

## POWER SYSTEMS INTERNATIONAL "SHORE POWER" POWER CONVERSION SYSTEMS

50Hz, 60Hz and 400Hz three phase and single phase

There is a growing world focus on energy conservation with the drive towards reducing the now familiar "carbon footprint", add to this the exhaust noise disturbance, smoke and air pollution from internal combustion engines. The maritime community is also taking this subject seriously with the Government Agencies, shipping companies, cruise lines, car ferry ports, Naval dockyards, Harbours and Marina operators actively seeking alternative ways of providing shore side power for the vessels when they berth at port.

Some background

There is an increasing number of luxury cruise liners and fast car carrying vessels calling at international ports and Navy vessels berthing at foreign locations.

When a vessel berths in a port the propulsion engines are turned off but normally its diesel engine driven generators would continue to run to provide power for all of the on board "auxiliaries" such as:

- > Air conditioning
- > Heating
- > Lighting
- > Battery charging
- > Communications centre
- > Computers
- > Navigation system
- > Water pumps and
- > Other utility services.

The diesel generators produce noise, vibration, exhaust smoke and air pollution. They also require bulk fuel storage and consume vast amounts of (smelly) diesel fuel, and incur costly maintenance and the inevitable need for replacement parts as necessary for all internal combustion engines. Many of the port and harbour operators are now offering visiting vessels the opportunity to "plug into" the local city power supply grid on the dockside or shore based generators so the on board diesel engine generators can be turned off while the vessel is in port.

Here there is the problem, many countries have their own local power distribution grid voltages, the American continent also has a frequency of 60Hz and most of the other countries of the world have a power distribution frequency of 50Hz, the Power Systems International "SHORE POWER" frequency converter could be the answer!

### ON BOARD "SHORE POWER" FREQUENCY CONVERTERS.

When the on board "SHORE POWER" converter is connected to the dockside power source service point, the frequency converter will automatically adjust to the local voltage and frequency and deliver to the Vessel a high stability and galvanically isolated power supply. The "SHORE POWER" frequency converters can also be provided with batteries to provide an uninterruptible power supply feature to cover any disturbances and power failures in the dockside service power.

Our "SHORE POWER" frequency converter will allow the shutting down of the vessel's engine driven auxiliary power generators, there would then be barely any audible noise to disturb passengers or neighbouring vessel or on board personnel, no vibration smoke, no fumes, no smell, no CO2 emissions, and no costly additional diesel fuel or oil bills.

Our on board "SHORE POWER" frequency converters are available in sizes from 25kVA to 150kVA with three phase 50Hz or 60Hz output. The single phase 50Hz or 60Hz output frequency converters are available in sizes up to 50kVA.

The "SHORE POWER" converters are suitable for installation on board vessels of all types. Providing them with an ability to connect to any shore based power supply anywhere in the world

## **FIXED INSTALLATION "SHORE POWER" FREQUENCY CONVERTERS.**

Our fixed "SHORE POWER" frequency converters are designed for use on the dockside public supply grid networks of 50Hz or 60Hz with 3 phase standard input voltages of 208V, 380V, 400V, 460V or 575V. The output voltage and frequency will be according to the needs of the ship.

The shore to ship frequency converters are manufactured in sizes of 50kVA to 500kVA in an indoors type of enclosure of IP20 or IP31 for installation in a sub-station or power distribution room. The shore to ship frequency converters are also manufactured in an all-weather IP54 outdoor enclosure for installing on the dockside or mooring berth.

The "SHORE POWER" on board frequency converters provide a galvanic isolation between dockside shore power pick up point and the on board vessel power distribution system.

## **MILITARY AND CUSTOM ENGINEERED "SHORE POWER" CONVERTERS.**

Custom engineered versions of the "SHORE POWER" converters are designed and manufactured to Military and customer specifications with 50Hz, 60Hz and 400Hz outputs and with integral batteries for provide a secure and isolated uninterruptible power supply for critical duty, submarine, Naval and Defence related applications.

