

Installation Instruction Manual

141536
A31-5K-120V-A6-100N-02672
A31 Inverter
5000 VA Output
120 Volts DC Input
120 Vac Output
60 HZ Output
100 Nickel Cells
Options Description.....
22P PRIME STATIC SWITCH 1MS
06C DC AMMETER (2%)
06D DC VOLTMETER (2%)
22A 22A RELAY PACKAGE
22D DIG METER PKG (22P & 22S)
09V I. D. TAGS (WBW)
311 SPL DATA ON DWGS PER CUST
09W WIRE MARKERS-HEAT SHRINK



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A31

DC – AC Sine Wave Inverter



Installation and Operation Manual

This manual is subject to change without notice. You may obtain the newest version of the manual at www.lamarchemfg.com

Important Safety Instructions

Before using this equipment, read all manuals and other documents related to this inverter and other equipment connected to this inverter. Always have a copy of an inverter's manual on file nearby, in a safe place; if a replacement or latest copy of a manual is needed, it can be found at www.lamarchemfg.com.

Electrical Safety



WARNING: Hazardous Voltages are present at the input of power systems. The output from inverters and from batteries may be low in voltage, but can have a very high current capacity that may cause severe or even fatal injury.

When working with any live battery or power system, follow these precautions:

- Never work alone on any live power system; someone should always be close enough to come to your aid.
- Remove personal metal items such as rings, bracelets, necklaces, and watches.
- Wear complete eye protection (with side shields) and clothing protection.
- Always wear gloves and use insulated hand tools.



WARNING: Lethal voltages are present within the inverter. Parts inside the inverter may still be energized even when the inverter has been disconnected from the AC input power. Check with a meter before proceeding. Do not touch any uninsulated parts.

- A licensed electrician should be used in the installation of any inverter.
- Always disconnect the inverter from the supply, batteries, and loads before performing maintenance, replacing parts, or cleaning.
- Always assume that an electrical connection is live and check the connection relative to ground.
- Be sure that neither liquids nor any wet material come in contact with any internal components.
- Do not operate this inverter outside the input and output ratings listed on the inverter nameplate.
- Do not use this inverter for any purpose not described in the operation manual.

Mechanical Safety

- This inverter or parts of the inverter may get very hot during normal operation, use care when working nearby and do not place any items on top of the inverter.
- Do not expose equipment to rain or snow. Always install in a clean, dry location.
- Do not operate equipment if it has received a sharp blow, been dropped, or otherwise damaged in any way.
- Do not disassemble this inverter. Incorrect re-assembly may result in a risk of electric shock or fire.
- If modifications to the enclosure are necessary, such as drilling for conduit fitting, ensure the interior is protected from metal shavings and debris. Additional precautions should be taken to remove any remaining debris from interior of inverter prior to energizing.

Battery Safety



WARNING: Follow all of the battery manufacturer's safety recommendations when working with or around battery systems. DO NOT smoke or introduce a spark or open flame in the vicinity of a battery. Some batteries generate explosive gases during normal battery operation.

- If it is necessary to remove battery connections, always remove the grounded terminal from the battery first.
- Remove personal metal items such as rings, bracelets, necklaces, and watches.
- Always wear rubber gloves, safety glasses, and a rubber lined vest/apron when working near a battery.
- Have plenty of fresh water and soap nearby in case battery electrolyte contacts skin, clothing, or eyes.
- If the battery electrolyte contacts skin or clothing, wash immediately with soap and water.
- If the electrolyte enters the eye, immediately flood the eye with running cold water for at least ten (10) minutes and seek medical attention immediately.
- Do not drop or place any materials on a battery. A spark or short-circuit could cause an explosion.

Inverter Location

- Allow at least 6 inches of free air on all vented surfaces for proper cooling.
- Allow sufficient clearance to open the front panel for servicing.
- Do not operate this inverter in a closed-in area or restrict ventilation in any way.
- Do not place inverter below battery.
- Never allow battery electrolyte to drip on this inverter when reading the specific gravity or filling the battery.
- Never place this inverter directly above a standard flooded battery. Gases from the battery will corrode and damage equipment.
- A sealed maintenance free or valve regulated lead acid (VRLA) battery may be placed below this equipment.

Check for Damages

Prior to unpacking the product, note any damage to the shipping container and take pictures. Unpack the product and inspect the exterior and interior of product for damage. If any damage is observed, take pictures and contact the carrier immediately to file a damage claim. Contact La Marche for a Return Material Authorization number to have the inverter sent back for evaluation and repair.



CAUTION: Failure to properly file a claim for shipping damages, or provide a copy of the claim to La Marche, may void warranty service for any physical damages reported for repair.

Returns for Service

Save the original shipping container. If the product needs to be returned for service, it should be packaged in its original shipping container. If the original container is damaged/unavailable, make sure the product is packed with at least three inches of shock-absorbing material to prevent shipping damage. *La Marche is not responsible for damage caused by improper packaging of returned products.*

Inspection Checklist

- Enclosure exterior and interior is not marred or dented.
- There are no visibly damaged components.
- All internal components are secure.
- Printed circuit boards are firmly seated.
- All hardware and connections are tight.
- All wire terminations are secure.
- All items on packing list have been included.

Handling

Equipment can be very heavy with uneven distribution of weight. Use adequate manpower or equipment for handling. Until the equipment is securely mounted, care must be used to prevent equipment from being accidentally tipped over or dropped.

Table of Contents

Important Safety Instructions	i
Electrical Safety	i
Mechanical Safety	i
Battery Safety	i
Inverter Location	ii
Check for Damages	ii
Returns for Service	ii
Inspection Checklist	ii
Handling	ii
Table of Contents	iii
Model Scope/General Description	1
Understanding the Model Number	1
1.0 Equipment Handling	2
1.1 Storing the A31	2
1.2 Moving the A31	2
2.0 Installation	2
2.1 Mounting the A31	2
2.1.1 Rack-Mounting the A31	3
2.1.2 Floor-Mounting the A31	4
2.2 Making the DC Input Connections	5
2.3 Making the AC Output/AC Bypass Line Connections	6
3.0 Operation	6
3.1 A31 Start-Up	6
3.2 Checking the Installation	6
3.3 Start-Up Sequence	6
3.4 LED Indicators	8
3.5 Factory Settings	8
4 Service	9
4.1 Performing Routine Maintenance	9
4.2 Troubleshooting Procedure	10
4.3 Troubleshooting Chart	11
Appendix A: A31 Specifications	13
Appendix B: Power Wiring Guide	14
Appendix C: Manufacturer's Standard Warranty	15
Appendix D: Manufacturer's Extended Parts Warranty	16
Appendix E: Document Control and Revision History	17

Model Scope/General Description

The La Marche Model A31 is a transistorized DC to AC inverter designed to power an AC load.

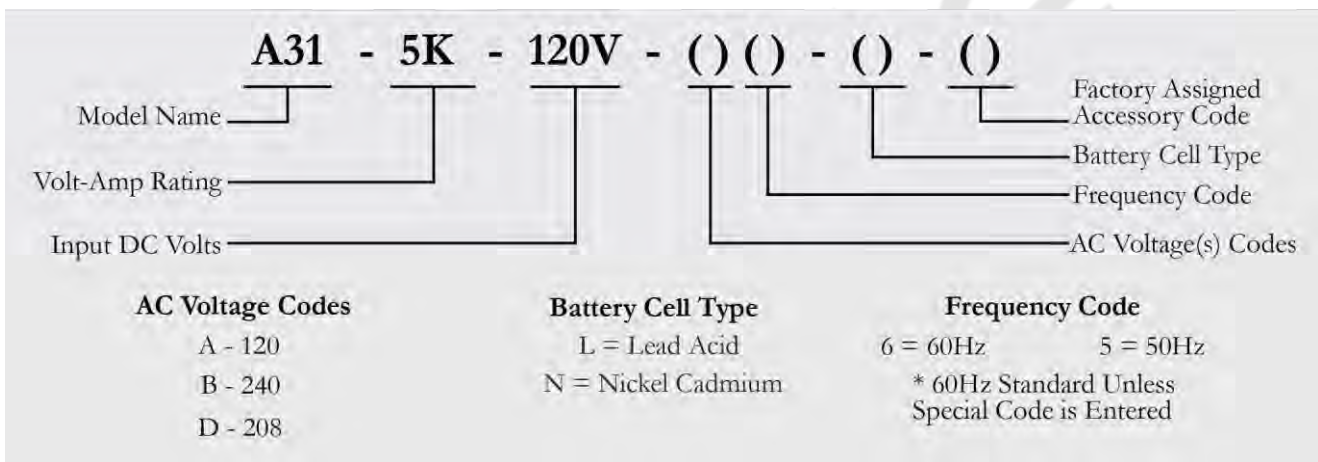
The Model A31 will provide a sine wave output with approximately 5% total harmonic distortion into AC loads with power factors up to 0.8 over a wide DC input range.

