

Operations Manual



for the AC121 Series
Marine Power Converter

P/N 601053, Revision ~
Issued 9/25/09

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:

AC081 8kVA Marine Power Converter

AC121 12kVA Marine 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:

ASEA Power Systems
15602 Commerce Lane
Huntington Beach, CA. 92649
Phone (714) 896-9695
FAX (714) 896-9679
www.aseapower.com

TABLE OF CONTENTS

CERTIFICATION.....	2
WARRANTY	2
1 USING THIS MANUAL	3
2 SAFETY NOTICES.....	6
3 INTRODUCTION TO THE AC121	8
4 SPECIFICATIONS	10
4.1 ELECTRICAL SPECIFICATIONS.....	10
4.1.1 Input Service	10
4.1.2 Output Service	10
4.1.3 Control, Metering, and Status	11
4.2 PHYSICAL SPECIFICATIONS.....	11
4.2.1 Mechanical	11
4.2.2 Environmental.....	11
5 INSTALLATION.....	12
5.1 MECHANICAL INSTALLATION	14
5.2 ELECTRICAL INSTALLATION.....	16
5.2.1 Input Power Connections	17
5.2.2 Output Power Connections	18

6	OPERATION	
6.1	POWER TURN-ON PROCEDURE.....	20
6.2	AUTO-RESTART FEATURE	23
6.2.1	OPERATION	24
6.3	TURN OFF PROCEDURE.....	24
6.2	REMOTE COMMUNICATIONS	25
7	DIAGNOSTICS	32
7.1	REMOTE COMMUNICATIONS	33
8	MAINTENANCE	35
9	INTERNATIONAL POWER FORM REFERENCE	36

FIGURES

1	SYSTEM BLOCK DIAGRAM	8
2	CONTROLS	9
3	MECHANICAL OUTLINE, FRONT AND TOP.....	14
4	MECHANICAL OUTLINE, SIDE	15
5	INPUT AND OUTPUT CONNECTIONS	17
6	CONTROLS AND INDICATORS.....	20
7	RS-232C PINOUT	26
8	STATUS WORD BIT DEFINITIONS	33

2 SAFETY NOTICES

The Model AC121 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 AC121

The AC121 is a high performance Marine 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 vessel.

Dual-conversion technology is the preferred technique for AC power conversion, and was chosen for the AC121. 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 vessel. Being a unit designed from the ground up specifically for the marine 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.

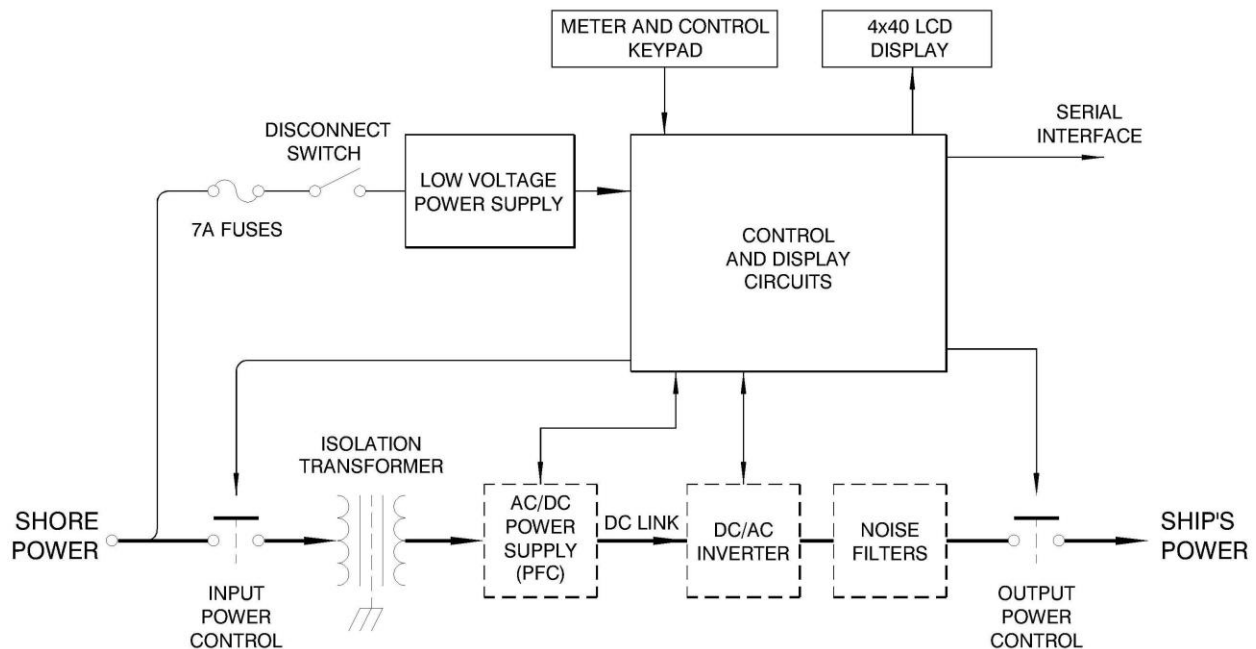


FIGURE 1 SYSTEM BLOCK DIAGRAM

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, the AC121 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.

