Operations Manual

for the AC15 & AC18
Yacht Power Converters

P/N 603050
Revised 4/19/06

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:

AC15 15kVA Yacht Power Converter
AC18 18kVA Yacht Power Converter

It is important that the operator reads this manual prior to installing and operating the AC18. 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:

ASEA Power Systems
15602 Commerce Lane
Huntington Beach, CA 92649
Phone (714) 896-9695
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www.aseapower.com

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FIGURES

2 SAFETY NOTICES

The AC18 is 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.**
- **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 FILTER ELEMENTS SHOULD BE REFERRED TO PERSONNEL AUTHORIZED BY THE FACTORY TO SERVICE THIS EQUIPMENT.**

3 INTRODUCTION TO THE AC18

The AC18 is a high performance Yacht Power Converter utilizing dual-conversion technology. The system 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.

Dual-conversion technology is the preferred technique for AC power conversion, and was chosen for the AC18. 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 required AC form (both voltage and frequency) required by the yacht.

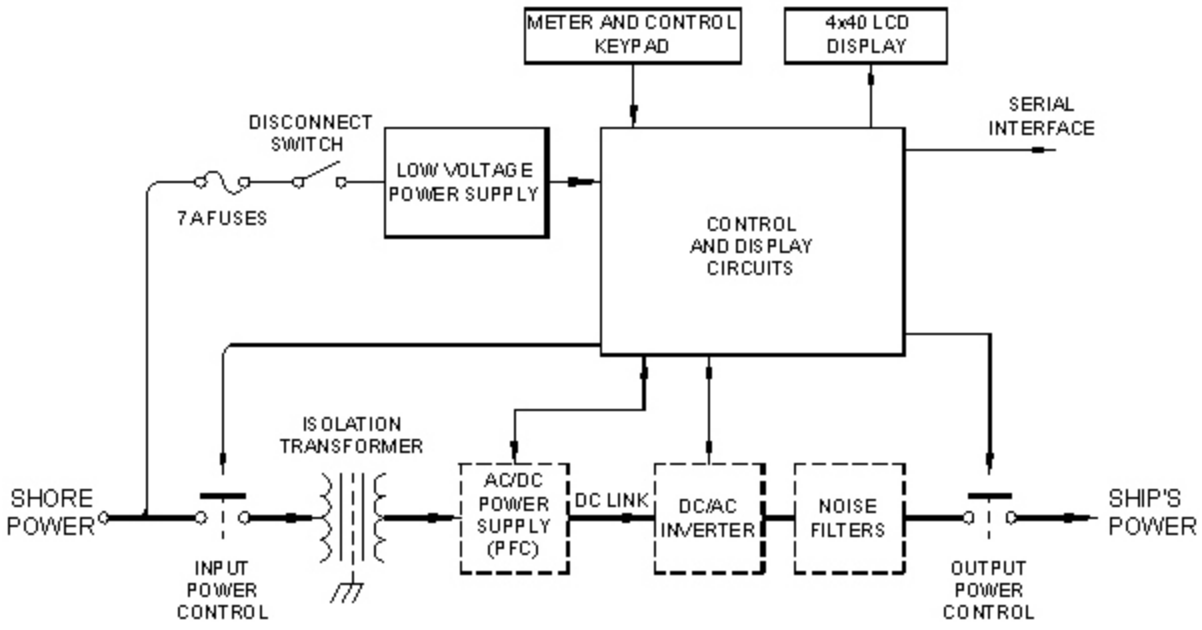

FIGURE 1 SYSTEM BLOCK DIAGRAM

Being a unit 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 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.

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 SHIPS 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, the AC18 provides 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.

