

ACS800

Hardware Manual ACS800-67 Wind Turbine Converters for Asynchronous Slip Ring Generators



ABB

ACS800-67 Manuals

HARDWARE MANUALS

ACS800-67 Wind Turbine Converters for Asynchronous Slip Ring Generators Hardware Manual 3AFE68392454 (English)

FIRMWARE MANUALS

ACS800 IGBT Supply Control Program 7.x Firmware Manual 3AFE68315735 (English)

ACS800-67 Cascade Generator Control Program Firmware Manual 3AFE68392462 (English)

OPTION MANUALS

NCAN-02 CANopen Adapter Module Installation and Start-up Guide 3BFE64254154 (English)

NDNA-02 DeviceNet Adapter Module Installation and Start-up Guide 3AFY58919829 (English)

NETA-01 Ethernet Adapter Module User's Manual 3AFE64605062 (English)

NIBA-01 InterBus-S Adapter Module Installation and Start-up Guide 3AFY58919811 (English)

ACS800-67
Wind Turbine Converters
for Asynchronous Slip Ring Generators

Hardware Manual

3AFE68392454 REV C
EN
EFFECTIVE: 2010-05-11

Safety instructions

What this chapter contains

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

Usage 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, and advise on 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:



Electricity warning warns of hazards from electricity 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 sensitive devices warning warns of electrostatic discharge which can damage the equipment.

Installation and maintenance work

These warnings are intended for all who work on the converter, generator cable or generator.

WARNING!



- Only qualified electricians are allowed to install and maintain the converter.
- Before any installation work, the stator of the generator and the supply line input of the ACS800-67 must be isolated from the supply grid. It is also highly recommended that the rotor of the generator is locked with a mechanical brake.
- The stator and the converter are not to be reconnected until the installation is complete.
- Never work on the converter, the generator cable or the generator when 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 converter, the generator or the generator cable. Measure the voltage between terminals UDC+ and UDC- with a multimeter (impedance at least 1 Mohm) to ensure that the converter is discharged before beginning work.
- Apply temporary grounding before working on the unit.
- Do not work on the control cables when power is applied to the converter or to the external control circuits. Externally supplied control circuits may cause dangerous voltages to exist inside the converter even when the main power of the converter is switched off.
- Control boards of the converter unit may be at the main circuit potential. Dangerous voltages may be present between the control boards and the frame of the converter unit when the main circuit voltage is on. It is critical that the measuring instruments, such as an oscilloscope, are used with caution and safety always as a priority. The fault tracing instructions give special mention of cases in which measurements may be performed on the control boards, also indicating the measuring method to be used.
- Do not make any insulation tests without disconnecting the converter from the cabling first.
- Live parts on the inside of the doors are protected against direct contact. Special attention shall be paid when handling metallic shrouds.

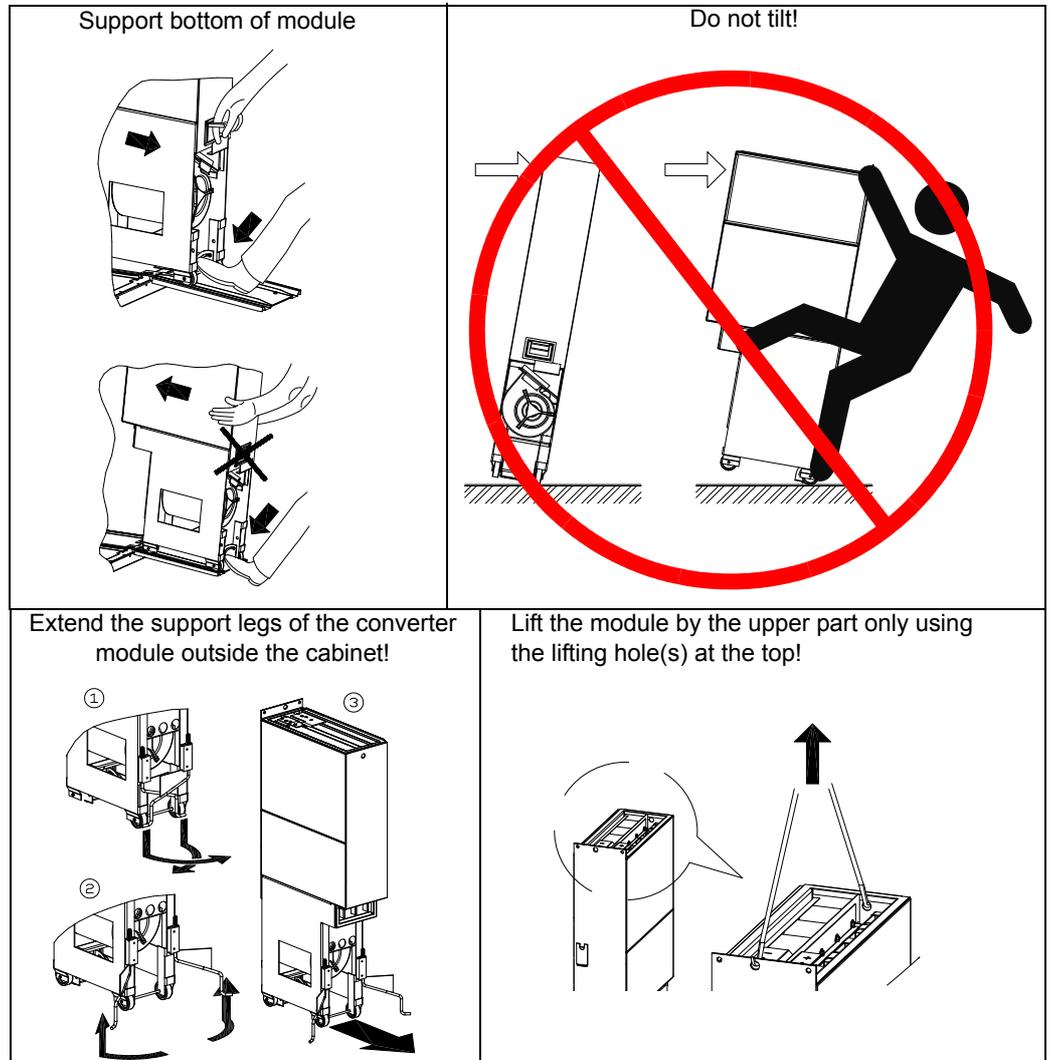
Note:

- If the main circuit of the converter unit is live, the output terminals are also live even if the converter stage is not modulating.
 - 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 relay outputs of the converter system.
-



WARNING! Ignoring the following instructions can cause physical injury or death, or damage to the equipment.

- Use extreme caution when manoeuvring a converter or filter module that runs on wheels. The modules are heavy and have a high centre of gravity. They topple over easily if handled carelessly.



- Beware of the cooling fan blades. The fans may continue to rotate for a while after the disconnection of the electrical supply.
- Beware of hot surfaces. Some parts inside the converter cabinet, such as heatsinks of power semiconductors, remain hot for a while after the disconnection of the electrical supply.
- Make sure that dust from drilling does not enter the converter when installing. Electrically conductive dust inside the unit may cause damage or lead to malfunction.

- Fastening the cabinet by riveting or welding is not recommended. However, if welding is necessary, ensure the return wire is properly connected in order not to damage the electronic equipment in the cabinet. Also ensure that welding fumes are not inhaled.
- Ensure sufficient cooling of the unit.

WARNING! Ignoring the following instructions can cause damage to the equipment.



- 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 converter.

WARNING! Ignoring the following instructions can cause physical injury or death, or damage to the equipment.



- Ground the converter, the generator 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-converter installation, connect each converter separately to protective earth (PE).
- Do not install a converter equipped with an EMC (line) filter to 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 converter is higher than 3.5 mA AC or 10 mA DC, a fixed protective earth connection is required by EN 61800-5-1, 4.3.5.5.2. The cross-section of the protective grounding conductor must be at least 10 mm² Cu or 16 mm² Al.
-

Fibre optic cables



WARNING! Ignoring the following instructions can damage to the equipment.

- Handle the fibre optic cables with care. When unplugging optic cables, always grab the connector, not the cable itself. Do not touch the ends of the fibres with bare hands as the fibre is extremely sensitive to dirt. The minimum allowed bend radius is 35 mm (1.4 in.).
-

Operation

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



WARNING! Ignoring the following instructions can cause physical injury or death, or damage to the equipment.

- Before adjusting the converter and putting it into service, make sure that the generator and all adjoining equipment are suitable for operation throughout the speed range provided by the converter.

Note:

- 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 converter. To stop the converter using the control panel, press the LOC/REM key and then the stop key .
-

Table of contents

ACS800-67 Manuals	2
-------------------------	---

Safety instructions

What this chapter contains	5
Usage of warnings and notes	5
Installation and maintenance work	6
Grounding	8
Fibre optic cables	9
Operation	9

Table of contents

About this manual

What this chapter contains	17
Compatibility	17
Safety instructions	17
Reader	17
Contents	17
Installation and commissioning flowchart	18
Terms and abbreviations	19
Product and service inquiries	20
Product training	20
Providing feedback on ABB Drives manuals	20

Hardware description

What this chapter contains	21
ACS800-67	21
Grid-side and rotor-side converters	22
Voltage and current waveforms	24
Distortion	24
Cabinet layout	27
Modules	30
Converter module	30
LCL filter module	32
Heating and cooling	33
Crowbar	33
Passive crowbar	33
Active crowbar	34
Crowbar resistor	35
Du/dt filters	35
Control section	35
Interboard connection diagram	36

Cold start	37
Type code	39
Basic code	39

Mechanical installation

What this chapter contains	41
General	41
Required tools	41
Moving the unit	42
...by crane	42
...by fork-lift or pallet truck	42
...on rollers	43
Final placement of the unit	43
Before installation	44
Delivery check	44
Installation procedure	45
Miscellaneous	46
Cable conduit in the floor below the cabinet	46
Electric welding	47
Roof support	48

Planning the electrical installation

What this chapter contains	49
Checking the compatibility of the generator	49
Protecting the generator winding and bearings	49
Supply connection	50
Disconnecting device (disconnecting means)	50
EU	50
US	50
Thermal overload and short circuit protection	50
Thermal overload protection	50
Protection against short circuit in generator rotor cable	50
Protection against short circuit inside the converter	50
DC fuses	51
Earth fault (Ground fault) protection	51
Emergency stop devices	51
Restarting after an emergency stop	51
Selecting the power cables	51
General rules	52
Power cable busbars	53
Alternative power cable types	53
Supply line cable connection for low power supply	54
Supply line cable connection for high power supply	54
Busbar connection	54
Cable bus system	55
Single core cables with concentric protective shields	55
Rotor cable connection	56
Additional US requirements	57

Conduit	57
Armored cable / shielded power cable	57
Power factor compensation capacitors	57
Equipment connected to the rotor cable	58
Installation of safety switches, contactors, connection boxes, etc.	58
Bypass connection	58
Relay output contacts and inductive loads	59
Auxiliary voltage cables	59
Selecting the control cables	60
Relay cable	60
Control panel cable	60
Coaxial cable (for use with Advant Controllers AC 80 / AC 800M)	60
Connection of a generator temperature sensor to the converter I/O	61
Routing the cables	61
Control cable ducts	62

Electrical installation

What this chapter contains	63
Checking the insulation of the assembly	64
Rotor cable	64
DC busbars	64
DC and AC busbars	65
Grid and rotor connections	65
Connection diagram	65
Connection procedure	68
Control connections	70
Connection procedure	71
Terminal strip	72
Control unit NDCU-33Cx/RDCU-12C	73
Voltage and Current Measurement Unit NUIM-61C/NUIM-10C	75

Installation checklist

Checklist	77
---------------------	----

Start-up

What this chapter contains	79
Start-up procedure	79
Basic checks with no voltage connected	79
Connecting voltage to input terminals and auxiliary circuit	80
Starting the supply unit	80
Application program set-up	80
On-load checks	80

Maintenance

What this chapter contains	81
--------------------------------------	----

Safety instructions	81
Maintenance intervals	81
Checking and replacing the air filters	82
Power connections	83
Cooling fans	83
Converter module fan replacement	84
LCL filter fan replacement	85
Heatsinks	85
Capacitors	86
Capacitor replacement	86
Other maintenance actions	86
Power module replacement	86
LEDs	86

Technical data

What this chapter contains	89
Converter and filter module types	89
IEC ratings	89
Grid-side converter IEC ratings	89
Rotor-side converter IEC ratings	89
Symbols	90
Derating	90
Temperature derating	90
Altitude derating	90
Dimensions, noise, cooling characteristics of the modules	90
Main AC fuses	91
DC fuses	91
Grid-side converter DC fuses	91
Rotor-side converter DC fuses	91
Power consumption of auxiliary devices	91
Boards	91
Filter	91
Cable terminals	92
Input power connection	92
Rotor connection	92
Efficiency	92
Cooling	92
Degrees of protection	92
Ambient conditions	93
Materials	93
CE marking	94
Compliance with the Low Voltage Directive	94
Compliance with the EMC Directive	94
Definitions	94
Free space requirements	94
Applicable standards	94
Compliance with EN 61800-3 (2004), category C3	95
Compliance with EN 61800-3 (2004), category C4	95
Compliance with the Machinery Directive	95

UL marking	95
Equipment warranty and liability	96
US patents	96
Declaration of incorporation	97

About this manual

What this chapter contains

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

Compatibility

The manual is compatible with ACS800-67 wind turbine converters.

Safety instructions

Follow all safety instructions delivered with the converter.

- Read the complete safety instructions on the first pages of this manual before you install, commission, or use the converter.
- Read task specific safety instructions before starting the task. See the section describing the task.

Reader

The reader of the manual is expected to know the standard electrical wiring practices, electronic components, and electrical schematic symbols.

Contents

The chapters of this manual are briefly described below.

Safety instructions gives safety instructions for the installation, commissioning, operation and maintenance of the converter.

Hardware description describes the converter.

Mechanical installation instructs how to move, place and mount the converter.

Planning the electrical installation provides advice on generator and cable selection, the protective functions of the converter, and cable routing.

Electrical installation describes the cabling and wiring of the converter.

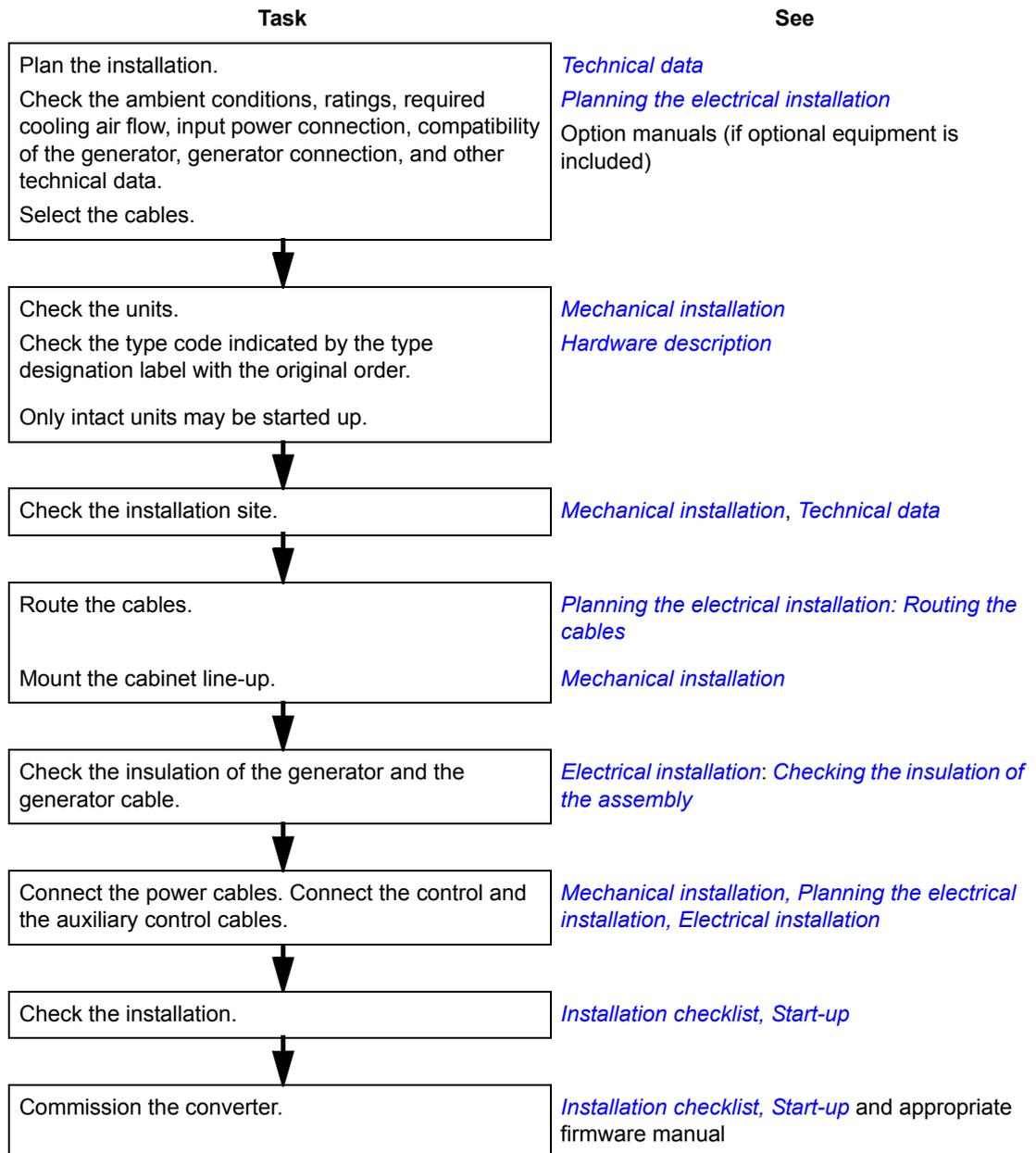
Installation checklist contains a list for checking the mechanical and electrical installation of the converter.

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

Maintenance contains preventive maintenance instructions.

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

Installation and commissioning flowchart



Terms and abbreviations

Term/Abbreviation	Explanation
AFIN	Fan Inverter Board
AGBB	Gate Driver Branching Board
AINT	Main Circuit Interface Board
APOW	Power Supply Board
DDCS	Distributed Drives Communication System. Communication protocol used with fibre optic link.
DTC	Direct Torque Control
EMC	Electromagnetic Compatibility
IGBT	Insulated Gate Bipolar Transistor. A voltage controlled semiconductor type widely used in converters due to their easy controllability and high switching frequency.
INU	Inverter Supply Unit, i.e. rotor-side converter
ISU	IGBT Supply Unit, i.e. grid-side converter
LCL	Filter
NAMC	Application and Motor Controller Board. Part of the NDCU Drive Control Unit
NCAN	CANopen® Adapter Module
NDCU	Drive Control Unit. Consists of a NAMC board and NIOC board built into a metal housing. NDCU-33 unit controls the rotor-side converter.
NDNA	DeviceNet™ Adapter Module
NETA	Ethernet Adapter Module
NGPS	Gate Driver Power Supply Board. An optional board used to implement the Prevention of Unexpected Start function.
NIOC	Input/Output Board. Part of the NDCU Drive Control unit
NPBU/APBU	PPCS branching unit. Used with parallel connected converters.
NTAC	Pulse Encoder Interface Module
NUIM	Voltage and Current Measurement Unit
PPCS	Power Plate Communication System. Communication protocol used with optic fibre link which controls the power stage of the converter modules.
RDCO	DDCS Communication Option with optic fibre channels
RDCU	Drive Control Unit which contains an RMIO (Motor Control and I/O) board. An RDCU unit controls the grid-side converter.
RFI	Radio Frequency Interference
RMIO	Motor Control and I/O Board. Part of the RDCU Drive Control Unit

Product and service inquiries

Address any inquiries about the product to your local ABB representative, quoting the type code and serial number of the unit in question. A listing of ABB sales, support and service contacts can be found by navigating to www.abb.com/drives and selecting *Sales, Support and Service network*.

Product training

For information on ABB product training, navigate to www.abb.com/drives and select *Training courses*.

Providing feedback on ABB Drives manuals

Your comments on our manuals are welcome. Go to www.abb.com/drives and select *Document Library – Manuals feedback form (LV AC drives)*.

Hardware description

What this chapter contains

This chapter describes the construction of the converter.

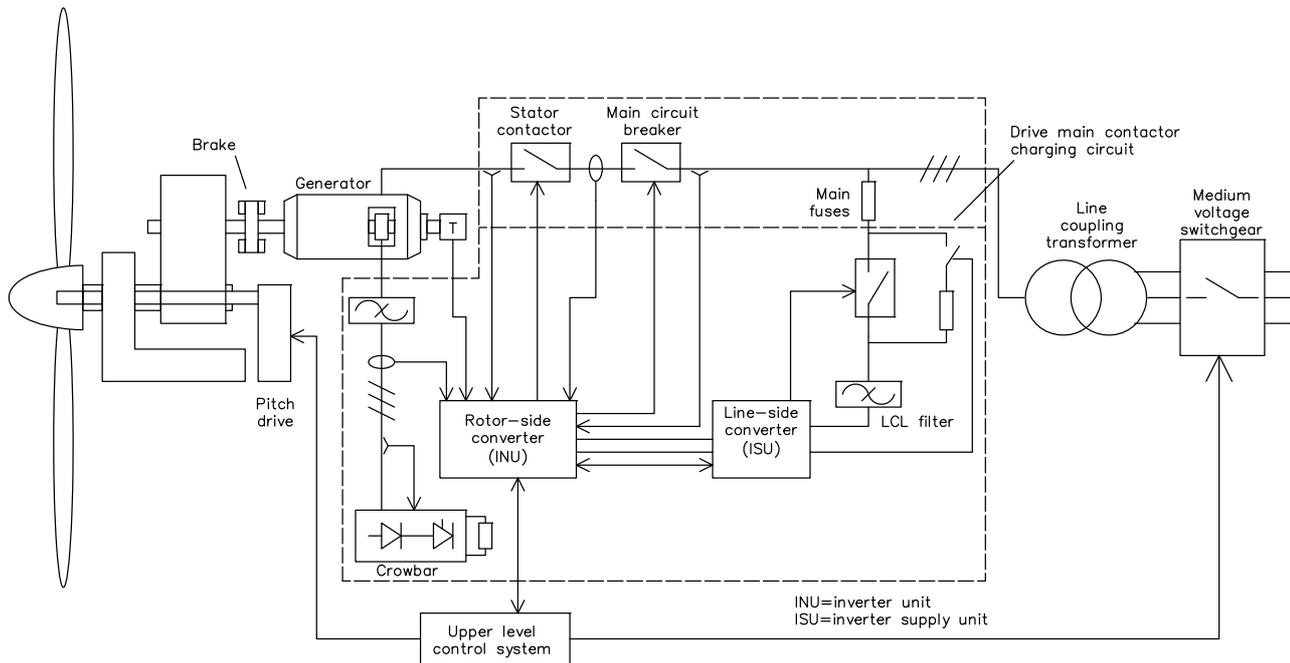
ACS800-67

ACS800-67 wind turbine converter is designed for use with induction generators with wound rotor and slip rings, such as the ABB AMK series. The converter is connected between the generator rotor and the supply network. The converter can be installed in the tower base or in the nacelle.

The speed of the rotor varies in relation to the wind speed. In order to keep the speed optimal (i.e. somewhat higher than the synchronous speed of the generator), the angle of the rotor blades is adjustable by means of a pitch drive. However, adjusting the pitch is fairly slow. To compensate for faster changes in rotor speed, the ACS800-67 quickly accelerates or decelerates the rotation speed of the field in the rotor in order to retain the optimal slip. When the wind decreases, the converter takes energy from the supply and accelerates the rotation of the rotor field so that the stator remains capable of feeding energy to the grid. Likewise, the rotation of the rotor field is decelerated at increasing wind speeds. The energy generated in the rotor above the synchronous speed can also be fed to the grid.

The converter is also used for synchronising the stator output with the grid before the actual grid connection. On disconnection, the converter adjusts the torque to zero. This also decreases the stator current to zero so that the generator can be disconnected.

The diagram below represents a typical application. The components included in the ACS800-67 delivery are separated by a dotted line.



