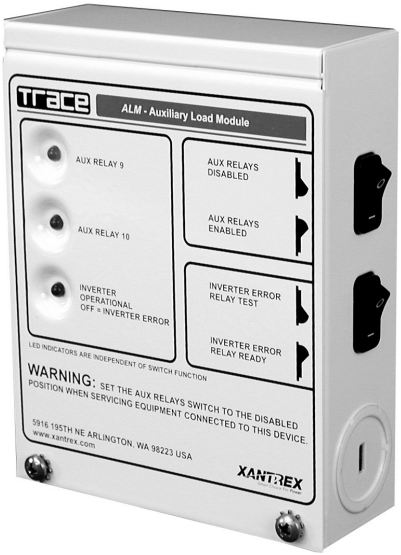
XANTREX
Smart Choice For **Power**

Owner's Manual



Auxiliary Load Module

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Xantrex Technology Inc., is a world-leading supplier of advanced power electronics and controls with products from 50 watt mobile units to 1 MW utility-scale systems for wind, solar, batteries, fuel cells, microturbines, and backup power applications in both grid-connected and stand-alone systems. Xantrex products include inverters, battery chargers, programmable power supplies, and variable speed drives that convert, supply, control, clean, and distribute electrical power.

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Date and Revision

September 2001, Revision A

Part Number

975-0027-01-01

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1.0 INTRODUCTION

The Auxiliary Load Module (ALM) is an accessory for selected Trace™/Xantrex inverter/charger models allowing battery voltage related tasks such as controlling charging sources, loads, etc., and inverter error indication. The unit contains three relays providing normally open (N.O.), normally closed (N.C.) and common (COM) contacts. Relays RY9 and RY10 are independently adjustable DC auxiliary signal relays. Relay RY11 is used to indicate an error condition (via an external indicator) whenever the inverter's output is shutdown. This could be a bell, buzzer, light, etc.

The unit interfaces with the inverter through a phone-type cable. Commands from the inverter control the relays when defined parameters (programmed via the inverter's control device, e.g., display panel or remote control) are met. Refer to the inverter operator's manual for setting the various parameters for operation.

Front panel LEDs provide a visual display of relay activity whenever a relay contact receives an engage command from the inverter. A highly visible blue LED indicates the connected inverter is operational.

Unpacking and Inspection

Carefully inspect the contents of the shipping carton for damages. Report any damages to the carrier immediately.

The following items are packed with the ALM:

- Auxiliary Load Module unit (ALM)
- 25-foot cable
- Operator's manual
- Warranty Card

Report any missing items to your dealer immediately.

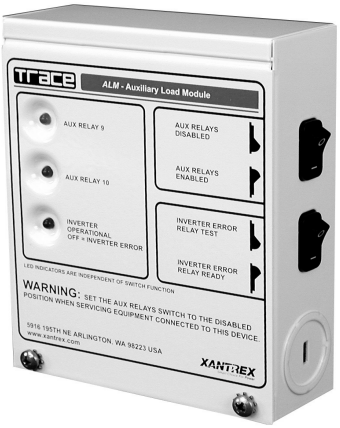

Figure 1-1
Auxiliary Load Module (ALM)

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1.0 INTRODUCTION

Controls and Indicators

Indicator LEDs

Three LEDs located on the front panel of the ALM indicate the relay control signal status from the inverter.

> *NOTE: The LEDs are unaffected by the ALM's switch positions or fuse condition.*

AUX RELAY 9 LED

The yellow LED indicates whether relay RY9 has engaged or not. If this LED is illuminated, the N.O. to COM contacts are connected. If this LED is not illuminated, the N.C. to COM contacts are connected.

AUX RELAY 10 LED

The green LED indicates whether relay RY10 has engaged or not. If this LED is illuminated, the N.O. to COM contacts are connected. If this LED is not illuminated, the N.C. to COM contacts are connected.

INVERTER OPERATIONAL LED

The blue LED indicates the inverter's operational status. If the inverter is powered and ready for operation, the blue SYSTEM OPERATIONAL LED turns ON as soon as the phone-type cable is plugged into the inverter. If the blue LED does not turn ON, the inverter is either not powered, is set to the CHG-only mode without any utility pass-through, or has no AC output which may be caused by an error condition.

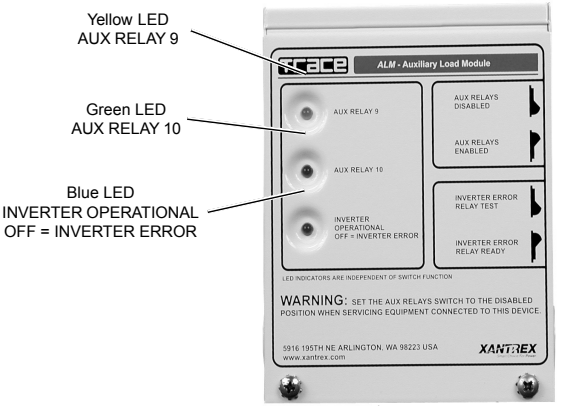

Figure 1-2
Indicator LEDs

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Controls and Indicators (continued)

Switches

Two switches are provided on the right side of the ALM to effectively disconnect the relay coils from the inverter's supply voltage (11 VDC), thus preventing the relays from engaging if a control signal is sent out from the inverter. This safety feature allows you to work with the auxiliary relays without having to power-down the connected inverter.

