

# Alpha FXM 650, 1100, 2000 UPS

## Installation and Operation Manual






# Alpha FXM 650, 1100, 2000 UPS Installation and Operation Manual

 **NOTE:**


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**Photographs contained in this manual are for illustrative purposes only. These photographs may not match your installation.**

 **NOTE:**

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**Operator is cautioned to review the drawings and illustrations contained in this manual before proceeding. If there are questions regarding the safe operation of this powering system, contact Alpha Technologies or your nearest Alpha representative.**

 **NOTE:**

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# Table of Contents

|  |    |
|--|----|
| 1. Safety.....   | 4  |
| 1.1 Safety Symbols .....                                   | 4  |
| 1.2 General Warnings and Cautions .....                    | 5  |
| 1.3 Certifications and Compliances.....                    | 6  |
| 2. General Description .....                               | 7  |
| 2.1 Overview .....   | 7  |
| 2.2 Front Panel.....                                       | 7  |
| 3. Site Planning.....                                      | 11 |
| 3.1 Safety Precautions .....                               | 11 |
| 3.2 Electromagnetic Compatibility (EMC) Requirements ..... | 12 |
| 4. Unpacking Alpha FXM .....                               | 13 |
| 5. Installation.....                                       | 14 |
| 5.1 Tools and Equipment Required for Installation.....     | 14 |
| 5.2 Wiring the External Batteries.....                     | 16 |
| 5.3 UATS and (UGTS) Option.....                            | 18 |
| 6. Operation .....   | 19 |
| 6.1 Communicating with the Alpha FXM .....                 | 20 |
| 6.2 Operating the Control Panel.....                       | 21 |
| 6.3 Switching the Alpha FXM On and Off.....                | 24 |
| 6.4 Operating the Alpha FXM.....                           | 25 |
| 6.5 Making Measurements.....                               | 27 |
| 6.6 Viewing the 100-Event Log .....                        | 28 |
| 6.7 Communicating with the RS-232 interface.....           | 29 |
| 6.8 Using the Main Menu .....                              | 31 |
| 6.9 RS-232 Menu Tree.....                                  | 32 |
| 6.10 Operation .....                                       | 44 |
| 6.11 Communicating Via The Intranet or Internet.....       | 65 |

|  |    |
|--|----|
| 7. Maintenance .....   | 68 |
| 7.1 Updating the Software.....   | 68 |
| 7.2 Testing and Replacing the Batteries.....                               | 71 |
| 7.3 Preventative Maintenance.....  | 74 |
| 8. Troubleshooting .....   | 75 |
| 8.1 Procedure.....   | 75 |
| 9. Specifications.....   | 77 |
| 10. Peukert Number and Battery Capacity .....                              | 80 |
| 10.1 Introduction .....  | 80 |
| 10.2 Determining the Peukert's Number and Peukert's Capacity .....         | 80 |
| 10.3 Determining Peukert's Capacity for Series Parallel Combinations ..... | 80 |
| 10.4 Example .....   | 81 |
| 10.5 Using the Spreadsheet.....  | 82 |
| 11. Warranty.....  | 83 |
| 11.1 Battery Warranty.....   | 83 |
| 12. Emergency Shutdown Procedure .....                                     | 84 |

# 1. Safety

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**SAVE THESE INSTRUCTIONS:** This manual contains important safety instructions that must be followed during the installation, servicing, and maintenance of the product. Keep it in a safe place. Review the drawings and illustrations contained in this manual before proceeding. If there are any questions regarding the safe installation or operation of this product, contact Alpha Technologies or the nearest Alpha representative. Save this document for future reference.

## 1.1 Safety Symbols

To reduce the risk of injury or death, and to ensure the continued safe operation of this product, the following symbols have been placed throughout this manual. Where these symbols appear, use extra care and attention.

The use of ATTENTION indicates specific regulatory/code requirements that may affect the placement of equipment and /or installation procedures.



### **NOTE:**

**A NOTE provides additional information to help complete a specific task or procedure. Notes are designated with a checkmark, the word NOTE, and a rule beneath which the information appears.**



### **CAUTION!**

**CAUTION indicates safety information intended to PREVENT DAMAGE to material or equipment. Cautions are designated with a yellow warning triangle, the word CAUTION, and a rule beneath which the information appears.**



### **WARNING!**

**WARNING presents safety information to PREVENT INJURY OR DEATH to personnel. Warnings are indicated by a shock hazard icon, the word WARNING, and a rule beneath which the information appears.**



### **HOT!**

**The use of HOT presents safety information to PREVENT BURNS to the technician or user.**

## 1.2 General Warnings and Cautions

You must read and understand the following warnings before installing the Alpha FXM and its components. Failure to do so could result in personal injury or death.

- Read and follow all instructions included in this manual.
- Do not work alone under hazardous conditions.
- Only qualified personnel are allowed to install, operate and service this system and its components.
- Use proper lifting techniques whenever handling equipment, parts, or batteries.
- Always assume electrical connections or conductors are live. Switch off all circuit breakers and double-check connections with a voltmeter before performing installation or maintenance.
- Place warning label(s) on the utility panel to tell emergency personnel a UPS is installed.
- The Alpha FXM uses more than one live circuit. AC power may be present at the outputs even if the system is disconnected from line or battery power.
- The Alpha FXM's surface can be very hot to the touch.
- Battery installation and servicing should be done or supervised by personnel knowledgeable about batteries and their safety procedures.
- If electrolyte splashes on your skin, immediately wash the affected area with water. If electrolyte gets into your eyes, wash them for at least 10 minutes with clean running water or a special neutralizing eye wash solution. Seek medical attention at once.
- Neutralize spilled electrolyte with special neutralizing solutions in a "spill kit" or a solution of 1 lb. (0.45 kg) of baking soda (bicarbonate of soda) in 1 gallon (3.8 L) of water.
- Be extra cautious when connecting or adjusting battery cabling. An improperly connected battery cable or an unconnected battery cable can result in arcing, fire, or explosion.
- Use new batteries when installing a new unit. Verify that all batteries are the same type with identical date codes.
- Always replace batteries with ones of identical number, type and rating. Never install old or untested batteries. One sealed lead-acid battery is rated to a maximum voltage of 12 VDC.
- A battery that shows signs of cracking, leaking or swelling must be replaced immediately by authorized personnel using a battery of identical type and rating.
- Keep the chassis area clear and dust-free during and after installation.
- Keep tools away from walk areas where you or others could fall over them.
- Wear safety glasses when working under any conditions that might be hazardous to your eyes.
- Do not work on the unit or connect or disconnect cables during periods of lightning activity.
- Do not smoke or introduce sparks in the vicinity of a battery.
- Never open or damage the batteries. Released electrolyte is harmful to the skin and eyes. It may be toxic and hazardous to the environment.
- A battery can present a risk of electrical shock and high short-circuit current. The following precautions should be observed when working on batteries:
  - a. Remove watches, rings, or other metal objects.
  - b. Use tools with insulated handles.
  - c. Wear rubber gloves and boots.
  - d. Do not lay tools or metal parts on top of batteries.
  - e. Disconnect the charging source before connecting or disconnecting battery terminals.
  - f. Determine if the battery is inadvertently grounded. If inadvertently grounded, remove the source from the ground. Contact with any part of a grounded battery can result in electrical shock. The likelihood of such shock can be reduced if the grounds are removed during installation and maintenance (applicable to equipment and remote battery supplies not having a grounded supply circuit).

- Never let live battery wires touch the Alpha FXM, the enclosure or any other metal objects. This can cause a fire or explosion.
- Never dispose of batteries in a fire. The batteries may explode. Follow the manufacturer's directions and check with your local jurisdictions for safe battery disposal.
- Before attaching the batteries to the Alpha FXM, make sure that the polarity is correct.
- If the batteries have been in storage for more than 3 months, recharge them for at least 24 hours and then test them with a load before installation.
- Each AlphaCell™ battery has a date code, found on the warning label, which must be recorded in the maintenance log. If non-Alpha batteries are used, see the manufacturer's documentation for date code type and placement.

### **1.3 Certifications and Compliances**

The Alpha FXM has been designed, manufactured, and tested to the requirements of the following national and international safety standards:

- CAN/CSA-C22.2 No. 107.3-05 – Uninterruptible Power Systems; additional requirements (RD): CAN/CSA-C22.2 No. 60950-1-03 - Information Technology Equipment - Safety.
- UL 1778 (Edition 4) – Uninterruptible Power Systems; additional requirements (RD): UL 60950-1 (Edition 1) - Information Technology Equipment - Safety.
- FCC CFR47 Part 15 Class A – This equipment has been tested and found to comply with the limits for a Class A digital device pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.
- Industry Canada - This Class A digital device apparatus complies with Canadian ICES-003.
- Industry Canada - Cet appareil numérique de la Classe A est conforme la norme NMB-003 du Canada.



## 2. General Description

### 2.1 Overview

The Alpha FXM is available in 3 models – FXM 650, FXM 1100 and FXM 2000. The FXM 650 and the FXM 1100/2000 look different, but all of the front panel connectors and circuit breakers operate in the same way. However the circuit breakers for each unit have different ratings. See “Specifications” for details. All units operate in the same way unless stated otherwise in this manual.

- FXM 650-24VDC – with a 24 VDC battery string voltage.
- FXM 650-48VDC – with a 48 VDC battery string voltage.
- FXM 1100-48VDC – with a 48 VDC battery string voltage.
- FXM 2000-48VDC – with a 48 VDC battery string voltage.

### 2.2 Front Panel.

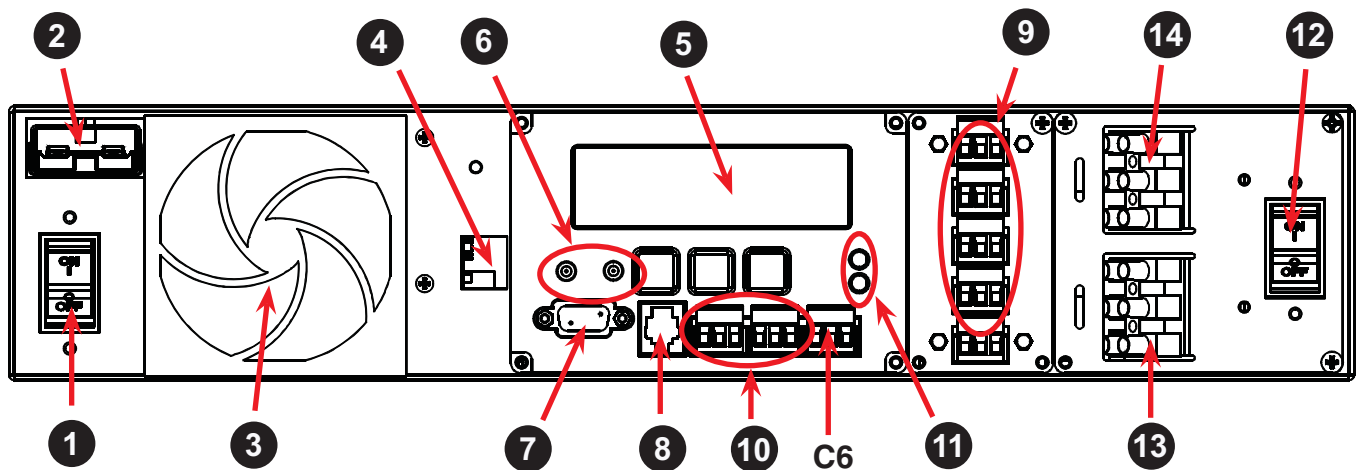


Figure 1 — FXM 650 front panel description

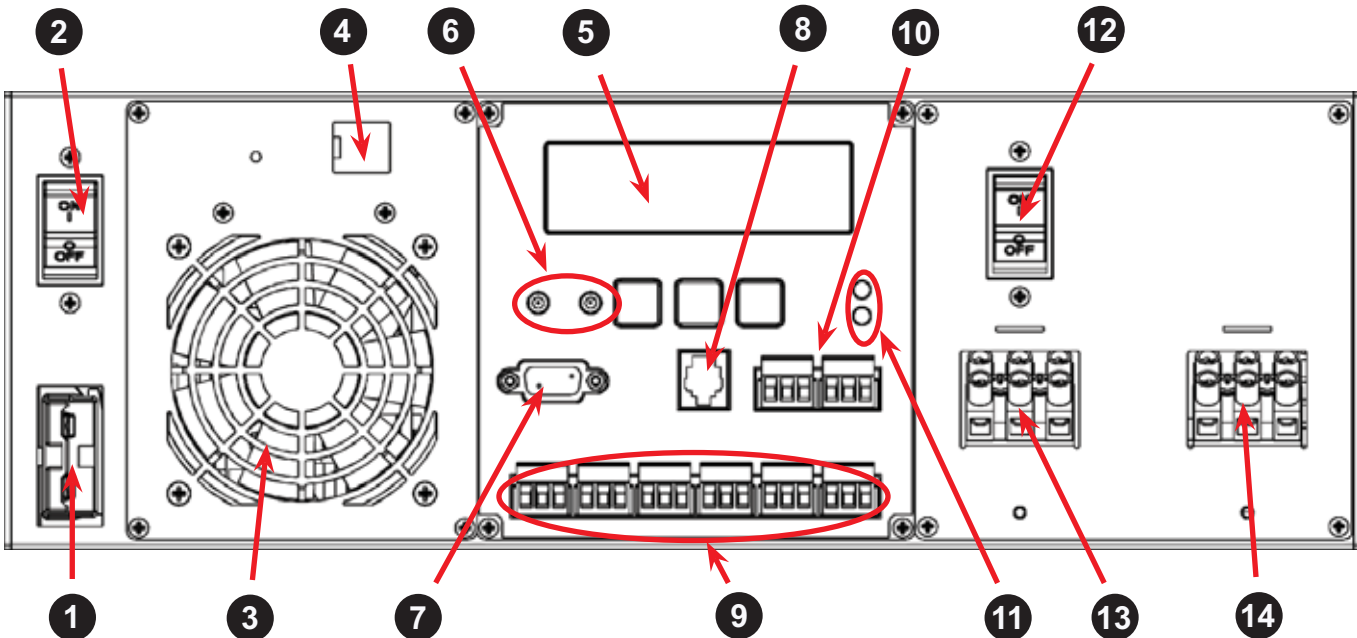


Figure 2 — FXM 1100/2000 front panel description

## **1 Battery Breaker**

This circuit breaker provides over-current protection and is used as an on/off switch for the battery power. It must be switched on for proper Alpha FXM operation.

## **2 Battery Connector**

The battery connector connects the external batteries to the Alpha FXM.

## **3 Internal Fan**

This microprocessor-controlled fan regulates the Alpha FXM's internal temperature for optimum performance. It must not be blocked. If the fan fails, an Alarm is generated.

## **4 LAN**

This optional RJ-45 connector is the Alpha FXM's Ethernet connector.

## **5 LCD Control Panel**

The LCD control panel together with the cancel, scroll and select buttons are used to monitor and control the Alpha FXM.

## **6 Battery Voltage Test Points**

These let you measure the battery voltage. They accept 2 mm diameter test probe tips. The battery circuit breaker must be on to measure the voltage.

The battery voltage test points are not and should not be used as a power outlet.

## **7 RS-232**

This DE-9 connector allows a straight-through DE-9 to DE-9 connector cable to be used to connect the Alpha FXM to a computer for remote control and monitoring.

## **8 Battery Temp**

The Battery Temp connector attaches the battery temperature sensor to the Alpha FXM to monitor the battery temperature. The charging voltage is temperature dependant. The Alpha FXM's microprocessor adjusts the charging voltage for optimum charging.

The sensor MUST be attached to the Alpha FXM for normal operation. Firmly attach the sensor end to the centre battery's case with high-strength flameproof tape such as duct tape as shown in "Wiring the External Batteries" section. If the sensor isn't attached, a "Temperature Probe Unplugged" alarm will appear on the LCD.

## **9 Contacts C1 to C6**

Contacts C1 to C5 allow the Alpha FXM to be connected to an external monitoring panel or to traffic control equipment.

The factory default settings can be reprogrammed to meet your requirements. See "Programming the Dry Contacts and the Clock" and "Alpha UPS Monitor, Operations, Relay and Load Shed".

For Contact C6, the default factory configuration is +48 VDC output (FXM 650-24 is +24 VDC), but it can be factory configured as a dry contact. Figure 4 shows the contact's layout while Figure 5 shows the +48 VDC or +24 VDC terminal block layout.

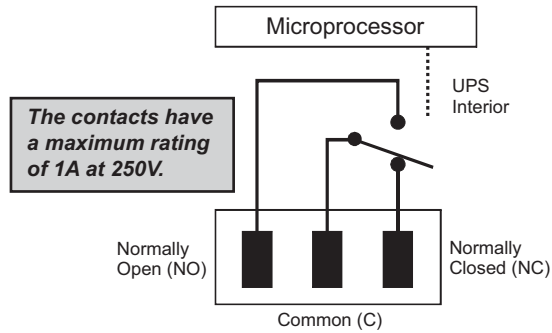


Figure 3 — Contact Layout (Standard for C1 to C5, Factory Option for C6)

**C1:** The C1 contact is energized when line power is unqualified and the Alpha FXM provides backup battery power to the load(s). It can be called the “On Battery” contact.

**C2, C3:** These contacts are energized when the battery drops below a pre-set voltage level. They can be called the “Low Battery” contacts. You can change the pre-programmed level to match the batteries used and the actual operating conditions. See “Operating the Alpha FXM “#35 Low Battery Warning Voltage”.

**C4:** This contact is energized after the Alpha FXM has been in Inverter mode for 2 hours. It can be called the “Timer” contact.

You can change the pre-programmed 2 hours to match your operating conditions. See “Programming the Dry Contacts and the Clock, Setting the Timer Contact”.

**C5:** The C5 contact is energized when the Alpha FXM is operating close to the specified limits. It can be called the “Alarm” contact.

**C6:** The factory default layout for the C6 contact is a relay that is energized when the Alpha FXM is in Line or Inverter modes and is de-energized when in the Standby mode. It provides 48 VDC (500 mA) or 24 VDC (500 mA) from the external batteries to an external fan or other equipment. C6 can be factory-configured as a dry contact.

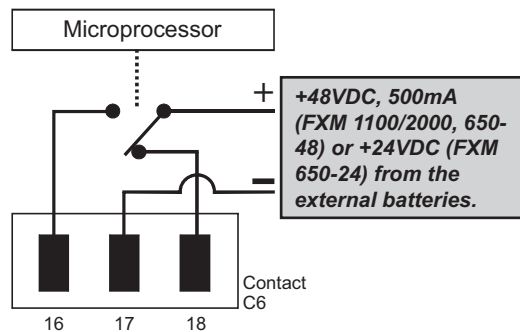


Figure 4 — 48 VDC / 24 VDC Contact Layout (De-energized Shown, Factory Default for C6)

## 10 Contacts C7 and C8

These optically isolated inputs are used to attach an external switch panel for remote control of the Alpha FXM or to allow the Alpha FXM to control Alpha Technologies's optional Automatic Transfer Switch (ATS).

**User Input (C7):** This relay has three contacts that are used to control the Alpha FXM (Figure 5). They are:

**19 (S1):** Shorting this contact starts the Alpha FXM's battery test. See "Operating the Alpha FXM, Battery Test".

**20 (S2):** Shorting this contact activates an alarm. See "Trouble Analysis, User Input Alarm".

**21 (S3):** Shorting this contact disables the AC output. There is no AC output power, the LCD display shows "SHUTDOWN" (Model 1000 only), but the Alpha FXM is still energized. A manual restart is required to put the Alpha FXM back to normal operation.

**22 (C):** Isolated return for contacts S1, S2 and S3. It is located on contact C8 (#22).

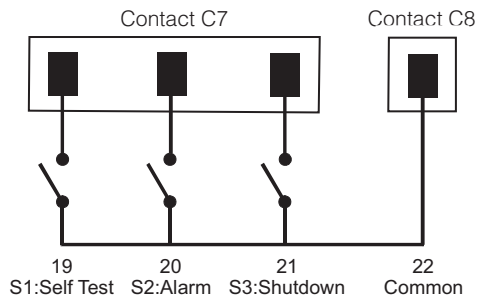


Figure 5 — User Input Layout

**ATS (C8):** When the Alpha FXM is in the Inverter mode, this normally open relay closes (Figure 6), sending 48 VDC (FXM 650-48, 1100, 2000) or 24 VDC (FXM 650-24) from the external batteries to this dry contact. If the optional Alpha Technologies's Automatic Transfer Switch (ATS) is connected, it will cause the ATS to switch the load from line power to the Alpha FXM's battery backup power.

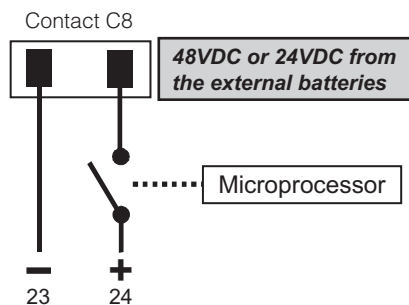


Figure 6 — ATS Layout

## 11 Status and Alarm LEDs

**Status:** When this green LED is illuminated, the Alpha FXM is in Line mode and line power is provided to the load. When this LED is flashing, the unit is in Inverter mode and backup battery power is provided to the load.

**Alarm:** When this red LED is illuminated, there is a fault in the Alpha FXM. When this LED is flashing, there is an alarm.

## 12 Input Circuit Breaker

This circuit breaker is an on/off switch for the line power into the Alpha FXM that also provides input protection. It must be switched on for proper Alpha FXM operation.

## 13 Input Terminal Block

This terminal block is the Alpha FXM's AC line power input.

## 14 Output Terminal Block

This terminal block is the Alpha FXM's AC power output.

## 3. Site Planning

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### WARNING!

**Restricted Access:** The Alpha FXM must be installed in a restricted area accessible only by qualified service personnel.

The Alpha FXM is intended for permanent AC connection only. The only exception is the FXM650(U) model.

The Alpha FXM must be correctly grounded for proper operation. Older facilities may have inadequate electrical grounding. Inspection must be performed by a qualified electrician before installation to ensure that grounding meets the local electrical code.

The utility line attached to the Alpha FXM input **MUST** be protected by a circuit breaker certified for this use in accordance with the local electrical code. The UPS must be connected only to a dedicated branch circuit.

The UPS equipment that is powered by this service panel requires the neutral to be permanently bonded to the ground. Always disconnect the batteries before servicing the circuit breaker panel.

The input and output lines to and from the Alpha FXM **MUST** have disconnect devices attached.

The Alpha FXM is suitable for installations in network telecommunication facilities and locations where the National Electrical Code applies.

**Grounding:** The Alpha FXM is suitable both for installation as part of a common bonding network and an isolated bonding network.

For installations above 1400 m (4500 ft) elevation, additional cooling may be needed to reduce the operating temperature of the Alpha FXM. The maximum allowable operating temperature must be reduced by 2°C for every 300 m (1000 ft) above 1400 m (4500 ft).

### 3.1 Safety Precautions

- Install the Alpha FXM on a surface that can support its weight. See "Specifications".
- The input wiring must reach a suitably grounded power outlet and the load wiring must reach the Alpha FXM's output terminal blocks.
- The Alpha FXM should be placed at a properly sheltered location or inside a weather-proof enclosure to protect the electronics from water, dust and other possible contamination.
- Alpha Technologies offers a wide range of outdoor enclosure systems. Visit our website at [www.alpha.ca](http://www.alpha.ca), or call customer service for more information.

- In the Generator mode, the Alpha FXM's range of acceptable input frequency and voltage is expanded to accept the fluctuations created by a generator. See "Operating the Alpha FXM, Sense Type". Use a generator with electronic speed and voltage controls which produces less than 10% voltage total harmonic distortion (THD). Mechanical governors can force the Alpha FXM to run continuously in the Battery mode. Before installation, make sure the generator's output voltage is compatible with the Alpha FXM's input voltage requirements. To make sure the system runs smoothly, use a generator that supplies twice as much power as drawn by the total load.

## **3.2 Electromagnetic Compatibility (EMC) Requirements**

Observe the following EMC requirements when setting up the Alpha FXM and its internal equipment:

- All AC mains and external supply conductors must be enclosed in a metal conduit or raceway when specified by local, national, and/or other applicable government codes and regulations.
- The customer facilities must provide suitable surge protection.

# 4. Unpacking Alpha FXM

Follow these guidelines for unpacking the Alpha FXM.



## WARNING!

**The Alpha FXM is heavy, up to 16 kg (35 lb). Use proper lifting techniques. The lifting and moving should be done by at least two people to avoid injury.**

1. Select a suitable area for unpacking.
2. Store all the packing material and boxes for possible equipment returns.
3. Check the contents in your product package. See “Checking the Package Contents” on this page.
4. Compare the packing slip and the list of parts with the items you received. If the list of parts on your packing slip does not match the items you received, or any items appear damaged, immediately notify your carrier agent and the supplier who prepared your shipment.

### 4.2.1 Checking the Package Contents

Before starting the installation, inspect the package contents and make sure the following standard items as well as purchased options are included.

| Table A — Standard Items |   |
|--------------------------|---|
| Quantity                 | Item  |
| 1                        | Alpha FXM                                       |
| 1                        | Alpha FXM Operator’s Manual                     |
| 8                        | Terminal blocks and labels for the dry contacts |
| 1                        | Temperature sensor cable                        |

| Table B — Optional Items |   |
|--------------------------|---|
| Quantity                 | Item  |
|                          | Batteries, if ordered from Alpha, will be shipped separately. |
|                          | Enclosure (with optional mounting hardware kit)               |
|                          | Battery heating mats  |
|                          | NetworkInterface Card   |

# 5. Installation

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## **WARNING!**

**The Alpha FXM module MUST be correctly grounded for proper operation.**

**The input and output lines to and from the Alpha FXM. MUST have disconnect devices attached.**

**The Alpha FXM must be installed in a restricted area accessible only by qualified service personnel.**

Once the installation location has been planned and prepared, you are ready to install the Alpha FXM. There are three steps to setting up the Alpha FXM:

1. Mounting the Alpha FXM.
2. Wiring the external batteries.
3. Wiring the Alpha FXM.

## **5.1 Tools and Equipment Required for Installation**

1. DC voltmeter.
2. Labels or masking tape and marker.
3. Torque wrench for input/output terminal blocks.
4. Slot head screwdriver to fit the terminal blocks.
5. Minimum #10 AWG copper wire for input/output terminal blocks.
6. High strength, flame-proof tape such as duct tape.
7. Battery terminal corrosion inhibitor such as NOCO Company's NCP-2 or Sanchem Inc.'s No-Ox ID Grease "A".