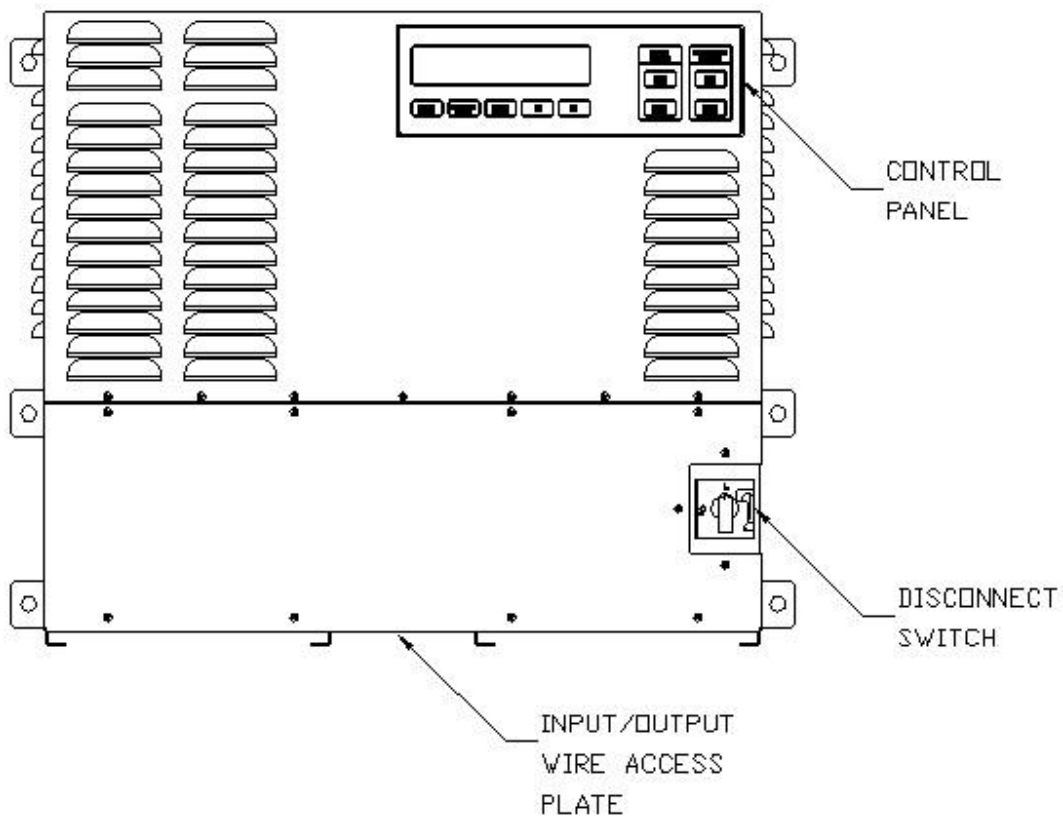


FIGURE 2 CONTROLS

4 SPECIFICATIONS

4.1 ELECTRICAL SPECIFICATIONS

<u>Parameter</u>	<u>AC081</u>	<u>AC121</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 110, 115, or 120 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	70 A _{RMS} @ 0.85 p.f.	100 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 SPECIFICATIONS, cont.

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

<u>Parameter</u>	<u>AC081</u>	<u>AC121</u>
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

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 vessel's 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 AC121 will be substantial, approximately 4750 BTU/Hr at maximum continuous load (3470BTU/Hr for the AC081).**



THE AC121 IS HEAVY, WEIGHING UP TO 230lbs 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 AC121 was designed for vertical bulkhead installations and as such is provided with six mounting ears, three per side. Mounting holes have been provided with 1/2" (12mm) diameters, stainless steel hardware in the range of 7/16" to 1/2" (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 AC121. Spacers (shim stock) may be added between the mounting surface and the AC121 mounting ears to adjust the mounting plane. Resilient mounts must not be used directly between the AC121 and the mounting surface. If the AC121 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 AC121 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 INSTALLATION, cont.