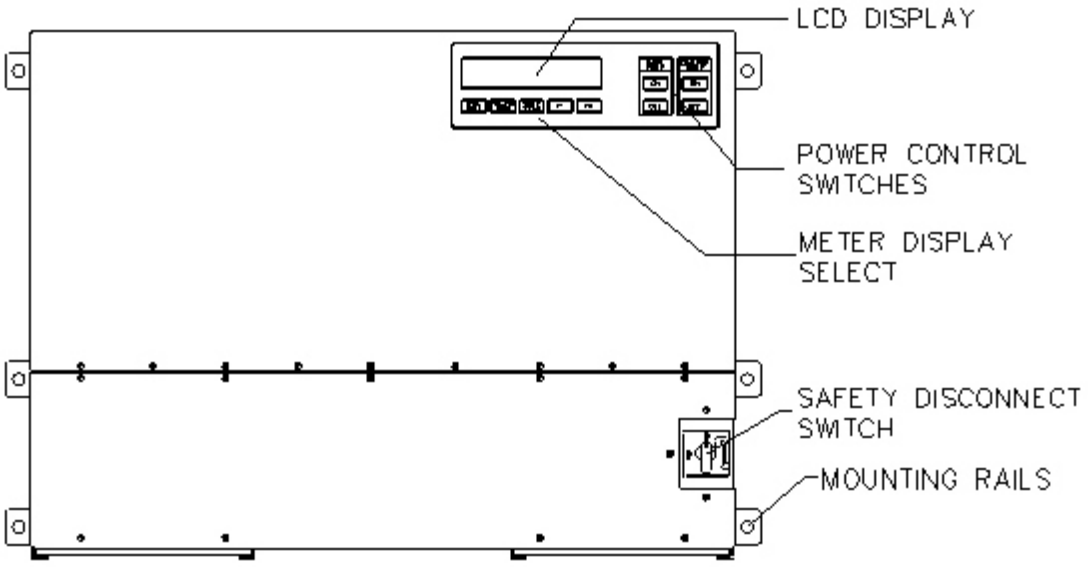

FIGURE 2 CONTROLS

4 SPECIFICATIONS

4.1 ELECTRICAL SPECIFICATIONS

Parameter	AC15	AC18
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	63 A_{RMS}	75 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 load
4.1.2 Output Service		
Output Power Rating	15kVA @ 0.85 p.f.	18kVA @ 0.85 p.f.
Output Power Form	Single Phase, 220 V_{RMS}	Single Phase, 220 V_{RMS}
or	Split Phase, 120/240 V_{RMS}	Split Phase, 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	63 A_{RMS} @ 0.85 p.f.	75 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	91% @ rated load	92% @ 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
Ship's Power Control	Membrane Switch, Output ON/OFF Control
Shore Power Metering	Voltage, Current, Frequency, kVA, kW, %Load
Ship's Power Metering	Voltage, Current, Frequency, kVA, kW, %Load
System Status	Operational status, Diagnostics, Software Calibration

4.2 PHYSICAL SPECIFICATIONS

Parameter	AC15	AC18
4.2.1 Mechanical		
Height	22.4"/56.9cm	22.4"/56.9cm
Width, Enclosure	29.13"/74.0cm	29.13"/74.0cm
Width, Mtg. Brackets	31.13"/79.0cm	31.13"/79.0cm
Depth	12"/30.5cm	12"/30.5cm
Weight	300lbs/136kg	300lbs/136kg
4.2.2 Environmental		
Ambient Temperature Range	0-50°C non-condensing	0-50°C non-condensing
Air Exchange Rate	400CFM	400CFM

5 INSTALLATION

The installation section will be divided into two parts. The first will cover mechanical installation, the second, electrical installation.

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

Proper planning will speed up installation, location, and connection of the equipment. Follow the suggested minimum clearances provided in Table 1. **Ensure the room/compartment has adequate ventilation and cooling. The thermal load presented by AC18 will be substantial, approximately 6,000BTU/Hr at maximum continuous load (5,200BTU/Hr for the AC15).**

THE AC18 IS HEAVY, WEIGHING UP TO 270lbs DEPENDING UPON MODEL AND INSTALLED OPTIONS. 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 AC18 was designed for vertical bulkhead installations and as such is provided with six mounting ears, three per side. Mounting holes have been provided with ½" (12mm) diameters, stainless steel hardware in the range of 7/16" to ½" (11-12mm) diameter is required.