Grid-side and rotor-side converters

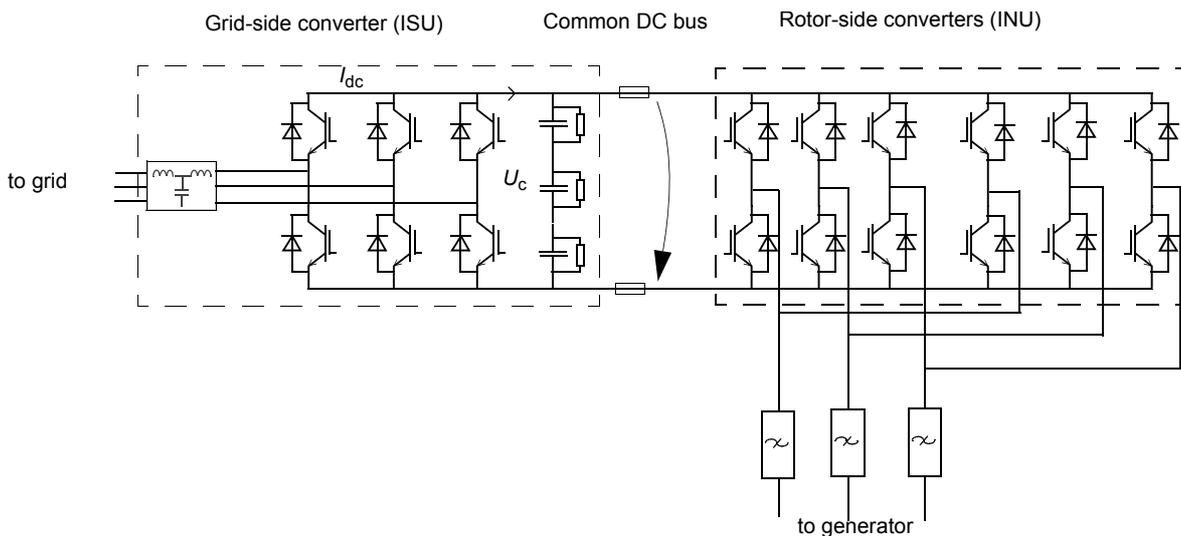
The grid-side converter is an IGBT based module (ISU) equipped with AC and DC fuses and optional devices. It has an RDCU control unit with IGBT Supply Control Program. The converter is controlled by the rotor-side converter control unit via a fibre optic link. (The RDCU-12C is fitted with an RDCO DDCS Communication Option module containing fibre optic terminals.)

The grid-side converter rectifies three phase AC current to direct current for the intermediate DC link of the converter. The intermediate DC link supplies the rotor-side converter. The line filter suppresses the AC voltage and current harmonics.

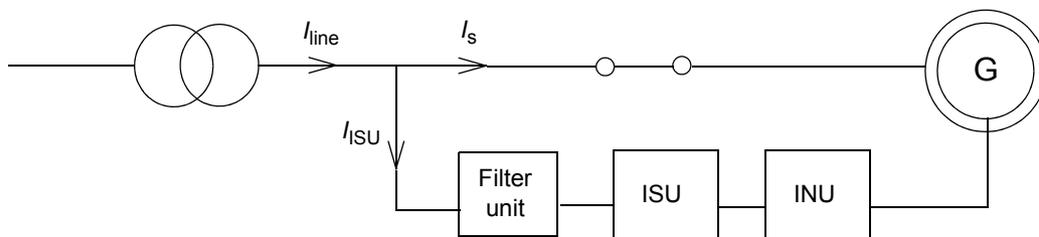
As default, the grid-side converter controls the DC link voltage to the peak value of the line-to-line voltage. The DC voltage reference can be set also higher by a parameter (see *ACS800 IGBT Supply Control Program 7.x Firmware Manual* [3AFE68315735 (English)]). The control of the IGBT power semiconductors is based on the Direct Torque Control (DTC) method typically used in motor control of the converter. Two line currents and DC link voltage are measured and used for the control.

The rotor-side converter consists of two IGBT based inverter modules (INU) and employs the NDCU-33 control unit. The converter is equipped with the Cascade Control Application Program, which also controls the grid-side converter module via a fibre optic link.

The diagram below shows an example of a common DC bus converter system. In this example the converter consists of one grid-side converter, ISU, and two parallel connected rotor-side converters, INUs.

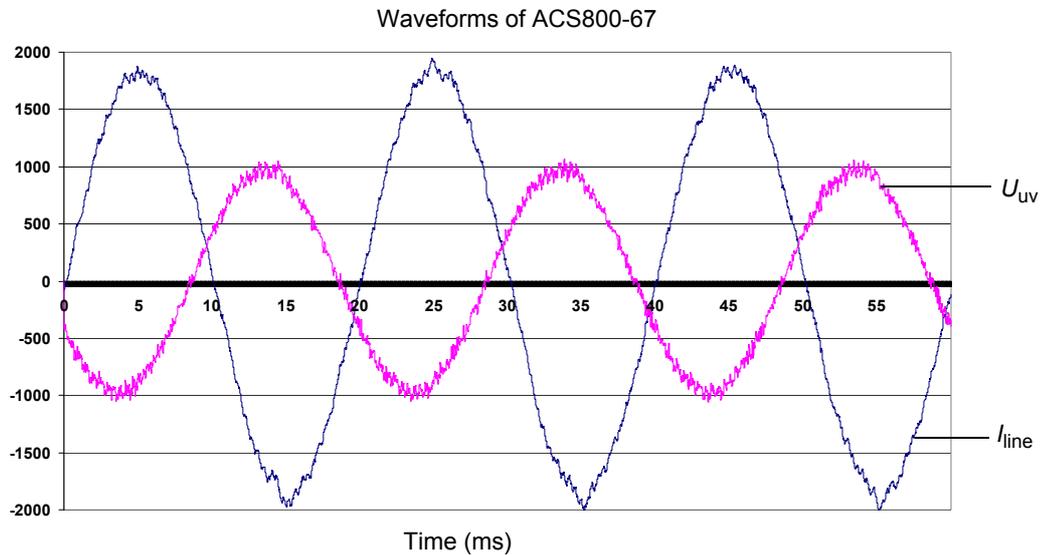


The wind turbine converter line current I_{line} consists of line-converter current I_{ISU} and stator current I_s .



Voltage and current waveforms

Typical line current I_{line} and line-to-line voltage U_{UV} waveforms are shown below.

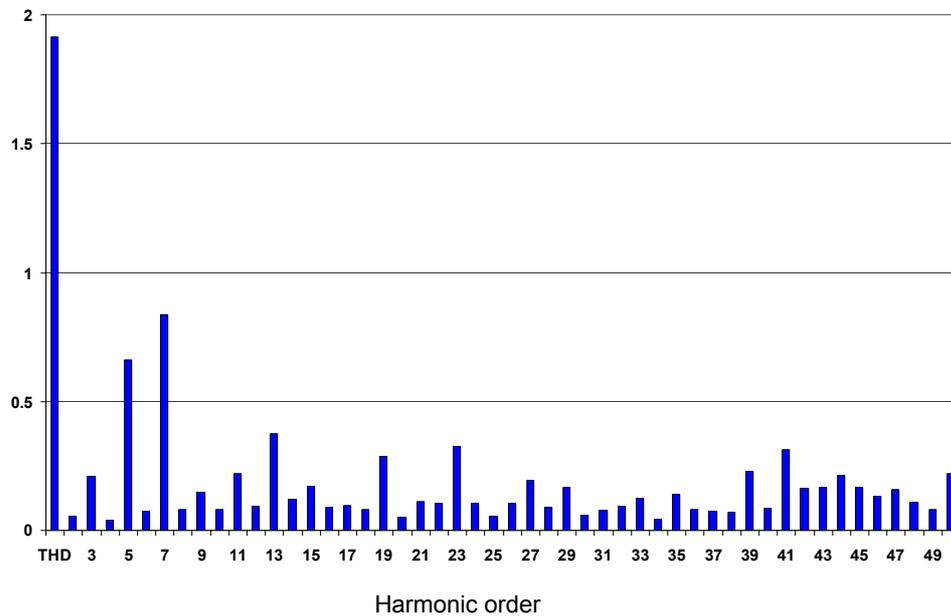


Distortion

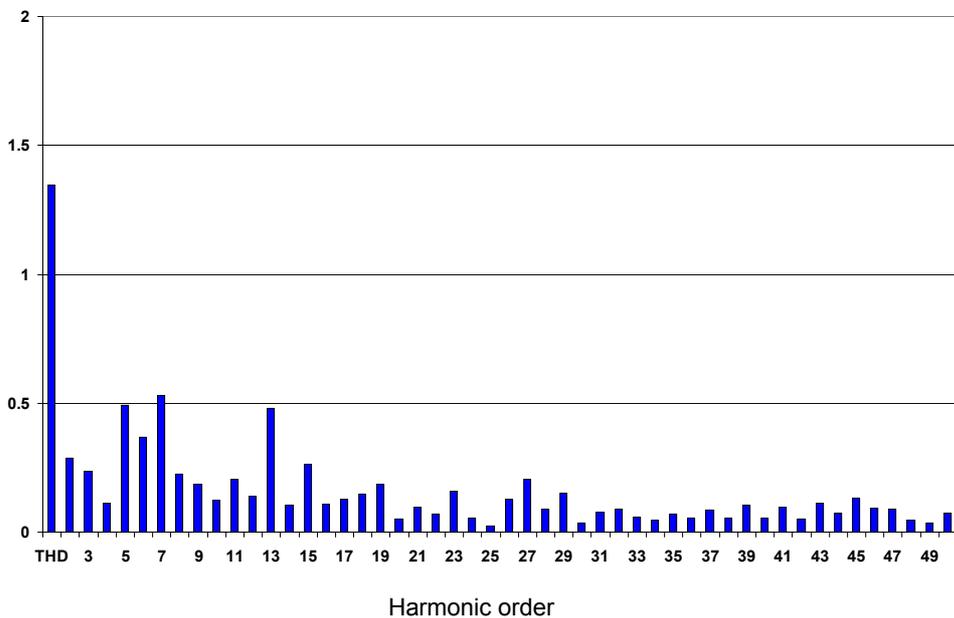
IGBT line-converter unit does not generate characteristic current/voltage harmonics like a traditional 6- or 12-pulse bridge does, because of the sinusoidal waveform of the line current.

Typical harmonic components of the voltage and current distortion are shown below. Each harmonic is presented as a percentage of the fundamental voltage. n denotes the ordinal number of the harmonic.

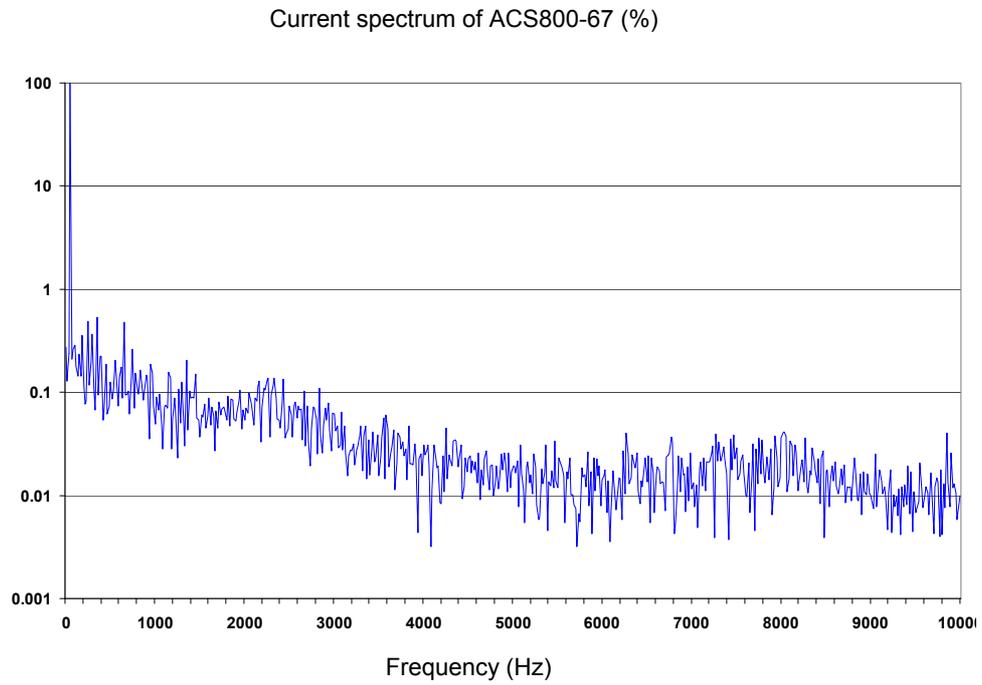
Harmonic distortion of voltage (%)



Harmonic distortion of current (%)



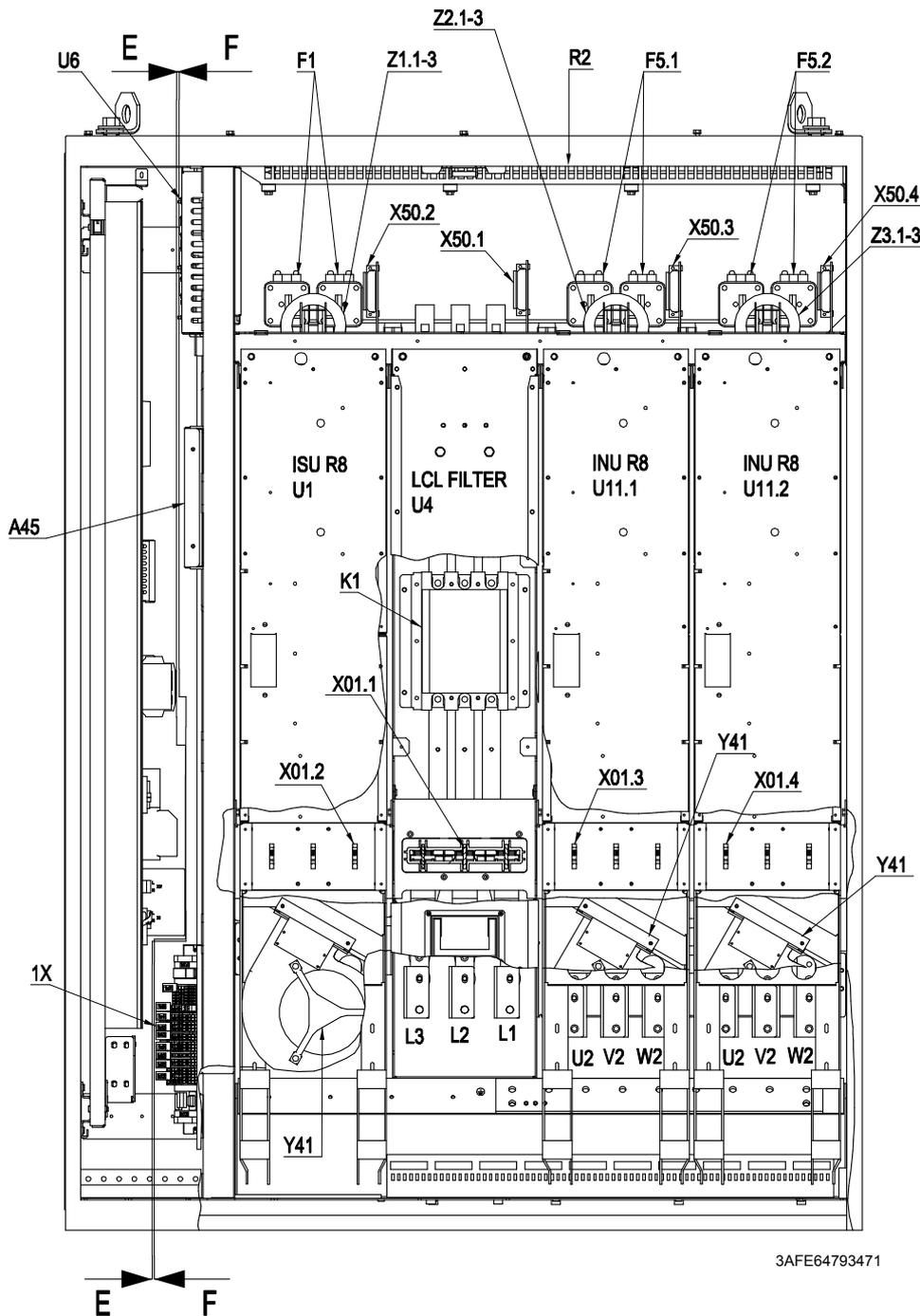
A typical spectrum of the current distortion is shown below. Each point is presented as a percentage of the fundamental current.



Cabinet layout

The converter is housed in a cabinet specially designed for wind turbine converters. An example layout of the converter is presented in the following drawings.

The cabinet is protected to IP23 or IP54.

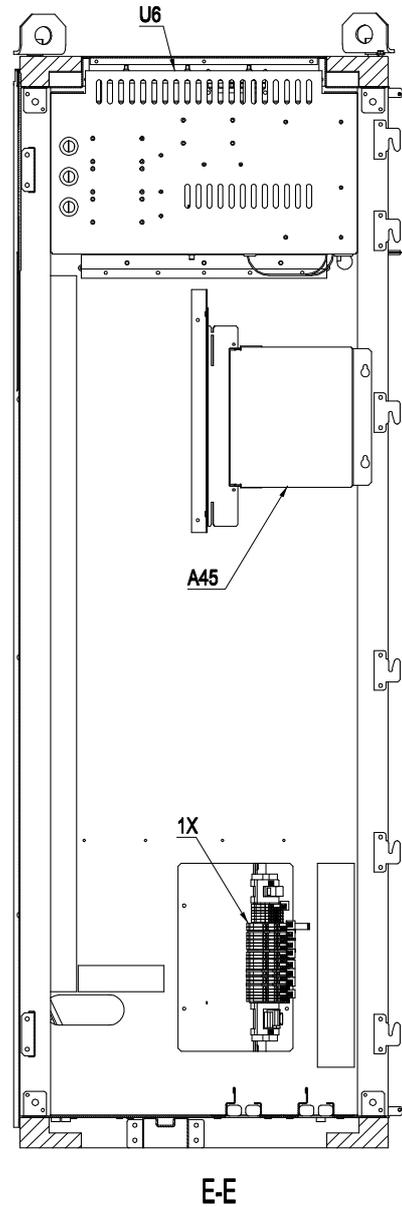
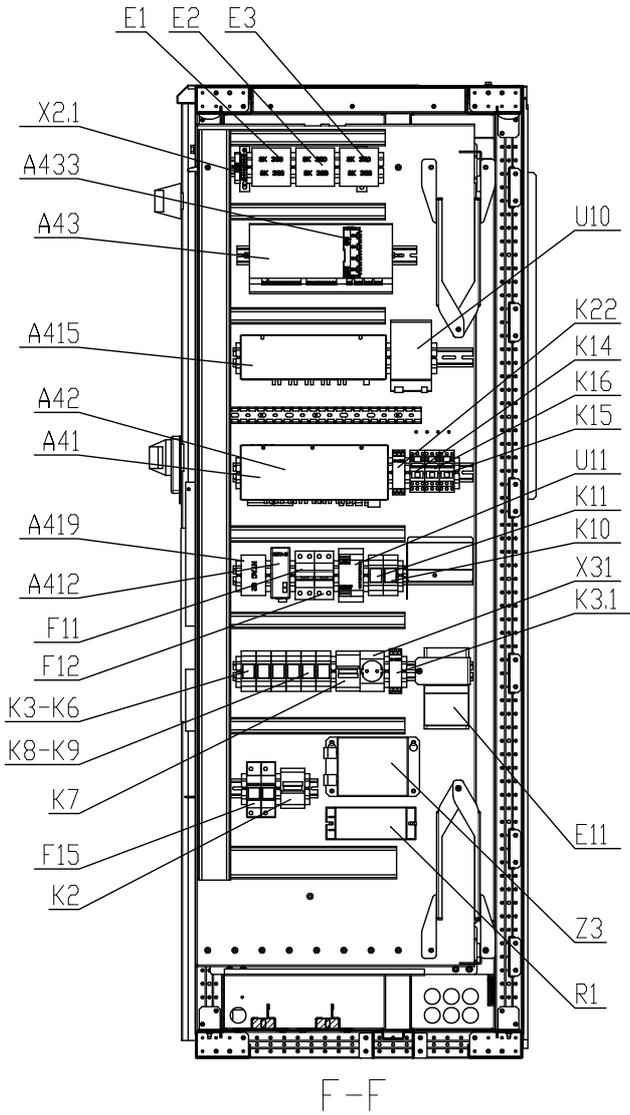


3AFE64793471

A45	NUIM-61C/NUIM-10C
F1	ISU DC fuse
F5,1-2	INU DC fuse
K1	Input contactor
L1, L2, L3	Line connection

R2	Crowbar resistor
U2, V2, W2	Rotor connection
U6	Crowbar
X01.1-4	Power connectors
X50.1	LCL filter fan supply

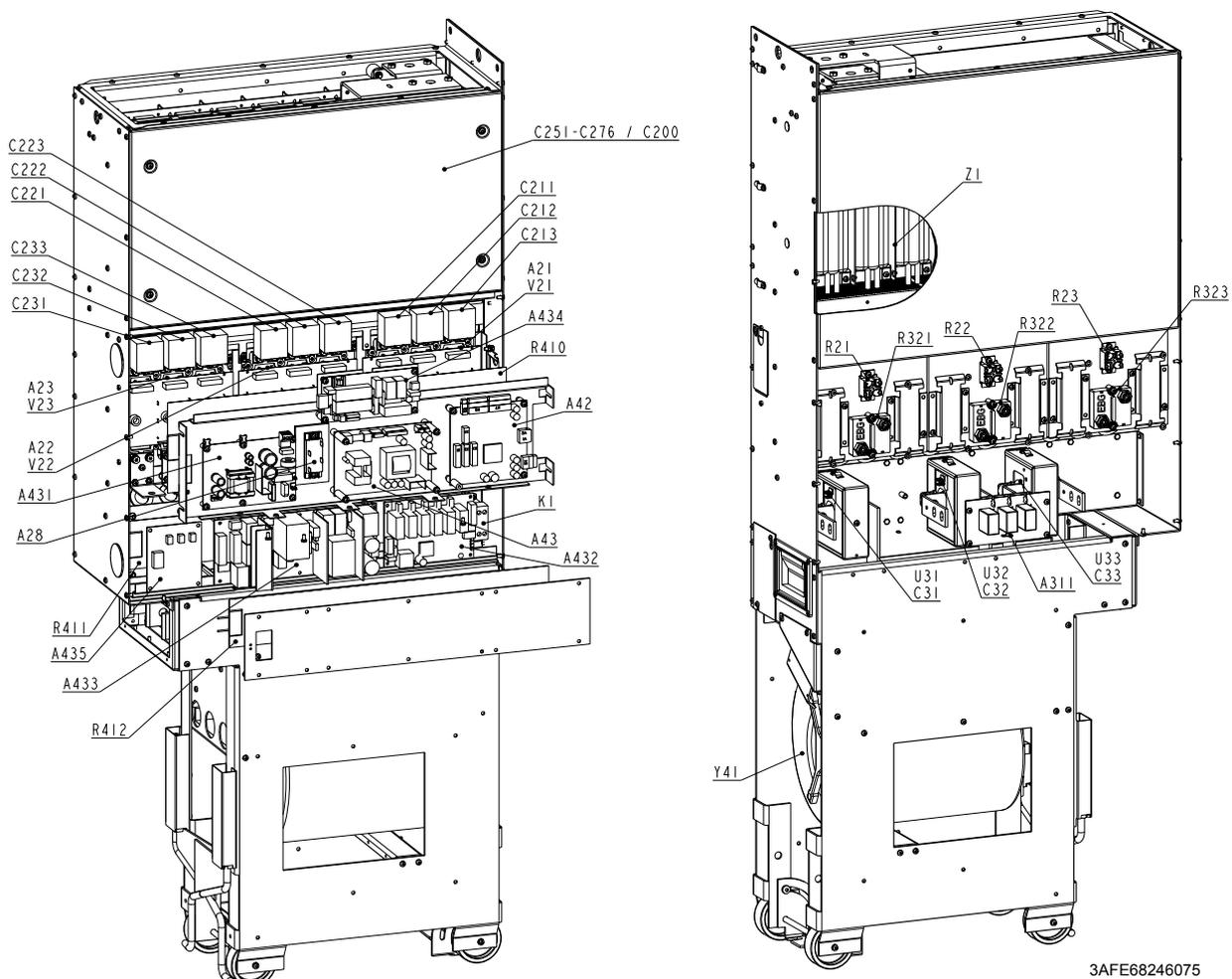
X50.2-4	Module control signals
Y41	Cooling fan
Z1-3	Common mode filter
1X	Terminal strip



A41	NDCU-33Cx Drive Control Unit	E11	Heating fan	U6	Crowbar
A43	RDCU-12C Drive Control Unit	F11,12	Protection switch	U10	Power supply 24 V / 3 A
A45	NUIM-61C/NUIM-10C Voltage and Current Measurement Unit	F15	Charging fuses	U11	Power supply 15 V / 1 A
A411	*	K2	Charging contactor	X31	Wall socket
A412	NETA-01 Ethernet Adapter Module	K3-K6	Relay	Z3	Control voltage filter
A415	NPBU-44C/APBU Branching Unit	K7	Heating contactor	1X	Terminal strip
A419	NTAC-02 Pulse Encoder Interface Module	K8-K9	Relay		
A433	RDCO-02C DDCS Communication Option	K14-K16	Relays		
E1	Humidity sensor	K22	Timer relay		
E2, E3	Temperature sensor	R1	Charging resistor		

* Project-specific: e.g. NCAN-02C/NDNA-02C/no option module

Converter module layout is presented in the following drawing.