### 5.1.1 Mounting the Alpha FXM

The Alpha FXM can be placed on a shelf with no other parts needed. Any version of the FXM can be rack or wall mounted or secured to a shelf, such as on an outdoor enclosure's shelf, with the optional mounting brackets as shown in the figure below. The brackets and the screws to attach them to the Alpha FXM's case are available from Alpha Technologies (part number 740-697-21).



#### CAUTION!

**Terminal block covers and the battery harness restraining bracket MUST be used and are available from Alpha Technologies (part number 740-698-21). If the Alpha FXM end application is mounted inside an enclosure or in an area restricted to authorized personnel, then the covers and bracket may or may not be needed.**

To meet NEBS Level 1 specifications when you are installing this unit in a rack or frame, do the following:

1. Before installation, clean all attachment points on the Alpha FXM, rack and mounting brackets and bring them to a bright finish. Then coat them with an anti-oxidant such as Sanchem Inc.'s No-Ox ID "A-Special Electrical Grade" or equivalent.
2. Attach the mounting brackets with the thread forming screws and the paint piercing washers provided with the brackets to insure adequate grounding between the Alpha FXM's chassis and the rack.

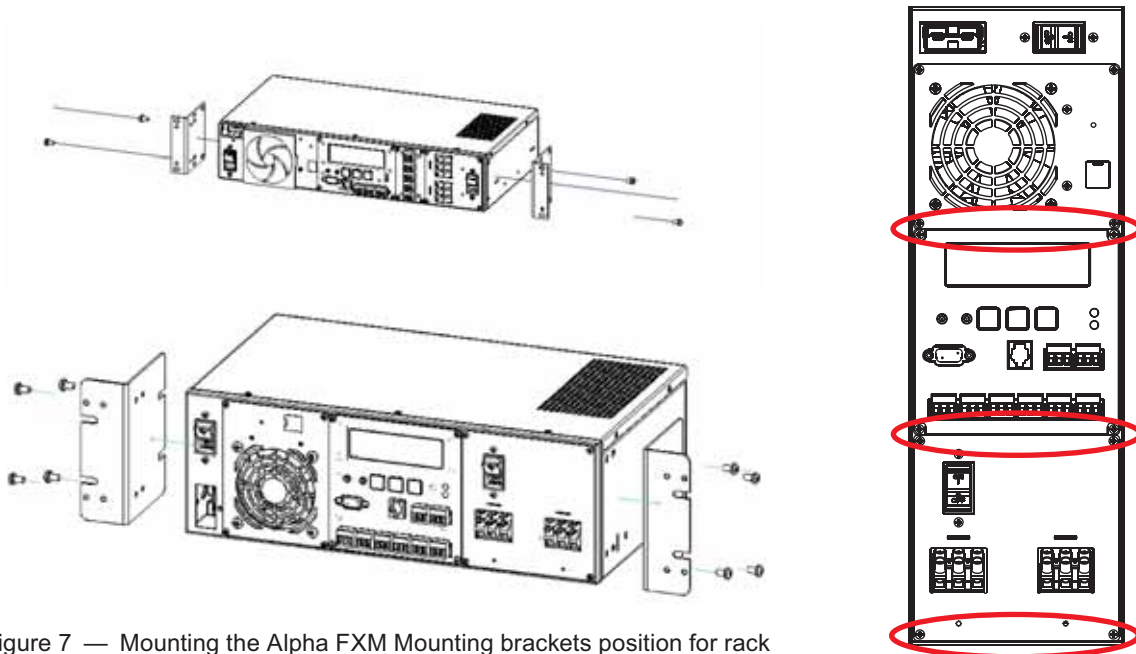


Figure 7 — Mounting the Alpha FXM. Mounting brackets position for rack mounting. Rotate to fit either 19" or 23" racks.

For the FXM 1100/2000 units only, the control panel and the power connection panel can be rotated to suit your needs. To rotate either one, unscrew the screws in each corner, remove the panel, rotate it and reinstall the screws.



#### CAUTION!

**Use care to avoid damaging or pulling out the wires or the ribbon cables when rotating the panels.**

## 5.2 Wiring the External Batteries



### WARNING!

The batteries must be installed by qualified personnel trained in the safe use of high-energy power supplies and their batteries. Refer to the safety section in this manual.

- Use new batteries when installing a new unit. Verify that all batteries are the same type with identical date codes.
- For the FXM 650-24, the battery string is 24 VDC. For the FXM 650-48/1100/2000, the battery string is 48 VDC.
- If you are making your own battery wiring harness, use at least 10 AWG (for FXM 650/1100) or 8 AWG (FXM 2000) wires.
- The battery return connection is to be treated as an Isolated DC return (DC-I) as defined in GR-1089-CORE.

### 5.2.1 Procedure

1. For FXM 650-48/1100/2000 (48 V battery string), number the batteries from 1 to 4 with labels or tape. For FXM 650-24 (24 V battery string), number the batteries from 1 to 2 as shown in the figure below.

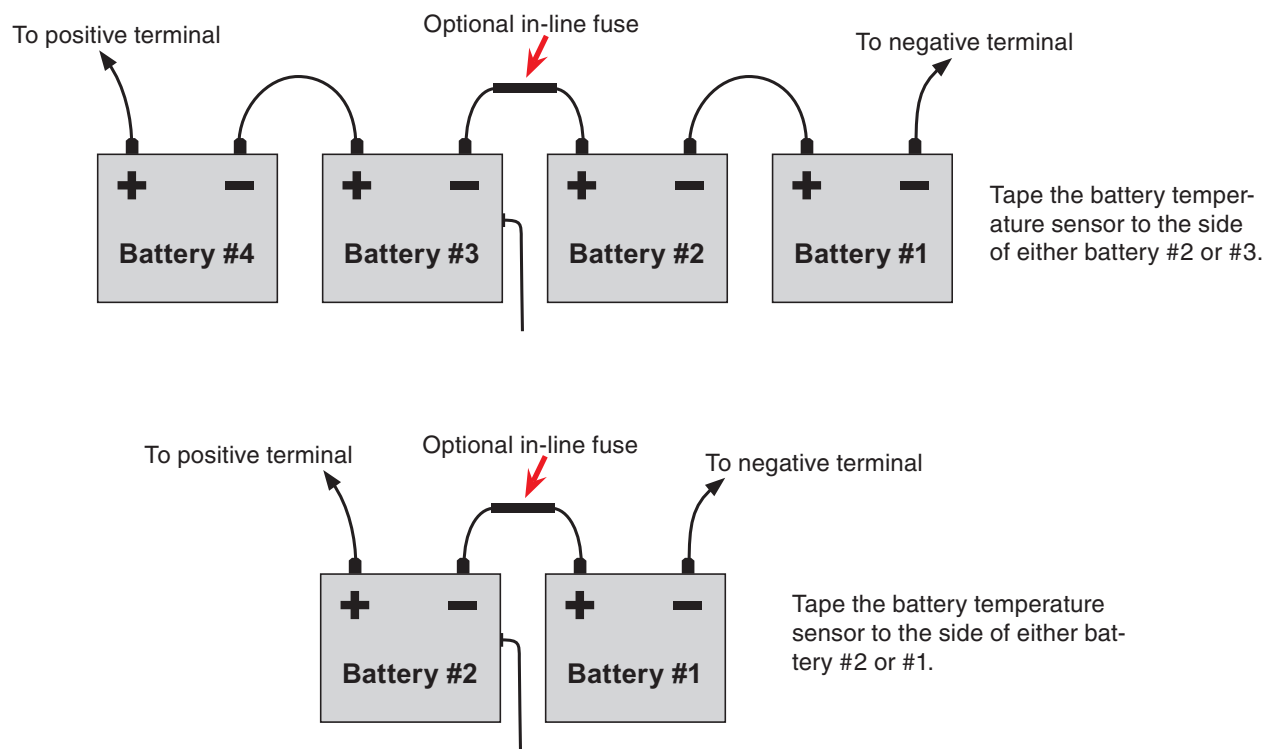


Figure 8 — External Battery Wiring (for 48 VDC string (top) and 24 VDC string)

2. Wire the batteries as shown in Figure 8. If used, install the in-line fuse as shown.



## CAUTION!

**Torque the battery terminals according to the manufacturer's specifications as given on the name plate or data sheet.**

3. Verify the battery connector polarity and the DC voltage with a DC voltmeter. If correct, attach it to the Alpha FXM's external battery connector. Otherwise, perform troubleshooting before connecting it to the Alpha FXM.
4. Route the sensor end of the battery temperature cable to the batteries. Tape it to the side of battery as shown in Figure 8.
5. If multiple battery strings are used, repeat steps 1 to 4 as required.

## 5.2.2 Wiring the Alpha FXM

### WARNING!

**Make sure the line power is off. Switch off all input and output circuit breakers on the Alpha FXM before making any electrical connections.**

**If stranded wires are used to connect the input and output terminal blocks, ferules or equivalent crimping terminals must be used.**

### 5.2.3 Procedure

1. Connect the temperature sensor to the Alpha FXM (Batt Temp connector **8**). Attach the end of the battery temperature sensor to the side of the centre battery.
2. If used, connect the following ports:
  - Ethernet port **4**.
  - RS-232 port **7**.
  - Dry contacts **9**.
  - User inputs **10**.
3. Connect the load to the Alpha FXM's Output terminal block **14**. Torque to 1.4 N-m (12 lb-in).
4. Connect the line power to the Alpha FXM's AC Input terminal block **13**. Torque to 1.4 N-m (12 lb-in).

### WARNING!

**Before proceeding, verify that the line wire is attached to the line terminal block, the ground wire is attached to the ground terminal block, and the neutral wire is attached to the neutral terminal block to prevent accidental shocks or electrocutions.**

5. Connect the external batteries to the Battery connector **2**. Refer to “Wiring the external batteries”.
6. If needed, attach the terminal block covers and battery harness restraining bracket. See “Mounting the Alpha FXM”.

## 5.3 UATS and (UGTS) Option

The Universal Automatic Transfer Switch (UATS) and Universal Generator Transfer Switch (UGTS) are the next generation of Automatic Transfer Switch (ATS) and Generator Transfer Switch (GTS) products. They are optional add-on switching units specifically designed for the FXM UPS family (FXM 650, 1100 and 2000) and the Micro UPS family (Micro 300 and 1000). These switching units provide power and/or bypass capacity (automatic or manual) so that the operator may safely disconnect the UPS from line or generator power for easy removal and servicing. In bypass mode, the loads are directly connected to the line or generator power without any conditioning. Depending on the use of one and/or the other, the UATS/UGTS allows the use of up to 3 different back-up sources (line, batteries and generator). Refer to the UATS/UGTS Installation Manual (Alpha P/N 020-165-B0) for details.

### WARNING!

**Make sure you have read and understood the instructions given in the UATS/UGTS Installation Manual before making any connection to the supply.**

## 6. Operation

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The following subsections describe the operation of the Alpha FXM:

- Communicating with the Alpha FXM.
- Operating the control panel.
- Switching the Alpha FXM on and off.
- Operating the Alpha FXM.
- Making measurements.
- Viewing the 100-event log.
- Communicating with the RS-232 interface.
- Communicating via the intranet or internet.

## 6.1 Communicating with the Alpha FXM

There are several ways you can communicate with the Alpha FXM UPS:

1. Using the control panel.
2. Using a RS-232 interface, you can access the UPS's command line system with Window's HyperTerminal or other terminal emulation program.
3. Using a RS-232 serial connection via the Alpha UPS Monitor installed on your computer. The Alpha UPS Monitor software can be downloaded from [www.alpha.ca./downloads/](http://www.alpha.ca./downloads/).
4. Using the optional factory-installed FXM communication module, you can communicate with the Alpha FXM over a company intranet or the internet using a web browser or with SNMP communications.

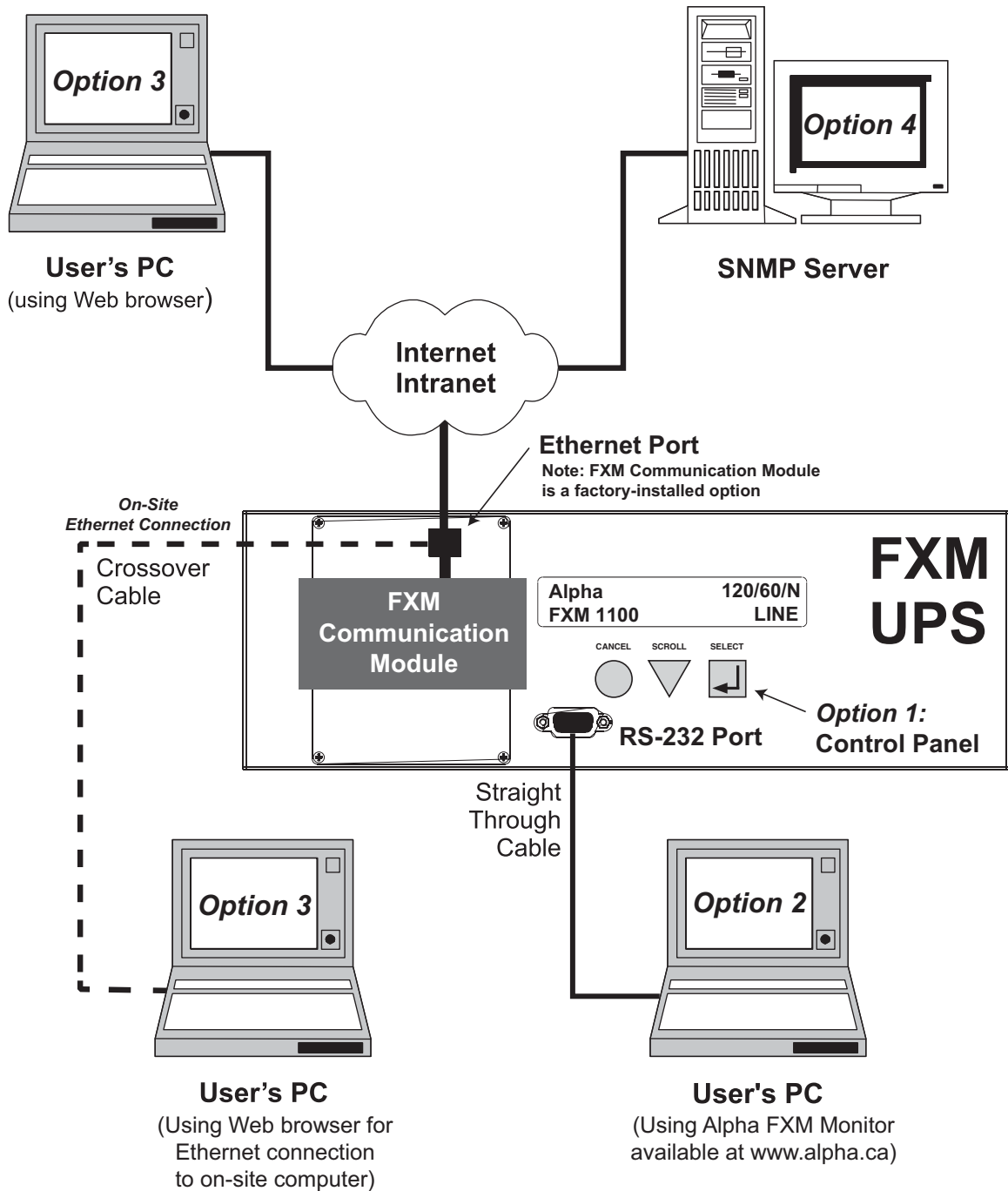


Figure 9 — Alpha FXM Communication Options

## 6.2 Operating the Control Panel

The LCD control panel provides “at a glance” monitoring. This panel, when used along with the **CANCEL**, **SCROLL** and **SELECT** buttons, allows you to program, make measurements, and troubleshoot the Alpha FXM. The layout is shown in the figure below.

The Alpha FXM is monitored and controlled with a series of menus and submenus. The Menu Tree is shown in Figure 11. For a tutorial on how to use this panel, see “Replacing the Batteries”.

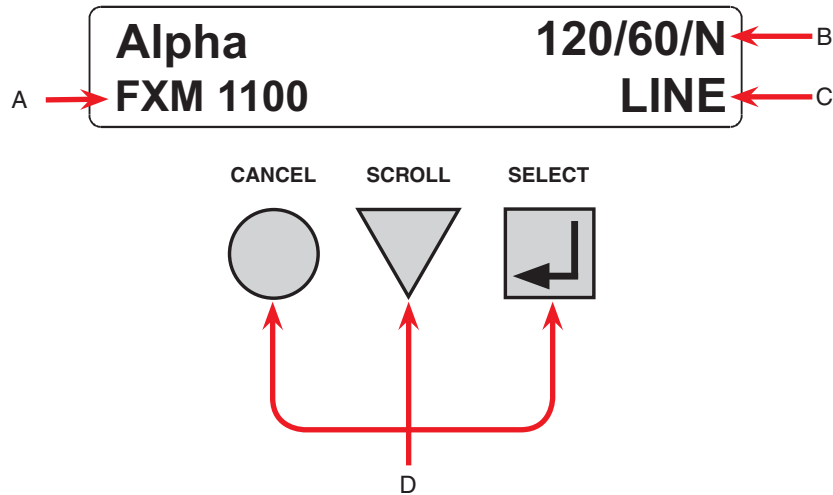


Figure 10 — LCD Control Panel Logo Screen

**A Alpha FXM model name**

Alpha FXM voltage configuration - 120 VAC or 230 VAC

Alpha FXM Frequency - 50 Hz or 60 Hz

**B** Sense Type setting - Normal (N) or Generator (G); see "Operating the Alpha FXM", Sense Type.

**C Present operating mode** - (LINE mode shown) See Figure 10.

Control buttons:

**SELECT** - Pressing SELECT moves you down 1 level in the menu tree (Table C) or accepts a change when programming.

**D SCROLL** - Pressing SCROLL moves you through the submenus (Table C) or toggles between choices when programming.

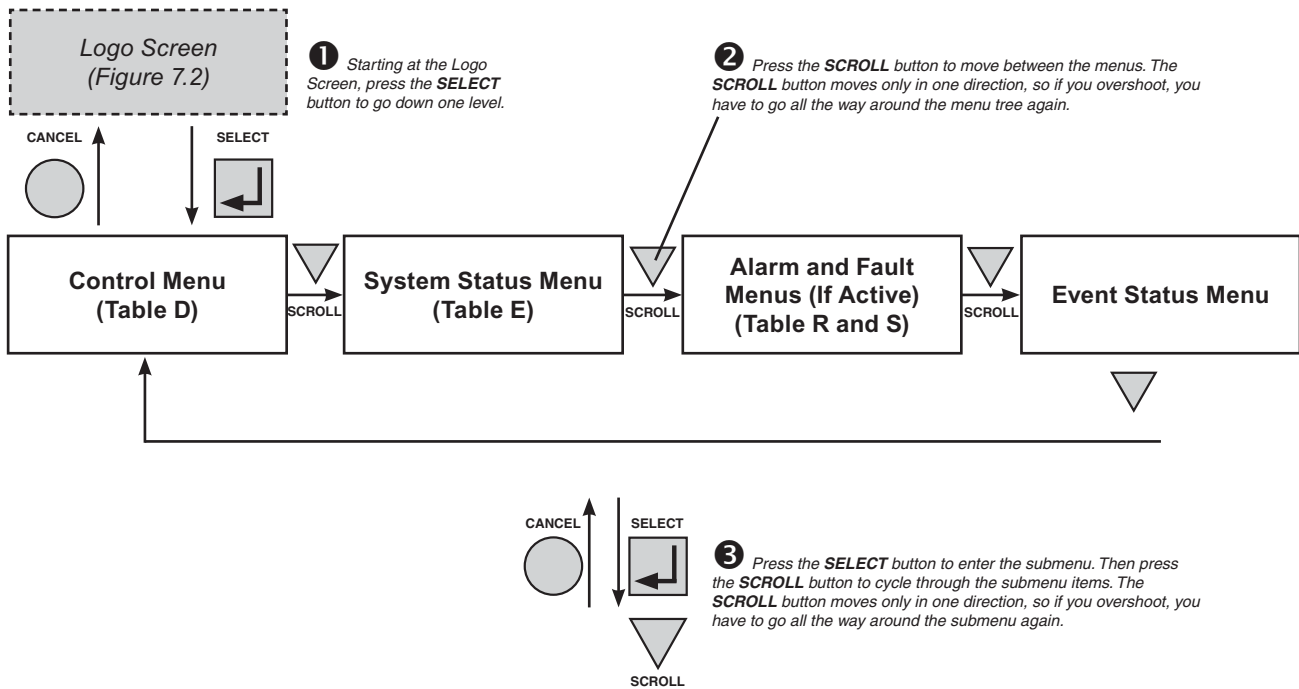
**CANCEL** - Pressing CANCEL moves you up one level in the menu tree (Table C).

The Alpha FXM's operating mode automatically changes as a result of changes in the line or the Alpha FXM's operating mode. See Table C and also "Specifications, Boost/Buck/Line Transfer Thresholds". The LCD panel automatically updates to reflect this.

| <b>Table C — UPS Operating Modes</b> |  |
|--------------------------------------|--|
| <b>LCD display</b>                   | <b>Description</b>   |
| <b>SHUTDOWN</b>                      | The Alpha FXM's inverter is switched off. Line power is disconnected from the load.  |
| <b>LINE</b>                          | The Alpha FXM is switched on. Line power is provided to the load.  |
| <b>BOOST1 OR BOOST2</b>              | The Alpha FXM's transformer is raising line voltage without using the batteries. AVR is enabled.   |
| <b>BUCK1 OR BUCK2</b>                | The Alpha FXM's transformer is lowering line voltage without using the batteries. AVR is enabled.  |
| <b>INVERTER</b>                      | The Alpha FXM is providing backup battery power to the load. See Figure 11, "Control Menu, INVERTER".  |
| <b>RETRAN</b>                        | The Alpha FXM is transferring from INVERTER mode to Line mode.   |
| <b>TRAN</b>                          | The Alpha FXM is transferring from the state it is now in into Inverter mode.  |
| <b>STANDBY</b>                       | The Alpha FXM is switched on and waiting for the line power to qualify or the user clear some faults.<br>CAUTION: Do not touch the AC output terminals, which may be still energized.  |
| <b>BYPASS</b>                        | This mode is manually set with the Control Menu. See Figure 11, "Control Menu, INV BYPASS". This locks the unit into line mode and turns off the battery charger so the unit can work with a manual break-before-make bypass switch. |

Pressing the CANCEL, SCROLL and SELECT buttons let you to navigate through the menus and submenus to control, monitor and troubleshoot the Alpha FXM as shown in Figure 11.





The CONTROL MENU (Table D) lets you control, program and adjust the Alpha FXM for connection to traffic intersection equipment or other applications. You can control the:

- INVERTER
- BYPASS
- BATT TEST
- AUTO TEST
- SHUTDOWN
- SENSE TYPE
- FUNC MODE
- VOLTAGE
- FREQUENCY
- QUAL TIME
- BATT COMP
- DATE FRMT
- INV RECORD
- CLOCK FRMT
- CHGR CUR
- RELAY TEMP
- TEMP DISP
- Daylight

The SYSTEM STATUS menu (Table E) lets you measure various inputs, outputs and other values. The available measurements are:

- VIN
- VOUT
- IOUT AC
- BATT TEMP
- FREQ IN
- OUTPUT PWR
- BATT VOLT
- CHGR CUR
- DATE
- TIME
- INV COUNT
- INV TIMER
- SHED TIMER 1, 2 OR 3
- VERSION
- MAC Address
- IP Address
- kWh
- Remain Tm
- Serial Number

The ALARM and FAULT menus in the Troubleshooting section are invisible and disabled until the Alpha FXM has a malfunction.

When the front panel's alarm LED is on or flashing, press SELECT.

One of the malfunctions listed in Table R and Table S will appear on the LCD. Press the SCROLL button to see if more than one malfunction is present.

Fix the malfunction. Press the SELECT button to clear the malfunction from the screen.

If the malfunction is fixed, the malfunction is cleared from the LCD. If it isn't fixed, it will reappear on the screen.

The EVENT STATUS menu displays the last 25 Alpha FXM events on the LCD. For the event log, see "Viewing the 100-Event Log".

Press the SELECT button to access the menu. Press the SELECT then the SCROLL button to scroll through the events. To see what a specific event was, press the SELECT button. Press the SCROLL button to see what malfunction triggered the event.

Figure 11 — LCD Menu Tree

## 6.3 Switching the Alpha FXM On and Off

Under normal operation, the Alpha FXM is always powered ON to supply uninterruptible power to the load. Switching off the Alpha FXM will disconnect the power supply to the load. If for any reason you need to switch off the Alpha FXM while maintaining power to your critical load, make sure that you have a plan that provides an alternate source of power.

### 6.3.1 Switch Off Procedure

1. Switch off the AC input circuit breaker.
2. Switch off the battery circuit breaker. The status LED turns off and the LCD panel goes blank. The Alpha FXM is now switched off and no backup power is supplied to the load.

### 6.3.2 Switch On Procedure (LINE mode)

Before you put the Alpha FXM back into commission, make sure that the line is qualified and the batteries are fully charged.

1. Switch on the battery circuit breaker. The LCD displays **STANDBY** and the fan turns on for about a minute. If the temperature is below  $-15^{\circ}\text{C}$ , the LCD display may not function. See "Troubleshooting".
2. Switch on the AC input circuit breaker. The Alpha FXM qualifies the line power. The LCD displays **RETRAN**, then shows **LINE**, **BUCK** or **BOOST**. The status LED illuminates.
3. If there is no line power, the Alpha FXM will remain in the STANDBY mode until it the line power is qualified. If you need to provide backup battery power to the load, perform a manual start by using the Inverter command See "Operating the Alpha FXM Inverter".
4. The Alpha FXM uses auto-frequency detection. When it is first switched on, it senses the line frequency and adjusts its output frequency to match that of the input. The load should be receiving power, If not, perform troubleshooting.

### 6.3.3 Switching the Alpha FXM from Line mode to Inverter mode

You can force the Alpha FXM to operate in the Inverter mode by manually switching off the input circuit breaker. Doing so will effectively disconnect any line power to the Alpha FXM, simulating a power outage which triggers the Alpha FXM to switch to the inverter mode of operation.

#### Procedure

1. Switch off the input circuit breaker. The LCD shows **INVERTER**, the status LED starts flashing to show that the Alpha FXM is running on backup battery power. Confirm that the load is receiving power.

### 6.3.4 Switching the Alpha FXM from Inverter mode to Line mode

The Alpha FXM remains in the Inverter mode for as long as the input circuit breaker is switched off. Backup power is provided to the load until the batteries are drained to a preset level which triggers the Alpha FXM to shut-down automatically. If it is not necessary to operate the Alpha FXM in the Inverter mode, switch the Alpha FXM back to the Line mode as soon as possible.

#### Procedure

1. Switch on the input circuit breaker. The Alpha FXM qualifies the line power. The LCD displays **RETRAN**, then shows **LINE**, **BUCK** or **BOOST**. The status LED illuminates.