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 AC18. Spacers (shim stock) may be added between the mounting surface and the AC18 mounting ears to adjust the mounting plane. Resilient mounts must not be used directly between the AC18 and the mounting surface. If the AC18 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 AC18 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

	FOR PROPER	
	Operation	Service
Front	6" (Airflow)	24" min
Bottom	12" (Airflow)	N/A
Sides	8" (Airflow)	6"
Top	0"	6"

5.1 MECHANICAL INSTALLATION, cont.

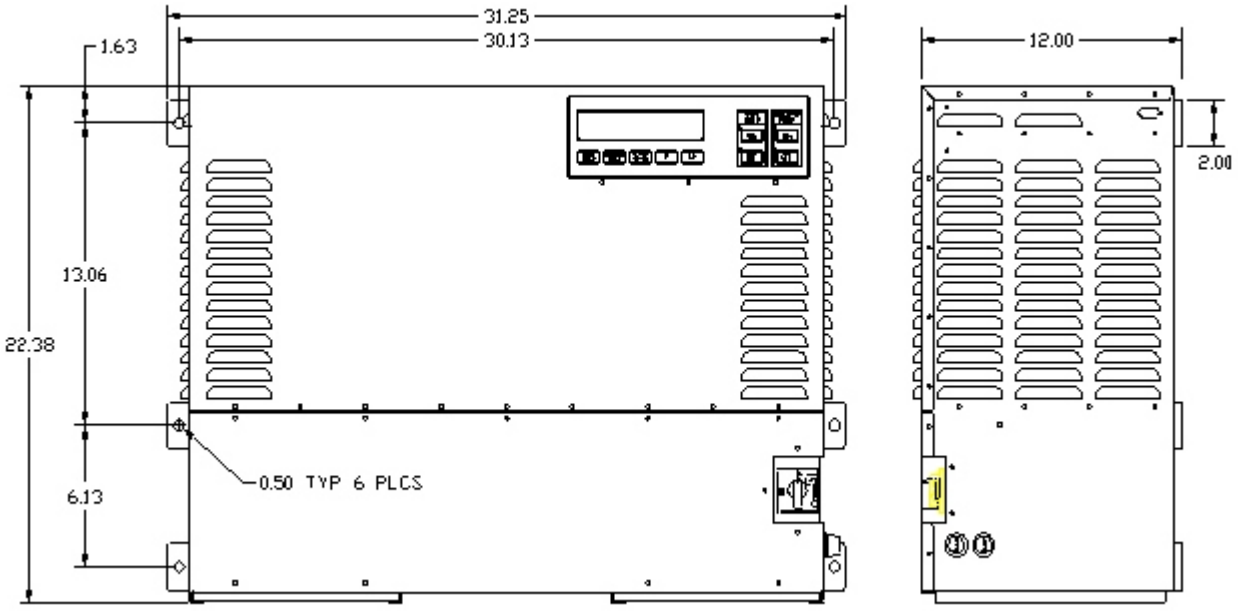

FIGURE 3 MECHANICAL OUTLINE

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5.2 ELECTRICAL INSTALLATION

This procedure assumes the physical installation of the AC18 has been completed. It is the users responsibility to provide input service over-current protection and disconnect means. Maximum continuous input current for the 18kVA AC18 is 75Amps. A circuit breaker with a 90Amp rating is recommended.

All power wiring requires the removal of the lower front cover. This cover is secured with 18 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 ½" 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. 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 AC18 PRIOR TO THE START OF THE FOLLOWING STEPS. INPUT POWER MUST BE SECURED (LOCKED) IN THE OFF (DE-ENERGIZED) STATE UNTIL INSTRUCTED OTHERWISE BY THIS DOCUMENT.

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

5.2.1 Input Power Connections

The AC18 is supplied with compression type terminal blocks for input power connections. These terminal blocks accept wires in the range of 6-2/0 AWG. 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". 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 AC18 is fully isolated with no phase orientation requirements to the input power service.