AUX RELAY Switch

The AUX RELAY switch enables the relays by providing the operating voltage to the relay coils RY9 and RY10. When the relays are enabled, they will respond to the control signals provided by the inverter. When the switch is in the RELAYS DISABLED position, the inverter control signals have no effect on relay operation (i.e., the COM and N.C. contacts engage). This switch does not affect the operation of the LEDs which continue to light whenever the inverter sends a CLOSE CONTACT command to the relays.

INVERTER ERROR Switch

The INVERTER ERROR switch provides a simple way to test an externally connected alarm. Once the alarm is tested, this switch should be set to the RELAY READY position.

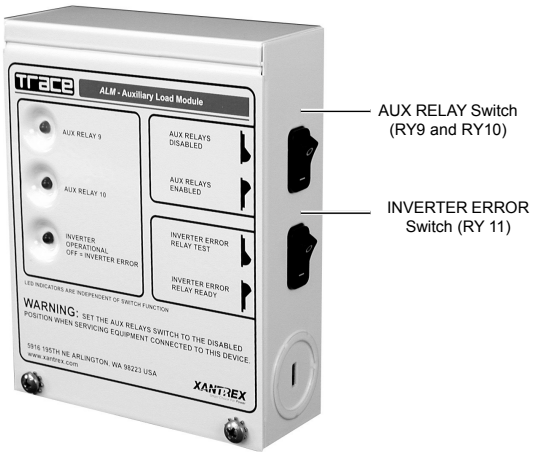

Figure 1-3
Switches

1.0 INTRODUCTION

Internal Components

The Auxiliary Load Module (ALM) is designed for multiple applications and allows for simple installation. Components provided are listed below.

Relays

There are three single-pole, double-throw relays, rated at 10 amps/250 VAC (8 amps/30 VDC–for resistive loads), with gold contacts providing "dry contact" closures to increase the low-end signal range.

- Relay RY9 and RY10 are used for battery voltage related functions.
- Relay RY11 can be connected to an external indicator device to display or sound an alarm whenever the inverter AC output is lost.
- The common, normally open , and normally closed contacts are available on each relay.

Relay Connections

- Common (COM) - The COM contact switches between the N.C. and N.O. terminals depending on whether the relay is energized or not (de-energized).
- Normally Closed (N.C.) - The N.C. contact is connected to the COM terminal of the relay when the relay is de-energized.
- Normally Open (N.O.) - The N.O. contact is connected to the COM terminal of the relay when the relay is energized.

CAUTION: These relays are not intended to directly control a load or charging source. Rather they are used to send a signal or operate the coil of another, higher amperage device which does the actual switching of power. A 6.3-amp fuse is included to help protect each of the relays. Connection to a high amperage device will open the fuse in the common line and possibly damage the relay. Damage to these relays from overloading is not covered by warranty and requires the ALM to be returned to a repair center.

Relay Terminal Block

Connections to the ALM are accomplished by the nine position, spring-clamp, terminal block with quick connect levers. All relay contacts (N.O., COM, and N.C.) are available at this connector, which accepts wire sizes from #28 AWG to #14 AWG. No tools are required to secure the wires as the spring clamp holds the wires securely in place.

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Internal Components (continued)

Ground Stud

A ground screw is provided in the ALM to provide a safety ground path when hazardous voltages are connected to the relays. Connect this screw to a grounded conductor whenever high voltages (i.e., above 60 volts) are connected to the relays.

NOTE: No hazardous voltages are supplied from the inverter to power or control the relays; however, 120 VAC could be used to power an external error indicator.

Fuses

Each relay's common (COM) contact is protected with a 6.3 amp (5 mm x 20 mm) 250 VAC fuse which will open if excess current is drawn through the relay contacts. Always replace this fuse with the same type and rating. Type GDC (Bussman) or 218 (Littlefuse) is recommended.

*NOTE: These fuses can be replaced with **lower** amperage fuses to also protect the connected circuitry, if desired. In **no** case, should this fuse be replaced with one of a **higher** amperage.*

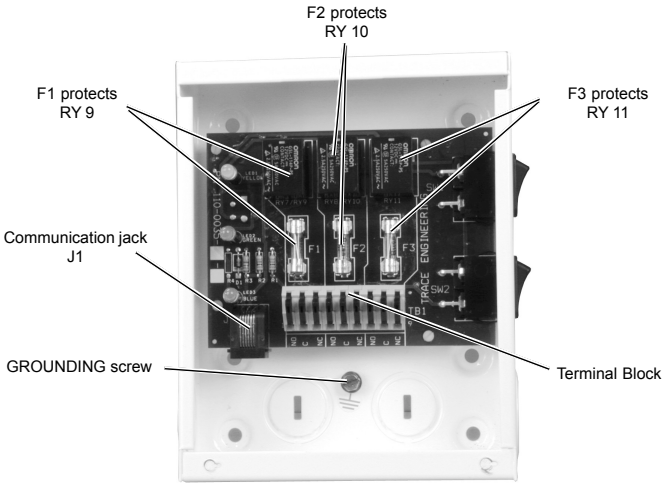

Figure 1-4
Internal Components

Notes:

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The ALM is required to be installed in a clean, dry, protected environment and should be mounted close to the load in a location where it is easily accessible. Dual knockouts, in the sizes of ½, ¾ and 1 inch, are provided for cable routing and conduit connections. Mount the ALM to a flat, vertical surface, such as a wall.

