

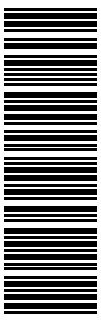
AC/DC Power Supply for inverter DC Link



SMB200

English

Rev. 0.2 – 27-9-2016



1S9MBEN

Quick start up guide
Specification and installation

Information about this manual

General information

Before using the product, read the safety instruction section carefully. Keep the manual in a safe place and available to engineering and installation personnel during the product functioning period.

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Thank you for choosing this Gefran product.

We will be glad to receive any possible information which could help us improving this manual.

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1 Safety Precautions

1.1 Symbols used in the manual



Warning!

Indicates a procedure, condition, or statement that, if not strictly observed, could result in personal injury or death.

Indique le mode d'utilisation, la procédure et la condition d'exploitation. Si ces consignes ne sont pas strictement respectées, il y a des risques de blessures corporelles ou de mort.



Caution

Indicates a procedure, condition, or statement that, if not strictly observed, could result in damage to or destruction of equipment.

Indique et le mode d'utilisation, la procédure et la condition d'exploitation. Si ces consignes ne sont pas strictement respectées, il y a des risques de détérioration ou de destruction des appareils.



Indicates that the presence of electrostatic discharge could damage the appliance. When handling the boards, always wear a grounded bracelet.

Indique que la présence de décharges électrostatiques est susceptible d'endommager l'appareil. Toujours porter un bracelet de mise à la terre lors de la manipulation des cartes.



Attention

Indicates a procedure, condition, or statement that should be strictly followed in order to optimize these applications.

Indique le mode d'utilisation, la procédure et la condition d'exploitation. Ces consignes doivent être rigoureusement respectées pour optimiser ces applications.

Note !

Indicates an essential or important procedure, condition, or statement.

Indique un mode d'utilisation, de procédure et de condition d'exploitation essentiels ou importants

Qualified personnel

For the purpose of this Instruction Manual, a "Qualified person" is someone who is skilled to the installation, mounting, start-up and operation of the equipment and the hazards involved. This operator must have the following qualifications:

- trained in rendering first aid.
- trained in the proper care and use of protective equipment in accordance with established safety procedures.
- trained and authorized to energize, de-energize, clear, ground and tag circuits and equipment in accordance with established safety procedures.

Personne qualifiée

Aux fins de ce manuel d'instructions, le terme « personne qualifiée » désigne toute personne compétente en matière d'installation, de montage, de mise en service et de fonctionnement de l'appareil et au fait des dangers qui s'y rattachent. L'opérateur en question doit posséder les qualifications suivantes :

- *formation lui permettant de dispenser les premiers soins*
- *formation liée à l'entretien et à l'utilisation des équipements de protection selon les consigne de sécurité en vigueur*
- *formation et habilitation aux manoeuvres suivantes : branchement, débranchement, vérification des isolations, mise à la terre et étiquetage des circuits et des appareils selon les consignes de sécurité en vigueur..*

Utilizzare Use for intended purpose only

The power drive system (electrical drive + application plant) may be used only for the application stated in the manual and only together with devices and components recommended and authorized by Gefran.

Utiliser uniquement dans les conditions prévues

Le système d'actionnement électrique (drive électrique + installation) ne peut être utilisé que dans les conditions d'exploitation et les lieux prévus dans le manuel et uniquement avec les dispositifs et les composants recommandés et autorisés par Gefran.

1.2 Safety precaution

The following instructions are provided for your safety and as a means of preventing damage to the product or components in the machines connected. This section lists instructions, which apply generally when handling electrical drives.

Specific instructions that apply to particular actions are listed at the beginning of each chapters.

Read the information carefully, since it is provided for your personal safety and will also help prolong the service life of your electrical drive and the plant you connect to it.

Les instructions suivantes sont fournies pour la sécurité de l'utilisateur tout comme pour éviter l'endommagement du produit ou des composants à l'intérieur des machines raccordées. Ce paragraphe dresse la liste des instructions généralement applicables lors de la manipulation des drives électriques.

Les instructions spécifiques ayant trait à des actions particulières sont répertoriées au début de chaque chapitre.

Lire attentivement les informations en matière de sécurité personnelle et visant par ailleurs à prolonger la durée de vie utile du drive tout comme de l'installation à laquelle il est relié.

1.3 General warnings



This equipment contains dangerous voltages and controls potentially dangerous rotating mechanical parts. Non-compliance with Warnings or failure to follow the instructions contained in this manual can result in loss of life, severe personal injury or serious damage to property.

Cet appareil utilise des tensions dangereuses et contrôle des organes mécaniques en mouvement potentiellement dangereux. L'absence de mise en pratique des consignes ou le non-respect des instructions contenues dans ce manuel peuvent provoquer le décès, des lésions corporelles graves ou de sérieux dégâts aux équipements.

The drives cause mechanical movements. The user is responsible for ensuring that these mechanical movements do not create unsafe conditions. The safety blocks and operating limits provided by the manufacturer cannot be bypassed or modified.

Les drives occasionnent des mouvements mécaniques. L'utilisateur est tenu de s'assurer que de tels mouvements mécaniques ne débouchent pas sur des conditions d'insécurité. Les butées de sécurité et les seuils d'exploitation prévus par le fabricant ne doivent être ni contournés ni modifiés.

Electrical Shock

The DC link capacitors of the drives connected to the DC bus remain charged with dangerous voltage even after the voltage supply has been switched off.

Never open the device or covers while the AC Input power supply is switched on. Minimum time to wait before working on the terminals or inside the device is 5 minutes. See also: section 5 **Wiring procedure**.

Risque de décharge électrique

Les condensateurs DC Link des entraînements branchés sur le bus CC demeurent dangereusement sous tension même après coupure de la tension d'alimentation.

Ne jamais ouvrir l'appareil lorsqu'il est sous tension. Le temps minimum d'attente avant de pouvoir travailler sur les bornes ou bien à l'intérieur de l'appareil est 5 min.

*Se reporter aussi au paragraphe 5 **Equipement électrique**.*

Electrical Shock and Burn Hazard

When using instruments such as oscilloscopes to work on live equipment, the oscilloscope's chassis should be grounded and a differential probe input should be used. Care should be used in the selection of probes and leads and in the adjustment of the oscilloscope so that accurate readings may be made. See instrument manufacturer's instruction book for proper operation and adjustments to the instrument.

Décharge Électrique et Risque de Brûlure

Lors de l'utilisation d'instruments (par exemple oscilloscope) sur des systèmes en marche, le chassis de l'oscilloscope doit être relié à la terre et une sonde différentiel devrait être utilisé en entrée. Les sondes et conducteurs doivent être choisis avec soin pour effectuer les meilleures mesures à l'aide d'un oscilloscope. Voir le manuel d'instruction pour une utilisation correcte des instruments.

Fire and Explosion Hazard

Fires or explosions might result from mounting Drives in hazardous areas such as locations where flammable or combustible vapors or dusts are present. Drives should be installed away from hazardous areas, even if used with motors suitable for use in these locations.

Risque d'incendies et d'explosions

L'utilisation des drives dans des zones à risques (présence de vapeurs ou de poussières inflammables), peut provoquer des incendies ou des explosions. Les drives doivent être installés loin des zones dangereuses, et équipés de moteurs appropriés.

1.4 Instruction for compliance with UL Mark (UL requirements), U.S. and Canadian electrical codes

Short circuit ratings

The SMB200 must be connected to a grid capable of supplying a symmetrical short-circuit power of less than or equal to "100kA rms (at 480 V +10% V max) in accordance with UL requirements (UL 508 c).

2 Introduction to the product

2.1 General description

Production machinery often has multiple drives and processes located in line and each controlled by an asynchronous motor.

When multiple motors are used to produce the finished product, very often some of the motors absorb energy from the primary power supply while others act as brakes and, therefore, generate energy.

An energy balance, and therefore lower operating costs, can be achieved in these systems by creating a common DC bus system to which all of the inverters that control the motors are connected.

The inverters channel energy from the common DC bus to the motors or from the motors to the common DC bus. In this way, energy from the motors that act as generators flows to the common DC bus and is used by the motors that need energy.

The common DC bus is obtained by equipping the line with SMB200 unidirectional power supplies.

The SMB200 is a three-phase unidirectional AC/DC power supply used to power a DC Link system to which one or more DC/AC inverters are connected in parallel.

Depending on the current level, it consists of a diode rectifier or of a half-controlled bridge, both in 6-pulse configuration.

A 12-pulse system can be configured by powering two SMB200s with parallel DC output via a transformer with two secondaries and 30° phase-shift.

This results in a sharp reduction of the THDi harmonic content on the power supply of the primary transformer circuit.

Due to the presence of a high capacitance value on the capacitors on the inverter DC link, the total capacitance of the DC link must be loaded gradually to avoid excessive peak currents.

The capacitors are precharged by appropriately modulating the thyristors on versions with SMB200-T half-controlled bridge and with a specific circuit on versions with SMB-D.....+PRC diode rectifier.



SMB-D versions (without PRC) always require an external precharge system.

Les versions SMB-D (sans PRC) exigent toujours un système de pré-charge externe.

For some lines or machines, the energy generated by motors powered by the DC Link system exceeds the level that the machine can reuse, and can be a high percentage of motorizing energy.

In these applications, instead of using systems that dissipate energy to the resistance, it is more efficient to regenerate energy to the primary power supply.

In this case, the SMB200 unidirectional power supply can be connected in parallel to an FFE200 regenerative power supply sized only for the regenerated power.

2.2 Drive type designation

The main technical characteristic of the SMB200 are showed in the product code and in the nameplate.

SMB200 - D - 2500 - 4 + PRC

Precharge

+ PRC = Internally installed precharge circuit

Rated voltage

4 = 400/500Vac

6 = 690Vac



Rated current I_{dN}

Model

D = Diode bridge

T = Semiconrolled diode bridge + thyristors

Power supply, SMB200 series

Identification label	
Serial number	Gefran S.p.A via G.Carducci, 24 I-21040-Gerenzano, VA
Power supply model	Type: SMB200-D-1600+PRC S/N: XXXXXXXX
Input (mains voltage, frequency, current)	Main Power Input 500Vac 1312A 50/60Hz 3Phase
Output (voltage, current)	Main Power Output 675Vdc 1600A
Precharge input (voltage, current)	Precharge Power Input 500Vac 70A 50/60Hz 3Phase
Fan supply (voltage, current)	Fan Supply 380 Vac 480Vac 0.3A 50/60Hz 3 Phase
Approvals	Code 39MB07  Made in Italy 

Firmware and boards revision label									
	Firmware HW Release S/N123456789 Prod.								
	Release SN SN3 SN7 R-PS S EMI SW CFG CONF								
Boards revision	<table border="1"> <tr> <td></td><td>A</td><td>C</td><td>B</td><td></td><td>A</td><td></td><td></td> </tr> </table>		A	C	B		A		
	A	C	B		A				
Firmware revision	<table border="1"> <tr> <td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td> </tr> </table>								

3 Transport and storage



Correct transport, storage, erection and mounting, as well as careful operation and maintenance are essential for proper and safe operation of the equipment.

Protect the SMB200 against physical shocks and vibration during transport and storage. Also be sure to protect it against water (rainfall) and excessive temperatures.

Le bon accomplissement des opérations de transport, de stockage, d'installation et de montage, ainsi que l'exploitation et l'entretien minutieux, sont essentiels pour garantir à l'appareil un fonctionnement adéquat et sûr.

Pendant les phases de transport et de stockage, protéger l'alimentateur SMB200 contre les chocs et les vibrations. S'assurer aussi qu'il soit à l'abri de l'eau (pluie), de l'humidité et de températures excessives.

3.1 General

A high degree of care is taken in packing the SMB200 and preparing them for delivery. They should only be transported with suitable transport equipment (see weight data). Observe the instructions printed on the packaging. This also applies when the device is unpacked and installed in the control cabinet.

Upon delivery, check the following:

- the packaging for any external damage
- whether the delivery note matches your order.

Open the packaging with suitable tools. Check whether:

- any parts were damaged during transport
- the device type corresponds to your order.

In the event of any damage or of an incomplete or incorrect delivery please notify the responsible sales offices immediately. The devices should only be stored in dry rooms within the specified temperature ranges.

Note !

A certain degree of moisture condensation is permissible if this arises from changes in temperature. This does not, however, apply when the devices are in operation. Always ensure that there is no moisture condensation in devices that are connected to the power supply!

3.2 Permissible Environmental Conditions

Temperature

Storage: -25...+55°C (-13...+131°F), class 1K4 per EN50178
Transport: -25...+70°C (-13...+158°F), class 2K3 per EN50178

Air humidity:

Storage: 5% to 95%, 1 g/m³ to 29 g/m³ (Class 1K3 as per EN50178)
Transport: 95% ⁽³⁾, 60 g/m³ ⁽⁴⁾

A light condensation of moisture may occur for a short time occasionally if the device is not in operation (class 2K3 as per EN50178).

Air pressure:

Storage: [kPa] 86 to 106 (class 1K4 per EN50178)

Transport: [kPa] 70 to 106 (class 2K3 per EN50178)

- (3) Greatest relative air humidity occurs with the temperature @ 40°C (104°F) or if the temperature of the device is brought suddenly from -25 ...+30°C (-13°...+86°F).
- (4) Greatest absolute air humidity if the device is brought suddenly from 70...15°C (158°...59°F).

4 Mechanical installation



SMB200 must be mounted on a wall that is constructed of heat resistant material. While the SMB200 is operating, the temperature of the supplier's cooling fins can rise to a temperature of 158° F (70°C).

SMB200 doit être monté sur un mur construit avec des matériaux résistants à la chaleur. Pendant le fonctionnement de l'alimentateur, la température des ailettes du dissipateur thermique peut arriver à 70°C (158° F).

Because the ambient temperature greatly affects supplier life and reliability, do not install the SMB200 in any location that exceeds the allowable temperature.

Étant donné que la température ambiante influe sur la vie et la fiabilité du alimentateur, on ne devrait pas installer le SMB200 dans des places où la température permise est dépassée.

Be sure to remove the desiccant dryer packet(s) when unpacking the SMB200. (If not removed these packets may become lodged in the fan or air passages and cause the supplier to overheat).

Lors du déballage du SMB200, retirer le sachet déshydraté. (Si celui-ci n'est pas retiré, il empêche la ventilation et provoque une surchauffe du alimentateur).

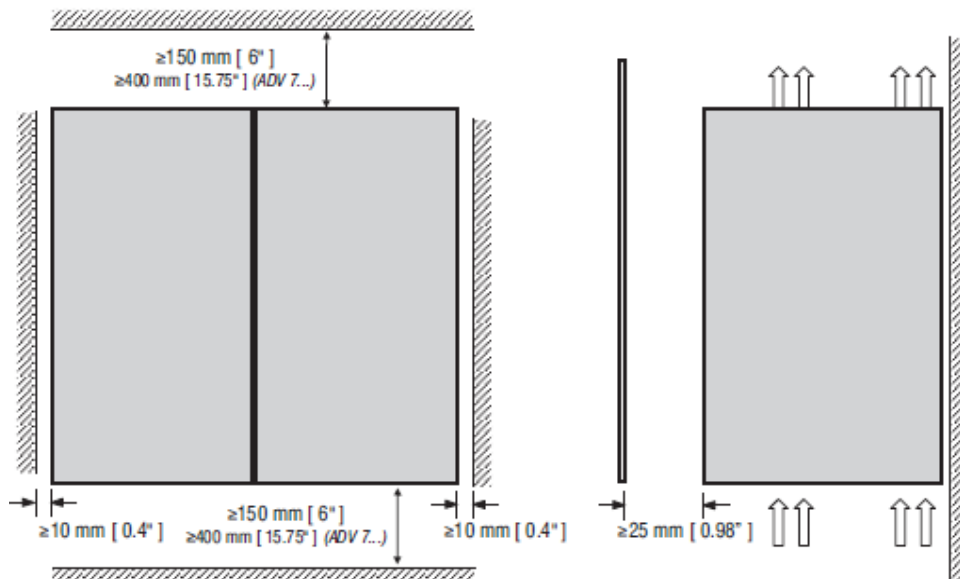
Protect the device from impermissible environmental conditions (temperature, humidity, shock etc.).

Protéger l'appareil contre des effets extérieurs non permis (température, humidité, chocs etc.).

4.1 Inclination and mounting clearance

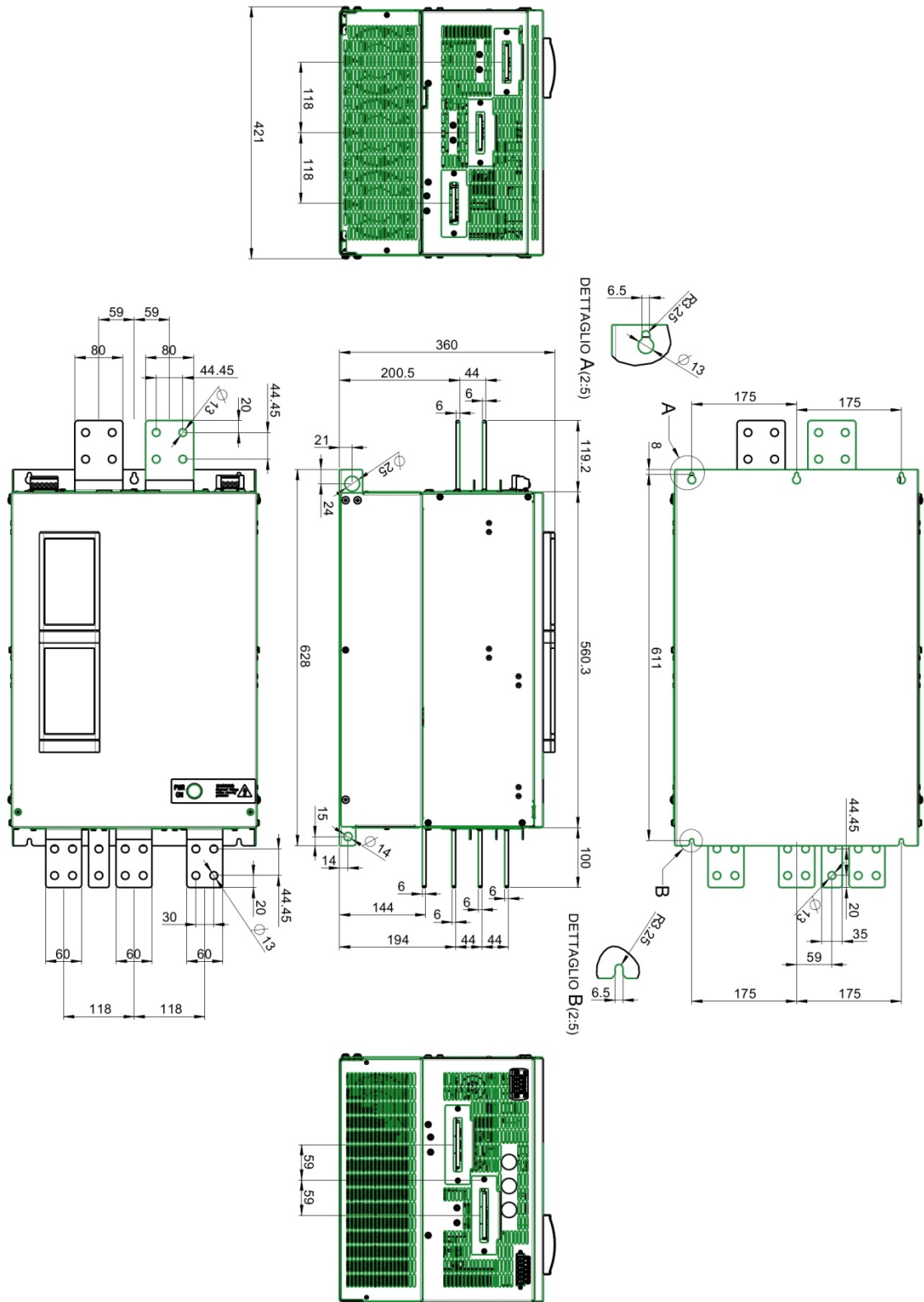
The SMB200 must be mounted in such a way that the free flow of air is ensured.