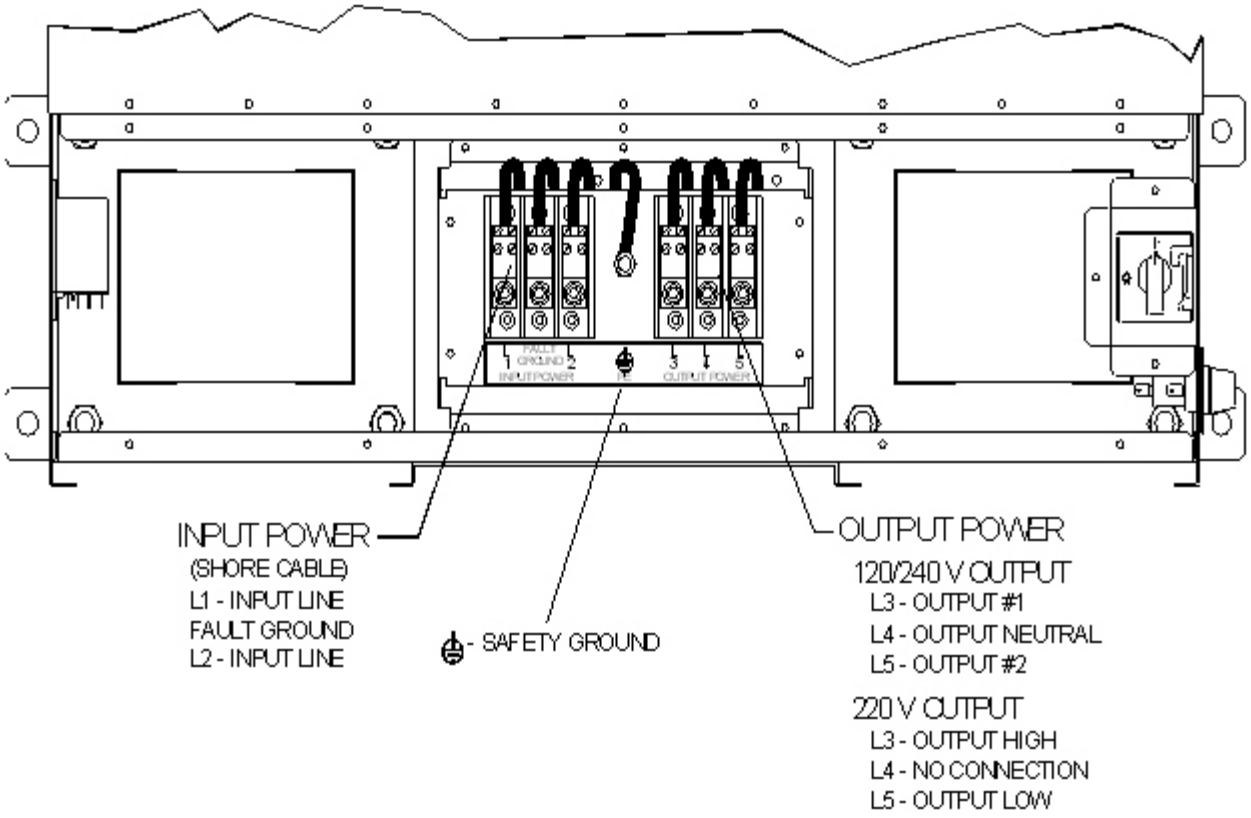

FIGURE 4 INPUT AND OUTPUT CONNECTIONS

5.2.2 Output Power Connections

The AC18 is supplied with compression type terminal blocks for output power connections. These terminal blocks accept wires in the range of 6-2/0AWG. 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.

THE AC18 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. NEUTRAL AND EQUIPMENT (SAFETY) GROUNDS TO BE CONNECTED PER ABYC STANDARDS.

Prepare the power cable by removing the outer cable insulation approximately 6". 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.

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6 OPERATION

6.1 POWER TURN-ON PROCEDURE

Close the input (shore power) circuit breaker to the AC18. 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.

