ABB INDUSTRIAL DRIVES

ACS880 multidrives, Optimal grid control (option +N8053)

Supplement

ACS880 multidrives, Optimal grid control (option +N8053)

Supplement

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1

Introduction to the manual

Contents of this chapter

This chapter describes the contents of the manual. It also contains information on the applicability, safety and intended audience.

Applicability

This document is a supplement to ACS880-207 IGBT supply units hardware manual (3AUA0000130644 [English]), ACS880-204 IGBT supply modules hardware manual (3AUA0000131525 [English]), ACS880-207LC IGBT supply units hardware manual (3AXD50000174782 [English]) and ACS880-204LC IGBT supply modules hardware manual (3AXD50000284436 [English]).

Units with BCU control unit: The supplement is applicable to the optimal grid control functionality of ACS880 IGBT supply control program (version 3.4x and later). For information on firmware-related issues (parameters, faults, warnings etc.) concerning optimal grid control functionality, see Optimal grid control of ACS880 IGBT supply control program supplement (3AXD50000164745 [English]). For information on ACS880 IGBT supply control program, see ACS880 IGBT supply control program firmware manual (3AUA0000131562 [English]).

Units with UCU control unit: The supplement is applicable to the optimal grid control functionality of ACS880 IGBT supply control program (version 1.1x and later). For information on firmware-related issues (parameters, faults, warnings etc.) concerning optimal grid control functionality, see Optimal grid control of ACS880 IGBT supply control program (YISLX) supplement (3AXD50001096762 [English]). For information on ACS880 IGBT supply control program, see ACS880 IGBT supply control program (YISLX and YLHLX) firmware manual (3AXD50001019464 [English]).

Licensing

Optimal grid control functionality is in use only when the license key N8053 has been activated on the memory unit. This has been done at the factory for a unit with the option +N8053.

You can see the license information with the Drive Composer PC tool or ACS-AP-x control panel in **System info** - **Licenses**.

If the license key for the optimal grid control is missing, the converter indicates fault 6E1F Licensing fault. Auxiliary code in the event logger indicates the plus code of missing license, in this case N8053. For further assistance, contact your local ABB representative.

Safety instructions

WARNING!
Follow all safety instructions of the drive before you install, commission, or use the drive. For single drives, the complete safety instructions are given at the beginning of the hardware manual. For multidrives safety instructions, see ACS880 multidrives cabinets and modules safety instructions (3AUA0000102301 [English]) for air-cooled units, and ACS880 liquid-cooled multidrives cabinets and modules safety instructions (3AXD50000048633 [English]) for liquid-cooled units.

Read the software function specific warnings and notes before changing the default settings of the function. For each function, the warnings and notes are given in the subsection the function or the related user-adjustable parameters.

Target audience

This manual is intended for people who design, commission, or operate the drive system.

Terms and abbreviations

Term/ Abbreviation	Description
BAMU	Auxiliary measurement unit
BCU	Type of control unit
DC link	DC circuit between rectifier and inverter
Drive	Frequency converter for controlling AC motors
DSU	Diode supply unit
Frame, frame size	Physical size of the drive or power module
IGBT	Insulated gate bipolar transistor
IGBT supply unit	IGBT supply module(s) under control of one control unit, and related components.
Inverter unit	Inverter module(s) under control of one control unit, and related components. One inverter unit typically controls one motor.
ISU	IGBT supply unit
LCL filter	Inductor-capacitor-inductor filter
Power module	Common term for drive module, inverter module, supply module, brake chopper module etc.
Supply unit	Supply module(s) under control of one control unit, and related components.
THD	Total harmonic distortion
UCU	Type of control unit.

Related documents

You can find manuals on the Internet. See below for the relevant code/link. For more documentation, go to www.abb.com/drives/documents.

	Manuals for ACS880 multidrives cabinets
	Manuals for ACS880 multidrives modules

Cyber security disclaimer

This product is designed to be connected to and to communicate information and data via a network interface. It is Customer's sole responsibility to provide and continuously ensure a secure connection between the product and Customer network or any other network (as the case may be). Customer shall establish and maintain any appropriate measures (such as but not limited to the installation of firewalls, application of authentication measures, encryption of data, installation of anti-virus programs, etc.) to protect the product, the network, its system and the interface against any kind of security breaches, unauthorized access, interference, intrusion, leakage and/or theft of data or information.

ABB and its affiliates are not liable for damages and/or losses related to such security breaches, any unauthorized access, interference, intrusion, leakage and/or theft of data or information.

2

Operation description

Contents of this chapter

This chapter describes the operation of ACS880 grid converter.

Overview

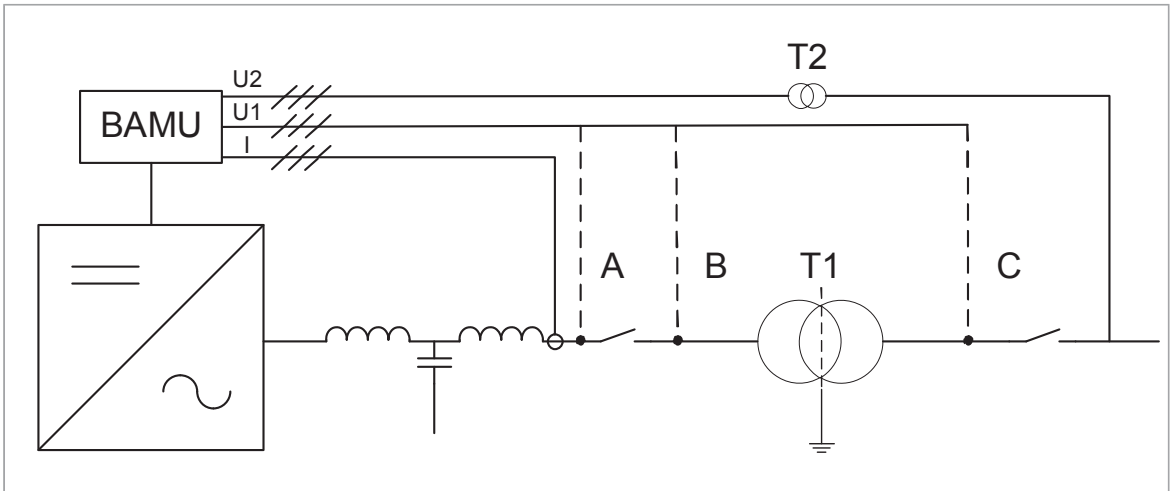
A grid converter is an IGBT supply unit equipped with optimal grid control functionality. The grid converter can be used to produce an island AC grid. It is also possible to use grid converters in parallel with generators to support the operation of a distributed power system. The grid converter produces sinusoidal three-phase AC voltages from the DC link voltage of the system. AC voltage magnitude and frequency can be defined by the user. A grid converter can be used in eg. marine applications where ordinary power grid connection is not available.

Safety

WARNING!
AC terminals of a grid converter can carry dangerous voltage even though the main disconnecting device of the drive is open. Grid converter can start and it can be started even though its AC terminals are unconnected, the main disconnecting device of the drive is open or there is no supplying AC power network.

Voltage and current measurements

BAMU board is an essential part of a grid converter. It is a multipurpose measurement unit for voltage and current measurements. It has two 3-phase voltage inputs and one 3-phase current input. The following table shows how BAMU board can be used for measuring current I and voltages U1 and U2 of a grid converter. U1 measurement is mandatory, U2 measurement is done only when synchronization is needed. Note that the figure below is an illustrative figure showing possible measurement locations. For further information, see delivery-specific circuit diagrams and BAMU-12C auxiliary measurement unit hardware manual (3AXD50000117840 [English]).



I	Always measured from grid-side terminals of an LCL filter. Direction of positive current using default parametrization is towards the converter.
U1	Three options: A) measured from grid-side terminals of an LCL filter B) measured after main circuit breaker (MCB) from grid-side terminals C) measured from the grid-side of the supply transformer. If secondary voltage exceeds 690 V, a measurement transformer needs to be used.
U2	Always measured from the point where synchronization is needed. Measurement transformer with equivalent effect on voltage vector to any transformers between U1 and U2 measurements is required. For example, if option B is used for U1, T2 must be identical with T1 in terms of phase shift and voltage ratio.
T1	Supply transformer
T2	Measurement transformer

Recommended nominal primary measurement range of the current transformer for BAMU I measurement is 130% of the nominal AC current (I_N) of the IGBT supply unit. Secondary current is 1 A.

BAMU board is typically located in incoming cubicle.

BAMU board is included in the delivery of a cabinet-installed unit when the license N8053 is ordered. In a module delivery, BAMU board and its accessories need to be ordered and installed separately by the user. See ACS880-204 IGBT supply modules hardware manual (3AUA0000131525 [English]) for air-cooled units and ACS880-204LC IGBT supply modules hardware manual (3AXD50000284436 [English]) for liquid-cooled units.

Synchronization

Internal synchronization using U1 is performed when the converter is started. This synchronization method is the default option for synchronizing to an existing grid on start-up and is typically the only synchronization needed by applications.

