

ACS 800

Hardware Manual

ACS800-02 Drives (90 to 500 kW)

ACS800-U2 Drives (125 to 600 HP)



ABB

ACS 800 Single Drive Manuals

GENERAL MANUALS

ACS800-01/U1 Hardware Manual 1.1 to 110 kW (1.5 to 150 HP) 3AFE 64382101 (English)

- Safety instructions
- Electrical installation planning
- Mechanical and electrical installation
- Motor control and I/O board (RMIO)
- Maintenance
- Technical data
- Dimensional drawings
- Resistor braking

ACS800-02/U2 Hardware Manual 90 to 500 kW (125 to 600 HP) 3AFE 64567373 (English)

- Safety instructions
- Electrical installation planning
- Mechanical and electrical installation
- Motor control and I/O board (RMIO)
- Maintenance
- Technical data
- Dimensional drawings
- Resistor braking

FIRMWARE MANUALS FOR DRIVE APPLICATION PROGRAMS (appropriate manual is included in the delivery)

Standard 3AFE 64527592 (English)

- Control panel use
- Standard application macros with external control connection diagrams
- Parameters of the Standard Application Program
- Fault tracing
- Fieldbus control

Application Guide for Adaptive Programming 3AFE 64527274 (English)

- Description of adaptive programming
- How to build a program
- How to document the program

OPTION MANUALS (delivered with optional equipment)

Fieldbus Adapters, I/O Extension Modules etc.

- Installation
- Programming
- Fault tracing
- Technical data

ACS800-02 Drives
90 to 500 kW
ACS800-U2 Drives
125 to 600 HP

Hardware Manual

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Safety instructions

What this chapter contains

This chapter contains the safety instructions which you must follow when installing, operating and servicing the drive. If ignored, physical injury or death may follow, or damage may occur to the drive, the motor or driven equipment. Read the safety instructions before you work on the unit.

To which products this chapter applies

This chapter applies to the ACS800-01/U1 and the ACS800-02/U2.

Use of warnings and notes

There are two types of safety instructions throughout this manual: warnings and notes. Warnings caution you about conditions which can result in serious injury or death and/or damage to the equipment. They also tell you how to avoid the danger. Notes draw attention to a particular condition or fact, or give information on a subject. The warning symbols are used as follows:



Dangerous voltage warning warns of high voltage which can cause physical injury and/or damage to the equipment.



General warning warns about conditions, other than those caused by electricity, which can result in physical injury and/or damage to the equipment.



Electrostatic discharge warning warns of electrostatic discharge which can damage the equipment.

Installation and maintenance work

These warnings are intended for all who work on the drive, motor cable or motor. Ignoring the instructions can cause physical injury or death.



Only qualified electricians are allowed to install and maintain the drive.

- Never work on the drive, the motor cable or the motor when main power is applied. After switching off the input power, always wait for 5 min to let the intermediate circuit capacitors discharge before you start working on the drive, the motor or the motor cable. Measure the voltage between terminals UDC+ and UDC- with a multimeter (impedance at least 1 Mohm) to ensure that the drive is discharged before beginning work.
- Do not work on the control cables when power is applied to the drive or to the external control circuits. Externally supplied control circuits may cause dangerous voltages inside the drive even when the main power on the drive is switched off.
- Do not make any insulation tests without disconnecting the drive from the cabling.
- When reconnecting the motor cable, always check that the phase order is correct.

Note:

- The motor cable terminals on the drive are at a dangerously high voltage when the input power is on, regardless of whether the motor is running or not.
 - The brake control terminals (UDC+, UDC-, R+ and R- terminals) carry a dangerous DC voltage (over 500 V).
 - Depending on the external wiring, dangerous voltages [115 V, 220 V or 230 V] may be present on the terminals of relay outputs RO1 to RO3.
-



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

Grounding

These instructions are intended for all who are responsible for the grounding of the drive. Incorrect grounding can cause physical injury, death or equipment malfunction and increase electromagnetic interference.



-
- Ground the drive, the motor and adjoining equipment to ensure personnel safety in all circumstances, and to reduce electromagnetic emission and pick-up.
 - Make sure that grounding conductors are adequately sized as required by safety regulations.
 - In a multiple-drive installation, connect each drive separately to protective earth (PE).
 - ACS800-01: In European CE compliant installations and in other installations where EMC emissions must be minimized, make a 360° high frequency grounding of cable entries in order to suppress electromagnetic disturbances. In addition, connect the cable shields to protective earth (PE) in order to meet safety regulations.
(ACS800-02: 360° high frequency grounding of cable entries is not required.)
 - Do not install a drive with EMC filter option +E202 or +E200 (available for ACS800-01 only) on an ungrounded power system or a high resistance-grounded (over 30 ohms) power system.

Note:

- Power cable shields are suitable for equipment grounding conductors only when adequately sized to meet safety regulations.
 - As the normal leakage current of the drive is higher than 3.5 mA AC or 10 mA DC (stated by EN 50178, 5.2.11.1), a fixed protective earth connection is required.
-

Mechanical installation

These notes are intended for all who install the drive. Handle the unit carefully to avoid damage and injury.



- ACS800-01: The drive is heavy. Do not lift it alone. Do not lift the unit by the front cover. Place the unit only on its back.



ACS800-02: See *Installation / Moving the unit*.

- Make sure that dust from drilling does not enter the drive when installing. Electrically conductive dust inside the unit may cause damage or lead to malfunction.
- Ensure sufficient cooling.
- Do not fasten the drive by riveting or welding.


Operation

These warnings are intended for all who plan the operation of the drive or operate the drive. Ignoring the instructions can cause physical injury or death or damage the equipment.



- Before adjusting the drive and putting it into service, make sure that the motor and all driven equipment are suitable for operation throughout the speed range provided by the drive. The drive can be adjusted to operate the motor at speeds above and below the speed provided by connecting the motor directly to the power line.
- Do not activate automatic fault reset functions of the Standard Application Program if dangerous situations can occur. When activated, these functions will reset the drive and resume operation after a fault.
- Do not control the motor with the disconnecting device (means); instead, use the control panel keys  and , or commands via the I/O board of the drive. The maximum allowed number of charging cycles of the DC capacitors (i.e. power-ups by applying power) is five in ten minutes.

Note:

- If an external source for start command is selected and it is ON, the drive (with Standard Application Program) will start immediately after fault reset unless the drive is configured for 3-wire (a pulse) start/stop.
- When the control location is not set to Local (L not shown in the status row of the display), the stop key on the control panel will not stop the drive. To stop the drive using the control panel, press the LOC/REM key and then the stop key .

Permanent magnet motor

These are additional warnings concerning permanent magnet motor drives.



WARNING! Do not work on the drive when the permanent magnet motor is rotating. Also when the supply power is switched off, a rotating permanent magnet motor feeds power to the intermediate circuit of the drive and also the supply connections become live (even when the inverter is stopped!).

Installation and maintenance work

- Disconnect the motor from the drive with a safety switch and additionally if possible
- lock the motor shaft and ground the motor connection terminals temporarily by connecting them together as well as to the PE.

Operation

Do not run the motor over the rated speed. Motor overspeed leads to overvoltage which may explode the capacitors in the intermediate circuit of the drive.

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About this manual

What this chapter contains

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

Intended audience

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

This manual is written for readers worldwide. Both SI and imperial units are shown. Special US instructions for installations within the United States that must be installed per the National Electrical Code and local codes are marked with (US).

Common chapters for two products

Three chapters of this manual, *Safety instructions*, *Electrical installation planning* and *Resistor Braking*, apply also to the ACS800-01 and are used as such in both ACS800-01 and ACS800-02 Hardware Manuals.

Categorization according to the frame size

Some instructions, technical data and dimensional drawings which concern only certain frame sizes are marked with the symbol of the frame size R2, R3... or R8. The frame size is not marked on the drive designation label. To identify the frame size of your drive, see the rating tables in chapter *Technical data*.

The ACS800-02 is manufactured in frame sizes R7 and R8. The ACS800-01 is manufactured in frame sizes R2 to R6.

Contents

The chapters of this manual are briefly described below.

Safety instructions give safety instructions for the installation, commissioning, operation and maintenance of the drive.

About this manual introduces this manual.

The ACS800-02/U2 describes the drive.

Electrical installation planning instructs on the motor and cable selection, the protections and the cable routing.

Installation instructs how to place, mount and wire the drive.

Motor control and I/O board (RMIO) shows external control connections to the motor control and I/O board and its specifications.

Installation checklist helps in checking the mechanical and electrical installation of the drive.

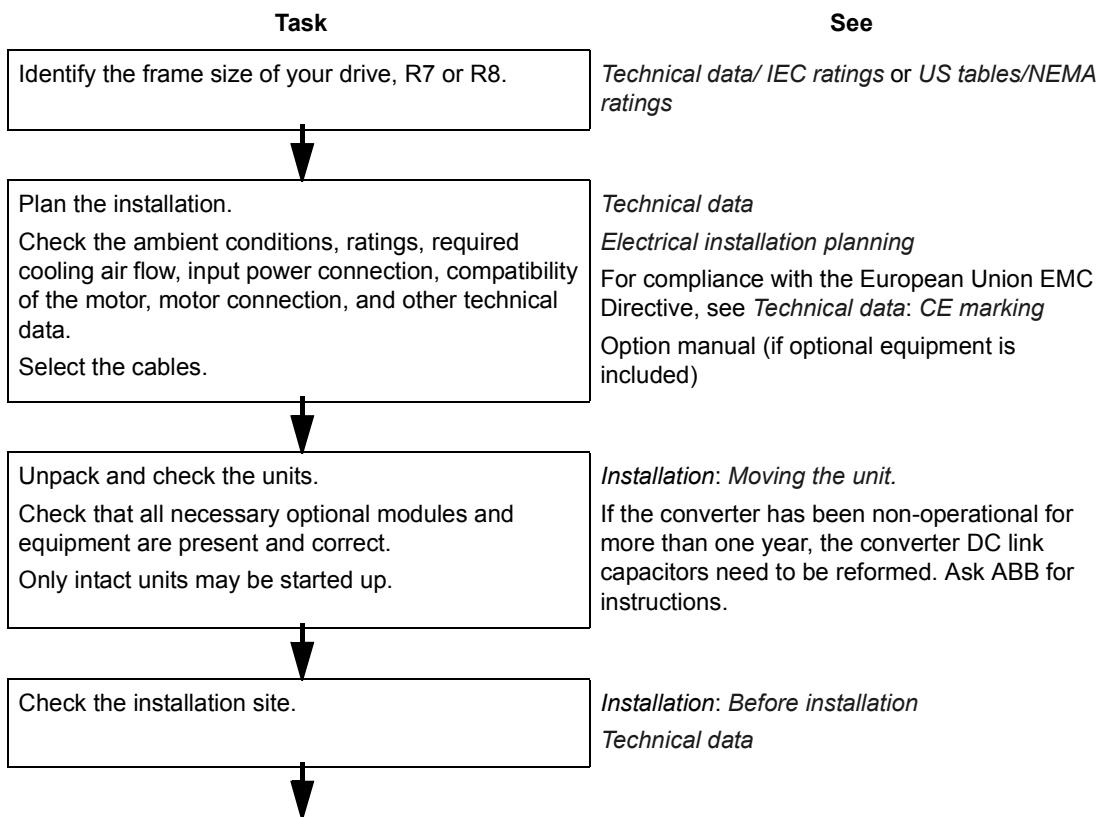
Maintenance contains preventive maintenance instructions.

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

Dimensional drawings contains the dimensional drawings of the drive.

Resistor Braking describes how to select, protect and wire optional brake choppers and resistors. The chapter also contains technical data.

Installation and commissioning flowchart



Task	See
Check the insulation of the motor and the motor cable.	<i>Installation: Checking the insulation of the assembly</i>
If the drive is about to be connected to an IT (ungrounded) system, check that the drive is not equipped with EMC filter +E202.	<i>The ACS800-02/U2: Type code. For instructions on how to disconnect the EMC filtering, contact ABB.</i>
Route the cables.	<i>Electrical installation planning: Routing the cables</i> For compliance with the European Union EMC Directive, see <i>Technical data: CE marking</i>
Install the drive. Connect the power cables. Connect the control and the auxiliary control cables.	<i>Installation, Resistor Braking (optional)</i>
Check the installation.	<i>Installation checklist</i>
Commission the drive.	Appropriate firmware manual
Commission the optional brake chopper (if present).	<i>Resistor Braking</i>

Inquiries

Address any inquiries about the product to the local ABB representative, quoting the type code and the serial number of the unit. If the local ABB representative cannot be contacted, address inquiries to the manufacturing facility (addresses and phone numbers are on the back cover of this manual).

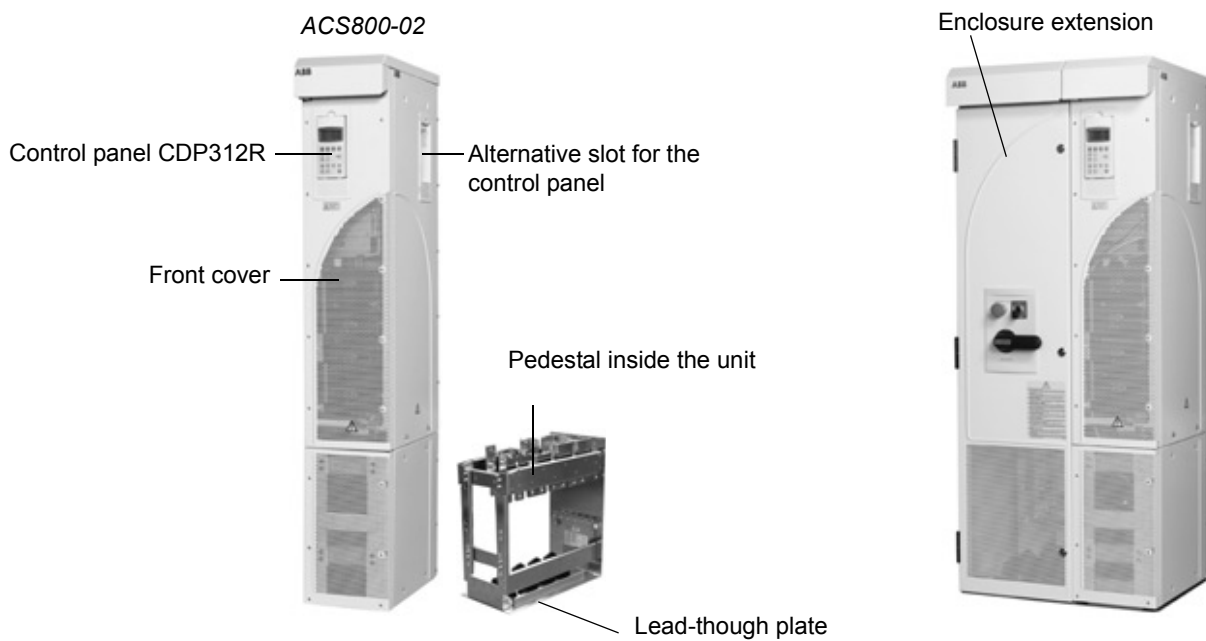
The ACS800-02/U2

What this chapter contains

This chapter describes the construction and operating principle of the drive in short.

The ACS800-02/U2

The ACS800-02/U2 is a free-standing drive for controlling AC motors. In the basic unit, the cabling direction is from below. When an optional enclosure extension is connected next to the basic unit, the cables can also be led from above.



Enclosure extension

The extension can be used for accommodating customer equipment; it is also automatically added whenever required by factory-installed options such as

- switch fuse (always included with the Enclosure extension)
- line contactor with Category 0 emergency stop devices (start/stop and emergency stop switches included)
- thermistor relay(s)
- Pt100 relays
- top cable entry/exit
- additional I/O terminal block.

Type code

The type code contains information on the specifications and configuration of the drive. The first digits from left express the basic configuration (e.g. ACS800-02-0170-5). The optional selections are given thereafter, separated by + signs (e.g. +E202). The main selections are described below. Not all selections are available for all types. For more information, refer to *ACS800 Ordering Information* (EN code: 64556568, available on request).

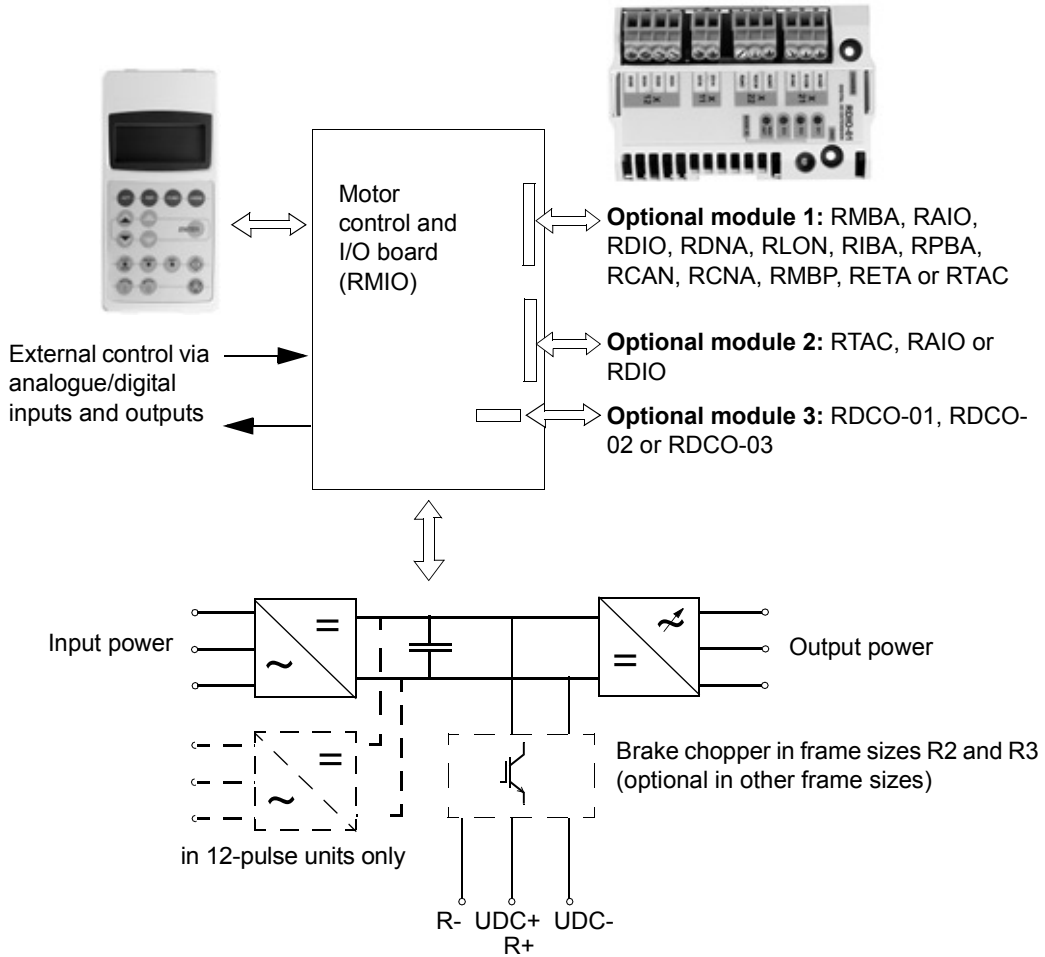
Selection	Alternatives
Product series	ACS800 product series
Type	01 = wall mounted. U1 = wall mounted (USA). UL type 1. 02 = free standing. When no options are selected: 6-pulse diode input bridge, IP 21, Control Panel CDP312R, no EMC filter, Standard Application Program, cable connection box (cabling from below), boards without coating, one set of English manuals. U2 = free standing (USA). When no options are selected: 6-pulse diode bridge, UL type 1, Control Panel CDP312R, no EMC filter, Standard Application Program (US), enclosure extension (top entry, top exit), US gland/conduit plate, common mode filter in frame size R8, boards without coating, one set of English manuals.
Size	Refer to <i>Technical data: IEC ratings</i> .
Voltage range (nominal rating in bold)	2 = 200/208/220/ 230 /240 VAC 3 = 380/ 400 /415 VAC 5 = 380/400/415/440/460/480/ 500 VAC 7 = 525/575/600/ 690 VAC
+ options	
Input bridge	A004 = 12-pulse
Degree of protection	B056 = IP 54 (UL type 12), not available with +C111 B059 = IP 54R with connection to air outlet duct (not available with +C111)
Construction	C111 = enclosure extension
Resistor braking	D150 = brake chopper

Selection	Alternatives
Filter	E202 = EMC/RFI filter for first environment TN (grounded) system, restricted (the A limits) E210 = EMC/RFI filter for second environment TN/IT (grounded/ ungrounded) system E204 = du/dt limitation by gate drivers E208 = common mode filter E209 = light common mode filter
Line options (+C111 required)	F250 = line contactor + emergency stop of category 0
Cabinet options (+C111 required)	G304 = 115 VAC auxiliary voltage transformer
Cabling	H351 = top entry (+C111 required) H353 = top exit (+C111 required) H356 = US/UK gland/conduit plate
Control panel	J405 = no control panel, LEDs on the panel mounting platform included
Fieldbus	Refer to <i>ACS800 Ordering Information</i> (EN code: 64556568).
I/O	
Application program	
Language of manual	
Specialities	P901 = coated boards P904 = extended warranty

Main circuit and control

Diagram

This diagram shows the control interfaces and the main circuit of the drive.



Operation

This table describes the operation of the main circuit in short.

Component	Description
six- or twelve-pulse rectifier	converts the three-phase AC voltage to DC voltage
capacitor bank	energy storage which stabilizes the intermediate circuit DC voltage
six-pulse IGBT inverter	converts the DC voltage to AC voltage and vice versa. The motor operation is controlled by switching the IGBTs.

Printed circuit boards

The drive contains the following printed circuit boards as standard:

- main circuit board (AINT)
- motor control and I/O board (RMIO-02) with a fibre optic link to the AINT board
- input bridge control board (AINP)
- input bridge protection board (AIBP) which includes varistors, snubbers for the thyristors
- power supply board (APOW)
- gate driver control board [AGDR-61 or AGDR-62 (with du/dt limitation option +E204)]
- diagnostics and panel interface board (ADPI)
- EMC filter boards (NRFC and ARFC) with option +E202
- brake chopper control board (ABRC) with option +D150

Motor control

The motor control is based on the Direct Torque Control (DTC) method. Two phase currents and DC link voltage are measured and used for the control. The third phase current is measured for earth fault protection.

Electrical installation planning

What this chapter contains

This chapter contains the instructions that you must follow when selecting the motor, the cables, the protections, the cable routing and the way of operation for the drive system. Always follow local regulations.

Note: If the recommendations given by ABB are not followed, the drive may experience problems that the warranty does not cover.

To which products this chapter applies

This chapter applies to the ACS800-01/U1 and the ACS800-02/U2.

Checking the compatibility of the motor

See *Technical data* for the drive ratings and the motor connection data.



WARNING! Operation is not allowed if the motor nominal voltage is less than 1/2 of the drive nominal input voltage, or the motor nominal current less than 1/6 of the drive nominal output current.

Protecting the motor winding and bearings

The output of the drive comprises – regardless of output frequency – pulses of approximately 1.35 times the mains network voltage with a very short rise time. This is the case with all drives employing modern IGBT inverter technology.

The voltage of the pulses can be almost double at the motor terminals, depending on the motor cable properties. This in turn can cause additional stress on the motor insulation.

Modern variable speed drives with their fast rising voltage pulses and high switching frequencies can cause current pulses through the motor bearings which can gradually erode the bearing races.

The stress on motor insulation can be avoided by using optional ABB du/dt filters. du/dt filters also reduce bearing currents.

To avoid damage to motor bearings, insulated N-end (non-driven end) bearings and output filters from ABB must be used according to the following table. In addition, the cables must be selected and installed according to the instructions given in this manual. Three types of filters are used individually or in combinations:

- optional du/dt limitation (protects motor insulation system and reduces bearing currents).
- common mode filter (mainly reduces bearing currents)
- light common mode filter (mainly reduces bearing currents).

The common mode filter is composed of toroidal cores installed onto the output busbars inside the drive at the factory.

Requirements table

The following table shows how to select the motor insulation system and when optional ABB du/dt limitation, insulated N-end (non-driven end) motor bearings and ABB common mode filters are required. The motor manufacturer should be consulted regarding the construction of the motor insulation and additional requirements for explosion-safe (EX) motors. Failure of the motor to fulfil the following requirements or improper installation may shorten motor life or damage the motor bearings.

Manufacturer	Motor type	Nominal mains voltage (AC line voltage)	Requirement for			
			Motor insulation system	ABB du/dt limitation, insulated N-end bearing and ABB common mode filter		
				$P_N < 100 \text{ kW}$ and frame size < IEC 315	$100 \text{ kW} \leq P_N < 350 \text{ kW}$ or frame size \geq IEC 315	$P_N \geq 350 \text{ kW}$ or frame size \geq IEC 400
				$P_N < 134 \text{ HP}$ and frame size < NEMA 500	$134 \text{ HP} \leq P_N < 469 \text{ HP}$ or frame size \geq NEMA 500	$P_N \geq 469 \text{ HP}$
A B B	Random-wound M2_ and M3_	$U_N \leq 500 \text{ V}$	Standard	-	+ N	+ N + CMF
		$500 \text{ V} < U_N \leq 600 \text{ V}$	Standard	+ du/dt	+ du/dt + N	+ du/dt + N + LCMF
			or			
		Reinforced	-	+ N	+ N + CMF	
	$600 \text{ V} < U_N \leq 690 \text{ V}$	Reinforced	+ du/dt	+ du/dt + N	+ du/dt + N + LCMF	
	Form-wound HXR and AM_	$380 \text{ V} < U_N \leq 690 \text{ V}$	Standard	n.a.	+ N + CMF	+ N + CMF
Old* form-wound HX_ and modular	$380 \text{ V} < U_N \leq 690 \text{ V}$	Check with the motor manufacturer.	+ du/dt limitation with voltages over 500 V + N + CMF			
Random-wound HXR and AM_	$380 \text{ V} < U_N \leq 690 \text{ V}$	Check with the motor manufacturer.	+ du/dt limitation with voltages over 500 V + N + CMF			

Manufacturer	Motor type	Nominal mains voltage (AC line voltage)	Requirement for			
			Motor insulation system	ABB du/dt limitation, insulated N-end bearing and ABB common mode filter		
				$P_N < 100 \text{ kW}$ and frame size < IEC 315	$100 \text{ kW} \leq P_N < 350 \text{ kW}$ or frame size \geq IEC 315	$P_N \geq 350 \text{ kW}$ or frame size \geq IEC 400
			$P_N < 134 \text{ HP}$ and frame size < NEMA 500	$134 \text{ HP} \leq P_N < 469 \text{ HP}$ or frame size \geq NEMA 500	$P_N \geq 469 \text{ HP}$	
N O N - A B B	Random-wound and form-wound	$U_N \leq 420 \text{ V}$	Standard: $\hat{U}_{LL} = 1300 \text{ V}$	-	+ N or CMF	+ N + CMF
		$420 \text{ V} < U_N \leq 500 \text{ V}$	Standard: $\hat{U}_{LL} = 1300 \text{ V}$	+ du/dt	+ du/dt + N	+ du/dt + N + CMF
				or	+ du/dt + CMF	
				or		
		$500 \text{ V} < U_N \leq 600 \text{ V}$	Reinforced: $\hat{U}_{LL} = 1600 \text{ V}$, 0.2 microsecond rise time	-	+ N or CMF	+ N + CMF
				+ du/dt	+ du/dt + N	+ du/dt + N + LCMF
	or				+ du/dt + CMF	
	$600 \text{ V} < U_N \leq 690 \text{ V}$	Reinforced: $\hat{U}_{LL} = 1800 \text{ V}$	-	+ N or CMF	+ N + CMF	
			+ du/dt	+ du/dt + N	+ du/dt + N + LCMF	
	Form-wound	$600 \text{ V} < U_N \leq 690 \text{ V}$	Reinforced: $\hat{U}_{LL} = 2000 \text{ V}$, 0.3 microsecond rise time	n.a.	N + CMF	N + CMF

* manufactured before 1992

Note 1: The abbreviations used in the table are defined below.

Abbreviation	Definition
U_N	nominal voltage of the supply network
\hat{U}_{LL}	peak line-to-line voltage at motor terminals which the motor insulation must withstand
P_N	motor nominal power
du/dt	du/dt filter at the output of the drive or internal du/dt limitation
CMF	common mode filter +E208 (3 toroidal cores)
LCMF	light common mode filter +E209 (1 toroidal core)
N	N-end bearing: insulated motor non-driven end bearing
n.a.	Motors of this power range are not available as standard units. Consult the motor manufacturer.

Note 2: Explosion-safe (EX) motors

The motor manufacturer should be consulted regarding the construction of the motor insulation and additional requirements for explosion-safe (EX) motors.

Note 3: High-output motors and IP 23 motors

For motors with higher rated output than what is stated for the particular frame size in IEC 50347 (2001) and for IP 23 motors, the requirements of range “100 kW < P_N < 350 kW” apply to motors with P_N < 100 kW. The requirements of range “ P_N > 350 kW” apply to motors with P_N within the range of “100 kW < P_N < 350 kW”.

Note 4: HXR and AMA motors

All AMA machines (manufactured in Helsinki) to be supplied by a drive have form-wound windings. All HXR machines manufactured in Helsinki since 1997 have form-wound windings.

Note 5: ABB motors of types other than M2_, M3_, HX_ and AM_

Select according to non-ABB motors.

