

PRODUCT DESCRIPTION

The converter series FFE (Fundamental Front End) consists of a three-phase IGBT bridge working at mains frequency and works as rectifier/regenerative bridge allowing the flow of energy from the mains to the DC-link and vice versa.

When operating as a rectifier bridge, the current flows through the free-wheeling diodes integrated in IGBT modules as in a normal three-phase diode bridge rectifier. The line voltage is converted into a voltage not stabilized and depending from load, any fluctuations of main supply have an impact on the DC-link voltage.

The average value of the DC-link voltage is higher than the input rms voltage by a factor of 1.35 at no load condition.

When operating as a regenerative bridge, the current flows through the IGBT modules, in this case the converter operates as a six-pulse converter that switches to the mains frequency.

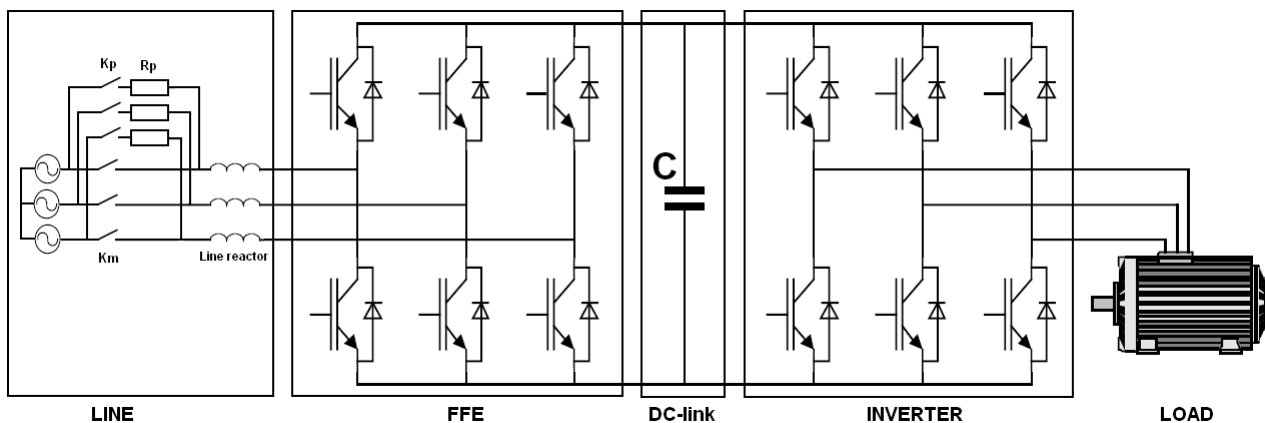
Because of the six-pulse converter operation produces a high harmonic content on the network, the line current contains even order harmonics $a_n = n * 6 \pm 1$ ($n = 1, 2, 3 \dots$).

When operating as a rectifier bridge, current harmonics produced are identical to those produced by a common three-phase diode rectifier with a THD (Total Harmonic Distortion) between 30% and 45%. When operating as a regenerative bridge, the low frequency harmonics are small but high-frequency harmonics are high consequently the overall THD remains high.

To reduce the effects of harmonic distortion is used a line reactor with a relative short-circuit voltage of 4 % on the line side (located between the AC bar and the main line) in order to improve the form factor of current drawn. The line reactor also reduces the harmonic current and voltage on the line and the thermal stress of power components and capacitors on the DC-link.

Since IGBTs can be turned off at any time (unlike thyristors) commutation short circuits do not occur if the line supply system fails in regenerative mode.

A typical situation of use is shown below with the FFE converter connected to a standard inverter.



CF converter are designed to be installed in cabinets, they are withdrawable power stack with an IP20 protection degree.

With the FFE CF converter is possible to convert the AC incoming voltage to a DC voltage level for supply several DC/AC inverter, also is possible to regenerate in the incoming line voltage during motor braking.

