

Operations Manual



for the ASEA Power Systems
Model AC08 and AC12 Series
Yacht Power Converters

P/N 601050
Revision G
Revised 12/14/11

CERTIFICATION

ASEA Power Systems certifies that this product was thoroughly tested and inspected and found to meet or exceed its published specifications when shipped from the factory.

WARRANTY

ASEA Power Systems warrants each unit to be free from defects in material and workmanship. For a period of 18 months after purchase or 12 months after installation (whichever is shorter), ASEA Power Systems will repair or replace any defective module provided the unit has been installed and operated in a manner according to this manual. A thorough inventory of spare parts & modules is maintained at our factory. Our world-wide sales/support facilities also inventory a complement of spare parts and modules.

ASEA Power Systems is not responsible for consequential damage arising from the use of its equipment. It does not apply to extensively modified or non-standard systems. Debit memos for returned units are not accepted, and will cause return of the system without repair.

LIFE SUPPORT POLICY

ASEA Power Systems does not authorize the use of any of its products or systems for use an AC voltage supply (source) for life support systems. Life support systems are devices which support or sustain life, and whose failure to perform, when properly used in accordance with this Operations Manual, can be reasonably expected to result in significant injury to the user.

1 USING THIS MANUAL

This manual has been written as an Operations Manual. Installation, operations, and preventative maintenance are covered in detail. This manual will cover the following models:

AC08 8kVA Yacht Power Converter

AC12 12kVA Yacht Power Converter

It is important that the operator reads this manual prior to installing and operating the converter. A thorough understanding of the information covered in this manual is required for proper installation and operation.

If any questions arise while reading this manual, the user is encouraged to call ASEA Power Systems. ASEA Power Systems is located at:

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2 SAFETY NOTICES

The AC08 and AC12 are capable of transferring very large amounts of electrical energy very quickly. This quality is fundamental to a high performance power converter. International symbols are used throughout this manual to stress important information. Read the text below each symbol carefully and use professional skills and prudent care when performing the actions described by the text.



THE CAUTION SYMBOL (TRIANGLE ENCLOSING AN EXCLAMATION POINT) INDICATES A CONDITION THAT COULD SERIOUSLY DAMAGE EQUIPMENT AND POSSIBLY INJURE PERSONNEL. CAUTIONS WILL BE PRESENTED IN THIS FORM. ALL CAUTIONS SHOULD BE RIGOROUSLY OBSERVED.



THE WARNING SYMBOL (TRIANGLE WITH A LIGHTNING BOLT) IS USED TO SIGNAL THE PRESENCE OF A POSSIBLE SERIOUS, LIFE THREATENING CONDITION. A CONDITION THAT IS HAZARDOUS TO BOTH PERSONNEL AND EQUIPMENT WILL BE ISSUED AS A WARNING. ALL WARNINGS WILL BE PRESENTED IN THIS FORM.

 **WARNING** 

- **THIS EQUIPMENT CONTAINS HIGH ENERGY, LOW IMPEDANCE CIRCUITS! LETHAL POTENTIALS ARE CONTAINED WITHIN THE SYSTEM EVEN WHEN IT IS APPARENTLY NOT OPERATING.**
- **CARE MUST BE EXERCISED WHEN SERVICING THIS EQUIPMENT IN ORDER TO PREVENT SERIOUS OPERATOR INJURY OR EQUIPMENT DAMAGE.**
- **DO NOT WORK ON OR OPERATE THIS EQUIPMENT UNLESS YOU ARE FULLY QUALIFIED TO DO SO. NEVER WORK ALONE.**
- **THE EQUIPMENT IS NOT IGNITION RATED, IT MUST NOT BE OPERATED IN AREAS WHERE COMBUSTIBLE GASES MAY ACCUMULATE.**
- **DO NOT REMOVE THE SHORE CORD FROM THE DOCK PEDESTAL WITHOUT FIRST OPENING THE DOCK OR YACHT BREAKER. FAILURE TO DO SO MAY RESULT IN DAMAGE TO THE CONVERTER AND PEDESTAL.**
- **OBSERVE THE FOLLOWING WHEN SERVICE AND MAINTENANCE ARE REQUIRED:**
 - **REMOVE ALL JEWELRY FROM ARMS AND NECK WHEN SERVICING THIS EQUIPMENT. THIS PREVENTS THE POSSIBILITY OF SHORTING THROUGH THE JEWELRY TO OR ELECTROCUTION OF THE OPERATOR.**
 - **WEAR SAFETY GLASSES WHEN SERVICING THIS EQUIPMENT TO PREVENT EYE INJURY DUE TO FLYING PARTICLES CAUSED BY ACCIDENTAL SHORT CIRCUIT CONDITIONS.**
 - **DO NOT REMOVE ANY PANELS OR COVERS WITHOUT FIRST OPENING ALL CIRCUIT BREAKERS AND THEN REMOVING THE INPUT SERVICE.**
 - **SERVICE OTHER THAN CLEANING AIR INTAKES AND EXHAUST AREAS SHOULD BE REFERRED TO PERSONNEL AUTHORIZED BY THE FACTORY TO SERVICE THIS EQUIPMENT.**

3 INTRODUCTION TO THE AC08 AND AC12

The AC08 and AC12 are high performance Yacht Power Converters that use dual-conversion technology. The systems will accept any single phase input service with a frequency between 40-70 Hertz, and a voltage between 170-520VAC. The output power form has been programmed at the factory for the power form, voltage, and frequency required by your yacht. Variable fan speed control has been provided (fan speed tied to output current level).

Dual-conversion technology is the preferred technique for AC power conversion, and was chosen for these converters. In this technology, the shore power service is isolated by transformers then converted to DC power by a Power Factor Correction (PFC) power supply. The output inverters then convert the DC power back to the AC form (both voltage and frequency) required by the yacht.

Being systems designed from the ground up specifically for the yachting industry, all efforts have been made to produce a system capable of sustaining the marine environment. All system components are packaged in one drip-proof, dust-resistant aluminum and stainless steel enclosure. Major components are internally modular, allowing a simple exchange in the unlikely event of failure. Complete maintenance and service can be provided with only front access to the system.

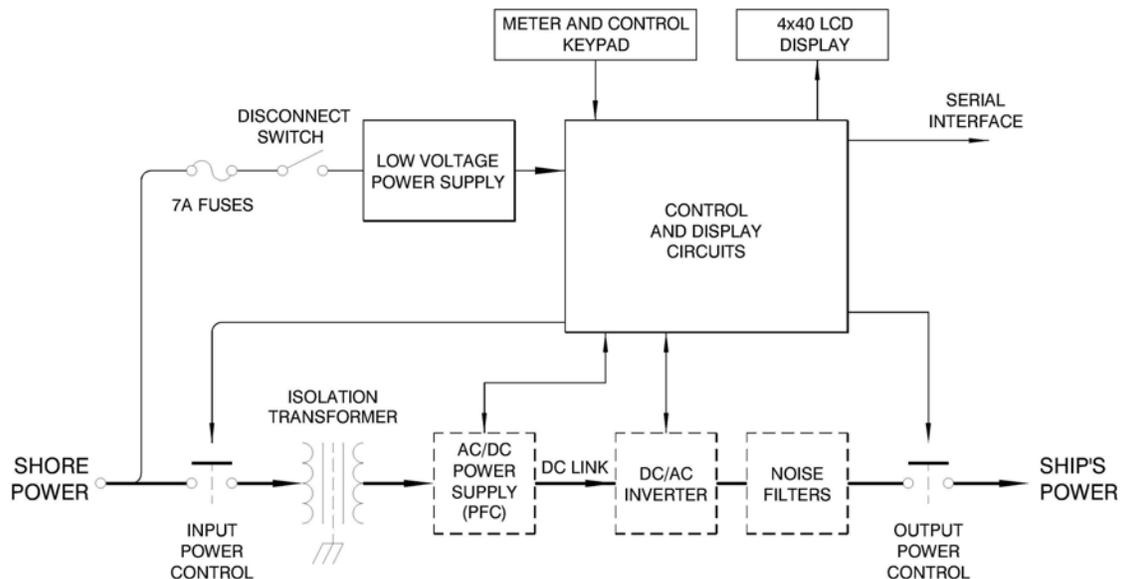


FIGURE 1 SYSTEM BLOCK DIAGRAM

3 INTRODUCTION TO THE AC08 AND AC12, cont.

System operation is managed through three basic operators. A safety disconnect at the bottom of the enclosure is used for securing input service during maintenance and service. Two membrane switch groups in the control console, SHORE POWER and CONVERTER POWER, provide normal operation of the system. Each switch group contains an ON and OFF switch with associated LED indicators.

In addition to the basic function of power conversion, these converters provide the user with a sophisticated power analysis and monitoring capacity. All parameters for input and output power, along with operations and status information, are available on the front panel display console. Various displays are selected through a long-life, sealed membrane switch panel. All front panel information is available through the serial port for remote display, status and diagnostics.

