



CONV-MAK FC Series Frequency Converters

20 kVA / 16 kW Frequency Converter
415V 50Hz / 115V 400Hz

MAK 
POWER SYSTEMS
www.mak-powersis.de



- True On Line-Double Conversion Technology (Class VFI-SS-111)
- IGBT PWM Rectifier & Inverter Technology - DSP Control
- Marine Application
- Low Input Current THD (<3%)
- High Input Power Factor (>0.99)
- High Efficiency up to 93%
- Optional Dual Input
- Wide Input Voltage Range
- If Needed Battery Connection Possibility & Perfect Battery Management
- Short Circuit and Overload Protection
- Unlimited Number of Paralleled Modules
- Perfect Sinus Output and Strong Protection and SNMP Control
- 500 Real Time Event Log with 180 Detailed Parameters "Excel Output"
- Perfect for Marine, Radar and Customized Solution
- Overload and Short Circuit Protection
- Small Footprint and Easy Maintenance
- Advanced Communication Capabilities
- Perfect Generator Compatibility
- Customizable as Customer Need for Radar Systems and Air Plane
- 50Hz / 60Hz / 200Hz / 400Hz - IP21 - IP22 - IP33 - IP44 - IP55



Industrial Applications



Outdoor Solutions



Planes Ground Units

*3kVA * 6kVA *10kVA *20kVA *30kVA *40kVA *60kVA *80kVA *100kVA *120kVA *160kVA *200kVA *250kVA *300kVA *400kVA *500kVA *600kVA *800kVA



20 kVA Frequency Converter





Technical Advantages of CONV-MAK FC

The CONV-MAK FC Series An Advanced Converter Technology

FC Series is a true Online Double Conversion, new generation fully digital controlled converter. It is designed with high efficiency and robust comply high availability power needs of a wide variety of critical applications and delivers advanced power solution with low cost of ownership.

High Performance Power Protection Designed for Maximum Efficiency and Flexibility

Equipped with its new IGBT rectifier FC series keeps your critical loads protected while its space-saving compact design and front access for maintenance successfully reduce mean time to repair (MTTR).

Thanks to the wide variety of accessories and options FC Series presents maximum flexibility advantage to users and optimizes total cost of ownership.

⦿ DSP Power Factor Corrected IGBT Rectifier

IGBT based power factor correction technology provides Input Power Factor close to 1 (≥ 0.99) and keeps Input Current Total Harmonic Distortion (THDi) less than 3%, that helps to avoid the disturbance.

⦿ Low Input Current THD

(THDi) less than 3% avoids the disturbance to connected loads

⦿ Digital Control System

All of the control functions for FC Marine Series Converter including power-on, start-up control, input stage power factor control, If needed battery charging and boosting control, output stage ac voltage regulation and shut-down control, can be realized by using a single DSP control board.

⦿ High Input Power Factor

0,99 Input power factor ensures clean and sinusoidal input current. The high input power leads to reduced electricity pay-out, minimizes cable, switchboard, fuse and generator requirements, thus reducing investment cost.

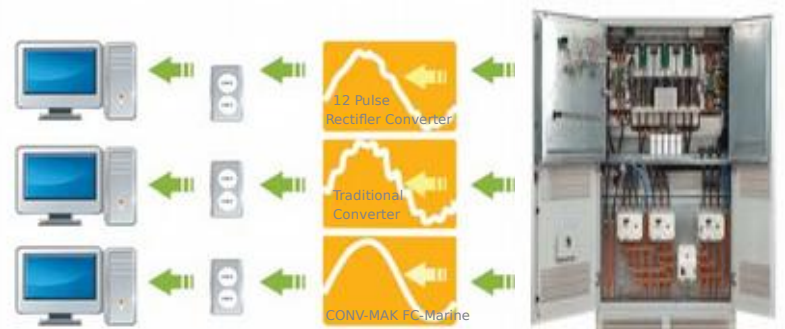
⦿ High Efficiency & Low Total Cost of Ownership

With its high efficiency up to 93% FC Series Converter consumes less energy to supply the loads. Thanks to this high efficiency rate, the percentage of energy that is produced as heat is reduced to a minimum. As a result of decreased heat emission users can reduce their electricity usage and air conditioning requirements.

⦿ Flexibility of The Converter

FC is compatible with wide range of application. Flexibility achieved through many choices, including type of battery, single or multi-unit configuration, accessories and options.

- ⦿ Battery connected converter mode
- ⦿ Optional temperature sensor for external battery cabinets (to assist the recharge voltage compensation)
- ⦿ Additional protection via redundant solutions
- ⦿ Optional separated bypass with additional converter
- ⦿ Isolation transformers to vary neutral connectivity in the event of separate power sources or for galvanic isolation between input and output
- ⦿ Customized dimensions if needed for your projects till IP54



	THD	Power Factor
CONV-MAK FC-Marine with IGBT Rectifier	<3%	<0.99
Traditional Converter with Input Filter	<10%	<0.95
Converter without Input Filter	<25%	<0.85



Technical Advantages of CONV-MAK FC

Auto Restart

When the main and additional converter or the connected bypass sources fails, the Converter draws the power from the battery system if needed to supply the load until the batteries are depleted. Or when the energy supply fails and after the utility power is restored the converter will restore the needed frequency and energy.