The ferroresonant output transformer provides input to output isolation, output regulation, current limiting, and filtering. The DC input from the battery source is switched by transistors in all solid-state electronic circuitry to produce a sine wave output.

The DC input sources are sensed for low and high voltage conditions, the unit is turned off automatically if the DC input is not within the proper range.

Understanding the Model Number

The A31 model number is coded to describe the features that are included. Find the model number on the nomenclature nameplate of the inverter. Follow the chart below to determine the configuration of the inverter.



Optional Accessories Included in the Inverter

This inverter may have been outfitted with a number of optional accessories or option packages. To determine the options included (if any) refer to the cover page of the manual package. If the manual package that is included with the inverter is no longer available, contact La Marche and provide the model or serial number of the inverter to receive a list of the included accessories.

1.0 Equipment Handling

1.1 Storing the A31

If the A31 is to be stored for more than a few days after delivery, it should be stored within its shipping container. The location chosen for storage should be within an ambient temperature of -40 to 140°F (-40 to 60°C) with a non-condensing relative humidity of 0 to 95%. Storage should not exceed 2 years due to the limited shelf life of the DC filtering capacitors when they are not in service.

1.2 Moving the A31

After careful inspection and upon verification that the A31 is undamaged, identify the enclosure style and weight of the A31 inverter. Refer to the table below:

Output Voltage	AC Output									
	1KVA	1.5KVA	2KVA	3KVA	4KVA	5KVA	7.5KVA	10KVA	15KVA	20KVA
24 VDC	9D Case 170.1 lbs 77.1 kg	9D Case 85 lbs 38.6 kg	9E Case 230 lbs 104.3 kg							
48 VDC	9D Case 176 lbs 79.8 kg	9D Case 195 lbs 88.4 kg	9E Case 225 lbs 102 kg	9E Case 267 lbs 121.1 kg	9E Case 205 lbs 156.9 kg	9E Case 240 lbs 170.1 kg		44 Case 910 lbs 412.7 kg		
120 VDC	9D Case 182 lbs 82.5 kg	9E Case 220 lbs 99.8 kg	9E Case 230 lbs 104.3 kg	9E Case 288 lbs 130.6 kg	9E Case 330 lbs 149.7 kg	9E Case 372 lbs 168.7 kg	72 Case 715 lbs 324.3 kg	72 Case 758 lbs 343.8 kg	44 Case 1170 lbs 530.6 kg	47B Case 1900 lbs 861 kg

Table 1 – Case Type and Weight Table

2.0 Installation

2.1 Mounting the A31

When mounting the A31 in any configuration, consider the size and weight of the inverter. The rack and/or floor must be able to support the weight of the inverter, as well as an additional safety factor. Refer to data sheet to verify the weight of the inverter and the method of mounting using the table below. The location chosen for the inverter **should be within an ambient temperature range of 32°F to 122°F (0°C to 50°C) with a non-condensing relative humidity no higher than 95%**. The inverter should be mounted in an area free of explosive materials and away from any liquids. The A31 utilizes convection cooling so a clearance of at least 6 in (152 mm) of free air must be maintained on the top, bottom, left and right side for cooling air. Maintain 36 in (914 mm) or more of clearance at the front of the inverter in order to allow for operation and maintenance. The bolts or screws used to secure the inverter should be sufficient length to assure a vibration-free mounting. The preferred fastener is a machine bolt backed with a flat washer, lock washer, and nut. All hardware should be corrosion resistant.

Enclosure Number	Cable Entry		Standard Mounting
	AC Input	DC Output	
39	Right	Left	19"/23" Rack
33	Right/Top/Bottom	Left/Top/Bottom	23" Rack
9D	Right	Left	23" Rack
9E	Right	Left	23" Rack
70	Bottom	Bottom	Floor
72	Top/Bottom	Top/Bottom	Floor
44	Top/Bottom	Top/Bottom	Floor
47B	Top/Bottom	Top/Bottom	Floor

Table 2 – Mounting Methods

2.1.1 Rack-Mounting the A31

The A31 can be installed in most relay racks with standard EIA hole spacing. If a relay rack is needed, they are available for purchase from La Marche. The 9D, 9E, 33, and 39 enclosures are shipped from the factory with the necessary brackets installed for rear mounting on a relay rack. The rack mounting bracket for the 39 enclosure allows for mounting on a 19" or 23" rack, and the 9D, 9E, and 33 enclosures allow for mounting on a 23" rack.

Rack Mounting Procedure

Before installing the inverter on the rack, locate the conduit entrances and assure the knockouts on the top, sides, or bottom of the inverter are accessible after the inverter is rack mounted. Provide at minimum 6in (152mm) of air space above and below to allow for cooling.

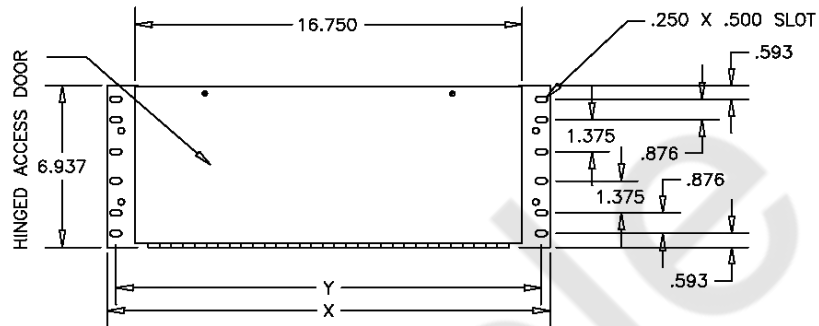


Figure 1 - 39 Enclosure Bolt Pattern

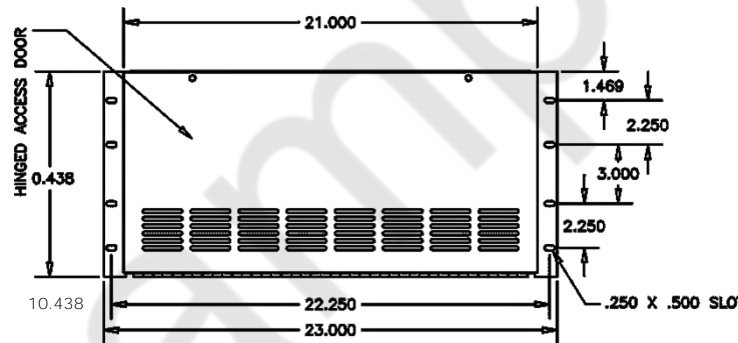


Figure 2 - 33 Enclosure Bolt Pattern

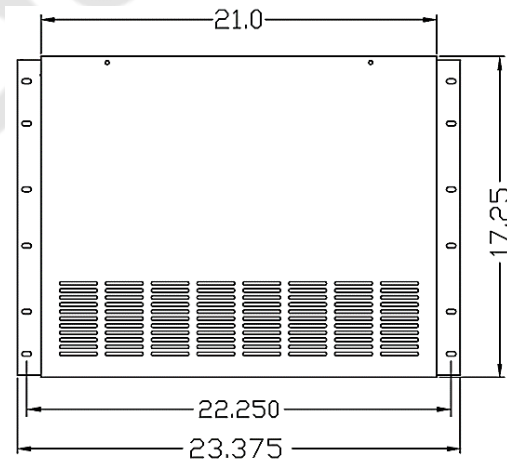


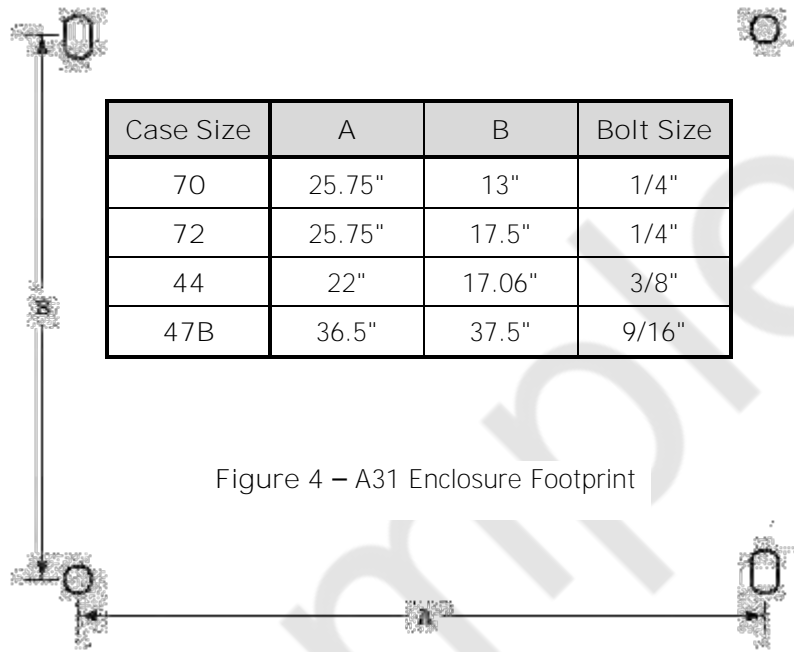
Figure 3 - 9D/9E Enclosure Bolt Pattern

NOTE: All dimensions are in inches. For further A31 enclosure information, see the outline drawings online at <http://www.lamarchemfg.com/info/enclosure-drawings.html>

2.1.2 Floor-Mounting the A31

Floor-Mounting Procedure

Floor-mounting the 70, 72, 44, and 47B enclosures is standard. To floor-mount the A31, install four anchor bolts into the floor. Place the inverter on the anchor bolts, add appropriate mounting hardware, and tighten securely. Refer to the figure below for hardware specifications and floor-mounting dimensions. All dimensions are given in inches.



