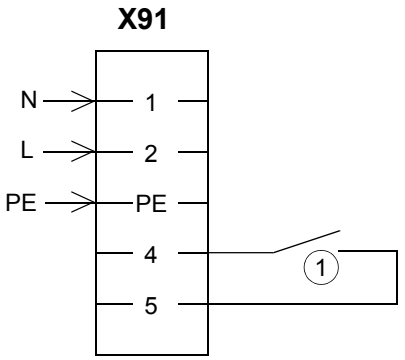
Notes:

- Do not ground the outer shield of the cable here since it is grounded at the lead-through.
- Keep any signal wire pairs twisted as close to the terminals as possible. Twisting the wire with its return wire reduces disturbances caused by inductive coupling.

At the other end of the cable, leave the shields unconnected or ground them indirectly via a high-frequency capacitor with a few nanofarads, eg. 3.3 nF / 630 V. The shield can also be grounded directly at both ends if they are in the same ground line with no significant voltage drop between the end points.

Connecting a 230/115 V AC auxiliary voltage supply (UPS, option +G307)

Wire the external control voltage to terminal block X91 at the back side of the mounting plate as shown below.



1 Internal wiring of UPS supervision: circuit breaker or fuse off/fault = contact open.

Connecting the emergency stop push buttons (options +Q951, +Q952, +Q963, +Q964)

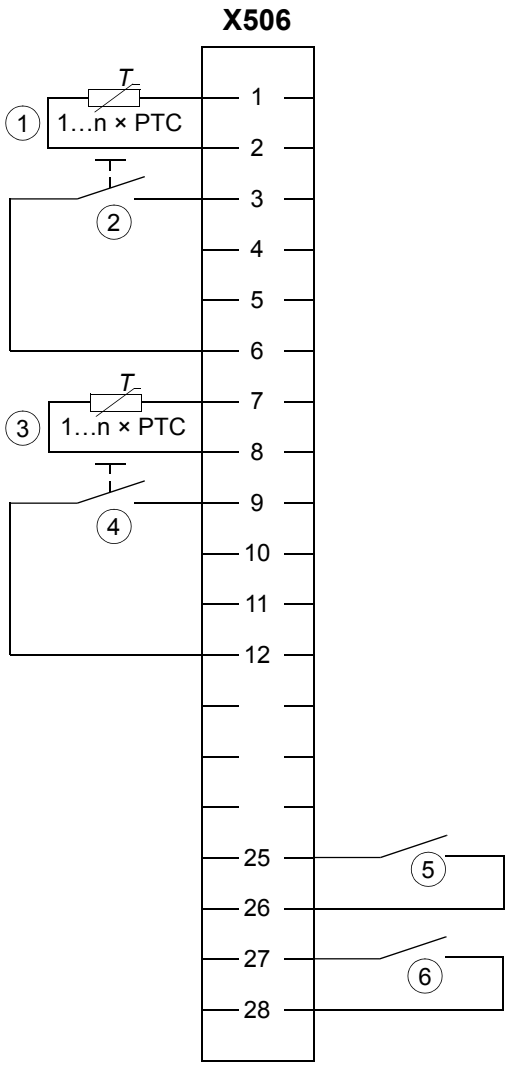
Connect external emergency stop push buttons according to the circuit diagrams delivered with the drive.

Wiring the starter for auxiliary motor fan (options +M602…+M610)

Connect the power supply wires for the auxiliary motor fan to terminal blocks X601…X610 according to the circuit diagrams delivered with the drive.

Wiring the thermistor relay(s) (options +L505 and +2L505)

The external wiring of option +2L505 (two thermistor relays) is shown below. For example, one relay can be used to monitor the motor windings, the other to monitor the bearings. The maximum contact load capacity is 250 V AC 10 A. For the actual wiring, see the circuit diagram delivered with the drive.



1 PTC sensors monitored by relay K74.
$R_G = R_1 + R_2 + R_N \leq 1.5$ kohm.

2 External reset for relay K74 (to be bridged for autoreset functionality)

3 PTC sensors monitored by relay K75.
$R_G = R_1 + R_2 + R_N \leq 1.5$ kohm.

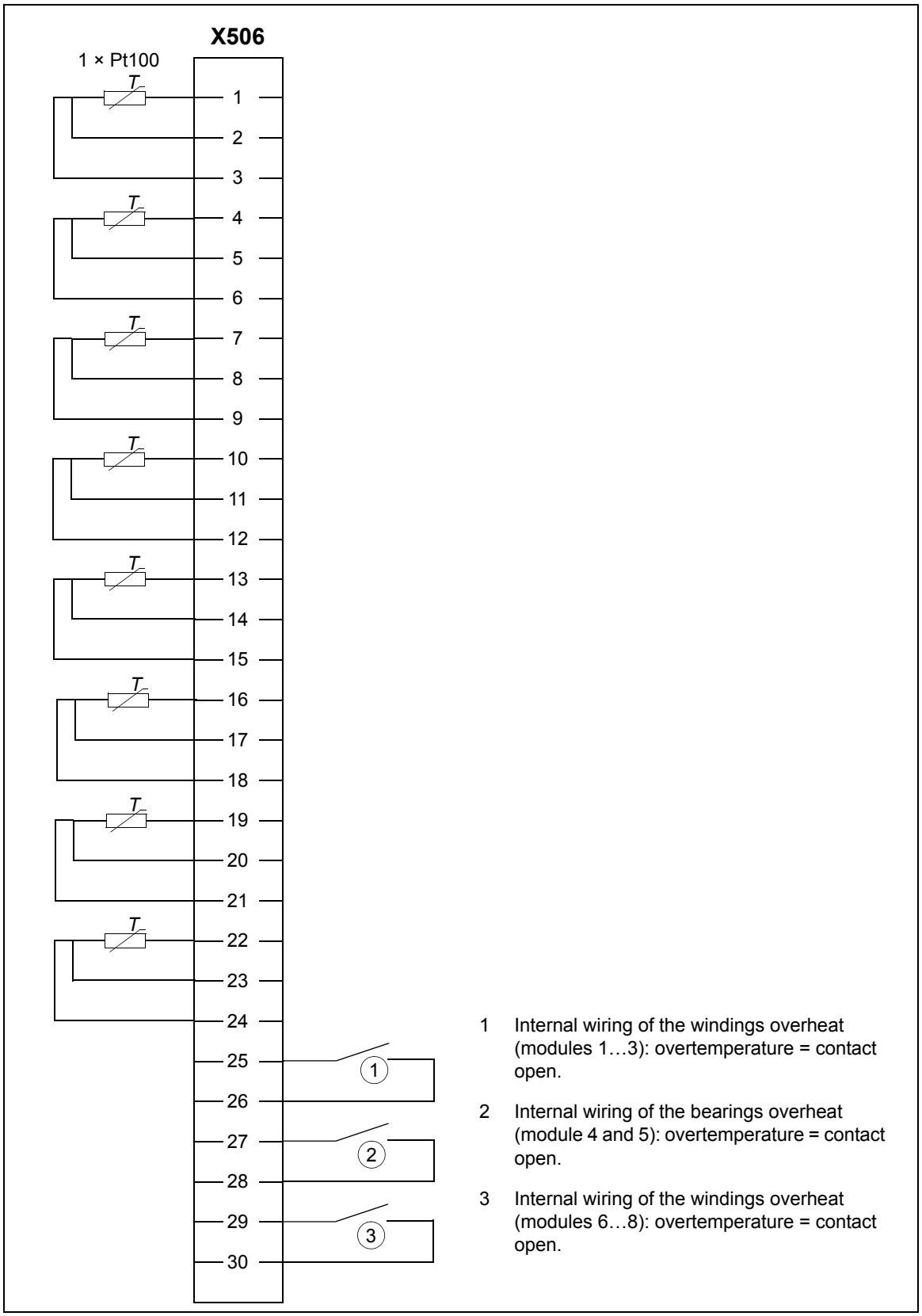
4 External reset for relay K75 (to be bridged for autoreset functionality)

5 Overheat indication from relay K74: overtemperature = contact open.

6 Overheat indication from relay K75: overtemperature = contact open.

Wiring the Pt100 relays (options +2L506, +3L506, +5L506 and +8L506)

External wiring of eight Pt100 sensor modules is shown below. Contact load capacity 250 V AC 10 A. For the actual wiring, see the circuit diagram delivered with the drive.



1 Internal wiring of the windings overheat (modules 1…3): overtemperature = contact open.

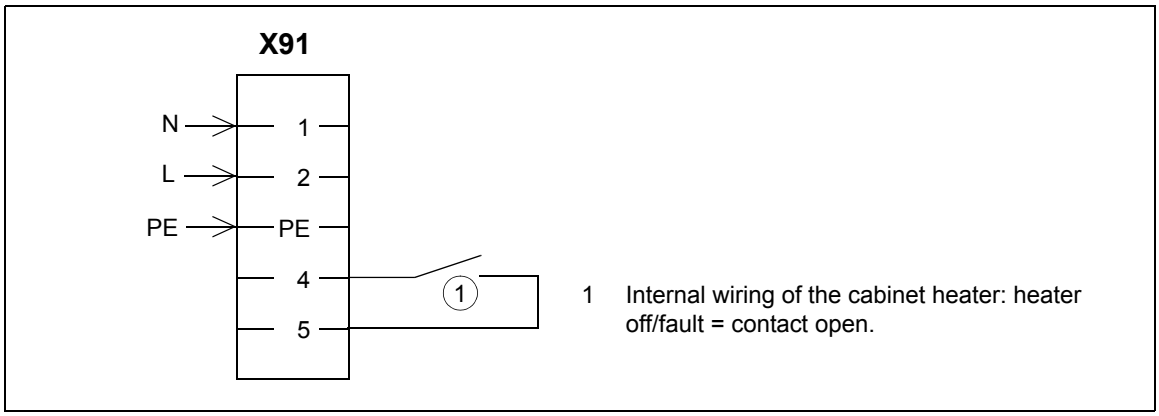
2 Internal wiring of the bearings overheat (module 4 and 5): overtemperature = contact open.

3 Internal wiring of the windings overheat (modules 6…8): overtemperature = contact open.

Powering the heating(options +G300)

See the circuit diagrams delivered with drive.

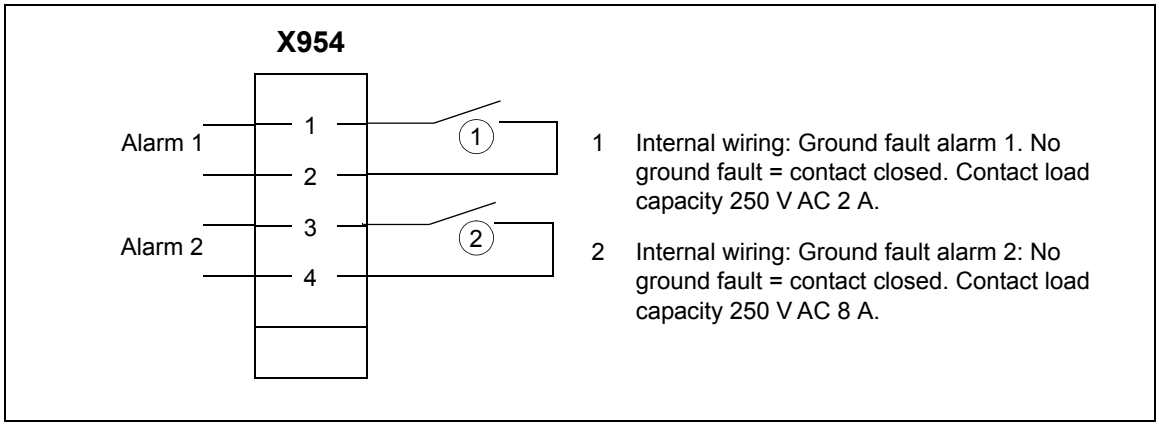
Connect the external power supply wires for the cabinet heater and lighting to terminal block X91 at the back of the mounting plate.



1 Internal wiring of the cabinet heater: heater off/fault = contact open.

Wiring ground fault monitoring for IT ungrounded systems (option +Q954)

We recommend to connect Alarm 1 for drive tripping and Alarm 2 for alarm signals in order to avoid unnecessary trippings due to the ground fault monitor self testing with Alarm 2.



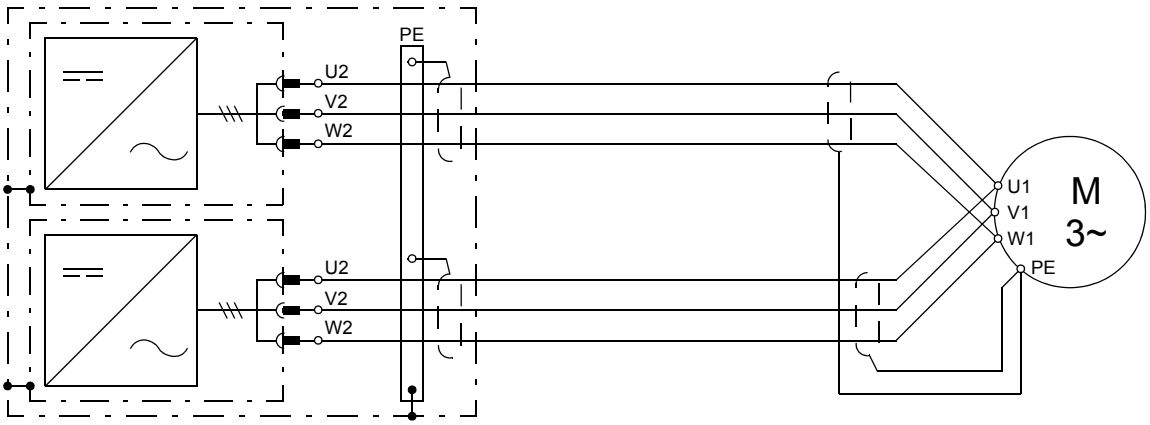
1 Internal wiring: Ground fault alarm 1. No ground fault = contact closed. Contact load capacity 250 V AC 2 A.

2 Internal wiring: Ground fault alarm 2: No ground fault = contact closed. Contact load capacity 250 V AC 8 A.

Connecting the motor cables (units without common motor terminal)

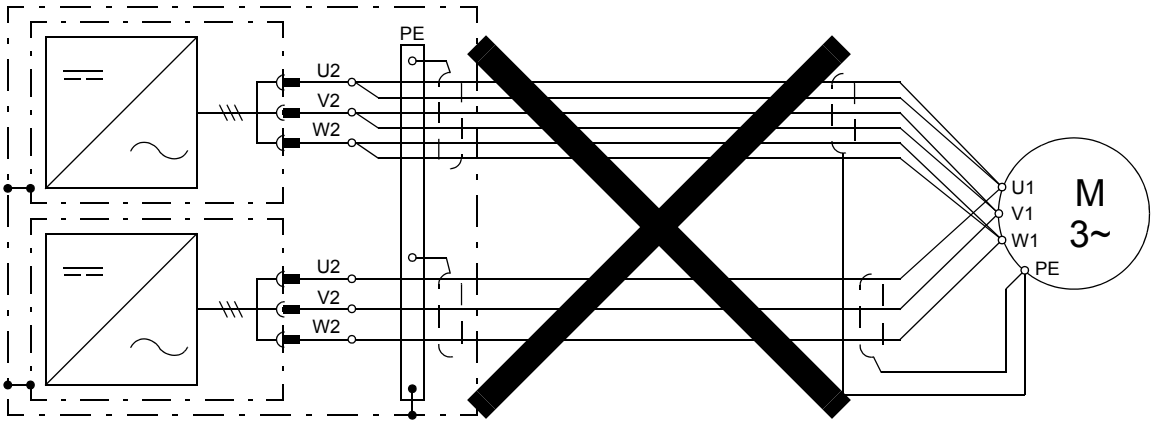
On units without a common motor terminal, the motor cables connect to busbars located aside of the module(s).

All parallel-connected modules are to be cabled separately to the motor. 360° earthing is to be used at cable lead-throughs. Motor cable should same and above 20m.



Module output

WARNING! The cabling from all inverter modules to the motor must be physically identical considering cable type, cross-sectional area, and length.

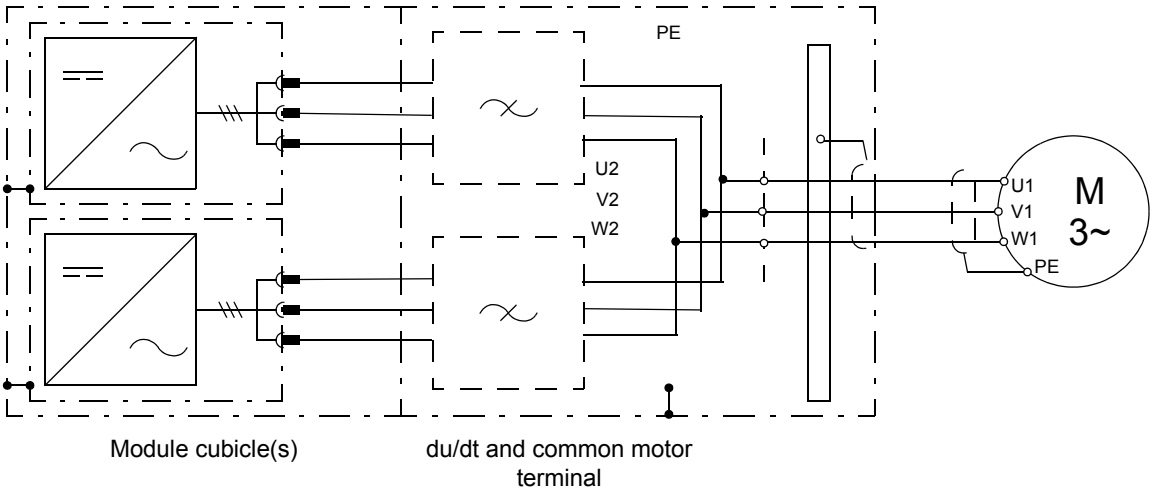


Module output

Connecting the motor cables (units with du/dt and common motor terminal)

If the drive is equipped with du/dt and common motor terminal, the motor cables connect to a common motor terminal.

Connection diagram

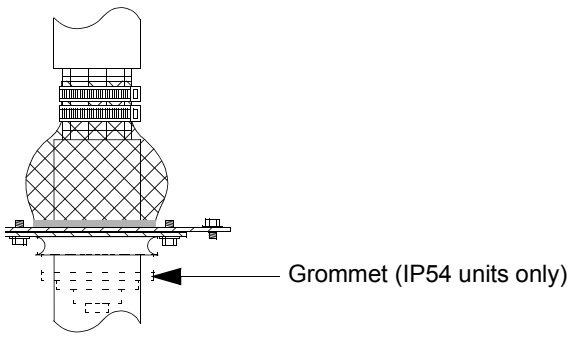


The recommended cable types are given in chapter *Guidelines for planning the electrical installation*.

Common guideline for connecting the motor cables

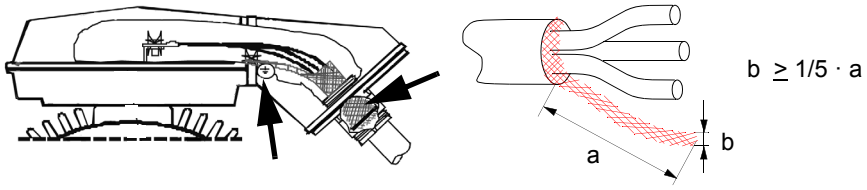
WARNING! Obey the instructions in chapter *Safety instructions*. If you ignore them, injury or death, or damage to the equipment can occur.

1. Do the steps in section *Precautions before electrical work* before you start the work.
2. Open the door of the common motor terminal or sine filter cubicle and remove the shrouding.
3. Lead the cables into the cubicle. Make the 360° earthing arrangement at the cable entry as shown.



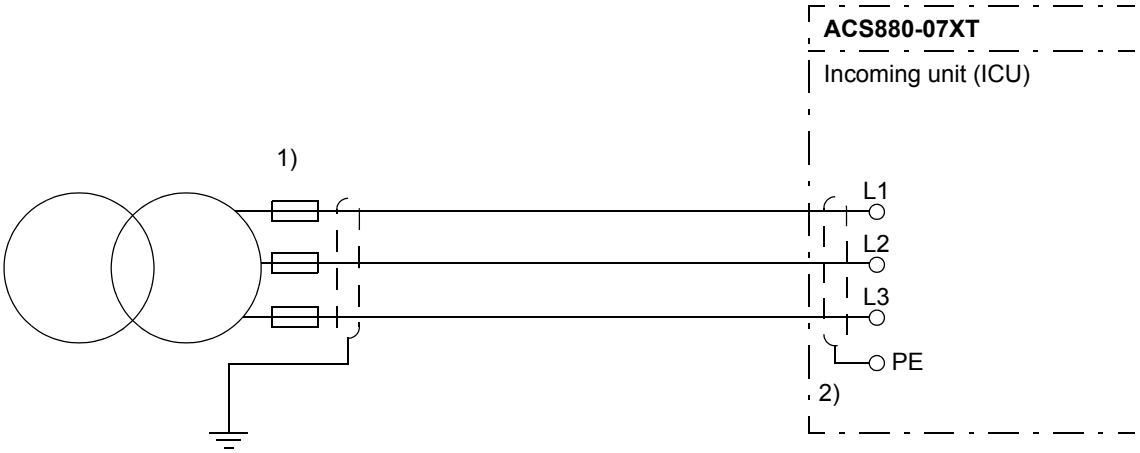
4. Cut the cables to suitable length. Strip the cables and conductors.
5. Twist the cable screens into bundles and connect the bundles to the PE busbar in the cubicle.

6. Connect any separate ground conductors/cables to the PE busbar in the cubicle.
7. Connect the phase conductors to the output terminals. Use the torques specified under *Tightening torques*.
8. Refit any shrouding removed earlier and close the cubicle doors.
9. At the motor, connect the cables according to instructions from the motor manufacturer. Pay special attention to the phase order. For minimum radio-frequency interference, ground the cable shield 360 degrees at the lead-through of the motor terminal box, or ground the cable by twisting the shield so that the flattened shield is wider than 1/5 of its length.



Connecting the input power cables

Connection diagram, 6-pulse units

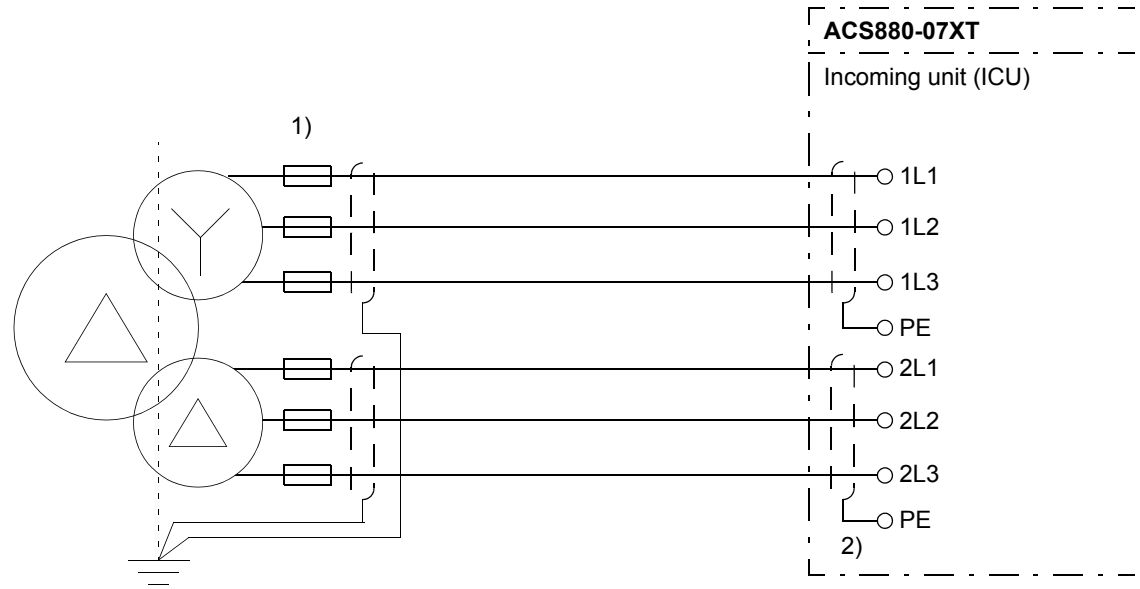


1) Fuses or other protection means.

2) 360-degree grounding is recommended if shielded cable is used. Ground the other end of the input cable shield or PE conductor at the distribution board.

Note: Use a separate grounding PE cable (1a) or a cable with a separate PE conductor (1b) if the conductivity of the shield does not meet the requirements for the PE conductor.

Connection diagram, 12-pulse units



1) Fuses or other protection means.