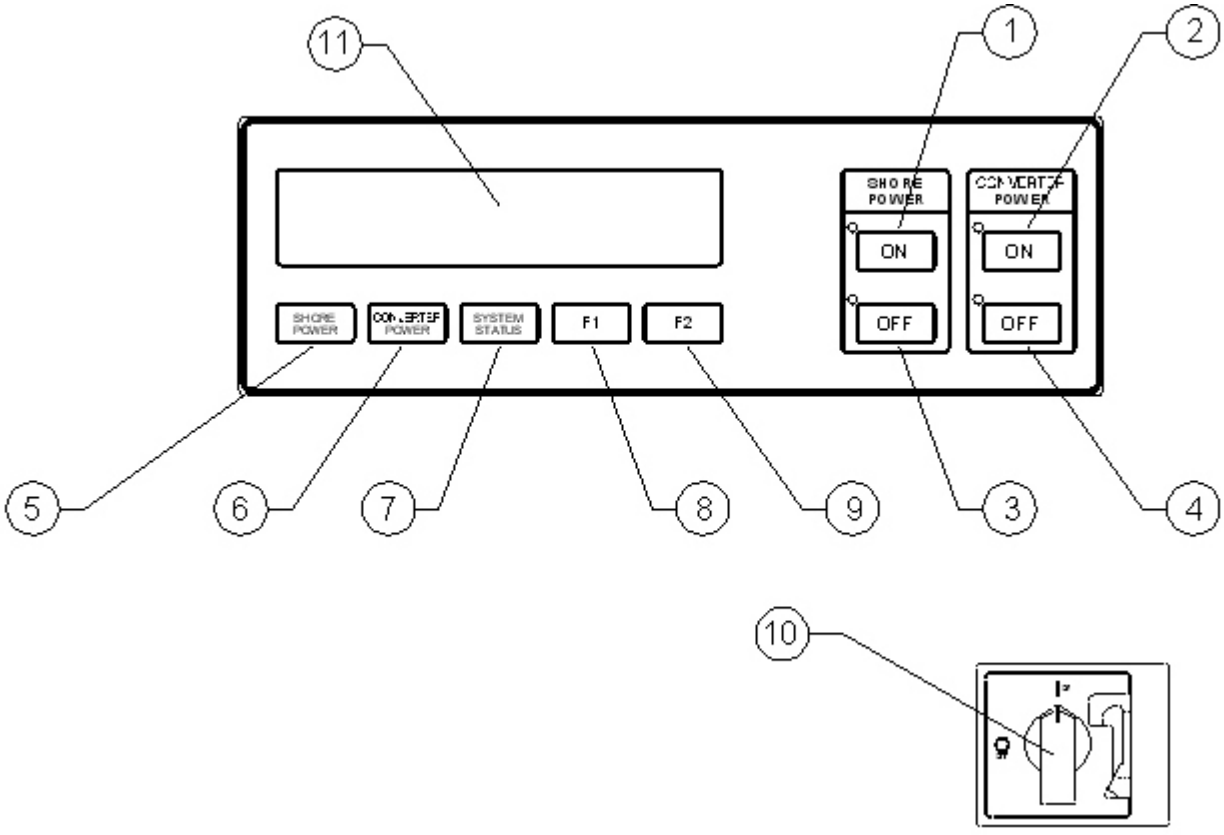

FIGURE 5 CONTROLS AND INDICATORS

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        ACXX  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
```

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 AC18, press the CONVERTER POWER ON **(2)** button on the control panel. This will place voltage at the output terminals of the AC18. The green ON indicator LED should now be lighted. The ships load may be transferred to the AC18 at this time.

When load has been transferred to the AC18, 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 must be enabled from the converter front panel by simultaneously pressing three keys. Anytime the Systems Status is "FAILURE", 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
Enable Auto-Restart	SHORE POWER**(5)** & CONVERTER POWER**(6)** & F1**(7)**
Disable Auto-Restart	SHORE POWER**(5)** & CONVERTER POWER**(6)** & F2**(8)**

6.3 TURN-OFF PROCEDURE

Transfer power from the AC18 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 process. 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 AC18.

The AC18 is now shut down.

6.5 REMOTE COMMUNICATIONS

The converter can be controlled remotely through the use of its RS-232C (Recommended Standard-232C) interface. The serial port settings can be viewed in the REMOTE INTERFACE CONFIGURATION DISPLAY (as depicted below) by pressing the CONVERTER POWER **(6)**, SYSTEM STATUS **(5)** and F2 **(9)** buttons simultaneously.