2.2 Making the DC Input Connections

Before beginning any work inside the inverter, ensure that all incoming AC/DC power is de-energized and/or isolated. Verify that no voltage is present inside the case by using a voltmeter at all input and output terminals. Assure the inverter that is being used is the same number and type of cell as the inverter front nameplate specifications. Select wire size using the table below. This is based on an overload current of 110-115% of the input current listed on the inverter nameplate.

NOTE: Feeder breaker should be sized to match the size of the DC protection used in inverter.

Breaker Size/ Fuse Size (Amps)	Minimum Wire Size Requirement for Customer Connection	Equipment Grounding Conductor Minimum
3	#14	#14
5	#14	#14
10	#14	#14
15	#14	#14
20	#12	#12
25	#10	#12
30	#10	#10
40	#8	#10
50	#8	#10
60	#6	#10
70	#6	#8
80	#4	#8
90	#4	#8
100	#4	#8
125	#2	#6
150	#1	#6
175	#1/0	#6
200	#2/0	#6
250	#4/0	#4
300	250 MCM	#4

Table 4 – AC/DC & Ground Wire Size Minimum Requirements
(All wires specified in the table are rated at 90 °C or 194 °F)

NOTE: These are recommended sizes per La Marche Standards. The National Electrical Code (NEC) and Local Wiring Codes must be followed.

DC Connection Procedure

Select proper size for the DC wires using the table above. If the distance between the inverter's DC input and the battery/load exceeds 10 feet, use the Power Wiring Guide in Appendix B to minimize the voltage drop across the wire distance.

Make sure that the AC/DC breakers and the Inverter ON/OFF switch are OFF. Check polarity of DC input cables and verify with multimeter. The positive battery wire should be connected to the POS terminal and the negative battery wire should be connected to the NEG terminal.

NOTE: It is recommended to use a battery disconnect breaker between inverter and battery bank; helpful during battery or inverter maintenance.

2.3 Making the AC Output/AC Bypass Line Connections

A terminal strip is provided for the AC load, as well as for the AC bypass line if applicable. Before beginning any work inside the inverter, ensure that all incoming AC/DC power is de-energized and/or isolated. Verify that no voltage is present inside the inverter by using a voltmeter at all input and output terminals.

First, select wire size using the Table 4. Connect an adequate earth ground lead (use table on previous page for sizing) to the terminal marked ground and to the LINE SYNC INPUT (GND) terminal.

For the AC load, connect the AC load phase (hot) to the LOAD (Ø) terminal and the AC load neutral to the LOAD (N) terminal.

For the AC bypass line, connect the AC bypass line phase (hot) to the LINE SYNC INPUT (Ø) terminal and the AC bypass line neutral to the LINE SYNC INPUT (N) terminal.

NOTE: For inverters with the static switch option (22P, 22S, 164, or 165), also connect the AC bypass line phase (hot) to the LINE (Ø) terminal and the AC bypass line neutral to the LINE (N) terminal.

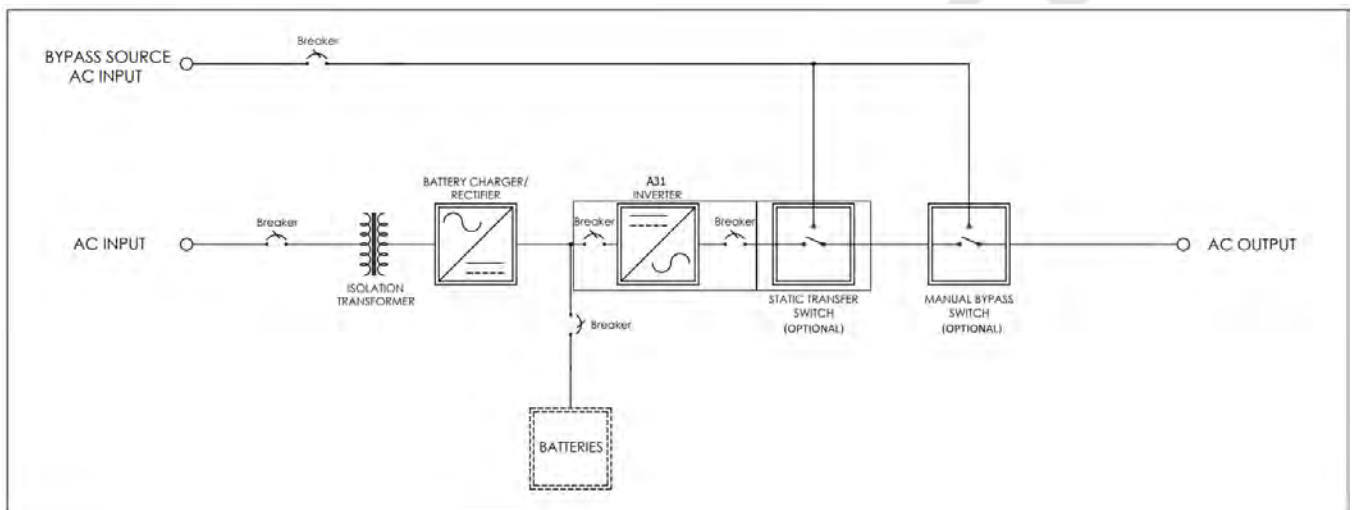


Figure 5 – One-Line Diagram for Typical A31 Inverter Application

3.0 Operation

3.1 A31 Start-Up

All equipment is shipped from the factory fully inspected and adjusted to manufacturer defined default values based on the model number. Do not make any adjustments unless the equipment has been energized and the settings have been determined to be incorrect.

3.2 Checking the Installation

Before attempting to start up the A31, check and verify that all connections are correct. Check that all terminations and contacts are tightened securely. Check for any loose connections or unsecured components in the inverter. Verify that the AC bypass line and battery/load voltage match the voltages on the nameplate of the inverter.

3.3 Start-Up Sequence

Before starting the A31 inverter, determine whether the inverter does or does not have the static switch option (22P, 22S, 164, or 165) by referring to the front page of the manual, then follow the appropriate instructions below:

For Standard Inverters (No Static Switch):

1. Push and hold the Pre-Charge button until the green READY LED illuminates. *
2. Release the Pre-Charge button and immediately turn on the DC breaker, then turn the inverter ON/OFF switch (SW-1) to the ON position. The inverter should begin to emit a humming sound.
3. Turn on the AC breaker.
4. Measure the output voltage of the inverter across the AC LOAD terminals to assure that it agrees with nameplate.

For Inverters with 1ms Static Switch (Option 22P/22S):

1. Push and hold the Pre-Charge button until the green READY LED illuminates. *
2. Release the Pre-Charge button and immediately turn on the DC breaker, then turn the inverter ON/OFF switch (SW-1) to the ON position. The inverter should begin to emit a humming sound.
3. Turn on the AC breaker. The front panel LEDs will perform a lamp test. After the lamp test, the Inverter Available LED should be lit. For option 22P, the Preferred Source LED should also be lit. For option 22S, the Alternate Source LED should also be lit.
4. Turn on the AC bypass source (utility). After a couple of seconds, and the Phase Lock and Utility Available LEDs should additionally be on. Assure the inverter is set to Auto Retransfer by setting the Retransfer toggle switch to Auto. For inverters with Option 22D, please read the appropriate instruction manual. For option 22S, the Preferred Source LED should also turn on and the Alternate Source LED turn off.
5. Measure the output voltage of the inverter across the AC LOAD terminals to assure that it agrees with nameplate.

For Inverters with 10-15ms Static Switch (Option 164/165):

1. Push and hold the Pre-Charge button until the green READY LED illuminates. *
2. Release the Pre-Charge button and immediately turn on the DC breaker, then turn the inverter ON/OFF switch (SW-1) to the ON position. The inverter should begin to emit a humming sound.