A21-23	AGDR-6x/7x Gate Driver Board (A23 is not used with 400 kVA units)	A433	AFPS-11C Fan Power Supply 1 kW	V21-23	IGBT module (V23 is not used with 400 kVA units)
A28*	AFCB-01 Protection board or NRED-16	A435	AHCB-01C Heating Control Board	R21-23	Discharging resistor
A42	AINT-14C Main Circuit Interface Board	C31-33	Filter capacitor set	R321-323	Output filter resistor
A43*	APOW-11C/01 Power Supply Board	C200	DC link capacitor (C251-276 are not used)	R410-413	Heating element
A46	AGBB-01C Gate Driver Branching Board (only with 400 kVA units)	C211-213	Clamp capacitor	U31-33	Current transducer
A311	AOFC-02 Output Filter Board	C221-223	Clamp capacitor	Y41	Fan
A432	AFIN-01C Fan Inverter 1 kW	C231-233	Clamp capacitor	Z1	AOFI-61 Output Filter Inductor

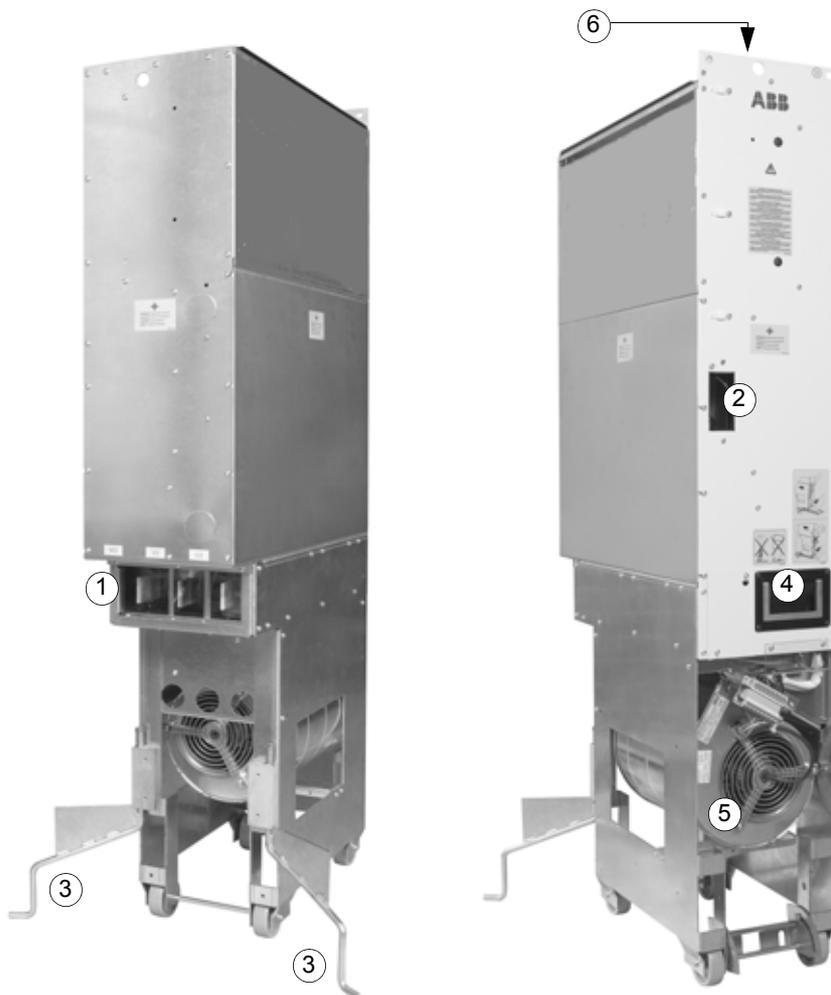
* Allowed combinations are:
NRED-16 and APOW-01
AFCB-01 and APOW-11C

Modules

The modules run on wheels, and can easily be removed from the cubicle for cable installation or service. Each module must be extracted from the cabinet for cabling and then re-inserted. The rotor/grid connection is via a quick connector at the back of the module that couples when the module is inserted into the cabinet.

Converter module

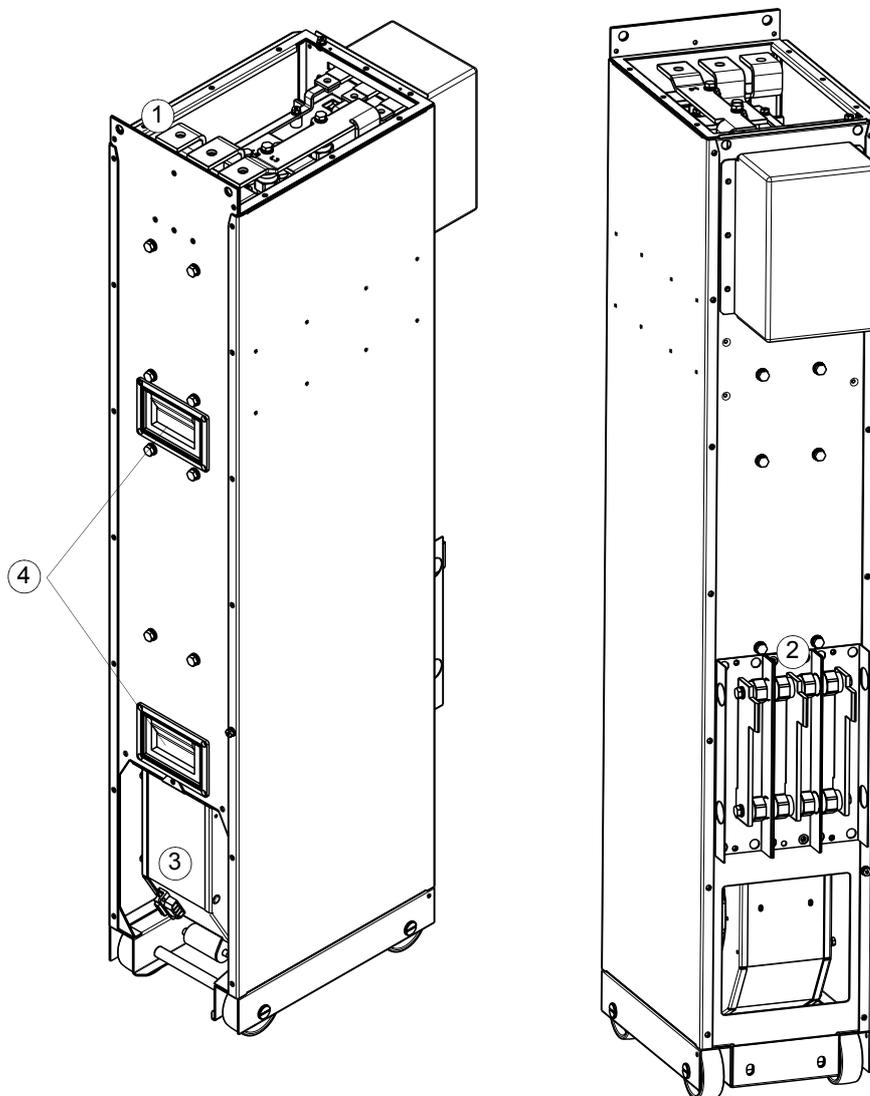
The DC input/output is located on the top front part of the converter module. The DC voltage is connected to the busbars through fuses. Common mode filtering is implemented by running the DC busbars through ferrite cores. The following drawing presents the converter module layout.



Item	Explanation
1	Busbars. To be aligned with the quick connector socket mounted in the cubicle. Direct connection of cables without using the quick connector is also possible.
2	Fibre optic connectors of the AINT board. Connected to the xDCU drive control unit.
3	Retractable support legs
4	Handle
5	Fan
6	DC connections

LCL filter module

LCL filters are used for minimising the emissions of the converter towards the supply grid.



Item	Explanation
1	AC input busbars
2	AC output terminals:
3	Fan
4	Handles

Heating and cooling

Each converter module is equipped with a speed controlled internal fan. The fan speed is adjusted according to module IGBT temperature. The use of a speed controlled fan decreases the temperature changes and prolongs the fan lifespan.

The LCL filter is equipped with a fan, which runs at constant speed.

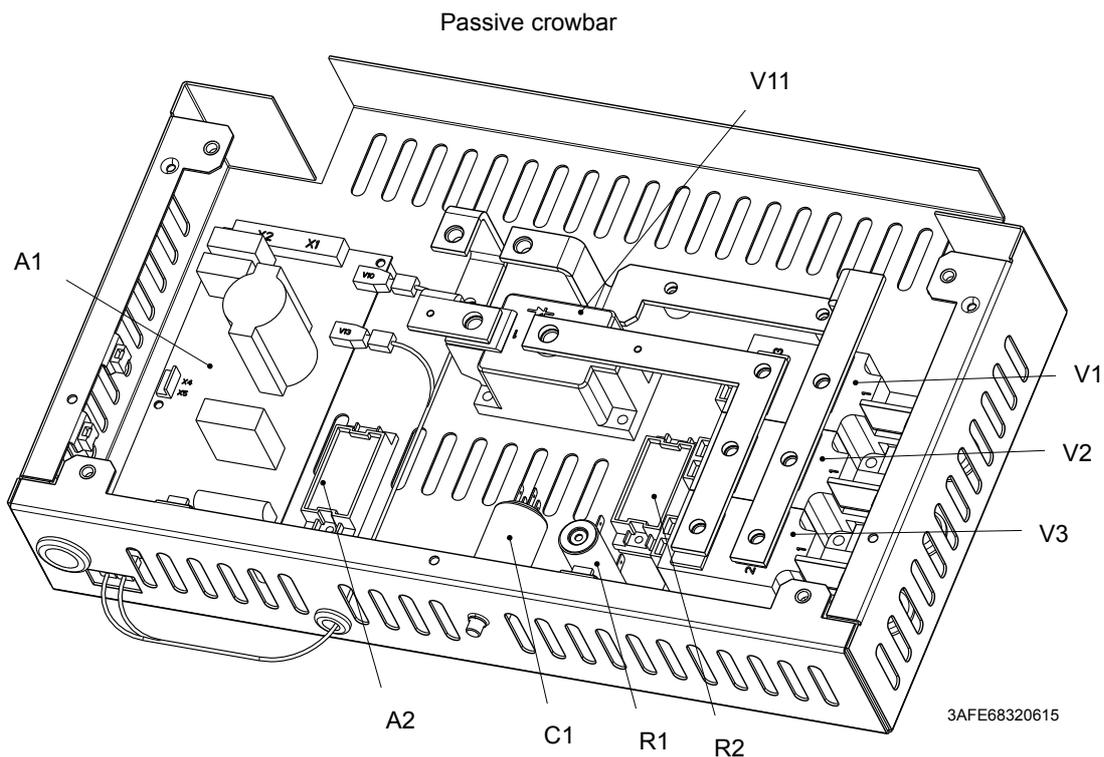
The cabinet also has a heating system. See section [Cold start](#).

Crowbar

The crowbar circuit is used for overvoltage protection in abnormal grid conditions, e.g. loss of supply grid voltage or short circuit. The converter can be equipped with passive or active crowbar. The crowbar consists of the crowbar unit and a high power resistor.

Passive crowbar

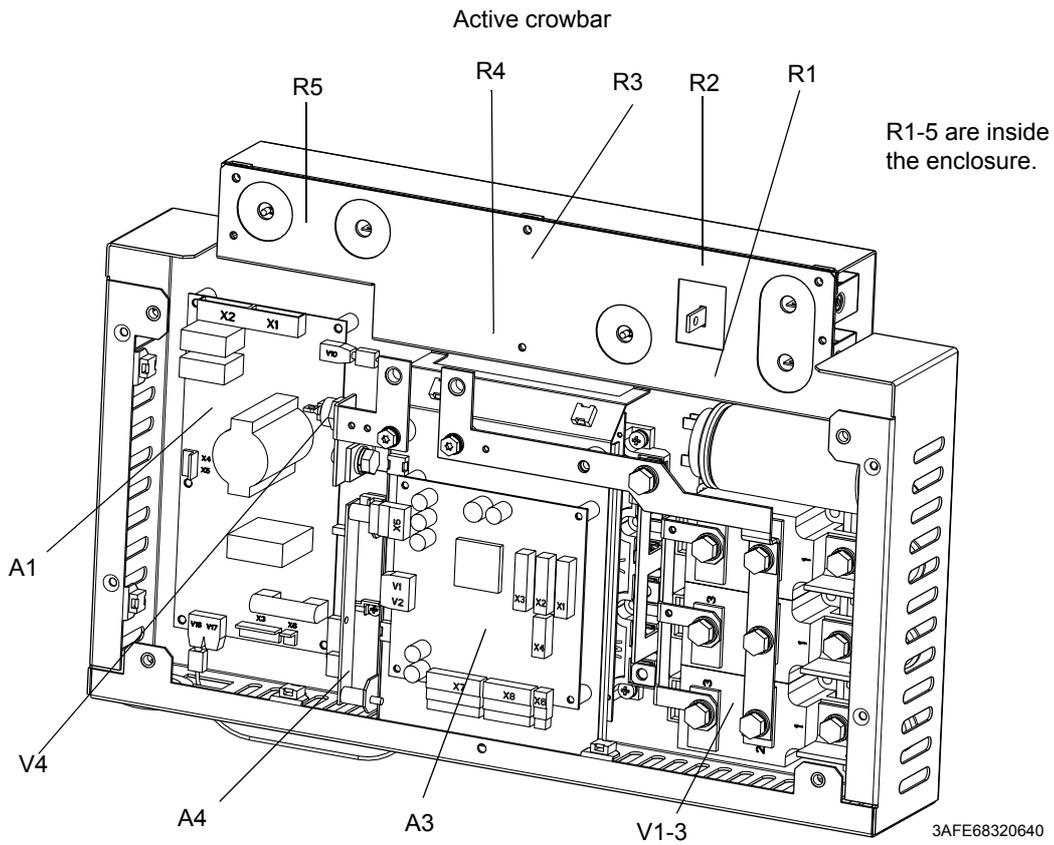
The passive crowbar measures the DC voltage, U_{DC} . If the voltage exceeds 1210 V, the crowbar is triggered and the converter is immediately disconnected from the grid supply.



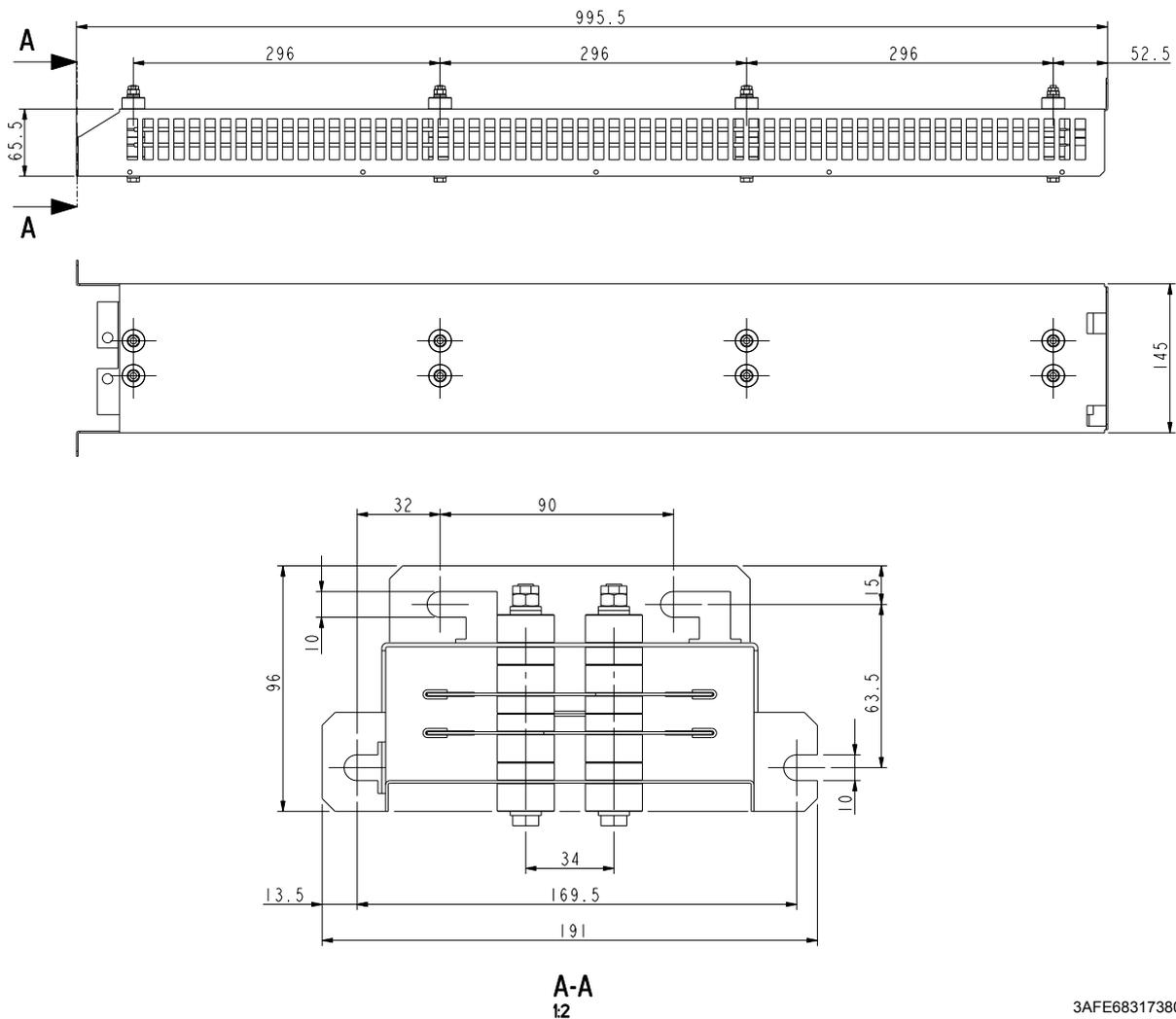
Active crowbar

Active crowbar is needed when the converter must stay connected to the grid during grid transients, i.e. the converter supports the grid by producing capacitive reactive power. The crowbar can be switched ON and OFF based on grid voltage transient influences on the rotor-side converter. This allows the converter to be connected to the grid even during very severe grid transient(s).

If the grid transient lasts longer than the predetermined time (e.g. 3 to 5 s), the converter trips on a fault.



Crowbar resistor



Du/dt filters

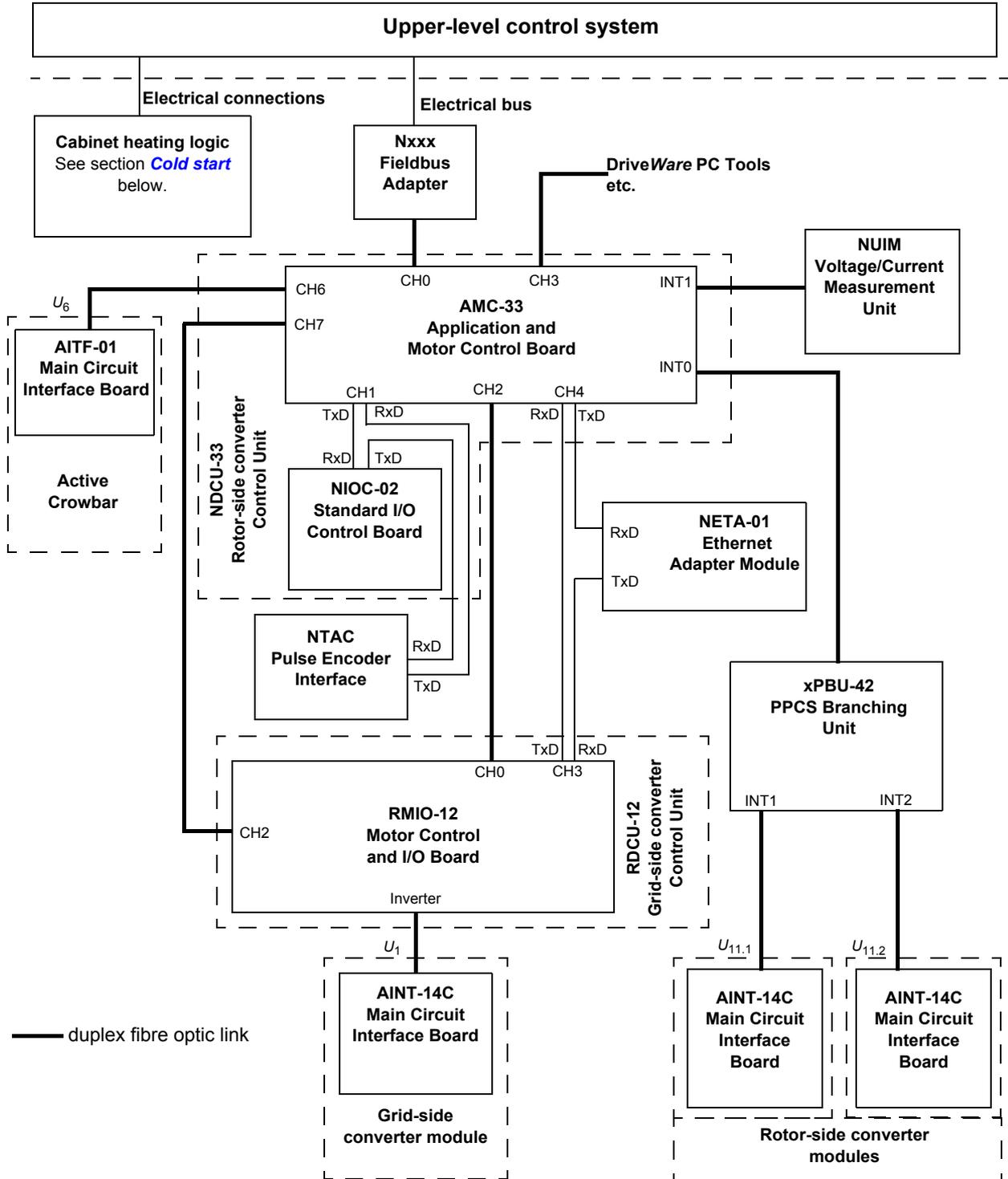
Du/dt filters suppress voltage spikes and rapid voltage changes that stress the rotor insulation. Du/dt filters are included in the grid-side and rotor-side converter modules.

Control section

All the control electronics are installed to a sliding frame, separate from the power section. See sections [Cabinet layout](#) and [Interboard connection diagram](#).

Interboard connection diagram

The diagram below shows the principal interboard optical connections of the converter. For details, see the circuit diagrams delivered with the converter.



Cold start

The temperature and humidity must be within allowed limits in the cabinet before the converter can be powered up. The converter cabinet is equipped with a heating logic which controls the cabinet heating system, allowing the converter to start only when the operating conditions are met. Heating is possible only when the grid-side converter contactor is open and the converter is disconnected from the network. When the converter is connected to the network, normal converter power losses keep the operating temperature above the required limit.