Maximum angle of inclination	30° (referred to vertical position)
Minimum top and bottom distance	150 mm (≥ SMB200-2500 = 400mm)
Minimum free space to the front	25 mm
Minimum distance between drives	none
Minimum distance to the side with the cabinet	10 mm



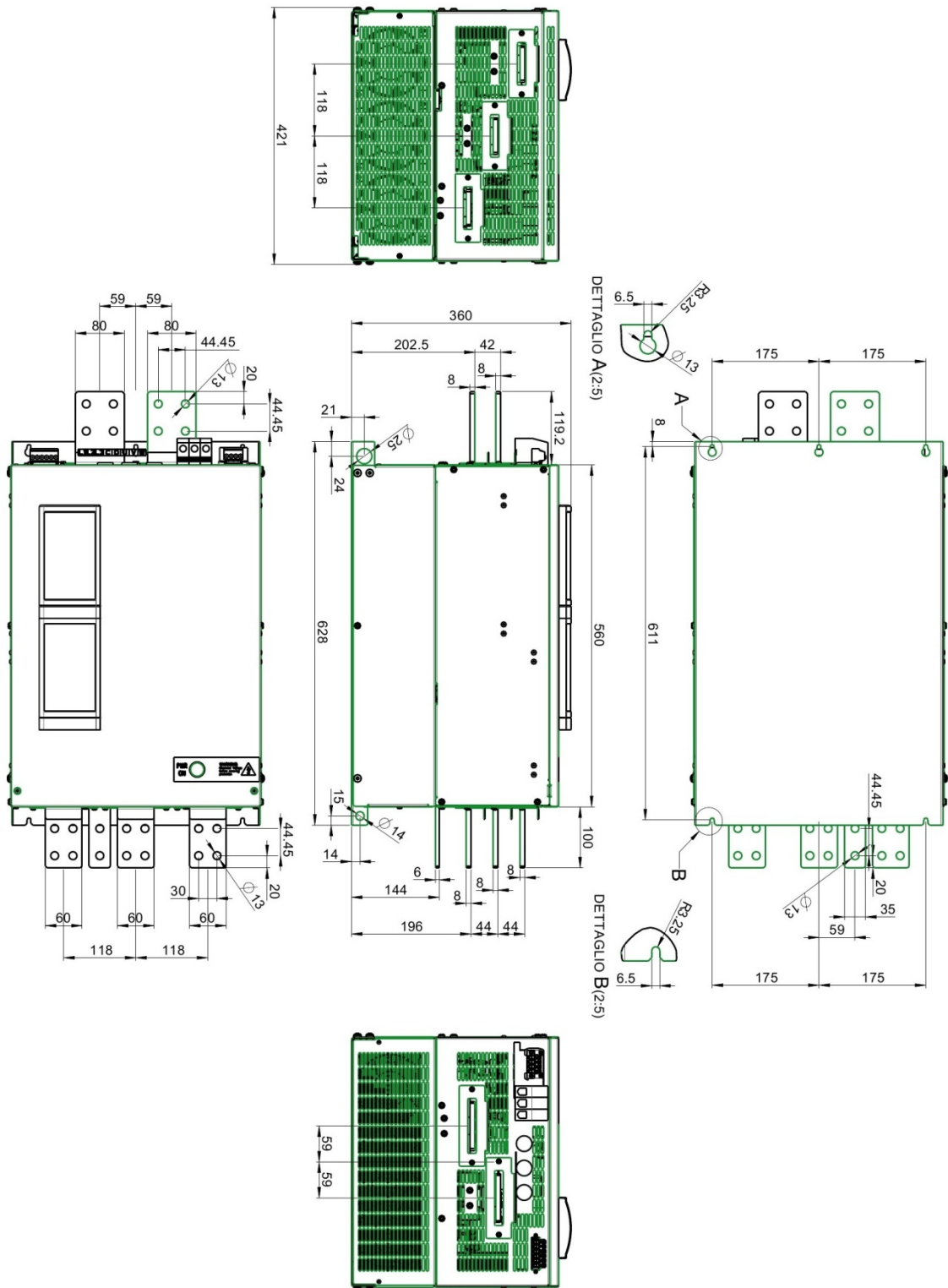
4.2 Fastening positions– Dimensions and weight

SMB200-T-1250-4 and SMB200-T-1000-6



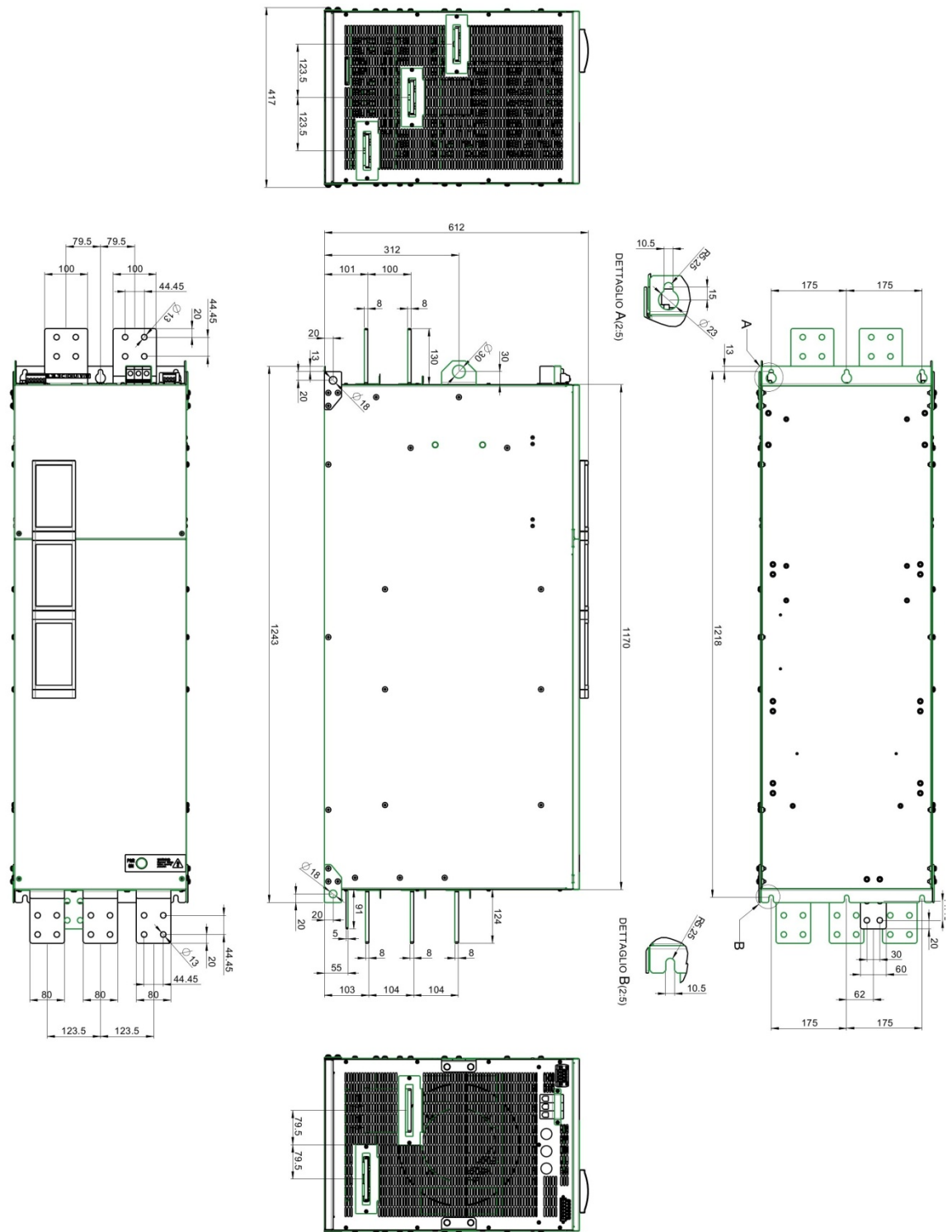
SMB200-D-1600-4 and SMB200-D-1600-6

(the diagram shows the version with built-in precharge circuit. The version without precharge does not have input terminals but has identical dimensions and drilling).



SMB200-D-2500-4 and SMB200-D-2500-6

(the diagram shows the version with built-in precharge circuit. The version without precharge does not have input terminals but has identical dimensions and drilling).



SMB200	Recommended screws for fastening
1000 ... 1600A	5 x M6 x 16 mm screws + Grover (spring-lock) washer + Flat washer
2500A	6 x M10 x 20 mm screws + Grover (spring-lock) washer + Flat washer

SMB200-...-4		
Model	Weight	
	[kg]	[lbs]
SMB200-T-1250-4	70	145
SMB200-D-1600-4	70	145
SMB200-D-2500-4	165	363
SMB200-D-1600-4+PRC	75	165
SMB200-D-2500-4+PRC	170	374

SMB200-...-6		
Model	Weight	
	[kg]	[lbs]
SMB200-T-1250-6	70	145
SMB200-D-1600-6	70	145
SMB200-D-2500-6	165	363
SMB200-D-1600-6+PRC	75	165
SMB200-D-2500-6+PRC	170	374

5 Wiring Procedure



SMB200 are electrical apparatus for use in industrial installations. Parts of the supplier are energized during operation.

The electrical installation and the opening of the device should therefore only be carried out by qualified personnel. Improper installation of motors or Devices may therefore cause the failure of the device as well as serious injury to persons or material damage.. Follow the instructions given in this manual and observe the local and national safety regulations applicable.

Les SMB200 à fréquence variable sont des dispositifs électriques utilisés dans des installations industriels. Une partie des alimentateur sont sous tension pendant l'opération.

L'installation électrique et l'ouverture des SMB200 devrait être exécuté uniquement par du personel qualifié. De mauvaises installations de moteurs ou de dispositifs peuvent provoquer des dommages matériels ou blesser des personnes. On doit suivre les instructions données dans ce manuel et observer les règles nationales de sécurité.

Replace all covers before applying power to the Device. Failure to do so may result in death or serious injury.

Remettre tous les capots avant de mettre sous tension le dispositif. Des erreurs peuvent provoquer de sérieux accidents ou même la mort.

The SMB200 must always be grounded. If the SMB200 is not connected correctly to ground, extremely hazardous conditions may be generated that may result in death or serious injury.

Le SMB200 doit toujours être raccordé au système de mise à la terre. Un mauvais raccordement du SMB200 au système de mise à la terre peut se traduire par des conditions extrêmement dangereuses susceptibles d'entraîner le décès ou de graves lésions corporelles.



Never open the device or covers while the AC Input power supply is switched on.

The red DC ON light, present on all sizes and versions, is on when the DC Link is charged. When power to the SMB200 modules is switched off, the luminosity of the light decreases in proportion to DC voltage and turns off completely at about 80VDC. DO NOT open the covers or work on the power connections before the light is completely off.

The DC Link discharge time depends on the value of the capacitor bank connected to the SMB200 power supply.

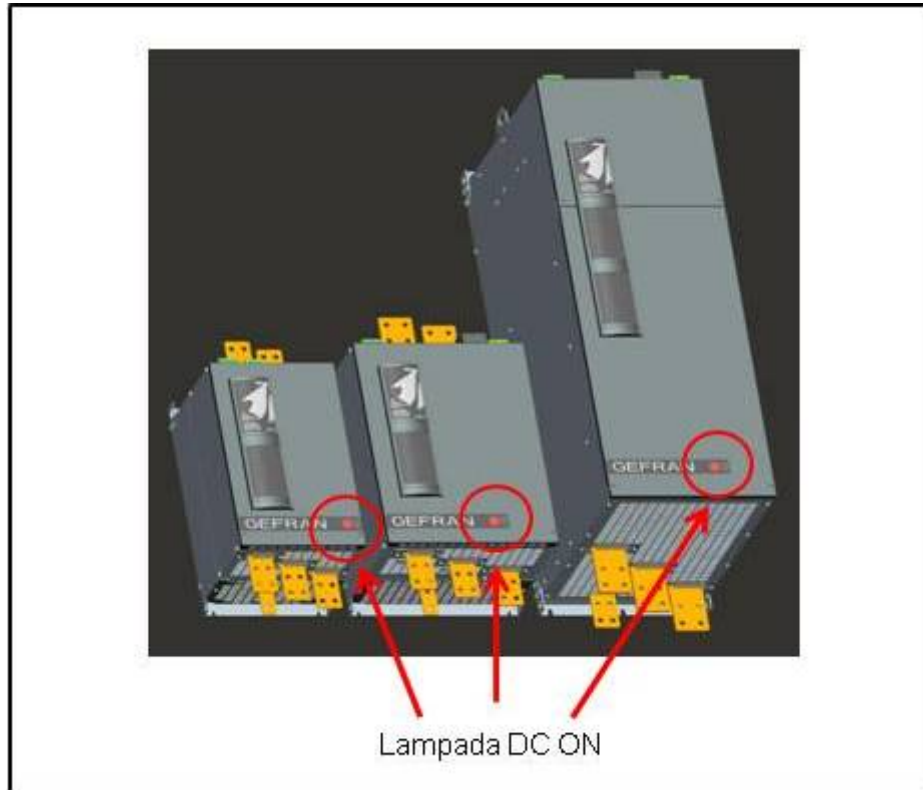
Minimum time to wait before working on the terminals or inside the device is 5 minutes.

Ne jamais ouvrir l'appareil lorsqu'il est sous tension.

Le témoin rouge DC ON, présent sur toutes les tailles et les versions, s'allume lorsque le DC Link est sous tension. Lors de la coupure de l'alimentation vers les modules SMB200, la luminosité de ce témoin diminue proportionnellement à la tension Vcc, jusqu'à s'éteindre complètement à environ 80Vcc. Ne pas ouvrir les caches de protection ni agir sur les connexions de puissance avant l'extinction complète du témoin.

Le temps de décharge du DC Link dépend de la valeur du groupe de condensateurs branché sur l'alimentateur SMB200.

Le temps minimum d'attente avant de pouvoir travailler sur les bornes ou bien à l'intérieur de l'appareil est 5 min.



Do not touch or damage any components when handling the device. The changing of the isolation gaps or the removing of the isolation and covers is not permissible.
Manipuler l'appareil de façon à ne pas toucher ou endommager des parties. Il n'est pas permis de changer les distances d'isolement ou bien d'enlever des matériaux isolants ou des capots.



Do not connect power supply voltage that exceeds the standard specification voltage fluctuation permissible. If excessive voltage is applied to the SMB200, damage to the internal components will result.
Ne pas raccorder de tension d'alimentation dépassant la fluctuation de tension permise par les normes. Dans le cas d'une alimentation en tension excessive, des composants internes peuvent être endommagés.

Operation with Residual Current Device

If an RCD (also referred to as ELCB or RCCB) is fitted, the inverters will operate without nuisance tripping, provided that:

- a type B RCD is used.
- the trip limit of the RCD is 300mA.
- the neutral of the supply is grounded (TT or TN systems)

RCD: Residual Current Device
 RCCB: Residual Current Circuit Breaker
 ELCB: Earth Leakage Circuit Breaker

Note !

The residual current operated circuit-breakers used must provide protection against direct-current components in the fault current and must be suitable for briefly suppressing power pulse current peaks. It is recommended to protect the frequency inverter by fuse separately. The regulations of the individual country (e.g. VDE regulations in Germany) and the regional power suppliers must be observed!

Fonctionnement avec un dispositif de courant résiduel

En cas d'installation d'un RCD – dispositif de courant résiduel – (également dénommé RCCB ou ELCB), les onduleurs fonctionneront sans faux arrêt à condition que :

- le RCD utilisé soit de type B
- le seuil de déclenchement du RCD soit fixé à 300 mA
- le neutre du bloc d'alimentation soit mis à la terre (systèmes TT ou TN)

RCD: Dispositif de courant résiduel

RCCB: Disjoncteur à courant résiduel

ELCB: Disjoncteur contre fuite à la terre

Remarque : Les RCD utilisés doivent assurer la protection contre les composants à courant continu présents dans le courant de défaut et doivent être capables de supprimer des crêtes de courant en peu de temps. Il est recommandé de protéger séparément l'onduleur au moyen de fusibles. Respecter la réglementation des pays concernés (par exemple, les normes VDR en Allemagne) et des fournisseurs locaux d'énergie électrique.



Functioning of the SMB200 without a ground connection is not permitted.

Défense de faire fonctionner le SMB200 sans qu'il y ait eu raccordement de mise à la terre préalable.

The grounding connector shall be sized in accordance with the NEC or Canadian Electrical Code. The connection shall be made by a UL listed or CSA certified closed-loop terminal connector sized for the wire gauge involved. The connector is to be fixed using the crimp tool specified by the connector manufacturer.

Le raccordement devrait être fait par un connecteur certifié et mentionné à boucle fermé par les normes CSA et UL et dimensionné pour l'épaisseur du câble correspondant. Le connecteur doit être fixé à l'aide d'un instrument de serrage spécifié par le producteur du connecteur.

Do not perform a megger test between the SMB200 terminals or on the control circuit terminals.

Ne pas exécuter un test megger entre les bornes du SMB200 ou entre les bornes du circuit de contrôle.

The electrical commissioning should only be carried out by qualified personnel, who are also responsible for the provision of a suitable ground connection and a protected power supply feeder in accordance with the local and national regulations.

La mise en service électrique doit être effectuée par un personnel qualifié. Ce dernier est responsable de l'existence d'une connexion de terre adéquate et d'une protection des câbles d'alimentation selon les prescriptions locales et nationales.

Type of networks

SMB200 are designed to be powered from standard three phase lines that are electrically symmetrical with respect to ground (TN or TT network).

The device can also be used with IT supply lines.

Type de réseaux

Les SMB200 sont conçus pour être alimentés à partir des lignes triphasées standard qui sont électriquement symétrique par rapport à la terre (TN ou réseau TT).

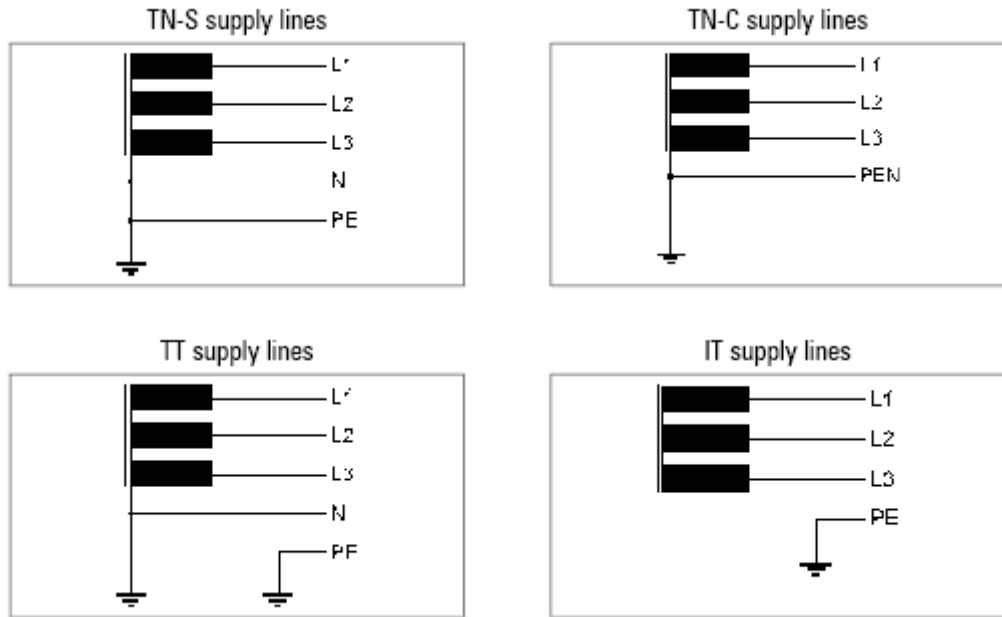
The device can also be used with IT supply lines.

Power supply networks

Based on the grounding method, the IEC 60634-1 describes three main types of grounding for power supply networks: TN, TT and IT systems.

In particular, the IT system has all the active parts insulated from earth or a point connected to ground through an impedance. The earths of the system are connected separately or collectively to the system ground.

The following figures show these different systems.





5.1 Power section

5.1.1 Cable Cross Section

Sizes SMB200-....4	Bars C – D			
	Maximum Cable Cross Section (flexible conductor)		Lock screw diameter (mm)	Tightening torque (min) (Nm)
	(mm ²)	AWG/kcmil		
SMB200-T-1250-4	4 x 150	4 x kcmil 300	M12	45
SMB200-D-1600-4	3 x 300	3 x kcmil 600		
SMB200-D-2500-4	5 x 300 (with adapter)	5 x kcmil 600 (with adapter)		
Sizes SMB200-....4	Bars U1 – V1 – W1			
	Maximum Cable Cross Section (flexible conductor)		Lock screw diameter (mm)	Tightening torque (min) (Nm)
	(mm ²)	AWG/kcmil		
SMB200-T-1250-4	4 x 95	4 x 4/0	M12	45
SMB200-D-1600-4	4 x 150	4 x kcmil 300		
SMB200-D-2500-4	5 x 240	5 x kcmil 500 (with adapter)		

Sizes SMB200-....6	Bars C – D			
	Maximum Cable Cross Section (flexible conductor)		Lock screw diameter (mm)	Tightening torque (min) (Nm)
	(mm ²)	AWG/kcmil		
SMB200-T-1000-6	3 x 150	3 x kcmil 300	M12	45
SMB200-D-1600-6	3 x 300	3 x kcmil 600		
SMB200-D-2500-6	5 x 300 (with adapter)	5 x kcmil 600 (with adapter)		
Sizes SMB200-....6	Bars U1 – V1 – W1			
	Maximum Cable Cross Section (flexible conductor)		Lock screw diameter (mm)	Tightening torque (min) (Nm)
	(mm ²)	AWG/kcmil		
SMB200-T-1000-6	3 x 120	3 x kcmil 250	M12	45
SMB200-D-1600-6	3 x 240	3 x kcmil 500		
SMB200-D-2500-6	5 x 300 (with adapter)	5 x kcmil 600 (with adapter)		

The cables listed above are sized according to EN 60204 part 1 / IEC 204-1 using cables insulated PVC at 70°C, max. environmental temperature = 40°C, group 3. Higher-performance cables (designed for higher working temperatures) or copper bars with adequate cross section can also be used.