Note 6: Resistor braking of the drive

When the drive is in braking mode for a large part of its operation time, the intermediate circuit DC voltage of the drive increases, the effect being similar to increasing the supply voltage by up to 20 percent. The voltage increase should be taken into consideration when determining the motor insulation requirement.

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

Permanent magnet synchronous motor

Only one permanent magnet motor can be connected to the inverter output.

Install a safety switch between a permanent magnet synchronous motor and the motor cable. The switch is needed to isolate the motor during any maintenance work in the drive.

Wire the position information of the safety switch to the drive. Before starting any maintenance work on the drive, the safety switch must be opened, and the open position acknowledged by the drive application program.

Supply connection

Disconnecting device (means)

Install a hand-operated input disconnecting device (means) 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.

EU

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

- a switch-disconnector of utilization category AC-23B (EN 60947-3)
- a 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)
- a circuit breaker suitable for isolation in accordance with EN 60947-2.

US

The disconnecting means must conform to the applicable safety regulations.

Fuses

See section *Thermal overload and short-circuit protection*.

Thermal overload and short-circuit protection

The drive protects itself and the input and 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.



WARNING! If the drive is connected to multiple motors, a separate thermal overload switch or a circuit breaker must be used for protecting each cable and motor. These devices may require a separate fuse to cut off the short-circuit current.

The drive protects the motor cable and the motor in a short-circuit situation when the motor cable is dimensioned according to the nominal current of the drive.

Mains cable (AC line cable) short-circuit protection

Always protect the input cable with fuses. Standard gG (US: CC or T for the ACS800-01; T or L for the ACS800-02) fuses will protect the input cable in short-circuit situations and prevent damage to adjoining equipment in case of a short-circuit inside the drive.

Size the fuses according to local safety regulations, appropriate input voltage and the rated current of the drive. For fuse ratings, see *Technical Data*.



WARNING! Circuit breakers are not capable of providing sufficient protection because they are inherently slower than fuses. Always use fuses with circuit breakers.

Ground fault protection

The drive is equipped with an internal ground fault protective function to protect the unit against ground faults in the motor and the motor cable. 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 appropriate *ACS 800 Firmware Manual*.

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 may cause fault current circuit breakers to function.

Emergency stop devices

For safety reasons, install the emergency stop devices at each operator control station and at other operating stations where emergency stop may be needed. 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.

Selecting the power cables

General rules

Dimension the mains (input power) and motor cables **according to local regulations**:

- The cable must be able to carry the drive load current. See chapter *Technical data* for the rated currents.
- The cable must be rated for at least 70 °C maximum permissible temperature of conductor in continuous use. For US, see *Additional US requirements*.
- 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 VAC cable is accepted for up to 500 VAC. For 690 VAC rated equipment, the rated voltage between the conductors of the cable should be minimum 1 kV.

For drive frame size R5 and larger, or motors larger than 30 kW, symmetrical shielded motor cable must be used (figure below). A four-conductor system can be used up to frame size R4 with up to 30 kW motors, but shielded symmetrical motor cable is recommended.

A four-conductor system is allowed for input cabling, but shielded symmetrical cable is recommended. To operate as a protective conductor, the shield conductivity must be as follows when the protective conductor is made of the same metal as the phase conductors:

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
$16 < S \leq 36$	16
$35 < S$	$S/2$

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

The motor cable and its PE pigtail (twisted screen) should be kept as short as possible in order to reduce electromagnetic emission as well as capacitive current.

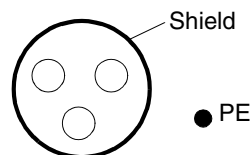
Alternative power cable types

Power cable types that can be used with the drive are represented below.

Recommended

Symmetrical shielded cable: three phase conductors and a concentric or otherwise symmetrically constructed PE conductor, and a shield

A separate PE conductor is required if the conductivity of the cable shield is < 50 % of the conductivity of the phase conductor.



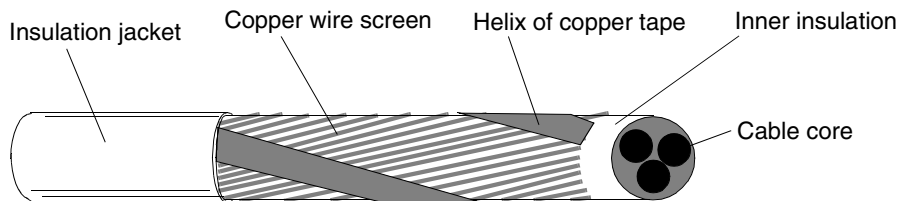
A four-conductor system: three phase conductors and a protective conductor.

Not allowed for motor cables

Not allowed for motor cables with phase conductor cross section larger than 10 mm² (motors > 30 kW).

Motor cable shield

To effectively suppress radiated and conducted radio-frequency emissions, the shield conductivity must be at least 1/10 of the phase conductor conductivity. The requirements are easily met with a copper or aluminium 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. The better and tighter the shield, the lower the emission level and the bearing currents.



Additional US requirements

Type MC continuous corrugated aluminum armor cable with symmetrical grounds or shielded power cable must be used for the motor cables if metallic conduit is not used. For the North American market, 600 VAC cable is accepted for up to 500 VAC. 1000 VAC cable is required above 500 VAC (below 600 VAC). For drives rated over 100 amperes, the power cables must be rated for 75 °C (167 °F).

Conduit

Where conduits must be coupled together, bridge the joint with a ground conductor bonded to the conduit on each side of the joint. Bond the conduits also to the drive enclosure. Use separate conduits for input power, motor, brake resistors, and control wiring. Do not run motor wiring from more than one drive in the same conduit.

Armored cable / shielded power cable

The motor cables can be run in the same cable tray as other 460 V or 600 V power wiring. Control and signal cables must not be run in the same tray as power cables. 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.

Power factor compensation capacitors

Do not connect power factor compensation capacitors or surge absorbers to the motor cables (between the drive and the motor). They are not designed to be used with drives, and will degrade motor control accuracy. They can cause permanent damage to the drive or themselves due to the rapid changes in the drive output voltage.

If there are power factor compensation capacitors in parallel with the three phase input of the drive, ensure that the capacitors and the drive are not charged simultaneously to avoid voltage surges which might damage the unit.

Equipment connected to the motor cable

Installation of safety switches, contactors, connection boxes, etc.

To minimize the emission level when safety switches, contactors, connection boxes or similar equipment are installed in the motor cable (i.e. between the drive and the motor):

- EU: Install the equipment in a metal enclosure with 360 degrees grounding for the screens of both the incoming and outgoing cable, or connect the screens of the cables otherwise together.
- US: Install the equipment in a metal enclosure in a way that the conduit or motor cable shielding runs consistently without breaks from the drive to the motor.

Bypass connection



WARNING! Never connect the supply power to the drive output terminals U2, V2 and W2. If frequent bypassing is required, employ mechanically connected switches or contactors. Mains (line) voltage applied to the output can result in permanent damage to the unit.

Before opening a contactor (DTC control mode selected)

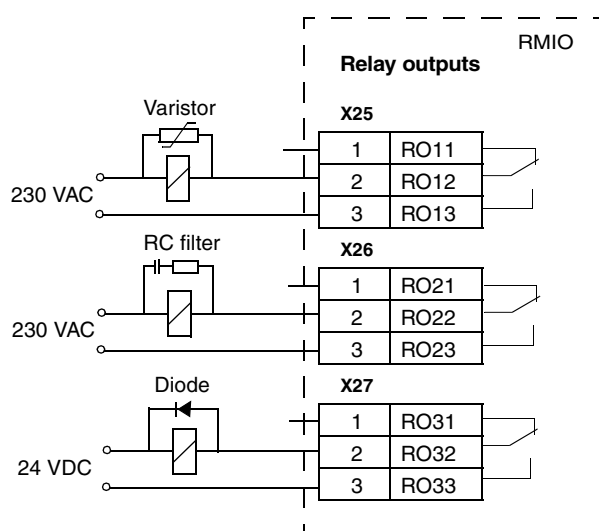
Control the output voltage of the drive to zero before opening a contactor between the output of the drive and the motor when the DTC control mode is selected. See the appropriate ACS800 application program firmware manual for the required parameter settings. Otherwise, the contactor will be damaged. In scalar control, the contactor can be opened with the drive running.

Protecting the relay output contacts and attenuating disturbances in case of inductive loads

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

The relay contacts on the RMIO board are protected with varistors (250 V) against overvoltage peaks. In spite of this, it is highly recommended to equip inductive loads 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 RMIO board terminal block.

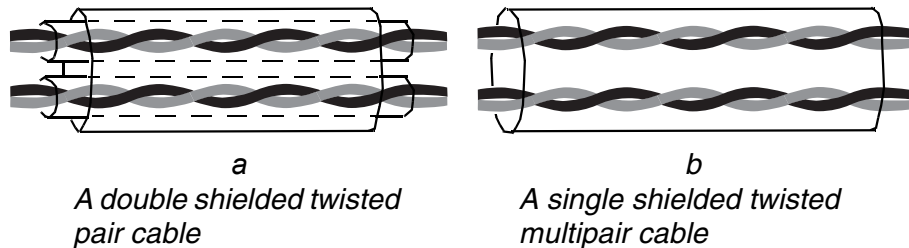


Selecting the control cables

All control cables must be shielded.

Use a double-shielded twisted pair cable (Figure a, e.g. JAMAK by NK Cables, Finland) for analogue signals. This type of cable is recommended for the pulse encoder signals also. Employ one individually shielded pair for each signal. Do not use common return for different analogue signals.

A double-shielded cable is the best alternative for low-voltage digital signals but single-shielded twisted multipair cable (Figure b) is also usable.



Run analogue and digital signals in separate, shielded cables.

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

Never mix 24 VDC and 115 / 230 VAC signals in the same cable.

Relay cable

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

Control panel cable

In remote use, the cable connecting the control panel to the drive must not exceed 3 metres (10 ft). The cable type tested and approved by ABB is used in control panel option kits.

Connection of a motor temperature sensor to the drive I/O



WARNING! IEC 664 requires double or reinforced insulation between live parts and the surface of accessible parts of electrical equipment which are either non-conductive or conductive but not connected to the protective earth.

To fulfil this requirement, the connection of a thermistor (and other similar components) to the digital inputs of the drive can be implemented in three alternate ways:

1. There is double or reinforced insulation between the thermistor and live parts of the motor.
 2. Circuits connected to all digital and analogue inputs of the drive are protected against contact and insulated with basic insulation (the same voltage level as the drive main circuit) from other low voltage circuits.
 3. An external thermistor relay is used. The insulation of the relay must be rated for the same voltage level as the main circuit of the drive. For connection, see *ACS800 Firmware Manual*.
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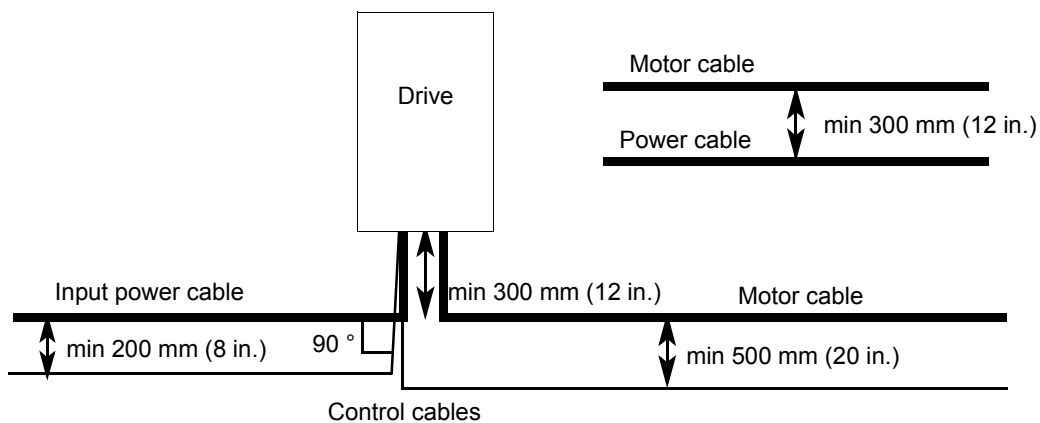
Routing the cables

Route the motor cable away from other cable routes. Motor cables of several drives can be run in parallel installed next to each other. It is recommended that the motor cable, input power cable and control cables 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 run extra cables through the drive.

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

A diagram of the cable routing is below.



Installation

What this chapter contains

This chapter describes the mechanical and electrical installation procedure of the drive.



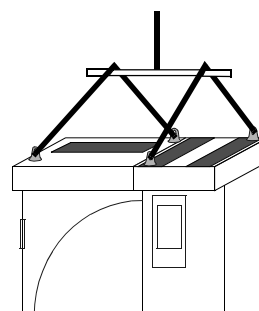
WARNING! Only qualified electricians are allowed to carry out the work described in this chapter. Follow the *Safety instructions* on the first pages of this manual. Ignoring the safety instructions can cause injury or death.

Moving the unit

Move the transport package by pallet truck to the installation site. Unpack the package as shown below.



Lifting when the enclosure extension is included

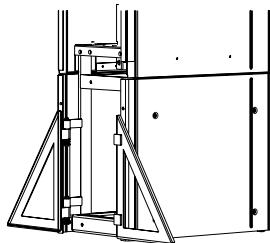
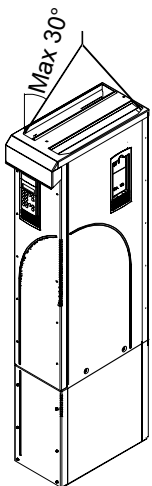
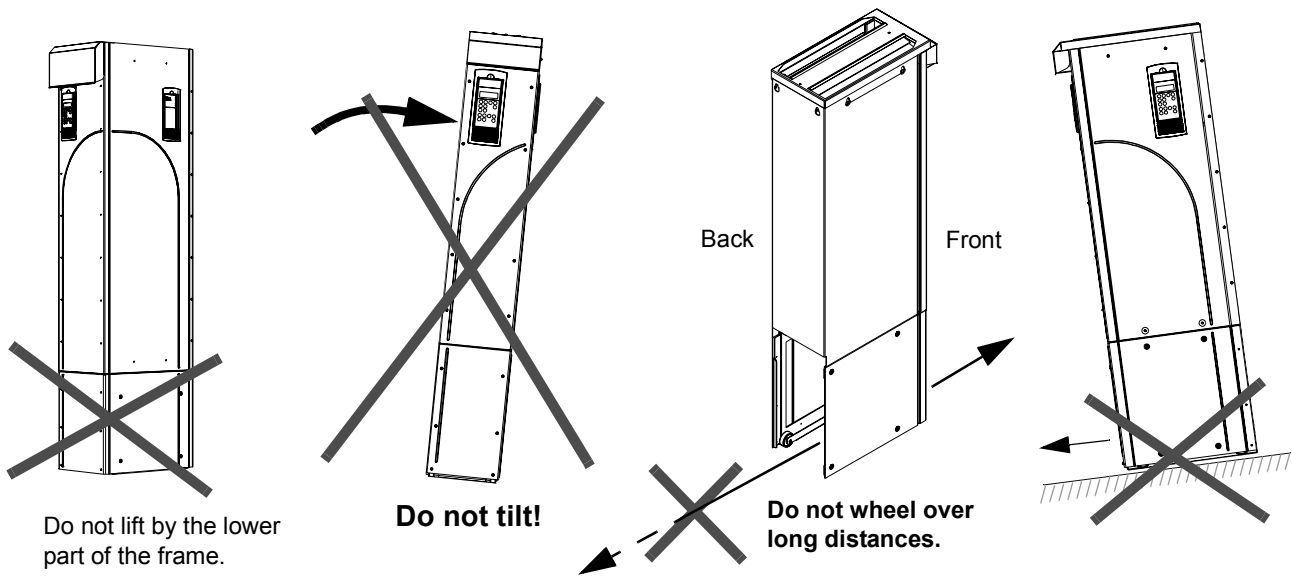




WARNING! The drive is heavy [frame size R7: 100 kg (220 lb), frame size R8: 230 kg (507 lb)]. Lift the drive by the upper part only using the lifting lugs attached to the top of the unit. The lower part will be deformed from lifting. Do not remove the pedestal before lifting.

Do not tilt the drive. The centre of gravity of the unit is high. The unit will overturn from a tilt of about 6 degrees.

Do not wheel the drive except for installation (the front direction is preferable because the front wheels are steadier). The drive frame may be deformed from wheeling when the pedestal is removed. If the drive is moved over long distances, place it on its back on a pallet and move it by fork-lift.



Frame size R8:
The support legs must be locked to open position during the installation and always when wheeling the unit.

Before installation

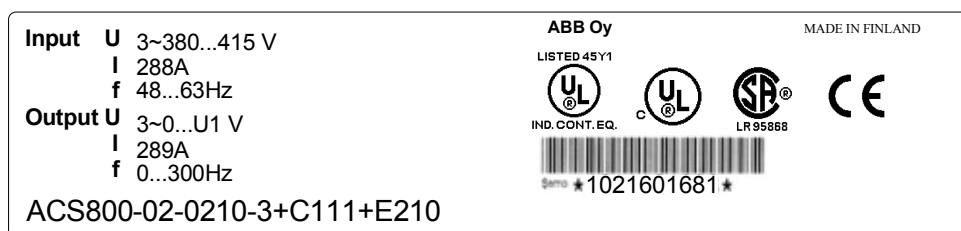
Delivery check

The drive is delivered in a box that also contains:

- hardware manual
- appropriate firmware manuals and guides
- 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 label of the drive to verify that the unit is of the correct type. The label includes an IEC and NEMA rating, UL, C-UL, CSA and CE markings, a type code and a serial number, which allow individual recognition of each unit. 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 serial number.

The type designation label is located under the front visor and the serial number label inside the unit. Example labels are shown below.



Type designation label



Serial number label

Requirements for the installation site

The drive must be installed in an upright position on floor (or wall). Check the installation site according to the requirements below. Refer to *Dimensional drawings* for frame details. See *Technical data* for the allowed operation conditions of the drive.

Wall

The wall/material near the unit must be of non-flammable material. Check that there is nothing on the wall to inhibit the installation.

If a unit is mounted on the wall, the wall must be as close to vertical as possible, and strong enough to carry the weight of the unit. The drive must not be installed without the pedestal on wall.

Floor

The floor/material below the installation should be non-flammable. The floor must be horizontal.

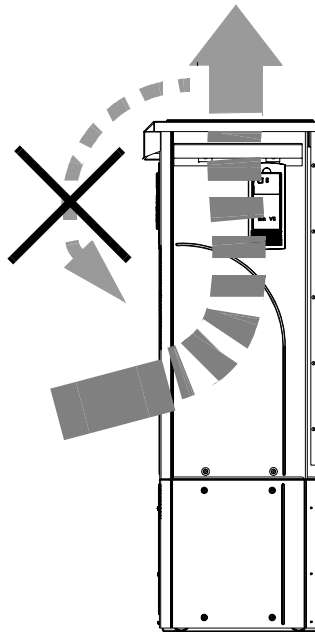
Free space around the unit

See section *Installation procedure: Choose the mounting orientation (a, b, c or d)*.

Cooling air flow

Provide the drive with the amount of fresh cooling air given in *Technical data / IEC ratings* or *US tables*.

The cooling air will enter the unit from the front air grating and flow upwards inside the unit. Recirculating cooling air into the unit is not allowed.



IT (ungrounded) systems

A drive equipped with no EMC filter or with EMC filter +E210 is suitable for IT (ungrounded systems). If the drive is equipped with EMC filter +E202, disconnect the filter before connecting the drive to an ungrounded system. For detailed instructions on how to do this, please contact your local ABB representative.



WARNING! If a drive with EMC filter +E202 is installed on an IT system [an ungrounded power system or a high resistance-grounded (over 30 ohms) 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.

Required tools

- 3 mm (0.12 in.) screw driver
- 10 mm (3/8 in.) Torx screw driver
- torque wrench with 500 mm (20 in.) or 2 x 250 mm (2 x 10 in.) extension bar
- 19 mm (3/4 in.) socket
for frame size R7: 13 mm (1/2 in.) magnetic end socket
for frame size R8: 17 mm (11/16 in.) magnetic end socket.

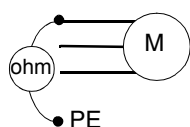
Checking the insulation of the assembly

Every drive has been tested for insulation between the main circuit and the chassis (2500 V rms 50 Hz for 1 second) at the factory. Therefore, do not make any voltage tolerance or insulation resistance tests (e.g. hi-pot or megger) on any part of the drive. When checking the insulation of the assembly, proceed in the following manner:

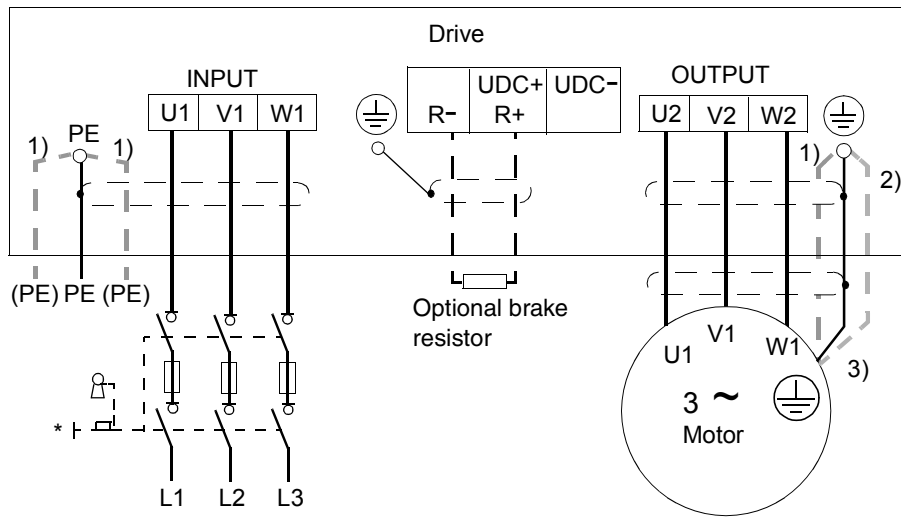


WARNING! Check the insulation before connecting the drive to the mains. Make sure that the drive is disconnected from the mains (input power).

1. Check that the motor cable is disconnected from the drive output terminals U2, V2 and W2.
2. Measure the insulation resistances of the motor cable and the motor between each phase and the Protective Earth by using a measuring voltage of 1 kV DC. The insulation resistance must be higher than 1 Mohm.



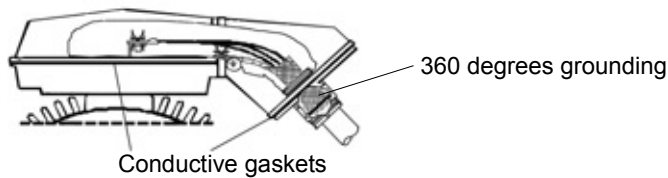
Power cable connection diagram



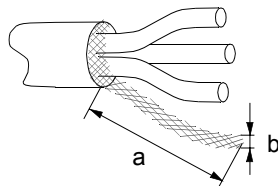
* For alternatives, see *Electrical installation planning: Disconnecting device (means)*

Ground the other end of the input cable shield / PE conductor at the distribution board.

- 1) an alternative to the grounding of the drive and the motor through the cable shield or armour
Note: Connecting the fourth conductor of the motor cable at the motor end increases bearing currents and causes extra wear.
- 2) used if the conductivity of the cable shield is < 50 % of the conductivity of the phase conductor.
- 3) For minimum radio frequency interference at the motor end:
 - ground the cable shield 360 degrees at the lead-through of the motor terminal box

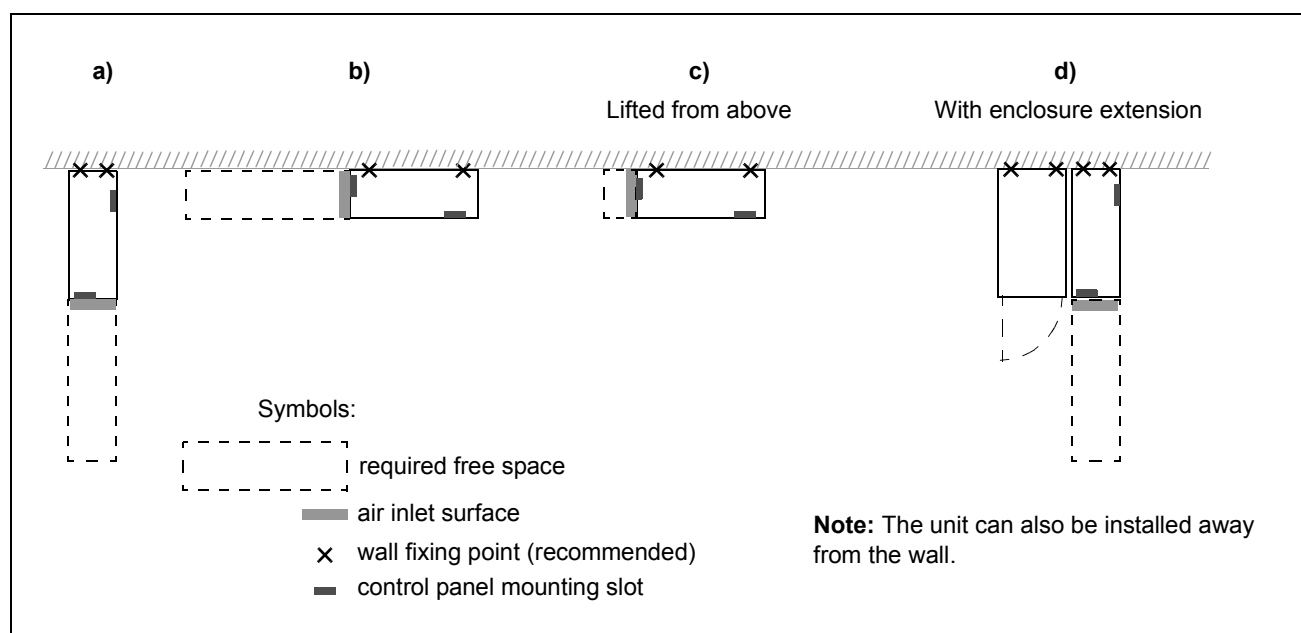


- or ground the cable by twisting the shield as follows: flattened width $\geq 1/5 \cdot$ length. In the figure below, $b \geq 1/5 \cdot a$.



Installation procedure

Choose the mounting orientation (a, b, c or d)



Frame size	Mounting orientation	Required free space around the unit for mounting, maintenance, service and cooling *					
		Front		Side		Above	
		mm	in.	mm	in.	mm	in.
R7	a, d	500	20	-	-	200	7.9
	b	-	-	500	20	200	7.9
	c	-	-	200**	7.9**	lifting space	lifting space
R8	a, d	600	24	-	-	300	12
	b	-	-	600	24	300	12
	c	-	-	300**	12**	lifting space	lifting space

* space for the installer not included

** space for fan and capacitor replacement not included

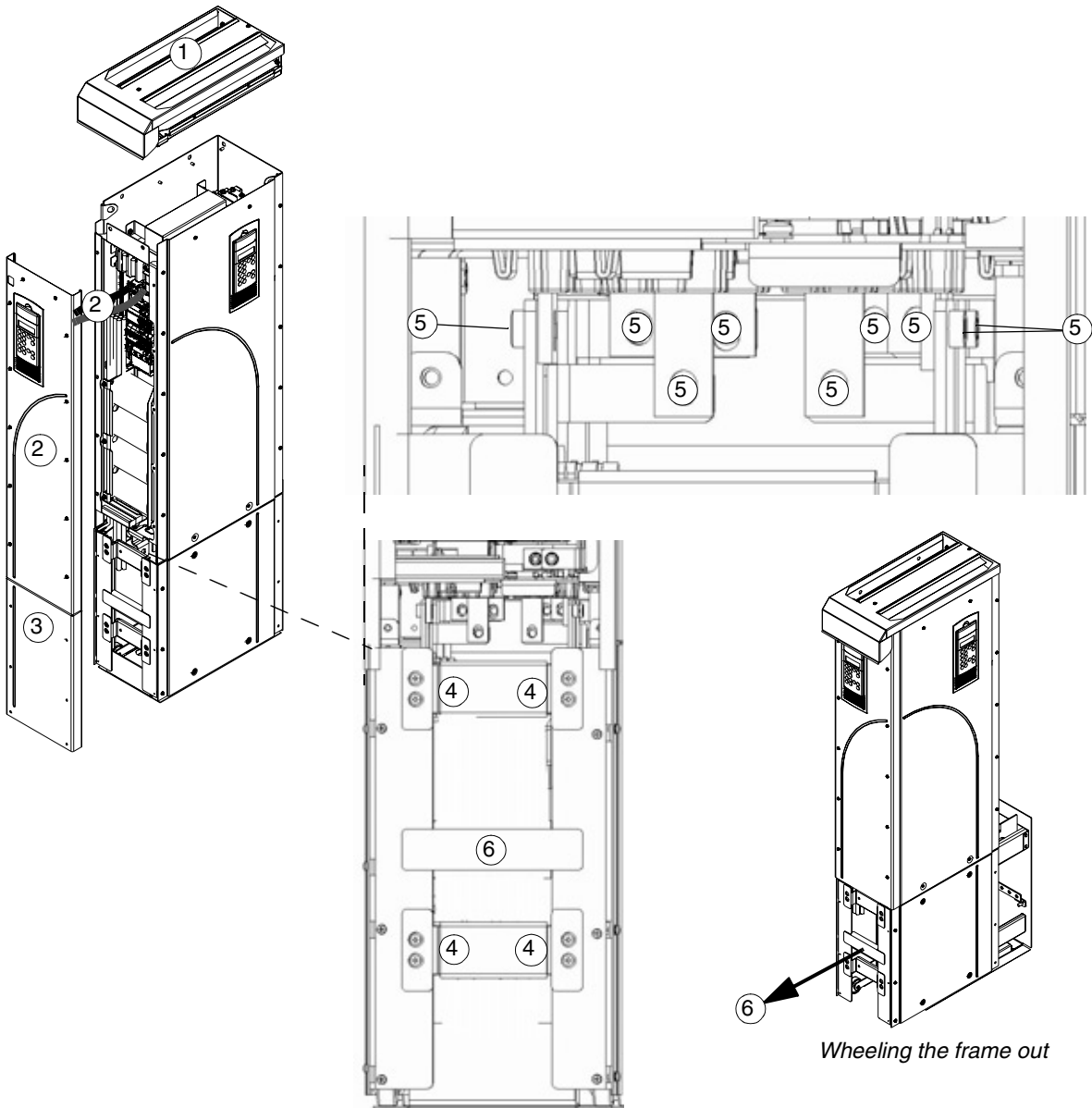
Mounting orientations a and b

Make holes in the wall (recommended):

1. Lift the unit against the wall into the mounting place.
2. Mark the locations for the two fixing points in the wall.
3. Mark the bottom edges of the unit to the floor.