```
REMOTE INTERFACE CONFIGURATION
BAUD: 19.2K   8-DATA BITS,1 START,1 STOP
PARITY: NONE    EOS: CR/LF  DEVICE: DCE
HANDSHAKING: NONE HALF-DUP
```

The baud rate can be increased by pressing the F1 **(8)** button, and decreased by pressing the F2 **(9)** button. Pressing SYSTEM STATUS **(7)** saves the setting. Standard baud rates are 1200, 2400, 4800, 9600, 19200, and 38400 where 19200 is the default and standard for communication with all ASEA Power Systems Touch Screens. No other parameters are user selectable.

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 (Data Communication Device). Figure 8 on page 35 demonstrates connection from a DCE to a DTE (Data Terminal Device as standard PC's are configured) or from a DCE to a DCE. Use of a shielded, jacketed, four-wire (two twisted pairs), color-coded cable for each converter in the system is required.

The RS-232C serial port is located in the upper right-hand corner of the converter's right side.

The TxD signal originating in the converter is approximately +15V when "High" and -15V when "Low."

6.5 REMOTE COMMUNICATIONS, cont.

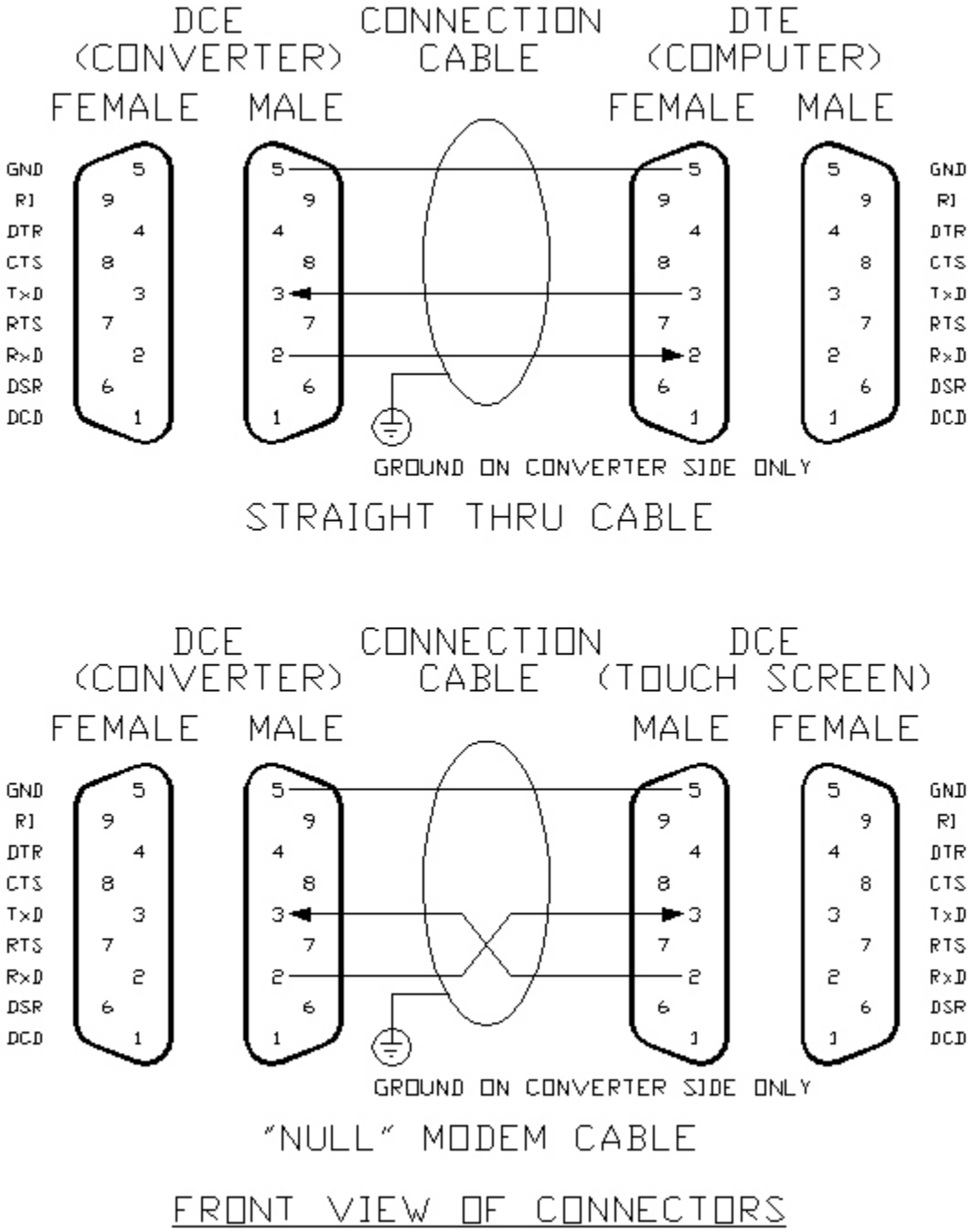

FIGURE 6 RS-232C PINOUT

The GND (ground) wire is connected to the chassis-ground of the converter.

6.5 REMOTE COMMUNICATIONS, cont.

Remote control can be accomplished with the use of an ASEA Power Systems defined Remote Communication Command Set, or through visual touch screen software that is described elsewhere. Many standard serial communication programs have been tested with the RS-232C Command Set and were found to function adequately.

What follows is a listing of the available commands through standard serial protocol. The commands are given in the form that they should be sent: the colons and upper-case characters are mandatory and the lower-case letters are optional. The commands may be sent in either lower-case or upper-case characters with a carriage return [Enter] following each command (except for the "Immediate Commands" which execute instantly after the two characters have been typed). Contact the factory for questions regarding the use of commands listed herein.

6.5 REMOTE COMMUNICATIONS, cont.

Command	Description	Comment
:SHORe:ON	Shore Power ON	Same as pressing the Shore Power ON button on the panel.
:SHORe:OFF	Shore Power OFF	Same as pressing the Shore Power OFF button on the panel.
:CONVerter:ON	Converter Power ON	Same as pressing the Converter Power ON button on the panel.
:CONVerter:OFF	Converter Power OFF	Same as pressing the Converter Power OFF button on the panel.
:AUTOSTART:ON	Enable AutoRestart function	
:AUTOSTART:OFF	Disable AutoRestart function	
:AUTOSTART:STATe?	State query	1=Enabled, 0=Disabled
*CLS	Comm Port Reinitialize	
*IDN	System Identification	
:STATus:CONV	Converter status	Integer, 0-4 (1)
:STATus:CPON	Converter Power status	0=Off, 1=On
:STATus:FAULT:LVDC	Fault status: LVDC Power Supply	0=OK, 1=LVDC Fault
