ALPHA
OUTBACK
ENERGY

Alpha FXM 650, 1100 and 2000

USER MANUAL

Table of Contents

1. Safety

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. Fail- ure 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 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 numrique 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 Chapter "9. 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 shows the front panel connectors and circuit breakers, which are described in detail in the following sections.

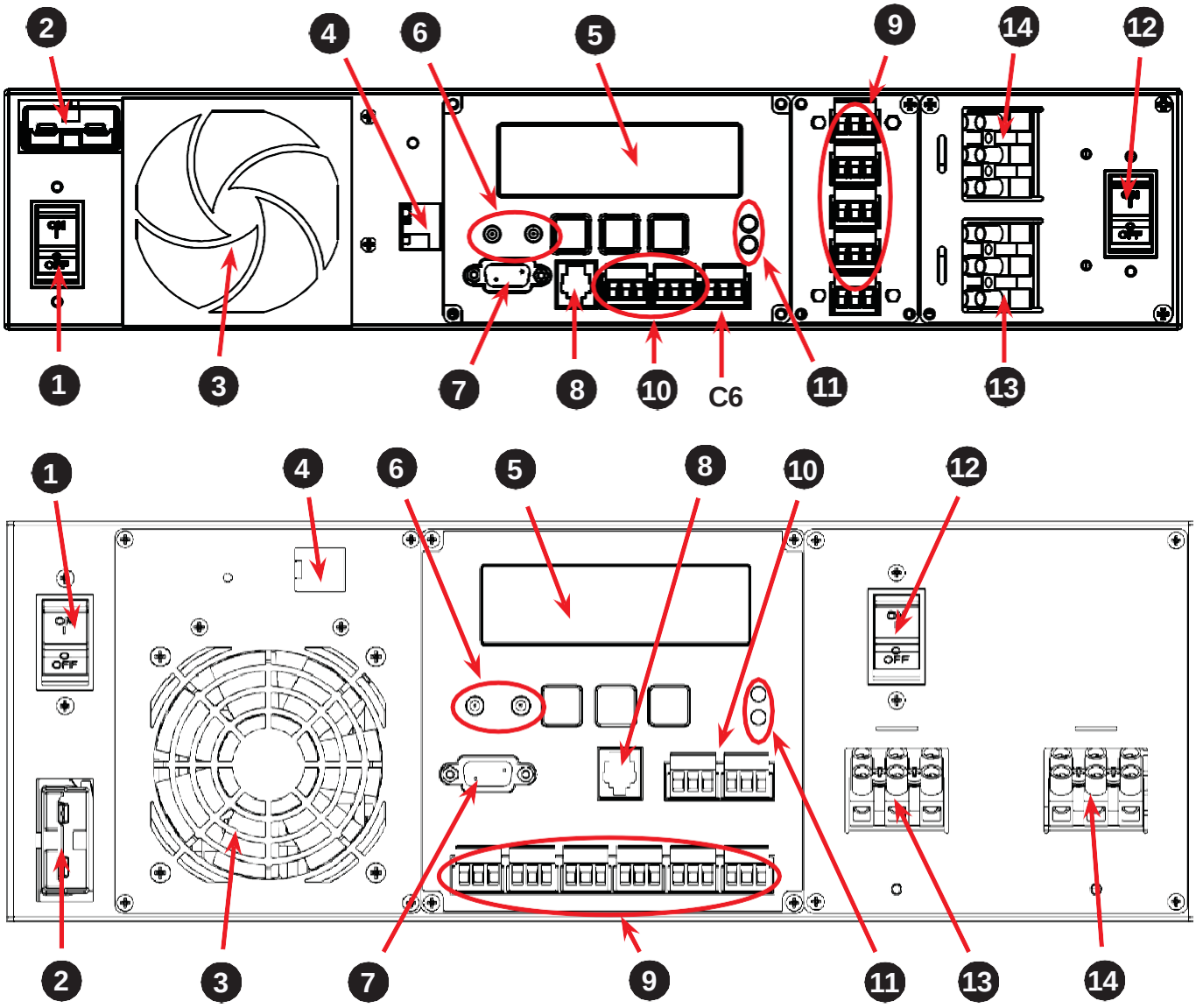


Figure 1 — FXM 650 (top) and FXM 1100/2000 front panel description

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 Replaceable fan assembly
This microprocessor-controlled fan turns on at a programmable temperature to lower the Alpha FXM internal temperature. It must not be blocked. An Alarm is generated if the fan fails; a failed fan can be replaced in the field.

4 RJ45 communication module connector
The RJ-45 connector is the Alpha FXM Ethernet connector.

5 LCD control panel and menu navigation buttons
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 test points 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 to 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 temperature sensor connector
The battery charging voltage is temperature dependant when compensation is not set to 0 mV/°C/cell. A battery temperature sensor connects to the Alpha FXM so the Alpha FXM microprocessor can adjust the charging voltage for optimum charging. Refer to "UPS Maintenance > Battery" on page 38.
The sensor MUST be attached to the Alpha FXM for normal operation. If the sensor is not attached, a “Temperature Probe Unplugged” alarm appears 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. Each contact can only be programmed for one function at a time and cannot show multiple conditions. See "UPS Maintenance > Relay & Load Shed" on page 41 and section 6.5.7 on page 66 for the HyperTerminal interface.
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 2 shows the contact’s layout while Figure 3 shows the +48 Vdc or +24 Vdc terminal block layout.

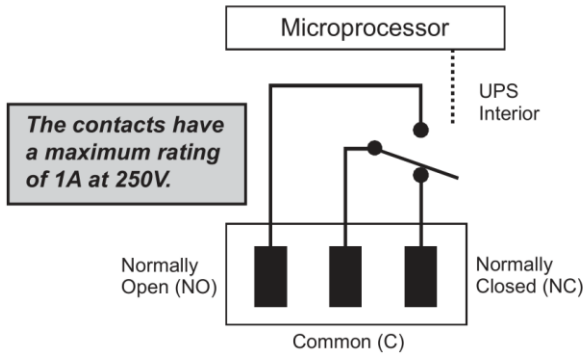


Figure 2 — Contact Layout (Standard for C1 to C5, Factory Option for C6)

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 used to generate an “On Battery” contact.
C2, C3: These contacts are energized when the battery drops below a pre-set voltage level. They can be used to generate a **Low Battery** alarm. To change the pre-programmed level to match the batteries used and the actual operating conditions, see **Low Battery Warning** in "UPS Maintenance > Battery" on page 38.
C4: This contact is energized after the Alpha FXM has been in Inverter mode for 2 hours.
To change the pre-programmed 2 hours to match your operating conditions, see **Load Shed Timer Configuration** in "UPS Maintenance > Relay & Load Shed" on page 41.

C5: The C5 contact is energized when any alarm is generated—see "Table P — Alarm Submenu" on page 78.
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 Standby mode. It provides 48 Vdc (500 mA) from the external batteries to an external fan or other equipment. C6 can be factory-configured as a dry contact.

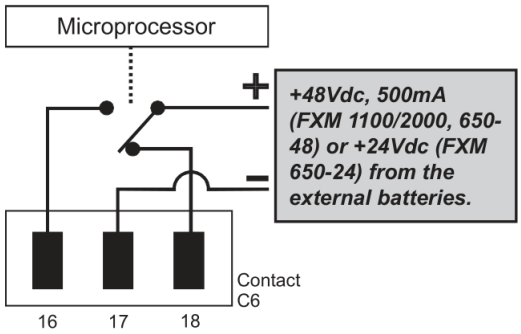


Figure 3 — 48 Vdc Contact Layout (De-energized Shown, Factory Default for C6)

Optically isolated user inputs C7 and contacts C8

The optically isolated user inputs are used to attach an external switch panel for remote control of the Alpha FXM or to allow the Alpha FXM to control optional Alpha Off-Line Automatic Transfer Switch (ATS).
User Input (C7): This relay has three contacts that are used to control the Alpha FXM:
19 (S1): Shorting this contact starts the Alpha FXM self-test. See "UPS Maintenance > Battery" on page 38.
20 (S2): Shorting this contact activates an alarm. See "UPS Maintenance > User Input" on page 46.
21 (S3): Shorting this contact disables the AC output. There is no AC output power, 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.

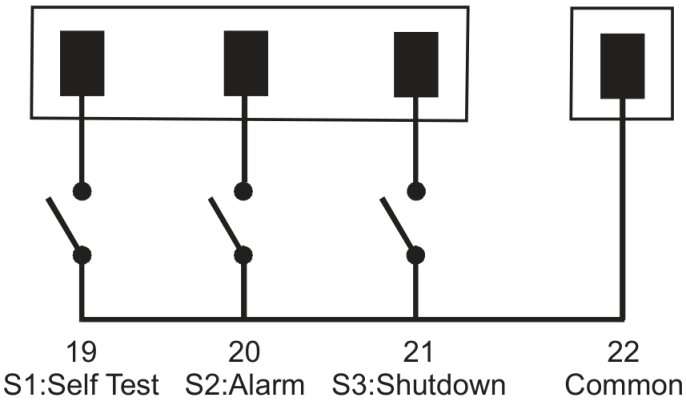


Figure 4 — User Input Layout

ATS (C8): When the Alpha FXM is in the Inverter mode, this normally open relay closes sending 48 Vdc (FXM 650-48, 1100, 2000) or 24 Vdc (FXM 650-24) from the external batteries to this dry contact (Figure 5). If the optional Alpha Off-Line Automatic Transfer Switch (ATS) is connected, it will cause the ATS to switch the load from line power to the Alpha FXM battery backup power.

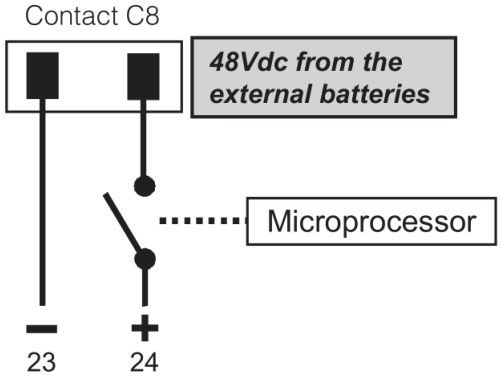


Figure 5 — ATS Layout

Status and Alarm LEDs Status:

Status:

11 Green LED solidly illuminated: the Alpha FXM is in Line mode and line power is provided to the load. Green LED flashing: the unit is in Inverter mode and backup battery power is provided to the load.

Alarm:

Red LED solidly illuminated: fault in the Alpha FXM. (See "Table Q — Fault Submenu" on page 79.) Red LED flashing indicates an alarm. (See "Table P — Alarm Submenu" on page 78.)

12 AC 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 AC line power input.

14 Output Terminal Block

This terminal block is the Alpha FXM AC power output.

3. Site Planning

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 (3.5 °F) 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 Chapter "9. Specifications".
- The input wiring must reach a suitably grounded power outlet and the load wiring must reach the Alpha FXM output terminal blocks.
- Place the Alpha FXM in a properly sheltered location or inside a weatherproof 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, or call customer service for more information.
- Backup Generator (If used)
- Use **Generator** mode so that noise tolerance is increased to accept the fluctuations created by a genera- tor. See **Sense Type** in Table B on page 24 .

  Use a generator with electronic speed and voltage controls which produces less than 10% voltage to- tal harmonic distortion (THD). Mechanical governors can force the Alpha FXM to run continuously in the Inverter mode.

  Before installation, make sure the generator's output voltage is compatible with the Alpha FXM input volt- age 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 Communicating with the Alpha FXM

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

1. Using the control panel.
2. Using an RS-232 interface, you can access the UPS command line system with Windows HyperTerminal or other terminal emulation program.
3. Using an 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/.
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.

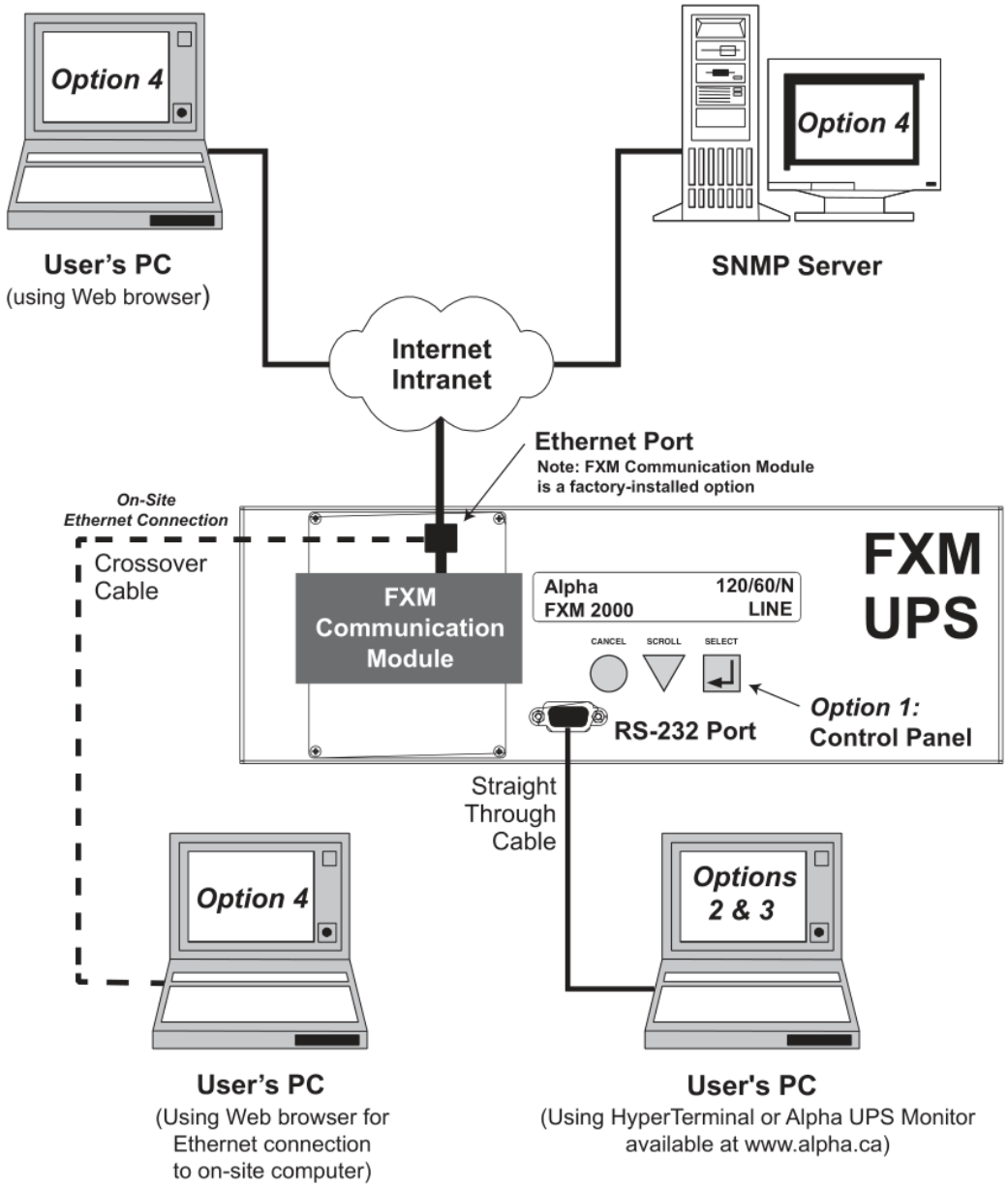


Figure 6 — Alpha FXM Communication Options

3.3 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

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.

Follow these guidelines for unpacking the Alpha FXM.

1. Select a suitable area for unpacking.
2. Store all the packing material and boxes for possible equipment returns.
3. Compare the packing slip and the list of parts with the items you received: make sure the standard items as well as purchased options are included:

   Standard items

   1 Alpha FXM
   1 Alpha FXM operator manual
   8 Terminal blocks and labels for the dry contacts
   1 Temperature sensor cable

   Purchased options

   - Batteries, if ordered from Alpha, will be shipped separately.
   - Enclosure (with optional mounting hardware kit)
   - Battery heating mats
   - Network Interface card
   - In-line fuse

4. 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.

5. Installation

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

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

5.2 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 shelf, with the optional mounting brackets as shown in the figure below. The brackets and the screws to attach them to the Alpha FXM 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. 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 chassis and the rack.

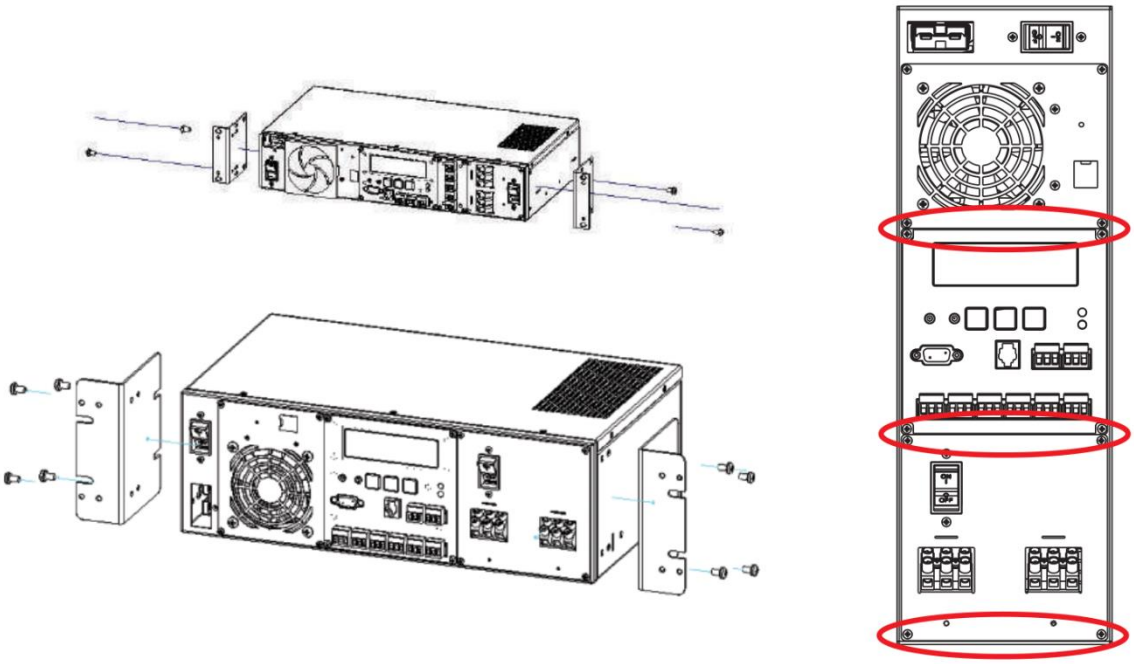


Figure 7 — Mounting the Alpha FXM Mounting brackets position for rack mounting. Rotate to fit either 19" or 23" racks.

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.

5.3 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.

5.3.1 Procedure

NOTE: The optional in-line fuse option shown in Figure 8 on page 18, is available as part number SPB98-645- 1, Kit, FuseUpgrade, 100A.

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 with labels or tape.
2. Coat the battery terminals with the corrosion inhibitor.
3. Connect the batteries as shown in Figure 8 on page 18. If used, install the in-line fuse as shown.
4. Connect the black battery cable to the negative terminal of the battery string, and the red battery cable to the positive terminal of the battery string.

5. When the batteries are wired, measure the voltage at the battery connection terminals. It should read between 42 and 54V for the FXM 650-48/1100/2000 or 21 and 27V for the FXM 650-24.
6. Note the polarity and ensure it is correct.
7. Ensure that the DC breaker if OFF.
8. Connect the external batteries to the Battery connector—location 2 in Figure 1.
9. Route the sensor end of the battery temperature cable to the batteries.
10. Attach the battery temperature sensor to the body of the battery, about 2 to 3" (5 to 7.5 cm) from the base of the battery.
11. If multiple battery strings are used, repeat steps 1 to 4 as required.

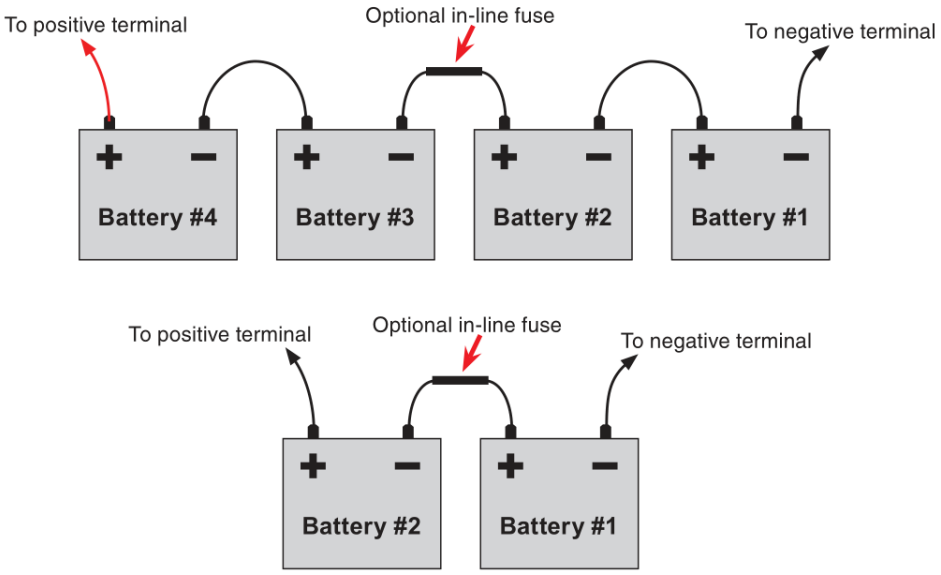


Figure 8 — External Battery Wiring (for 48 Vdc string (top) and 24 Vdc string)

CAUTION!

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

5.3.2 Wiring the Alpha FXM

WARNING!

Make sure the line power is off. Switch off all 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.

5.3.3 Procedure

1. If used, connect the following ports (see Figure 1 on page 7 for location of numbered elements):
   - Ethernet port 4.
   - RS-232 port 7.
   - Dry contacts 9.
   - User inputs 10.
2. Connect the load to the Alpha FXM Output terminal block 14. Torque to 1.4 N-m (12 lb-in).
3. Connect the line power to the Alpha FXM AC Input terminal block 13. Torque to 1.4 N-m (12 lb-in).
4. If needed, attach the terminal block covers and battery harness restraining bracket.

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.

5.4 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), the Micro UPS family (Micro 300 and 1000) and the Alpha FXM350/ Micro350 UPS. 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. Operating the Alpha FXM

6.1 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.

6.1.1 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.

6.1.2 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 –15ºC, the LCD display may not function. See Chapter "8. 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 remains in the **STANDBY** mode until the line power is qualified. To provide backup battery power to the load, perform a manual start by using the Inverter command: From the Control Menu, scroll till the LCD displays **Inverter**, press **Select** and select **ON**. (See Figure 11 on page 23).

The Alpha FXM uses auto-frequency detection. When it is first switched on, it senses the line frequency and ad- justs its output frequency to match that of the input. The load should be receiving power, If not, perform trouble- shooting.