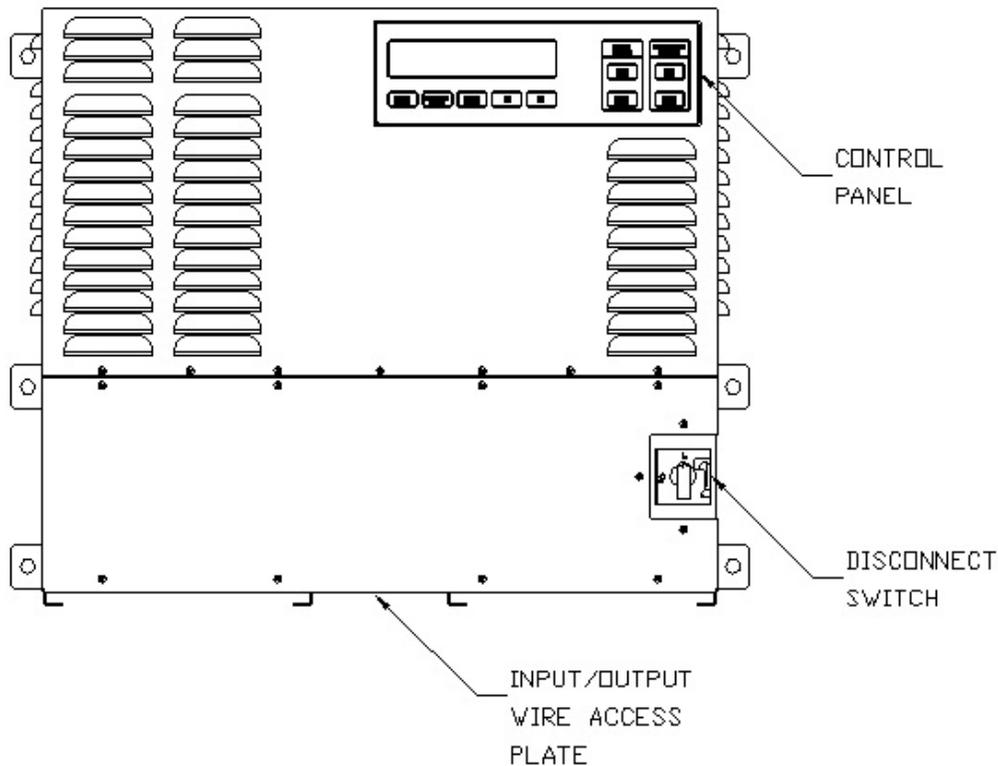


FIGURE 2 CONTROLS

4 SPECIFICATIONS

4.1 ELECTRICAL SPECIFICATIONS

| <u>Parameter</u> | <u>AC08</u> | <u>AC12</u> |
|---------------------------------|---|---------------------------------|
| 4.1.1 Input Service | | |
| Input Power Form | Single Phase | Single Phase |
| Input Voltage Range | 170-520 V _{AC} | 170-520 V _{AC} |
| Input Frequency Range | 40-70 Hertz | 40-70 Hertz |
| Input Current, Max., Std Range | 40 A _{RMS} | 55 A _{RMS} |
| Input Current, Soft Start, Max. | 20 A _{RMS} | 20 A _{RMS} |
| Input Current Distortion | <10% @ rated load | <10% @ rated load |
| Input Power Factor | >0.95 @ rated load | >0.95 @ rated |
| 4.1.2 Output Service | | |
| Output Power Rating | 8kVA @ 0.85 p.f. | 12kVA @ 0.85 p.f. |
| Output Power Form | Single Phase 220, 230, or 240 V _{RMS} and Split Phase 110/220, 115/230, or 120/240 V _{RMS} | |
| Output Frequency | 50 or 60 Hertz | 50 or 60 Hertz |
| Output Frequency Accuracy | 0.01% | 0.01% |
| Output Voltage Distortion | < 1% THD | < 1% THD |
| Output Voltage Line Regulation | 0.50% | 0.50% |
| Output Voltage Load Regulation | 1.0% | 1.0% |
| Output Voltage Response Time | 0.20 msec. | 0.20 msec. |
| Output Current, Continuous | 35 A _{RMS} @ 0.85 p.f. | 50 A _{RMS} @ 0.85 p.f. |
| Output Current, Peak | 420% of continuous rating | 420% of continuous rating |
| Output Current, Surge | 300% of continuous rating | 300% of continuous rating |
| Conversion Efficiency | 87% @ rated load | 88% @ rated load |

4.1 ELECTRICAL SPECIFICATIONS, cont.

4.1.3 Control, Metering, and Status

| | |
|--------------------------|--|
| Shore Power Control | Input Service Disconnect Switch, 2 pos. Membrane Switch, Input ON/OFF Control |
| Converter Power Control | Membrane Switch, Output ON/OFF Control |
| Shore Power Metering | Voltage, Current, Frequency, kVA, kW, %Load |
| Converter Power Metering | Voltage, Current, Frequency, kVA, kW, %Load |
| System Status | Operational status, Diagnostics, Software Calibration |

4.2 PHYSICAL SPECIFICATIONS

Parameter

AC08

AC12

4.2.1 Mechanical

| | | |
|----------------------|--------------|--------------|
| Height | 20"/50.8cm | 20"/50.8cm |
| Width, Enclosure | 23"/58.4cm | 23"/58.4cm |
| Width, Mtg. Brackets | 25"/63.7cm | 25"/63.7cm |
| Depth | 10"/25.4cm | 10"/25.4cm |
| Weight | 230lbs/104kg | 230lbs/104kg |

4.2.2 Environmental

| | | |
|---------------------------|-----------------------|-----------------------|
| Ambient Temperature Range | 0-45°C non-condensing | 0-45°C non-condensing |
| Air Exchange Rate | 300CFM | 300CFM |

5 INSTALLATION

Read this manual thoroughly prior to attempting equipment installation. Improper installation is the most significant cause of system start-up and service problems over the product's life. Perform an external visual inspection upon receipt of the equipment. Verify that the nameplate information is consistent with the ship's power requirements (required form, voltage, and frequency).

Proper planning will speed up location, installation, and connection of the equipment. Follow the suggested minimum clearances provided in Table 1. **Ensure the room/compartments has adequate ventilation and cooling. The thermal load presented by the converters will be substantial: approximately 3,470 BTU/Hr for the AC08 and approximately 4,750 BTU/Hr for the AC12 at maximum continuous load.**



THE AC08 AND AC12 ARE HEAVY, WEIGHING UP TO 230lbs (104kg). EXTREME CAUTION MUST BE EXERCISED IN HANDLING AND INSTALLATION TO AVOID EQUIPMENT DAMAGE OR INJURY TO PERSONNEL. AN ADEQUATE MATERIAL HANDLING DEVICE SHOULD BE USED FOR UNLOADING, MOVING, AND POSITIONING THE SYSTEM.

5.1 MECHANICAL INSTALLATION

The converters are designed for vertical, bulkhead-mounted installations and as such are provided with six mounting ears, three per side. The provided mounting holes are ½” (12.7mm) in diameter; stainless steel hardware in the size range of 7/16” to ½” (11 to 12mm) is required for mounting.

The mounting surface should be flat and dimensionally stable to within 1/16” (1.5mm) to prevent torsional stresses being applied to the structure of the converter. Spacers (shim stock) may be added between the mounting surface and the converter mounting ears to adjust the mounting plane. Resilient mounts must not be used directly between the converter and the mounting surface. If the converter is to be mounted in a high vibration/shock environment, then the factory must be consulted concerning the application. Drawings for approved shock mounting panels will be supplied.

The converter may be mounted horizontally with the correct preparations to the mounting surface. The factory must be contacted concerning the application prior to order/delivery of the system to allow the required internal modifications to be included, and for concurrence on the application and installation.

The following recommended clearances must be considered during installation:

TABLE 1

| | <u>FOR PROPER</u> | |
|--------|-------------------|----------------|
| | <u>Operation</u> | <u>Service</u> |
| Front | 6” (Airflow) | 24” min |
| Bottom | 6” (Airflow) | N/A |
| Sides | 6” (Airflow) | 6” |
| Top | 0” | 6” |