:STATus:FAULT:OVERTEMP	Fault status: system temperature	0=OK, 1=System Overtemp
:STATus:SP1	Shore Power status	Integer, 0-4 (1)
:STATus:SW1	Status Word #1	Integer, 0-65535
:STATus:SYST	System Status	0=OK, 1=Warning, 2=Failure
:SYSTem:CONFiguration	System Configuration	Integer, 0-65535
:SYSTus:ERR	Command error status	(2)
!~	Immediate command, Shore Off	
!#	Immediate command, :STATus:SW0	

Notes:
1. 0=Offline, 1=Online, 2=Fault, 3=Under-voltage, 4=Over-voltage
2. 0=Successful Communiqué, -100=Command Error (includes: parity, framing, and overrun errors), -200=Execution Error, -300=Device Specific Error

6.5 REMOTE COMMUNICATIONS, cont.

Command	Description	Return Value Range
:MEASure:SP1:FREQuency	Shore Power Frequency	Real number, 0 to 100
:MEASure:SP1:VLL1	Shore Power A-B Voltage	Real number, 0 to 1000
:MEASure:SP1:CURRent1	Shore Power A RMS Current	Real number, 0 to 1000
:MEASure:SP1:KVA1	Shore Power Phase A kVA	Real number, 0 to 1000
:MEASure:SP1:POWer1	Shore Power Phase A kW	Real number, 0 to 1000
:MEASure:SP1:PF1	Shore Power Phase A Power Factor	Real number, 0 to 1.00
:MEASure:SP1:ALL	VLL1,CURR1, kVA, FREQ	Real numbers, comma delimited, 3.2 to 1.2 precision with leading zero suppression
:MEASure:SP1:RATE1	Greatest of kW, kVA, or Amps in % rating, Shore Power #1	Real number, 0 to 1000
:MEASure:CONVerter:FREQuency	Converter Output Frequency	Real number, 0 to 100
:MEASure:CONVerter:VOLTage1	Converter Output #1 Voltage	Real number, 0 to 1000
:MEASure:CONVerter:CURRent1	Converter Output #1 RMS Current	Real number, 0 to 1000
:MEASure:CONVerter:KVA1	Converter Output #1 kVA	Real number, 0 to 1000
:MEASure:CONVerter:POWer1	Converter Output #1 kW	Real number, 0 to 1000
:MEASure:CONVerter:PF1	Converter Output #1 Power Factor	Real number, 0 to 1.00
:MEASure:CONVerter:VOLTage2	Converter Output #2 Voltage	Real number, 0 to 1000
:MEASure:CONVerter:CURRent2	Converter Output #2 Current	Real number, 0 to 1000
:MEASure:CONVerter:KVA2	Converter Output #2 kVA	Real number, 0 to 1000
:MEASure:CONVerter:POWer2	Converter Output #2 kW	Real number, 0 to 1000
:MEASure:CONVerter:PF2	Converter Output #2 Power Factor	Real number, 0 to 1.00
:MEASure:CONVerter:ALL	VOLT1, VOLT2, CURR1, CURR2, kW1, kW2, FREQ	See above, expressed in 3.2 precision
:MEASure:CONV:RATE1	Greatest of kW, kVA, or Amps in % rating, Converter Power #1	Real number, 0 to 1000
:MEASure:CONV:RATE2	Greatest of kW, kVA, or Amps in % rating, Converter Power #2	Real number, 0 to 1000
:MEASure:RATE	Greatest of kW, kVA, or Amps in % rating, Shore Power #1, #2, Converter Power #1, or #2	Real number, 0 to 1000

7 DIAGNOSTICS

As an aid to system diagnostics, a Status Word has been provided at the bottom of the SUMMARY DISPLAY screen. This Status Word is comprised of 16 digits, each indicating a separate internal logic term. It can also be found along with other useful system data on the STATUS DISPLAY screen accessed by pressing the SYSTEM STATUS **(7)** and F2 **(9)** buttons simultaneously.