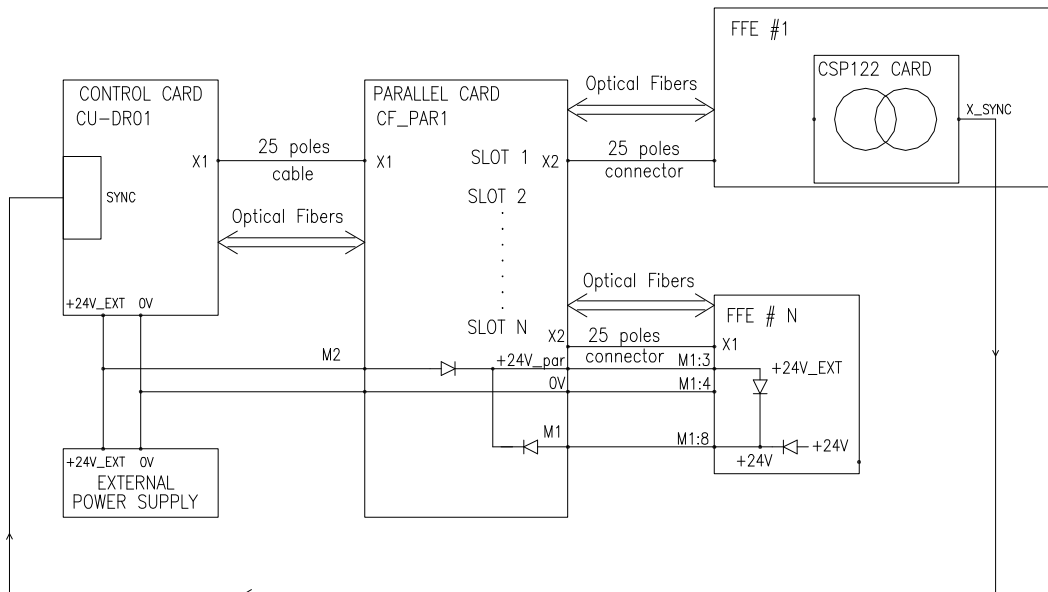
The internal electronic board are powered with an external power supply of 24V=, in addition an internal power supply is present when the DC link is energized.

The semiconductor devices used inside the CF converter are IGBT (insulated gate bipolar transistor) of two ranges: 1200V (for 400Vac incoming line voltage) and 1700V (for 690Vac incoming line voltage).

For more power stack in parallel it is necessary to use a Parallel Card module interface to adapt the control signals to all the power module to the CU-DR01 control unit and vice versa.

For the control unit CU-DR01, using the parallel card CU-P the system appears as a single more powerful system.

The parallel card has the following order code: CU_P-S0x, with x equal to the number of power module present.