If the Alpha FXM constantly switches between Inverter and Line modes because of a noisy line, the Alpha FXM's input parameters should be broadened from Normal to Generator. See "Operating the Alpha FXM, Sense Type". Also see the specifications, "Boost/Buck/Line Transfer Thresholds".

In the Generator mode, the range of acceptable input frequency and voltage are expanded to accept the fluctuations created by a generator.

## 6.4 Operating the Alpha FXM

The control menu (Table D) lets you operate the Alpha FXM or program it to suit your operating conditions. You can also use the Alpha UPS Monitor to make these adjustments. See “Alpha UPS Monitor”.

### 6.4.1 Procedure

1. From the Logo screen go to the Control menu.
2. Press the **SELECT** button to enter the submenu (Table D).
3. Press the **SCROLL** button to move between items in the submenu.
4. When you have reached the item you want to change, press the **SELECT** button. The item chosen is blinking.
5. To toggle between the choices, press the **SCROLL** button. Stop when you reach the choice you want.
6. To make the change, press the **SELECT** button. The blinking stops.

| Table D — Control Menu |                 |   |
|------------------------|-----------------|---|
| LCD display            | Meaning         | Description   |
| <b>INVERTER</b>        | Inverter        | When inverter mode is set to ON, the Alpha FXM provides backup battery power to the load. This mode of operation is normally activated automatically when line power becomes unavailable, or the line power is not qualified. You can also put the Alpha FXM into this mode during initial startup in the absence of line power or because of unqualified line power. See “Adjusting and Controlling the Alpha FXM, #31 Inverter On/Off”.               |
| <b>INV BYPASS</b>      | Inverter Bypass | This function can only be switched on when the Alpha FXM is in line mode. When switched on, it locks the Alpha FXM into the Line mode, switched off the battery charger and makes the output voltage equal to the input voltage. This is done to:<br>Replace the batteries.<br>OR:<br>Allow the use of a break-before-make manual bypass switch so the Alpha FXM can be shut off for maintenance or replacement without interrupting power to the load. |
| <b>BATT TEST</b>       | Battery Test    | Lets you set the desired battery test duration to a value between 0 and 250 minutes. Make sure that the set time duration is shorter than the depth of discharge of your battery bank. Otherwise, you will drain the battery and trigger a fault. See "Batt Volt low".  |
| <b>AUTO TEST</b>       | Automatic Test  | If the GUI's periodic self test is enabled, this starts the test no matter when it is scheduled to take place.  |
| <b>SHUTDOWN</b>        | Shutdown        | When this function is switched on, the Alpha FXM's inverter is shut off. Neither Line nor Inverter power is supplied to the load.   |
| <b>SENSE TYPE</b>      | Sense Type      | This function can only be used when the Alpha FXM is in Standby or Shutdown mode (Table C). This function toggles between:<br>NORMAL: The Alpha FXM can operate successfully with most line conditions.<br>OR:<br>GENERATOR: The Alpha FXM's input voltage and frequency parameters are expanded so the Alpha FXM can work with the fluctuations caused by a generator or noisy line.   |
| <b>FUNC MODE</b>       | Functional Mode | The Functional mode can only be changed when the Alpha FXM is in Standby or Shutdown mode (Table C and Specifications, “Boost/Buck/Line Transfer Thresholds”). This function toggles between:<br>AUTOMATIC VOLTAGE REGULATION (AVR): The buck and boost modes are active.<br>OR:<br>QUALITY: The buck and boost modes are switched off, the input voltage is the Alpha FXM's output voltage.  |
| <b>VOLTAGE</b>         | Voltage         | Lets you set the Alpha FXM's output voltage setting to 120 VAC, 230 VAC or 220 VAC. This should ONLY be done by a qualified technician acting under the instructions of Alpha Technologies Customer Service Department. Failure to contact Alpha Technologies before performing this procedure could void your warranty.  |
| <b>FREQUENCY</b>       | Frequency       | The frequency can only be changed when the Alpha FXM is in Standby mode. This lets you set the Alpha FXM's frequency setting to 50 Hz or 60 Hz. This should ONLY be done by a qualified technician acting under the instructions of Alpha Technologies Customer Service Department. See "Service and Technical Support". Failure to contact Alpha Technologies before doing this procedure could void your warranty.                                    |

**Table D — Control Menu**

| LCD display       | Meaning                          | Description  |
|-------------------|----------------------------------|--|
| <b>QUAL TIME</b>  | Line qualify time                | Lets you set how long it takes for the Alpha FXM to return to Line mode after the line has become requalified to make sure the line is stable. It can be set to 3, 10, 20, 30, 40 or 50 seconds. The factory default setting is 3 seconds. Also See "Adjusting and Controlling the Alpha FXM, #34: Line Qualify Time". |
| <b>BATT COMP</b>  | Battery temperature compensation | Lets you set the battery temperature compensation to match the batteries you are using. It can be set to -2.5, -4, -5 or -6 mV/°C/Cell. The factory default setting is -5 mV/°C/Cell.  |
| <b>DATE FRMT</b>  | Date Format Selection            | This lets you toggle the Alpha FXM's date format between YY-MM-DD, MM-DD-YY, YYYY-MM-DD, MM-DD-YYYY, DD-MM-YYYY, YY-TXT-DD, TXT-DD-YY, DD-TXT-YY, YYYY-TXT-DD, TXT-DD-YYYY, DD-TXT-YYYY, YYYY-DD-TXT, YY-DD-TXT, YYYY-DD-MM, YY-DD-MM. The factory default setting is MM-DD-YY.  |
| <b>CLOCK FRMT</b> | Clock display format option      | Lets you select which format to display time information: in 24 hour clock format or 12 hour clock (AM/PM) format.   |
| <b>INV RECORD</b> | Inverter record clear            | This clears the inverter counter and timer from the LCD's system status menu. This does not clear the 100-event log in the RS-232 menus.   |
| <b>CHGR CUR</b>   | Charger current                  | Allows you to set the battery charger current to either 0 A, 3 A, 6 A or 10 A. NOTE: If you set the battery charger to 0 A, you will turn the charger off.   |
| <b>RELAY TEMP</b> | Relay temperature                | Temperature setting to activate the specified dry contact. The configured dry contact will activate when the set battery temperature is reached. Setting range: 20°C to 55°C.  |
| <b>TEMP DISP</b>  | Temperature display format       | The temperature can be displayed in Celsius or Fahrenheit.   |
| <b>Daylight</b>   | Daylight saving option           | Switch "ON" this option to activate Day Light Saving time.   |

## 6.5 Making Measurements

The System Status menu lets you make measurements of various Alpha FXM inputs, outputs, temperatures and other values. You can also use the Alpha UPS Monitor to make these measurements. See “Alpha UPS Monitor”.

### 6.5.1 Procedure

1. From the Logo screen go to the System Status menu.
2. Press the SELECT button to enter the submenu (Table E).
3. Press the SCROLL button to move between items in the submenu. When you reach the item you want to measure, stop pressing the button. The measurement is automatically displayed on the LCD. It is automatically updated every 0.5 second.

| LCD display          | Meaning  | Description   |
|----------------------|--|---|
| <b>VIN</b>           | Input Voltage                                      | The line input voltage into the Alpha FXM.  |
| <b>VOUT</b>          | Output Voltage                                     | The Alpha FXM's output voltage (true RMS).  |
| <b>IOUT AC</b>       | Output Current (AC)                                | The Alpha FXM's AC output current (true RMS).   |
| <b>BATT TEMP</b>     | Battery Temperature                                | The battery's temperature (°C).   |
| <b>FREQ IN</b>       | Input Frequency                                    | The frequency of line power into the Alpha FXM (Hz).  |
| <b>OUTPUT PWR</b>    | Output Power                                       | The Alpha FXM's output power in VA (true RMS).  |
| <b>BATT VOLT</b>     | Battery Voltage                                    | The battery's output voltage (VDC).   |
| <b>CHGR CUR</b>      | Charger Current                                    | The Alpha FXM's battery charging current is set to this value (Amps).   |
| <b>SHED TIMER1</b>   | Amount of time until the dry contact is activated. | The factory default dry contact for this setting is contact C4. SHED TIMER2 and SHED TIMER3 can be field programmed. See “Setting the Timer Contact”. This display shows the amount of time left in seconds until the contact is activated. The factory default setting is 2 hours, but this can be changed as shown in “Programming the Dry Contacts and the Clock”. |
| <b>SHED TIMER2</b>   |  |   |
| <b>SHED TIMER3</b>   |  |   |
| <b>MAC Address</b>   | CXC MAC  | The CXC MAC address will be displayed.  |
| <b>IP Address</b>    | CXC IP   | The CXC IP will be displayed.   |
| <b>kWh</b>           | kW Meter   | The accumulated output power will be displayed.   |
| <b>Remain Tm</b>     | Remaining Battery Runtime                          | The remaining runtime of the battery will be displayed.   |
| <b>Serial Number</b> | Unit Serial Number                                 | The unit serial number of the Alpha FXM will be displayed.  |
| <b>VERSION</b>       | Software Version                                   | The software version used in this Alpha FXM.  |

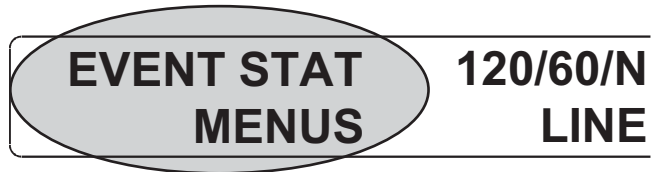
## 6.6 Viewing the 100-Event Log

Using the LCD display, RS-232 or web interface, you can view up to the last 100 events the Alpha FXM went through and the malfunctions that triggered each of them. If more than 100 events occurred, the oldest is overwritten. To clear this log, see “Operating the Alpha FXM, INV RECORD.”

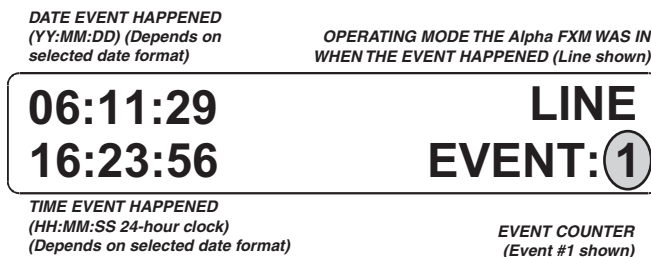
To view the events on the LCD display, refer to the following procedure. To view the events using the RS-232 or web interface, see “100-Event Log” or “Alpha UPS Monitor, Event History” respectively.

### 6.6.1 Procedure

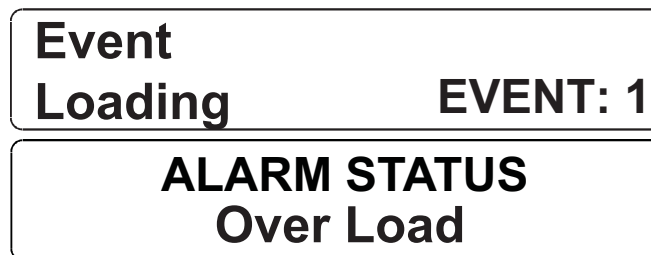
1. From the Logo screen, navigate to the **EVENT STATUS MENU**.



2. Press the **SELECT** button to enter the submenu.
3. The following log screen appears.



4. Press the **SELECT** button. The event counter flashes.
5. Press the **SCROLL** button to scroll through the event counter.
6. When you reach the event you want press the **SELECT** button.
7. The event loading screen appears and then the log screen reappears with the details for that event.



8. Press the **SCROLL** button. One of the faults or alarms shown in Table R and S is displayed and is the malfunction that triggered the event.

## 6.7 Communicating with the RS-232 interface

The following subsections describe the operation of the Alpha FXM via the RS-232 interface.

- Wiring the RS-232 port.
- Using the Main menu.
- Adjusting and controlling the Alpha FXM.
- Programming the dry contacts and the clock.
- 100-event log.
- Communicating with the "Alpha UPS Monitor".

### 6.7.1 Wiring the RS-232 port

The Alpha FXM's front panel has a DE-9 female connector. When connected to a PC with Windows HyperTerminal or other terminal emulation software, the Alpha FXM can be remotely monitored and controlled with its command-line system. The Alpha UPS Monitor provides a Windows or web browser type of control.

#### Procedure

1. Connect a 9-pin, fully shielded, straight-through DE-9 to DE-9 connector cable between the computer's port and the Alpha FXM's port.

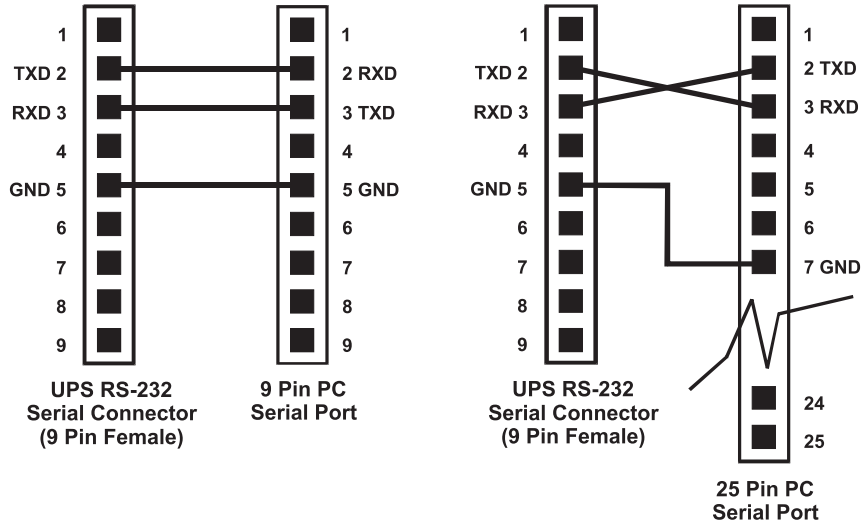


Figure 12 — RS-232 pin connections

2. Configure the communications parameters to the values shown in the terminal set up table below.

| Table F — Terminal Set Up Table |                      |                                 |   |
|---------------------------------|----------------------|---------------------------------|---|
| Emulation Type                  | VT 100 or Compatible | Backspace                       | N/A   |
| Duplex Mode                     | Half Duplex          | Break Length                    | N/A   |
| Xon/Xoff Flow Control           | None                 | Emulation Type                  | N/A   |
| RTS/CTS Flow Control            | Off                  | <b>Communication Parameters</b> |   |
| Line Wrap                       | On                   | Handshaking                     | Software Handshaking                                |
| Screen Scroll                   | On                   | Baud Rate                       | 2400 bps  |
| CR Translation                  | CR                   | Data Format                     | 8-bit Data, No Parity, 1 Stop Bit, No Flow Control. |



## 6.8 Using the Main Menu

The Alpha FXM's main menu screen runs on a command line system. This program does not recognize the backspace or delete keys even if it appears that way on the monitor. If you make a mistake and press **Enter**, the Alpha FXM echoes the command back exactly as you typed it. Press **Enter** and retype the command again.

If you choose not to use the command line system, you can use the Alpha UPS Monitor to control and monitor the Alpha FXM.

### 6.8.1 Main Menu Screen

The main menu screen shows the Alpha FXM's current input and output values, displays if any faults or alarms are present and gives access to the submenus. It can be accessed from anywhere in the menu tree by typing **0** and pressing **Enter**. The Alpha FXM is controlled by submenu 3.

To access a particular submenu, type in the submenu number and press **Enter**. To update the main menu screen, press **Enter**.

The complete menu tree is given in Figure 14. Tables describing the Line Status, Output Status, Faults and Alarms displays are given in Tables G, H, I, and J.

- The readings on the main menu screen do not automatically update to reflect changes in the Alpha FXM's status. Press **Enter** to update the screen.
- For many functions you need to enter a password. The factory setting is 1111.

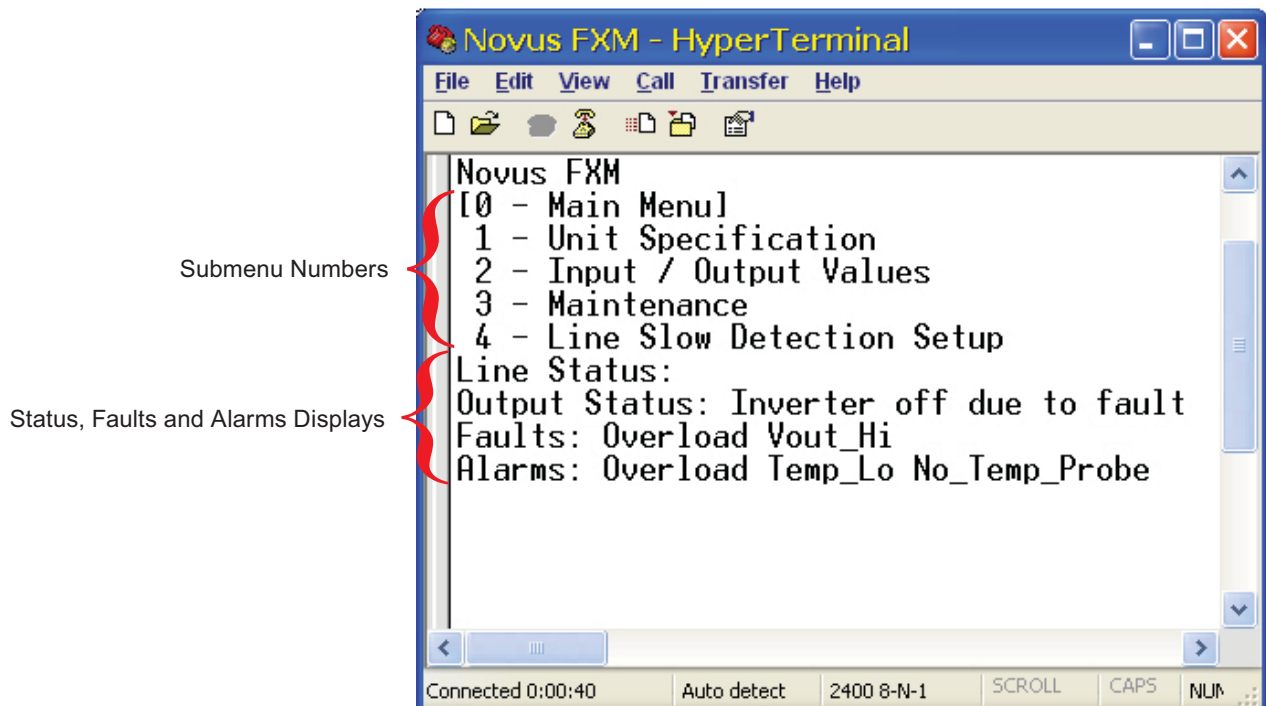


Figure 13 — Main Menu Screen

## 6.9 RS-232 Menu Tree

Submenus #1, 2 and 4 are read-only screens for monitoring the Alpha FXM. To control the Alpha FXM, use submenu #3, the Maintenance submenu.

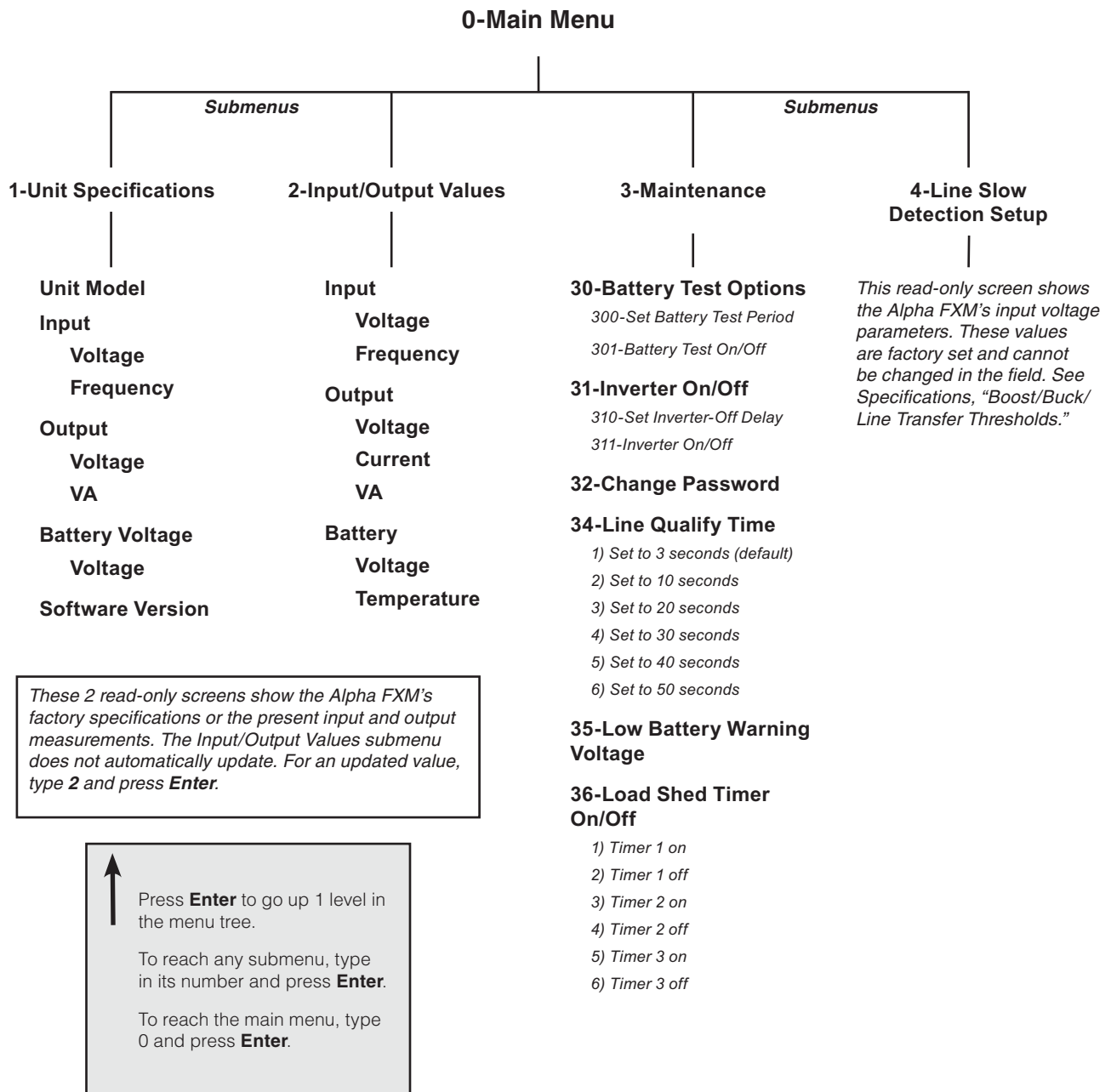


Figure 14 — RS-232 Menu Tree

## 6.9.1 Line Status

Line status tells you the line's condition. For an updated value, press **Enter**.

| <b>Table G — Line Status</b> |  |
|------------------------------|--|
| <b>Normal</b>                | The line is within specifications. See specifications, "Boost/Buck/Line Transfer Thresholds". The Alpha FXM is operating in Line mode. |
| <b>Boost</b>                 | Line voltage is out of tolerance. The Alpha FXM is operating in Boost mode.  |
| <b>Boost2</b>                | Line voltage is out of tolerance. The Alpha FXM is operating in Boost 2 mode.  |
| <b>Buck</b>                  | Line voltage is out of tolerance. The Alpha FXM is operating in Buck mode.   |
| <b>Buck2</b>                 | Line voltage is out of tolerance. The Alpha FXM is operating in Buck 2 mode.   |
| <b>Blackout</b>              | The line is absent.  |
| <b>Freq low</b>              | Line frequency is too low.   |
| <b>Freq high</b>             | Line frequency is too high.  |

## 6.9.2 Output Status

Output status tells you how the Alpha FXM is producing power. For an updated value, press **Enter**.

| <b>Table H — Output Status</b>         |
|--|
| <b>Line mode</b>                       |
| <b>Battery mode</b>                    |
| <b>Battery mode, low bat. warning</b>  |
| <b>Battery mode (testing battery)</b>  |
| <b>Boost mode</b>                      |
| <b>Boost 2 mode</b>                    |
| <b>Buck mode</b>                       |
| <b>Buck 2 mode</b>                     |
| <b>Hot swap mode</b>                   |
| <b>Inverter off due to fault</b>       |
| <b>Inverter off due to low battery</b> |
| <b>Inverter off at start-up</b>        |
| <b>Shutdown due to user request</b>    |

### 6.9.3 Fault and Alarm Displays

Fault and alarm displays any malfunctions the Alpha FXM has encountered. Also see "Troubleshooting".

| <b>Table I — Faults</b> |   |
|-------------------------|---|
| <b>Short_Circuit</b>    | The load has a short.   |
| <b>Vout_Hi</b>          | The output voltage is above specifications.   |
| <b>Batt_Hi</b>          | The batteries cannot be charged.  |
| <b>Batt_Lo</b>          | The batteries are almost discharged.  |
| <b>Vout_Lo</b>          | The output voltage is below specifications.   |
| <b>Overload</b>         | The Alpha FXM is overloaded. Remove excess loads.   |
| <b>Backfeed</b>         | A relay inside the Alpha FXM has failed and it cannot be replaced in the field. Contact Alpha Technologies customer service department. |
| <b>Bad_Battery</b>      | The battery voltage has dropped below a specified level. Inverter shuts down.   |
| <b>Temp_Hi</b>          | The Alpha FXM is operating above temperature range.   |

| <b>Table J — Alarms</b> |  |
|-------------------------|--|
| <b>Overload</b>         | The Alpha FXM is overloaded. Switch off excess loads.                  |
| <b>Temp_Hi</b>          | The ambient battery temperature is too high.                           |
| <b>Temp_Lo</b>          | The ambient battery temperature is too low.                            |
| <b>User_Input</b>       | The user input contact "User Input: S2" is shorted.                    |
| <b>Line_Freq</b>        | The line frequency is outside of the Alpha FXM's input specifications. |
| <b>No_Temp_Probe</b>    | The battery temperature sensor has become disconnected or has failed.  |
| <b>Weak_Battery</b>     | The battery has failed the background scan in Line mode.               |
| <b>Batt_Low</b>         | The battery voltage is low.  |
| <b>Batt_Brkr_Open</b>   | The battery breaker is opened.   |
| <b>Self_test</b>        | The Alpha FXM is performing self test.                                 |
| <b>Fan_Fail</b>         | The Alpha FXM internal fan has failed.                                 |
| <b>Wrong_Software</b>   | The Alpha UPS Monitor is invalid (either version or part number).      |
| <b>AC_Brkr_Open</b>     | The AC breaker is opened.  |

## 6.9.4 Adjusting and Controlling the Alpha FXM

The Maintenance submenu lets you control the Alpha FXM and change selected items to meet your operational needs.