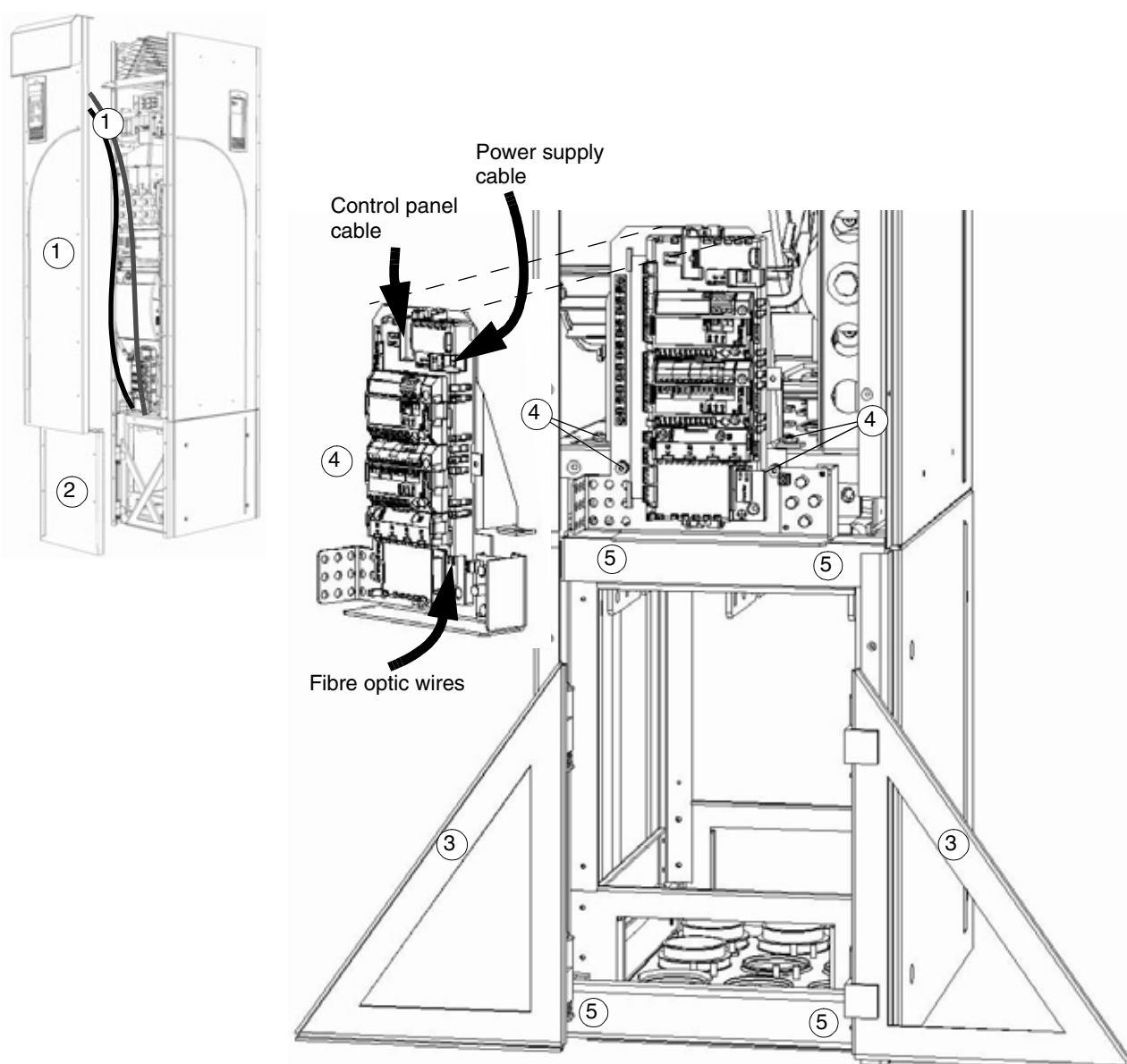
Remove the pedestal (frame size R7):

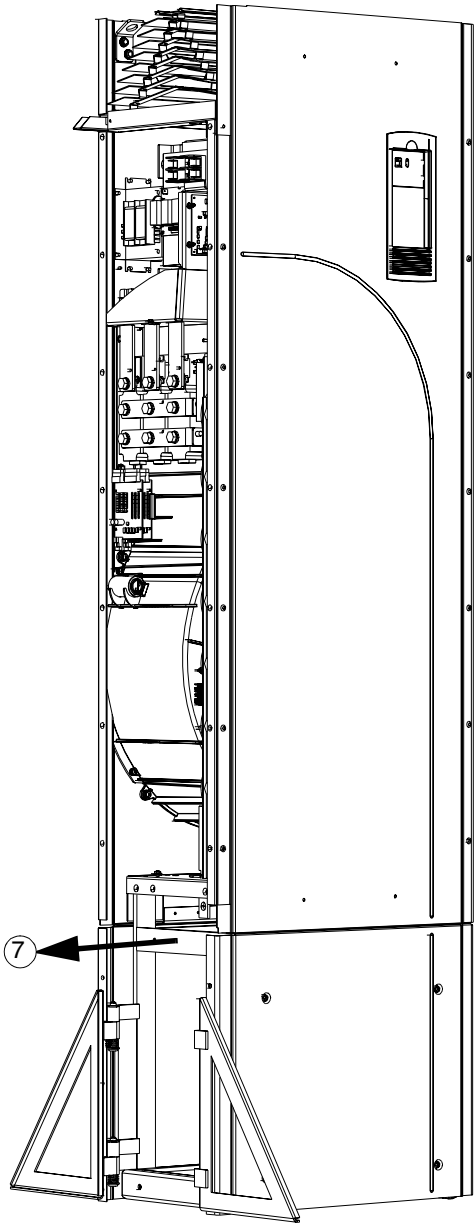
1. Remove the roof by undoing the fixing screws.
2. Remove the upper front cover by undoing the fixing screws and disconnecting the control panel cables.
3. Remove the lower front cover by undoing the fixing screws.
4. Undo the black screws that fix the pedestal to the frame from front.
5. Undo the black M8 combi screws (9 pcs) that connect the busbars of the pedestal to the upper frame. Use a torque wrench with an extension bar.
6. Wheel the drive frame out by using the handle.



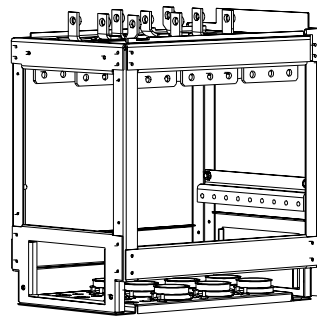
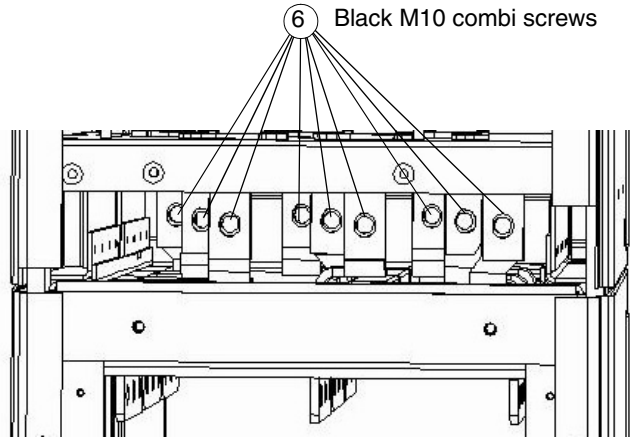
Remove the pedestal (frame size R8):

1. Remove the upper front cover by undoing the fixing screws and disconnecting the control panel cables.
2. Remove the lower front cover by undoing the fixing screws.
3. Lift the right support leg a little up and turn it right. Let it lock down. Turn the left leg aside in the same way. The legs will prevent the unit from falling down during the installation.
4. Remove the RMIO board by undoing the fixing screws and disconnecting the control panel, power supply and the fibre optic cables. **Note:** Mark down the connection terminals before disconnecting the cables.
5. Undo the screws that fix the pedestal to the frame from front.
6. Undo the screws that connect the busbars of the pedestal to the upper frame with a torque wrench with an extension bar.
7. Wheel the drive frame out by using the handle.



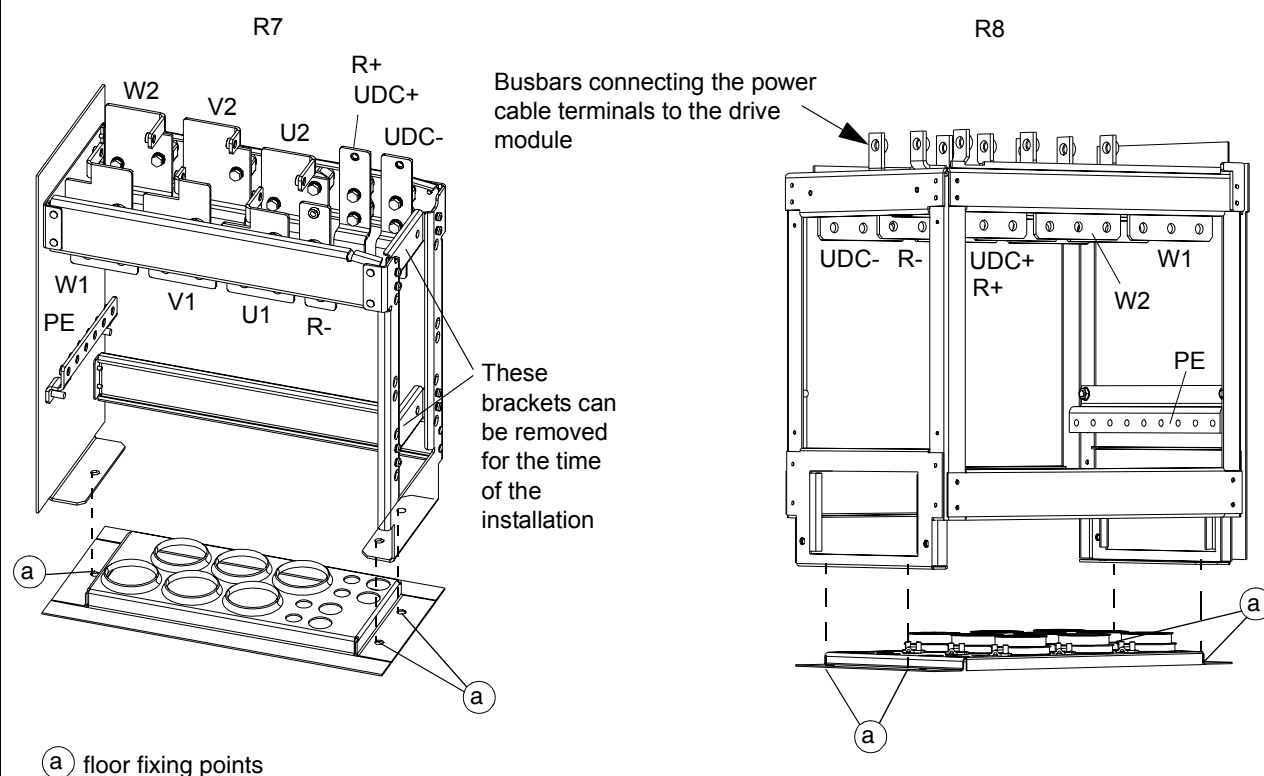


View from front when the RMIO board has been removed



Pedestal disconnected

Remove the lead-through plate from the pedestal:



Fix the lead-through plate to the floor:

1. Make a hole in the floor or cable conduit cover below the lead-through plate. See *Dimensional drawings*.
2. Check that the floor is horizontal with a spirit level.
3. Fasten the lead-through plate with screws or bolts.

Note: The screws/bolts will be removed and refastened when the pedestal is fastened through the same holes later on. The lead-through plate can be fastened after leading the cables through it if the cabling procedure is more convenient in that way.

Lead the power (input, motor and optional brake) cables through the lead-through plate:

1. Make adequate holes in the grommets to fit them tightly on the cables.
2. Lead the cables through the holes and slide the grommets onto the cables.

Prepare the power cables:

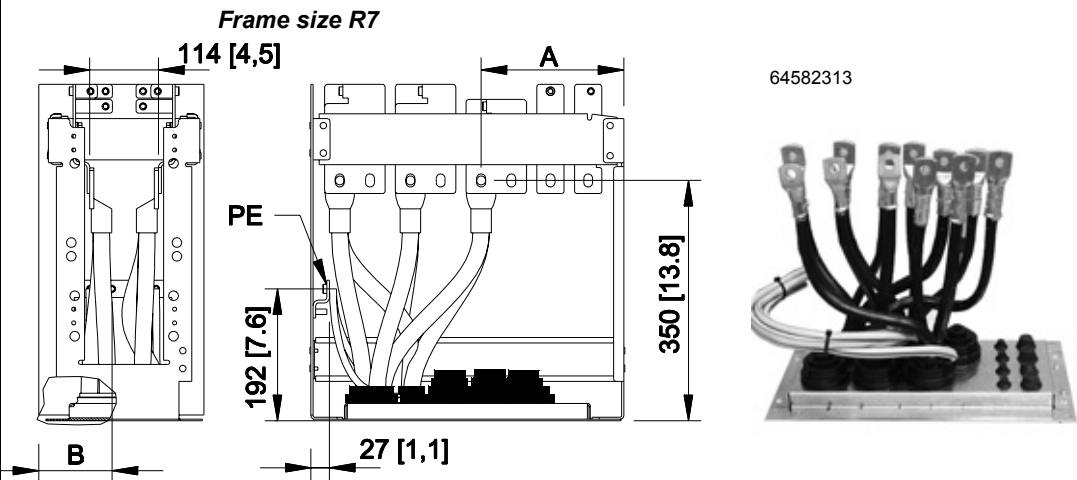
1. Strip the cables.
2. Twist the shield wires.
3. Bend the conductors to the terminals.
4. Cut the conductors to adequate length. Put the pedestal onto the lead-through plate and check the length of the conductors. Remove the pedestal.
5. Press cable lugs in the conductors, or screw in connectors.



WARNING! The maximum allowed width of the cable lug is 38 mm (1.5 in.). Wider cable lugs may cause a short-circuit.

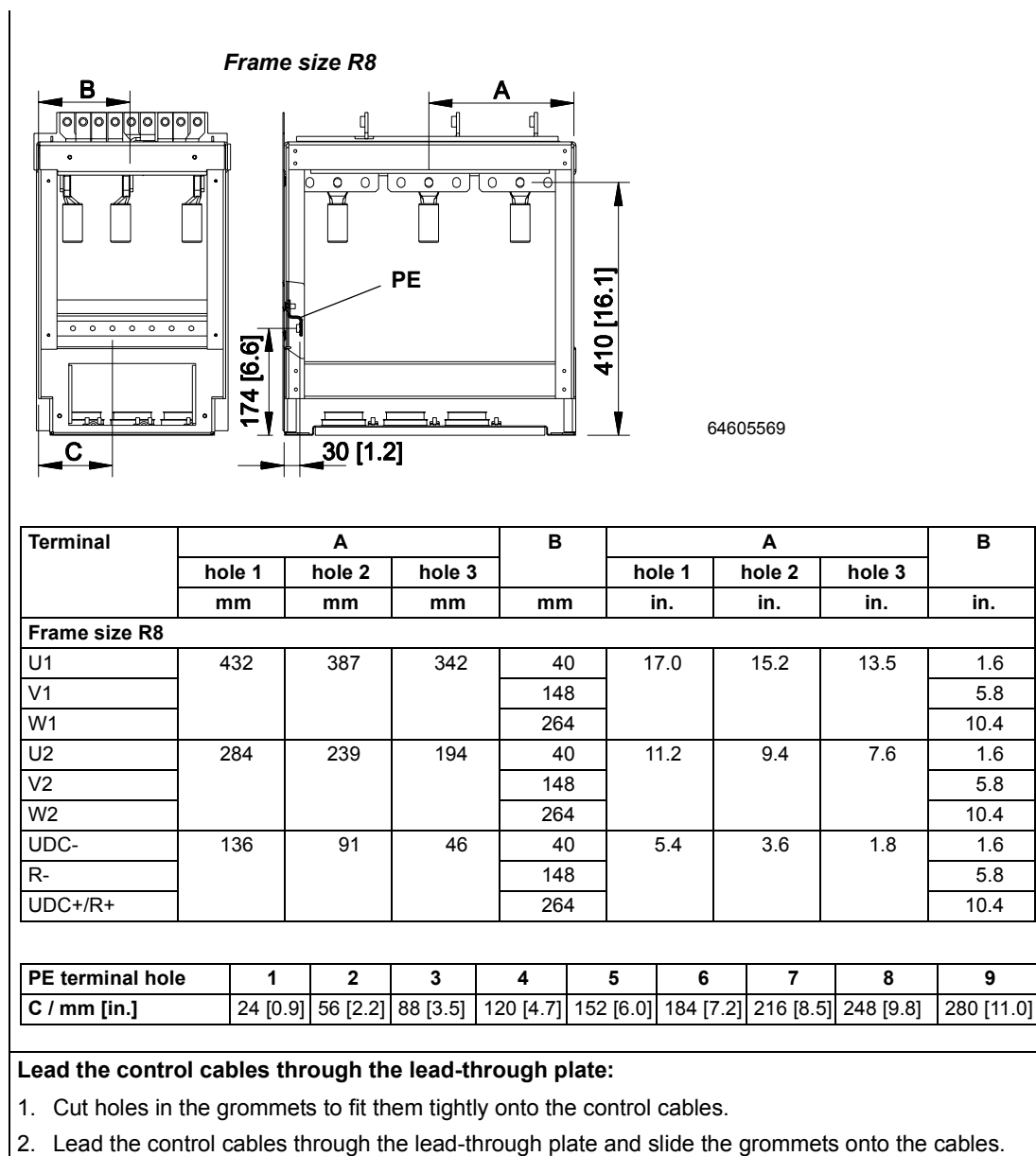
6. Connect the twisted shields of the cables to the PE terminal (frame size R7), or to the grounding clamps or PE terminal (frame size R8).

Note: 360 degrees grounding is not needed at the cable entry. The short twisted shield provides, in addition to the protective grounding, also sufficient disturbance suppression.



Terminal	U1, U2	V1, V2	W1, W2	UDC+/R+, R-	UDC-
A (hole 1) / mm [in.]	159 [6.3]	262 [10.3]	365 [14.4]	58 [2.3]	3 [0.1]
A (hole 2) / mm [in.]	115 [4.5]	218 [8.5]	321 [12.6]	-	-

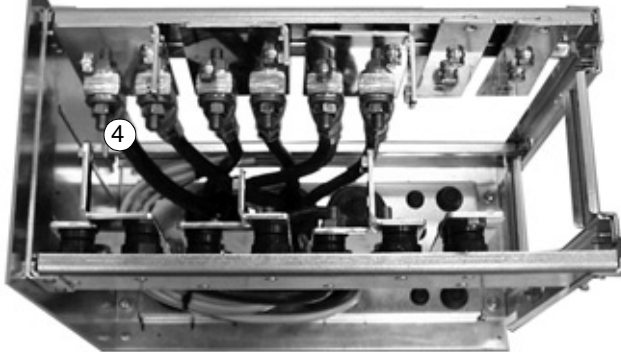
PE terminal hole	1	2	3	4	5	6
B / mm [in.]	43 [1.7]	75 [3.0]	107 [4.2]	139 [5.5]	171 [6.7]	203 [8.0]



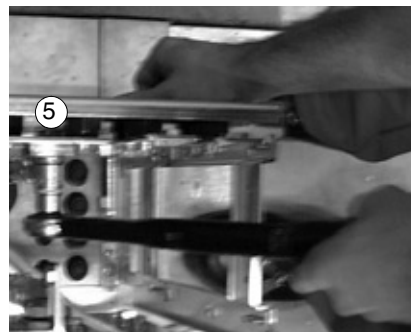
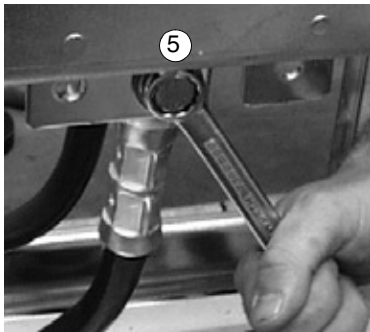
Connect the cable lugs to the pedestal:

1. If the lead-through plate is fixed to the floor, undo the fixing screws.
2. Place the pedestal onto the lead-through plate.
3. Fasten the pedestal and the lead-through plate to the floor with the screws through the same holes.
4. Connect the cable lugs to the pedestal (U1, V1, W1, U2, V2, W2 and PE; optional brake resistor cable lugs to UDC+/R+ and R-).
5. Tighten the connections.

View of frame size R7



Frame sizes R7 and R8:
 M12 (1/2 in.) bolt
 Tightening torque: 50...75 Nm
 (37...55 lbf ft)



WARNING! It is not allowed to connect the cables directly to the drive module terminals. The leadthrough insulation material is not strong enough to carry the mechanical stress exerted by the cables. The cable connections must be performed in the pedestal.

Wheel the drive frame back on the pedestal (See step *Remove the pedestal*).

Fix the pedestal to the drive frame in reverse order to step *Remove the pedestal*:

1. Fix the fastening screws.



WARNING! The fixing is important because the screws are required for the grounding of the drive.

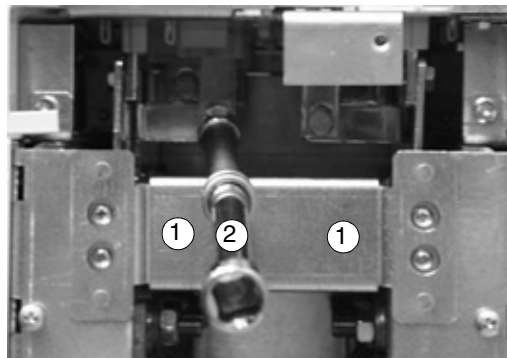
2. Connect the terminals at the top of the pedestal to the terminals at the bottom of the upper part of the drive frame.



WARNING! Be careful not to drop screws inside the pedestal. Loose metal pieces inside the unit may cause damage.

3. Tighten the connections.

View of frame size R7



Terminal connection screws

R7: M8 (5/16 in.) combi screws

Tightening torque: 15...22 Nm (0.59...0.87 lbf ft)

R8: M10 (3/8 in.) combi screws

Tightening torque: 30...44 Nm (22...32 lbf ft)

R8: Fasten the RMIO board in reverse order to step *Remove the pedestal*.

Fasten the drive frame to the wall (recommended):

Fasten unit with screws or bolts to the holes in the wall.

Connect the control cables as described in section *Connecting the control cables*.

Fasten the covers:

1. Connect the control panel cables. See step ***Remove the Pedestal***.
2. Fasten the upper front cover.
3. R7: Fasten the roof.
4. Fasten the lower front cover.

Mounting orientation c (lifting from above)

Make the installation otherwise as described in *Mounting orientations a and b* but leave the pedestal connected to the frame (Remove the lead-through plate and the lower front and side plates only).

- Lift the drive frame onto the lead-through plate from above.
- Connect the cable lugs to the terminals.

Mounting orientation d (optional enclosure extension included)

The customer connections of the drive (power cable terminals, I/O terminal blocks, option module slots) are provided in the enclosure extension instead of the actual drive cubicle. The extension cubicle and the drive cubicle are fastened together at the factory with two screws at the top of the cubicles. The drive pedestal is fastened to the base plate of the enclosure extension.

Fastening the unit

There are six holes available in the base plate of the enclosure extension for fastening the unit to the floor (two on the drive module side, four on the extension cubicle side). Use at least four screws, two at the front, two at the back. See *Dimensional drawings* for the exact locations of the fastening points.

It is recommended to fasten the top of the unit to the rear wall as well. Two holes are provided at the top of the enclosure extension and the drive cubicle for this.

Connecting the Power Cables

Refer to *Dimensional drawings* for terminal locations and hole sizes. The same screw can be used for connecting two cable lugs (on both sides of the busbar).

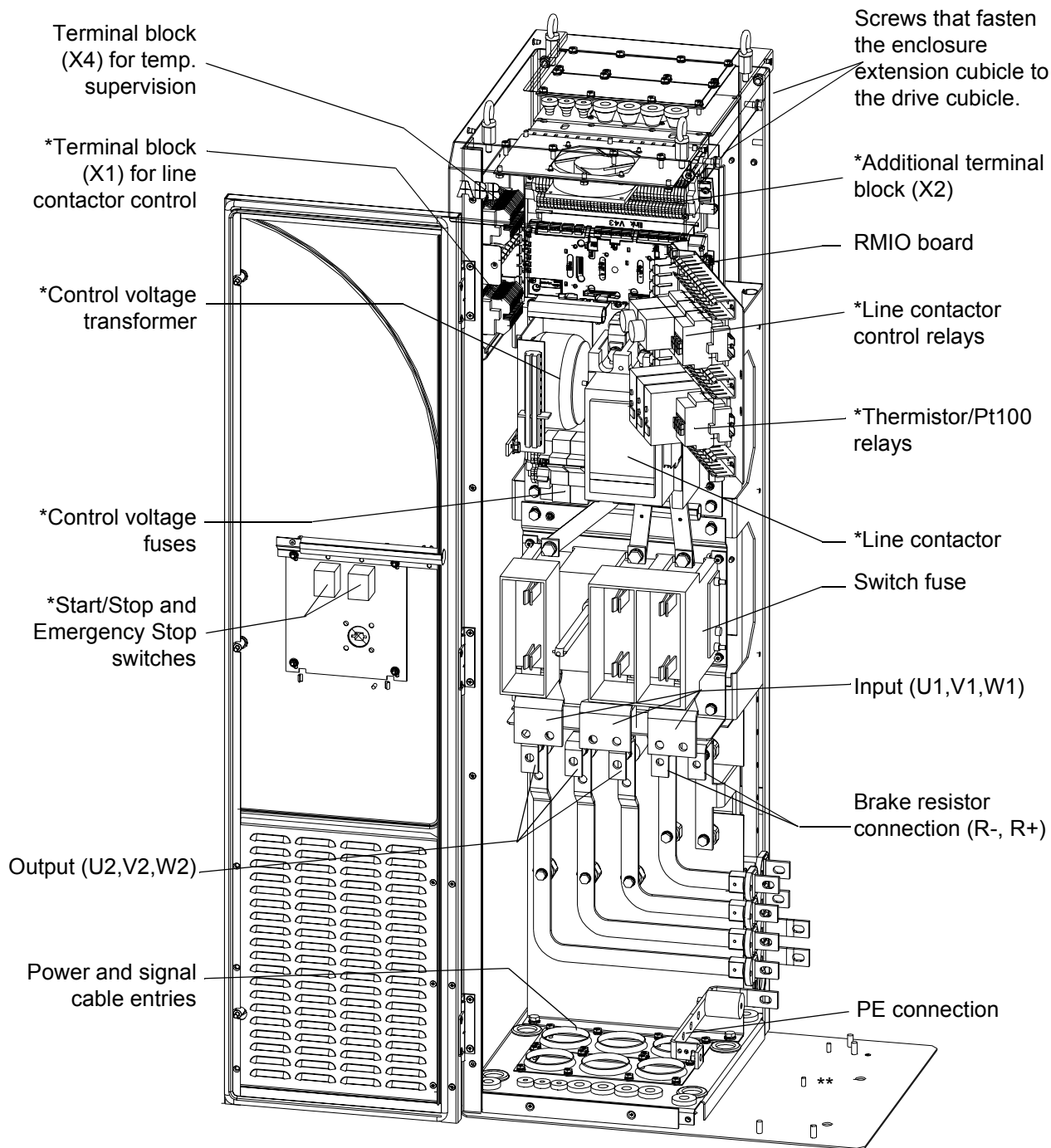
Procedure:

- Lead the cables into the cubicle through the cable entries provided.
Note: 360 degrees grounding is not needed at the cable entry. The short twisted shield provides, in addition to the protective grounding, also sufficient disturbance suppression.
- Slide the grommets onto the cables.
- Cut the cables to appropriate length.
- Terminate the conductors with cable lugs or connectors.
- Connect the cable shields to the PE busbar.
- Connect the phase conductors of the motor cable to the U2, V2 and W2 terminals.
- Connect the phase conductors of the supply cable to the U1, V1 and W1 terminals.
- Connect the optional brake conductors to R+ and R- terminals.

