



# ***CS300***

***Half Controlled Power Supply for Inverter DC-Link***

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## **User's Guide**

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These instructions do not purport to cover all details or variations in equipment, nor to provide every possible contingency to be met during installation, operation, and maintenance. If further information is desired or if particular problems arise that are not covered sufficiently for the purchaser's purpose, the matter should be referred to GE Industrial Systems, Salem, Virginia, USA.

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## SAFETY SYMBOL LEGEND / LÉGENDE DES SIGNES DE SÉCURITÉ

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**WARNING!**

Commands attention to an operating procedure, practice, condition, or statement which, if not strictly observed, could result in personal injury or death.

*Attire l'attention sur les modes d'utilisation et les procédés et conditions d'exploitation qui, en cas d'observation, pourraient entraîner des blessures corporelles ou la mort.*

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**CAUTION!**

Commands attention to an operating procedure, practice, condition, or statement which, if not strictly observed, could result in damage or destruction of equipment.

The seriousness of the injuries and of the damages which could be caused by the non-observance of such indications, depends on the different conditions. Anyway, the instructions given below should always be followed with the highest attention.

*Attire l'attention sur les modes d'utilisation et les procédés et conditions d'exploitation qui, en cas d'observation, pourraient entraîner la détérioration ou la destruction des appareils.*

*La gravité des blessures et des dommages matériels possibles dépendent de différents facteurs. Toutefois, les instructions mentionnées ci-dessous devraient être toujours suivies avec la plus grande attention.*

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**NOTE!**

Commands attention to an operating procedure, practice, condition, or statement that must be highlighted.

*Attire l'attention sur les modes d'utilisation et les procédés et conditions d'exploitation qui présentent un intérêt particulier.*

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# Chapter 1 - SAFETY PRECAUTIONS

## **NOTE!**

The terms “Inverter”, “Controller” and “Drive” are sometimes used interchangeably throughout the industry. We will use the term “Drive” in this document

*Les mots “Inverter”, “Controller” et “Drive” sont interchangeables dans le domaine industriel. Nous utiliserons dans ce manuel seulement le mot “Drive”.*

## **WARNING! / ATTENTION!**

According to the EEC standards the CS300 and accessories must be used only after checking that the machine has been produced using those safety devices required by the 89/392/EEC set of rules.

Drive systems cause mechanical motion. It is the responsibility of the user to insure that any such motion does not result in an unsafe condition. Factory provided interlocks and operating limits should not be bypassed or modified.

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 internal devices is 5 minutes.

If the front plate has to be removed because the ambient temperature is higher than 40 degrees, the user has to ensure that no occasional contact with live parts will occur.

Always connect the Drive to the protective ground (PE) via the marked connection terminals (PE2) and the housing (PE1). Adjustable Frequency Drives and AC Input filters have ground discharge currents greater than 3.5 mA. EN 50178 specifies that with discharge currents greater than 3.5 mA the protective conductor ground connection (PE1) must be fixed type and doubled for redundancy.

The drive may cause accidental motion in the event of a failure, even if it is disabled, unless it has been disconnected from the AC input feeder.

*Selon les normes EEC, les drives CS300 et leurs accessoires doivent être employés seulement après avoir vérifié que la machine ait été produit avec les mêmes dispositifs de sécurité demandés par la réglementation 89/392/EEC concernant le secteur de l'industrie.*

*Les systèmes provoquent des mouvements mécaniques. L'utilisateur est responsable de la sécurité concernant les mouvements mécaniques. Les dispositifs de sécurité prévues par l'usine et les limitations opérationnelles ne doivent être dépassés ou modifiés.*

*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 minutes.*

*Si la plaque frontale doit être enlevée pour un fonctionnement avec la température de l'environnement plus haute que 40°C, l'utilisateur doit s'assurer, par des moyens opportuns, qu'aucun contact occasionnel ne puisse arriver avec les parties sous tension.*

*Effectuer toujours des connexions de terre (PE) par le biais des bornes (PE2) et du châssis (PE1). Le courant de dispersion vers la terre est supérieur à 3,5 mA. Selon EN 50178 il faut prévoir dans ces cas une double connexion à terre.*

## **WARNING! - ELECTRICAL SHOCK AND BURN HAZARD / ATTENTION! – DÉCHARGE ÉLECTRIQUE ET RISQUE DE BRÛLURE :**

When using instruments such as oscilloscopes to work on live equipment, the oscilloscope's chassis should be grounded and a differential amplifier 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.

*Lors de l'utilisation d'instruments (par exemple oscilloscope) sur des systèmes en marche, le châssis de l'oscilloscope doit être relié à la terre et un amplificateur 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.*

**WARNING! - FIRE AND EXPLOSION HAZARD / ATTENTION! – RISQUE D'INCENDIES ET D'EXPLOSIONS:**

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.

*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.*

**WARNING! - STRAIN HAZARD:**

Improper lifting practices can cause serious or fatal injury. Lift only with adequate equipment and trained personnel.

*Une élévation inappropriée peut causer des dommages sérieux ou fatals. Il doit être élevé seulement avec des moyens appropriés et par du personnel qualifié.*

**WARNING! - ELECTRIC SHOCK HAZARD / ATTENTION! - CAS DE DECHARGE ELECTRIQUE:**

- Drives and motors must be grounded according to NEC (for USA) and EN 60204 (for Europe).
- Replace all covers before applying power to the Drive. Failure to do so may result in death or serious injury.
- Adjustable frequency drives are electrical apparatus for use in industrial installations. Parts of the Drives are at high voltage 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 Drives 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.
- *Tous les moteurs et les drives doivent être mis à la terre selon le Code Electrique National ou équivalent.*
- *Remettre tous les capots avant de mettre sous tension le drive. Des erreurs peuvent provoquer de sérieux accidents ou même la mort.*
- *Les drives à fréquence variable sont des dispositifs électriques utilisés dans des installations industriels. Une partie des drives sont sous tension pendant l'opération. L'installation électrique et l'ouverture des drives devrait être exécuté uniquement par du personel qualifié. De mauvaises installations de moteurs ou de drives 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.*