6.1.3 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.

6.1.4 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

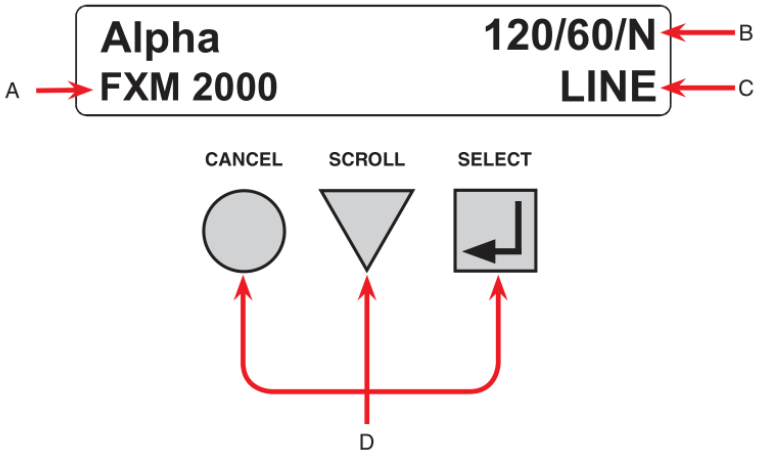
1. Switch on the input circuit breaker. The Alpha FXM qualifies the line power. The LCD displays **RETRAN**, then shows **LINE**, **BUCK** or **BOOST**. The status LED illuminates.

If the Alpha FXM constantly switches between Inverter and Line modes because of a noisy line, broaden the input parameter tolerances from **Normal** to **Generator**. See **Sense Type** in Table B on page 24.

6.2 Operating from the Control Panel Interface

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 of the LCD interface is shown in Figure 9.

The Alpha FXM is monitored and controlled with a series of menus and submenus.



A **Alpha FXM model name**

Alpha FXM voltage configuration - 120 Vac or 230 Vac

B Alpha FXM Frequency - 50 Hz or 60 Hz
Sense Type setting - Normal (N) or Generator (G); see Sense Type in Table B

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

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

Figure 9 — LCD Control Panel Logo Screen

The Alpha FXM operating mode automatically changes as a result of changes in the line or the Alpha FXM operating mode. (The LCD panel automatically updates to reflect the new mode. See Table A and also "Table V — Boost/Buck/Line Transfer Thresholds" on page 82.

Table A — UPS Operating Modes

LCD display	Description
SHUTDOWN	The Alpha FXM inverter is switched off. Line power is disconnected from the load.
LINE	The Alpha FXM is switched on. Line power is provided to the load.
BOOST1 OR BOOST2	The Alpha FXM transformer is raising line voltage without using the batteries. AVR is enabled.
BUCK1 OR BUCK2	The Alpha FXM transformer is lowering line voltage without using the batteries. AVR is enabled.
INVERTER	The Alpha FXM is providing backup battery power to the load.
RETRAN	The Alpha FXM is transferring from INVERTER mode to Line mode.
STANDBY	The Alpha FXM is switched on and waiting for the line power to qualify or the user to clear some faults. CAUTION: Do not touch the AC output terminals, which may still be energized.
BYPASS	This mode is manually set with the Control Menu. See Figure 11, “Control Menu, 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.

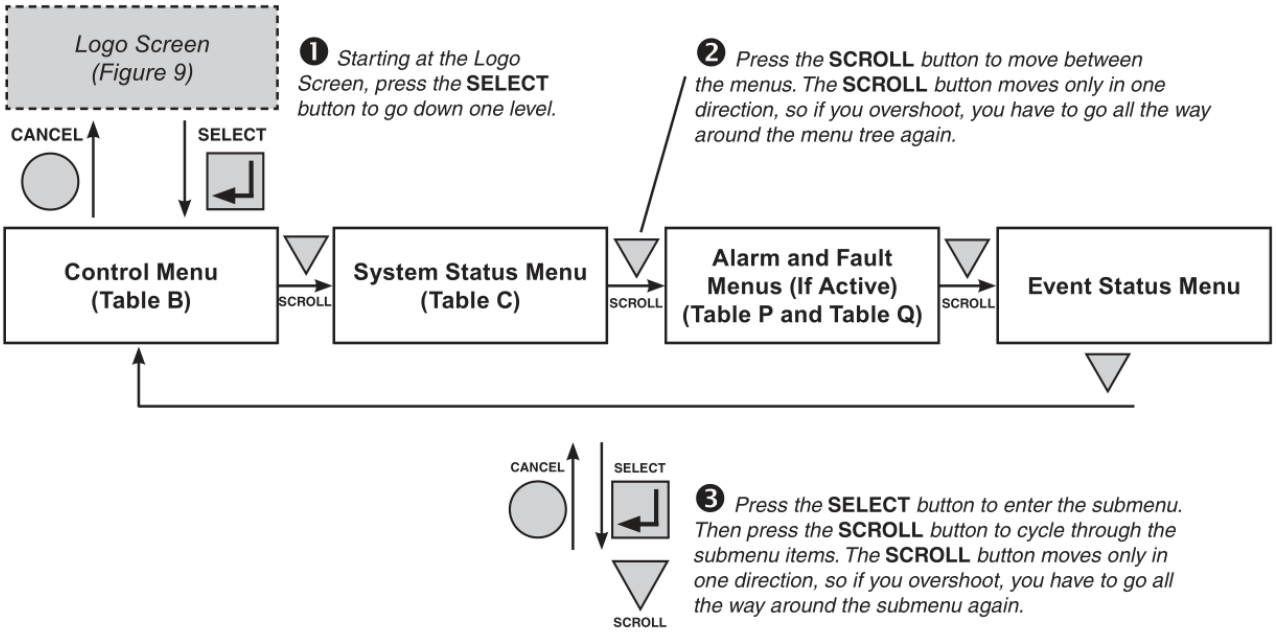


Figure 10 — LCD Menu Structure

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

- INVERTER Enable/ Disable
- INVERTER On/Off
- LVD DSCNNCT
- LVD CONNECT
- BYPASS
- BATT TEST
- BT TS DOD
- AUTO TEST
- SHUTDOWN
- SHUTDOWN AC
- SHUTDOWN DC
- SENSE TYPE
- FUNC MODE
- VOLTAGE
- AUTO FREQ
- FREQUENCY
- QUAL TIME
- INVERTER CUTOFF Enable/Disable
- INVERTER CUTOFF (voltage)
- CHARGER
- BATT FLOAT
- CHGR CUR
- BATT COMP
- DATE FRMT
- CLOCK FRMT
- INV RECORD
- RELAY TEMP
- TEMP DISP
- DAYLIGHT
- CONFIGURE IP

The SYSTEM STATUS menu (Table C) 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
- BUCK/BOOST
- SHED TIMER 1, 2 OR 3
- MAC Address
- IP Address
- kWh
- Remain Tm
- Serial Number
- VERSION

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

When the front panel 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 200 Alpha FXM events on the LCD.

Press the SELECT button to access the menu. Press SELECT and 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

6.2.1 The LCD Control Menu

The control menu (Table B) lets you operate the Alpha FXM or program it to suit your operating conditions.

Procedure

1. From the Logo screen go to the Control menu.
2. Press the **SELECT** button to enter the submenu (Table B).
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 B — Control Menu

LCD display	Meaning	Description
INVERTER	Inverter (Enabled/ Disabled)	When **Disable** is selected and AC is lost, the FXM will be in Standby mode. The inverter cannot be started through the Inverter On/Off menu, When **Enable** is selected and AC is lost, the FXM will be in Inverter mode. Turning inverter on/off manually will work.
INVERTER	Inverter (On/Off)	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.
LVD DSCNNCT	Battery voltage value at which the LVD configured relay should open	
LVD CONNECT	Battery voltage value at which the LVD configured relay should close	
BYPASS	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, switches off the battery charger and makes the output voltage equal to the input voltage. Used when: • Replacing the batteries. OR: • To 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.
BATT TEST	Battery Test	Available when **CHARGER** on the Control Menu is set to **Standard** method. Starts the battery test, which uses depth-of-discharge setting, the battery capacity, Peukert number, and open-circuit voltage. This setting can be adjusted using **BT TS DOD** menu. A battery test is also performed during the self-test.
BT TS DOD	Battery Test Depth-of-Discharge	Available when **CHARGER** on the Control Menu is set to **Standard** method. Sets the desired battery test depth-of-discharge to a value between 0 and 100%. Make sure that the set time duration is shorter than the max back up time of your battery bank. Otherwise, you will drain the battery and trigger a fault – Batt Volt Low. The default value is set to 20% DoD.
AUTO TEST	Automatic Test	Available when **CHARGER** on the Control Menu is set to **Standard** method. If the GUI periodic self-test is enabled, this starts the test when it is scheduled to take place.
SHUTDOWN	Shutdown AC and DC (On/ Off)	When this function is switched **On**, the Alpha FXM inverter is shut off. Neither Line nor Inverter power is supplied to the load. If a dry contact was used as a LVD, the LVD will open.
SHUTDOWN AC	Shutdown AC (On/Off)	When this function is switched **On**, the Alpha FXM inverter is shut off. Neither Line nor Inverter power is supplied to the load.

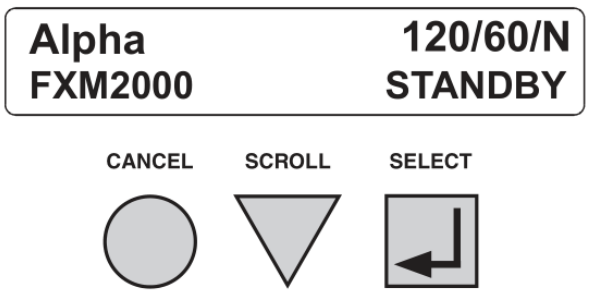
Table B — Control Menu		
LCD display	**Meaning**	**Description**
SHUTDOWN DC	Shutdown DC (On/Off)	When this function is switched **On**, the LVD configured relay will be de-energized. Applies when ANY programmable dry contact is programmed to be the Low Voltage Disconnect indicator. See "UPS Maintenance > Relay & Load Shed" on page 41. When the function is switched from **On** to **Off,** a 10 second delay occurs before the LVD configured relay is re-energized.
SENSE TYPE	Sense Type	This function can only be used when the Alpha FXM is in Standby or Shutdown mode (Table A). **Normal:** The Alpha FXM can operate successfully with most line conditions. OR: **Generator**: This setting increases noise tolerance so the fluctuations created by a generator are acceptable. (A noisy line can cause the Alpha FXM to constantly switch between inverter and line modes.)
FUNC MODE	Functional Mode	The Functional mode can be changed when the Alpha FXM is in any mode (Table C and "Table V — Boost/Buck/Line Transfer Thresholds" on page 82). **Automatic Voltage Regulation (AVR):** Buck and boost modes are active. OR: **Quality**: Buck and boost modes are switched off; the input voltage is the Alpha FXM output voltage.
VOLTAGE	Voltage	Sets the Alpha FXM output voltage setting to one of the voltages specified in "Specifications" on page 80. Changing the voltage setting from factory default should be done by a qualified technician acting under the instructions of Alpha Technical Support (1 888 462 7487). Failure to contact Alpha Technologies before performing this procedure could void your warranty.
AUTO FREQ	Automatic Frequency Detection	**Enable** (default) allows the unit to detect and automatically configure the AC input frequency (50Hz or 60Hz). In cases where the AC input frequency can be out of range for long periods, **Disable** prevents the unit from switching back and forth between 50Hz and 60Hz.
FREQUENCY	Frequency	The frequency can only be changed when the Alpha FXM is in Standby mode—to 50 Hz or 60 Hz. This change should ONLY be done by a qualified technician acting under the instructions of Alpha Technical Support (1 888 462 7487). Failure to contact Alpha Technologies before doing this procedure could void your warranty.
QUAL TIME	Line qualify time	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. The factory default setting is 3 seconds. User adjustable in increments of 1 sec until 1 minute, and then in increments of 1 minute to 15 minutes max.
INV CUTOFF	Inverter Cutoff (Enabled/ Disabled)	When **Disable** is selected the default FXM inverter cutoff threshold is used. When **Enable** is selected the user configured inverter cutoff threshold voltage is used.
	Inverter Cutoff Threshold (Voltage)	Defines the point where the unit will switch from Inverter to Standby when the battery is considered to be low or in order to preserve the battery. See "UPS Maintenance > Inverter" on page 40.
CHARGER	Battery charging options	When **Standard** charger is selected, set **BATT FLOAT** to **AUTO** or **Constant**. When **Bulk** charger is selected, set MAX VOLT and FLOAT VOLT. See section 6.2.2
BATT FLOAT	Battery charging float options	When **BATT FLOAT** is set to **Constant**, the default max charge voltage is 54.6V and float is 54.2V, both at 25°C. Temperature compensation will be active When **BATT FLOAT** is set to **AUTO**, the float voltage is set to 1.8V below the max charge voltage. The default max charge voltage is 54.6V and default float is 52.8V, both at 25°C
BATT COMP	Battery temperature compensation	Sets the battery temperature compensation to match the batteries you are using. It can be set from 0 to -6 mV/°C/Cell in increments of 0.5. The factory default setting is -5 mV/°C/Cell.

Table B — Control Menu		
LCD display	**Meaning**	**Description**
DATE FRMT	Date Format Selection	Toggles the Alpha FXM date format between YY-MM-DD, MM-DD-YY, DD-MM-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.
CLOCK FRMT	Clock display format option	Format to display time information: in 24 hour clock format or 12 hour clock (AM/PM).
INV RECORD	Inverter record clear	Clears the inverter counter and timer from the LCD system status menu.
CHGR CUR	Charger current	Charging current can be set to 0A or any value between 2 and maximum in increments of 1A, where maximum = 15A for FXM1100/FXM2000 and 10A for FXM650. (Charging current cannot be set to 1A). When charging current is set to 0A, the charger will stop charging.
RELAY TEMP	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: 20ºC to 55ºC in increments of 5ºC.
TEMP DISP	Temperature display format	The temperature can be displayed in Celsius or Fahrenheit.
DAYLIGHT	Daylight saving option	Switch ON this option to activate Daylight Saving time.
CONFIGURE IP	FXM IP	Configure the FXM IP address

6.2.2 Battery Charging Options

CAUTION!

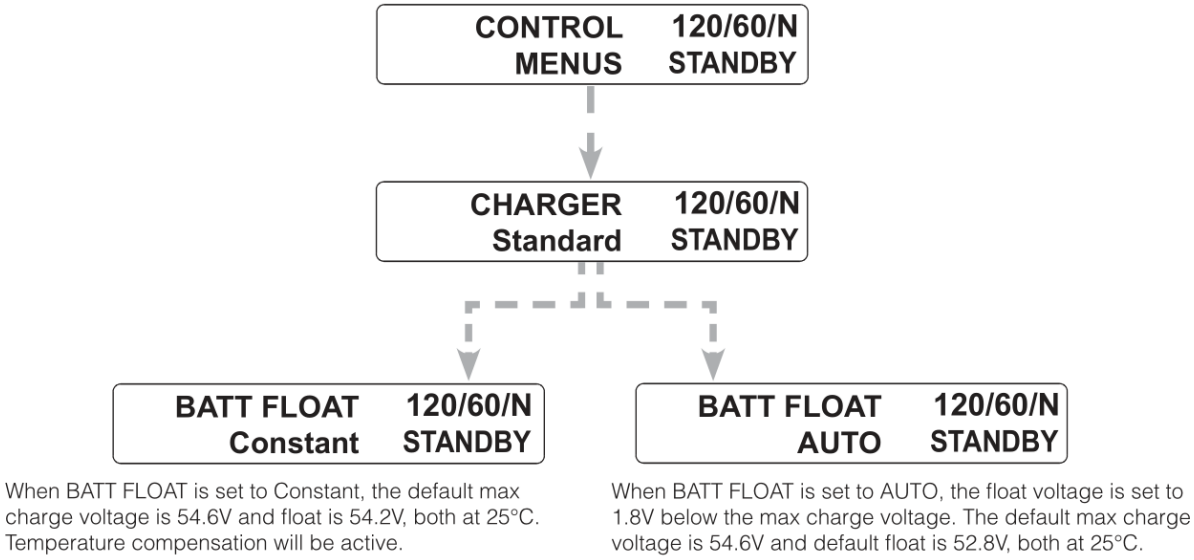
The adjustments to the charge algorithm must be made only by qualified personnel, who understand the different charging modes and their suitability to the battery chemistry.



Standard Battery Charging

For more information on standard battery charging, refer to the web GUI description "UPS Maintenance > Battery" on page 38.

1. Put the unit in **STANDBY** mode before starting this procedure.
2. Use a combination of the **SCROLL** and **SELECT** keys on the control panel interface to select **CHARGER** in the **Control** menu.
3. Select **Standard** to charge the batteries in **AUTO** or **Constant** mode.



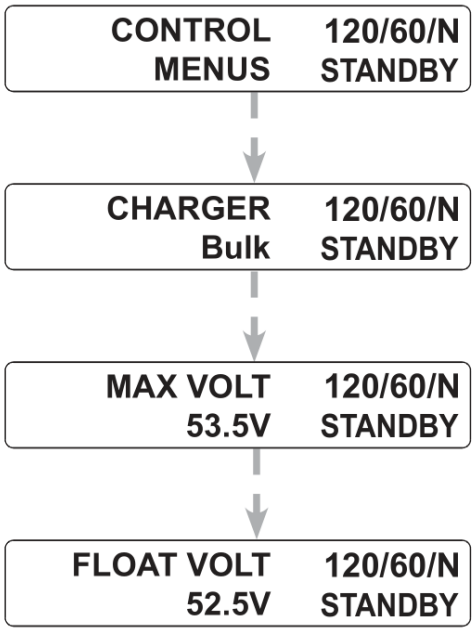
When BATT FLOAT is set to Constant, the default max charge voltage is 54.6V and float is 54.2V, both at 25°C. Temperature compensation will be active.

When BATT FLOAT is set to AUTO, the float voltage is set to 1.8V below the max charge voltage. The default max charge voltage is 54.6V and default float is 52.8V, both at 25°C.

Bulk Battery Charging

Selecting **Bulk** allows programming of the max voltage and the float voltage. For more information on bulk battery charging, refer to the web GUI description "UPS Maintenance > Battery" on page 38.

1. Put the unit in **STANDBY** mode before starting this procedure.
2. Use a combination of the **SCROLL** and **SELECT** keys on the control panel interface to select **CHARGER** in the Control menu.
3. Select **Bulk** to set the max charge voltage and float voltage for charging the batteries (selectable in 0.1V increments).



Selecting **Bulk** allows programming of the max charge voltage and the float voltage.

Selectable in 0.1V steps: from 52 to 56V. (Default is 53.5V)

Selectable in 0.1V steps: from 52V to less than or equal to max charge voltage. (Default is 53.5V)

NOTE:

Temperature compensation defaults to 0 mv/ °C/ cell in this mode, but can be changed to non-zero values.

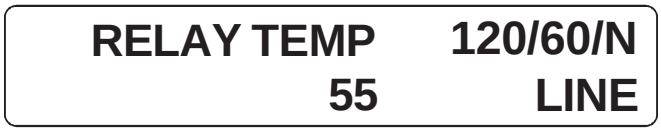
If you set the max charging voltage to a value lower than currently set float voltage, float voltage will be automatically adjusted to be equal to the new max charging voltage.

6.2.3 Controlling the external fan by temperature triggered dry contact

The Temperature trigger has a user configurable range of +20°C to +55°C (68 to 131 °F). When the battery temperature (monitored by the Battery Temperature Probe) reaches the threshold, the assigned relay closes and turns on the external fan.

Procedure

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.



Dry contact functions are not programmable through the LCD. Use the Web GUI or HyperTerminal instead.

6.2.4 Making Measurements

The System Status menu lets you make measurements of various Alpha FXM inputs, outputs, temperatures and other values.

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. Stop at the item you want to measure. The measurement is displayed on the LCD and automatically updated every 0.5 second.

Table C — System Status Menu

LCD display	Meaning	Description
VIN	Input Voltage	Line input voltage into the Alpha FXM
VOUT	Output Voltage	Alpha FXM output voltage (true RMS)
IOUT AC	Output Current (AC)	Alpha FXM AC output current (true RMS)
BATT TEMP	Battery Temperature	Battery temperature (°C)
FREQ IN	Input Frequency	Frequency of line power into the Alpha FXM (Hz)
OUTPUT PWR	Output Power	Alpha FXM output power in VA (true RMS)
BATT VOLT	Battery Voltage	Battery output voltage (Vdc)
CHGR CUR	Charger Current	Alpha FXM battery charging current (Amps)
DATE	Current date	Displays in the format set by the user
TIME	Current time	Displays in the format set by the user

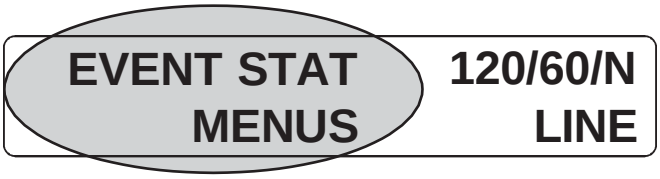
Table C — System Status Menu		
LCD display	**Meaning**	**Description**
INV COUNT	# of line failures	Shows how many times the inverter has been active since the last time the inverter counter was cleared. See INV RECORD description in Table B.
INV (min)	Amount of time inverter was on	Shows total time in minutes the inverter has been active since the last time the inverter timer was cleared. See INV RECORD description in Table B.
BUCK/BOOST	Buck/Boost count	Number of times FXM goes into Buck and Boost mode
SHED TIMER1	Amount of time (in seconds) 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. The factory default setting is 2 hours, To change the setting see "UPS Maintenance > Relay & Load Shed" on page 41.
SHED TIMER2		
SHED TIMER3		
MAC Address	FXM MAC	FXM MAC address
IP Address	FXM IP	FXM IP
kWh	kWh Meter	Accumulated output energy
Remain Tm	Remaining Battery Runtime	Remaining runtime of the battery (standard charging method)
Serial Number	Unit Serial Number	Unit serial number of the Alpha FXM
VERSION	Software Version	Software version used in this Alpha FXM

6.2.5 Viewing the 200-Event Log

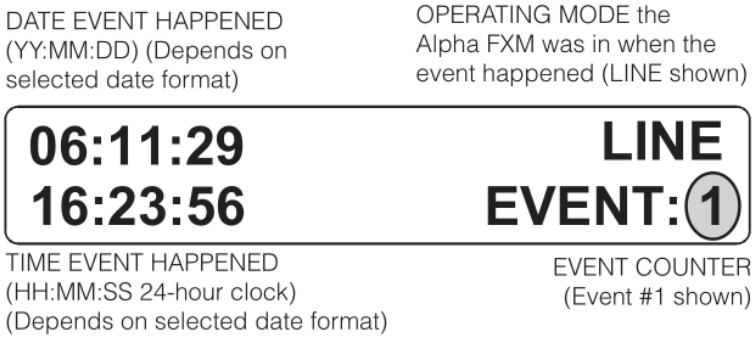
Use the LCD display to view up to the last 200 events, and the malfunctions that triggered each of them. If more than 200 events occurred, the oldest is overwritten. The 200-event log cannot be cleared in the LCD menus.