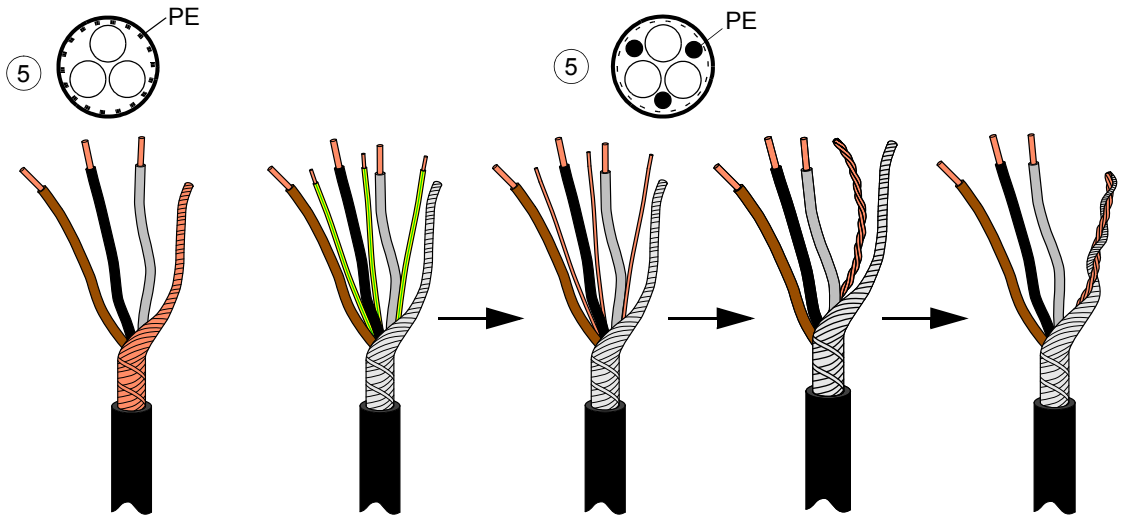
2) 360-degree grounding is recommended if shielded cable is used. Ground the other end of the input cable shield or PE conductor at the distribution board.

Note: Use a separate grounding PE cable (1a) or a cable with a separate PE conductor (1b) if the conductivity of the shield does not meet the requirements for the PE conductor.

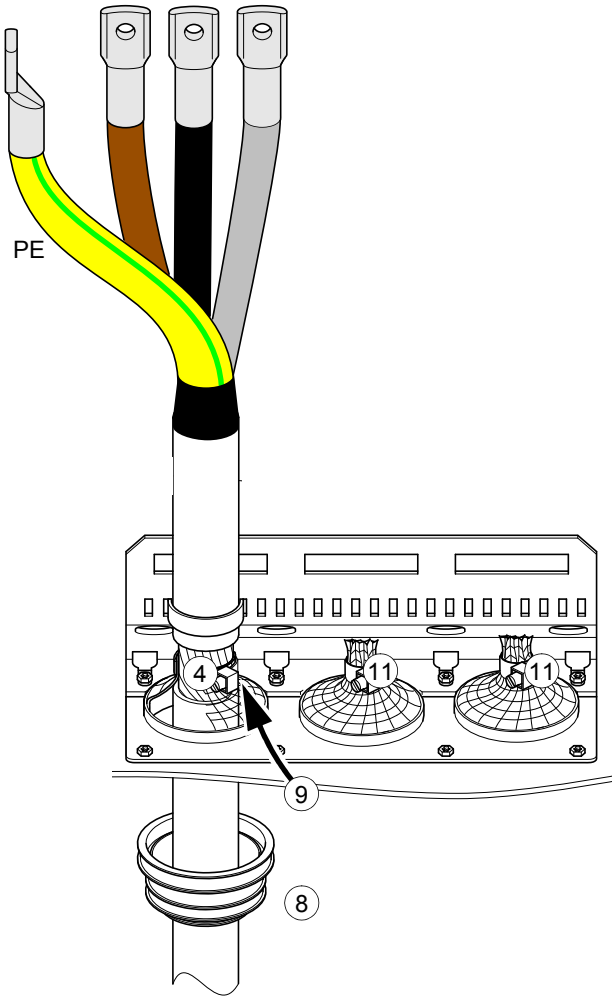
Connection procedure

WARNING! Obey the instructions in chapter *Safety instructions*. If you ignore them, injury or death, or damage to the equipment can occur.

1. Do the steps in section *Precautions before electrical work* before you start the work.
2. Open the door of the incoming cubicle (ICU).
3. Remove the shrouding covering the input terminals.
4. Peel off 3 to 5 cm of the outer insulation of the cables above the lead-through plate for 360° high-frequency grounding.
5. Prepare the ends of the cables.



6. If fire insulation is used, make an opening in the mineral wool sheet according to the diameter of the cable.
7. For IP22, IP42 drives: Slide the cables through the lead-throughs with the conductive sleeves.
8. For IP54 drives: Remove the rubber grommets from the lead-through plate for the cables to be connected. Cut adequate holes into the rubber grommets. Slide the grommets onto the cables. Slide the cables through the lead-throughs with the conductive sleeves and attach the grommets to the holes.
9. Fasten the conductive sleeves to the cable shields with cable ties.
10. Seal the slot between the cable and mineral wool sheet (if used) with sealing compound.
11. Tie up the unused conductive sleeves with cable ties.
12. Connect the twisted shields of the cables to the PE busbar of the cabinet.
13. Connect the phase conductors of the input cable to the L1, L2 and L3 terminals. (With 12-pulse connection, the terminals are 1L1, 1L2 and 1L3 for one 6-pulse supply line, 2L1, 2L2 and 2L3 for the other.).
14. Reinstall the shrouding removed earlier.
15. Close the door.


PE
4
11
11
9
8

Connecting a PC

A PC (with eg. the Drive composer PC tool) can be connected to the drive unit as follows:

1. Connect an ACS-AP-I control panel to the control unit either by using an Ethernet (eg. CAT5E) networking cable, or by inserting the panel into the panel holder (if present).

WARNING! Do not connect the PC directly to the control panel connector of the inverter unit as this can cause damage.

2. Remove the USB connector cover on the front of the control panel.
3. Connect an USB cable (Type A to Type Mini-B) between the USB connector on the control panel (3a) and a free USB port on the PC (3b).
4. The panel will display an indication whenever the connection is active.



5. See the documentation of the PC tool for setup instructions.

Installing option modules

Mechanical installation of I/O extension, fieldbus adapter and pulse encoder interface modules

Install the option modules as follows:



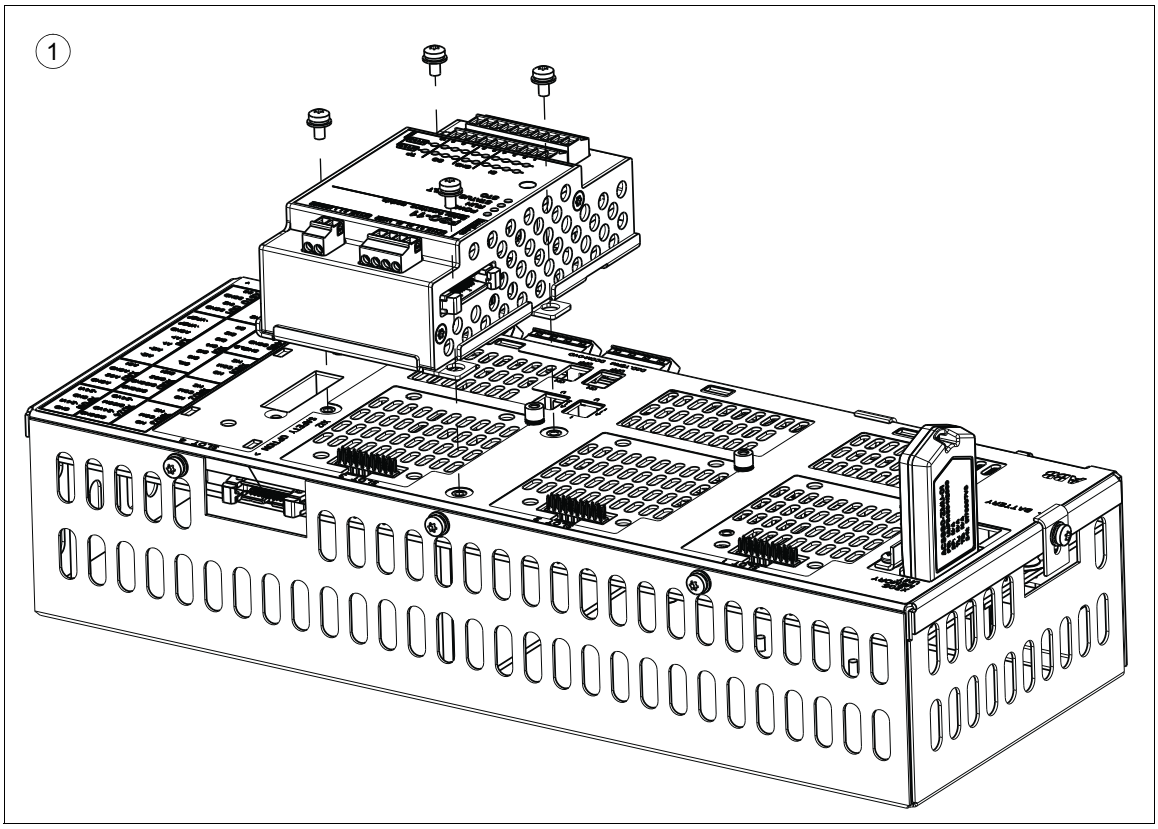
WARNING! Obey the instructions in chapter *Safety instructions*. If you ignore them, injury or death, or damage to the equipment can occur.

1. Stop the drive and do the steps in section *Precautions before electrical work* before you start the work.
2. Open the door of the auxiliary control cubicle.
3. Remove the shrouding at the top of the cubicle.
4. Locate the control unit (A41).
5. Insert the module carefully into its position on the control unit.
6. Fasten the mounting screw. **Note:** The screw tightens the connections and grounds the module. It is essential for fulfilling the EMC requirements and for proper operation of the module.

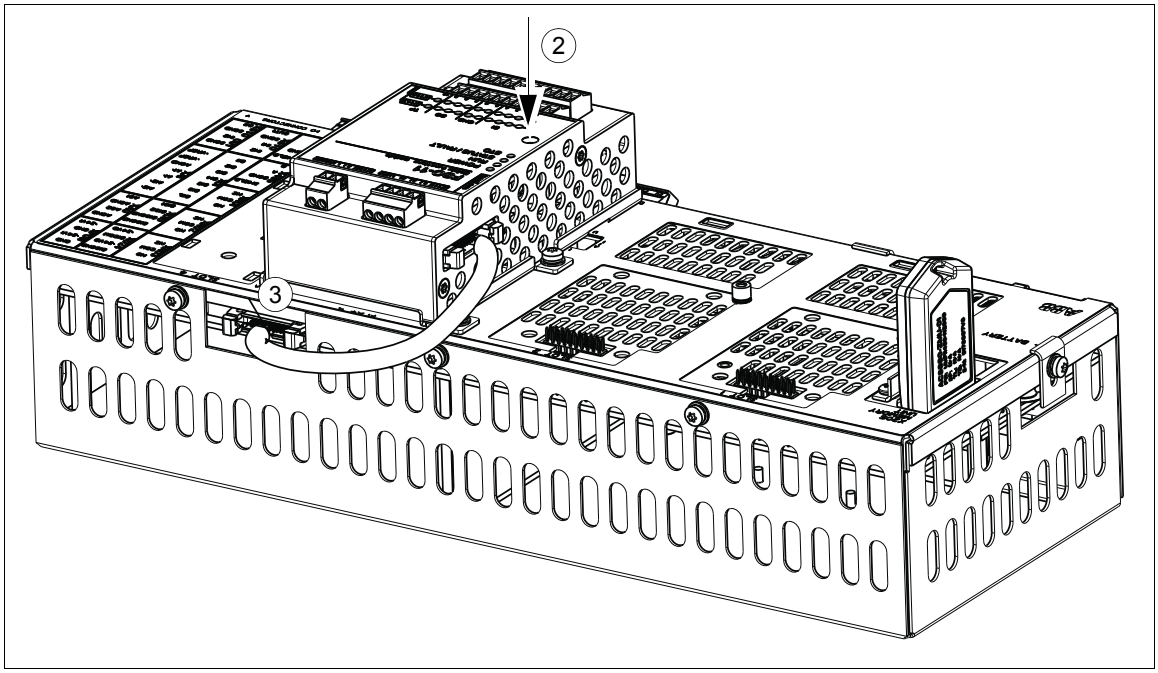
Mechanical installation of an FSO-xx safety functions module

This procedure describes the mechanical installation of an FSO-xx safety functions module onto the inverter control unit. (The FSO-xx can alternatively be installed beside the control unit, which is the standard with factory-installed FSO-xx modules. For instructions, see the FSO-xx manual.)

1. Fasten the module onto slot 3 of the control unit (A41) with four screws.



2. Tighten the FSO-xx electronics grounding screw.
3. Connect the FSO-xx data cable between FSO-xx connector X110 and to BCU-02 connector X12.



Wiring of optional modules

See the appropriate optional module manual for specific installation and wiring instructions.



7

Control units of the drive

What this chapter contains

This chapter

- describes the connections of the control units used in the drive,
- contains the specifications of the inputs and outputs of the control units.

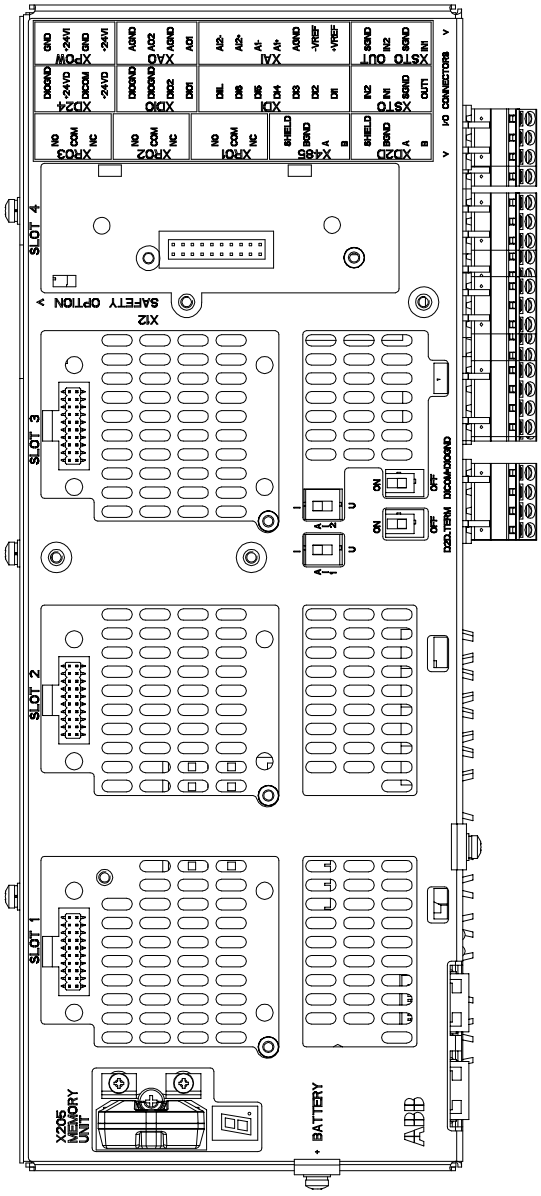
General

The ACS880-07XT drive utilizes BCU-02 control units. The BCU-02 consists of a BCON-12 control board (and a BIOC-01 I/O connector board and power supply board) built in a metal housing.

ACS880-07XT is controlled by a dedicated BCU-02 control unit. The designation of the control unit is A41. It connect to the modules by fiber optic cables.

In this manual, the name “BCU-x2” or “BCU-02” represents the control unit types BCU-02.

Control unit layout and connections



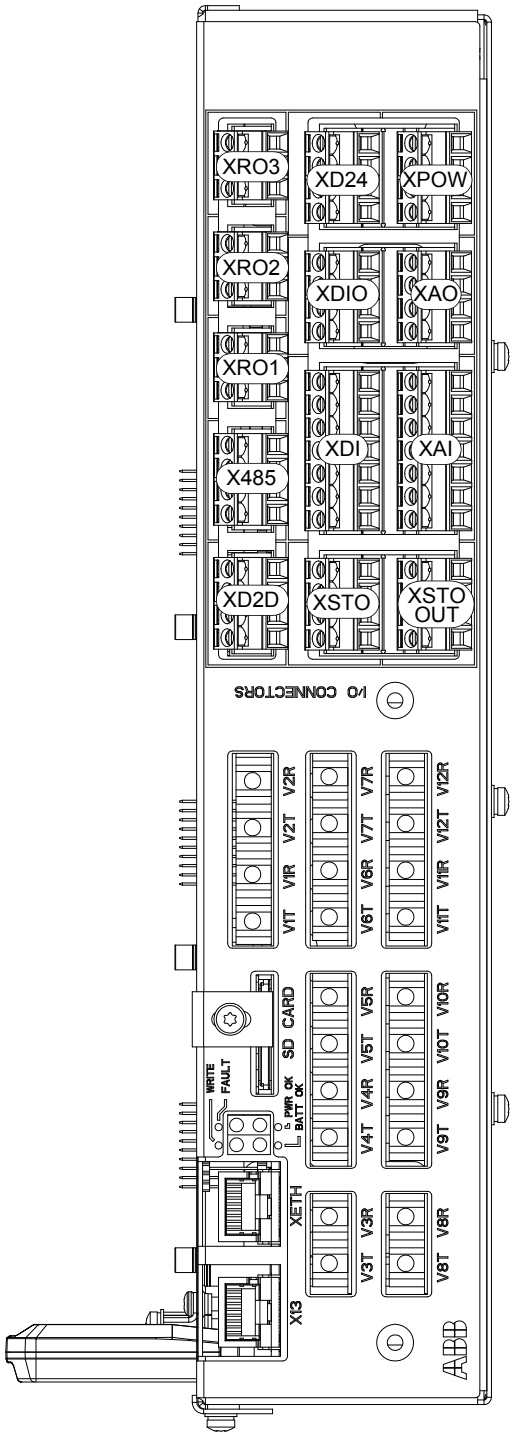
	Description
I/O	I/O terminals (see following diagram)

SLOT 1	I/O extension, encoder interface or fieldbus adapter module connection. (This is the sole location for an FDPI-02 diagnostics and panel interface.)
SLOT 2	I/O extension, encoder interface or fieldbus adapter module connection
SLOT 3	I/O extension, encoder interface, fieldbus adapter or FSO-xx safety functions module connection
SLOT 4	RDCO-0x DDCS communication option module connection

X205	Memory unit connection
BATTERY	Holder for real-time clock battery (CR 2032)

AI1	Mode selector for analog input AI1 (I = current, U = voltage)
AI2	Mode selector for analog input AI2 (I = current, U = voltage)
D2D TERM	Termination switch for drive-to-drive link (D2D)
DICOM= DIOGND	Ground selection. Determines whether DICOM is separated from DIOGND (ie. the common reference for the digital inputs floats).

7-segment display Multicharacter indications are displayed as repeated sequences of characters	
o	(“U” is indicated briefly before “o”.) Control program startup in progress
U	(Flashing) Firmware cannot be started. Memory unit missing or corrupted
L	Firmware download from PC to control unit in progress
1	At power-up, the display may show short indications of eg. “1”, “2”, “b” or “U”. These are normal indications immediately after power-up. If the display ends up showing any other value than those described, it indicates a hardware failure.
2	



	Description
XAI	Analog inputs
XAO	Analog outputs
XDI	Digital inputs, Digital input interlock (DIIL)
XDIO	Digital input/outputs
XD2D	Drive-to-drive link
XD24	+24 V output (for digital inputs)
XETH	Ethernet port (eg. for PC communication)
XPOW	External power input
XRO1	Relay output RO1
XRO2	Relay output RO2
XRO3	Relay output RO3
XSTO	Safe torque off connection (input signals)
XSTO OUT	Safe torque off connection (to inverter modules)
X13	Control panel / PC connection
X485	Not in use

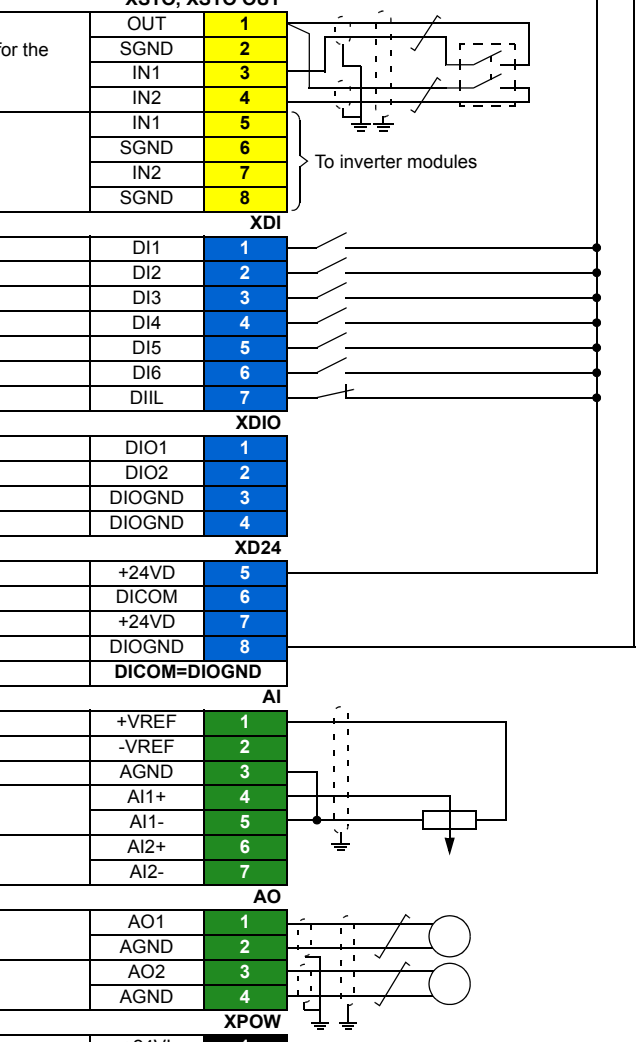
V1T/V1R, V2T/V2R	Fiber optic connection to inverter modules 1 and 2 (VxT = transmitter, VxR = receiver)
V3T/V3R … V7T/V7R	Fiber optic connection to inverter modules 3…7 (BCU-12/22 only) (VxT = transmitter, VxR = receiver)
V8T/V8R … V12T/V12R	Fiber optic connection to inverter modules 8…12 (BCU-22 only) (VxT = transmitter, VxR = receiver)

SD CARD	Data logger memory card for inverter module communication

BATT OK	Real-time clock battery voltage is higher than 2.8 V. If the LED is off when the control unit is powered, replace the battery.
FAULT	The control program has generated a fault. See the firmware manual of the inverter unit.
PWR OK	Internal voltage supply is OK
WRITE	Writing to memory card in progress. Do not remove the memory card.

Default I/O diagram of the control unit (A41)

Drive-to-drive link		**XD2D**
Drive-to-drive link [1]	B	1
	A	2
	BGND	3
	Shield	4
RS485 connection		**X485**
Not in use	B	5
	A	6
	BGND	7
	Shield	8
Relay outputs		**XRO1…XRO3**
Ready 250 V AC / 30 V DC 2 A	NC	11
	COM	12
	NO	13
Running 250 V AC / 30 V DC 2 A	NC	21
	COM	22
	NO	23
Faulted(-1) 250 V AC / 30 V DC 2 A	NC	31
	COM	32
	NO	33
Safe torque off		**XSTO, XSTO OUT**
Safe torque off input. Both circuits must be closed for the drive to start. [2]	OUT	1
	SGND	2
	IN1	3
	IN2	4
Safe torque off output to inverter modules [2]	IN1	5
	SGND	6
	IN2	7
	SGND	8
Digital inputs		**XDI**
Stop (0) / Start (1)	DI1	1
Forward (0) / Reverse (1)	DI2	2
Reset	DI3	3
Acceleration & deceleration select [3]	DI4	4
Constant speed 1 select (1 = on) [4]	DI5	5
By default not in use.	DI6	6
Run enable [5]	DIIL	7
Digital input/outputs		**XDIO**
Output: Ready	DIO1	1
Output: Running	DIO2	2
Digital input/output ground	DIOGND	3
Digital input/output ground	DIOGND	4
Auxiliary voltage output		**XD24**
+24 V DC 200 mA [6]	+24VD	5
Digital input ground	DICOM	6
+24 V DC 200 mA [6]	+24VD	7
Digital input/output ground	DIOGND	8
Ground selection switch [7]	**DICOM=DIOGND**	
Analog inputs, reference voltage output		**AI**
10 V DC, R_L 1…10 kohm	+VREF	1
-10 V DC, R_L 1…10 kohm	-VREF	2
Ground	AGND	3
Speed reference 0(2)…10 V, R_{in} > 200 kohm [8]	AI1+	4
	AI1-	5
By default not in use. 0(4)…20 mA, R_{in} = 100 ohm [9]	AI2+	6
	AI2-	7
Analog outputs		**AO**
Motor speed rpm 0…20 mA, R_L < 500 ohm	AO1	1
	AGND	2
Motor current 0…20 mA, R_L < 500 ohm	AO2	3
	AGND	4
External power input		**XPOW**
24 V DC, 2.05 A Two supplies can be connected for redundancy.	+24VI	1
	GND	2
	+24VI	3
	GND	4
Safety functions module connection		**X12**
Control panel connection		**X13**
Memory unit connection		**X205**



Notes:

The wire size accepted by all screw terminals (for both stranded and solid wire) is 0.5 … 2.5 mm^2 (24…12 AWG). The torque is 0.5 N·m (5 lbf·in).

[1] See section *Drive-to-drive link (XD2D)*.

[2] See chapter *Safe torque off function*.

[3] 0 = Acceleration/deceleration ramps defined by parameters 23.12/23.13 in use.
1 = Acceleration/deceleration ramps defined by parameters 23.14/23.15 in use.

[4] Constant speed 1 is defined by parameter 22.26.

[5] See section *DIIL input* (page *100*).

[6] Total load capacity of these outputs is 4.8 W (200 mA at 24 V) minus the power taken by DIO1 and DIO2.