Enclosure extension layout

There are two main layouts of the enclosure extension, one for each cabling direction. The pictures below show both the bottom and top entry/exit layouts of the enclosure extension.

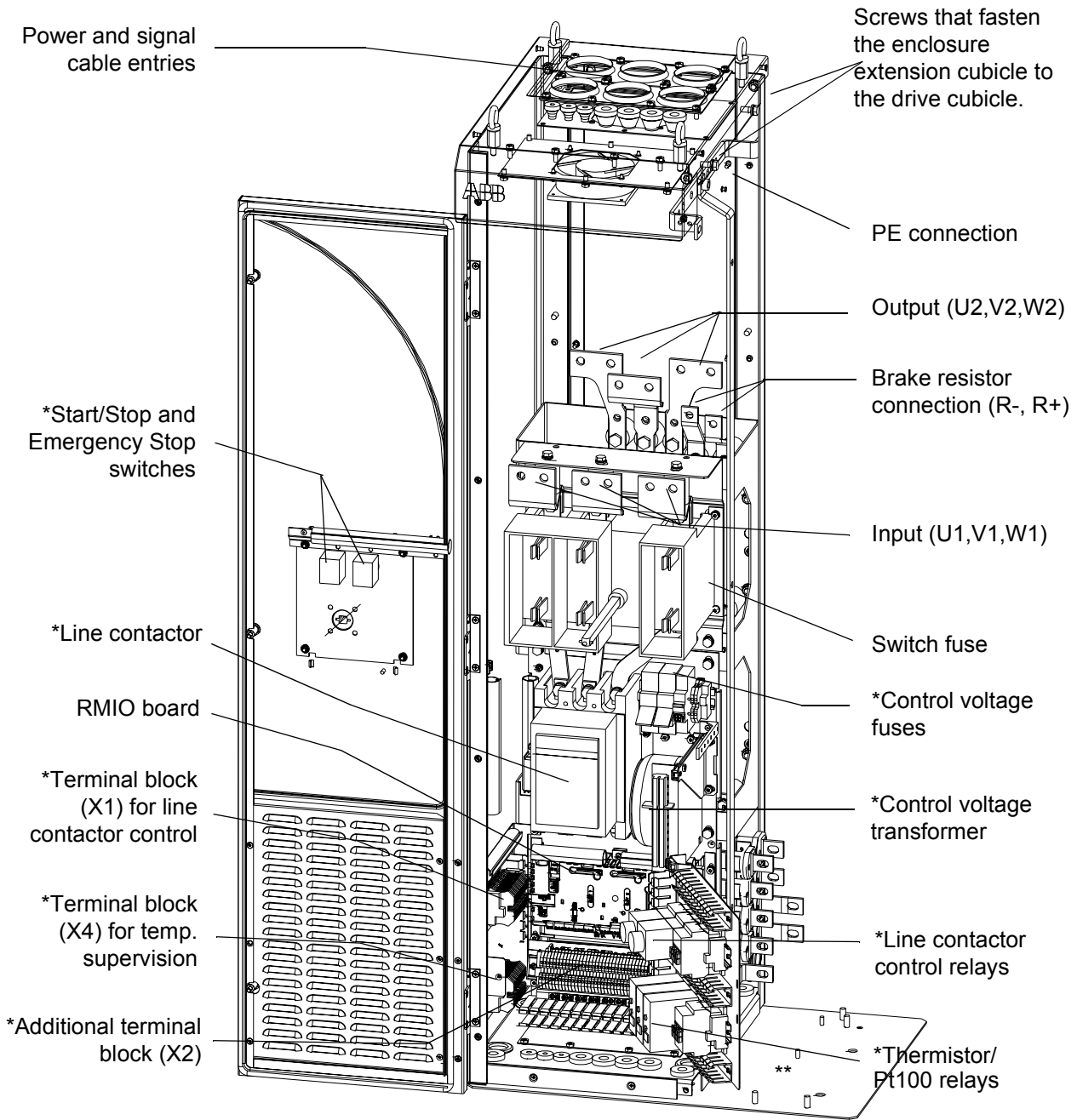
Bottom cable entry/exit (R7)



* Denotes optional equipment not present on all units.

** The drive module is fastened to this bottom plate.

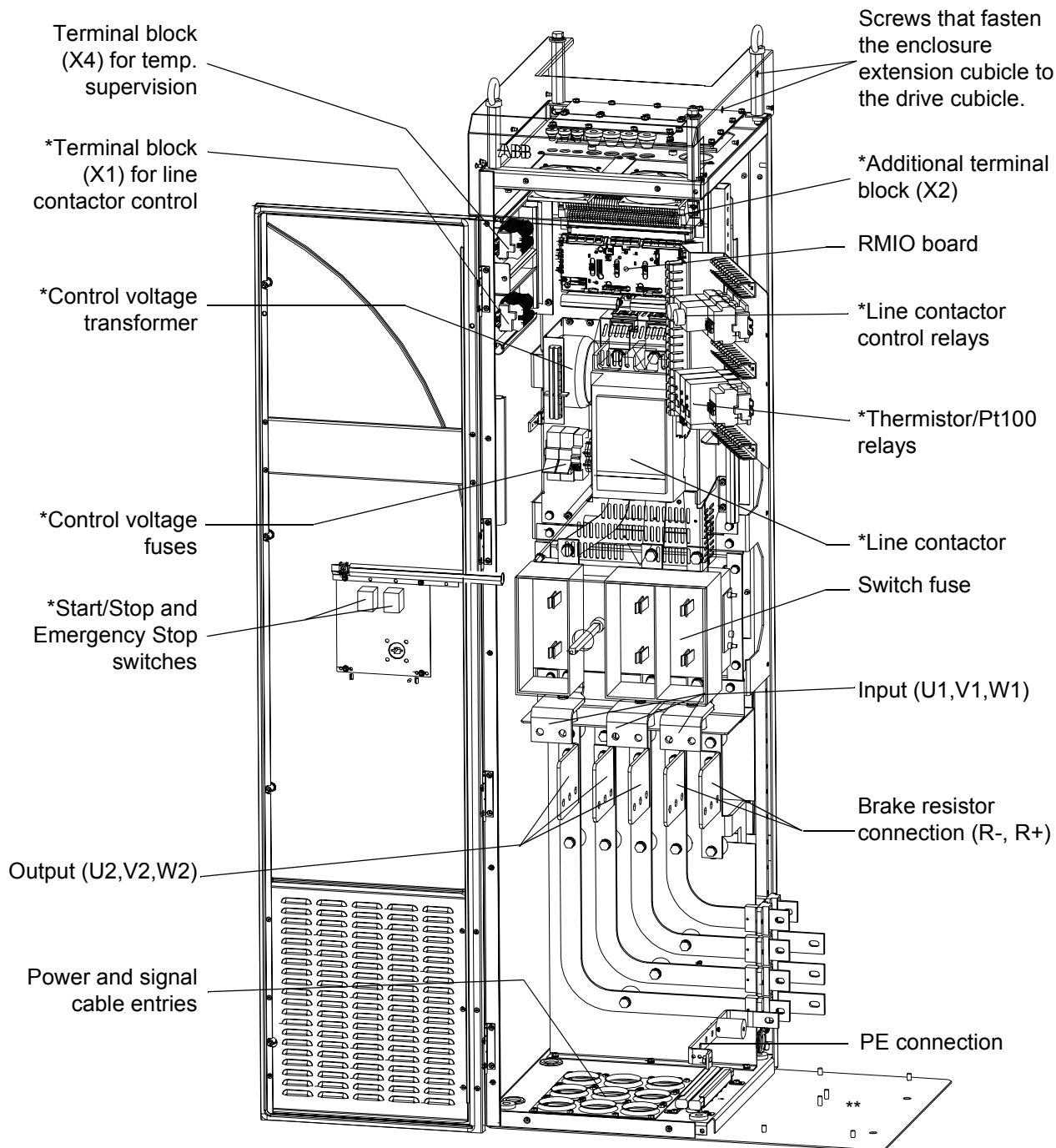
Top cable entry/exit (R7)



* Denotes optional equipment not present on all units.

** The drive module is fastened to this bottom plate.

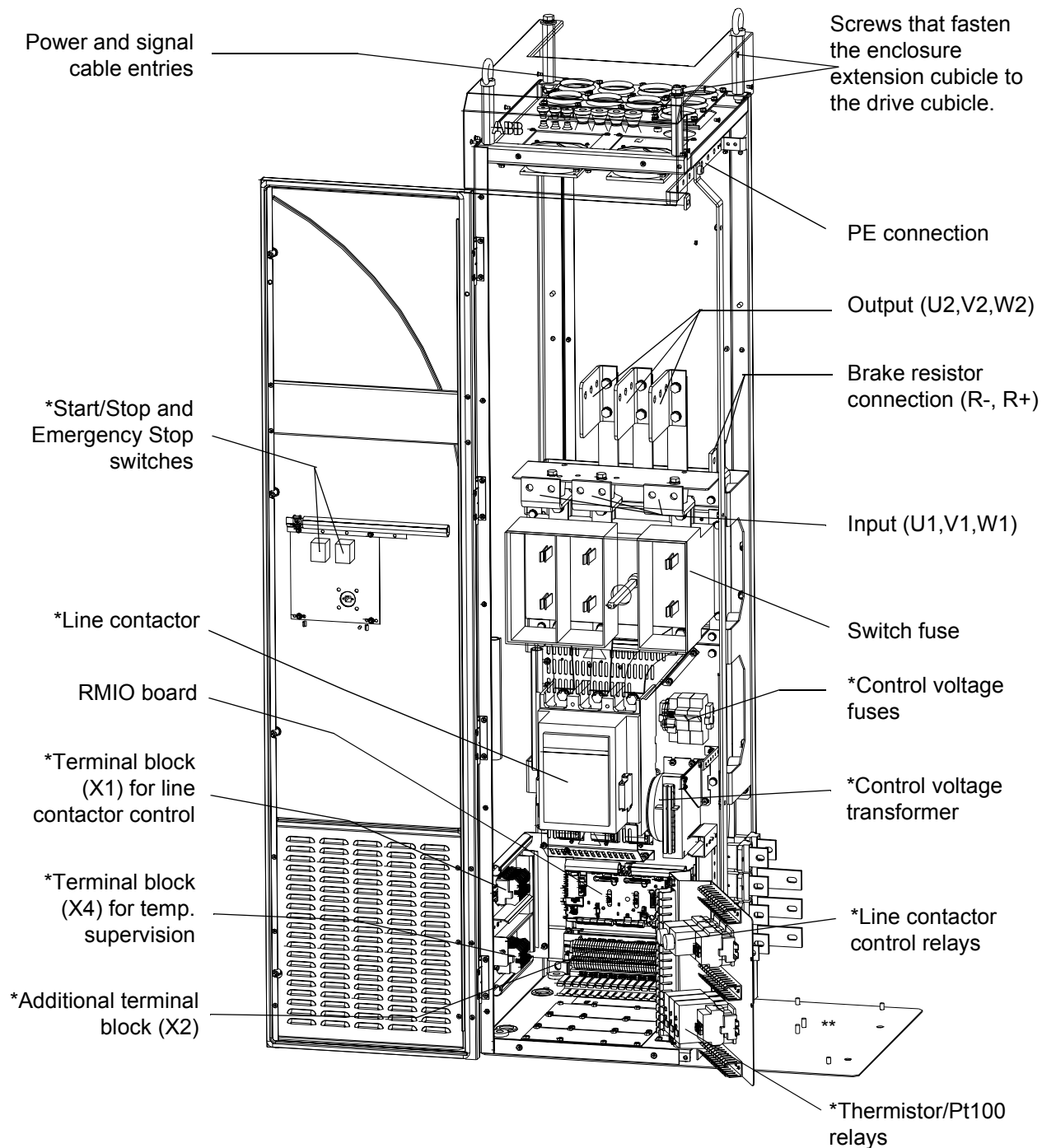
Bottom cable entry/exit (R8)



* Denotes optional equipment not present on all units.

** The drive module is fastened to this bottom plate.

Top cable entry/exit (R8)

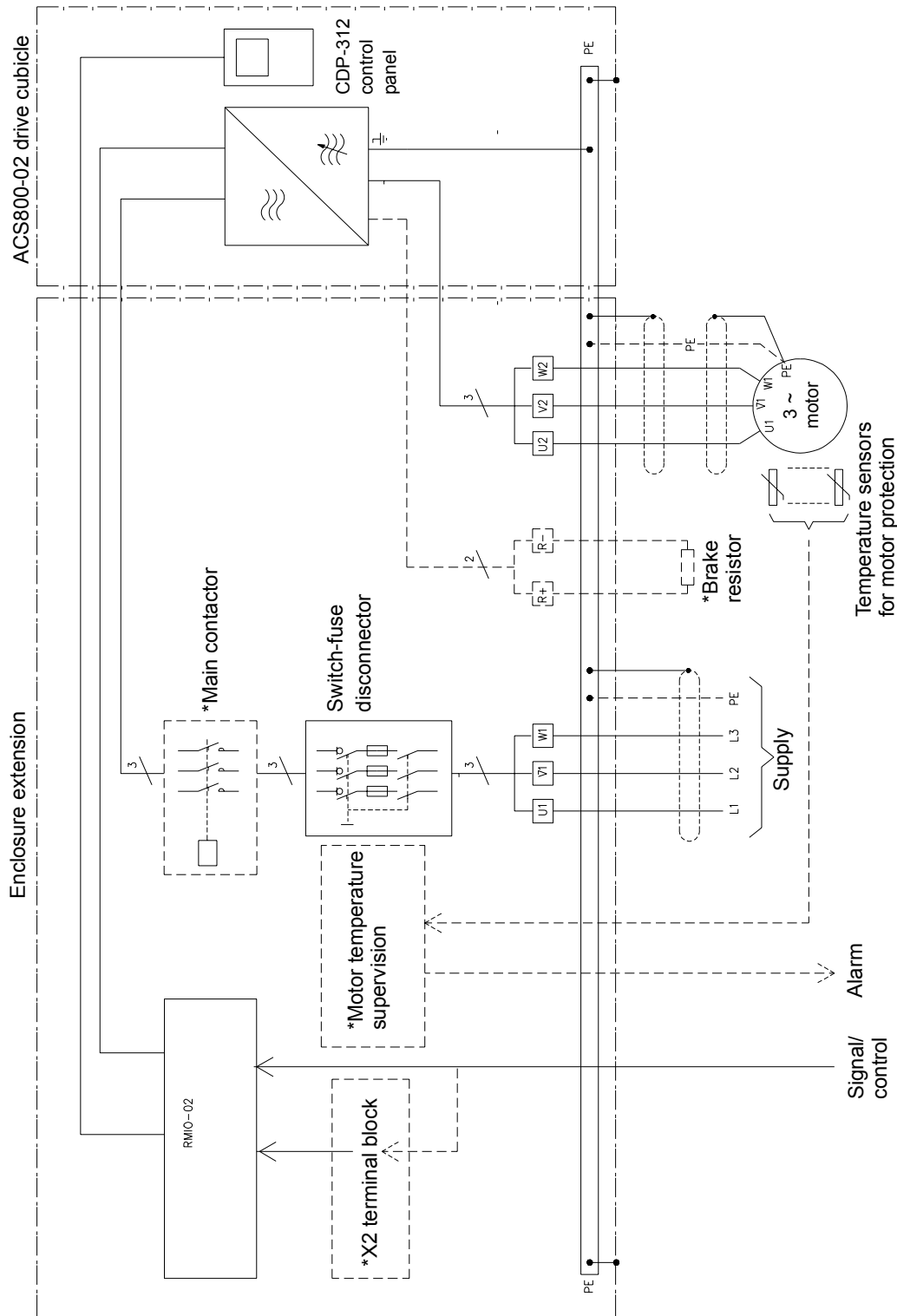


* Denotes optional equipment not present on all units.

** The drive module is fastened to this bottom plate.

Main wiring diagram

The diagram below presents the main wiring of the enclosure extension. Note that the diagram includes optional components (marked *) which are not always included in the delivery.



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Routing the control/signal cables inside the cubicle

Units without an enclosure extension

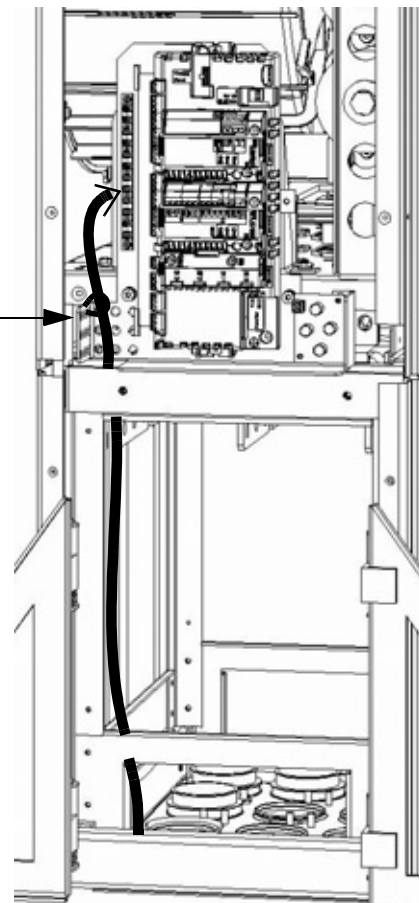
R7



Secure the cables with cable ties to the holes in the capacitor pack frame

Lead the cables through the cushions. This is for mechanical support only. (No 360 degrees EMC grounding is needed here.)

R8

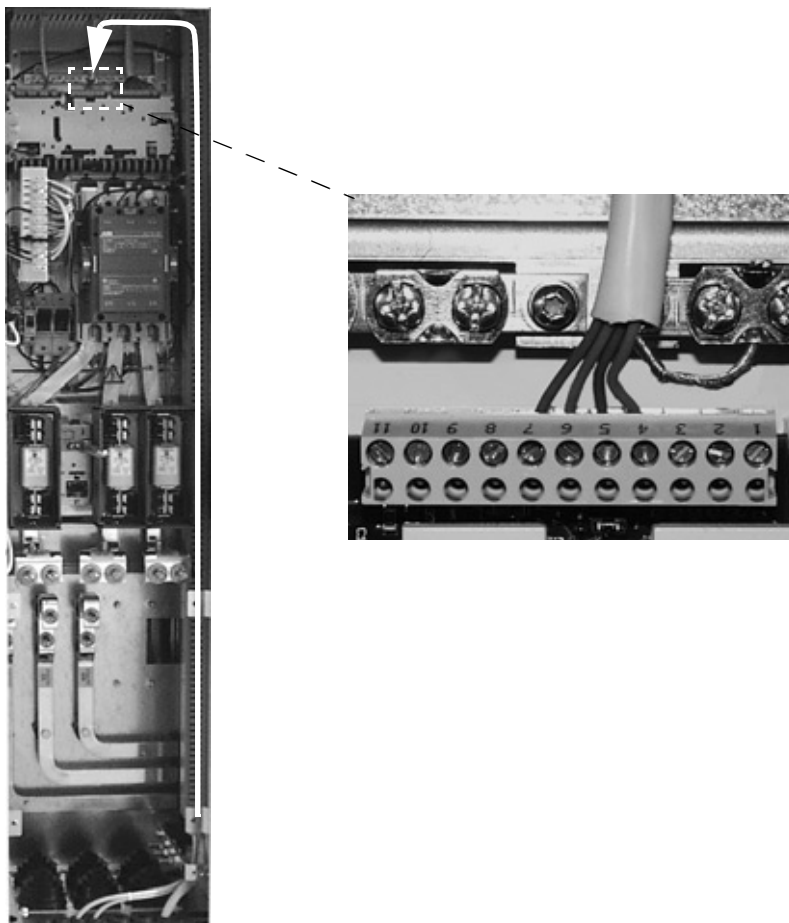


Secure the cables with cable ties to these holes

Units with an enclosure extension

Control and signal cables can be led into the cubicle either through the bottom plate or the roof regardless of power cabling direction. Cable entries with grommets for multiple cable diameters are provided.

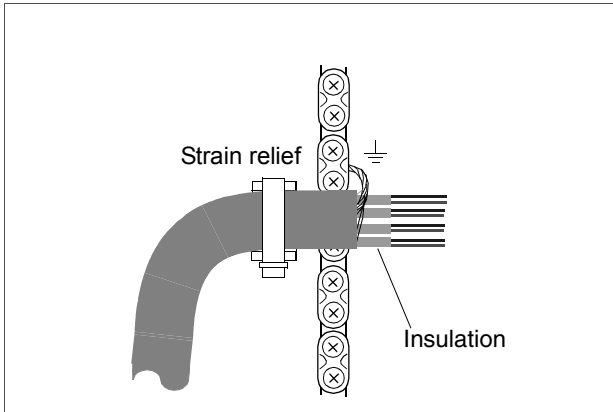
The following diagram gives an example of signal/control cabling routing inside the cubicle.



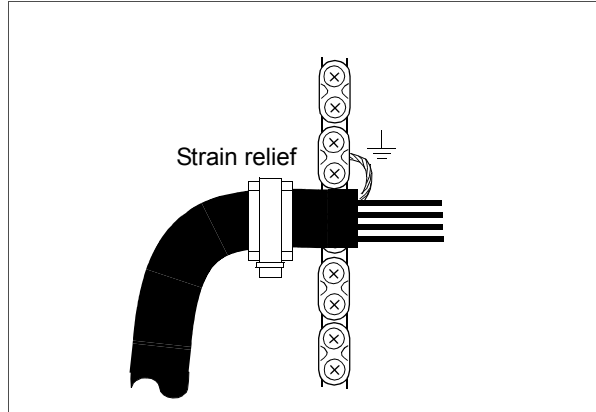
Connecting the control cables

Connect the control cables as described below. Connect the conductors to the appropriate detachable terminals of the RMIO board (refer to chapter *Motor control and I/O board (RMIO)*). Tighten the screws to secure the connection.

Connecting the shield wires at RMIO board



Double shielded cable



Single shielded cable

Single shielded cables: Twist the grounding wires of the outer shield and connect them through the shortest possible route to the nearest grounding clamp. **Double shielded cables:** Connect each pair cable shield (twisted grounding wires) with other pair cable shields of the same cable and the grounding wires of the outer shield to the nearest grounding clamp.

Do not connect shields of different cables to the same grounding clamp.

Leave the other end of the shield unconnected or ground it indirectly via a few nanofarads high-frequency, high-voltage capacitor (e.g. 3.3 nF / 3000 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.

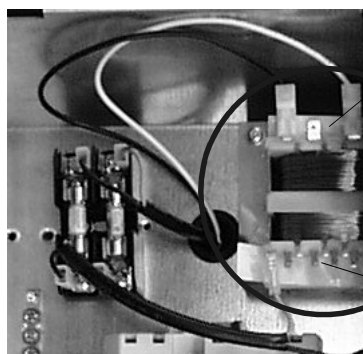
Keep the signal wire pairs twisted as close to the terminals as possible. Twisting the wire with its return wire reduces disturbances caused by inductive coupling.

Securing the control cables mechanically

Use strain relief clamps as shown above. Fasten the control cables together and to the drive frame with cable ties as shown in section *Routing the control/signal cables inside the cubicle*.

Settings of the cooling fan transformer

The voltage transformer of the cooling fan is located at the top right-hand corner of the drive.



Set to 220 V if the supply frequency is 60 Hz. (The voltage is set to 230 V (50 Hz) at the factory.)

Set according to the supply voltage:
380 V, 400 V, 415 V, 440 V, 480 V or 500 V; or
525 V, 575 V, 600 V, 660 V or 690 V.

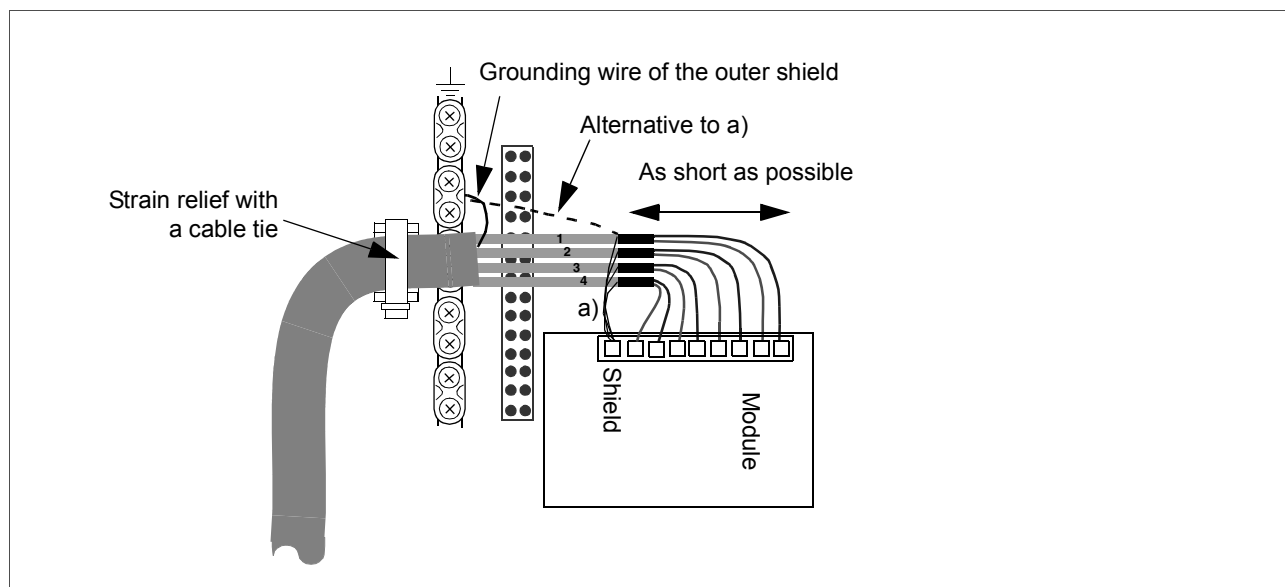
Setting of the auxiliary voltage transformer of the line contactor option

Adjust the setting of the transformer (located in the enclosure extension) according to the input voltage.

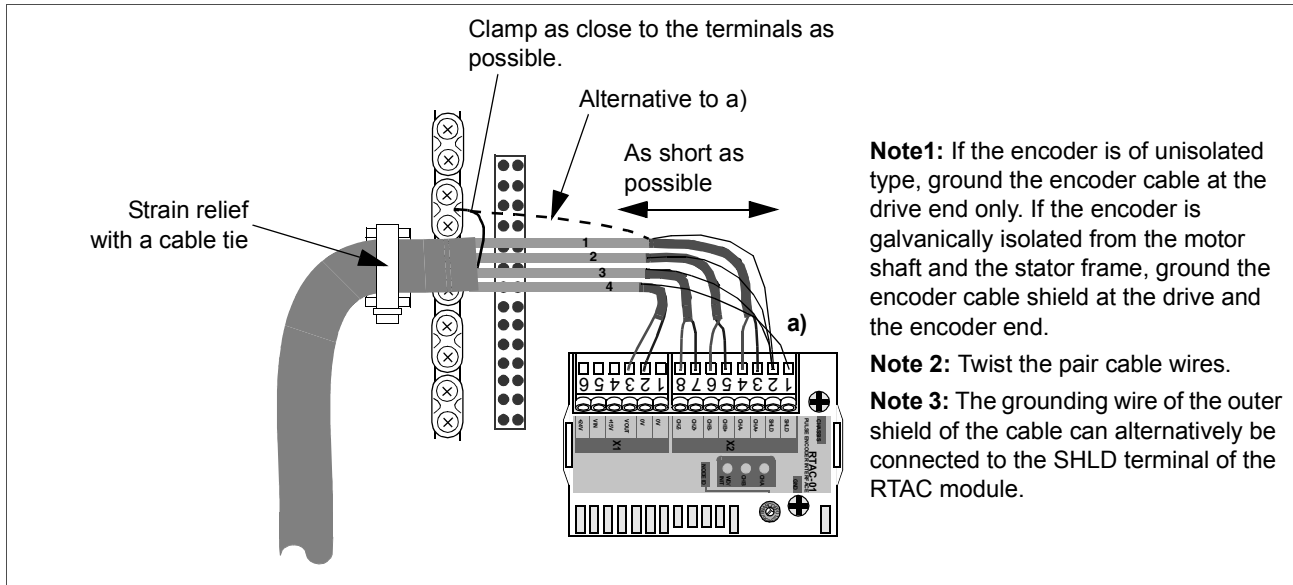
Installation of optional modules and PC

The optional module (such as fieldbus adapter, I/O extension module and the pulse encoder interface) is inserted in the optional module slot of the RMIO board and fixed with two screws. See the appropriate optional module manual for cable connections.

Cabling of I/O and fieldbus modules



Pulse encoder module cabling



Fibre optic link

A DDCS fibre optic link is provided via the RDCO optional module for PC tools, master/follower link, NDIO, NTAC, NAI0, AIMA I/O module adapter and fieldbus adapter modules of type Nxxx. See *RDCO User's Manual* [3AFE 64492209 (English)] for the connections. Observe colour coding when installing fibre optic cables. Blue connectors go to blue terminals, and grey connectors to grey terminals.

When installing multiple modules on the same channel, connect them in a ring.

Installation of a motor thermistor relay

A motor thermistor relay can be installed to the DIN rail at the front left-hand post of the pedestal or in the enclosure extension.

Installation of brake resistors

See *Resistor Braking*. Connect the resistor as shown in section *Power cable connection diagram* above.

Parameter settings

To enable dynamic braking, certain drive parameters must be adjusted. For further information, refer to the *Firmware Manual*.