Procedure

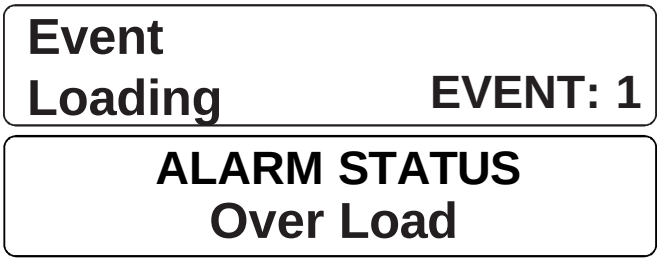
1. From the Logo screen, navigate to the **EVENT STATUS MENU**.



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



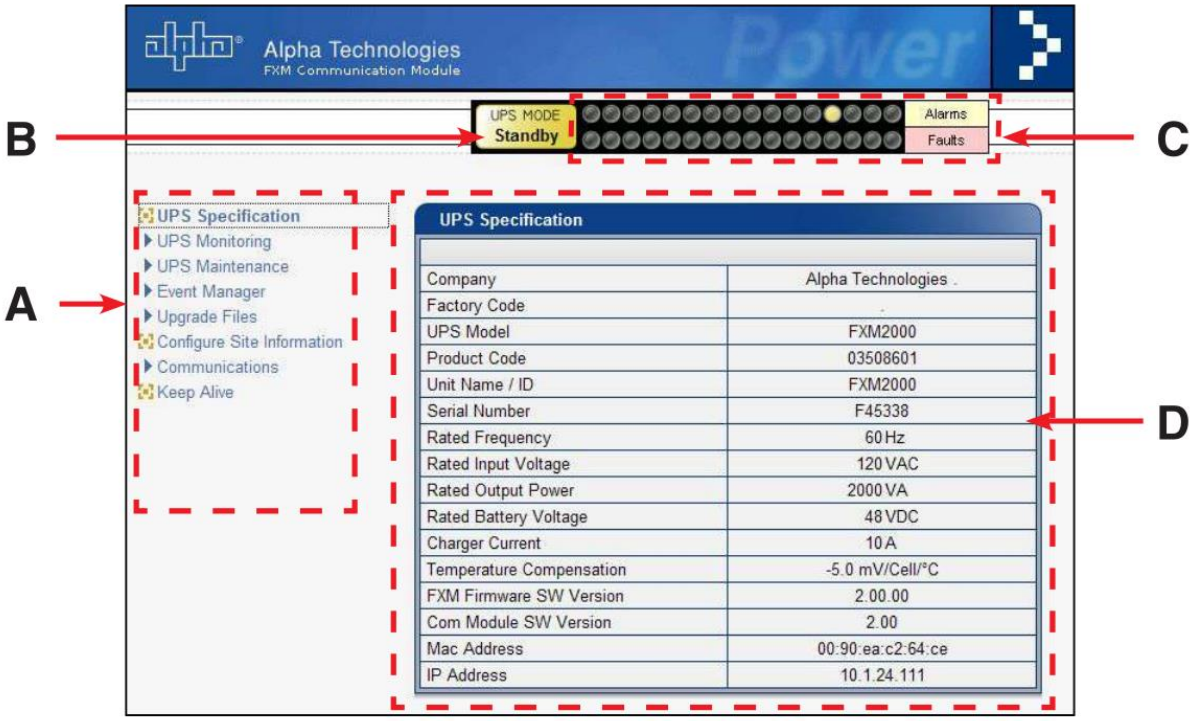
4. Press the **SELECT** button. The event counter flashes.
5. Press the **SCROLL** button to scroll through the event counter.
6. When you reach the event you want press the **SELECT** button.
7. The event loading screen appears and then the log screen reappears with the details for that event.



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

6.3 Operating via the FXM Communication Module (Intranet or Internet)

The internet or a company intranet can be used to communicate with the Alpha FXM through the factory-installed FXM communication module.



A	Screen selection menus
B	Current UPS operating mode. Updates automatically.
C	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.
D	Readout screens

Figure 12 — Web GUI (UPS Specification screen shown)

6.3.1 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 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 are installed on the same network, configure each unit's IP address before the installation. (See "Figure 1 — FXM 650 (top) and FXM 1100/2000 front panel description" on page 7.) Each UPS on the network MUST have its own unique IP ad- dress.

Procedure

1. Connect the Alpha FXM to a personal computer with either the cross over cable or through a hub.
2. Switch on the personal computer.
3. Configure the network card to talk to the FXM communication module. The module default address is http://192.168.0.90.
4. Cut and paste the IP address into the browser and press ENTER.
5. Select **Communications > Configure TCP/IP** in the home screen (Figure 12).
6. Configure the TCP/IP properties according to your network requirements.
7. Click **Apply Settings**.

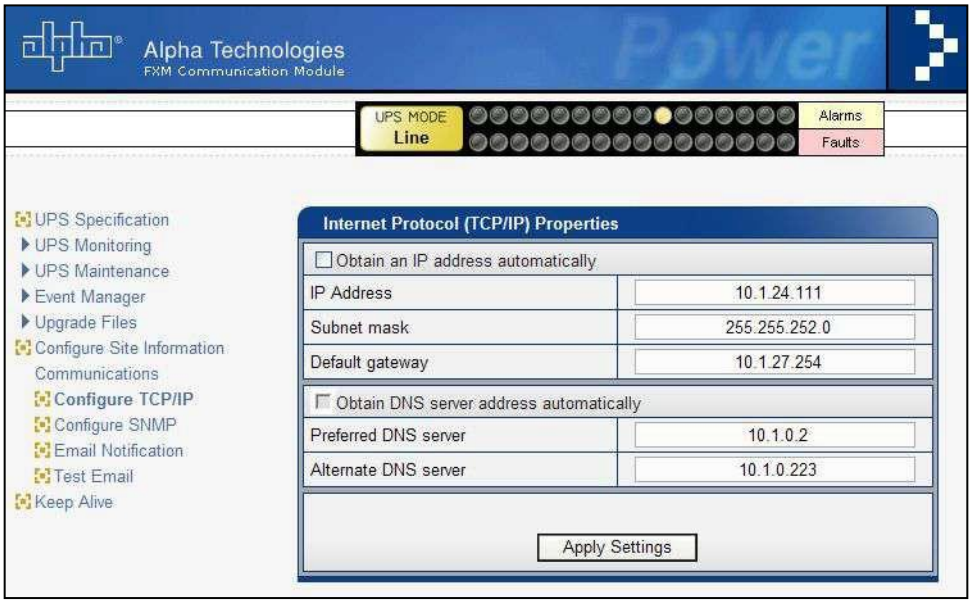


Figure 13 — Communications screen

6.3.2 UPS Specifications

This screen displays the Alpha FXM2000 specifications.

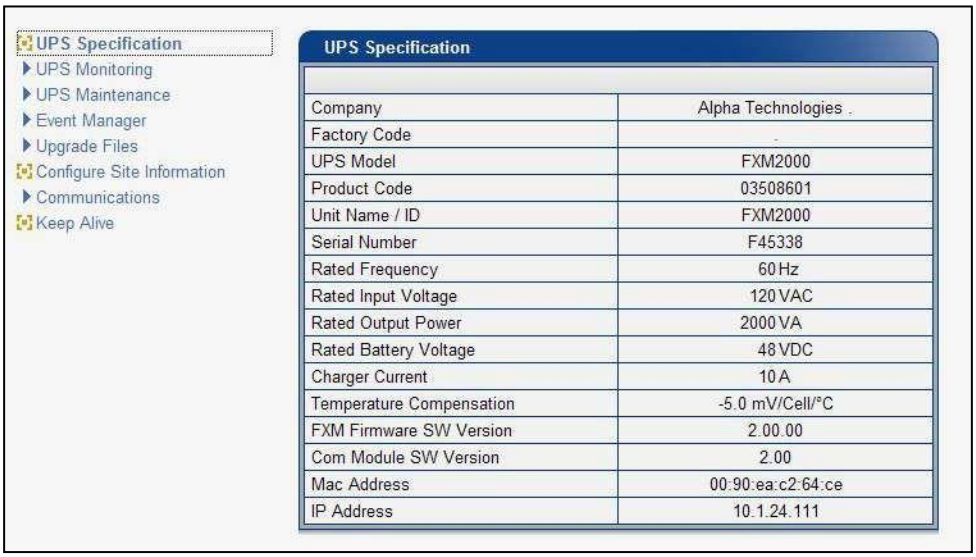


Figure 14 — UPS Specification screen

6.3.3 UPS Monitoring

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

UPS Monitoring > Input & Output

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

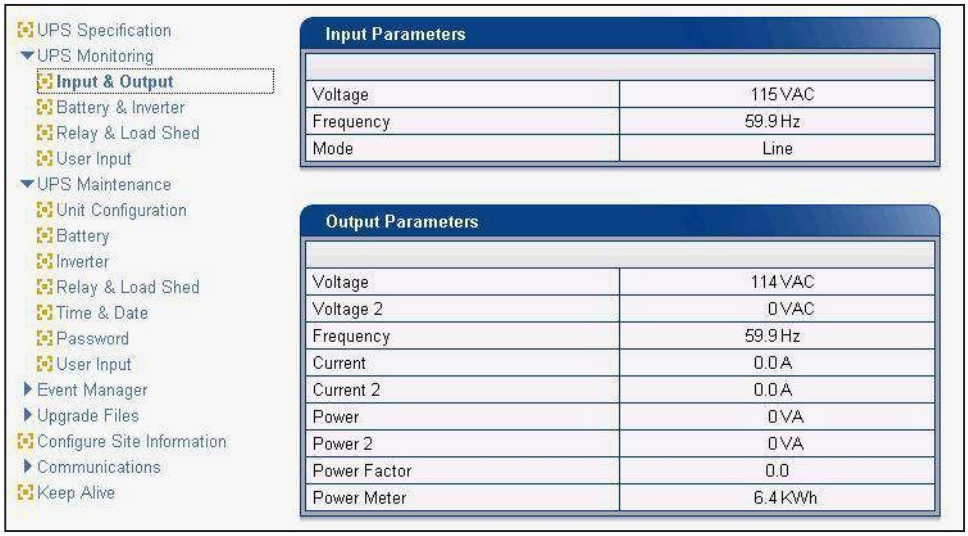


Figure 15 — UPS Monitoring: Input & Output screen

UPS Monitoring > Battery & Inverter

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

The appearance of the Battery Parameters table depends on the choice of charging method—see "UPS Maintenance > Battery" on page 38.

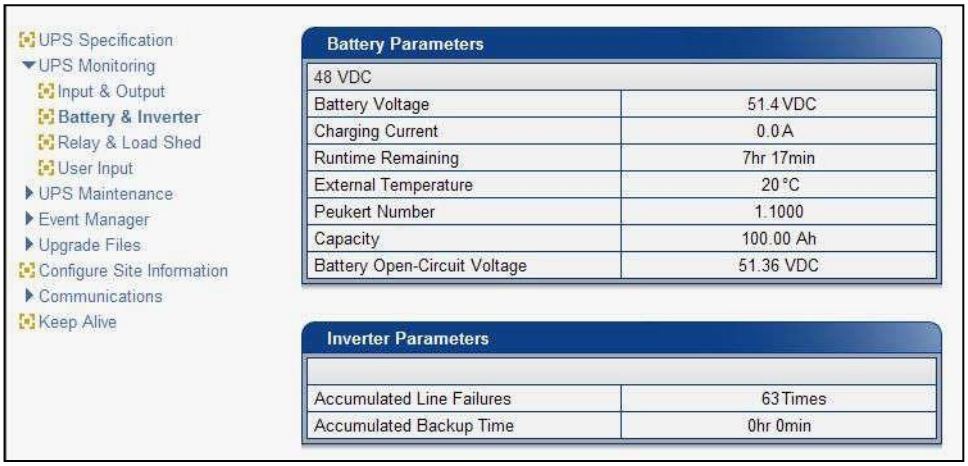


Figure 16 — UPS Monitoring: Battery & Inverter screen—standard charging method

The Battery & Inverter monitoring page for bulk charger does not display a number of parameters: Runtime Remaining, Peukert Number, Capacity and Battery Open-Circuit Voltage.

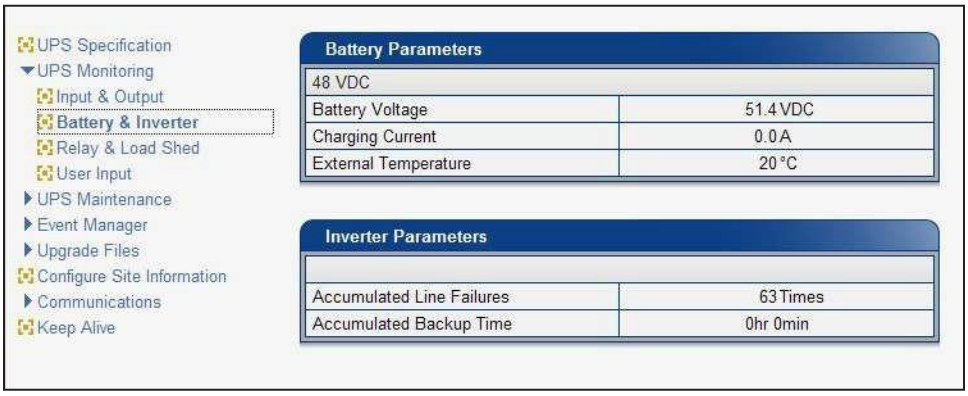


Figure 17 — UPS Monitoring: Battery & Inverter screen—bulk charging method

Monitoring > 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.

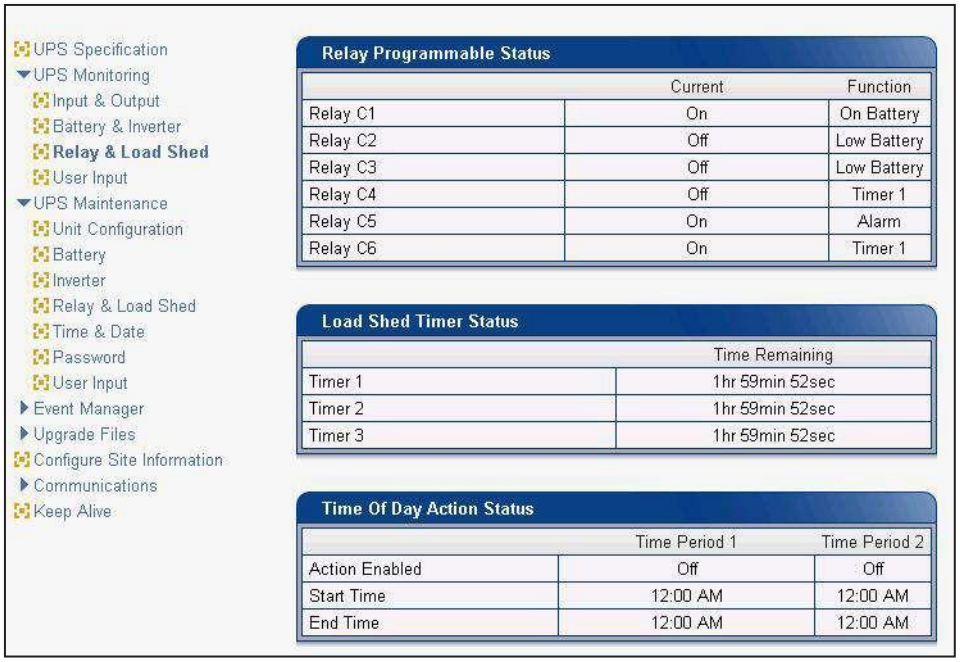


Figure 18 — UPS Monitoring: Relay & Load Shed screen

Monitoring > User Input Status

Shows the current status of the user programmable inputs 1 to 4. NOTE: User input 4 is only available on some models.

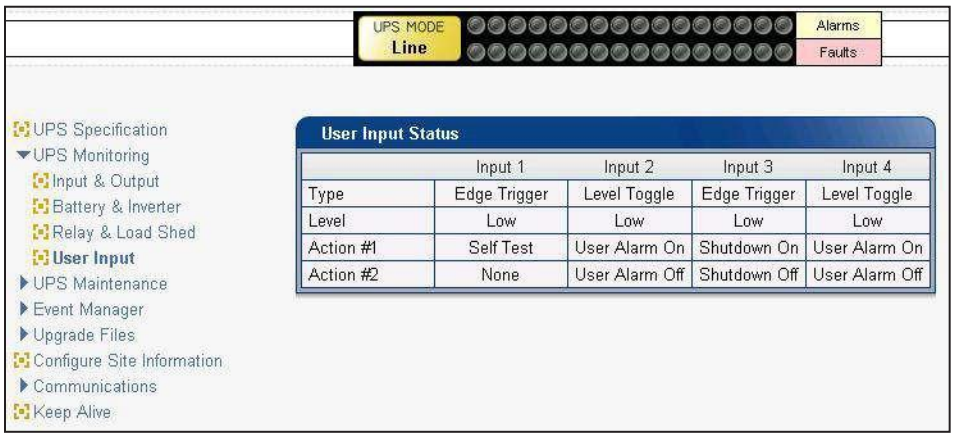


Figure 19 — UPS Monitoring: User Input Status screen

6.3.4 UPS Maintenance Menus

Use the UPS Maintenance screens to configure and adjust the Alpha FXM to meet your operating needs. To change parameters, either click the **On/Off** buttons or select an item from a drop down menu.
To execute the changes, click on the **Update Configuration** button.

UPS Maintenance > Unit Configuration
Sets the unit name, input, output and how often the Alpha FXM parameters update.
AC Output Shutdown
When this function is switched **On**, the Alpha FXM inverter is shut off. Neither line nor inverter power is supplied to the load.
DC Output Shutdown
When this function is switched **On**, the LVD configured relay will be de-energized (**Off**).
Applies when ANY programmable dry contact is programmed to be the Low Voltage Disconnect indicator. See "UPS Maintenance > Relay & Load Shed" on page 41. When the function is switched from **On** to **Off,** a 10 second delay occurs before the LVD configured relay is energized.
Automatic Frequency Detection
This setting is enabled by default and allows the unit to detect and automatically configure the AC input frequency (50Hz or 60Hz).
In cases where the AC input frequency can be out of range for long periods, disabling the automatic configuration prevents the unit from switching back and forth between 50Hz and 60Hz.

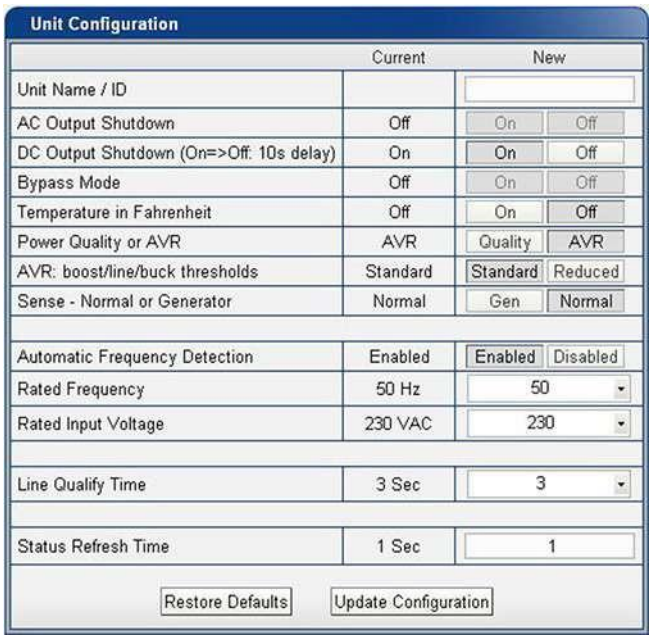


Figure 20 — Shown for 230Vac unit, Power set to AVR,

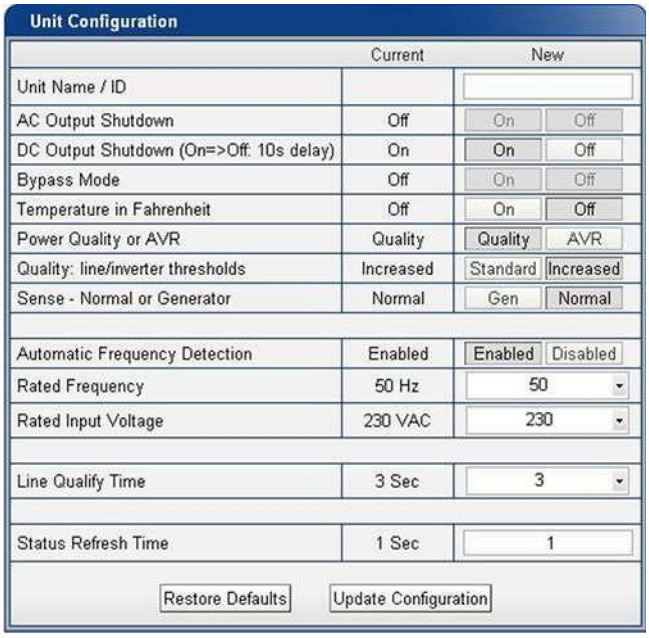


Figure 21 — Shown for 230Vac unit, Power set to Quality

Power Quality or AVR
AVR (Automatic Voltage Regulation) switches on the buck and boost modes.
Quality switches off the buck and boost modes. The input voltage is the Alpha FXM output voltage.
AVR boost/line/buck thresholds (field not available for 120Vac units)
For 230Vac units only, the AVR boost/buck thresholds can be configured (Figure 20). Select **Reduced** to decrease the thresholds in order to be in Line mode when the AC input is between 195Vac and 239Vac.
Quality: line/inverter thresholds (field not available for 120Vac units)
For 230Vac units only, the Quality thresholds can be configured (Figure 21). Select **Increased** to increase the thresholds by 7Vac in order to be in Line mode when the AC input is between 219Vac and 260Vac.

Restoring All Parameters to Default Values

The purpose of this command is to reset the Alpha FXM to the factory default parameters in Table D. Battery charger related defaults are reset according to the charging method selected at the time the defaults are applied.

CAUTION!

This command resets all parameters that are user-configurable. The command is password protected. All previously programmed operation will be lost.