External synchronization using U2 can be used for synchronizing the grid formed by the converter (or a cluster of converters) to another grid. This operation typically results in a small power transient in the system, which must be absorbed by DC-forming devices. This synchronization method is typically needed when there are two separate microgrids created on board a vessel (eg. starboard and port sides) and these sides need to be connected over a bus tie.

Restrictions for using optimal grid control functionality

ABB recommends to use always a supply transformer with a static shielding. If there is no static shielding, the customer must

- make sure that there are no devices sensitive to common mode voltage connected to the AC grid that the grid converter is connected to,
- arrange the attenuation of the common mode current. If there are several grid converters connected to the same AC grid and DC link, the circulating common mode current between the grid converters must be prevented by using transformers.

3

Dimensioning

Contents of this chapter

This chapter describes the dimensioning (current derating) curves that are used for selecting an ACS880 grid converter for a certain application.

Information of this chapter is applicable to air-cooled ACS880 IGBT supply units of frame sizes R6i, R7i and R8i (and multiples), and liquid-cooled ACS880 IGBT supply units of frame sizes R7i and R8i (and multiples). The derating based on the electrical properties of the grid is considered. For derating based on other conditions, such as ambient temperature or installation altitude, see appropriate hardware manual.

Sign convention

The sign convention used with grid converter is the load sign convention, which means that the grid converter is considered as load. This is the same sign convention as with standard IGBT supply unit. Positive current direction is from grid to the grid converter and as a result active power is positive if equipment in the grid (formed by the grid converter) supplies power to the grid converter, and negative if it consumes power (eg. resistive load). Similarly, the reactive power is considered as if the grid converter was a passive component.

Example of the effect of the sign convention: Assume that a symmetric resistor-inductor load is connected to the grid created by the grid converter. The load consumes active power (resistor) and is inductive. From the grid converter point of view, since load sign convention is used, the power flow through the grid converter is negative active power and capacitive reactive power.

Derating curves in continuous operation conditions

When selecting the grid converter, continuous operation conditions must be taken into account. The derating factors are:

- Liquid-cooled units: Grid voltage or grid voltage range (grid converter output), K_U
- Liquid-cooled units: Grid frequency, K_f
- Maximum continuous load current, I_{load}
- Liquid-cooled units: Maximum load current THD, K_{THD}
- Phase angle of the load current, ie. amount of reactive load, K_ϕ
- DC link voltage of the grid converter, K_{DC}
- Load current unbalance, $K_{unbalance}$

Grid voltage and frequency are typically well known, and also the maximum continuous load is known. Current THD (total harmonic distortion) and the amount of reactive current may be more difficult to estimate depending on the application. These, however, may have a big effect on the dimensioning so they should be realistically approximated to avoid selecting too large converter. DC link voltage depends on the load type: nonlinear loads and highly reactive loads require higher DC link voltage than linear resistive loads. Also, higher DC link voltage reduces the loadability of the converter. The total derating factor K_T is

$$K_A = K_U\, K_f\, K_\phi\, K_{THD} \quad (1)$$

$$K_T = \min(K_A, K_{DC}, K_{unbalance}) \quad (2)$$

Most of the derating factors are simply multiplied together, but since some factors affect different components, other factors only act as a limit and thus the minimum value of the factors is used.

Taking all the factors into account, the continuous grid converter output current can be calculated from the nominal AC current of the IGBT supply unit:

$$I_{grid\ converter} = I_{ISU}\, K_T \quad (3)$$

The equation can be re-arranged to select the IGBT supply unit based on the load current:

$$I_{ISU} = I_{grid\ converter} / K_T \quad (4)$$

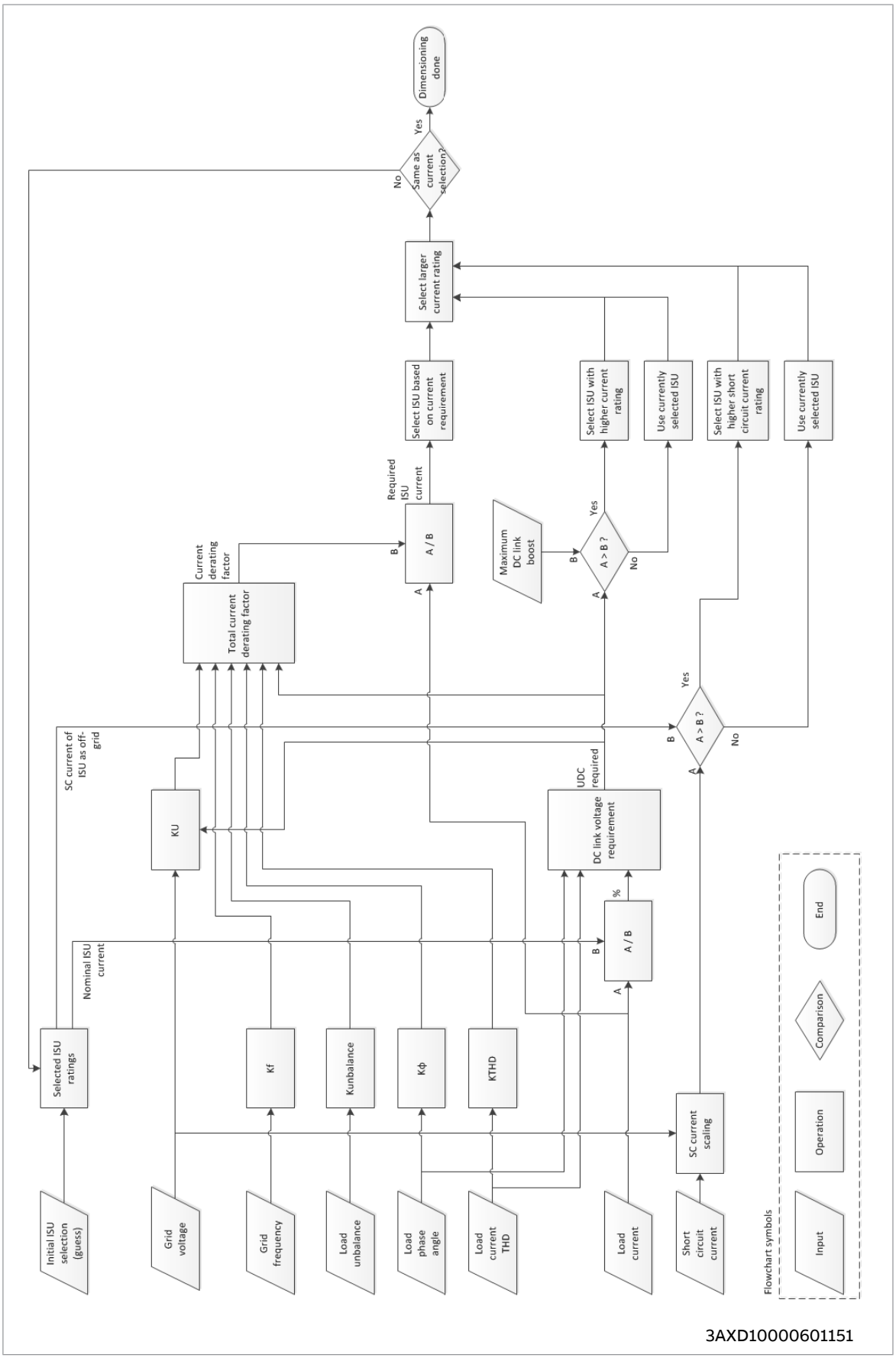
The nominal DC link voltage is calculated from the nominal AC voltage of the IGBT supply unit by taking the peak voltage of the AC main voltage:

$$U_{DC,nominal} = \sqrt{2}\, U_{AC,nominal} \quad (5)$$

Note that in practice the DC link voltage needs to be about 3% above the nominal DC voltage calculated with equation above. For more details on DC link voltage margin, see section DC link voltage requirement (page 24).

The flowchart below describes the dimensioning flow for a grid converter. Since multiple parameters affect each other and the nominal ratings of the IGBT supply unit

also affect some derating factors, it is necessary to iterate the selection or calculate the derating factors for multiple drive sizes and then select a suitable one.