### Procedure

From the Main menu, type **3** and press **Enter**.

| <b>Table K — Maintenance Submenu</b>  |   |
|---------------------------------------|---|
| <b>30 Battery Test Options</b>        | This starts the battery test and sets how long the test will run. The default setting for the test duration is 2 minutes, but this can be adjusted in 1 minute intervals. See "Operating the Alpha FXM, BATT TEST".   |
| <b>31 Inverter On/Off</b>             | This switches the inverter on or off to allow you to prevent a damaging deep battery discharge or to provide backup battery power to the load. See "Operating the Alpha FXM, INVERTER".<br>You can set a delay before the inverter switches off to allow time for switching off critical loads. The Set Inverter ON/OFF delay is only available when the Alpha FXM is in the Battery or Standby modes.<br>The delay can be adjusted in 1 second steps with a default setting of 0 seconds to a maximum of 600 seconds (10 minutes). The delay is only available in the Standby or Battery modes. Once the Alpha FXM returns to the Line mode, the delay resets itself to 0 seconds. |
| <b>32 Change Password</b>             | This changes the Alpha FXM's password. The factory set password is 1111, which can only be changed when the Alpha FXM is in Line mode. The password is limited to 4 alpha-numeric characters in length.   |
| <b>34 Line Qualify Time</b>           | This lets you set the delay when the Alpha FXM goes from Battery mode to Line mode after the line becomes requalified. The purpose of this delay is to make sure the line is stable before the Alpha FXM switches back to it. See "Operating the Alpha FXM, QUAL TIME".<br>The default setting is 3 seconds, but you can set this to 3, 10, 20, 30, 40 or 50 seconds.   |
| <b>35 Low Battery Warning Voltage</b> | The lets you set the Alpha FXM's low battery warning voltage, adjusting the setting to match the batteries you are using and the actual operating conditions.<br>The default value is 40% (47 VDC) and can be adjusted in 1% (0.05 VDC) increments between 45.0 (0 %) and 50.0 VDC (100%) by typing in the % battery voltage level where you want the warning to be triggered.  |
| <b>36 Load Shed Timer On/Off</b>      | This lets you switch the timer contacts on or off. See "Contacts C1 to C6".   |

## 6.9.5 Programming the Dry Contacts and the Clock

The Alpha FXM's front panel contacts (C1 to C6) can be programmed to meet your specifications with RS-232 communications. You can also adjust the Alpha FXM's date and time.

### Programming the Dry Contacts

The functions of dry contacts C1 to C5 (and if factory configured, dry contact C6) can be changed with RS-232 communications.

For example, to change contact C1:

1. To see how it is currently programmed, type **c1** (all lower case) and press **Enter**.
2. The Alpha FXM responds with **\*c1=1** where the **\*** shows the unit responded to your command. For example: a **"1"** shows it is programmed to be the **On Battery** indicator as shown in the Dry Contact Configuration table below.

| <b>Table L — Dry Contact Configuration</b> |                    |  |
|--|--------------------|--|
| <b>1= On Battery</b>                       | <b>4= Alarm</b>    | <b>7= Timer 2</b>                                    |
| <b>2= Low Battery</b>                      | <b>5= Fault</b>    | <b>8= Timer 3</b>                                    |
| <b>3= Timer 1</b>                          | <b>6= Disabled</b> | <b>9= 48 VDC<br/>(Only available for contact C6)</b> |

3. To change the contact, type **c1=X** where X is 1 to 9 and press **Enter**. The Alpha FXM responds with **\*c1=(1 to 9)**. The programming is done for that contact. Repeat as necessary for the other contacts.

Each contact can only be programmed for one function at a time and cannot show multiple conditions.

4. To reset the contacts to the factory default, type **default** and press **Enter**. The Alpha FXM responds with **\*default**, showing it is reset. This command also resets the timer setting to the 2 hours factory default. See "Setting the Timer Contact". See "Specifications" for the factory default settings of dry contacts C1 to C6.

## 6.9.6 Setting the Timer Contact

The front panel's timer contact can be programmed to suit your application. See "Contacts C1 to C6" and "Programming the Dry Contacts and the Clock". The table below explains how.

|   | <b>Enter command</b>                                 | <b>UPS display</b> | <b>Description</b>   |
|---|--|--------------------|--|
| Displaying the Timer  | <b>timer</b> and press <b>Enter</b>                  | *timer=02:00:00    | Returns the value of timer   |
|   | <b>timer1</b> and press <b>Enter</b>                 | *timer1=02:00:00   | Returns the value of timer1  |
|   | <b>timer2</b> and press <b>Enter</b>                 | *timer2=02:00:00   | Returns the value of timer2  |
| Setting the Timer   | <b>timer=00:01:00</b> and press <b>Enter</b>         | *timer=00:01:00    | Sets the value of timer1 to 60 seconds.  |
|   | <b>timer=00:01:00</b> and press <b>Enter</b>         | *timer=120         |  |
|   | <b>timer1=00:01:00</b> and press <b>Enter</b>        | *timer1=00:01:00   | Sets the value of timer1 to 60 seconds.  |
|   | <b>timer1=120<sup>†</sup></b> and press <b>Enter</b> | *timer1=120        |  |
|   | <b>timer2=00:01:00</b> and press <b>Enter</b>        | *timer2=00:01:00   | Sets the value of timer2 to 60 seconds.  |
|   | <b>timer2=120<sup>†</sup></b> and press <b>Enter</b> | *timer2=120        |  |
|   | <b>default</b> and press <b>Enter</b>                | *default           | Resets the timer to the factory default of 02:00:00 (2 hours); and resets contacts C1 to C5 to the factory default settings. See "Programming the Dry Contacts". |
| <p>Note: In the above example, the default timer setting of 2 hours is used.<br/>           * Indicates that the Alpha FXM has responded to the command you entered.<br/>           † Time can be entered in units of 0.5 second; e.g. 120 units of 0.5 seconds = 60 seconds. However, it is more intuitive to enter time in the hh:mm:ss format, such as 00:01:00 for 1 minute or 60 seconds in the above example.</p> |  |                    |  |

## 6.9.7 Setting the Date and Time

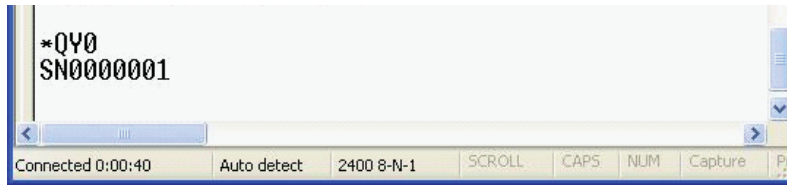
**Table N — Setting the Date and Time**

| Enter command  | UPS display                           | Description                                       |
|--|---------------------------------------|---|
| <b>clock</b> and press <b>Enter</b>  | *clock=12/31/07 22:00:00              | Returns the current date and time.                |
| <b>clock=010107 _ 120000</b> and press <b>Enter</b>  | *clock=01/01/07 12:00:00 <sup>†</sup> | Sets the date and time to Jan 01, 2007, 12:00 pm. |
| <p>Notes:</p> <ol style="list-style-type: none"> <li>1. Time is displayed in the 24 hours clock format.</li> <li>2. Changing the mm/dd/yy format with DATE SEL on the LCD Control menu does not change the RS-232 mm/dd/yy format.</li> <li>3. If the Alpha FXM has been in storage or switched off for a prolonged period, the backup Lithium coin battery could be drained and may not correctly keep a backup of the date and time you entered. After switching on the Alpha FXM, check the date and time settings. The Alpha FXM should display the current date and time. If it displays the date as "00:01:00", then the battery is spent and you need to ask a qualified service personnel to replace the lithium coin battery. See "Troubleshooting".</li> </ol> <p>* Indicates that the Alpha FXM has responded to the command you entered.<br/> <sup>†</sup> If the date or time change is invalid, the Alpha FXM will return the time and date it was set to before you tried making the change. The date and time must be entered as one complete line command. You cannot change only the time or the date alone. Both must be set at the same time. If you make a mistake, press <b>Enter</b> and try again.</p> |                                       |   |



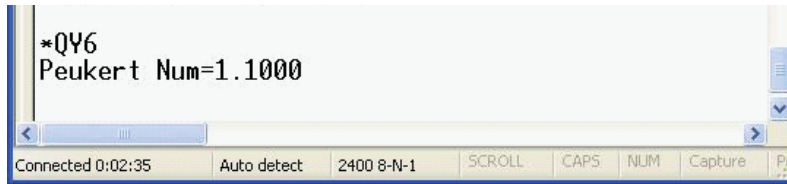
### 6.9.8 Viewing the Serial Number

To display the serial number of the Alpha FXM UPS, type `*QY0` at the command line and press "Enter".

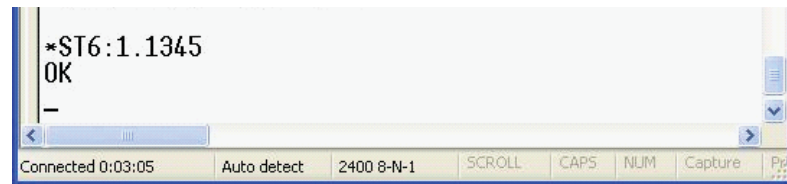


### 6.9.9 Setting the Peukert Number and Capacity

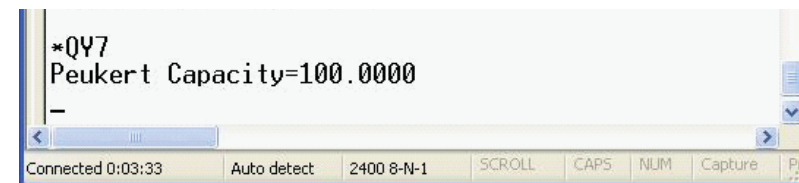
You can set the Peukert Number and Capacity using the RS-232 interface or the web interface. To display the current Peukert Number, type `*QY6` at the command line and press "Enter".



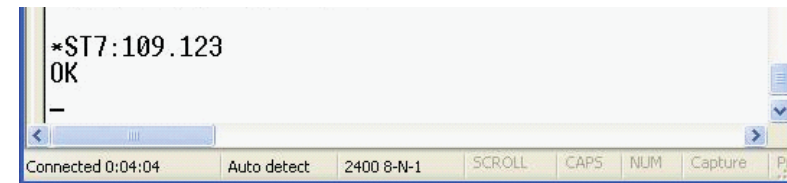
To change the Peukert Number to 1.1345, type `*ST6:1.1345` at the command line and press "Enter".



To display the current Peukert Capacity, type `*QY7` at the command line and press "Enter".



To change the Peukert Capacity to 109.123, type `*ST7:109.123` at the command line and press "Enter".



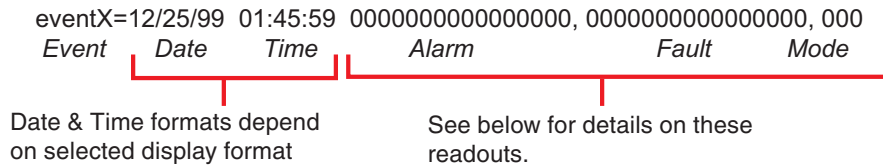
To determine the Peukert number and capacity of your battery, refer to "Peukert Number and Battery Capacity".

### 6.9.10 100-Event Log

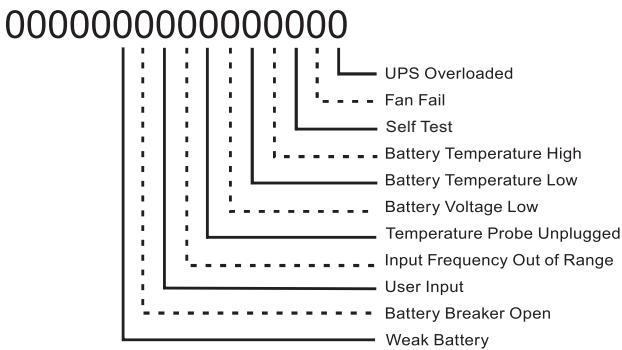
Up to 100 events are stored in the Alpha FXM's log. If more than 100 events occur, the oldest is over-written.

#### Procedure

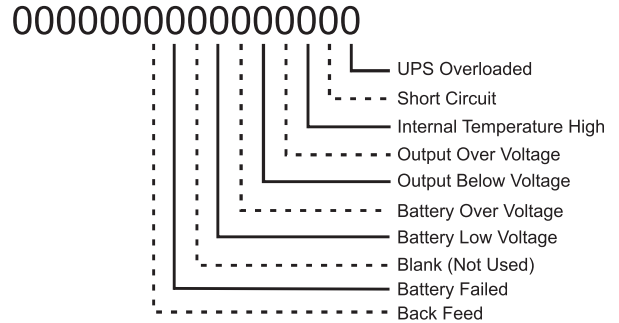
- To see the log, type **event** (all lower case) and press **Enter**. The events are listed starting with the most recent and appear as: If less than 100 events occurred, the last entry will appear as:



Alarm: When the following bits show a 1, the following alarms are displayed.



Fault: When the following bits show a 1, the following faults are displayed..



| Code | Mode    | Code | Mode    | Code | Mode     |
|------|---------|------|---------|------|----------|
| 000  | Standby | 003  | Boost 1 | 006  | Inverter |
| 001  | Line    | 004  | Buck 1  | 009  | Shutdown |
| 002  | Boost 2 | 005  | Buck 2  | 010  | Bypass   |

- If less than 100 events occurred, the last entry will appear as:  
 eventX=00/00/00 00:00:00 0000000000000000, 0000000000000000, 000
- To clear the log, type **eventclr** and press **Enter**. It takes the Alpha FXM 30 seconds to clear the log. Do not enter any other commands during this time.
- To see a specific event, type **eventX** where X is from 1 to 100 and press **Enter**. To see a range of events (for example, events 20 to 30), type **eventX-X** where X are events from 1 to 100 and press **Enter**. To clear the log, type **eventclr** and press **Enter**. It takes the Alpha FXM 30 seconds to clear the log. Do not enter any other commands during this time.
- To see a specific event, type **eventX** where X is from 1 to 100 and press **Enter**. To see a range of events (for example, events 20 to 30), type **eventX-X** where X are events from 1 to 100 and press **Enter**.

## 6.9.11 Communicating with the Alpha UPS Monitor

### Introduction

The Alpha UPS Monitor graphical user interface (GUI) provides web or Windows® like computer communications with the Alpha FXM. The screen and its features are shown below. It is used to monitor, control and set various parameters like the date and time, determine when to perform the weekly self test, change the relay configurations, etc. The Fault or Alarm indicators show if the Alpha FXM has experienced a malfunction and the cause. Descriptions of all the screens and their functions are given in “Operation”.

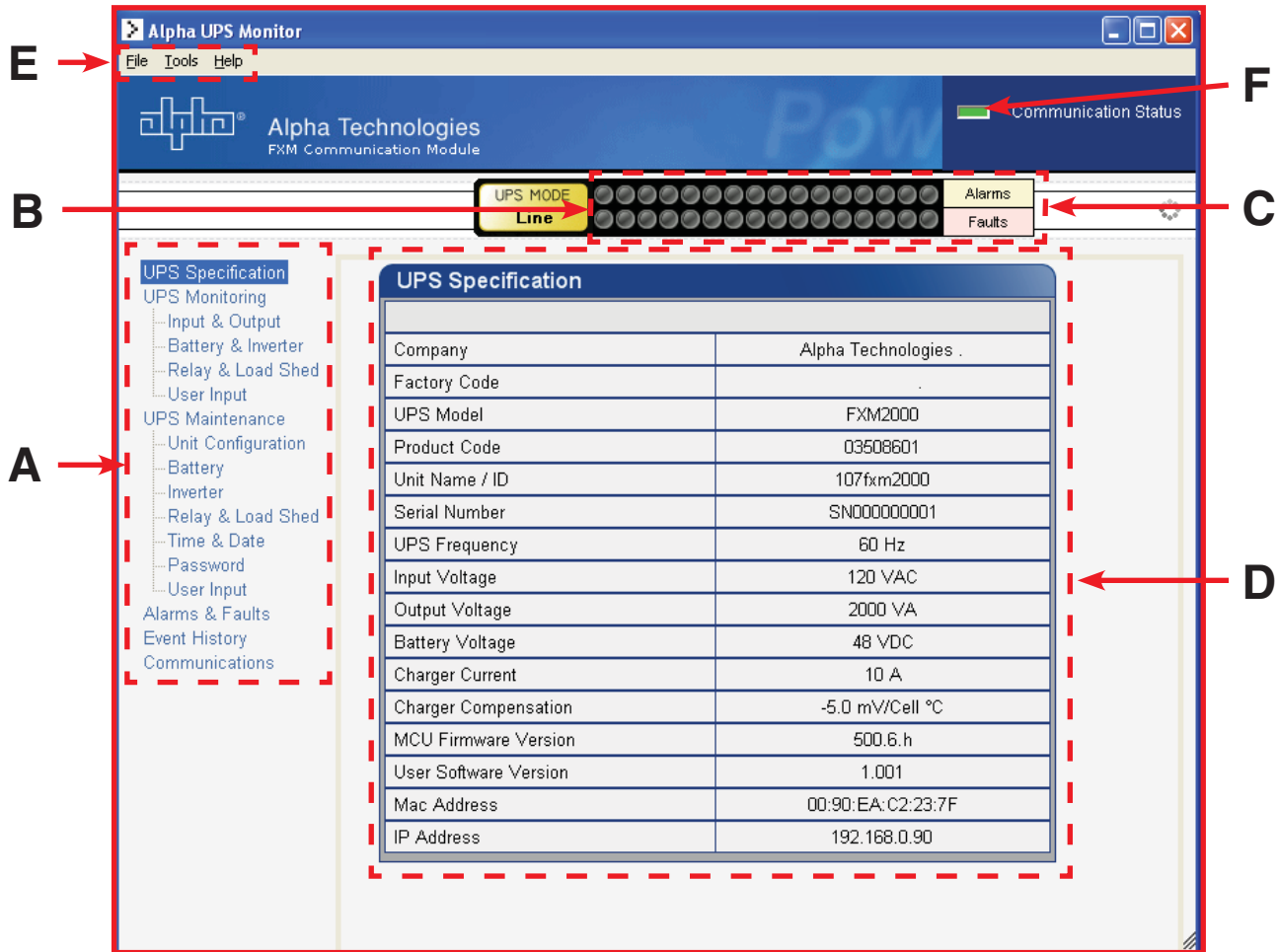


Figure 15 — Alpha UPS Monitor (UPS Specification Screen shown)

|          |  |
|----------|--|
| <b>A</b> | Screen selection menus.  |
| <b>B</b> | Current UPS operating mode. This is updated automatically.   |
| <b>C</b> | Fault and alarm indicators – when a light in this bar is illuminated, move the mouse cursor over the light to determine the malfunction. Double-clicking on the light will send you to the Alarms & Faults screen. |
| <b>D</b> | Readout screens.   |
| <b>E</b> | Drop-down menus.   |
| <b>F</b> | Online indicator.  |

## 6.9.12 Checking Your Windows Computer for the .NET Framework

1. Click on the **Start** button.
2. Go to and click on **Settings**.
3. Click on **Control Panel**.
4. Double-click on the **Add or Remove Programs** icon.
5. When the window shown in the figure below appears, scroll through the list of applications. If you see Microsoft .NET Framework listed, the Framework is already installed and you can install the Alpha UPS Monitor. If you don't see it listed, you MUST install it from the Microsoft Windows update web site before installing the software.

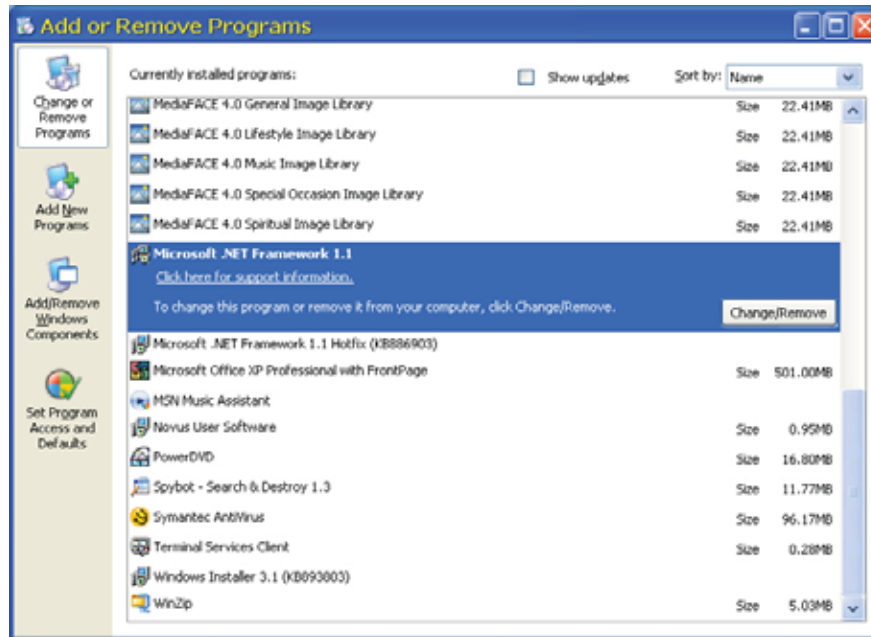


Figure 16 — Add or Remove Programs Window

If you are downloading from Microsoft's web site, an Internet web browser such as Internet Explorer or Firefox must be installed on your computer. In addition to installing .NET, downloading from the web site will update your computer with all the latest security updates. If your computer is part of a company network, check with your network administrator before downloading software from the Internet.

### 6.9.13 Installation and Set Up

The following tools and materials are required:

- Alpha UPS Monitor, available for download from [www.alpha.ca/downloads/](http://www.alpha.ca/downloads/).
- Windows 98 or later with Microsoft's .NET framework installed.
- DE-9 serial straight-through computer cable.

#### Procedure

1. Install the Alpha UPS Monitor onto your computer. Restart the computer.

If you install the Alpha UPS Monitor on a version of Windows without the .NET framework installed, an error message saying the framework is not installed will appear. Install the framework onto your computer according to "Communicating With the Alpha UPS Monitor". Restart your computer and then try to install the Alpha UPS Monitor again.

2. Connect the computer cable from any available communications port on the computer to the RS-232 port on the Alpha FXM's front panel. See "Wiring the RS-232 Port".
3. Set the communications parameters on your computer to:
  - a. COM Port: The COM port on your computer you have selected to use.
  - b. Baud Rate: 2400.
4. To start communications between the computer and the Alpha FXM, do one of the following:
  - a. Click on the screen's Online Indicator, or
  - b. In the **File** drop-down menu, click on **Connect to FXM**.

If the computer cannot connect to the Alpha FXM, a pop up screen appears asking you to check the wiring and that you are connected to the proper com port.

## 6.10 Operation

The various screens are described on the following pages and operate like Web or Windows-type screens. Point and click to change the various functions or fields.

The on line indicator shows if you are connected to the Alpha FXM. The Alpha UPS Monitor automatically polls the Alpha FXM to obtain its status. The default setting is polling once every 3 seconds, but you can change this in the **UPS Maintenance-Unit Configuration** screen in the “**Status Refresh Time**” menu.

If a light or lights are illuminated in the Fault or Alarm fields, the Alpha FXM has a malfunction. Hover your mouse cursor over the light to learn the type of malfunction or double-click on it to go straight to the Alarms & Faults screen.

To control the unit or change it's settings or parameters, either click on the On/Off buttons, or choose an item from a drop down menu. Then click on the **Update Settings** button.

If you do not click on this button, the change will not happen.

### 6.10.1 UPS Specifications

This screen displays the various specifications of the Alpha FXM.

The screenshot shows the Alpha UPS Monitor software interface. At the top, there is a title bar with the text "Alpha UPS Monitor" and standard window controls. Below the title bar is a menu bar with "File", "Tools", and "Help". The main interface area is divided into several sections. On the left, there is a navigation tree with the following items: "UPS Specification" (highlighted), "UPS Monitoring" (with sub-items: "Input & Output", "Battery & Inverter", "Relay & Load Shed", "User Input"), "UPS Maintenance" (with sub-items: "Unit Configuration", "Battery", "Inverter", "Relay & Load Shed", "Time & Date", "Password", "User Input"), "Alarms & Faults", "Event History", and "Communications". The main content area displays the "UPS Specification" screen, which contains a table with the following data:

| UPS Specification     |                      |
|-----------------------|----------------------|
| Company               | Alpha Technologies . |
| Factory Code          | .                    |
| UPS Model             | FXM2000              |
| Product Code          | 03508601             |
| Unit Name / ID        | 107fxm2000           |
| Serial Number         | SN000000001          |
| UPS Frequency         | 60 Hz                |
| Input Voltage         | 120 VAC              |
| Output Voltage        | 2000 VA              |
| Battery Voltage       | 48 VDC               |
| Charger Current       | 10 A                 |
| Charger Compensation  | -5.0 mV/Cell °C      |
| MCU Firmware Version  | 500.6.h              |
| User Software Version | 1.001                |
| Mac Address           | 00:90:EA:C2:23:7F    |
| IP Address            | 192.168.0.90         |

Figure 17 — Alpha UPS Monitor: UPS Specification screen

## 6.10.2 UPS Monitoring

These read-only screens show the Alpha FXM's current input and output values and other measurements.