5.1 MECHANICAL INSTALLATION, cont.

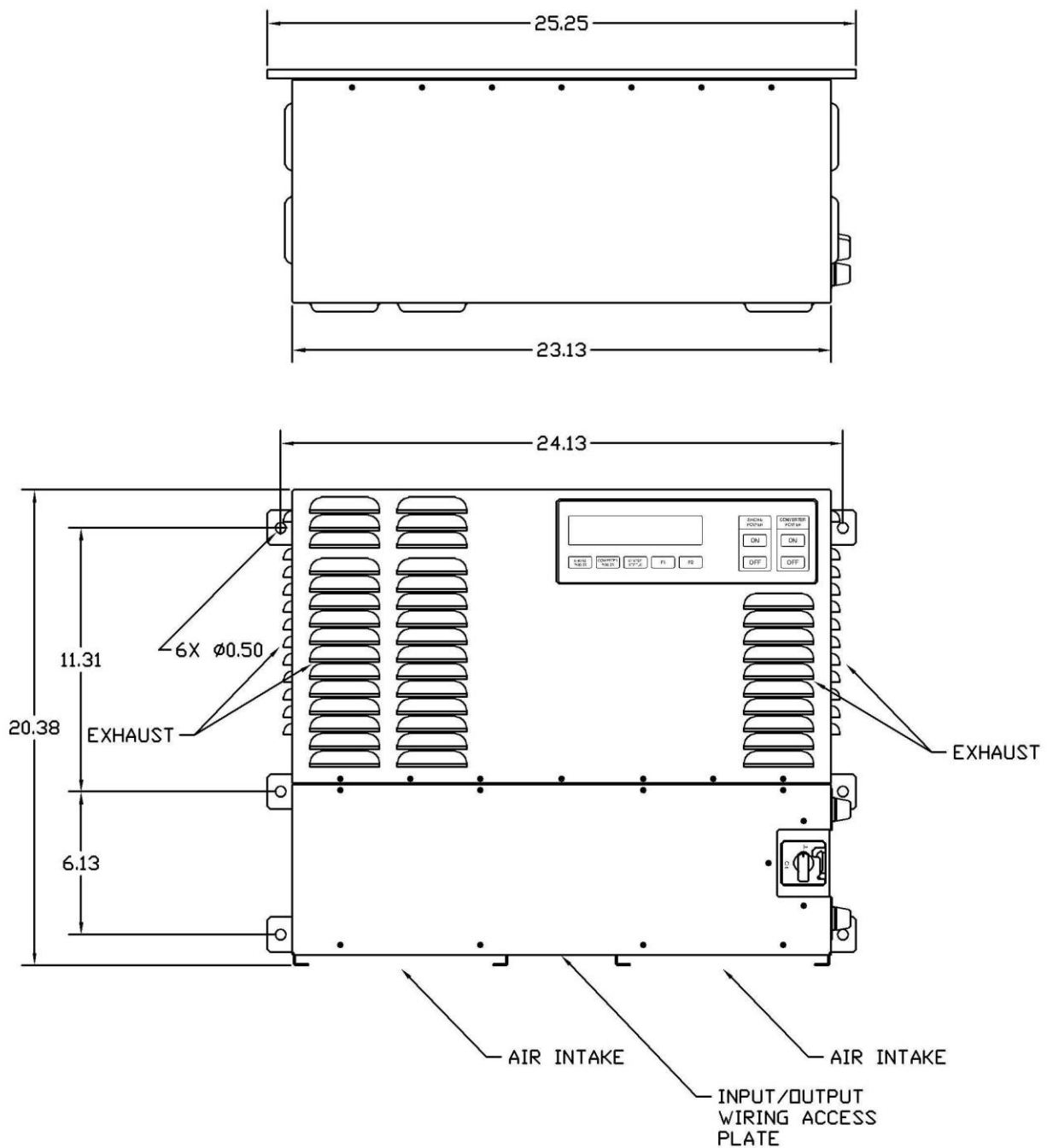


FIGURE 3 MECHANICAL OUTLINE, FRONT AND TOP

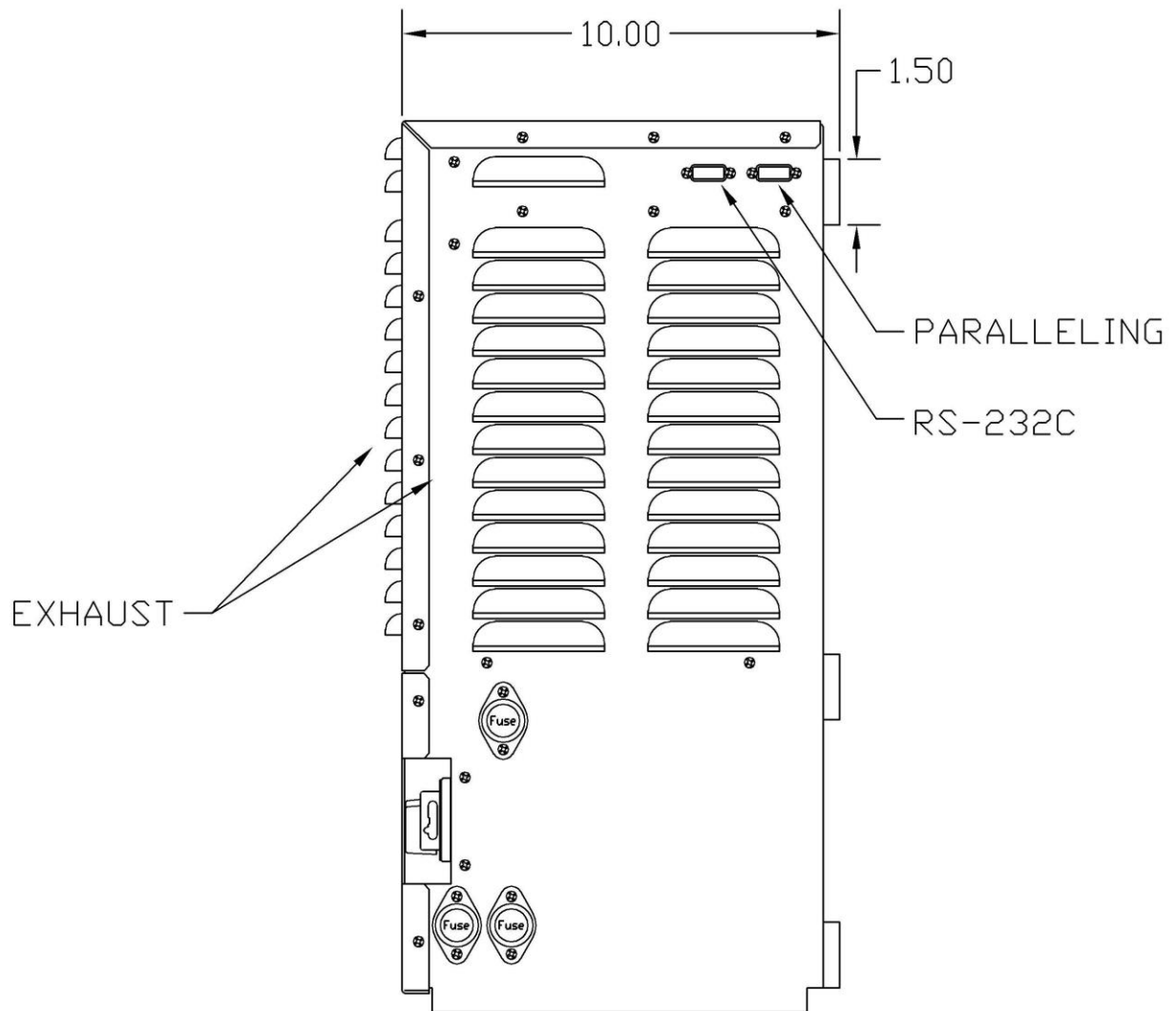


FIGURE 4 MECHANICAL OUTLINE, SIDE

5.2 ELECTRICAL INSTALLATION

This procedure assumes the physical installation of the AC121 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 12kVA AC121 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 AC121 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 PROCEDURES CAN RESULT IN DAMAGE TO THE EQUIPMENT, AND CAN PRESENT THE RISK OF INJURY OR DEATH TO THE INSTALLER OR THE OPERATOR.

5.2.1 Input Power Connections

The AC121 is 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". 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 AC121 is fully isolated with no phase orientation requirements to the input power service.