Table D — Parameters/ Default Settings

Parameters	Default Settings
Battery charging current (Amps)	10
Temperature compensation of battery charging (mV/°C/Cell)	Standard charging method: -5.0 Bulk charging method: 0
Maximum charge voltage: Standard > Auto mode @25°C (V)	54.6
Maximum float voltage: Standard > Auto mode @25°C (V)	52.8
Maximum charge voltage: Standard > Constant mode @25°C (V)	54.6
Maximum float voltage: Standard > Constant mode @25°C (V)	54.2
Maximum charge voltage: Bulk mode (V)	53.5
Maximum float voltage: Bulk mode (V)	53.5
Default low battery warning Bulk mode (V)	44
Type setting of programmable user input #1	Edge trigger
Level setting of programmable user input #1	Low
Action #1 setting of programmable user input #1	Self test
Action #2 setting of programmable user input #1	None
Type setting of programmable user input #2	Level toggle
Level setting of programmable user input #2	Low
Action #1 setting of programmable user input #2	User alarm on
Action #2 setting of programmable user input #2	User alarm off
Type setting of programmable user input #3	Edge trigger
Level setting of programmable user input #3	Low
Action #1 setting of programmable user input #3	Shutdown on
Action #2 setting of programmable user input #3	Shutdown off
Type setting of programmable user input #4	Edge trigger
Level setting of programmable user input #4	Low
Action #1 setting of programmable user input #4	None
Action #2 setting of programmable user input #4	None
Start hour of rush hour of time of day action period #1	00
Start minute of rush hour of time of day action period #1	00
End hour of rush hour of time of day action period #1	00
End minute of rush hour of time of day action period #1	00
Start hour of rush hour of time of day action period #2	00
Start minute of rush hour of time of day action period #2	00
End hour of rush hour of time of day action period #2	00

Table D — Parameters/ Default Settings	
Parameters	**Default Settings**
End minute of rush hour of time of day action period #2	00
Format setting of date display on LCD	YY-MM-DD
Line qualify time (sec)	3
Inverter off delay setting (sec)	0
Number of weeks setting of periodical self-test	4
Day of the week setting of periodical self-test	Monday
Time of the day setting of periodical self-test	00:00:00
Battery low warning threshold setting: Standard charge mode (%)	40
Self test depth-of-discharge setting: Standard charge mode (%)	20
Temperature setting to turn on cooling fan (°C)	55
Load shed timer1 duration	2: 00:00
Load shed timer2 duration	2: 00:00
Load shed timer3 duration	2: 00:00
Programmable dry contact #1 setting	On Batt
Programmable dry contact #2 setting	Low Batt
Programmable dry contact #3 setting	Low Batt
Programmable dry contact #4 setting	Timer 1
Programmable dry contact #5 setting	Alarms
Password setting	1111

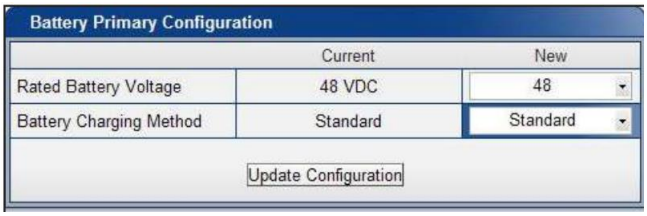
UPS Maintenance > Battery

Setting the **Battery Charging Method** to **Standard** or **Bulk** in the **Battery Primary Configuration** table determines which parameters can be set or adjusted. See Figure 22 and Figure 23. The **Standard** charging method is the default setting.

Standard Charging Method

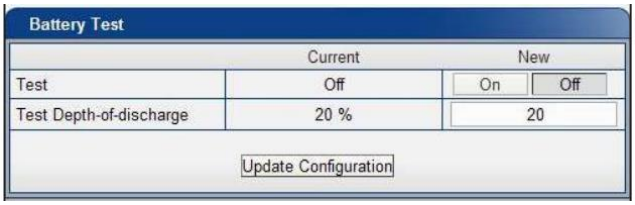
Standard Charger Mode

Auto: Charger stops charging when the battery is fully charged.
Constant: Charger switches to float mode when the battery becomes charged. Float voltage is 0.4V lower than maximum charging voltage and is temperature compensated.



Temperature Compensation

Adjustable from 0 to -6.0 in increments of 0.5. (Factory default is -5 mV/°C/Cell)



Max Charger Current

Charging current can be set to 0 or any value between 2A and maximum in increments of 1A (maximum = 15A for FXM1100/FXM2000 and 10A for FXM650). Charging current cannot be set to 1A. When charging current is set to 0A, charger will stop charging.

Low Battery Warning

Battery voltage value that activates the low battery warning alarm. For the range of 24V and 48V settings, refer to the Low Battery Warning entry in Table I on page 65. The alarm is removed when battery voltage is 2V above the warning setting for a 48V battery, or 1V above the warning setting for a 24V battery.

Peukert Number

Refer to Appendix A to calculate the Peukert number.

Capacity

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

Obtain this number from the battery data sheet. The value is for a single battery, so for a 48V system with 4 batteries connected in series, multiply the number by 4. For a 24V system with 2 batteries connected in series, multiply by 2.

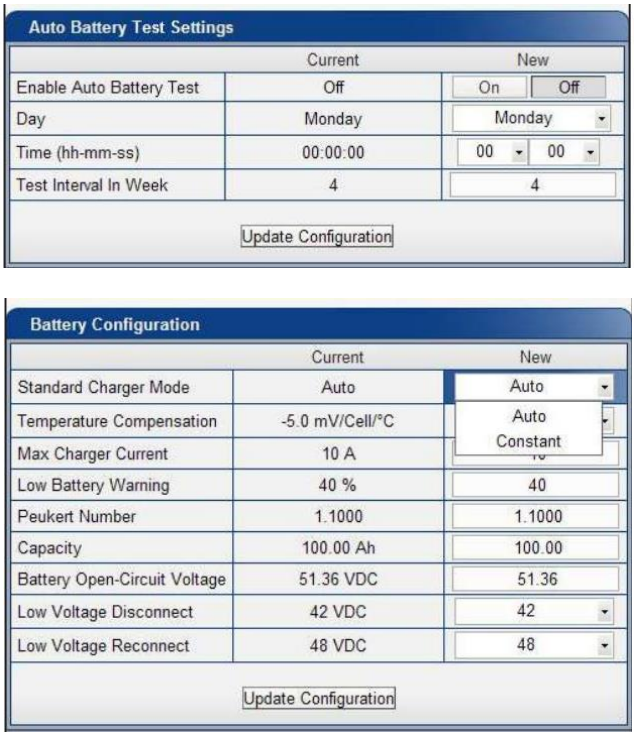


Figure 22 — UPS Maintenance: Battery, Standard charging method

Low Voltage Disconnect and **Low Voltage Reconnect** are available when either standard or bulk charging method is selected.

Parameter	48V			24V		
	Default	Minimum	Maximum	Default	Minimum	Maximum
Low Voltage Disconnect (Vdc)	42	42	45	21	21	23
Low Voltage Reconnect (Vdc)	48	48	51	24	24	26

NOTE:

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.

Bulk Charging Method

The Battery maintenance page has two tables: **Battery Primary Configuration** and **Battery Configuration**. In the **Battery Primary Configuration** table, select **Bulk** battery charging method.

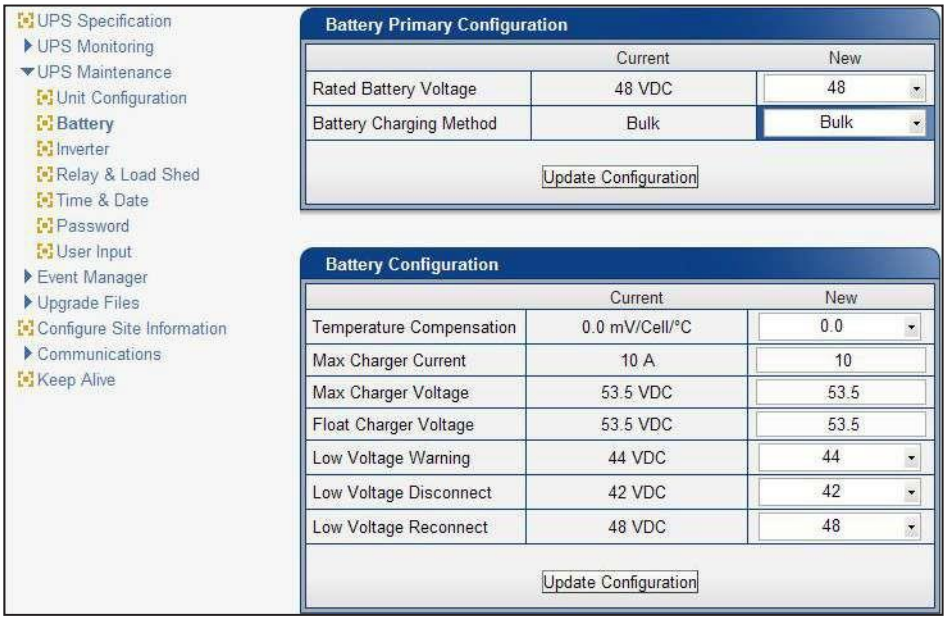


Figure 23 — UPS Maintenance: Battery, Bulk charging method

In the **Battery Configuration** table, **Temperature Compensation** (default 0.0mV/Cell/°C for bulk charger) and **Max Charger Current** have the same function as the Standard charging method.

The following three parameters are only available when the Bulk battery charging method is selected:

Parameter	48V			24V		
	Default	Minimum	Maximum	Default	Minimum	Maximum
Max Charger Voltage (Vdc)	53.5	52	56	26.8	26	28
Float Charger Voltage (Vdc)	53.5	52	56	26.8	26	28
Low Voltage Warning*(Vdc)	44	44	47	22	22	23
*Low voltage warning value has to be higher than **Low Voltage Disconnect** and lower than **Low Voltage Reconnect**						

Low Voltage Disconnect and **Low Voltage Reconnect** have the same function as the Standard charging method.

UPS Maintenance > Inverter

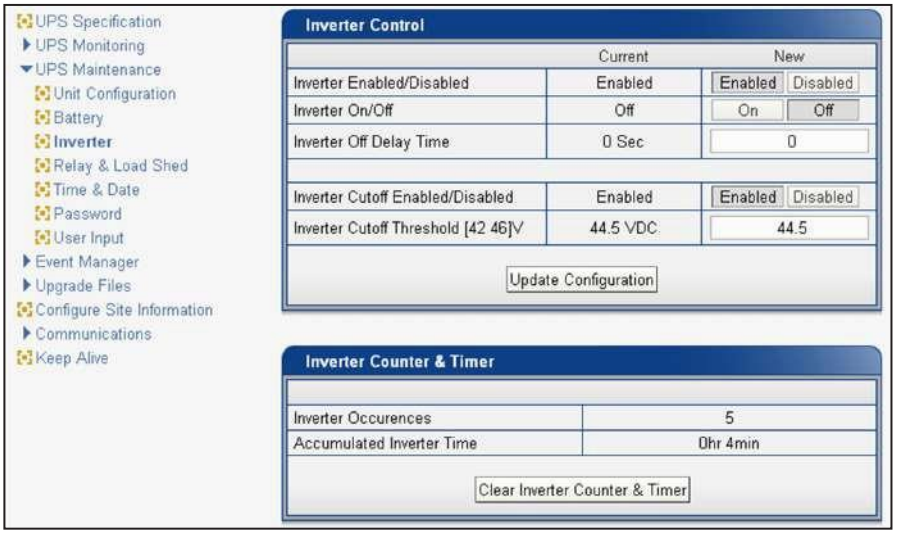


Figure 24 — UPS Maintenance: Inverter screen

Inverter Enabled/Disabled

Enabled: the inverter can function depending on the setting of the Inverter On/Off field. Disabled: the FXM will not go into Inverter mode when it loses AC power.

Inverter On/Off

Selecting inverter On/Off will not turn on the inverter unless inverter is enabled first.

Inverter Off Delay Time

Used to 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.

The delay can be adjusted in 1 second steps with a default setting of 0 seconds to a maximum of 600 sec- onds (10 minutes). The delay is only available in the Standby or Inverter modes. Once the Alpha FXM returns to the Line mode, the delay resets to 0 seconds.

Inverter Cutoff Enable/Disable

Enabled: the user configured inverter cutoff threshold is used. Disabled: the default FXM inverter cutoff threshold is used.

Inverter Cutoff Threshold

Defines the point where the unit will switch from Inverter to Standby when the battery is considered to be low or in order to preserve the battery.

The inverter cutoff threshold is configurable in 0.1Vdc increments according to the battery voltage as described in the following table.

Parameter	24Vdc Battery			48Vdc Battery		
	Default	Minimum	Maximum	Default	Minimum	Maximum
Inverter Cutoff (Vdc)	21.5	21.5	23	42	42	46
Battery Low Warning Threshold (Vdc)	Vset + 1			Vset + 2		

UPS Maintenance > Relay & Load Shed

The Alpha FXM has up to 6 dry contacts (C1 to C6) on the front panel, which can be configured to open or close for any of the following trigger conditions:

On Battery	**Timer 3**
Low Battery	**48 Vdc (Only available with contact C6)**
Timer 1	**Generator**
Alarm	**Temperature**
Fault	**Low Battery, Shutdown**
Disabled	**Low Battery and Line**
Timer 2	**LVD**

Figure 25 shows the defaults for Relays C1 to C5. For Relay C6, the default factory configuration is +48 Vdc out- put, but it can be factory configured as a dry contact.
See Table S on page 80 for factory defaults.

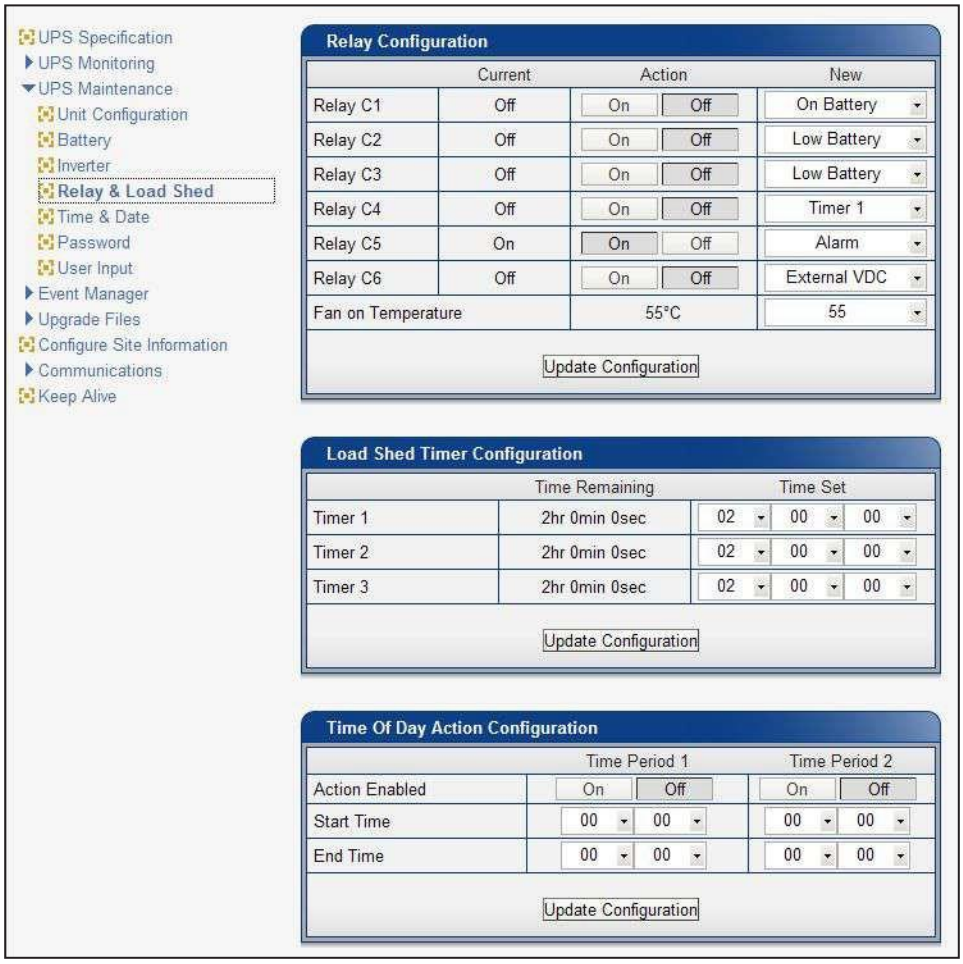


Figure 25 — UPS Maintenance: Relay & Load Shed screen

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 is activated (Status = ON).

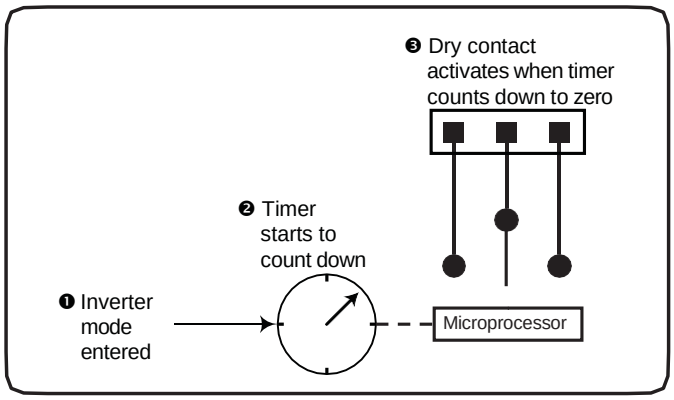


Figure 26 — Programmable Timer Operation

An example of a typical application of this timer-controlled dry contact function is control of 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 for non-rush hour traffic, but during rush hour, it may be desirable to keep the traffic light running normally 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.

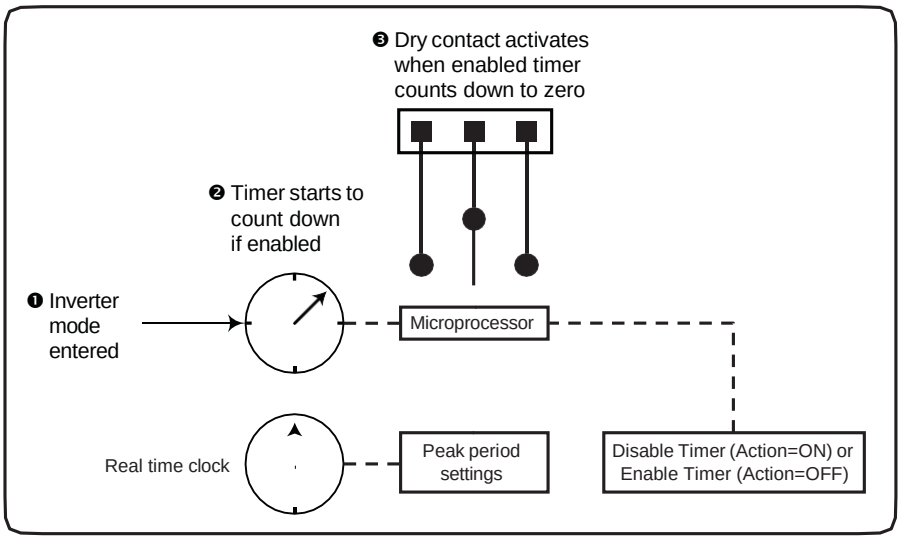


Figure 27 — Time Of Day Action Operation

You can define up to 2 peak time periods of the day in the Maintenance > Relay & Load Shed screen:

1. 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).
2. Select ON under each time period. Click the Update Configuration button under the time periods to store the settings.

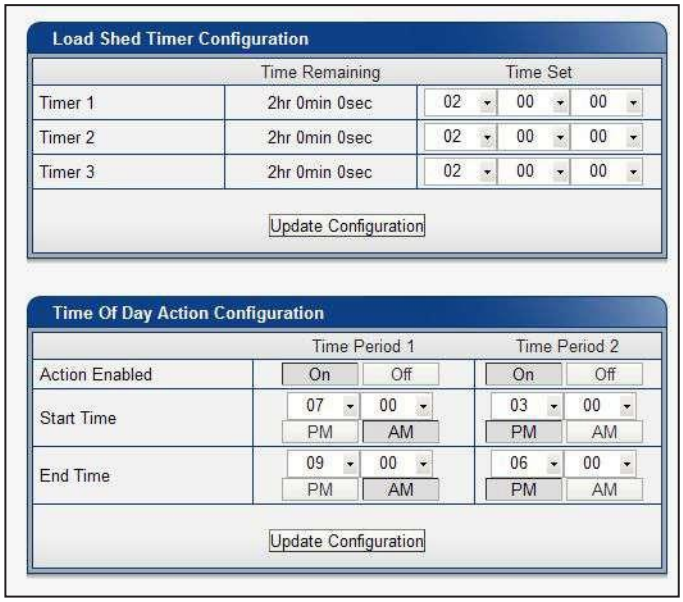


Figure 28 — Time Of Day Configuration

3. Confirm your settings in the UPS Monitoring > Relay & Load Shed > Time of Day Action Status screen.

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** (Figure 29). The dry contact will be activated by the timer regardless of the peak period settings.

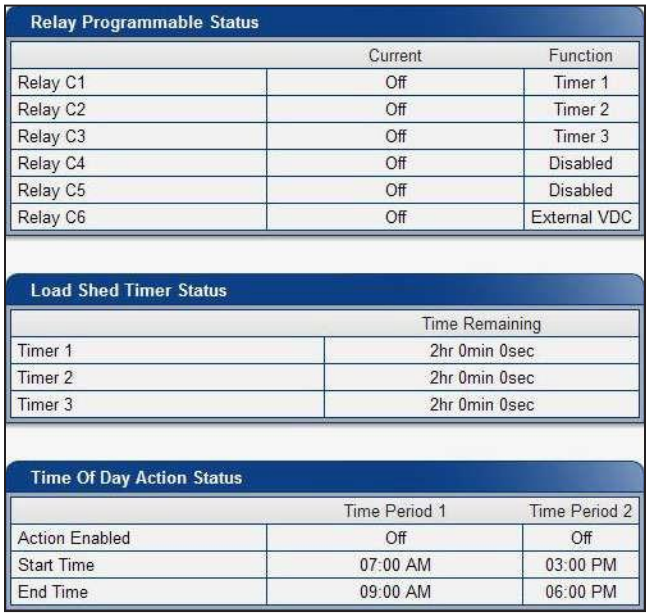


Figure 29 — Time Of Day Action Status

Controlling the external fan with a temperature triggered dry contact

The Temperature trigger has a user configurable range of +20°C to +55°C (68 – 131 °F). When the battery temperature (monitored by the Battery Temperature Probe) reaches the threshold, the assigned relay closes and turns on the external fan.

Figure 30 shows the Relay Configuration window under the **UPS Maintenance > Relay & Load Shed** screen. As an example, to assign C3 as the Temperature trigger,

a. Select **Temperature** from the drop down menu.
b. Click **Update Configuration** and the current status updates momentarily.
c. Figure 31 shows the fan-on temperature threshold set at 55°C. To change this value, 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.