### Input & Output

Shows the current line input and Alpha FXM output values and the Alpha FXM's present operating mode.

| Input Parameters |         |
|------------------|---------|
| Voltage          | 109 VAC |
| Frequency        | 60 Hz   |
| Mode             | Boost 1 |

| Output Parameters |         |
|-------------------|---------|
| Voltage           | 124 VAC |
| Frequency         | 60 Hz   |
| Current           | 0 A     |
| Power             | 0 VA    |
| Power Factor      | 0.0     |
| Power Meter       | 0 kWh   |

Figure 18 — UPS Monitoring: Input & Output screen

### Battery & Inverter

Shows the battery string's status and how many times and for how long the inverter has been active.

| Battery Parameters           |           |
|------------------------------|-----------|
| Battery Voltage              | 46.5 VDC  |
| Charging Current             | 0.0 A     |
| Runtime Remaining            | 5hr 10min |
| External Temperature         | 19 °C     |
| Peukert Number               | 1.1000    |
| Capacity                     | 100.00 aH |
| Battery Open-Circuit Voltage | 53.46     |

| Inverter Parameters       |           |
|---------------------------|-----------|
| Accumulated Line Failures | 50 Times  |
| Accumulated Backup Time   | 4hr 12min |

Figure 19 — UPS Monitoring: Battery & Inverter screen

## Relay & Load Shed

Shows how the front panel dry contacts are configured. If any relays are used for load shedding, the time setting is shown.

|                              |                                  |  |
|------------------------------|----------------------------------|--|
| UPS Specification            | <b>Relay Programmable Status</b> |  |
| UPS Monitoring               |                                  |  |
| Input & Output               |                                  |  |
| Battery & Inverter           |                                  |  |
| <b>Relay &amp; Load Shed</b> |                                  |  |
| User Input                   |                                  |  |
| UPS Maintenance              |                                  |  |
| Unit Configuration           |                                  |  |
| Battery                      |                                  |  |
| Inverter                     |                                  |  |
| Relay & Load Shed            |                                  |  |
| Time & Date                  |                                  |  |
| Password                     |                                  |  |
| User Input                   |                                  |  |
| Alarms & Faults              |                                  |  |
| Event History                |                                  |  |
| Communications               |                                  |  |

|          | Current | Function     |
|----------|---------|--------------|
| Relay C1 | Off     | On Battery   |
| Relay C2 | Off     | Low Battery  |
| Relay C3 | Off     | Low Battery  |
| Relay C4 | Off     | Timer 1      |
| Relay C5 | On      | Alarm        |
| Relay C6 | On      | External VDC |

|         | Time Remaining |
|---------|----------------|
| Timer 1 | 2hr 0min 0sec  |
| Timer 2 | 2hr 0min 0sec  |
| Timer 3 | 2hr 0min 0sec  |

|                | Time Period 1 | Time Period 2 |
|----------------|---------------|---------------|
| Action Enabled | OFF           | OFF           |
| Start Time     | 03:00:00 PM   | 04:00:00 AM   |
| End Time       | 04:16:00 PM   | 07:07:00 AM   |

Figure 20 — UPS Monitoring: Relay & Load Shed screen

## User Input Status

Shows the current status of the user programmable inputs 1 to 3.

|                          |                                  |  |  |
|--------------------------|----------------------------------|--|--|
| UPS Specification        | <b>User Input Current Status</b> |  |  |
| UPS Monitoring           |                                  |  |  |
| Input & Output           |                                  |  |  |
| Battery & Inverter       |                                  |  |  |
| Relay & Load Shed        |                                  |  |  |
| <b>User Input Status</b> |                                  |  |  |
| UPS Maintenance          |                                  |  |  |
| Unit Configuration       |                                  |  |  |
| Battery                  |                                  |  |  |
| Inverter                 |                                  |  |  |
| Relay & Load Shed        |                                  |  |  |
| Time & Date              |                                  |  |  |

|                  | Input 1      | Input 2        | Input 3      |
|------------------|--------------|----------------|--------------|
| <b>Type</b>      | Edge Trigger | Level Toggle   | Edge Trigger |
| <b>Level</b>     | Low          | Low            | Low          |
| <b>Action #1</b> | Self Test    | User Alarm On  | Shutdown On  |
| <b>Action #2</b> | None         | User Alarm Off | Shutdown Off |

Figure 21 — UPS Monitoring: User Input Status screen



### 6.10.3 UPS Maintenance

The UPS Maintenance screens are used to configure and adjust the Alpha FXM to meet your operating needs. To change parameters, either click on the **On/Off** buttons or choose an item from a drop down menu. To execute the changes, click on the **Update Settings** button. If you do not click this button, the changes will not happen.

#### Unit Configuration

Is used to set the name, input, output and how often the GUI polls the Alpha FXM.

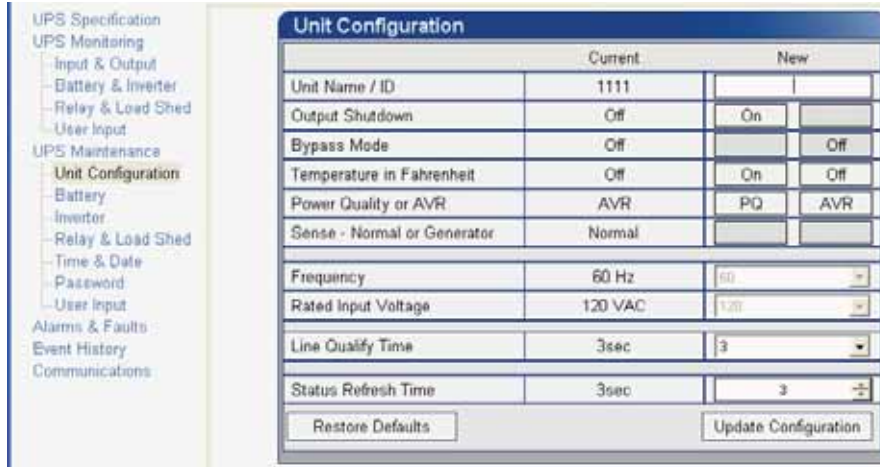


Figure 22 — UPS Maintenance: Unit Configuration screen

#### Battery

Allows adjustments of battery string voltage, charging parameters, low battery warning time, periodic self test time, and starts the self test.

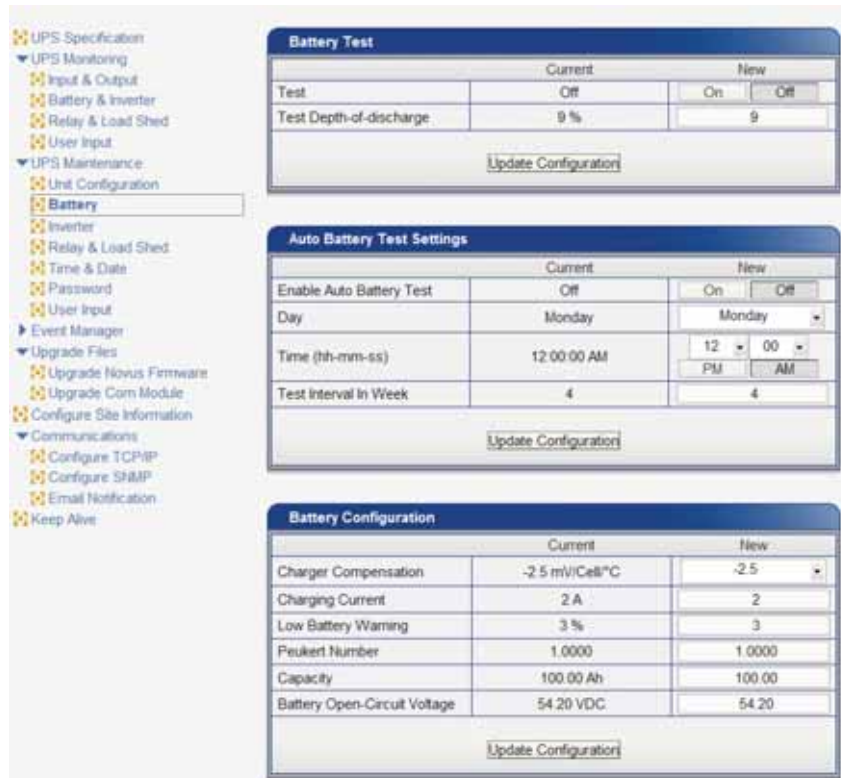


Figure 23 — UPS Maintenance: Battery screen

An accurate battery runtime estimation requires the following parameter to be adjusted:

- **Peukert Number:** Refer to the appendix for information about how to calculate the Peukert number to be entered here.
- **Battery Capacity:** This is the rated capacity (Ah) of the battery shown on the battery data sheet. Do not confuse the battery capacity with the Peukert capacity.
- **Battery Open Circuit Voltage:** This number is obtained from the battery data sheet. The battery data sheet shows the value for a single battery, so for a 48 V system where 4 batteries are connected in series, this number must be multiplied by four.

The "Battery Runtime Remaining" algorithm attempts to calculate the health of the battery to get a more accurate prediction of the remaining battery runtime. An accurate estimate of the battery health requires that at least one battery discharge greater than 20% depth of discharge has taken place since the unit was switched on. When the unit is powered up from an off state, the algorithm assumes that a new battery is connected to the unit. Each discharge of greater than 20% will result in a new calculation for the relative battery health. This value is then used in the "Battery Runtime Prediction algorithm to compensate for an aging battery. We recommend that the user set up a periodic (every 6 months) battery test with a depth of discharge of at least 20%.

The "Battery Runtime Remaining" algorithm relies heavily on the battery voltage to predict the remaining runtime. This results in a less accurate predicted runtime during periods when the battery voltage is changing rapidly. The battery voltage typically changes rapidly during the first few minutes of discharge when the unit switches from charging to discharging while the unit is in the Inverter mode. The battery voltage may also change rapidly during the last 20% of the discharge time when the battery is almost drained.

## Inverter

Is used to turn the inverter on or off to start or stop backup battery power to the load.



Figure 24 — UPS Maintenance: Inverter screen

## Relay & Load Shed

Is used to configure the front panel's dry contact to provide a signal for turning off the load.

The screenshot shows the 'Relay & Load Shed' configuration screen. On the left is a navigation menu with the following items: UPS Specification, UPS Monitoring, Input & Output, Battery & Inverter, Relay & Load Shed (highlighted), User Input, UPS Maintenance, Unit Configuration, Battery, Inverter, Relay & Load Shed (highlighted), Time & Date, Password, User Input, Alarms & Faults, Event History, and Communications.

**Relay Configuration**

| Current            | Action | New                   |
|--------------------|--------|-----------------------|
| Relay C1           | On Off | On Battery            |
| Relay C2           | On Off | Low Battery           |
| Relay C3           | On Off | Timer 1               |
| Relay C4           | On Off | Temperature           |
| Relay C5           | On Off | Low Battery + No Line |
| Relay C6           | On Off | Timer 2               |
| Fan on Temperature |        | 20                    |

Update Configuration

**Load Shed Timer Configuration**

| Time Remaining | Time Set |
|----------------|----------|
| Timer 1        | 2 0 0    |
| Timer 2        | 2 0 0    |
| Timer 3        | 2 0 0    |

Update Configuration

**Time Of Day Action Configuration**

|                | Time Period 1 | Time Period 2 |
|----------------|---------------|---------------|
| Action Enabled | ON            | OFF           |
| Start Time     | 6 10 AM PM    | 8 10 AM PM    |
| End Time       | 8 10 AM PM    | 10 20 AM PM   |

Update Configuration

Figure 25 — UPS Maintenance: Relay & Load Shed screen

### Controlling the external fan by temperature triggered dry contact

The Alpha FXM has up to 6 dry contacts (C1 to C6) on the front panel which can be configured by the user to open or close based on the specific trigger conditions. Dry contact functions currently available include: Alarm, Fault, Timer, Low Battery, On Battery, etc. The Temperature trigger has been added as a new function, with a user configurable range of +20°C to +55°C. When the battery temperature (monitored by the Battery Temperature Probe) reaches the threshold, the assigned relay closes and turns on the external fan.

Dry contact C6 is by default factory hard wired to External VDC. To configure C6 as a programmable dry contact, the unit must be sent back to the factory.

The Temperature trigger can be programmed via one of the following 3 interfaces:

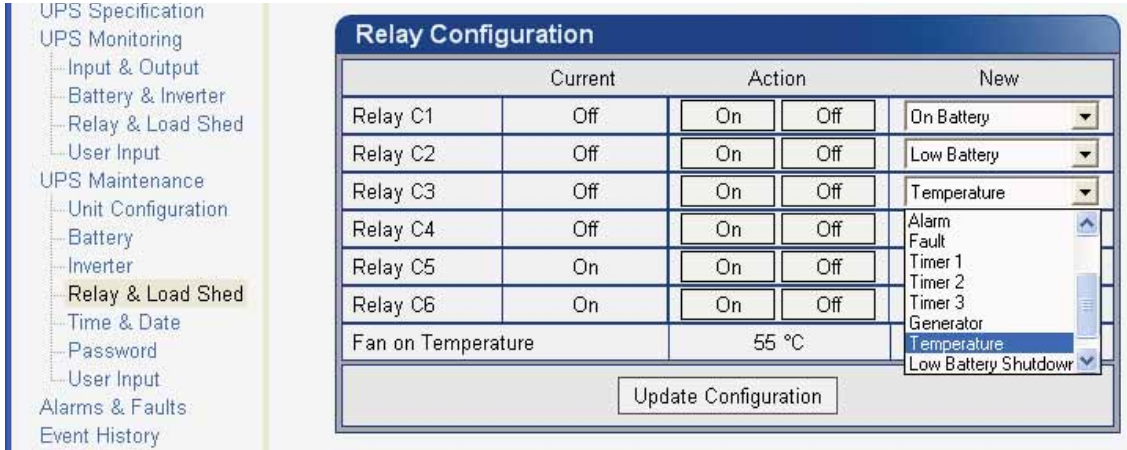
1. LCD panel – from the Logo screen, navigate to **Control Menu > RELAY TEMP**. Press the **SELECT** button and the current temperature display will start flashing. Use the **Scroll** button to change the temperature in 5°C increments. Press **SELECT** to accept the changes or **CANCEL** to abort.

|                   |                 |
|-------------------|-----------------|
| <b>RELAY TEMP</b> | <b>120/60/N</b> |
| <b>55</b>         | <b>LINE</b>     |

Dry contact functions are not programmable through the LCD. Use the RS-232 GUI or the HyperTerminal instead.

2. RS-232 GUI – Figure 26a shows the Relay Configuration window under the UPS Maintenance > Relay & Load Shed screen. As an example, to assign C1 as the Temperature trigger, select Temperature from the drop down menu. Click Update Configuration and the current status will update momentarily. In the example shown below, the fan on temperature threshold is set at 55°C. To change this value, simply type the new value into the Fan On Temperature box (or use the up/down arrow keys) and click Update Configuration to update the current status display.

a. Assigning the Temperature trigger function to a dry contact.



b. Setting the Temperature trigger value.

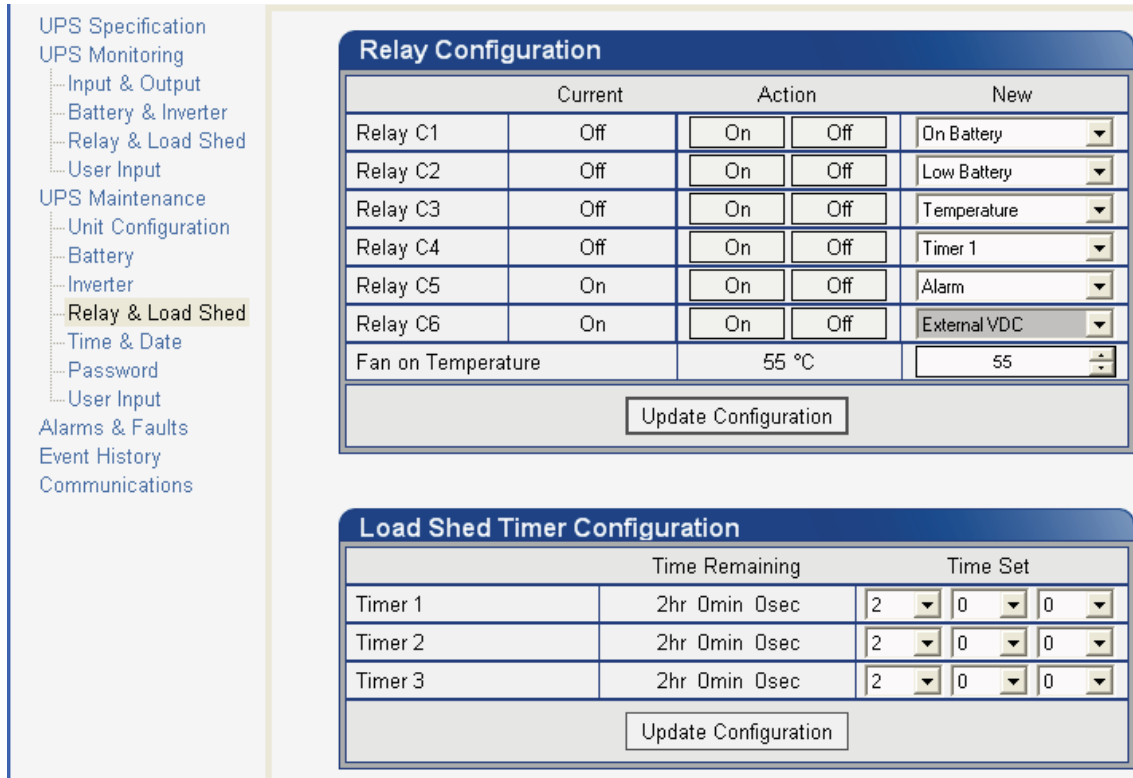


Figure 26 — Temperature trigger function via Alpha UPS Monitor

- RS-232 HyperTerminal – the Temperature trigger function can be assigned to any available dry contacts as described in "Programming the Dry Contacts" (e.g. c1=11, where 11 is the assigned index for the Temperature trigger function.)  
After establishing an RS-232 connection with the Alpha FXM at the HyperTerminal screen prompt, type Temp and press Enter to display the current temperature setting (Alpha FXM returns \*temp=20). To change the value to +35°C, type temp=35 and press Enter. The Alpha FXM returns \*temp=35 as confirmation.

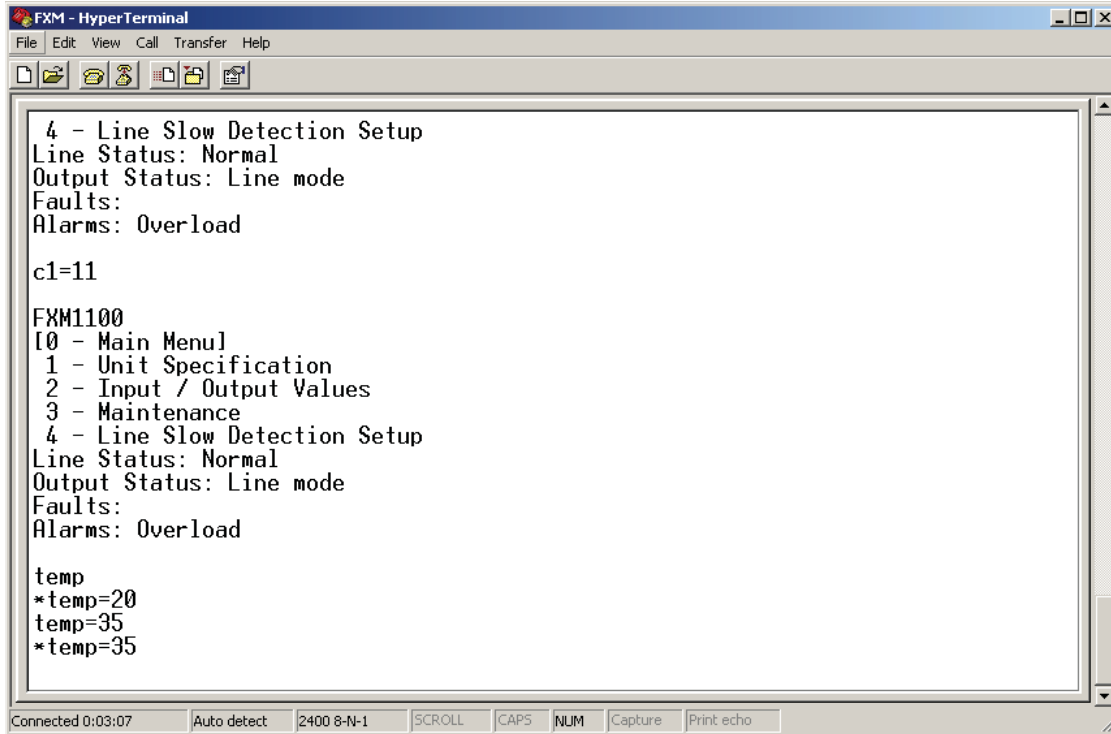


Figure 27 — Temperature trigger function via HyperTerminal

### Programmable Dry Contact Time of Day Action

You can assign a dedicated timer to a dry contact. Upon entering the Inverter operating mode, the timer is activated and begins to count down from a user defined value. When the timer reaches zero, the programmed dry contact relay will be activated (Status = ON).

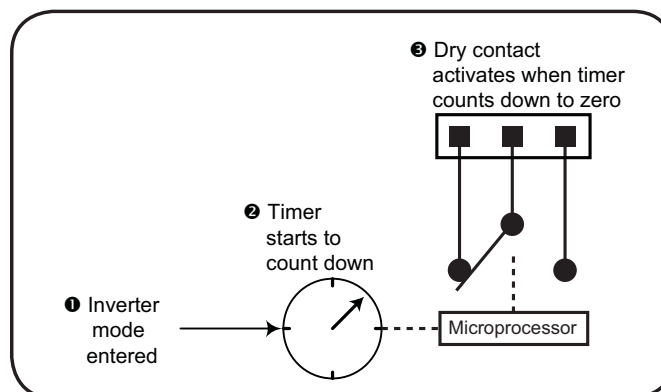


Figure 28 — Programmable Timer Operation

A typical application of this timer controlled dry contact function is to control a traffic light. When the grid power fails, the Alpha FXM goes into the Inverter mode and continues supplying backup power to the traffic light. Since the batteries supplying the backup power have limited capacity, a timer controlled dry contact is usually configured to switch the traffic light into the flashing amber or flashing red mode after a user-defined period to conserve battery power. This setup works fine during non rush hour traffic, but during rush hour, it may be more desirable to keep the traffic light running normally for as long as backup power is available. To address this issue, a new feature called the **Time of Day Action** has been added to deactivate the timer during a user defined time period up to twice each day.

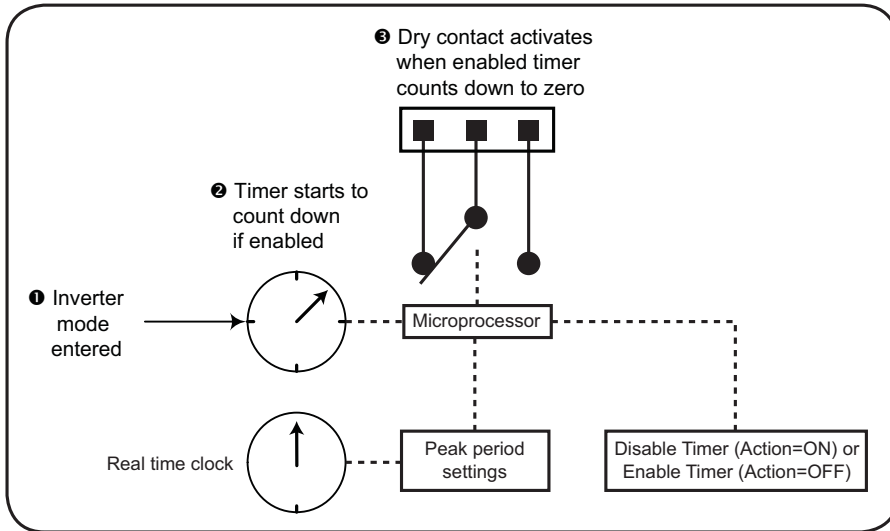


Figure 29 — Time Of Day Action Operation

You can define up to 2 peak time periods of the day:

1. Go to the UPS Maintenance > Relay & Load Shed screen.
2. In the Time of Day Action Configuration dialogue box, set up the start and end time of the first rush hour under Time Period 1 and the second rush hour under Time Period 2. In this example, during the first time period (7 AM to 9 AM), all 3 timers are disabled (they do not count down at all). Similarly, all timers are disabled during the second time period (3 PM to 6 PM).
3. Select ON under each time period. Click the Update button under each time period to store the settings. Confirm your settings in the UPS Monitoring > Relay & Load Shed > Time of Day Action Status screen.

The figure shows two screenshots from a web interface. The top screenshot is titled 'Load Shed Timer Configuration' and shows a table with three rows for Timer 1, Timer 2, and Timer 3. Each row has a 'Time Remaining' column showing '2hr 0min 0sec' and a 'New Setting' column with three dropdown menus set to '2', '0', and '0'. There is an 'Update Configuration' button below the table. The bottom screenshot is titled 'Time Of Day Action Configuration' and shows a table with two columns for 'Time Period 1' and 'Time Period 2'. The rows are for 'ON/OFF', 'Hour of Start', 'Minute of Start', 'Hour of End', and 'Minute of End'. The 'ON/OFF' row has 'ON' selected for both periods. The 'Hour of Start' row has '7' and '15' selected. The 'Minute of Start' row has '0' and '0' selected. The 'Hour of End' row has '9' and '18' selected. The 'Minute of End' row has '0' and an empty dropdown selected. There are 'Update' buttons for each time period.

Figure 30 — Time Of Day Configuration

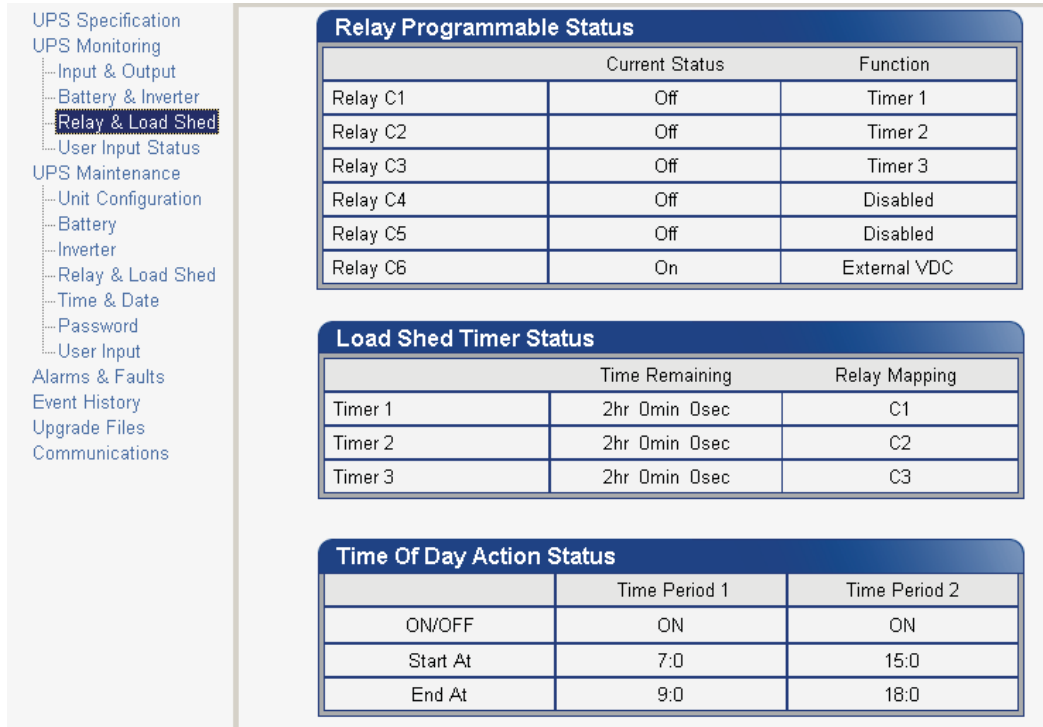


Figure 31 — Time Of Day Action Status

Once the Time of Day Action is configured, the Alpha FXM will automatically disable the timers during the Inverter mode at the defined peak periods.