Sizes SMB200-....4	Connection  on bars			
	Cable cross-section		Lock screw diameter (mm)	Tightening torque (Nm)
	(mm ²)	AWG/kcmil		
SMB200-T-1250-4	1 x 185	3 x kcmil 350	M12	45
SMB200-D-1600-4	2 x 120	2 x kcmil 250		
SMB200-D-2500-4	2 x 240	2 x kcmil 250		
Sizes SMB200-....6	Connection  on bars			
	Cable cross-section		Lock screw diameter (mm)	Tightening torque (Nm)
	(mm ²)	AWG		
SMB200-T-1000-6	1 x 150	1 x kcmil 300	M12	45
SMB200-D-1600-6	2 x 120	2 x kcmil 250		
SMB200-D-2500-6	2 x 240	2 x kcmil 250		

5.1.2 EMC guide line



In a domestic environment, this product may cause radio interference, in which case supplementary mitigation measures may be required.

Dans un environnement domestique, ce produit peut causer des interférences radio, auquel cas des mesures d'atténuation supplémentaire peuvent être nécessaires.

SMB200 are designed to operate in an industrial environment where a high level of electromagnetic interference are to be expected. Proper installation practices will ensure safe and trouble-free operation. If you encounter problems, follow the guidelines which follow.

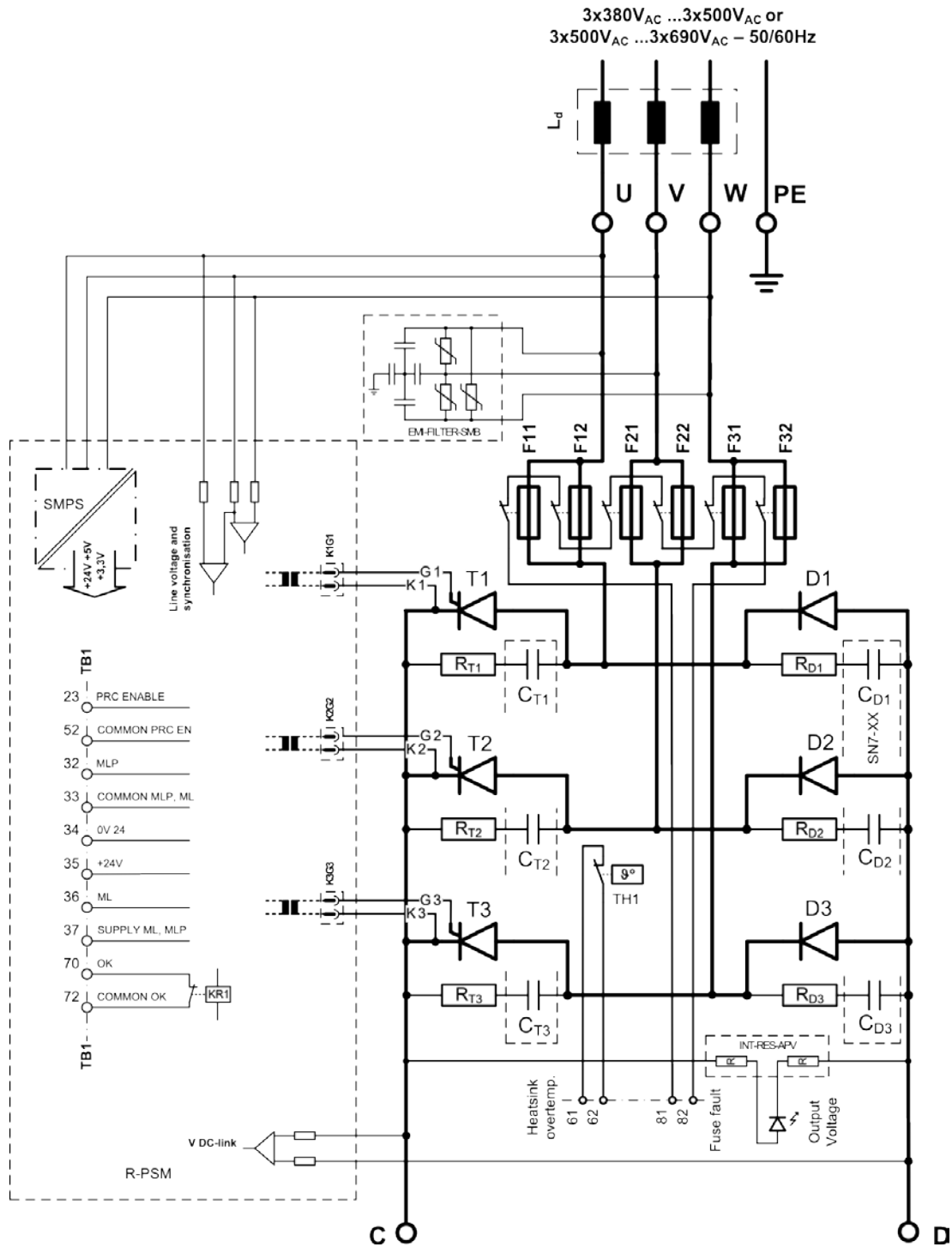
- Check for all equipment in the cabinet are well grounded using short, thick grounding cable connected to a common star point or busbar. Better solution is to use a conductive mounting plane and use that as EMC ground reference plane.
- Flat conductors, for EMC grounding, are better than other type because they have lower impedance at higher frequencies.
- Make sure that any control equipment (such as a PLC) connected to the SMB200 is connected to the same EMC ground or star point as the SMB200 via a short thick link.
- Separate the control cables from the power cables as much as possible, using separate trunking, if necessary at 90° to each other.
- Whenever possible, use screened leads for the connections to the control circuitry.
- Ensure that the contactors in the cubicle are suppressed, either with R-C suppressors for AC contactors or 'flywheel' diodes for DC contactors fitted to the coils. Varistor suppressors are also effective. This is important when the contactors are controlled from the SMB200 relay.

Note !

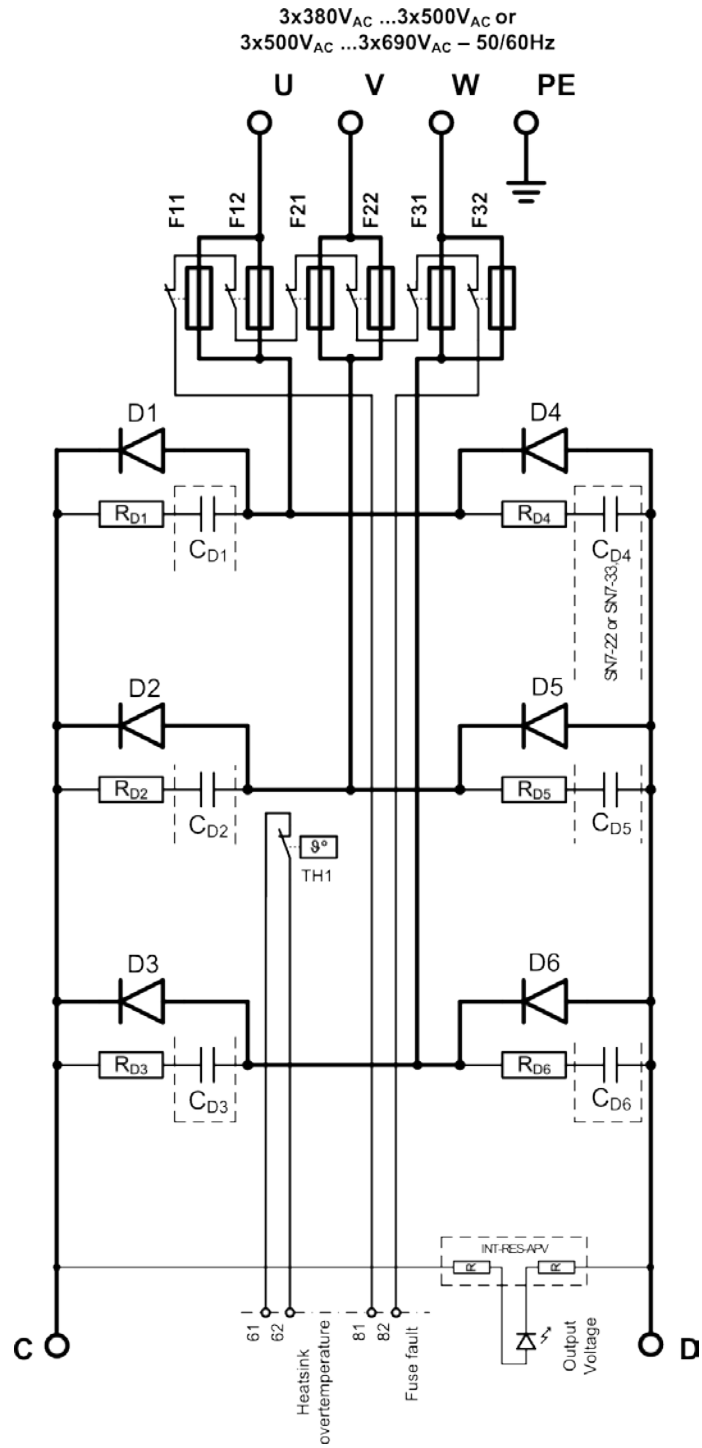
For further information regarding electro-magnetic compatibility standards, according to Directive 2014/30/EC, conformity checks carried out on Gefran appliances, connection of filters and mains inductors, shielding of cables, ground connections, etc., consult the "**Electro-magnetic compatibility guide**" on the CD attached to this drive.