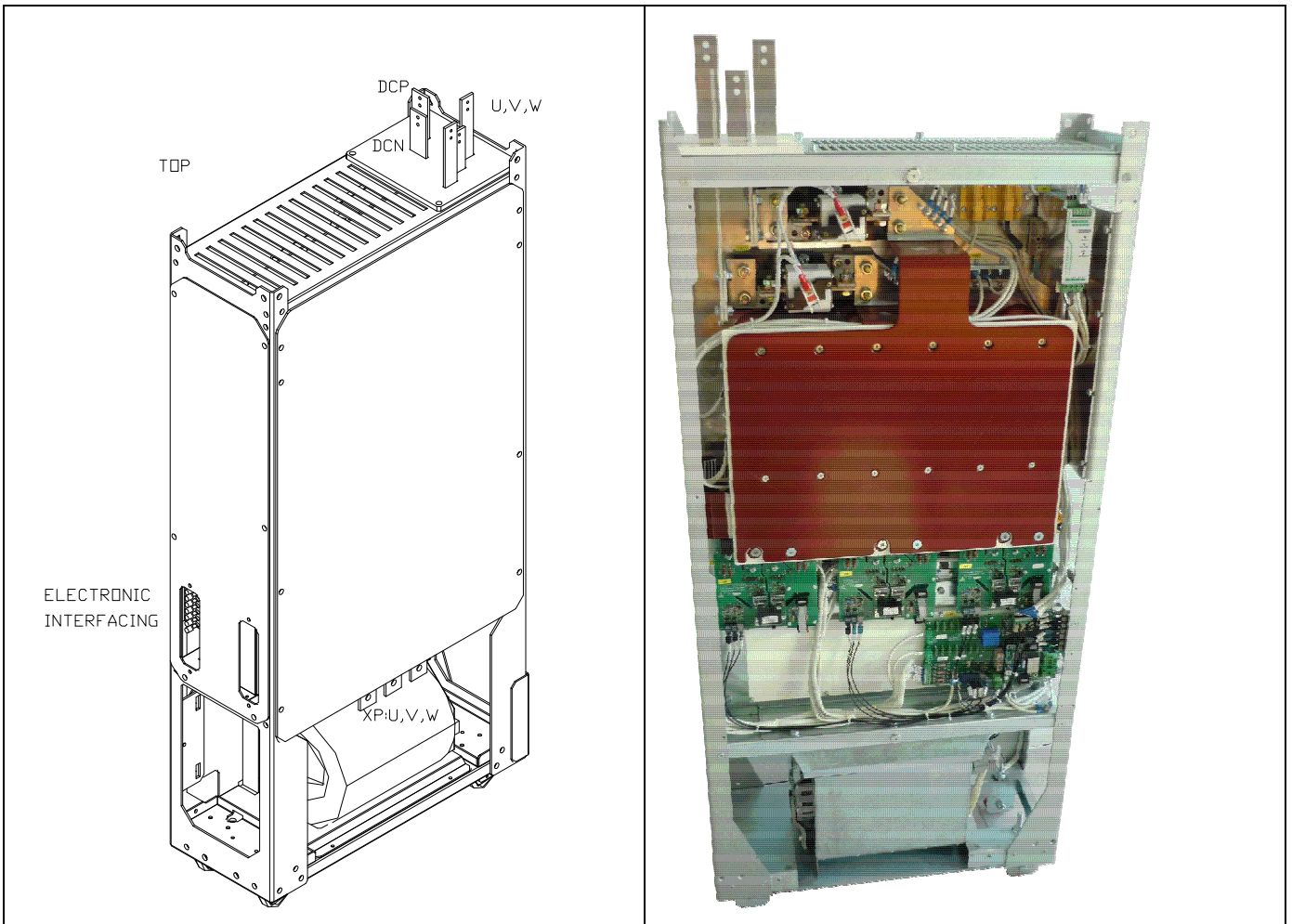


FFE with Parallel Card interface

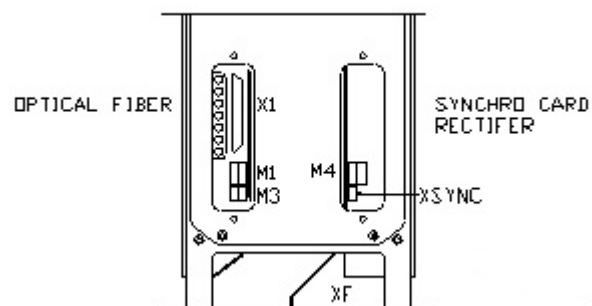
When several power rack are parallel connected, from the power rack point of view, only the first power module has to be equipped with the internal AC/DC precharge converter. The FFE power rack are connected in parallel: in the AC side an input reactor has to be installed, in the DC side, the output bar can be connected in parallel.

After the precharge of the internal capacitor is performed, the main supply to the input bar U, V, W has to be given closing the main circuit breaker.