You can switch off the Time of Day Action by setting one or both time period(s) to **OFF**. The dry contact will be activated by the timer regardless of the peak period settings.

## Time & Date

Is used to set the Alpha FXM's date and time.

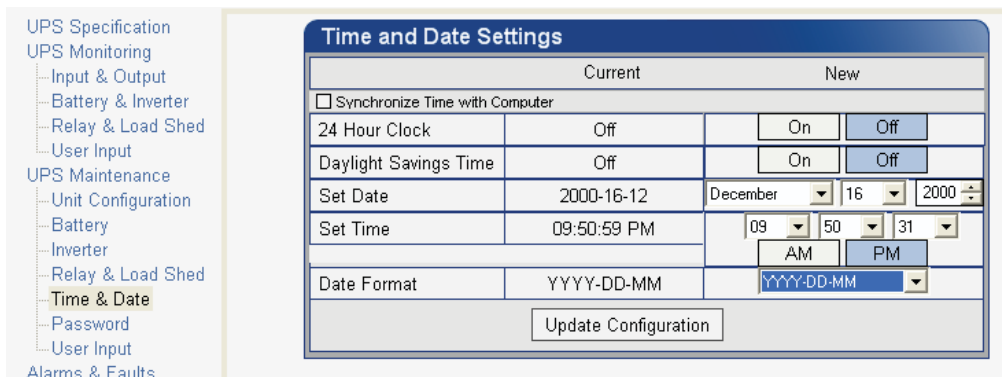


Figure 32 — UPS Maintenance: Time & Date screen

## Password

Is used to set the Alpha FXM's password. The factory set password is 1111.

| Novus Password Configuration                   |      |
|--|------|
| New Password                                   | **** |
| Confirm New Password                           | **** |
| <input type="button" value="Change Password"/> |      |

Figure 33 — UPS Maintenance: Password screen

The password is limited to 4 alphanumeric characters. The software will not accept more than 4 characters.

## User Input

Three programmable User Inputs exist. Their functions are similar to the Dry Contact relays. Supported functions include: (a) Shutdown, (b) User Alarm and (c) Self Test.

|           | Input 1                               | Input 2                               | Input 3                               |
|-----------|---------------------------------------|---------------------------------------|---------------------------------------|
| Type      | Edge Trigger                          | Edge Trigger                          | Level Toggle                          |
| Level     | Low                                   | Low                                   | Low                                   |
| Action #1 | None                                  | None                                  | User Alarm On                         |
| Action #2 | None                                  | None                                  | User Alarm Off                        |
|           | <input type="button" value="Update"/> | <input type="button" value="Update"/> | <input type="button" value="Update"/> |

Figure 34 — UPS Maintenance: User Input screen

Any user input can be configured to perform a certain action in response to different trigger types and logic levels. For example, if you want the Alpha FXM to issue an intrusion alarm when the door is opened, you will need to wire the door with a switch that triggers a user input every time the door is opened. The following procedure describes how User Input 1 can be configured as an intrusion alarm input.



**Procedure**

1. Select **UPS Maintenance > User Input** to display the **User Input Configuration** window.

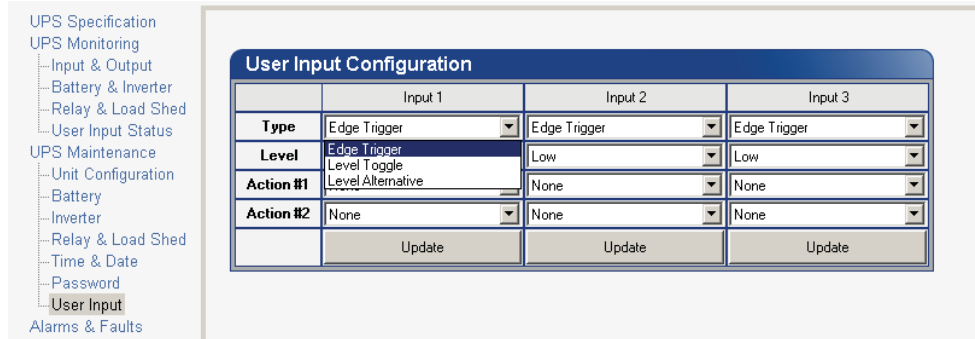


Figure 35 — User Input Configuration: Setting the Trigger Type

2. In the Input 1 column, select the **Type** down arrow to display the 3 types of available triggers: Edge Trigger, Level Toggle, and Level Alternative. For more information on how triggers work, see "Types of Trigger".
3. Select **Edge Trigger**.
4. Select **Low** from the **Level** drop down menu. The User Input will go to logic level "low" whenever it is triggered.
5. Select **User Alarm On** from the **Action #1** drop down menu.

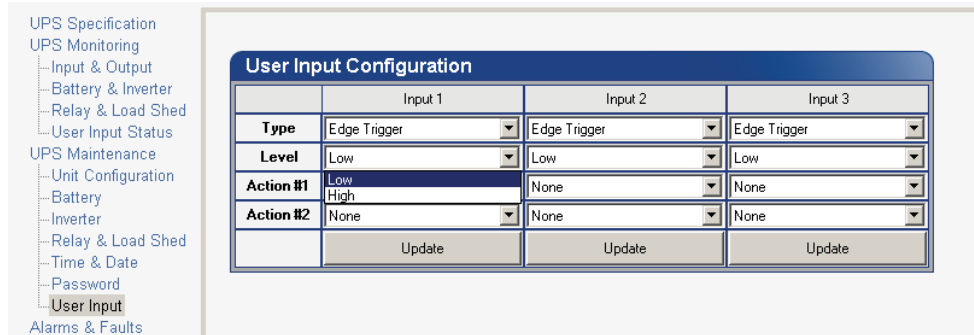


Figure 36 — User Input Configuration: Setting the Logic Level

6. Click the **Update** button and enter the password to confirm if required.

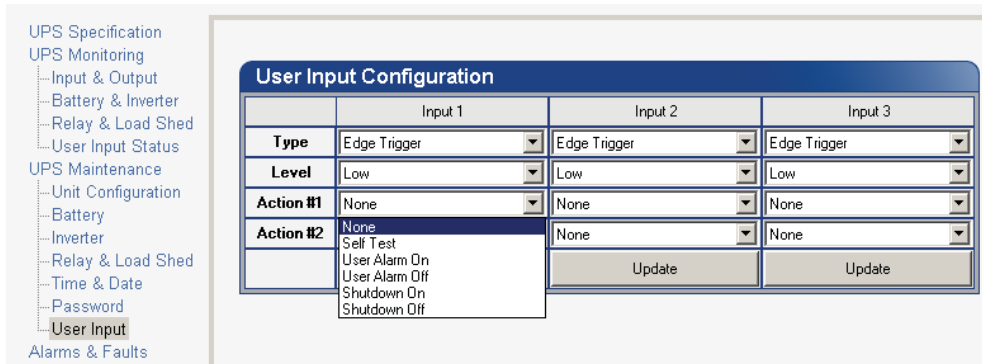


Figure 37 — User Input Configuration: Setting an Action

7. Check the **User Input Current Status** at the **UPS Monitoring > User Input Status** page.

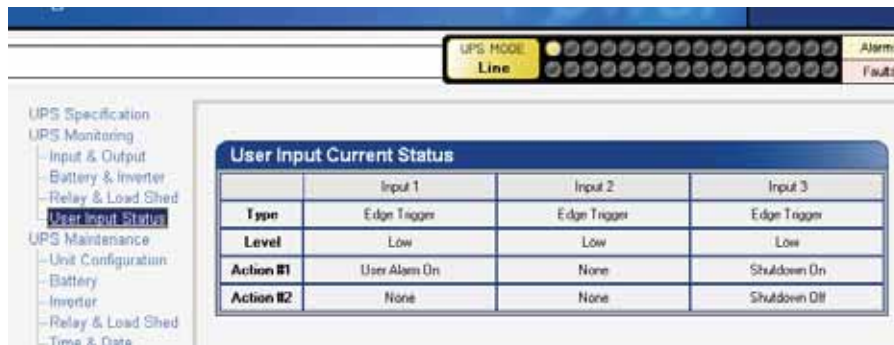


Figure 38 — User Input Current Status

Perform a quick test by shorting the User Input 1 dry contact pin (Pin 19 of C6) to ground (Pin 22 of C6) with a short length of PVC insulated electronic wire. This will trigger the Alpha FXM to issue a User Input Alarm as shown below.

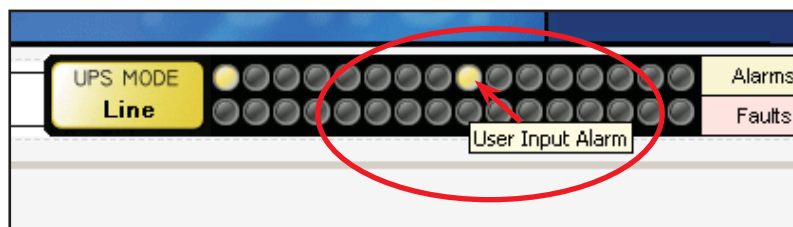


Figure 39 — User Input Current Status

Hovering the cursor over the amber indicator will display the corresponding context sensitive message.

## Operation

Many of the screens used for Ethernet communications look and function the same and contain the same information as the Alpha UPS Monitor screens. There are additional screens only available with Ethernet communications which are detailed below.

### Configure Site Information

This screen is used to enter site location information into the UPS's memory.

| Site Information   |                         |
|--------------------|-------------------------|
| Site Name          | FYM Supervisory         |
| City               | Burnaby                 |
| Prov./State/Region | B.C.                    |
| Country            | Canada                  |
| Contact Name       | Alpha Technical Support |
| Phone Number       | 604-430-1476            |

Apply Settings

Figure 40 — Alpha UPS Monitor: Configure Site Information

## Communications

- Configure TCP/IP is used to set the UPS's IP or TCP address.
- Configure SNMP is used to set the UPS for use with SNMP communications.
- Configure RS-232: You cannot change RS-232 parameters with this screen.
- Email Notification tells the card to send an e-mail message whenever selected UPS events happen.

| Internet Protocol (TCP/IP) Properties                            |               |
|--|---------------|
| <input type="checkbox"/> Obtain an IP address automatically      |               |
| IP address   | 24.80.96.158  |
| Subnet mask  | 255.255.252.0 |
| Default gateway  | 24.80.96.1    |
| <input type="checkbox"/> Obtain DNS server address automatically |               |
| Preferred DNS server   | 64.59.144.18  |
| Alternate DNS server   | 64.59.144.19  |

Apply Settings

Figure 41 — Alpha UPS Monitor: UPS Communications screen

## Restoring All Parameters to Default Values

The purpose of this command is to reset the Alpha FXM to the factory default state. See Table P for a list of parameters that will be restored to their default values.



### CAUTION!

**This command resets all parameters that are user-configurable. All previously programmed operation will be lost. Implement a backup plan for mission critical operations. This command is password protected.**

The default command can be issued via the RS-232 HyperTerminal or the RS-232 GUI as follows:

- RS-232 HyperTerminal – type **default:all** and **press Enter**. **Enter the password and the** Alpha FXM returns **\*default** as confirmation.
- RS-232 GUI – From the UPS Maintenance > Unit Configuration screen, click the Restore Defaults button. Enter the password to execute the command.

| Unit Configuration          |                |  |
|-----------------------------|----------------|--|
|                             | Current Status | New Setting  |
| Unit Name / ID              | 1111           | <input type="text"/>   |
| Output Shutdown             | Off            | <input type="button" value="On"/> <input type="button" value="Off"/>     |
| Bypass Mode                 | Off            | <input type="button" value="On"/> <input type="button" value="Off"/>     |
| Power Quality or AVR        | AVR            | <input type="button" value="PQ"/> <input type="button" value="AVR"/>     |
| Sense - Normal or Generator | Normal         | <input type="button" value="Normal"/> <input type="button" value="Gen"/> |
| Frequency                   | 60 Hz          | <input type="text" value="60"/>  |
| Rated Input Voltage         | 120 VAC        | <input type="text" value="120"/>   |
| Rated Output Voltage        | 120 VAC        | <input type="text" value="120"/>   |
| Line Qualify Time           | 3sec           | <input type="text" value="3"/>   |
| Status Refresh Time         | 4sec           | <input type="text" value="3"/>   |

Restore Defaults      Update Configuration

Figure 42 — Restore all default commands

| <b>Table P — List of Parameters</b>                                |
|--|
| Maximum battery charging current                                   |
| Temperature compensation of battery charging                       |
| Maximum allowable duration of output short circuit before shutdown |
| Property settings of programmable user input #1                    |
| Action #1 setting of programmable user input #1                    |
| Action #2 setting of programmable user input #1                    |
| Property settings of programmable user input #2                    |
| Action #1 setting of programmable user input #2                    |
| Action #2 setting of programmable user input #2                    |
| Property settings of programmable user input #3                    |
| Action #1 setting of programmable user input #3                    |
| Action #2 setting of programmable user input #3                    |
| Start hour of rush hour of time of day action period #1            |
| Start minute of rush hour of time of day action period #1          |
| End hour of rush hour of time of day action period #1              |
| End minute of rush hour of time of day action period #1            |
| Start hour of rush hour of time of day action period #2            |
| Start minute of rush hour of time of day action period #2          |
| End hour of rush hour of time of day action period #2              |
| End minute of rush hour of time of day action period #2            |
| Scheduled events   |
| Format setting of date display on LCD                              |
| Line qualify time  |
| Time setting of periodical self-test (minute) (hh:mm)              |
| Inverter off delay setting   |
| RS-232 baud rate   |
| Number of weeks setting of periodical self-test                    |
| Day of the week setting of periodical self-test                    |
| Time of the day setting of periodical self-test                    |
| Battery low warning threshold setting (%)                          |
| Self test duration setting (minutes)                               |
| Internal temperature setting to turn on cooling fan                |
| Load shed timer1 duration  |
| Load shed timer2 duration  |
| Load shed timer3 duration  |
| Programmable dry contact #1 setting                                |
| Programmable dry contact #2 setting                                |
| Programmable dry contact #3 setting                                |
| Programmable dry contact #4 setting                                |
| Programmable dry contact #5 setting                                |
| Programmable dry contact #6 setting                                |
| Password setting   |

## Alarms & Faults

This read-only screen shows the operating status of the Alpha FXM. When the fault or alarm indicators on the horizontal bar are illuminated, place the mouse cursor over the light to display the context sensitive message.



Figure 44 — Alpha UPS Monitor: UPS Alarms & Faults screen

## Event History

This screen shows the last 100 events recorded by the Alpha FXM. Choosing a number in the **Event Index** drop-down box and then clicking on the **View Selected** button will display the updated information about the selected event.



Figure 43 — Alpha UPS Monitor: UPS Event History screen



## Upgrade Files

This feature is available only on Alpha FXM UPS equipped with the network interface card factory option.

To upgrade the Alpha UPS Monitor firmware, browse to the .bin file and click OK to start the upload. This may take a few minutes to complete.

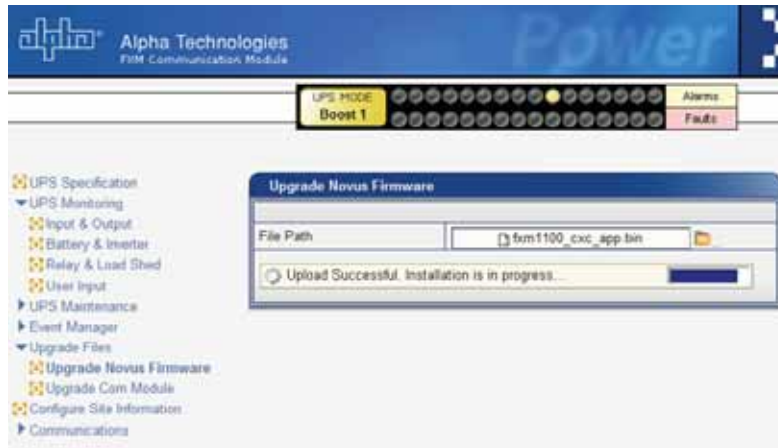


Figure 47 — Alpha UPS Monitor: Upgrade Firmware

To upgrade the Communication module, browse to the .ezip file and click OK to start the upload. This may take a few minutes to complete.



Figure 48 — Alpha UPS Monitor: Upgrade Communication Module

## Communications

This screen changes the Alpha FXM's communication parameters. The RS-232 Baud Rate cannot be changed.

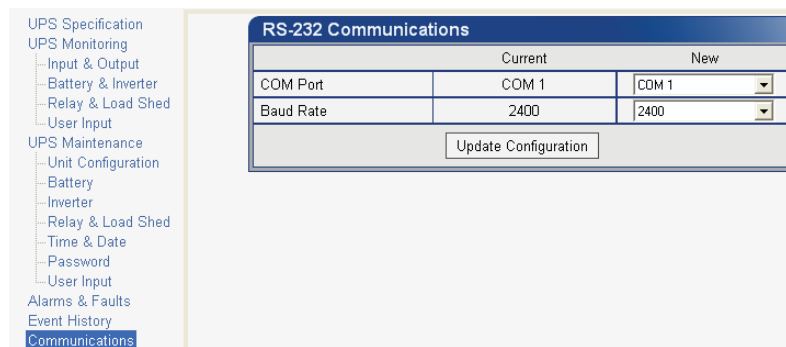


Figure 49 — Alpha UPS Monitor: UPS Communications screen



## Keep Alive

The Keep Alive feature can be used to reset power when a communication failure is detected. The purpose of the reset is to temporarily remove power and reset the local communications equipment powered by this unit. The goal of the Keep Alive feature is to attempt to restore communications by resetting the local communication equipment until communications is re-established

The screenshot shows the web interface for the Alpha Technologies Power FXM Communication Module. The top navigation bar includes the company logo and name, and a status indicator for 'UPS MODE' set to 'Line'. Below the navigation bar is a sidebar menu with various configuration options, including 'Keep Alive' which is currently selected. The main content area displays several configuration panels, each with a table for 'Current' and 'New' settings and an 'Update Configuration' button.

**Keep Alive Status/Manual Control**

|                  | Current            | New  |
|------------------|--------------------|--|
| Status           | Ping Echo Recieved | On <input type="checkbox"/> Off <input type="checkbox"/> |
| Delay To Startup | 60 Sec             | 60   |

[Update Configuration](#)

**Keep Alive Method To Detect Communication Failure**

|                     | Current    | New        |
|---------------------|------------|------------|
| Protocol            | Ping       | Ping       |
| IP address          | 10.1.8.172 | 10.1.8.172 |
| Delay Between Retry | 5 Sec      | 5          |

[Update Configuration](#)

**How To Detect Communication Failure**

|                        | Current | New |
|------------------------|---------|-----|
| Timeout                | 15 Sec  | 15  |
| Retries Before Failure | 3       | 3   |

[Update Configuration](#)

**Keep Alive Action To Attempt To Restore Communication**

|                 | Current     | New         |
|-----------------|-------------|-------------|
| Action          | Reset Power | Reset Power |
| Action Duration | 30 Sec      | 30          |

[Update Configuration](#)

**When To Fail**

|                             | Current | New |
|-----------------------------|---------|-----|
| After X Consecutive Actions | 3       | 3   |

[Update Configuration](#)

**Keep Alive Failure**

|                     | Current  | New  |
|---------------------|--|--|
| Send Trap           | On <input type="checkbox"/> Off <input type="checkbox"/> | On <input type="checkbox"/> Off <input type="checkbox"/> |
| Delay To Re-Startup | 120 Sec  | 120  |

[Update Configuration](#)

**Keep Alive status/manual control:**

- a. The Status field allows the user to enable or disable the Keep Alive function. When disabled the alarm is cleared.
- b. The Delay to Startup field allows the user to set the time to the first ping from the enable ping or UPS restart after a ping failure. Minimum = 5 s, Maximum = 3600 s.

**Keep Alive Method to detect communication failure:**

- a. The Protocol field allows Ping as the only option.
- b. The IP Address field is used to enter the IP address to be pinged.
- c. The Delay Between Retry field is the delay between pings. Minimum = 5 s, Maximum = 65535 s.

**How to detect communication failure:**

- a. The Timeout field is where the ping time out setting is configured. Minimum = 2 s, Maximum = 65534 s.
- b. The Retries Before Failure field is the number of pings to repeat before power cycling. Minimum = 1, Maximum = 20.

**Keep Alive action to attempt to restore communication:**

- a. The Action field allows Reset Power as the only option.
- b. The Action Duration field is how long the output will be shut off by the UPS, Minimum = 1 s, Maximum = 3600 s.

**When To Fail:**

- a. The After X Consecutive Actions field determines the number of times the UPS will go through the ping and power down and back up cycle before registering an Alarm for Keep Alive. Other alarms and events will occur regardless of this value. After the final power cycle, the UPS will issue another ping after the Delay between retry has elapsed. This ensures the destination IP is not alive. The UPS will then set the Keep Alive alarm. Minimum = 1, Maximum = 20.

**Keep Alive Failure:**

- a. The Send Trap field allows the email and SNMP trap notification to be switched on and off for the Keep Alive only.
- b. The Delay to Re-Startup field configures the delay after the Keep Alive alarm is set and the next ping is sent in delay to restart. Minimum = 5 s, Maximum = 3600 s.

## 6.11 Communicating Via The Intranet or Internet

If the Alpha FXM is equipped with the optional, factory-installed FXM communication module, then the internet or a company intranet can be used to communicate with the Alpha FXM. In addition, the Alpha FXM can be monitored and controlled via a web browser or with SNMP protocols.

### 6.11.1 Installation and Set Up

The following tools and materials are needed:

- Computer with network card and web browser.
- Cross over cable or hub.
- The UPS's: Final IP Address and Subnet Mask and if needed the Default Gateway and the DNS Server addresses.



#### **CAUTION!**

**To successfully complete this procedure, you should have a working knowledge of network protocols and how to configure them. Consult your network administrator for details.**

**If multiple UPS's are installed on the same network, configure each unit's IP address before the installation. Each UPS on the network MUST have its own unique IP address See "Communications, Configure TCP/IP".**

### 6.11.2 Procedure

1. Connect the Alpha FXM to the computer with either the cross over cable or a hub.
2. Switch on the computer.
3. Configure the network card to talk to the FXM communication module. The module's default address is `http://192.168.0.90`.
4. Type the IP address into the browser and press ENTER. The input and output screen appears. See "UPS Monitoring".
5. Go to the communications screen, "Configure TCP/IP", and configure the TCP/IP properties according to your network's requirements. Push the Apply Settings button. The screen will prompt for the password. The factory default password is 1111.
6. Connect the Alpha FXM to the configured network according to your new properties.
7. Access the Alpha FXM according to the new network properties.

### 6.11.3 Types of Trigger

There are 3 types of trigger:

#### Edge trigger

When the user input changes from one state to the other, the Alpha FXM is triggered to perform Action #1. If the level is set to High, the action will be triggered by a Low to High edge (leading edge). If the level is set to Low, the action will be triggered by the High to Low edge (falling edge).

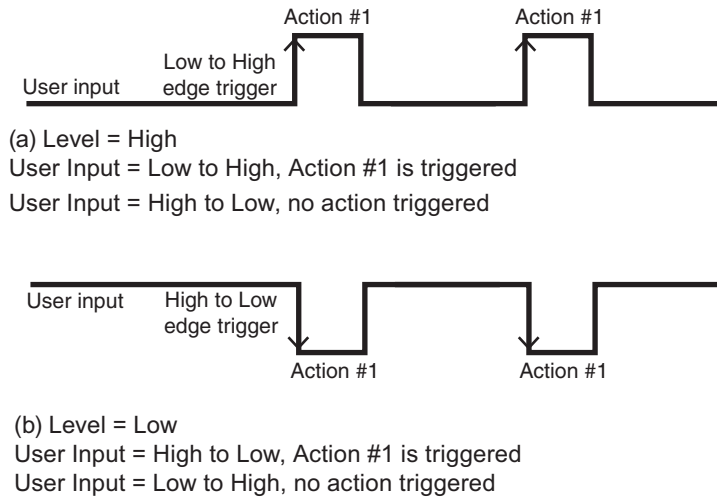


Figure 50 — Edge Trigger

#### Level Toggle

When the Level is set to High, the Alpha FXM is triggered to perform the other action when the user input changes from Low to High. If the input then changes from High to Low, Action #2 will be triggered. In other words, a level change in the user input will trigger an action toggle between Action #1 and #2.

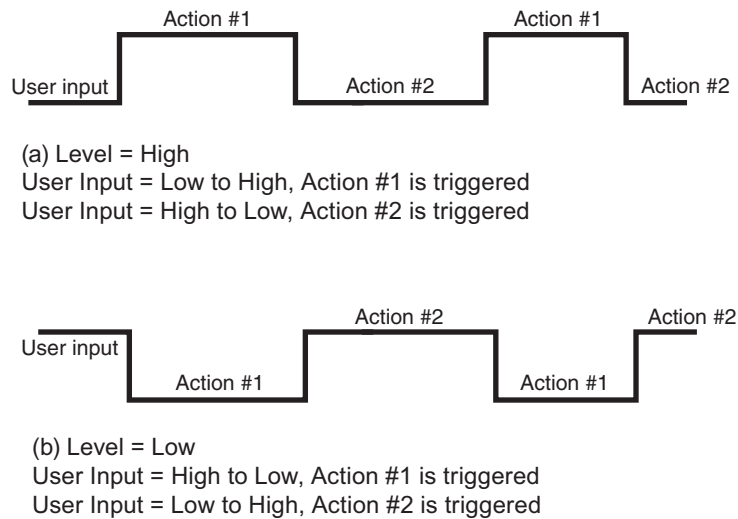
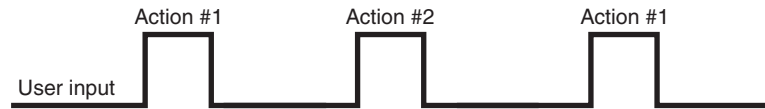


Figure 51 — Level Trigger

## Level Alternative

When the level is set to High, the Alpha FXM is triggered to perform the next action when the user input changes from Low to High. If the input then changes from High to Low, no action will be triggered because the level is set to High. In other words, only a Low to High user input level triggers an action when Level is set to High. Similarly, when Level is set to Low, the Alpha FXM will trigger an action only with a High to Low user input.



User Input = Low to High, Action #1 is triggered  
User Input = High to Low, no action triggered  
User Input = Low to High, Action #2 is triggered  
User Input = High to Low, no action triggered



User Input = High to Low, Action #1 is triggered  
User Input = Low to High, no action triggered  
User Input = High to Low, Action #2 is triggered  
User Input = Low to High, no action triggered

Figure 52 — Level Alternative

# 7. Maintenance

---

## 7.1 Updating the Software

The Alpha FXM's firmware can be reinstalled or updated to the latest version with this procedure.