5.1.3 Block diagram power section and Power line connection

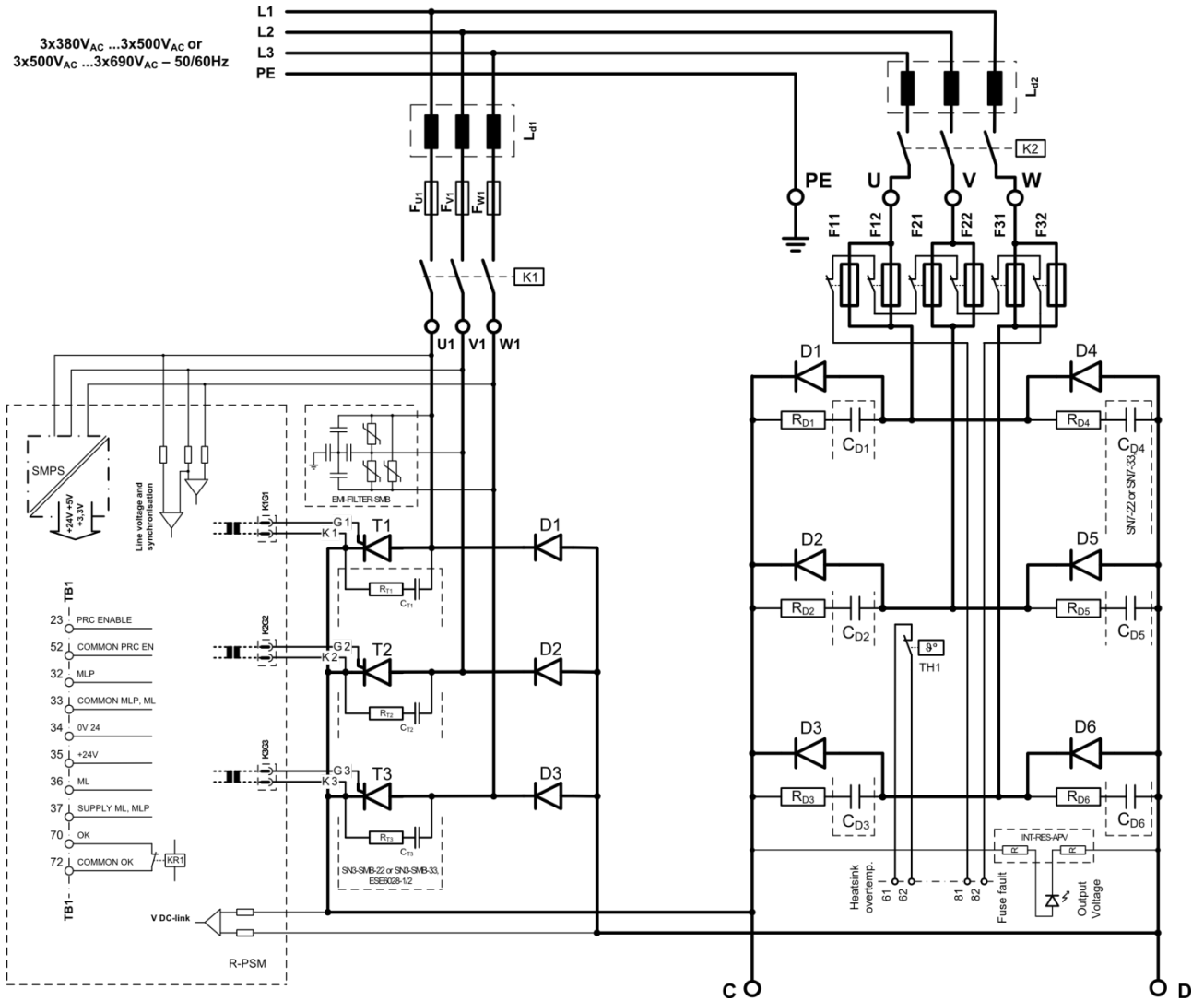
SMB200-T-1250-4; SMB-T-1000-6



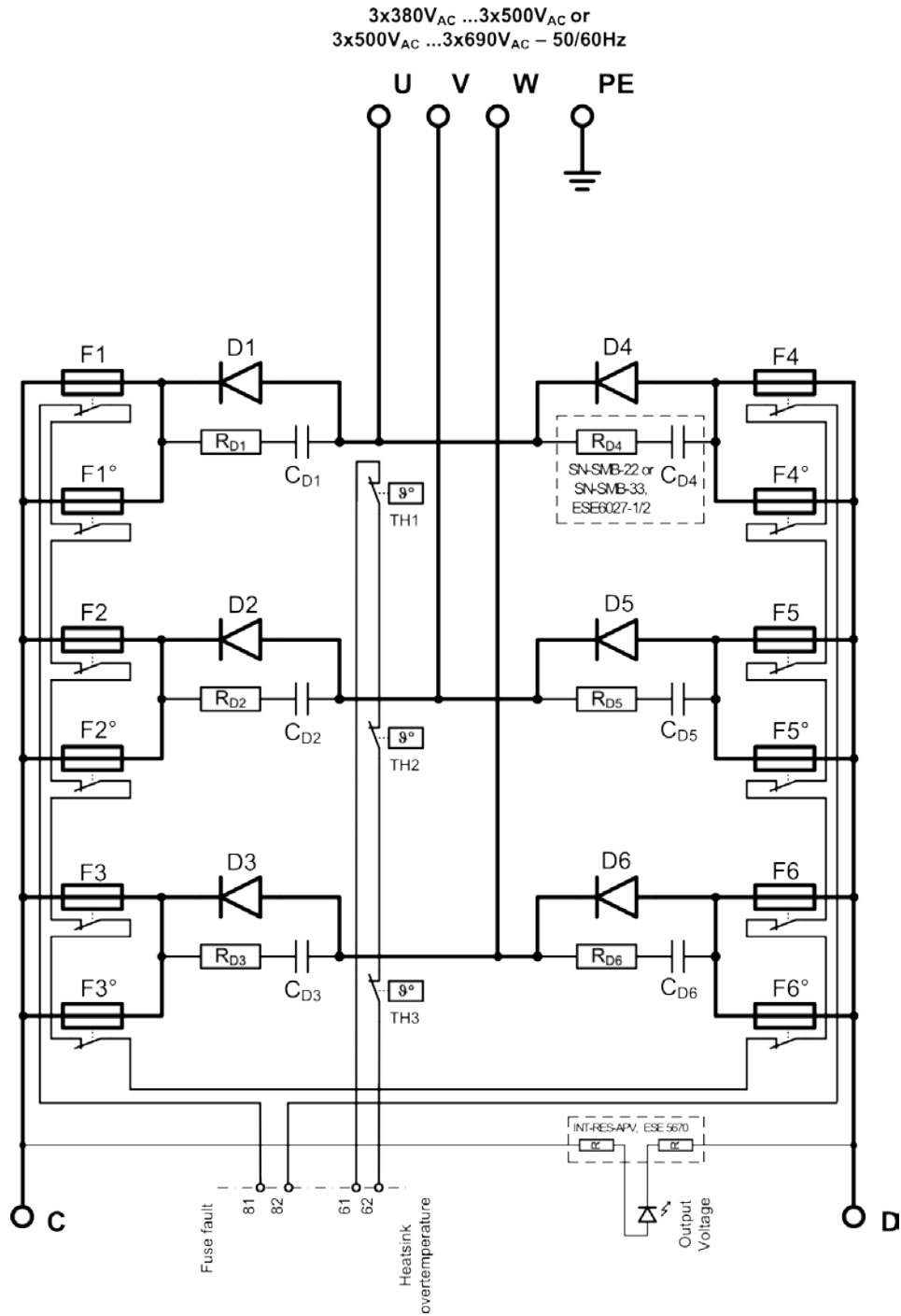
SMB200-D-1600-4; SMB200-D1600-6



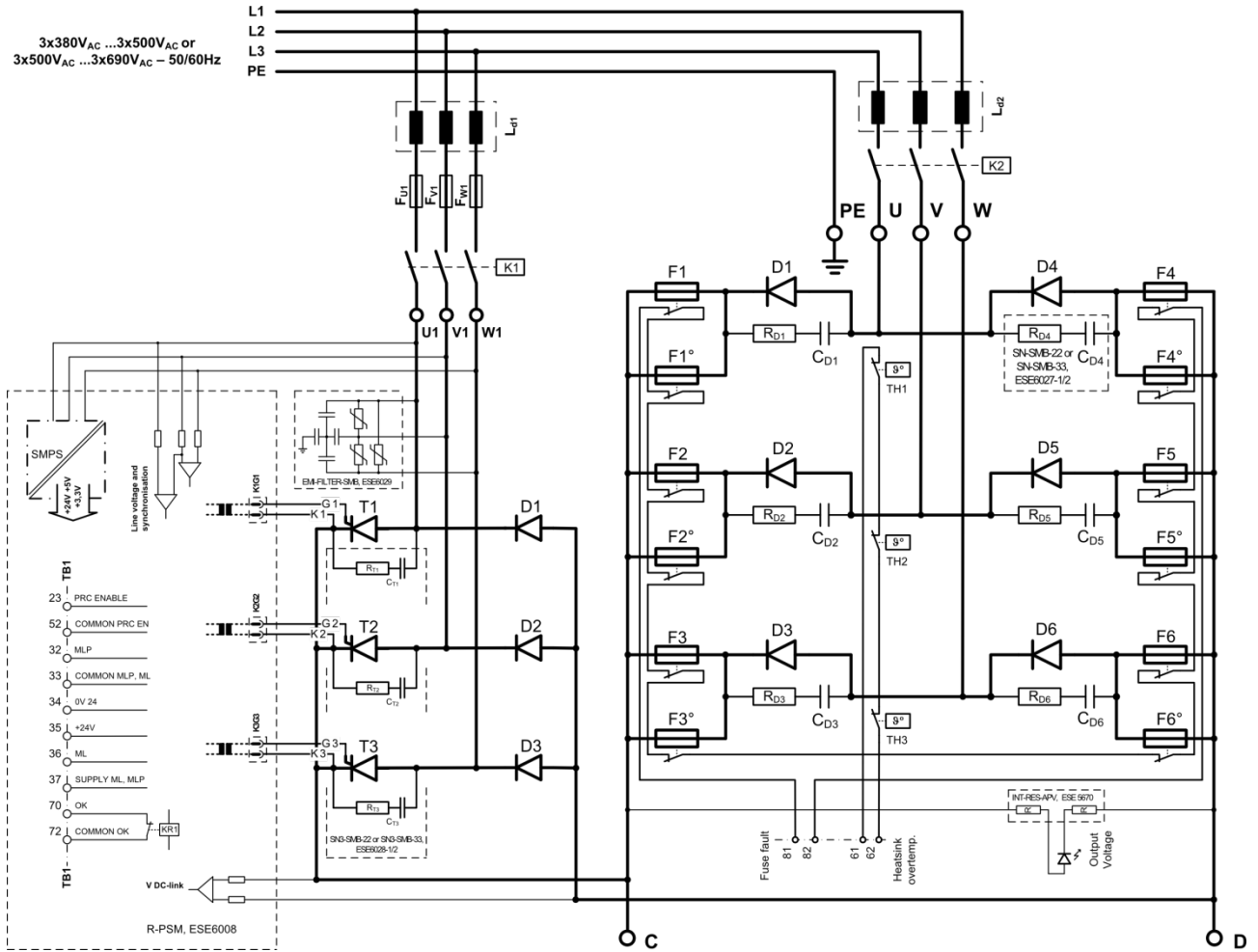
SMB200-D-1600-4+PRC; SMB200-D1600-6+PRC



SMB200-D-2500-4; SMB200-D-2500-6

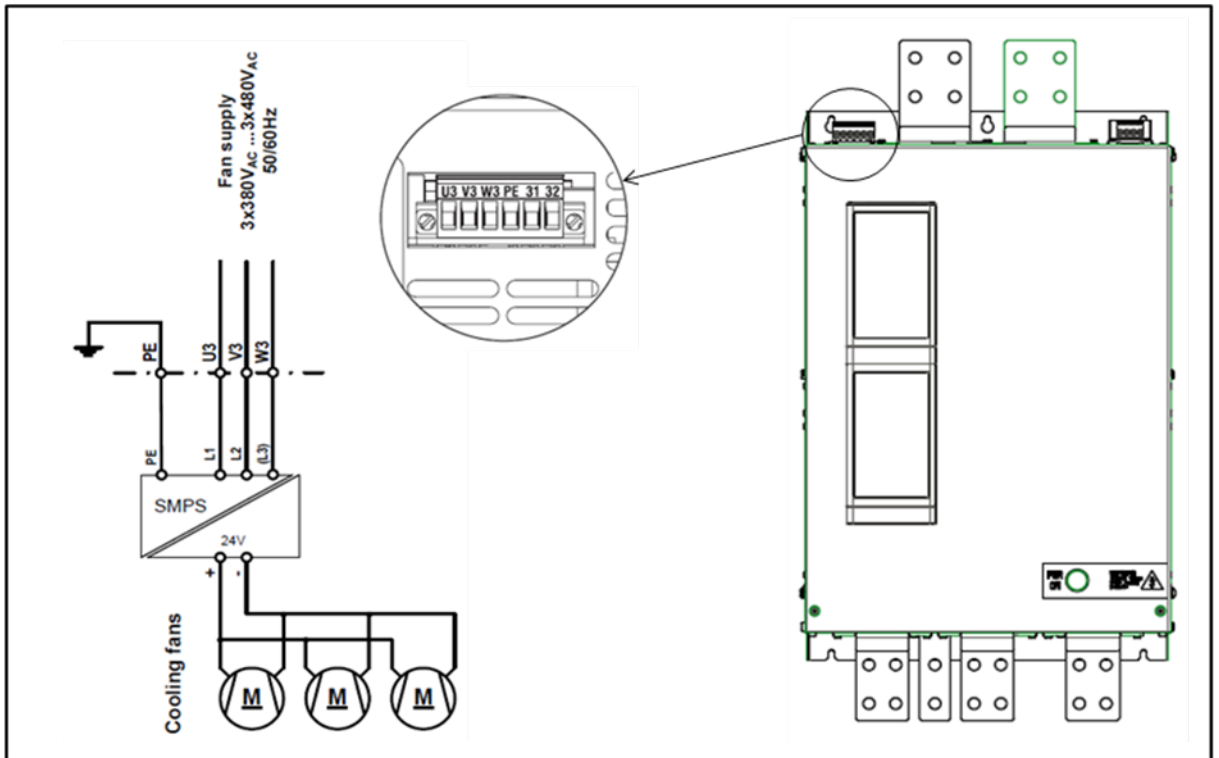


SMB200-D-2500-4+PRC; SMB200-D-2500-6+PRC

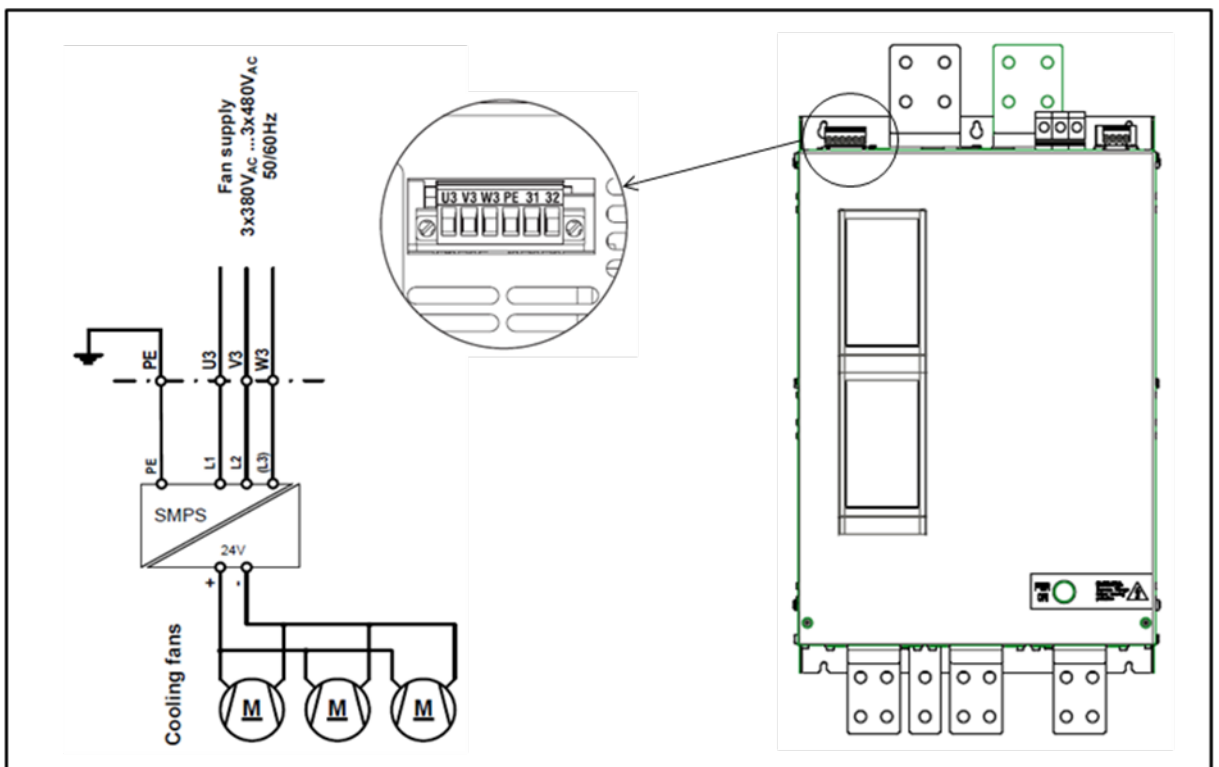


5.1.4 Cooling fans power supply

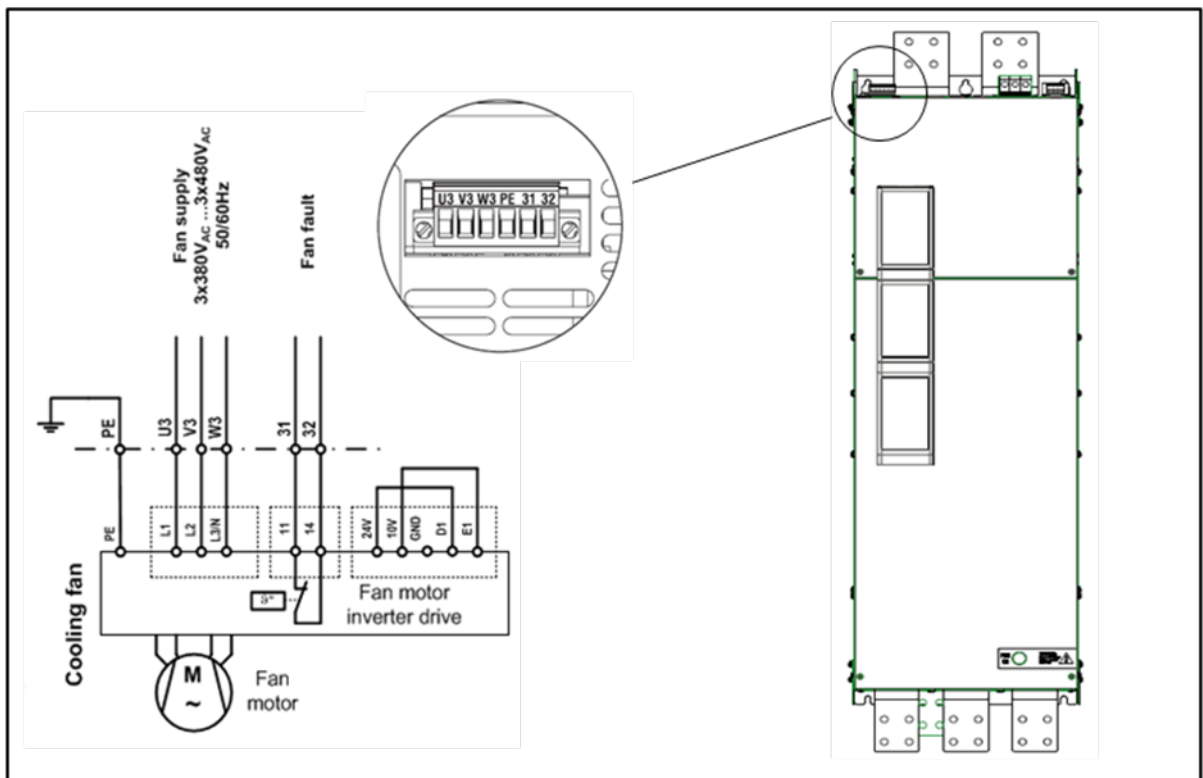
SMB200-T-1250-4 and SMB200-T-1250-6



SMB200-D-1600-4 and SMB200-D-1600-6



SMB200-D-2500-4 and SMB200-D-2500-6



Models SMB200-D-2500-4 and 690VAC SMB200-D-2500-6 are equipped with inverter-controlled fans. An **“Inverter fault”** signal is available only for these sizes. On all sizes, failure of the cooling fans trips the thermal protection (see diagram and data table in section 5.2.).

Cooling fan connections

Model	Terminal connection	Supply voltage	Supply current
SMB200-T-1250-4 SMB200-D-1600-4 SMB200-T-1000-6 SMB200-D-1600-6	U3, V3, W3	3 x 400V _{AC} , 50/60Hz	0,3A _{AC}
SMB200-D-2500-X+X			1,35A _{AC}

Terminal connection	Wire section			Tightening torque
	min	max	Recommended	
U3, V3, W3, 31, 32	0,2mm ² (24AWG)	6mm ² (8AWG)	1,5mm ² 16AWG	0,5 ... 0,8Nm

Signal	Terminal connection	Characteristics (potential free contact)
Fan inverter fault (for SMB200-2500 only)	31 - 32	250V _{AC} / 1A Closed: Fan inverter OK and powered Open: Fan inverter in alarm or not powered

5.1.5 Internal power fuses

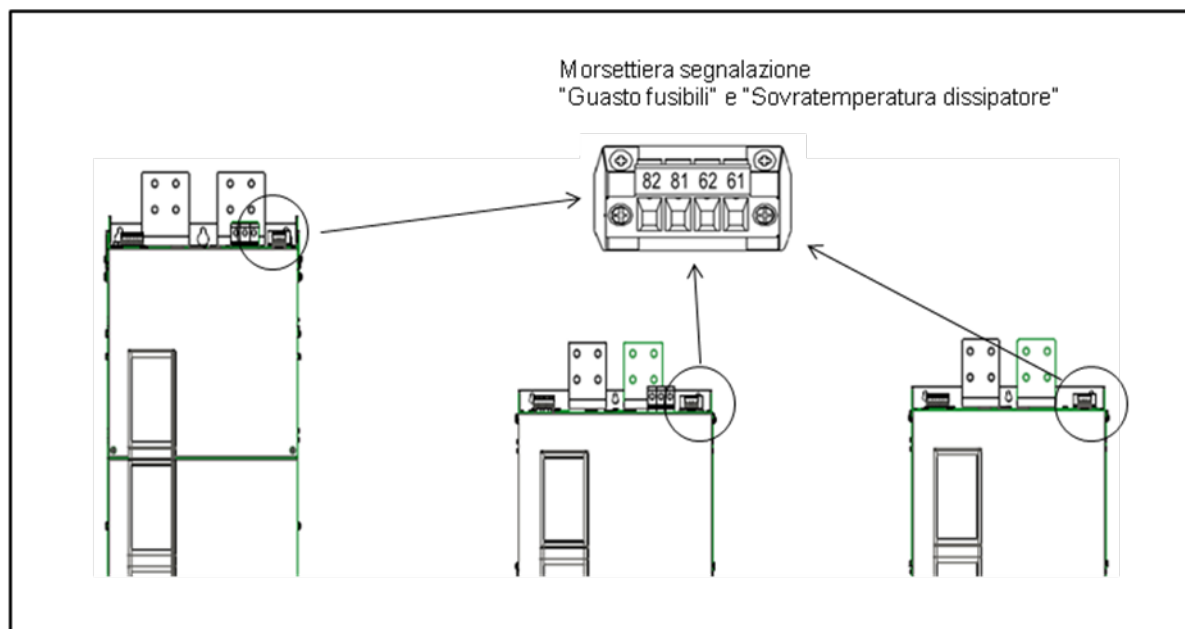
The entire line of SMB200 power supplies is equipped with internal high-speed fuses.

Fuse type and quantity

Sizes SMB-...-4	Fuses Q.ty	Fuse data	Fuse type
SMB200-T-1250-4	(1+1) x 3 Line fuses	700A / 690V _{AC}	170M5463 or equivalent Gefran code S7791
SMB200-D-1600-4		800A / 690V _{AC}	170M5464 or equivalent Gefran code S826B
SMB200-D-2500-4	(1+1) * 6 branch fuses	800A / 690V _{AC}	170M5464 or equivalent Gefran code S826B

Sizes SMB-...-4	Fuses Q.ty	Fuse data	Fuse type
SMB200-T-1000-6	(1+1) x 3 Line fuses	550A / 690V _{AC}	170M5461 or equivalent Gefran code S85C11
SMB200-D-1600-6		800A / 690V _{AC}	170M5464 or equivalent Gefran code S826B
SMB200-D-2500-6	(1+1) * 6 branch fuses	800A / 690V _{AC}	170M5464 or equivalent Gefran code S826B

A tripped fuse is signaled by opening of the clean contact shown at terminals 81 – 82. The “Heatsink overtemperature” signal is available on the same connector. Use a 40Nm tightening torque when replacing a fuse.



Signal	Terminal connection	Characteristics (potential free contact)
Fuse fault (SMB200-2500)	81 - 22	NC - 250V _{AC} / 1A
Heatsink overtemperature	61 - 62	NC - 250V _{AC} / 1A

5.1.6 Relative line impedance, transformers, line inductors and Precharge

As a general rule, an SMB200 must always be connected to a supply line that “shows” a relative impedance ZL of at least 1%, meaning that between the line voltage generator and the SMB200 there should be impedance with relative voltage drop Ukl of at least 1%. By ignoring the resistive component, this voltage drop may be assigned completely to a single XL reactance.

More simply put, this means that considering standard transformers with VSC = 4%, a single SMB200 can be connected directly (without inserting line coils) for transformers with rated power up to about 4 times the rated power of the SMB200. If available power is more than 4 times the rated power of the SMB200, decoupling line reactors are required.

Of course, if more than one device is connected to the same line, the rules of EN 61800-3 apply to the common PCC connection point, which makes it mandatory to use line inductors for all of the devices.

The theoretical value of rated power for the power supply transformer can be calculated with the following formula:

$$P_{dN} = 1,35 * U_{LN} * I_{dN} = [W]$$

Power losses (only about 0.3 – 0.4% of this value) can be overlooked. (SMB200 dissipation values are shown in the chapter on technical characteristics).

This active power is linked only to the fundamental (first) harmonic of line current, while a rectifier bridge with DC leveling capacitors generates different harmonic currents that constitute a supplemental load for the transformer as well.

The distribution of the harmonics also depends on factors linked to installation parameters (RSC), but in general, if specific filters to reduce harmonic content are not inserted on the line, the real RMS value of the line current can be considered about 1.3 time the first harmonic value.

To conclude, the following (conservative) formula can be used to calculate the apparent rated power P_{tL} of the required line transformer:

$$P_{tL} = 1,3 * P_{dN} = [VA]$$

Line inductances, when necessary, must be calculated for a voltage drop uk = 2%

In general, the following formula is used to calculate line inductances:

$$L_d = \frac{\Delta V}{2\pi * f_N * I_{LN}} * 10^6 = [\mu H]$$

Or:

$$L_d = \frac{\Delta V}{2\pi * f_N * I_{dN} * \frac{\sqrt{2}}{\sqrt{3}}} * 10^6 = [\mu H]$$

$$\Delta V = \frac{u_k}{100} * \frac{U_{LN}}{\sqrt{3}} = [V]$$

Where f_N = primary power supply frequency [Hz]

5.1.7 Standard line inductances: Rated data, Dimension, Losses

Sizes SMB200	Choke type	Choke L [μ H]	Thermal current I_{th} [A]	Saturation current I_s [A]
Mains power supply $380V_{AC} \leq U_{LN} \leq 500V_{AC}$				
SMB200-T-1250-4	LR3-4-SMB-1250	18	1127	2152
SMB200-D-1600-4	LR3-4-SMB-1600	14	1443	2755
SMB200-D-2500-4	LR3-4-SMB-2500	9	2255	4305
Mains power supply $500V_{AC} \leq U_{LN} \leq 690V_{AC}$				
SMB200-T-1000-6	LR3-6-SMB-1000	31	902	1722
SMB200-D-1600-6	LR3-6-SMB-1600	20	1443	2755
SMB200-D-2500-6	LR3-6-SMB-2500	13	2255	4305

Choke type	Height [mm]	Width [mm]	Depth [mm]	Weight [Kg]	Losses [W]
LR3-4-SMB-1250	500	400	390	150	
LR3-4-SMB-1600	600	460	460	150	
LR3-4-SMB-2500	730	510	460	180	
LR3-6-SMB-1000	390	500	410	160	
LR3-6-SMB-1600	600	460	560	210	
LR3-6-SMB-2500	720	480	370	270	

The standard line inductances for the range $380V_{AC} \leq U_{LN} \leq 500V_{AC}$ are calculated in order to have $\pm 2\%$ with mains power = $500V_{AC}$ ($\pm 2,5\%$ with $400V_{AC}$)
The standard line inductances for the range $500V_{AC} \leq U_{LN} \leq 690V_{AC}$ are calculated in order to have $\pm 2\%$ with mains power = $69V_{AC}$

Up to **four** SMB200 power supplies can be connected in parallel to increase the total output current supplied. **Power supplies with identical input voltage and output current must be used.**

In this case, you **must** use **line inductors with $\pm 2\%$ uk** and the SMB200 output current value must be derated due to current division that is not perfectly symmetrical.

The reactors installed must be identical models from the same manufacturer and their tolerance on **inductance value must be below 5%**.

5.1.8 Standard precharge inductances: Rated data, Dimension, Losses

The SMB200-D-....-4+PRC and SMB200-D-....-6+PRC power supplies are equipped with a precharge circuit made of a three-phase half-controlled bridge plus an R-PSM (Regulation - Power Supply Module) regulation card.

The DC-Link capacitor is charged by slicing conduction of the thyristors of all three phases by means of a ramp with programmable duration.

The power supply line of the precharge circuit must be equipped with a precharge inductance.

Given the impulsive and brief nature of the precharge current, the inductances have relatively low thermal current and high saturation current.

Sizes SMB200	Choke type	Choke L [μ H]	Thermal current I_{th} [A]	Saturation current I_s [A]
Mains power supply $380V_{AC} \leq U_{LN} \leq 500V_{AC}$				
SMB200-D-1600-4	LR3-4-PRC	100	70	400
SMB200-D-2500-4				
Mains power supply $500V_{AC} \leq U_{LN} \leq 690V_{AC}$				
SMB200-D-1600-6	LR3-6-PRC	200	70	400
SMB200-D-2500-6				

Choke type	Height [mm]	Width [mm]	Depth [mm]	Weight [Kg]	Losses [W]
LR3-4-PRC	165	180	140	8	45
LR3-6-PRC	157	180	170	15	71

6 Regulation section: R-PSM card

The R-PSM regulation card is used on modules **SMB200-T-...-4** and **SMB200-T-...-6** to control the three SCRs installed on the half-controlled power bridge. When the SMB module is connected to the mains (terminals U – V – W), the R-PSM regulation card generates the internal power supplies needed for operation. Therefore, additional external power supplies are unnecessary.