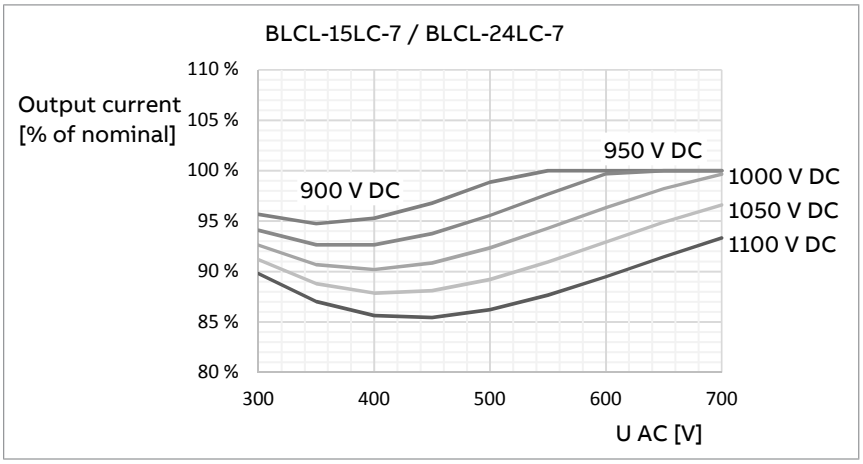


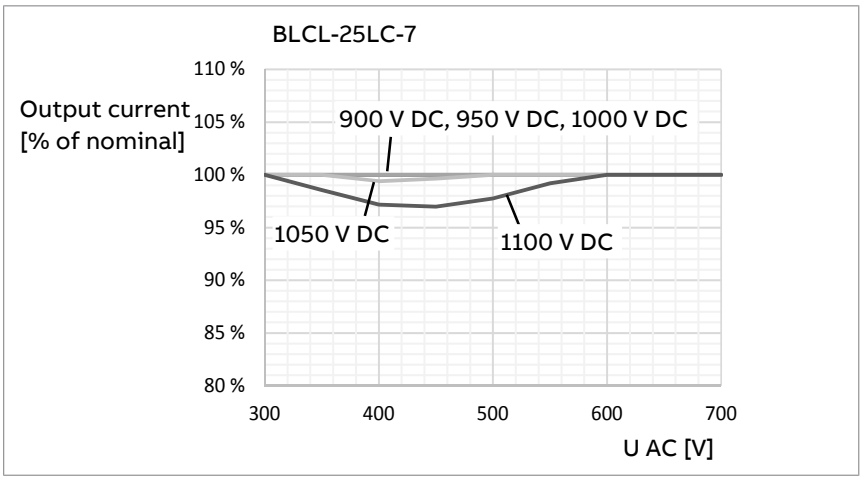
Voltage derating, factor K_U

Air-cooled units

There is no need for voltage derating.

Liquid-cooled units





Select the derating curve according to the LCL filter type that is used with the desired IGBT supply unit type. There is no need for voltage derating for LCL filter types BLCL-13LC-7 and BLCL-14LC-5. Voltage derating factor depends on grid voltage and DC link voltage. To be able to calculate the derating factor, the DC link voltage requirement must be known. For calculating the DC link voltage, see section DC link voltage requirement (page 24).

To be able to calculate the voltage derating factor, the relative AC voltage and DC link voltage boost must be calculated according to equations below, while limiting the result accordingly.

$$U_{AC,\%} = U_{AC}\sqrt{2} / U_{DC},\ 0 \le U_{AC,\%} \le 1 \quad (6)$$

$$U_{DC,\%} = U_{DC} / (U_{AC,nominal}\sqrt{2}) - 1.0 \quad (7)$$

Using the relative voltages, a voltage stress factor K_{Stress} can be calculated with following equation.

$$K_{Stress} = 0.353\ U_{AC,\%}^3 - 0.865\ U_{AC,\%}^2 + 0.635\ U_{AC,\%} - 0.04 + 0.105\ U_{DC,\%} \quad (8)$$

Using the voltage stress factor, the voltage derating factor can be calculated with following equations, limiting the output when necessary.

$$C = 1.0 - B\,K_{Stress},\ 0 \le C \tag{9}$$

$$K_U = \sqrt{(C / A)},\ 0 \le K_U \le 1 \tag{10}$$

where A and B are coefficients that depend on the LCL filter used according to the table below.

Coefficient	BLCL-24LC-7 BLCL-15LC-7	BLCL-25LC-7
A	0.60	0.5
B	4.70	4.43

For example, assuming following operation conditions:

- ISU nominal voltage $U_{AC,nominal}$ = 690 V AC
- Grid voltage formed by the grid converter U_{AC} = 525 V AC
- DC link voltage produced by the DC supply U_{DC} = 1030 V DC
- LCL filter type is BLCL-24LC-7

The calculations give

- Actual AC voltage in percent is $U_{AC,\%}$ = 525×√2 / 1030 = 72% = 0.72 (equation (6))
- Actual DC link boost in percent is $U_{DC,\%}$ = 1030 / (690×√2) - 1.0 = 5.6% = 0.056 (equation (7))
- Voltage stress factor then is K_{Stress} = 0.106 (equation (8))
- Derating factor is K_U = √(0.502 / 0.600) = 0.915 = 91.5% (equations (9) and (10))

If the DC link voltage is boosted from the nominal, an additional derating factor shown in section DC link voltage derating, factor K_{DC} (page 23), needs to be taken into account also.

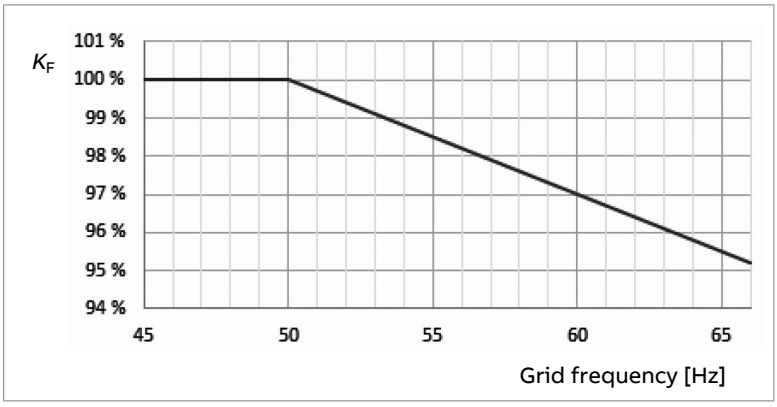
This factor assumes that the load is resistive, linear and symmetric and that grid frequency is 50 Hz. Nonlinearity, nonresistive loads, load unbalance and different grid frequencies are taken into account with other factors.

Output frequency derating, factor K_F

Air-cooled units

There is no need for output frequency derating.

Liquid-cooled units



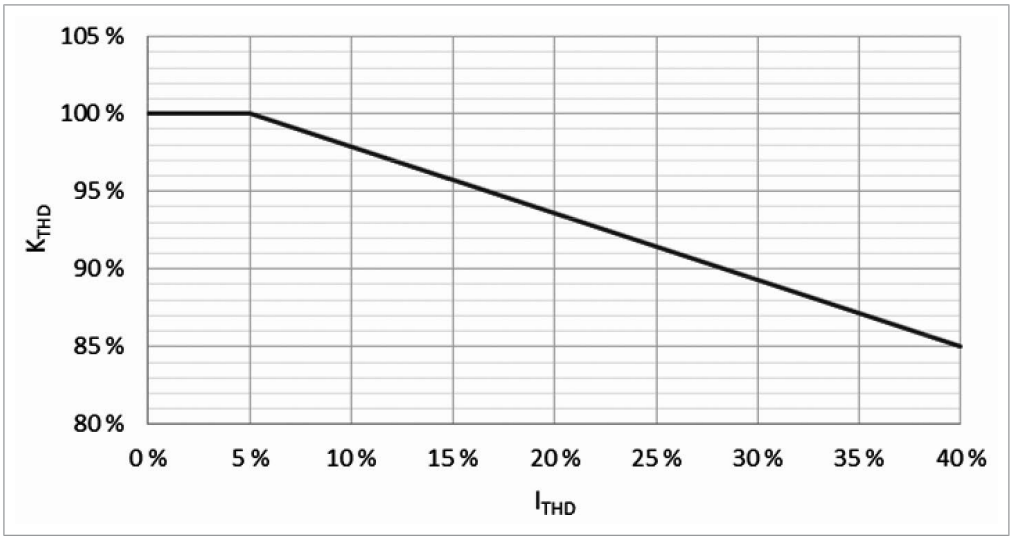
Above 50 Hz the output current is derated 0.3% / Hz.

Load current THD derating, factor K_{THD}

Air-cooled units

There is no need for load current THD derating.

Liquid-cooled units



Above 5% load current THD, the current is derated 0.43% / 1% THD.

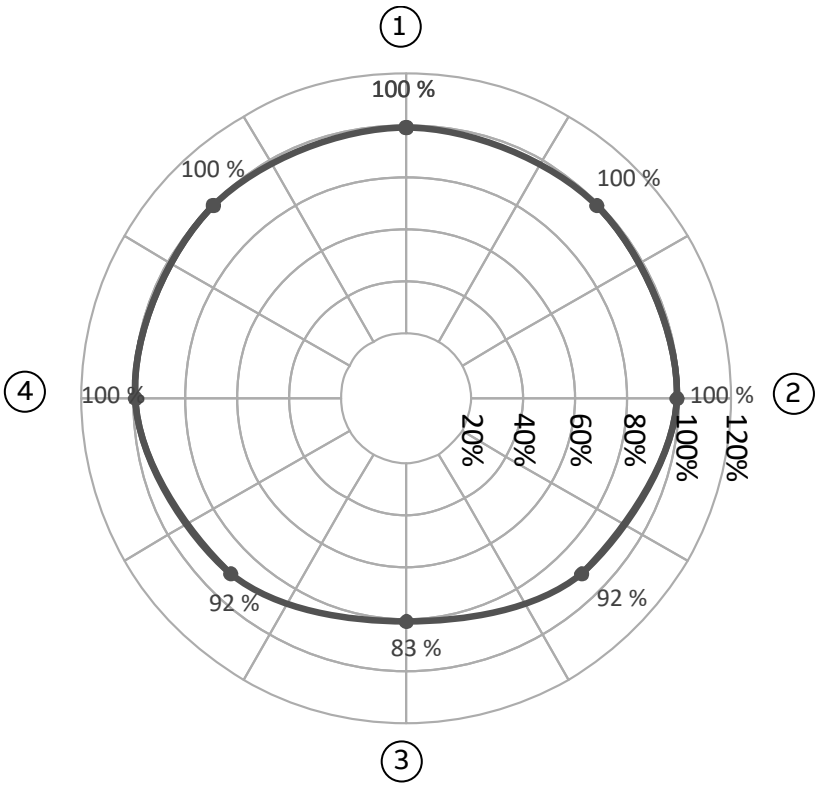
The load in the figure above is considered to be symmetric, having linear resistive component and also 6-phase diode bridge load. The diode bridge is assumed to have a 3-phase AC choke, inductance of which is selected so that at nominal load its current THD is 40%. Note that derating is calculated with the assumption that harmonic current compensation is used.