Tools Required

screwdrivers (Phillips and flat blade)
drill and assorted bits
wire strippers
wood screws (#10)
anchors (if required)

WARNING: BEFORE MAKING ANY CONNECTIONS TO THE LOAD OR INVERTER, ENSURE THAT ALL AC AND DC POWER IS DISCONNECTED FROM THE INVERTER AND THE ALM.

Pre-Installation

Before installing the ALM, read all instructions and cautionary markings located in this manual.

Determine the wire route (or conduit runs) to the ALM and loads.

NOTE: Check for existing electrical, plumbing, or other potential areas of accidental damage prior to making cuts in structural surfaces.

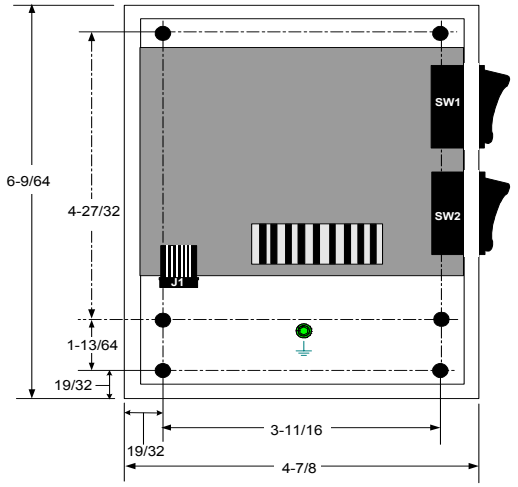

Figure 2-1
Dimensional Drawing (Not to Scale)

2.0 INSTALLATION

Mounting

- Remove the two Phillips screws from the unit's front panel and remove the cover. Figure 2-2.
- Open the inverter's access panel and locate the AUX connector if necessary. Refer to the inverter operator's manual for the location of the connector.
- Hold the ALM against the surface to be mounted and use the unit as a template to mark the four hole locations. See Figure 2-3.

> *NOTE: Six holes are provided in the back panel of the ALM. Use the two top and two bottom screw holes. Do not use the middle two holes.*

- Drill holes for mounting and insert appropriate anchors if necessary.
- Use four #10 wood screws to mount the unit to the wall or other vertical surface.
- Install conduit runs or strain reliefs for the RY9 and RY10 control wires, error indicator (if used), and communication cable (between the inverter and ALM).

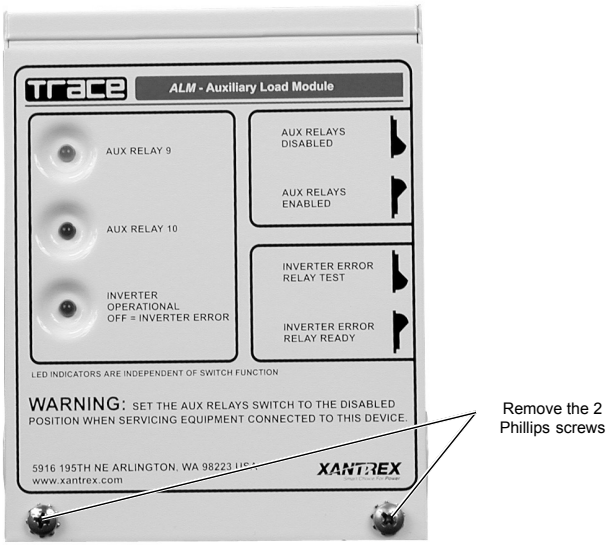

Figure 2-2
Removing the Front Cover

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Mounting (continued)