[7] Determines whether DICOM is separated from DIOGND (ie. common reference for digital inputs floats; in practice, selects whether the digital inputs are used in current sinking or sourcing mode). See also *Ground isolation diagram*.
DICOM=DIOGND ON: DICOM connected to DIOGND. OFF: DICOM and DIOGND separate.

[8] Current [0(4)…20 mA, R_{in} = 100 ohm] or voltage [0(2)…10 V, R_{in} > 200 kohm] input selected by switch **AI1**. Change of setting requires reboot of control unit.

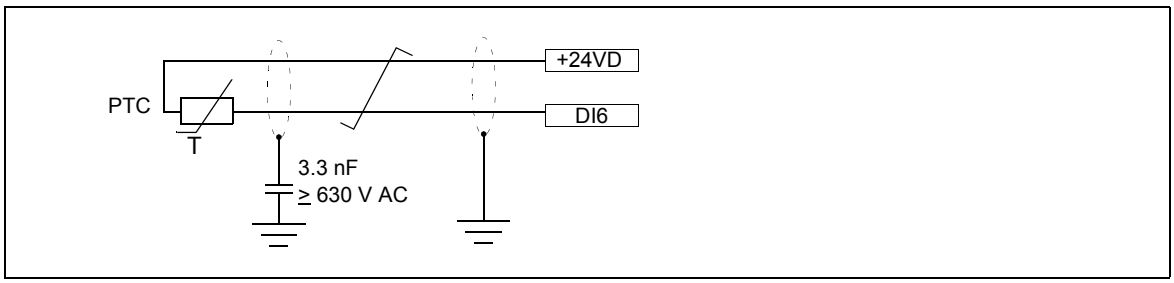
[9] Current [0(4)…20 mA, R_{in} = 100 ohm] or voltage [0(2)…10 V, R_{in} > 200 kohm] input selected by switch **AI2**. Change of setting requires reboot of control unit.

External power supply for the control unit (XPOW)

The BCU-x2 is powered from a 24 V DC, 2 A supply through terminal block XPOW. A second supply can be connected to the same terminal block for redundancy.

DI6 as a PTC sensor input

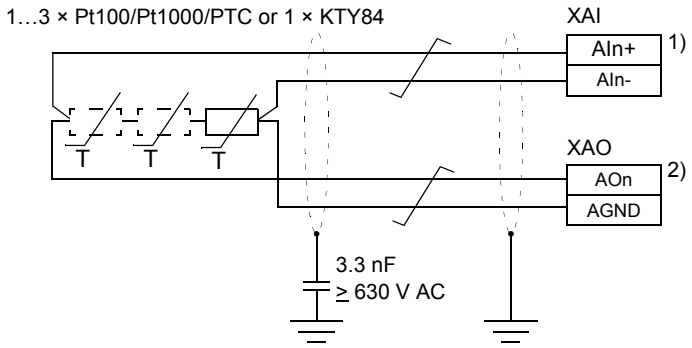
A PTC sensor can be connected to this input for motor temperature measurement as follows. The sensor can alternatively be connected to FEN-xx encoder interface module. Do not connect both ends of the cable shield directly to ground. If a capacitor cannot be used at one end, leave that end of the shield unconnected. See the firmware manual for parameter settings.



WARNING! As the inputs pictured above are not insulated according to IEC 60664, the connection of the motor temperature sensor requires double or reinforced insulation between motor live parts and the sensor. If the assembly does not fulfill the requirement, the I/O board terminals must be protected against contact and must not be connected to other equipment or the temperature sensor must be isolated from the I/O terminals.

AI1 or AI2 as a Pt100, Pt1000 or KTY84 sensor input

Three Pt100/Pt1000 sensors or one KTY84 sensor for motor temperature measurement can be connected between an analog input and output as shown below. (Alternatively, you can connect the KTY to an FIO-11 or FAIO-01 analog I/O extension module or FEN-xx encoder interface module.) Do not connect both ends of the cable shields directly to ground. If a capacitor cannot be used at one end, leave that end of the shield unconnected.



1) For AI1, set input type to voltage with switch AI1. For AI2, set input type with switch AI2. Set the appropriate analog input unit to V (volt) in parameter group **12 Standard AI**.
2) Select the excitation mode in parameter group **13 Standard AO**.

WARNING! As the inputs pictured above are not insulated according to IEC 60664, the connection of the motor temperature sensor requires double or reinforced insulation between motor live parts and the sensor. If the assembly does not fulfill the requirement, the I/O board terminals must be protected against contact and must not be connected to other equipment or the temperature sensor must be isolated from the I/O terminals.

DIIL input

On both the supply and inverter units, the DIIL input is used for the connection of safety circuits. The input is parametrized to stop the unit when the input signal is lost.

Drive-to-drive link (XD2D)

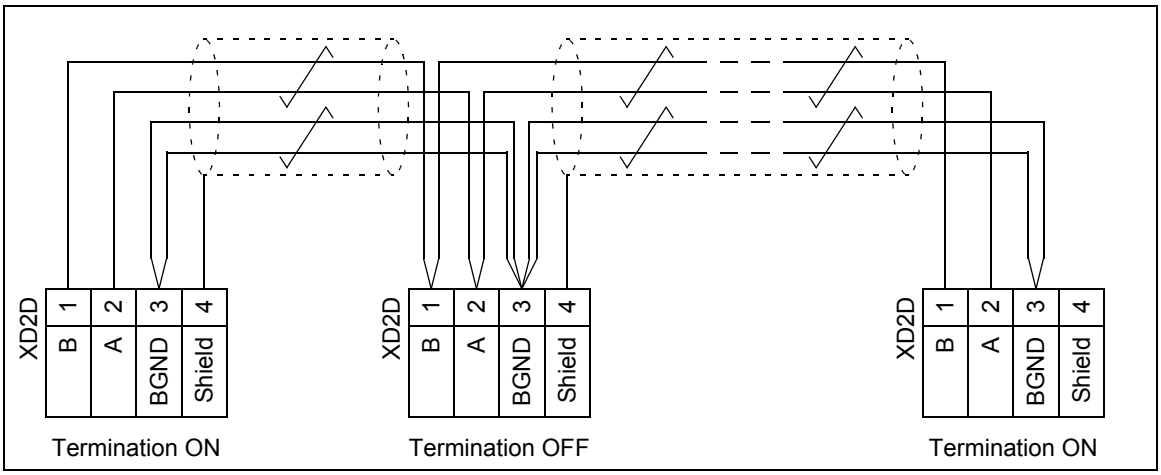
The drive-to-drive link is a daisy-chained RS-485 transmission line that allows basic master/follower communication with one master drive and multiple followers.

Enable bus termination on the inverters at the ends of the drive-to-drive link by setting switch D2D TERM on the control unit to ON. On intermediate inverters, disable bus termination.

Use shielded twisted-pair cable (~100 ohm, for example, PROFIBUS-compatible cable) for the wiring. For best immunity, high quality cable is recommended. Keep the cable as short

as possible; the maximum length of the link is 50 meters (164 ft). Avoid unnecessary loops and running the cable near power cables (such as motor cables). Ground the cable shields as described in section *Connecting the control cables* on page *77*.

The following diagram shows the wiring of the drive-to-drive link.



Safe torque off (XSTO, XSTO OUT)

On the inverter control unit (A41), the XSTO input can be used to implement a safe torque off (STO) function. For the drive to start, both connections (OUT1 to IN1 and IN2) must be closed. By default, the terminal block has jumpers to close the circuit. Remove the jumpers before connecting an external Safe torque off circuit to the drive. For information on the implementation of a Safe torque off function, see chapter *Safe torque off function* (page *151*).

The XSTO OUT connector is wired to the STO IN connector of one inverter module. In case the inverter unit consists of multiple modules, the STO OUT connector of one module is wired to the STO IN connector of the next module etc. so that all modules are part of the chain.

SDHC memory card slot

The BCU-x2 has an on-board data logger that collects real-time data from the power modules to help fault tracing and analysis. The data is stored onto the SDHC memory card inserted into the SD CARD slot and can be analyzed by ABB service personnel.

Control unit connector data

Power supply (XPOW)

Connector pitch 5 mm, wire size 2.5 mm^2
24 V (±10%) DC, 2 A
External power input. Two supplies can be connected for redundancy.

Relay outputs RO1…RO3 (XRO1…XRO3)

Connector pitch 5 mm, wire size 2.5 mm^2
250 V AC / 30 V DC, 2 A
Protected by varistors

+24 V output (XD24:2 and XD24:4)

Connector pitch 5 mm, wire size 2.5 mm^2
Total load capacity of these outputs is 4.8 W (200 mA / 24 V) minus the power taken by DIO1 and DIO2.

Digital inputs DI1…DI6 (XDI:1…XDI:6)

Connector pitch 5 mm, wire size 2.5 mm^2
24 V logic levels: “0” < 5 V, “1” > 15 V
R_{in}: 2.0 kohm
Input type: NPN/PNP (DI1…DI5), NPN (DI6)
Hardware filtering: 0.04 ms, digital filtering up to 8 ms
DI6 (XDI:6) can alternatively be used as an input for a PTC sensor.
“0” > 4 kohm, “1” < 1.5 kohm
I_{max}: 15 mA (DI1…DI5), 5 mA (DI6)

Start interlock input DIIL (XDI:7)

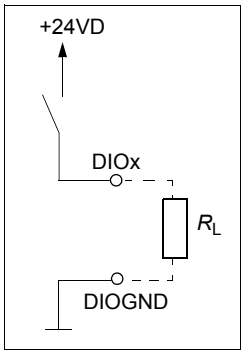
Connector pitch 5 mm, wire size 2.5 mm^2
24 V logic levels: “0” < 5 V, “1” > 15 V
R_{in}: 2.0 kohm
Input type: NPN/PNP
Hardware filtering: 0.04 ms, digital filtering up to 8 ms

Digital inputs/outputs DIO1 and DIO2 (XDIO:1 and XDIO:2)

Input/output mode selection by parameters.

DIO1 can be configured as a frequency input (0…16 kHz with hardware filtering of 4 microseconds) for 24 V level square wave signal (sinusoidal or other wave form cannot be used). DIO2 can be configured as a 24 V level square wave frequency output. See the firmware manual, parameter group 11.

Connector pitch 5 mm, wire size 2.5 mm^2
As inputs:
24 V logic levels: “0” < 5 V, “1” > 15 V
R_{in}: 2.0 kohm
Filtering: 1 ms
As outputs:
Total output current from +24VD is limited to 200 mA



Reference voltage for analog inputs +VREF and -VREF (XAI:1 and XAI:2)

Connector pitch 5 mm, wire size 2.5 mm^2
10 V ±1% and –10 V ±1%, R_{load} 1…10 kohm
Maximum output current: 10 mA

Analog inputs AI1 and AI2 (XAI:4 … XAI:7).

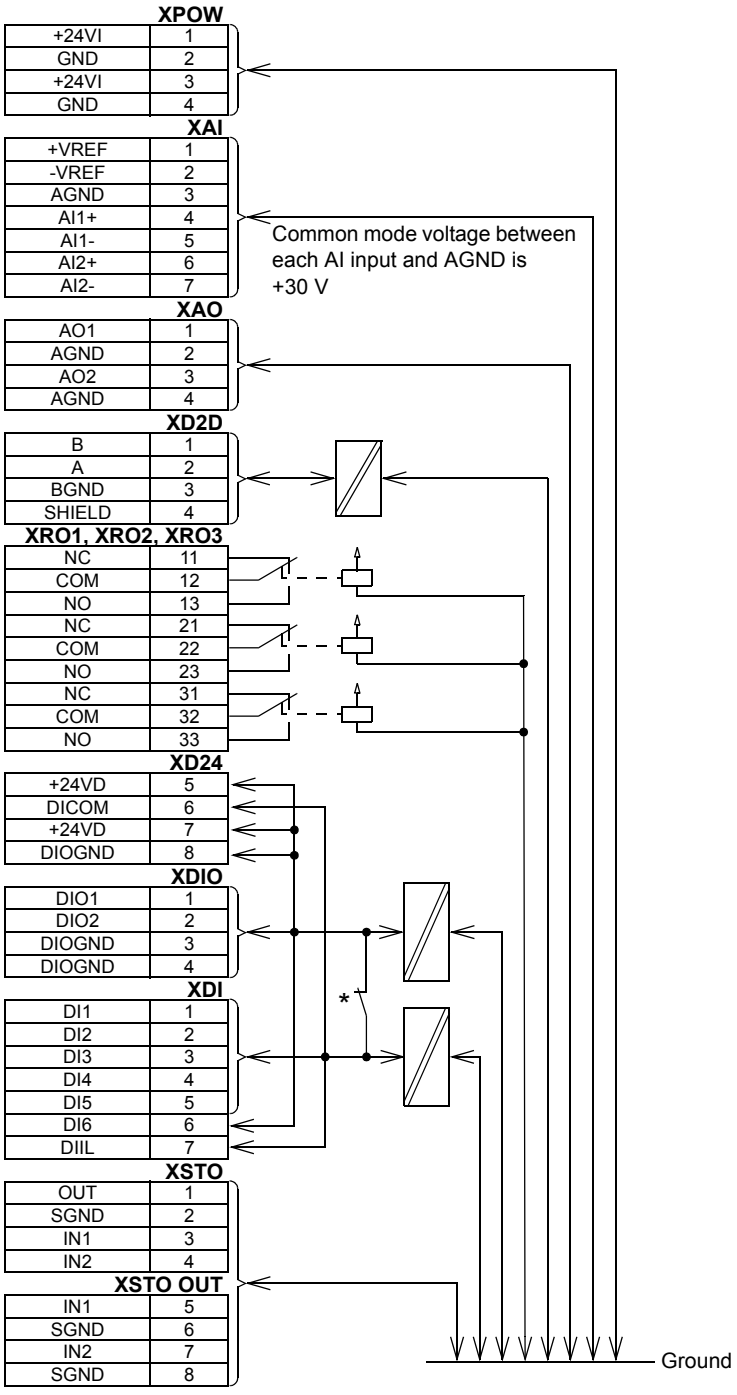
Current/voltage input mode selection by switches.

Connector pitch 5 mm, wire size 2.5 mm^2
Current input: –20…20 mA, R_{in} = 100 ohm
Voltage input: –10…10 V, R_{in} > 200 kohm
Differential inputs, common mode range ±30 V
Sampling interval per channel: 0.25 ms
Hardware filtering: 0.25 ms, adjustable digital filtering up to 8 ms
Resolution: 11 bit + sign bit
Inaccuracy: 1% of full scale range

Analog outputs AO1 and AO2 (XAO)	Connector pitch 5 mm, wire size 2.5 mm^2 0…20 mA, R_{load} < 500 ohm Frequency range: 0…500 Hz Resolution: 11 bit + sign bit Inaccuracy: 2% of full scale range
Drive-to-drive link (XD2D)	Connector pitch 5 mm, wire size 2.5 mm^2 Physical layer: RS-485 Termination by jumper
RS-485 connection (X485)	Connector pitch 5 mm, wire size 2.5 mm^2 Physical layer: RS-485
Safe torque off connection (XSTO)	Connector pitch 5 mm, wire size 2.5 mm^2 Input voltage range: -3…30 V DC Logic levels: “0” < 5 V, “1” > 17 V For the unit to start, both connections must be “1” Current consumption: 66 mA (continuous) per STO channel per R8i inverter module EMC (immunity) according to IEC 61326-3-1
Safe torque off output (XSTO OUT)	Connector pitch 5 mm, wire size 2.5 mm^2 To STO connector of inverter module. See chapter *Safe torque off function* (page *151*).
Control panel connection (X13)	Connector: RJ-45 Cable length < 3 m
Ethernet connection (XETH)	Connector: RJ-45
SDHC memory card slot (SD CARD)	Memory card type: SDHC Maximum memory size: 4 GB

The terminals of the control unit fulfill the Protective Extra Low Voltage (PELV) requirements. The PELV requirements of a relay output are not fulfilled if a voltage higher than 48 V is connected to the relay output.

Ground isolation diagram



***Ground selector (DICOM=DIOGND) settings**

DICOM=DIOGND: ON All digital inputs share a common ground (DICOM connected to DIOGND). This is the default setting.
DICOM=DIOGND: OFF Ground of digital inputs DI1…DI5 and DIIL (DICOM) is isolated from DIO signal ground (DIOGND). Isolation voltage 50 V.

8

Installation checklist

Contents of this chapter

This chapter contains an installation checklist which you must complete before you start up the drive.

Warnings



WARNING! Obey the instructions in chapter *Safety instructions*. If you ignore them, injury or death, or damage to the equipment can occur.

Checklist

Do the steps in section *Precautions before electrical work* before you start the work. Go through the checklist together with another person..

Check that …	☑
The ambient operating conditions meet the specifications given in chapter *Technical data*.	☐
The drive cabinet has been fixed to floor, and if necessary due to vibration etc, also from top to the wall or roof.	☐
The cooling air will flow freely in and out of the drive cabinet,	☐
If the drive will be connected to an IT (ungrounded) or a corner grounded TN network: The optional EMC filter (+E201) of the drive (if any) has been disconnected.	☐
If the drive has been stored over one year: The electrolytic DC capacitors in the DC link of the drive have been reformed. See *Converter module capacitor reforming instructions* (3BFE64059629 [English]).	☐

Check that …	☑
There is an adequately sized protective earth (ground) conductor between the drive and the switchboard, and the conductor has been connected to appropriate terminal. Proper grounding has also been measured according to the regulations.	☐
There is an adequately sized protective earth (ground) conductor between the motor and the drive, and the conductor has been connected to appropriate terminal. Proper grounding has also been measured according to the regulations.	☐
Only for drives with option +D150: There is an adequately sized protective earth (ground) conductor between the user-installed brake resistor and the drive, and the conductor has been connected to appropriate terminal. Proper grounding has also been measured according to the regulations.	☐
The supply voltage matches the nominal input voltage of the drive. Check the type designation label.	☐
The voltage setting of the auxiliary voltage transformers T21 (standard), T101 (option-specific) and T111 (option-specific) is correct.	☐
The input power cable has been connected to the appropriate terminals, the phase order is right, and the terminals have been tightened. (Pull the conductors to check.)	☐
The motor cable has been connected to the appropriate terminals, the phase order is right, and the terminals have been tightened. (Pull the conductors to check.)	☐
The motor cable (and brake resistor cable, if present) has been routed away from other cables.	☐
No power factor compensation capacitors have been connected to the motor cable.	☐
The external brake resistor (if present) has been connected to the appropriate terminals, and the terminals have been tightened. (Pull the conductors to check.)	☐
The brake resistor cable has been routed away from other cables.	☐
The control cables have been connected to the appropriate terminals, and the terminals have been tightened. (Pull the conductors to check.)	☐
There are no tools, foreign objects or dust from drilling inside the drive.	☐
All shrouds and cover of the motor connection box are in place. Cabinet doors have been closed.	☐
The motor and the driven equipment are ready for start.	☐

9

Start-up

Contents of this chapter

This chapter contains the start-up procedure of the drive.

Start-up procedure

The tasks which are needed in certain cases only are marked with underlining, and option codes are given in brackets. Default device designations (if any) are given in brackets after the name, for example “main switch-disconnector [Q1]”. The same device designations are also used in the circuit diagrams, typically.

These instructions cannot and do not cover all possible start-up tasks of a customized drive. Always refer to the delivery-specific circuit diagrams when proceeding with the start-up.



WARNING! Only qualified electricians are allowed to do the work described in this chapter.

Note: For certain functional safety options (such as +Q951, +Q952, +Q963 and +Q964), the start-up instructions are given in their separate manuals rather than in this chapter. See the listing of manuals inside the front cover.

Action	☑
Safety	
WARNING! Obey the safety instructions during the start-up procedure. See chapter *Safety instructions.*	☐
Checks/Settings with no voltage connected	
Ensure that the disconnector of the supply transformer is locked to the off (0) position, ie. no voltage is, and cannot be connected to the drive inadvertently.	☐
Check that the main switch-disconnector (Q1.1) is switched off, or main breaker (Q1) racked out. **Note:** Some 12-pulse units are equipped with two switch-disconnectors or breakers – check that both are open before you proceed.	☐
Check that the grounding switch (Q9.1) (option +F259) is switched on. 12-pulse units have two switches, Q9.1 and Q9.2.	☐
Check the mechanical and electrical installation of the drive. See *Installation checklist.*	☐
Check the settings of breakers/switches in the auxiliary circuits. See the circuit diagrams delivered with the drive.	☐
Disconnect any unfinished or uninspected auxiliary voltage (115/230 V AC) cables that lead from the terminal blocks to the outside of the equipment.	☐
Check that both channels of the Safe torque off circuit connected to the STO inputs of control unit [A41] are closed. Refer to the wiring diagrams delivered with the drive.	☐
If the Safe torque off functionality is used, check that the STO OUT output on the inverter control unit (A41) is chained to the STO inputs of all modules. If the Safe torque off functionality is not used, check that the STO input on all inverter modules is correctly wired to +24 V and ground.	☐
Drives with ground fault monitoring for IT (ungrounded) systems (option +Q954): Adjust the settings of the ground fault monitor to suit the installation. See the circuit diagrams of the delivery and *IRDH275B Ground Fault Monitor Operating Manual* by Bender (code: TGH1386en).	☐
Drives with Pt100 relays (option +(n)L506): • Check the connections against the circuit diagrams of the delivery. • Set the alarm and trip levels of the Pt100 relays. Set the alarm and trip levels of the Pt100 relay as low as possible based on the operating temperature and test results of the machine. The trip level can be set, for example, 10 °C higher than what the temperature of the machine is at maximal load in the maximum environmental temperature. We recommend to set the operating temperatures of the relay, typically for example, as follows: • 120…140 °C when only tripping is in use • alarm 120…140 °C and trip 130…150 °C when both alarm and tripping are used.	☐
Powering up the auxiliary circuit of the drive	
Make sure that it is safe to connect voltage. Ensure that • nobody is working on the drive or circuits that have been wired from outside into the drive cabinet • the cover of the motor terminal box is in place.	☐
Close the circuit breakers supplying the auxiliary circuits.	☐
Close the cabinet doors.	☐
Close the main breaker of the supply transformer.	☐
Switch on the auxiliary voltage (Q21,if present).	☐

Action	☑
Setting up the supply unit parameters	
Check the voltage range setting in parameter *195.01 Supply voltage*.	☐
Setting up the Main Fan fault parameters	
Check the 31.35 Main Fan Fault Function = Fault for better protection of cabinet.	☐
Setting up the drive parameters, and performing the first start	
Set up the inverter control program. See the appropriate start-up guide and/or firmware manual. There is a separate start-up guide only for some control programs. If you need more information on the use of the control panel, see *ACS-AP-X Assistant control panels user's manual* (3AUA0000085685 [English]).	☐
Drives with a brake chopper (option +D150): Refer also to chapter *Resistor braking*.	☐
Drives with an fieldbus adapter module (optional): Set the fieldbus parameters. Activate the appropriate assistant in the control program, or see the user's manual of the fieldbus adapter module, and the drive firmware manual. Not all control programs include assistants. Check that the communication works between the drive and the PLC.	☐
Drives with an encoder interface module (optional): Set the encoder parameters. Activate the appropriate assistant in the control program, or see the user's manual of the encoder interface module, and the drive firmware manual. Not all control programs include assistants.	☐
Powering up the main circuit of the drive	
Switch the grounding switch (Q9.1) (option +F259) off. 12-pulse units have two grounding switches, Q9.1 and Q9.2.	☐
Close the main switch-disconnector (Q1.1) or main breaker (Q1). **Note:** Do not use excessive force. The main switch-disconnector (or main breaker) can only be closed when • the main input terminals (L1, L2, L3) are powered, and • auxiliary voltage is switched on (Q21, if present), and • grounding switch is off (Q9.1, Q9.2) (option +F259).	☐
Turn the operating switch (S21) to the ON (1) position to activate the run enable signal. Depending on control source settings, this may also close the main contactor (if present). If a main contactor is present and does not close, refer to the circuit diagrams delivered by the drive as well as the appropriate firmware manuals.	☐
On-load checks	
Start the motor to perform the ID run.	☐
Check that the cooling fans rotate freely in the right direction, and the air flows upwards. A paper sheet set on the intake (door) gratings stays. The fans run noiselessly.	☐
Check that the motor starts. stops and follows the speed reference in the correct direction when controlled with the control panel.	☐
Check that the motor starts. stops and follows the speed reference in the correct direction when controlled through the customer-specific I/O or fieldbus.	☐
Drives in which the Safe torque off control circuit is connected in use: Test and validate the operation of the Safe torque off function.	☐
Drives with an emergency stop circuit (options +Q951, +Q952, +Q963, +Q964): Test and validate the operation of the emergency-stop circuit. See the delivery specific circuit diagrams and wiring, start-up and operating instructions of the option.	☐

Action	☑
Test and validate the operation of Prevention of unexpected start with FSO-xx (option +Q950)	☐

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Fault tracing

Contents of this chapter

This chapter describes the fault tracing possibilities of the drive.

LEDs

Where	LED	Color	Indication
Control panel mounting platform	POWER	Green	Control unit is powered and +15 V is supplied to the control panel.
	FAULT	Red	Drive in fault state.
Control unit (A41)	BATT OK	Green	Battery voltage of the real-time clock is OK (higher than 2.8 V). When the LED is not lit, • battery voltage is below 2.8 V, • the battery is missing, or • the control unit is not powered.
	PWR OK	Green	Internal voltage OK
	FAULT	Red	The control program indicates that the equipment is faulty. See the appropriate firmware manual.
	WRITE	Yellow	Writing to SD card in progress.