**CAUTION! / PRECAUTION!:**

- Do not connect power supply voltage that exceeds the standard specification voltage fluctuation permissible. If excessive voltage is applied to the Drive, damage to the internal components will result.
- Do not operate the Drive without the ground wire connected. The motor chassis should be grounded to earth through a ground lead separate from all other equipment ground leads to prevent noise coupling.
- 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.
- Do not perform a megger test between the Drive terminals or on the control circuit terminals.
- Because the ambient temperature greatly affects Drive life and reliability, do not install the Drive in any location that exceeds the allowable temperature. Leave the ventilation cover attached for temperatures of 104° F (40° C) or below.
- Be sure to remove the desiccant dryer packet(s) when unpacking the Drive. (If not removed these packets may become lodged in the fan or air passages and cause the Drive to overheat).
- The Drive must be mounted on a wall that is constructed of heat resistant material. While the Drive is operating, the temperature of the Drive's cooling fins can rise to a temperature of 194° F (90°C).
- Do not touch or damage any components when handling the device. Changing of isolation gaps or removing the isolation covers is not permissible.



- Protect the device from disallowed environmental conditions (temperature, humidity, shock etc.)
- 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. The motor must be protected against overloads.
- No dielectric tests should be carried out on parts of the frequency inverter. A suitable measuring instrument (internal resistance of at least 10 k $\Omega$ /V) should be used for measuring the signal voltages.
- No voltage should be connected to the output of the drive (terminals C, D).
  
- *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.*
- *Ne pas faire fonctionner le drive sans prise de terre. Le châssis du moteur doit être mis à la terre à l'aide d'un connecteur de terre séparé des autres pour éviter le couplage des perturbations.*
- *Le connecteur de terre devrait être dimensionné selon la norme NEC ou le Canadian Electrical code. Le raccordement devrait être fait par un connecteur certifié et mentionné à boucle fermée 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.*
- *Ne pas exécuter un test megger entre les bornes du drive ou entre les bornes du circuit de contrôle.*
- *Étant donné que la température ambiante influe sur la vie et la fiabilité du drive, on ne devrait pas installer le drive dans des places où la température permise est dépassée. Laisser le capot de ventilation en place pour températures de 104°F (40°C) ou inférieures.*
- *Lors du déballage du drive, retirer le sachet déshydraté. (Si celui-ci n'est pas retiré, il empêche la ventilation et provoque une surchauffe du drive).*
- *Le drive doit être monté sur un mur construit avec des matériaux résistants à la chaleur. Pendant le fonctionnement du drive, la température des ailettes du dissipateur thermique peut arriver à 194°F (90°).*
- *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.*
- *Protéger l'appareil contre des effets extérieurs non permis (température, humidité, chocs etc.).*
- *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. Le moteur doit être protégé contre la surcharge*
- *Il ne faut pas exécuter de tests de rigidité diélectrique sur des parties du convertisseurs. Pour mesurer les tensions, des signaux, il faut utiliser des instruments de mesure appropriés (résistance interne minimale 10 k $\Omega$ /V).*
- *Aucune tension ne doit être appliquée sur la sortie du convertisseur (bornes C, D).*



## Chapter 2 - COMPONENT IDENTIFICATION AND SPECIFICATION

### 2.1 GENERAL DESCRIPTION

CS300 is a half-controlled three phase AC/DC converter for supplying DC link voltage to a series of AC Drives, with C and D terminals parallel connected.

The precharge of the drive capacitors (time setting set via dip-switches) is done by partializing the mains voltage via a thyristors bridge. A diagnostic circuit allows detection of a mains power supply dip for system use.

**NOTE!** The direct parallel connection of the outputs (U2,V2,W2 terminals) of two or more inverters is not possible !

### 2.2 POWER SUPPLY

CS300 converter can be connected to the three phase power supply having the following characteristics:

400V-15%      up to      480+10%  
50 or 60 Hz                      (Dip-switch selectable)

The maximum input power of the internal switching power supply is 100W, and the supplied voltages are:

+/-15V 500mA                      Control card  
+24 V 2A                              Fan power supply (if present) and auxiliary functions (regulator terminals power supply)

### 2.3 DESCRIPTION OF POWER TERMINALS

Terminals	Function
U, V, W	Power supply via AC mains, 3Ph (400V -15% up to 480V +10%)
C	Positive terminal to be connected to the inverter DC-LINK
D	Negative terminal to be connected to the inverter DC-LINK
U3, V3	Supply for internal fan (only for 1050A size and higher) (1Ph, 230V ± 15%)

cs010

## 2.4 DESCRIPTION OF CONTROL TERMINALS

Terminals	Function	Voltage, Current
23	Input of the precharge enable control	(15 - 35V, 5 - 11mA)
32	Output of the MLP static signal (low - active signal)	(5 ... 35V, 20mA source)
33	(Common) Ground of the MLP and ML static signals	-
34	Reference point for Power supply +24V	-
35	Power supply output +24V	(32V / 300mA max)
36	Output of the ML signal (low - active signal)	(5 ... 35V, 20mA max sink)
37	Power supply of the ML and MLP signals	(35V max)
52	(Common) Ground of the precharge enable control	-
70, 72	OK Relay	(max 250V, 1A – AC11)

cs020

## 2.5 PROTECTIONS

### 2.5.1 Internal Protection Components

Converter	Designation	Varistors
6KCS3185-480	V1, V2, V3	575 V / 220 J Ø 20 mm
6KCS3280-480		
6KCS3420-480		
6KCS3650-480		
6KCS310H-480		
6KCS315H-480		