5.1 MECHANICAL INSTALLATION, cont.

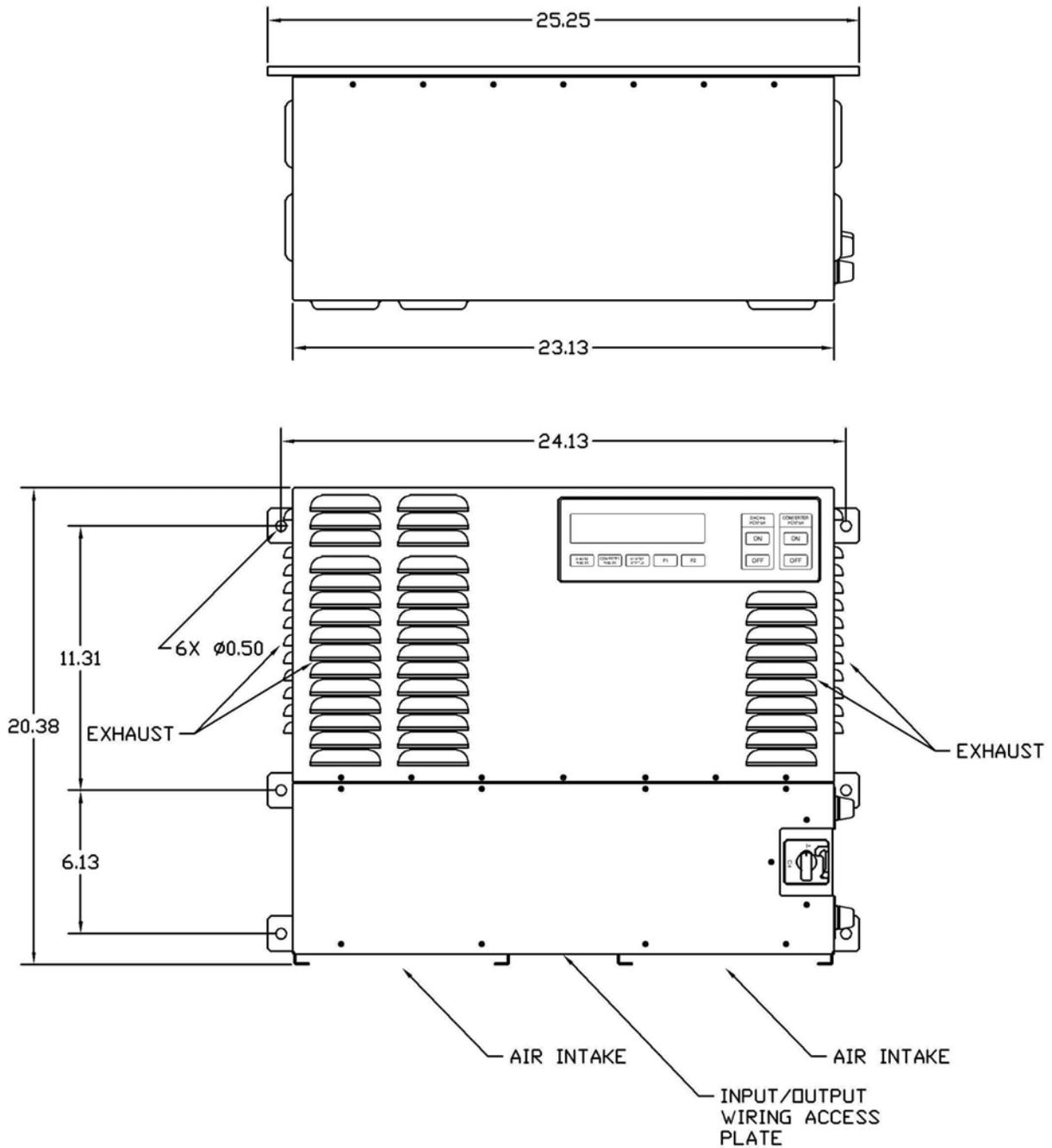


FIGURE 3 MECHANICAL OUTLINE, FRONT AND TOP

5.1 MECHANICAL INSTALLATION, cont.

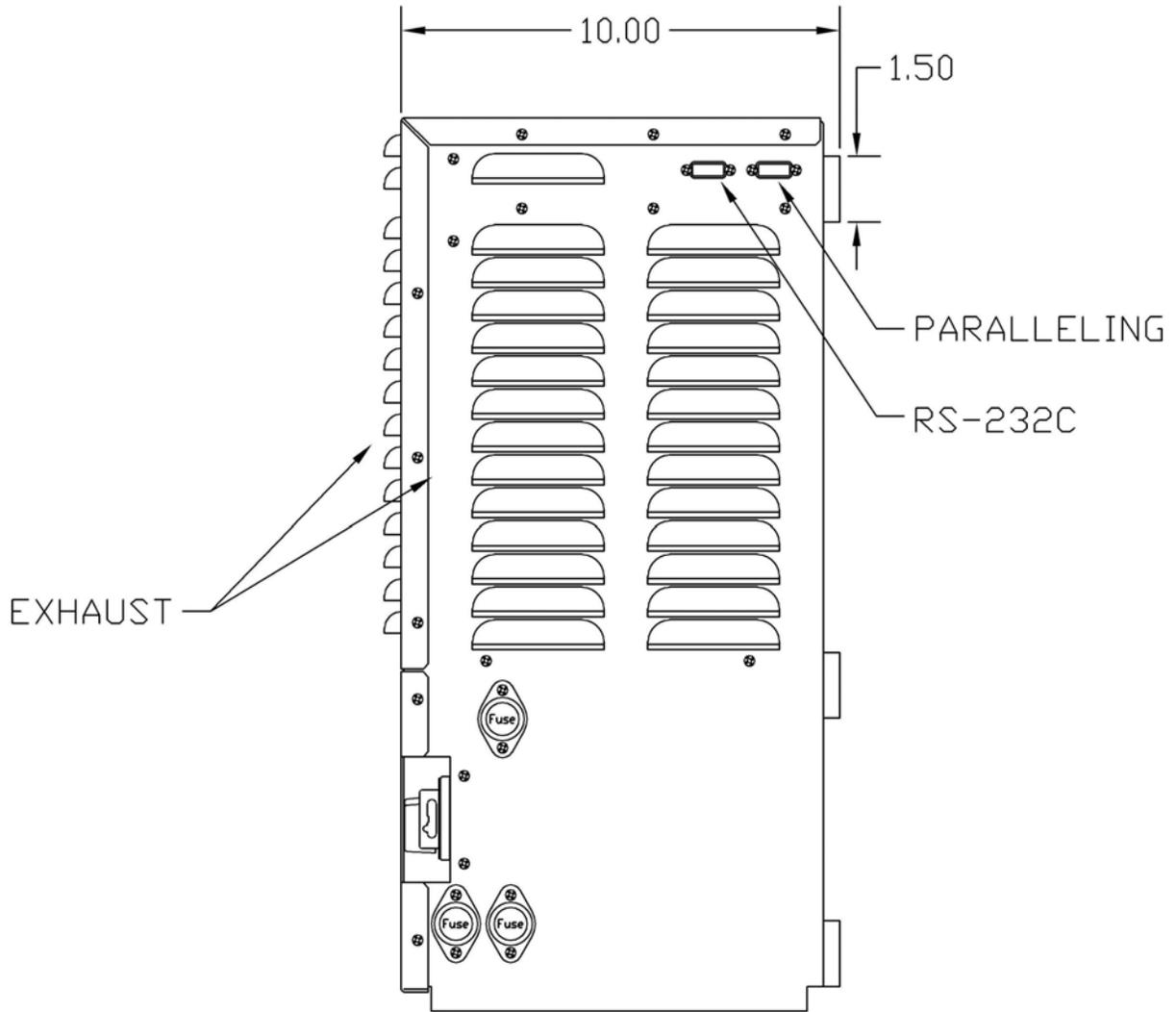


FIGURE 4 MECHANICAL OUTLINE, SIDE

5.2 ELECTRICAL INSTALLATION

This procedure assumes the physical installation of the converter has been completed. It is the user's responsibility to provide input service over-current protection and disconnect means. Maximum continuous input current for the 8kVA AC08 is 40Amps, and for the 12kVA AC12 is 55Amps. A circuit breaker with a 60Amp rating is recommended.

All power wiring requires the removal of the lower front cover. This cover is secured with 15 ea 6-32 x 1/4" stainless steel screws. Do not remove the upper front cover, or the disconnect switch/bracket assembly. Place the disconnect switch in the OFF position.

Remove the input service panel from the bottom of the system. This panel is secured with 10 ea 10-32 x 3/8" stainless steel screws. The input service panel is supplied with two pilot holes for power wiring strain reliefs. Drill or punch the appropriate holes for the selected strain reliefs. Drill a 1/4" diameter hole in the input service panel for equipment (safety) ground terminations. Re-install the input service panel using the removed hardware.



INPUT WIRING MUST BE PERFORMED BY A QUALIFIED ELECTRICIAN FAMILIAR WITH STANDARD SAFEGUARDS AND PROCEDURES REQUIRED BY THE INSTALLATION OF THIS TYPE OF EQUIPMENT. POWER MUST BE REMOVED FROM THE INPUT DISTRIBUTION SYSTEMS SUPPLYING POWER TO THE AC08 OR AC12 PRIOR TO THE START OF THE FOLLOWING STEPS. INPUT AND OUTPUT POWER MUST BE SECURED (LOCKED) IN THE OFF (DE-ENERGIZED) STATE UNTIL INSTRUCTED OTHERWISE BY THIS DOCUMENT.

FAILURE TO FOLLOW THESE PROCEDURES CAN RESULT IN DAMAGE TO THE EQUIPMENT, AND CAN PRESENT THE RISK OF INJURY OR DEATH TO THE INSTALLER OR THE OPERATOR.

5.2 ELECTRICAL INSTALLATION, cont.

5.2.1 Input Power Connections

The converters are supplied with compression type terminal blocks for input power connections. These terminal blocks accept wires in the range of 6-10AWG. Refer to the applicable standard for selection of required wire gauge and type.

Prepare the power cable by removing the outer cable insulation approximately 6" (in the case of SO type portable cables). Strip the insulation back exposing ½" of bare conductor on all three wires. Insert the prepared cable and strain relief assembly into the rearmost hole in the input service panel. Follow the wire table in the illustration below for correct termination.

The input to the converters is fully isolated with no phase orientation requirements to the input power service.