When Converter will reach its end of discharge or without energy, So the converter will shut down.

The Converter will automatically restart and enable output power:

- After utility power is restored
- After the "Auto Start Delay Time" is expired (the default delay is 5 minutes) .

EPO(Emergency Power Off)

EPO function is designed to switch off the converter in emergency conditions (fire, flood, etc.). The system will turn off the rectifier, inverter and will stop powering the load immediately (including the inverter and busbar).

Reverse Energy Tolerance for Regenerative Loads

The FC-Marine Converter can be used with regenerative loads, such as synchronous motors. The regenerative loads pump the energy back to mains, traditional systems burn this feedback energy and this causes lower efficiency. Boxer Series with IGBT rectifier are able to absorb intermittent load generated power. Additionally, this reverse power tolerance permits execution of important system operations like closed transition transfers of the Converter load directly to an engine generator Source if connected.

Advanced User Interface

The Converter has Large and user-friendly 320x240 LCD display that provides operating information in four different languages. Thanks to this advanced LCD display all parameters of working device can be monitored and controlled. Converter is capable of recording up to 500 events and 180 Parameters/event.

Parallel Operation

FC-Marine Series features easy and simple scalability and redundancy. It is ready to grow with your business demands. Different power rated units and any number of Converters can be connected in parallel.

Power Increase: The converter's can be connected in parallel to increase total capacity of the system. If one of the devices goes out of order, the critical loads are transferred to by-pass.

Parallel Operation Features :

- Internal standard parallel microprocessor for all models.
- Up to 16 units parallel able as customized.
- Parallel connection with ring cable
- Autosensing disconnected parallel cable
- Equal current share with DSP control
- Easy power upgrade without any interruption
- All parallel systems can be controlled from the front panel of one unit
- Full synchronization of parallel units
- Isolated parallel operation card
- Static by-pass for the power security if needed.



Vibration Reduction



CONV-MAK FC Series Solution Specifications

Capacity	20KVA
Power Watt	16 kW
INPUT	
Input Voltage Range	415 V -10% +10% 3P+N+PE / Delta or Star Connected 60Hz
Input Power Factor	At Full Load >0.99
Input Frequency Range	45 - 66 Hz (Selectable) Wide Range Optional 40Hz - 70Hz
Rectifier	IGBT
Total Harmonic Distortion (THDi)	<3%
OUTPUT	
Output Voltage Range	115V 3P+N+PE / 400Hz & Delta or Star Connected / Please Confirm
Recovery	1% Back to Band <40ms
Efficiency	Online Mode Up to 89%
Output Frequency Range	400Hz ±0.1% Synchronous With the Network / "Optional 50Hz or 60Hz ±0.01% Battery Mode or 83Hz or 200Hz or 400Hz "
THD (THDv)	Lineer Load <2% Non-Lineer Load <5%
Crest Factor (CF)	3:1
Overload Capacity*	At 125% Load 10min, at 150% Load 1min
COMMUNICATION	
Communication Port	Optional RS232 Standart, RS485, SNMP Adapter Option & Dry Contact Card
Dry Contact	Optional
Protocol	SEC, TELNET
STANDARDS	
Quality	ISO 9001 - ISO 14001 - ISO 18001
Performance	AC 1500V / 600Hz 1 Min & 5 Mohm by 500V Megger
EMC/LVD	EN62040 - 2 / EN62040 -1 EN60950 / EN62040 -3 (VFI-SS-111)
GENERAL	
Running Temperature	Customized 0°C~45°C Fresh Air Cooling with Special Design & "Optional -5°C~55°C or -10°C~60°C With Air Conditioners "
Storage Temperature	0°C ~45°C
Protection Class	Marine Standard IP23 or Customized Marine / Outdoor / Off Shore IP55 with or without Air Conditioner
Chassis & Humidity	Anti-Static Paint Protection & 0-95%
Screen	Standard 4x20mm or 320mm x 240mm or Touch or & Outdoor Screen & With Mimic Diagram Languages English, German, Spanish & Russian
Altitude	<1000Meter @35°C & <1500Meter @30°C & after 1500Meter for Each Meter %1 Loss
Alerts	500 Event Logs & 180 Parameters for Each Log "As Excel Sheet"
Parallel Operation	Optional: "Parallel Power Increase up to 16pcs. And Customized Solutions As Well"
EPO (Emergency Power Off)	Standard
Isolation Transformer	Optional
Net Weight (kg)	280kg / Packed 310kg
Dimensions (WxDxH) (mm)	Dimensions: 800 x 800 x 1300 / Packed: W850mmxD850mmxH1550mm <1000m, Correction Factor 1. <2000m, Correction Factor >0.92, <3000m; Correction Factor >0.84

NOTE: CUSTOMIZED SOLUTIONS ARE POSSIBLE, PLEASE ASK FOR THE NEEDED SOLUTION / Customisable Connection Cables for Airplane

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CONV-MAK FC Series Solution Drawings