Warning and fault messages

See the firmware manual for the descriptions, causes and remedies of the drive control program warning and fault messages.

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Maintenance

Contents of this chapter

This chapter contains preventive maintenance instructions.

Maintenance intervals

The table below shows the maintenance tasks which can be done by the end user. The complete maintenance schedule is available on the Internet.

Preventive maintenance interval table

	Years from start-up																			
Component	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**
Cooling																					
Internal cabinet cooling fans *			(R)			R (R)			(R)			R (R)			(R)			R (R)			(R)
IP54 roof fans *			(R)			R (R)			(R)			R (R)			(R)			R (R)			(R)
Module cooling fans *						R						R						R			
Aging																					
DC circuit electrolytic capacitors and discharging resistors *, [1)]									R									R			
Control panel battery, BCU control unit batteries						R						R						R			
Connections and environment																					
IP54 air filters in the cabinet door and roof	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
IP22 and IP42 air inlet (door) meshes	(I)	(I)	(I)	(I)	(I)	(I)	(I)	(I)	(I)	(I)	(I)	(I)	(I)	(I)	(I)	(I)	(I)	(I)	(I)	(I)	(I)
Tightness of terminals	(I)	(I)	(I)	(I)	(I)	(I)	(I)	(I)	(I)	(I)	(I)	(I)	(I)	(I)	(I)	(I)	(I)	(I)	(I)	(I)	(I)
Dustiness, corrosion and temperature	(I)	(I)	(I)	(I)	(I)	(I)	(I)	(I)	(I)	(I)	(I)	(I)	(I)	(I)	(I)	(I)	(I)	(I)	(I)	(I)	(I)
Cabinet heat sink cleaning	(I)	(I)	(I)	(I)	(I)	(I)	(I)	(I)	(I)	(I)	(I)	(I)	(I)	(I)	(I)	(I)	(I)	(I)	(I)	(I)	(I)

	Years from start-up																			
Component	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**
Spare parts																					
DC capacitor reforming	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P

I Visual inspection and maintenance action if needed

(I) We recommend annual visual inspection and corrective actions if needed if the operating conditions are especially dusty or moist or ambient temperature is contatantly high.

P Non-site work

R Replacement of component. Required conditions: ambient temperature is below 40 °C (104 °F) and there is no cyclic heavy load or continuous nominal load.

(R) Replacement of component in demanding operation conditions:

* (R) if ambient temperature is higher than 40 °C (104 °F) or operation is continuous or maintenance counter indicates replacement.

1) For replacement contact ABB.

Cabinet

Cleaning the interior of the cabinet

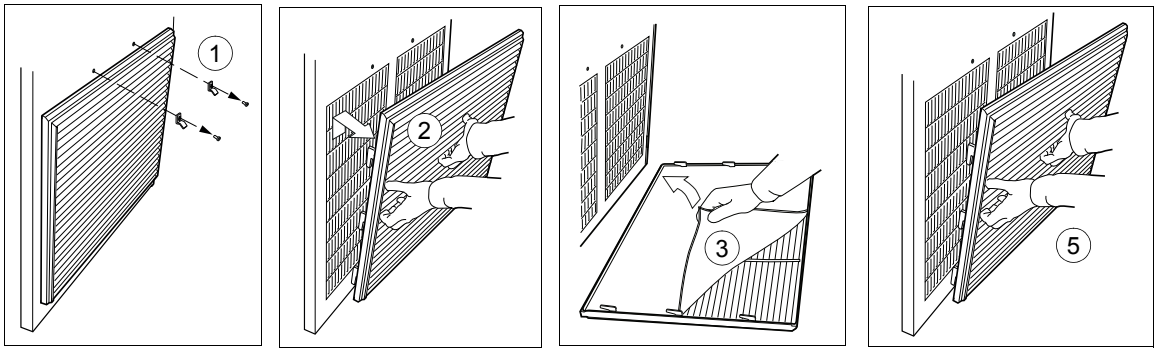
WARNING! Obey the instructions in chapter *Safety instructions*. If you ignore them, injury or death, or damage to the equipment can occur.

WARNING! Use a vacuum cleaner with an antistatic hose and nozzle, and wear a grounding wristband. Otherwise an electrostatic charge might build up and damage the circuit boards.

1. Stop the drive and do the steps in section *Precautions before electrical work* before you start the work.
2. Open the cabinet doors.
3. Clean the interior of the cabinet. Use a vacuum cleaner and a soft brush.
4. Clean the air inlets of the fans and air outlets of the modules (top).
5. Clean the air inlet gratings on the doors (see below).
6. Close the doors.

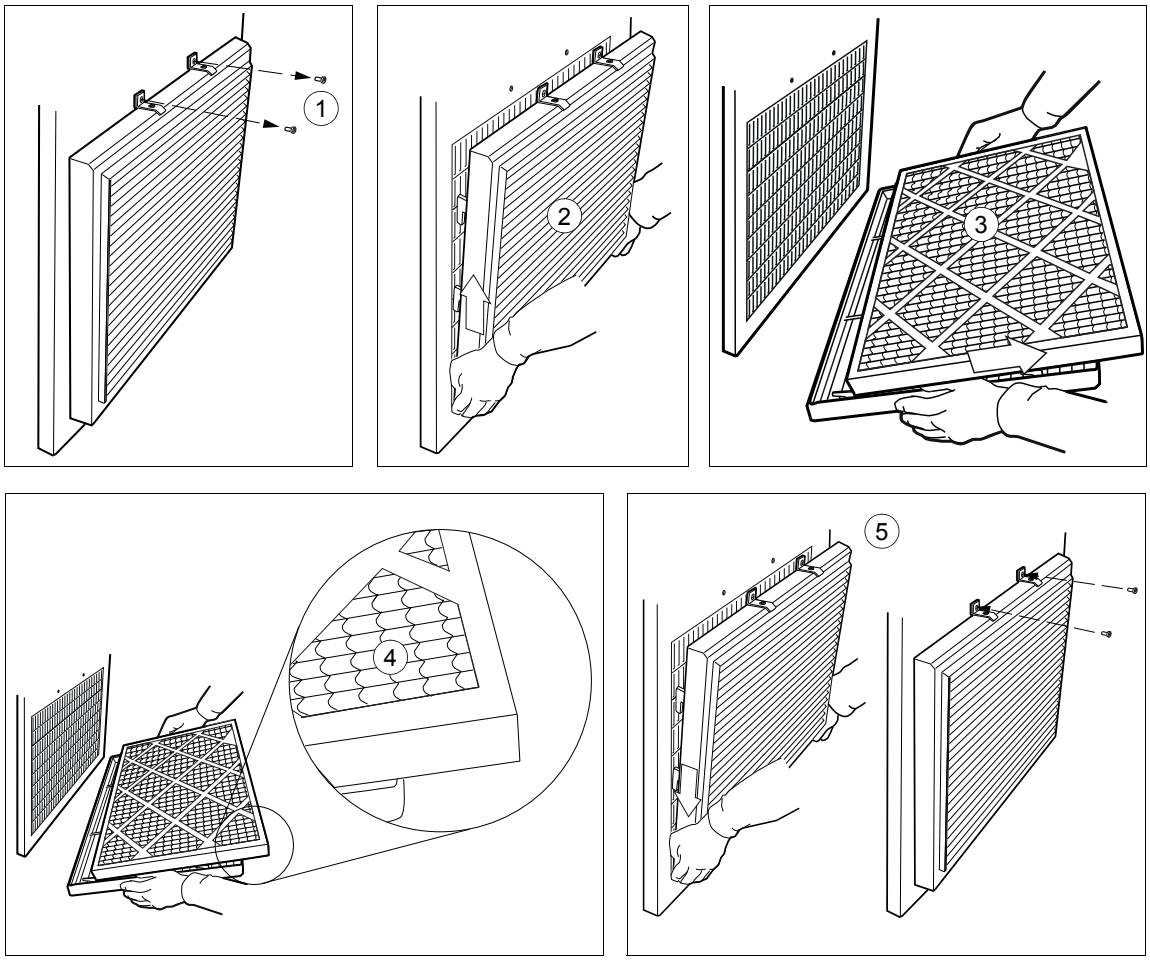
Cleaning the door air inlets (IP22 and IP42)

1. Remove the fasteners at the top of the grating.
2. Lift the grating and pull it away from the door.
3. Clean the stainless steel mesh and grating. If necessary, remove the mesh by turning the clips gently.
4. Install the mesh and grating in reverse order.



Cleaning the door air inlets (IP54)

1. Remove the fasteners at the top of the grating.
2. Lift the grating and pull it away from the door.
3. Remove the air filter mat.
4. Place the new filter mat in the grating the metal wire side facing the door.
5. Reinstall the grating in reverse order.



Cleaning the outlet (roof) filters (IP54)

The outlet (roof) filters in IP54 units can be accessed by pulling the gratings upwards.

Replacing the outlet (roof) filters (IP54)

1. Remove the front and back gratings of the fan cubicle by lifting them upwards
2. Remove the air filter mat.
3. Place the new filter mat in the grating.
4. Reinstall the grating in reverse order.

Heatsink

The drive module heatsink fins pick up dust from the cooling air. The drive runs into overtemperature warnings and faults if the heatsink is not clean. When necessary, clean the heatsink as follows.



WARNING! Obey the instructions in chapter *Safety instructions*. If you ignore them, injury or death, or damage to the equipment can occur.



WARNING! Use a vacuum cleaner with antistatic hose and nozzle. Using a normal vacuum cleaner creates static discharges which can damage circuit boards.

1. Stop the drive and do the steps in section *Precautions before electrical work* before you start the work.
2. Remove the drive module from the cabinet.
3. Remove the module cooling fan(s). See section *Fans* below.
4. Blow dry, clean compressed air from bottom to top and simultaneously use a vacuum cleaner at the air outlet to trap the dust. **Note**: If there is a risk of dust entering adjoining equipment, perform the cleaning in another room.
5. Reinstall the cooling fan.

Fans

The lifespan of the cooling fans of the drive depends on the running time, ambient temperature and dust concentration. See the firmware manual for the actual signal which indicates the running time of the cooling fan. Reset the running time signal after fan replacement.

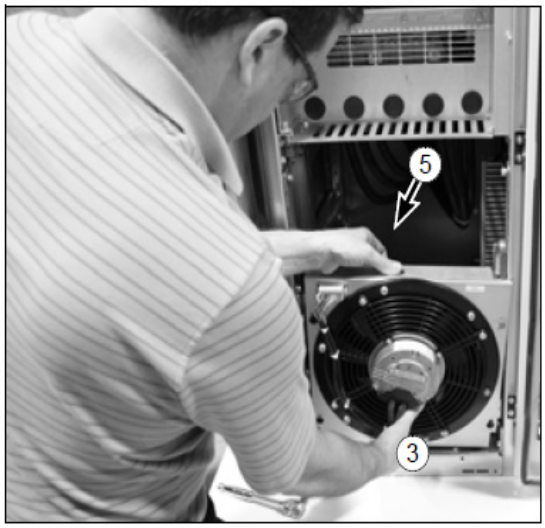
Replacement fans are available from ABB. Do not use other than ABB specified spare parts.

Replacing the cooling fan in the auxiliary control cubicle

WARNING! Obey the instructions in chapter *Safety instructions*. If you ignore them, injury or death, or damage to the equipment can occur.

1. Stop the drive and do the steps in section *Precautions before electrical work* before you start the work.
2. Remove the mounting plate above the fan.
3. Loosen the four mounting screws of the fan mounting plate.
4. Lift the mounting plate upwards.
5. Unplug the power supply wires.
6. Lift the fan mounting plate off.
7. Remove the fan from the mounting plate.
8. Install the new fan in reverse order.

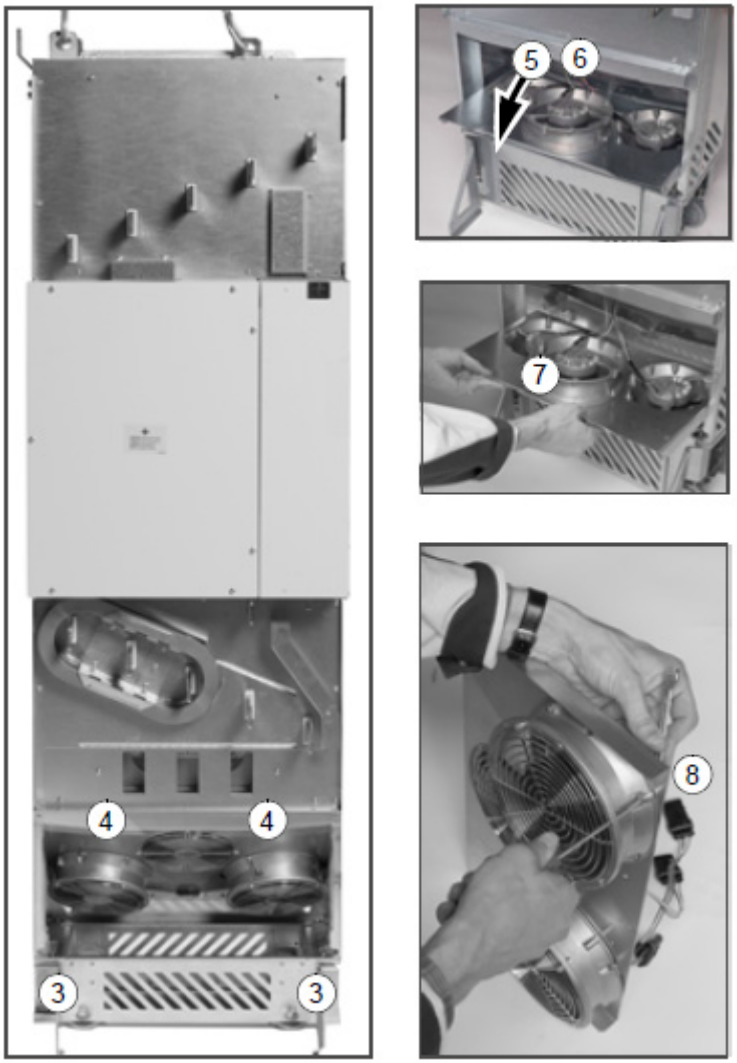




Replacing the drive module main fans

WARNING! Obey the instructions in chapter *Safety instructions*. If you ignore them, injury or death, or damage to the equipment can occur.

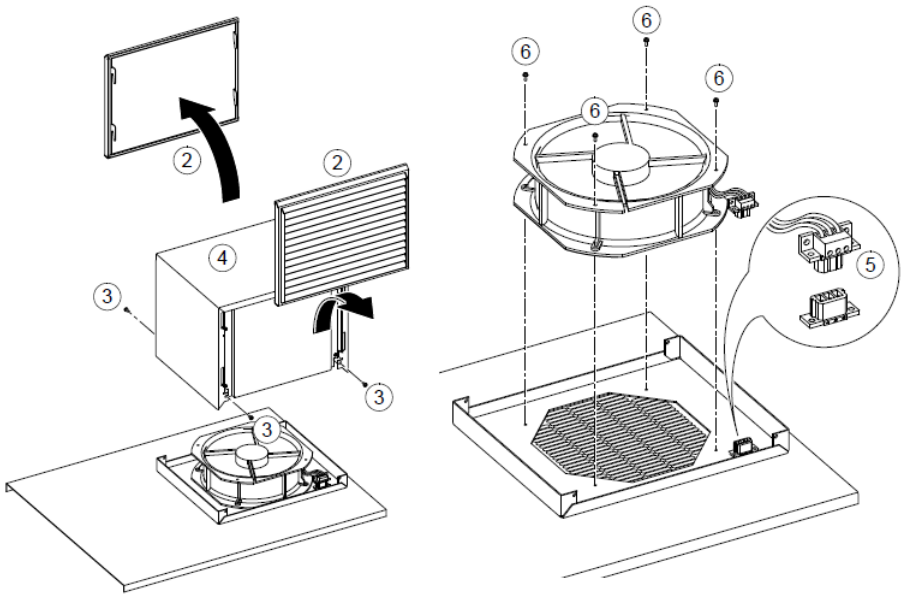
1. Stop the drive and do the steps in section *Precautions before electrical work* before you start the work.
2. Remove the drive module out of the cabinet as described in section *Capacitors*.
3. Open the support legs of the pedestal.
4. Undo the two screws that fasten the fan assembly plate.
5. Tilt the fan assembly plate down.
6. Disconnect the power supply wires of the fans.
7. Remove the fan assembly from the drive module.
8. Undo the fastening screws of the fan(s) and remove the fan(s) from the assembly plate.
9. Install the new fan(s) in reverse order..



Replacing a roof fan (IP54)

WARNING! Obey the instructions in chapter *Safety instructions*. If you ignore them, injury or death, or damage to the equipment can occur.

1. Stop the drive and do the steps in section *Precautions before electrical work* before you start the work.
2. Lift the front and back gratings upwards and remove them.
3. Loosen the mounting screws of the fan cover.
4. Lift the cover off.
5. Disconnect the fan supply wires.
6. Loosen the mounting screws of the fan.
7. Lift the fan off.
8. Install the new fan in reverse order.



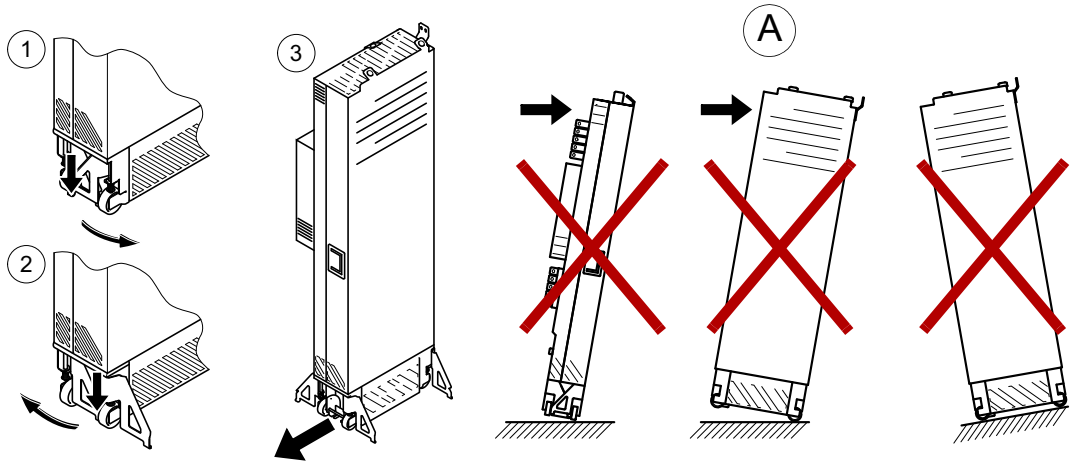
Replacing the drive module

This replacing procedure requires: two persons, installation ramp, a set of screw drivers and a torque wrench with an extension bar.

The drawings show frame R11. The details in frame R10 are slightly different. There are two modules in ACS880-07XT. Replacing of each module is introduced respectively because of different installation.

WARNING! Obey the instructions in chapter *Safety instructions*. If you ignore them, injury or death, or damage to the equipment can occur.

- Handle the drive module carefully:
  - Use safety shoes with a metal toe cap to avoid foot injury.
  - Lift the drive module only by the lifting lugs.
  - Make sure that the module does not topple over when you move it on the floor: Open the support legs by pressing each leg a little down (1, 2) and turning it aside. Whenever possible secure the module also with chains.
  - Do not tilt the drive module (A). It is **heavy** and its **center of gravity is high.** The module overturns from a sideways tilt of 5 degrees. Do not leave the module unattended on a sloping floor.



Replacing the right module

The Process of replacing the right module in the cabinet is as below.

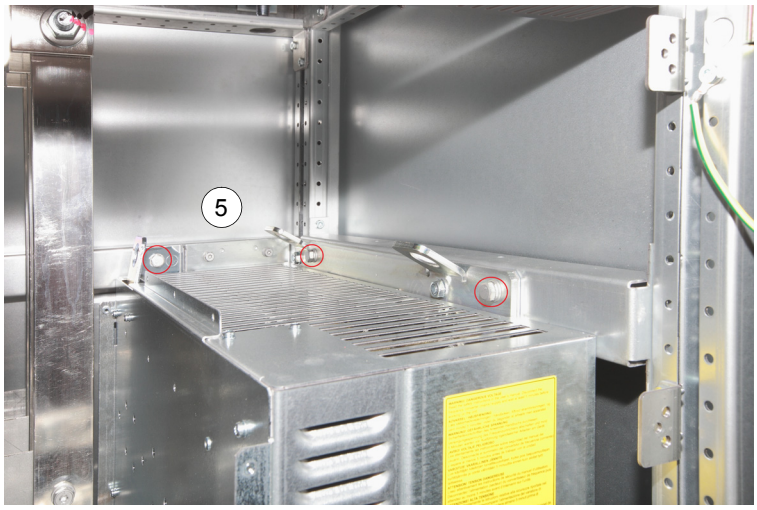
1. Stop the drive and do the steps in section *Precautions before electrical work* before you start the work. Prepare to unplug right drive module.
2. Remove metal grid (Grid was removed below picture).
3. Remove upper bracket.
4. Remove the Shield of fan.
5. Remove three screws at the top of the module.
6. Remove two screws at the bottom of the module.

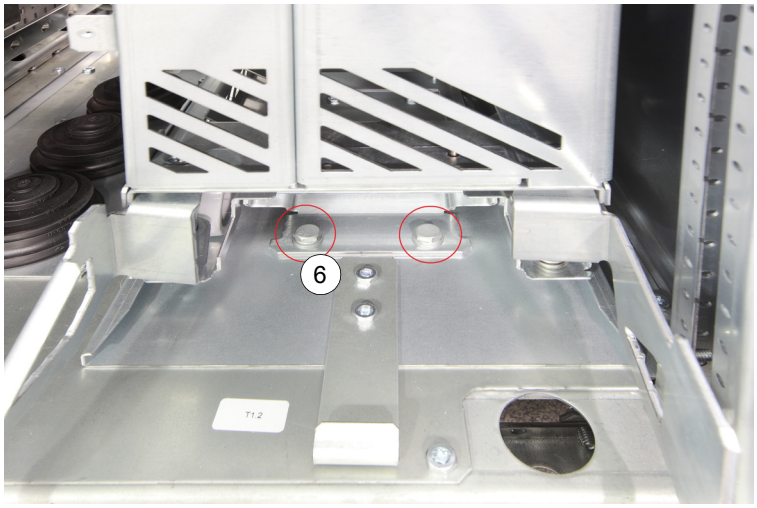
7. Remove the five screws on the bar at upper side of the module.
8. Remove the four screws on the bar at lower side of the module.
9. Unplug cable and optical fiber.
10. Pull the drive module carefully out of the cabinet preferably with help from another person.
11. Install the new module in reverse order.