Motor control and I/O board (RMIO)

What this chapter contains

This chapter shows

- external control connections to the RMIO board for the the ACS800 Standard Application Program (Factory Macro)
- specifications of the inputs and outputs of the board.

To which products this chapter applies

This chapter applies to ACS800 units which employ the RMIO board.

Note for the ACS800-02

In units with the enclosure extension, the terminals of the RMIO board are wired to optional terminal block X2 (if present). The connections shown below apply also to terminal block X2 (the markings are equal to the ones on the RMIO board).

Terminals of X2 accept cables from 0.5 to 4.0 mm² (22 to 12 AWG). Tightening torque: 0.4 to 0.8 Nm (3.5 to 7.1 lbf in.)

Note for external power supply



WARNING! If the RMIO board is supplied from an external power source, the loose end of the cable removed from the RMIO board terminal must be secured mechanically to a location where it cannot come into contact with electrical parts. If the screw terminal plug of the cable is removed, the wire ends must be individually insulated.

External control connections (non-US)

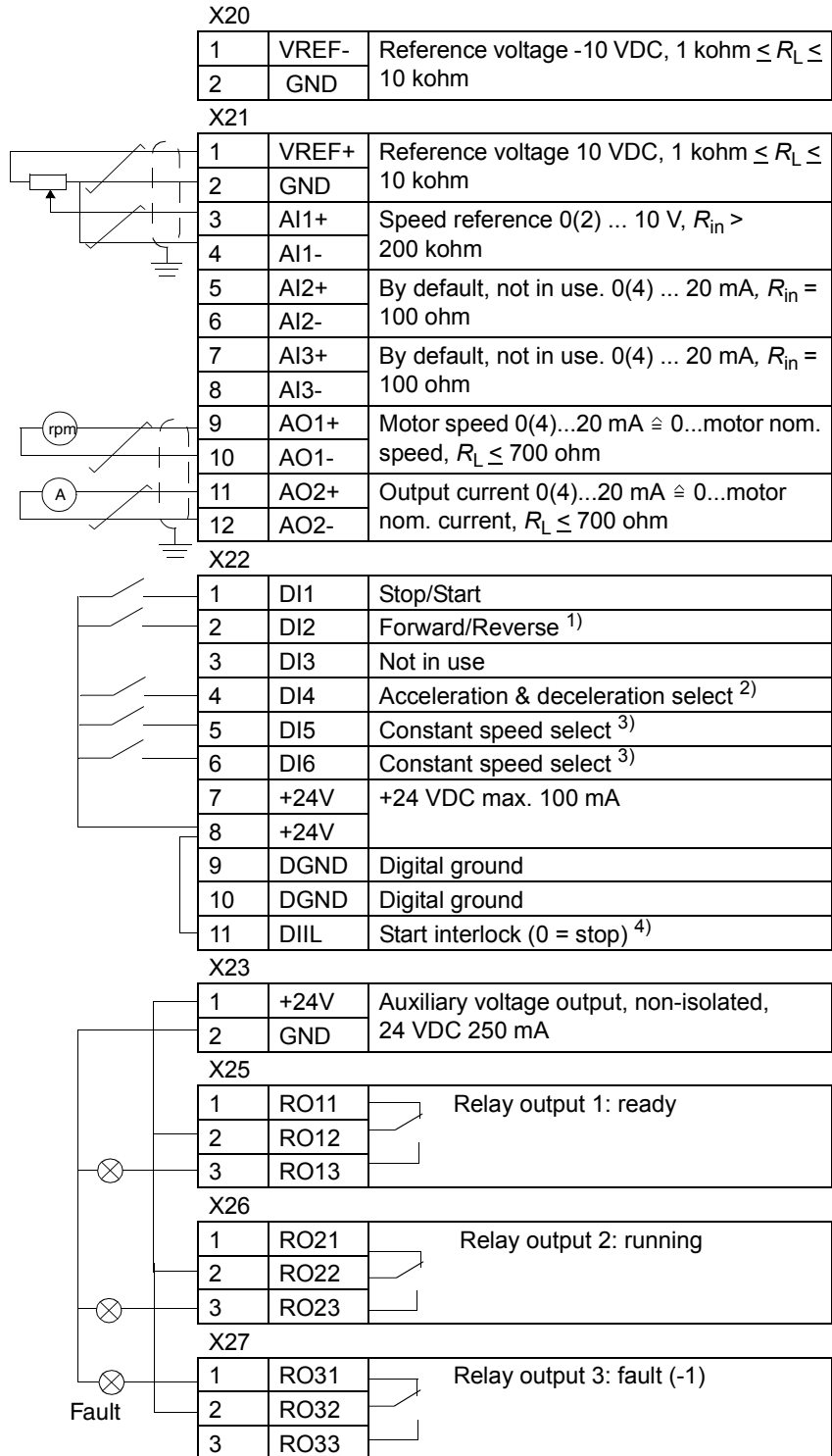
External control cable connections to the RMIO board for the ACS800 Standard Application Program (Factory Macro) are shown below. For external control connections of other application macros and programs, see the appropriate *Firmware Manual*.

Terminal block size:

cables 0.3 to 3.3 mm² (22 to 12 AWG)

Tightening torque:

0.2 to 0.4 Nm (2 to 4 lbf in.)



¹⁾ Only effective if par. 10.03 is set to REQUEST by the user.

²⁾ 0 = open, 1 = closed

DI4	Ramp times according to
0	parameters 22.02 and 22.03
1	parameters 22.04 and 22.05

³⁾ See par. group 12 CONSTANT SPEEDS.

DI5	DI6	Operation
0	0	Set speed through AI1
1	0	Constant speed 1
0	1	Constant speed 2
1	1	Constant speed 3

⁴⁾ See parameter 21.09 START INTRL FUNC.

External control connections (US)

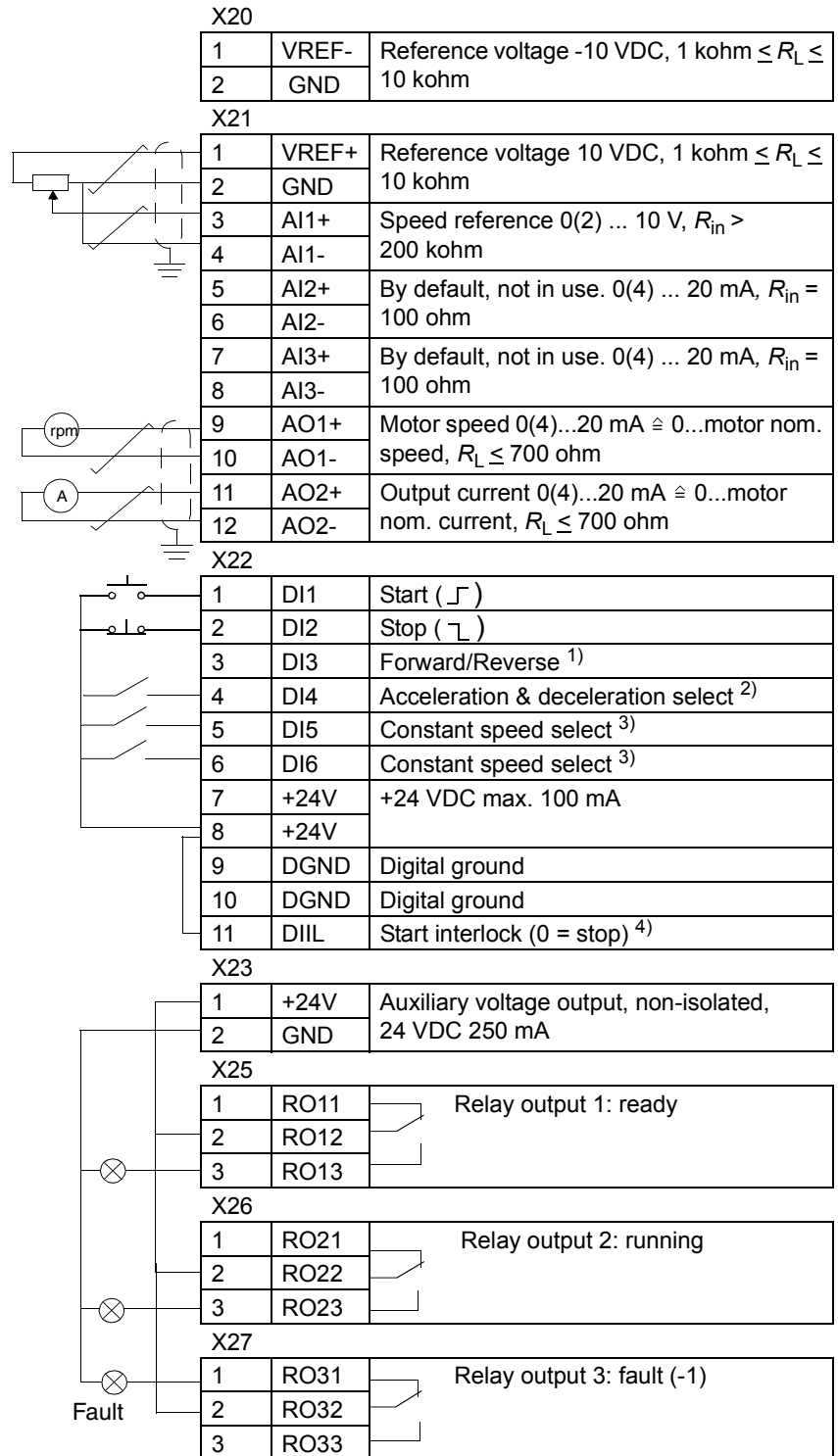
External control cable connections to the RMIO board for the ACS800 Standard Application Program (Factory Macro US version, +N665) are shown below. For external control connections of other application macros and programs, see the appropriate *Firmware Manual*.

Terminal block size:

cables 0.3 to 3.3 mm² (22 to 12 AWG)

Tightening torque:

0.2 to 0.4 Nm (2 to 4 lbf in.)



1) Only effective if par. 10.03 is set to REQUEST by the user.

2) 0 = open, 1 = closed

DI4	Ramp times according to
0	parameters 22.02 and 22.03
1	parameters 22.04 and 22.05

3) See par. group 12 CONSTANT SPEEDS.

DI5	DI6	Operation
0	0	Set speed through AI1
1	0	Constant speed 1
0	1	Constant speed 2
1	1	Constant speed 3

4) See parameter 21.09 START INTRL FUNC.

RMIO board specifications

Analogue inputs

	With Standard Application Program two programmable differential current inputs (0 mA / 4 mA ... 20 mA, $R_{in} = 100 \text{ ohm}$) and one programmable differential voltage input (-10 V / 0 V / 2 V ... +10 V, $R_{in} > 200 \text{ kohm}$).
	The analogue inputs are galvanically isolated as a group.
Isolation test voltage	500 VAC, 1 min
Max. common mode voltage between the channels	$\pm 15 \text{ VDC}$
Common mode rejection ratio	$\geq 60 \text{ dB}$ at 50 Hz
Resolution	0.025 % (12 bit) for the -10 V ... +10 V input. 0.5 % (11 bit) for the 0 ... +10 V and 0 ... 20 mA inputs.
Inaccuracy	$\pm 0.5 \%$ (Full Scale Range) at 25 °C. Temperature coefficient: $\pm 100 \text{ ppm}/^\circ\text{C}$, max.

Constant voltage output

Voltage	+10 VDC, 0, -10 VDC $\pm 0.5 \%$ (Full Scale Range) at 25 °C. Temperature coefficient: $\pm 100 \text{ ppm}/^\circ\text{C}$ ($\pm 56 \text{ ppm}/^\circ\text{F}$) max.
Maximum load	10 mA
Applicable potentiometer	1 kohm to 10 kohm

Auxiliary power output

Voltage	24 VDC $\pm 10 \%$, short circuit proof
Maximum current	250 mA (without any optional modules inserted onto slots 1 and 2)

Analogue outputs

	Two programmable current outputs: 0 (4) to 20 mA, $R_L \leq 700 \text{ ohm}$
Resolution	0.1 % (10 bit)
Inaccuracy	$\pm 1 \%$ (Full Scale Range) at 25 °C (77 °F). Temperature coefficient: $\pm 200 \text{ ppm}/^\circ\text{C}$ ($\pm 111 \text{ ppm}/^\circ\text{F}$) max.

Digital inputs

	With Standard Application Program six programmable digital inputs (common ground: 24 VDC, -15 % to +20 %) and a start interlock input. Group isolated, can be divided in two isolated groups (see <i>Isolation and grounding diagram</i> below).
	Thermistor input: 5 mA, $< 1.5 \text{ kohm} \hat{=} \text{"1"}$ (normal temperature), $> 4 \text{ kohm} \hat{=} \text{"0"}$ (high temperature), open circuit $\hat{=} \text{"0"}$ (high temperature).
	Internal supply for digital inputs (+24 VDC): short circuit proof. An external 24 VDC supply can be used instead of the internal supply.
Isolation test voltage	500 VAC, 1 min
Logical thresholds	$< 8 \text{ VDC} \hat{=} \text{"0"}$, $> 12 \text{ VDC} \hat{=} \text{"1"}$
Input current	DI1 to DI 5: 10 mA, DI6: 5 mA
Filtering time constant	1 ms

Relay outputs

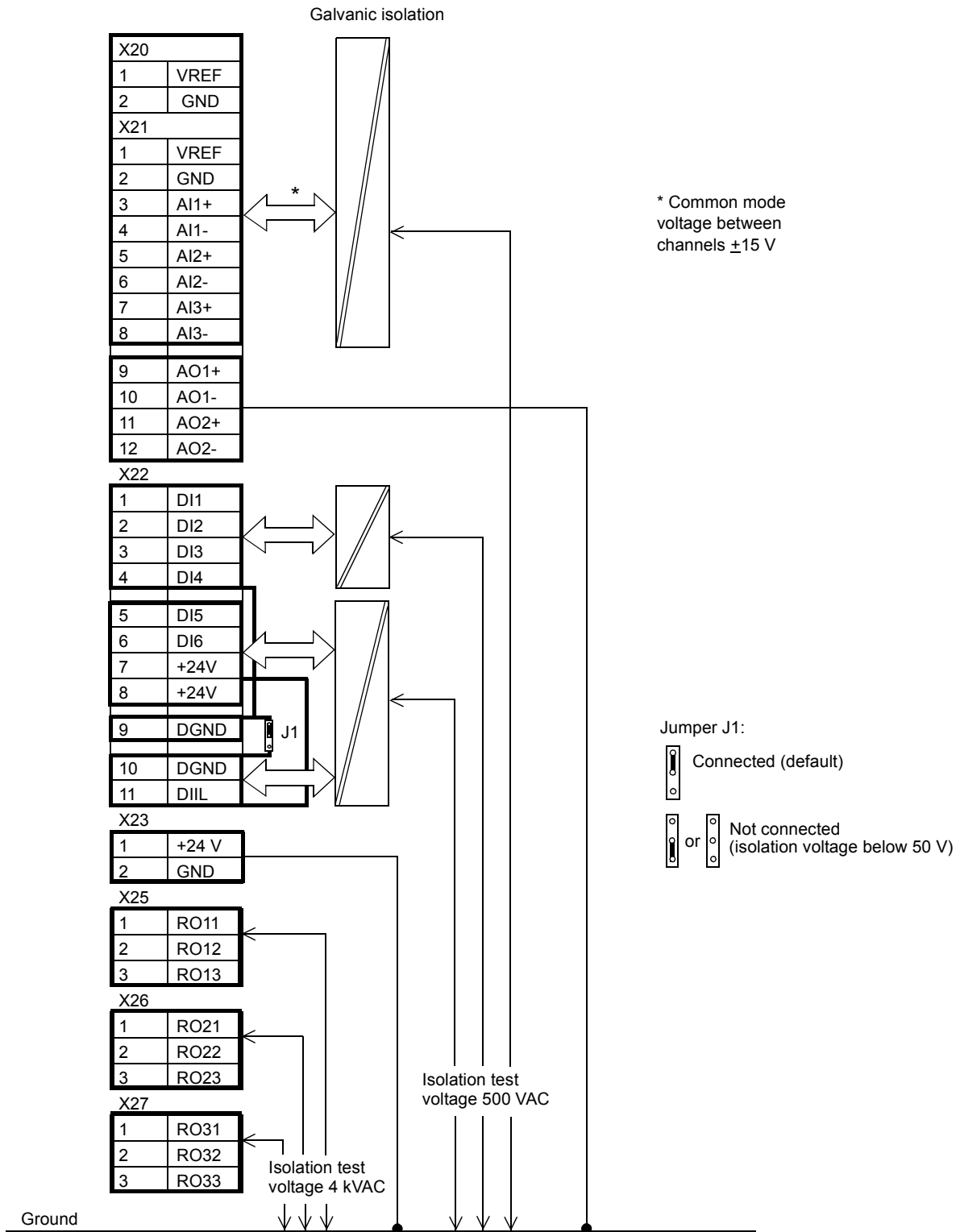
	Three programmable relay outputs
Switching capacity	8 A at 24 VDC or 250 VAC, 0.4 A at 120 VDC
Minimum continuous current	5 mA rms at 24 VDC
Maximum continuous current	2 A rms
Contact material	Silver Cadmium Oxide (AgCdO)
Isolation test voltage	4 kVAC, 1 minute

DDCS fibre optic link

With optional communication adapter module RDCO. Protocol: DDCS (ABB Distributed Drives Communication System)

The RMIO board as well as the optional modules attachable to the board fulfil the Protective Extra Low Voltage (PELV) requirements stated in EN 50178.

Isolation and grounding diagram



Installation checklist

Checklist

Check the mechanical and electrical installation of the drive before start-up. Go through the checklist below together with another person. Read the *Safety instructions* on the first pages of this manual before you work on the unit.

Check	
MECHANICAL INSTALLATION	
The ambient operating conditions are allowed. See <i>Installation, Technical data: IEC ratings or US tables / NEMA ratings, Ambient conditions</i> .	<input type="checkbox"/>
The unit is fixed properly on floor and a vertical non-flammable wall. See <i>Installation</i> .	<input type="checkbox"/>
The cooling air will flow freely.	<input type="checkbox"/>
ELECTRICAL INSTALLATION See <i>Electrical installation planning, Installation</i> .	
The motor and the driven equipment are ready for start. See <i>Electrical installation planning: Checking the compatibility of the motor, Technical data: Motor connection</i> .	<input type="checkbox"/>
The +E202 EMC filter capacitors are disconnected if the drive is connected to an IT (ungrounded) system.	<input type="checkbox"/>
The drive is grounded properly.	<input type="checkbox"/>
The mains (input power) voltage matches the drive nominal input voltage.	<input type="checkbox"/>
The mains (input power) connections at U1, V1 and W1 and their tightening torques are OK.	<input type="checkbox"/>
Appropriate mains (input power) fuses and disconnectors are installed.	<input type="checkbox"/>
The motor connections at U2, V2 and W2 and their tightening torques are OK.	<input type="checkbox"/>
The motor cable is routed away from other cables.	<input type="checkbox"/>
Setting of the fan voltage transformer	<input type="checkbox"/>
Setting of the auxiliary voltage transformer (option +G304)	<input type="checkbox"/>
There are no power factor compensation capacitors in the motor cable.	<input type="checkbox"/>
The external control connections inside the drive are OK.	<input type="checkbox"/>
There are no tools, foreign objects or dust from drilling inside the drive.	<input type="checkbox"/>
Mains (input power) voltage cannot be applied to the output of the drive (with bypass connection).	<input type="checkbox"/>
Drive, motor connection box and other covers are in place.	<input type="checkbox"/>

Maintenance

What this chapter contains

This chapter contains preventive maintenance instructions.

Safety



WARNING! Read the *Safety instructions* on the first pages of this manual before performing any maintenance on the equipment. Ignoring the safety instructions can cause injury or death. **Note:** There are parts carrying dangerous voltages near the RMIO board when the drive is powered.

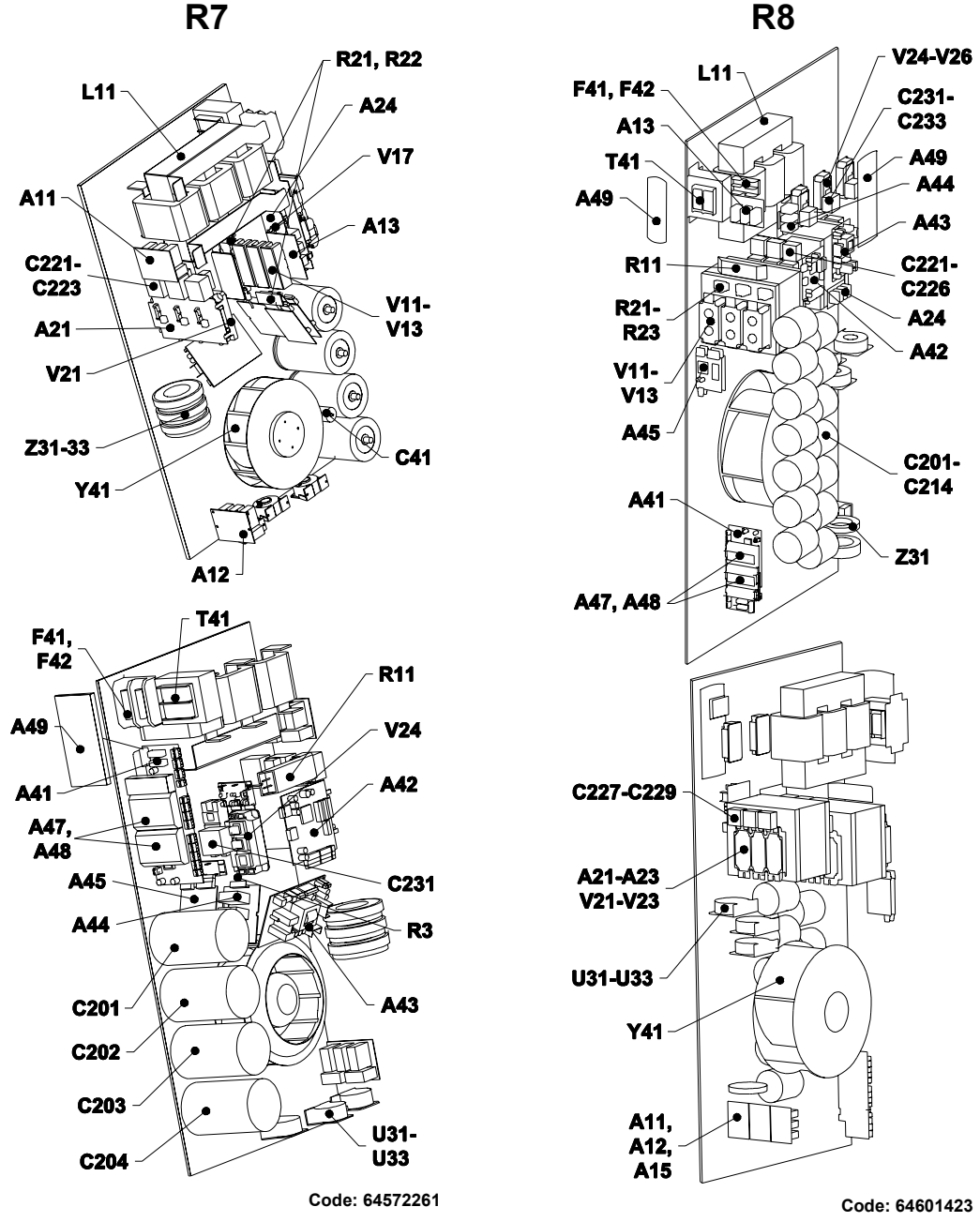
Maintenance intervals

If installed in an appropriate environment, the drive requires very little maintenance. This table lists the routine maintenance intervals recommended by ABB.

Interval	Maintenance	Instruction
Every year when stored	Capacitor reforming	See <i>Reforming</i> .
Every 6 to 12 months (depending on the dustiness of the environment)	Heatsink temperature check and cleaning	See <i>Heatsink</i> .
Every 7 years	Cooling fan change	See <i>Fan</i> .
Every 10 years	Capacitor change	See <i>Capacitors</i> .
Every 5 years	Enclosure extension cooling fan change (with contactor option)	See <i>Replacing the fan of the enclosure extension</i>

Layout

The layout stickers of the drive are shown below. The stickers show all possible components. Not all of them are present in each delivery.



Designation	Component
A49	Control panel
A41	Motor control and I/O board (RMIO)
Y41	Cooling fan
C_	Capacitors

Heatsink

The heatsink fins pick up dust from the cooling air. The drive runs into overtemperature warnings and faults if the heatsink is not clean. In a “normal” environment (not dusty, not clean) the heatsink should be checked annually, in a dusty environment more often.

Clean the heatsink as follows (when necessary):

1. Remove the cooling fan (see section *Fan*).
2. Blow dry clean compressed air from bottom to top and simultaneously use a vacuum cleaner at the air outlet to trap the dust. **Note:** Prevent dust from entering adjoining equipment.
3. Replace the cooling fan.

Fan

The lifespan of the cooling fan of the drive is about 50 000 (R7) and 60 000 (R8) hours. The actual lifespan depends on the running time of the fan, ambient temperature and dust concentration. See the appropriate ACS800 firmware manual for the actual signal which indicates the running time of the cooling fan.

A cooling fan is included in the enclosure extension with a contactor option. Its lifespan is at least 40 000 h.

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

Replacing the fan of the enclosure extension

The fan is fastened to the inside of the roof.

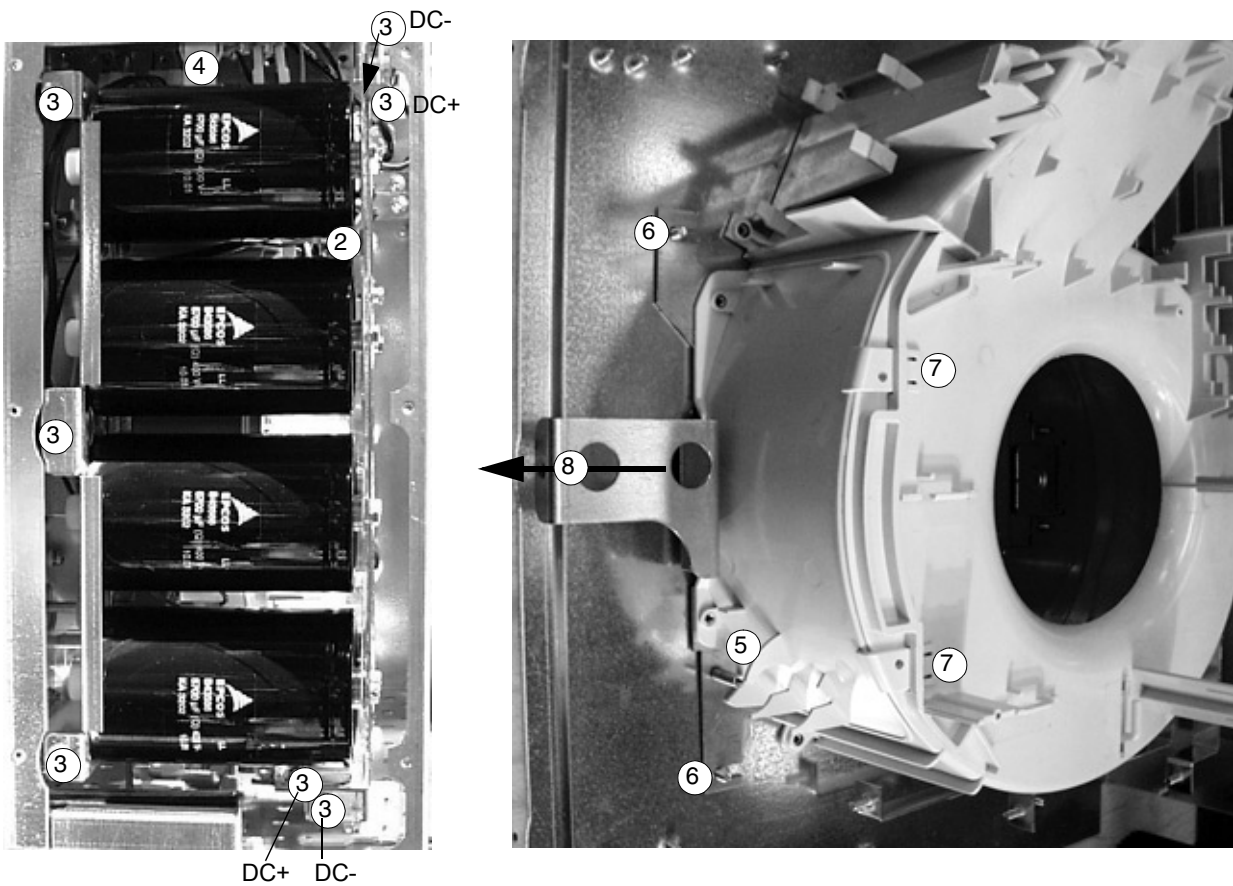
Remove the fan as follows:

- Disconnect the wires.
- Undo the four fixing screws.
- Pull the fan out.

Install the fan in reverse order to the above.