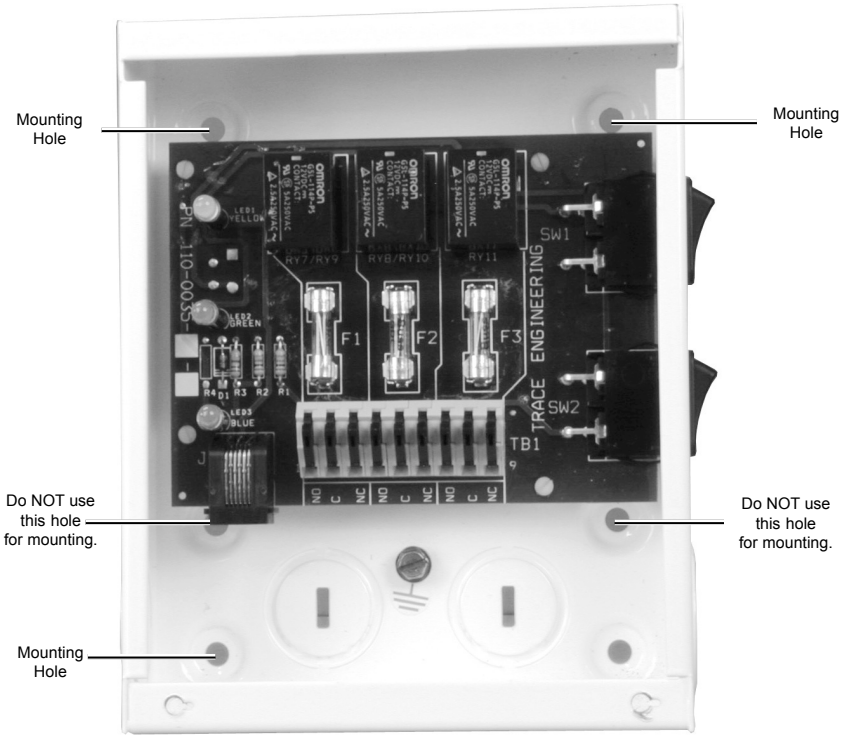

Figure 2-3
Mounting Holes

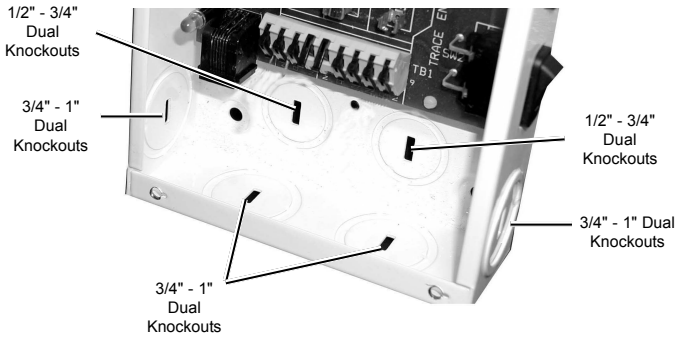

Figure 2-3a
Dual Knockout Locations

2.0 INSTALLATION

Wiring

NOTE: All wiring described in this manual must be performed by a qualified, licensed electrician and meet local and national codes, such as NEC.

Terminal Block Wiring

- Lift the appropriate lever for the relay contact.
- Insert the wire (stripped back 1/4 inch) into the terminal block.
- Snap the lever down to secure the wire.

Please refer to the auxiliary relay section of the inverter's operation manual for additional information.

NOTE: Due to the various ways the ALM can be wired, detailed wiring instructions can not be given in this manual. Please refer to the operation section of this manual for wiring suggestions.

CAUTION: Do not wire the relays directly to a high-amperage device. Connection to a high-current device will open the fuse in the common line and possibly damage the relay.

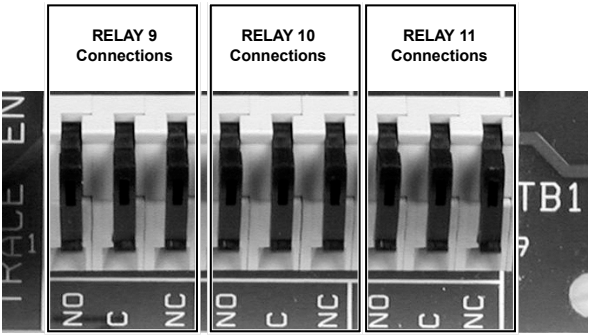

Figure 2-4
Terminal Block Connections

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RY 11 Error Indicator Wiring

If an error indicator is used (light, buzzer, bell, etc.), connect the wires to the RY11 relay contacts. Depending on the error indicator used, either the N.O. or N.C. contacts can be used. Typically, the N.C. and COM contacts are used to complete a circuit, turning on a light, buzzer, etc. The N.C. contacts are held "open" until an error condition is detected (or the AC output is OFF); at which time the N.C. contact will "close" completing the circuit and activating the external device.

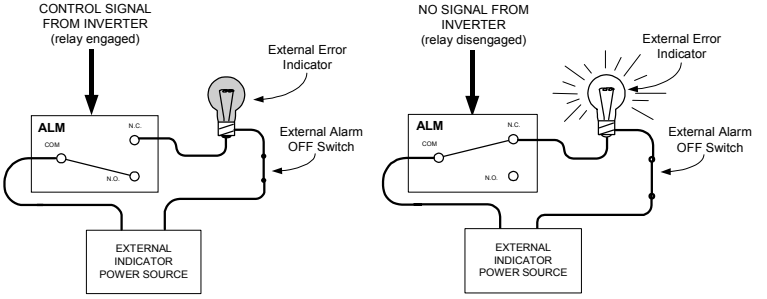

Figure 2-5
External Error Indicator Connections

For convenience, add an external OFF switch in line with the alarm device. This allows turning off the alarm until the inverter's output is restored.

NOTE: The diagrams shown here are intended as an example of how the relays operate an external alarm device. Actual alarm types may operate differently from these diagrams. Refer to the external indicator's owner's manual for specific alarm wiring. Do not exceed the voltage or amperage ratings of the relay and fuse.

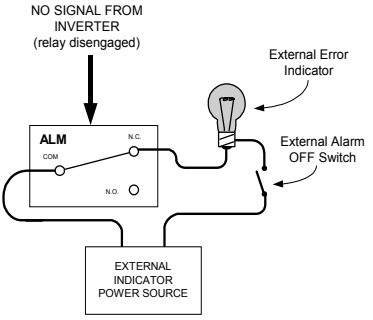

Figure 2-6
External Alarm OFF Switch

2.0 INSTALLATION

Communication Cable

The ALM is supplied with a 25-foot, telephone-type, cable with RJ11 connectors on each end.

> *NOTE: Longer cable lengths are available for purchase from your Xantrex Dealer: part numbers TC/50 for 50 feet (15.24 m) and TC/100 for 100 feet (30.48 m).*

- Route the telephone-type cable through one of the knockouts fitted with a strain relief (or conduit).
- Connect one end of the cable to the jack labeled J1 on the ALM circuit board.
- Connect the other end of the cable to the jack labeled AUX inside the inverter (refer to the inverter's operator's manual for location).
- Reinstall the cover on the ALM using the two Phillips screws.
- Reinstall the inverter's cover.