cs025

### 2.5.2 Internal Fuses

Converter	Designation	Fuses	Designation	Fuses for	Fuses
6KCS3185-480	F1, F2, F3	16 A / 500 V fast 6 x 32 mm	F4	Power supply protection	4 A, 250 V fast 6,3 x 32
6KCS3280-480					
6KCS3420-480					
6KCS3650-480		25 A / 500 V fast 6 x 32 mm	F5	+24V protection	1 A, 250 V slow 5 x 20
6KCS310H-480					
6KCS315H-480					

cs030

### 2.5.3 External AC Mains Fuses

Converter	Ref.	Pieces	Europe		USA		
			Type	Code	Type	Code	
6KCS3185-480	A	3	S00üF1/80/200A/660V	SKF4G23	A70QS200-4K	FWP200A	PDFP7V200ABLADE
	B	1+1	S1üF1/110/250A/660V	SKF4G28	A70QS300-4	FWP300A	PDFP7V300ABLADE
6KCS3280-480	A	3	S1üF1/110/315A/660V	SKF4G30	A70QS350-4	FWP350A	PDFP7V350ABLADE
	B	1+1	S1üF1/110/315A/660V	SKF4G30	A70QS350-4	FWP350A	PDFP7V350ABLADE
6KCS3420-480	A	3	S2üF1/110/500A/660V	SKF4E30	A70QS500-4	FWP500A	PDFP7V500ABLADE
	B	1+1	S2üF1/110/500A/660V	SKF4E30	A70QS500-4	FWP500A	PDFP7V500ABLADE
6KCS3650-480	A	3	S2üF1/110/630A/660V	SKF4E31	A70QS600-4	FWP600A	PDFP7V600ABLADE
	B	1+1	S3üF1/110/800A/660V	SKF4H02	A70QS800-4	FWP800A	PDFP7V800ABLADE
6KCS310H-480	A <sup>(1)</sup>	3	170M5466 (1000A/700V)	SKS827B	170M5466 (1000A/700V)		SKS827B
	B <sup>(1)</sup>	3	S2üF1/110/630A/660V	SKF4E31	A70QS600-4	FWP600A	PDFP7V600ABLADE
6KCS315H-480	A <sup>(1)</sup>	3	G3MUEF1/1000A/660V	SKF4G76	G3MUEF1/1000A/660V		SKF4G76
	B <sup>(1)</sup>	(1+1)+ (1+1)	S3üF1/110/1000A/660V	SKF4H03	A70P1000	FWP1000	SKS7812

cs041

Ref: A: External fuses for the input side power supply bridge

B: External fuses for the DC link output

(<sup>1</sup>): Fuses integrated in the device

**Fuse manufactures:** S... , G...                      Jean Muller, Eltville  
 A70...    Ferraz Shawmutt  
 FWP..., 170M..    Bussmann

### 2.5.4 AC Mains Choke

Converter	Main frequency [Hz]	Main three-phase inductance			
		Rated inductance [mH]	Rated AC current [A]	Saturation current [A]	Type
6KCS3185-480	50/60	0.148	173	350	
6KCS3280-480	50/60	0.082	360	540	KLR 420 CCB
6KCS3420-480	50/60	0.082	360	540	KLR 420 CCB
6KCS3650-480	50/60	0.053	560	840	KLR 600 CCB
6KCS310H-480	50/60	0.033	900	1350	KLR 950 CCB
6KCS315H-480	50/60	0.019	1425	2138	

cs050

#### **NOTE!**

The use of AC mains choke on the power supply input is **MANDATORY**

## 2.6 CONVERTER SIZE SELECTION

Within the specified voltage field, the CS300 converter supplies the same rated direct current independently of the voltage itself. *The increase of the output voltage causes an increasing in the transferred power*, whereas inverters are devices with a typically *constant transferred power* (the supplied current decreases with the increasing of the output voltage).

As for the choice, therefore, the calculation is based on a common unit, *the direct current of the intermediate circuit*, which, as for the inverters, is not mentioned into the product instruction manual and has therefore to be calculated. Furthermore, the confrontation between the two foreseen functioning classes has to be homogeneous (IEC 146 class 1 and 2).

### 2.6.1 Output Rated Currents for the Two Functioning Classes

Converter	DC link current (Terminals C / D)	
	IEC 146 Class 1 *	IEC 146 Class 2 **
<b>6KCS3185-480</b>	185 A	150 A
<b>6KCS3280-480</b>	280 A	225 A
<b>6KCS3420-480</b>	420 A	340 A
<b>6KCS3650-480</b>	650 A	540 A
<b>6KCS310H-480</b>	1050 A	850 A
<b>6KCS315H-480</b>	1500 A	1300 A

cs060

\* Continuous service

\*\* Service with overload possibility of 150% for 60 seconds

## 2.6.2 Drive DC Current (DC Link Circuit)

Rated motor power $P_{Mot}$ [kW]	Motor efficiency $\eta_{Mot}$	Current Dclink $I_{DCL}$	Current DClink $I_{DCL}$	Fuses DClink Superfast [A]	AV300 -...	
		Continuous class 1 [A]	Overload class 2 [A]		class 1	class 2
0,55	0,71	1,56	2,12	6	4003	4003
0,75	0,74	2,04	2,77	6	4003	4003
1,1	0,75	2,95	4,01	6	4003	4003
1,5	0,75	4,02	5,47	8	4003	4003
2,2	0,79	5,60	7,61	10	4003	4003
3	0,81	7,44	10,12	16	4003	4003
4	0,83	9,68	13,17	16	4005	4005
5,5	0,84	13,16	17,90	20	4005	4007
7,5	0,86	17,53	23,83	30	4007	4011
11	0,88	25,12	34,16	40	4011	4015
15	0,89	33,87	46,06	63	4015	4022
18,5	0,905	41,08	55,87	63	4022	4022
22	0,912	48,48	65,93	80	4022	4030
30	0,918	65,67	89,32	100	4030	4037
37	0,923	80,56	109,56	125	4037	4045
45	0,93	97,24	132,25	160	4045	4055
55	0,935	118,21	160,77	200	4055	4075
75	0,943	159,83	217,37	250	4075	4090
90	0,946	191,19	260,02	315	4090	4110
110	0,947	233,43	317,46	350	4110	4132
132	0,951	278,94	379,35	450	4132	4160
160	0,955	336,69	457,90	500	4160	4250
200	0,958	419,54	570,58	630	4250	4250
250	0,96	523,33	711,74	800	4250	4315
315	0,963	657,35	893,99	1000	4315	
355	0,963	740,82	1007,52			
400	0,965	833,00	1132,88			