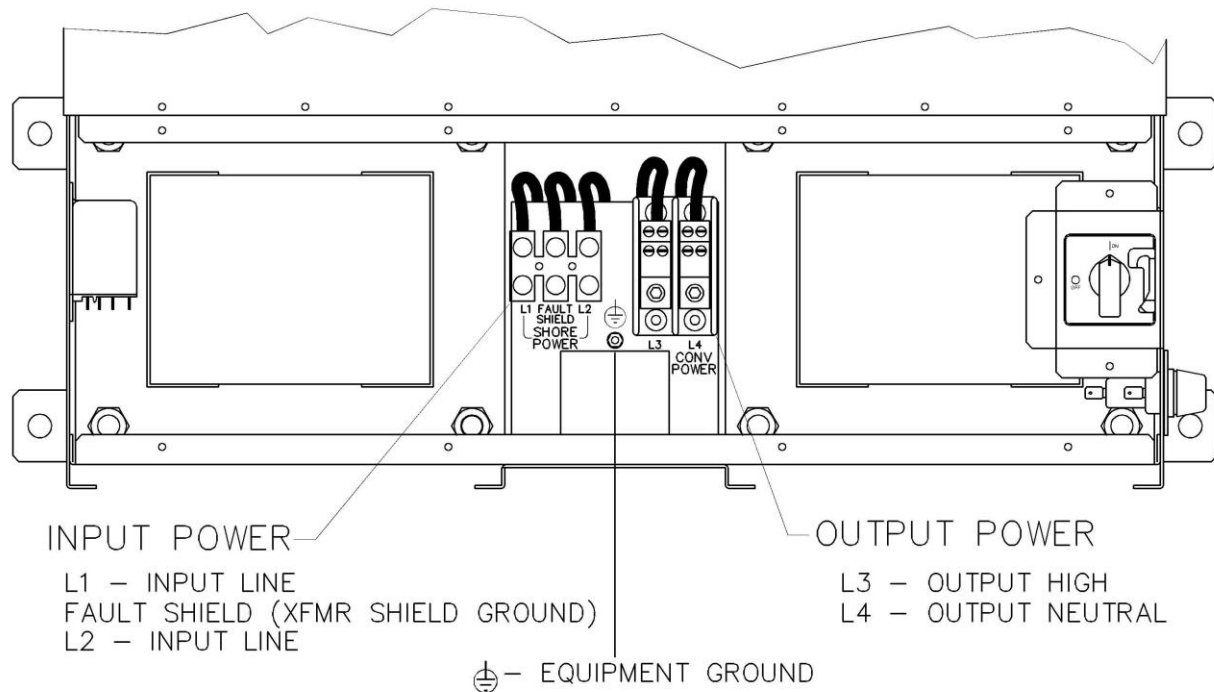


FIGURE 5 INPUT AND OUTPUT CONNECTIONS

5.2.2 Output Power Connections

The AC121 is supplied with compression type terminal blocks for output power connections. These terminal blocks accept wires in the range of 2/0 - 8AWG. A #10 stud is provided for connection to equipment ground. 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 AC121 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.

This page intentionally left blank

6 OPERATION

6.1 POWER TURN-ON PROCEDURE

Close the input (shore power) circuit breaker to the AC121. 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.