5.2 ELECTRICAL INSTALLATION, cont.

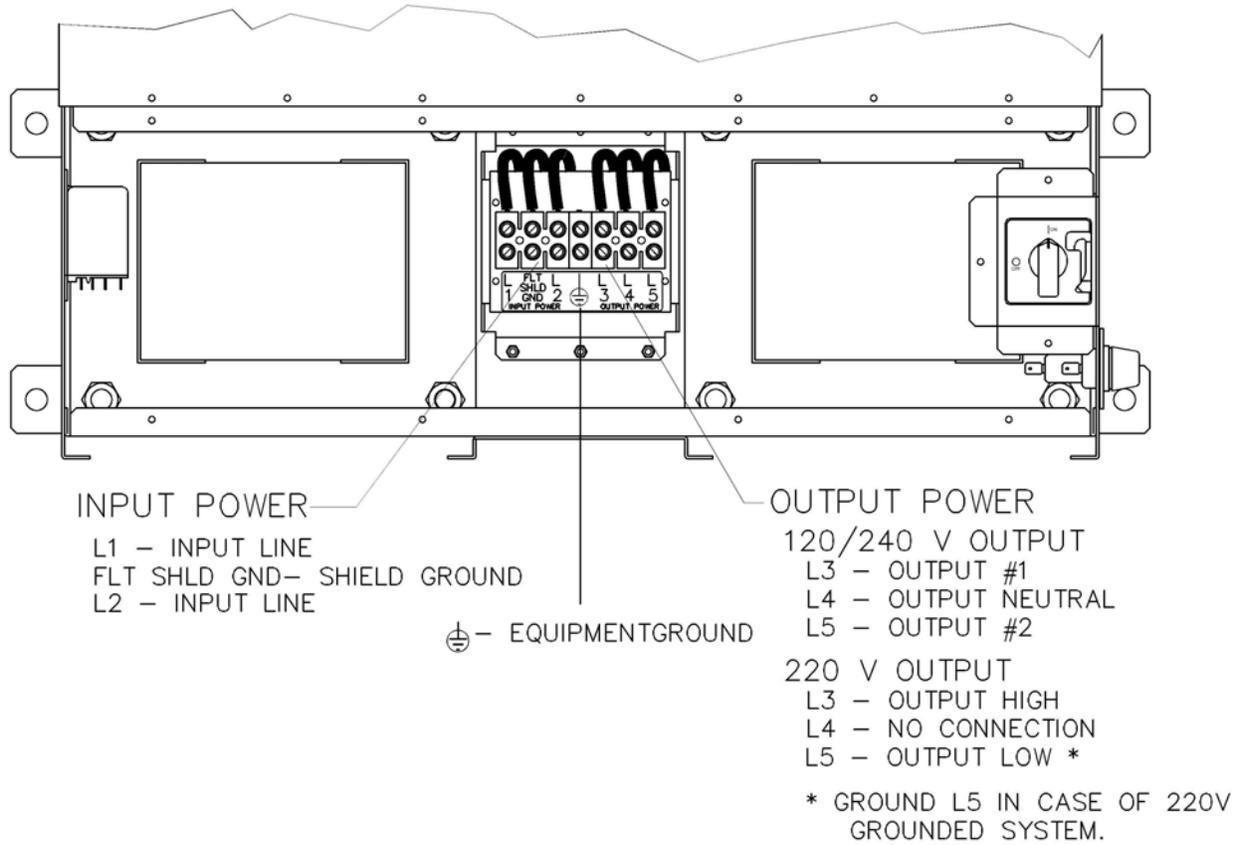


FIGURE 5 INPUT AND OUTPUT CONNECTIONS

5.2 ELECTRICAL INSTALLATION, cont.

5.2.2 Output Power Connections

The converters area supplied with compression type terminal blocks for output power connections. These terminal blocks accept wires in the range of 6-10AWG. Refer to the applicable standard for selection of the required wire gauge and type. Please refer to the diagram on the previous page for additional detail.

Prepare the power cable by removing the outer cable insulation approximately 6" (in the case of SO type portable cables). Strip the insulation back exposing ½" of bare conductor on all three conductors. Insert the prepared cable and strain relief assembly into the forward hole in the input service panel. Insert the wire ends into the output terminal block and tighten.

Replace the lower front panel using the removed hardware.

5.2 ELECTRICAL INSTALLATION, cont.

5.2.3 Grounding

The converter chassis ground **MUST** be connected to the ship's hull or common ground point via the compression fitting terminal adjacent to the output power connections. Failure to do so may create conditions that may in turn cause injury or death to operators; failure to do so will also result in the voiding of the equipment warranty. In the case of paralleled converter systems, and where such ground connections are not local and directly adjacent to the paralleled converters, the chassis ground connections must be interconnected between the paralleled converters as well as connected to the remote ship's common ground point.



THE CONVERTER ISOLATES THE OUTPUT POWER FROM THE INPUT POWER AND EQUIPMENT (SAFETY) GROUNDS SIMILAR TO AN ISOLATION TRANSFORMER. THE INSTALLER MUST RE-ESTABLISH THE GROUND REFERENCE FOR THE EQUIPMENT AT TIME OF INSTALLATION. THE NEUTRAL AND EQUIPMENT (SAFETY) GROUNDS MUST TO BE CONNECTED PER THE APPROPRIATE CLASS STANDARD.

6 OPERATION

6.1 POWER TURN-ON PROCEDURE

Close the input (shore power) circuit breaker to the converter. Turn the disconnect switch (10) to the ON position. After 1-3 seconds the fans will be heard and the display will illuminate and become active. Allow the opening message to complete.

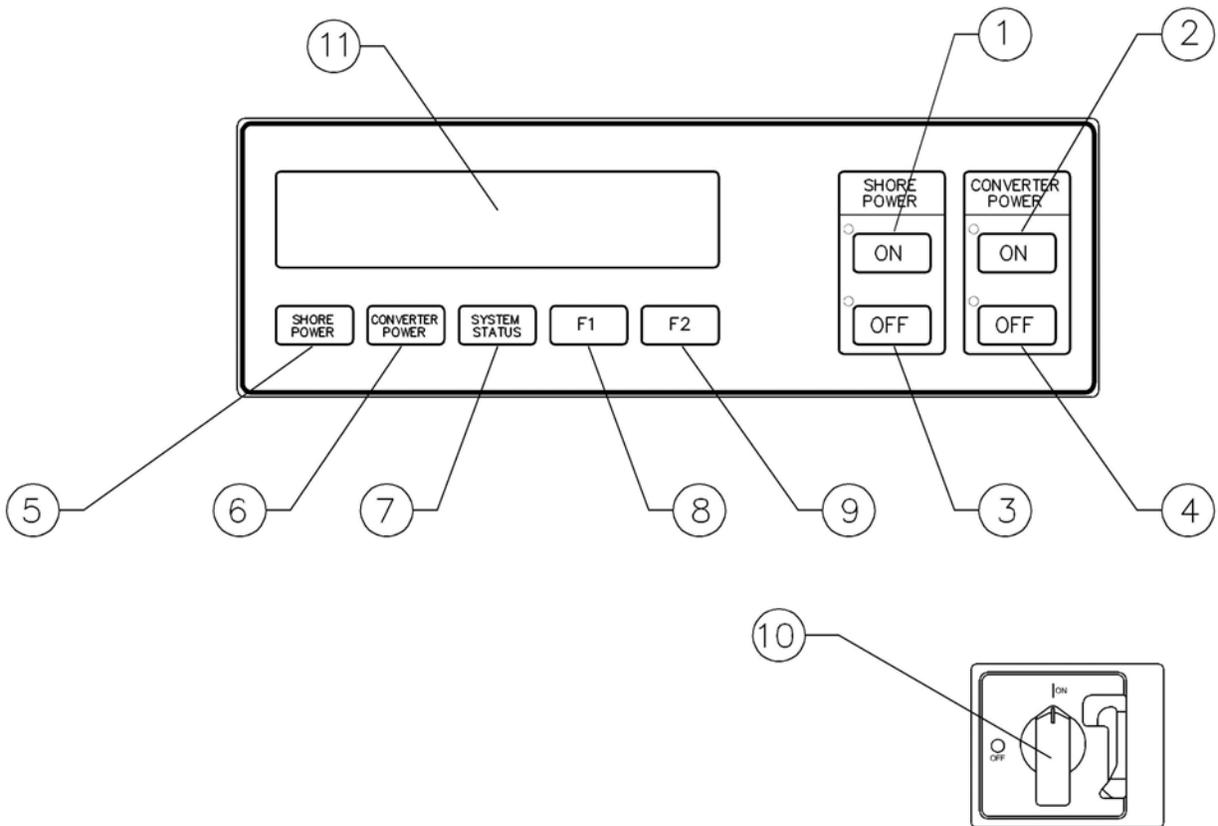


FIGURE 6 CONTROLS AND INDICATORS

6.1 POWER TURN-ON PROCEDURE, cont.

The display will sequence to the SUMMARY DISPLAY indicating the system's operational state. Both input and Converter output power should indicate OFFLINE at this time. Return to this screen at any time by pressing the SYSTEM STATUS (7) button.

| | | |
|----------------------|------------|--------------|
| SUMMARY DISPLAY | AC12 | LOAD:XXX.X % |
| INPUT#1:OFFLINE | STATUS: | OK |
| SYS:XXXXXXXXXXXXXXXX | CONVERTER: | OFFLINE |
| AUTO-RESTART: OFF | | XX:XX:XX |

At this time both of the red LED indicators next to the OFF buttons (3 & 4) should be illuminated.