If your Alpha FXM is provided with the factory-installed FXM communication module, the firmware upgrade can be done via an intranet or internet connection.

You will need the following items:

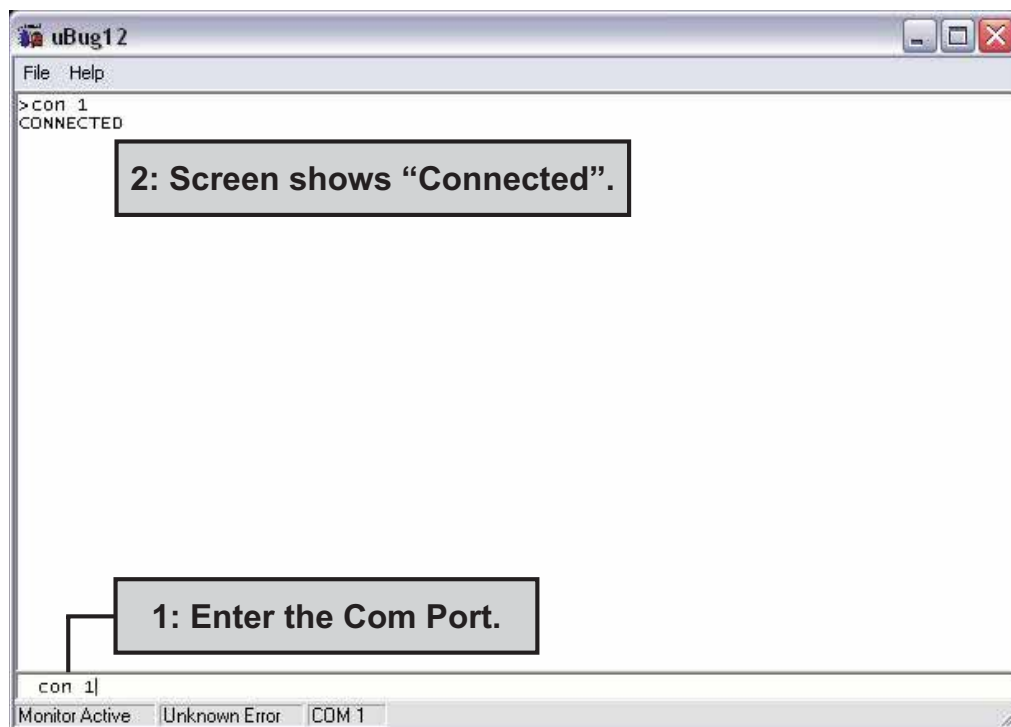
- RS-232 connection cable to the Alpha FXM.
- **uBug12** software must be installed. It is available for download at [www.alpha.ca/downloads](http://www.alpha.ca/downloads).
- Alpha's firmware must be installed. It can be accessed with your computer and downloaded at [www.alpha.ca/downloads](http://www.alpha.ca/downloads).

### 7.1.1 Procedure

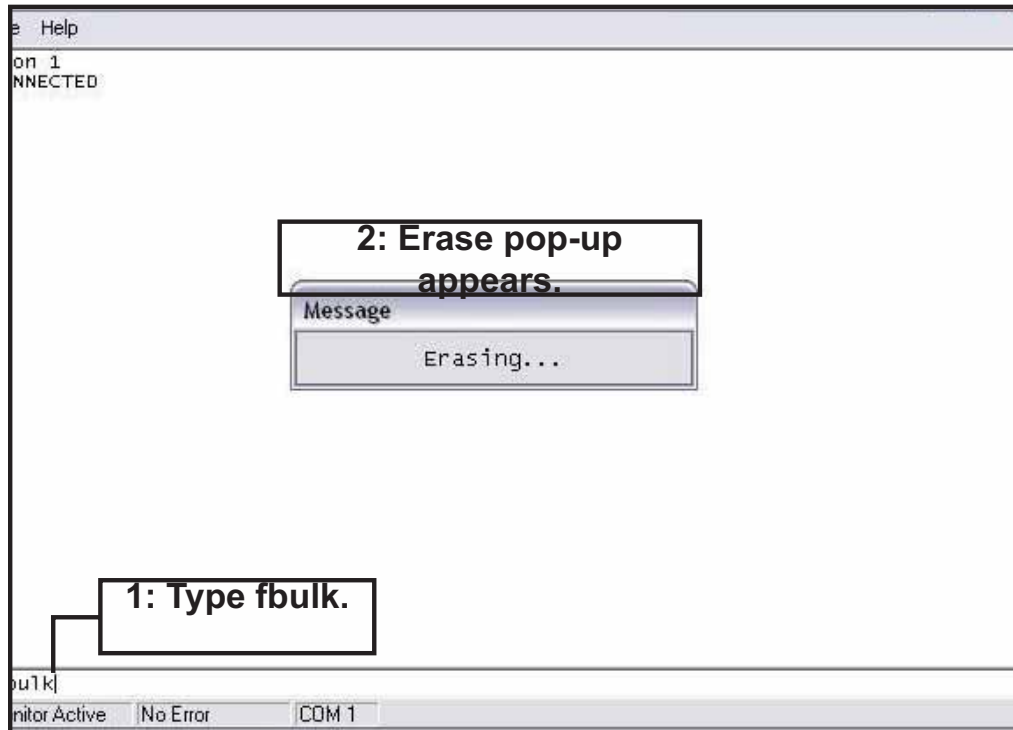
1. Switch off the Alpha FXM.
2. Connect the RS-232 cable if it is not already connected.
3. While pressing and holding the **SELECT** button, switch on the battery circuit breaker. The LCD panel shows "**Alpha XP ISP**".



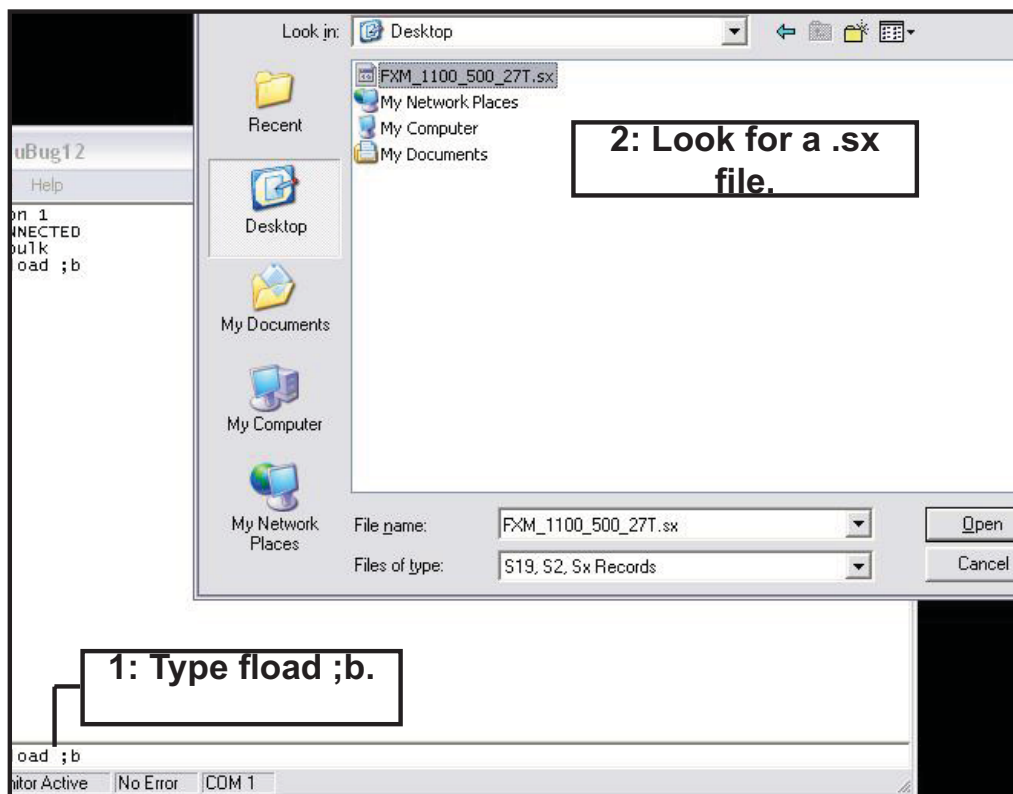
4. Start **uBug12**.
5. Type (all lower case) **con**(1 space)**1**(or the number of the computer's comm port you are using) and press **ENTER**. The screen shows "connected" when the connection is established.



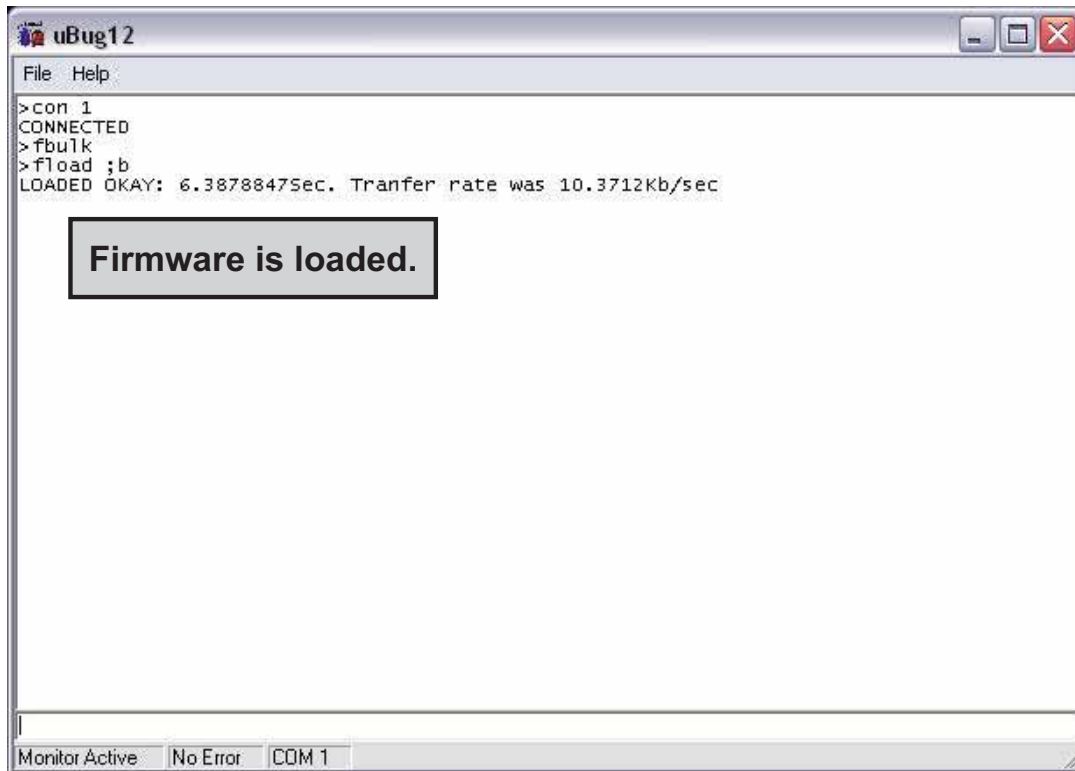
6. In the **uBug12** screen, type (all lower case) **fbulk** and press **ENTER**. The erase pop-up appears. It disappears when the Alpha FXM's memory is erased. If an error message appears, send the **fbulk** command again.



7. In the **uBug12** screen, type (all lower case) **load**(1 space);**b** and press **ENTER**. A pop-up appears asking you to locate the new firmware. Look for a "**sx record**" (\*.sx). Select this new firmware. The **load** pop-up appears.



8. When the software has finished loading into the Alpha FXM, the pop-up shows "**Loaded OK in (xx) seconds.**" If an error message appears, switch off the Alpha FXM and start over again. It should not take more than one or two restarts to load the software. If problem persists, contact Alpha technical support.



9. Type (all lower case) **exit** and press **ENTER**. The **uBug12** screen disappears.
10. Switch of the battery breaker.
11. To check if the installation was successful, switch on the battery breaker. The LCD's logo screen should appear as follows. If it shows "**Alpha XP ISP**" as shown in Step 3, try installing the firmware again.

|                      |                          |
|----------------------|--------------------------|
| <b>Alpha<br/>FXM</b> | <b>120/60/N<br/>LINE</b> |
|----------------------|--------------------------|



## 7.2 Testing and Replacing the Batteries

### 7.2.1 Battery life

Batteries lose their ability to store power as they age. Regularly test the batteries to ensure that they can continue providing reliable service. Battery life is reduced by three major factors:

- Temperature – higher ambient temperatures, especially above 25°C, will reduce battery life. For example, an average operating temperature of 27°C will likely reduce the life of the battery by 25%. Ensure that the Alpha FXM and batteries are situated in a well ventilated area with adequate temperature control. A cool environment is preferable.
- Number of discharge cycles – the more frequent the batteries are discharged, the shorter the battery life. Frequent power outages imply the need for more frequent battery replacement.
- Depth of discharge – the longer the batteries are required to provide back up power, the shorter the battery life. Frequent full discharging and the associated recharging of the batteries reduces the life. Shut down the electrical load or return to primary power as soon as possible to extend the battery life.

### 7.2.2 Battery Run Time

The chart below shows typical run times (time to full discharge) for the standard batteries supplied with this unit. These runtimes are for batteries in new and good condition. The run time performance will deteriorate over time in a progressively decreasing curve.

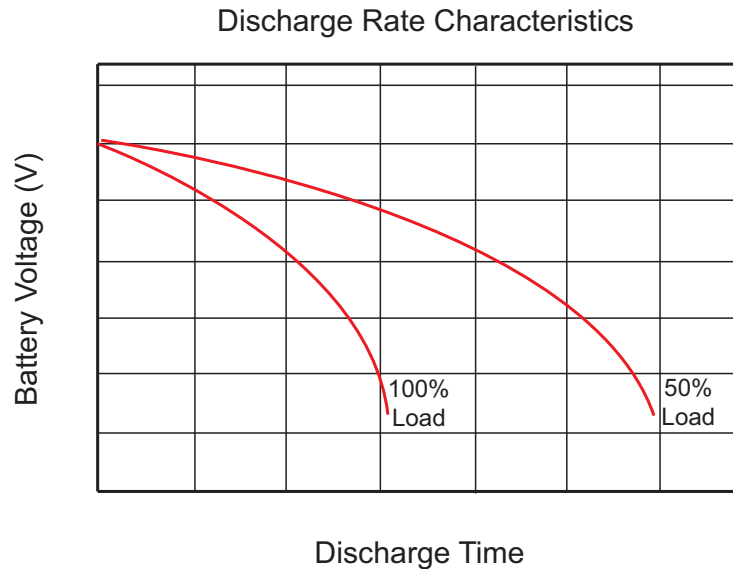


Figure 53 — Typical Discharge Characteristics for Lead Acid Batteries

### 7.2.3 Battery Maintenance

The batteries supplied with this unit are sealed and maintenance free. Regularly ensure that all connectors are tight and free of corrosion. The presence of corrosion, swelling of the battery case, or distortion in the shape of the case suggests that the batteries need to be replaced.

### 7.2.4 Battery Conductance Test (Optional)

1. Place the conductance meter probes across Battery #1.
2. Record the voltage and Siemens values in a log book.
3. Repeat for batteries #2, #3 and #4.

A new AlphaCell 180GXL battery has a conductance reference value of 1100 Siemens at 25°C. When this value drops to 550 Siemens or 50% of the new battery reference value, the battery capacity is suspect of being below 80% and should be evaluated further. When the temperature of the batteries is not between 20°C and 30°C, use the following temperature compensation values.

| <b>Table Q — Battery Temperature Compensation Values</b> |                                   |                      |
|--|-----------------------------------|----------------------|
| <b>Battery Temperature</b>                               | <b>Reference Value New 180GXL</b> | <b>Suspect Value</b> |
| 35°C or higher   | 1183                              | 592                  |
| 30°C   | 1140                              | 570                  |
| 25°C   | 1100                              | 550                  |
| 20°C   | 1063                              | 532                  |
| 15°C   | 1028                              | 514                  |
| 10°C   | 995                               | 498                  |
| 5°C  | 965                               | 483                  |
| 0°C or colder  | 936                               | 468                  |

### 7.2.5 Replacing the Batteries

Replace the batteries according to the results of the self test or the presence of terminal corrosion, swelling of the battery case, or distortion in the shape of the case. New batteries will normally provide longer run times than older ones. Larger capacity batteries may be available. Contact Alpha Technical Support (1 888 462 7487) to order replacement batteries or to obtain assistance. On-site service may be available in your area.

#### Tools and Materials Required

- AC/DC voltmeter or multimeter.
- Labels or masking tape and marker.
- Torque wrench.
- Slot head screwdriver to fit the terminal blocks.
- High strength, flame-proof tape such as duct tape.
- Battery terminal corrosion inhibitor (such as NOCO Company's NCP-2 or Sanchem Inc.'s No-Ox ID Grease "A").



## WARNING!

Read and understand the battery safety instructions in “Product Safety Information”.



## CAUTION!

**Make sure all the replacement batteries are of the same type and rating. Failure to do so could result in improper charging and damage to the batteries.**

The Alpha FXM cannot provide backup battery power while the batteries are being replaced. If the line becomes unqualified while the batteries are being replaced, the Alpha FXM shuts down and no power is provided to the load.

### Procedure

1. The Alpha FXM must be in the Line state. If it isn't, wait until the line is qualified before proceeding.
2. Switch the Alpha FXM into the Bypass State by doing one of the following:
  - a. From the Alpha FXM control panel, navigate to the **UPS Control Menu > INV BYPASS**. Press the **SELECT** button once OFF is flashing. Press the **SCROLL** button once ON is flashing. Press the **SELECT** button once ON is displayed continuously, indicating that the Alpha FXM has been switched into the Bypass state.
  - b. From the Alpha UPS Monitor main screen, go to the **UPS Maintenance > Unit Configuration** screen. Switch on the **Bypass Mode** by clicking the **ON** button and then the **Update Configuration** button. The Alpha FXM responds by displaying a “Bypass State” alarm. This is normal and does not indicate a problem. It will clear itself when the Bypass state is subsequently disabled.
3. Switch off the battery circuit breaker.
4. Replace the batteries.
5. Switch on the battery circuit breaker.
6. Switch the Alpha FXM out of the Bypass state by switching the **Bypass Mode** OFF.

## 7.3 Preventative Maintenance

Perform preventative maintenance on the Alpha FXM module every 6 to 12 months. For mission critical applications such as backup traffic intersections, more frequent maintenance should be done. Proper implementation of the following procedure will insure that your system continues to provide reliable backup power in the event of a utility power failure.

### 7.3.1 Tools and Materials Required

- Wrench set.
- Labels and marker to number batteries.
- Conductance meter for optional conductance test.

### 7.3.2 Procedure

1. Inspect the Alpha FXM and wiring for any physical damage. Repair or replace as required.
2. Verify that all connections are securely fastened. Tighten if necessary.
3. Inspect the batteries for cracks or swelling. Replace all four batteries if any of the batteries are cracked or swollen. Replace only a faulty battery if an Alphaguard battery balancer is installed.
4. Inspect the battery terminals for corrosions. Clean and apply a corrosion prevention compound such as NOCO Company NCP-2 or Sanchem Inc. NO-OX-ID if required.
5. Re-tighten the battery terminal bolts on Insert Terminal batteries. Re-torque the battery terminal bolts on Flag Terminal batteries to the manufacturers specifications on if required.
6. Label the batteries #1, #2, #3 and #4. The battery negative cable from the Alpha FXM is connected to Battery #1, and the battery positive cable from the Alpha FXM is connected to Battery #4.
7. Verify that the battery temperature probe is securely taped to the side of either battery #2 or #3.

### 7.3.3 Operational Test

1. Activate the Alpha FXM self-test function.
2. After passing the self-test, disconnect the AC input to the Alpha FXM to trigger the Alpha FXM into the backup (Inverter) mode.
3. Let the Alpha FXM operate in the backup mode for approximately 10 minutes.
4. Measure the individual battery voltages while the Alpha FXM is operating in the backup mode. There should be no more than 0.6 volts difference between the highest battery voltage and the lowest battery voltage.



#### **CAUTION!**

**A battery that measures 2 V lower than the other three batteries in the string probably has a shorted cell. Replace all four batteries.**

**Three batteries in the string measuring the same voltage and one battery measuring several volts higher indicates an open cell in the battery with the higher reading. Replace all four batteries.**

5. Verify that there is no Low Battery Alarm.
6. Reconnect the AC input.

## 8. Troubleshooting

When the front panel alarm LED is illuminated or flashing, the Alpha FXM has a malfunction. The alarm and fault submenus describe the malfunction. The Alpha UPS Monitor can also be used for troubleshooting.

### 8.1 Procedure

1. Press the **SELECT** button.
2. The LCD may display one or more conditions in the following table.
3. Press the **SCROLL** button to see if more than one malfunction is present.
4. To clear the malfunction from the screen, press and hold the **SELECT** button for 5 seconds.

| <b>Table R — Alarm Submenu</b> |   |  |
|--------------------------------|---|--|
| <b>LCD Shows</b>               | <b>Problem Description</b>  | <b>What To Do</b>  |
| <b>Over Load</b>               | The Alpha FXM is overloaded.  | Remove excess loads.   |
| <b>Batt Temp High</b>          | The battery temperature is above the specification limit.   | If used, ensure that the battery fan is working. Contact Alpha Technical Support to purchase an upgrade if required. |
| <b>Batt Temp Low</b>           | The battery temperature is below the specification limit.   | Use optional battery heating mats or heater. Contact Alpha technical support to place the order.                     |
| <b>Batt Low Warning</b>        | The batteries are almost discharged. Also see “Adjusting and Controlling the Alpha FXM, #35: Low Battery Warning Voltage”.                        | Ensure that the Alpha FXM charger is working. If the charging voltage is low, the battery may need to be replaced.   |
| <b>FAN Alarm</b>               | The fan has failed.   | Contact Alpha technical support. The fan is not a replaceable part.  |
| <b>Temp Probe Unplug</b>       | The temperature probe is unplugged.   | Plug it back into the Alpha FXM or change the probe.   |
| <b>User Input Alarm</b>        | When the user input is shorted. See “User Input: S2”.   | Check the user input parameters.   |
| <b>In Freq Out Of Range</b>    | The line frequency is outside of the Alpha FXM’s allowable range. The Alpha FXM goes into Inverter mode.  | Info only.   |
| <b>Weak Battery</b>            | The battery is being monitored continuously in the background in Line mode. This alarm is issued if the battery did not pass the background scan. | Check the battery life and replace the battery if necessary.   |
| <b>Battery Test</b>            | The Alpha FXM is performing a battery test.   | Info only.   |
| <b>Batt Breaker Open</b>       | The battery breaker is opened.  | Ensure the battery breaker is functioning.   |
| <b>Wrong_Software</b>          | The Alpha UPS Monitor is invalid (either version or p/n).   | Contact Alpha technical support.   |

| <b>Table S — Fault Submenu</b> |  |   |
|--------------------------------|--|---|
| <b>LCD Shows</b>               | <b>Problem Description</b>   | <b>What To Do</b>   |
| <b>Overload Fault</b>          | The load draws more power than the Alpha FXM can provide. This can lead to an automatic Alpha FXM shutdown.  | Remove excess loads.  |
| <b>Short Circuit</b>           | The load has a short.  | Check the output. Remove the faulty load if necessary.  |
| <b>Intl Temp Fault</b>         | The Alpha FXM's internal temperature is too high and could cause an automatic Alpha FXM shutdown.  | Verify that the fan is not blocked and that it is working by performing a battery test. Also See Fan Fail Alarm.                              |
| <b>Output Over Voltage</b>     | The output voltage is above or below the Alpha FXM's specifications.   | Info only.  |
| <b>Output Voltage Low</b>      |  |   |
| <b>Battery Fail</b>            | In Inverter mode, the battery voltage has dropped below a specified level. This fault is triggered and the inverter shuts down. This fault is also known as a Low Battery Shutdown or Bad Battery. | Info only. The Alpha FXM will recharge the battery when the Alpha FXM requalifies the line.   |
| <b>Backfeed</b>                | A relay inside the Alpha FXM has failed. It cannot be fixed in the field.  | <b>DANGER:</b> Do NOT touch the AC input terminals. Contact Alpha Technical Support.  |
| <b>Battery Over Voltage</b>    | Battery voltage is abnormally high.  | Check the voltage at the battery voltage test points. Ensure that the battery is in good working condition. Replace the battery if necessary. |
| <b>Batt Volt Low</b>           | Battery voltage is low and is close to the self-kill level.  | Ensure that the Alpha FXM charger is working. If the charging voltage is low, the battery may need to be replaced.                            |

| <b>Table T — Problems Not Reported by System</b>            |   |   |
|---|---|---|
| <b>LCD Shows</b>  | <b>Problem Description</b>  | <b>What To Do</b>   |
| <b>No LCD display even when the Alpha FXM is powered on</b> | The LCD may not function below -15°C. This does not affect the normal operation of the Alpha FXM.   | Bring the operating temperature above -15°C and the LCD display will gradually resume operation.  |
| <b>Date and time reset to 00:01:00 and 00:00:00</b>         | The backup lithium coin battery may need to be replaced. This is possible if the Alpha FXM has been in storage or switched off for a prolonged period. The average operating life of the lithium coin battery is about 5 years. | Replace the lithium coin battery.<br><b>Caution:</b> This must be performed by a qualified service personnel. Dispose of used batteries according to your local laws and jurisdictions. |