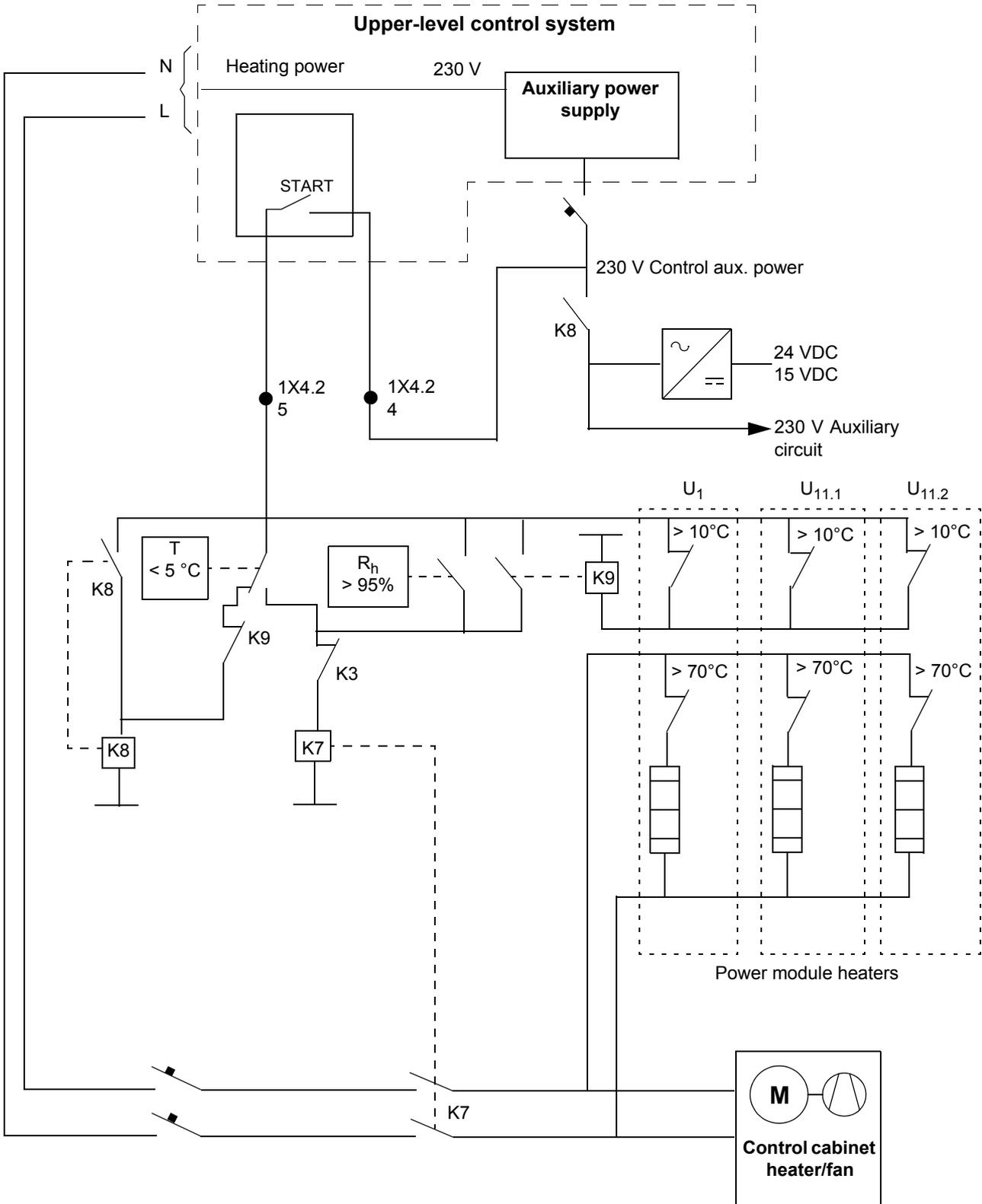
A simplified diagram of the heating logic is shown below. For more detailed information, refer to the wiring diagrams delivered with the converter.

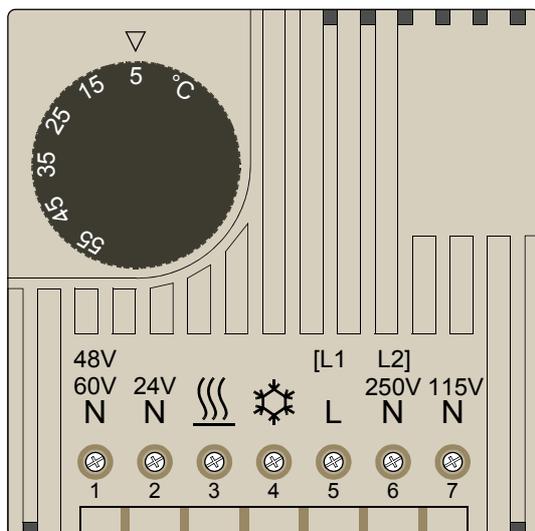
The system has two auxiliary power inputs: one for the heating power and one for the control power. When the contact between connectors 4 and 5 of terminal 1X4.2 is closed, auxiliary voltage is connected to the control relays. With thermostat and hygostat default settings, power is fed through the heating resistors in the power modules and control unit, until the temperature reaches +5°C inside the control unit and +10°C inside the power modules and the humidity inside the control section drops below 95%. Because the control unit and the converter modules are located in separate sections of the cabinet, the control unit can reach the required temperature before the converter modules. Relay K9 prevents the control power from turning on before the converter modules have reached the appropriate temperature. The 70°C thermistors inside the converter module will disconnect the heating power in case of overheating.

When the heating is completed, relay K8 closes and auxiliary power is connected to the control boards. After the control boards are booted (lasts about 1 minute), the converter is ready to start.

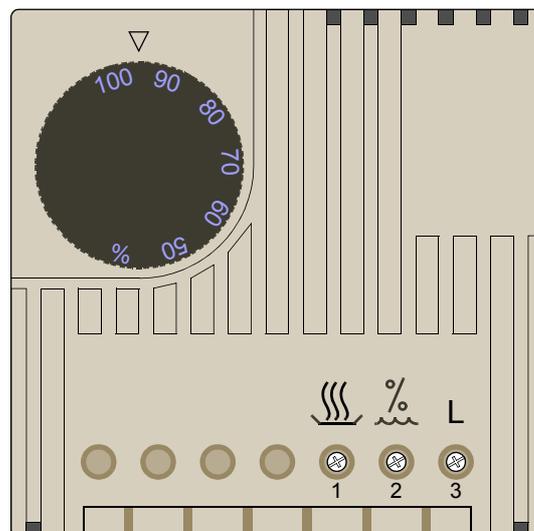
Cabinet heating is activated always when the converter has been without power for a long cold period. If heating power is available after cold start, heating is activated and deactivated according to the sensor settings. Relay K8 keeps auxiliary voltages connected to the control boards.

Converter auxiliary power consumption can be disabled by opening the contact between connectors 4 and 5 of terminal 1X4.2. This can be an advantage when there is no wind power available for a long time.





Thermostat
Default setting: 5°C



Hygrostat
Default setting: 95%

Type code

The cabinet has a type designation label attached, containing e.g. the type code of the unit (ACS800-67-0480/0580-7). The type code contains information on the specifications and configuration of the unit.

- The first 21 digits form the basic code. It describes the basic construction of the unit. The fields in the basic code are separated with hyphens.
- The option codes follow the basic code. Each option code starts with an identifying letter (common for the whole product series), followed by descriptive digits. The option codes are separated by plus signs.

The main selections are described below. For more information, contact your local ABB representative.

Basic code

Digit no.	Name/Description	Alternatives	Description
1...6	Product series	ACS800	
8...9	Construction	67	Cabinet mounted wind turbine converter
11...19	Size	0480/0580 0480/0770 0480/1160	Grid-side converter kVA rating / Rotor-side converters kVA rating
21	Voltage rating	7	525/575/600/660/690 V. Nominal voltage: 690 V.

Mechanical installation

What this chapter contains

This chapter describes the mechanical installation procedure of the converter.

General

See chapter [Technical data](#) for allowable operating conditions and requirements for free space around the unit.

The unit should be installed in an upright vertical position.

The floor that the unit is installed on should be of non-flammable material, as smooth as possible, and strong enough to support the weight of the unit. The floor flatness must be checked with a spirit level before the installation of the cabinets into their final position. The maximum allowed deviation from the surface level is 2 mm (0.08 in.) in every 1 metre. The installation site should be levelled, if necessary, as the cabinet is not equipped with adjustable feet.

The wall behind the unit should be of non-flammable material.

The converter can be installed on elevated floor and over a cable duct. The integrity of the supporting structure must be checked before the converter is placed in such a position.

Provide the converter with the amount of fresh **cooling air** given in [Technical data](#).

Sufficient clearance must be left in front of and behind the converter to enable installation, cooling air flow and maintenance.

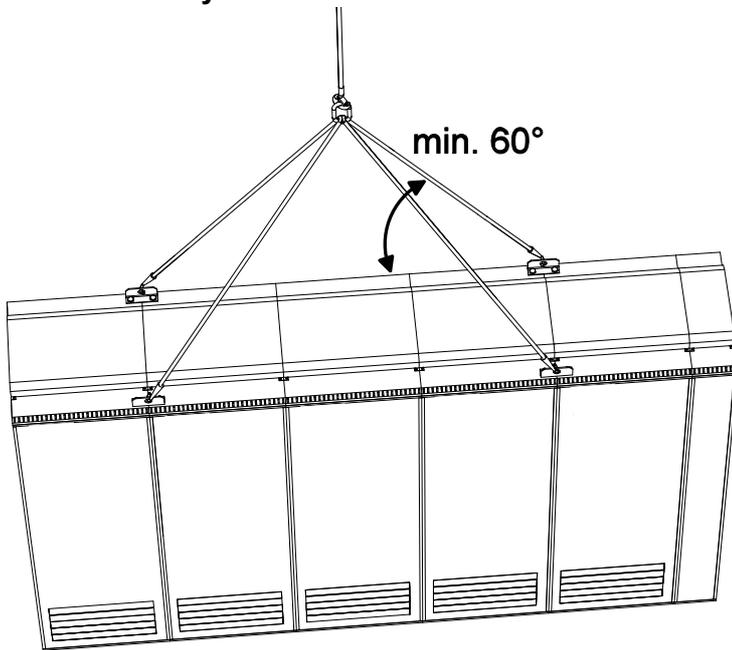
Required tools

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

- crane, fork-lift or pallet truck (check load capacity!); iron bar, jack and rollers
- Pozidrive and Torx (2.5–6 mm) screwdrivers for the tightening of the frame screws.
- torque wrench
- set of wrenches or sockets.

Moving the unit

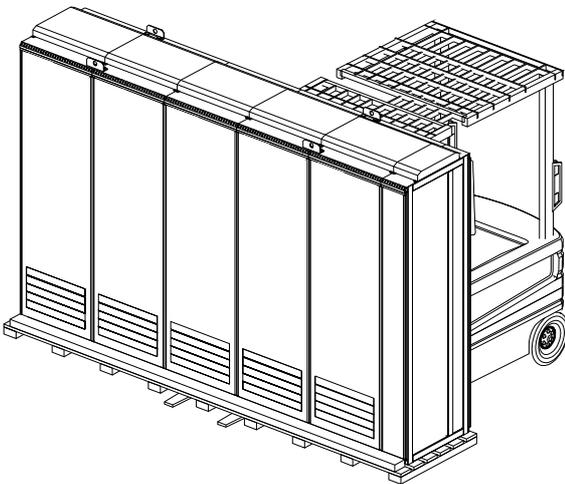
...by crane



Use the steel lifting lugs attached to the top of the cabinet. Insert the lifting ropes or slings into the holes of the lifting lugs.

The lifting lugs can be removed (not mandatory) once the cabinet is in its final position. **If the lifting lugs are removed, the bolts must be refastened to retain the degree of protection of the cabinet.**

...by fork-lift or pallet truck

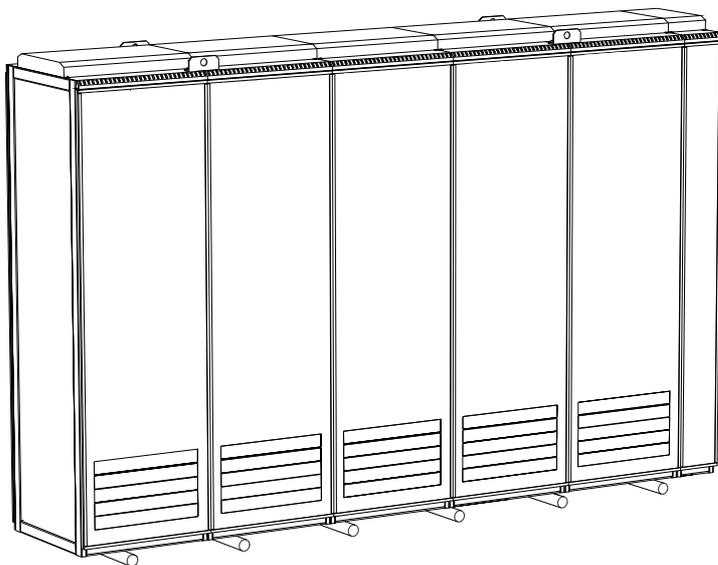


The centre of gravity may be quite high. Be therefore careful when transporting the unit. Tilting the cabinets must be avoided.

The units are to be moved only in the upright position.

If using a pallet truck, check its load capacity before attempting to move the unit.

...on rollers

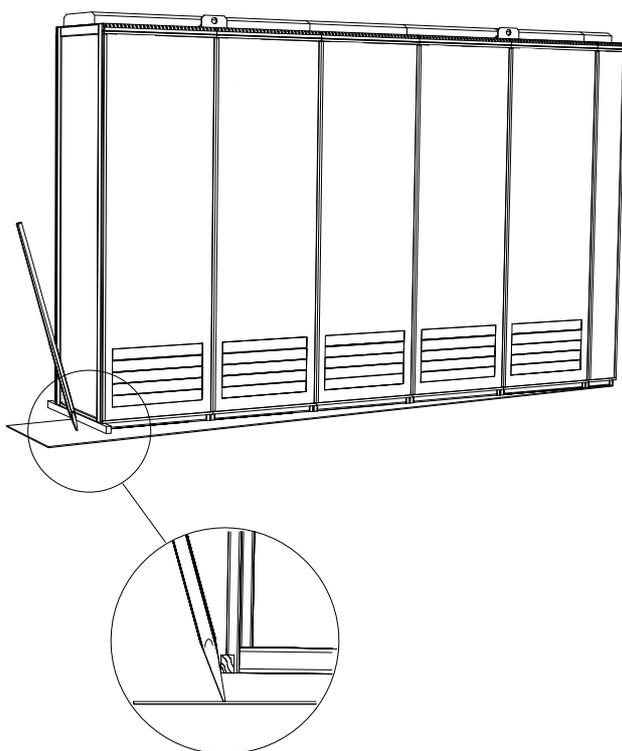


Remove the wooden bottom frame which is part of the shipment.

Lay the unit on the rollers and move it carefully until close to its final location.

Remove the rollers by lifting the unit with a crane, fork-lift, pallet truck or jack as described above.

Final placement of the unit



The cabinet can be moved into its final position with an iron bar and a wooden piece at the bottom edge of the cabinet. Care is to be taken to properly place the wooden piece so as not to damage the cabinet frame.

Before installation

Delivery check

The converter delivery contains:

- converter cabinet
- optional modules (if ordered) installed into the sliding frame at the factory
- ramp for extracting modules from the cabinet
- hardware manual
- appropriate firmware manuals and guides
- optional module manuals
- delivery specific circuit diagrams
- delivery specific dimensional drawings
- 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 converter to verify that the unit is of the correct type. The label includes an IEC and NEMA rating, a type code and a serial number, which allow individual recognition of each unit.

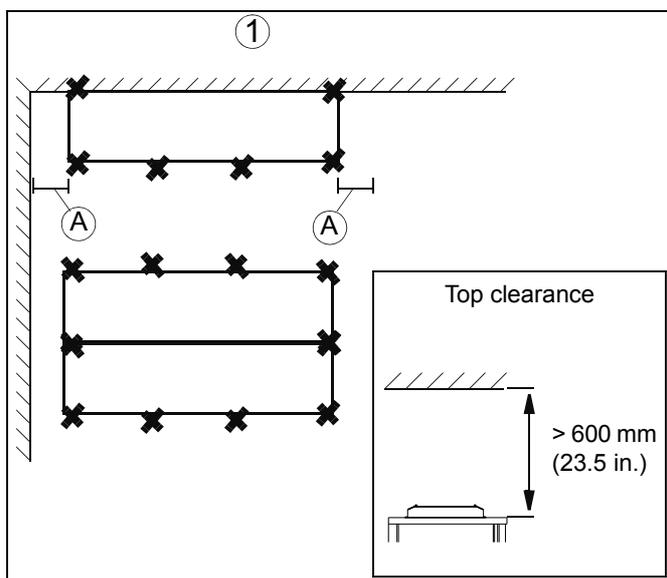
The type designation label is located on the cabinet door.

ABB Oy		Made in Finland			
TYPE	ACS800-67-0480/0770-7				
CODE	64791419	NO	109482/100		
U1	3ph 690V	U2	3ph 0...U1		
I1hd/I1n		I2hd/I2n			
I1n/I1nsq	400A /	I2n/I2nsq	770A /		
f1	48...62Hz	f2	0...100Hz		
DATE	06/2004	Icw	37kA	CLASS.	IP54

36657294

Each converter module is also labelled.

Installation procedure



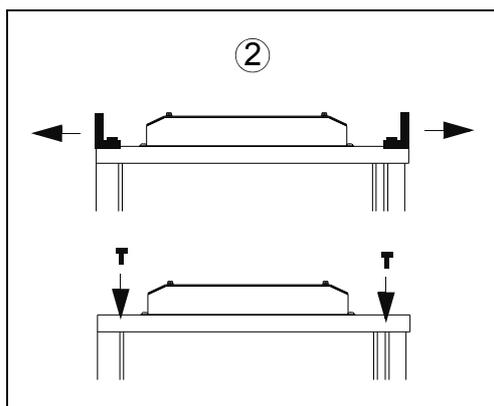
(1) The cabinet can be installed with its back against a wall. Fasten the unit (or first shipping split) to the floor with fastening clamps or through the holes inside the cabinet. For the location of the fastening holes, see delivery specific dimensional drawings.

Note: A clearance of 600 mm (23.5 in.) minimum above the basic roof level of the cabinet (see inset on left) is required for cooling.

Note: Leave some space at the left-hand and right-hand sides of the line-up (A) to allow the doors to open sufficiently.

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

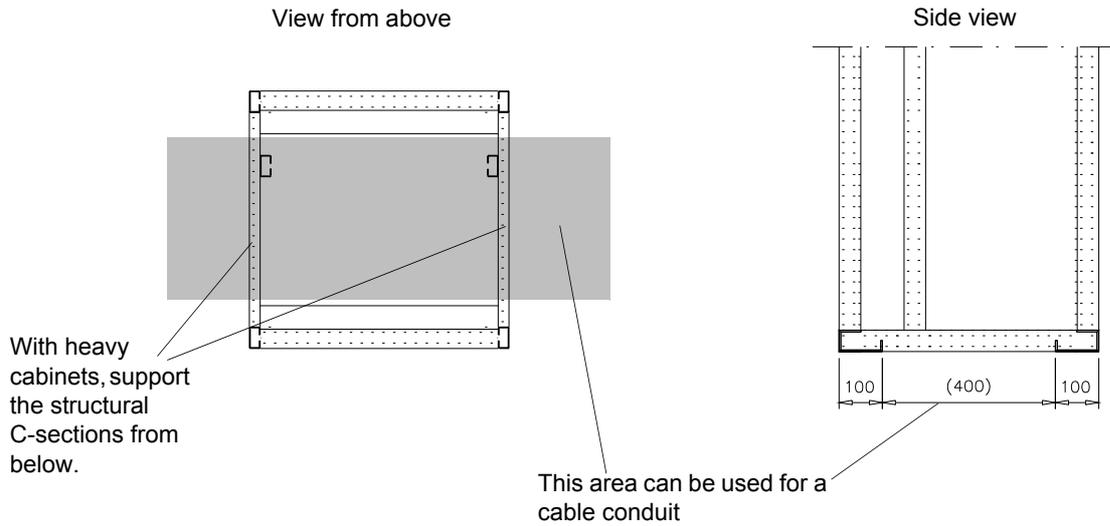
(2) Remove the lifting bars (if present). Use the original bolts to block any unused holes.



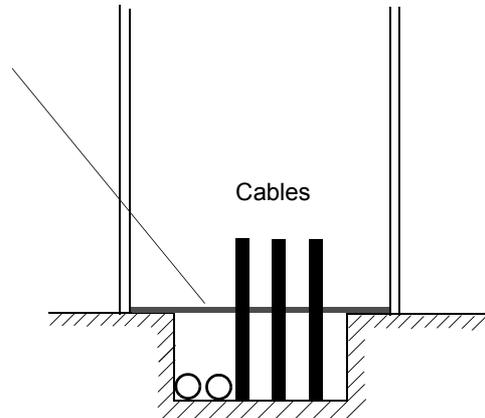
Miscellaneous

Cable conduit in the floor below the cabinet

A cable conduit can be constructed below the 400 mm (15.7 in.) wide middle part of the cabinet. The cabinet weight lies on the two 100 mm (3.9 in.) wide transverse sections which the floor must carry.



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



Electric welding

It is not recommended to fasten the cabinet by welding. However, if welding is necessary, follow the instructions below.

Cabinets without flat bars at the base

- Connect the return conductor of the welding equipment to the cabinet frame at the bottom within 0.5 metres of the welding point.

Cabinets with flat bars at the base

- Weld only the flat bar under the cabinet, never the cabinet frame itself.
- Clamp the welding electrode onto the flat bar about to be welded or onto the floor within 0.5 metres of the welding point.



WARNING! If the welding return wire is connected improperly, the welding circuit may damage electronic circuits in the cabinet. The thickness of the zinc coating of the cabinet frame is 100 to 200 micrometres; on the flat bars the coating is approximately 20 micrometres. Ensure that the welding fumes are not inhaled.

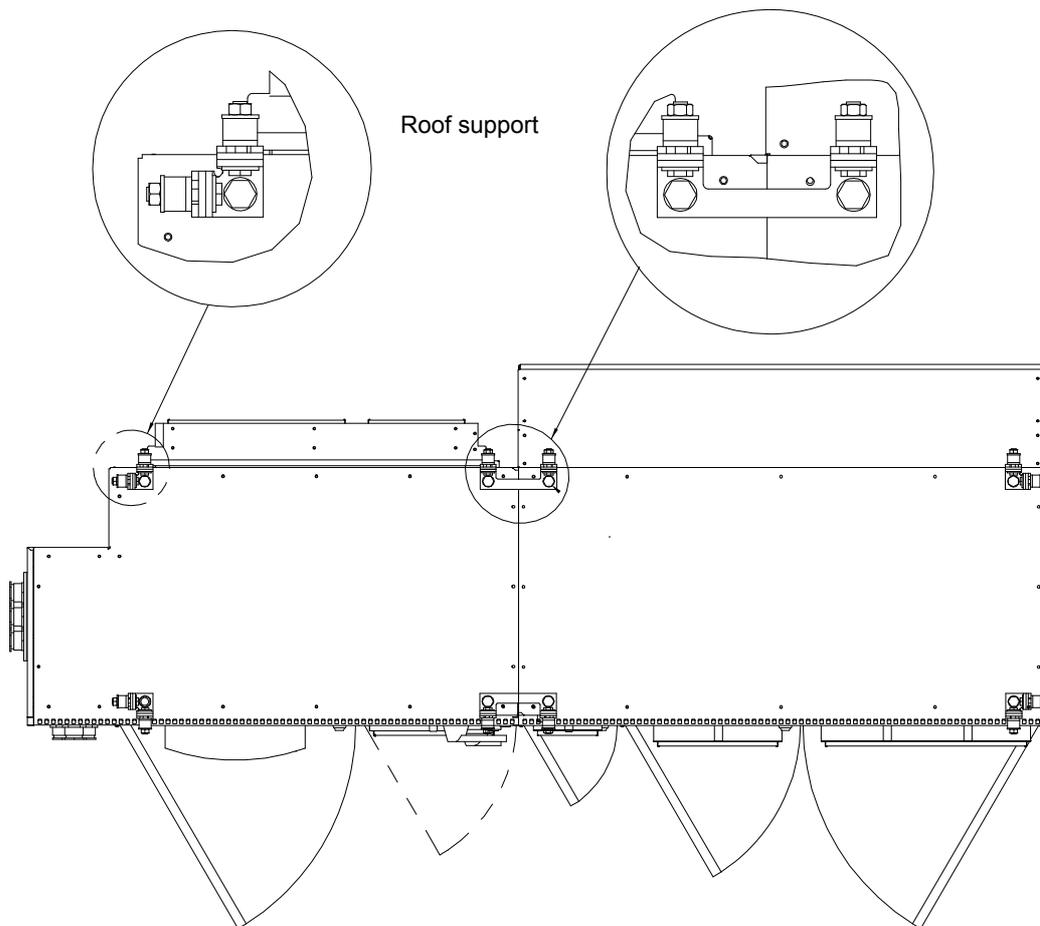
Roof support

If the converter is installed in a nacelle, the cabinet roof must be fixed to the nacelle structure for roof support. Special roof support kits are available as option.