```
STATUS DISPLAY                CONFIG:  XXXX
BIT: FEDCBA9876543210         CONTROL: 0000
SW1: XXXXXXXXXXXXXXXX         STATUS1: XXXX
```

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 run-hours.

```
ASEA MARINE CONVERTER  SYSTEM STATUS: OK
 AC MARINE POWER CONVERTER Version X.XX
       (c)200X ASEA POWER SYSTEMS
     HOURS OF OPERATION:    XX:XX:XX
```

This screen will alternatively contain plain-language failure data if the SUMMARY DISPLAY or STATUS DISPLAY is currently flashing WARNING or FAILURE. The example below is displayed when internal converter temperatures exceed sensor limits. After a WARNING or FAILURE condition subsides, the message can be cleared by pressing the F1 **(8)** and F2 **(9)** buttons simultaneously.

```
DIAGNOSTIC:XXX_X_OT * * FAILURE * *
OVER-TEMPERATURE CONDITION.
CHECK INTAKE AND AMBIENT TEMPERATURE.
CONVERTER SHUTDOWN.
```

7.1 STATUS WORD BIT DEFINITION

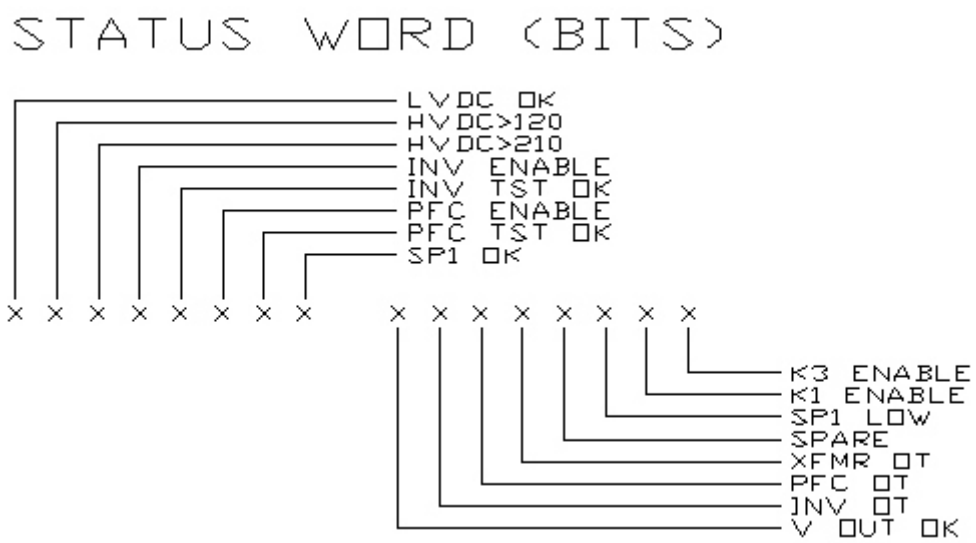

FIGURE 7 STATUS WORD DEFINITION

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.

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 MAINTENANCE

Due to the design and construction of the AC18, preventative maintenance is held to a modest level. The following table lists minimum recommended tasks and frequency.

TASK	FREQUENCY	COMMENTS
Tighten electrical connections 	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 licenced electrician or factory authorized technician.**
CPU Battery replacement 	Every 3 years	May require greater frequency with elevated ambient temperature, or extended periods of non-operation. **Refer to factory authorized technician.**
Calibration 	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.**

9 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	

Gibralter	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	