Replacing the fan (R7)

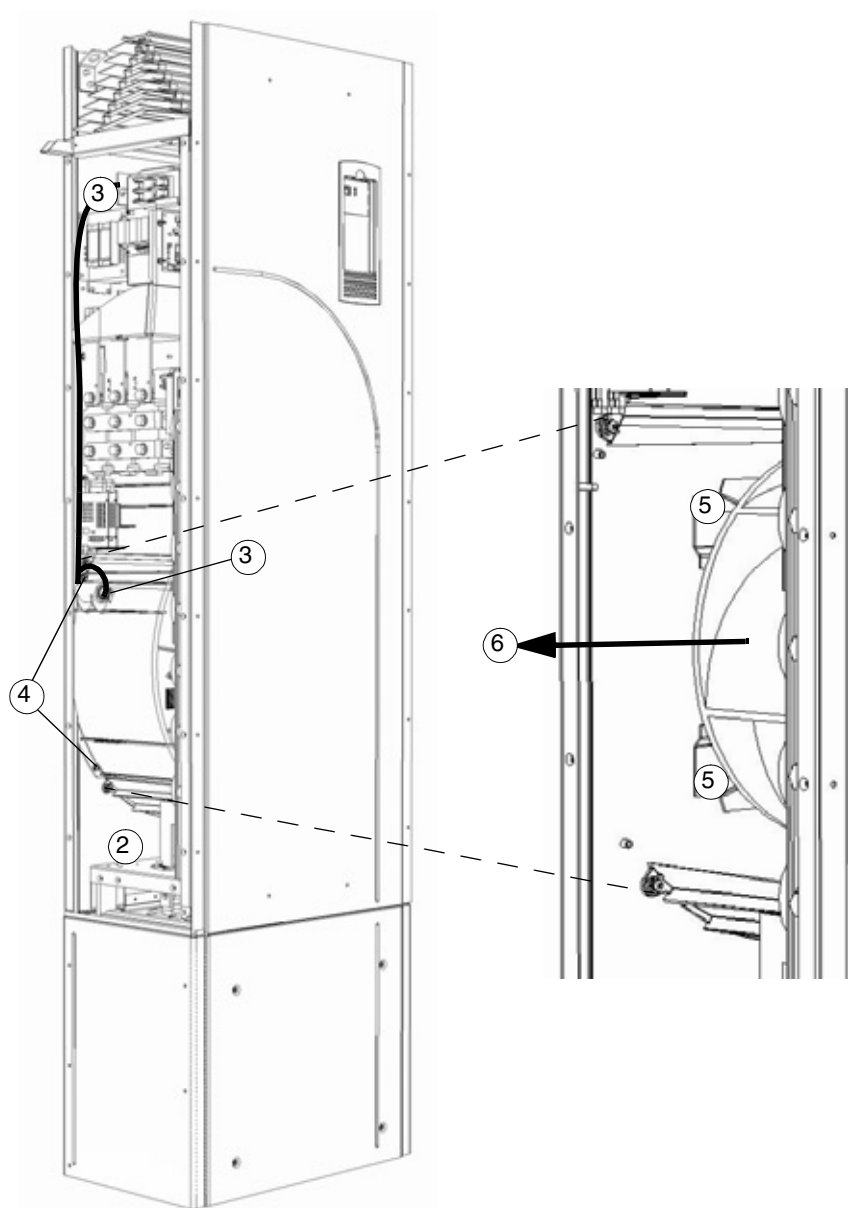
1. Remove the upper front cover and disconnect the control panel cables.
2. Disconnect the discharging resistor wire.
3. Remove the DC capacitor pack by undoing the black fixing screws.
4. Disconnect the fan supply wires (detachable terminal).
5. Disconnect the fan capacitor wires.
6. Undo the black fixing screws of the fan cassette.
7. Press the snap-on holders to release the side cover.
8. Lift from the handle and pull the fan cassette out.



Install the fan in reverse order to the above and replace the fan capacitor.

Replacing the fan (R8)

1. Remove the upper front cover.
2. Remove the RMIO board as described in *Installation / Installation procedure / Mounting orientations a and b*.
3. Disconnect the fan capacitor and power supply wires. Replace the starting capacitor.
4. Undo the black fastening screws of the plastic side cover of the fan and lift the cover off.
5. Undo the black fastening screws of the fan.
6. Lift the fan out of the cabinet.



Install the fan in reverse order to the above.

Capacitors

The drive intermediate circuit employs several electrolytic capacitors. Their lifespan is at least 90 000 hours depending on the operating time of the drive, loading and ambient temperature. Capacitor life can be prolonged by lowering the ambient temperature.

It is not possible to predict a capacitor failure. 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

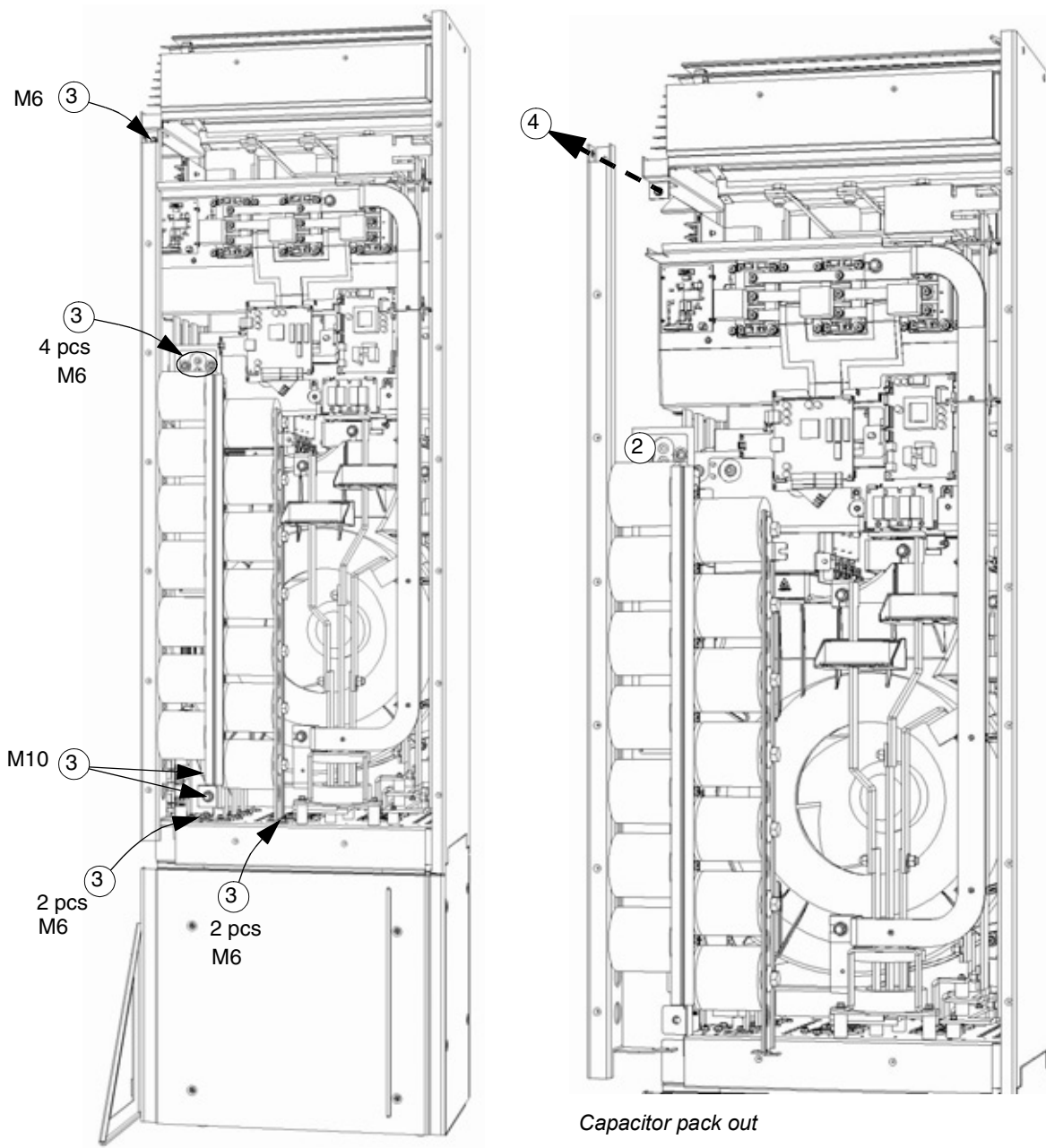
Reform (re-age) spare part capacitors once a year according to *ACS 600/800 Capacitor Reforming Guide* [code: 64059629 (English)].

Replacing the capacitor pack (R7)

Replace the capacitor pack as described in section *Replacing the fan (R7)*.

Replacing the capacitor pack (R8)

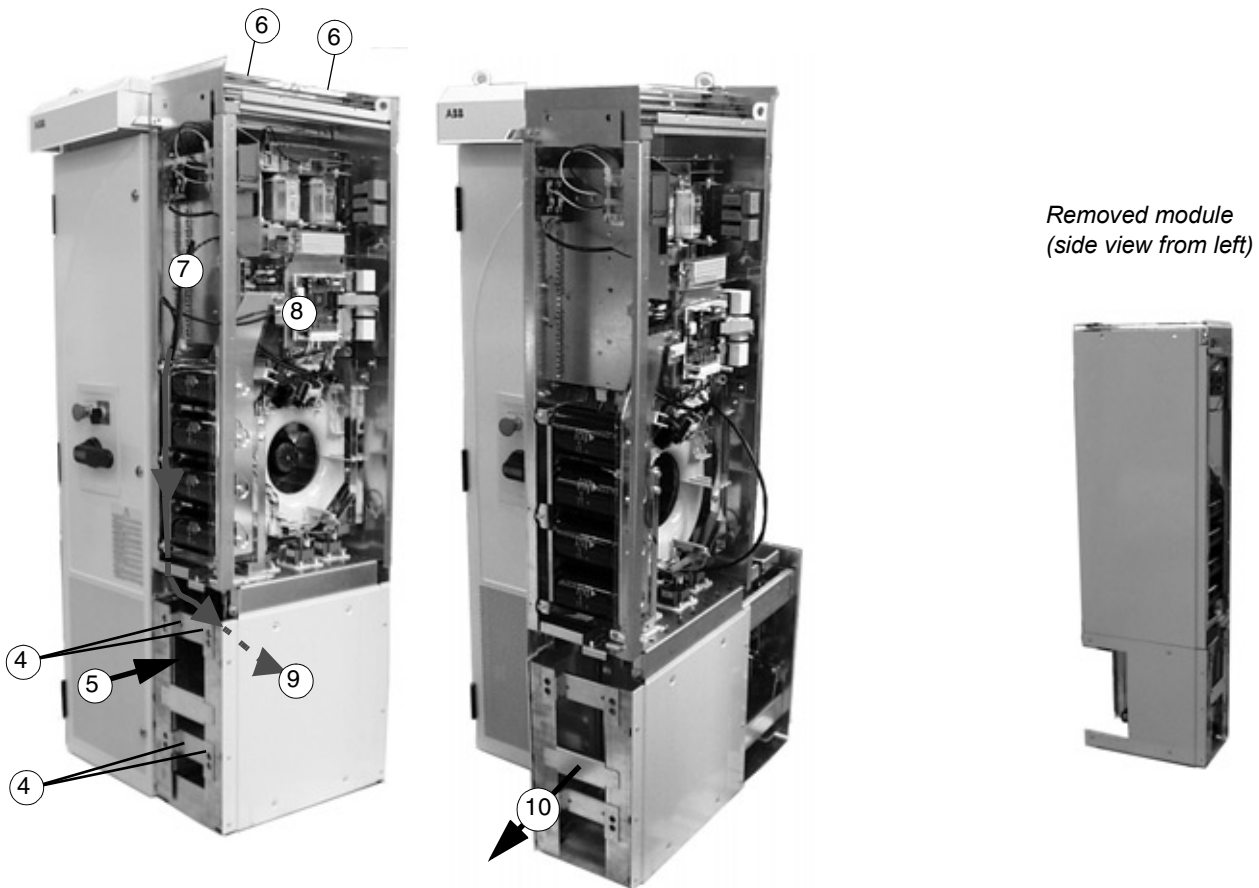
1. Remove the upper front cover and the side plate equipped with control panel mounting slot.
2. Disconnect the discharging resistor wire.
3. Undo the fastening screws.
4. Lift the capacitor pack out.



Install the capacitor pack in reverse order to the above.

Module replacement of units with the enclosure extension

1. Remove the upper front cover and disconnect the control panel cable.
2. Remove the lower front cover.
3. Remove the upper side plate if convenient.
4. Undo the fastening screws of the pedestal.
5. Disconnect the pedestal from the drive module by undoing the connection screws. For detailed instructions, see *Installation / Installation procedure / Mounting orientations a and b*.
6. Undo the two screws that fasten the unit to the enclosure extension.
7. Disconnect the power supply wire of the RMIO board.
8. Disconnect the fibre optic cables of the RMIO board from the AINT board and mark down the terminals for reconnecting.
9. Pull the cables 7 and 8 carefully down inside the pedestal and roll them aside so that they will not get damaged when the unit is wheeled out. The cables go through the lower side plate into the extension.
10. Wheel the module out.



Install the module in reverse order to the above.

LEDs

This table describes LEDs of the drive.

Where	LED	When the LED is lit
RMIO board	Red	Drive in fault state
	Green	The power supply on the board is OK.
Control panel mounting platform	Red	Drive in fault state
	Green	The main + 24 V power supply for the control panel and the RMIO board is OK.
AINT board	V204 (green)	+5 V voltage of the board is OK.
	V309 (red)	Prevention of unexpected start is ON.
	V310 (green)	IGBT control signal transmission to the gate driver control boards is enabled.

Technical data

What this chapter contains

This chapter contains the technical specifications of the drive, e.g. the ratings, sizes and technical requirements, provisions for fulfilling the requirements for CE and other markings, and warranty policy.

IEC ratings

The IEC ratings for the ACS800-02 with 50 Hz and 60 Hz supplies are given below. The symbols are described below the table.

ACS800-02 size	Nominal ratings		No-overload use	Light-overload use		Heavy-duty use		Frame size	Air flow m ³ /h	Heat dissipation W
	$I_{\text{cont.max}}$ A	I_{max} A	$P_{\text{cont.max}}$ kW	I_{2N} A	P_N kW	I_{2hd} A	P_{hd} kW			
Three-phase supply voltage 380 V, 400 V or 415 V										
-0140-3	206	326	110	202	110	163	90	R7	612	3100
-0170-3	245	404	132	240	132	202	110	R7	612	3650
-0210-3	289	432	160	284	160	240	132	R7	612	4250
-0260-3	368	568	200	361	200	284	160	R8	1220	4900
-0320-3	487	720	250	477	250	361	200	R8	1220	6150
-0400-3	602	904	315	590	315	477	250	R8	1220	7250
-0440-3	648	1017	355	635	355	590	315	R8	1220	7900
-0490-3	718	1017	400	704	400	635	355	R8	1220	9250
Three-phase supply voltage 380 V, 400 V, 415 V, 440 V, 460 V, 480 V or 500 V										
-0170-5	196	326	132	192	132	162	110	R7	540	3150
-0210-5	245	404	160	240	160	192	132	R7	540	3550
-0260-5	289	432	200	284	200	224	160	R7	540	4600
-0320-5	368	568	250	361	250	284	200	R8	1220	5350
-0400-5	486	720	315	477	315	361	250	R8	1220	6650
-0440-5	526	904	355	515	355	477	315	R8	1220	6800
-0490-5	602	1017	400	590	400	515	355	R8	1220	7250
-0550-5	645	1017	450	632	450	590	400	R8	1220	8900
-0610-5	718	1017	500	704	500	632	450	R8	1220	10050

PDM code: 00096931

Symbols

Nominal ratings

$I_{\text{cont.max}}$ continuous rms output current. No overload capability at 40 °C.

I_{max} maximum output current. Available for 10 s at start, otherwise as long as allowed by drive temperature.

Typical ratings:

No-overload use

$P_{\text{cont.max}}$ typical motor power. The power ratings apply to most IEC 34 motors at the nominal voltage, 400 V or 500 V.

Light-overload use (10 % overload capability)

I_{2N} continuous rms current. 10 % overload is allowed for one minute.

P_N typical motor power. The power ratings apply to most IEC 34 motors at the nominal voltage, 400 V or 500 V.

Heavy-duty use (50 % overload capability)

I_{2hd} continuous rms current. 50 % overload is allowed for one minute.

P_{hd} typical motor power. The power ratings apply to most IEC 34 motors at the nominal voltage, 400 V or 500 V.

Sizing

The current ratings are the same regardless of the supply voltage within one voltage range. 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.

Note 1: The maximum allowed motor shaft power is limited to $1.5 \cdot P_{hd}$. If the limit is exceeded, motor torque and current are automatically restricted. The function protects the input bridge of the drive against overload.

Note 2: The ratings apply in ambient temperature of 40 °C (104 °F). In lower temperatures the ratings are higher (except I_{max}).

Note 3: Use the DriveSize PC tool for a more accurate dimensioning if the ambient temperature is below 40 °C (104 °F) or the drive is loaded cyclically.

Derating

The load capacity (current and power) decreases if the installation site altitude exceeds 1000 metres (3281 ft), or if the ambient temperature exceeds 40 °C (104 °F).

Temperature derating

In the temperature range +40 °C (+104 °F) to +50 °C (+122 °F), the rated output current is decreased 1 % for every additional 1 °C (1.8 °F). The output current is calculated by multiplying the current given in the rating table by the derating factor.

Example If the ambient temperature is 50 °C (+122 °F), the derating factor is $100\% - 1 \frac{\%}{\text{°C}} \cdot 10 \text{ °C} = 90\%$ or 0.90. The output current is then $0.90 \cdot I_{2N}$, $0.90 \cdot I_{2hd}$ or $0.90 \cdot I_{\text{cont.max}}$.

Altitude derating

At altitudes from 1000 to 4000 m (3281 to 13123 ft) above sea level, the derating is 1 % for every 100 m (328 ft). For a more accurate derating, use the DriveSize PC tool. If the installation site is higher than 2000 m (6600 ft) above sea level, please contact your local ABB distributor or office for further information.

Mains cable fuses

Fuses for short-circuit protection of the mains cable are listed below. The fuses also protect the adjoining equipment of the drive in case of a short-circuit. **Check that the operating time of the fuse is below 0.5 seconds.** The operating time depends on the supply network impedance and the cross-sectional area, material and length of the supply cable. See also *Electrical installation planning: Thermal overload and short-circuit protection*. For UL recognized fuses, see *US tables*.

Note 1: Install only one fuse per phase (not one fuse per cable).

Note 2: Mains cable sizing is based on a correction factor of 0.71 (max. 9 cables laid on a cable ladder side by side, ambient temperature 30 °C, EN 60204-1 and IEC 364-5-523). For other conditions, size the cables according to local safety regulations, appropriate input voltage and the load current of the drive. You can choose a thicker cable but the fuses must be rated according to the table (bigger fuses must not be used).

Note 3: Fuses from other manufacturers can be used if they meet the ratings.

Note 4: The enclosure extension is equipped with these fuses as standard.

ACS800-02 size	Cable		Fuse				
	Cu (mm ²)	Al (mm ²)	A	V	Manufacturer	Type	IEC size
Three-phase supply voltage 380 V, 400 V or 415 V							
-0140-3	3x185+95	3x240+95Cu	250	500	ABB Control	OFAF1H250	1
-0170-3	3x240+120	2x(3x120+50Cu)	315	500	ABB Control	OFAF2H315	2
-0210-3	2x(3x95+50)	2x(3x150+50Cu)	315	500	ABB Control	OFAF2H315	2
-0260-3	2x(3x150+95)	2x(3x240+95Cu)	400	500	ABB Control	OFAF2H400	2
-0320-3	2x(3x240+120)	3x(3x150+50Cu)	500	500	ABB Control	OFAF3H500	3
-0400-3	3x(3x150+95)	3x(3x240+95Cu)	630	500	ABB Control	OFAF3H630	3
-0440-3	3x(3x185+95)	3x(3x240+95Cu)	800	500	ABB Control	OFAF3H800	3
-0490-3	3x(3x185+95)	3x(3x240+95Cu)	800	500	ABB Control	OFAF3H800	3
Three-phase supply voltage 380 V, 400 V, 415 V, 440 V, 460 V, 480 V or 500 V							
-0170-5	3x185+95	3x240+95Cu	250	500	ABB Control	OFAF1H250	1
-0210-5	3x240+120	2x(3x120+50Cu)	250	500	ABB Control	OFAF1H250	1
-0260-5	2x(3x95+50)	2x(3x150+50Cu)	315	500	ABB Control	OFAF2H315	2
-0320-5	2x(3x150+95)	2x(3x240+95Cu)	400	500	ABB Control	OFAF2H400	2
-0400-5	2x(3x240+120)	3x(3x150+50Cu)	500	500	ABB Control	OFAF3H500	3
-0440-5	3x(3x150+95)	3x(3x240+95Cu)	630	500	ABB Control	OFAF3H630	3
-0490-5	3x(3x185+95)	3x(3x240+95Cu)	630	500	ABB Control	OFAF3H630	3
-0550-5	3x(3x185+95)	3x(3x240+95Cu)	800	500	ABB Control	OFAF3H800	3
-0610-5	3x(3x185+95)	3x(3x240+95Cu)	800	500	ABB Control	OFAF3H800	3

Cable entries

Mains, motor and brake resistor cable terminal sizes (per phase), maximum accepted cable diameters and tightening torques are given below. The maximum allowed width of the cable lug is 38 mm.

Frame size	U1, V1, W1, U2, V2, W2, UDC+/R+, UDC-, R-				Earthing PE	
	Number of holes per phase	Cable Ø mm	Screw	Tightening torque Nm	Screw	Tightening torque Nm
R7	2	58	M12	50...75	M8	15...22
R8	3	58	M12	50...75	M8	15...22

Dimensions, weights and noise

Frame size	IP 21				IP 54				W3 kg	W4 kg	Noise dB
	H mm	W1 mm	W2 mm	Depth mm	Height mm	W1 mm	W2 mm	Depth mm			
R7	1507	250	602	520					100	195	71
R8	2024	347	793	617					230	375	72

H height

W1 width of the basic unit

W2 width with the optional enclosure extension

W3 weight of the basic unit

W4 weight with the optional enclosure extension (basic configuration with switch fuse but without contactor and other options).

Input power connection

Voltage (U_1)	200/208/220/230/240 VAC 3-phase $\pm 10\%$ for 230 VAC units 380/400/415 VAC 3-phase $\pm 10\%$ for 400 VAC units 380/400/415/440/460/480/500 VAC 3-phase $\pm 10\%$ for 500 VAC units 525/550/575/600/660/690 VAC 3-phase $\pm 10\%$ for 690 VAC units
Prospective short-circuit current (IEC 60439-1)	For units without an enclosure extension, maximum allowed prospective short-circuit current in the supply is 65 kA in a second providing that the supply cable of the drive is protected with appropriate fuses. US: 65,000 AIC.
Frequency	48 to 63 Hz, maximum rate of change 17 %/s
Imbalance	Max. $\pm 3\%$ of nominal phase to phase input voltage
Fundamental power factor ($\cos \phi_1$)	0.98 (at nominal load)

Motor connection

Voltage (U_2) 0 to U_1 , 3-phase symmetrical, U_{\max} at the field weakening point
Frequency DTC mode: 0 to $3.2 \cdot f_{\text{FWP}}$. Maximum frequency 300 Hz.

$$f_{\text{FWP}} = \frac{U_{\text{Nmains}}}{U_{\text{Nmotor}}} \cdot f_{\text{Nmotor}}$$

f_{FWP} : frequency at field weakening point; U_{Nmains} : mains (input power) voltage;
 U_{Nmotor} : rated motor voltage; f_{Nmotor} : rated motor frequency

Frequency resolution 0.01 Hz

Current See section *IEC ratings*.

Power limit $1.5 \cdot P_{\text{hd}}$

Field weakening point 8 to 300 Hz

Switching frequency 3 kHz (average). In 690 V units 2 kHz (average).

Maximum recommended motor cable length

Type code (EMC equipment)	Max. motor cable length	
	DTC control	Scalar control
-	300 m (984 ft)	300 m (984 ft)
+E202 *, +E210 *	100 m (328 ft)	100 m (328 ft)

* Motor cable longer than 100 m (328 ft) is allowed but EMC filtering within the specified limits will not come true.

Efficiency

Approximately 98 % at nominal power level

Cooling

Method Internal fan, flow direction from front to top

Free space around the unit See chapter *Installation*.

Cooling air flow See *IEC ratings*.

Degrees of protection

IP 21 (UL type 1) and IP 54 (UL type 12 for indoor use only)

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 4000 m (13123 ft) above sea level [above 1000 m (3281 ft), see section <i>Derating</i>]	-	-
Air temperature	-15 to +50 °C (5 to 122 °F). See section <i>Derating</i> .	-40 to +70 °C (-40 to +158°F)	-40 to +70 °C (-40 to +158°F)
Relative humidity	5 to 95%	Max. 95%	Max. 95%
	No condensation allowed. Maximum allowed relative humidity is 60% in the presence of corrosive gases.		
Contamination levels (IEC 60721-3-3, IEC 60721-3-2, IEC 60721-3-1)	No conductive dust allowed.		
	Boards without coating: Chemical gases: Class 3C1 Solid particles: Class 3S2 Boards with coating: Chemical gases: Class 3C2 Solid particles: Class 3S2	Boards without coating: Chemical gases: Class 1C2 Solid particles: Class 1S3 Boards with coating: Chemical gases: Class 1C2 Solid particles: Class 1S3	Boards without coating: Chemical gases: Class 2C2 Solid particles: Class 2S2 Boards with coating: Chemical gases: Class 2C2 Solid particles: Class 2S2
Atmospheric pressure	70 to 106 kPa 0.7 to 1.05 atmospheres	70 to 106 kPa 0.7 to 1.05 atmospheres	60 to 106 kPa 0.6 to 1.05 atmospheres
Vibration (IEC 60068-2)	Max. 1 mm (0.04 in.) (5 to 13.2 Hz), max. 7 m/s ² (23 ft/s ²) (13.2 to 100 Hz) sinusoidal	Max. 1 mm (0.04 in.) (5 to 13.2 Hz), max. 7 m/s ² (23 ft/s ²) (13.2 to 100 Hz) sinusoidal	Max. 3.5 mm (0.14 in.) (2 to 9 Hz), max. 15 m/s ² (49 ft/s ²) (9 to 200 Hz) sinusoidal
Shock (IEC 60068-2-29)	Not allowed	Max. 100 m/s ² (330 ft./s ²), 11 ms	Max. 100 m/s ² (330 ft./s ²), 11 ms
Free fall	Not allowed	100 mm (4 in.) for weight over 100 kg (220 lb)	100 mm (4 in.) for weight over 100 kg (220 lb)

Materials

Drive enclosure	<ul style="list-style-type: none"> • PC/ABS 2.5 mm, colour NCS 1502-Y (RAL 9002 / PMS 420 C) • hot-dip zinc coated steel sheet 1.5 to 2.5 mm, thickness of coating 100 micrometres, colour NCS 1502-Y
Package	corrugated board or plywood. Plastic covering of the package: PE-LD, bands PP or steel.
Disposal	<p>The drive contains raw materials that should be recycled to preserve energy and natural resources. The package materials are environmentally compatible and recyclable. All metal parts can be recycled. The plastic parts can either be recycled or burned under controlled circumstances, according to local regulations. Most recyclable parts are marked with recycling marks.</p> <p>If recycling is not feasible, all parts excluding electrolytic capacitors and printed circuit boards can be landfilled. The DC capacitors (C1-1 to C1-x) contain electrolyte and the printed circuit boards contain lead, both of which will be classified as hazardous waste within the EU. They must be removed and handled according to local regulations.</p> <p>For further information on environmental aspects and more detailed recycling instructions, please contact your local ABB distributor.</p>

Applicable standards

	The drive complies with the following standards. The compliance with the European Low Voltage Directive is verified according to standards EN 50178 and EN 60204-1.
• EN 50178 (1997)	Electronic equipment for use in power installations
• EN 60204-1 (1997)	Safety of machinery. Electrical equipment of machines. Part 1: General requirements. <i>Provisions for compliance:</i> The final assembler of the machine is responsible for installing - an emergency-stop device - a supply disconnecting device.
• EN 60529: 1991 (IEC 529), IEC 60664-1 (1992)	Degrees of protection provided by enclosures (IP code)
• EN 61800-3 (1996) + Amendment A11 (2000)	EMC product standard including specific test methods
• UL 508C	UL Standard for Safety, Power Conversion Equipment, second edition
• CSA C22.2 No. 14-95	Industrial control equipment

CE marking

A CE mark is attached to the drive to verify that the unit follows the provisions of the European Low Voltage and EMC Directives (Directive 73/23/EEC, as amended by 93/68/EEC and Directive 89/336/EEC, as amended by 93/68/EEC).

Definitions

EMC stands for **Electromagnetic Compatibility**. 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.

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 covers requirements stated for drives.

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.

Restricted distribution: mode of sales distribution in which the manufacturer restricts the supply of equipment to suppliers, customers or users who separately or jointly have technical competence in the EMC requirements of the application of drives.

Unrestricted distribution: mode of sales distribution in which the supply of equipment is not dependent on the EMC competence of the customer or user for the application of drives.

Compliance with the EMC Directive

The drive complies with the EMC Directive on low-voltage networks with the following provisions.

First environment (restricted distribution)

1. The drive is equipped with EMC filter E202.
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 cable length is 100 metres.

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: It is not allowed to install a drive equipped with the EMC filter E202 on IT (unearthed) systems. The supply network becomes connected to earth potential through the EMC filter capacitors which may cause danger or damage the unit.

Second environment

In second environment two alternatives are available. The provisions are described under Unrestricted distribution and Restricted distribution.