The lifting lugs on the top of the cabinet are replaced with the roof support. Support for both sides of the cabinet roof is required, but it is recommended that each corner of the cabinet is supported.

For more information on roof support, contact your local ABB representative.

View from above



3AFE68306931

Planning the electrical installation

What this chapter contains

This chapter contains the instructions that you must follow when selecting the generator, cables, protections, cable routing and way of operation for the converter system.

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

Checking the compatibility of the generator

See chapter [Technical data](#) for the converter ratings and the generator connection data.

Protecting the generator winding and bearings

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

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

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

The stress on generator insulation is reduced by using du/dt filters. Du/dt filters also reduce bearing currents.

To avoid damage to generator bearings, insulated N-end (non-driven end) bearings and output filters from ABB must be used. In addition, the cables must be selected and installed according to the instructions given in this manual. These types of filters are included in the ACS800-67 converter as default:

- du/dt limitation (protects generator insulation system and reduces bearing currents).
- common mode filtering (mainly reduces bearing currents).

The common mode filter is composed of toroidal cores installed inside the converter.

Supply connection

Disconnecting device (disconnecting means)

The converter must be equipped with a hand operated input disconnecting device (disconnecting means) which isolates the converter and the generator from the supply grid. A switch fuse disconnecter is available as option.

The disconnecting device does not, however, isolate the input busbars from the supply grid. Therefore during installation and maintenance work on the converter, the input cables and busbars must be isolated from the supply with a disconnecter at the distribution board or at the supplying transformer.

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 disconnecter of utilization category AC-23B (EN 60947-3)
- a disconnecter 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 disconnecter (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.

Thermal overload and short circuit protection

Thermal overload protection

The converter protects itself against thermal overload.

Protection against short circuit in generator rotor cable

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

Protection against short circuit inside the converter

Equip the converter with main fuses listed in chapter [Technical data](#). The fuses restrict converter damage and prevent damage to adjoining equipment in case of a short circuit inside the converter. **Check that the operating time of the fuse is below 0.5 seconds.** The operating time depends on the fuse type (gG or aR), supply network impedance and the cross-sectional area, material and length of the cable. In case the 0.5 seconds operating time is exceeded with gG fuses, ultrarapid (aR) fuses will in most cases reduce the operating time to an acceptable level.

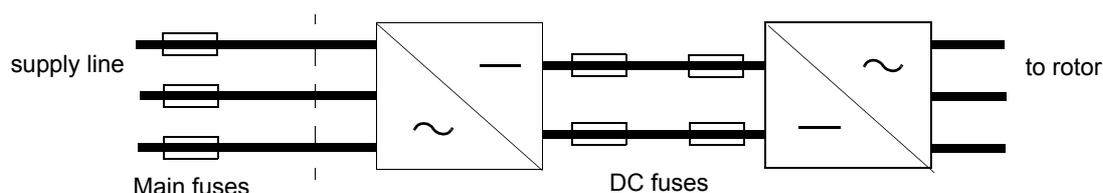
Input fuses are available as option.



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

DC fuses

The converter employs fuses in the DC link between the grid-side and rotor-side converter modules. See chapter *Technical data* for fuse ratings.



Earth fault (Ground fault) protection

All units are equipped with an internal earth fault protective function to protect the converter against earth faults in the converter, generator and generator cable. (This is not a personal safety or a fire protection feature.) Earth fault protective functions can be disabled; refer to the appropriate *Firmware Manual* of the converter application program.

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 converter, or turning the operating switch of the converter from position “1” to “0” does not generate an emergency stop of the generator or separate the converter from dangerous potential.

An emergency stop function is available for stopping and switching off the whole converter. Two modes are available: immediate removal of power (Category 0) and controlled emergency stop (Category 1).

Restarting after an emergency stop

After an emergency stop, the emergency stop button must be released and a reset performed before the main contactor (or air circuit breaker and stator contactor) can be closed and the converter started.

Selecting the power cables

This section contains the general cable selection rules. For a list of recommended cables, see chapter *Technical data*.

Note: The converter configuration may require multiple cabling. See section [Grid and rotor connections](#) in chapter [Electrical installation](#).

General rules

Dimension the cables **according to local regulations:**

- The cable must be able to carry the converter load current. See chapter [Technical data](#) for the rated currents.
- The cable must be rated for at least 70°C (140°F) maximum permissible temperature of conductor in continuous use. For US, see section [Additional US requirements](#).
- The cable must withstand the short circuit current given in chapter [Technical data](#).
- 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.

The rated voltage of the supply line cables should be $U_o/U = 0.6/1$ kV for 690 VAC rated equipment. (U_o = rated voltage between the conductor and the earth, U = rated voltage between the conductors.) For the North American market, 600 VAC rated cable is accepted for 600 VAC rated equipment. As a general rule, the rated voltage for the rotor cables should be minimum $U_o/U = 0.6/1$ kV.

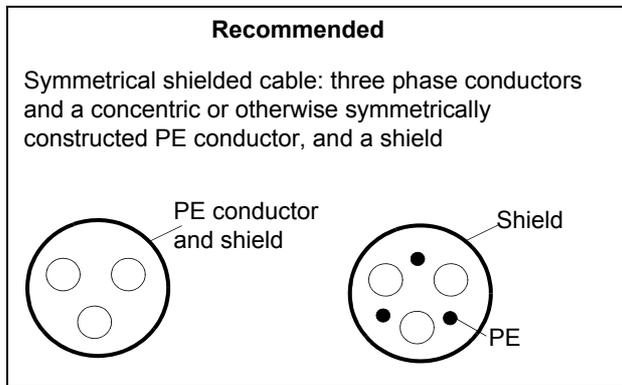
A four conductor system is allowed for input cabling, but shielded symmetrical cable is recommended. To operate as a protective conductor, the shield conductivity must be at least 50% of the conductivity of the phase lead. Compared to a four conductor system, the use of symmetrical shielded cable reduces electromagnetic emission of the whole converter system as well as generator bearing currents and wear. The rotor cable and its PE pigtail should be kept as short as possible in order to reduce electromagnetic emission as well as capacitive current.

Power cable busbars

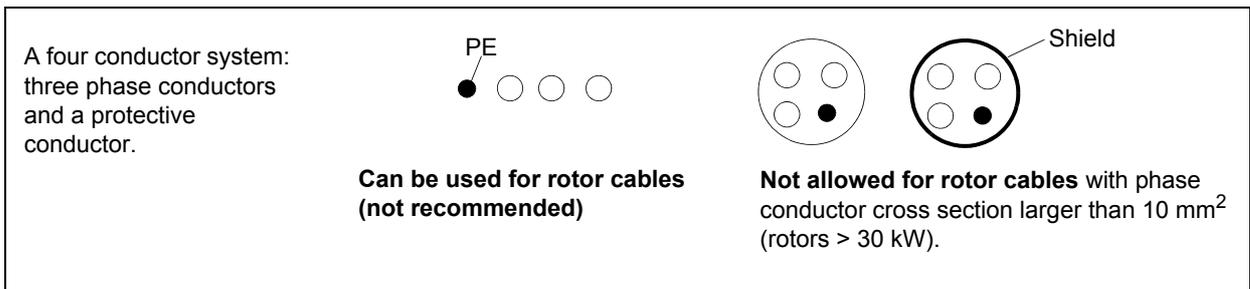
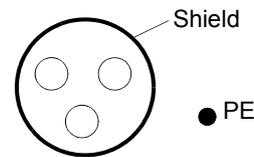
If necessary, the same screw can be used for connecting two cable lugs (on both sides of the busbar). Cable lugs with one or two holes can be used. Always use a torque wrench for tightening the busbar connections.

Alternative power cable types

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



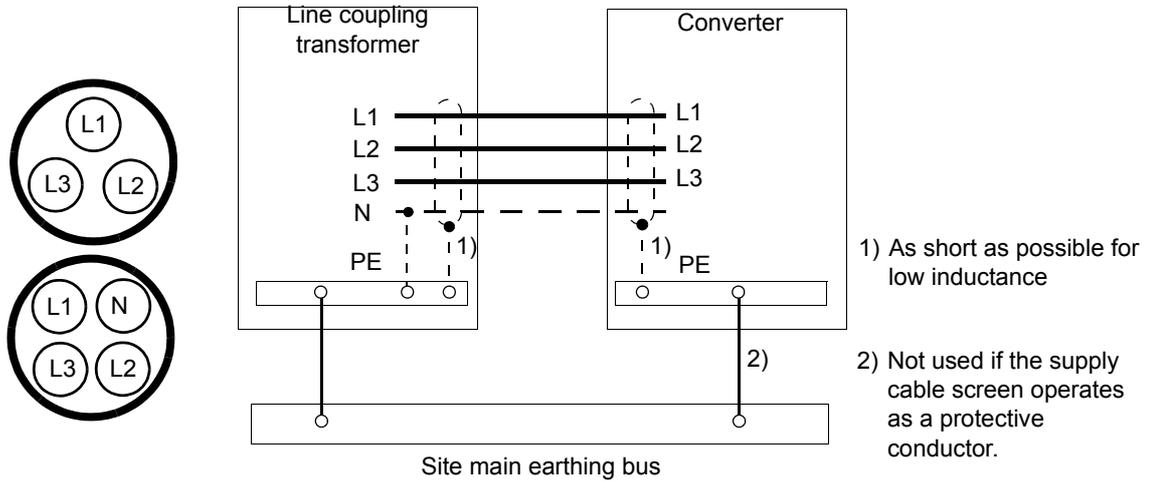
A separate PE conductor is required if the conductivity of the cable shield is <50% of the conductivity of the phase conductor.



Note: The N conductor is not normally used with ACS800-67 converters although it is visible in the following diagrams.

Supply line cable connection for low power supply

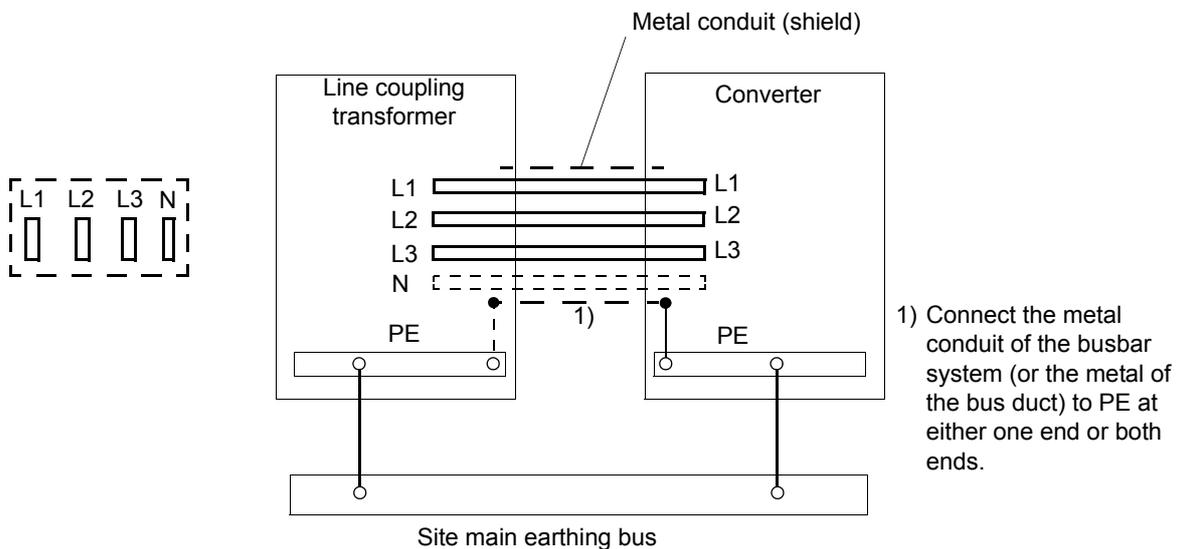
A low current (< 300 A) single cable connection is represented below.



Supply line cable connection for high power supply

Busbar connection

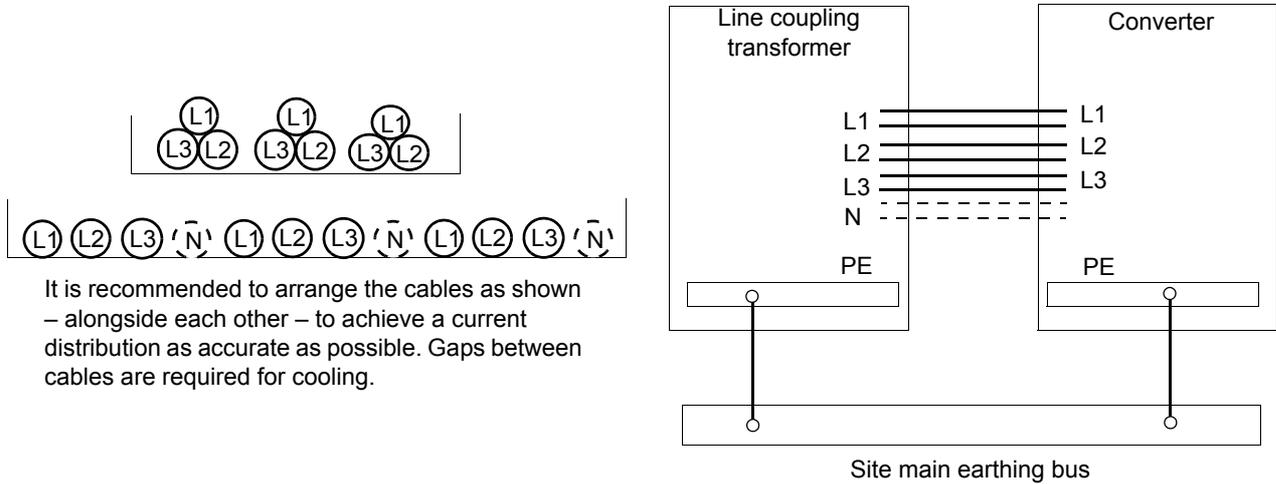
A high current (> 300 A) busbar connection is represented below.



Note: Paint should be removed to allow a good connection to the cabinet frames throughout the whole perimeter of the metal conduit (or a bus duct). The metal conduit (or the bus duct metal) should be electrically continuous throughout its complete length.

Cable bus system

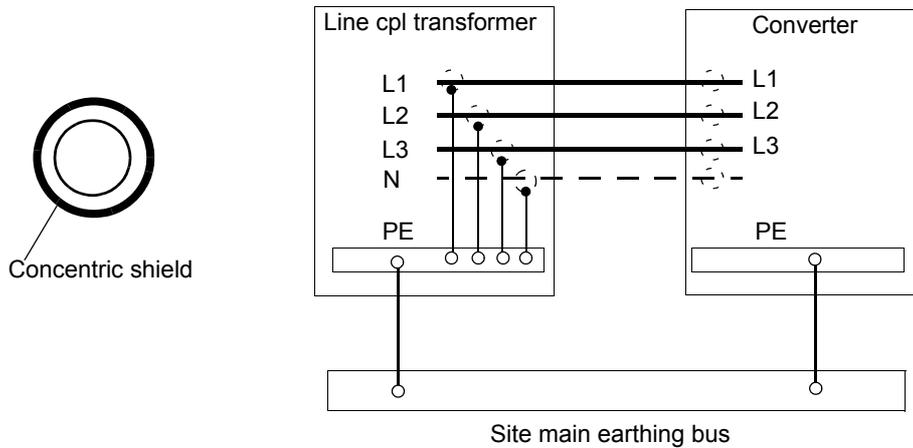
The connection of a high current (> 300 A) cable bus system that consists of several cables is represented below. In this system, less conductor material is needed due to better cooling of separate conductors.



Note: Current derating of the cables is required when installing the cables in a cable tray. This derating factor must be taken into account as per the local electrical safety code.

Single core cables with concentric protective shields

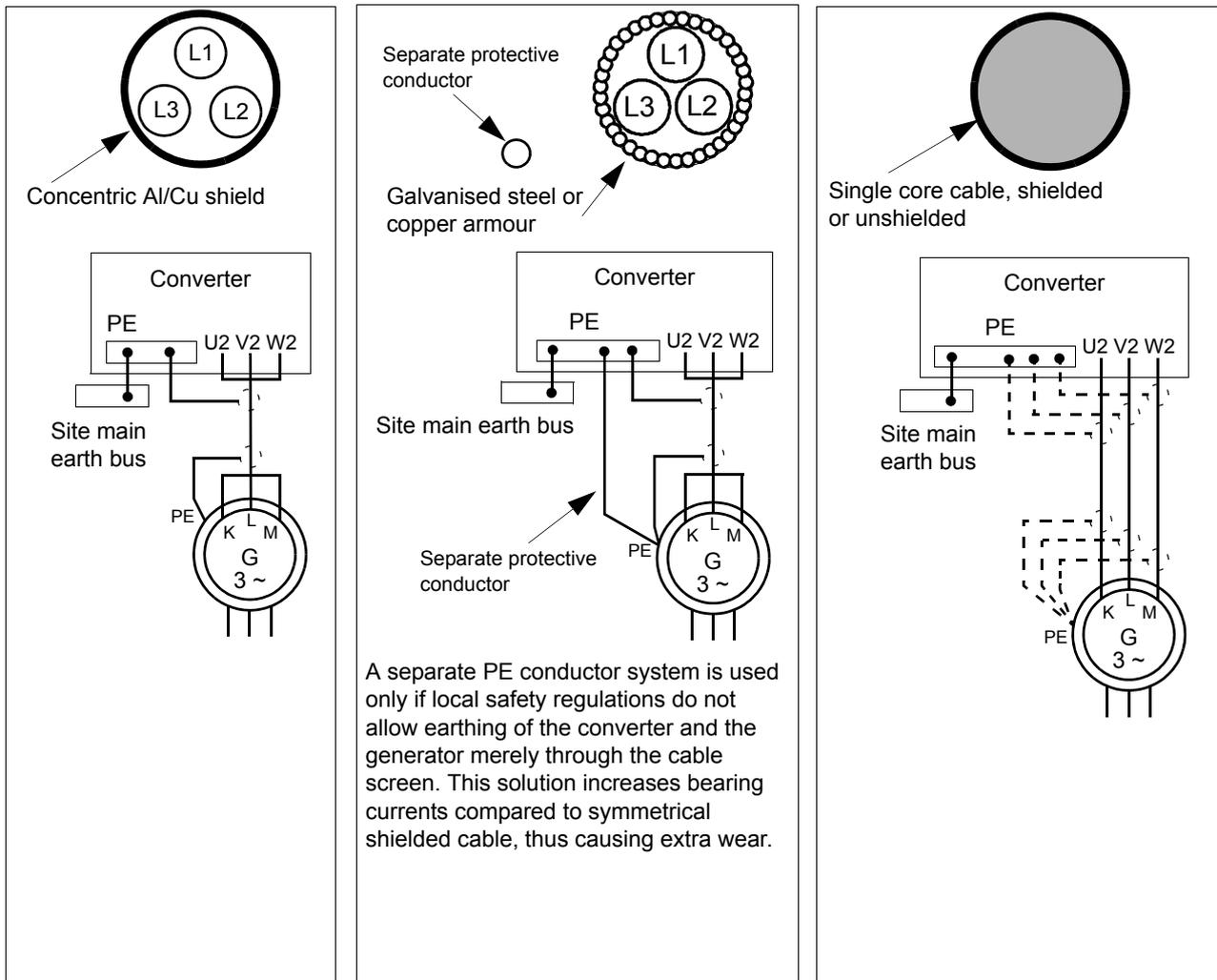
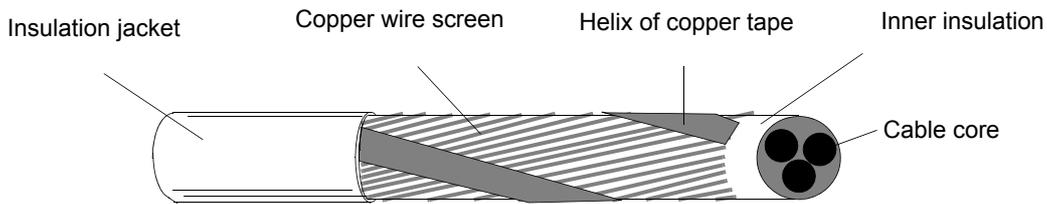
When single core cables equipped with concentric protective shields (metal) are used, the phase current will induce voltage to the cable shield. If the shields are connected to each other at both ends of the cable, current will flow in the cable shield. In order to prevent this and to ensure personal safety, the cable shield must be connected only to PE at the transformer side and insulated on the converter side. The connection is represented below.



Rotor cable connection

Rotor cable connections for different cable types are represented below. For minimum radio frequency interference (RFI) at the generator end, earth the cable screen 360 degrees at the lead through or earth the cable by twisting the screen (flattened width $\geq 1/5 \times$ length).

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 converter 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 aluminium 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 converters 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 converter enclosure. Use separate conduits for input power, generator, brake resistors, and control wiring. When conduit is employed, type MC continuous corrugated aluminium armor cable or shielded cable is not required. A dedicated ground cable is always required. Do not run generator wiring from more than one converter in the same conduit.

Armored cable / shielded power cable

Six conductor (3 phases and 3 ground) type MC continuous corrugated aluminium 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, among others.

Power factor compensation capacitors

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

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

Equipment connected to the rotor 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 rotor cable (i.e. between the converter and the rotor):

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

Bypass connection



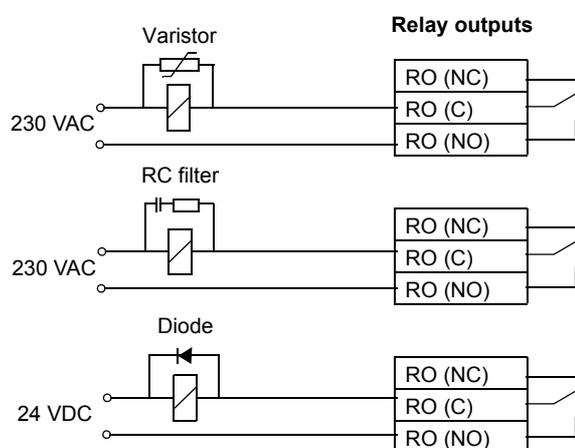
WARNING! Never connect the supply power to the converter output terminals U2, V2 and W2. If frequent bypassing is required, employ mechanically connected switches or contactors. Mains (line) voltage applied to the output can result in permanent damage to the unit.

Relay output contacts and inductive loads

Inductive loads (such as relays, contactors, generators) cause voltage transients when switched off.

The relay contacts of 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 the protective components at the terminal block.



Auxiliary voltage cables

The auxiliary voltage (115, 230 V, etc.) cables must be rated for the required voltage and current. Wire types H07V-U and H07V-R as specified by CENELEC HD 21 S2 Part 3 are highly recommended. A separate PE wire must be provided.

Connection of a generator temperature sensor to the converter I/O



WARNING! IEC 60664 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 converter can be implemented in three alternate ways:

1. There is double or reinforced insulation between the thermistor and live parts of the generator.
2. Circuits connected to all digital and analogue inputs of the converter are protected against contact and insulated with basic insulation (the same voltage level as the converter 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 converter. For connection, see appropriate *Firmware Manual*.