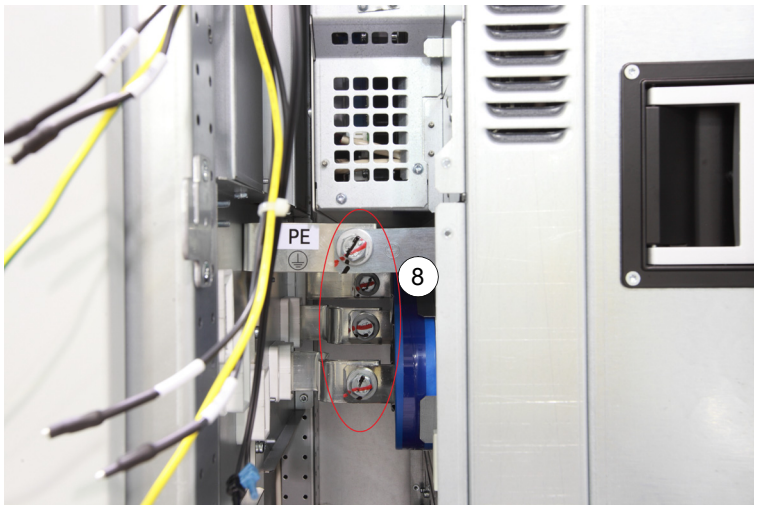


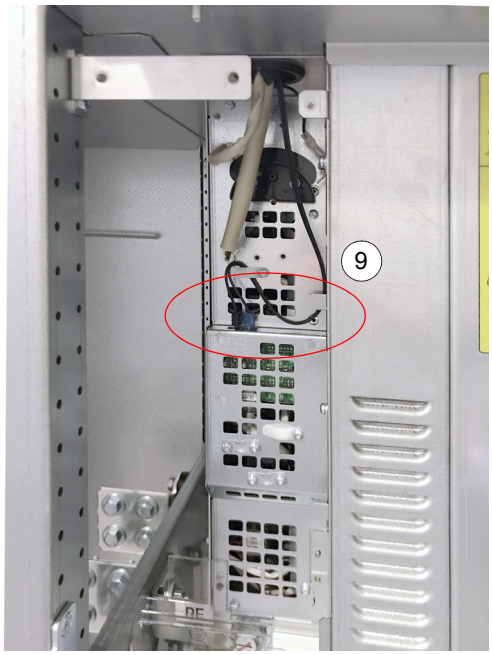



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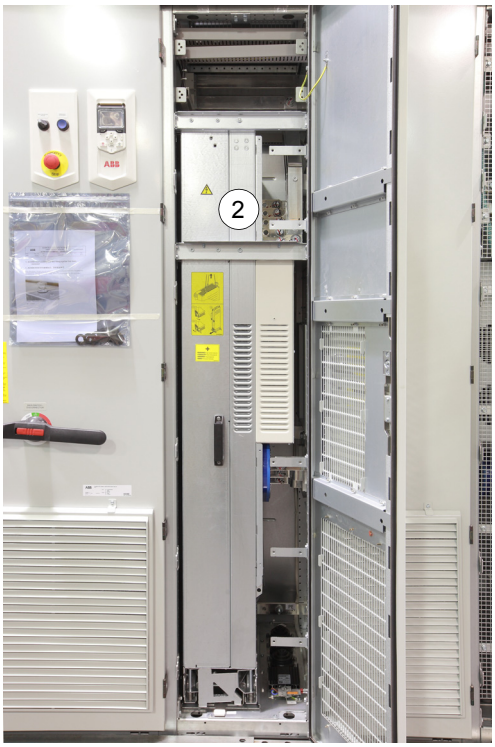

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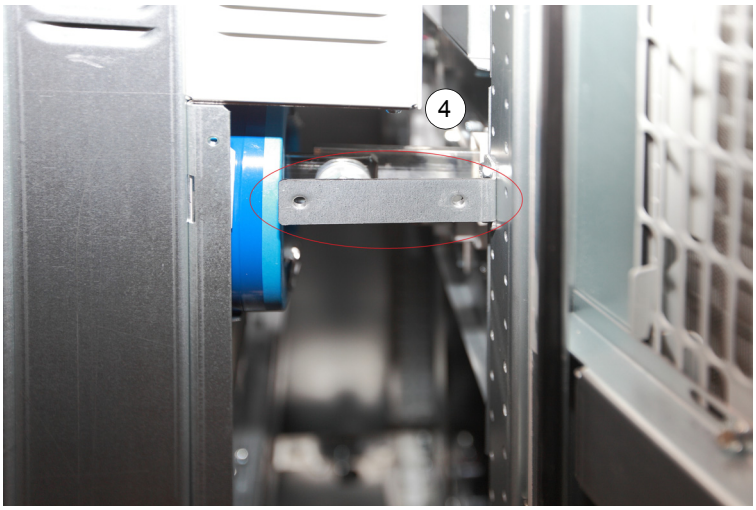
Replacing the left module

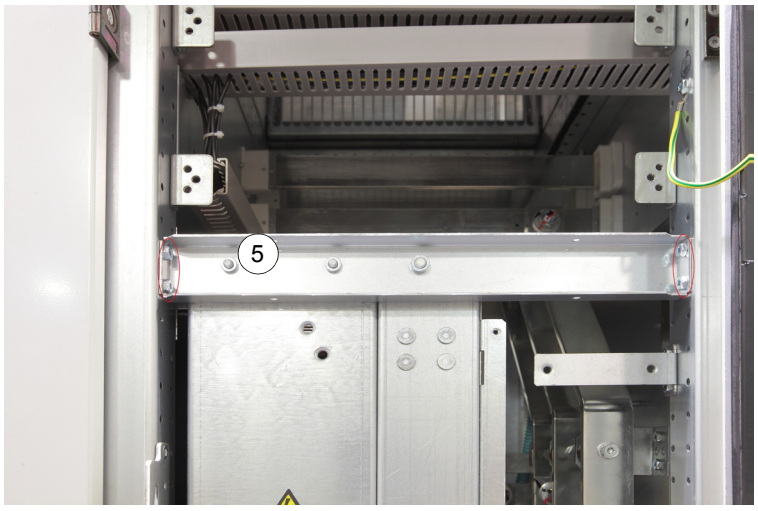
The Process of replacing the left module in the cabinet is as below.

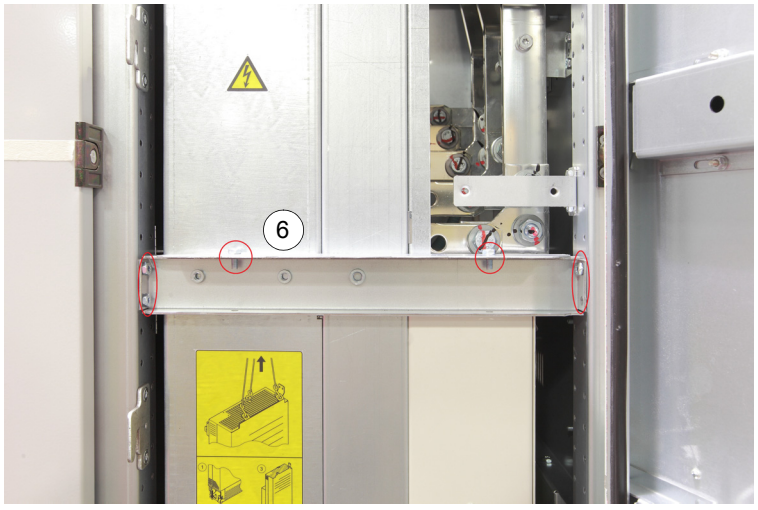
1. Stop the drive and do the steps in section *Precautions before electrical work* before you start the work. Prepare to unplug left drive module.
2. Remove metal grid(Grid was removed below picture).
3. Remove upper brackets.
4. Remove lower bracket.
5. Remove four screws and take off the upper beam.
6. Remove six screws and take off middle beam.
7. Remove two screws at the side on top of module.
8. Remove two screws at the bottom of module.
9. Remove the five screws on the bar at the upper side of module.
10. Remove the four screws on the bar at the lower side of module.
11. Pull the drive module carefully out of the cabinet preferably with help from another person.
12. Unplug fan power and optical fiber.
13. Install the new module in reverse order.



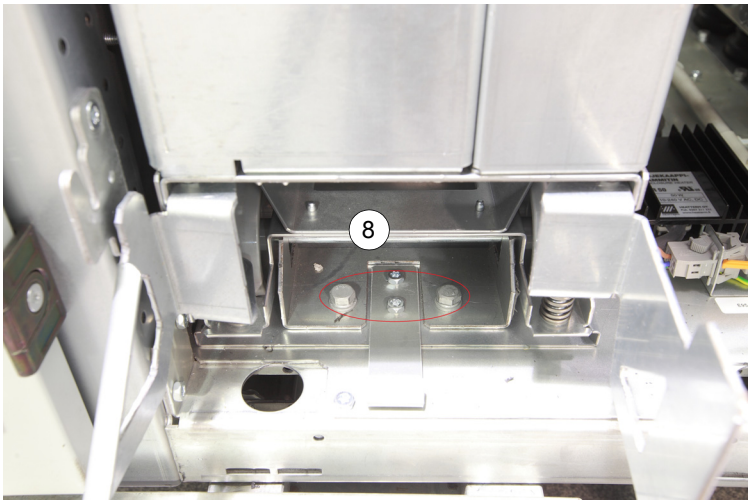



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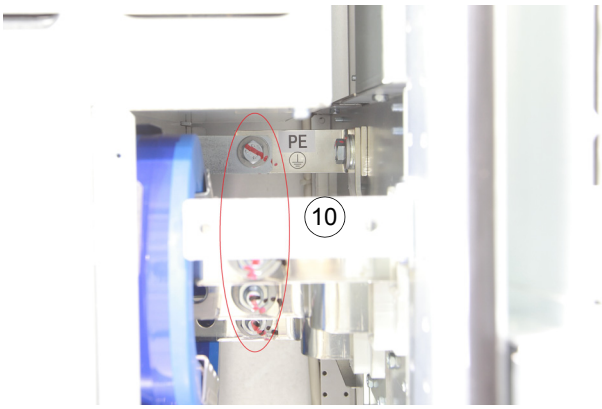

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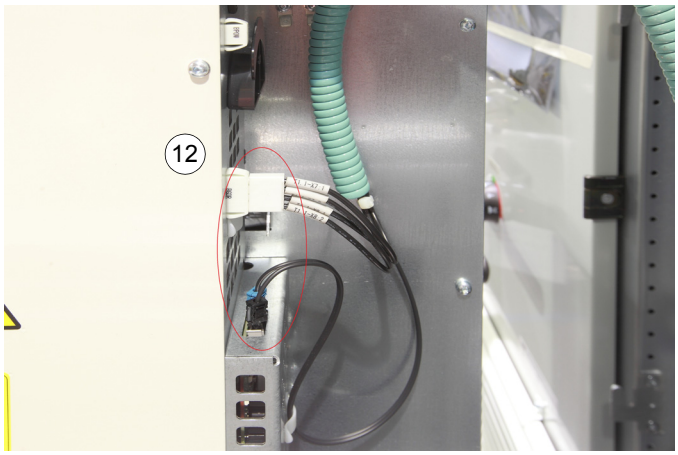

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Capacitors

The DC circuit of the power modules of the drive contain several electrolytic capacitors. Their lifespan depends on the operating time of the drive, loading and ambient temperature. Capacitor life can be prolonged by lowering the ambient temperature.

Capacitor failure is usually followed by damage to the unit and an input cable fuse failure, or a fault trip. Contact ABB if capacitor failure is suspected. Replacements are available from ABB. Do not use other than ABB specified spare parts.

Reforming the capacitors

The capacitors must be reformed if the drive has been stored for a year or more. For information on reforming the capacitors, see *Converter module capacitor reforming instructions* (3BFE64059629 [English]).

Control panel

Replacing the battery

1. Turn the lid on the back of the panel counter-clockwise until the lid opens.
2. Replace the battery with a new CR2032 battery.
3. Put the lid back and tighten it by turning it clockwise.
4. Dispose of the old battery according to local disposal rules or applicable laws.



Cleaning

See *ACS-AP-x assistant control panels user's manual* [3AUA0000085685 (English)].

Control units

BCU control unit types

ACS880-07XT uses BCU-02 control unit. There are three variants of the BCU control unit used in ACS880 drives: BCU-02, BCU-12 and BCU-22. These have a different number of converter module connections (2, 7 and 12 respectively) but are otherwise identical. The three BCU types are interchangeable as long as the number of connections is sufficient. For example, the BCU-22 can be used as a direct replacement for both BCU-02 and BCU-12.

Memory unit

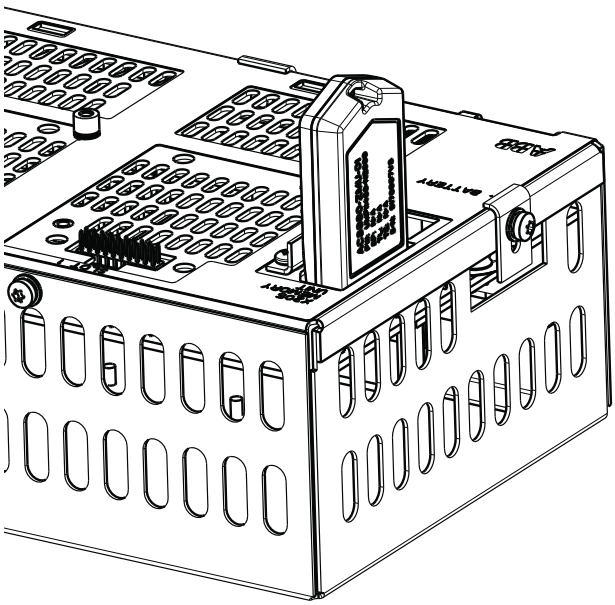
After replacing a supply or inverter control unit, the existing parameter settings can be retained by transferring the memory unit from the defective control unit to the new control unit.

WARNING! Do not remove or insert the memory unit when the control unit is powered.

WARNING! Obey the instructions in chapter *Safety instructions*. If you ignore them, injury or death, or damage to the equipment can occur.

1. Do the steps in section *Precautions before electrical work* before you start the work.
2. Make sure that the control unit is not powered.
3. Undo the fastening screw and pull the memory unit out.
4. Install a memory unit in reverse order.

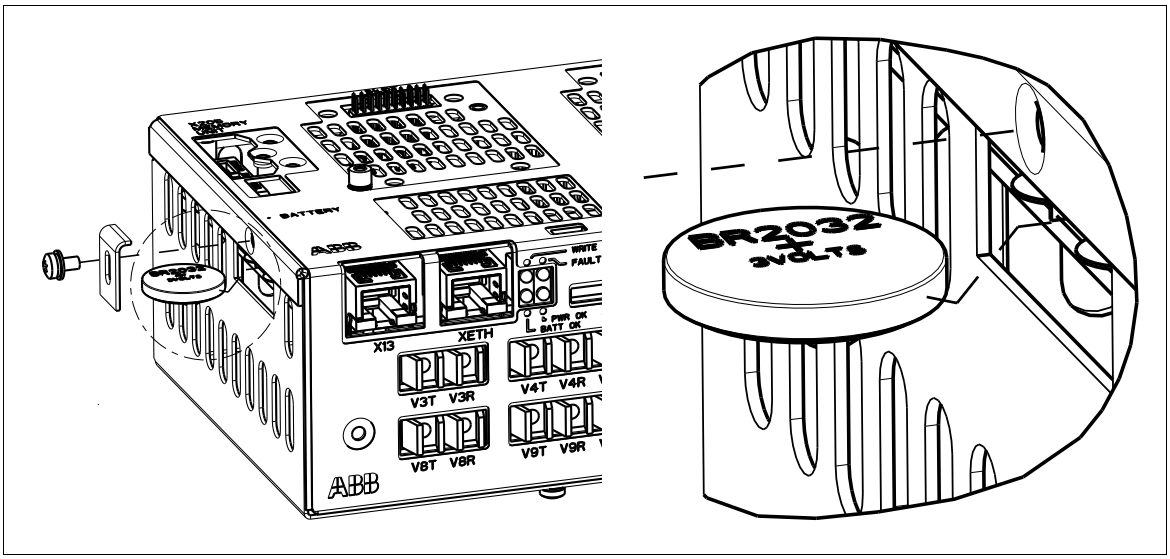
One end of the BCU control unit



Control unit battery

Replace the real-time clock battery if the BATT OK LED is not illuminated when the control unit is powered. For information on the LED, see *Control unit layout and connections* (page *96*).

1. Do the steps in section *Precautions before electrical work* before you start the work.
2. Undo the fastening screw and remove the battery
3. Replace the battery with a new BR2032 battery.
4. Dispose of the old battery according to local disposal rules or applicable laws.
5. Set the real-time clock.



Reduced run

A “reduced run” function makes it possible to continue operation with one drive module if the other module is out of service, for example, because of maintenance work. In principle, reduced run is possible with only one module, but the physical requirements of operating the motor still apply; the remaining module in use must be able to provide the motor with enough magnetizing current.

Starting reduced run operation



WARNING! Obey the instructions in chapter *Safety instructions*. If you ignore them, injury or death, or damage to the equipment can occur.

1. Stop the drive and do the steps in section *Precautions before electrical work* before you start the work.
2. If the control unit is powered from the faulty module, connect the control unit to another 24 V DC power supply. We strongly recommend using an external power supply with parallel-connected drive modules.
3. Disconnect all cables from the module to be serviced and remove it from its bay.
4. Switch on the power to the remaining drive module. Enter the number of drive modules present into parameter 95.13 Reduced run mode.
5. Reset all faults and start the drive module. The maximum current is now automatically limited according to the new drive module configuration. A mismatch between the number of detected modules (95.14) and the value set in 95.13 will generate a fault.
6. If the STO function is in use, validate it.

Resuming normal operation

1. Stop the drive and do the steps in section *Precautions before electrical work* before you start the work.
2. Reinstall the module into its bay.
3. Connect all wires and fibres.
4. Switch on the power to the drive module package.
5. Enter “0” into parameter 95.13 Reduced run mode.
6. If the STO function is in use, validate it.

12

Technical data

Contents of this chapter

This chapter contains the technical specifications of the drive, for example, the ratings, fuse data, sizes and technical requirements.

Ratings

The ratings of the drive modules with 50 Hz and 60 Hz supply are given below.

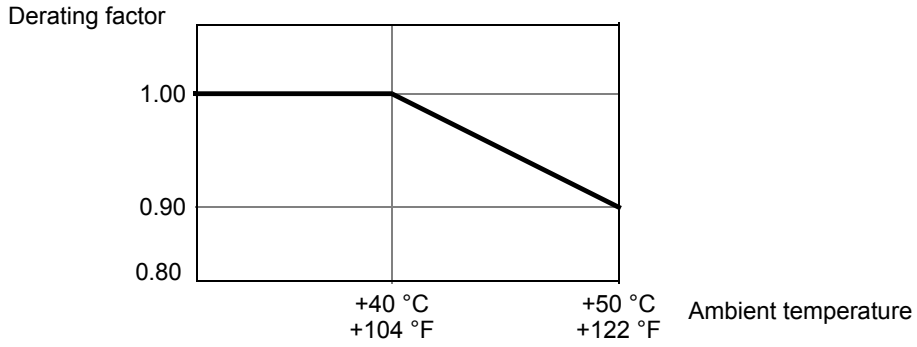
IEC RATINGS										
Drive unit type ACS880-07XT-	**Frame size**	**Input current**	**Output ratings**							
			Nominal use				**Light-duty use**		**Heavy-duty use**	
		I_{1N}	I_{max}	I_N	P_N	S_N	I_{Ld}	P_{Ld}	I_{Hd}	P_{Hd}
		A	**A**	**A**	**kW**	**kVA**	**A**	**kW**	**A**	**kW**
U_N = 400 V										
1010A-3	2×R10	1010	1270	1010	560	700	997	560	746	400
1190A-3	2×R10	1190	1343	1190	630	824	1167	630	878	500
1330A-3	2×R11	1330	1886	1330	710	921	1316	710	1041	560
1610A-3	2×R11	1610	2024	1610	900	1115	1570	900	1274*	710
U_N = 500 V										
1010A-5	2×R10	1010	1270	1010	710	875	997	710	720	500
1160A-5	2×R10	1160	1343	1160	800	1005	1146	800	878	630
1310A-5	2×R11	1310	1564	1310	900	1134	1297	900	1041	710
1610A-5	2×R11	1610	2024	1610	1000	1394	1570	1000	1274**	900
U_N = 690 V										
0810A-7	2×R10	810	1017	810	800	968	791	710	678***	630
0960A-7	2×R11	960	1260	960	900	1147	929	900	837	800
1080A-7	2×R11	1080	1472	1080	1000	1291	1051	1000	929	900
1320A-7	2×R11	1320	1509	1320	1200	1578	1297	1200	1051***	1000

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U_N	Nominal voltage of the drive
I_{1N}	Nominal input current (rms) at 40 °C (104 °F)
S_N	Apparent power (no overload)
I_{max}	Maximum output current. Available for 10 seconds at start, otherwise as long as allowed by drive temperature. 140% … 200% of I_{Hd}, depending on power rating.
I_N	Continuous rms output current. No overload capability at 40 °C (104 °F)
P_N	Typical motor power in no-overload use.
I_{Ld}	Continuous rms output current allowing 10% overload for 1 minute every 5 minutes
P_{Ld}	Typical motor power for light-overload use.
I_{Hd}	Continuous rms output current allowing 50% overload for 1 minute every 5 minutes
*	Continuous rms output current allowing 30% overload for 1 minute every 5 minutes
**	Continuous rms output current allowing 25% overload for 1 minute every 5 minutes
***	Continuous rms output current allowing 40% overload for 1 minute every 5 minutes
P_{Hd}	Typical motor power for heavy-duty use.
Note: To achieve the rated motor power given in the table, the rated current of the drive must be higher than or equal to the rated motor current. The power ratings apply to most IEC 34 motors at the nominal voltage of the drive. We recommend to select the drive, motor and gear combination for the required motion profile with the DriveSize dimensioning tool available from ABB.	

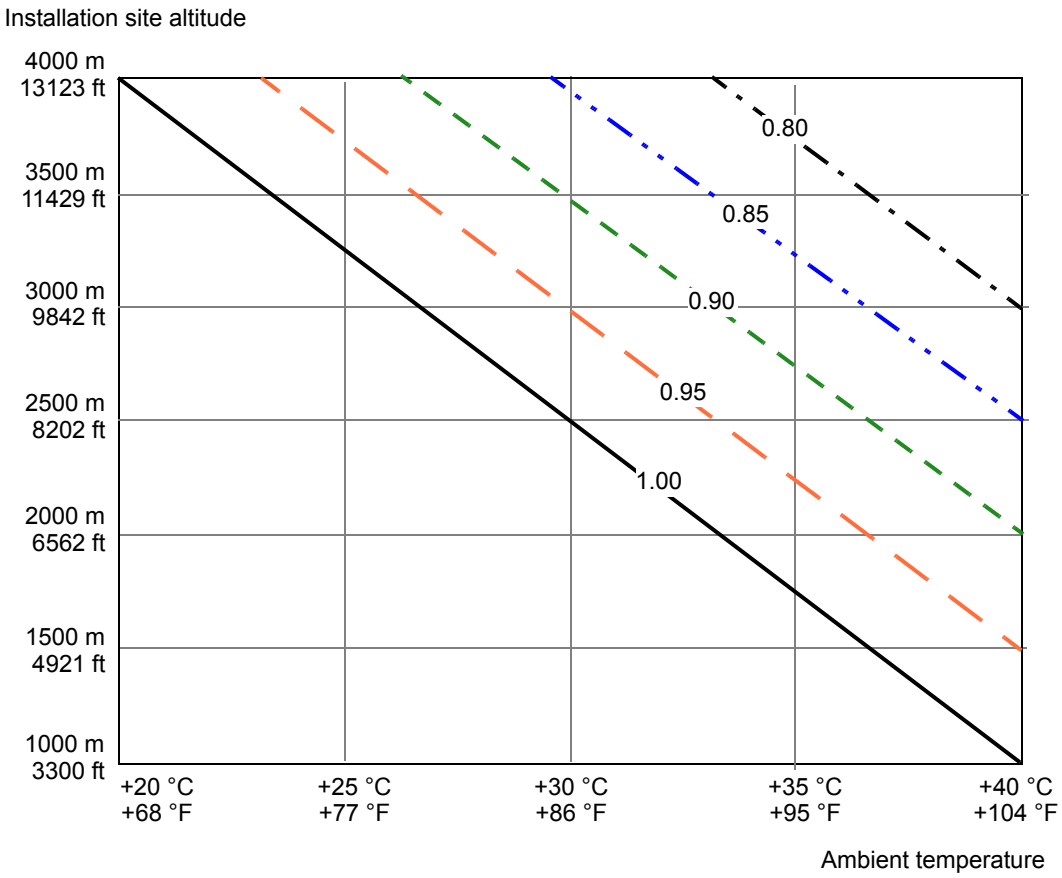
Ambient temperature derating

In the temperature range +40…50 °C (+104…122 °F), the rated output current is derated by 1% for every added 1 °C (1.8 °F) as follows. Calculate the output current by multiplying the current given in the rating table by the derating factor.



Altitude derating

At altitudes from 1000 to 4000 m (3300 to 13123 ft) above sea level, the derating is 1% for every 100 m (328 ft). If ambient temperature is below +40 °C (+104 .°F), the derating can be reduced by 1.5% for every 1 °C reduction in temperature. For a more accurate derating, use the DriveSize PC tool. A few altitude derating curves are shown below.



	Derating factor 1.00
	Derating factor 0.95
	Derating factor 0.9
	Derating factor 0.85
	Derating factor 0.80

High speed mode

Selection **High speed mode** of parameter **95.15 Special HW settings** improves control performance at high output frequencies. We recommend it to be selected with output frequency of 120 Hz and above.

This table gives the drive module ratings for 120 Hz output frequency and the maximum output frequency for the drive ratings when **High speed mode** in parameter **95.15 Special HW settings** is enabled: With output frequencies smaller than this recommended maximum output frequency, the current derating is less than the values given in the table. Contact ABB for operation above the recommended maximum output frequency or for the output current derating with output frequencies above 120 Hz and below the maximum output frequency.

Drive module type ACS880-07XT-	**Deratings with selection High speed mode of parameter 95.15 Special HW settings**									
	120 Hz output frequency					**Maximum output frequency**				
		Nominal use		**Light-duty use**	**Heavy-duty use**		**Nominal use**		**Light-duty use**	**Heavy-duty use**
	f	I_N	P_N	I_{Ld}	I_{Hd}	f_{max}	I_N	P_N	I_{Ld}	I_{Hd}
	Hz	**A**	**kW**	**A**	**A**	**Hz**	**A**	**kW**	**A**	**A**
U_N = 400 V										
1010A-3	120	1010	544	997	746	500	760	435	729	541
1190A-3	120	1190	650	1167	878	500	892	460	857	637
1330A-3	120	1330	734	1316	1041	500	955	460	913	718
1610A-3	120	1610	915	1570	1274*	500	1159	653	1104	920*
U_N= 500 V										
1010A-5	120	1010	693	997	720	500	696	435	661	519
1160A-5	120	1160	822	1146	878	500	754	460	721	548
1310A-5	120	1310	916	1297	1041	500	850	580	788	666
1610A-5	120	1610	1153	1570	1274*	500	1012	736	938	754
U_N= 690 V										
0810A-7	120	810	753	791	678*	375	546	471	528	445*
0960A-7	120	960	920	929	837	375	552	460	534	482
1080A-7	120	1080	1025	1051	929	375	626	580	607	552
1320A-7	120	1320	1300	1297	1051*	375	828	736	791	644*

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f	Output frequency
f_{max}	Maximum output frequency with High speed mode
U_N	Nominal voltage of the drive
I_N	Continuous rms output current. No overload capability at 40 °C (104 °F)
P_N	Typical motor power in no-overload use.
I_{Ld}	Continuous rms output current allowing 10% overload for 1 minute every 5 minutes
I_{Hd}	Continuous rms output current allowing 50% overload for 1 minute every 5 minutes
*	Continuous rms output current allowing 30% overload for 1 minute every 5 minutes

Frame sizes and power module types

Drive unit type	Drive module type	Basic module type	Qty + size
U_N = 400 V			
ACS880-07XT-1010A-3	ACS880-04XT-1010A-3	ACS880-04-585A-3+P943	2×R10
ACS880-07XT-1190A-3	ACS880-04XT-1190A-3	ACS880-04-650A-3+P943	2×R10
ACS880-07XT-1330A-3	ACS880-04XT-1330A-3	ACS880-04-725A-3+P943	2×R11
ACS880-07XT-1610A-3	ACS880-04XT-1610A-3	ACS880-04-880A-3+P943	2×R11
U_N = 500 V			
ACS880-07XT-1010A-5	ACS880-04XT-1010A-5	ACS880-04-583A-5+P943	2×R10
ACS880-07XT-1160A-5	ACS880-04XT-1160A-5	ACS880-04-635A-5+P943	2×R10
ACS880-07XT-1310A-5	ACS880-04XT-1310A-5	ACS880-04-715A-5+P943	2×R11
ACS880-07XT-1610A-5	ACS880-04XT-1610A-5	ACS880-04-880A-5+P943	2×R11
U_N = 690 V			
ACS880-07XT-0810A-7	ACS880-04XT-0810A-7	ACS880-04-430A-7+P943	2×R10
ACS880-07XT-0960A-7	ACS880-04XT-0960A-7	ACS880-04-522A-7+P943	2×R11
ACS880-07XT-1080A-7	ACS880-04XT-1080A-7	ACS880-04-590A-7+P943	2×R11
ACS880-07XT-1320A-7	ACS880-04XT-1320A-7	ACS880-04-721A-7+P943	2×R11

Fuses (IEC)

aR fuses by Cooper Bussmann for protection against short-circuit in the input power cable or drive are listed below.