> *NOTE: Recheck all wiring before proceeding to the Operation section of this manual.*

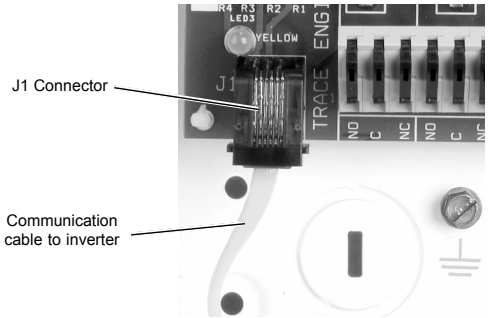

Figure 2-7
J1 Control Signal Connection

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Internal Sticker

Please refer to the component layout sticker located inside the front cover. This label can be used as a quick reference for component location and fuse sizing information.

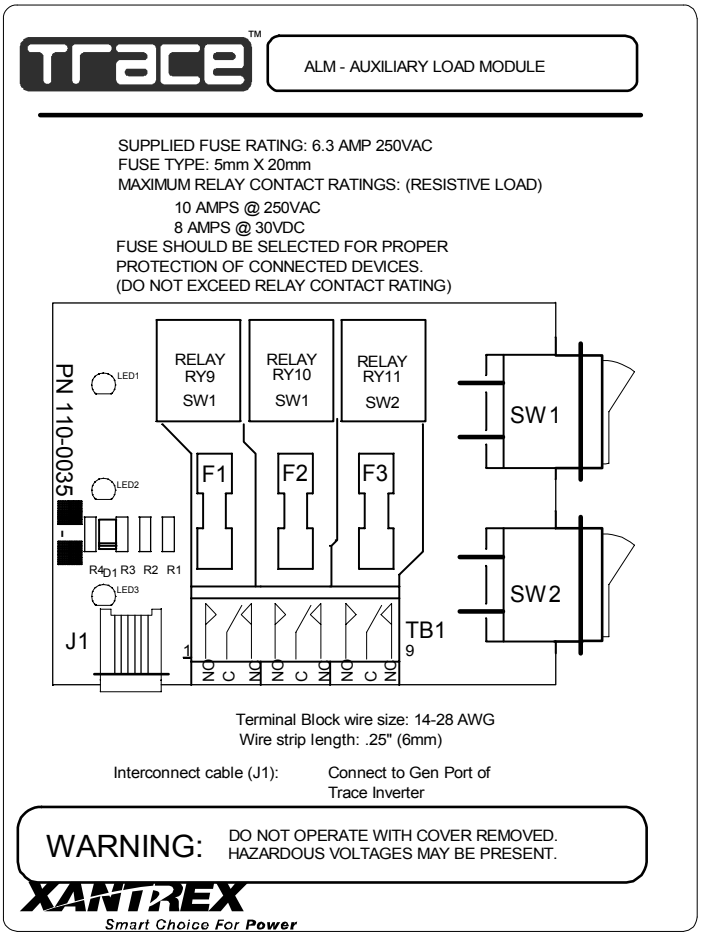

Figure 2-8
Internal Component Identification Sticker

Notes:

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Test Procedures

NOTE: Refer to the inverter's operator's manual for setting the RY11 relay for testing.

Immediately after installation, the ALM should be tested for proper operation.

- Ensure the AUX RELAY switch on the ALM is in the ON (ENABLED) position and the INVERTER ERROR relay is in the RELAY READY position.
- Reconnect all power to the inverter.
- Using the inverter's control device (i.e., display, SWRC remote), press the INV MENU button to access the inverter menu. Select ON from the display. The blue INVERTER OPERATIONAL LED should immediately turn ON.

NOTE: The LEDs will turn ON differently, depending upon the function selected from your inverter.

- If an external alarm is connected to the ALM, turn the INVERTER ERROR switch to the RELAY TEST position. The external device should activate.
- Place the INVERTER ERROR switch in the RELAY READY position.

NOTE: If the tests did not pass, recheck the wiring and the ALM for proper relay contact selection (N.O. or N.C.).

3.0 OPERATION

Operation

The inverter that is connected to the ALM monitors its battery voltage to determine when to signal relays RY9 and RY10. These relays are individually controlled and each responds to user-programmable, voltage setpoints via the inverter's control panel. These two auxiliary relays operate independently of the inverter's status - whether the inverter is ON or OFF.

The software revision of your inverter determines whether RY9 and RY10 operate as active-high or active-low type relays. This depends on whether the inverter has:

1) the programming to allow for a "user-defined delay" when the relay energizes or de-energizes,

2) a hysteresis voltage setting (the difference between the relay activation and deactivation), or

3) a temperature compensation setting.

For specifics on the operation, programming, and adjustment values for the ALM, refer to your inverter's manual (Auxiliary Relay section).

Active-High Type Relay

This relay type energizes when the voltage is above the high-voltage setpoint and de-energizes when the voltage goes below the low-voltage setpoint.

Active-Low Type Relay

This relay type energizes when the voltage is below the low-voltage setpoint and de-energizes when the voltage goes above the high-voltage setpoint.

ALM Applications

There are a number of applications for the ALM. These applications are based on the configuration of the relays – whether configured active-high or active-low.

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Active-High Configurations

High-Voltage Alarm

The ALM can be configured to monitor the inverter's battery voltage and to engage an external alarm when the battery voltage increases above a safe level.