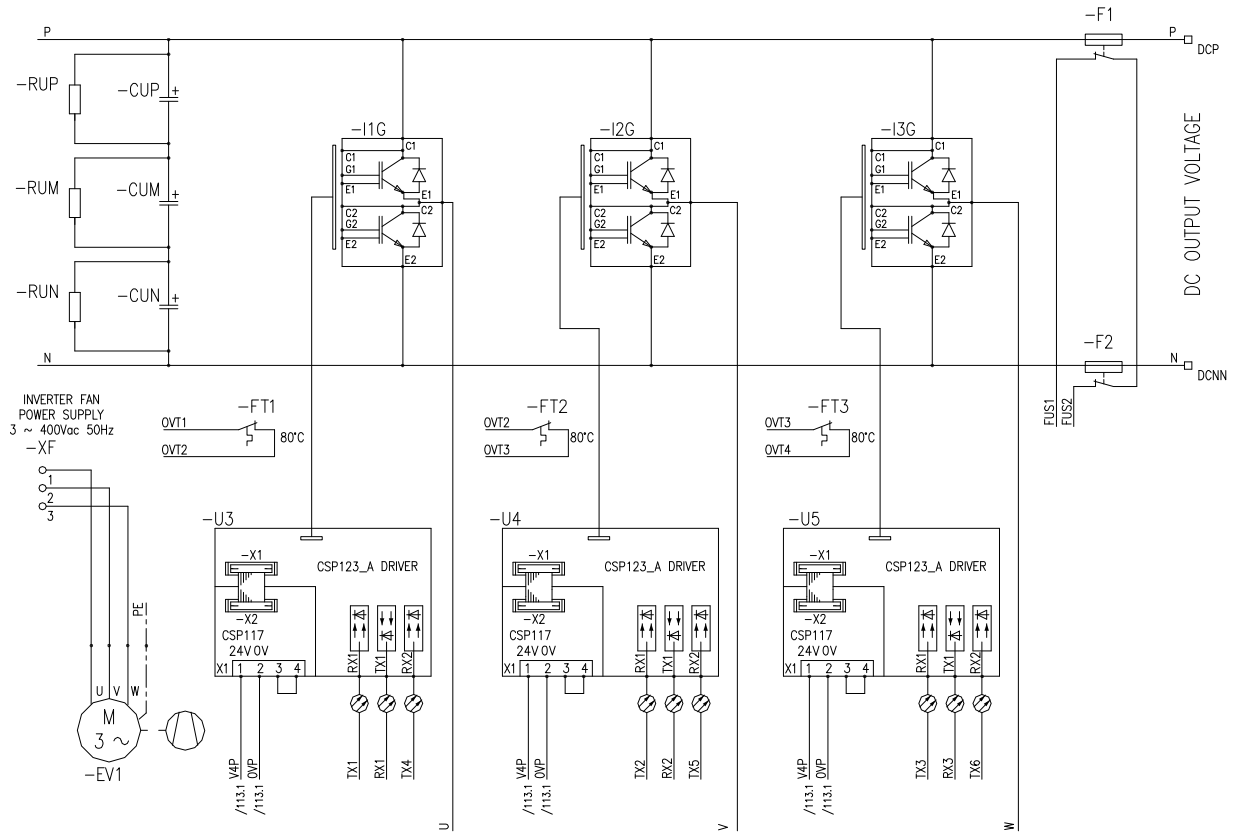
The integrated high voltage power supply and IGBT driver cards optically insulated are included in CF converter, Also the DC link capacitor, the DC link fuses and the cooling fan are integrated inside the converter.



FFE layout



FFE interfacing connector layout



FFE Main electrical connections



**AC/DC FFE converter
power module**

Document Nr

Rev. 02

CF_EN_B_R02

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TECHNICAL FEATURES

The following technical features are valid for AC/DC FFE converter power module for the 690Vac(±10%) type at 50Hz (or 60 Hz).

MODEL	A _N kVA	I _N A	I _{dcouT} Acc	I _{dcMAX} Acc	Losses W	Air flow m ³ /h	Power Module Number
CF460/69.FFE	550	460	520	690	1500	2000	1
CF530/69.FFE	630	530	599	795	1800	2000	1
CF690/69.FFE	820	690	780	1035	2600	2000	1
CF910/69.FFE	1085	910	1025	1365	3000	4000	2
CF1050/69.FFE	1250	1050	1185	1575	3600	4000	2
CF1360/69.FFE	1625	1360	1540	2050	5200	4000	2
CF1570/69.FFE	1870	1570	1775	2365	5400	6000	3
CF2040/69.FFE	2440	2040	2310	3070	7800	6000	3
CF2700/69.FFE	3250	2700	3080	4100	10400	8000	4

MODEL	Height (mm)	Width (mm)	Depth (mm)	Weight (kg)	Number of Units
CF460/69.FFE	1398	245	650	112	1
CF530/69.FFE	1398	245	650	113	1
CF690/69.FFE	1398	245	650	113	1
CF910/69.FFE	1398	2 x245	650	112 x 2	2
CF1050/69.FFE	1398	2 x245	650	113 x 2	2
CF1360/69.FFE	1398	2x 245	650	113 x 2	2
CF1570/69.FFE	1398	3 x 245	650	112 x 3	3
CF2040/69.FFE	1398	3 x 245	650	113 x 3	3
CF2700/69.FFE	1398	4 x 245	650	113 x 4	4