The R-PSM regulation card is used on modules **SMB200-D-...-4+PRC** and **SMB200-D-...-6+PRC** to control the precharge circuit.

When the SMB module precharge circuit is connected to the mains (terminals U1 – V1 – W1), the R-PSM regulation card generates the internal power supplies needed for operation. Therefore, additional external power supplies are unnecessary.

If an UNDERVOLTAGE alarm is detected when the SCR bridge is enabled, the precharge ramp can be repeated only after 300ms, the time needed for the phase loss circuit to confirm that normal mains conditions have been restored.

6.1 I/O R-PSM Regulation card

The switches and jumpers on the R-PSM card are factory-set. If the module is used according to its standard power supply characteristics:

- SMB200-...-4 = 400VAC / 50Hz
- SMB200-...-6 = 690VAC / 50Hz

The settings should not be changed.

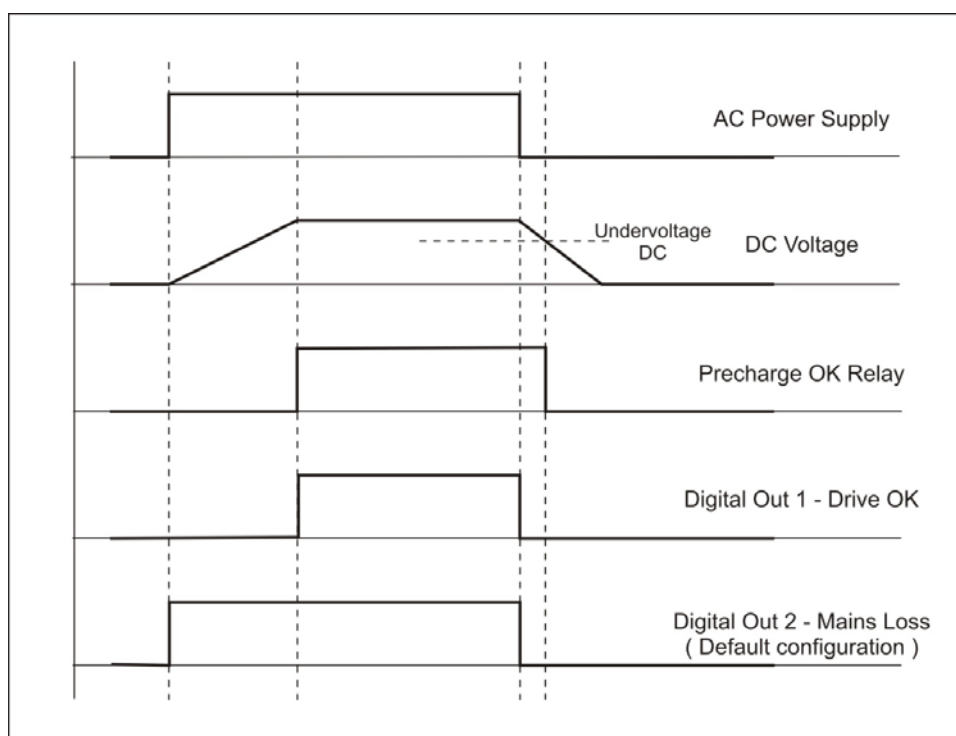
In case of non-standard power supply, see the configuration tables shown further below.

R-PSM control card terminal strip

TB1 terminal strip			
Terminal	Name	Function	Electrical specifications
23	Enable	ENABLE digital input	5mA a +24Vdc (+20% max, -20% min)
52	Enable In Com	ENABLE common digital input	
32	Digital Out 1	Drive OK	24V / 20mA typ (40mA max)
33	Dig Out Com	Digital Out 1 and Digital Out 2 common	
34	0V24 Out	I/O power reference	
35	+24V Out	I/O power	150mA resettable fuse
36	Digital Out 2	Factory preset as Mains Loss	24V / 20mA typ (40mA max)
37	Dig Out Supply	Power input of digital outputs	
70 - 72	Relay 1	Factory preset as Precharge OK	250Vac - 30Vdc - 0,5A

TB1 Terminal strips	Maximum Cable Cross Section (flexible conductor)		Recommended stripping (mm)	Tightening torque (min) (Nm)
	(mm ²)	AWG		
	0.2 ... 2.5	24 ... 12	7	0,5

Behavior of Precharge OK Relay- Digital Out 1 - Digital Out 2 at “Power On” and “Power Off”.



Relay 1 – Precharge OK (factory setting)

The relay between terminals 70 – 72 closes at the end of the precharge phase and opens when DC voltage drops below the DC Undervoltage threshold.

On versions SMB-D +PRC, the Precharge OK relay must be used to control the main line contactor. After the line contactor has closed, the encoders connected to the DC bus can be enabled.

On versions SMB-T, when the Precharge OK relay has closed, the encoders connected to the DC bus can be enabled.

Digital Out 1 – Mains Loss (factory setting)

Digital output 1 connected to terminal 36 goes high at Power On and goes low under one of the following conditions.

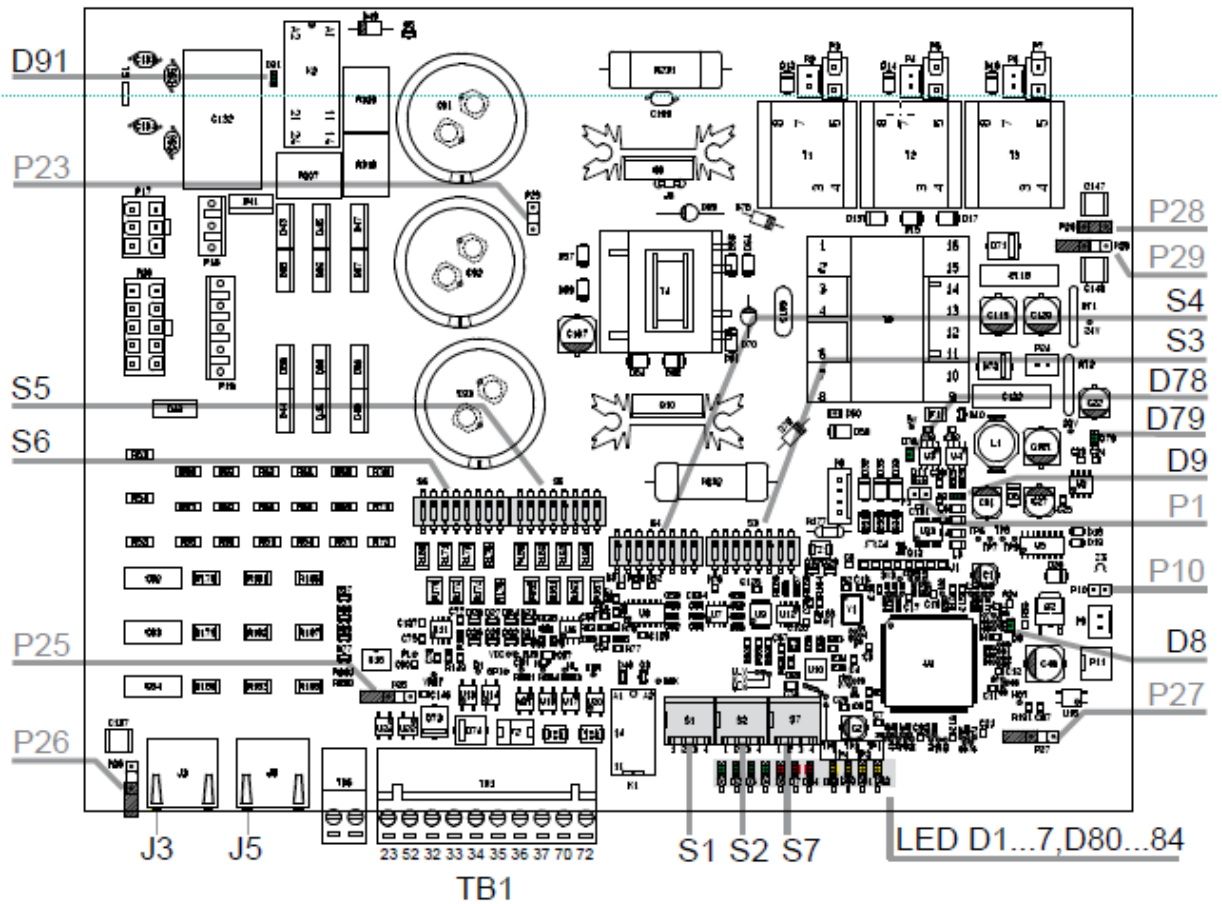
- Power failure
- Lack of a power supply phase

Digital Out 2 – Drive OK

Digital output 2 connected to terminal 32 goes high at the end of the precharge phase and goes low under one of the following conditions:

- Power failure
- Lack of a power supply phase
- Lack of Enable command
- Mains frequency out of range ($> \pm 5\%$). This condition occurs only during the power-on phase.
- Presence of Overtemperature OT alarm

6.2 R-PSM card configuration switches



The jumpers and switches on these cards are factory-set. **If the module is used according to its standard power supply characteristics the settings should not be changed.**

The R-PSM card has three 4-position configuration SWITCHES. The following tables show all of the permitted combinations.

Legend:

0 OPEN

1 CLOSE

(*) Default setting for models SMB200-...-4,

(**) Default setting for models SMB200-...-6

(***) P23 = CLOSE when 230Vac mains supply,

S1 – Mains voltage configuration switches						
Mains voltage [Vac]	DC undervoltage trip threshold [VDC]	DC undervoltage return threshold [VDC]	S1-1	S1-2	S1-3	S1-4
230 (***)	225	255	0	0	0	0
380	372	402	1	0	0	0
400 (*)	392	422	0	1	0	0
415	407	437	1	1	0	0
440	431	461	0	0	1	0
460	451	481	1	0	1	0
480	470	500	0	1	1	0
500	490	520	1	1	1	0
575	563	593	0	0	0	1
690 (**)	676	706	1	0	0	1

The correct selection of line voltage is very important for correct setting of UNDERVOLTAGE limits

S2-1 – Mains frequency configuration switch	
Mains frequency [Hz]	S2-1
50 (*) (**)	0
60	1

An incorrect line frequency setting will block the control card: the line frequency tolerance is $\pm 5\%$.

S2-2...4 – Precharge time configuration switches				
Selection of precharge time [s] for 50[Hz] line	Selection of precharge time [s] for 60[Hz] line	S2-2	S2-3	S2-4
17.4	24.1	0	0	0
11.6 (*) (**)	12.1	1	0	0
8.7	8	0	1	0
6.9	6	1	1	0
5.0	4.8	0	0	1
3.5	03.4	1	0	1
2.7	2.7	0	1	1
1.9	2	1	1	1

Switch S2-2...4 lets you set the precharge time for the capacitors connected to the DC link.

The default configuration calls for a time of 11.6[s] for a 50[Hz] line and 12.1[s] for a 60[Hz] line.

Remember that with equal levels of energy to be transferred to the capacitor bank, decreasing the precharge time increases the current draw.

On versions SMB-D- +PRC the rectifier bridge and precharge inductance are sized for maximum peak current of 400[Apk] (unified value for all sizes of SMB-D- + PRC).

Considering that with decreased precharge time the increased current is not linear, and that the larger the capacitors bank connected to the DC Link the greater the energy to be transferred, if you need a precharge time shorter than the default configuration you have to run the following check procedure:

- 1) Keep the default configuration of switches S2-2...4 and connect an current probe to output C or D of the rectifier bridge (or to a power supply phase). The probe must be able to measure a peak current ≤ 10 [ms].
- 2) Power and enable the precharge bridge by measuring the value of the peak current absorbed.
- 3) Cut power to the precharge bridge and wait for the DC Link to discharge completely (discharge time depends on the total capacitance installed on the DC Link).
- 4) Set the switches to have a precharge time of 8.7[s] (8[s] for 60[Hz] line).
- 5) Repeat point 2). If the peak current measured is below 400[Apk] you can further reduce the precharge time. In this case, run the entire procedure again until you reach the required precharge time.

On versions SMB-T- the capacitor bank is precharged by the power bridge (because it is configured with 3 diodes + 3 thyristors). In this case, given that the rectifier modules are larger than the precharge bridge on versions SMB-D- +PRC, you can obtain a precharge time much shorter than default.

In any case, it is advisable to run the above-described test and check that peak current during the precharge phase is not greater than 150% of continuous current I_{dN} .

S7-1...3 – Dig Out 2 configuration switch			
	S7-1	S7-2	S7-3
No Mains Loss o Phase Loss (*) (**)	0	0	0
Mains Loss alarm	1	0	0
Phase Loss alarm	0	1	0
Drive OK (excluding UV alarm)	1	1	0
Heatsink OT alarm	0	0	1
SCRs pulses enabled	1	0	1
Precharge ramp finished	0	1	1
Undervoltage alarm	1	1	1

The configurable output goes high when the condition indicated in the table occurs.

S7-4 – Function exchange between Relay 1 and Digital Out 2	
Function	S7-4
Factory preset	0 (*) (**)
Function exchange between Relay 1 and Digital Out 2	1

6.3 Jumper R-PSM card

The configuration of the configuration Jumpers can be changed ONLY by Gefran personnel. Unauthorized changes will invalidate the warranty.

Jumper	Function	Default
P1	FPGA manual reset	OPEN
P10	Disables heatsink overtemperature monitor	OPEN
P23	Enables function of 230VAC line power supply	OPEN
P25	Internal use	OPEN
P26	Connects J3 shield with ground	OPEN
P27	Connects 0V control with 0V_24 I/O	CLOSE
P28	Grounds 0V control	CLOSE
P29	Grounds 0V_24 I/O	OPEN

6.4 R-PSM card LED functions

LEDs	“MONITOR” function	Color
D9	+3V3 logic power	GREEN
D78	+5V logic power	GREEN
D79	+22V driver power	GREEN
D91	Presence of DC-Link voltage	BLUE

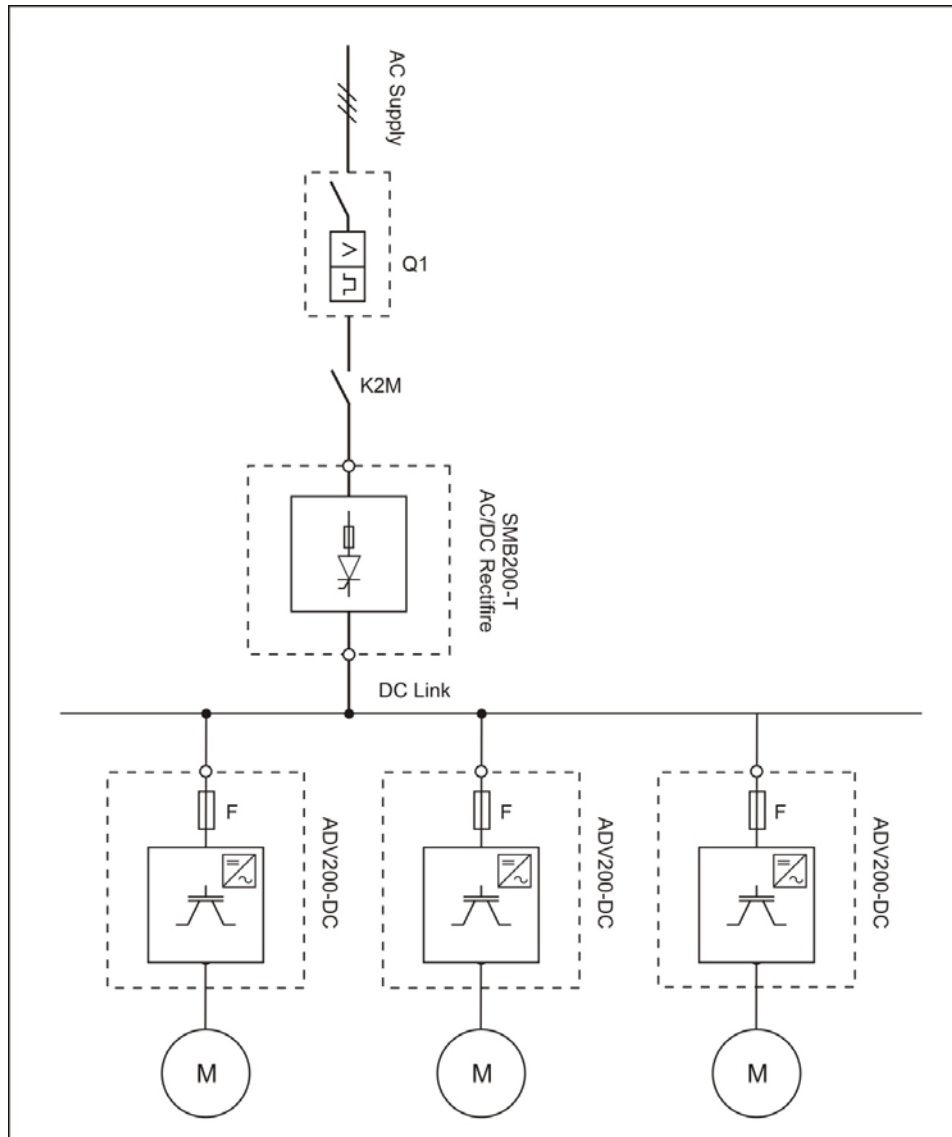
LED	“SIGNAL” function	Color
D1	DC-Link voltage above UNDERVOLTAGE limit	GREEN
D2	Power supply enabled	GREEN
D3	Not used	GREEN
D4	Power supply OK (no alarms – excluding UV)	GREEN
D6	Phase loss or Main loss alarm	RED
D7	Heatsink overtemperature alarm	RED
D8	FPGA configuration in progress	GREEN
D84	Wrong line frequency alarm	RED
J3 – J5	Cable inserted to synchronize J3 master and J5 SLAVE	YELLOW

LED	“POWER SUPPLY STATE” functions	Color
D83	Bit S0: codes STATE of power supply (LSB)	YELLOW
D80	Bit S1: codes STATE of power supply	YELLOW
D81	Bit S2: codes STATE of power supply (MSB)	YELLOW
D82	SCR bridge enabled	YELLOW

7 Typical connection diagrams

The connection of SMB..... modules depends on the HW configuration of the bridge. The following are examples of single-line diagrams for versions SMB-T, SMB-D...+PRC.