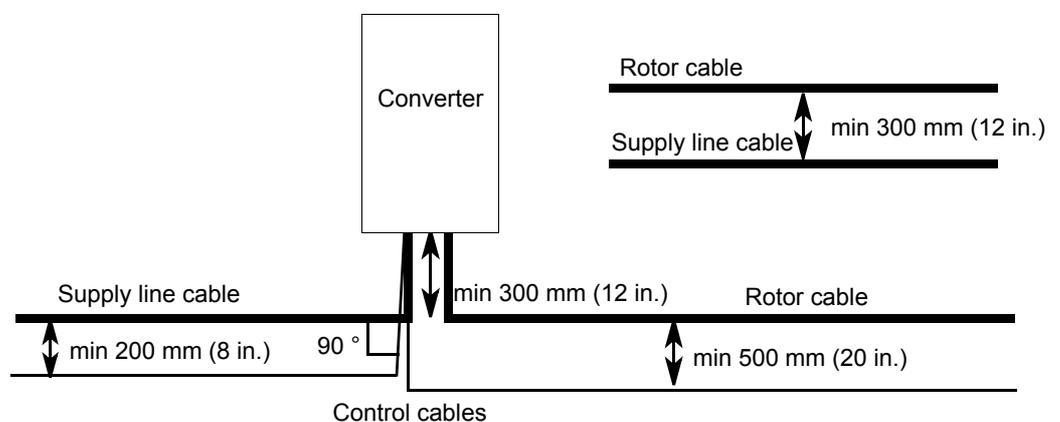
Routing the cables

Route the rotor cable away from other cable routes. Rotor cables of several converters can be run in parallel installed next to each other. It is recommended that the rotor cable, supply line cable and control cables be installed on separate trays. Avoid long parallel runs of rotor cables with other cables in order to decrease electromagnetic interference caused by the rapid changes in the rotor voltage.

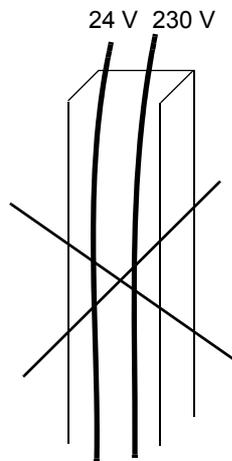
Where control cables must cross supply line and rotor cables, make sure they are arranged at an angle as near to 90 degrees as possible. Do not run extra cables through the converter.

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.

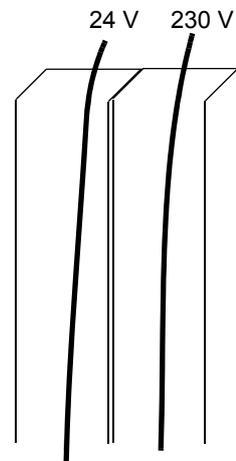
A diagram of the cable routing is shown below.



Control cable ducts



Not allowed unless the 24 V cable is insulated for 230 V or insulated with an insulation sleeving for 230 V.



Lead 24 V and 230 V control cables in separate ducts inside the cabinet.

Electrical installation

What this chapter contains

This chapter describes the electrical installation procedure of the ACS800-67.



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.



WARNING! During the installation procedure, the converter modules and the LCL filter module have to be temporarily extracted from the cabinet. The modules are heavy, and have a high centre of gravity. Be careful when manoeuvring the modules. In order to minimise the danger of toppling over, keep the support legs of the converter modules extended whenever manoeuvring outside the cabinet.

Checking the insulation of the assembly

Every converter has been tested for insulation between the main circuit and the chassis (2500 V rms 50 Hz for 1 second) at the factory.

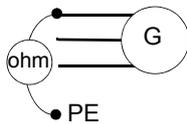
When checking the insulation of the assembly, proceed in the following manner.



WARNING! Check the insulation before connecting the converter to the supply. Make sure that the converter is disconnected from the grid.

Rotor cable

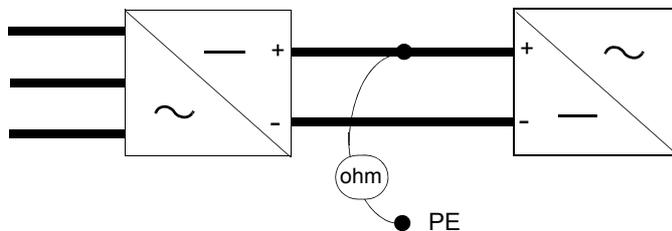
- Check that all rotor cables are disconnected from the converter output terminals.
- Measure the insulation resistances of the rotor cable and the rotor between each phase and the protective earth by using a measuring voltage of 1 kV DC. The insulation resistance must be higher than 1 Mohm.



$$R \geq 1 \text{ Mohm}$$

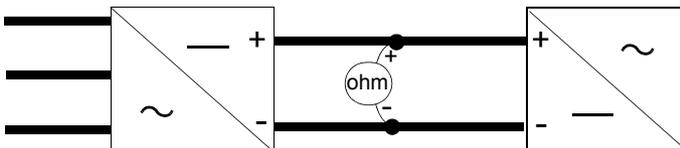
DC busbars

- Measure the resistance between each DC busbar and protective earth with a multimeter.



$$R \geq 100 \text{ k}\Omega$$

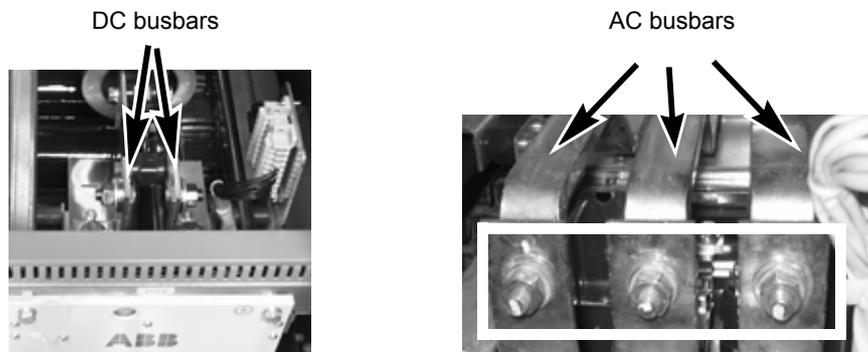
- Measure the resistance between the DC busbars with a multimeter.



$R = \infty$ or rises gradually, depending on multimeter type

DC and AC busbars

- Short circuit the L-shaped DC busbars of the converter modules.
- Short circuit the L-shaped AC busbars of the LCL filter module.



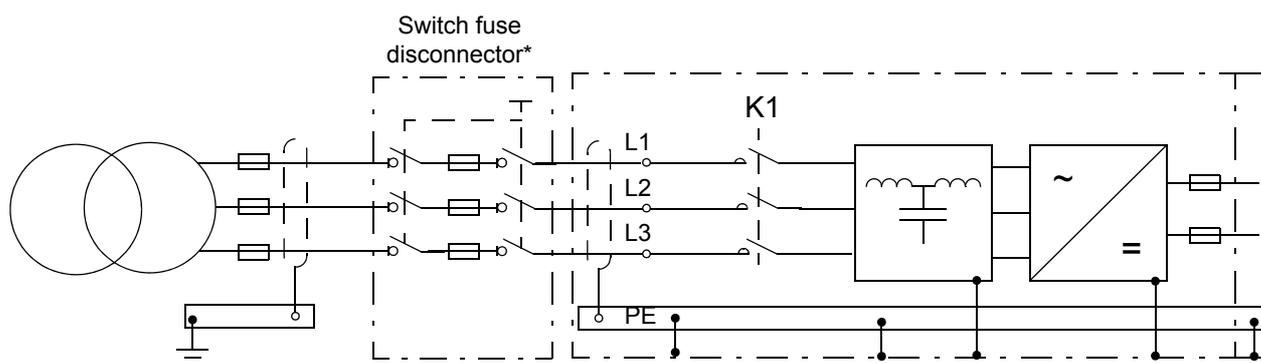
- Measure the insulation resistances between the DC busbars and the converter frame and between the AC busbars and the converter frame by using a measuring voltage of 1 kV DC. The insulation resistance must be higher than 1 Mohm.

Grid and rotor connections

Connection diagram

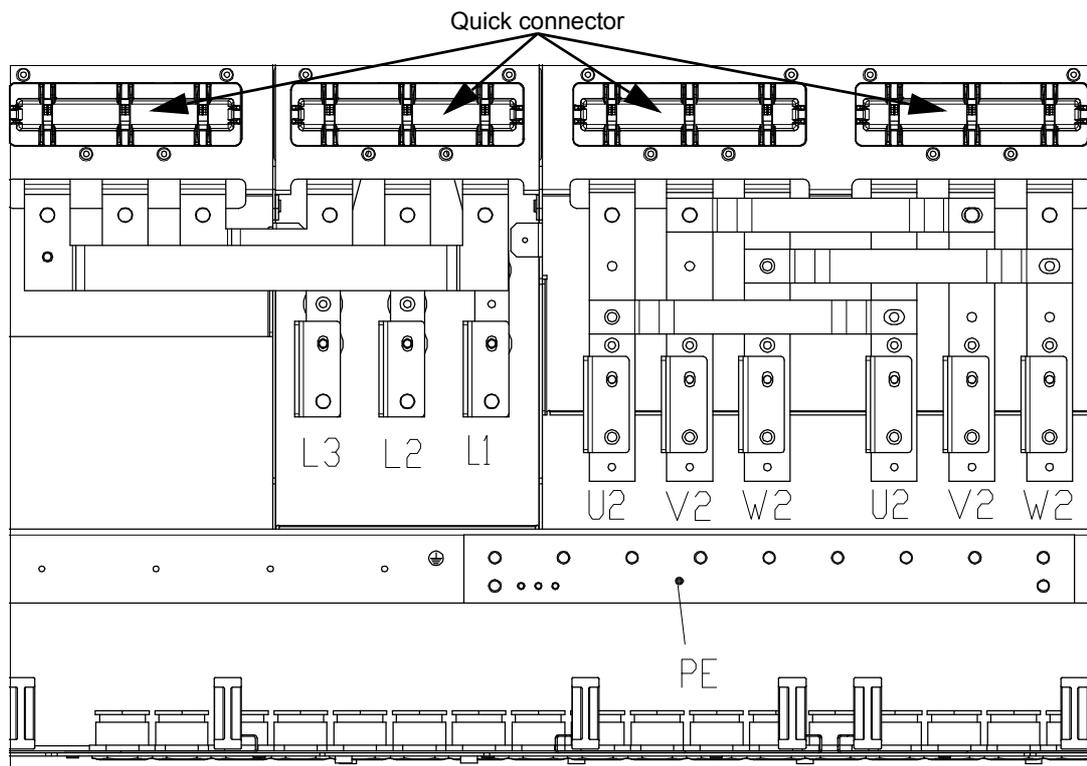
The diagram presents an example of the main connection diagram.

*The switch fuse disconnecter is not always included in the delivery!



The grid and the rotor connections are located behind the power modules. The following figure shows the connectors inside the cabinet.

Protective earth cable may be connected to PE busbar under any free bolt. Note that marked bolts are mounting bolts of the PE busbar and are not for connecting the PE cables.

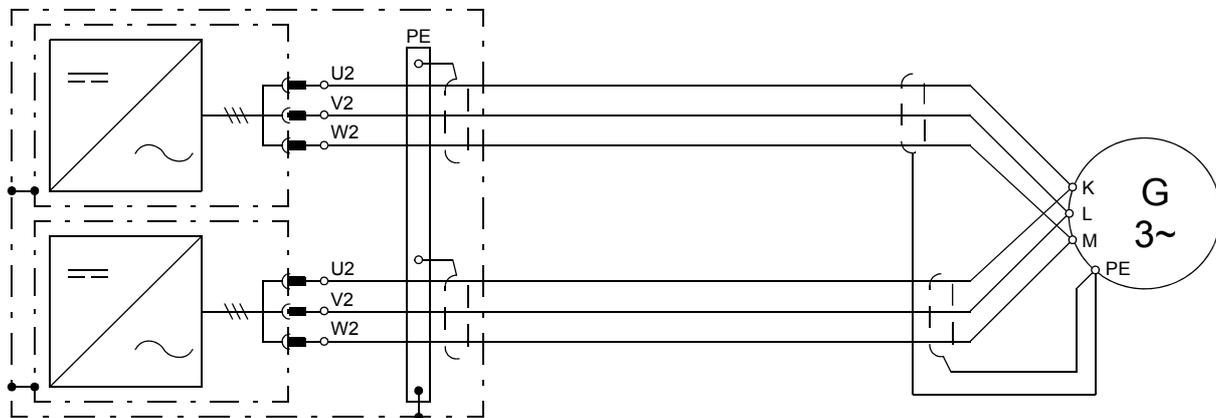


L1, L2, L3 = input busbars
U2, V2, W2 = output busbars

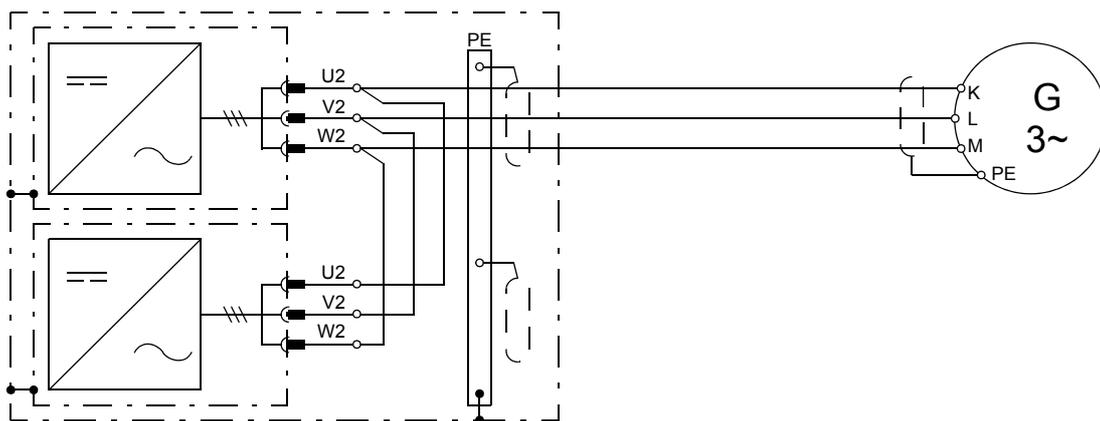
Rotor cabling example



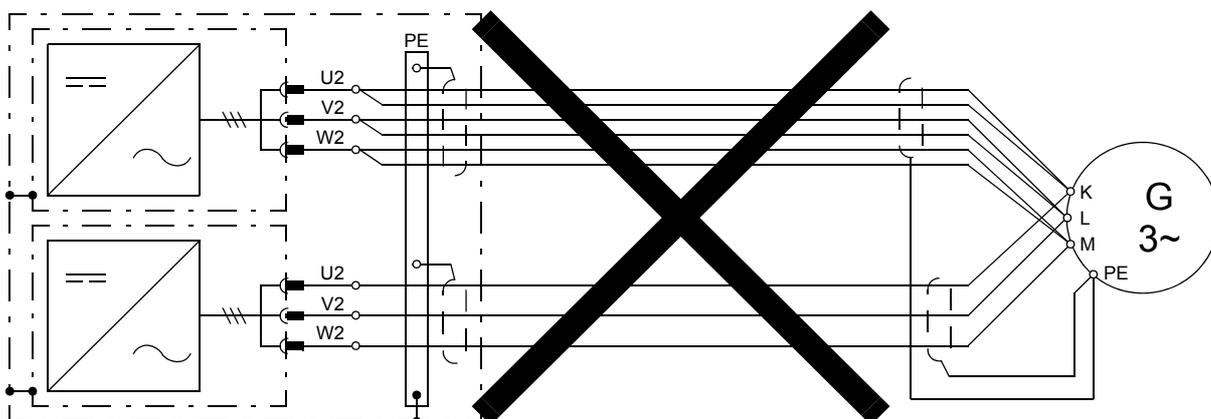
All rotor-side converter modules (two are shown below) are to be connected in parallel. It is recommended that the cabling from all rotor-side converter modules to the rotor is physically identical considering cable type, cross-sectional area, and length. Jumping the output cables from one rotor-side converter to another (and then to the rotor) is also possible, but not recommended.



Rotor-side converter modules



Rotor-side converter modules



Rotor-side converter modules

The recommended cable types are given in chapter [Planning the electrical installation](#).

Connection procedure



WARNING! Use extreme caution when manoeuvring a converter or filter module that runs on wheels. The modules are heavy and have a high centre of gravity. They topple over easily if handled carelessly.

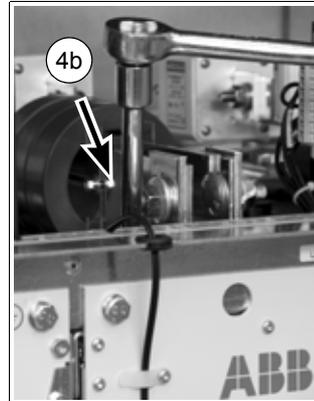
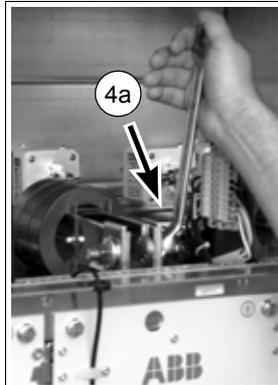
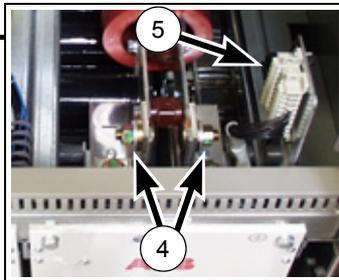


Extract each module from the cabinet as follows:

- (1) Open the cabinet doors.
- (2) Remove the shroud covering the upper part of the cabinet.

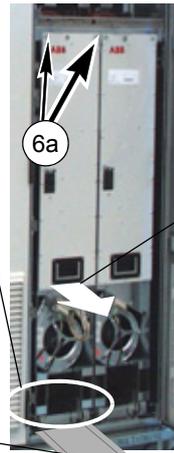
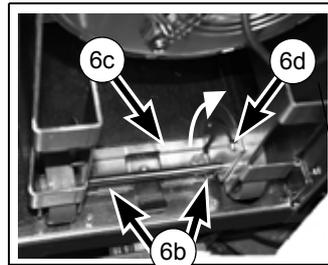
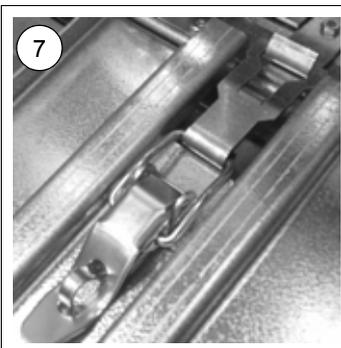
Converter modules:

- (3) Open the transparent cover on the front of the converter module and disconnect the fibre optic cables. Move the cables aside.
- (4) Disconnect the L-shaped DC busbars on top of the converter module: Loosen the two upper screws (4a), but leave them in place. Remove the two lower screws (4b).
- (5) Disconnect the socket terminal block next to the DC busbars.

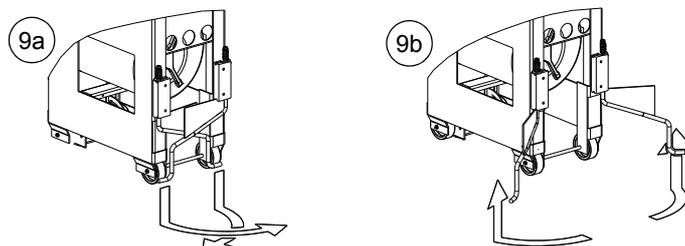


- (6) Remove the two module fastening screws (6a) at the top. At the base of the module, loosen the two fastening screws (6b) but leave them in place; lift the bracket (6c) to the up position and lock it with two screws (6d).

- (7) Latch the module ramp to the hook at the base of the cabinet.
- (8) Pull the module carefully out of the cabinet along the ramp. Make sure the wires do not catch.



(9) Extend the support legs of the module. Keep the legs extended until the module is about to be inserted back into the cabinet.



LCL filter module:

(10) Disconnect the L-shaped AC busbars on top of the filter module: Loosen the three upper screws (10a), but leave them in place. Remove the three lower screws (10b).

(11) Disconnect the socket terminal block next to the AC busbars.

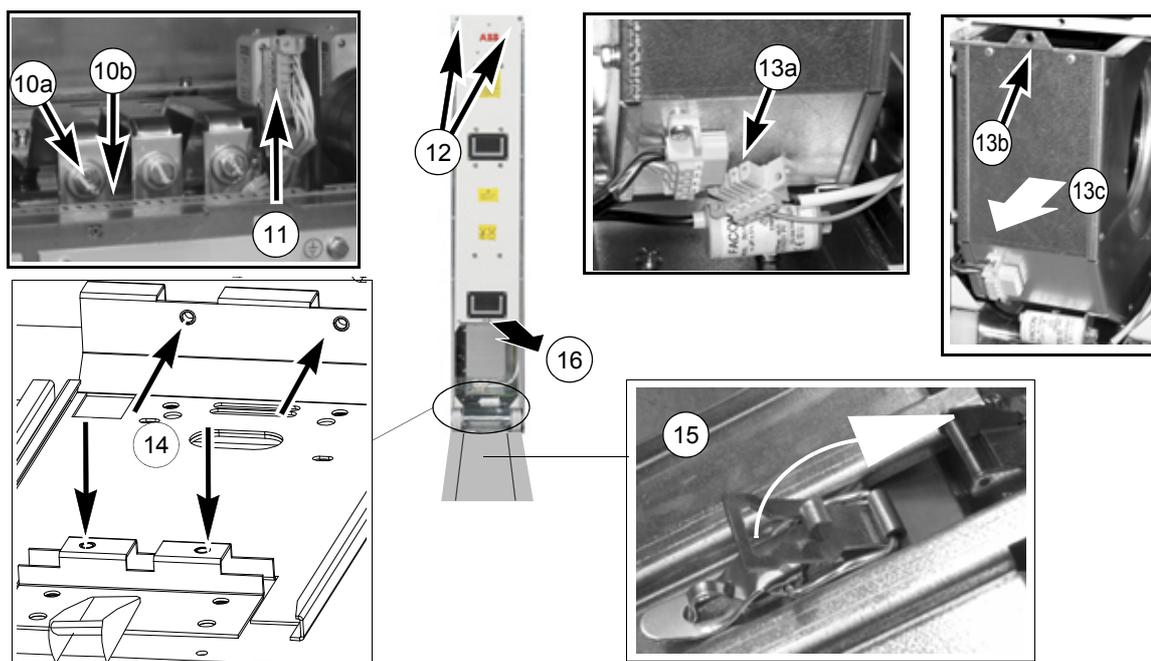
(12) Remove the two module fastening screws at the top.

(13) Remove the fan: Disconnect the fan wiring plug (13a). Remove the locking screw (13b). Pull the fan out along its sliding rails (13c).

(14) At the base of the module, remove the four fastening screws.

(15) Latch the module ramp to the hook at the base of the cabinet.

(16) Pull the module carefully out of the cabinet along the ramp.



Lead the cables into the cabinet.

Cut the cables to suitable length.

Strip the cables and conductors.

Twist the cable screens into bundles and connect to cabinet PE (ground) busbar.

Connect any separate ground conductors/cables to cabinet PE (ground) busbar.

Connect the phase conductors to the output (U2, V2, W2) and input (L1, L2, L3) terminals. See section [Cable terminals](#) in chapter [Technical data](#).

Insert each module into the cabinet as follows:

- (1) Move the module close to the ramp. With converter modules, retract the support legs of the module.
- (2) Push the module back into the cabinet.
- (3) Refasten the module fixing screws at the top. Reconnect the busbars and the cables (socket terminal block, fibre optic cables).
- (4) Remove the pull-out ramp.
- (5) With converter modules, flip the module fastening bracket into the down position and tighten the screws. With LCL filter module, fix the four fastening screws at the bottom of the filter module and reconnect the fan.
- (6) Replace the shroud covering the upper part of the cabinet.
- (7) Close the doors.
- (8) At the generator, connect the cables according to instructions from the generator manufacturer. Pay special attention to the phase order.