Press the SHORE POWER (5) display button. The display will indicate basic shore power information; voltage, current, kVA, and frequency. Verify the displayed voltage indicates the expected voltage and frequency. If not, do not proceed until contacting factory personnel. Additional SHORE POWER information can be obtained by pressing the F2 (9) button: wattage and input power factor can now be viewed. Return to the primary screen by pressing the F1 (8) button.

| | | |
|-------------|---------|--------|
| SHORE POWER | INPUT | 50.1Hz |
| VOLTAGE: | 221 V | |
| CURRENT: | 1 A | |
| LOAD: | 0.2 kVA | |

Press the CONVERTER POWER (6) button and the screen will now change. Output voltage(s) and current(s) should indicate zero.

| | | | |
|-----------|----------|----------|--------|
| CONVERTER | OUTPUT#1 | OUTPUT#2 | 60.0Hz |
| VOLTAGE: | 0 V | 0 V | |
| CURRENT: | 0 A | 0 A | |
| LOAD: | 0.0 kVA | 0.0 kVA | |

6.1 POWER TURN-ON PROCEDURE, cont.

To start the system, press the SHORE POWER - ON (1) button. The system will begin a soft-start procedure which requires approximately 2 seconds to complete. At the conclusion of this process the indicator LED in the SHORE POWER control area of the display should change from red to green. View the display information for CONVERTER POWER (6) and verify the displayed voltage is at the desired potential, frequency, and form.

| | | | |
|-----------|----------|----------|--------|
| CONVERTER | OUTPUT#1 | OUTPUT#2 | 60.0Hz |
| VOLTAGE: | 120 V | 120 V | |
| CURRENT: | 2 A | 2 A | |
| LOAD: | 0.2 kVA | 0.2 kVA | |

NOTE: It is normal under no load conditions for the currents to indicate 2-4 Amps flowing. This level of current is due to the internal filters and will not degrade the system's power rating.

When ready to transfer the yacht's load to the converter, press the CONVERTER POWER ON (2) button on the control panel. This will place voltage at the output terminals of the converter. The green ON indicator LED should now be lighted. The yacht's load may be transferred to the converter at this time.

When load has been transferred to the converter, monitor the load currents and voltages. Ensure the load is within the system ratings. Monitor the shore power voltage and current levels with load applied. Refer to published rating curves for maximum current, kVA, and kW levels.

6.2 AUTO-RESTART FEATURE

The Auto-Restart feature will safely and automatically bring the shore power converter back on-line following a power failure and recovery event. Highlights include:

- Automatically routes power from the dock to the ships power buss.
- Front panel controls allow auto-restart to be enabled or disabled.
- Auto-Restart status displayed on the LCD STATUS screen.
- Fault tolerant to guarantee safe operation.
- Valid shore power verified prior to restart
- Handles repeated power failures without operator intervention.



- **LETHAL VOLTAGES ARE AUTOMATICALLY ROUTED WITHIN THE CONVERTER WHEN (1) INPUT POWER IS PRESENT, (2)THE DISCONNECT SWITCH IS IN THE “ON” POSITION, AND (3) AUTO-RESTART IS ENABLED.**
- **LETHAL VOLTAGES WILL BE AUTOMATICALLY ROUTED TO THE CONVERTER OUTPUT AND THE OUTPUT CONTACTOR WILL AUTOMATICALLY CLOSE WHEN (1) INPUT POWER IS PRESENT, (2)THE DISCONNECT SWITCH IS IN THE “ON” POSITION, AND (3) AUTO-RESTART IS ENABLED.**
- **NEVER REMOVE ANY PANELS OR COVERS WITHOUT SECURING (REMOVING) SHORE POWER WHEN AUTO-RESTART IS ENABLED.**
- **NEVER PERFORM MAINTENANCE OR SERVICE WHILE AUTO-RESTART IS ENABLED.**
- **NEVER ASSUME AUTO-RESTART IS DISABLED.**
- **NEVER USER THE DISCONNECT SWITCH TO TURN THE CONVERTER OFF WITH AUTO-RESTART ENABLED. THE CONVERTER CANNOT DISTINGUISH BETWEEN A VALID POWER FAILURE AND IMPROPER USE OF THE DISCONNECT SWITCH.**

6.2 AUTO-RESTART FEATURE, cont.

6.2.1 Operation

Auto-Restart is enabled in the Auto-Restart Control panel accessed by simultaneously pressing two buttons. Anytime the Systems Status is “FAILURE,” the converter will disable the Auto-Restart feature. Every time the Shore Power OFF button is pressed the converter will disable the Auto-Restart feature. The converter must be ON and ONLINE before Auto-Restart may be enabled. Pressing the “SYSTEM STATUS” button (7) will display the “SUMMARY DISPLAY” which will indicate the Auto-Restart status.

CONVERTER ACTION

FRONT PANEL OPERATION

Enter Auto-Restart Control panel SHORE POWER(5) & CONVERTER POWER(6)

Follow the on-screen instructions to enable or disable the feature.

6.3 TURN-OFF PROCEDURE

Transfer power from the AC08 or AC12 to the generator.

Press the CONVERTER POWER OFF (4) button. The indicator LED should change to red. If the STATUS display is active, it should indicate CONVERTER:OFFLINE. Power has now been removed from the output, but the system remains active. This is the systems “standby” state.

Next press the SHORE POWER OFF (3) button. This will initiate the inverter shutdown. The system will complete the shutdown process within 10 seconds.

Turn the disconnect switch (10) to the OFF position.

Open the input (shore power) circuit breaker to the AC12.

The AC08 or AC12 is now shut down.

6.4 REMOTE COMMUNICATIONS

The converter can be controlled remotely and be queried for alarm, electrical, and status data through its RS-232C port. The port's hardware configuration is by default RS-232C unless modified by the inclusion of the Modbus Option—which converts the default hardware protocol to the RS-485 standard via a din-rail mounted converter/optical-isolator.

The two software protocols supported by the converter are SCPI and Modbus. Please contact an ASEA Power Systems authorized distributor or the factory for additional information and comprehensive command/query listings.

The Baud Rate and fixed serial port settings can be viewed in the REMOTE INTERFACE CONFIGURATION display (as depicted below) by pressing the CONVERTER POWER (6) and SYSTEM STATUS (7) buttons simultaneously, and then pressing the Comm (**SHORE POWER**) button. The software protocol in use is indicated in the lower-right corner (SCPI or Modbus) of the display. The software protocol is auto-detected by the converter based on the incoming command/query formatting.

| | | | | |
|--------------------------------|--------------|------------|--------|------|
| REMOTE INTERFACE CONFIGURATION | | | | |
| BAUD: 19200 | 8-DATA BITS, | 1 START, | 1 STOP | |
| PARITY:NONE | EOS:CR/LF | DEVICE:DCE | | |
| More | Less | Exit | Cursor | SCPI |

| | | | | |
|--------------------------------|--------------|------------|--------|--------|
| REMOTE INTERFACE CONFIGURATION | | | | |
| BAUD: 19200 | 8-DATA BITS, | 1 START, | 1 STOP | |
| PARITY:NONE | Node Id: 3 | DEVICE:DCE | | |
| More | Less | Exit | Cursor | Modbus |

The Baud Rate can be increased by pressing the Press the More (**SHORE POWER**) button, and decreased by pressing the Less (**CONVERTER POWER**) button. Press the SCPI/Modbus (**F2**) button to manually move between the SCPI and Modbus modes. Press the Cursor (**F1**) button to change the Node Id while the mode is set for Modbus. Press the Exit (**SYSTEM STATUS**) button to save settings and exit. Standard baud rates are 1200, 2400, 4800, 9600, 19200, and 38400 where 19200 is the standard for communication with ASEA Power Systems Touch Screens.

6.4 REMOTE COMMUNICATIONS, cont.

6.4.1 RS-232C/SCPI

The RS-232C serial port is located in the upper-right corner of the converter's right side (see Figure 4 on page 15).

The RS-232C Tx/D signal originating in the converter is approximately +15V when "High" and -15V when "Low." The RS-232C GND (ground) wire is connected to the low voltage DC common of the converter power supply system, which is normally also connected to the chassis-ground of the converter. When the Metering Isolation Option is installed in the converter, the link to the chassis ground is removed.

The RS-232C serial port is a DE9S (female, 9-pin D-subminiature connector). The pinout of the connector is standard for an RS-232C DCE. Figure 7 below demonstrates connection from a DCE to a DTE. Use of a shielded, jacketed, four-wire (two twisted pairs), color-coded cable for each converter in the system is required.

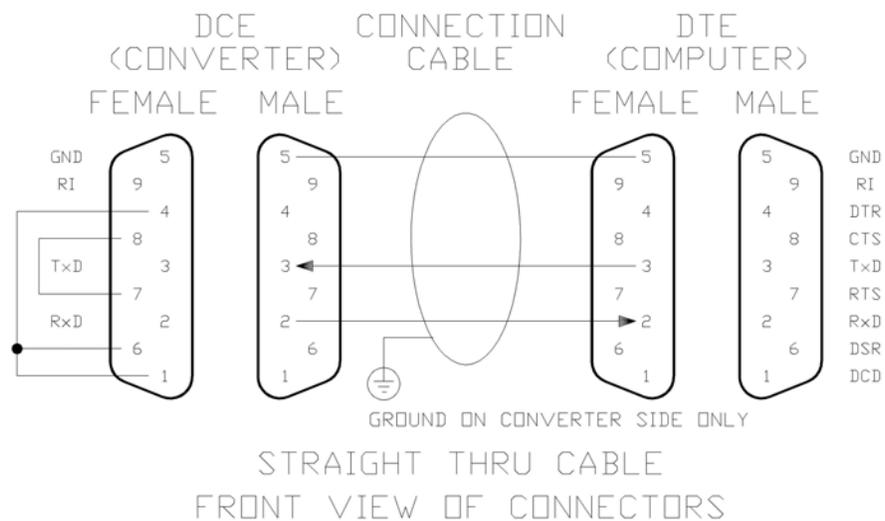


FIGURE 7 RS-232C PINOUT

It is strongly recommended that an RS-232C optical isolation be included in any RS-232C/SCPI protocol integration to avoid the creation of ground-loops and ground-fault paths through the remote communication port; such isolation is not included with the standard product.