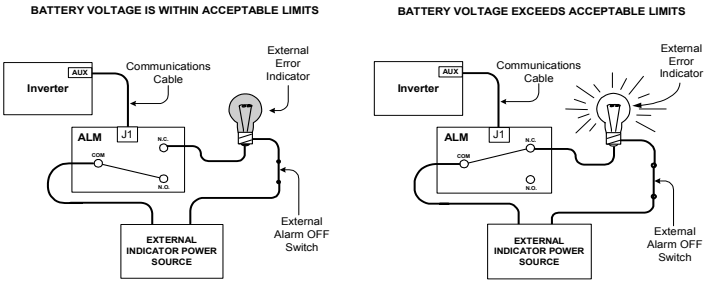

Figure 3-1
High-Voltage Alarm Configuration

Battery Exhaust Fan Controller

Use the ALM to ventilate enclosed battery compartments to remove explosive gasses, acid fumes, excess heat, and humidity. The ALM can be connected to automatically turn on exhaust fans when the battery reaches its gassing voltage and turn off the fan once the battery voltage returns to a lower level.

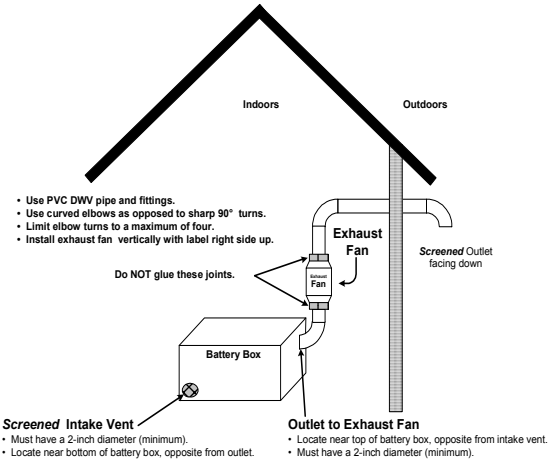

Figure 3-2
Exhaust Fan Installation Diagram

3.0 OPERATION

Exhaust Fan Electrical Wiring

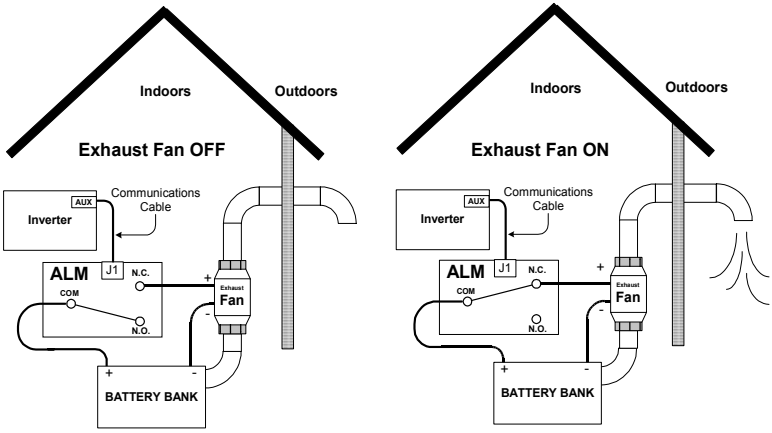

Figure 3-3
Exhaust Fan Electrical Wiring

Simple Charge Controllers

These configurations for the ALM provide over-voltage protection for your batteries.

Photovoltaic Charge Controller

The ALM can be used to control the charging of batteries from a solar array. The relays can be adjusted to open if the PV array's output increases above the maximum charge voltage and to automatically reconnect when the voltage falls to a "resume" recharge voltage level.

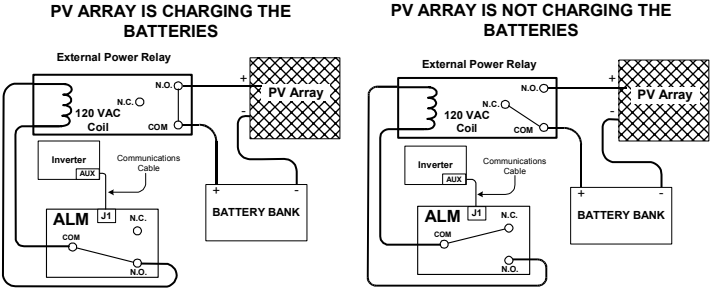

Figure 3-4
Using the ALM as a Photovoltaic Charge Controller

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Over-Voltage Protection Using a Grid-Tie Inverter

Normally, the grid-tie inverter will regulate the charging process of the battery by selling excess power into the utility grid. If the utility grid is not available (due to an outage or tripped AC input circuit breaker, etc.) or if the inverter shuts off, the inverter is not able to sell the excess power and the battery voltage will not be regulated, resulting in possible overcharging of the battery.

Therefore, the ALM can be configured to provide over-voltage protection for the battery when a utility outage has occurred. These relays can be configured to control an externally connected, power relay that disconnects the solar array and stops the charging process. The external relay can be either a standard mechanical type or a mercury displacement type, depending on the voltage and current required. The mercury displacement type relay is usually required when the system voltage is 48 VDC or if the current of the solar array exceeds about 20 amps. Multiple relays can be used if the solar array is divided into several source circuits (do not parallel relays for higher current).

A typical wiring configuration for this over-voltage protection is shown in Figure 3-5.

This circuit does draw a small amount of power all of the time to power the coil of the relay. This circuit provides protection against overcharging the batteries.