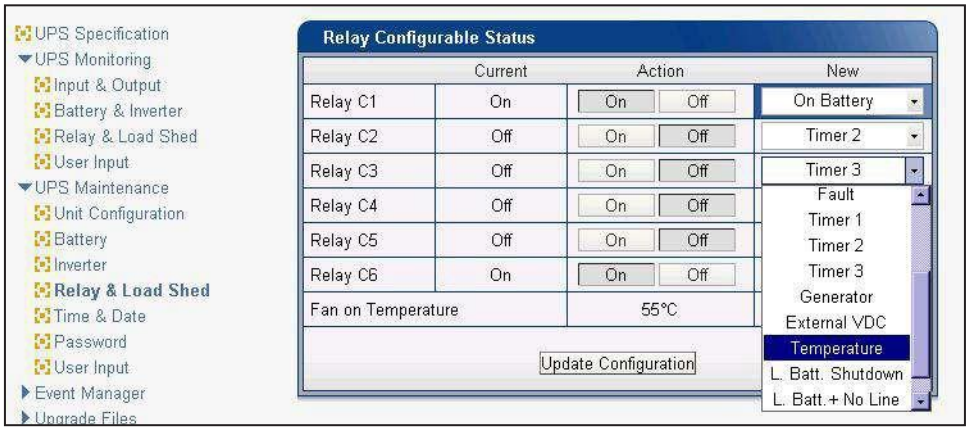


Figure 30 — Assigning the Temperature trigger function to a dry contact

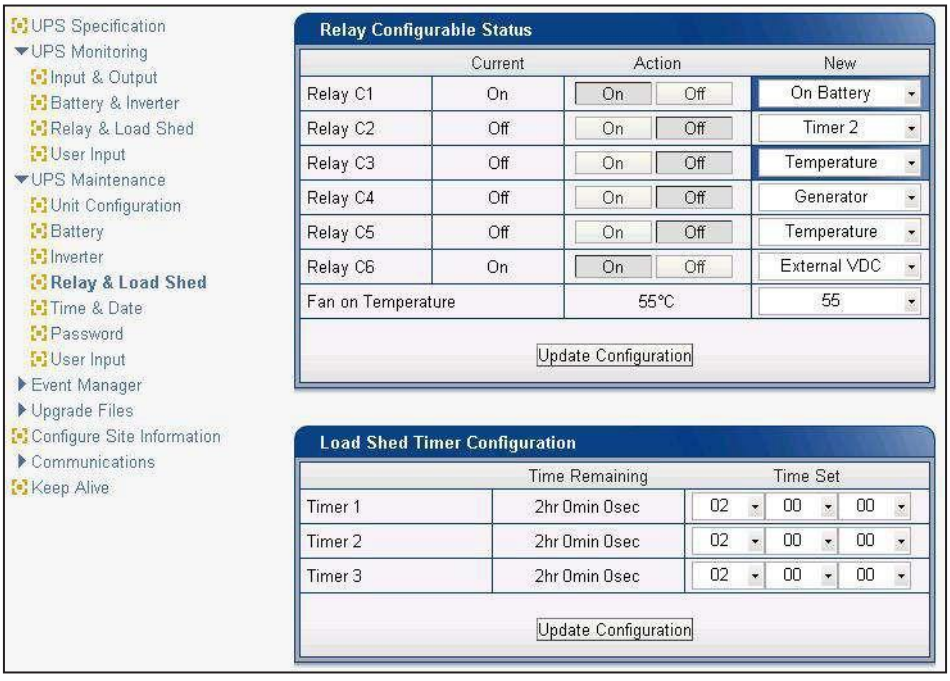


Figure 31 — Setting the Temperature trigger value

UPS Maintenance > Time & Date: used to set the Alpha FXM date and time.

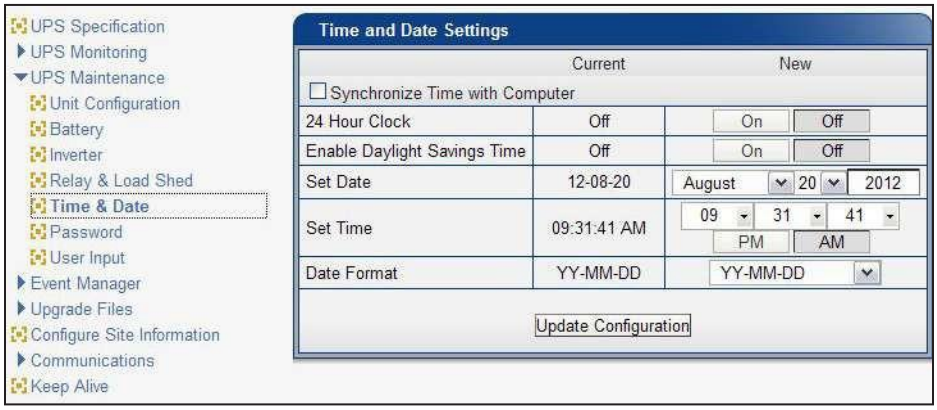


Figure 32 — UPS Maintenance: Time & Date screen

UPS Maintenance > Password: used to reset the Alpha FXM password, which is limited to 4 alphanumeric characters. The factory set password is 1111.

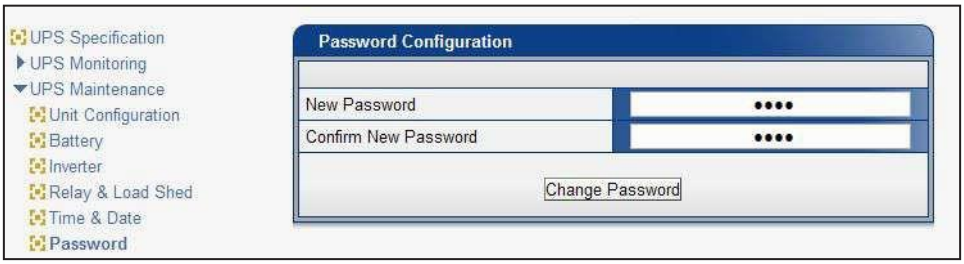


Figure 33 — UPS Maintenance: Password screen

UPS Maintenance > User Input

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

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 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.
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 "Appendix B - Types of Triggers" on page 88.

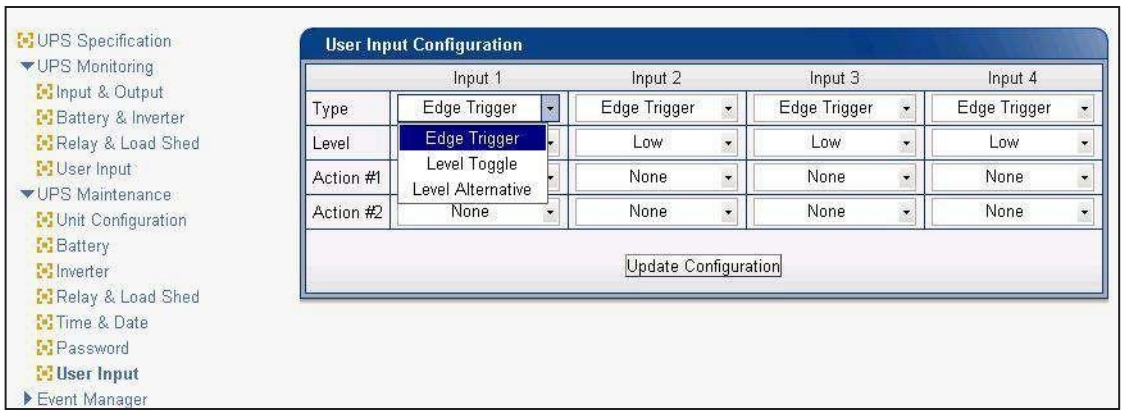


Figure 34 — User Input Configuration: Setting the Trigger Type

3. Select **Edge Trigger**.
4. Select **Low** from the **Level** drop down menu. The User Input goes to logic level "low" whenever it is triggered.
5. Select **User Alarm On** from the **Action #1** drop down menu.

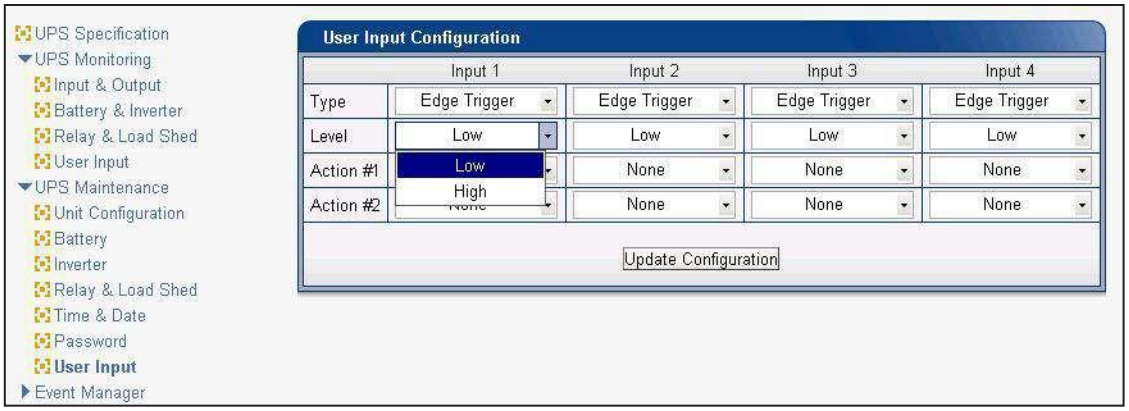


Figure 35 — User Input Configuration: Setting the Logic Level

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

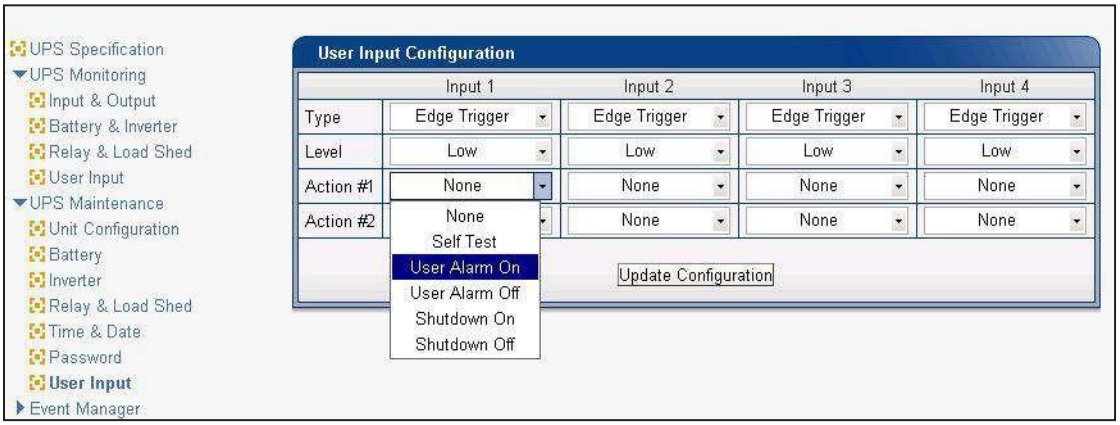


Figure 36 — User Input Configuration: Setting an Action

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

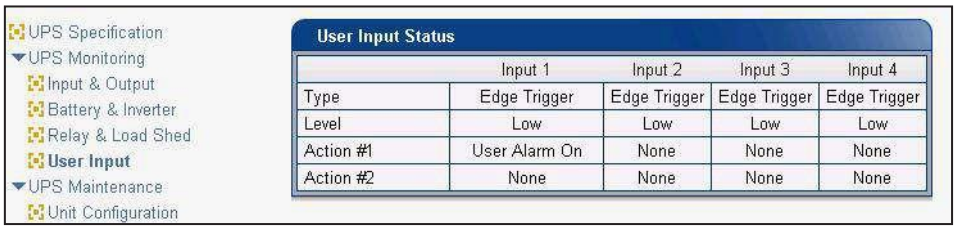


Figure 37 — User Input Current Status

Perform a quick test by shorting the User Input 1 to SC (ground) with a short length of PVC insulated electronic wire. The Alpha FXM should issue a User Input Alarm .

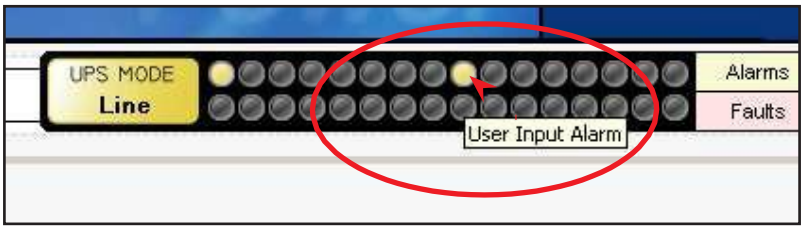


Figure 38 — User Input Current Status

Hovering the cursor over the amber indicator displays the corresponding context sensitive message.

6.3.5 Event Manager

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.

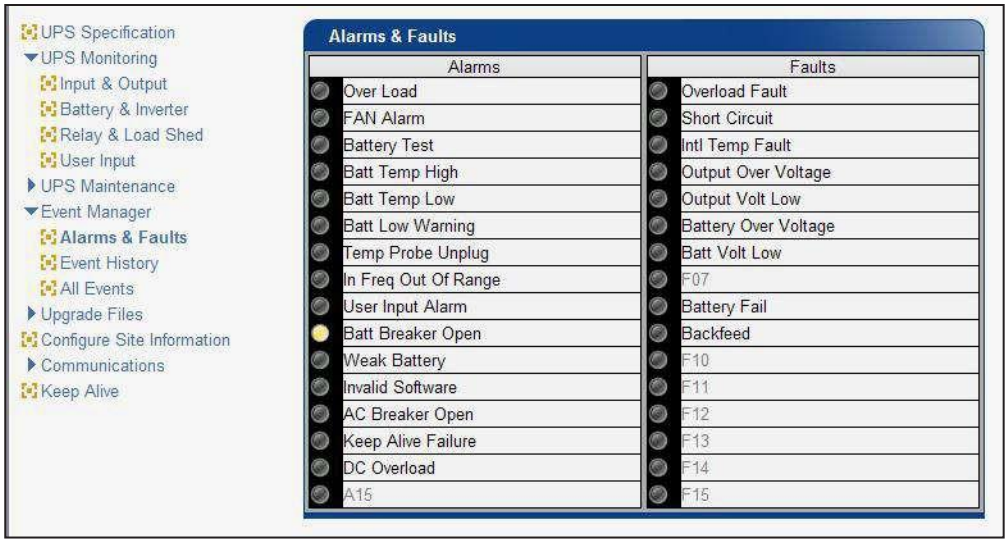


Figure 39 — Event Manager > Alarms & Faults screen

Event History

This screen shows the last 200 events recorded by the Alpha FXM. Choosing a number in the **Event Index** drop-down box and then clicking on the **View Event** button, displays the updated information about the selected event.
Clicking the **Clear History** button clears the log. This action cannot be undone.

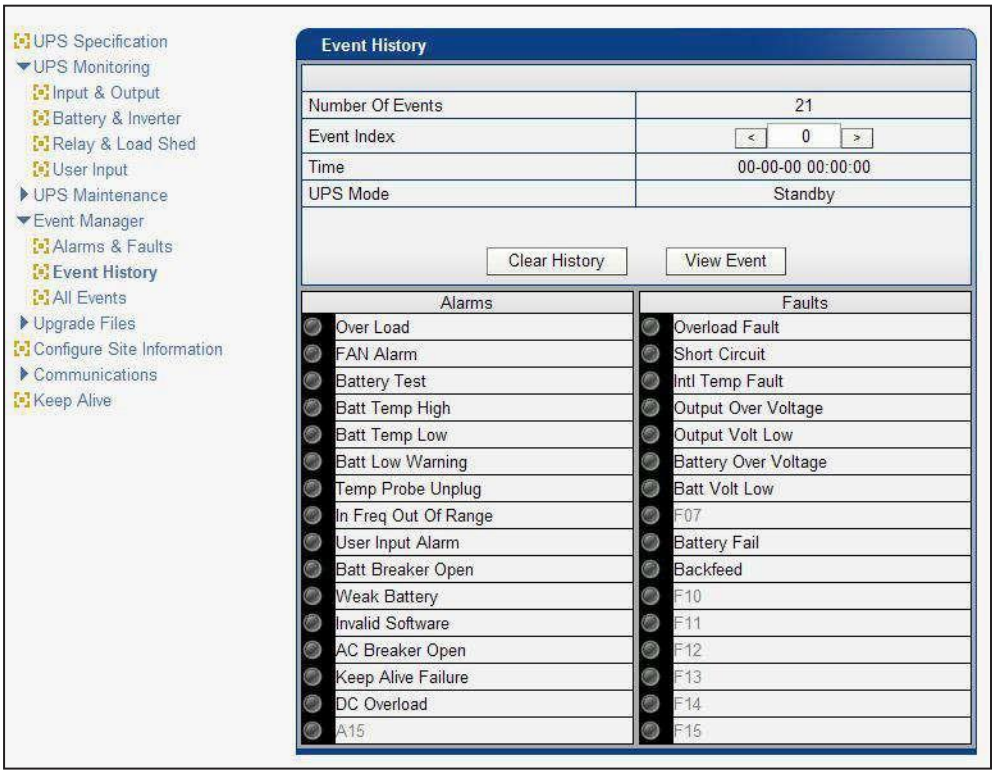


Figure 40 — Event Manager > Event History screen

All Events

To see the latest events, click **Get Events** and wait for the latest events to download from the FXM. It might take a couple of minutes to download all of the events to the web page (depending on the total number of events). If you leave the page before the download is finished, you will have to start over when you come back.

- To save the event log once all events are downloaded, use **File → Print** and one of the following options:
  - Select a printer or document writer that will save the event log in a file to view later.
  - Right click anywhere on the page to **Select All**, copy and paste into a text editor (e.g. notepad), and then save as a text file.
- To choose which events are logged, click the check boxes in the Event Configuration screen. Once an alarm is disabled, then no new alarms will appear in the event log. All alarms that were saved prior to disabling alarms are still in the event log. Email notifications will also cease for any of the disabled alarms/faults/other events – see "Figure 46 — Email Notification screen" on page 52.

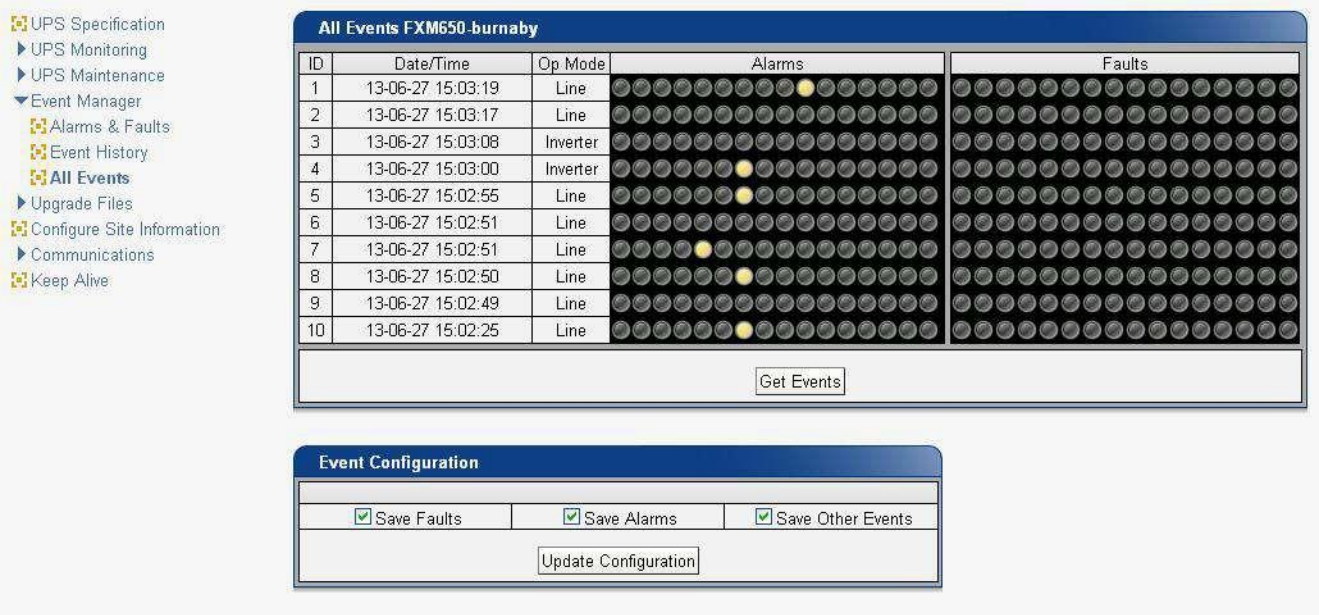


Figure 41 — Event Manager > All Events

6.3.6 Upgrade Files

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

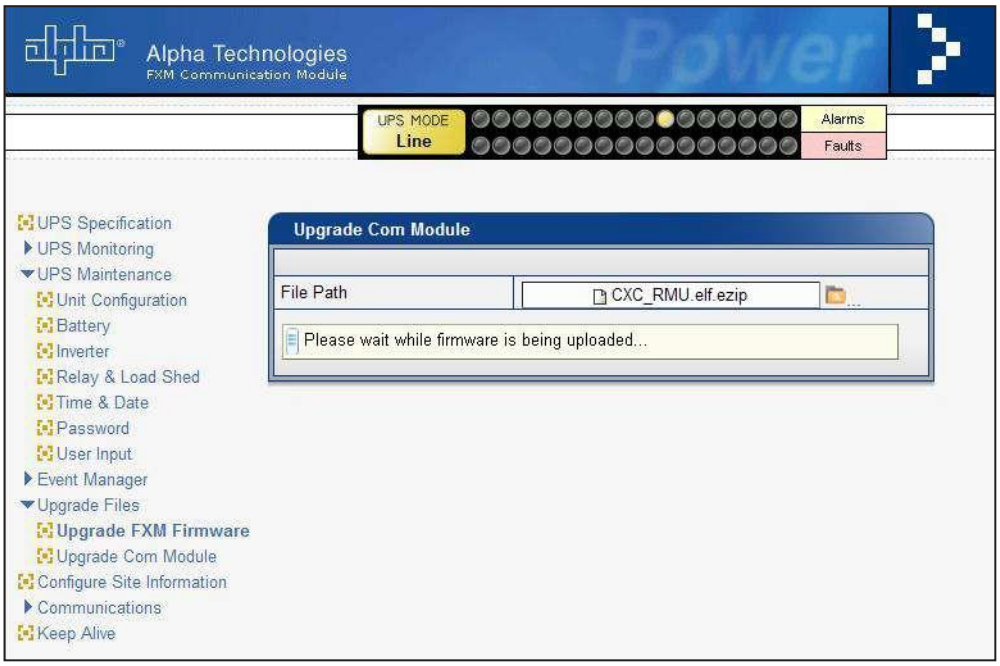


Figure 42 — Upgrade Communication Module

To upgrade the FXM firmware, browse to the .fbin or .bin file and click **Send File** to start the upload. This may take a few minutes to complete.