cs070

The following table states the direct current values of the dc-link according to the rated power of the motor connected to the inverter. The current is calculated on the basis of the following:

- 4-pole "standard" motor
- "typical" efficiency for "standard" motors ( $\eta_{Mot}$ )
- the "typical" inverter efficiency is considered equal to 0.97 ( $\eta_i$ )
- mains power supply voltage 3 x 380V (conservative value if referred to a rated voltage of 3 x 400V)
- there are two value columns referring to a continuous functioning (class 1) or to a functioning during an overload phase (class 2) (150% for 60 seconds).

The current value in column 1 is calculated as

$$I_{DCL} = P_{Mot} / (h_{Mot} \times h_i \times U_{LN} \times 1.35)$$

where for column „Current Dclink  $I_{DCL}$  Overload class 2“ it is obtained multiplying by 1.36.

## Chapter 3 - SELECTION OF THE CS300 CONVERTER

The CS300 converter has to be chosen so that the sum of the inverter DC-link currents, both for class 1 and 2, is lower or equal to the corresponding ones stated in chapter 2.6.1.

### 3.1 DIP-SWITCHES AND JUMPER

*On R-SM3-L card*

<b>S1.1-4</b>	Selection of the delay for thyristor disabling during mains dip.
<b>S2.1-3</b>	Selection of the undervoltage threshold.
<b>S3.1-4</b>	Selection of the capacitors precharge time
<b>S4 - S5</b>	Selection of the AC mains frequency: 50 or 60 Hz
<b>CV</b>	Selection of the ML signal function

### 3.2 USE OF S1 SWITCH

*Relevant only for limited application cases*

If the system functioning allows a limited dip voltage value of the DC-LINK, (a condition obtainable by handling the DC-LINK with a suitable software or with additional external capacitors) it is possible, during a mains dip with a maximum duration time of 10mS, to prevent the thyristor switching off, of the CS300, during the detection of the voltage drop (repeating then the precharging sequence once the voltage is restored).

The disadvantage of such function is obviously the presence of a high current inside the CS300 once the voltage is restored. For this reason it is necessary to take appropriate countermeasures by checking the decreasing slope of the DC-LINK voltage during the mains dip. Therefore, knowing the value of the connected capacitors and the maximum current supplied by the CS300, it is possible to calculate the maximum “mains dip” bearable by the converter itself.

#### *Example:*

Calculate the maximum “mains dip” bearable by a converter size 185A, whose mains choke has the following values: 0.148mH 173 rated A and 350A of saturation current. The converter supplies 8 inverters AV300- 3011 (the internal capacitors value of each inverter is equal to 470 $\mu$ F); using an oscilloscope, it has been stated that during a normal functioning, in case of a mains dip, the DC-LINK discharges 70V after a 3-mS mains dip.

The aim is to state whether such “mains dip” can be overcome without the precharging phase.

Considering a series resistance (sum of the capacitor parasite drag and of the connection contact resistances) equal to 100mOHM (0.1 OHM), act as following:

DATA:	R = 0.1 W	C = 3760 mF
	L = 0.14 mH	e = 2.718
	V = 70V	



1)

$$\omega = \sqrt{\frac{1}{L * C} - \left(\frac{R}{2 * L}\right)^2}$$

Having as a unit of measure the “L” inductance in Henry, the “C” capacitor in Farad and the “R” resistance in Ohm, according to the above mentioned data:

$$\omega = 1331.21 \text{ rad/S}$$

2)

$$\alpha = \frac{R}{2 * L}$$

from which:  $\alpha = 357.14$

3)

$$t_M = \frac{\pi}{2 * \omega}$$

from which:  $t_M = 0.00117 \text{ s}$

(  $t_M$  states the time needed by the current to reach its maximum value )

4) the peak current can be calculated with the following formula:

$$I_P = \left(\frac{V}{\omega * L}\right) * e^{\alpha * t_M}$$

from which :  $I_p = 572.3A$

It is obvious that considering a 70V discharge of the DC-LINK (3-mS mains dip) **the current is too high for the converter**. As a consequence, it is necessary to consider a lower voltage reduction (corresponding to a shorter mains dip). Therefore, with a voltage reduction of 35V (1.5-mS mains dip), the new value will be:

$$I_p = 286.1 \text{ A}$$

Such value meets the need of both the converter (which for short periods is able to bear a current value two times the rated one) and the inductance, whose saturation current is higher than 300A.

Table of S1.1-4 Delay for thyristor switching off during mains dip.