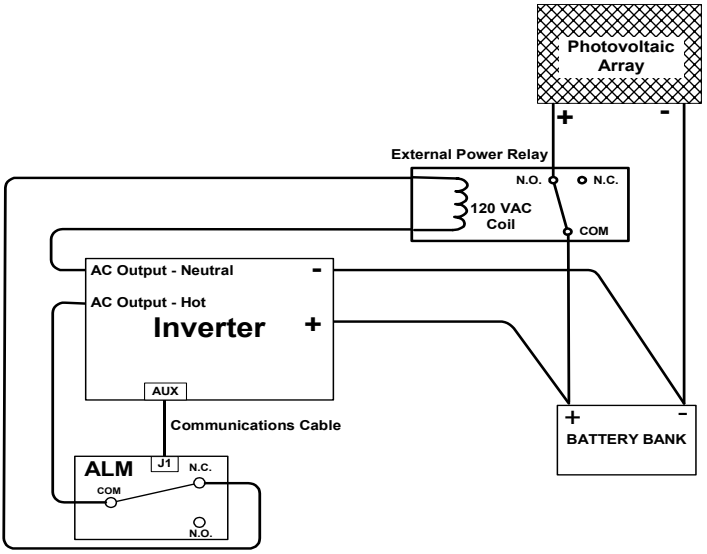

Figure 3-5
Over-Voltage Protection using a Grid-Tie Inverter

Active-Low Configurations

DC Load Controller

The ALM can also be configured to operate as a load controller to manage the discharging of the inverter's battery. (See Figure 3-6.) A load controller prevents damage to the battery from over-discharge during periods of poor charging or excessive loads. The ALM also can provide automatic reconnection of the loads at the reconnect setting. Reconnection of the load is allowed once the battery voltage has exceeded your reconnect setting. When used as a DC load controller, the user adjustments, enabled by your inverter's control device, control the reconnect and disconnect settings.

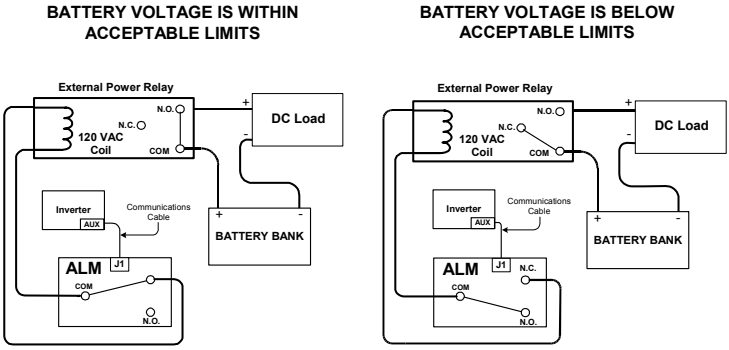

Figure 3-6
Using the ALM as a DC Load Controller

Diversion Load Controller

Diversion load controllers (also known as wind or Hydro-Dump controllers) operate by diverting excess charge current from the battery that is being charged to another load, for example, power resistors, water heater, etc. (See Figure 3-7.) This prevents damage to the charging source from an over-speed condition that could occur if the charging source is suddenly disconnected from all loads. Even with a solar-based system, it may be desirable to use this configuration to divert excess PV power to operate DC loads.

When the ALM is configured this way, its setpoint would energize the relay to energize a contactor (one that could handle the excess current). This would allow the excess charge current to divert to the "dump load" thereby preventing overcharged batteries.

CAUTION: If you are using AC loads as your diversion load through the inverter, be aware that you may overcharge your battery if the inverter fails or is turned OFF.

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When using this type of configuration, the separate diversion or "dump" load must be able to absorb more power than the charging source is able to produce at its peak output; otherwise, the DC voltage becomes unregulated. The current draw of the diversion load is very important. Problems can arise from operating with a load that is too small or too large. A diversion load that is too small will not be able to absorb all the excess power from the current source once the batteries are full; a load that is too big may cause a large in-rush of current above the design rating of the relay, causing premature failure. A good design practice is to use a diversion load that draws about 25% more current than the charging source's maximum output capability. The diversion load must be available for the diversion of power at all times. Resistive-type heating elements are the best diversion loads. Special direct current water heating elements are available. Light bulbs and motors are not recommended.

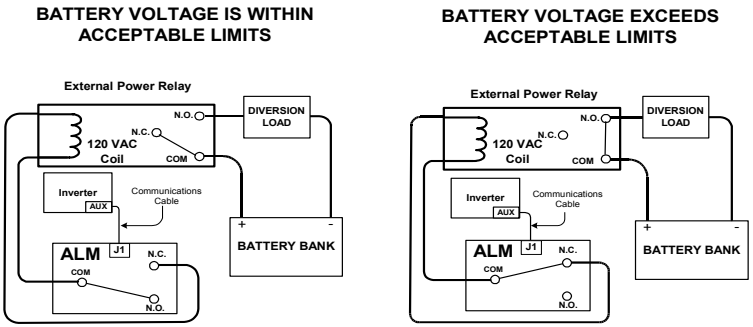

Figure 3-7
Using the ALM as a Diversion Load Controller

Low-Voltage Alarm

The ALM can be configured to monitor the inverter's battery voltage and to engage an external alarm when the battery voltage decreases to a low level.

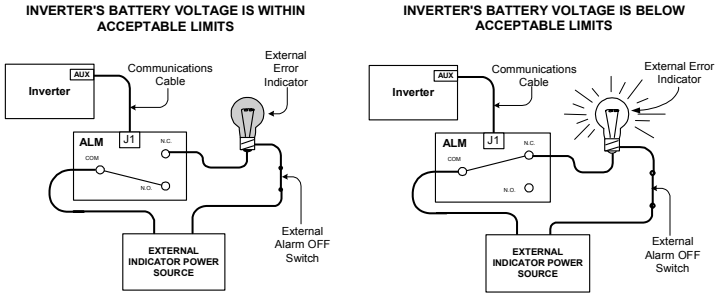

Figure 3-8
Low-Voltage Alarm Configuration

Notes:

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The ALM contains no serviceable parts other than the three fuses in the common contact circuit of the relays. If the module requires servicing, return it to an authorized Xantrex Technology Inc., service center or contact a Xantrex representative for assistance.