We can also provide the "SHORE POWER" converters with DC output or as a combination converter with AC and DC output. The power converters can be designed for installing on board ships, mobile rough terrain vehicles, and trailer or for permanent fixed installations

## **CABLES, CABLE STOWAGE AND REELING SYSTEMS FOR "SHORE POWER" CONVERTERS.**

We can also supply the "SHORE POWER" frequency converters with input and output cable, cable stowage, reeling systems and distribution systems for the fixed shore to ship power converters.

## **"SHORE POWER" TECHNICAL DETAILS:**

The "SHORE POWER" frequency converters up to 250kVA are available for installation on board all types of Super-yachts, Cruise Liners, passenger ships, Vehicle ferries, Navy vessels and Coastguard fast patrol and search & rescue boats.

Outdoor all weather versions of SHORE POWER frequency converters are available in sizes of 50kVA to 500kVA for connection to the local power supply Grid or dockside power source. These frequency converters are for installation on the dockside or Marina jetty to provide a galvanically isolated precisely regulated voltage and frequency to suit the service requirement of the user.

The Power Systems International SHORE POWER frequency converters have integral isolation transformers, and can accept three phase input voltages of 200V to 600V, 50Hz or 60Hz, the rectifier converts the AC input to DC and the PWM high performance IGBT inverters convert the DC back to high stability, precise 3 phase and neutral, 50Hz or 60Hz at voltages of 208V, 380V, 400V, 460V or 575V.

The on-board version of the SHORE POWER frequency converter provides for the Yachting community a power converter that will enable them to connect to the shore power in any marina or dockside power source in the world.

Power Systems International "SHORE POWER" frequency converters provide the user with a secure power supply which isolates the vessel from any power line disturbances present on the public power network.

The output of the converter also isolates and protects the on board electrical and electronic equipment from the damaging effects of harmonic distortion spikes, voltage dips, surges often present in dockside power supplies.



Figure 1  
SHORE POWER mobile Cable Reeler trolley



Figure 2  
SHORE POWER distribution unit

## FEATURES:

- Three phase power capacities from 50kVA to 500kVA. Sizes above are available on request
- Single phase power capacities from 10kVA to 50kVA
- Input voltage range 350V to 500V 50Hz, 60Hz or 200V 3 phase for 400Hz
- Transient voltage suppression and lightning protection
- Output voltages from 208V to 575V three phase
- Output voltages 115V and 230V single phase and neutral
- Output frequency, 50Hz, 60Hz or 400Hz
- Enclosure ingress protection, IP20 or IP31 indoors, IP54 outdoors
- Analogue and digital metering
- Sine wave output
- Electronic and current limit protection
- Input and output circuit breakers
- Emergency power off (EPO)
- Diagnostics and event logging
- Remote status indication interface

## SPECIFICATION FOR "SHORE POWER" FREQUENCY CONVERTERS. BASIC "SHORE POWER" FREQUENCY CONVERTER.

The power converter comprises three stages, an optional input module with auto voltage and frequency selector and transformer. A rectification to convert the AC to DC stage and an inverter stage for converting the DC to AC.

### INPUT

- Standard 3 phase voltages: 380V, 400V, 415V, 460V, 480V, 575V and 690V
- Standard frequency: 50Hz or 60Hz
- Frequency range: 40Hz to 70Hz
- Power factor: 0.95 lagging
- Inrush current:  $I_n \times 0.5$  to  $1.5$  depending on size
- Protection: voltage, current monitoring with electronic protection.
- Operational Environment: Temperature range from  $-10^{\circ}\text{C}$  to  $+50^{\circ}\text{C}$
- Humidity: to 95% non-condensing.