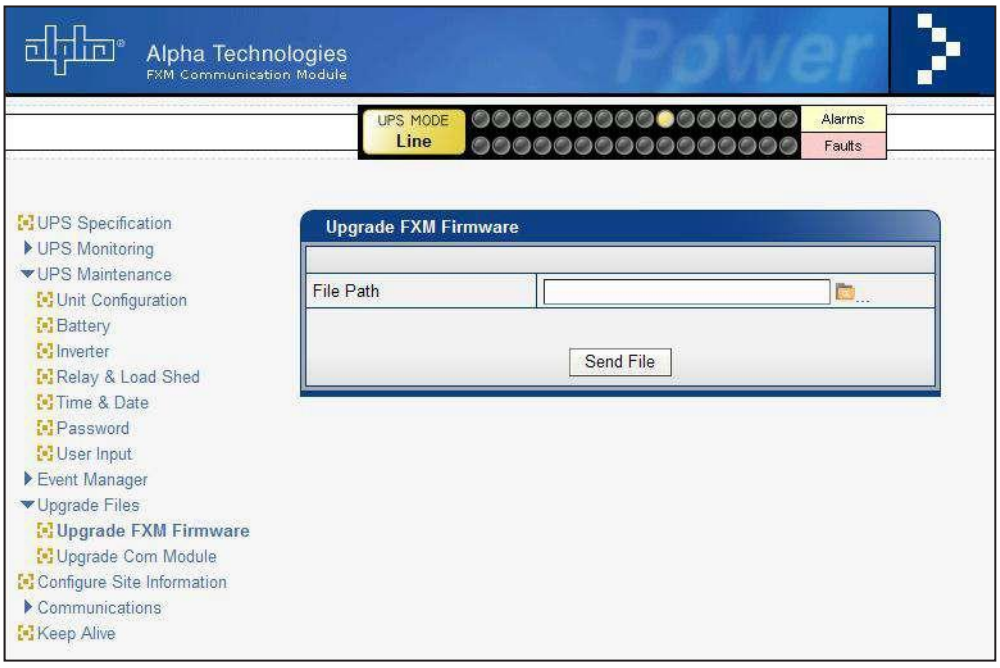


Figure 43 — Upgrade Firmware

6.3.7 Configure Site Information

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

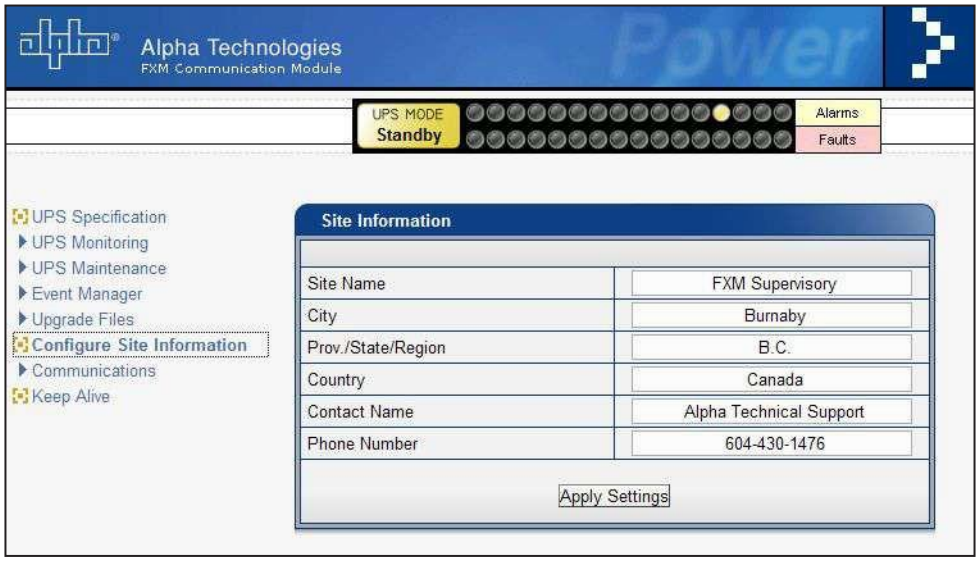


Figure 44 — Configure Site Information

6.3.8 Communications

Configure TCP/IP

See section 6.3.1.

Configure SNMP

The Configure SNMP screen is used to configure the UPS for use with SNMP communications.

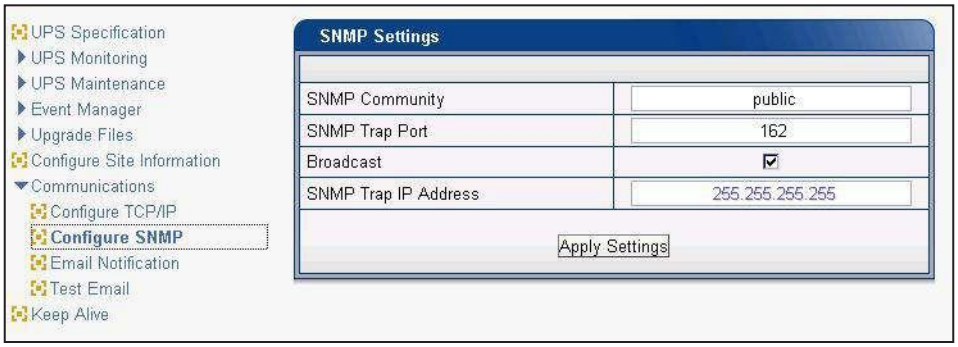


Figure 45 — Configure SNMP screen

Email Notification

NOTE:

The FXM communications module does not pass authentication details to the SMTP server. You must enable anonymous authentication in the SMTP server to allow the FXM to email anonymously.

Enabling Email Notification sends an email message whenever selected UPS events happen. (See page 49 to configure logged events.)

To create up to 4 different destinations, click **Add Destination** and then fill in the required fields:

- Enter a **To** address.
- Check off at least one of the **Notify** boxes.
- **CC** and **Subject** fields are optional.

NOTE:

Email destinations can only save up to 63 characters. More than 63 characters can be typed, but only the first 63 characters will be saved.

To edit an existing destination, select the destination by clicking on it.

To remove a destination, click on the destination and click **Remove Destination**.

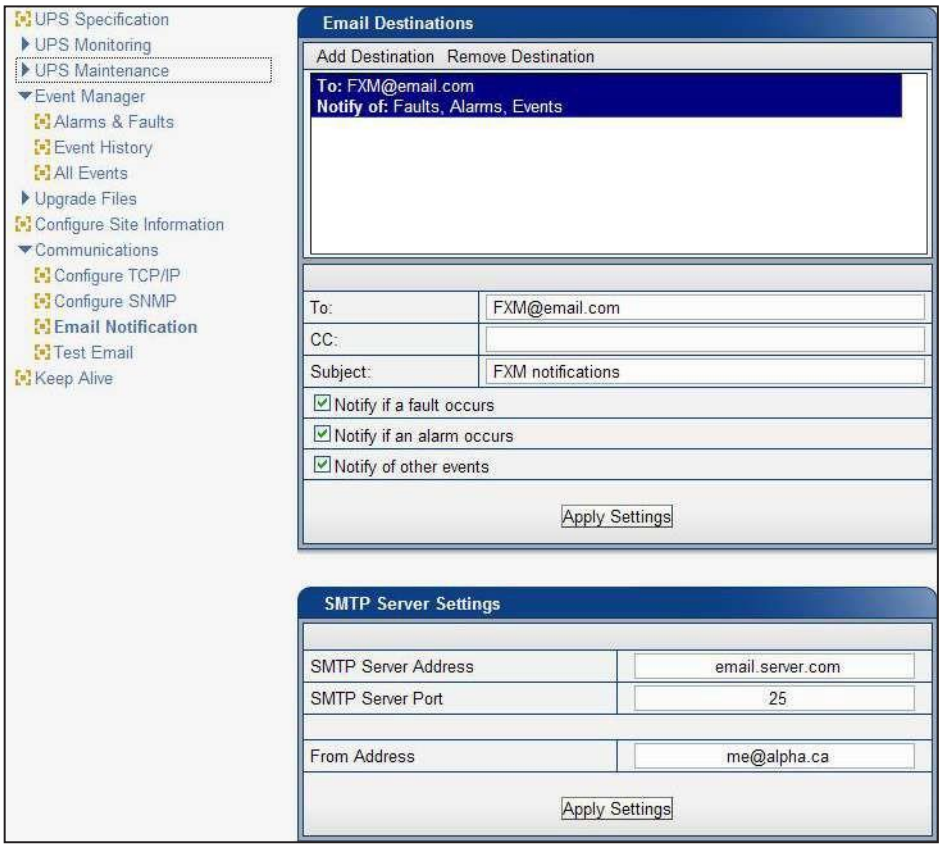


Figure 46 — Email Notification screen

Test Email

The **Test Email** feature tests the operation of the email notification option. Mail server settings can be tested as well.

1. Select **Communications** > **Test Email**.
2. If settings have already been saved with the Email Notification option, they will appear under:
   - **Test Email Server Settings** (with a check mark next to **Same as Email Notification**) and
   - **Test Email Destinations**
3. If necessary, modify the mail server settings and press the **Update Configuration** button to save the settings.
4. In the **Test Email Destinations** box, use the default email address or add one if none is specified. Add a subject and test message.
5. Press the **Start Email Test** button.
6. When the test starts running, log messages are displayed in **Test Email Log** text area.
7. If after the test is finished, the test email does not arrive at its destination, copy the text from the **Test Email Log** and email it to Alpha tech support: alpha@alpha.com.

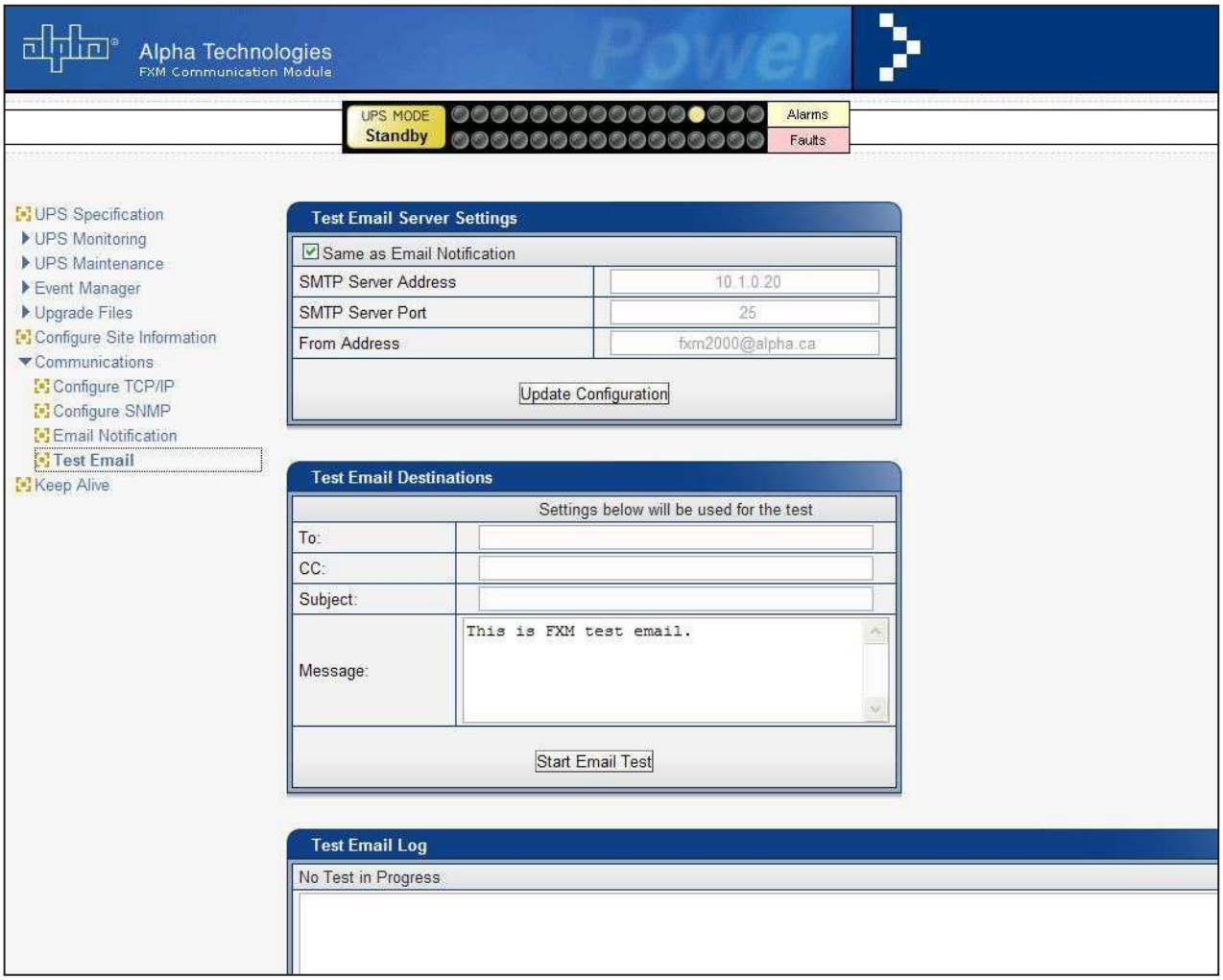


Figure 47 — Test Email feature

6.3.9 Keep Alive

Activation of the Keep Alive feature provides a method to restore communications when a communication failure is detected. A reset temporarily removes power and resets the local communications equipment powered by this unit.

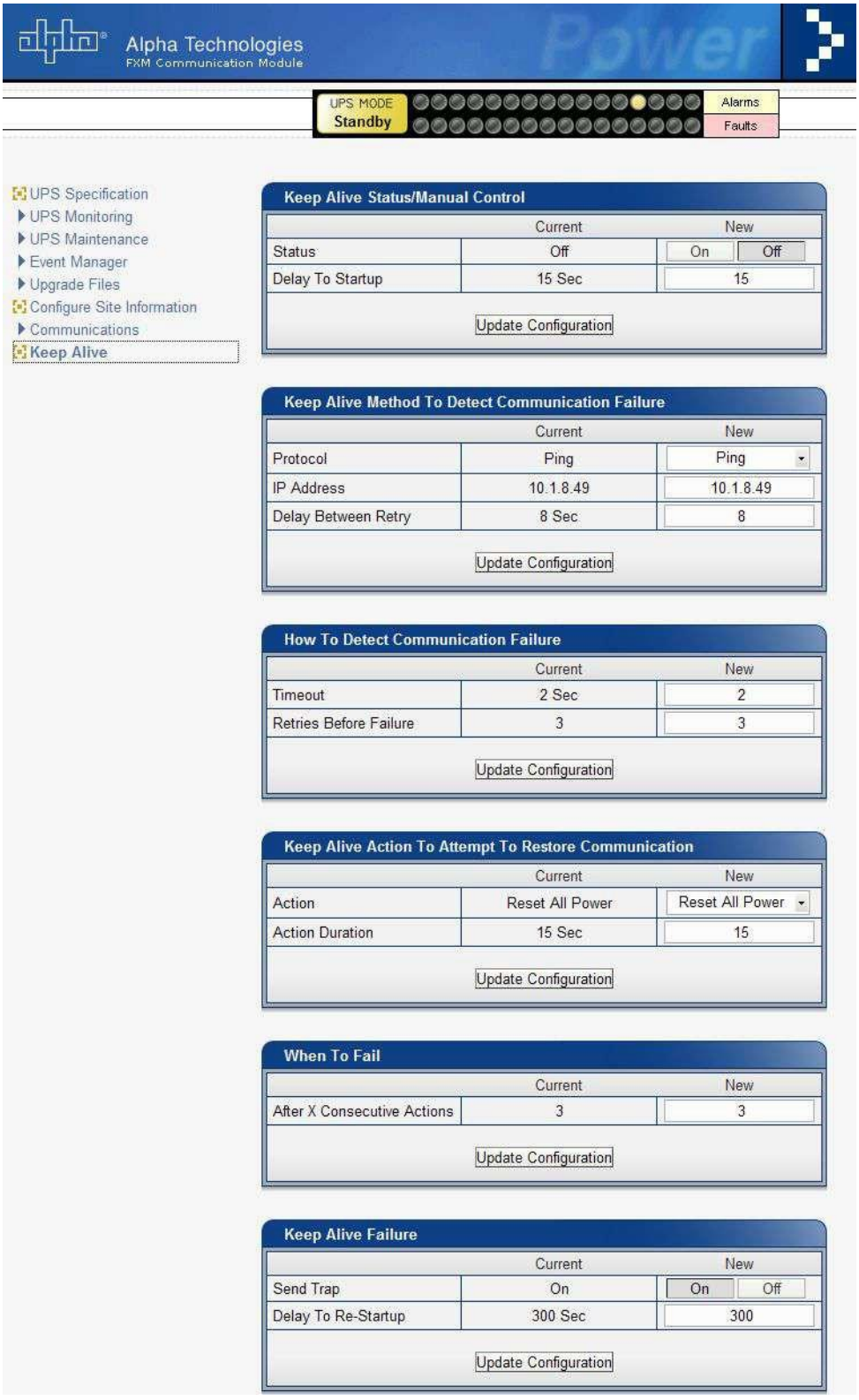


Figure 48 — Keep Alive feature

Keep Alive Method to detect communication failure:

a. Ping is the only option in the **Protocol** field.
b. In the **IP Address** field, enter the IP address of this FXM.
c. In the **Delay Between Retry** field, enter the delay between pings: minimum = 5 sec, maximum = 65535 sec.

How to detect communication failure:

a. In the **Timeout** field, enter the ping timeout. Minimum = 2 sec, Maximum = 65535 sec.
b. In the **Retries Before Failure** field, enter 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 has 3 options: reset all power (AC and DC), reset AC power, and reset DC power. This action resets the power for the duration set in Step b.
b. The **Action Duration** field is how long the output will be shut off by the UPS, Minimum = 5 sec, Maximum = 3600 sec.

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 sec, Maximum = 3600 sec.

Operation of the Keep Alive Feature

When [Status] is [On], the feature is enabled as follows:

1. Wait for [Delay To Startup] seconds and ping the [IP Address] every [Delay Between Retry] seconds.
2. When a ping fails, wait for [Timeout] seconds before doing another ping. If the ping still fails, repeat this process [Retries Before Failure] times.
3. After retrying for [Retries Before Failure] times and pinging still fails, perform the selected [Action] for [Action Duration] seconds.
4. Wait for [Delay Between Retry] seconds before pinging again.
5. If the ping still fails, repeat the last three points (3-5) for [After X Consecutive Actions] times.
6. If the ping still fails, activate the Keep Alive alarm and if [Send Trap] is [On], send a trap. The unit then waits for [Delay To Re-Startup] to start the whole thing again.

6.4 The Alpha UPS Monitor Interface

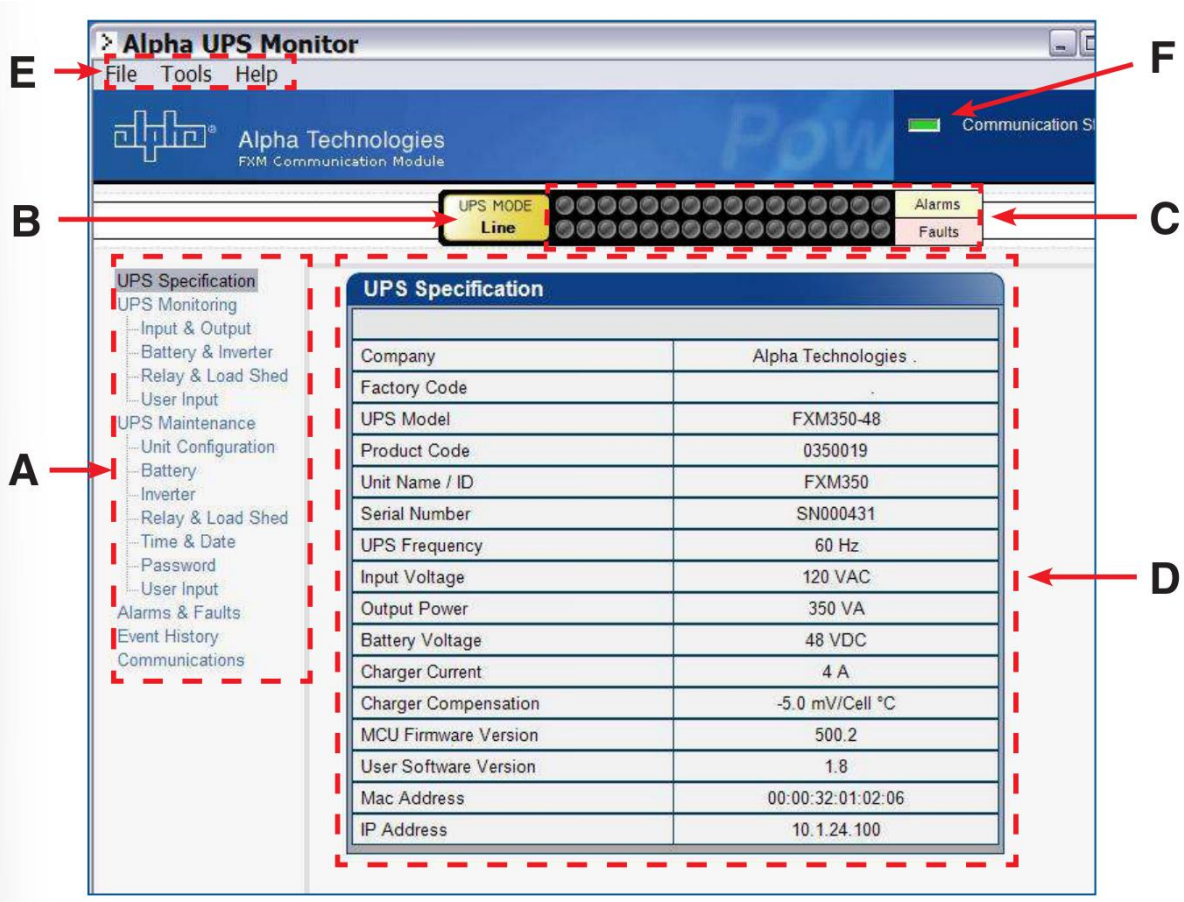
CAUTION!

Close the Alpha UPS Monitor application and disconnect when not in use.

The Alpha UPS Monitor graphical user interface (GUI) provides web or Windows like computer communications with the Alpha FXM. The screen and its features, shown in Figure 12, are used to monitor, control and set various parameters like the date and time, determine when to perform a weekly self test, change the relay configurations, etc. The on line indicator (F) shows if you are connected to the Alpha FXM.

The Alpha UPS Monitor automatically polls the Alpha FXM to obtain its status. 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 settings or parameters, either click on the On/Off buttons, or choose an item from a drop down menu. Then click on the **Update Configuration** button. If you do not click on this button, the change will not happen.



A	Screen selection menus
B	Current UPS operating mode. Updates automatically.
C	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.
D	Readout screens
E	Drop-down menus
F	Online indicator

Figure 49 — Alpha UPS Monitor (UPS Specification Screen shown)

6.4.1 Installation and Set Up of the Alpha UPS Monitor

The following tools and materials are required:

- Alpha UPS Monitor, available for download from www.alpha.ca./downloads/
- Windows 2000 or later with Microsoft .NET framework installed
- DE–9 serial straight-through computer cable

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. Scroll through the list of applications. If Microsoft .NET Framework is already in the list, 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.