Inverter Prime (Option 164):

- A. Turn on the AC breaker. The LOAD ON PRIME and PRIME AVAIL. LEDs should be lit on the 139A static switch board. On the front panel, the green INVERTER AVAILABLE LED should be lit.
- B. Turn on the AC bypass source (utility). The yellow BYPASS AVAILABLE LED should additionally be lit.
- C. Measure the output voltage of the inverter across the AC LOAD terminals to assure that it agrees with nameplate.

Inverter Standby (Option 165):

- A. Turn on the AC breaker. The LOAD ON PRIME and PRIME AVAIL. LEDs should be lit on the 139A static switch board. On the front panel, the green INVERTER AVAILABLE and the red LOAD ON ALTERNATE LED should be lit.
- B. Turn on the AC bypass source (utility). The yellow BYPASS AVAILABLE LED should additionally be lit. The LOAD ON ALTERNATE LED should be off after a couple of seconds.
- C. Measure the output voltage of the inverter across the AC LOAD terminals to assure that it agrees with nameplate.

CAUTION: Before resetting the DC breaker, the pre-charge instructions must be followed before restarting the inverter or damage to the inverter may occur.

**NOTE: If the green READY LED does not light, check the type and number of cells of the battery to verify that it is correct. If the red REVERSE POLARITY LED illuminates, the battery has not been installed correctly. Disconnect the battery wires immediately or damage to the inverter may occur.*

3.4 LED Indicators

All A31 inverters include the S2A-167S oscillator/line sync board which has voltage sensing circuitry and oscillator circuits, providing protection for low/high DC input voltages and assuring the inverter output syncs with the AC bypass line. The S2A-167S board includes 3 red status LEDs, as follows:

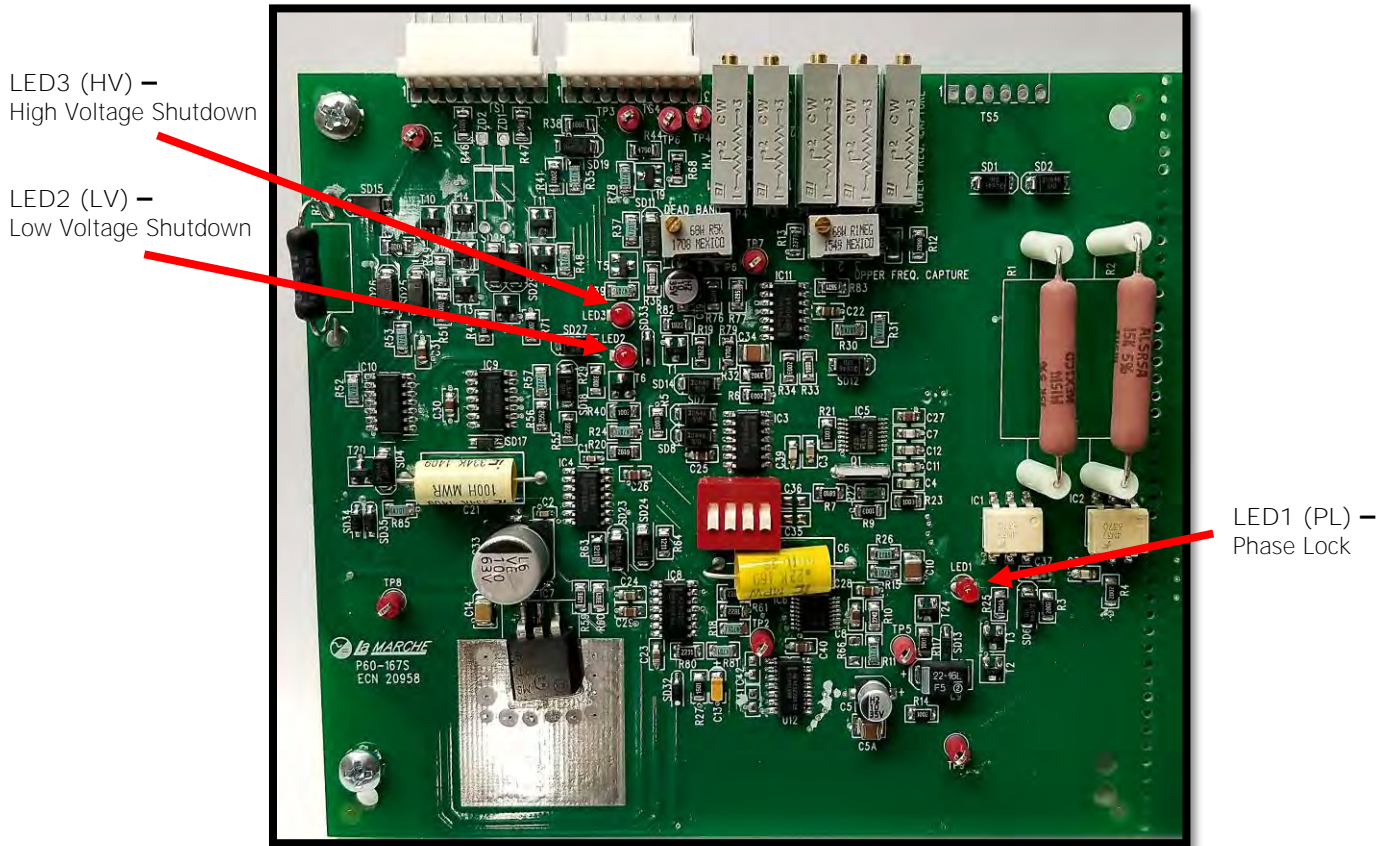


Figure 6 – S2A-167S Oscillator/Line Sync Board

Phase Lock (PL) – This PL LED will turn on if the inverter output is in sync with the AC bypass line.

High DC Voltage (HV) – This HV LED will turn on and output from the inverter will be inhibited if the DC input voltage rises above the specified voltage threshold. The LED will turn off once the high DC voltage condition is no longer present.

Low DC Voltage (LV) – The LV LED will turn on and output from the inverter will be inhibited if the DC input voltage falls below the specified voltage threshold. The LED will turn off and the inverter output will once the low DC voltage condition is no longer present.

3.5 Factory Settings

All A31 inverters are set at the factory based on the model number with the following settings:

- | | |
|------------------------------------|---------------------------------------------------------------|
| <i>Low DC Voltage Shutdown:</i> | <i>1.73 V/C for LA</i>
<i>1.10 V/C for NC</i> |
| <i>High DC Voltage Shutdown:</i> | <i>2.45 V/C for LA</i>
<i>1.60 V/C for NC</i> |
| <i>Phase Lock Frequency Range:</i> | <i>57.5 Hz – 62.5 Hz</i> |
| <i>Current Limit:</i> | <i>150% of nominal output current (fixed; not adjustable)</i> |

NOTE: V/C – Volts per Cell, LA – Lead Acid, NC – Nickel Cadmium, Hz – Hertz

4 Service

All work inside the A31 inverter should be performed by qualified personnel. La Marche is not responsible for any damages caused by an unqualified technician.



Before working inside the A31, ensure the AC power is off at the main breaker box and the battery has been removed from the inverter's **DC input** terminals, either by removing the battery cables or exercising the battery disconnect. Verify that no voltage is present by using a voltmeter at all input and output terminals.

4.1 Performing Routine Maintenance

Although minimal maintenance is required on the A31 inverter, routine checks and adjustments are recommended to ensure optimum system performance.

Yearly

1. Confirm air vents are open. Remove dust and debris from interior of inverter.
2. Verify all connections are tight.
3. Perform a visual inspection on all internal components.
4. Check front panel meters for accuracy and LED operation.
5. Check capacitors for electrolyte leakage and replace if necessary.

Every 7 Years

1. If the inverter is consistently operated in extreme temperature environments, the capacitors should be replaced.

Every 10 Years

1. Check magnetics, components and wiring for signs of excessive heat.
2. Replace capacitors if not done at the 7-year interval.

4.2 Troubleshooting Procedure

Troubleshooting should be performed only by trained service personnel or experienced electricians. Before setting up any complicated testing or making any conclusions, inspect the inverter using the guide below.

Check the following:

1. Check AC output cables, connections, battery type, and number of cells against the inverter's **rating**.
2. Check input connections, input voltage and breaker size.
3. Check for shipping damage, loose connections, broken wires, etc.
4. Check the DC input cables to make sure they are proper polarity and secure. The DC voltage input must be above 1.73 volts per cell (lead acid) and 1.1 volts per cell (nickel cadmium).
5. Check the AC bypass line connections to make sure they are proper and secure. Total load must not exceed the nameplate rating.
6. Certain failures can be caused by defective batteries and user loads; make sure batteries and loads are free from defects.

NOTE: If the problem is found to be located in the printed circuit boards, the board should be replaced. No attempt should be made to repair circuit boards in the field.