### OUTPUT

- Standard sizes: 50kVA to 500kVA. Larger units are available on request.
- Rating: Continuously rated at 0.85 power factor.
- Waveform: Sinusoidal  $\pm 2\%$  distortion
- Overload permitted: Motor starting peak  $I_n \times 6$ ,  $I_n \times 2$  for 30 seconds,  $I_n \times 1.5$  for 1 minute,  $I_n \times 1.1$  for 10 minutes all depending on operating temperature and duty cycle.
- Voltage: 220V, 380V, 400V, 460V, 480V and 575V standard voltages, 3 phase 3 wire delta or 3 phase 4 wire star connected with neutral and earth.  
(variable selectable voltage option available on request)
- Voltage regulation:  $\pm 1\%$
- Frequency: 50Hz, 60Hz or 400Hz (variable selectable frequency option available on request)
- Frequency regulation:  $> 1\%$
- Harmonic distortion:  $< 2\%$  with linear load connected.
- Load non linearity: Permitted  $< 3:1$  crest factor
- Phase imbalance: Up to 50% within the voltage limits
- Efficiency:  $> 93\%$  at full load, depending on size
- Protection: voltage, current, frequency, short circuit and temperature

## MECHANICAL AND GENERAL

Ingress protection:	Indoors IP20, IP42 standard, outdoors all weather IP54
Construction:	Press formed, folded and stiffened passive plated steel structure frame and base and painted. Top, base frame, doors and removable exterior panels press formed from rust inhibited sheet steel primed and painted in two part resin light textured finish, colour RAL 9010 as standard.
Ventilation and cooling:	Fans are fitted to the heat sinks of the electronic power assemblies with additional fans to extract the air from the enclosure.
Features:	Supplied as a basic frequency converter for specific voltages and frequencies or with the optional multi voltage and dual frequency input module.
Metering:	Analogue metering of input and output voltage, current and frequency. Digital metering is available as an option with analogue instruments as supplementary metering
Controls:	On/Off output, On/Off input, emergency power off (EPO). Input isolator, output isolator, push buttons
Indicators:	On, alarm, fault
Optional features:	Data logger event recorder, diagnostics data, remote communications data interface card, generator/converter seamless power transfer module, output load disconnect MCB, input stage MCB, mimic power status and alarm panel.
Audible noise level:	Depending on size, between 60dBA and 65dBA measured at 1 metre and 1.8 metres from the floor level. DIMENSIONS of basic unit

## IN IP20 ENCLOSURE:

Power Capacity	Width	Height	Depth	Weight
kVA	mm	mm	mm	Kg
50	800	1,575	705	414
60	800	1,575	705	454
80	800	1,575	705	490
100	1,000	2,000	950	563
120	1,000	2,000	950	730
150	1,000	2,000	950	828
180	1,600	2,000	1,000	1,505
200	1,600	2,000	1,000	1,635
250	1,600	2,000	1,000	1,898
300	1,600	2,000	1,000	2,242
400	1,600	2,000	1,000	2,588
500	1,600	2,000	1,000	3,585

The base plinth is for bolting the converter to the deck is 150mm high.

The dimensions are based on the basic converter design with input and output of 380V, 400V or 415 volts 50Hz or 60Hz.

The actual final dimensions could differ from those shown above and confirmation should be sought at the request for quotation stage when all required options, features and ingress protection should be clearly stated.

## IMPORTANT SELLING POINTS FOR OUR "SHORE POWER" FREQUENCY CONVERTERS

Shore power is often provided by dockside diesel engine driven generators or from public power supply grid network. The diesel generators produce smoke, fumes, noise, toxic smells, vibration and require fuel storage facilities, frequent maintenance and replacement parts. They also need storage batteries for starting and are often subject to neglect and misuse. The rising cost of diesel fuel is a major consideration and can no longer be ignored.

- Our "SHORE POWER" frequency converters have distinct advantages
- Little audible noise
- No vibration
- Maintenance inspection once a year
- Simple fault diagnostics
- Repairs can be made quickly by the user
- No mechanical parts to wear out
- 20 years design life
- Isolation from external power disturbances.
- No combustion smells
- No fuel to spill
- No smoke
- No pollution
- No harmful emissions
- No fuel storage



Figure 3  
100kVA on board  
SHORE POWER  
frequency converter with  
digital metering



Figure 4  
100kVA outdoor  
SHORE POWER  
frequency converter



Figure 5  
150kVA on board  
SHORE POWER  
frequency converter with  
input select module and  
mimic features