Also note that the curve assumes that the grid converter is supplied with IGBT supply unit or similar supply, with low amount of low-frequency ripple in the DC link. If a diode supply or similar with high amount of low-frequency ripple is used, derating may be steeper.

When the load current THD increases, also the DC link voltage required to produce that current increases. This relation is described in section DC link voltage requirement (page 24). If the DC link voltage increases above the nominal DC link voltage (grid voltage is high and current THD is high), additional derating is required according to section DC link voltage derating, factor K_{DC} (page 23).

Load phase angle derating / reactive current, factor K_ϕ

Air-cooled units



Reactive power derating factor K_ϕ as the variable of the load phase angle:	
1.	Positive, capacitive, current leads voltage
2.	Positive, load produces power
3.	Negative, inductive, current lags voltage
4.	Negative, load consumes power

The amount of reactive power affects also the loadability of the converter. The basic rating is given for negative active power and the output current needs to be derated if there is reactive power or if the active power is positive. The figure above shows the derating factor depending on the phase angle of the load current.

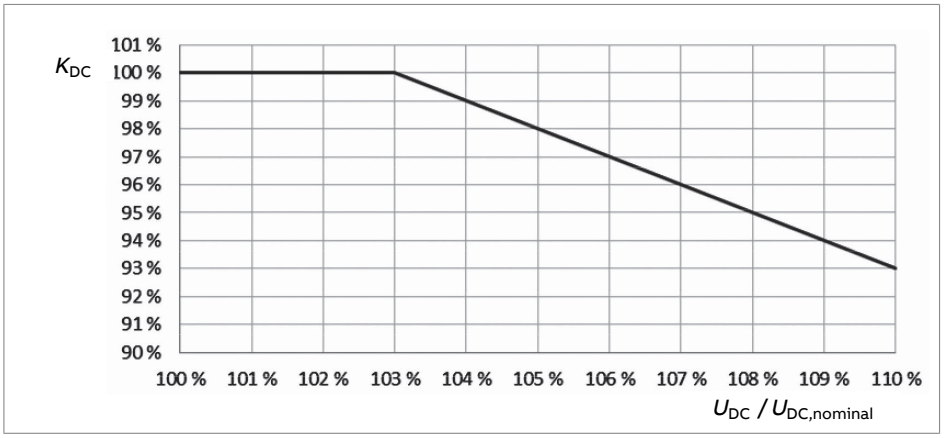
Generating reactive power may also require higher DC link voltage, which in turn may cause additional derating. DC link voltage requirements are described in section DC link voltage requirement (page 24) and DC link voltage effect on derating in sections Voltage derating, factor K_U (page 18) and DC link voltage derating, factor K_{DC} (page 23).

Liquid-cooled units

There is no need for derating as a function of load phase angle (ie. K_ϕ = 1).

DC link voltage derating, factor K_{DC}

Air-cooled units



DC link voltage derating is 1% for each 1% of DC link voltage boost above 103%. Derating factor can be calculated with following equation:

$$K_{DC} = \min(1.0, 1.0 - (U_{DC,percent} - 1.03)) \quad (11)$$

Liquid-cooled units

There is no need for separate DC link voltage derating (K_{DC}) to determine the total derating factor K_T (equation 2) of the liquid-cooled units. The effects of high DC link voltage are covered by the voltage derating factor K_U.

DC link voltage requirement

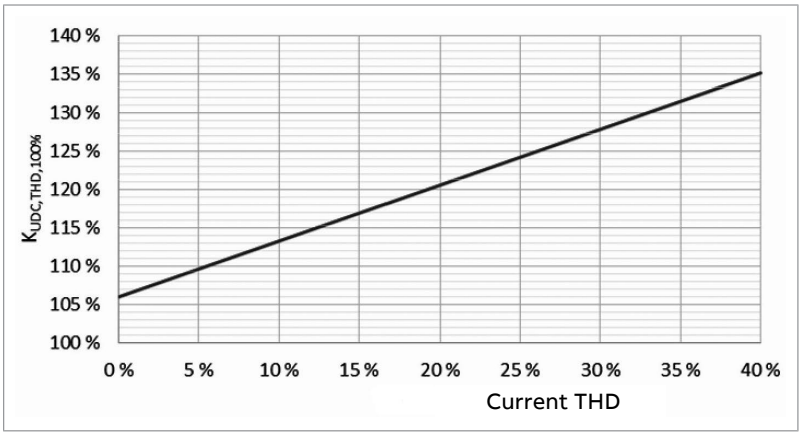
DC link voltage may need to be increased from nominal because harmonic current compensation needs to have certain voltage margin from AC voltage peak value to DC link voltage. Also reactive current, especially capacitive reactive current, needs higher than nominal DC link voltage to be able to produce the required current.

The total DC link voltage required, compared to the nominal value, can be calculated with

$$U_{DC} = U_{DC,nominal}\, K_{UDC,THD}\, K_{UDC,\phi} = \sqrt{2}\, U_{AC}\, K_{UDC,THD}\, K_{UDC,\phi} \quad (12)$$

where $K_{UDC,THD}$ is the DC link voltage increase required by the load current THD, ie. harmonic current compensation, and $K_{UDC,\phi}$ is the DC link voltage increase required by reactive current. Note that even when current is sinusoidal (THD = 0%), there is some amount of DC link voltage margin required according to the figure below.

The following figure shows DC link voltage compared to nominal when converter is at full load (current is nominal).



The curve follows approximately function (THD as 0% = 0 and 40% = 0.4)

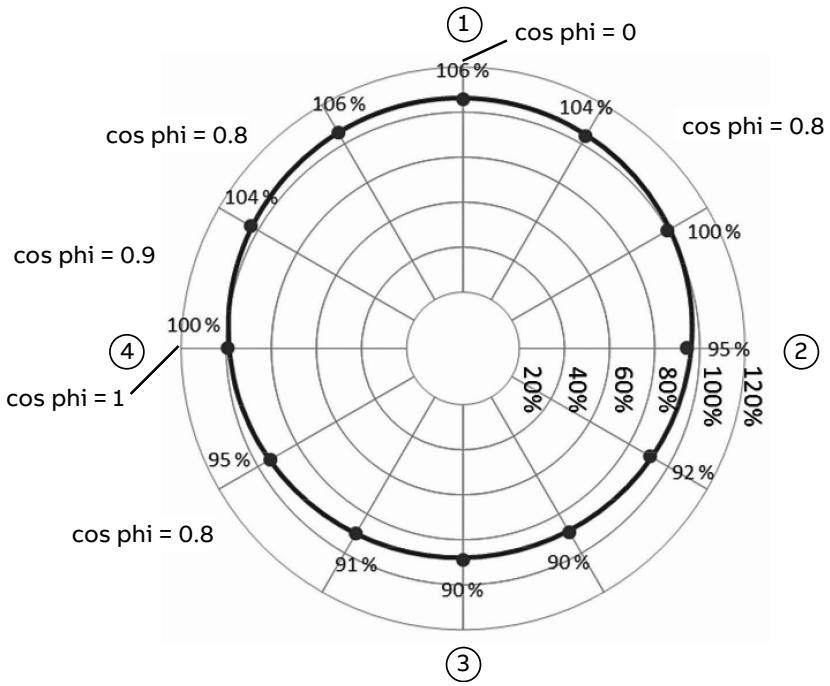
$$K_{UDC,THD,100\%} = 1.06 + 0.73\ THD \quad (13)$$

The curve is given for full load, the margin for partial loads can be calculated with

$$K_{UDC,THD} = 1.03 + I_{load,percent}\,(K_{UDC,THD,100\%} - 1.03) \quad (14)$$

which means that in no-load case, DC link voltage needs to be 103% of nominal, and between no-load and full load a linear fit between 103% and the respective DC link voltage margin value can be used. $I_{load,percent}$ is load current in percent of nominal current rating of IGBT supply unit.

For reactive power, the following curve must be used in addition to the THD related curve to get the required DC link voltage multiplier in full load condition. For the sign convention used, see section Sign convention (page 15).



U_{DC} required for reactive power, full load $K_{UDC,\phi,100\%}$:	
1.	Positive, capacitive, current leads voltage
2.	Positive, load produces power
3.	Negative, inductive, current lags voltage
4.	Negative, load consumes power

A linear fit equation can also be used for the loading between no load and full load.