6.4 REMOTE COMMUNICATIONS, cont.

6.4.2 RS-485/Modbus

If included in the converter, a Modbus Option converter/optical-isolator will be located behind the converter's lower front panel.

The Modbus Option included converter/optical-isolator connections are depicted in Figure 7 below.

MASTER CONVERTER
 MODBUS RTU SLAVE--Modbus Node Id:3

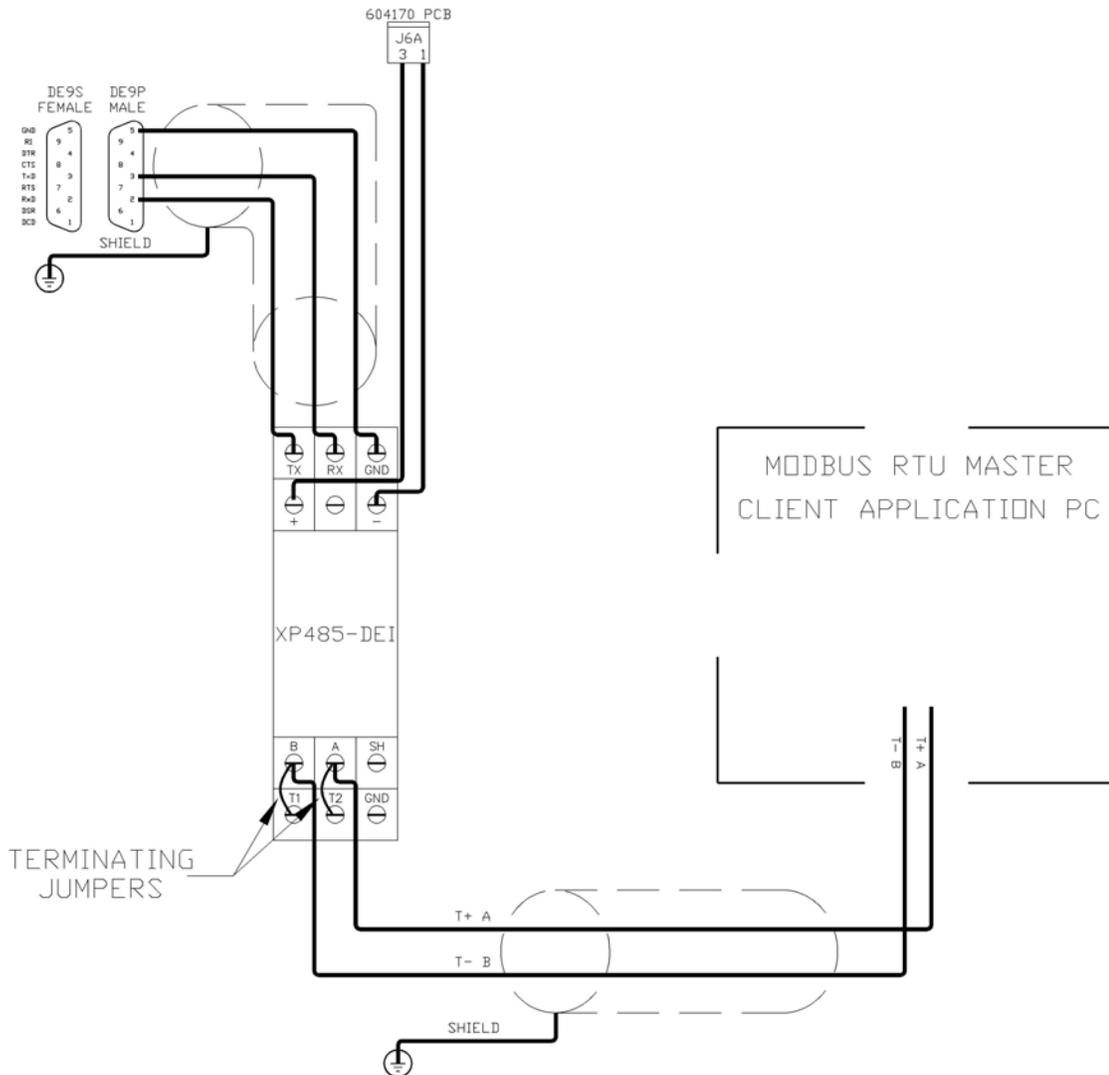


FIGURE 8 RS-485 CONNECTIONS

6.4 REMOTE COMMUNICATIONS, cont.

6.4.2 RS-485/Modbus, cont.

All wiring between the converter's RS-232C port and the Modbus Option converter/optical-isolator is included and wired at the factory. RS-485 bus wiring between a master converter and slave converter(s) and ultimately to the customer side connections is the responsibility of the customer. Such wiring should be shielded as depicted in Figure 8 on the previous page.

Each converter/optical-isolator contains terminating jumpers used to link the T1 and T2 terminals to the B and A terminals, respectively, and provide internal terminating resistances. Install such jumpers as indicated in Figure 8 at the first and last device in daisy-chained RS-485 bus, but remove the jumpers for any intermediately connected devices.

A converter's Node Id is factory defaulted to 3; an additional converter, or slave converter in a parallel set, should be set to Node Id 4. These are the default values for communication with ASEA Power Systems designed Touch Panels. As ASEA Power Systems uses Node Id numbers 9-13 for GMM products, use of these should be avoided.

7 SOFTWARE FEATURES

7.1 GENERAL

ASEA Power Systems' shore power converters provide a variety of software-based resources. Each major function is described in detail in the following pages.

BOLD upper-case text indicates when a display button is being referenced. Where two buttons are given as **BUTTON + BUTTON**, the buttons must be pressed simultaneously.

7.2 AGC CONTROL

Press the **CONVERTER POWER + F2** buttons to access the Automatic Gain Control (AGC) CONTROL display.

| |
|---|
| AGC CONTROL SCREEN Automatic Gain Control is: ENABLED Va_out: 120.00 Vb_out: 120.00 Active Line-to-Neutral Exit Enable Disable |
|---|

This function enables or disables AGC. Press the Enable (**F1**) button to enable the feature, the Disable (**F2**) button to disable the feature, and the Exit (**SYSTEM STATUS**) button to save the settings and exit.

| | Default | Range |
|------------------------|---------|-------------------|
| Automatic Gain Control | Enabled | Enabled, Disabled |

Application: this function will compensate for changes in output voltage not already corrected by hardware and software calibration such as load-dependent output voltage variances. This function should be disabled before calibrating the hardware oscillator pots on the Modulator PCB (usually only done when initially setting the output voltage configuration at the factory).

7.3 WATT-HOUR METER AND MAXIMUM POWER DISPLAY

Press the **SHORE POWER + F1** buttons to access the Automatic WATT-HOUR METER and maximum power display.

| | |
|----------------------------|-----------------------|
| WATT-HOUR METER | Run-Time:day:HH:MM:SS |
| INPUT kW-Hours:XXXXXXXX.XX | Max: XX% |
| ONLINE Real-Power:XX.XXkW | Level: XX% |
| Exit | Clear |

Press the Clear (**F2**) button to clear all data and the Exit (**SYSTEM STATUS**) button to exit.

Application: this reference kW-hour meter can be used to check the billing received in a marina for consumption of electric energy. Immediately after connecting shore power and turning the converter's red disconnect switch, clear the data in this screen. When ready to leave, take down the kW-hours and run time before disconnecting the shore power.

Additionally, this screen can be used to diagnose converter shutdowns. Since the Max. (greatest kW) and Level (greatest percentage of System Level) data are updated with slow-response metering (approximately 1 second), only average use data are represented. Instantaneous motor-start surges and such will not be represented by the data. If the Level exceeds 110%, and a shutdown of the Shore Power has occurred, it is very likely the average loading is exceeding the converter's capacity. The Max (kW) is provided since Level is affected by Shore Cord Setup settings.

7.4 CONVERTER OUTPUT VOLTAGE CONTROL

Press the **CONVERTER POWER + F1** buttons to access the **CONVERTER OUTPUT VOLTAGE CONTROL** display.

| | | | |
|----------------------------------|-----------------|------|------|
| CONVERTER OUTPUT VOLTAGE CONTROL | | | |
| Vout = XXX.X | Line-to-XXXXXXX | | |
| XXXV | Exit | More | Less |

This function allows the user to increase or decrease the converter output voltage (Vout). Press the More (**F1**) button to increase the Vout, the Less (**F2**) button to decrease the Vout, the XXXV (**SHORE POWER**) button to return Vout to the factory programmed setting, and the Exit (**SYSTEM STATUS**) button to save the setting and exit.

| | Default | Range | Increments |
|------|-----------------------|-------|------------|
| Vout | factory prog. voltage | +/-5% | 0.5 volts |

Application: if the line-drop losses in a yacht are such that locations remote of the converter and Ship's Bus experience undesirable, lower-than-expected voltages, the programmed Vout can be raised up to 5% via this function. Also, to decrease total power usage, the Vout could be reduced up to 5%. The new, programmed Vout will be used as the basis for AGC and all other voltage dependent functions.