La Marche Service Technicians are available to help with troubleshooting or with scheduling inverter service. When calling for a service inquiry or for troubleshooting assistance, be sure to have all of the following information on hand:

1. Equipment model number and serial number.
2. The measured DC input voltage and AC bypass voltage (if applicable).
3. The measured AC output voltage, with and without the loads.
4. Result of the check of the AC and DC breakers.
5. The AC output current and voltage, measured with load connected to inverter.

NOTE: When ordering replacement parts, drawings, or schematics, provide the model number, serial number, and description of problem, if available.

La Marche Phone Number: (847) 299-1188
24-hour Emergency Number: (847) 296-8939

4.3 Troubleshooting Chart



Isolate from all power sources prior to performing any interior verifications or part replacements.

Symptom	Possible Cause
1 Inverter AC Breaker Trips	Overload Condition
	Shorted Equipment or Component on AC output
	Defective AC Breaker
	Shorted SCRs (if applicable)
2 Inverter DC Breaker Trips	Capacitor Pre-Charge Circuitry Improperly Used
	Defective C1, C2, or C4 Capacitor
	Defective S2A-167S Oscillator/Line Sync Board
	Defective S2A-297/S2A-306 IGBT Drive Board
	Defective IGBT Module
	Shorted Wiring
	Incorrect Battery Connected
	Shorted Battery Cells
3 Lockout (No AC Output)	Low or No DC Voltage Input
	Defective Inverter AC Breaker
	Defective Inverter DC Breaker
	Broken Wire
	Shorted or Open C1 Capacitor
	Low or High DC Voltage Shutdown Activated or Improperly Set
	Open F2 Fuse
	Open Fuse on S2A-297/S2A-306 IGBT Drive Board
4 F2 Fuse Clears	Defective S2A-167S Oscillator/Line Sync. Board
	Defective S2A-297/S2A-306 IGBT Drive Board
5 Bypass AC Breaker Tripped	AC Bypass Line Overload Condition
	Shorted SCRs (if applicable)
6 READY LED for Pre-Charge Circuitry Not Illuminating	Defective C2 Capacitor
	Defective READY LED
	Improper Connection to S2A-172 Reverse Polarity Board
	No or Low DC Voltage Input
	Inverter ON/OFF Switch set to ON
	Defective IGBT Module
	Defective C4 Capacitor
	Open Pre-Charge Resistor
Defective Batteries	
7 Inverter's AC Load Supplied by Wrong Source	Defective SCR Module
	Defective Static Switch
	Overloaded Prime Source

Ordering Replacement Parts

Contact La Marche to place an order for spare or replacement parts. To order replacement parts; please provide the model and serial number of the battery inverter, the parts needed, and the quantity required.

SCR Modules

The procedure for checking the SCR module is as follows:

- Disconnect the wiring going to the module.
- Using an ohmmeter, the three main terminals (A1K2, K1, A2) you should read high resistance in both directions on your meter.
- Gate (G1) should read a high resistance between the top (A1K2), bottom (A2) terminals and a low resistance (10 Ohm - 40 Ohm) to the middle (K1) terminal.
- Gate (G2) should read a high resistance between the middle (K1) and (A2) terminal and a low resistance between terminal (A1K2).

NOTE: A wiring diagram of the module is located on the side of the component.

IGBT Modules

- With an ohmmeter, measure the resistance between Terminal 1 (collector) and Terminal 2 (emitter) negative lead on Terminal 1 should read, low resistance. Reverse the meter leads and it should read a high resistance.
- With negative lead on one, measure to Terminal 3, it should read high resistance.
- With negative lead on Terminal 1, measure to Terminal 5, it should read a low resistance.
- When the S2A-297 or S2A-306 card is removed, jump the gate and emitter of the IGBT with copper wire to protect from ESD damage.

C1, Resonating Capacitors 560 VAC – 660 VAC (approximately)

- With an ohmmeter, the meter should deflect to low resistance, then gradually rise to high resistance.

Appendix A: A31 Specifications

<i>ELECTRICAL</i>	
DC Input Voltages	24VDC: 21 – 30VDC 48VDC: 42 – 60VDC 120VDC: 105 – 150VDC Voltage Range: $\pm 10\%$ from nominal
AC Output	AC Output Voltage: 1 Phase – 120VAC (Standard), 208VAC, 220VAC, 240VAC AC Output Power: 1000VA – 15000VA (0.8 lagging factor)
Regulation	Line Regulation: $\pm 3\%$ over DC battery range Load Regulation: $\pm 4\%$ from no load to full load Frequency Regulation: $\pm 0.5\%$ (Quartz Clock)
Approximate Efficiency	24VDC: 70 – 75% 48VDC: 85 – 90% 120VDC: 85 – 90%
Total Harmonic Distortion	Approximately 5% at nominal DC input & full load. Less than 3% for any single harmonic
Meters	Options 06C/06D – Analog DC Ammeter & DC Voltmeter $\pm 2\%$ Accuracy Option 22D – Digital DC Ammeter & DC Voltmeter $\pm 1\%$ Accuracy
<i>PROTECTION</i>	
Current Limit	Approximately 150%, protected by AC Output Breaker
Input/ Output	Input: DC Breaker, Reverse Polarity Protection Indicator, Filter Pre-Charge Circuit Output: AC Breaker, AC Bypass Line Fuse
<i>ENVIRONMENTAL</i>	
Audible Noise	Less than 65dBA at any point 5 feet from any vertical surface
Operating Temperature	32 to 122°F (0 to 50°C)
Storage Temperature	-40 to 140°F (-40 to 60°C)
Relative Humidity	0 to 95% (non-condensing)
Cooling	Convection Cooled (4000VA and larger inverters are fan-assisted)
Shock	The inverter in its shipping container withstands shock developed when one edge of the container is dropped six inches while the opposite edge is resting on the ground, or it is dropped two inches without any physical damage or degradation of the electrical performance.
Vibration	The inverter in its shipping container, withstands vibration encountered in shipping without physical damage or degradation of the electrical performance.
Altitude	This inverter is capable of operation at altitudes up to 3,300 feet at an ambient temperature of up to +50°C (122°F) and 10,000 feet at an ambient temperature of up to +40°C (104°F).
Ventilation	The inverter should be mounted so that ventilating openings are not blocked and air entering the cabinet does not exceed 50° C (122°F).

Appendix B: Power Wiring Guide

Use the following formulas and table to determine proper wire size for minimal voltage drop. At distances exceeding 10 feet, the DC wire size should be chosen to keep the voltage difference between the inverter's DC input terminals and the battery at less than 1/2 volt when the inverter is fully loaded.

Table of Conventions:

- CMA*** = Cross section of wire in circular MIL area
- A*** = Ultimate drain in amps
- LF*** = Conductor loop feet
- MaxAmp*** = Maximum allowable amps for given voltage drop
- AVD*** = Allowable voltage drop
- K*** = 11.1 for commercial (TW) copper wire
= 17.4 for aluminum

Size (AWG)	Area CIR.MILS	Size (MCM)	Area CIR.MILS
18	1620	250	250000
16	2580	300	300000
14	4110	350	350000
12	6530	400	400000
10	10380	500	500000
8	16510	600	600000
6	26240	700	700000
4	41740	750	750000
3	52620	800	800000
2	66360	900	900000
1	83690	1000	1000000
0	105600	1250	1250000
00	133100	1500	1500000
000	167800	1750	1750000
0000	211600	2000	2000000

Calculating Wire Size Requirements:

$$CMA = \frac{A \times LF \times K}{AVD}$$

Table 5 – Wire Size/Area Table

Calculating Current Carrying Capacity of Wire:

$$MaxAmp = \frac{CMA \times AVD}{LF \times K}$$

Appendix C: Manufacturer's Standard Warranty

(IF THE INVOICE SHOWS THAT YOU HAVE PURCHASED THE EXTENDED PARTS WARRANTY OR IF YOU ARE INTERESTED IN PURCHASING THE EXTENDED PARTS WARRANTY, SEE THE MANUFACTURER'S EXTENDED PARTS WARRANTY)

All La Marche Manufacturing Co. equipment has been thoroughly tested and found to be in proper operating condition upon shipment from the factory and is warranted to be free from any defect in workmanship and material that may develop within one year from date of purchase. In addition to the standard one (1) year warranty, La Marche warrants its magnetics and power diodes on a parts replacement basis only for nine (9) more years under normal use.

Any part or parts of the equipment (except protective devices, DC connectors and other wear-related items) that prove defective within a one (1) year period shall be replaced without charge providing such defect, in our opinion, is due to faulty material or workmanship and not caused by tampering, abuse, misapplication or improper installation. Magnetics and power diodes are warranted for ten (10) years after date of purchase. During the last nine (9) years of this ten (10) year warranty period, the warranty covers parts replacement only, no labor or other services are provided by La Marche, nor is La Marche obligated to reimburse the owner or any other person for work performed.