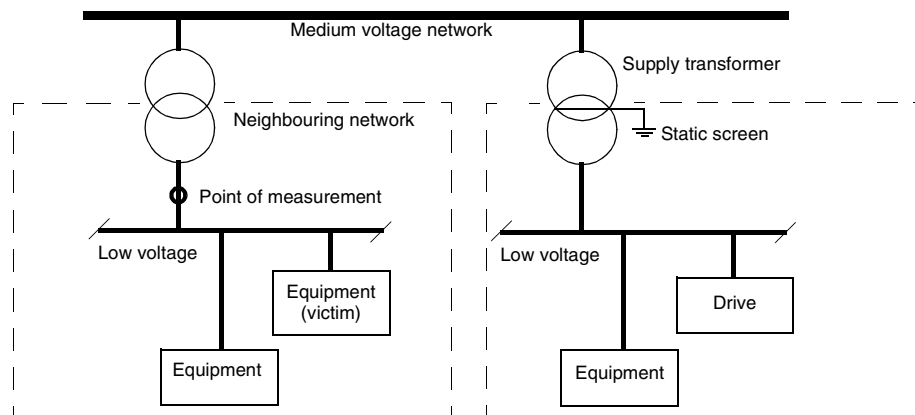
Unrestricted distribution

1. The drive is equipped with EMC filter E210. The filter is suitable for TN (earthed) and IT (unearthed) networks.
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 cable length is 100 metres.

Restricted distribution

These provisions concern cases where the drive is not equipped with EMC filtering (no +Exxx selected in the type code).

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. The installation is described in an EMC plan. 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*.

Machinery Directive

The drive complies with the European Union Machinery Directive (89/392/EEC) requirements for an equipment intended to be incorporated into machinery.

“C-tick” marking

“C-tick” marking is pending as follows.

A “C-tick” mark is attached to each drive in order to verify compliance with the relevant standard (IEC 61800-3 (1996) – Adjustable speed electrical power drive systems – Part 3: EMC product standard including specific test methods), mandated by the Trans-Tasman Electromagnetic Compatibility Scheme.

Definitions

EMC stands for **E**lectromagnetic **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.

The Trans-Tasman Electromagnetic Compatibility Scheme (EMCS) was introduced by the Australian Communication Authority (ACA) and the Radio Spectrum Management Group (RSM) of the New Zealand Ministry of Economic Development (NZMED) in November 2001. The aim of the scheme is to protect the radiofrequency spectrum by introducing technical limits for emission from electrical/ electronic products.

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.

Restricted distribution: mode of sales distribution in which the manufacturer restricts the supply of equipment to suppliers, customers or users who separately or jointly have technical competence in the EMC requirements of the application of drives.

Unrestricted distribution: mode of sales distribution in which the supply of equipment is not dependent on the EMC competence of the customer or user for the application of drives.

Compliance with IEC 61800-3

First environment (restricted distribution)

The drive complies with the limits of IEC 61800-3 with the following provisions:

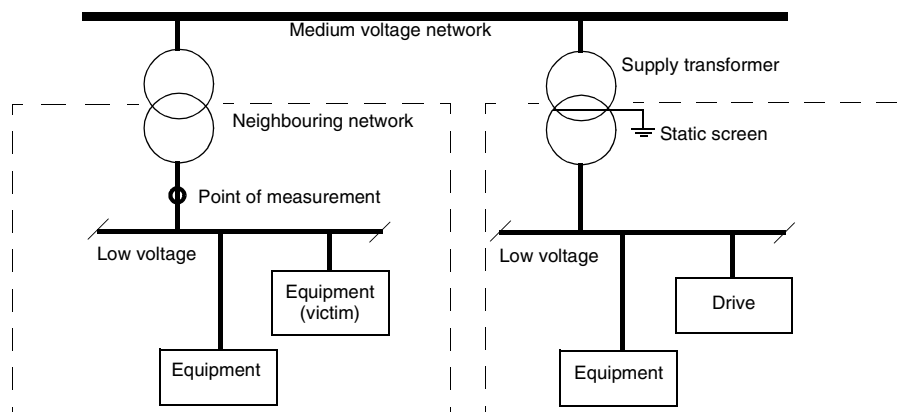
1. The drive is equipped with EMC filter E202.
2. The drive is installed according to the instructions given in the *Hardware Manual*.
3. The motor and control cables used are selected as specified in the *Hardware Manual*.
4. Maximum cable length is 100 metres.

Note: The drive must not be equipped with the EMC filter E202 when installed to IT (unearthed) systems. The mains becomes connected to earth potential through the EMC filter capacitors. In IT systems this may cause danger or damage the unit.

Second environment

The drive complies with the limits of IEC 61800-3 with the following provisions:

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 is strongly recommended.



2. The drive is installed according to the instructions given in the *Hardware Manual*.
3. The motor and control cables used are selected as specified in the *Hardware Manual*.

Equipment warranty and liability

The manufacturer warrants the equipment supplied against defects in design, materials and workmanship for a period of twelve (12) months after installation or twenty-four (24) months from date of manufacturing, whichever first occurs. The local ABB office or distributor may grant a warranty period different to the above and refer to local terms of liability as defined in the supply contract.

The manufacturer is not responsible for

- any costs resulting from a failure if the installation, commissioning, repair, alternation, or ambient conditions of the drive do not fulfil the requirements specified in the documentation delivered with the unit and other relevant documentation.
- units subjected to misuse, negligence or accident
- units comprised of materials provided or designs stipulated by the purchaser.

In no event shall the manufacturer, its suppliers or subcontractors be liable for special, indirect, incidental or consequential damages, losses or penalties.

If you have any questions concerning your ABB drive, please contact the local distributor or ABB office. The technical data, information and specifications are valid at the time of printing. The manufacturer reserves the right to modifications without prior notice.

US tables

NEMA ratings

The NEMA ratings for the ACS800-U2 with 60 Hz supplies are given below. The symbols are described below the table. For sizing, derating and 50 Hz supplies, see *IEC ratings*.

ACS800-U2 size	Normal use		Heavy-duty use		Frame size	Air flow ft ³ /min	Heat dissipation BTU/Hr
	I_{2N} A	P_N HP	I_{2hd} A	P_{hd} HP			
Three-phase supply voltage 380 V, 400 V, 415 V, 440 V, 460 V, 480 V							
-0170-5	196	150	162	125	R7	318	10600
-0210-5	245	200	192	150	R7	318	12000
-0260-5	289	200	224	200	R7	318	15600
-0320-5	368	300/250	284	200	R8	718	18150
-0400-5	486	400/350	361	300/250	R8	718	22600
-0440-5	526	450	477	400/350	R8	718	23150
-0490-5	602	500	515	450	R8	718	24650
-0550-5	645	500	590	500	R8	718	30300
-0610-5	718	600	632	500	R8	718	34250

PDM code: 00096931

Symbols

Normal use (10 % overload capability)

I_{2N} continuous rms current. 10 % overload is allowed for a period of time dependent on ambient temperature – typically for one minute.

P_N typical motor power. The power ratings apply to most 4-pole NEMA rated motors (460 V).

Heavy-duty use (50 % overload capability)

I_{2hd} continuous rms current. 50 % overload is allowed for one minute.

P_{hd} typical motor power. The power ratings apply to most 4-pole NEMA rated motors (460 V).

Note: The ratings apply in ambient temperature of 40 °C (104 °F). In lower temperatures the ratings are higher.

Input cable fuses

The recommended fuses are for branch circuit protection per NEC. **Check that the operating time of the fuse is below 0.5 seconds.** The operating time depends on the supply network impedance and the cross-sectional area, material and length of the cable. See also *Electrical installation planning / Thermal overload and short-circuit protection*.

Note 1: Install only one fuse per phase (not one fuse per cable).

Note 2: Input cable sizing is based on NEC Table 310-16 for copper wires, 75 °C (167 °F) wire insulation at 30 °C (86 °F) ambient temperature, located in one raceway. For other conditions, dimension the cables according to local safety regulations, appropriate input voltage and the load current of the drive. You can choose a thicker cable but the fuses must be rated according to the table (bigger fuses must not be used).

Note 3: Fuses from other manufacturers can be used if they meet the ratings.

Note 4: The enclosure extension is equipped with these fuses as standard.

ACS800-U2 type	Cable * Cu (AWG)	Fuse				
		A	V	Manufacturer	Type	UL class
Three-phase supply voltage 380 V, 400 V, 415 V, 440 V, 460 V, 480 V or 500 V						
-0170-5	300MCM	250	600	Bussmann	JJS-250	T
-0210-5	400MCM	300	600	Bussmann	JJS-300	T
-0260-5	2x250MCM	400	600	Bussmann	JJS-400	T
-0320-5	2x350MCM	500	600	Bussmann	JJS-500	T
-0400-5	2x500MCM	600	600	Bussmann	JJS-600	T
-0440-5*	3x400MCM	800	600	Bussmann	JJS-800	T
-0490-5*	3x500MCM	800	600	Bussmann	JJS-800	T
-0550-5*	3x600MCM or 4x350MCM	800	600	Bussmann	JJS-800	T
-0610-5*	3x700MCM or 4x400MCM	1000	600	Bussmann	KTU-1000	L

* Check the fuse ratings for the enclosure extension from the ABB representative.

Cable Entries

Input, motor and brake resistor cable terminal sizes (per phase) and tightening torques are given below. One hole cable lugs (1/2 inch diameter) can be used. The maximum allowed width of the cable lug is 1.5 inches.

Frame size	U1, V1, W1, U2, V2, W2, UDC+/R+, UDC-, R-		Earthing PE	
	Screw	Tightening torque lbf ft	Screw	Tightening torque lbf ft
R7	1/2	37...55	5/16	11...16
R8	1/2	37...55	5/16	11...16

Dimensions and weights

Frame size	UL type 1				UL type 12				W3 lb	W4 lb
	H1 in.	W1 in.	W2 in.	Depth in.	Height in.	W1 in.	W2 in.	Depth in.		
R7	59.3	9.8	23.76	20.5					220	430
R8	79.7	13.6	31.16	24.3					507	827

H height

W1 width of the basic unit

W2 width with the optional enclosure extension

W3 weight of the basic unit

W4 weight with the optional enclosure extension (basic configuration with switch fuse but without contactor and other options).

UL/CSA markings

The UL/C-UL/CSA markings are pending for the drive as follows. The approval is valid with rated voltages (up to 600 V).

ACS800-02/U2 type	UL	C-UL	CSA
UL type 1	x	x	x
UL type 12	x	x	x

¹⁾ the approval is valid up to 600 V

UL

The drive is suitable for use on a circuit capable of delivering not more than 65 kA rms symmetrical amperes at the drive nominal voltage (600 V maximum for 690 V units).

The drive provides overload protection in accordance with the National Electrical Code (US). See *ACS 800 Firmware Manual* for setting. Default setting is off, must be activated at start-up.

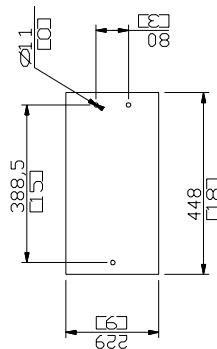
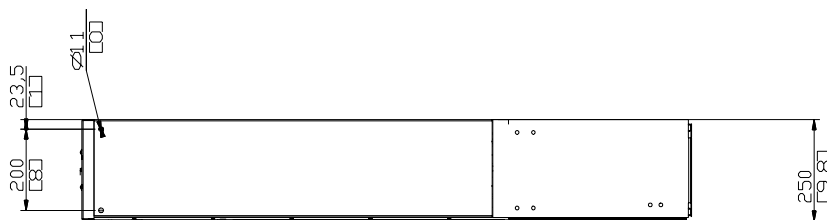
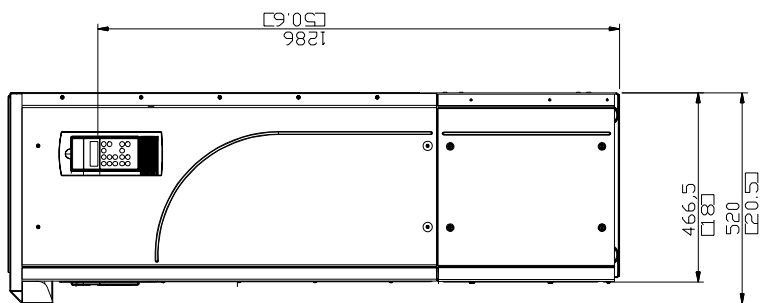
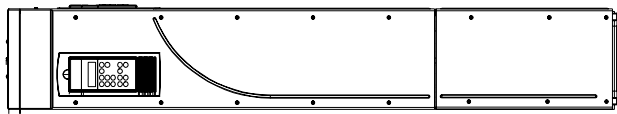
The drives are to be used in a heated indoor controlled environment. See section *Ambient conditions* for specific limits.

Brake chopper - ABB has brake choppers that, when applied with appropriately sized brake resistors, will allow the drive to dissipate regenerative energy (normally associated with quickly decelerating a motor). Proper application of the brake chopper is defined in chapter *Resistor Braking*. This can be applied to a single drive or multiple drives with DC bus connected to allow a sharing of regenerative energy.

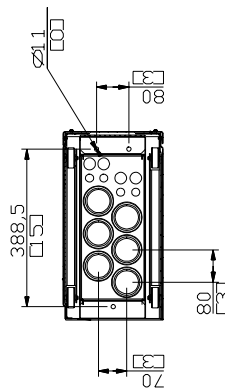
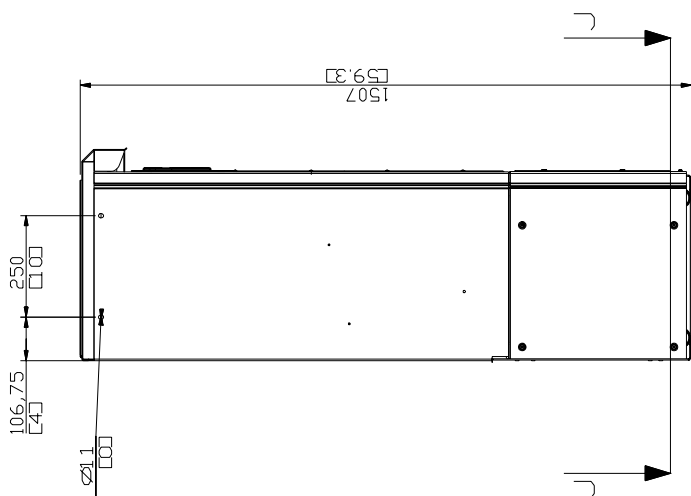
Dimensional drawings

The dimensions are given in millimetres and [inches].

Frame size R7

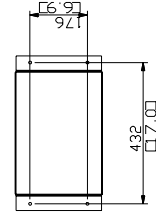
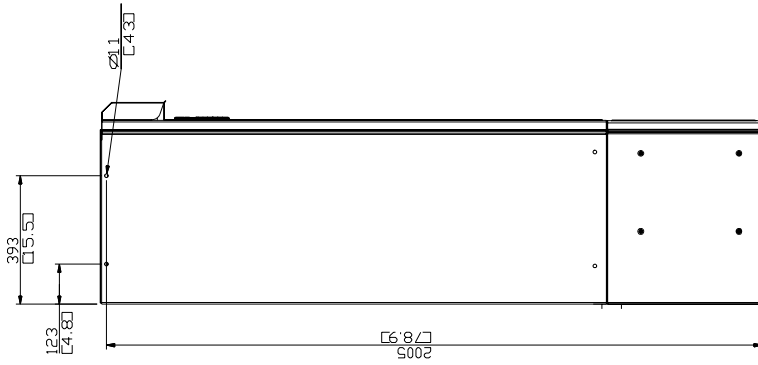
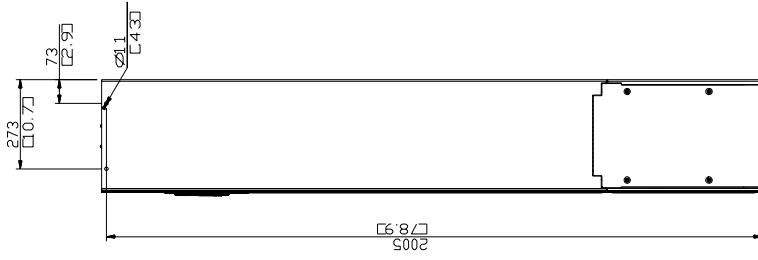


US gland/conduit plate

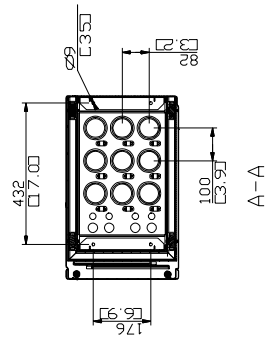
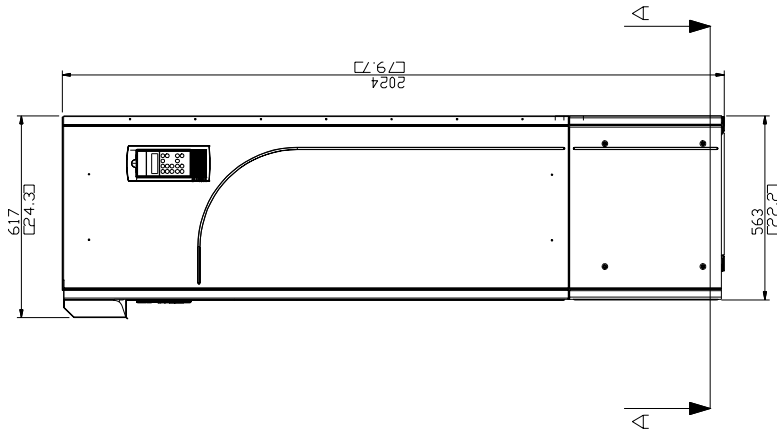
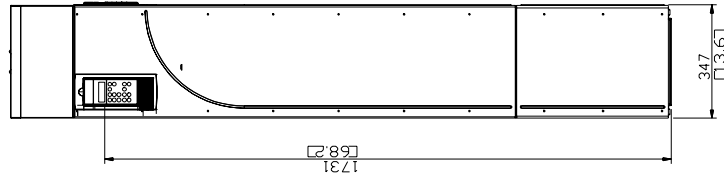


J-J

Frame size R8

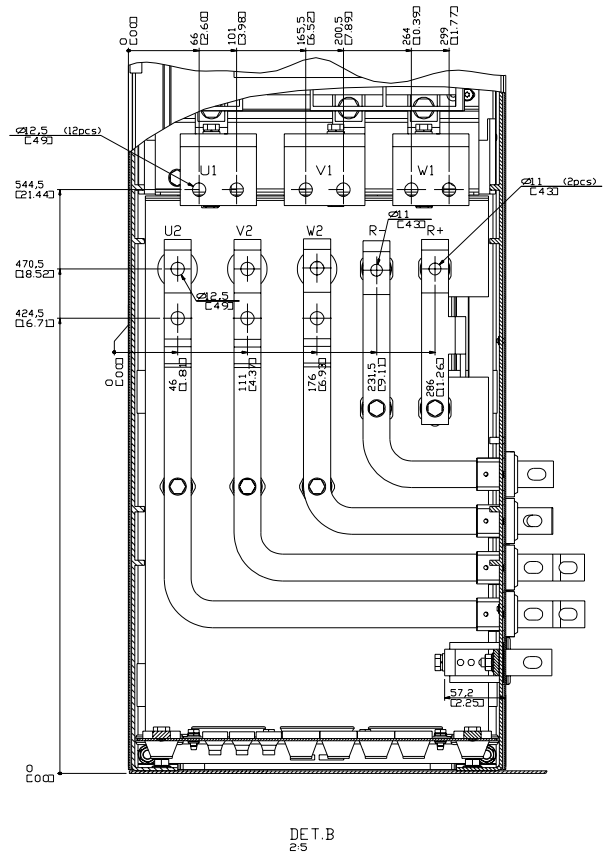
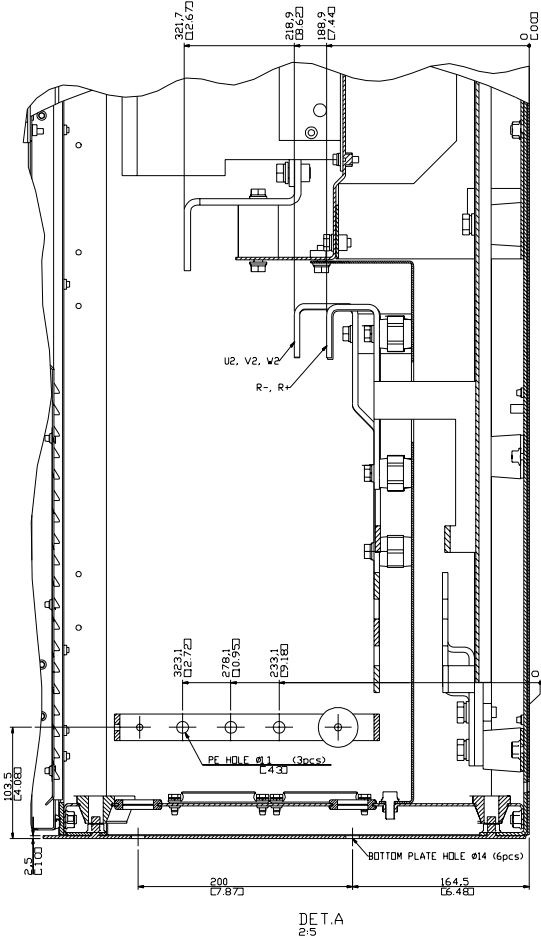


US gland/conduit plate

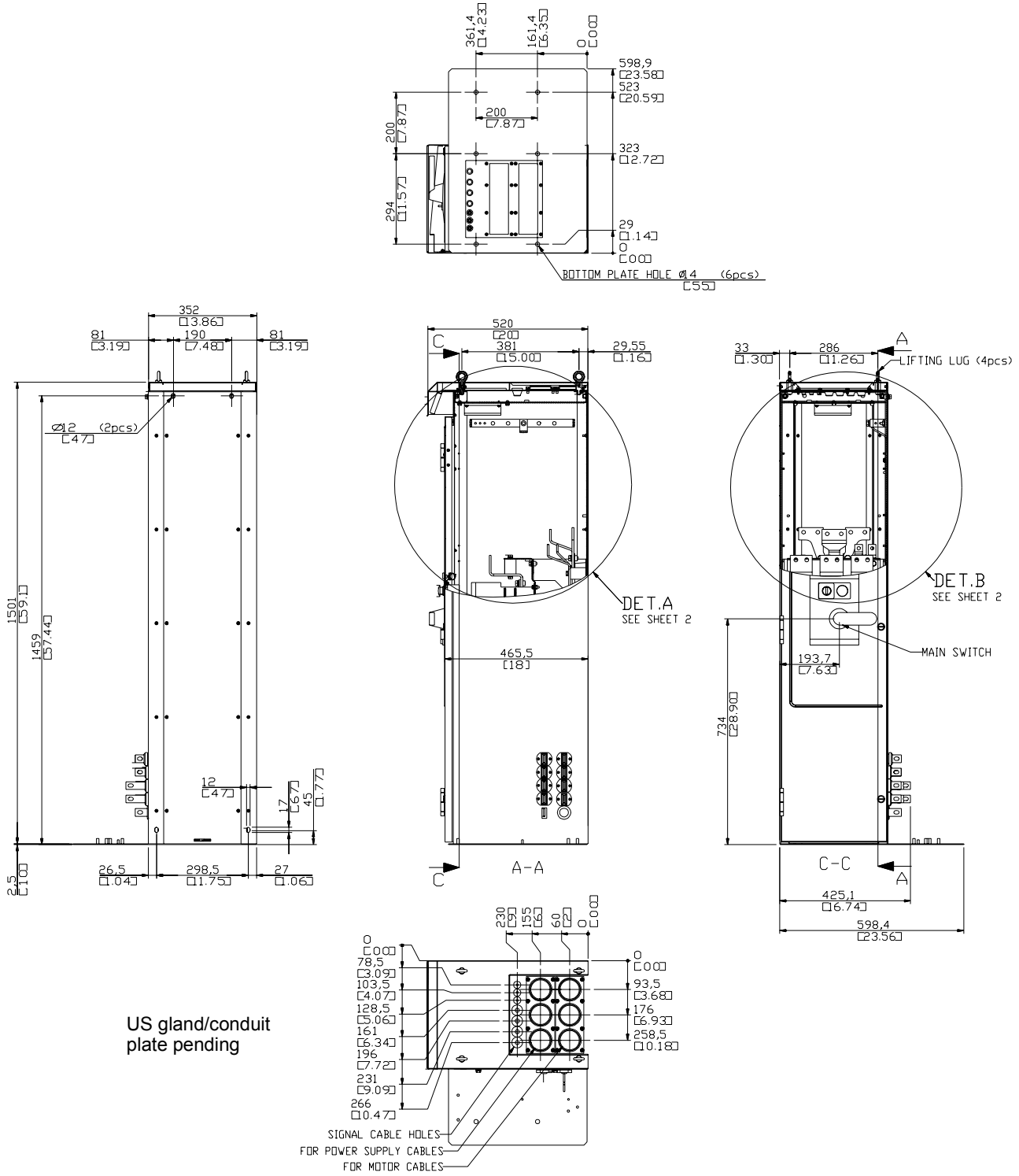


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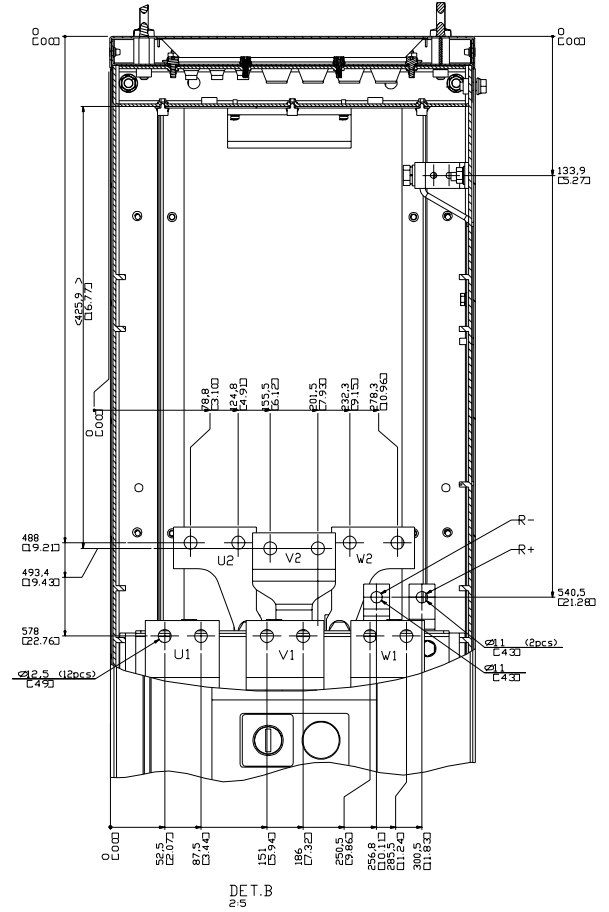
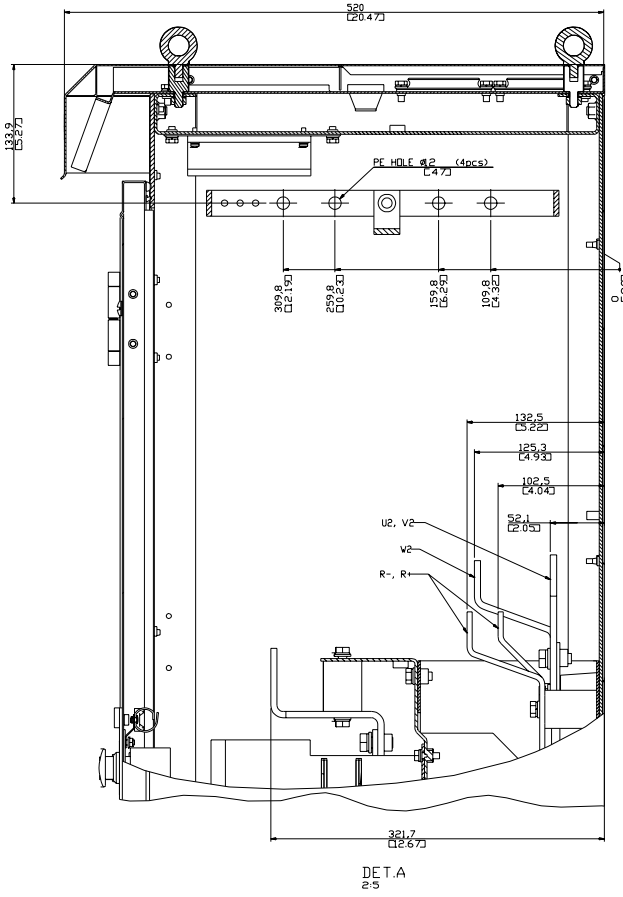
Detail