7.5 EVENT LOG

Press the **SHORE POWER + SYSTEM STATUS** buttons to access the EVENT LOG CONTROL display.

| | | | | |
|-------------------|-------|------|------|-------|
| EVENT LOG CONTROL | | | | |
| XXX Events Logged | | | | |
| View | Track | Exit | Edit | Erase |

This is for monitoring internal converter logic operation. Press the Erase (**F2**) button while in the above screen to erase all events. Press the Exit (**SYSTEM STATUS**) button to exit.

Press the View (**SHORE POWER**) button (while in the EVENT LOG CONTROL display) to access the EVENT LOG VIEWER display.

| | | | | |
|-----------------|-------------------|------|----------|------|
| XXX:XX:XX:XX:XX | ****START_LOG**** | | | |
| XXX:XX:XX:XX:XX | Event_1 | | | HIGH |
| XXX:XX:XX:XX:XX | Event_2 | | | LOW |
| Event Viewer | Exit | Next | Previous | |

This is for reviewing all past events (1000 max.) since the log was last cleared. Press the Next (**F1**) button to scroll down (newer events). Press the Previous (**F2**) button to scroll up (older events). Press the Exit (**SYSTEM STATUS**) button to exit to the EVENT LOG CONTROL display, and again to exit completely.

Press the Track (**CONVERTER POWER**) button (while in the EVENT LOG CONTROL display) to access the EVENT LOG TRACKER display.

| | | |
|-----------------|------------|------|
| XXX:XX:XX:XX:XX | Event_1 | HIGH |
| XXX:XX:XX:XX:XX | Event_2 | HIGH |
| XXX:XX:XX:XX:XX | Event_3 | LOW |
| XXX:XX:XX:XX:XX | Event_Next | HIGH |

This is for reviewing events as they occur. Press the **SYSTEM STATUS** button to exit.

7.5 EVENT LOG, cont.

Press the Edit (**F1**) button (while in the EVENT LOG CONTROL display) to access the EVENT LOG REGISTRY display.

| | | | | |
|-------------------------------|---------|------|------|----------|
| EVENT LOG REGISTRY | | | | |
| Event Name: | Ev VOID | | ID: | 0 |
| Logging for this Event is: ON | | | | |
| Log-ON | Log-OFF | Exit | Next | Previous |

This is for editing which events are logged and clearing the log. Press the Log-on (**SHORE POWER**) button to turn logging ON for the Event. Press the Log-off (**CONVERTER POWER**) button to turn logging OFF for the Event. Press the Next (**F1**) button to move to the next event. Press the Previous (**F2**) button to move to the previous event. Press the Exit (**SYSTEM STATUS**) button to exit to the EVENT LOG CONTROL display, and again to exit completely.

8 TROUBLE-SHOOTING AND DIAGNOSTICS

8.1 COMMON PROBLEMS

When encountering difficulty in achieving successful operation of the converter, there are some problems which are easily identified and solved. The following list is not intended to be exhaustive.

| SYMPTOM | POSSIBLE CAUSE/SUGGESTED ACTION |
|---|---|
| <p>Upon initial power-up, the converter does not behave in accordance with the Section 6.1 description (no display, LEDs, or fans).</p> | <ul style="list-style-type: none"> • Ensure dock power is available. Check pedestal and shore cord circuit breakers. • Have input power to the converter checked by a qualified electrician. • Have the input fuses located on the lower-right side of the converter checked by a qualified electrician (refer to Figure 4). |
| <p>The converter powers-up in accordance with the Section 6.1 description, but does not accept a SHORE POWER ON button press.</p> | <ul style="list-style-type: none"> • Review SHORE POWER metering at the converter for an input between 170-520VAC. |
| <p>The converter does not accept a CONVERTER POWER ON button press.</p> | <ul style="list-style-type: none"> • Review CONVERTER POWER metering at the converter for the correct and expected output voltages. |
| <p>The converter trips to a SHORE POWER OFF state unexpectedly and reports the message “INPUT_OVERLOAD”</p> | <ul style="list-style-type: none"> • Review Section 7.3. Clear the kW-HOUR screen before placing the converter on-line, and review the maximum kW entry after a trip. |

8.2 FAILURE AND WARNING MESSAGES

The converter can display various FAILURE or WARNING messages under certain circumstances. If the event causing such as message has subsided, pressing buttons F1 (8) and F2 (9) simultaneously will clear the FAILURE or WARNING message. Common messages are:

| | |
|---------------------|---|
| D86 LVDC FAULT | (low voltage power supply fault) |
| INPUT POWER CORRUPT | (control power to the computer has dropped out of range) |
| INV_X_OT | (the output Inverter circuit has exceeded its max. temp.) |
| PFC_X_OT | (the input PFC circuit has exceeded its max. temp.) |
| XFMR_OT | (the input transformer has exceeded its max. temp.) |

If either the D86 LVDC FAULT or INPUT POWER CORRUPT message appears and cannot be cleared, please turn the converter completely OFF using its red/yellow disconnect switch and contact an authorized service center or the factory for assistance. Leaving the red/yellow disconnect switch in the ON position with these messages present could cause further damage to the converter.

8.3 STATUS WORD

To aid in system diagnostics, a STATUS WORD has been provided in the SUMMARY DISPLAY. This STATUS WORD contains information about internal logic levels and changes dynamically in accordance with the converter's operational state.

| | |
|----------------------|--------------------|
| SUMMARY DISPLAY | AC12 LOAD:XXX.X % |
| INPUT#1:OFFLINE | STATUS: OK |
| SYS:XXXXXXXXXXXXXXXX | CONVERTER: OFFLINE |
| AUTO-RESTART: OFF | XX:XX:XX |

The STATUS WORD is comprised of 16 digits—each indicating a separate internal logic term (see Figure 9 and the subsequent text on the following page for a description of the individual bits).

Press the SYSTEM STATUS (7) and F2 (9) buttons simultaneously to access the STATUS display.

| | |
|----------------------|---------------|
| STATUS DISPLAY | CONFIG: XXXX |
| BIT:FDECBA9876543210 | CONTROL: |
| SW1:XXXXXXXXXXXXXXXX | STATUS1: XXXX |

In the STATUS display, the STATUS WORD is given in binary (SW1) and HEX format (STATUS1). If reporting problems to an authorized service center or the factory, please use the HEX format (example... STATUS 1: DF85) to reduce the chance of transcription error.

If a problem has been encountered by the system, carefully record the Status Word before removing power to the system (*Diagnostic data may be deleted or reset with power cycling*). When calling the factory for assistance, please have the Status Word handy along with the system model, serial number, and software version number.

Pressing the SYSTEM STATUS (7) and F1 (8) buttons simultaneously opens a system data screen containing the converter software version as well as the accumulated run-hours.

8.3 STATUS WORD, cont.

STATUS WORD BITS

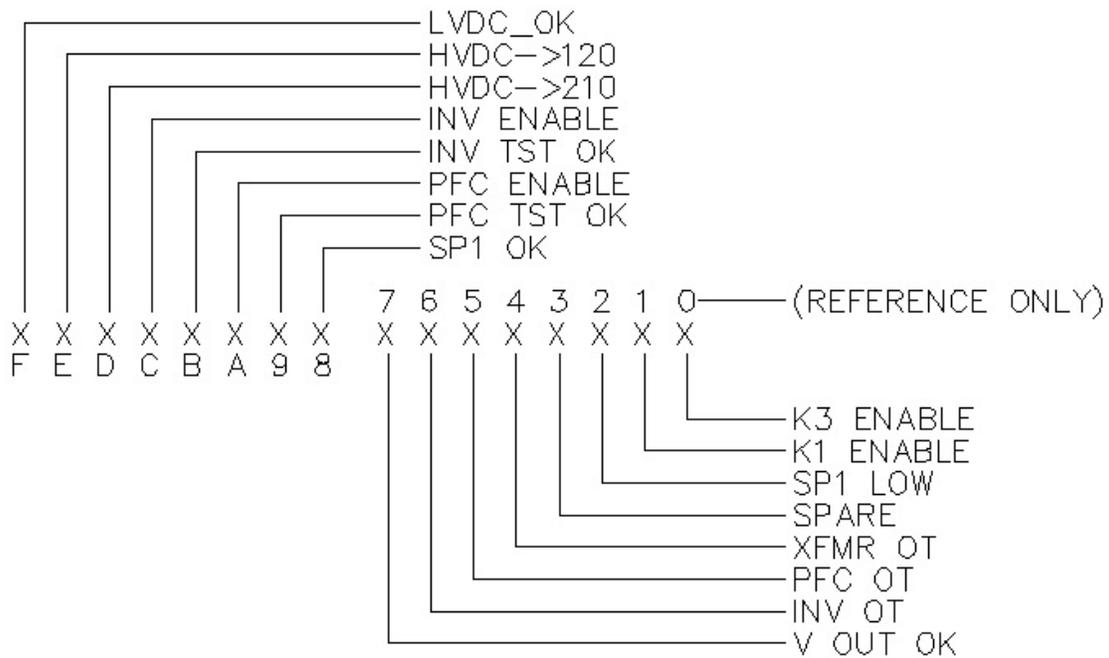


FIGURE 9 STATUS WORD BIT DEFINITIONS

| | |
|------------|---|
| LVDC OK | All low voltage (housekeeping) supplies are valid. Should always be “1.” |
| HVDC >120 | Both high voltage supplies (+/- 185VDC) are above the minimum threshold for PFC operation. Should be a “0” when the inverter is off, a “1” when the inverter has been started and the Shore Power LED is green. |
| HVDC>210 | One or both of the high voltage power supplies has failed in an over-voltage state. Should always be a “0.” |
| INV ENABLE | The inverter is enabled. A “0” when the system is off, turns to a “1” when the inverter is on. |