Should a piece of equipment require major component replacement or repair during warranty period, these can be handled in one of three ways:

1. If the Purchaser elects to take the responsibility of repairing the equipment and requests replacement part(s), Purchaser or Sales Representative must contact Factory for return authorization and a purchase order must be issued. Replacement part(s) will be promptly shipped and invoiced. After the defective part(s) are returned and inspected at the Factory, if the defect(s) were due to faulty material or workmanship, credit will be issued.
2. The equipment can be returned to the La Marche factory to have the inspections, parts replacements and testing performed by factory personnel. Should it be necessary to return a piece of equipment or parts to the factory, the customer or sales representative must obtain authorization from the factory. If upon inspection at the factory, the defect was due to faulty material or workmanship, all repairs will be made at no cost to the customer during the first year. If the Extended Warranty is purchased, the parts required for repair will also be at no cost but La Marche will notify the Purchaser of the costs of Labor to replace the defective part(s). A Purchase Order to cover this labor is required before repairs will be initiated. Transportation charges or duties shall be borne by Purchaser.
3. If the purchaser elects not to return the equipment to the factory and wishes a factory service representative to make adjustments and/or repairs at the equipment location, La Marche's field service labor rates will apply. A purchase order to cover the labor and transportation cost is required prior to the deployment of the service representative.

In accepting delivery of the equipment, the purchaser assumes full responsibility for proper installation, installation adjustments and service arrangements. Should minor adjustments be required, the local La Marche sales representative should be contacted to provide this service only.

All sales are final. Only standard La Marche inverters will be considered for return. A 25% restocking fee is charged when return is factory authorized. Special inverters are not returnable.

In no event shall La Marche Manufacturing Co. have any liability for consequential damages, or loss, damage or expense directly or indirectly arising from the use of the products, or any inability to use them either separately or in combination with other equipment or materials, or from any other cause. In addition, any alterations of equipment made by anyone other than La Marche Manufacturing Co. renders this warranty null and void. Failure to follow safety precautions specified by the manufacturer during replacement of components or verifications renders this warranty null and void.

La Marche Manufacturing Co. reserves the right to make revisions in current production of equipment, and assumes no obligation to incorporate these revisions in earlier models.

The failure of La Marche Manufacturing Co. to object to provisions contained in customers' purchase orders or other communications shall not be deemed a waiver of the terms or conditions hereof, nor acceptance of such provisions.

THE ABOVE WARRANTY IS EXCLUSIVE, SUPERSEDES AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS. NO PERSON, AGENT, OR DEALER IS AUTHORIZED TO GIVE ANY WARRANTIES ON BEHALF OF THE MANUFACTURER, OR TO ASSUME FOR THE MANUFACTURER ANY OTHER LIABILITY IN CONNECTION WITH ANY OF ITS PRODUCTS UNLESS MADE IN WRITING AND SIGNED BY AN OFFICIAL OF THE MANUFACTURER.

Appendix D: **Manufacturer's Extended Parts Warranty**

(THIS IS YOUR WARRANTY IF YOU HAVE PURCHASED THE EXTENDED PARTS WARRANTY AS SHOWN ON OUR INVOICE TO YOU OR IF YOU PURCHASE THE EXTENDED PARTS WARRANTY ANYTIME DURING THE FIRST 12 MONTHS AFTER THE DATE OF OUR INVOICE)

All La Marche Manufacturing Co. equipment has been thoroughly tested and found to be in proper operating condition upon shipment from the factory. Any part or parts of the equipment (except protective devices, d.c. connectors and other wear-related items) that prove defective within a one (1) year period from the date of our invoice to you shall be replaced without charge providing such defect, in our opinion, is due to faulty material or workmanship and not caused by tampering, abuse, misapplication or improper installation. Labor and parts are covered during this one (1) year period.

For the next four (4) years after the expiration of the one-year warranty, on a parts replacement only basis, any part or parts of the equipment (except protective devices, d.c. connectors and other wear-related items) that prove defective within the additional four (4) year period shall be replaced providing such defect, in our opinion, is due to faulty material or workmanship and not caused by tampering, abuse, misapplication or improper installation. During this four (4) year period, the warranty covers parts replacement only, no labor or other services are provided by La Marche, nor is La Marche obligated to reimburse the owner or any other person for work performed. If you return the equipment to our factory (freight prepaid), we will repair and cover parts and labor.

In addition, magnetics and power diodes are warranted for ten (10) years after the date of our invoice to you. The defect in the magnetics or power diodes must, in our opinion, be due to faulty material or workmanship and not caused by tampering, abuse misapplication, or improper installation. Labor and replacement magnetics and power diodes are covered under the extended warranty during the initial five (5) year period from the date of our invoice to you. During the next five (5) years of this ten (10) year warranty period for magnetics and power diodes, the warranty covers parts replacement only, no labor or other services are provided by La Marche, nor is La Marche obligated to reimburse the owner or any other person for work performed.

Should a piece of equipment require major component replacement or repair during the extended warranty period, these can be handled in one of three ways:

1. If the Purchaser elects to take the responsibility of repairing the equipment and requests replacement part(s), Purchaser or Sales Representative must contact Factory for return authorization and a purchase order must be issued. Replacement part(s) will be promptly shipped and invoiced. After the defective part(s) are returned and inspected at the Factory, if the defect(s) were due to faulty material or workmanship, credit will be issued.
2. The equipment can be returned to the La Marche factory to have the inspections, parts replacements and testing performed by factory personnel. Should it be necessary to return a piece of equipment or parts to the factory, the customer or sales representative must obtain authorization from the factory. If upon inspection at the factory, the defect was due to faulty material or workmanship, all repairs will be made at no cost to the customer under the Extended Warranty. Transportation charges or duties shall be borne by Purchaser.
3. If the purchaser elects not to return the equipment to the factory and wishes a factory service representative to make adjustments and/or repairs at the equipment location, La Marche's field service labor rates will apply. A purchase order to cover the labor and transportation cost is required prior to the deployment of the service representative.

In accepting delivery of the equipment, the purchaser assumes full responsibility for proper installation, installation adjustments and service arrangements. Should minor adjustments be required, the local La Marche sales representative should be contacted to provide this service only.

All sales are final. Only standard La Marche units will be considered for return. A 25% restocking fee is charged when return is factory authorized. Special units are not returnable.

In no event shall La Marche Manufacturing Co. have any liability for consequential damages, or loss, damage or expense directly or indirectly arising from the use of the products, or any inability to use them either separately or in combination with other equipment or materials, or from any other cause. In addition, any alteration of equipment made by anyone other than La Marche Manufacturing Co. renders this warranty null and void.

La Marche Manufacturing Co. reserves the right to make revisions in current production of equipment, and assumes no obligation to incorporate these revisions in earlier models.

The failure of La Marche Manufacturing Co. to object to provisions contained in customers' purchase orders or other communications shall not be deemed a waiver of the terms or conditions hereof, nor acceptance of such provisions.

THE ABOVE WARRANTY IS EXCLUSIVE, SUPERSEDES AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS. NO PERSON, AGENT OR DEALER IS AUTHORIZED TO GIVE ANY WARRANTIES ON BEHALF OF THE MANUFACTURER, OR TO ASSUME FOR THE MANUFACTURER ANY OTHER LIABILITY IN CONNECTION WITH ANY OF ITS PRODUCTS UNLESS MADE IN WRITING AND SIGNED BY AN OFFICIAL OF THE MANUFACTURER.

Appendix E: Document Control and Revision History

Part Number: 40966
Instruction Number: P25-LA31STD-1
Issue ECN: 12266 - 08/98

22782 – 01/21	18601 – 03/10	16816 – 09/05	16651 – 01/05
15884 – 04/03	15349-05 – 06/02	14575 – 02/01	13608 – 01/00