# 9. Specifications

| Table U — Mechanical Specifications  |   |             |  |   |  |  |             |             |             |             |           |     |       |  |   |           |     |       |  |  |            |      |       |  |  |            |      |       |   |   |
|--|---|-------------|--|---|--|--|-------------|-------------|-------------|-------------|-----------|-----|-------|--|---|-----------|-----|-------|--|--|------------|------|-------|--|--|------------|------|-------|---|---|
| Parameter  | Value   |             |  |   |  |  |             |             |             |             |           |     |       |  |   |           |     |       |  |  |            |      |       |  |  |            |      |       |   |   |
| <b>Dimensions H x W x D mm (in)</b>  | FXM 1100-2000: 5.22 x 15.5 x 8.75 (133 x 394 x 222)<br>FXM 650: 3.47 x 17 x 9 (89 x 432 x 229)  |             |  |   |  |  |             |             |             |             |           |     |       |  |   |           |     |       |  |  |            |      |       |  |  |            |      |       |   |   |
| <b>Weight without batteries kg (lb)</b>  | FXM 650: 25 (11.3)<br>FXM 1100-2000: 35 (15.9)  |             |  |   |  |  |             |             |             |             |           |     |       |  |   |           |     |       |  |  |            |      |       |  |  |            |      |       |   |   |
| <b>Color</b>   | Black   |             |  |   |  |  |             |             |             |             |           |     |       |  |   |           |     |       |  |  |            |      |       |  |  |            |      |       |   |   |
| <b>Mounting</b>  | Shelf, rack or wall; horizontal or vertical mount.  |             |  |   |  |  |             |             |             |             |           |     |       |  |   |           |     |       |  |  |            |      |       |  |  |            |      |       |   |   |
| <b>Humidity</b>  | Operating (non-condensing): Up to 95%<br>Storage: Up to 95%   |             |  |   |  |  |             |             |             |             |           |     |       |  |   |           |     |       |  |  |            |      |       |  |  |            |      |       |   |   |
| <b>Cooling</b>   | <p>Method of cooling: forced convection (fan cooled)<br/>Maximum heat release: see table below.</p> <table border="1"> <thead> <tr> <th rowspan="2"></th> <th colspan="2">Maximum heat release</th> <th colspan="2">Maximum heat release per foot (meter) of vertical frame height used*</th> </tr> <tr> <th>Normal Mode</th> <th>Backup Mode</th> <th>Normal Mode</th> <th>Backup Mode</th> </tr> </thead> <tbody> <tr> <td>FXM650-24</td> <td>9 W</td> <td>217 W</td> <td>4.4 W/ft<sup>2</sup><br/>(155 W/m<sup>2</sup>)</td> <td>105.5 W/ft<sup>2</sup><br/>(3723 W/m<sup>2</sup>)</td> </tr> <tr> <td>FXM650-48</td> <td>9 W</td> <td>143 W</td> <td>4.4 W/ft<sup>2</sup><br/>(155 W/m<sup>2</sup>)</td> <td>69.5 W/ft<sup>2</sup><br/>(2452 W/m<sup>2</sup>)</td> </tr> <tr> <td>FXM1100-48</td> <td>22 W</td> <td>242 W</td> <td>7.3 W/ft<sup>2</sup><br/>(258 W/m<sup>2</sup>)</td> <td>78.4 W/ft<sup>2</sup><br/>(2775 W/m<sup>2</sup>)</td> </tr> <tr> <td>FXM2000-48</td> <td>41 W</td> <td>439 W</td> <td>13.2 W/ft<sup>2</sup><br/>(469 W/m<sup>2</sup>)</td> <td>142.5 W/ft<sup>2</sup><br/>(5046 W/m<sup>2</sup>)</td> </tr> </tbody> </table> <p>* Based on installation in an equipment rack with 26" overall width and 12" depth, with 30" maintenance aisle and 24" wiring aisle.</p> |             | Maximum heat release   |   | Maximum heat release per foot (meter) of vertical frame height used* |  | Normal Mode | Backup Mode | Normal Mode | Backup Mode | FXM650-24 | 9 W | 217 W | 4.4 W/ft <sup>2</sup><br>(155 W/m <sup>2</sup> ) | 105.5 W/ft <sup>2</sup><br>(3723 W/m <sup>2</sup> ) | FXM650-48 | 9 W | 143 W | 4.4 W/ft <sup>2</sup><br>(155 W/m <sup>2</sup> ) | 69.5 W/ft <sup>2</sup><br>(2452 W/m <sup>2</sup> ) | FXM1100-48 | 22 W | 242 W | 7.3 W/ft <sup>2</sup><br>(258 W/m <sup>2</sup> ) | 78.4 W/ft <sup>2</sup><br>(2775 W/m <sup>2</sup> ) | FXM2000-48 | 41 W | 439 W | 13.2 W/ft <sup>2</sup><br>(469 W/m <sup>2</sup> ) | 142.5 W/ft <sup>2</sup><br>(5046 W/m <sup>2</sup> ) |
|  | Maximum heat release  |             | Maximum heat release per foot (meter) of vertical frame height used* |   |  |  |             |             |             |             |           |     |       |  |   |           |     |       |  |  |            |      |       |  |  |            |      |       |   |   |
|  | Normal Mode   | Backup Mode | Normal Mode  | Backup Mode   |  |  |             |             |             |             |           |     |       |  |   |           |     |       |  |  |            |      |       |  |  |            |      |       |   |   |
| FXM650-24  | 9 W   | 217 W       | 4.4 W/ft <sup>2</sup><br>(155 W/m <sup>2</sup> )                     | 105.5 W/ft <sup>2</sup><br>(3723 W/m <sup>2</sup> ) |  |  |             |             |             |             |           |     |       |  |   |           |     |       |  |  |            |      |       |  |  |            |      |       |   |   |
| FXM650-48  | 9 W   | 143 W       | 4.4 W/ft <sup>2</sup><br>(155 W/m <sup>2</sup> )                     | 69.5 W/ft <sup>2</sup><br>(2452 W/m <sup>2</sup> )  |  |  |             |             |             |             |           |     |       |  |   |           |     |       |  |  |            |      |       |  |  |            |      |       |   |   |
| FXM1100-48   | 22 W  | 242 W       | 7.3 W/ft <sup>2</sup><br>(258 W/m <sup>2</sup> )                     | 78.4 W/ft <sup>2</sup><br>(2775 W/m <sup>2</sup> )  |  |  |             |             |             |             |           |     |       |  |   |           |     |       |  |  |            |      |       |  |  |            |      |       |   |   |
| FXM2000-48   | 41 W  | 439 W       | 13.2 W/ft <sup>2</sup><br>(469 W/m <sup>2</sup> )                    | 142.5 W/ft <sup>2</sup><br>(5046 W/m <sup>2</sup> ) |  |  |             |             |             |             |           |     |       |  |   |           |     |       |  |  |            |      |       |  |  |            |      |       |   |   |
| <b>Sound power level</b>   | LWAd = 59 dBA with fan at maximum speed.  |             |  |   |  |  |             |             |             |             |           |     |       |  |   |           |     |       |  |  |            |      |       |  |  |            |      |       |   |   |
| <b>Mounting</b>  | Shelf, rack or wall; horizontal or vertical mount.  |             |  |   |  |  |             |             |             |             |           |     |       |  |   |           |     |       |  |  |            |      |       |  |  |            |      |       |   |   |
| <b>Temperature Range<sup>1,2</sup>, °C</b><br><b>FXM 650</b><br><br><b>FXM 1100/2000</b> | Operating: -40 to 55<br>Storage: -40 to 75<br>Operating: -40 to 50 <sup>3</sup> for 120 VAC unit, -40 to 50 for 230 VAC unit<br>Storage: -40 to 75  |             |  |   |  |  |             |             |             |             |           |     |       |  |   |           |     |       |  |  |            |      |       |  |  |            |      |       |   |   |
| <b>Altitude, m (ft)</b><br><b>Operating</b><br><b>Storage</b>                            | Operating: Up to 3700 <sup>4</sup> (12,000)<br>Storage: Up to 4600 (15,000)   |             |  |   |  |  |             |             |             |             |           |     |       |  |   |           |     |       |  |  |            |      |       |  |  |            |      |       |   |   |
| <b>AC input and output connectors</b>  | Terminal block, Weco p/n 324-HDS/03 or equivalent (max 10 AWG)  |             |  |   |  |  |             |             |             |             |           |     |       |  |   |           |     |       |  |  |            |      |       |  |  |            |      |       |   |   |
| <b>Dry contact connectors</b>  | Terminal block, mating plug JITE p/n PTB750B-03-1-03-3 or equivalent (max 16 AWG)   |             |  |   |  |  |             |             |             |             |           |     |       |  |   |           |     |       |  |  |            |      |       |  |  |            |      |       |   |   |
| <b>RS-232 connector</b>  | DE-9 Female   |             |  |   |  |  |             |             |             |             |           |     |       |  |   |           |     |       |  |  |            |      |       |  |  |            |      |       |   |   |
| <b>Ethernet connector</b>  | Optional, factory installed RJ-45   |             |  |   |  |  |             |             |             |             |           |     |       |  |   |           |     |       |  |  |            |      |       |  |  |            |      |       |   |   |
| <b>Dry contacts</b>  | 6 sets of single-pole, double-throw relays located on the front panel. They are rated at 250 VAC, 1A. The factory default settings are:<br>C1: On Battery.<br>C2, C3 <sup>5</sup> : Low Battery.<br>C4: Load Shed Timer1.<br>C5: Alarm.<br>C6: 48/24 VDC for an external fan. It can be factory configured as a dry contact.  |             |  |   |  |  |             |             |             |             |           |     |       |  |   |           |     |       |  |  |            |      |       |  |  |            |      |       |   |   |

**Table U — Mechanical Specifications**

| Parameter                         | Value   |
|-----------------------------------|---|
| <b>User inputs</b>                | Three optically-isolated and powered inputs are located on the front panel. When they are shorted, their functions are:<br>S1: Starts the self test.<br>S2: Activates an alarm.<br>S3: Unit shutdown. |
| <b>User interface<sup>6</sup></b> | 2 x 20 backlit alpha-numeric LCD screen. Three control buttons located below.   |

1. Capable of operating at 73% of rated full load for up to 2 hours at 74°C. Above 55°C ambient, derate output power by 1.4% per °C rise, up to 74°C max.
2. Capable of operating at 100% of rated full load below 0°C down to -40°C after the Alpha FXM has been stabilized at 0°C for at least 1 hour.
3. FXM 1100/2000-120V only: above 50°C ambient, derate output power by 1.1% per °C rise, up to 74°C max.
4. Derate 2°C per 300 m (1000 ft) above 1400 m (4500 ft).
5. For FXM650/1100-48(Q), the default setting of C3 is "FAULT".
6. The LCD display may not function below -15°C. It gradually resumes normal operation as the temperature rises above -15°C. This will not affect the operation of the Alpha FXM.

**Table V — Electrical Specifications**

| Parameter   | Value  |
|---|--|
| <b>Input</b>  |  |
| <b>Voltage (nominal), VAC</b>   | 120 or 230, optional 220, optional 210 for FXM 2000, 120 only for FXM 650-48   |
| <b>Frequency, Hz, ±5%</b>   | 60/50 (auto-detection), Output frequency = Input frequency   |
| <b>Current, Amps<br/>(@ nominal Vin and max<br/>battery charging current)</b> | FXM 650-24: 8.7/4.5 @120/230 VAC<br>FXM 650-48: 10.5 @120 VAC<br>FXM 1100: 15.5/8 @120/230 VAC<br>FXM 2000: 20/12 @120/230 VAC |
| <b>Input Circuit Breaker<br/>Ratings, Amps</b>                                | FXM 650-24: 15/10 @120/230 VAC<br>FXM 650-48: 15 @120 VAC<br>FXM 1100: 20/10 @120/230 VAC<br>FXM 2000: 25/15 @120/230 VAC      |
| <b>Battery Circuit Breaker<br/>Ratings, Amps</b>                              | FXM 650-48/1100: 50<br>FXM 650-24/2000: 80   |
| <b>Output</b>   |  |
| <b>Voltage (nominal), VAC</b>   | 120 or 230, optional 220, optional 210 for FXM 2000, 120 only for FXM 650-48   |
| <b>Frequency, Hz, ±5%</b>   | 60/50 (output frequency = input frequency.)  |
| <b>Power, W/VA</b>  | FXM 650: 650<br>FXM 1100: 1100<br>FXM 2000: 2000   |
| <b>Waveform</b>   | Pure sine wave   |
| <b>Load Crest Factor</b>  | 3:1 (load dependent)   |
| <b>Output Voltage Distortion</b>  | < 3% THD (resistive load)  |
| <b>Efficiency<sup>7</sup><br/>Normal Mode<br/>Backup (Inverter) Mode</b>      | > 98%<br>> 82% (48 Vbatt), >75% (24 Vbatt)   |
| <b>Transfer Time, mS<br/>AVR to Backup<br/>Backup to AVR</b>                  | 5 (typical)<br>5 (typical)   |
| <b>Line Qualification Time,<br/>Seconds</b>                                   | 3 (factory default), user adjustable to 3, 10, 20, 30, 40, or 50.  |
| <b>Battery String Voltage</b>   | FXM 650 - 24: 24 VDC<br>FXM 650 - 48/1100/2000: 48 VDC   |



| <b>Table V — Electrical Specifications</b>                  |  |
|---|--|
| <b>Parameter</b>  | <b>Value</b>   |
| <b>Battery Charger Current, Amps</b>                        | FXM 650-48/1100/2000: 48 VDC.  |
| <b>Battery Charger Temperature Compensation<sup>8</sup></b> | -5 mV/°C/Cell (factory default), user adjustable to -2.5, -4, -5 or -6 mV/°C/Cell. |
| <b>Battery type</b>   | Anderson Power mating part SB50 or equivalent.                                     |

7. Efficiency is measured at an ambient temperature of 25°C, full resistive condition and nominal Line and Battery voltage.  
8. With external battery temperature probe assembly. For FXM650-48(Q), charger compensation is disabled.

| <b>Table W — Boost/Buck/Line Transfer Thresholds</b> |                      |                      |
|--|----------------------|----------------------|
| <b>Parameter</b>                                     | <b>Value</b>         |                      |
|  | <b>120 VAC Units</b> | <b>230 VAC Units</b> |
| <b>High Line Transfer</b>                            | 175 VAC              | 325 VAC              |
| <b>High Line Retransfer</b>                          | 162 VAC              | 303 VAC              |
| <b>Buck 2 Transfer</b>                               | 152 VAC              | 282 VAC              |
| <b>Buck 2 Retransfer</b>                             | 146 VAC              | 272 VAC              |
| <b>Buck 1 Transfer</b>                               | 134 VAC              | 250 VAC              |
| <b>Buck 1 Retransfer</b>                             | 128 VAC              | 236 VAC              |
| <b>Boost 1 Retransfer</b>                            | 116 VAC              | 210 VAC              |
| <b>Boost 1 Transfer</b>                              | 112 VAC              | 207 VAC              |
| <b>Boost 2 Retransfer</b>                            | 102 VAC              | 180 VAC              |
| <b>Boost 2 Transfer</b>                              | 98 VAC               | 176 VAC              |
| <b>Low Line Retransfer</b>                           | 97 VAC               | 162 VAC              |
| <b>Low Line Transfer</b>                             | 88 VAC               | 151 VAC              |

| <b>Table X — Regulatory</b> |   |
|-----------------------------|---|
| <b>Parameter</b>            | <b>Value</b>  |
| <b>Electrical Safety</b>    | UL 1778, CSA 107.3, EN 62040-1-2, EN60950-1.              |
| <b>Emission</b>             | FCC Part 15, Subpart B, Class A, CSRR22, EN55022 Level A. |
| <b>Marks</b>                | c_CSA_US, CE (230 VAC versions only).                     |
| <b>Packaging</b>            | Designed to meet requirements for ISTA program.           |

# 10. Peukert Number and Battery Capacity

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## 10.1 Introduction

The Alpha FXM series UPS units run on batteries when the AC utility power fails. In this mode, the user may want to estimate the remaining time that UPS batteries can supply power to the loads.

The battery run time remaining is calculated based on the Peukert equation. Two critical parameters are required for the equation:

- Peukert number.
- Peukert capacity.

The Peukert number and Peukert capacity depend on the battery characteristics. This document describes the procedures to determine the Peukert number, and Peukert capacity for the selected battery.

Once the Peukert's number and capacity are determined, enter these values in the GUI or web interface. The FXM will report the remaining battery run time.

The Peukert's equation and the remaining battery run time are estimates only. The actual run time may vary based on various parameters like the age and status of the batteries etc.

## 10.2 Determining the Peukert's Number and Peukert's Capacity

1. Obtain the data sheet of the selected battery.
2. Calculate the nominal load current for the application.

Example: If the load is 150 W and the battery string is 24 VDC, the load current is calculated as  $150 \text{ W} / 24 \text{ V} = 6.25 \text{ A}$ .

3. Find the current discharge ratings table in the data sheet. From the table, pick two current discharge values ( $I_1$  and  $I_2$ ) that are closest to the calculated load current and look up the two discharge hours ( $R_1$  and  $R_2$ ).
4. Use the following formula to calculate Peukert's number and capacity:

$$\text{Peukert's number} = n = \frac{\text{Log}(R_2/R_1)}{(\text{Log}(I_1) - \text{Log}(I_2))} \dots\dots\dots (1)$$

$$\text{Peukert's capacity} = (I_1)^n \times R_1 \text{ per battery} \dots\dots\dots (2)$$

## 10.3 Determining Peukert's Capacity for Series Parallel Combinations

1. For batteries connected in series, the Peukert's capacity for the battery bank is given by the equation:

$$\text{Peukert's capacity}_{\text{Battery bank}} = \text{Peukert's capacity}_{\text{per battery}} \text{ Ah} \\ \text{(as calculated in equation (2))}$$

2. For batteries connected in parallel, the Peukert's capacity for the battery bank is given by the equation:

$$\text{Peukert's capacity}_{\text{Battery bank}} = \text{Peukert's capacity}_{\text{per battery}} \times N \text{ Ah} \\ \text{(where N = number of batteries in parallel)}$$

## 10.4 Example

The following example shows how to calculate Peukert's number and capacity from a configured battery string. Consider four Alpha 180GXL batteries connected and configured as shown in the figure below. Two of the four batteries are connected in series, and the two series strings are connected in parallel to the 24 V DC output.

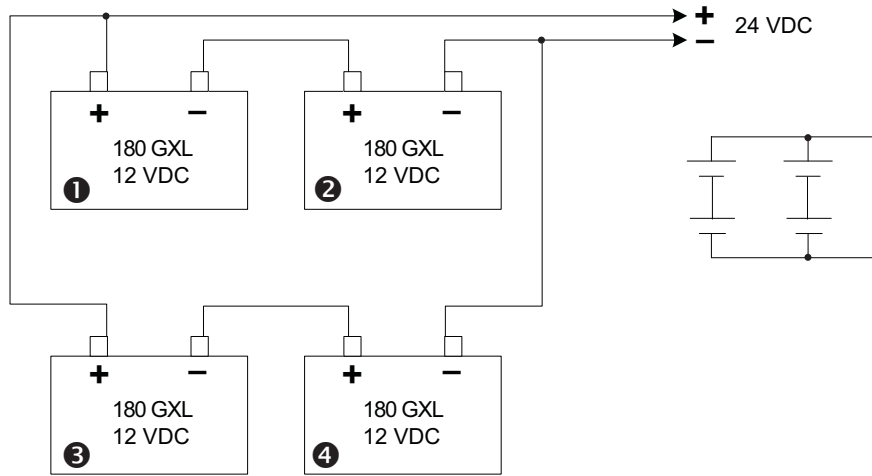


Figure 54 — Battery string example

The Peukert's number and capacity for the above configuration can be determined as follows:

1. Obtain the data sheet of the selected battery. See table below.
2. Find the current discharge ratings table in the data sheet. From the table, pick two current discharge values ( $I_1$  and  $I_2$ ) that are closest to the calculated load current value. Look up the two discharge hours ( $R_1$  and  $R_2$ ).

| Current Discharge Ratings Table in Amps (end Voltage 1.75VPC) |      |      |      |      |      |      |      |      |      |      |       |       |       |
|---|------|------|------|------|------|------|------|------|------|------|-------|-------|-------|
| Hours   | 1    | 2    | 3    | 4    | 6    | 8    | 10   | 12   | 20   | 24   | 48    | 72    | 100   |
| 215 Gold  | 67.8 | 40.5 | 29.1 | 22.9 | 16.1 | 12.6 | 10.2 | 8.7  | 5.46 | 4.61 | Call* | Call* | Call* |
| 210 GXL   | 66.3 | 39.6 | 28.5 | 22.4 | 15.8 | 12.3 | 10.0 | 8.54 | 5.34 | 4.51 | Call* | Call* | Call* |
| 190 Gold  | 64.5 | 37.1 | 26.6 | 20.8 | 14.6 | 11.4 | 9.4  | 7.9  | 4.96 | 4.2  | 2.2   | 1.5   | 1.08  |
| 180 GXL   | 61.2 | 35.2 | 25.2 | 19.7 | 13.9 | 10.8 | 8.9  | 7.5  | 4.7  | 4.0  | 2.1   | 1.4   | 1.03  |
| 85 GXL HP   | 33.2 | 18.8 | 13.5 | 10.4 | 7.34 | 5.70 | 4.88 | 3.97 | 2.50 | 2.12 | 1.11  | 0.76  | 0.56  |

\* Call Alpha for current discharge ratings.

3. From the table,  $I_1 = 13.9\text{A}$ ,  $I_2 = 10.8\text{A}$ ,  $R_1 = 6\text{ hrs}$ ,  $R_2 = 8\text{ hrs}$ .

From Equation (1) earlier:

$$\text{Peukert's number} = n = \frac{\text{Log}(R_2/R_1)}{(\text{Log}(I_1) - \text{Log}(I_2))}$$

$$n = \frac{\text{Log}(8/6)}{\text{Log}(13.9) - \text{Log}(10.8)} = 1.14$$


From Equation (2) earlier

$$\begin{aligned} \text{Peukert's capacity} &= (I_1)^n \times R_1 \text{ per battery} \\ &= (13.9)^{1.14} \times 6 \\ &= 120.55 \text{ Ah per battery} \dots\dots\dots (3) \end{aligned}$$

4. The Peukert's capacity for the series combination (Batteries #1 and #2) is 120.55 Ah.
5. The Peukert's capacity for the parallel combination (Batteries #1, #2 and #3, #4) is  $2 \times 120.55 \text{ Ah} = 241.10 \text{ Ah}$ .

# 10.5 Using the Spreadsheet

Download the spreadsheet "Peukert's Parameters Calculator.xls" from [www.alpha.ca](http://www.alpha.ca) website.



**To determine Peukert's Number and Peukert's Capacity**

This spreadsheet assists in determining the Peukert's parameters for a battery string and load. This data will be used by the FXM firmware 1.07 to estimate the battery run time remaining in back up mode (Invert mode)

|                                |       |       |
|--------------------------------|-------|-------|
| Enter Battery String Voltage   | 24    | VDC   |
| Enter nominal load on inverter | 275   | Watts |
| Calculated nominal current     | 11.46 | ADC   |

From the Current discharge table enter the 2 current discharge values ( $I_1$  and  $I_2$ ) closest to the calculated load current value and look up the 2 discharge hours ( $R_1$  and  $R_2$ ).

|                             |      |     |
|-----------------------------|------|-----|
| Discharge Current ( $I_1$ ) | 13.9 | A   |
| Rating 1 ( $R_1$ )          | 6    | Hrs |
| Discharge Current ( $I_2$ ) | 10.8 | A   |
| Rating 2 ( $R_2$ )          | 8    | Hrs |

|                      |       |
|----------------------|-------|
| Peukert's Number = n | 1.140 |
|----------------------|-------|

|                                  |         |
|----------------------------------|---------|
| Peukert's Capacity per Battery = | 120.570 |
|----------------------------------|---------|

|   |   |
|---|---|
| Enter Number of Battery strings in Parallel | 2 |
|---|---|

|   |         |
|---|---------|
| Peukert's Capacity for the Battery Bank = | 241.140 |
|---|---------|

Enter the Battery voltage and nominal load

From the data sheet of the batteries enter the 2 closest currents and discharge hours

Enter the number of parallel strings

# 11. Warranty

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Alpha Technologies Ltd. warrants all equipment manufactured by it to be free from defects in parts and labor, for a period of two years from the date of shipment from the factory. The warranty provides for repairing, replacing or issuing credit (at Alpha's discretion) for any equipment manufactured by it and returned by the customer to the factory or other authorized location during the warranty period. There are limitations to this warranty coverage. The warranty does not provide to the customer or other parties any remedies other than the above. It does not provide coverage for any loss of profits, loss of use, costs for removal or installation of defective equipment, damages or consequential damages based upon equipment failure during or after the warranty period. No other obligations are expressed or implied. Warranty also does not cover damage or equipment failure due to cause(s) external to the unit including, but not limited to, environmental conditions, water damage, power surges or any other external influence.

The customer is responsible for all shipping and handling charges. Where products are covered under warranty Alpha will pay the cost of shipping the repaired or replacement unit back to the customer.

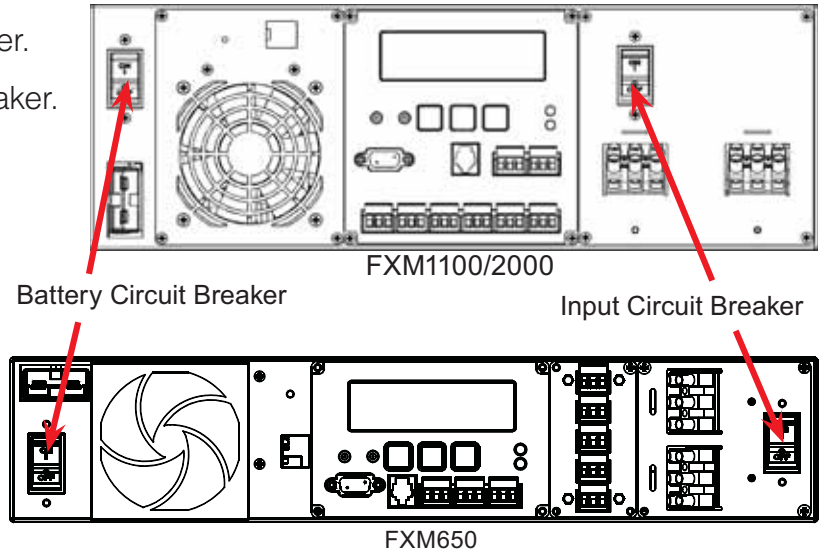
## 11.1 Battery Warranty

Note that battery warranty terms and conditions vary by battery and by intended use. The most common battery warranty provided by Alpha is a two year full replacement warranty with a pro-rated warranty for the following three years. Pro rated warranty provides a credit applicable toward the purchase of new batteries from Alpha. The credit is calculated as the purchase price multiplied by the percentage of the battery life that was not available (in months). Battery warranty coverage is lost where the battery charge is not maintained for 6 months. Contact your Alpha sales representative or the Technical Support team at the above number to understand your entitlements under Battery Warranty.

# 12. Emergency Shutdown Procedure

The Alpha FXM UPS contains more than one live circuit. In an emergency, line power may be disconnected at the UPS's input, but AC power can still be present at the output.

1. Switch OFF the input circuit breaker.
2. Switch OFF the battery circuit breaker.
3. Disconnect the AC input power.
4. Disconnect the battery string.



### Complete the following for your records:

Serial # \_\_\_\_\_

Options \_\_\_\_\_

Purchase Date \_\_\_\_\_

### This unit was purchased from:

Dealer \_\_\_\_\_

City \_\_\_\_\_

State/Province \_\_\_\_\_

Zip/Postal Code \_\_\_\_\_

Country \_\_\_\_\_

Telephone # \_\_\_\_\_

Fax # \_\_\_\_\_

E Mail Address \_\_\_\_\_



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