Delay in the thyristor disabling	S1.1	S1.2	S1.3	S1.4
		ON	OFF	OFF
1.1mS +/- 10%	OFF	ON	ON	OFF
2.2mS +/- 10%	OFF	ON	OFF	ON
3.3mS +/- 10%	OFF	ON	OFF	OFF
4.4mS +/- 10%	OFF	OFF	ON	ON
5.5mS +/- 10%	OFF	OFF	ON	OFF
6.6mS +/- 10%	OFF	OFF	OFF	ON
7.7mS +/- 10%	OFF	OFF	OFF	OFF

cs080

From the above table, considering the example, a delay of 1.1mS is selected by setting:

**S1.1 OFF - S1.2 ON - S1.3 ON - S1.4 OFF.**

**NOTE!**

With **S1.1 ON** the delay circuit for the thyristors switching off is disabled. In this case when a mains dip occurs, the thyristors will be switched off; once mains dip is elapsed, **the capacitor precharging sequence will be executed again (default configuration).**

### 3.3 USE OF S2 SWITCH

Via the S2 switch it is possible to select the undervoltage threshold, which depends on the AC main voltage of the converter. *Dip S2.4 not used*

Power supply voltage	S2.1	S2.2	S2.3	Threshold of the PS drop
460V -10% ÷ 480V +10% (Default)	ON	OFF	OFF	370 Vdc
400V +/-15%	OFF	ON	OFF	300 Vdc
( 230 +10/-10% )	OFF	OFF	ON	180 Vdc

cs090

### 3.4 USE OF S3 SWITCH

The S3 switch is able to set the precharge time for the DC link capacitors (**the higher precharge time, the lower will be the current during the precharging phase to the supplied capacitors**).

Time (Seconds)	S3.1	S3.2	S3.3	S3.4
18 S +/-15%	OFF	OFF	OFF	OFF
11 S +/-15% (Default)	OFF	OFF	ON	OFF
7 S +/-15%	ON	OFF	OFF	OFF
4 S +/-15%	OFF	ON	OFF	OFF
2 S +/-15%	OFF	OFF	OFF	ON

cs100

Use the following way to select the precharge time:

- 1) Set all the switches in off position (18-seconds ramp time), use a current probe **able to detect a current peak  $\leq 10\text{mS}$**  between the C or D terminal of the DC-LINK.
- 2) At this point read the measuring of the maximum peak current present on the DC-LINK during the precharging phase.
- 3) If the measured peak current is much lower than twice the value of the CS300 rated current, it is possible to select the switch for a lower ramp time (SW3.4 - 8- second ramp time). Go back to point 2.

Such operation will be repeated till the measured peak current is **equal or lower** than twice the value of the converter rated current.

### **3.5 USE OF S4 AND S5 DIP SWITCH**

The S4 and S5 dip switches are used to select the AC mains frequency.

AC Mains frequency	S4	S5
50 Hz (Default)	OFF	OFF
60 Hz	ON	ON

cs110

### **3.6 USE OF CV JUMPER**

(See the ML signal function)

With “CV” jumper mounted (on), the signal available on the terminal 36 will be LOW with AC mains voltage lower than the undervoltage threshold (see figure 3). It will be HIGH, with AC mains voltage higher than the undervoltage threshold.

With “CV” jumper open (off), the signal on the terminal 36 will indicate, with an impulse of about 150ms, (low level signal) that the power supply voltage has had a transition at a level lower than the undervoltage threshold.

## Chapter 4 - CONTROL DESCRIPTION

### 4.1 OK RELAY

The OK relay has a normally open contact which close at the end of the precharging phase if no alarm condition is present (overtemperature, power supply on the regulation card +/-15V).

The contact is closed during the normal functioning of the device and also during an undervoltage situation. The contact opens when a failure occurs (see the alarm conditions described above) or when the power supply is switched off and the DC-LINK is completely discharged (C and D terminals).

### 4.2 PRECHARGE ENABLING CONTROL

Such input allows to delay the precharging phase with respect to the moment in which the power supply (U,V,W terminals) is applied.

The precharging phase occurs supplying terminals 23 to +24V (available on the terminal strip).  
(common on terminal 52).

### 4.3 MLP SIGNAL

The MLP signal is a digital output available on the terminal 32.

This signal is a sum of the undervoltage threshold (via S2.1-3 set) and the precharging phase.

It will be LOW with a 0.5mS delay after the undervoltage threshold is reached. The digital output will be again HIGH, at the end of the precharging phase. (This sequence is repeated at every mains dip)

(see chapter 6.2 figure B).

### 4.4 ML SIGNAL

The ML signal is a digital output available on terminal 36

It is the AC mains voltage monitoring.

With "CV" jumper mounted (on), the ML signal will be LOW when the undervoltage threshold is reached.

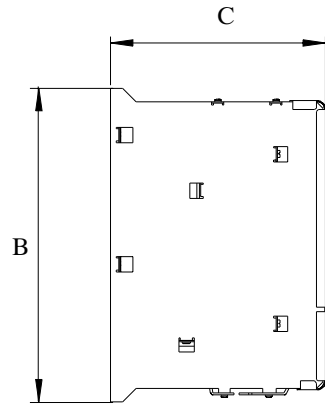
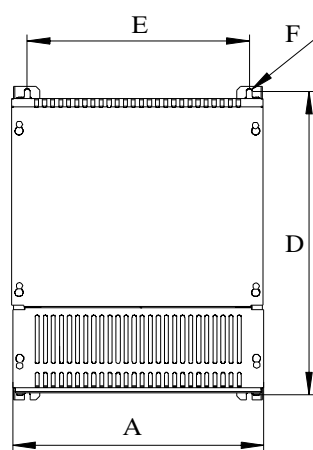
The digital output will be HIGH when the voltage is above the threshold (see the above table).

With "CV" jumper not mounted (off), the ML signal will indicate, with a 150mS pulse, an undervoltage value transition.