Symptom	Possible Cause	Remedy
Blue LED does not light.	Inverter not turned ON.	Turn ON inverter.
	Communication cable not connected to inverter or is in the wrong jack.	Check connection. Ensure it is connected to the proper jack in the inverter.
	Inverter error detected.	Check the inverter for proper operation. Troubleshoot the cause of the error using your control device (i.e., control panel, remote control) as a guide.
	Inverter is in CHR (charge only) mode.	Change the mode or apply AC utility (or generator) power to the inverter's input.
Blue LED lights, green and yellow LEDs do not light.	Inverter is not setup correctly.	Check the setup of the inverter using your control device (i.e., control panel, remote control). Refer to inverter operator's manual.
Green and yellow LEDs light but the circuit does not work.	Aux Relay Switch is in the OFF position.	Ensure the upper switch is in the ON position.
	Fuse(s) open.	Replace fuse, troubleshoot cause of overcurrent.
	Circuit wired incorrectly.	Recheck wiring and correct.
Relays actuate but the corresponding LED does not illuminate.	Bad LED.	Have the unit serviced.
NOTE: For additional information, refer to the the troubleshooting section in the inverter's operator's manual.		

Table 4-1
Troubleshooting Guide for the Auxiliary Relay Module

Notes:

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5.0 SERVICE INFORMATION

Xantrex Technology Inc., takes great pride in its products and makes every effort to ensure your unit fully meets your independent powering needs.

If your product needs repair, contact our Customer Service department at: (360) 435-8826 to obtain an RMA# and shipping information; or, fax this page with the following information to: (360) 474-0616. You can also contact us by email at tracewarranty@traceengineering.com.

Please provide:

Model Number: _____
Serial Number: _____
Purchase Date: _____
Problem: _____

Include a telephone number where you can be reached during business hours and a complete return shipping address (P.O. Box numbers are not acceptable).

Name: _____
Address: _____
City: _____
State / Province: _____
Zip / Postal Code: _____
Country: _____
Phone: (_____) _____
FAX: (_____) _____
E-mail Address: _____

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Notes:

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Limited Warranty

Xantrex Technology Inc., warrants its power products against defects in materials and workmanship for a period of two (2) years from the date of purchase, established by proof of purchase or formal warranty registration, and extends this warranty to all purchasers or owners of the product during the warranty period. Xantrex Technology Inc., does not warrant its products from any and all defects:

- arising out of material or workmanship not provided by Xantrex or its Authorized Service Centers;
- when the product is installed or exposed to an unsuitable environment as evidenced by generalized corrosion or biological infestation;
- resulting from abnormal use of the product, alteration, or use in violation of the instructions;
- in components, parts, or products expressly warranted by another manufacturer.

Xantrex Technology Inc., agrees to supply all parts and labor to repair or replace defective products covered by this warranty with parts or products of original or improved design, at the company's option. Xantrex Technology Inc., also reserves the right to improve the design of its products without obligation to modify or upgrade those previously manufactured. Defective products must be returned to Xantrex Technology Inc., or its Authorized Service Center in the original packaging or equivalent. The cost of transportation and insurance on items returned for service is the responsibility of the customer. Return transportation (UPS Ground or equivalent) as well as insurance on all repaired items is paid by Xantrex Technology Inc.

All remedies and the measure of damages are limited to the above. Xantrex Technology Inc., shall in no event be liable for consequential, incidental, contingent, or special damages, even if Xantrex Technology Inc., has been advised of the possibility of such damages. Any and all other warranties, expressed or implied, arising by law, course of dealing, course of performance, usage of trade or otherwise, including, but not limited to, implied warranties of merchantability and fitness for a particular purpose, are limited in duration for a period of two (2) years from the original date of purchase.

Some states or counties do not allow limitations on the term of an implied warranty, or the exclusion or limitation of incidental or consequential damage, which means the limitations and exclusions of this warranty may not apply to you. Even though this warranty gives you specific legal rights, you may also have other rights which vary from state to state.

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6.0 WARRANTY

Notes:

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Specifications

Electrical

Operating Voltage	11 VDC (provided by inverter)
Operating Current	< 10 mA
Relay Contact Rating	250 VAC, 10 amps max. (resistive load only) 30 VDC, 8 amps max. (resistive load only)
Wire Size Accepted	28 AWG to 14 AWG
Switches	2 DPDT switches
Protection	3–Fuses, 6.3 amps max. (5 mm x 20 mm), time delay Bussman–GDC, Littlefuse–218 series
Indicator LEDs	3–LEDs, green, yellow, and blue
Interface Cable 25 ft.	Telephone-type cable with RJ11 plugs
Interface Connection	Telephone-type RJ11 jack
Terminal Block	Snap-lock type connection

Mechanical

Material	Indoor-type, powder coated, steel enclosure for wall mounting
Dimensions	6.8" H x 4.8" W x 2.0" D (15.6 cm H x 12.4 cm W x 5.0 cm D)

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7.0 SPECIFICATIONS

Notes:

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