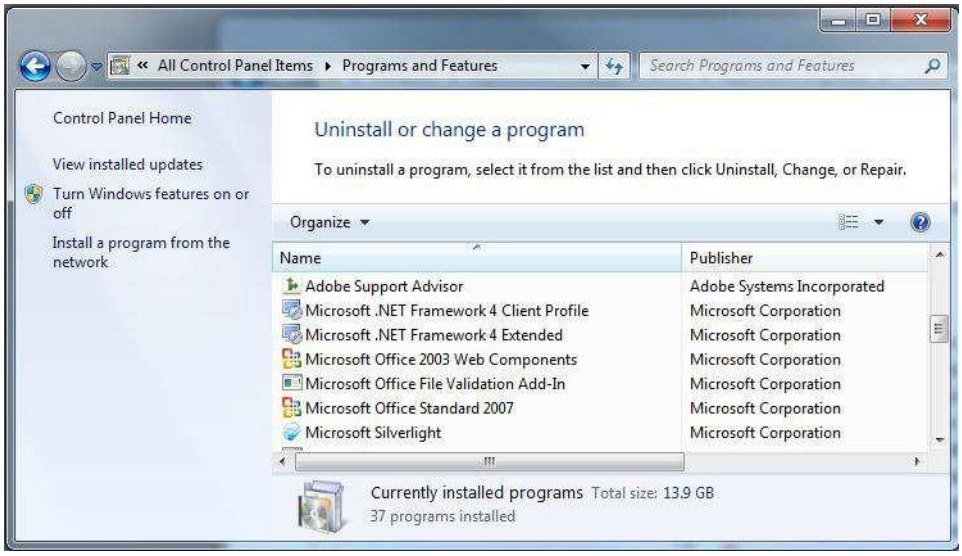


Figure 50 — Add or Remove Programs Window

Alpha UPS Monitor Installation 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, restart your computer, and then try again to install the Alpha UPS Monitor.
2. Connect the computer cable from any available communications port on the computer to the RS–232 port on the Alpha FXM front panel. Select a COM port from the drop down menu on the Communications tab and then click on the update button. (The baud rate cannot be changed since the FXM can only operate at 2400.)
3. To start communications between the computer and the Alpha FXM, do one of the following:
   - Click on the screen's Online Indicator, OR
   - 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 your connection to the proper COM port.

6.4.2 Event History (Alpha UPS Monitor)

This screen shows the most recent events recorded by the Alpha FXM. (Once the number of events reaches 200, the oldest entries are overwritten.) Choose a number in the **Event Index** drop-down box and then click on the **View Selected** button to display the updated information about the selected event.

Clicking on the **Clear History** button clears the log. This action cannot be undone.

To view all events, click the **View All** button to open the **Event Log Monitor** window shown in Figure 52).

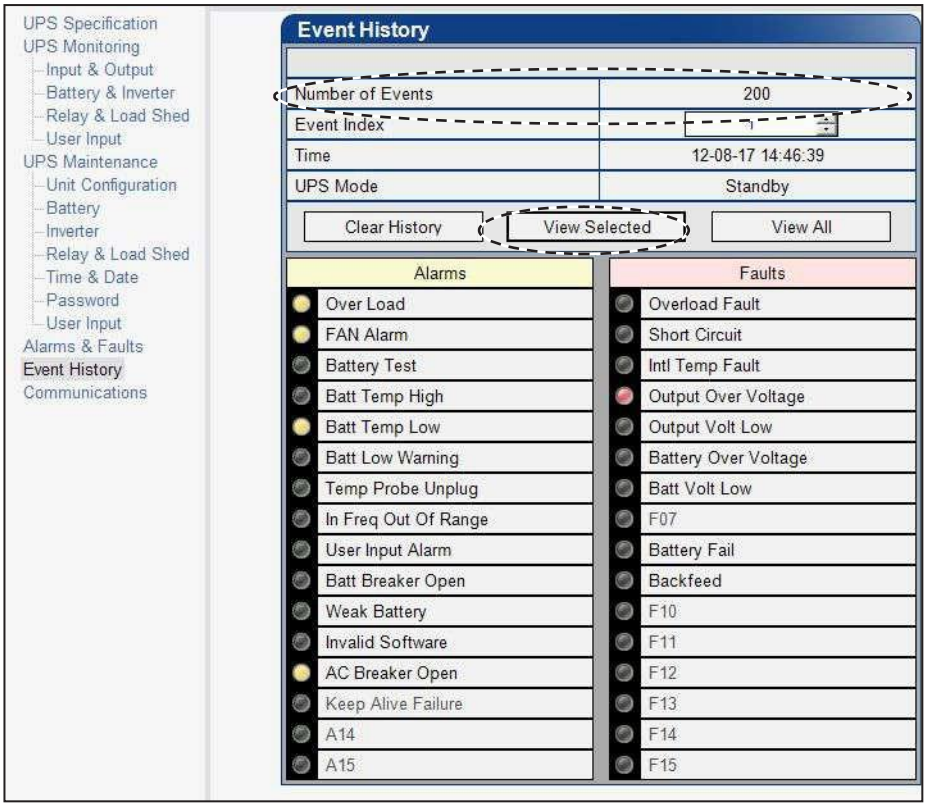


Figure 51 — Alpha UPS Monitor: UPS Event History screen

In the **Event Log Monitor** window, the events are displayed by date and time.

To see the latest events, click **Get Events** and wait for the latest events to download from the FXM (could take several minutes).

The event log is automatically saved in a default location in the UPS Monitor application, but it can be saved permanently in an alternate location with **File > Save As**. Saving to the same event file gives the option of appending to an existing event file

You can also display events previously saved with **File → Open** and browsing to the location of the event log file you want to display.

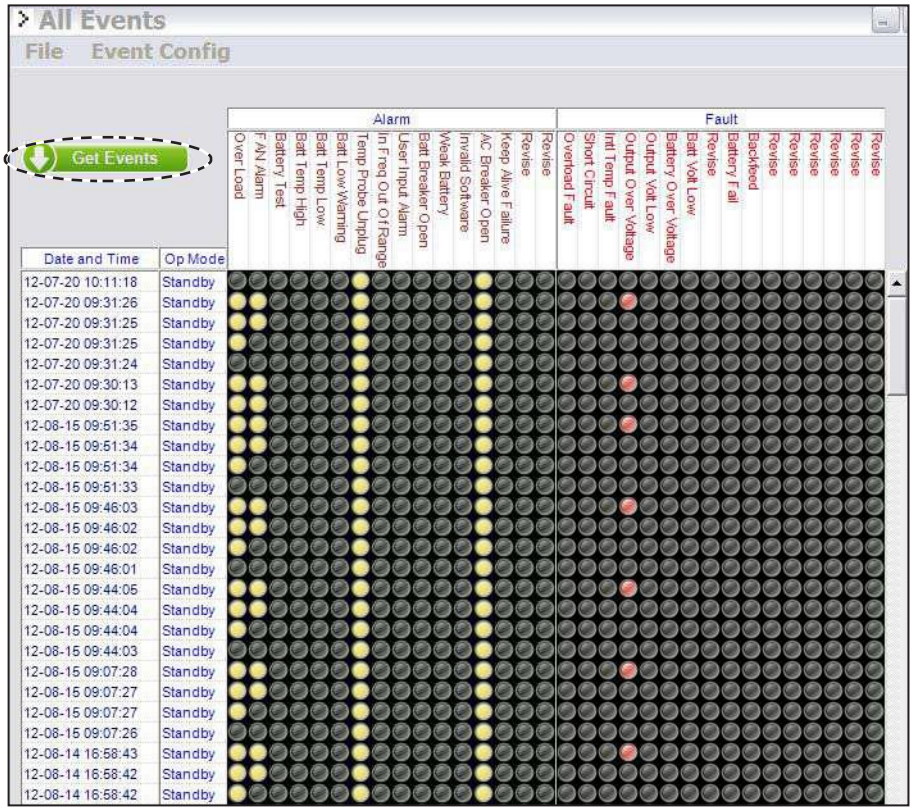


Figure 52 — Alpha UPS Monitor: Event Log Monitor screen

To filter which events are logged, use the drop-down menu under **Event Config** to enable/disable event types.
For example if **Save Alarm Events** is disabled, new alarms no longer appear in the event log. The alarms that occurred prior to disabling alarms are still visible.
If the unit has an Ethernet card, E-mail notifications can also be set up for alarms, faults, and mode change events. (See "Email Notification" on page 52.)

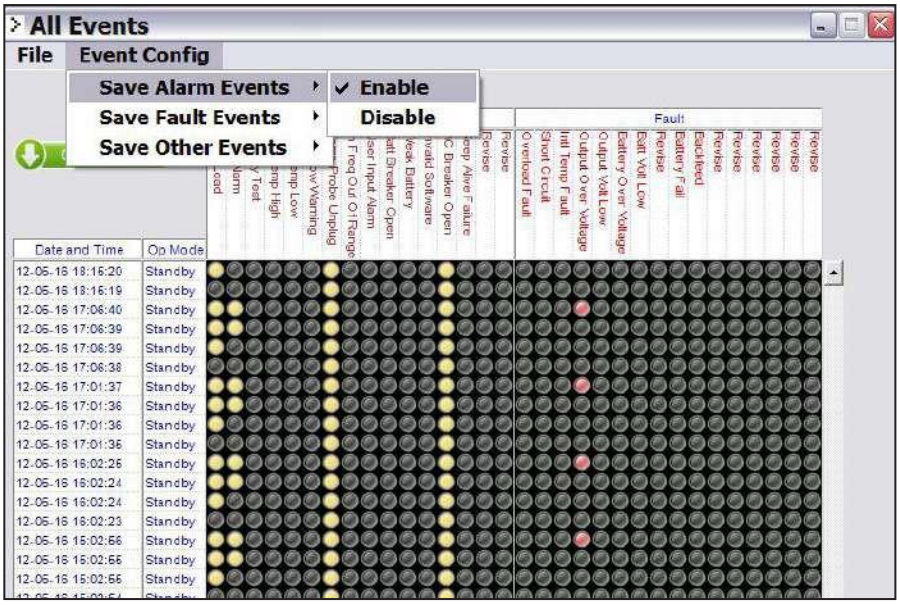


Figure 53 — Enabling/Disabling the logging of events

6.4.3 Other Alpha UPS Monitor Functions

Alpha UPS Monitor interface is similar to the Web interface. Refer to the corresponding heading in section 6.3.

6.5 HyperTerminal Interface

The Alpha FXM 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 commandline system.

The following subsections describe the operation of the Alpha FXM via the RS232 interface and Windows HyperTerminal:

- Using the Main menu
- Adjusting and controlling the Alpha FXM
- Programming the dry contacts and the clock
- Viewing the 200-event log

6.5.1 Set-up

1. Connect a 9-pin, fully shielded, straight-through DE-9 to DE-9 connector cable between the computer port and the Alpha FXM port.
2. Use Device Manager to locate which COM port is connected to the UPS.
3. Open HyperTerminal (**Start>All Programs>Accessories>Communications>HyperTerminal**).
4. Enter a name for the connection (e.g. **FXM**) and click **OK**.
5. Under **Connect Using** choose the COM port found in step 2 and click **OK**.
6. Set the following parameters and click **OK**:
   - **Bits per second**: 2400
   - **Data bits**: 8
   - **Parity**: None
   - **Stop bits** 1
   - **Flow control**: None.
7. Click on the **Properties** icon (far right on the toolbar). Go to **Settings>ASCII Setup**. Check **Echo typed characters locally**. Click **OK**.
8. Press **Enter** and the FXM main menu should appear.

6.5.2 Main Menu Screen

The main menu screen (Figure 54) shows the Alpha FXM current input and output values, displays any faults or alarms and gives access to the submenus. The complete menu tree is shown in Figure 55.

HyperTerminal runs on a command line system:

a. The program does not recognize the backspace or delete keys even if it appears that way on the monitor.
b. To access a particular submenu, type in the submenu number and press Enter. The Alpha FXM is controlled by submenu 3.
c. To update the main menu screen, press Enter.
d. If you make a mistake and press Enter, the Alpha FXM echoes the command back exactly as you typed it. Press Enter and reenter the correct command.
e. The readings on the main menu screen do not automatically update to reflect changes in the Alpha FXM status. Press **Enter** to update the screen.
f. For many functions you need to enter a password. The factory setting is **1111**.

Submenu Numbers

Line Status Table E
Output Status Table F
Faults Table G
Alarms Table H

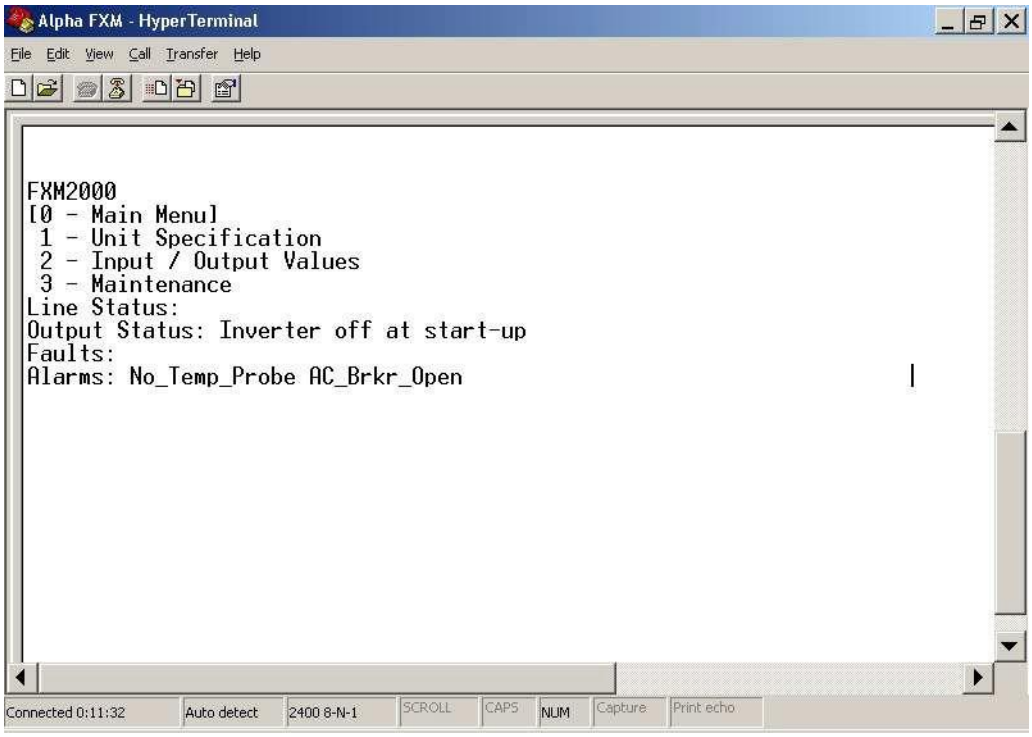


Figure 54 — Main Menu Screen

HyperTerminal Menu Tree

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

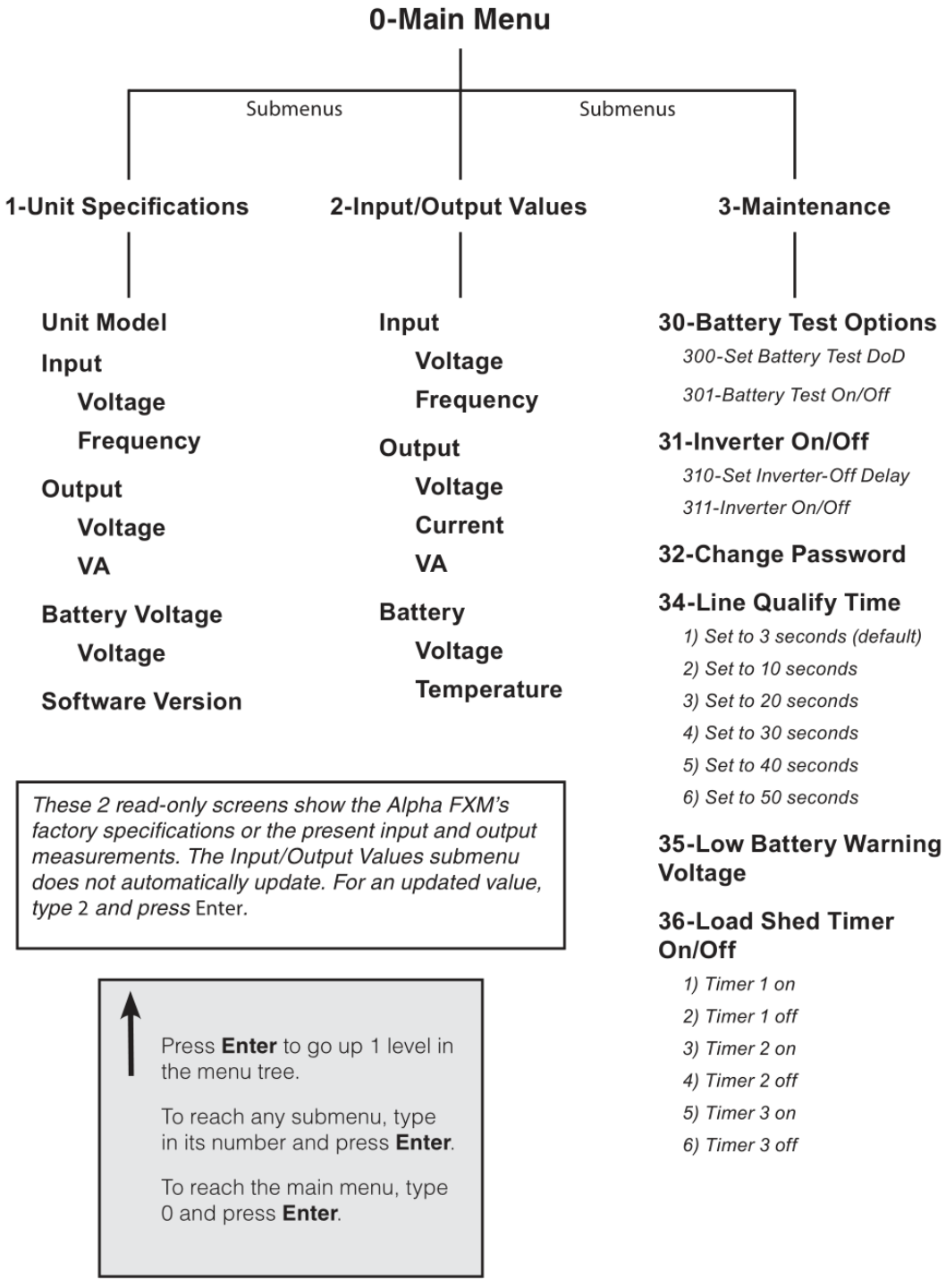


Figure 55 — Menu Tree

6.5.3 Line Status

Line status reports the line condition. For an updated value, press **Enter**.

Table E — Line Status (see Figure 54)	
Normal	The line is within specifications. See "Table V — Boost/Buck/Line Transfer Thresholds" on page 82. The Alpha FXM is operating in Line mode.
Boost	Line voltage is out of tolerance. The Alpha FXM is operating in Boost mode.
Buck	Line voltage is out of tolerance. The Alpha FXM is operating in Buck mode.
Blackout	The line is absent.
Freq low	Line frequency is too low.
Freq high	Line frequency is too high.

6.5.4 Output Status

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

Table F — Output Status (see Figure 54)
Line mode
Battery mode
Battery mode, low bat warning
Battery mode (testing battery)
Battery bypass mode
Boost mode
Boost 2 mode
Buck mode
Hot swap mode
Inverter off due to fault
Inverter off due to low battery
Inverter off at start-up
Shutdown due to user request

NOTE:

When using the terminal interface, Battery mode and Battery bypass mode are the same as Inverter mode and Inverter bypass mode when using other communications methods.

6.5.5 Fault and Alarm Displays

Faults and alarms display on the main menu screen. See Chapter "8. Troubleshooting" on page 78.

Table G — Faults (see Figure 54)	
Short_Circuit	The load has a short.
Vout_Hi	The output voltage is above specifications.
Batt_Hi	The batteries cannot be charged.
Batt_Lo	The batteries are almost discharged.
Vout_Lo	The output voltage is below specifications.
Overload	The Alpha FXM is overloaded. Remove excess loads.
Backfeed	A relay inside the Alpha FXM has failed and it cannot be replaced in the field. Contact Alpha Technologies customer service department.
Bad_Battery	The battery voltage has dropped below a specified level. Inverter shuts down.
Temp_Hi	The Alpha FXM is operating above temperature range.

Table H — Alarms (see Figure 54)	
AC_Brkr_Open	The AC breaker is opened.
Batt_Brkr_Open	The battery breaker is opened.
Batt_Low	The battery voltage is low.
DC_Overload	When a battery string is charging, the status of the battery voltage is checked every three minutes. An alarm is generated if the battery voltage continues to drop while charging. .
Fan_Fail	The Alpha FXM internal fan has failed.
Keep_Alive	The Alpha FXM keep alive feature failed to restore communication.
Line_Freq	The line frequency is outside of the Alpha FXM input specifications.
No_Temp_Probe	The battery temperature sensor has become disconnected or has failed.
Overload	The Alpha FXM is overloaded. Switch off excess loads.
Self_test	The Alpha FXM is performing a self test.
Temp_Hi	The ambient battery temperature is too high.
Temp_Lo	The ambient battery temperature is too low.
User_Input	The user input contact "User Input: S2" is shorted.
Weak_Battery	The battery has failed the background scan in Line mode.

6.5.6 Adjusting and Controlling the Alpha FXM

Use submenu #3, the Maintenance submenu (Figure 54 and Figure 55) to control the Alpha FXM and change selected items to meet your operational needs.

From the Main menu (Figure 54), type **3** and press **Enter**.

Table I — Maintenance Submenu	
30 Battery Test Options	Starts the battery test and sets how long the test will run. The default setting for the test depth-of-discharge is 20%, but this can be adjusted from 0 to 100%. For a description of the battery test, see BATT TEST in Figure 2.
31 Inverter On/Off	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. For a description, see INVERTER in Figure 2. 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. 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 Inverter modes. Once the Alpha FXM returns to the Line mode, the delay resets itself to 0 seconds.
32 Change Password	Changes the Alpha FXM 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.
34 Line Qualify Time	Lets you set the delay when the Alpha FXM goes from Inverter mode to Line mode after the line becomes re-qualified. The purpose of this delay is to make sure the line is stable before the Alpha FXM switches back to it. The default setting is 3 seconds, but user adjustable in increments of 1 sec until 1 minute, and then in increments of 1 minute to 15 minutes max.
35 Low Battery Warning Voltage	Let's you set the Alpha FXM low battery warning voltage by typing in the % battery voltage level where you want the warning to be triggered. Adjust the setting to match the batteries you are using and the actual operating conditions. **48V**: Default 40% -47 Vdc Adjusted in 1% increment – 0.05 Vdc Minimum 0% - 45.0 Maximum 100% - 50.0 Vdc **24V**: Default 40% - 23.5 Vdc Adjusted in 1% increment – 0.025 Vdc Minimum 0% - 22.5 Vdc Maximum 100% - 25 Vdc
36 Load Shed Timer On/Off	Lets you switch the timer contacts on or off while the timer is counting down. This feature has no effect if the timers are not counting. See "Contacts C1 to C2". In Table C.