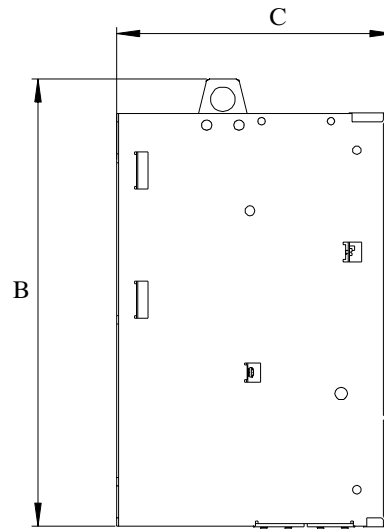
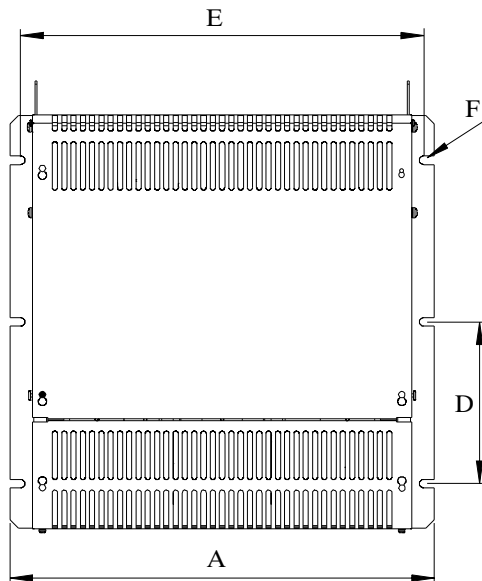
When the voltage comes back above the threshold value, this will be not revealed by the ML signal.

(see chapter 6.2 figure B).

## Chapter 5 - CONVERTER DIMENSIONS



Form 1



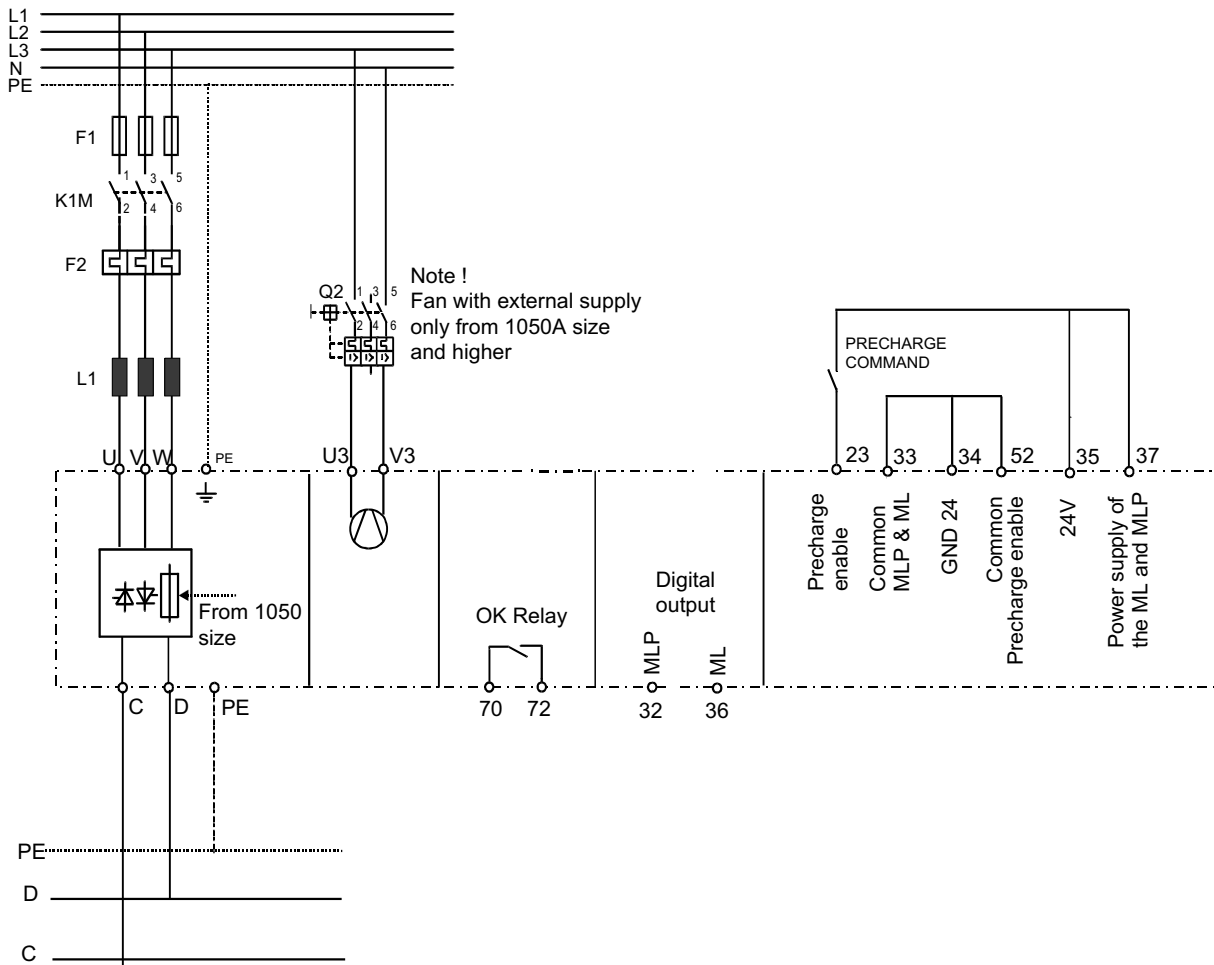
Form 2

Converter	Form	A	B	C	D	E	F	Weight lbs [kg]
		inch [mm]	inch [mm]	inch [mm]	inch [mm]	inch [mm]	Ø	
6KCS3185-480	1	12.22 [311]	15.25 [388]	10.61 [270]	14.73 [375]	10.70 [275]	M6	36.6 [18]
6KCS3280-480		12.22 [311]	15.25 [388]	10.61 [270]	14.73 [375]	10.70 [275]	M6	57.3 [26]
6KCS3420-480		12.22 [311]	15.25 [388]	10.61 [270]	14.73 [375]	10.70 [275]	M6	66.1 [30]
6KCS3650-480		12.22 [311]	15.25 [388]	10.61 [270]	14.73 [375]	10.70 [275]	M6	68.3 [31]
6KCS310H-480	2	20.63 [525]	21.77 [554]	13.48 [343]	7.86 [200]	19.65 [500]	M6	138.8 [63]
6KCS315H-480		21.65 [551]	26.96 [686]	14.93 [380]	7.86 [200]	20.67 [526]	M8	187.3 [85]