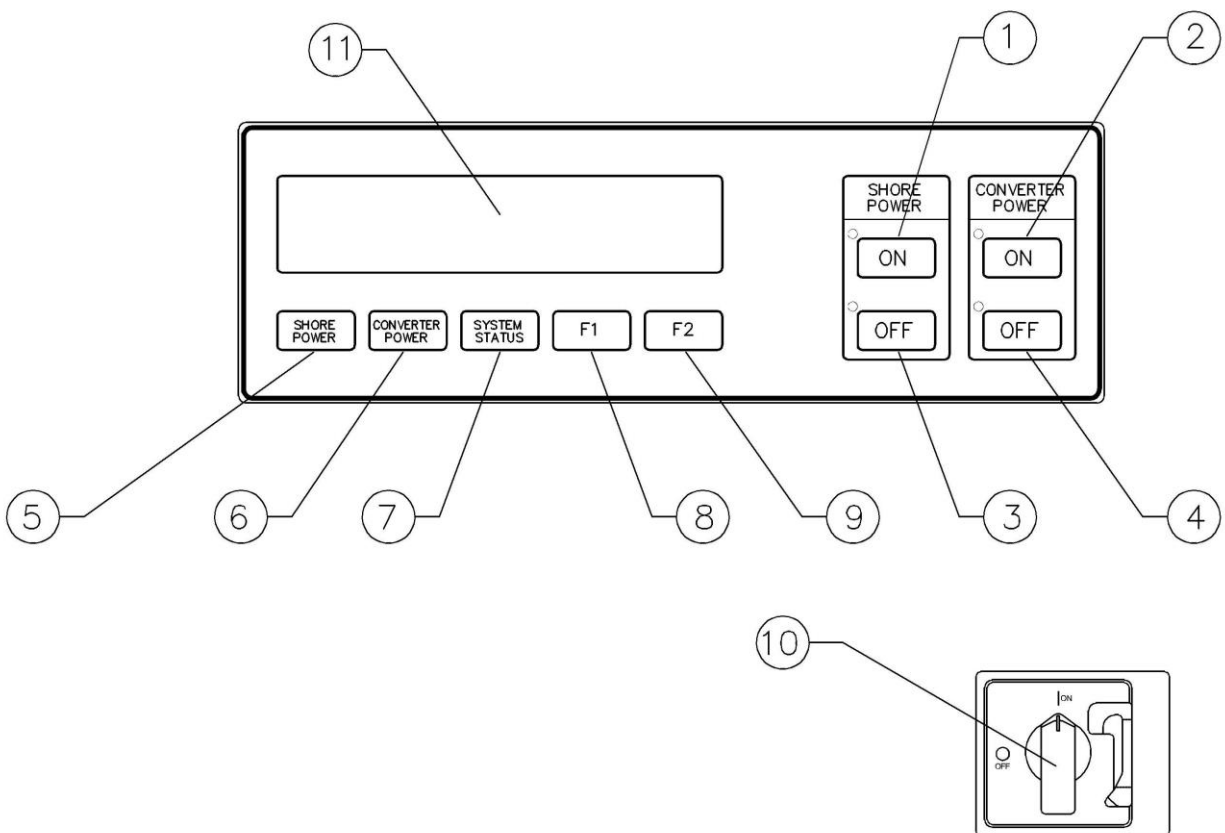


FIGURE 6 CONTROLS AND INDICATORS

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	ACXXX LOAD:XXX.X %
INPUT#1:OFFLINE	STATUS: OK
SYS:XXXXXXXXXXXXXXXXX	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	60.0Hz
VOLTAGE:	0 V	
CURRENT:	0 A	
LOAD:	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	60.0Hz
VOLTAGE:	120 V	
CURRENT:	2 A	
LOAD:	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 vessel's load to the AC121, press the CONVERTER POWER ON (2) button on the control panel. This will place voltage at the output terminals of the AC121. The green ON indicator LED should now be lighted. The vessel's load may be transferred to the AC121 at this time.

When load has been transferred to the AC121, 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 vessel's 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 AC121 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 AC121.

The AC121 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) and SYSTEM STATUS (5) buttons simultaneously, and selecting the appropriate menu item (the F1 (8) button under COMM).

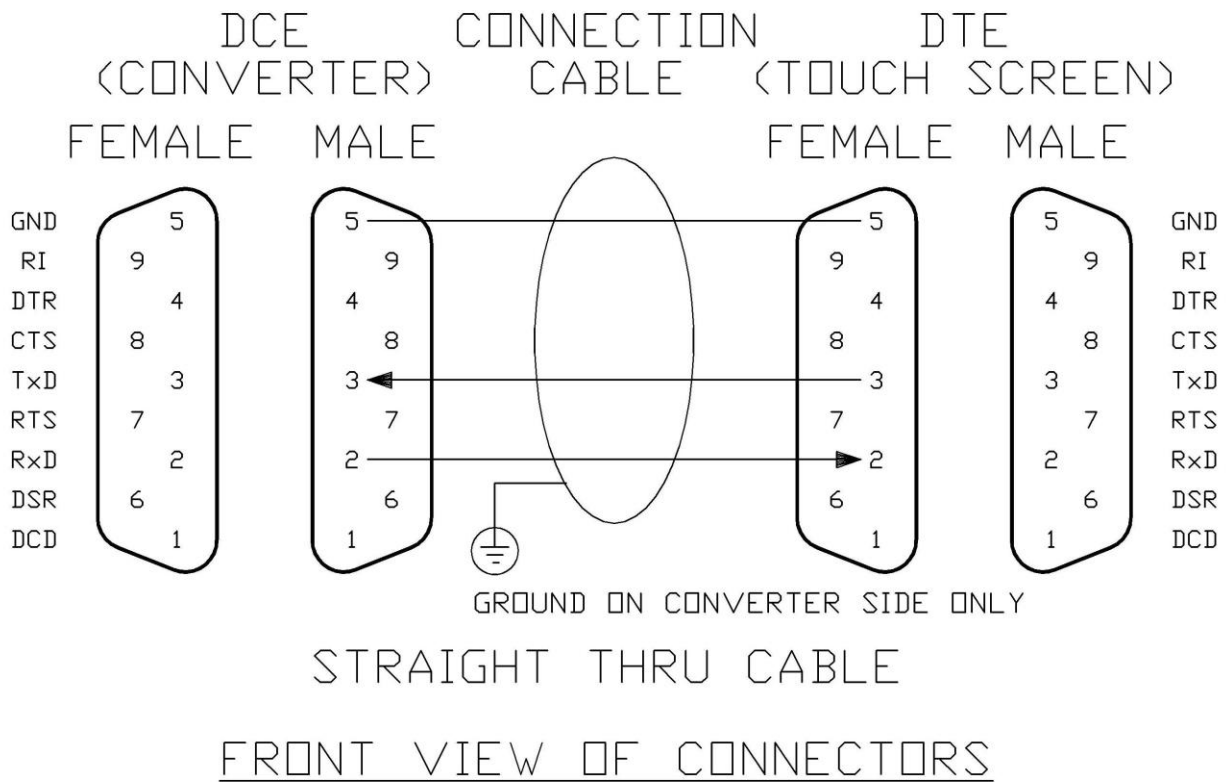
REMOTE INTERFACE CONFIGURATION		
BAUD: 19.2K	8-DATA BITS,1	START,1 STOP
PARITY: NONE	EOS: CR/LF	DEVCIE: DCE
HANDSHAKING: NONE	HALF-DUP	

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 DB9S (female, 9-pin D-subminiature connector). The pinout of the connector is standard for an RS-232C DCE (Data Communication Device). Figure 7 on page 26 demonstrates connection from a DCE to a DTE (Data Terminal Device as standard PC's are configured). 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 7 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; the question marks and 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.