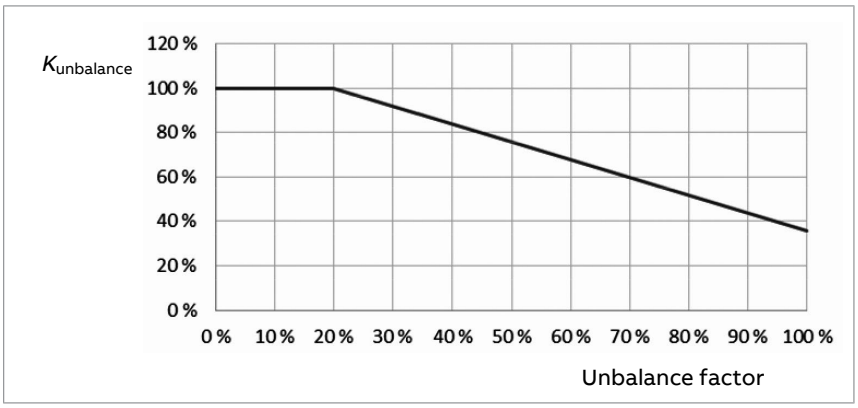
$$K_{UDC,\phi} = 1.0 + I_{load,percent} (K_{UDC,\phi,100\%} - 1.0) \quad (15)$$

Note that the curve above is given for nominal current rating of IGBT supply unit; however at all phase angles nominal current is not allowed but must be derated according to the figure in section Load phase angle derating / reactive current, factor K_ϕ (page 22).

If the DC link voltage requirement is not reached, the grid converter cannot supply the harmonic current components or reactive current components completely. As a result, output voltage quality will decrease and output voltage THD will increase.

Load unbalance derating, factor $K_{unbalance}$

The following curve shows maximum available current in relation to phase unbalance. Phase unbalance is defined so that the difference of maximum and minimum phase current is compared to maximum phase current. Thus 100% unbalance is achieved when one phase is not loaded at all, while all current flows through the remaining two phases.



Unbalance factor is calculated with

$$\text{Unbalance} = (\max(I_{L1,RMS}, I_{L2,RMS}, I_{L3,RMS}) - \min(I_{L1,RMS}, I_{L2,RMS}, I_{L3,RMS})) / \max(I_{L1,RMS}, I_{L2,RMS}, I_{L3,RMS}) \quad (16)$$

The derating factor is 0.8% for each percent of unbalance above 20%.

Short-circuit current

Air-cooled units

The grid converter supplies short-circuit (overload) current for 5 seconds maximum. If the short-circuit (overload) condition is not cleared by that time, the converter trips on overcurrent. Short-circuit current values apply for up to 18% I_{THD} with ISU/DSU load.

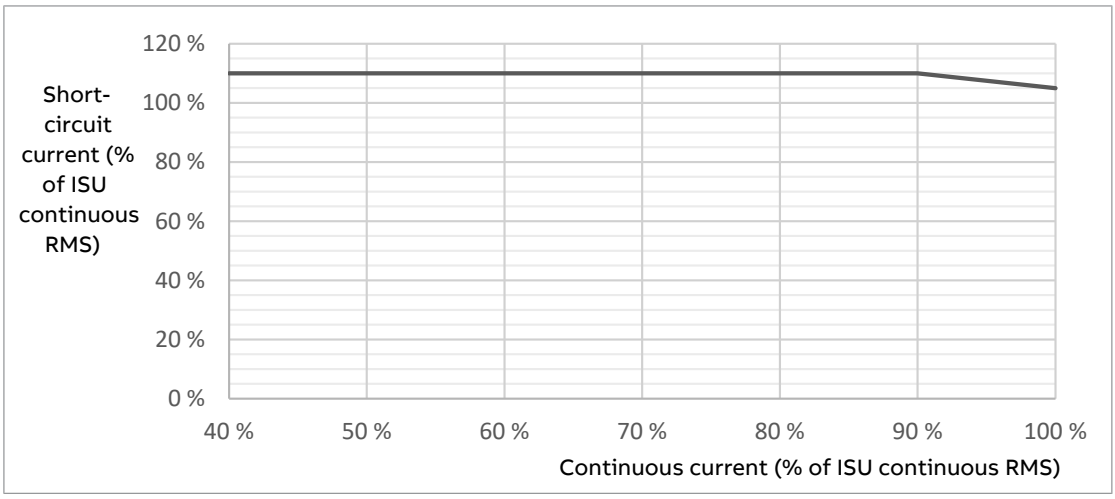
400 V and 500 V units

The maximum short-circuit current and continuous output current must be limited according to the figure below to prevent the grid converter from tripping to overcurrent fault when a short-circuit happens under load.

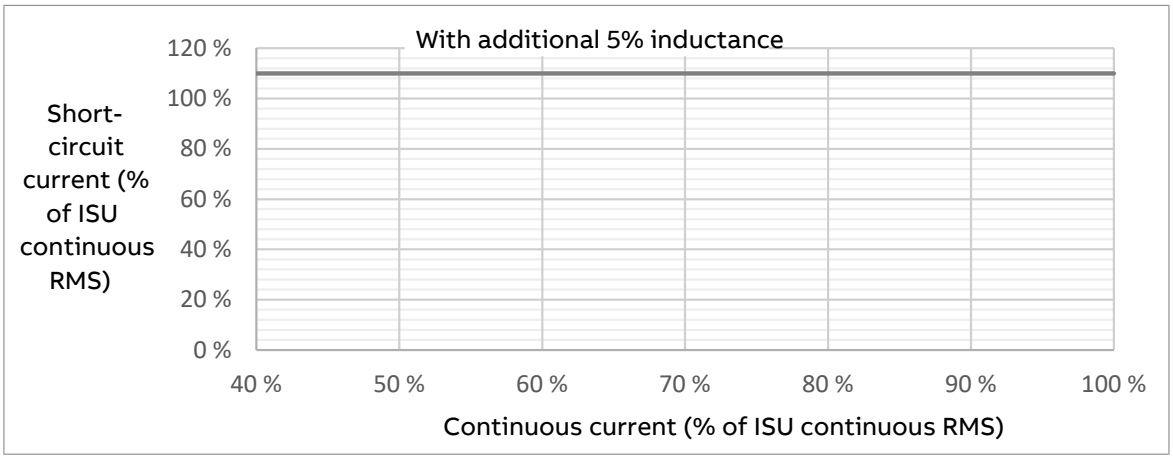
In addition, a transformer with at least 5% leakage inductance (calculated from the rated current of the IGBT supply unit) must be used at the output of the grid converter. The inductance values for IGBT supply module types are listed in the table below.

IGBT supply module type	L phase [µH]
U_N = 400 V	
ACS880-204-0210A-3	175
ACS880-204-0270A-3	136
ACS880-204-0420A-3	87
ACS880-204-0580A-3	64
ACS880-204-0810A-3	46
ACS880-204-1130A-3	33

IGBT supply module type	L phase [µH]
ACS880-204-1330A-3	28
ACS880-204-1580A-3	24
ACS880-204-2350A-3	16
ACS880-204-3110A-3	12
ACS880-204-4620A-3	8
U_N = 500 V	
ACS880-204-0210A-5	219
ACS880-204-0260A-5	177
ACS880-204-0400A-5	117
ACS880-204-0530A-5	87
ACS880-204-0730A-5	64
ACS880-204-1040A-5	45
ACS880-204-1420A-5	33
ACS880-204-2120A-5	22
ACS880-204-2800A-5	17
ACS880-204-4150A-5	12

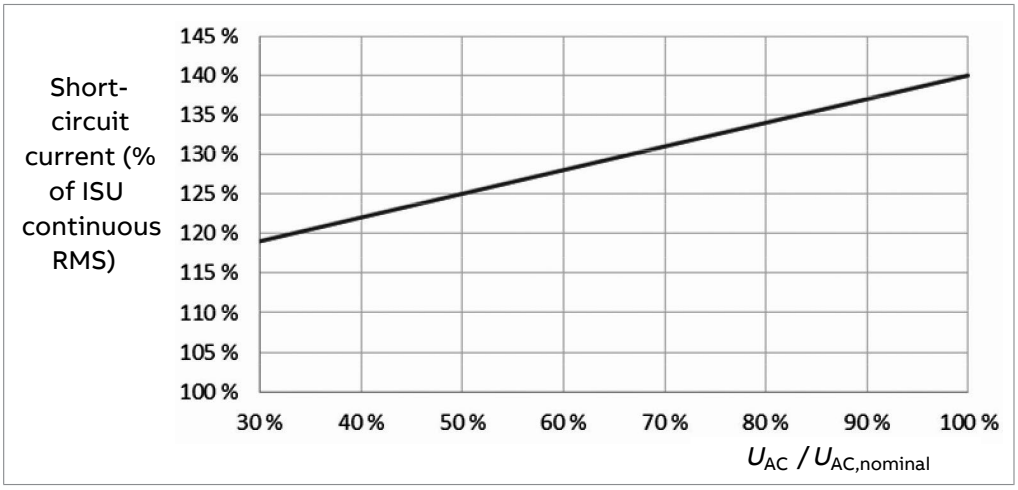


Frames R6i and R7i: Available short circuit current based on continuous loading:



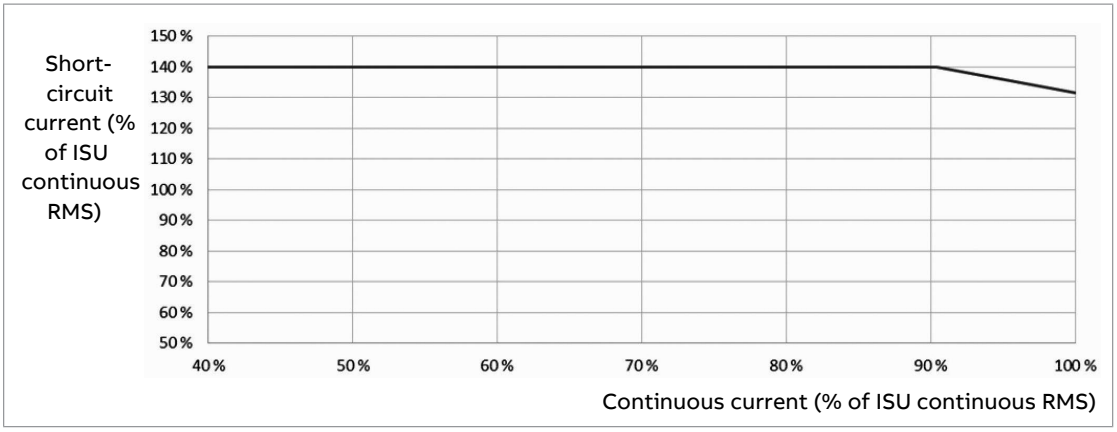
690 V units

The maximum short-circuit current supplied by the grid converter depends on the output voltage. The following curve shows the relationship between output voltage (percent of the drive nominal voltage) and maximum short-circuit current.



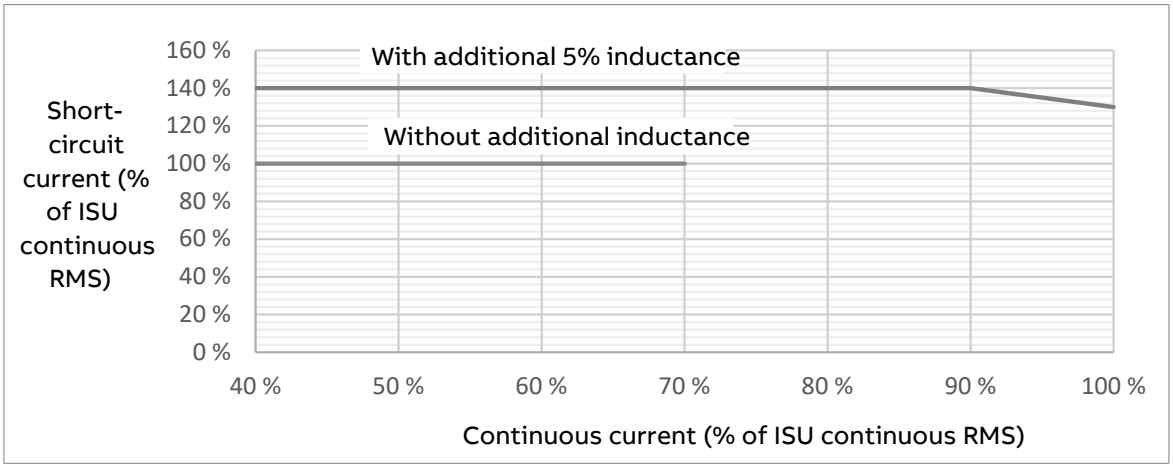
The curve is based on the nominal (continuous) current rating of the IGBT supply unit. Current available from the grid converter is less especially with lower grid voltage. See section Voltage derating, factor K_U (page 18).

If the output current rating is close to the nominal rating of IGBT supply unit, the short-circuit current limit must be lowered to guarantee that no overtemperature trip occurs during the fault. The following curve shows the available short-circuit current relative to the continuous load current of the grid converter, in percent of nominal current rating of IGBT supply unit.



Frames R6i and R7i: The short-circuit current supplying capability depends on the total inductance at the converter output. If additional inductance is connected to the converter output (eg. transformer leakage inductance), the short-circuit current limits can be extended from the situation without additional inductance. 5% inductance values (calculated from rated current) for IGBT supply module types of frames R6i and R7i are listed in the table below.

IGBT supply module type	L phase [µH]
U_N = 690 V	
ACS880-204-0150A-7	437
ACS880-204-0170A-7	373



Liquid-cooled units

The grid converter supplies short-circuit (overload) current for 2 seconds maximum (5 seconds maximum for frame R7i modules). If the short-circuit (overload) condition is not cleared by that time, the converter trips on overcurrent.

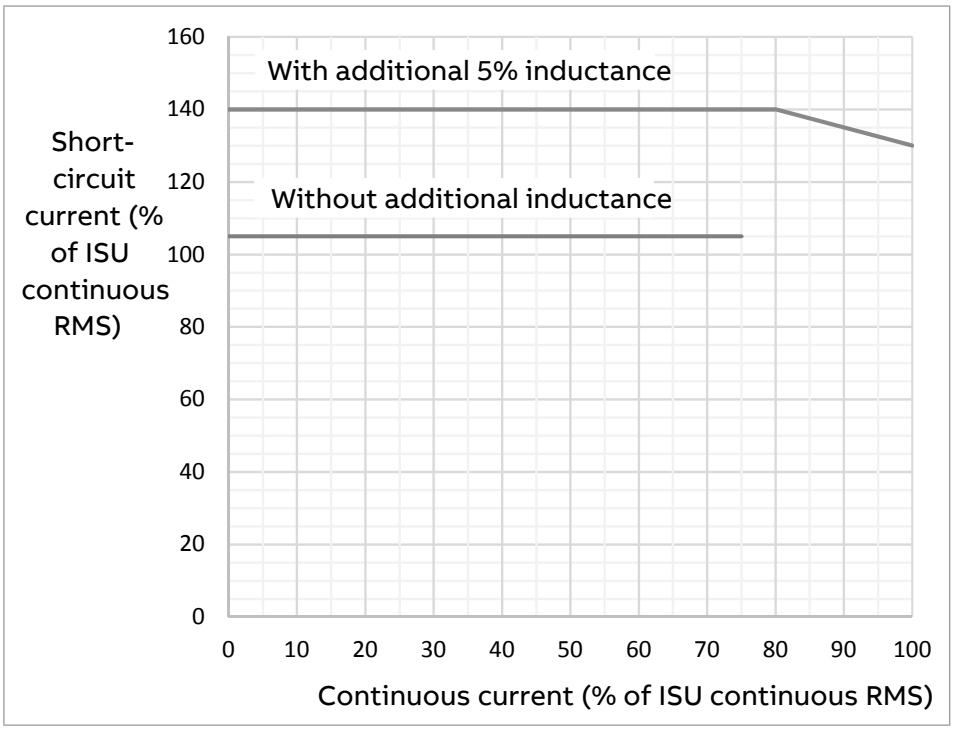
The maximum short-circuit current and continuous output current must be limited according to the figure below to prevent the grid converter from tripping to overcurrent fault when a short-circuit happens under load.

The short-circuit current supplying capability depends on the total inductance at the converter output. If additional inductance is connected to the converter output (eg. transformer leakage inductance), the short-circuit current limits can be extended from the situation without additional inductance. 5% inductance values (calculated from rated current) for IGBT supply module types are listed in the table below.

IGBT supply module type	L phase [µH]
U_N = 400 V	
ACS880-204LC-0270A-3	136
ACS880-204LC-0340A-3	108
ACS880-204LC-0420A-3	88
ACS880-204LC-0530A-3	70
ACS880-204LC-0670A-3	56
ACS880-204LC-0770A-3	48
ACS880-204LC-1000A-3	37
ACS880-204LC-1180A-3	32
ACS880-204LC-1310A-3	28
ACS880-204LC-1500A-3	25
U_N = 500 V	
ACS880-204LC-0270A-5	169
ACS880-204LC-0340A-5	135
ACS880-204LC-0410A-5	111
ACS880-204LC-0530A-5	87
ACS880-204LC-0670A-5	69
ACS880-204LC-0770A-5	60
ACS880-204LC-1000A-5	46

IGBT supply module type	L phase [µH]
ACS880-204LC-1180A-5	39
ACS880-204LC-1310A-5	35
ACS880-204LC-1500A-5	31
U_N = 690 V	
ACS880-204LC-0260A-7	244
ACS880-204LC-0310A-7	208
ACS880-204LC-0350A-7	181
ACS880-204LC-0500A-7	126
ACS880-204LC-0590A-7	107
ACS880-204LC-0680A-7	93
ACS880-204LC-0760A-7	84
ACS880-204LC-0880A-7	72
ACS880-204LC-1020A-7	63
ACS880-204LC-1170A-7	55
ACS880-204LC-1340A-7	48
ACS880-204LC-0360A-7	177
ACS880-204LC-0400A-7	159
ACS880-204LC-0450A-7	141
ACS880-204LC-0480A-7	133
ACS880-204LC-0560A-7	114
ACS880-204LC-0620A-7	103
ACS880-204LC-0700A-7	91
ACS880-204LC-0770A-7	83
ACS880-204LC-0930A-7	69
ACS880-204LC-1090A-7	59
ACS880-204LC-1180A-7	54
ACS880-204LC-1360A-7	47
ACS880-204LC-1500A-7	43
ACS880-204LC-1800A-7	36
ACS880-204LC-2020A-7	32
ACS880-204LC-2220A-7	29
ACS880-204LC-2670A-7	24
ACS880-204LC-2930A-7	22
ACS880-204LC-3320A-7	20
ACS880-204LC-3840A-7	17
ACS880-204LC-4360A-7	15
ACS880-204LC-5240A-7	13
ACS880-204LC-5810A-7	11

The figure below shows the current limits without additional inductance, and with 5% inductance (calculated from the rated current of the IGBT supply unit).