Ultrarapid (aR) fuses per basic drive module						
Drive unit type	Input current (A)	Fuse				
		A	A^2s	V	Type	Size
U_N = 400 V						
ACS880-07XT-1010A-3	1010	900	670 000	690	170M6463	3
ACS880-07XT-1190A-3	1190	1000	945 000	690	170M6464	3
ACS880-07XT-1330A-3	1330	1250	1 950 000	690	170M6466	3
ACS880-07XT-1610A-3	1610	1400	2 450 000	690	170M6467	3
U_N = 500 V						
ACS880-07XT-1010A-5	1010	900	670 000	690	170M6463	3
ACS880-07XT-1160A-5	1160	1000	945 000	690	170M6464	3
ACS880-07XT-1310A-5	1310	1250	1 950 000	690	170M6466	3
ACS880-07XT-1610A-5	1610	1400	2 450 000	690	170M6467	3
U_N = 690 V						
ACS880-07XT-0810A-7	810	700	300 000	690	170M6461	3
ACS880-07XT-0960A-7	960	800	465 000	690	170M6462	3
ACS880-07XT-1080A-7	1080	900	670 000	690	170M6463	3
ACS880-07XT-1320A-7	1320	1250	1 950 000	690	170M6466	3

Note 1: See also *Implementing thermal overload and short-circuit protection*.

Note 2: In multicable installations, install only one fuse per phase (not one fuse per conductor).

Note 3: Fuses with higher current rating than the recommended ones must not be used. Fuses with lower current rating can be used.

Note 4: Fuses from other manufacturers can be used if they agree with the ratings and the melting curve of the fuse does not exceed the melting curve of the fuse mentioned in the table

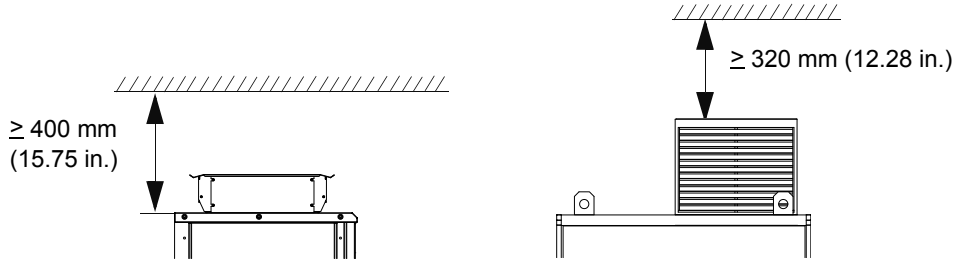
Dimensions and weights

See chapter *Dimensions*.

Free space requirements

Front*		Sides*		Above**	
mm	in.	mm	in.	mm	in.
150	5.91	0	0	400	15.75

*As required by cooling.
Measured from the base plate of the cabinet top. **Note: 320 mm (12.3 in.) is required for fan replacement of IP54 cabinets.



Losses, cooling data and noise

Drive unit type	Frame size	Air flow per module		Heat dissipation per module	Noise	
					Basic drive module	Drive unit
		m^3/h	ft^3/min	W	dB(A)	dB(A)
U_N = 400 V						
ACS880-07XT-1010A-3	2×R10	1200	707	6409	72	75
ACS880-07XT-1190A-3	2×R10	1200	707	8122	72	75
ACS880-07XT-1330A-3	2×R11	1420	848	8764	71	75
ACS880-07XT-1610A-3	2×R11	1420	848	10578	71	75
U_N = 500 V						
ACS880-07XT-1010A-5	2×R10	1200	707	6409	72	75
ACS880-07XT-1160A-5	2×R10	1200	707	8122	72	75
ACS880-07XT-1310A-5	2×R11	1420	848	8764	71	75
ACS880-07XT-1610A-5	2×R11	1420	848	10578	71	75
U_N = 690 V						
ACS880-07XT-0810A-7	2×R10	1200	707	6409	72	75
ACS880-07XT-0960A-7	2×R11	1420	848	8764	72	75
ACS880-07XT-1080A-7	2×R11	1420	848	9862	71	75
ACS880-07XT-1320A-7	2×R11	1420	848	10578	71	75

The cooling air temperature rises 30 degrees Celsius when it goes through the drive module if the temperature of the input cooling air is 40 degrees Celsius

Terminal and lead-through data for the power cables

The locations and sizes of lead-throughs are shown by the dimension drawings delivered with the drive, and the dimension drawing.

Electrical power network specification

Voltage (U_1)	ACS880-07XT-xxxxx-3: 380…415 V AC 3-phase ±10%. This is indicated in the type designation label as typical input voltage level (3~ 400 V AC). ACS880-07XT-xxxxx-5: 380…500 V AC 3-phase ± 10%. This is indicated in the type designation label as typical input voltage levels (3~ 400/480/500 V AC). ACS880-07XT-xxxxx-7: *525…690 V AC 3-phase ± 10%. This is indicated in the type designation label as typical input voltage levels (3~ 525/600/690 V AC). *525…600 V AC in corner-grounded TN systems
Network type	TN (grounded) and IT (ungrounded) systems
Frequency	48 to 63 Hz, maximum rate of change 17%/s
Imbalance	Max. ± 3% of nominal phase-to-phase input voltage
Short-circuit withstand strength (IEC 61439-1)	Maximum allowable prospective short-circuit current is 65 kA when by the fuses given in the fuse table. For the maximum allowable prospective short-circuit current with circuit breakers.
Fundamental power factor (cos phi$_1$)	0.98 (at nominal load)
Transformer specification for 12-pulse supply (IEC 60076-1:2011)	Connection: Dy 11 d0 or Dyn 11 d0 Phase shift between secondaries: 30° electrical Voltage difference between secondaries: < 0.5% Short-circuit impedance of secondaries: > 5% Short-circuit impedance difference between secondaries: ≤ 10% of the percentage short-circuit impedance No grounding of the secondaries allowed. Static shield recommended.

Motor connection data

Motor types	Asynchronous AC induction motors, permanent magnet motors and AC induction servomotors.
Voltage (U_2)	0 to U_1, 3-phase symmetrical, U_{max} at the field weakening point
Frequency	DTC mode: 0 to 3.2 · f_f. Maximum frequency 500 Hz (120 Hz with du/dt). Low motor noise mode is recommended with high frequencies (see also the firmware manual). $f_f = \frac{U_N}{U_m} \cdot f_m$ f_f: frequency at field weakening point; U_N: electrical power system voltage; U_m: nominal motor voltage; f_m: nominal motor frequency
Frequency resolution	0.01 Hz
Current	See section *Ratings*.
Frequency	0…500 Hz For drives with du/dt filter: 120 Hz
Switching frequency	3 kHz (typically)
Maximum recommended motor cable length	**DTC control**: 300 m (984 ft); **Scalar control**: 300 m (984 ft) **Note**: Motor cable longer than 100 m (328 ft) is allowed but then the EMC Directive requirements of Category C3 may not be fulfilled.

Control unit connection data

See chapter *Control units of the drive*.

Efficiency

96.0 … 98.0% at nominal power level depending on drive type

Protection classes

Degrees of protection (IEC/EN 60529)	IP22 (standard), IP42 (optional),IP54(pending)
Overvoltage category (IEC 60664-1)	III
Protective class (IEC/EN 61800-5-1)	I

Ambient conditions

Environmental limits for the drive are given below. The drive is to be used in a heated, indoor, controlled environment.

	Operation installed for stationary use	**Storage** in the protective package	**Transportation** in the protective package
Installation site altitude	0 to 2000 m above sea level. For attitude over 2000m, contact ABB. Output derated above 1000 m (3281 ft). See section *The ratings of the drive modules with 50 Hz and 60 Hz supply are given below.*.	-	-
Air temperature	0 … +40 °C (+32 … +104 °F). No condensation allowed. Output derated in the range +40 … +50 °C (+104 … +122 °F). See section *The ratings of the drive modules with 50 Hz and 60 Hz supply are given below.*.	-40 to +70 °C (-40 to +158 °F)	-40 to +70 °C (-40 to +158 °F)
Relative humidity	Max. 95%	Max. 95%	Max. 95%
	No condensation allowed. Maximum allowed relative humidity is 60% in the presence of corrosive gases.		
Contamination	IEC/EN 60721-3-3:2002: Classification of environmental conditions - Part 3-3: Classification of groups of environmental parameters and their severities - Stationary use of weather protected locations	IEC 60721-3-1:1997	IEC 60721-3-2:1997
Chemical gases	Class 3C2	Class 1C2	Class 2C2
Solid particles	Class 3S2. No conductive dust allowed.	Class 1S3 (packing must support this, otherwise 1S2)	Class 2S2

Shock IEC 60068-2-27:2008, EN 60068-2-27:2009 Environmental testing - Part 2-27: Tests - Test Ea and guidance: Shock	Not allowed	With packing max. 100 m/s^2 (328 ft/s^2) 11 ms	With packing max. 100 m/s^2 (328 ft/s^2) 11 ms

Materials

Cabinet Hot-dip zinc coated 1.5 mm thick steel sheet (thickness of coating approximately 20 micrometers). Polyester thermosetting powder coating (thickness approximately 80 micrometers) on visible surfaces, color RAL 7035 and RAL 9017. PC/ABS 3 mm, color NCS 1502-Y (RAL 9002 / PMS 1C Cool Grey).

Busbars Tin-plated copper

Fire safety of materials (IEC 60332-1) Insulating materials and non-metallic items mostly self-extinctive

Disposal The main parts of the drive can be recycled to preserve natural resources and energy. Product parts and materials should be dismantled and separated.

Generally all metals, such as steel, aluminum, copper and its alloys, and precious metals can be recycled as material. Plastics, rubber, cardboard and other packaging material can be used in energy recovery. Printed circuit boards and DC capacitors (C1-1 to C1-x) need selective treatment according to IEC 62635 guidelines. To aid recycling, plastic parts are marked with an approppriate identification code.

Contact your local ABB distributor for further information on environmental aspects and recycling instructions for professional recyclers. End of life treatment must follow international and local regulations.

Parts Name	Hazard Substance					
	(Pb)	(Hg)	(Cd)	(Cr^{6+})	(PBB)	(PBDE)
PCBA	×	○	○	○	○	○
Metal parts	○	○	○	○	○	○
Plastic parts	○	○	○	○	○	○
Other Nonmetal parts	○	○	○	○	○	○
Fans	○	○	○	○	○	○
Cable/wires	○	○	○	○	○	○

This table is made according to SJ/T 11364

○：means the content of this hazard substance in the homogeneous materials of the parts is less than the limit requirement in GB/T 26572

×：means the content of this hazard substance in the homogeneous materials of the parts is exceed the limit requirement of GB/T 26572

PCBA: include Printed Circuit Board and the components.
Depending on the model/type of product, it may not contain all of the above parts. It is subject to the purchased actual product model/type.

 This environmental protection period applies only when the product is used according to the conditions required by the user manual.

To protect the environment and human health:

1. The scrapped product should be separated from domestic waste and sent to a qualified place of disposal.
2. Recycling center should use appropriate methods to recycle/deal with the materials.
3. For more information about this product recycling, please contact local government, recycling center or your local dealer.

Applicable standards

	The drive complies with the standards below. The compliance with the European Low Voltage Directive is verified according to standard EN 61800-5-1.
EN 61800-5-1:2007	*Adjustable speed electrical power drive systems. Part 5-1: Safety requirements – electrical, thermal and energy*
EN 60204-1:2006 +A1 2009	*Safety of machinery. Electrical equipment of machines. Part 1: General requirements. Provisions for compliance: The final assembler of the machine is responsible for installing emergency-stop device.*
IEC/EN 60529:1991 + A1 2000	*Degrees of protection provided by enclosures (IP code)*
EN 61800-3:2004	*Adjustible speed electrical power drive systems. Part 3: EMC requirements and specific test methods*
IEC/EN 61439-1:2009	*Low voltage switchgear and controlgear assemblies --Parts 1: general rules*

Tightening torques

Unless a tightening torque is specified in the text, the following torques can be used.

Electrical connections

Size	Torque N·m	Note
M3	0.5	Strength class 4.6...8.8
M4	1	Strength class 4.6...8.8
M5	4	Strength class 8.8
M6	9	Strength class 8.8
M8	22	Strength class 8.8
M10	42	Strength class 8.8
M12	70	Strength class 8.8
M16	120	Strength class 8.8

Mechanical connections

Size	Max. torque N·m	Note
M5	6	Strength class 8.8
M6	10	Strength class 8.8
M8	24	Strength class 8.8

Insulation supports

Size	Max. torque N·m	Note
M6	5	Strength class 8.8
M8	9	Strength class 8.8
M10	18	Strength class 8.8
M12	31	Strength class 8.8

Cable lugs

Size	Max. torque N·m	Note
M8	15	Strength class 8.8
M10	32	Strength class 8.8
M12	50	Strength class 8.8

Disclaimers

Generic disclaimer

The manufacturer shall have no obligation with respect to any product which (i) has been improperly repaired or altered; (ii) has been subjected to misuse, negligence or accident; (iii) has been used in a manner contrary to the manufacturer's instructions; or (iv) has failed as a result of ordinary wear and tear.

CE marking

A CE mark is attached to the drive to verify that the drive complies with the provisions of the European Low Voltage and EMC Directives. The CE marking also verifies that the drive, in regard to its safety functions (such as Safe torque off), conforms with the Machinery Directive as a safety component.

Compliance with the European Low Voltage Directive

The compliance with the European Low Voltage Directive has been verified according to standard EN 61800-5-1.

Compliance with the European EMC Directive

The EMC Directive defines the requirements for immunity and emissions of electrical equipment used within the European Union. The EMC product standard (EN 61800-3:2004) covers requirements stated for drives. See section *Compliance with EN 61800-3:2004* below.

Compliance with the European Machinery Directive

The drive is an electronic product which is covered by the European Low Voltage Directive. However, the drive includes the Safe torque off function and can be equipped with other safety functions for machinery which, as safety components, are in the scope of the Machinery Directive. These functions of the drive comply with European harmonized standards such as EN 61800-5-2. The related declarations of conformity are shown below.

Compliance with EN 61800-3:2004

Definitions

EMC stands for **E**lectro**m**agnetic **C**ompatibility. It is the ability of electrical/electronic equipment to operate without problems within an electromagnetic environment. Likewise, the equipment must not disturb or interfere with any other product or system within its locality.

First environment includes establishments connected to a low-voltage network which supplies buildings used for domestic purposes.

Second environment includes establishments connected to a network not supplying domestic premises.

Drive of category C2: drive of rated voltage less than 1000 V and intended to be installed and started up only by a professional when used in the first environment. **Note:** A professional is a person or organization having necessary skills in installing and/or starting up power drive systems, including their EMC aspects.

Drive of category C3: drive of rated voltage less than 1000 V and intended for use in the second environment and not intended for use in the first environment.

Drive of category C4: drive of rated voltage equal to or above 1000 V, or rated current equal to or above 400 A, or intended for use in complex systems in the second environment.

Category C2

The drive complies with the standard with the following provisions:

1. The drive is equipped with EMC filter.
2. The motor and control cables are selected as specified in the hardware manual.
3. The drive is installed according to the instructions given in the hardware manual.
4. Maximum motor cable length is 100 meters (328 ft).

WARNING! The drive may cause radio interference if used in a residential or domestic environment. The user is required to take measures to prevent interference, in addition to the requirements for CE compliance listed above, if necessary.

Note: Do not install a drive equipped with EMC filter on IT (ungrounded) systems. The supply network becomes connected to ground potential through the EMC filter capacitors which may cause danger or damage the unit.

Category C3

The drive complies with the standard with the following provisions:

1. The motor and control cables are selected as specified in the hardware manual.
2. The drive is installed according to the instructions given in the hardware manual.
3. Maximum motor cable length is 100 meters (328 ft).

WARNING! A drive of category C3 is not intended to be used on a low-voltage public network which supplies domestic premises. Radio frequency interference is expected if the drive is used on such a network.

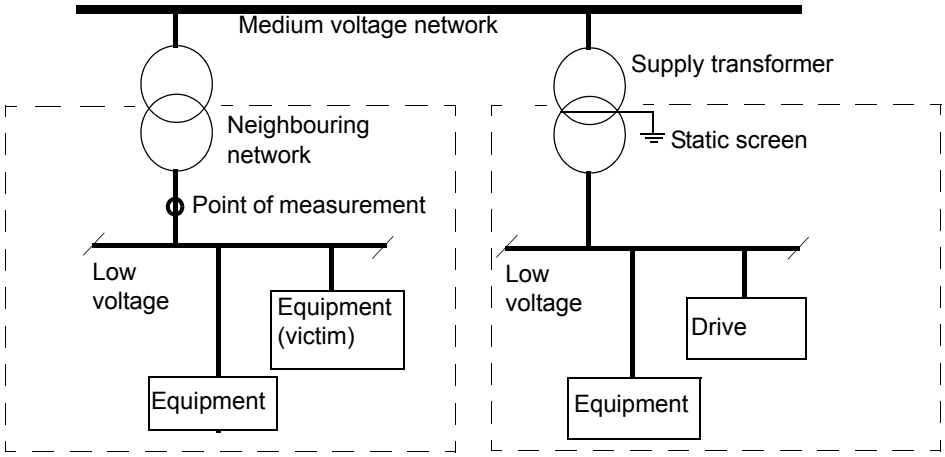
Category C4

If the provisions under *Category C3* cannot be met, the requirements of the standard can be met as follows:

1. It is ensured that no excessive emission is propagated to neighbouring low-voltage networks. In some cases, the natural suppression in transformers and cables is

---

sufficient. If in doubt, the supply transformer with static screening between the primary and secondary windings can be used.



2. An EMC plan for preventing disturbances is drawn up for the installation. A template is available from the local ABB representative.
3. The motor and control cables are selected as specified in the hardware manual.
4. The drive is installed according to the instructions given in the hardware manual.

WARNING! A drive of category C4 is not intended to be used on a low-voltage public network which supplies domestic premises. Radio frequency interference is expected if the drive is used on such a network.

13

Dimensions

What this chapter contains

This chapter contains the following dimension data:

- Composition of cabinet line-ups in tabular form for each frame size with options
- Approximate weights of basic line-ups
- Dimension drawing examples of selected line-ups

Cabinet line-up dimensions

The drive consists of cubicles built into a cabinet line-up. The tables below show the composition of cabinet line-ups for each frame size and the standard combinations of options. The dimensions are in millimeters.

Notes:

- The side panels at the left and right ends of the line-up increase the total line-up width by 30 millimeters (1.2”).
- The standard depth of the cabinet line-up is 644 mm (25.35”) excluding equipment such as handles and air inlet gratings.
- The data given is preliminary. ABB reserves the right to modify the design at any time without notice. Consult ABB for up-to-date, drive-specific information.

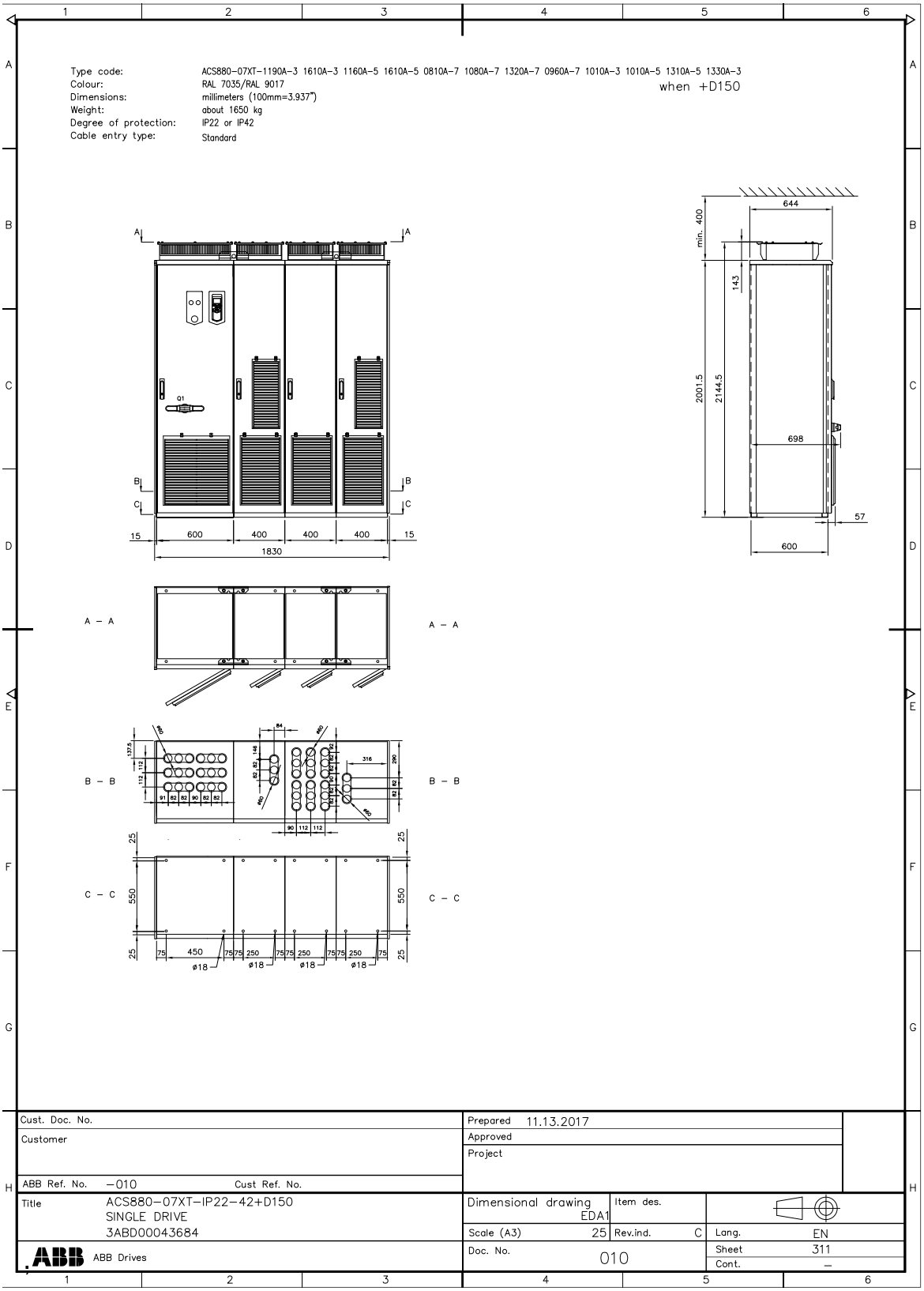
Weights

The table below lists the approximate basic weights of the ACS880-07XT frame sizes.