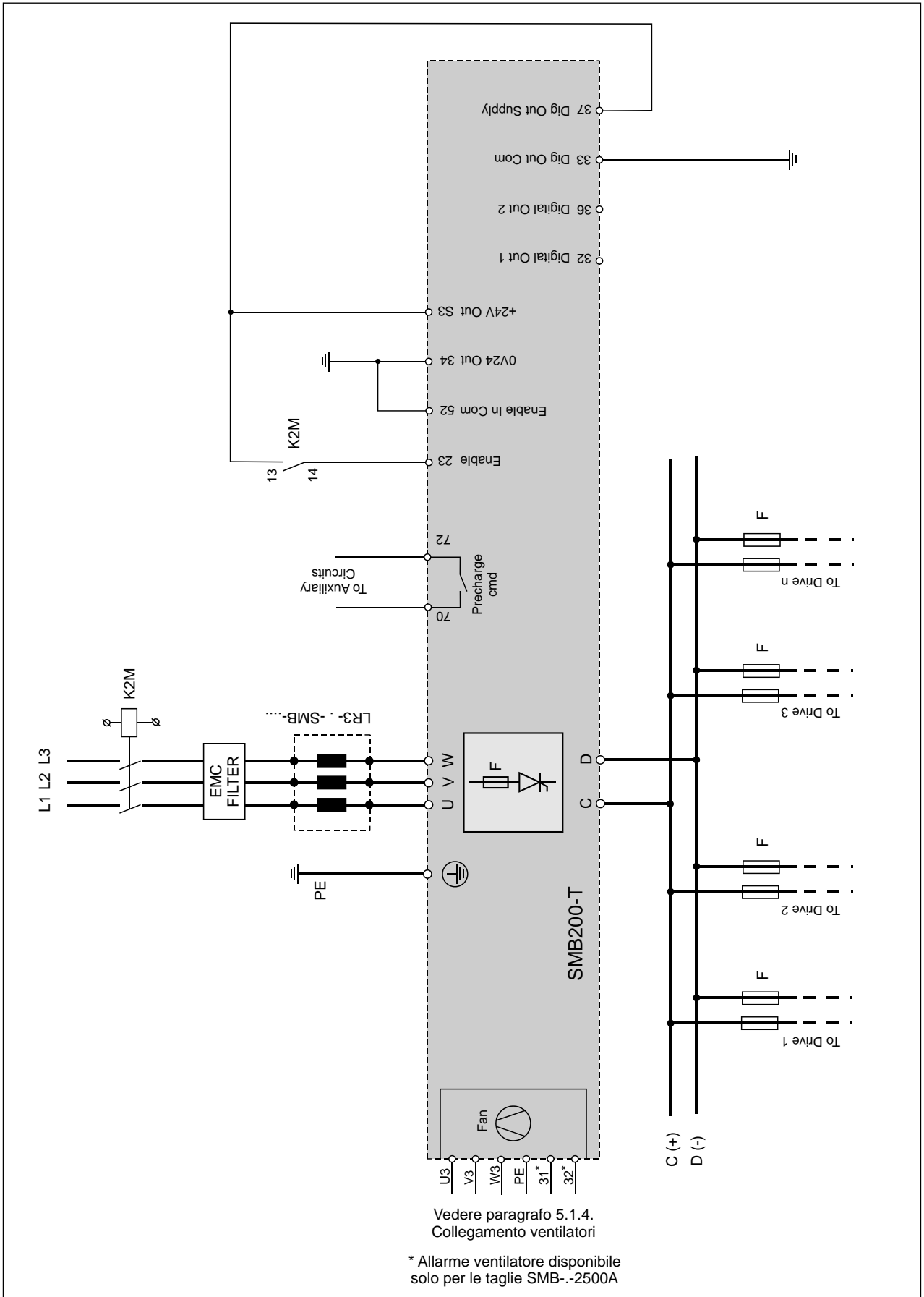
7.1 SMB-T connection



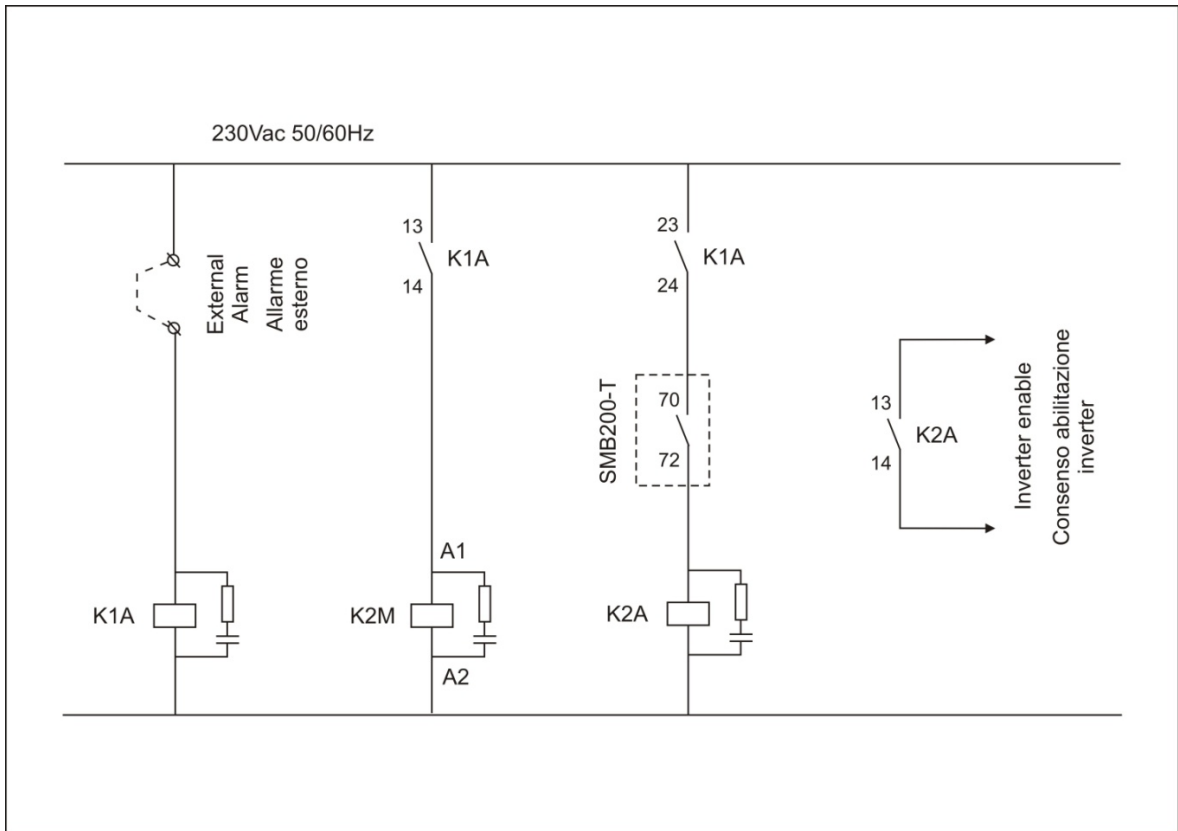
The connection shown above is suitable for 400...500VAC mains and SMB-T....-4 modules and for 690VAC mains and SMB-T....-6 modules.

The ADV200 inverters connected to the DC Link can be enabled only after the DC bus has been precharged. The end of the precharge phase is signaled by the Precharge OK relay (terminals 70-72).

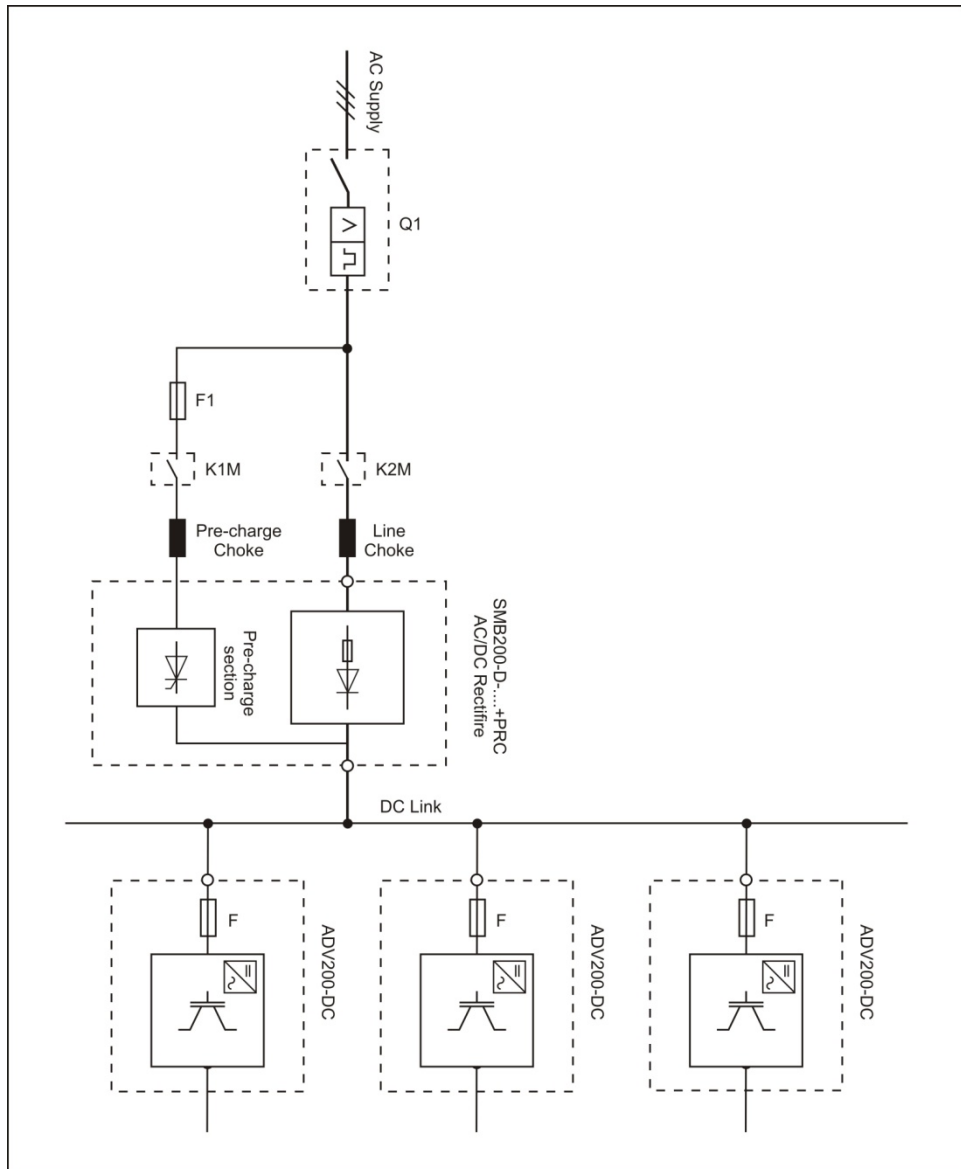
Typical connection diagram SMB-T



Auxiliary control circuit SMB-T



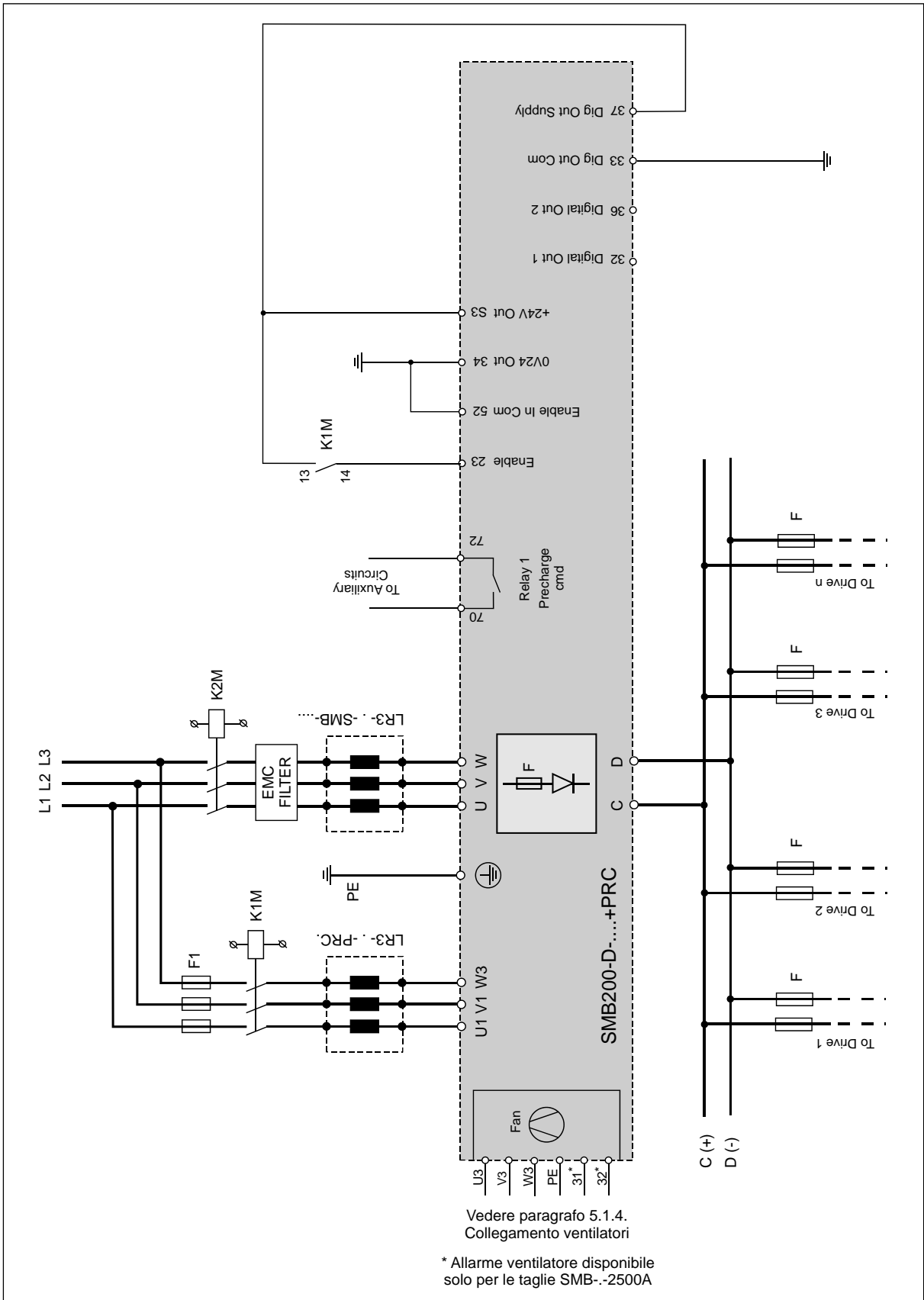
7.2 SMB-D- +PRC connection



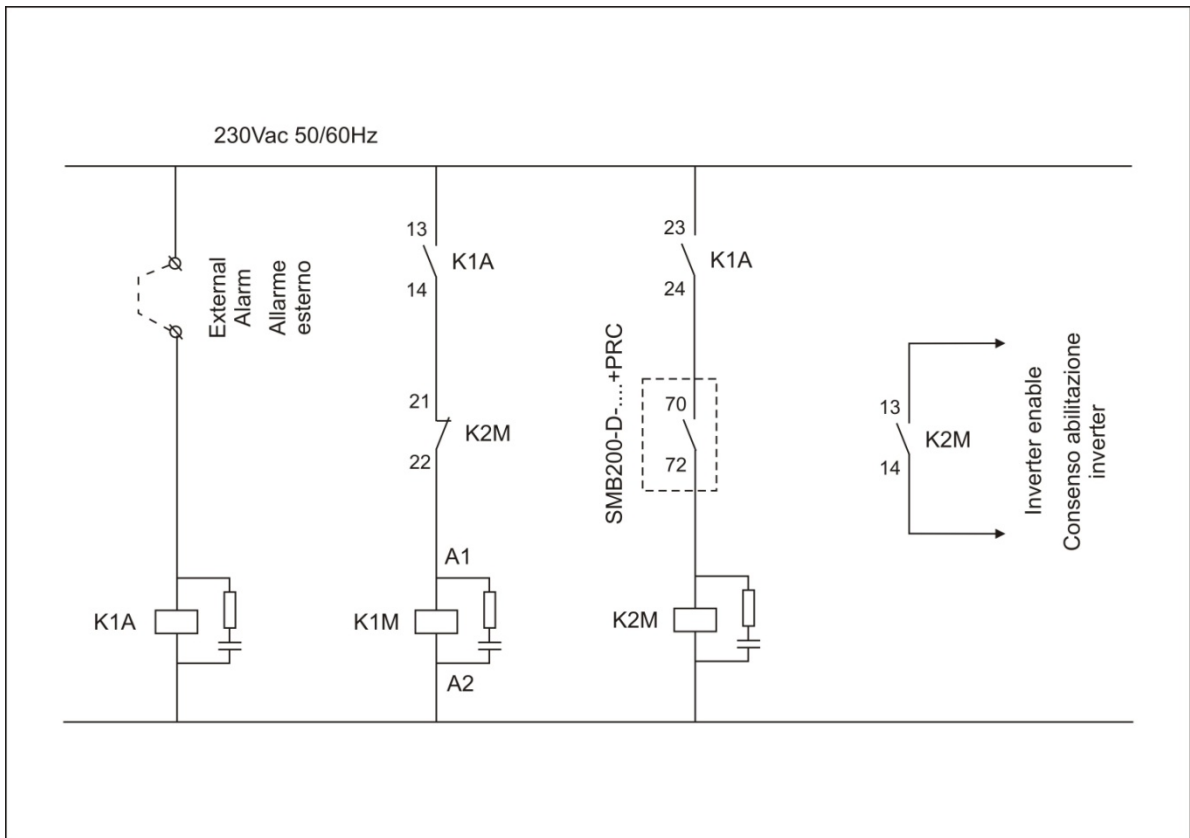
The connection shown above is suitable for 400...500VAC mains and SMB-T....-4 modules and for 690VAC mains and SMB-T....-6 modules.

The ADV200 inverters connected to the DC Link can be enabled only after the DC bus has been precharged. The end of the precharge phase is signaled by the Precharge OK relay (terminals 70-72).

Typical connection diagram SMB-D- +PRC



Auxiliary control circuit SMB-D- +PRC



8 Typical connection diagrams SMB + FFE

For some lines or machines, the energy generated by motors powered by the DC Link system exceeds the level that the machine can reuse, and can be a high percentage of motorizing energy.

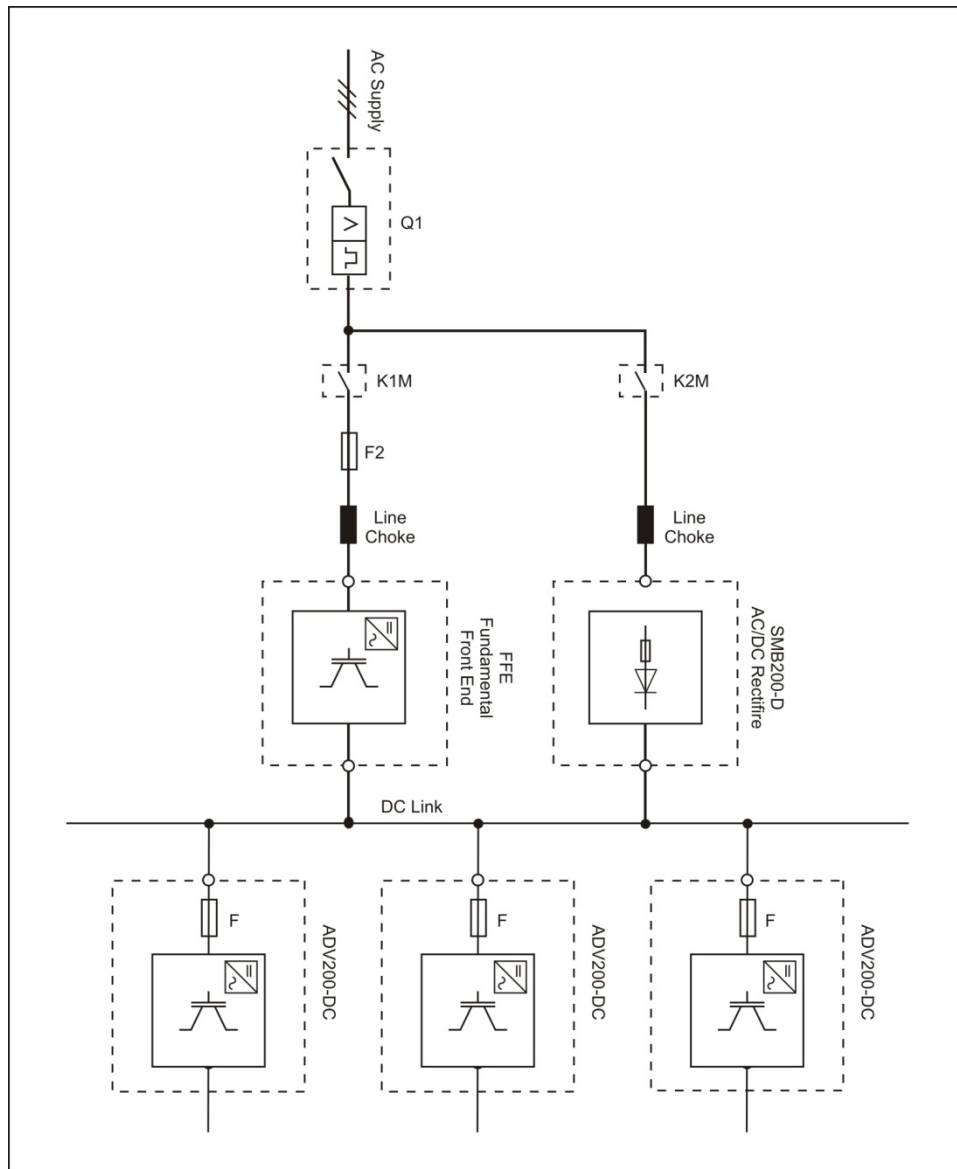
In these applications, instead of using systems that dissipate energy to the resistance, it is more efficient to regenerate energy to the primary power supply.

In this case, the SMB200 unidirectional power supply can be connected in parallel to an FFE200 regenerative power supply sized only for the regenerated power.

The connection of the SMB200 unidirectional modules with FFE200 regenerative modules depends on the HW configuration of the bridge.

The following are single-line diagrams for versions SMB-T and SMB-D.

8.1 SMB-T- + FFE connection



The connection shown above is suitable for 400...500VAC mains and SMB-T.... -4 modules with FFE- -4 regenerative modules and for 690VAC mains and SMB-T....-6 modules with FFE- -6 regenerative modules.