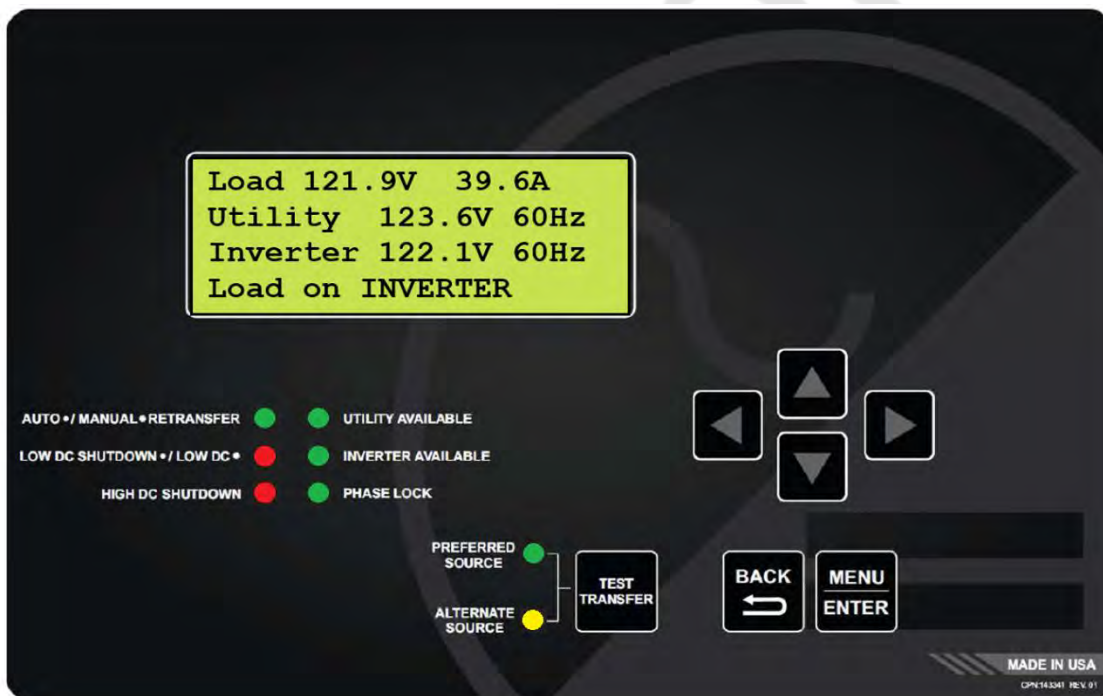
Sample



La Marche Manufacturing Company | www.lamarchemfg.com

Option 22D

Digital Meter Package (for Option 22P/22S)



Operation Manual

This manual is subject to change without notice. You may obtain the newest version of the manual at www.lamarchemfg.com

1 Option 22D – Operation

1.1 General Description

The 22D option revolves around the electronic static switch; an automatic device which will transfer, in a rapid 1 millisecond, an AC load its primary source to its alternate source in the event of a primary source failure.

The static switch is controlled by the S2A-239DS digital static switch board, working alongside the S2A-526 display assembly on the front panel which provides a user-friendly interface. The S2A-526 display assembly includes a 4-line LCD display, 7 push buttons, and 8 alarm & status LEDs as seen below.

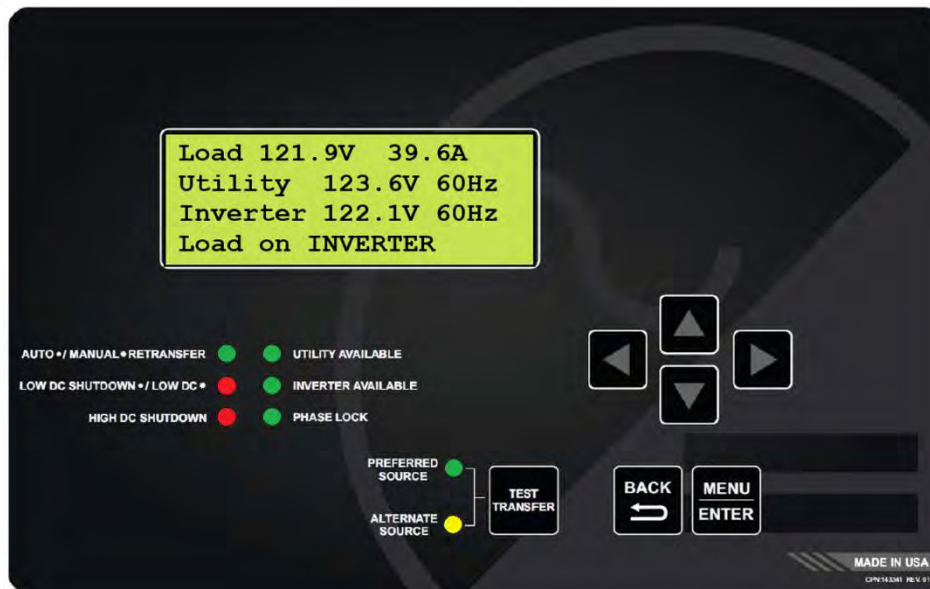


Figure 1 – A31 Front Panel

The display will show the software version and the date code, as well as go through a lamp test. Afterwards, the display will show "Building Envelope Tables" and then show "Waiting for Source to Start..." Once the inverter begins to output, the idle display will read out the following information:

- Load Voltage
- Load Current
- Volt-Amps
- Utility Voltage
- Utility Frequency
- Input DC Volts
- Inverter Voltage
- Inverter Frequency
- Input DC Amps (Optional)
- Load on Inverter/Utility
- Preferred Source

NOTE: The Up/Down arrow buttons can be used to scroll through the information.

Status Indicator LEDs

Auto/Manual Retransfer LED is ON solid when the inverter is set to automatically transfer back to preferred source when available. LED is ON blinking when the inverter is set to be manually transferred (by the user) back to the preferred source.

Low DC/Shutdown LED is ON solid when the inverter source has shut down due to very low input DC voltage. LED is ON blinking when the inverter has low input DC voltage.

High DC Shutdown LED is ON when the inverter source has shut down due to very high input DC voltage.

Utility Available LED is ON when the utility source is deemed available.

Inverter Available LED is ON when the inverter source is deemed available.

Phase Lock LED is ON when the both sources are in sync within the phase window.

Preferred Source LED is ON when the load is operating on the preferred source.

Alternate Source LED is ON when the load is operating on the alternate source.

The Test Transfer push button allows for transferring the load to the alternate source, if available, to assure static switch functionality.

3.3 Alarm/Status Description

AUTO/MANUAL RETRANSFER LED will be on solid when the inverter is set to automatically transfer back to preferred source when available. The LED will be blinking when the inverter is set to be manually transferred (by the user) back to the preferred source.

PHASE LOCK LED will turn on if the inverter and utility (AC Bypass) sources are synchronized within the phase window.

UTILITY AVAILABLE LED will turn on if the utility (AC Bypass) source is deemed available.

INVERTER AVAILABLE LED will turn on if the inverter source is deemed available.

PREFERRED SOURCE LED will turn on if the A31 is operating on the preferred source. The preferred source may be set to either Inverter or Utility (AC Bypass).

ALTERNATE SOURCE LED will turn on if the A31 is operating on the alternate source. The preferred source may be set to either Inverter or Utility (AC Bypass).

LOW DC VOLTAGE ALARM **will trigger and the red "LOW DC/LOW DC SHUTDOWN" LED will** blink if the input DC voltage falls below the specified voltage threshold of the alarm for longer than the specified alarm delay setpoint. The alarm will clear once the input DC voltage rises above the Low DC Voltage Reset threshold.

LOW DC SHUTDOWN ALARM **will trigger and the red "LOW DC/LOW DC SHUTDOWN" LED will turn on** solid if the DC voltage falls below the specified percentage or voltage threshold of the alarm for longer than the specified alarm delay setpoint. If the Low DC Shutdown alarm activates, the inverter source shuts off to prevent irreversible damage to the inverter. The alarm will clear, and the inverter source will power back up once the input DC voltage rises above the Low DC shutdown reset threshold.

HIGH DC SHUTDOWN ALARM **will trigger and the red "HIGH DC SHUTDOWN" LED will turn on if the** input DC voltage of the charger rises above the alarm threshold for longer than the specified alarm delay setpoint. If the High DC Shutdown alarm activates, the inverter source shuts off to prevent irreversible damage to the inverter. The alarm will clear, and the inverter source will power back up once the input DC voltage falls below the High DC shutdown reset threshold.

Most alarms have adjustable time delays to energize; ranging from 0 through 255 seconds. Refer to Table 1 for the factory setting of each alarm.

Parameter	Default Value		Delay (secs.)
	Lead Acid	Nickel Cadmium	
Re-Transfer Mode	Automatic		20
Preferred Source	Inverter		
Load Window High	+20%		
Load Window Low	-20%		
Utility Voltage High	+10%		10
Utility Voltage Low	-10%		
Inverter Voltage High	+10%		10
Inverter Voltage Low	-10%		
Low DC Voltage	1.98 V/C	1.20 V/C	5
Low DC Voltage Reset	2.10 V/C	1.25 V/C	
Low DC Voltage Shutdown	1.73 V/C	1.10 V/C	5
Low DC Voltage S.D. Reset	2.05 V/C	1.35 V/C	
High DC Voltage Shutdown	2.45 V/C	1.60 V/C	5
High DC Voltage S.D. Reset	2.40 V/C	1.55 V/C	
Current Limit	150% of Nominal Output Current		
Transfer Time	1 Millisecond		
Hit Counter	8		

Table 1 – Inverter Factory Default Values

NOTE: V/C – Volts per Cell.

3 Adjusting Parameters

All equipment is shipped from the factory fully tested and set per model number. Do not make any adjustments unless the equipment has been powered-up and the settings have been determined to be incorrect. If the settings have been determined to be incorrect, adjustments may be made as detailed below.