MODEL	Fuse Details (DC side)				
	Type	I _N	U _N	Size	Manufacturer
FFE 690V					
CF460/69.FFE	170M4197	630	1250	1	Bussmann
CF530/69.FFE	170M4197	630	1250	1	Bussmann
CF690/69.FFE	170M4197	630	1250	1	Bussmann
CF910/69.FFE	170M4197	630	1250	1	Bussmann
CF1050/69.FFE	170M4197	630	1250	1	Bussmann
CF1360/69.FFE	170M4197	630	1250	1	Bussmann
CF1570/69.FFE	170M4197	630	1250	1	Bussmann
CF2040/69.FFE	170M4197	630	1250	1	Bussmann
CF2700/69.FFE	170M4197	630	1250	1	Bussmann

MODEL	CAPACITANCE VALUE µF
690V	
CF460/69.FFE	7.833
CF530/69.FFE	7.833
CF690/69.FFE	9.400
CF910/69.FFE	7.833 x 2
CF1050/69.FFE	7.833 x 2
CF1360/69.FFE	9.400 x 2
CF1570/69.FFE	7.833 x 3
CF2040/69.FFE	9.400 x 3
CF2700/69.FFE	9.400 x 4

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The following technical features are valid for AC/DC FFE converter power module for the 400Vac (±10%) type at 50Hz (or 60 Hz).

MODEL	A _N kVA	I _N A	I _{dcouT} Acc	I _{dcMAX} Acc	Losses W	Air flow m ³ /h	Power Module Number
CF470/40.FFE	325	470	530	707	1500	2000	1
CF580/40.FFE	400	580	656	870	2000	2000	1
CF760/40.FFE	526	760	859	1140	2900	2000	1
CF930/40.FFE	644	930	1050	1400	3000	4000	2
CF1140/40.FFE	795	1140	1300	1726	4000	4000	2
CF1500/40.FFE	1040	1500	1700	2260	5800	4000	2
CF1720/40.FFE	1190	1700	1940	2590	6000	6000	3
CF2250/40.FFE	1560	2250	2550	3390	8700	6000	3
CF3000/40.FFE	2070	2970	3390	4500	11600	8000	4

MODEL	Height (mm)	Width (mm)	Depth (mm)	Weight (kg)	Number of Units
CF470/40.FFE	1398	245	650	111	1
CF580/40.FFE	1398	245	650	112	1
CF760/40.FFE	1398	245	650	112	1
CF930/40.FFE	1398	2 x245	650	111 x 2	2
CF1140/40.FFE	1398	2 x245	650	112 x 2	2
CF1500/40.FFE	1398	2x 245	650	112 x 2	2
CF1720/40.FFE	1398	3 x 245	650	111 x 3	3
CF2250/40.FFE	1398	3 x 245	650	112 x 3	3
CF3000/40.FFE	1398	4 x 245	650	112 x 4	4

MODEL	Fuse Details				
	Type	I _N	U _N	Size	Manufacturer
FFE 400V					
CF470/40.FFE	170M4216	630	660	1	Bussmann
CF580/40.FFE	170M4216	630	660	1	Bussmann
CF760/40.FFE	170M4216	630	660	1	Bussmann
CF930/40.FFE	170M4216	630	660	1	Bussmann
CF1140/40.FFE	170M4216	630	660	1	Bussmann
CF1500/40.FFE	170M4216	630	660	1	Bussmann
CF1720/40.FFE	170M4216	630	660	1	Bussmann
CF2250/40.FFE	170M4216	630	660	1	Bussmann
CF3000/40.FFE	170M4216	630	660	1	Bussmann

MODEL	CAPACITANCE VALUE µF
	400V
CF470/40.FFE	11.750
CF580/40.FFE	11.750
CF760/40.FFE	14.100
CF930/40.FFE	11.750 x 2
CF1140/40.FFE	11.750 x 2
CF1500/40.FFE	14.100 x 2
CF1720/40.FFE	11.750 x 3
CF2250/40.FFE	14.100 x 3
CF3000/40.FFE	14.100 x 4