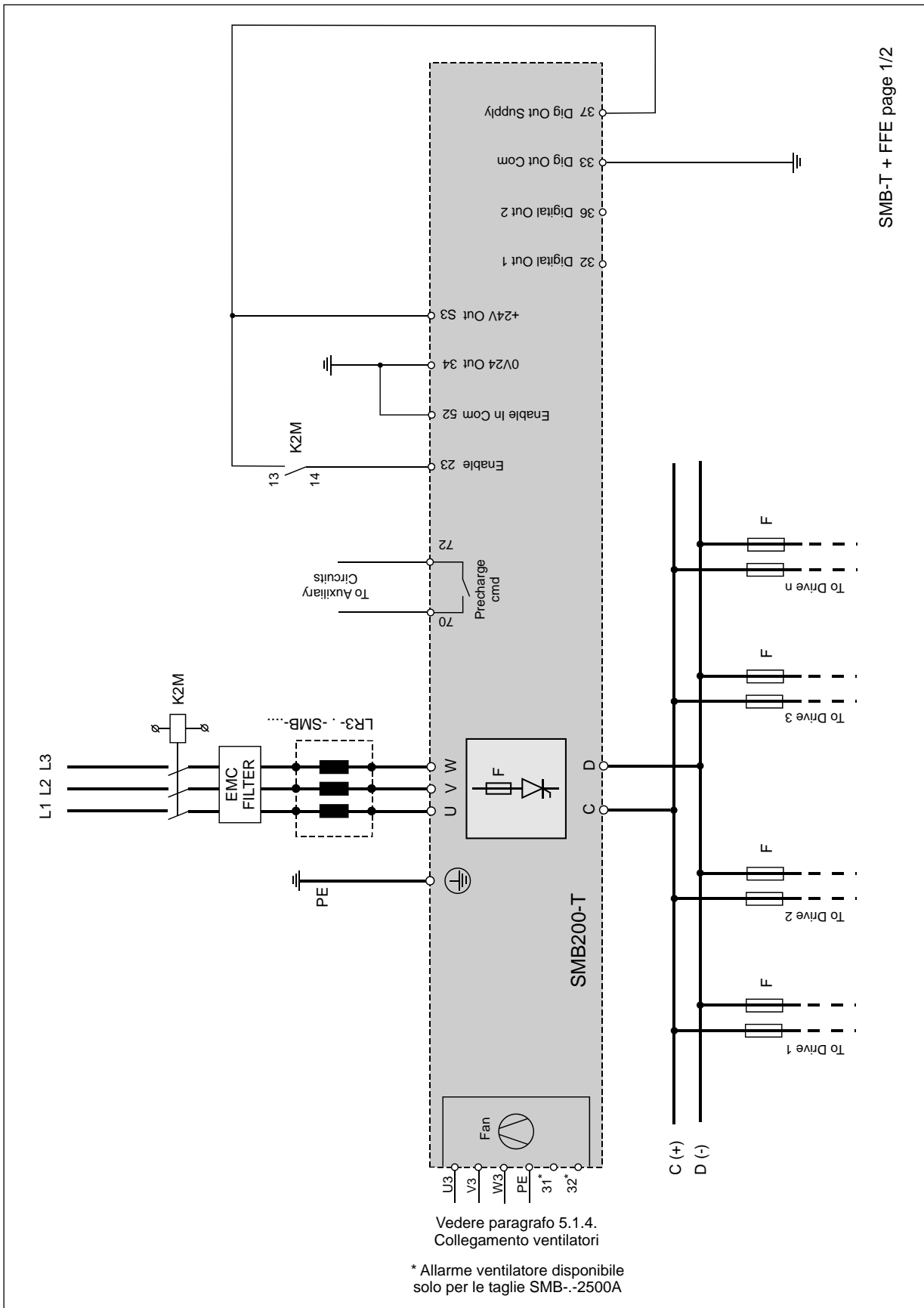
It is preferable to charge the DC Link with the SMB-T rectifier module, which provides shorter precharge times than the precharge circuit built into the FFE regenerative module.

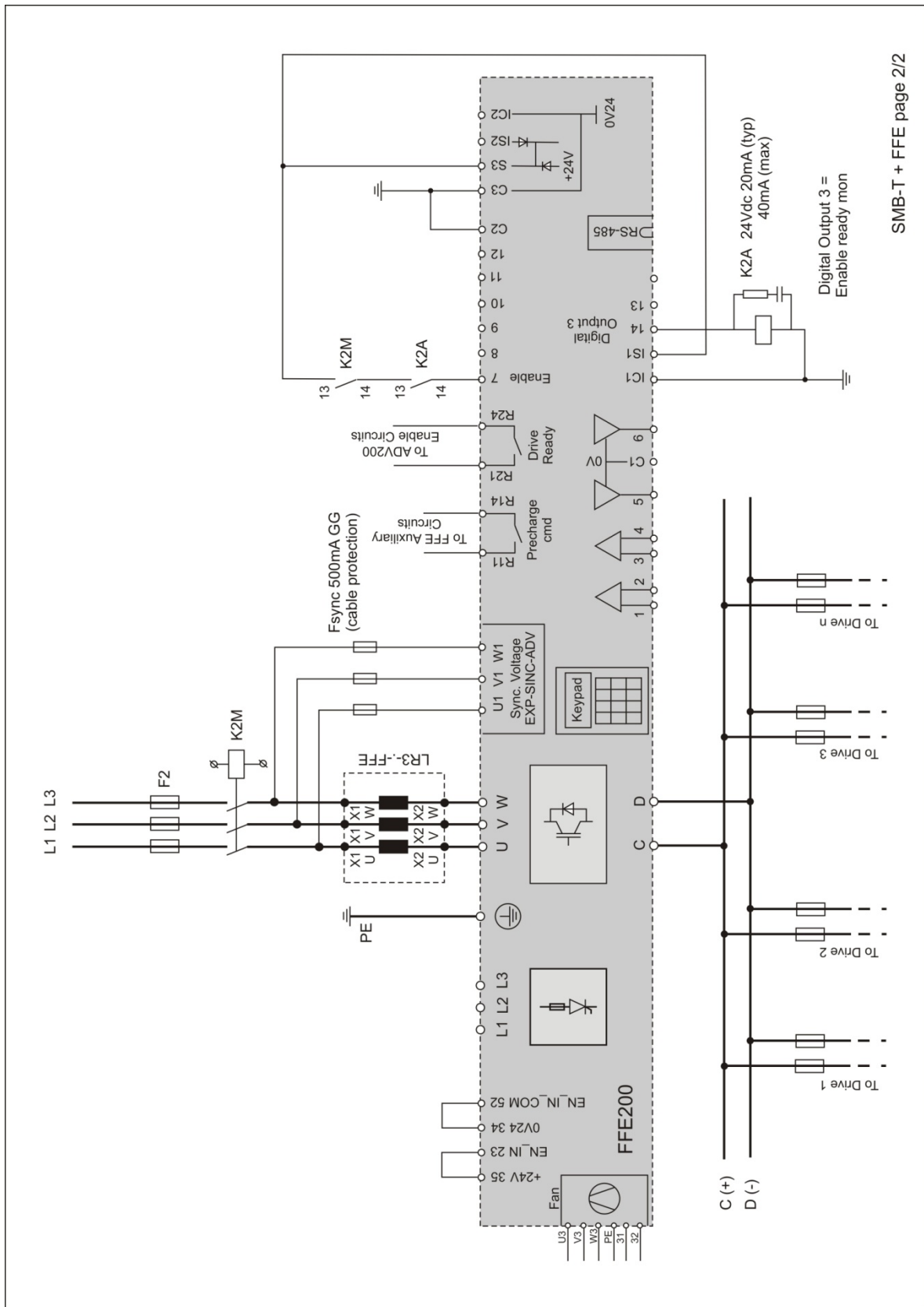
The end of the precharge phase is signaled by the Precharge OK relay (terminals 70-72).

When the precharge phase is done and the Precharge OK relay (terminals 70-72) on the SMB-T module is energized, you can power the FFE regenerative module.

The ADV200 inverters connected to the DC Link can be enabled only after the Drive Ready relay (terminals R21 and R24) on the FFE regenerative module is energized.

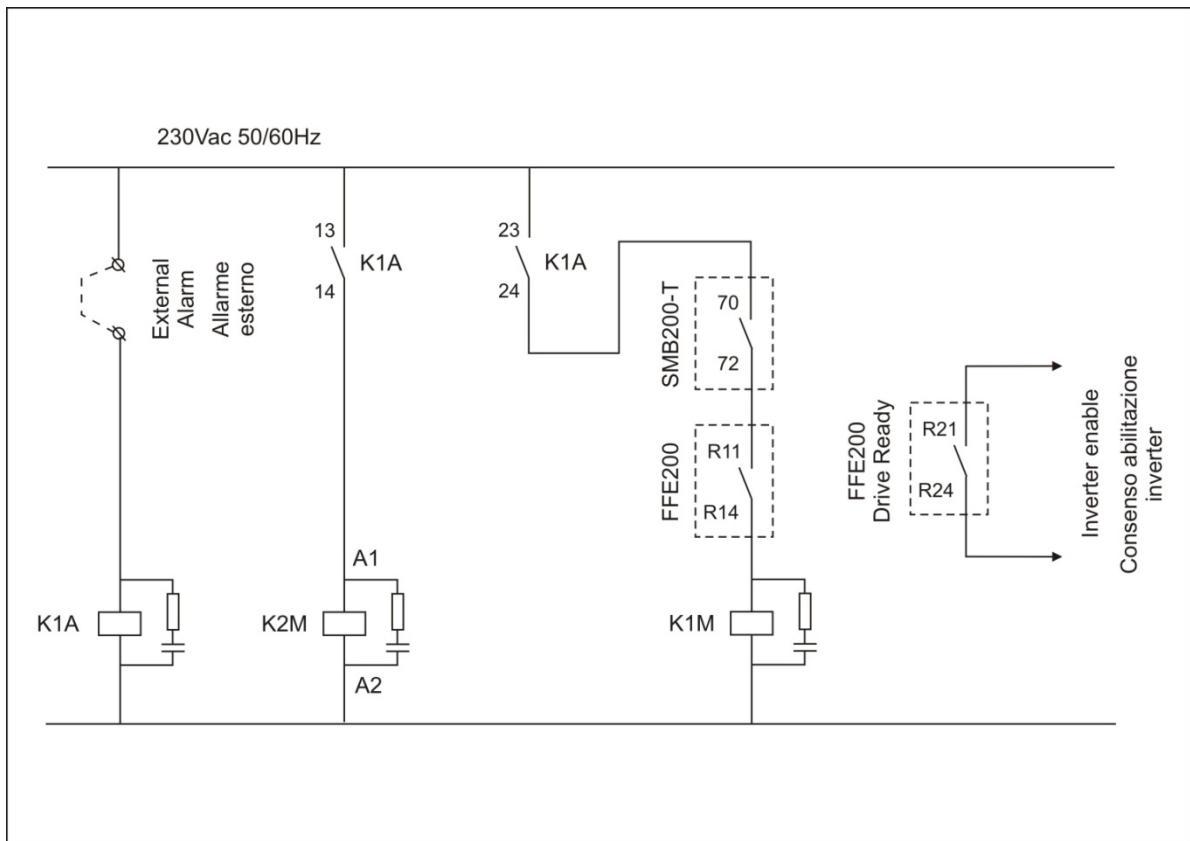
Typical connection diagram SMB-T +FFE



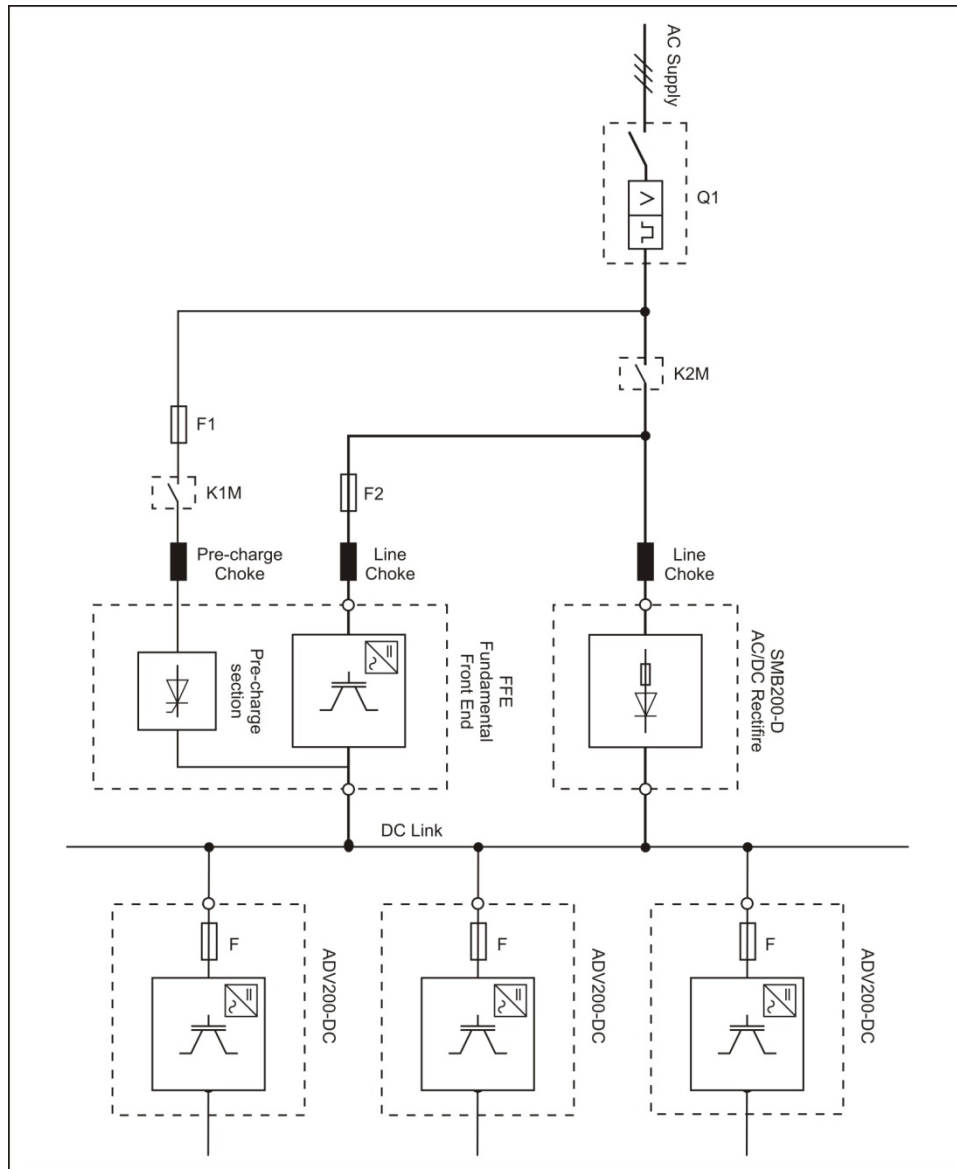


SMB-T + FFE page 2/2

Auxiliary control circuit SMB-T +FFE



8.2 SMB-D- + FFE connection



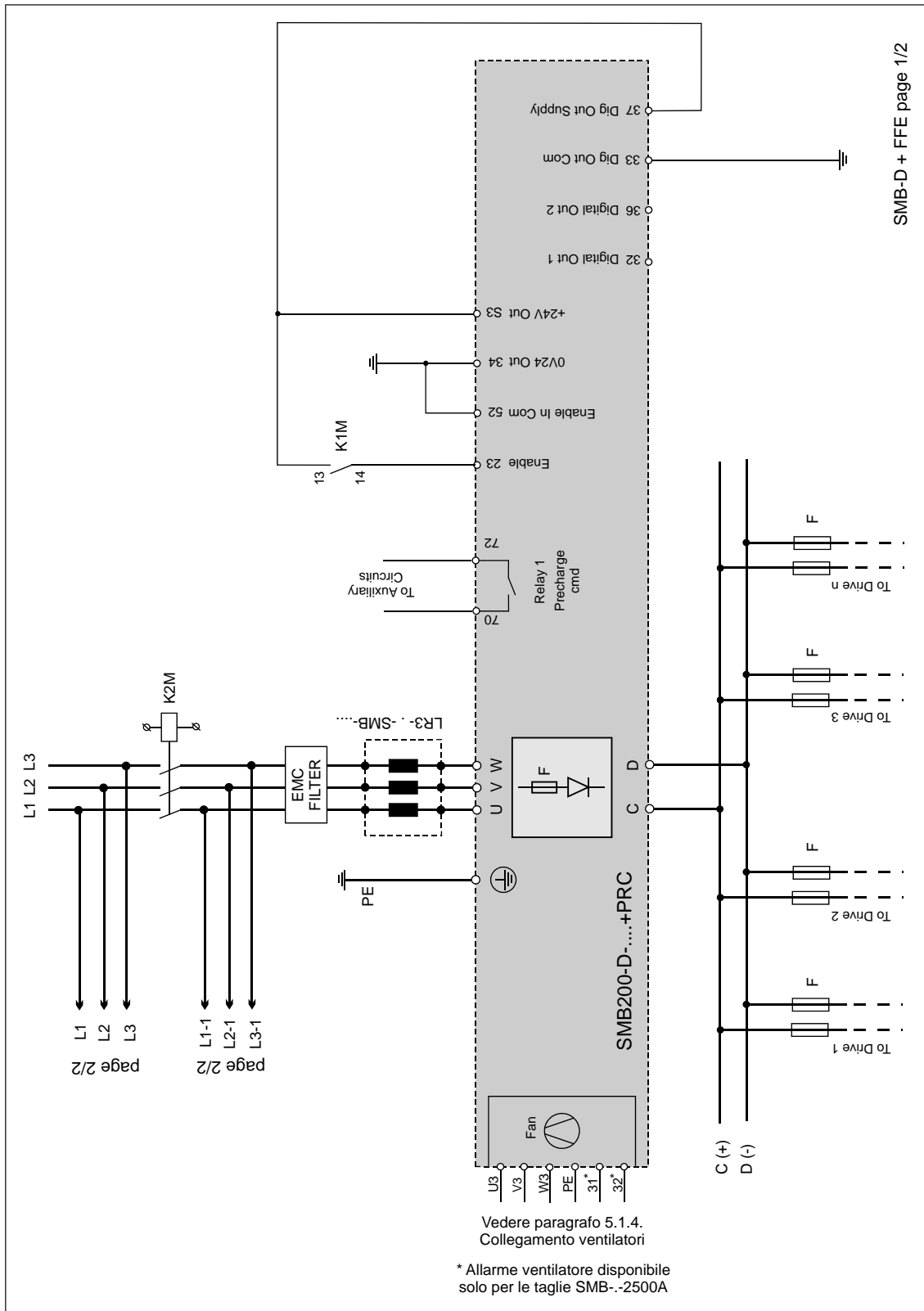
The connection shown above is suitable for 400...500VAC mains and SMB-D....-4 modules with FFE- -4 regenerative modules and for 690VAC mains and SMB-D....-6 modules with FFE- -6 regenerative modules.