cs120

# Chapter 6 - CONVERTER OPERATION

## 6.1 EXAMPLE OF TERMINAL STRIP CONNECTION



## 6.2 SIGNAL DIAGRAM

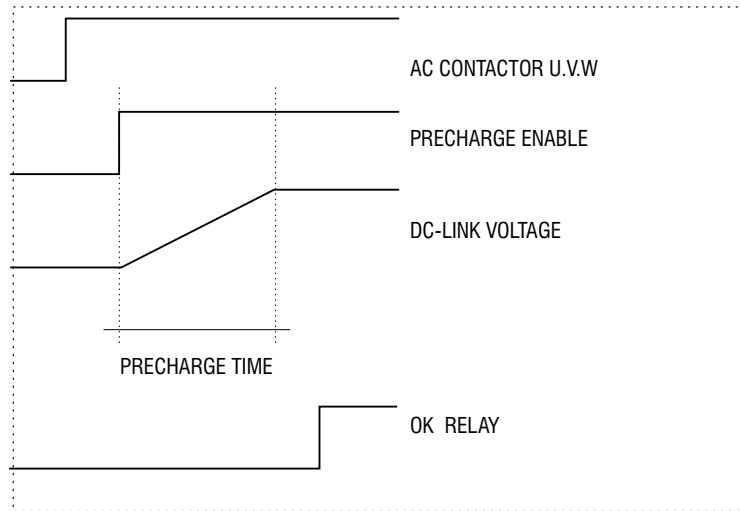


Figure A

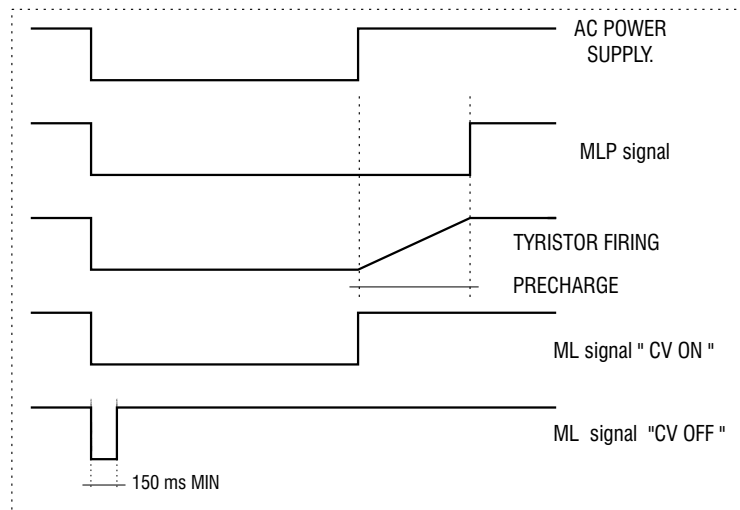
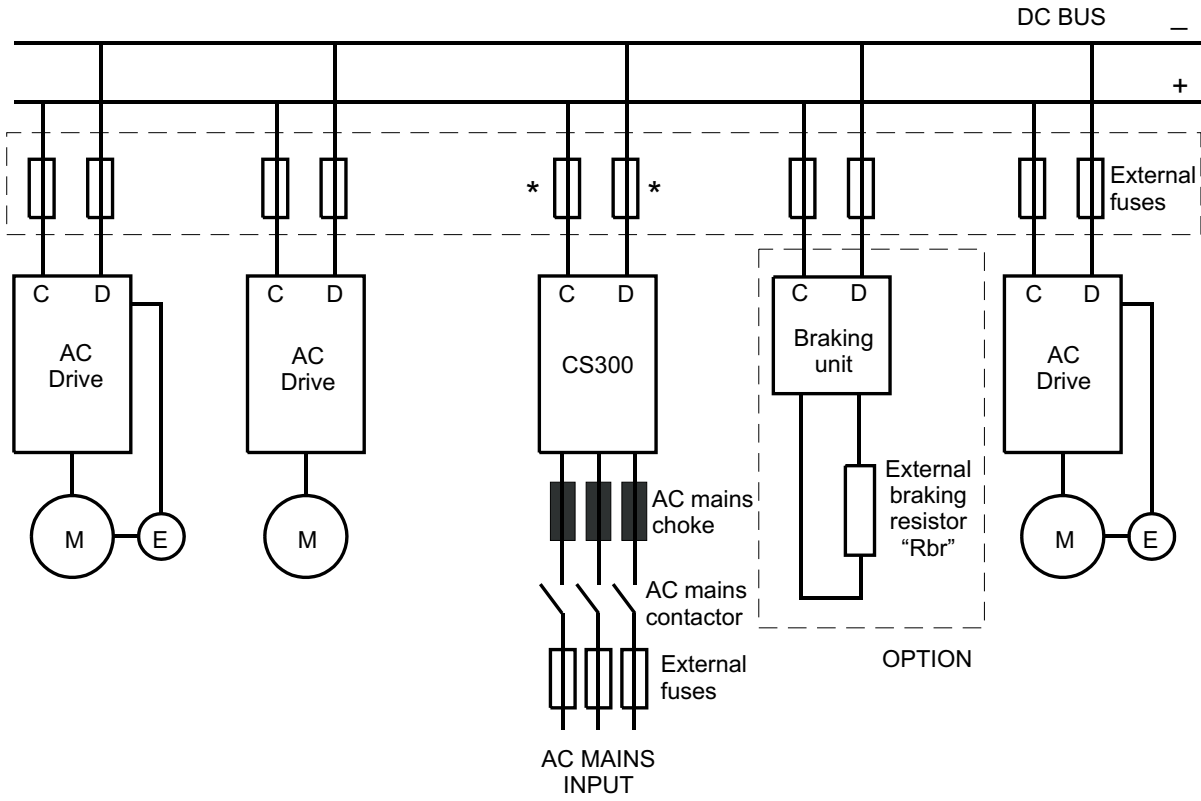


Figure B

### 6.3 COMMON BUS MULTI-INVERTER SYSTEM



\* : Fuses for cables protection.