Control connections

The cabinet installed unit is controlled using the local control devices mounted in the sliding frame. See sections [Cabinet layout](#) and [Interboard connection diagram](#) in chapter [Hardware description](#). No additional control connections are needed. However, it is possible to:

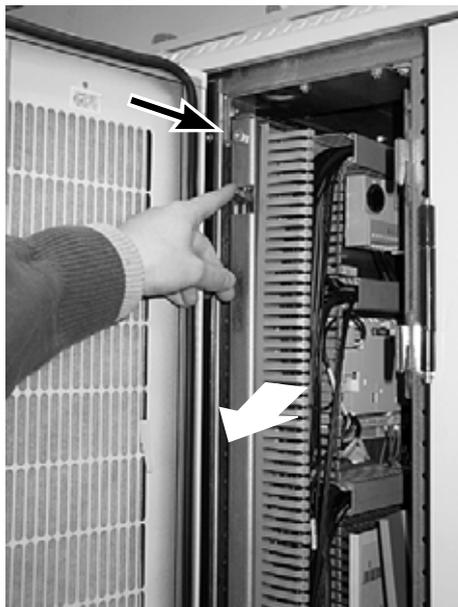
- halt the unit by an external emergency stop button (if the unit is equipped with a local emergency stop button, external buttons can be connected in series)
- read fault indications through a relay output
- communicate with the unit through a serial communication interface.

See the circuit diagrams delivered with the converter for the default control connections and the connection terminals.

To access the control unit:

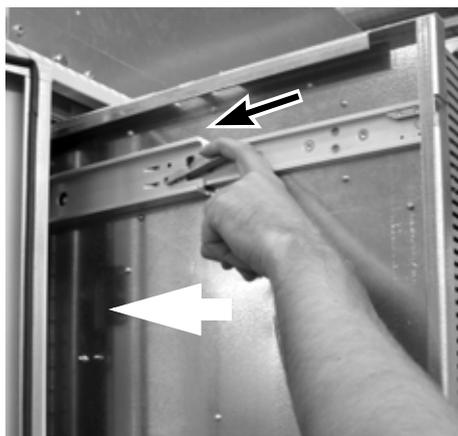
- Open the control unit cubicle door.
- Press down the knob on the side of the control unit and pull the unit out of the cubicle.
- The versions with a locking screw in the pull-out frame: remove the locking screw.

Note: When the converter is in operation the locking screw must be on its place.



To push the control unit back into the cubicle:

- press down the knob on the back of the unit.



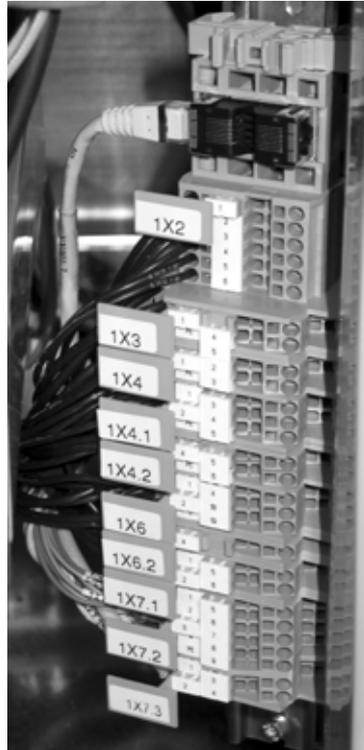
- Close the control unit cubicle door.

Connection procedure

- Lead the cables into the cabinet below the control unit. Wherever possible, use the existing cable trunking in the cabinet. Use sleeving wherever the cables are laid against sharp edges. Leave some slack in the cable (at the hinge) to allow the control unit to extend fully. Tie the cables to the braces to provide strain relief.
- Cut the cables to suitable length. Strip the cables and conductors.
- Twist the cable shields into bundles and connect them to the ground terminal nearest to the terminal block. Keep the unshielded portion of the cables as short as possible.
- Connect the conductors to appropriate terminals (see the circuit diagrams delivered with the unit).

Terminal strip

Connections to the wind turbine converter control system are made via 1X-terminal strip located in the bottom right wall of the control section.

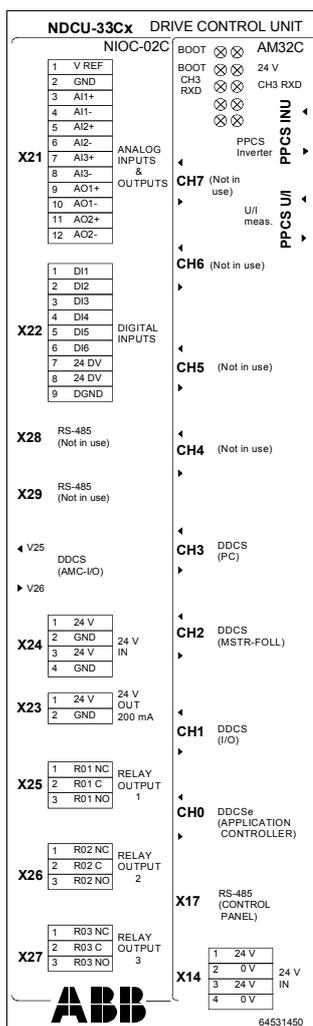


Terminal strip

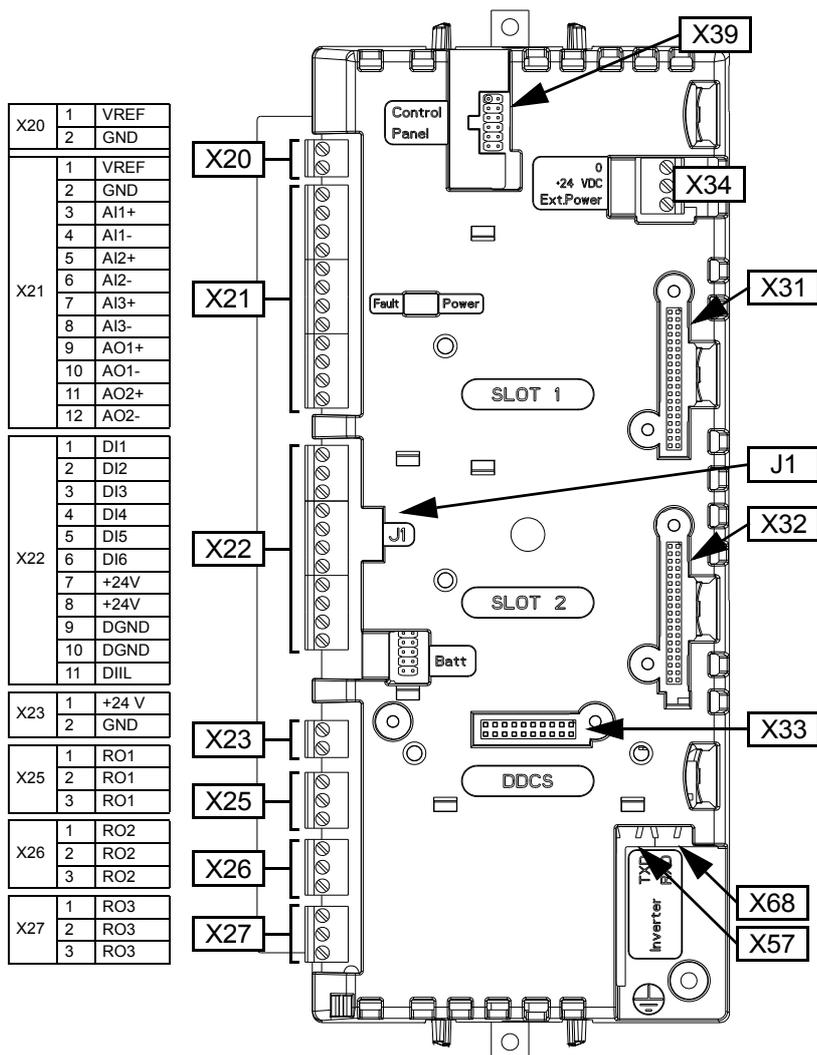
Control unit NDCU-33Cx/RDCU-12C

The connectors of the rotor-side converter control unit NDCU-33Cx (consisting of the NIOC-02C and AM33C boards) and the grid-side converter control unit RDCU-12C (containing the RMIO-12C board) are presented below. For further information on the RDCU control unit, see the document *RDCU-02(C) Drive Control Unit Hardware Manual* [3AFE64636324 [English]].

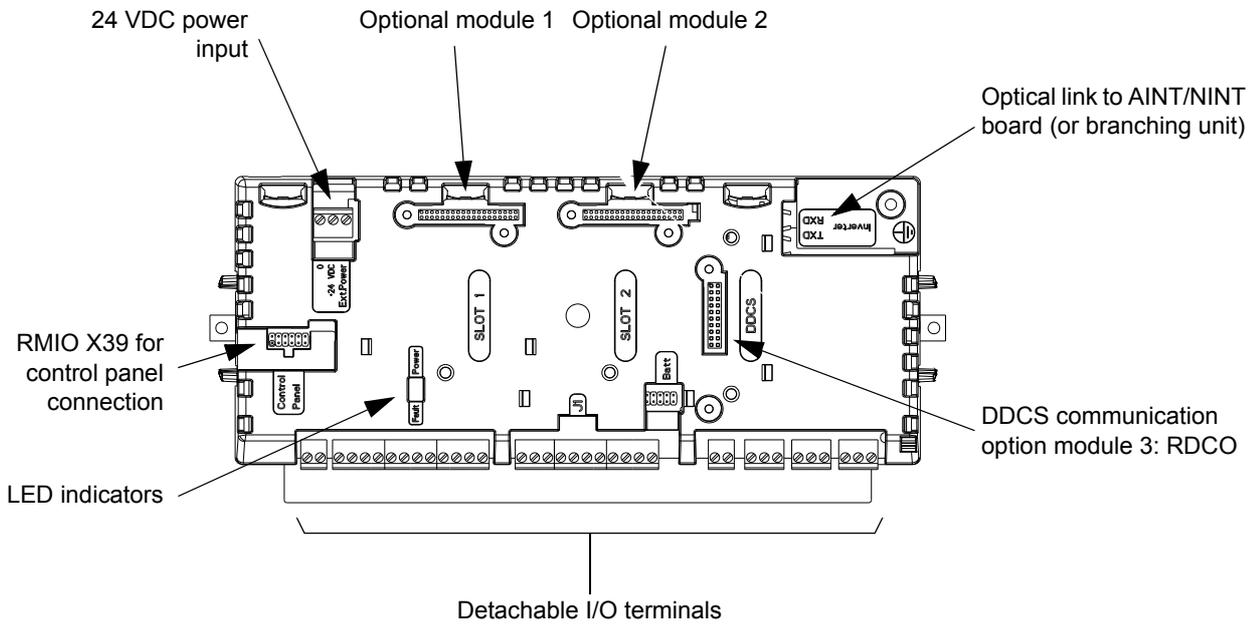
NDCU-33Cx



RDCU-12C

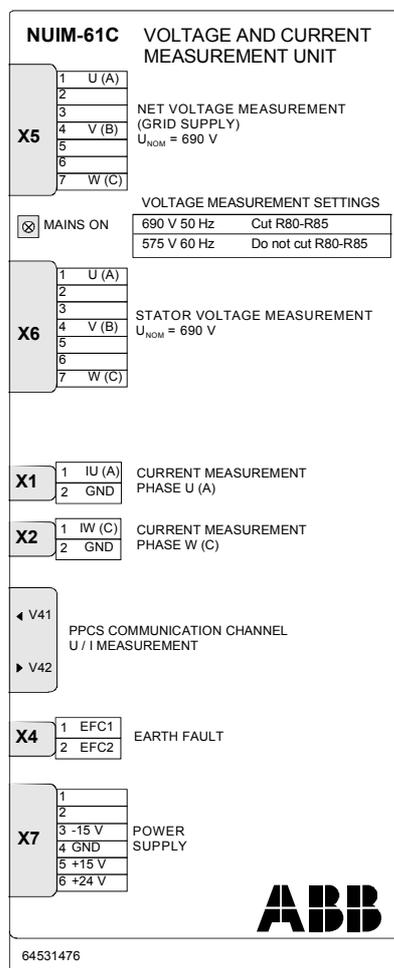


RDCU-12C



Voltage and Current Measurement Unit NUIM-61C/NUIM-10C

The connectors of the Voltage and Current Measurement Unit NUIM-61C are presented below. See *Cascade Generator Control Program for ACS800-67 Wind Turbine Drive Firmware Manual* [3AFE68392462 (English)] for more information.



- ❑ if there is a cable conduit below the cabinet, air flow from the conduit is prevented by plates around the cable entries.
 - ❑ there is no condensed humidity or ice anywhere on or inside the unit. If condensed humidity or ice is detected, use external heaters for evaporation.
 - ❑ the L-shaped DC busbar connections (of the converter modules) and their tightening torques are OK.
 - ❑ there is enough space between the two lower screws and bolts of the L-shaped DC busbars (of the converter modules) and the module frame. Use a mirror to check this.
The air gap must be > 13 mm.
-
- ❑ the X50 terminal connectors of the modules are in place and their connections are OK.
 - ❑ fibre optic cables are undamaged and their connections are OK (i.e. transmitters are connected to receivers and vice versa):
 - Blue cable is connected to the dark grey connector of the control unit.
 - Black cable is connected to the light grey connector of the control unit
 - ❑ the insulation resistances are OK. See chapter *Electrical installation: [Checking the insulation of the assembly.](#)*
 - ❑ the emergency stop cable connections are OK.
 - ❑ if other external cables are used, both ends of the cables are connected and the cables do not cause any damage or danger when the power is switched on.
 - ❑ all shrouds and covers are in place.

Start-up

What this chapter contains

This chapter describes the start-up procedure of the converter. The installation of the converter system must be checked before start-up. See chapter [Installation checklist](#).

Start-up procedure

Action	Additional information
 <p>WARNING! The work described in this chapter must only be carried out by a qualified electrician. The Safety instructions on the first pages of this manual must be followed. Negligence of the safety instructions can cause injury or death.</p> <p>WARNING! Ensure that the disconnecter of the supply transformer is locked out, i.e. no voltage is, or can be, connected to the converter system inadvertently. Check also by measuring that there is no voltage connected. Ensure that the stator of the generator is isolated from the supply. It is also highly recommended to close the mechanical brake of the generator.</p>	
<p>Basic checks with no voltage connected</p> <ul style="list-style-type: none"> <input type="checkbox"/> If the unit is equipped with an air circuit breaker, check the current trip limits of the breaker (preset at the factory). <i>General rule</i> Ensure the selectivity condition is fulfilled i.e. the breaker trips at a lower current than the protection device of the supplying network, and that the limit is high enough not to cause unnecessary trips during the intermediate DC circuit load peak at start. <i>Long term current limit</i> As a rule of thumb, this should be set to the rated AC current of the module. <i>Peak current limit</i> As a rule of thumb, this should be set to a value 3-4 times the rated AC current of the module. <input type="checkbox"/> Check the settings of the relays and breakers/switches of the auxiliary circuits. <input type="checkbox"/> Disconnect any unfinished or unchecked 230/115 VAC cables that lead from the terminal blocks to the outside of the equipment. <input type="checkbox"/> Check the means of stopping the machinery. Can the rotation of the driven machine be stopped if necessary? Check the mechanical brakes. <input type="checkbox"/> Write down the following data on the converter system for later use. Note down any deviations from delivery documents. <ul style="list-style-type: none"> • Generator, pulse encoder and cooling fan rating plate data • Maximum and minimum speeds • Speed scaling factor, gear ratio, etc. • Acceleration and deceleration times • Inertia compensation 	<p>Optional device. See the circuit diagrams delivered with the converter.</p> <p>Optional devices. See the circuit diagrams delivered with the converter.</p>

Action	Additional information
<input type="checkbox"/> Check that circuit breakers and protection switches in the cooling fan supply circuit are closed. <input type="checkbox"/> Locate the PPCS branching unit (APBU-xx). Enable memory backup battery by setting actuator 6 of switch S3 to ON. (Only with parallel connected rotor-side modules.)	<p>See the circuit diagrams delivered with the converter.</p> <p>By default, memory backup is switched off to save the battery.</p>
<p>Connecting voltage to input terminals and auxiliary circuit</p>  <p>WARNING! When voltage is connected to the input terminals, voltage may also be connected to the auxiliary circuits of the converter.</p> <p>WARNING! Never remove or insert the DC fuses of the converter's DC link when the main contactor is closed (DC busbar is live).</p> <p>Make sure that it is safe to apply voltage. Ensure that</p> <ul style="list-style-type: none"> • nobody is working on the unit or circuits that are wired from outside into the cabinets • cabinet doors are closed. <input type="checkbox"/> Disconnect the auxiliary voltage cables that lead from the terminal blocks to the outside of the equipment and have not yet been checked. Also disconnect any uncompleted wiring. <input type="checkbox"/> Disconnect the communication link between the converter system and any overriding system. <input type="checkbox"/> Make sure the main contactor / air circuit breaker cannot be switched on inadvertently by remote control. <input type="checkbox"/> Be ready to trip the main breaker of the supply transformer in case something abnormal occurs. <input type="checkbox"/> Close the main breaker of the supply transformer. <input type="checkbox"/> Close the auxiliary circuit On/Off switch.	<p>See the circuit diagrams delivered with the converter.</p> <p>The input terminals of the converter system are now energised.</p> <p>The auxiliary voltage circuit is now energised.</p>
<p>Starting the supply unit</p> <input type="checkbox"/> If the converter is equipped with an input fuse cubicle (optional), close the fuse switches. <input type="checkbox"/> Close the supply (rectifier) unit switch disconnecter. <input type="checkbox"/> Close the contactor and start the supply unit.	<p>Optional devices. See the circuit diagrams delivered with the converter.</p> <p>On units with line contactors, the supply unit charges the contactor control capacitors (3 s at first start). The supply unit performs a fault status check.</p> <p>See appropriate <i>Firmware manual</i>.</p>
<p>Application program set-up</p> <input type="checkbox"/> Follow the instructions in the appropriate <i>Firmware Manual</i> to start-up the converter and to set the converter parameters.	
<p>On-load checks</p> <input type="checkbox"/> Check that the cooling fans of the grid-side and rotor-side converter modules rotate freely in the right direction. <input type="checkbox"/> Check that the LCL filter module fan rotates freely clockwise. <input type="checkbox"/> Check the correct operation of the emergency stop circuits from each operating location.	<p>The fan rotates noiselessly in the direction the arrow on the fan cover points to (clockwise).</p> <p>The fan runs noiselessly.</p>

Maintenance

What this chapter contains

This chapter contains a table of maintenance intervals, maintenance instructions, and the descriptions of LEDs.

Safety instructions



Only a qualified electrician is allowed to perform the maintenance.

Before starting work inside the converter system,

- isolate the stator of the generator and the supply line input of the ACS800-67 from the supply grid. It is also highly recommended that the rotor of the generator is locked with a mechanical brake
- switch off any voltages connected to the I/O terminals
- wait for 5 minutes to let the intermediate circuit capacitors discharge
- open the cabinet doors
- ensure there is no dangerous voltage present by measuring the voltage of the input terminals and the intermediate circuit terminals.

Maintenance intervals

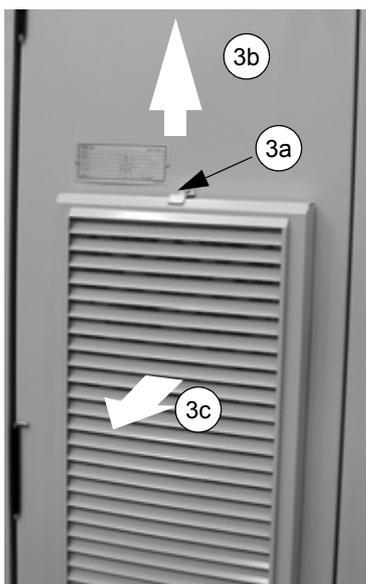
If installed in an appropriate environment, the converter requires very little maintenance. This table lists the routine maintenance intervals recommended by ABB.

Interval	Maintenance action	Instruction
Every 6 to 12 months (depending on dustiness of environment)	Heatsink temperature check and cleaning	See section Heatsinks .
6 months after commissioning and every 2 years thereafter	Checking the tightness of the connections at the terminal strip	
Every year	Air filter replacement	See section Checking and replacing the air filters .
Every 3 years	Power connections check and cleaning	See section Power connections .
Every 6 years	Cooling fan change	See section Cooling fans .
Every 6 years	APBU branching unit - Memory backup battery renewal (Only with parallel connected rotor-side modules.)	Locate the APBU unit. Switch off the power to the unit. Remove cover. Replace battery with a new CR 2032 battery.

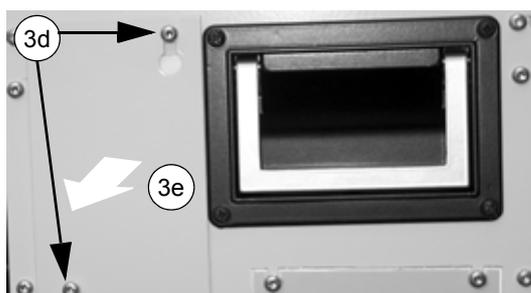
Checking and replacing the air filters

1. Read and repeat the steps in *Safety instructions* above.
2. Open the cabinet doors.
3. Check the air filters and replace if necessary (see chapter *Technical data* for the correct filter types).

The inlet (door) filters can be accessed by removing the fastener(s) at the top of the grille (3a), then lifting the grille (3b) and pulling it away from the door (3c).



The module air filter can be accessed by removing the screws (3d) and then pulling out the air filter (3e).



4. Check the cleanliness of the cabinet. Clean the interior of the cabinet if necessary using a soft brush and a vacuum cleaner.
5. Close the cabinet doors.

Power connections



WARNING! Use extreme caution when manoeuvring a converter or filter module that runs on wheels. The modules are heavy and have a high centre of gravity. They topple over easily if handled carelessly.

1. Read and repeat the steps in [Safety instructions](#) above.
2. Open the cabinet doors.
3. Extract one module from the cabinet as described in section [Connection procedure](#) in chapter [Electrical installation](#).
4. Check the tightness of the cable connections at the quick connector. Use the tightening torque table in chapter [Technical data](#).
5. Clean all contact surfaces of the quick connector and apply a layer of suitable joint compound (e.g. Isoflex® Topas NB 52 from Klüber Lubrication) onto them.
6. Re-insert the module.
7. Repeat steps 3 to 6 for all remaining modules.

Cooling fans

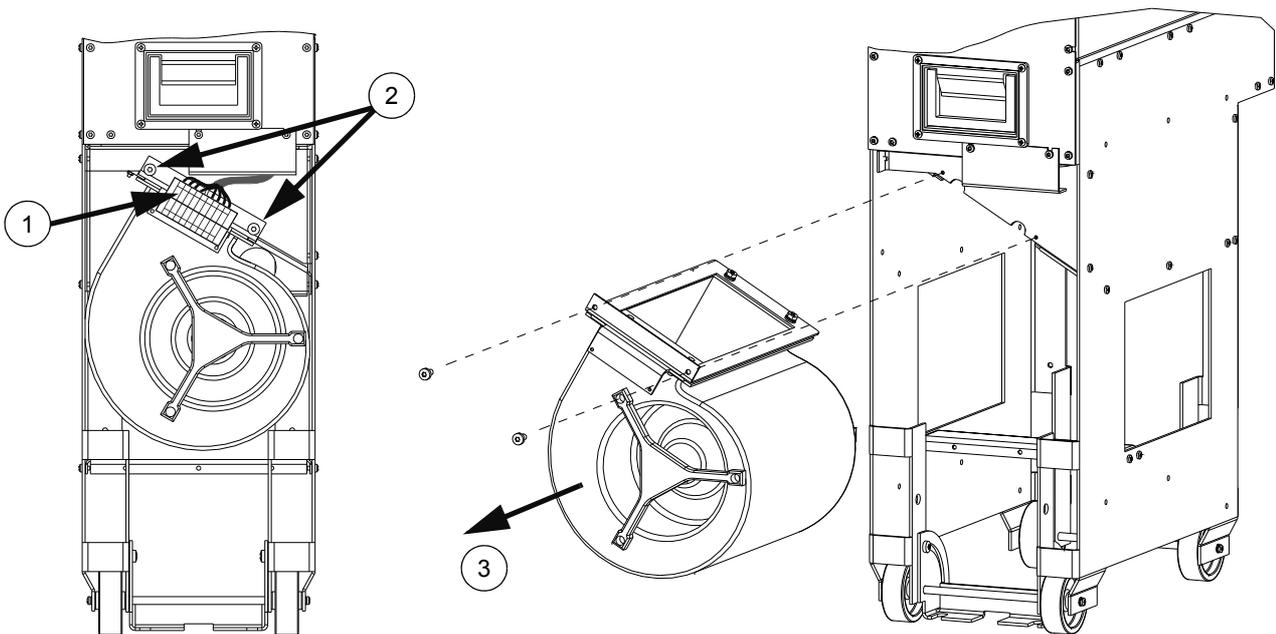
The cooling fan lifespan depends on the running time of the fan, ambient temperature and dust concentration. Each module has its own cooling fan. Replacements are available from ABB. Do not use other than ABB specified spare parts.