Frame size	Weight
	kg
2×R10	1160
2×R11	1300

Dimension drawing examples

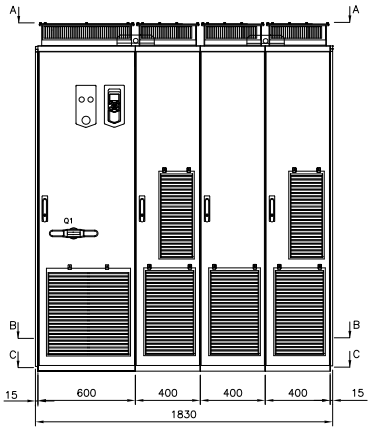
Frame 2×R11/R10 (with brake chopper)

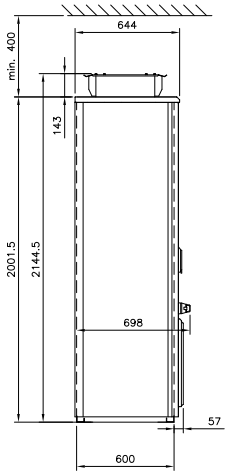


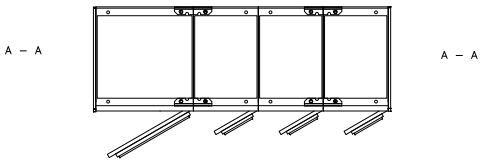
Frame 2×R11/R10 (without brake chopper)

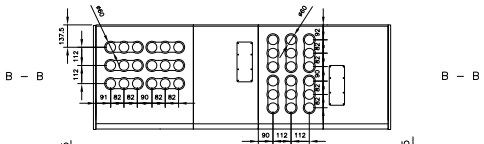
Type code: ACS880-07XT-1190A-3 1610A-3 1160A-5 1610A-5 0810A-7 1080A-7 1320A-7 0960A-7 1010A-3 1010A-5 1310A-5 1330A-3
Colour: RAL 7035/RAL 9017
Dimensions: millimeters (100mm=3.937")
Weight: about 1650 kg
Degree of protection: IP22 or IP42
Cable entry type: Standard

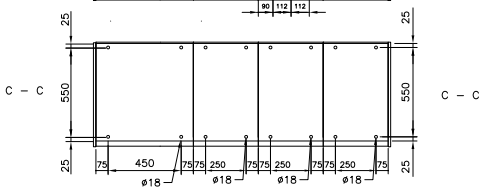
without D150





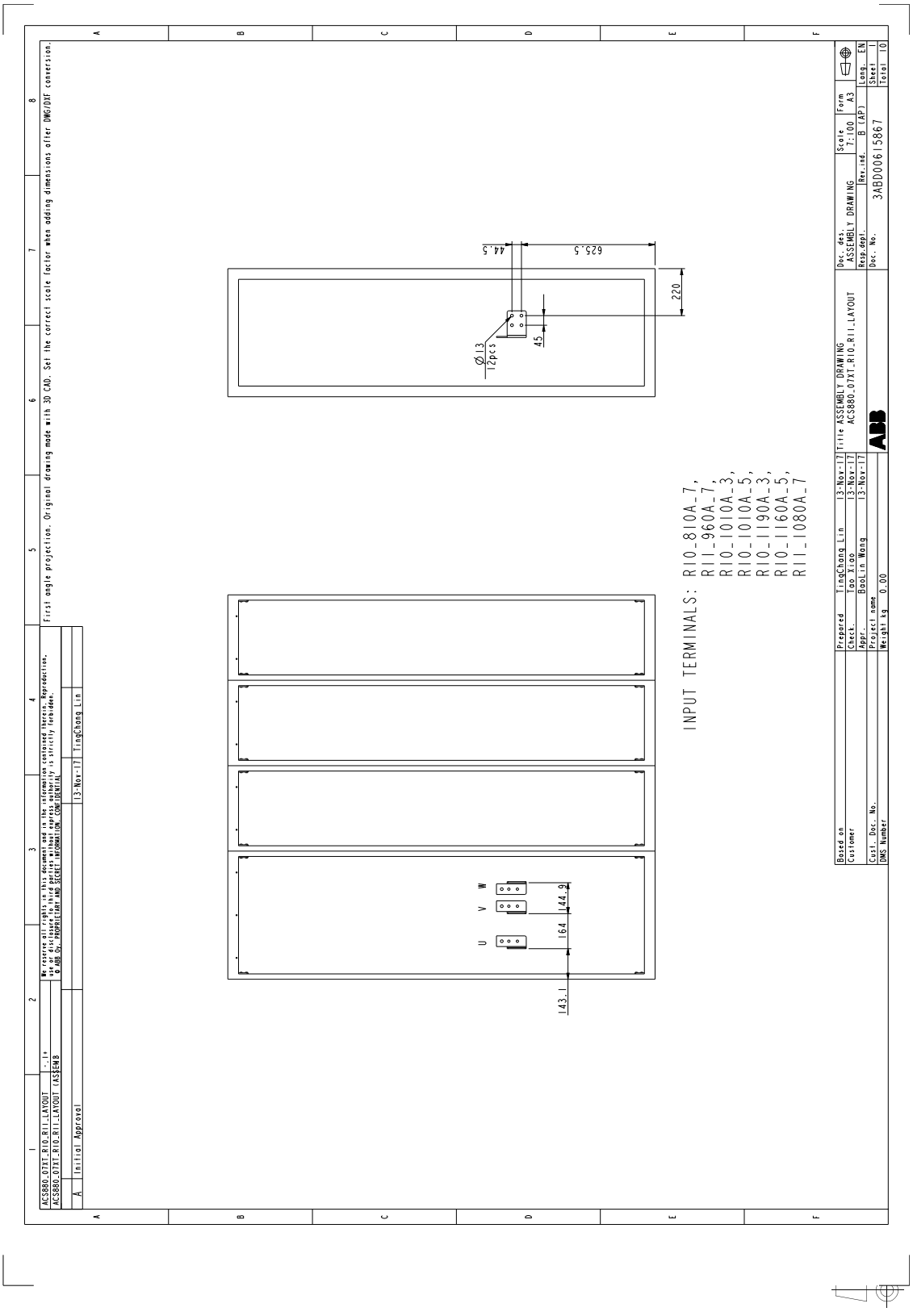




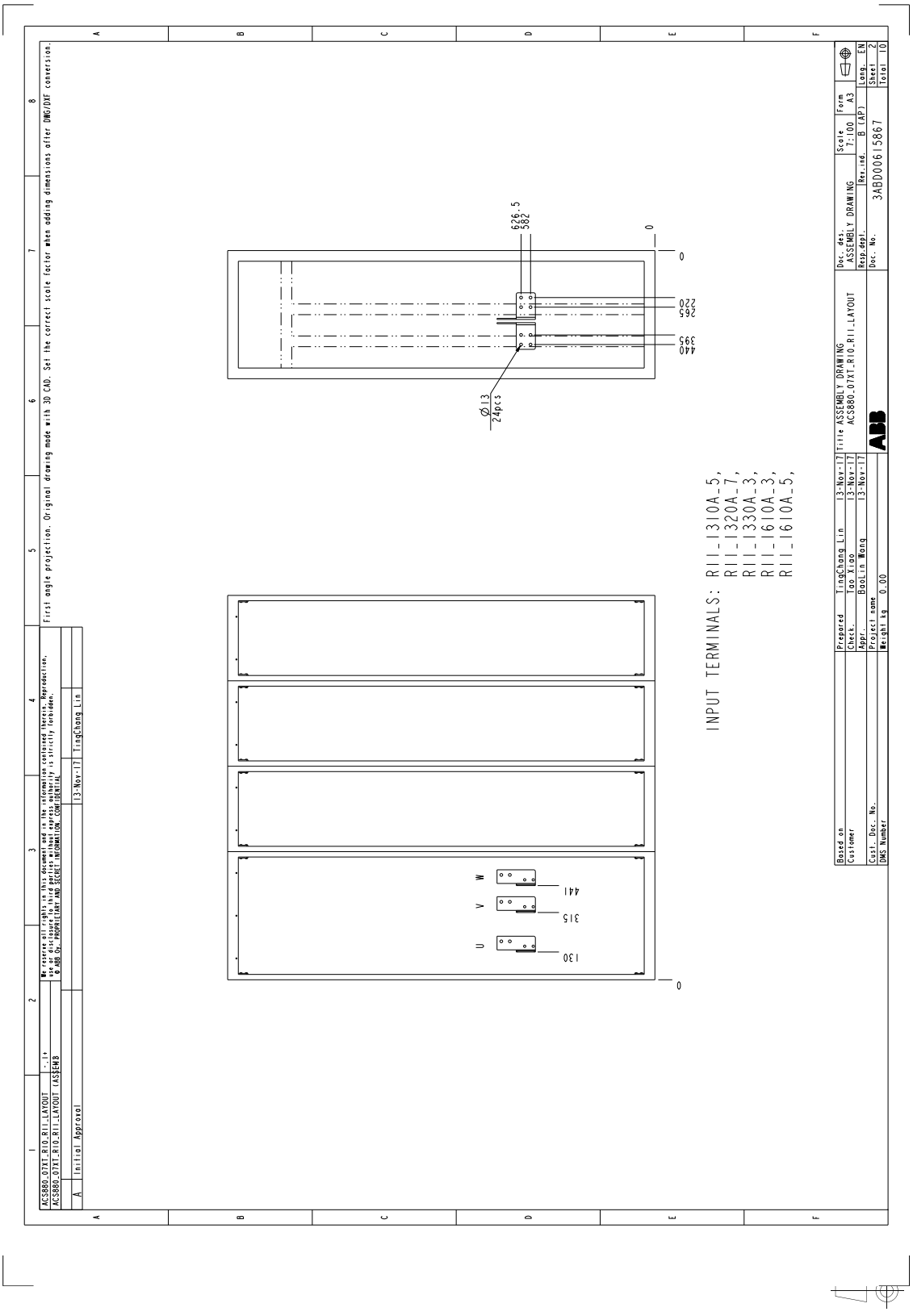


Cust. Doc. No.		Prepared 11.13.2017	
Customer		Approved	
		Project	
ABB Ref. No. –010	Cust Ref. No.		
Title ACS880-07XT-IP22-IP42 without D150 SINGLE DRIVE 3ABD00052716		Dimensional drawing EDA1	Item des.
		Scale (A3) 25	Rev.ind. D
ABB Drives		Doc. No. 010	Lang. EN
			Sheet 311
			Cont. –

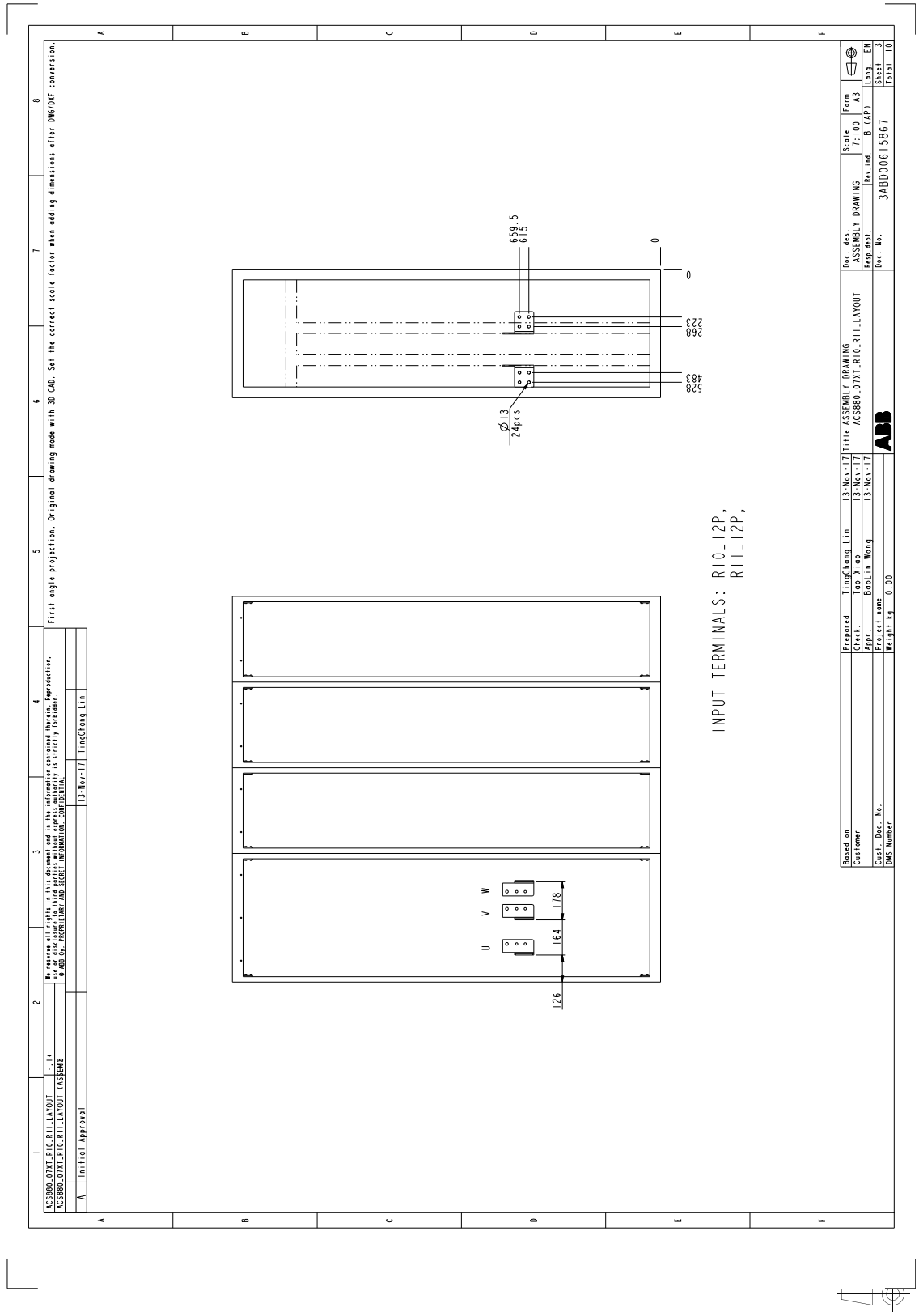
Location of input terminals (ACS880-07XT-0810A-7, ACS880-07XT-0960A-7, ACS880-07XT-1010A-3, ACS880-07XT-1010A-5, ACS880-07XT-1190A-3, ACS880-07XT-1160A-5, ACS880-07XT-1080A-7)



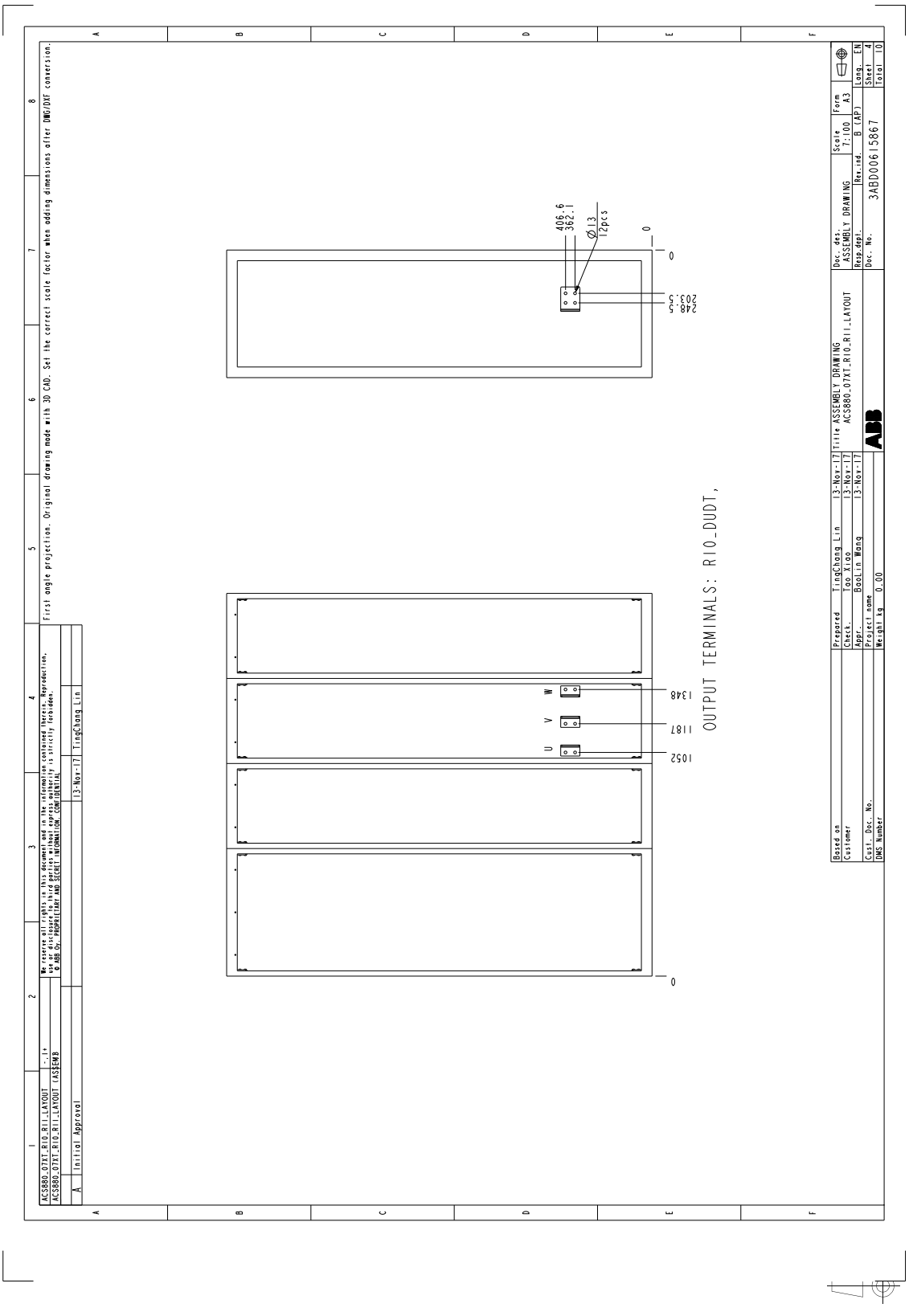
Location of input terminals (ACS880-07XT-1310A-5, ACS880-07XT-1320A-7, ACS880-07XT-1330A-3, ACS880-07XT-1610A-3, ACS880-07XT-1610A-5)



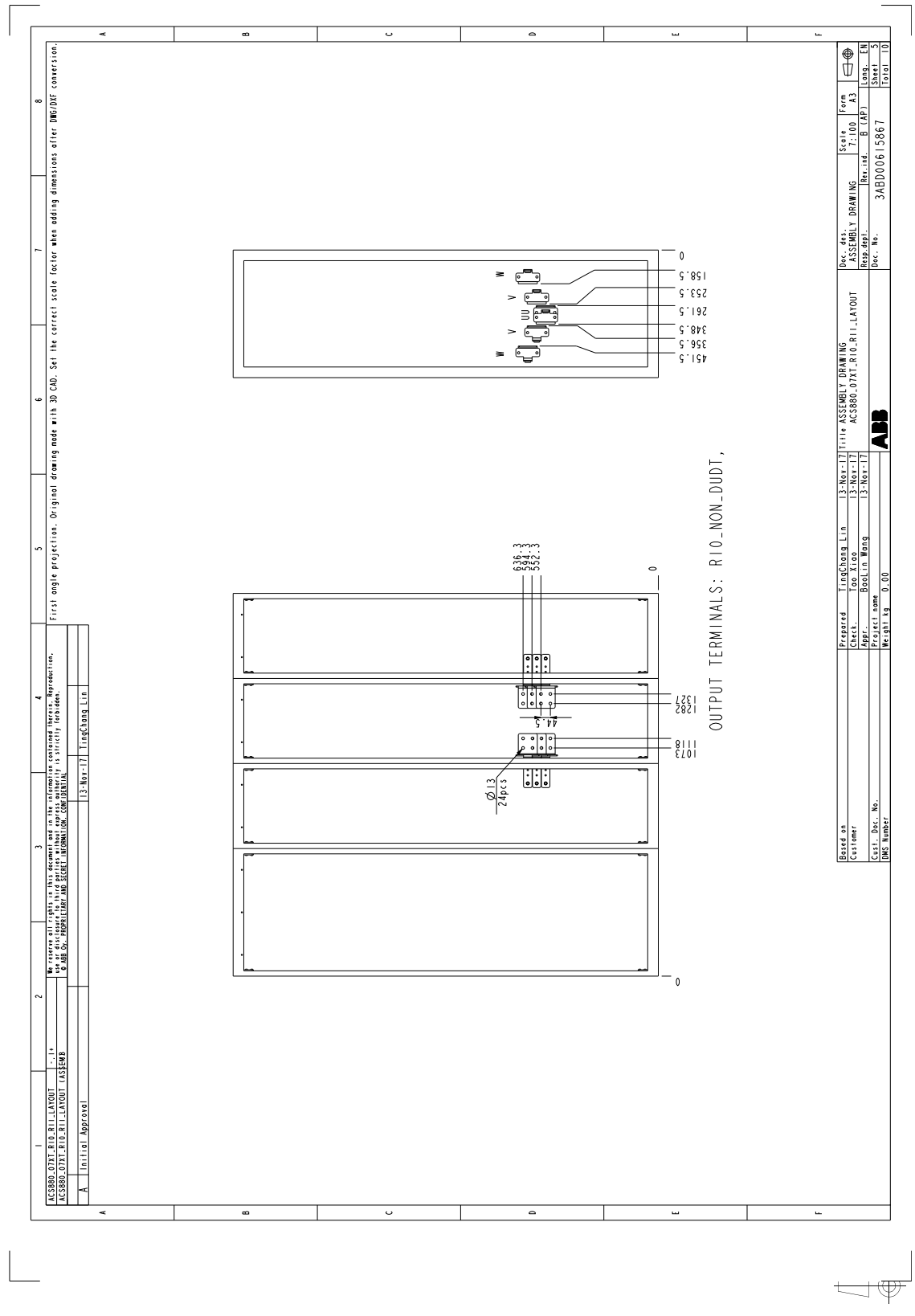
Location of input terminals (ACS880-07XT, 12 pulse)



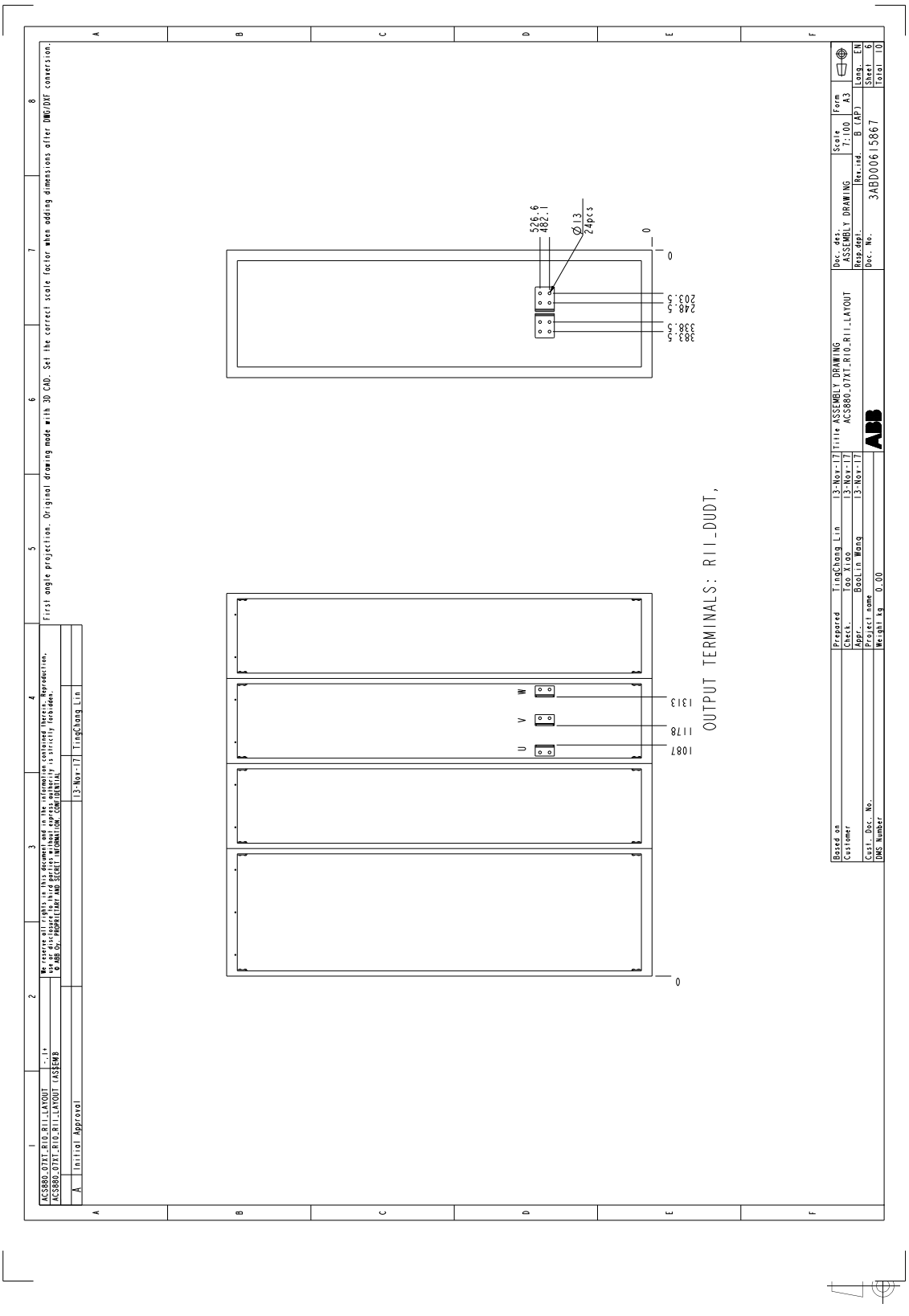
Location of output terminals (ACS880-07XT, R10, with du/dt)