## Chapter 7 - REPLACEMENT PARTS

CODE	Catalog No.	Rating	Converter power & quantity per product					
			185	280	420	650	1050	1500
<b>Regulation card</b>								
6KS5V99	R-SM3L		1	1	1	1		1
6KS5V98	R-SM3-LM						1	
<b>Filter cards</b>								
6KS5N14	SN5-31		1	1	1	1		
<b>Filter link</b>								
6KS5V97	V-SM3		1	1	1	1		
6KS5N15	FL-31						1	1
<b>SCR MODULE</b>								
6KS776F	SCR MODULE	116A 1K6V	3					
6KS781F	SCR MODULE	130A 1K6V		3				
6KS79F4	SCR MODULE	210A 1K6V			3			
6KS79F6	SCR MODULE	320A 1K6V				3		
6KS79F5	SCR MODULE	500A 1K6V					3	
6KS714F	SCR AT 1007 S16							3
<b>Diode</b>								
6KS8T79	DIODES AR1104 S16							3
<b>Fans</b>								
6KS7G76	FAN A 024 DC-62/72-B-20/+60		2					
6KS7G71	FAN A 024 DC-170-B-20/+75			2	2			
6KS7G78	FAN 024 DC-345-B-15/+60					2		
6KS7G17	FAN A 230V AC 50HZ						3	3
<b>Thermistors</b>								
6KS7G33	BIM. THERM.85°C EC		2					
6KS7G29	BIM. THERM.80°C EV				2	2		
6KS7G30	BIM. THERM.90°C EC						3	3
	BIM. THERM.90°C EC							3
<b>SCR filters</b>								
6KS7S58	RC SCR FILTER	18ohm50W						3
6KS8S61	RC SCR FILTER	1mF 850Vac						3
<b>Internal fuses</b>								
6KS8B28	FUSES 5X20 T20	1A 250V	1	1	1	1	1	1
6KS8B19	FUSES 6,3X32	4A 500V	1	1	1	1	1	1
6KS8B30	FUSES 6,3X32	1,6A 500V					1	1
6KS820B	FAST FUSES 6,3X32	16A 500V	3	3	3	3		
6KS821B	FAST FUSES 6,3X32	25A 500V					3	3
6KS827B	FUS. PWR GOULD (for Europe only)	1000A 660V					3	
6KF4G76	G3MUEF1 JM (for Europe only)	1000A 660V						6
6KS827B	FUS. PWR GOULD (for USA only)	1000A 660V					3	
6KF4G76	G3MUEF1 JM (for USA only)	1000A 660V						6
<b>External fuses (Europe)</b>								
6KFAG23	S00UF1/80/200A/660V		3					
6KF4G30	S2UF2/110/315A/660V			3				
6KF4E30	S2UF1/110/500A/660V				3			
6KF4E31	S2UF1/110/630A/660V					3		
6KF4C10	MK MICROSWITCH FUS. JM							6
<b>External fuses (USA)</b>								
PDFP7V200ABLADE	FAST FUSE CSA 200A 700V		3					
PDFP7V350ABLADE	FAST FUSE CSA 350A 700V			3				
PDFP7V500ABLADE	FAST FUSE CSA 500A 700V				3			
PDFP7V600ABLADE	FAST FUSE CSA 600A 700V					3		
6KF4C10	MK MICROSWITCH FUS. JM							6

## Chapter 8 - WARRANTY PARTS AND SERVICE

The purpose of this section is to provide specific instructions to the user of the standard drive referenced in this book regarding warranty administration and how to obtain assistance on both in-warranty and out-of-warranty equipment.

If assistance is required to determine warranty status, identify defective parts, or obtain the name of your local distributor, call:

### GE Industrial Systems

#### Product Service Engineering

1501 Roanoke Blvd.

Salem, VA 24153-6492 USA

Phone: + 1 800 533 5885 (United States)

+ 1 540 378 3280 (International)

Fax: + 1 540 387 8606 (All)

("+" indicates the international access code required when calling from outside of the USA.)

### WARRANTY COVERAGE

The warranty covers all major parts of the drive such as the main printed circuit boards, transistor modules, etc. The warranty does not cover replacement of fuses or of the entire drive.

"Warranty period is 12 months after installation or 18 months after shipment from the Company, whichever occurs first".

However, the guarantee will not apply in the following cases, even if the guarantee term has not expired:

1. Damage was caused by incorrect use or inappropriate repair or modification.
2. The product was used in an environment outside the standard specified range.
3. Damage was caused by dropping the product after purchase or occurred during transportation.
4. Damage was caused by an earthquake, fire, flooding, lightning, abnormal voltage, or other natural calamities and secondary disasters.

Before calling the number at left to determine warranty status, the drive serial number will be required. This is located on the drive nameplate.

### OUT-OF WARRANTY PROCEDURES

When the defective part has been identified, contact your local authorized GE standard drives distributor to order replacement parts.

### MOTORS

Motors repairs on General Electric motors are generally handled by GE Authorized Electric Motor Servicenters or GE Apparatus Service Shops. For specific instructions on your motor, call the distributor from which it was purchased and be prepared to furnish complete nameplate data.

*Notes:*



## **GE Industrial Systems**

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+ 1 540 387 7000  
[www.GEindustrial.com](http://www.GEindustrial.com)

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