Output fuse rating

Because of limited short-circuit current, the ratings of the output fuses are critical so that fuses in each downstream branch operate in short enough time in all fault cases. The following table shows the maximum allowed size of different circuit breakers depending on the IGBT supply unit type, current and short-circuit current rating.

Air-cooled units

Type ACS880-204-...	Nom. current [A AC]	Short-circuit current, 5 s [A AC]	Miniature circuit breaker (IEC 60898-1) Max. size (Instantaneous tripping 0.1 s)							Fuse (IEC 60269-1:2006)			
			Char.	B		C		D		gG Max. size		aM Max. size	
			Coeff.	5	% of nom.	10	% of nom.	20	% of nom.	5 s based		0.5 s based 1)	
										[A]	% of nom.	[A]	% of nom.
U_N = 400 V 2)													
0210A-3	210	231	40 A	19%	20 A	10%	10 A	5%		40 A	19%	16 A	8%
0270A-3	270	297	50 A	19%	25 A	9%	13 A	5%		50 A	19%	20 A	7%
0420A-3	423	465	80 A	19%	40 A	9%	20 A	5%		80 A	19%	35 A	8%
0580A-3	576	634	125 A	22%	63 A	11%	25 A	4%		100 A	17%	50 A	9%
0810A-3	810	891	125 A	15%	80 A	10%	40 A	5%		125 A	15%	63 A	8%
1130A-3	1125	1238	125 A	11%	100 A	9%	50 A	4%		160 A	14%	80 A	7%
1330A-3	1332	1465	125 A	9%	125 A	9%	63 A	5%		200 A	15%	100 A	8%
1580A-3	1584	1742	125 A	8%	125 A	8%	80 A	5%		250 A	16%	125 A	8%
2350A-3	2349	2584	125 A	5%	125 A	5%	125 A	5%		315 A	13%	200 A	9%
3110A-3	3105	3416	125 A	4%	125 A	4%	125 A	4%		400 A	13%	250 A	8%
4620A-3	4617	5079	125 A	3%	125 A	3%	125 A	3%		500 A	11%	400 A	9%
U_N = 500 V 2)													
0210A-5	210	231	40 A	19%	20 A	10%	10 A	5%		40 A	19%	16 A	8%
0260A-5	260	286	50 A	19%	25 A	10%	13 A	5%		50 A	19%	20 A	8%
0400A-5	396	436	80 A	20%	40 A	10%	20 A	5%		80 A	20%	32 A	8%
0530A-5	531	584	100 A	19%	50 A	9%	25 A	5%		100 A	19%	40 A	8%
0730A-5	729	802	125 A	17%	80 A	11%	40 A	5%		125 A	17%	63 A	9%
1040A-5	1035	1139	125 A	12%	100 A	10%	50 A	5%		160 A	15%	80 A	8%
1420A-5	1422	1564	125 A	9%	125 A	9%	63 A	4%		200 A	14%	125 A	9%
2120A-5	2115	2327	125 A	6%	125 A	6%	100 A	5%		315 A	15%	160 A	8%
2800A-5	2799	3079	125 A	4%	125 A	4%	125 A	4%		400 A	14%	200 A	7%
4150A-5	4149	4564	125 A	3%	125 A	3%	125 A	3%		500 A	12%	315 A	8%
U_N = 690 V 3)													
0150A-7	145	203	40 A	28%	20 A	14%	10 A	7%		40 A	28%	16 A	11%
0170A-7	170	238	40 A	24%	20 A	12%	10 A	6%		40 A	24%	16 A	9%
0310A-7	306	428	80 A	26%	40 A	13%	20 A	7%		80 A	26%	32 A	10%
0370A-7	369	516	100 A	27%	50 A	14%	25 A	7%		80 A	22%	40 A	11%
0540A-7	540	756	125 A	23%	63 A	12%	32 A	6%		125 A	23%	50 A	9%
0720A-7	720	1008	125 A	17%	100 A	14%	50 A	7%		160 A	22%	80 A	11%

Type ACS880-204-...	Nom. current [A AC]	Short-circuit current, 5 s [A AC]	Miniature circuit breaker (IEC 60898-1) Max. size (Instantaneous tripping 0.1 s)							Fuse (IEC 60269-1:2006)			
			Char.	B		C		D		gG Max. size		aM Max. size	
			Coeff.	5	% of nom.	10	% of nom.	20	% of nom.	5 s based		0.5 s based [1]	
										[A]	% of nom.	[A]	% of nom.
1050A-7	1053	1474	125 A		12%	125 A	12%	63 A	6%	200 A	19%	100 A	9%
1570A-7	1566	2192	125 A		8%	125 A	8%	100 A	6%	250 A	16%	160 A	10%
2070A-7	2070	2898	125 A		6%	125 A	6%	125 A	6%	400 A	19%	200 A	10%
3080A-7	3078	4309	125 A		4%	125 A	4%	125 A	4%	500 A	16%	315 A	10%
4100A-7	4104	5745	125 A		3%	125 A	3%	125 A	3%	630 A	15%	400 A	10%
5130A-7	5130	7182	125 A		2%	125 A	2%	125 A	2%	800 A	16%	500 A	10%
3AXD10001100724													

1) Overload needs to be controlled.

2) Fuse dimensioning is calculated with 110% short-circuit current. For other short-circuit currents, fuse dimensioning needs to be calculated according to the short-circuit current.

3) Fuse dimensioning is calculated with 140% short-circuit current. For other short-circuit currents, fuse dimensioning needs to be calculated according to the short-circuit current.

Liquid-cooled units

Type ACS880-204LC-...	Nom. current [A AC]	Short-circuit current, 2 s / 5 s [A AC]	Miniature circuit breaker (IEC 60898-1) Max. size (Instantaneous tripping 0.1 s)							Fuse (IEC 60269-1:2006)			
			Char.	B		C		D		gG Max. size		aM Max. size	
			Coeff.	5	% of nom.	10	% of nom.	20	% of nom.	5 s based[1)] 0.1 s based[2)]		0.5 s based[3)]	
										[A]	% of nom.	[A]	% of nom.
U_N = 400 V[4)]													
0270A-3	272	286	50 A	18%	25 A	9%	13 A	5%		50 A	18%	20 A	7%
0340A-3	342	359	63 A	18%	32 A	9%	16 A	5%		63 A	18%	25 A	7%
0420A-3	419	440	80 A	19%	40 A	10%	20 A	5%		80 A	19%	35 A	8%
0530A-3	531	558	100 A	19%	50 A	9%	25 A	5%		80 A	15%	40 A	8%
0670A-3	666	699	125 A	19%	63 A	9%	32 A	5%		100 A	15%	50 A	8%
0770A-3	770	809	125 A	16%	80 A	10%	40 A	5%		125 A	16%	63 A	8%
1000A-3	999	1049	125 A	13%	100 A	10%	50 A	5%		160 A	16%	80 A	8%
1180A-3	1180	1239	125 A	11%	100 A	8%	50 A	4%		160 A	14%	80 A	7%
1310A-3	1314	1380	125 A	10%	125 A	10%	63 A	5%		200 A	15%	100 A	8%
1500A-3	1500	1575	125 A	8%	125 A	8%	63 A	4%		200 A	13%	125 A	8%
U_N = 500 V[4)]													
0270A-5	272	285	50 A	18%	25 A	9%	13 A	5%		50 A	18%	20 A	7%
0340A-5	342	359	63 A	18%	32 A	9%	16 A	5%		63 A	18%	25 A	7%
0410A-5	415	436	80 A	19%	40 A	10%	20 A	5%		80 A	19%	32 A	8%
0530A-5	531	558	100 A	19%	50 A	9%	25 A	5%		80 A	15%	40 A	8%
0670A-5	666	699	125 A	19%	63 A	9%	32 A	5%		100 A	15%	50 A	8%
0770A-5	770	809	125 A	16%	80 A	10%	40 A	5%		125 A	16%	63 A	8%
1000A-5	999	1049	125 A	13%	100 A	10%	50 A	5%		160 A	16%	80 A	8%
1180A-5	1180	1239	125 A	11%	100 A	8%	50 A	4%		160 A	14%	80 A	7%
1310A-5	1314	1380	125 A	10%	125 A	10%	63 A	5%		200 A	15%	100 A	8%
1500A-5	1500	1575	125 A	8%	125 A	8%	63 A	4%		200 A	13%	125 A	8%
U_N = 690 V[4)]													
0260A-7	260	273	50 A	19%	25 A	10%	13 A	5%		50 A	19%	20 A	8%
0310A-7	306	321	63 A	21%	32 A	10%	16 A	5%		63 A	21%	25 A	8%
0350A-7	351	369	63 A	18%	32 A	9%	16 A	5%		63 A	18%	25 A	7%
0500A-7	504	529	100 A	20%	50 A	10%	25 A	5%		80 A	16%	40 A	8%
0590A-7	594	624	100 A	17%	50 A	8%	25 A	4%		100 A	17%	40 A	7%
0680A-7	684	718	125 A	18%	63 A	9%	32 A	5%		125 A	18%	50 A	7%
0760A-7	756	794	125 A	17%	63 A	8%	32 A	4%		125 A	17%	63 A	8%
0880A-7	882	926	125 A	14%	80 A	9%	40 A	5%		125 A	14%	63 A	7%
1020A-7	1017	1068	125 A	12%	100 A	10%	50 A	5%		160 A	16%	80 A	8%
1170A-7	1170	1229	125 A	11%	100 A	9%	50 A	4%		160 A	14%	80 A	7%
1340A-7	1341	1408	125 A	9%	125 A	9%	63 A	5%		200 A	15%	100 A	7%
0360A-7	360	378	63 A	18%	32 A	9%	16 A	4%		32 A	9%	25 A	7%