8.3 STATUS WORD, cont.

| | |
|------------|--|
| INV TST OK | Inverter tests OK. Proper switching action taking place in power stages. Does not mean output voltage is correct yet. A “1” when operating. |
| PFC ENABLE | The PFC stages have been enabled by the logic. Is a “0” when the system is off, turns to “1” at the end of the “walk-in” stage. |
| PFC TST OK | The PFC tests OK when a “1” is indicated. The PFC ENABLE bit (see above) must be set to “1” first. |
| SP1_OK | Shore power #1 is acceptable for use by the system when a “1” is indicated. Voltage only is checked, not frequency. |
| V OUT OK | Hardware has determined that the output voltages are acceptable for use when a “1” is indicated. Frequency is not checked. |
| INV OT | Inverter or Power Supply (PFC) has over-temped and has caused a shutdown. Should normally be a “0.” |
| PFC OT | Incorporated into the INV OT bit (see above). |
| XFMR OT | Not used at this time. Reserved for transformer over-temp. |
| SPARE | Spare |
| SP1 LOW | The logic has determined the shore power input is in the low range, 180-260VAC when a “1” is indicated. Used for voltage range control relay. |
| K1 ENABLED | Should indicate a “1” when the system is in the walk-in state, for approximately 1 second after the start of the inverter start sequence. |
| K3 ENABLED | The output contactor has been commanded to close when a “1” is indicated. The inverter voltage must be in an acceptable range and the ships power button is pressed. |

8.4 GATHERING DATA

If a converter problem has occurred, carefully record any **FAULT** or **WARNING** messages and the **STATUS WORD** before removing power to the system. When calling an authorized service center or the factory for assistance, please have the above mentioned data and the converter model number, serial number, and software version ready.

8.5 SOFTWARE TOOLS

The **EVENT LOG** described in Section 7.5 on pages 33-34 can assist in determining the cause of unexpected behavior. Several software tools exist which can be downloaded from the aseapower.com website to aid in trouble-shooting—including an **EVENT LOG VIEWER** used to download the converter **EVENT LOG** for analysis. Contact an authorized service center or the factory for additional assistance with these tools.

9 MAINTENANCE

Due to the design and construction of the AC08 and AC12, preventative maintenance is held to a modest level. The following table lists minimum recommended tasks and frequency.

| TASK | FREQUENCY | COMMENTS |
|--|----------------|--|
| Tighten electrical connections  WARNING  | Every 6 months | Must be adjusted by the user based upon experience in the environment. Frequency will vary due to wire gauge, wire type, and applied vibration. Refer to licensed electrician or factory authorized technician. |
| CPU Battery replacement  WARNING  | Every 3 years | May require greater frequency with elevated ambient temperature, or extended periods of non-operation. Refer to factory authorized technician. |
| Calibration  WARNING  | Every year | May require additional calibration after battery replacement. Lack of calibration may result in a 3% increase in metering and voltage programming accuracy. Refer to factory authorized technician. |

10 INTERNATIONAL POWER FORM REFERENCE

| Country | Frequency | Nominal Voltage | Comments |
|------------------|--------------|--------------------|----------|
| American Samoa | 60Hz | 120/240 277/480 | |
| Antigua | 60Hz | 230/400 | |
| Argentina | 50Hz | 220/380 | |
| Aruba | 60Hz | 127/220 115/230 | |
| Australia | 50Hz | 240/415 250/435 | |
| Azores | 50Hz | 110/190 220/380 | |
| Bahamas | 60Hz | 120/240 120/208 | |
| Bahrain | 50Hz 60Hz | 230/400 110/220 | |
| Balearic Islands | 50Hz | 127/220 220/380 | |
| Barbados | 50Hz | 115/230 115/200 | |
| Belgium | 50Hz | 220/380 | |
| Belize | 60Hz | 110/220 250/440 | |
| Benin | 50Hz | 220/380 | |
| Bermuda | 60Hz | 120/240 120/208 | |
| Brazil | 60Hz | 115/230 127/220 | |

| | | | |
|--------------------|------|-------------------------------|--|
| | | 220/380 | |
| Brunei | 50Hz | 240/415 | |
| Bulgaria | 50Hz | 220/380 | |
| Burma | 50Hz | 230/400 | |
| Canada | 60Hz | 120/240 120/208 277/480 | |
| Canary Islands | 50Hz | 127/220 220/380 | |
| Cape Verde | 50Hz | 220/380 | |
| Cayman Islands | 60Hz | 120/240 120/208 | |
| Chile | 50Hz | 220/380 | |
| China (PRC) | 50Hz | 220/380 | |
| Columbia | 60Hz | 110/220 120/208 150/260 | |
| Costa Rica | 60Hz | 120/240 120/208 | |
| Cyprus | 50Hz | 240/415 | |
| Denmark | 50Hz | 220/380 | |
| Dominica | 50Hz | 230/400 | |
| Dominican Republic | 60Hz | 120/240 120/208 | |
| Ecuador | 60Hz | 120/240 120/208 | |
| Fiji | 50Hz | 240/415 | |
| Finland | 50Hz | 220/380 | |
| France | 50Hz | 115/230 115/200 | |

| | | | |
|------------|--------------|--------------------|--|
| | | 220/380 | |
| Gibraltar | 50Hz | 240/415 | |
| Greece | 50Hz | 220/380 | |
| Greenland | 50Hz | 220/380 | |
| Grenada | 50Hz | 230/400 | |
| Guadeloupe | 50Hz | 220/380 | |
| Guam | 60Hz | 110/220 120/208 | |
| Guatemala | 60Hz | 120/240 120/208 | |
| Haiti | 60Hz | 110/220 120/208 | |
| Honduras | 60Hz | 110/220 120/208 | |
| Hong Kong | 50Hz | 220/380 | |
| Ireland | 50Hz | 220/380 | |
| Israel | 50Hz | 230/400 | |
| Italy | 50Hz | 127/220 220/380 | |
| Jamaica | 50Hz | 110/220 | |
| Japan | 50Hz 60Hz | 100/200 100/200 | |
| Korea | 60Hz | 110/220 220/380 | |
| Kuwait | 50Hz | 240/415 | |
| Madagascar | 50Hz | 127/220 220/380 | |
| Malaysia | 50hz | 240/415 | |
| Maldives | 50Hz | 230/400 | |
| | | | |

| | | | |
|----------------------|--------------|-------------------------------|--|
| Malta | 50Hz | 240/415 | |
| Martinique | 50Hz | 220/380 | |
| Mauritius | 50Hz | 230/400 | |
| Mexico | 60Hz | 127/220 | |
| Monaco | 50Hz | 127/220 220/380 | |
| Montserrat | 60Hz | 230/400 | |
| Morocco | 50Hz | 127/220 220/380 | |
| Netherlands | 50Hz | 220/380 | |
| Netherlands Antilles | 50Hz 60Hz | 127/220 220/380 120/240 | |
| New Caledonia | 50Hz | 220/380 | |
| New Zealand | 50Hz | 230/400 | |
| Norway | 50Hz | 230/400 | |
| Panama | 60Hz | 110/220 120/208 | |
| Philippines | 60Hz | 115/230 | |
| Portugal | 50Hz | 220/380 | |
| Puerto Rico | 60Hz | 120/240 120/208 | |
| St. Kitts | 60Hz | 230/400 | |
| St. Lucia | 50Hz | 240/415 | |
| St. Vincent | 50Hz | 230/400 | |
| Saudi Arabia | 60Hz | 127/220 | |
| Seychelles | 50Hz | 240/415 | |
| Sierra Leone | 50Hz | 230/400 | |

| | | | |
|----------------------|------|--------------------|--|
| Singapore | 50Hz | 230/400 | |
| South Africa | 50Hz | 220/380 | |
| Spain | 50Hz | 127/220 220/380 | |
| Sweden | 50Hz | 220/380 | |
| Tahiti | 60Hz | 127/220 | |
| Taiwan | 60Hz | 110/220 120/208 | |
| Thailand | 50Hz | 220/380 | |
| Togo | 50Hz | 127/220 220/380 | |
| Trinidad | 60Hz | 115/230 230/400 | |
| Tunisia | 50Hz | 127/220 220/380 | |
| United Arab Emirates | 50Hz | 230/400 | |
| United Kingdom | 50Hz | 240/415 | |
| Uruguay | 50Hz | 220/380 | |
| Venezuela | 60Hz | 120/240 120/208 | |
| Amer. Virgin Islands | 60Hz | 120/240 120/208 | |
| | | | |
| | | | |

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