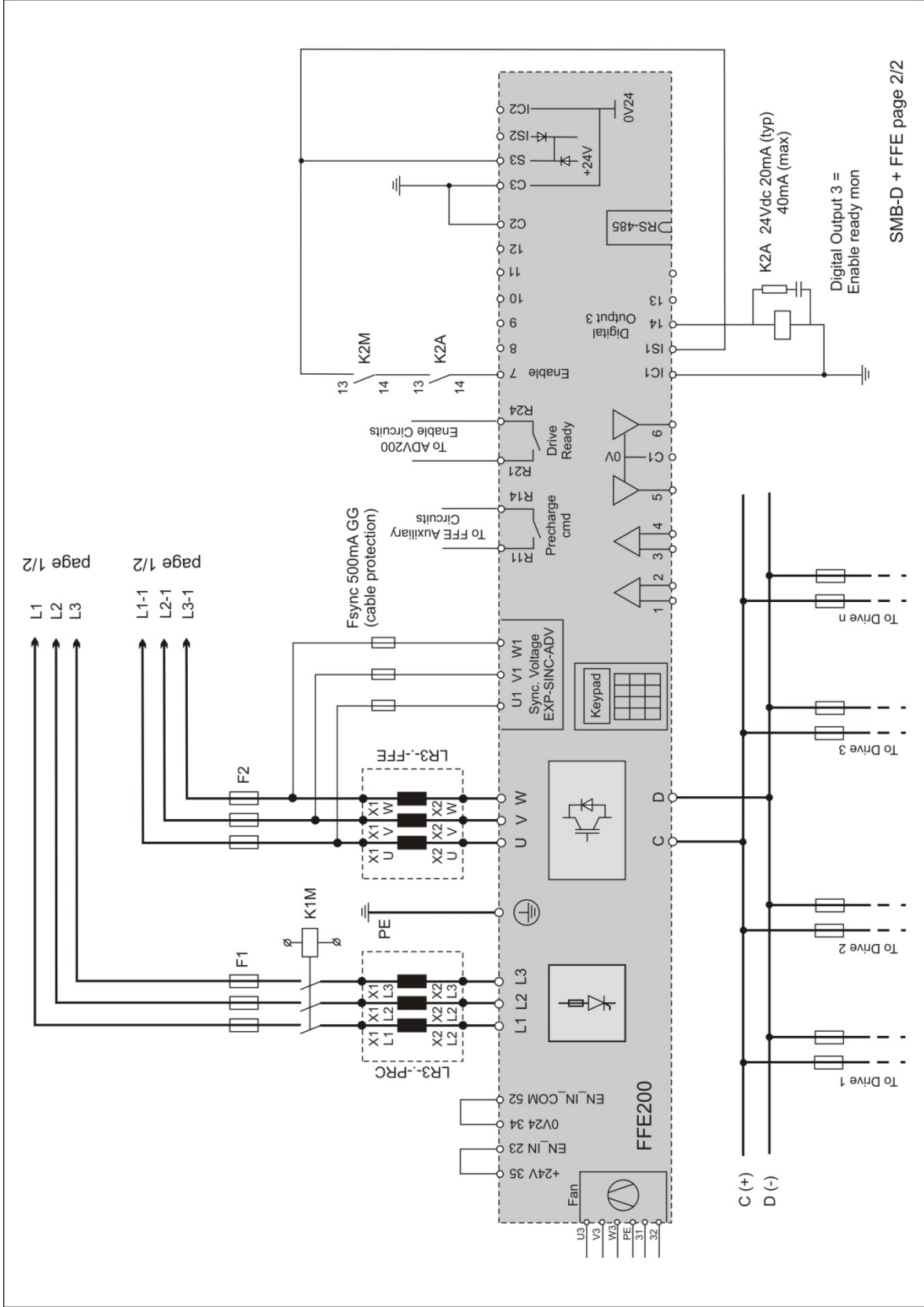
The DC Link is charged by a specific circuit built into the FFE regenerative module. The end of the precharge phase is signaled by the Precharge cmd relay (terminals R11-R14) on the FFE module.

When the Precharge cmd relay is energized, you can power the power section of the FFE regenerative module and of the SMB-D module.

The ADV200 inverters connected to the DC Link can be enabled only after the Drive Ready relay (terminals R21 and R24) on the FFE regenerative module is energized.

Typical connection diagram SMB-D +FFE



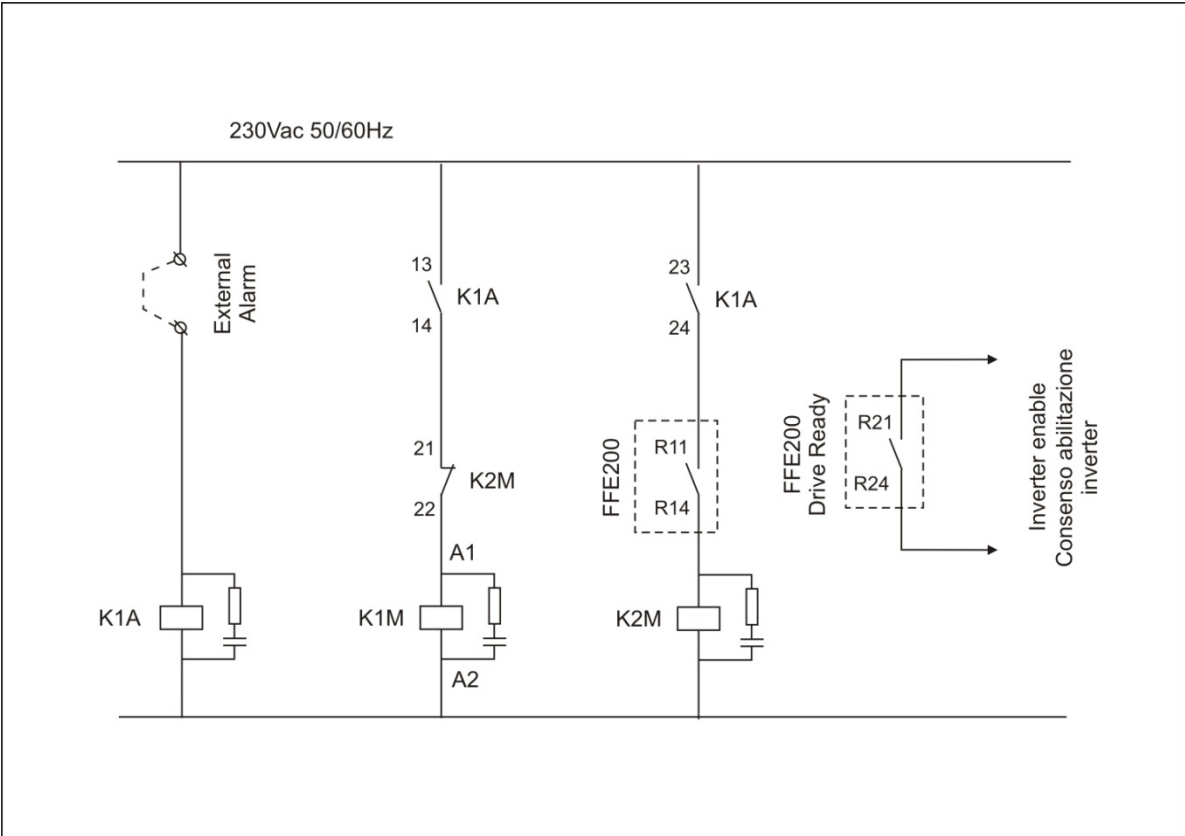


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SMB-D + FFE page 2/2

Auxiliary control circuit SMB-D +FFE



9 Specification

9.1 Environmental Conditions

Installation location _____	Pollution degree 2 or lower (free from direct sunlight, vibration, dust, corrosive or inflammable gases, fog, vapour oil and dripped water, avoid saline environment).
Installation altitude _____	Max 2000m (6562 feet) above sea level. For higher altitudes, output current must be reduced by 0.75% for each 100 m. Maximum installation altitude: 4000m
Mechanical conditions for installation _____	Vibrational stress: EN 60721-3-3 Class 3M1
Operating temperature _____	-10...+40°C (32°...104°F) +40 ... +50°C (104 ... +122°F) with derating
Air humidity (operating) _____	5 % to 85 % and 1 g/m ³ to 25 g/ m ³ without moisture condensation or icing (class 3K3 as per EN50178)
Air pressure (operating) [kPa] _____	86 to 106 (class 3K3 as per EN50178)

|||||



The drive is suitable for use under the environmental service conditions (climate, mechanical, pollution, etc.) defined as usual service conditions according to EN61800-2.

|||||

9.2 Normative

Climatic conditions _____	EN 60721-3-3 class 3K3, EN60068-2-6
Electrical safety _____	EN 50178, EN 61800-5-1
Vibration _____	EN 60068-2-6, test Fc., EN 60721-3-3 class 3M1
EMC compatibility _____	EN61800-3 immunity, according to environment Conducted emissions EN 61800-3, class C3.
Rated input voltage _____	IEC 60038
Power quality _____	EN 61800-3
Protection degree _____	IP20 housing excluding higher and lower power connections, where protection degree is IP00 (as per EN 60529).
Marks _____	CE in accordance with EC directives: LVD 2006/35/EC and EMC 2004/30/EC.
Approvals _____	UL , cULus ("ON PROGRESS". only up to 600VAC of power line voltage)

9.3 Input electrical data

Input voltage ULN, SMB200- - 4	3 * 400 [Vac] - 15% ... 500 [Vac] + 10% ⁽¹⁾ 3 * 230 [Vac] - 10% ... 400 [Vac] + 10% ⁽²⁾
Input voltage ULN, SMB200- - 6	3 * 500 Vac - 10% ... 690Vac + 10% ⁽¹⁾ 3 * 230 Vac - 10% ... 400Vac + 10% ⁽²⁾
Input frequency	50/60 [Hz], ± 5%
Total harmonic distortion (THD)	40%

(1) Jumper P23 = OPEN, (2) Jumper P23 = CLOSED

Size	Input current AC [A] – Power supply 400 ... 500[Vac] - 50/60[Hz]		
	Continuous load (no overload)	Heavy duty (150% overload)	Light duty (110% overload)
SMB200-T-1250-4	1025	746	984
SMB200-D-1600-4	1312	984	1271
SMB200-D-2500-4	2050	1574	1984
2 * SMB200-T-1250-4	1886	1378	1820
2 * SMB200-D-1600-4	2427	1820	2345
2 * SMB200-D-2500-4	3788	2911	3665
3 * SMB200-T-1250-4	2829	2066	2731
3 * SMB200-D-1600-4	3641	2731	3518
3 * SMB200-D-2500-4	5683	4367	5498
4 * SMB200-T-1250-4	3772	2755	3641
4 * SMB200-D-1600-4	4854	3641	4690
4 * SMB200-D-2500-4	7577	5822	7331

Size	Input current AC [A] – Power supply 500 ... 690[Vac] - 50/60[Hz]		
	Continuous load (no overload)	Heavy duty (150% overload)	Light duty (110% overload)
SMB200-T-1000-6	820	615	779
SMB200-D-1600-6	1312	984	1271
SMB200-D-2500-6	2050	1574	1984
2 * SMB200-T-1000-6	1509	1132	1435
2 * SMB200-D-1600-6	2427	1820	2345
2 * SMB200-D-2500-6	3788	2911	3665
3 * SMB200-T-1000-6	2263	1697	2153
3 * SMB200-D-1600-6	3641	2731	3518
3 * SMB200-D-2500-6	5683	4367	5498
4 * SMB200-T-1000-6	3018	2263	2870
4 * SMB200-D-1600-6	4854	3641	4690
4 * SMB200-D-2500-6	7577	5822	7331

9.4 Output electrical data

Output voltage U2, SMB- -4 @ 500 [Vac]	675 [Vdc]
Output voltage U2, SMB- -6 @ 690 [Vac]	930 [Vdc]
Heavy overload	150% I_{dH} * 60[s] each 300[s]
Light overload	110% I_{dL} * 60[s] each 300[s]
Undervoltage threshold	See "Line voltage configuration" table

Size	DC Output current [A]		
	I_{dN} Continuous load (no overload)	I_{dH} Heavy duty (150% overload)	I_{dL} Light duty (110% overload)
SMB200-T-1250-4	1250	910	1200
SMB200-D-1600-4	1600	1200	1550
SMB200-D-2500-4	2500	1920	2420
2 * SMB200-T-1250-4	2300	1680	2220
2 * SMB200-D-1600-4	2960	2220	2860
2 * SMB200-D-2500-4	4620	3550	4470
3 * SMB200-T-1250-4	3450	2520	3330
3 * SMB200-D-1600-4	4440	3330	4290
3 * SMB200-D-2500-4	6930	5325	6705
4 * SMB200-T-1250-4	4600	3360	4440
4 * SMB200-D-1600-4	5920	4440	5720
4 * SMB200-D-2500-4	9240	7100	8940

Size	DC Output current [A]		
	I_{dN} Continuous load (no overload)	I_{dH} Heavy duty (150% overload)	I_{dL} Light duty (110% overload)
SMB200-T-1000-6	1000	750	950
SMB200-D-1600-6	1600	1200	1550
SMB200-D-2500-6	2500	1920	2420
2 * SMB200-T-1000-6	1840	1380	1750
2 * SMB200-D-1600-6	2960	2220	2860
2 * SMB200-D-2500-6	4620	3550	4470
3 * SMB200-T-1000-6	2760	2070	2625
3 * SMB200-D-1600-6	4440	3330	4290
3 * SMB200-D-2500-6	6930	5325	6705
4 * SMB200-T-1000-6	3680	2760	3500
4 * SMB200-D-1600-6	5920	4440	5720
4 * SMB200-D-2500-6	9240	7100	8940

Up to **four** SMB200 power supplies can be connected in parallel to increase the total output current supplied. **Power supplies with identical input voltage and output current must be used.**

In this case, you **must** use **line inductors with 2% uk** and the SMB200 output current value must be derated due to current division that is not perfectly symmetrical.

The reactors installed must be identical models from the same manufacturer and their tolerance on **inductance value must be below 5%.**

The table of output currents already includes current derating.

9.5 Derating factors

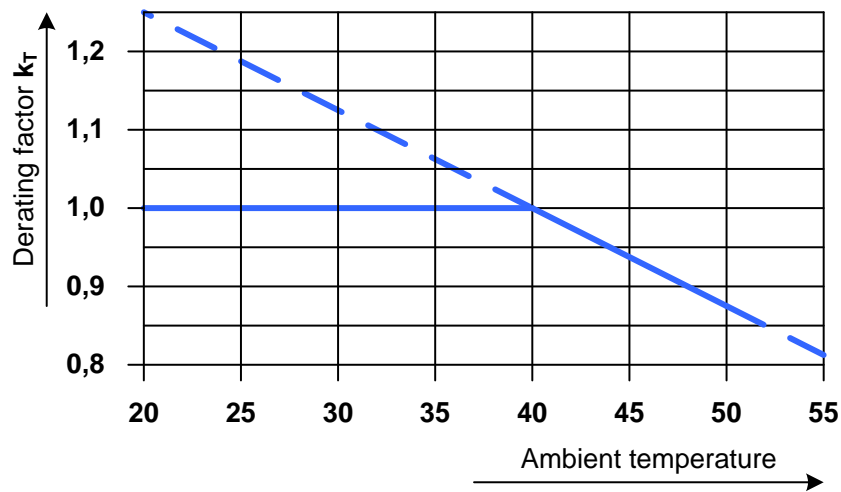
Two derating factors for rated currents I_{dN} , I_{dH} and I_{dL} should be considered:

- Temperature higher than rated for design - K_T
- Altitude higher than rated for design - K_I

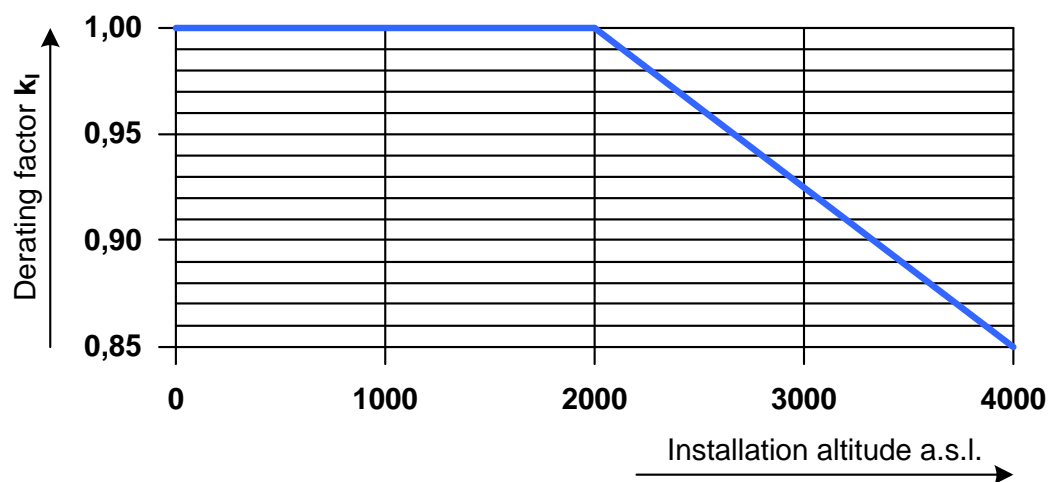
Derating of the rated line voltage U_{LN} should also be considered based on installation altitude higher than rated for the design – K_U .

Derating factors are shown on the following graphs

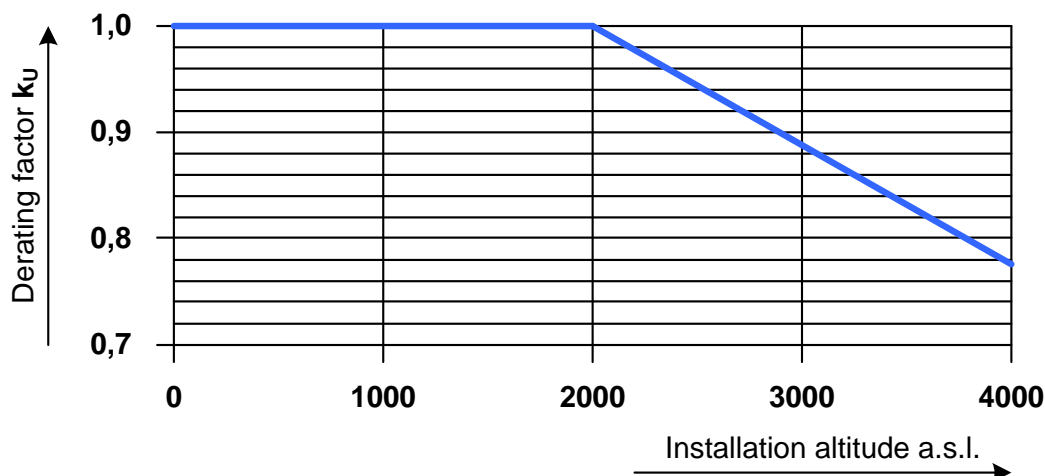
Derating factor of I_{dN} , I_{dH} and I_{dL} output currents based on ambient temperature



Derating factor of I_{dN} , I_{dH} and I_{dL} output currents based on installation altitude



Derating factor of U_{LN} supply voltage based on installation altitude (IEC 60664-1)



The three derating factors must always be applied when the power supplies have to be used in environmental conditions beyond the standard limits contained in the technical specifications.

The derating tables must be applied according to the following rules:

- K_U is applied only to SMB- ...-6 ($U_{LN} = 690VAC$) products. SMB- ...-4 ($U_{LN} = 500VAC$) products are designed with insulation distances suitable for use at higher altitudes.
- K_I and K_T must be applied individually if at least one of the standard limit conditions is exceeded or multiplied together if both limit conditions are exceeded.

Nevertheless, K_T can be used to compensate K_I if the ambient temperature is definitely below $40^\circ C$. In any case, if $K_I * K_T$ is greater than 1, the applicable value must be limited to 1. **The rated current (and voltage) values must never exceed the values on specification!**

Example 1:

An SMB-D-1600-4 power supply is installed at an altitude of 2400[m] at a maximum ambient temperature of $30^\circ C$.

- $K_U = 1$ because SMB- ...-4 ($U_{LN} = 500VAC$)
- $K_I = 0.97$ (value derived from tables above)
- $K_T = 1.12$ (value derived from tables above)
- Therefore the derating factor is: $K = 0.97 * 1.12 = 1.086 = 1$

Example 2:

An SMB-D-2500-6 power supply is installed at an altitude of 3000[m] at a maximum ambient temperature of $45^\circ C$.

- $K_U = 0.89$ (value derived from tables above). Therefore the maximum voltage must be limited to 614VAC, corresponding to 828VDC.
- $K_I = 0.925$ (value derived from tables above)
- $K_T = 0.93$ (value derived from tables above)
- Therefore the derating factor is: $K = 0.925 * 0.93 = 0.86$

The rated currents of the power supply will therefore be limited to:

- $I_{dN} = 2150[A]$
- $I_{dH} = 1650[A]$
- $I_{dL} = 2080[A]$

9.6 Power lost by rectifier modules

Sizes SMB-...	Loss [W]
SMB200-T-1250-4	2835
SMB200-D-1600-4	3630
SMB200-D-2500-4	6350
SMB200-T-1000-6	2990
SMB200-D-1600-6	3650
SMB200-D-2500-6	5635

10 Options

10.1 External EMC Filters

Optional external EMI filters able to guarantee the performance levels required by EN 61800-3 standard (according to 2nd environment, category C3) are listed in the table below.

SMB200 sizes	Filter type	Code	Category / Max cable length
SMB200-T-1250-4	EMI-480-1000	S7DGN	C3/100mt
SMB200-D-1600-4	EMI-480-1600	S7DGO	C3/100mt
SMB200-D-2500-4	EMI-FN3359-480-2500	S7EMI5	C3/100mt
SMB200-T-1000-6	EMI-690-1000	S7DGT	C3/100mt
SMB200-T-1600-6	EMI-690-1600	S7DGK	C3/100mt
SMB200-T-2500-6	EPCOS B84143B2500S021		C3/100mt

Filter type	Dimensions: W x H x d (mm)	Weights (kg)
EMI-480-1000	350 x 280 x 150	24
EMI-480-1600	400 x 300 x 160	
EMI-FN3359-480-2500	600 x 370 x 200	55
EMI-690-1000	300 x 260 x 140	
EMI-690-1600	300 x 260 x 140	24.5
EPCOS B84143B2500S021	650 x 320 x 221.5	105

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