<u>Command</u>	<u>Description</u>	<u>Comment</u>
*CLS	Comm Port Reinitialize	
*IDN	System Identification	
!~	Immediate command, Shore Off	
!#	Immediate command, :STATus:SW0	
:AGC:GAIN?	Automatic Gain Control response gain.	Gain setting
:AGC:GAIN <g>	Set Automatic Gain Control response gain. Range: $0.10 \leq g \leq 0.90$	
:AGC:STATE?	Automatic Gain Control Enable state	1 = Enabled, 0 = Disabled
:AGC:OFF	Disable Automatic Gain Control command	
:AGC:ON	Enable Automatic Gain Control command	
:AUTOSTART:ON	Enable AutoRestart function	
:AUTOSTART:OFF	Disable AutoRestart function	
:AUTOSTART:STATE?	State query	1=Enabled, 0=Disabled
: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.
:CORD:LEV?	Shore Cord Alarm Level (%)	Alarm Trigger Level
:CORD:LEV <d>	Set Shore Cord Alarm Level Range: $50 \leq d \leq 100$	
:CORD:RATE?	SP Cord Rating in Amperes	Standard Cord Rating in Amps
:CORD:RATE <d>	Set SP Cord Rating in Amperes Range: $30 \leq d \leq 250$	
:CORD:STATE?	Shore Cord Alarm Enable state	1 = Enabled, 0 = Disabled
:CORD:STATE 	Set Shore Cord Alarm Enable state	
:CORD:TEST?	Test if Cord Alarm is being asserted.	1 = Alarm, 0 = No alarm
:CORD:TEST 	1 = Turn Alarm On, 0 = Turn Alarm Off	
:DROOP:RATE?	Percentage of Vout to Droop	
:DROOP:RATE <d>	Set Droop percentage Range: $1\% \leq d \leq 5\%$	
:DROOP:STATE?	Droop Enable state.	1 = Enabled, 0 = Disabled
:DROOP:STATE 	Set Droop Enable state.	
:DROOP:DELAY?	Recovery Delay period	minutes
:DROOP:DELAY <d>	Set Droop Recovery Delay Range: $1 \leq d \leq 60$	
:KWH:CLEAR	Resets the kW-Hour Meter readings.	
:LOG:CLEAR	Clear all Event Log entries	
:LOG:COUNT	Number of events in Event Log	1 to 1000
:LOG:TOP	Query first item in Event Log	String <= 40 chars
:LOG:NEXT	Query next item in Event Log	String <= 40 chars
:LOG:PREVIOUS	Query previous item in Event Log	String <= 40 chars

6.5 REMOTE COMMUNICATIONS, cont.

<u>Command</u>	<u>Description</u>	<u>Return Value Range</u>
:MAX:CLEAR	Command to clear/refresh all maximum measurements	
:MEAS:CONV:ALL	VOLT1, VOLT2, CURR1, CURR2, kW1, kW2, FREQ	See above, expressed in 3.2 precision
:MEAS:CONV:CURR1	Converter Output #1 RMS Current	Real number, 0 to 1000
:MEAS:CONV:FREQ	Converter Output Frequency	Real number, 0 to 100
:MEAS:CONV:KVA1	Converter Output #1 kVA	Real number, 0 to 1000
:MEAS:CONV:POW1	Converter Output #1 kW	Real number, 0 to 1000
:MEAS:CONV:MAXRAT	Maximum output percent of rated	Percentage
:MEAS:CONV:MAXPOW	Maximum output power usage.	kW
:MEAS:CONV:MAXAMP	Maximum output current usage.	Amps RMS
:MEAS:CONV:MAXRAT1	Maximum output#1 percent of rated	Percentage
:MEAS:CONV:MAXPOW1	Maximum output#1 power usage.	kW
:MEAS:CONV:MAXAMP1	Maximum output#1 current usage.	Amps RMS
:MEAS:CONV:MAXFREQ	Maximum output frequency.	Hertz
:MEAS:CONV:MINFREQ	Minimum output frequency.	Hertz
:MEAS:CONV:PF1	Converter Output #1 Power Factor	Real number, 0 to 1.00
:MEAS:CONV:VOLT1	Converter Output #1 Voltage	Real number, 0 to 1000
:MEAS:CONV:WF:VLL	Output voltage waveform Phase A to B	Comma separated voltages
:MEAS:CONV:WF:CURR1	Output current waveform Phase A	Comma separated currents
:MEAS:CONV:WF:SPC	Output waveform sample count	Typical: 64spc @50Hz, 54spc@ 60Hz (samples-per-cycle)
:MEAS:CONV:WF:VOLT1	Output voltage waveform Phase A to N	Comma separated voltages