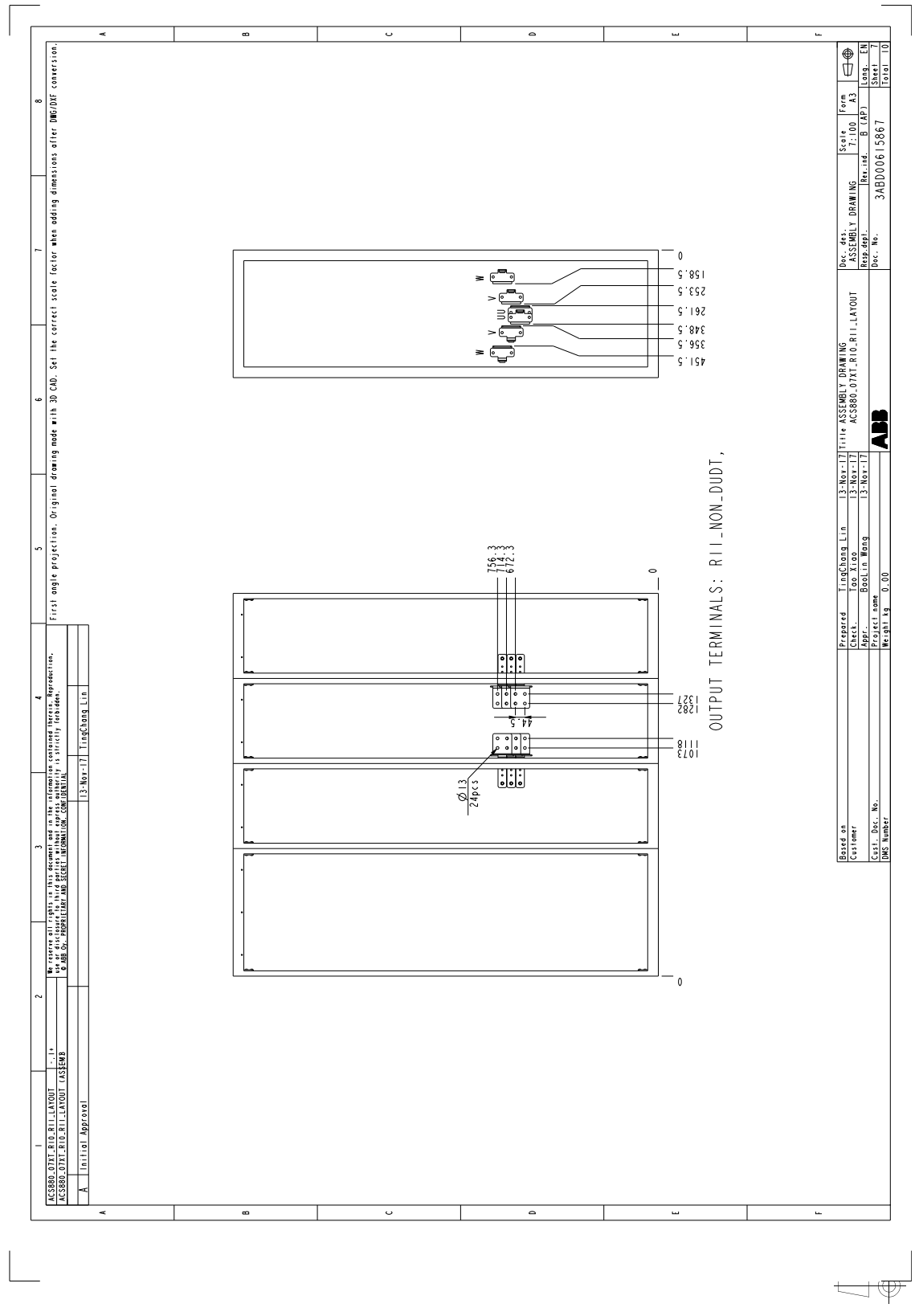
Location of output terminals (ACS880-07XT, R10, without du/dt)



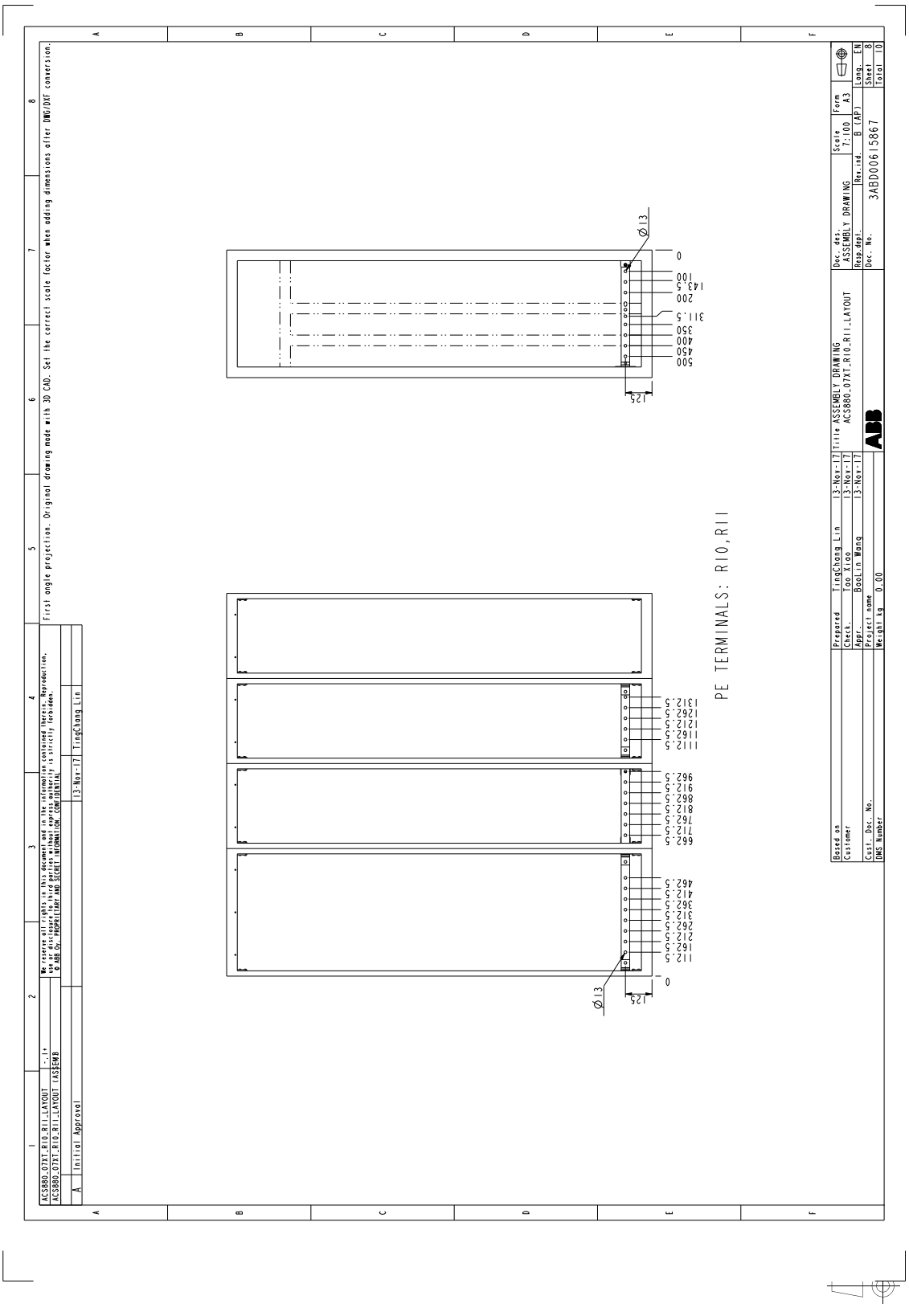
Location of output terminals (ACS880-07XT, R11, with du/dt)



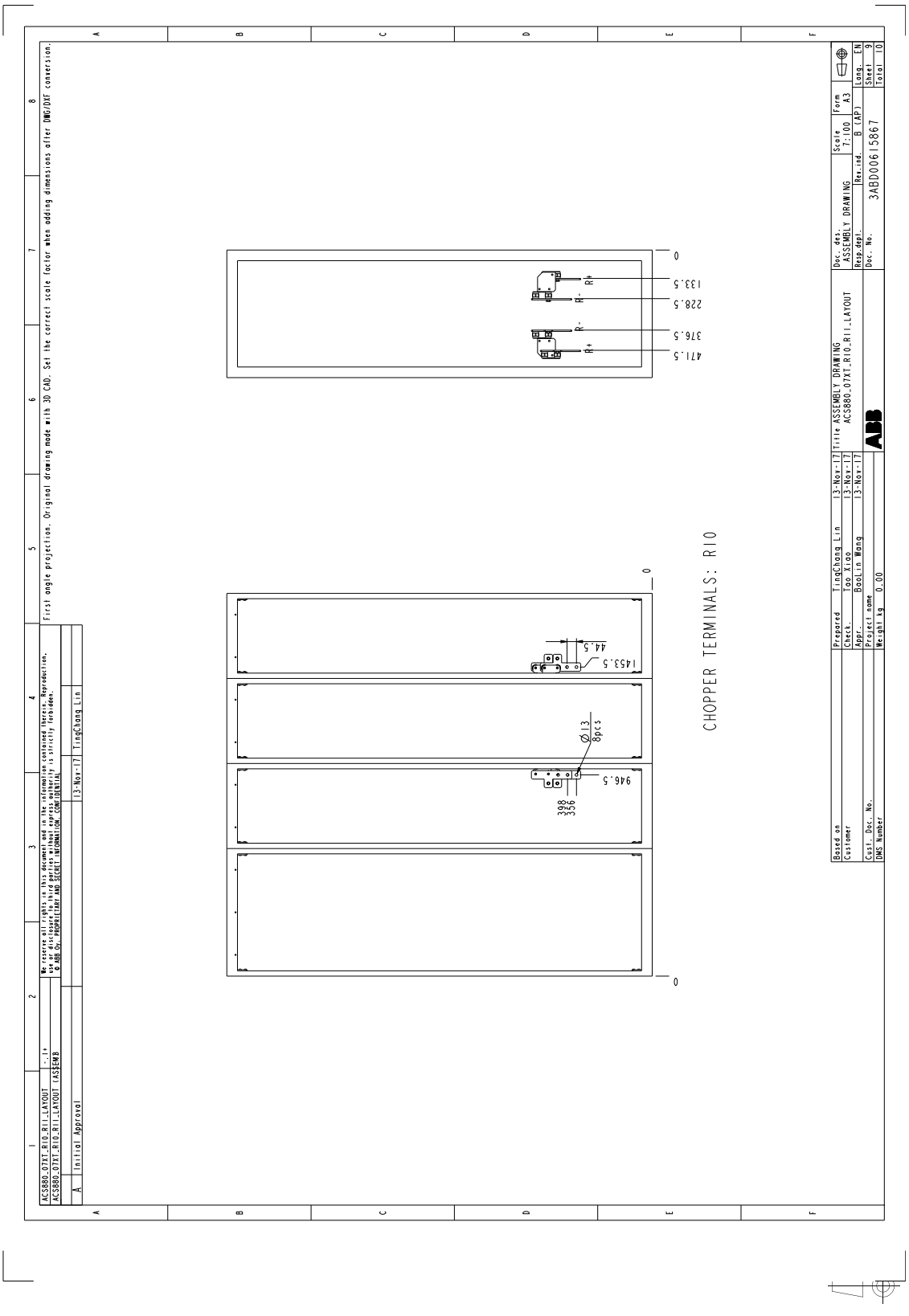
Location of output terminals (ACS880-07XT, R11, without du/dt)



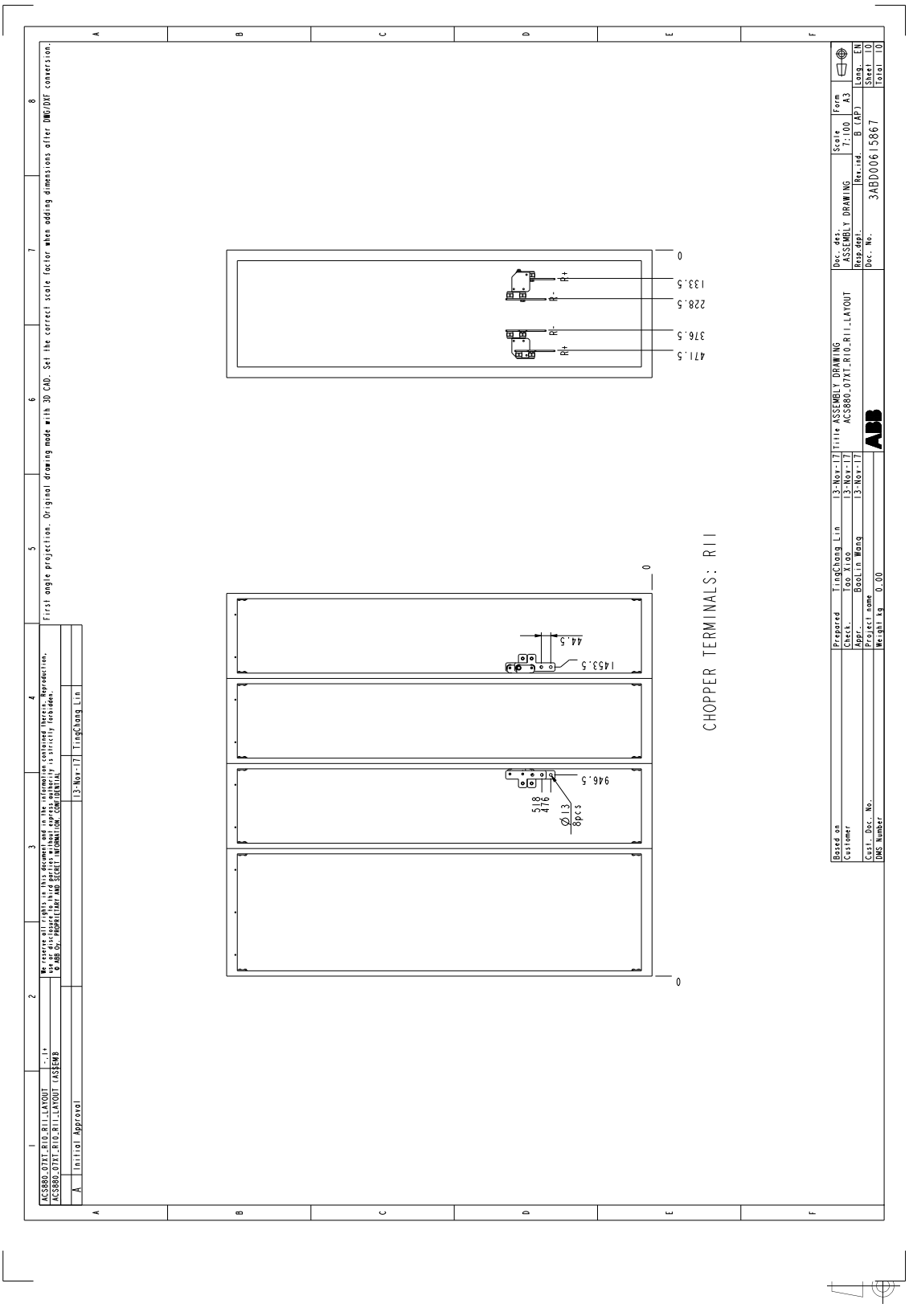
Location of PE terminals (ACS880-07XT)



Location of resistor terminals (ACS880-07XT, R10)



Location of resistor terminals (ACS880-07XT, R11)



15

Resistor braking

Contents of this chapter

This chapter describes how to select, protect and wire brake choppers and resistors. The chapter also contains the technical data.

Operation principle and hardware description

The dive can be equipped with optional built-in brake chopper (+D150). Brake resistors are available as add-on kits.

The brake chopper handles the energy generated by a decelerating motor. The chopper connects the brake resistor to the intermediate DC circuit whenever the voltage in the circuit exceeds the limit defined by the control program. Energy consumption by the resistor losses lowers the voltage until the resistor can be disconnected.

Planning the braking system

Selecting the default brake circuit components

1. Calculate the maximum power generated by the motor during braking (P_{max}).
2. Select a suitable drive, brake chopper and brake resistor combination for the application from the rating table. The braking power of the chopper must be greater or equal than the maximum power generated by the motor during the braking.
3. Check the resistor selection. The energy generated by the motor during a 400-second period must not exceed the resistor heat dissipation capacity E_R.
   Note: If the E_R value is not sufficient, it is possible to use a four-resistor assembly in which two standard resistors are connected in parallel, two in series. The E_R value of the four-resistor assembly is four times the value specified for the standard resistor.

Selecting a custom resistor

If you use a resistor other than the default resistor, make sure that:

1. The resistance of the custom resistor is greater or equal than the resistance of the default resistor in the rating table:

$$R \geq R_{min}$$

where

R Resistance of the custom resistor.



WARNING! Never use a brake resistor with a resistance smaller than R_{min}. The drive and the chopper are not able to handle the overcurrent caused by the low resistance.

R_{min} Resistance of the default resistor

2. The load capacity of the custom resistor is higher than the instantaneous maximum power consumption of the resistor when it is connected to the drive DC link voltage by the chopper:

$$P_r > \frac{U_{DC}^2}{R}$$

where

P_r Load capacity of the custom resistor

U_{DC} Drive DC link voltage.
1.35 · 1.25 · 415 V DC (when supply voltage is 380 to 415 V AC)
1.35 · 1.25 · 500 V DC (when supply voltage is 440 to 500 V AC) or
1.35 · 1.25 · 690 V DC (when supply voltage is 525 to 690 AC)

R Resistance of the custom resistor

Selecting and routing the external brake resistor cables

Use the same cable type for the resistor cabling as for the drive input cabling to ensure that the input fuses also protect the resistor cable. Alternatively, a two conductor shielded cable with the same cross-sectional area can be used.

Minimizing electromagnetic interference

Obey these rules in order to minimize electromagnetic interference caused by the rapid current changes in the resistor cables:

- Shield the braking power line completely, either by using shielded cable or a metallic enclosure. Unshielded single-core cable can only be used if it is routed inside a cabinet that efficiently suppresses the radiated emissions.
- Install the cables away from other cable routes.
- Avoid long parallel runs with other cables. The minimum parallel cabling separation distance should be 0.3 meters.
- Cross the other cables at right angles.
- Keep the cable as short as possible in order to minimize the radiated emissions and stress on chopper IGBTs. The longer the cable the higher the radiated emissions, inductive load and voltage peaks over the IGBT semiconductors of the brake chopper.

Maximum cable length

The maximum length of the resistor cable(s) is 10 m (33 ft).

EMC compliance of the complete installation

Note: ABB has not verified that the EMC requirements are fulfilled with external user-defined brake resistors and cabling. The EMC compliance of the complete installation must be considered by the customer.

Placing the brake resistors

Install the resistors outside the drive module in a place where they will cool.

Arrange the cooling of the resistor in a way that:

- no danger of overheating is caused to the resistor or nearby materials
- the temperature of the room the resistor is located in does not exceed the allowed maximum.

Supply the resistor with cooling air/water according to the resistor manufacturer's instructions.

WARNING! The materials near the brake resistor must be non-flammable. The surface temperature of the resistor is high. Air flowing from the resistor is of hundreds of degrees Celsius. If the exhaust vents are connected to a ventilation system, ensure that the material withstands high temperatures. Protect the resistor against contact.

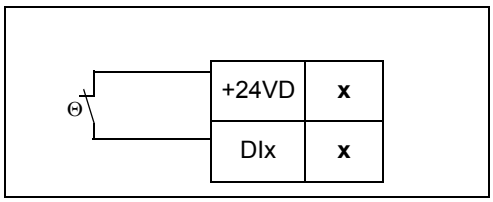
Protecting the system against thermal overload

The brake chopper protects itself and the resistor cables against thermal overload when the cables are dimensioned according to the nominal current of the drive. The drive control program includes a resistor and resistor cable thermal protection function which can be tuned by the user. See the firmware manual.

A main contactor is not required for protecting against resistor overheating when the resistor is dimensioned according to the instructions and the internal brake chopper is in use. The drive will disable power flow through the input bridge if the chopper remains conductive in a fault situation but the charging resistor may fail.

Note: If an external brake chopper (outside the drive module) is used, a main contactor is always required.

A thermal switch (standard in ABB resistors) is required for safety reasons. The thermal switch cable must be shielded and may not be longer than the resistor cable. Wire the switch to a digital input on the drive control unit as shown in the figure below.



Protecting the resistor cable against short-circuits

The input fuses will also protect the resistor cable when it is identical with the input cable.

Mechanical installation of external brake resistors

All brake resistors must be installed outside the drive. Obey the resistor manufacturer's instructions.

Electrical installation

Checking the insulation of the assembly

Obey the instructions given in section *Brake resistor and resistor cable*.

Connection diagram

See section *Connection diagram*.

Connection procedure

- Connect the resistor cables to the R+ and R- terminals in the same way as the other power cables. If a shielded three-conductor cable is used, cut the third conductor and ground the twisted shield of the cable (protective earth conductor of the resistor assembly) at both ends.
- Connect the thermal switch of the brake resistor as described in section *Protecting the system against thermal overload*.

Start-up

Set the following parameters (ACS880 primary control program):

- Disable the overvoltage control of the drive by parameter **30.30 Overvoltage control**.
- Set parameter **31.01 External event 1 source** to point to the digital input where the thermal switch of the brake resistor is wired.
- Set parameter **31.02 External event 1 type** to **Fault**.
- Enable the brake chopper by parameter **43.06 Brake chopper enable**. If **Enabled with thermal model** is selected, set also the brake resistor overload protection parameters **43.08** and **43.09** according to the application.
- Check the resistance value of parameter **43.10 Brake resistance**.

With these parameter settings, the drive stops by coasting at brake resistor overtemperature. For settings of other control programs, see the appropriate firmware manual.



WARNING! If the drive is equipped with a brake chopper but the chopper is not enabled by the parameter setting, the internal thermal protection of the drive against resistor overheating is not in use. In this case, the brake resistor must be disconnected.

Note: Some brake resistors are coated with oil film for protection. At the start-up, the coating burns off and produces a little bit of smoke. Ensure proper ventilation at the start-up.

Technical data

Ratings

Drive module unit type ACS880-07XT-	Basic module type ACS8880-04-	Internal brake chopper per basic brake module		Example brake resistor(s) per basic module			
		P_{brcont}	R_{min}	Type	R	E_R	P_{Rcont}
		kW	ohm		ohm	kJ	kW
U_N = 400 V							
1010A-3	585A-3+P943	315	1.3	2xSAFUR200F500	1.35	10800	27
1190A-3	650A-3+P943	315	1.3	2xSAFUR200F500	1.35	10800	27
1330A-3	725A-3+P943	400	0.7	3xSAFUR200F500	0.90	16200	40
1610A-3	880A-3+P943	400	0.7	3xSAFUR200F500	0.90	16200	40
U_N = 500 V							
1010A-5	583A-5+P943	315	1.3	2xSAFUR200F500	1.35	10800	27
1160A-5	635A-5+P943	315	1.3	2xSAFUR200F500	1.35	10800	27
1310A-5	715A-5+P943	400	0.7	3xSAFUR200F500	0.90	16200	40
1610A-5	880A-5+P943	400	0.7	3xSAFUR200F500	0.90	16200	40
U_N = 690 V							
0810A-7	430A-7+P943	285	2.2	SAFUR200F500	2.70	3600	13
0960A-7	522A-7+P943	350	2.0	2xSAFUR125F500	2.0	7200	18
1080A-7	590A-7+P943	400	1.8	2xSAFUR125F500	2.0	7200	18
1320A-7	721A-7+P943	400	1.8	2xSAFUR125F500	2.0	7200	18

3AXD10000363510, 3AXD00000588487

P_{brcont} Maximum continuous braking power. The braking is considered continuous if the braking time exceeds 30 seconds.

R_{min} The minimum allowed resistance value of the brake resistor

R Resistance value for the listed resistor assembly

E_R Short energy pulse that the resistor assembly withstands every 400 seconds

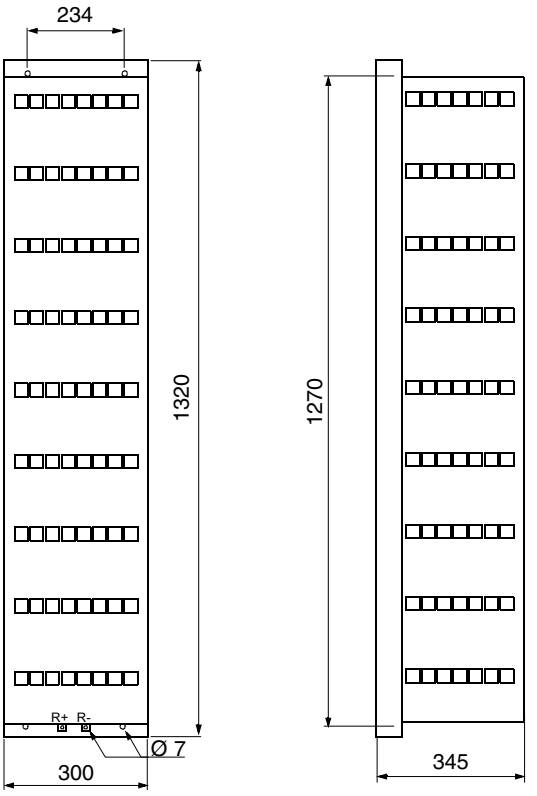
P_{Rcont} Continuous power (heat) dissipation of the resistor when placed correctly

The ratings apply at an ambient temperature of 40 °C (104 °F). For 690 V data, please contact your local ABB representative.

SAFUR resistors

The degree of protection of SAFUR resistors is IP00. The resistors are not UL listed. The thermal time constant of the resistors is 555 seconds.

Dimensions and weights



Brake resistor type	Weight
SAFUR125F500	25 kg (55 lb)
SAFUR200F500	30 kg (66 lb)

Ordering codes

Brake resistor type	ABB ordering code
SAFUR125F500	68759285
SAFUR200F500	68759340

Terminals and cable lead-through data

See section *Terminal and lead-through data for the power cables*.

Further information

Product and service inquiries

Address any inquiries about the product to your local ABB representative, quoting the type designation and serial number of the unit in question. A listing of ABB sales, support and service contacts can be found by navigating to www.abb.com/searchchannels.

Product training

For information on ABB product training, navigate to new.abb.com/service/training.

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