The application program keeps track of the running time of the cooling fan of the line-side converter modules. See appropriate *Firmware Manual* for the actual signal which indicates the running time.

Fan failure can be predicted from increased noise from fan bearings and gradual rise in the heatsink temperature in spite of heatsink cleaning. Fan replacement is recommended once these symptoms appear.

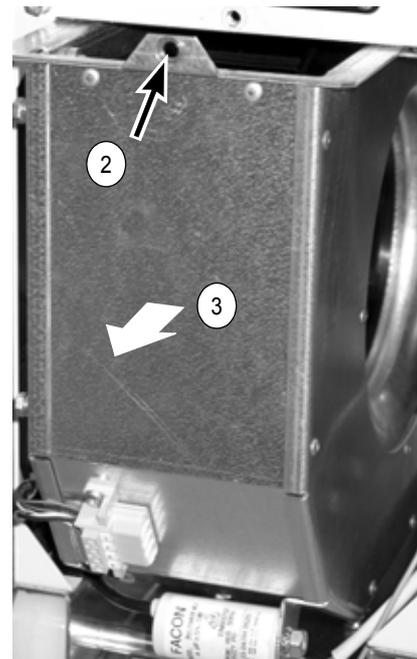
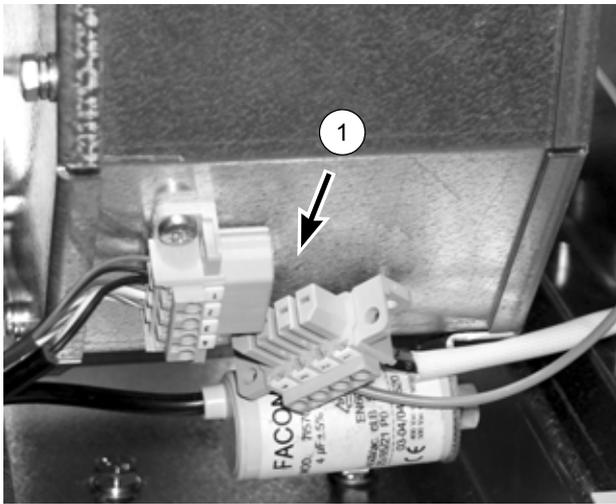
Converter module fan replacement

1. Read and repeat the steps in [Safety instructions](#) above.
2. Open the cabinet doors.
3. Disconnect the fan wiring plug (1).
4. Remove the locking screws (2).
5. Pull the fan out along its sliding rails (3).
6. Install a new fan in reverse order.



LCL filter fan replacement

1. Read and repeat the steps in [Safety instructions](#) above.
2. Open the cabinet doors.
3. Disconnect the fan wiring plug (1).
4. Remove the locking screw (2).
5. Pull the fan out along its sliding rails (3).
6. Install a new fan in reverse order.



Heatsinks

The heatsink fins of the power modules pick up dust from the cooling air. The module runs into overtemperature warnings and faults if the heatsinks are not clean. In a “normal” environment (not especially dusty nor clean) the heatsinks should be checked annually, in a dusty environment more often.

Whenever necessary, clean the heatsinks as follows:

1. Remove the cooling fan (see section [Cooling fans](#)).
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 the dust from entering adjoining equipment.
3. Refit the cooling fan.

Capacitors

The converter modules employ several film capacitors. The lifespan depends on the operating time of the converter, loading and ambient temperature. Capacitor life can be prolonged by lowering the ambient temperature.

It is not possible to predict 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.

Capacitor replacement

Contact an ABB service representative.

Other maintenance actions

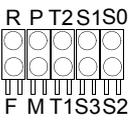
Power module replacement

To replace converter modules, follow the instructions on module removal and refitting given in section [Connection procedure](#) in chapter [Electrical installation](#).

LEDs

This table describes the LEDs.

Location	LED	When LED is lit
RMIO-12		
V30	Red	Converter in fault state
V22	Green	The 5 V power supply on the board is OK.
Control panel mounting platform		
	Red	Converter in fault state
	Green	The main 24 VDC power supply for the control panel and the RMIO board is OK.
AINT-14		
V203	Green	The 5 V power supply on the board is OK.
V309	Green	Converter operation is enabled.
V310	Red	Prevention of unexpected start is ON.
V311	Green	The 24 V power supply for the gate drivers is OK.
AITF-01C*		
V203	Green	The 5 V power supply on the board is OK.
V309	Green	Converter operation is enabled.
V310	Red	Prevention of unexpected start is ON.
V311	Green	The 24 V power supply for the gate drivers is OK.
AFIN-01		
V13	Green	The 5 V power supply on the board is OK.
V14	Green	The converter is running.
V15	Yellow	Motor thermal switch is active (open).
V16	Red	Motor overcurrent
APOW-11		
V16	Green	The 24 V output voltage is ON.

AMC-33**			
	F	Red	Internal fault: LED is on during program boot.
	R	Green	Not in use with the current software version
	M	Green	RESET signal is ON.
	P	Green	Auxiliary voltage is OK.
	T1...T2	Yellow	DDCC channels CH0 (T1) and CH3 (T2) are receiving data.
	S0	Yellow (blinking)	Application program is running.
	S1	Yellow	Not in use with the current software version
APBU-44			
	V18 A (upper)	Green	The 3.3 V power supply voltage is OK.
	V18 B (lower)	Green	Backup battery voltage is OK. LED does not indicate missing battery or the OFF state of the battery ON/OFF switch in APBU board revision D or earlier.
	V19 A (upper)	Yellow	Master channel (CNTL) is sending data.
	V19 B (lower)	Yellow	Master channel (CNTL) is receiving data.
NPBU-42			
	V5	Green	The 5 V logic voltage is OK. (RESET is inactive.)
	V13	Green	AMC channel is receiving data.
	V8	Green	AMC channel is sending data.
	V20-23	Green	INT channel CH1...4 is receiving data.
	V18	Red	Internal configuration fault
	V24, V26	Red	For test use only

* Located on the active crowbar unit ACBU-A1.

**Located on the NDCU-33 unit.

Technical data

What this chapter contains

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

Converter and filter module types

The ACS800-67 wind turbine converter types are listed in the following table.

ACS800-67	Grid-side converter		Rotor-side converter		LCL filter
	Type	Frame size	Type	Frame size	Type
-0480/0580-7	ACS800-104-0580-7	R8i	ACS800-104-0580-7	R8i	ALCL-1x-x
-0480/0770-7	ACS800-104-0580-7	R8i	ACS800-104-0770-7	2xR8i	ALCL-1x-x
-0480/1160-7	ACS800-104-0580-7	R8i	ACS800-104-1160-7	2xR8i	ALCL-1x-x

IEC ratings

The IEC ratings for the ACS800-67 with 50 Hz and 60 Hz supplies are given below. The symbols are described below the table.

Grid-side converter IEC ratings

ACS800-104	Frame size	Nominal ratings				No overload use	Light overload use		Heavy duty use		Heat dissipation kW
		$I_{cont,max}$ A (AC)	$I_{cont,max}$ A (DC)	I_{max} A (DC)	S_N kVA	$P_{cont,max}$ kW (DC)	I_{2N} A (DC)	P_N kW (DC)	I_{2hd} A (DC)	P_{hd} kW (DC)	
Three-phase supply voltage: 690 V											
-0580-7	R8i	400	485	726	478	473	466	454	363	354	14.6

* Including an ALCL-15-7 LCL filter.

Rotor-side converter IEC ratings

ACS800-104	Frame size	Nominal ratings		No overload use	Light overload use		Heavy duty use		Heat dissipation kW
		$I_{cont,max}$ A (AC)	I_{max} A (AC)	$P_{cont,max}$ kW (AC)	I_{2N} A (AC)	P_N kW (AC)	I_{2hd} A (AC)	P_{hd} kW (AC)	
Three-phase supply voltage: 690 V									
-0580-7	R8i	486	727	450	467	450	364	315	7.4
-0770-7	2xR8i	645	965	605	620	605	482	384	10.0
-1160-7	2xR8i	953	1425	900	914	900	713	630	14.4

Symbols

Nominal ratings

$I_{\text{cont.max}}$ Continuous rms output current. No overloadability at 40°C.

I_{max} Maximum output current. Allowable for 10 seconds at start, otherwise as long as allowed by converter temperature.

Typical ratings for no overload use

$P_{\text{cont.max}}$ Typical converter output power.

Typical ratings for light overload use (10% overloadability)

I_{2N} Continuous rms current. 10% overload is allowed for 1 minute every 5 minutes.

P_N Typical converter output power.

Typical ratings for heavy duty use (50% overloadability)

I_{2hd} Continuous rms current. 50% overload is allowed for 1 minute every 5 minutes.

P_{hd} Typical converter output power.

Derating

The load capacity (current and power) decreases if the installation site altitude exceeds 1000 metres (3300 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 by 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 $100\% - 1 \frac{\%}{^{\circ}\text{C}} \cdot 10^{\circ}\text{C} = 90\%$ or 0.90. The output current is then $0.90 \times I_{2N}$ or $0.90 \times I_{2hd}$.

Note: $I_{\text{cont.max}}$ rating is not allowed above 40°C (104°F).

Altitude derating

At altitudes from 1000 to 4000 m (3300 to 13123 ft) above sea level, the derating is 1% for every 100 m (328 ft). 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 representative or office for further information.

Dimensions, noise, cooling characteristics of the modules

Unit	Frame size	Height mm (in.)	Width mm (in.)	Depth mm (in.)	Weight kg (lbs)	Noise level dBA	Air flow m ³ /h (ft ³ /min)
Grid-side converter	R8i	1397 (55)	235 (9.5)	596 (23.46)	150 (330)	72	1280 (750)
Rotor-side converter	R8i	1397 (55)	235 (9.25)	596 (23.46)	150 (330)	72	1280 (750)
Rotor-side converter	2×R8i	1397 (55)	2×235 (2×9.25)	596 (23.46)	300 (660)	74	2560 (1510)
LCL filter (ALCL-1x-x)	-	1397 (55)	240 (9.45)	199 (7.83)	180 (397)	-	400 (236)

See also delivery specific dimensional drawings.

Main AC fuses

The main AC fuses are optional and must be installed separately. Suitable Bussmann types are listed below. Equivalent fuses from other manufacturers can also be used.

ACS800-67- type	AC Fuses (aR)					
	I_N A	U_N V	Quantity	Type	Fuse size	ABB code
$U_N = 690$ V (Range 525 - 690 V)						
0480/0580-7	630	690	3	170M6810	DIN3	68301572

DC fuses

The DC fuses (manufactured by Bussmann) used in the ACS800-67 are listed below. Any blown fuses must be replaced with an identical type. U_N and I_N are the nominal voltage and current of the fuse.

Grid-side converter DC fuses

ACS800-67- type	DC Fuses (aR)					
	I_N A	U_N V	Quantity	Type	Fuse size	ABB code
$U_N = 690$ V (Range 525 - 690 V)						
0480/0580-7 0480/0770-7 0480/1160-7	800	1000	2	170M8637	DIN3	68327440

Rotor-side converter DC fuses

ACS800-67- type	DC Fuses (aR)					
	I_N A	U_N V	Quantity	Type	Fuse size	ABB code
$U_N = 690$ V (Range 525 - 690 V)						
0480/0580-7	1000	1000	2	170M8639	DIN3	68327431
0480/0770-7	700	1000	4	170M8636	DIN3	68327458
0480/1160-7	1000	1000	4	170M8639	DIN3	68327431

Power consumption of auxiliary devices

Boards

Type	U_n V DC	U_n V AC	f Hz	I_n A	I_{max} A
APBU-44	24	–	–	0.2	–
NPBU-42	24	–	–	0.2	0.235

Filter

Filter type	Type	U_n V AC	f Hz	I_n A
ALCL_1x_xx	R2E225-PD-92-12	230	50	0.78
		230	60	1.12

Cable terminals

DC input and motor cable terminal sizes and tightening torques are given below.

Cable terminals	Screw size	Tightening torque
DC terminals	M12 Max. intrusion into module: 20 mm (0.8 in.)	50 N·m (37 lbf·ft)
Input and output busbars (U2, V2, W2, L1, L2, L3)	M12	70 N·m (52 lbf·ft)

Input power connection

Voltage (U_1)	525/550/575/600/660/690 VAC 3-phase $\pm 10\%$
Frequency	48 to 63 Hz, maximum rate of change 17 %/s US and Canada: The converter is suitable for use on a circuit capable of delivering not more than 65,000 symmetrical amperes (rms) at 600 V maximum.

Rotor connection

Voltage (U_2)	0 to U_1 , 3-phase symmetrical, U_{\max} 750 V
Frequency	0 to 100 Hz
Current	See section IEC ratings .

Switching frequency 2 kHz (average)

Efficiency

Approximately 98% at nominal power level

Cooling

Method Internal fans, flow direction from bottom to top

Filter material

Converter module air filter	Elpis OY ELSU-W-F6-400X65-94	
Control section air filter (door)	AIR-TEX G-150540X170	
	Inlet (door)	Outlet*
IP23 cabinet	Lufffilter airTex G150	–
IP54 cabinet	Lufffilter airComp 300-50	Lufffilter airTex G150
*Outlet filter is not always included in the delivery.		

Free space around the unit See section [Free space requirements](#).

Cooling air flow See section [IEC ratings](#).

Degrees of protection

IP23; IP54R (with air outlet duct)

Ambient conditions

Environmental limits for the converter are given below. The converter 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 Derating]	-	-
Air temperature	-15 to +50°C (5 to 122°F). See section Derating .	-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

Cabinet	Hot-dip zinc-coated sheet steel with polyester thermosetting powder coating on visible surfaces.
Busbars	Tin- or silver-plated copper
Fire safety of materials (IEC 60332-1)	Insulating materials and non-metallic items mostly self-extinctive
Packaging	Frame: Wood or plywood. Plastic wrapping: PE-LD. Bands: PP or steel.
Disposal	<p>The converter 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 representative.</p>

Free space requirements

Front: Make sure there is enough room for the doors to open fully. Allow for room for module extraction and insertion.

Rear: 500 mm (20 in.) from the rear air outlet.

Left/Right: None; however, there should be enough room for the leftmost and/or rightmost cabinet doors to open fully.

Top: 600 mm (23.5 in.) above the basic roof level of the cabinet.

Applicable standards

	The wind turbine converter complies with the standards below. The compliance with the European Low Voltage Directive is verified according to standards EN 61800-5-1 and EN 60204-1.
• EN 60204-1:2006	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
• EN 60529:1991	Degrees of protection provided by enclosures (IP code)
• IEC 60664-1:2007	Insulation coordination for equipment within low-voltage systems. Part 1: Principles, requirements and tests.
• IEC 61400-1:2005	Wind turbines. Part 1: design requirements
• EN 61800-3:2004	Adjustable speed electrical power drive systems. Part 3: EMC requirements and specific test methods
• EN 61800-5-1:2003	Adjustable speed electrical power drive systems. Part 5-1: Safety requirements – electrical, thermal and energy.
• NEMA 250:2003	Enclosures for Electrical Equipment (1000 Volts Maximum)
• UL 508C:2008	Power Conversion Equipment

CE marking

A CE mark is attached to the wind turbine converter to verify that the unit follows the provisions of the European Low Voltage and EMC Directives.

Compliance with the Low Voltage Directive

The compliance with the European Low Voltage Directive has been verified according to standard EN 61800-5-1 and applicable parts of standard EN 60204-1.

Compliance with the EMC Directive

The EMC Directive defines the requirements for immunity and emissions of electrical equipment used within the European Union. The EMC product standard EN 61800-3 covers requirements stated for drives.

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.

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

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

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

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

Compliance with EN 61800-3 (2004), category C3

The wind turbine converter complies with the standard with the following provisions:

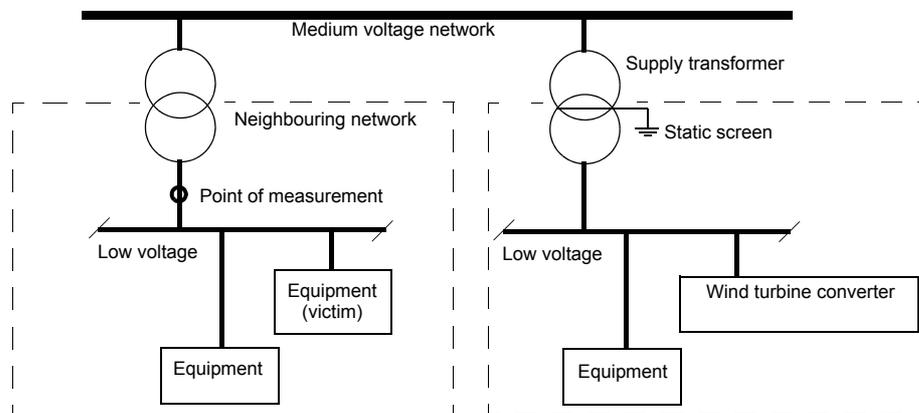
1. The generator and control cables are selected as specified (recommended cable types) in the *Hardware Manual*.
2. The wind turbine converter is installed according to the instructions given in the *Hardware Manual*.
3. Maximum cable length is 100 metres.

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

Compliance with EN 61800-3 (2004), category C4

If the provisions under [Compliance with EN 61800-3 \(2004\), category C3](#) cannot be met, the requirements of the standard can be met as follows:

1. It is ensured that no excessive emission is propagated to neighbouring low-voltage networks. In some cases, the natural suppression in transformers and cables is sufficient. If in doubt, the supply transformer with static screening between the primary and secondary windings can be used.



2. An EMC plan for preventing disturbances is drawn up for the installation. A template is available from the local ABB representative.
3. The generator and control cables are selected as specified in the *Hardware Manual*.
4. The wind turbine converter is installed according to the instructions given in the *Hardware Manual*.

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

Compliance with the Machinery Directive

The wind turbine converter complies with the European Union Machinery Directive requirements for a partly completed machinery. The declaration of incorporation is available from ABB.

UL marking

The wind turbine converter is UL marked:

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

The converter is to be used in a heated indoor controlled environment. See section [Ambient conditions](#) for specific limits.

For installation in the United States, branch circuit protection must be provided in accordance with National Electric Code (NEC) and any applicable local codes. The fuses recommended by ABB fulfil the NEC requirements.

For installation in Canada, branch circuit protection must be provided in accordance with Canada Electric Code and any applicable provincial codes. The fuses recommended by ABB fulfil the requirements of Canada Electric Code.

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 converter 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.

This is the sole and exclusive warranty given by the manufacturer with respect to the equipment and is in lieu of and excludes all other warranties, express or implied, arising by operation of law or otherwise, including, but not limited to, any implied warranties of merchantability or fitness for a particular purpose.

If you have any questions concerning your ABB converter, 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 patents

This product is protected by one or more of the following US patents:

4,920,306	5,301,085	5,463,302	5,521,483	5,532,568	5,589,754
5,612,604	5,654,624	5,799,805	5,940,286	5,942,874	5,952,613
6,094,364	6,147,887	6,175,256	6,184,740	6,195,274	6,229,356
6,252,436	6,265,724	6,305,464	6,313,599	6,316,896	6,335,607
6,370,049	6,396,236	6,448,735	6,498,452	6,552,510	6,597,148
6,600,290	6,741,059	6,774,758	6,844,794	6,856,502	6,859,374
6,922,883	6,940,253	6,934,169	6,956,352	6,958,923	6,967,453
6,972,976	6,977,449	6,984,958	6,985,371	6,992,908	6,999,329
7,023,160	7,034,510	7,036,223	7,045,987	7,057,908	7,059,390
7,067,997	7,082,374	7,084,604	7,098,623	7,102,325	7,109,780
7,164,562	7,176,779	7,190,599	7,215,099	7,221,152	7,227,325
7,245,197	7,250,739	7,262,577	7,271,505	7,274,573	7,279,802
7,280,938	7,330,095	7,349,814	7,352,220	7,365,622	7,372,696
7,388,765	7,408,791	7,417,408	7,446,268	7,456,615	7,508,688
7,515,447	7,560,894	7,589,984	7,652,602	7,670,163	7,671,548
7,679,425	7,688,845	D503,931	D510,319	D510,320	D511,137
D511,150	D512,026	D512,696	D521,466	D541,743S	D541,744S
D541,745S	D548,182S	D548,183S	D573,090S		

Declaration of incorporation



Declaration of Incorporation

(According to Machinery Directive 2006/42/EC)

Manufacturer: ABB Oy
Address: P.O Box 184, FIN-00381 Helsinki, Finland. Street address: Hiomotie 13,

herewith declare under our sole responsibility that the frequency converter series with type marking:

ACS800-67

ACS800-77

is intended to be incorporated into machinery or to be assembled with other machinery to constitute machinery covered by Machinery Directive 2006/42/EC and relevant essential health and safety requirements of the Directive and its Annex I have been complied with.

The technical documentation is compiled in accordance with part B of Annex VII, the assembly instructions are prepared according Annex VI and the following harmonised European standard has been applied:

EN 60204-1:2006 + A1:2009

Safety of machinery - Electrical equipment of machines- Part 1: general requirements

The person authorised to compile the technical documentation:

Name: Kimmo Heinonen
Address: P.O Box 184, FIN-00381 Helsinki, Finland

The equipment referred in this Declaration is in conformity with Low voltage directive 2006/95/EC and EMC directive 2004/108/EC. The Declaration of Conformity according to these directives is available from the manufacturer.

ABB Oy furthermore declares that it is not allowed to put the equipment into service until the machinery into which it is to be incorporated or of which it is to be a component has been found and declared to be in conformity with the provisions of the Directive 2006/42/EC and with national implementing legislation, i.e. as a whole, including the equipment referred to in this Declaration.

ABB Oy gives an undertaking to the national authorities to transmit, in response to a reasoned request by the national authorities, relevant information on the partly completed machinery. The method of transmission can be either electrical or paper format and it shall be agreed with the national authority when the information is asked. This transmission of information shall be without prejudice to the intellectual property rights of the manufacturer.

Helsinki, 21.12.2009

A handwritten signature in blue ink, appearing to read 'Timo Salmela'.

Timo Salmela

Vice President
ABB Oy

Development of ACS800-67*April 2007*

Introduction of new version of power modules. The new modules have a new code. The new and old modules may not be mixed, parallel connection of two modules with different code is forbidden.

Introduction of new Emax breakers in power cabinet stator breaker. The original version has PR111 trip unit and new version PR121 trip unit in addition of the internal modifications. The breakers are not compatible without hardware changes.

April 2008

Introduction of the DC chopper option.

May 2010

Introduction of the stator contactor in the power cabinet.



3AFE68392454 REV C / EN
EFFECTIVE: 2010-05-11

ABB Oy

Drives
P.O. Box 184
FI-00381 HELSINKI
FINLAND
Telephone +358 10 22 11
Fax +358 10 22 22681
Internet www.abb.com/drives

ABB Inc.

Automation Technologies
Drives & Motors
16250 West Glendale Drive
New Berlin, WI 53151
USA
Telephone 262 785-3200
1-800-HELP-365
Fax 262 780-5135

ABB Beijing Drive Systems Co. Ltd.

No. 1, Block D, A-10 Jiuxianqiao Beilu
Chaoyang District
Beijing, P.R. China, 100015
Telephone +86 10 5821 7788
Fax +86 10 5821 7618
Internet www.abb.com/drives