6.5 REMOTE COMMUNICATIONS, cont.

<u>Command</u>	<u>Description</u>	<u>Return Value Range</u>
:MEAS:MAXAMP	Maximum system current usage	Amps RMS
:MEAS:MAXPOW	Maximum system power usage	kW
:MEAS:MAXRATE	Maximum system percent of rated	Percentage
:MEAS:RATE	Active percent of rated power usage	Percentage
:MEAS:SP:ALL	VLL1,CURR1, kVA, FREQ	Real numbers, comma delimited, 3.2 precision
:MEAS:SP:CURR1	Shore Power A RMS Current	Real number, 0 to 1000
:MEAS:SP:FREQ	Shore Power Frequency	Real number, 0 to 100
:MEAS:SP:KVA1	Shore Power Phase A kVA	Real number, 0 to 1000
:MEAS:SP:KWH	Accumulated SP kilo-Watt-Hours.	kW-Hours
:MEAS:SP:POW1	Shore Power Phase A kW	Real number, 0 to 1000
:MEAS:SP:PF1	Shore Power Phase A Power Factor	Real number, 0 to 1.00
:MEAS:SP:MAXAMP	Maximum input#1 current usage.	Amps RMS
:MEAS:SP:MAXFREQ	Maximum input frequency.	Units: Hertz
:MEAS:SP:MAXPOW	Maximum input#1 power usage.	kW
:MEAS:SP:MAXRAT	Maximum input#1 percent of rated	Percentage
:MEAS:SP:MINFREQ	Minimum input frequency. Units: Hertz	
:MEAS:SP:VLL1	Shore Power A-B Voltage	Real number, 0 to 1000
:MEAS:SP:WF:SPC	Input waveform sample count	Typical:64spc@50Hz 54spc, @ 60Hz (samples-per-cycle)
:MEAS:SP:WF:VOLT1	SP1 input voltage waveform L1-L2	Comma separated voltages
:MEAS:SP:WF:CURR1	SP1 input current waveform L1-L2	Comma separated currents

6.5 REMOTE COMMUNICATIONS, cont.

<u>Command</u>	<u>Description</u>	<u>Comment</u>
: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.
:STAT:SW1	Status Word #1	Integer, 0-65535
:STAT:SP1	Shore Power Contactor State	1 = Closed, 0 = Open
:SYST:CONF	System Configuration	Integer, 0-65535
:SYST:ERR	0=Successful Communiqué -100=Command Error (includes: parity, framing, and overrun errors) -200=Execution Error -300=Device Specific Error -400=Query Error	

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	STATUS: 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)20XX 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 DEFINITION

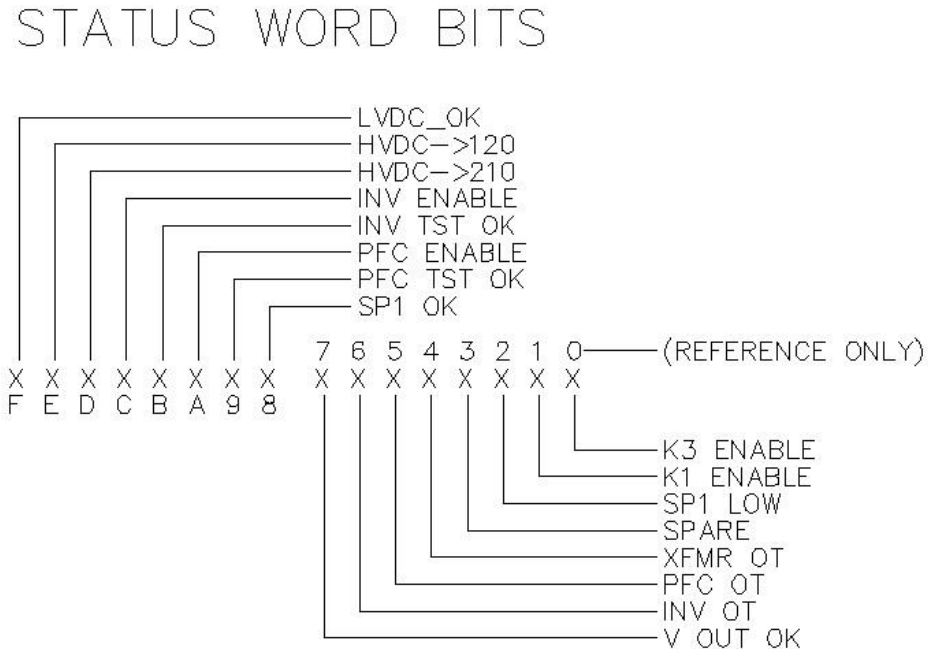


FIGURE 8 STATUS WORD BIT DEFINITIONS







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.
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	Input transformer over-temperature condition.
SPARE	Spare
SP1 LOW	The logic has determined the shore power input is in the low range, 170-270VAC 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 converter power button is pressed.

8 MAINTENANCE

Due to the design and construction of the AC121, 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.

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	
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	