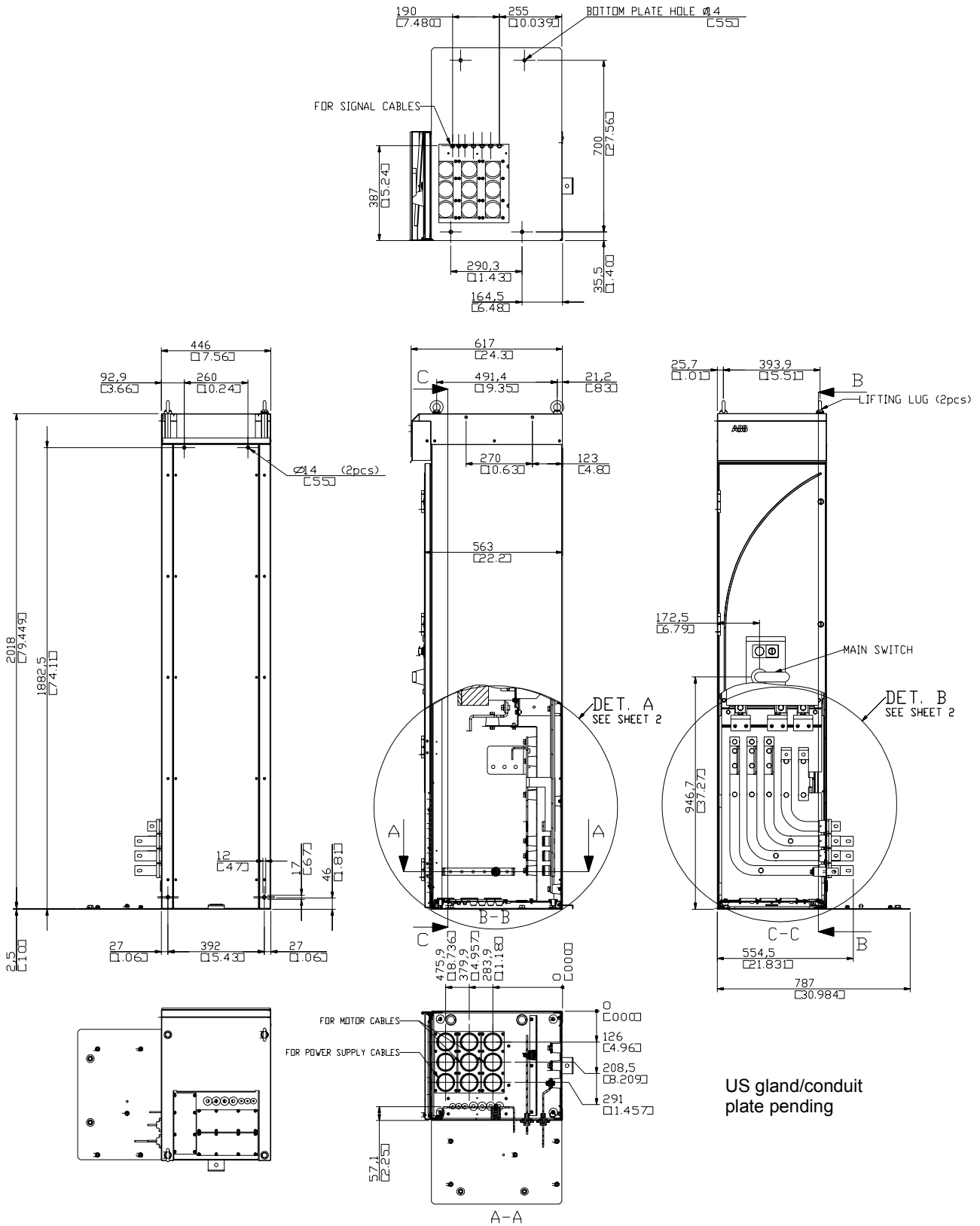
Enclosure extension R7 – top entry



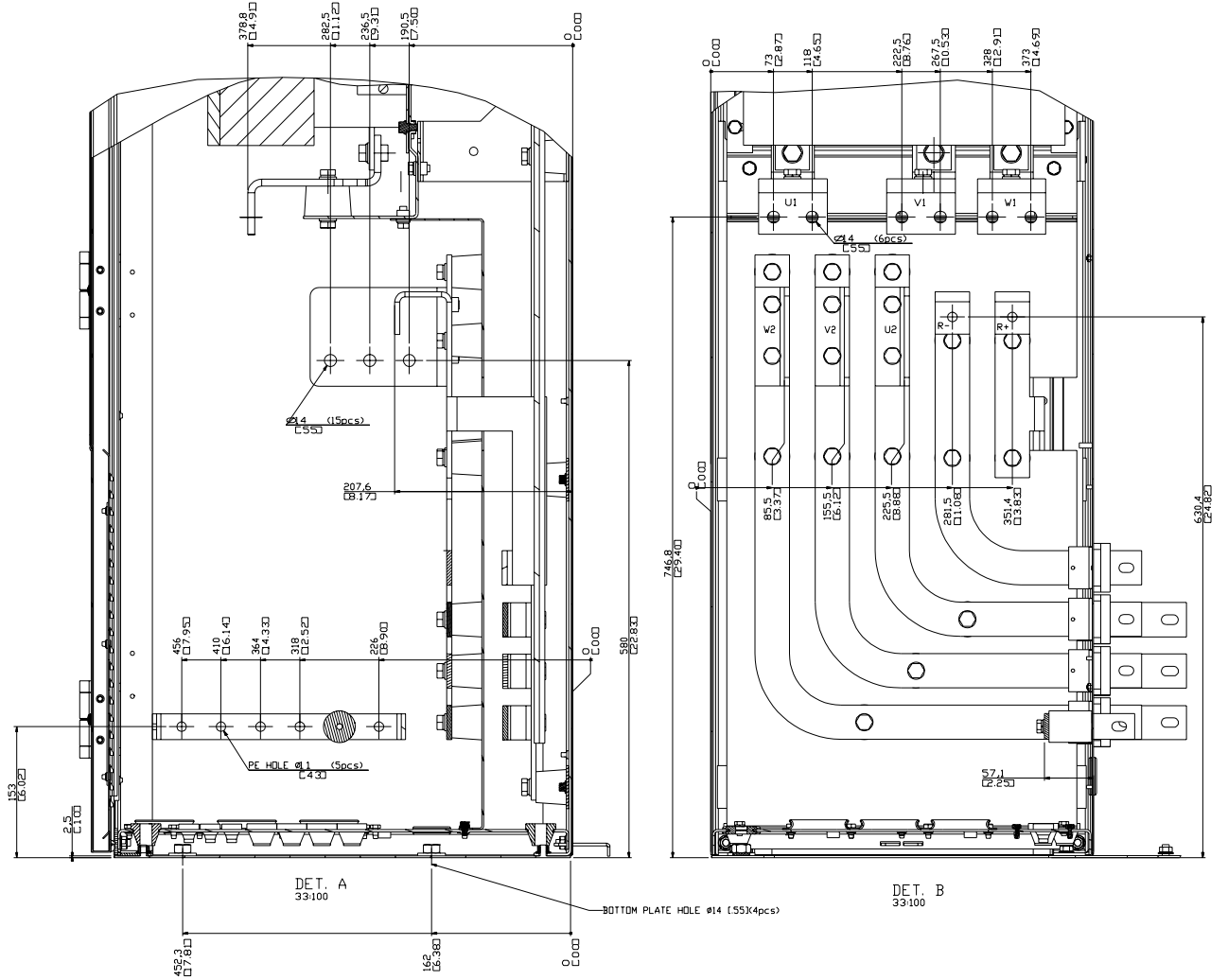
Detail



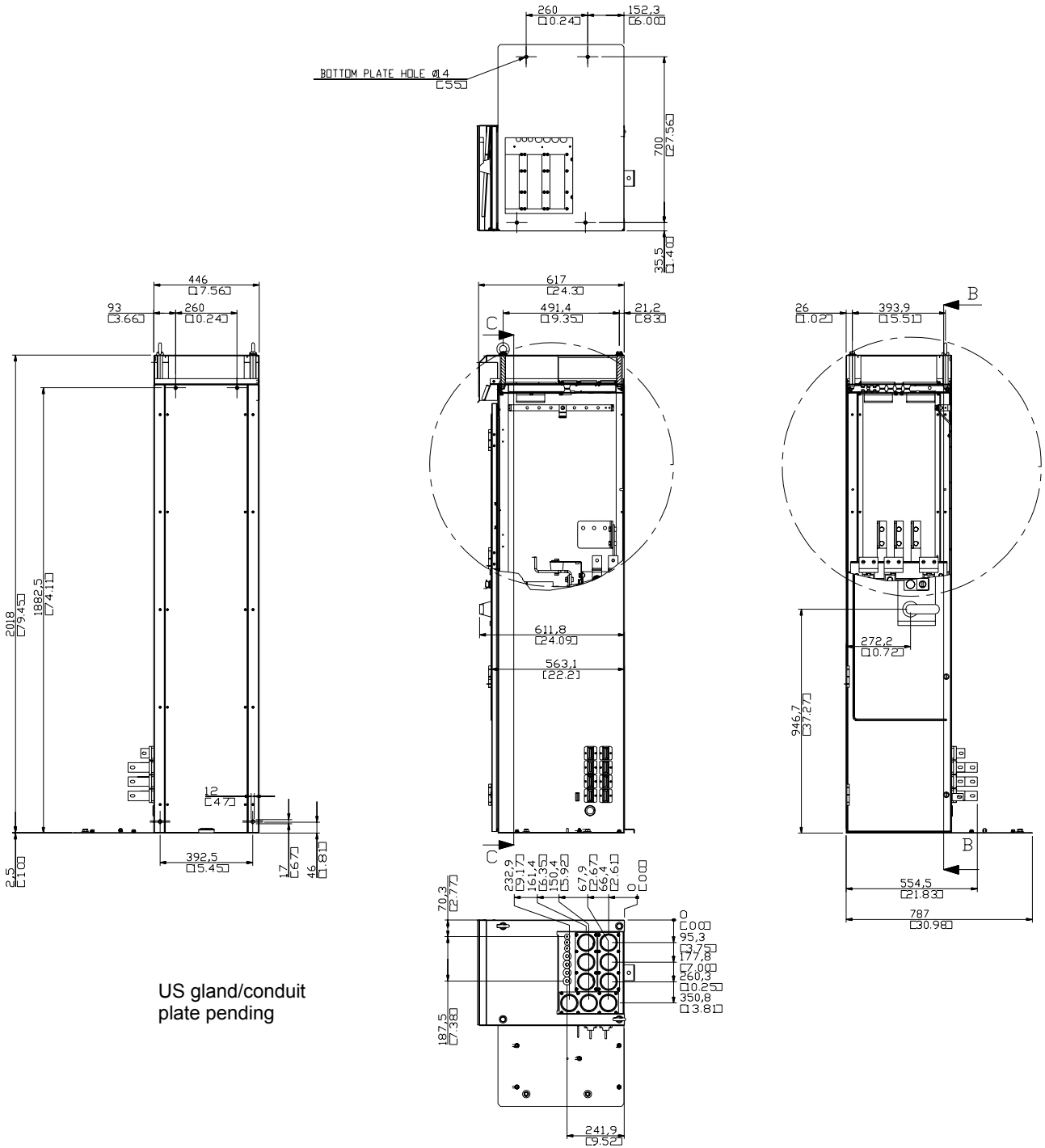
Enclosure extension R8 – bottom entry



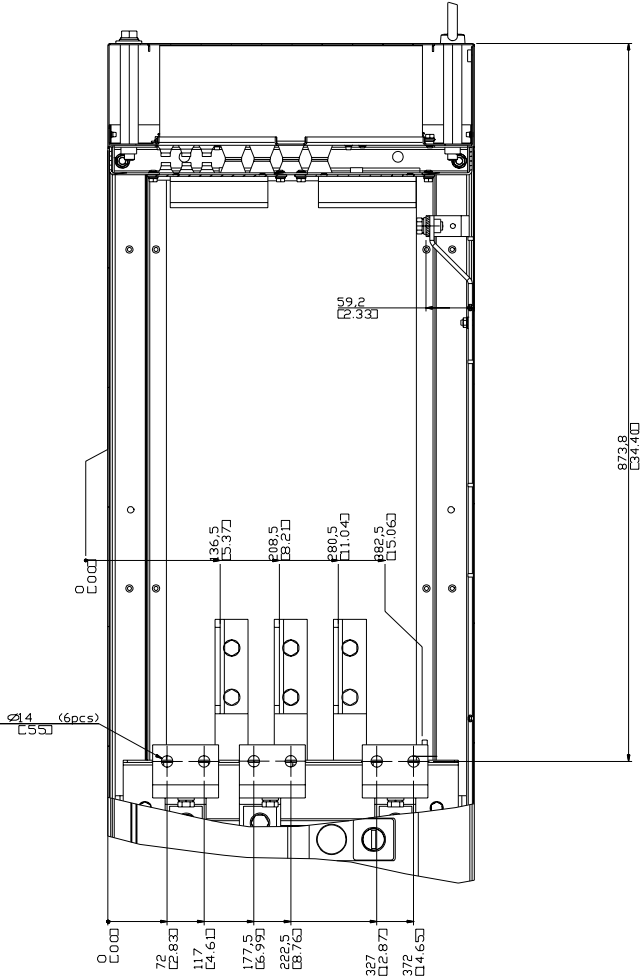
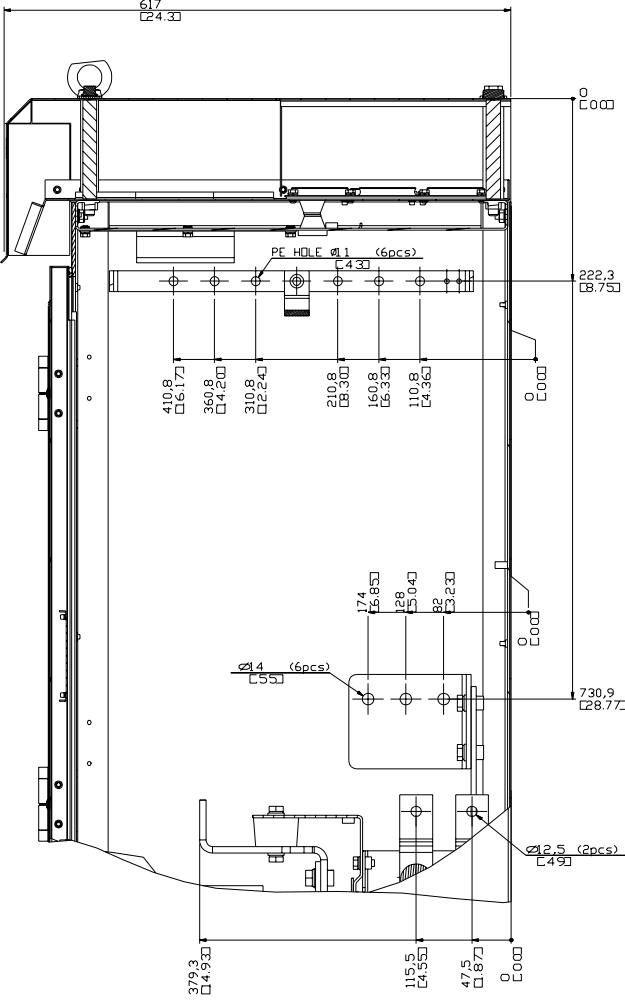
Detail



Enclosure extension R8 – top entry



Detail



Resistor Braking

What this chapter contains

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

To which products this chapter applies

This chapter applies to the ACS800-01/U1 (frame sizes R2 to R6) and the ACS800-02/U2 (frame sizes R7 and R8).

Availability of brake choppers and resistors for the ACS 800

Frame R2 and R3 drives have a built-in brake chopper as standard equipment. For frames R4 and up, brake choppers are optionally available as built-in units, indicated in the type code by +D150.

Resistors are available as add-on kits.

How to select the correct drive/chopper/resistor combination

1. Calculate the maximum power (P_{\max}) generated by the motor during braking.
2. Select a suitable drive / brake chopper / brake resistor combination for the application according to the following tables (take account of other factors in the drive selection also). The following condition must be met:

$$P_{\text{br}} \geq P_{\max}$$

where

P_{br} denotes $P_{\text{br}5}$, $P_{\text{br}10}$, $P_{\text{br}30}$, $P_{\text{br}60}$, or P_{brcont} depending on the duty cycle.

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 .

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.

Note: A resistor other than the standard resistor can be used provided that:

- its resistance is not lower than the resistance of the standard resistor.



WARNING! Never use a brake resistor with a resistance below the value specified for the particular drive / brake chopper / resistor combination. The drive and the chopper are not able to handle the overcurrent caused by the low resistance.

- the resistance does not restrict the braking capacity needed, i.e.,

$$P_{\max} < \frac{U_{\text{DC}}^2}{R}$$

where

P_{\max} maximum power generated by the motor during braking

U_{DC} voltage over the resistor during braking, e.g.,

1.35 · 1.2 · 415 VDC (when supply voltage is 380 to 415 VAC),

1.35 · 1.2 · 500 VDC. (when supply voltage is 440 to 500 VAC) or

1.35 · 1.2 · 690 VDC (when supply voltage is 525 to 690 VAC).

R resistor resistance (ohm)

- the heat dissipation capacity (E_R) is sufficient for the application (see step 3 above).

Optional brake chopper and resistor(s) for the ACS800-01/U1

ACS 800-01 type	Braking power of the chopper and the drive		Brake resistor(s)			
	10/60 s P_{br10} (kW)	1/10 min P_{br60} (kW)	Type	R (ohm)	E_R (kJ)	P_{Rcont} (kW)
400 V AC units						
-01-0003-3	1.1	1.1	SACE08RE44	44.0	210	1
-01-0004-3	1.5	1.5	SACE08RE44	44.0	210	1
-01-0005-3	2.2	2.2	SACE08RE44	44.0	210	1
-01-0006-3	3.0	3.0	SACE08RE44	44.0	210	1
-01-0009-3	4.0	4.0	SACE08RE44	44.0	210	1
-01-0011-3	5.5	5.5	SACE15RE22	22.00	420	2
-01-0016-3	7.5	7.5	SACE15RE22	22.00	420	2
-01-0020-3	11.0	11.0	SACE15RE22	22.00	420	2
-01-0025-3	22.5	22.5	SACE15RE13	13.0	435	2
-01-0030-3	27.8	27.8	SACE15RE13	13.0	435	2
-01-0040-3	33.0	33.0	SAFUR90F575	8.0	1800	4.5
-01-0050-3	45.0	45.0	SAFUR90F575	8.0	1800	4.5
-01-0060-3	55.5	55.5	SAFUR90F575	8.0	1800	4.5
-01-0070-3	67.5	67.5	SAFUR80F500	6.0	2400	6
-01-0100-3	82.5	82.5	SAFUR125F500	4.0	3600	9
-01-0120-3	113	113	SAFUR125F500	4.0	3600	9
500 V AC units						
-01-0004-5	1.5	1.5	SACE08RE44	44.0	210	1
-01-0005-5	2.2	2.2	SACE08RE44	44.0	210	1
-01-0006-5	3.0	3.0	SACE08RE44	44.0	210	1
-01-0009-5	4.0	4.0	SACE08RE44	44.0	210	1
-01-0011-5	5.5	5.5	SACE08RE44	44.0	210	1
-01-0016-5	7.5	7.5	SACE15RE22	22.00	420	2
-01-0020-5	11.0	11.0	SACE15RE22	22.00	420	2
-01-0025-5	15.0	15.0	SACE15RE22	22.00	420	2
-01-0030-5	27.8	27.8	SACE15RE13	13.0	435	2
-01-0040-5	33.0	33.0	SACE15RE13	13.0	435	2
-01-0050-5	45.0	45.0	SAFUR90F575	8.0	1800	4.5
-01-0060-5	55.5	55.5	SAFUR90F575	8.0	1800	4.5
-01-0070-5	67.5	67.5	SAFUR90F575	8.0	1800	4.5
-01-0100-5	82.5	82.5	SAFUR125F500	4.0	3600	9
-01-0120-5	113	113	SAFUR125F500	4.0	3600	9
-01-0140-5	135	135	SAFUR125F500	4.0	3600	9

PDM code 00096931

P_{brxx} Maximum braking power of the drive with the specified resistor(s). The drive and the chopper will withstand this braking power for the period specified (10 seconds per minute or one minute per ten minutes).

Note: The braking energy transmitted to the specified resistor(s) in 400 seconds may not exceed E_R .

R Resistance value for the listed resistor assembly. **Note:** This is also the minimum allowed resistance for the braking resistor.

E_R Short energy pulse that the resistor assembly withstands every 400 seconds. This energy will heat the resistor element from 40 °C (104 °F) to the maximum allowable temperature.

P_{Rcont} Continuous power (heat) dissipation of the resistor when placed correctly. Energy E_R dissipates in 400 seconds.

All braking resistors must be installed outside the converter module. The SACE braking resistors are built in an IP 21 metal housing. The SAFUR braking resistors are built in an IP 00 metal frame.

Optional brake chopper and resistor(s) for the ACS800-02/U2.

ACS 800-02 type	Frame size	Braking power of the chopper and the drive				Brake resistor(s)			
		5/60 s P_{br5} (kW)	10/60 s P_{br10} (kW)	30/60 s P_{br30} (kW)	P_{brcont} (kW)	Type	R (ohm)	E_R (kJ)	P_{Rcont} (kW)
400 V AC Units									
-02-0140-3	R7	135	135	99	66	SAFUR200F500	2.70	5400	13.5
-02-0170-3	R7	165	150	99	66	SAFUR200F500	2.70	5400	13.5
-02-0210-3	R7	165	150	99	66	SAFUR200F500	2.70	5400	13.5
-02-0260-3	R8	240	240	237	120	2xSAFUR200F500	1.35	10800	27
-02-0320-3	R8	300	300	237	120	2xSAFUR200F500	1.35	10800	27
-02-0400-3	R8	375	355	237	120	4xSAFUR125F500	1.00	14400	36
-02-0440-3	R8	473	355	237	120	4xSAFUR210F575	0.85	16800	42
-02-0490-3	R8	500	355	237	120	4xSAFUR210F575	0.85	16800	42
500 V AC Units:									
-02-0170-5	R7	165	160	120	80	SAFUR200F500	2.70	5400	13.5
-02-0210-5	R7	198	160	120	80	SAFUR200F500	2.70	5400	13.5
-02-0260-5	R7	240 ¹⁾	160	120	80	SAFUR200F500	2.70	5400	13.5
-02-0320-5	R8	300	300	300	170	2xSAFUR125F500	2.00	7200	18
-02-0400-5	R8	375	375	300	170	2xSAFUR210F575	1.70	8400	21
-02-0440-5	R8	473	450 ³⁾	300	170	2xSAFUR180F460	1.20	12000	30
-02-0490-5	R8	533	450 ³⁾	300	170	4xSAFUR125F500	1.00	14400	36
-02-0550-5	R8	600	450 ³⁾	300	170	4xSAFUR125F500	1.00	14400	36
-02-0610-5	R8	630 ²⁾	450 ³⁾	300	170	4xSAFUR125F500	1.00	14400	36

PDM code 00096931

P_{br5} Maximum braking power of the drive with the specified resistor(s). The drive and the chopper will withstand this braking power for 5 seconds per minute.

P_{br10} The drive and the chopper will withstand this braking power for 10 seconds per minute.

P_{br30} The drive and the chopper will withstand this braking power for 30 seconds per minute.

P_{brcont} The drive and the chopper will withstand this continuous braking power. The braking is considered continuous if the braking time exceeds 30 s.

Note: Check that the braking energy transmitted to the specified resistor(s) in 400 seconds does not exceed E_R .

R Resistance value for the resistor assembly. **Note:** This is also the minimum allowed resistance for the braking resistor.

E_R Short energy pulse that the resistor assembly withstands every 400 seconds. This energy will heat the resistor element from 40 °C (104 °F) to the maximum allowable temperature.

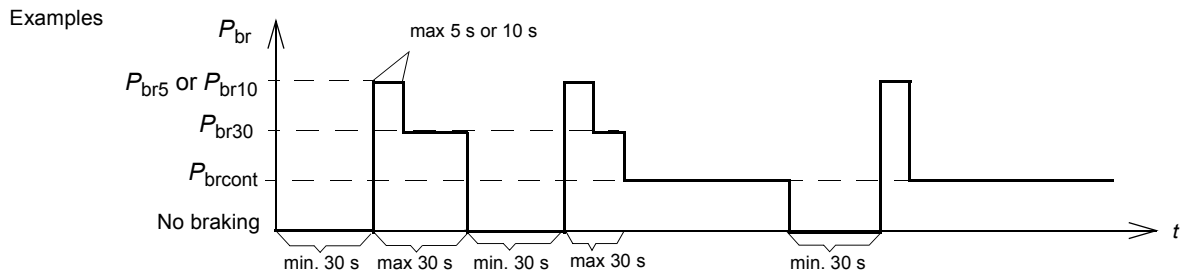
P_{Rcont} Continuous power (heat) dissipation of the resistor when placed correctly. Energy E_R dissipates in 400 seconds.

1) Possible if ambient temperature is below 33 °C (91 °F), otherwise for 3 seconds or 198 kW for 5 seconds.

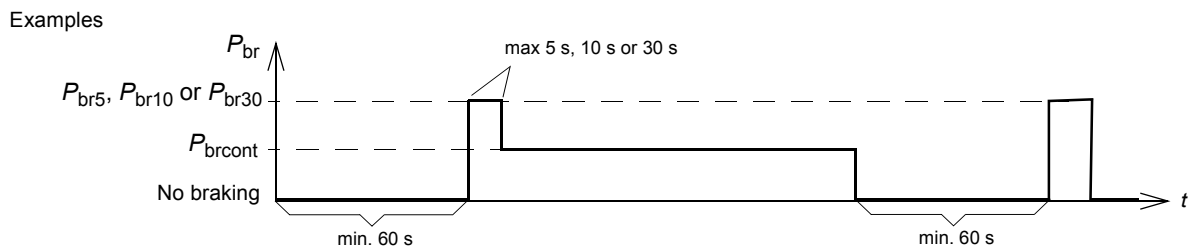
2) Possible if ambient temperature is below 33 °C (91 °F), otherwise for 3 seconds or 600 kW for 5 seconds.

3) Possible if ambient temperature is below 33 °C (91 °F), otherwise for 8 seconds or 400 kW for 10 seconds.

Continues on the next page.

Combined braking cycles for R7:

- After P_{br5} , P_{br10} or P_{br30} braking, the drive and the chopper will withstand P_{brcont} continuously.
- Before P_{br5} , P_{br10} or P_{br30} braking, there has to be at least 30 seconds without any braking.
- After P_{br5} or P_{br10} braking, the drive and the chopper will withstand P_{br30} within a total braking time of 30 seconds.
- P_{br10} braking is not acceptable after P_{br5} braking.

Combined braking cycles for R8:

- After P_{br5} , P_{br10} or P_{br30} braking, the drive and the chopper will withstand P_{brcont} continuously. (P_{brcont} is the only allowed braking power after P_{br5} , P_{br10} or P_{br30} .)
- Before P_{br5} , P_{br10} or P_{br30} braking there has to be at least 60 seconds without any braking.

All braking resistors must be installed outside the converter module. The resistors are built in an IP 00 metal frame. The 2xSAFUR and 4xSAFUR resistors are connected in parallel.

Resistor installation and wiring

All resistors must be installed outside the drive module in a place where they will cool.



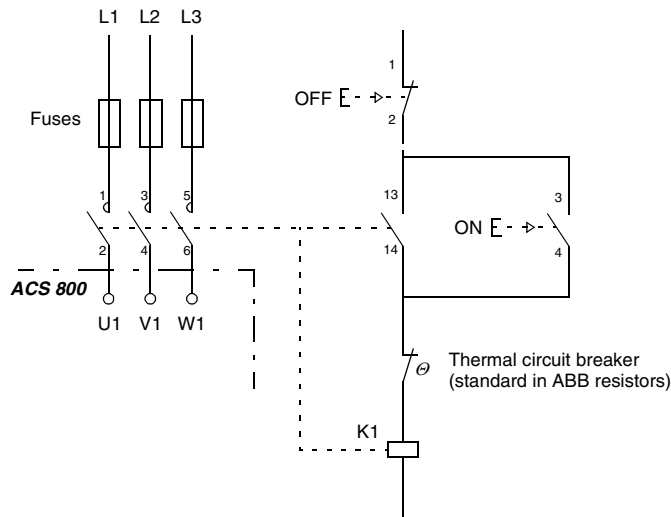
WARNING! The materials near the brake resistor must be non-flammable. The surface temperature of the resistor is high. Air flowing from the resistor is of hundreds of degrees Celsius. Protect the resistor against contact.

Use the cable type specified for drive input cabling (specified under chapter *Technical Data*) so the input fuses will protect the resistor cable also. Two-conductor shielded cable with the same cross-sectional area can alternatively be used. The maximum length of the resistor cable(s) is 10 m. For the connections, see the power connection diagram of the drive.

Protection of frame sizes R2 to R5 (ACS800-01)

It is highly recommended to equip the drive with a main contactor for safety reasons. Wire the contactor so that it opens in case the resistor overheats. This is essential for safety since the drive will not otherwise be able to interrupt the main supply if the chopper remains conductive in a fault situation.

Below is a simple example wiring diagram.



Protection of frame size R6 (ACS800-01) and frame sizes R7 and R8 (ACS800-02)

A main contactor is not required for protecting against resistor overheating if the resistor is dimensioned according to the instructions. The drive will disable power flow through the input bridge if the chopper remains conductive in a fault situation.

A thermal circuit breaker (standard in ABB resistors) is required for security. Wire the thermal circuit breaker to a digital input of the drive to trip the drive by "EXTERNAL FAULT".

Brake circuit commissioning

For Standard Application Program:

- Enable the brake chopper function (parameter 27.01).
- Switch off the overvoltage control of the drive (parameter 20.05).
- Check the resistance value setting (parameter 27.03).
- Frame sizes R7 and R8: Set parameter 30.03 to the digital input where the thermal circuit breaker is wired.

For the use of the brake resistor overload protection (parameters 27.02...27.05), consult the ABB representative.



WARNING! If the drive is equipped with a brake chopper but the chopper is not enabled by parameter setting, the brake resistor must be disconnected.



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