Type ACS880-204LC-...	Nom. current [A AC]	Short-circuit current, 2 s / 5 s [A AC]	Miniature circuit breaker (IEC 60898-1) Max. size (Instantaneous tripping 0.1 s)							Fuse (IEC 60269-1:2006)			
			Char.	B		C		D		gG Max. size		aM Max. size	
			Coeff.	5	% of nom.	10	% of nom.	20	% of nom.	5 s based[1] 0.1 s based[2]		0.5 s based[3]	
										[A]	% of nom.	[A]	% of nom.
0400A-7	400	420	80 A		20%	40 A	10%	20 A	5%	32 A	8%	32 A	8%
0450A-7	450	473	80 A		18%	40 A	9%	20 A	4%	40 A	9%	35 A	8%
0480A-7	480	504	100 A		21%	50 A	10%	25 A	5%	40 A	8%	40 A	8%
0560A-7	560	588	100 A		18%	50 A	9%	25 A	4%	40 A	7%	40 A	7%
0620A-7	620	651	125 A		20%	63 A	10%	32 A	5%	50 A	8%	50 A	8%
0700A-7	700	735	125 A		18%	63 A	9%	32 A	5%	50 A	7%	50 A	7%
0770A-7	770	809	125 A		16%	80 A	10%	40 A	5%	50 A	6%	63 A	8%
0930A-7	930	977	125 A		13%	80 A	9%	40 A	4%	63 A	7%	63 A	7%
1090A-7	1090	1145	125 A		11%	100 A	9%	50 A	5%	80 A	7%	80 A	7%
1180A-7	1180	1239	125 A		11%	100 A	8%	50 A	4%	80 A	7%	80 A	7%
1360A-7	1360	1428	125 A		9%	125 A	9%	63 A	5%	80 A	6%	100 A	7%
1500A-7	1500	1575	125 A		8%	125 A	8%	63 A	4%	100 A	7%	125 A	8%
1800A-7	1800	1890	125 A		7%	125 A	7%	80 A	4%	100 A	6%	125 A	7%
2020A-7	2020	2121	125 A		6%	125 A	6%	100 A	5%	125 A	6%	160 A	8%
2220A-7	2220	2331	125 A		6%	125 A	6%	100 A	5%	125 A	6%	160 A	7%
2670A-7	2670	2804	125 A		5%	125 A	5%	125 A	5%	160 A	6%	200 A	7%
2930A-7	2930	3077	125 A		4%	125 A	4%	125 A	4%	160 A	5%	200 A	7%
3320A-7	3320	3486	125 A		4%	125 A	4%	125 A	4%	200 A	6%	250 A	8%
3840A-7	3840	4032	125 A		3%	125 A	3%	125 A	3%	200 A	5%	315 A	8%
4360A-7	4360	4578	125 A		3%	125 A	3%	125 A	3%	250 A	6%	315 A	7%
5240A-7	5240	5502	125 A		2%	125 A	2%	125 A	2%	250 A	5%	400 A	8%
5810A-7	5810	6101	125 A		2%	125 A	2%	125 A	2%	315 A	5%	400 A	7%
3AXD10001008774													

1) For frame R7i modules.
2) For frame R8i modules.
3) Overload needs to be controlled.
4) Fuse dimensioning is calculated with 105% short-circuit current. For other short-circuit currents, fuse dimensioning needs to be calculated according to the short-circuit current.

4

Example circuit diagrams

Contents of this chapter

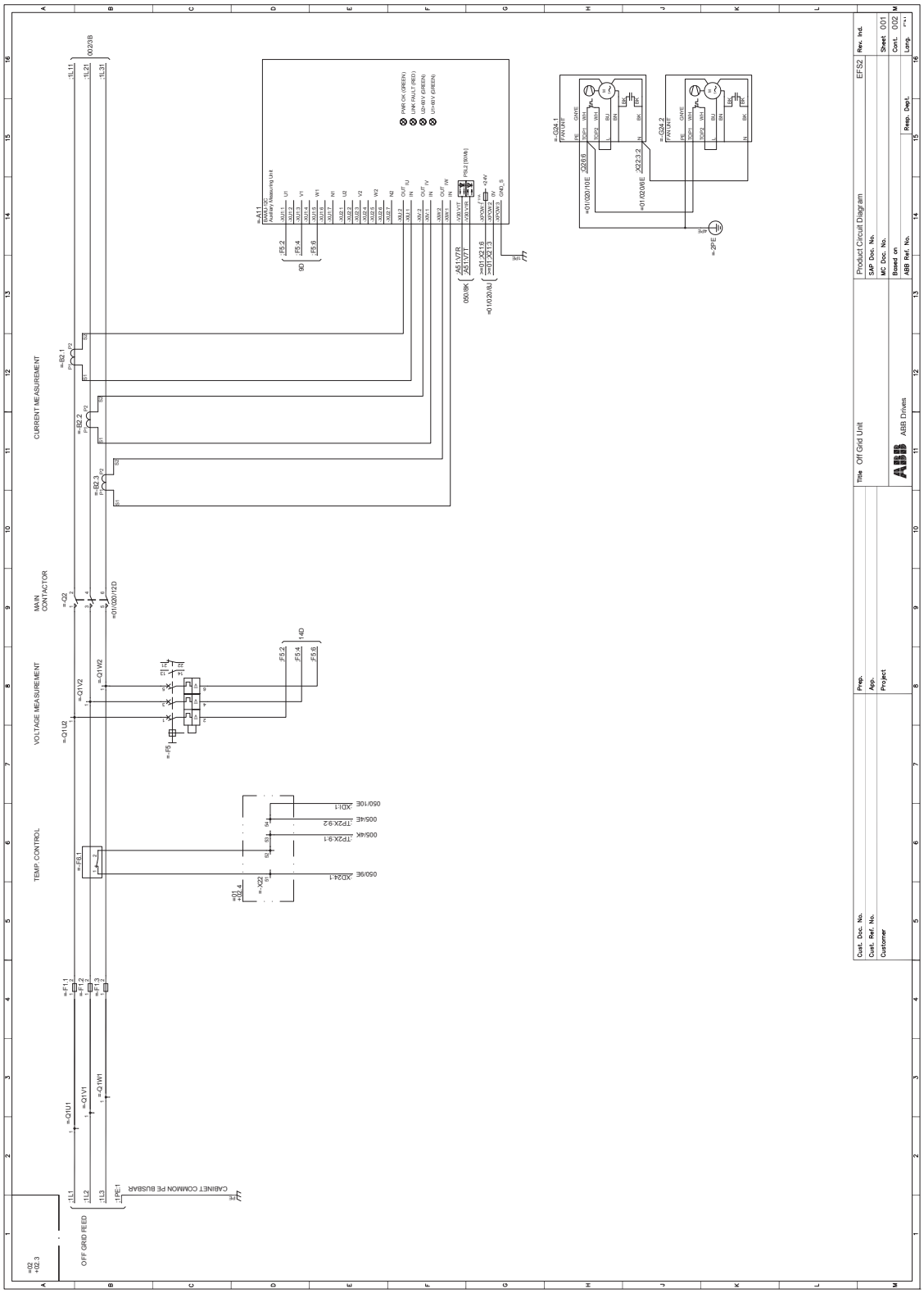
This chapter contains example circuit diagrams of an ACS880 grid converter.

Note: These diagrams do not necessarily match the installation-specific circuit diagrams of a tailor-made cabinet-installed unit.

The purpose of these diagrams is to help in:

- understanding the internal connections and operation of the converter
- learning how to wire a grid converter.

38 Example circuit diagrams



Further information

Product and service inquiries

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

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