3.1 Settings Menu

In the Settings Menu, the user can access and change various parameters. Access menus by pressing the ENTER/MENU button on the front panel. Navigate using the UP, DOWN, ENTER, and BACK buttons. To enter a submenu, use the ENTER button. To exit a submenu, use the BACK button. To exit the Settings Menu, continue to press the BACK button until prompted to exit and save settings. Follow the prompts as desired.

NOTE: It is important to be aware that transfers are disabled in the calibration modes.

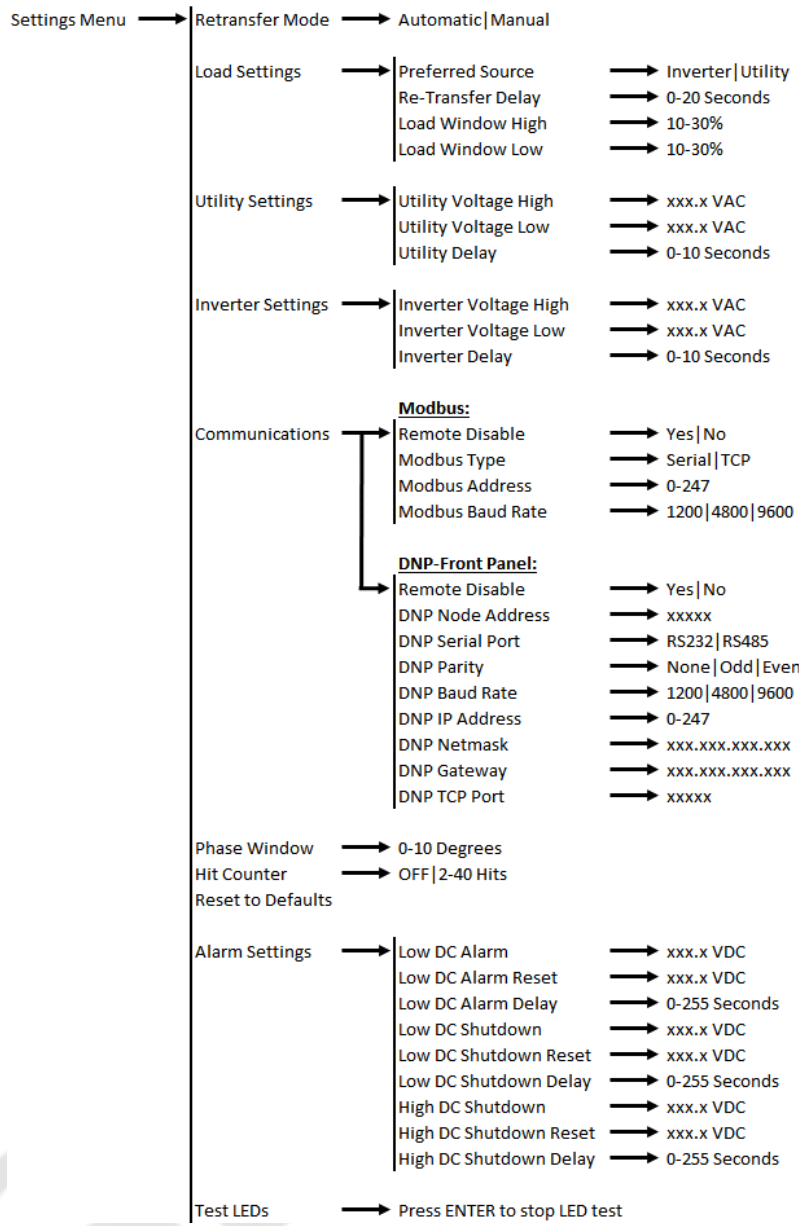


Figure 3 – A31 Settings Menu Structure

The Settings Menu is as follows:

3.1.1 Retransfer Mode

This setting is used for selecting the mode for re-transferring the load. The Automatic setting would cause the load to transfer to the preferred source whenever available. The Manual setting would cause the load to maintain on the present source if both sources are available. The currently used source can be changed in this mode by pressing the Test Transfer button when in the main screen.

NOTE: When in Manual Retransfer Mode, the user will have to press the Test Transfer button in order to transfer the load from alternate source to preferred source in the event of a preferred source failure or outage.

3.1.2 Load Settings

Preferred Source

This setting allows the user to select whether the primary source is either the inverter or the utility.

Re-Transfer Delay

This setting is used to set the time the inverter will attempt to retransfer from the Alternate Source back to the Primary Source. The inverter must be in Auto Re-Transfer Mode for this setting to have any effect. The Re-transfer Delay may be adjusted from 0 to 20 seconds in 1-second increments, with 20 being the default.

Load Window High

The upper allowable limit for the Load Voltage signal may be set in terms of percent. The maximum allowable upper setting is +30% and the minimum allowable upper setting is +10%. The default is +20%. The setting is adjustable in 1% increments.

Load Window Low

The lower allowable limit for the Load Voltage signal may be set in terms of percent. The maximum allowable lower setting is -30% and the minimum allowable lower setting is -10%. The default is -20%. The setting is adjustable in 1% increments.

3.1.3 Utility Settings

Utility Voltage High

The maximum allowable/acceptable limit on the Utility Voltage defaults to the Output Voltage setting plus 10% (*EX: The default setting for a 120VAC output inverter is 132VAC RMS*). Once the voltage is out of range, the utility source will be deemed unavailable and the inverter will transfer to the inverter source if available.

Utility Voltage Low

The minimum allowable/acceptable limit on the Utility Voltage defaults to the Output Voltage setting minus 10% (*EX: The default setting for a 120VAC output inverter is 108VAC RMS*). Once the voltage is out of range, the utility source will be deemed unavailable and the inverter will transfer to the inverter source if available.

Utility Delay

This setting is used to set the amount of time the Utility Voltage must be within the upper and lower limits described above for the logic to consider the Utility Voltage to be within tolerance. The Utility Delay may be adjusted from 0 to 10 seconds in 1-second increments, with 10 being the default.

3.1.4 Inverter Settings

Inverter Voltage High

The maximum allowable/acceptable limit on the Inverter Voltage defaults to the Output Voltage setting plus 10% (*EX: The default setting for a 120VAC output inverter is 132VAC RMS*). Once the voltage is out of range, the inverter source will be deemed unavailable and the inverter will transfer to the utility source if available.

Inverter Voltage Low

The minimum allowable/acceptable limit on the Inverter Voltage defaults to the Output Voltage setting minus 10% (*EX: The default setting for a 120VAC output inverter is 108VAC RMS*). Once the voltage is out of range, the inverter source will be deemed unavailable and the inverter will transfer to the utility source if available.

Inverter Delay

This setting is used to set the amount of time the Inverter Voltage must be within the upper and lower limits described above for the logic to consider the Inverter Voltage to be within tolerance. The Inverter Delay may be adjusted from 0 to 10 seconds in 1-second increments, with 10 being the default.

3.1.5 Communications

The communication settings menu changes depending on the type of communication protocol used in the inverter. For details on connection and operation instructions, refer to the communication instruction manual included with the inverter.

3.1.6 Phase Window

This setting allows the user to adjust the maximum allowable amount of degrees the two sources may have in difference in order for the sources to be considered out of phase. If the difference is greater, the Phase Lock LED will turn off. The Phase Window may be adjusted from 1-10 degrees, with 8 being the default setting.

3.1.7 Reset to Defaults

This setting allows the user to reset all settings to how they were programmed from the factory.

3.1.8 Hit Counter

This setting is used to determine the maximum allowable Load Voltage deviations outside of the predefined envelope that will trigger a transfer. The Hit Counter may be adjusted from 1 to 40 hits, with 8 being the default setting.



WARNING: Adjusting the Hit Counter setting will affect the 1-millisecond transfer time. The higher the Hit Counter value, the slower the transfer time will be. Only adjust if absolutely necessary.

3.1.9 Alarm Settings

The Alarm Settings menu provides access to adjust basic settings related to the alarms. The user can set the threshold values that trigger an alarm, that clear an alarm, and the alarm time delays. This applies to the following alarms: Low DC Voltage, Low DC Voltage Shutdown, and High DC Voltage Shutdown.

When a value is changed and ENTER is pressed, the inverter immediately uses these new values. However, if the user exits out of the Settings Menu without saving, the threshold values will revert to the previously set thresholds.

3.1.10 Test LEDs

The Test LEDs menu allows the user to run a basic lamp test on the A31. After selecting this menu, press the ENTER button to light all of the LEDs on the front panel display. To end the LED test, press the BACK button.

NOTE: Any additional LEDs on auxiliary boards will not be affected by this LED test.

Document Control and Revision History

Part Number: 108859
Instruction Number: P25-LOPT22D-1
Issue ECN: 16282 – 12/03

22782 – 01/21	16282 – 12/03		

Sample