From the Main menu, type **4** and press **Enter**.

Table J — Maintenance Submenu	
40 Quality mode high limit	Changes the upper limit of the Power Quality mode threshold
41 Quality mode low limit	Changes the lower limit of the Power Quality mode threshold

6.5.7 Programming the Dry Contacts

The Alpha FXM front panel contacts C1 to C5 can be programmed to meet your specifications. 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 functions of dry contacts can be changed with HyperTerminal; For example, to change contact C2:

1. To see how it is currently programmed, type **c2** (all lower case) and press **Enter**.
2. The Alpha FXM responds with ***c2=2** where the ***** shows the unit responded to your command. For example: a "**2**" shows it is programmed to be the **Low Battery** indicator as shown in Table K.

Table K — Dry Contact Configuration

1= On Battery	**4= Alarm**	**7= Timer 2**	**10 = Generator**	**13= Low Battery and Line**
2= Low Battery	**5= Fault**	**8= Timer 3**	**11= Temperature**	**14= LVD**
3= Timer 1	**6= Disabled**	**9 = 48Vdc (Only available with contact C6)**	**12= Low Battery, Shutdown**	

3. To change the contact, type **c2=X** where X is 1 to 14 and press **Enter**.
   The Alpha FXM responds with ***c2=(1 to 14)**. For example, to change the c2 contact to be the Temperature indicator, type **c2=11**.

Setting the Timer Contact Interval

If you configure one of the dry contacts to act as a timer, the next step is to set the value of the timer.

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. Both methods are shown in the following example.

Table L — Setting the Timer Contact

	Enter command	UPS display	Description
Displaying the Timer	**timer1** and press **Enter**	*timer1=02:00:00	Returns the value of Timer 1
	timer2 and press **Enter**	*timer2=02:00:00	Returns the value of Timer 2
	timer3 and press **Enter**	*timer3=02:00:00	Returns the value of Timer 3
Setting the Timer	**timer1=00:01:00** and press **Enter**	*timer1=00:01:00	Sets the value of Timer 1 to 60 seconds.
	timer1=120† and press **Enter**	*timer1=120	
	timer2=00:01:00 and press **Enter**	*timer2=00:01:00	Sets the value of Timer 2 to 60 seconds.
	timer2=120† and press **Enter**	*timer2=120	
	timer3=00:01:00 and press **Enter**	*timer3=00:01:00	Sets the value of Timer 3 to 60 seconds.
	timer3=120† and press **Enter**	*timer3=120	
	default and press **Enter**	*default	Resets the timer to the factory default of 02:00:00 (2 hours); and resets contacts C1 to C6 to the factory default settings.

Note: In the above example, the default timer setting of 2 hours is used.
* Indicates that the Alpha FXM has responded to the command you entered.
† 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.

Controlling the external fan by temperature triggered dry contact

The Temperature trigger has a user configurable range of +20°C to +55°C (68 – 131 °F). When the battery temperature (monitored by the Battery Temperature Probe) reaches the threshold, the assigned relay closes and turns on the external fan.

1. Assign the Temperature trigger function to an available dry contact, (for example, **c1=11**, where 11 is the assigned index for the Temperature trigger function.)
2. At the HyperTerminal screen prompt, type **Temp** and press Enter to display the current temperature setting. For example the Alpha FXM might return ***temp=20**.
3. To change the value to +35°C, type **temp=35** and press Enter. The Alpha FXM returns ***temp=35** as confirmation.

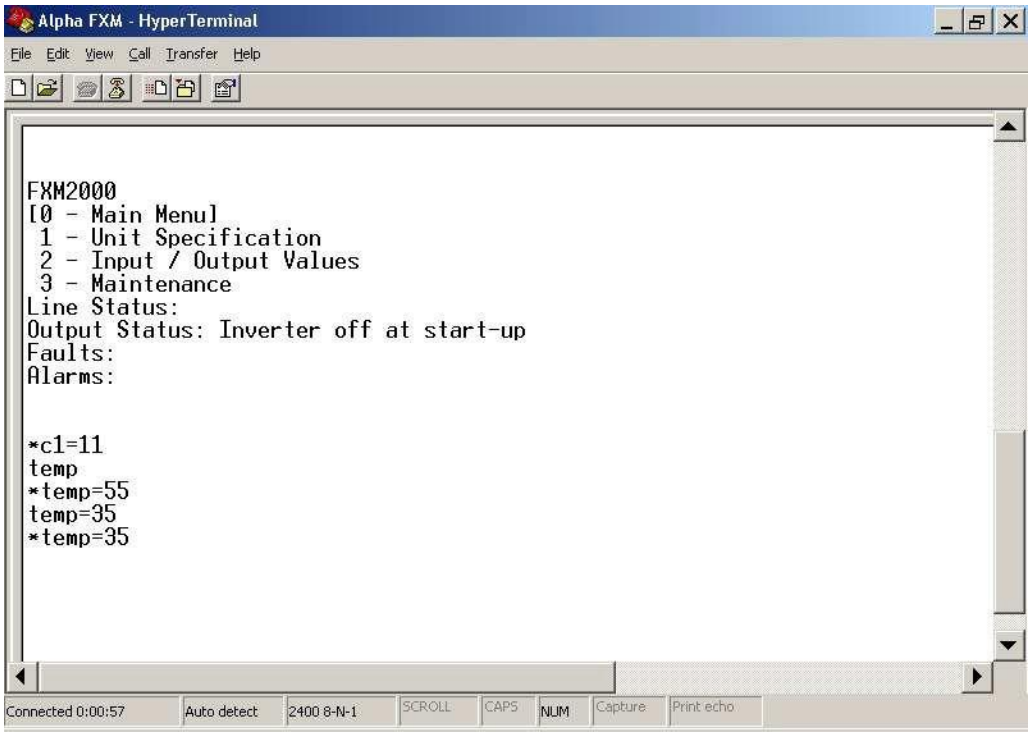


Figure 56 — Temperature trigger function via HyperTerminal

Resetting the Dry Contact Settings

To reset the dry contact settings 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 Table S on page 80 for the factory default settings of dry contacts.

6.5.8 Setting the Date and Time

You can adjust the Alpha FXM date and time.

Table M — Setting the Date and Time

Description	Enter command	UPS display
Query time	**clock** and press **Enter**	***clock=12/31/07 22:00:00** (format of the response depends on user's choice of date format and 12 or 24 hour clock)
Change time	**clock=MMDDYY hhmmss** and press **Enter** Date format "MMDDYY" is constant and does not reflect currently selected date format. Time hours "hhmmss" is always in 24 hour format regardless of whether user set 12 or 24 hour clock.	FXM replies with time entered but it could be in a format that is different from the format of the set time command. For example, to set time to Jan 02, 2011, 05:30:00 pm: **clock= 010211 173000** and press **Enter** Response if YYYY-MM-DD date format and 12hr clock are selected: **clock=2011-JAN-02 05:30:00pm**

Notes:

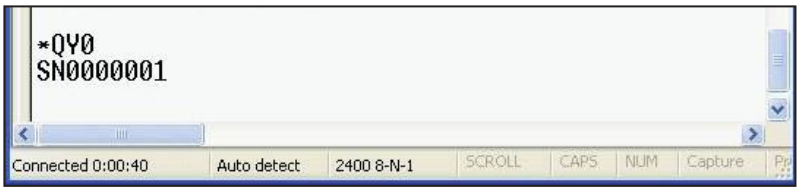
1. Time is displayed in the 12 or 24 hours format depending on user settings.
2. Changing the mm/dd/yy format with DATE FRMT on the LCD Control menu does not change the USB mm/dd/yy for- mat.
3. If the Alpha FXM has been in storage or switched off for a prolonged period, the backup Lithium coin battery 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 "Table P — Alarm Submenu" on page 78.

* Indicates that the Alpha FXM has responded to the command you entered.

† 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 **Enter** and try again.

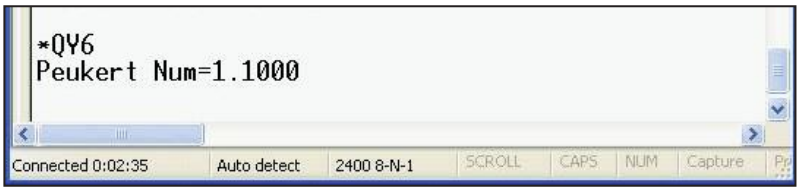
6.5.9 Viewing the Serial Number

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

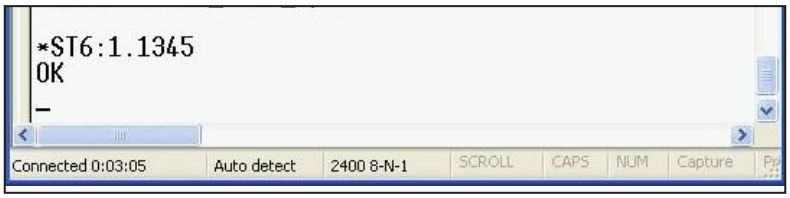


6.5.10 Setting the Peukert Number and Capacity

You can set the Peukert Number and Capacity using the HyperTerminal interface or the web interface. To display the current Peukert Number, type " ∗QY6" at the command line and press "Enter".

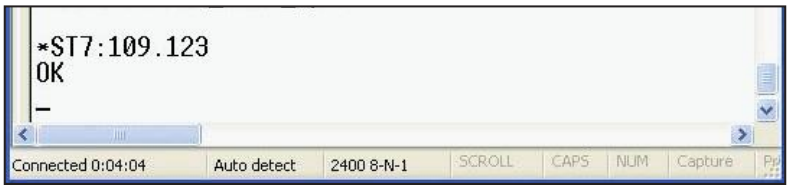


To change the Peukert Number to 1.1345 fro example, type " ∗ST6:1.1345" at the command line and press "Enter".



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

To change the Peukert Capacity to 109.123 for example, type " ∗ST7:109.123" at the command line and press "Enter".



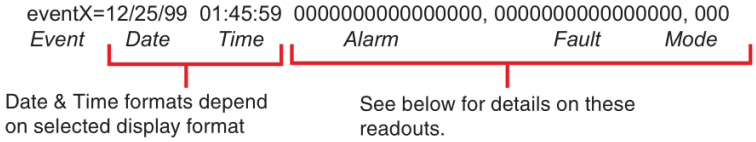
To determine the Peukert number and capacity of your battery, refer to Appendix A.

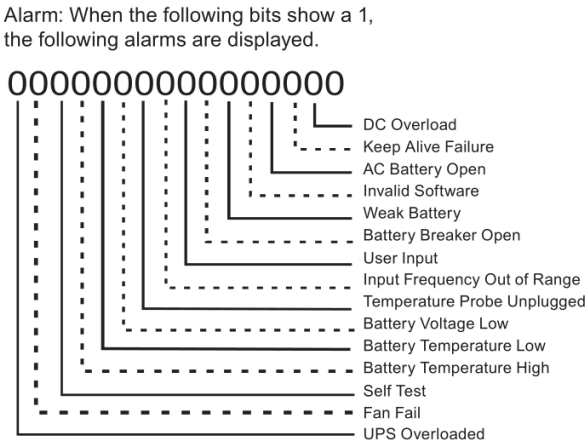
6.5.11 200-event Log

Up to 200 events are stored in the Alpha FXM log. If more than 200 events occur, the oldest is over-written.

Procedure

1. To see the log, type **event** (all lower case) and press **Enter**. The events are listed starting with the most recent and appear as:





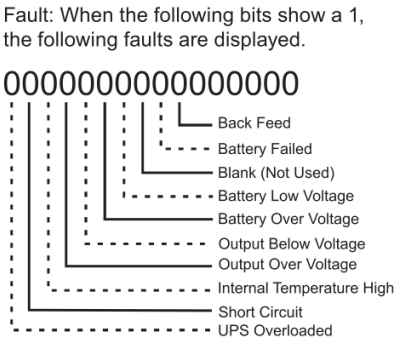


Table N — Event Codes					
Code	**Mode**	**Code**	**Mode**	**Code**	**Mode**
000	Standby	003	Boost 1	006	Inverter
001	Line	004	Buck 1	009	Shutdown
002	Boost 2	005	Buck 2	010	Bypass

2. If less than 200 events occurred, the last entry will appear as:

   eventX=00/00/00 00:00:00 0000000000000000, 0000000000000000, 000

3. 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.
4. To see a specific event, type **eventX** where X is from 1 to 200 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 200 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.
5. To see a specific event, type **eventX** where X is from 1 to 200 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 200 and press **Enter**.

6.5.12 Restoring All Parameters to Default Values

The purpose of this command is to reset the Alpha FXM to the factory default state. See Table D on page 36 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.

Procedure

1. Type **default:all** and **press Enter**.
2. Alpha FXM returns ***OK** as confirmation.

7. Maintenance

7.1 Upgrading the FXM Firmware

The Alpha FXM firmware can be reinstalled or upgraded via an RS232 interface using FXM Programmer, or on the web. The web interface requires the factory-installed FXM communication module.

7.1.1 Upgrading using the RS232 Interface

You will need the following items:

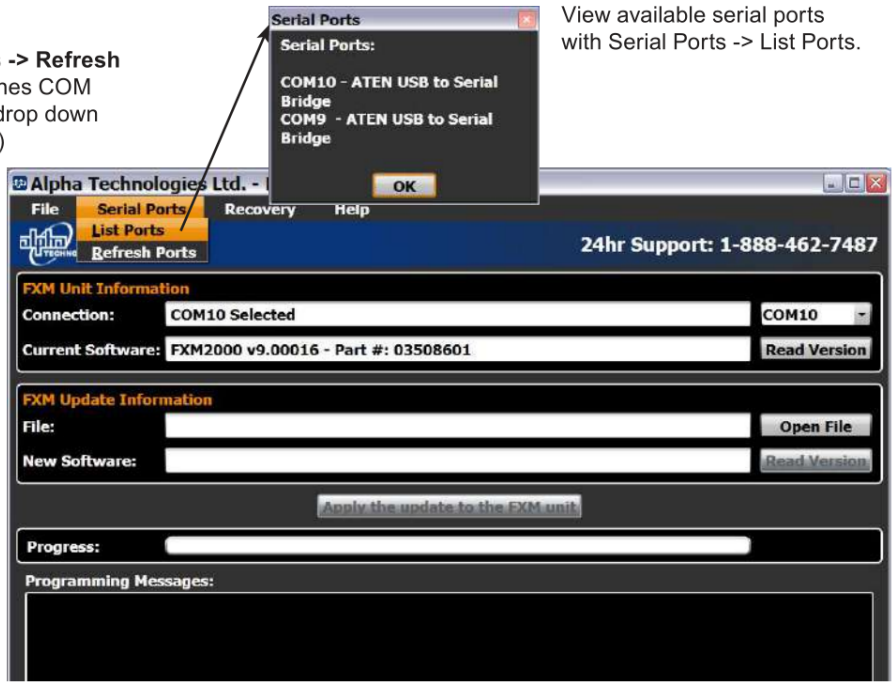
- RS-232 connection cable to the Alpha FXM.
- **FXMProgrammer** software must be installed. It is available for download at www.alpha.ca\downloads.

1. Switch off the Alpha FXM.
2. Connect the RS-232 cable.
3. While pressing and holding the **SELECT** button, switch on the battery circuit breaker. The LCD panel shows "**Alpha XP ISP**".

Alpha XP ISP
V0.0.0.1

4. Start **FXMProgrammer**.
5. Select a COM port from the drop down list of available ports.

Serial Ports -> Refresh Ports refreshes COM ports in the drop down box top right)

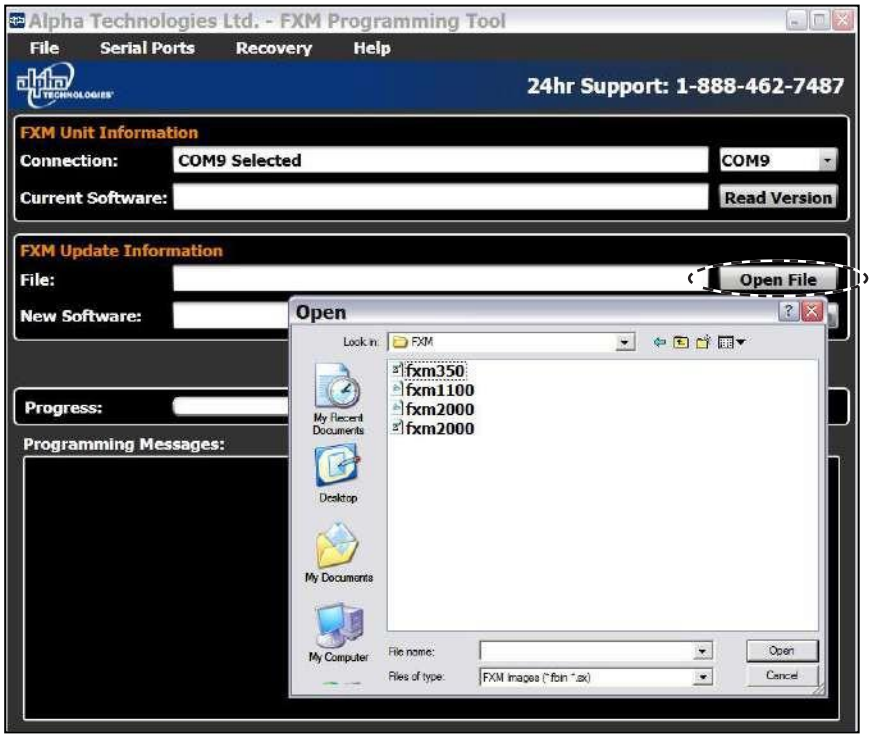


View available serial ports with Serial Ports -> List Ports.

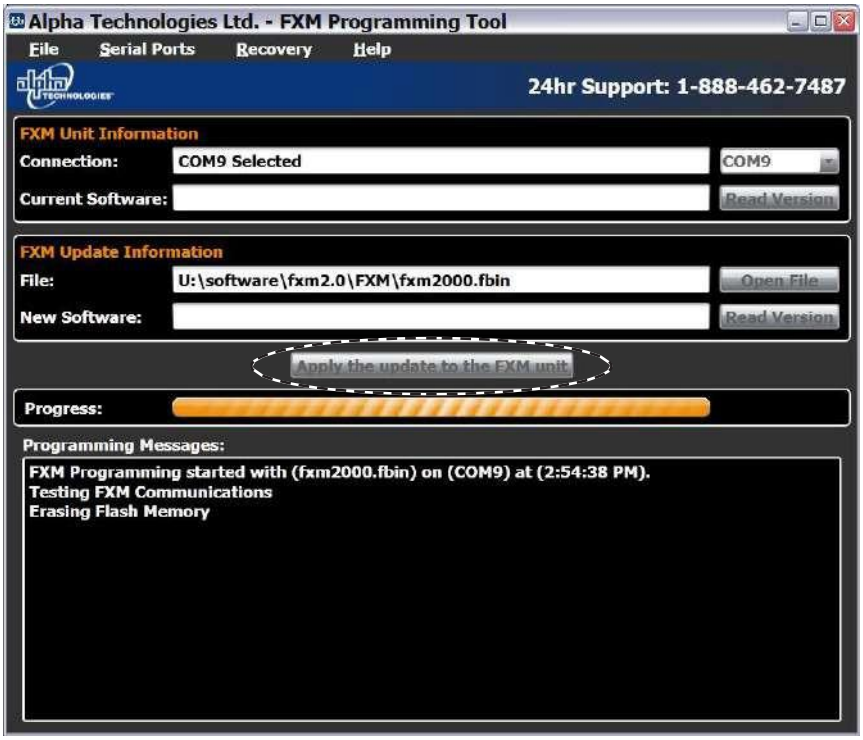
Displays the software version currently installed on the FXM

Displays the software version about to be installed on the FXM.

6. Click on **Open File** to browse to the software file location (only .sx or .fbin files are supported)



7. Click on **Apply the update to the FXM unit**.
8. Watch the progress bar and the **Programming Messages** window. (If there is a connection or any other kind of error, click on **Apply the update again**.)



9. The FXM will reset automatically once the upgrade is finished. Check if the LCD logo screen appears as follows:

Alpha	**120/60/N**
FXM2000	**LINE**

10. If upgrade was not successful, try to install the firmware again.
11. If the upgrade failed, copy “Programming Messages” text and provide it to alpha tech support.
12. Close **FXMProgrammer** application after upgrade is finished.

7.1.2 Upgrading using the Web Interface

This feature is available if the FXM has a network interface card. See the procedure in Section "6.3.6 Upgrade Files" on page 50.

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.

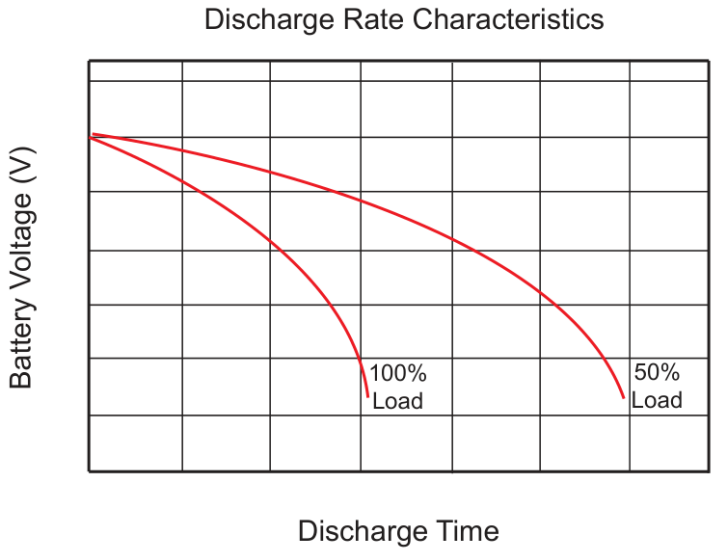


Figure 57 — Typical Discharge Characteristics for Lead Acid Batteries

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.

Table O — Battery Temperature Compensation Values

Battery Temperature	Reference Value New 180GXL	Suspect Value
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 AOE Technical Support (+49 9122 79889 0) 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 > 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 2V 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.

Table P — Alarm Submenu

LCD Shows	Problem Description	What To Do
Over Load	The Alpha FXM is overloaded.	Remove excess loads.
Batt Temp High	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.
Batt Temp Low	The battery temperature is below the specification limit.	Use optional battery heating mats or heater. Contact Alpha technical support to place the order.
Batt Low Warning	The batteries are almost discharged. Also see Low Battery Warning in "UPS Maintenance > Battery" on page 38.	Ensure that the Alpha FXM charger is working. If the charging voltage is low, the battery may need to be replaced.
FAN Alarm	The fan has failed.	Contact Alpha technical support. The fan is not a replaceable part.
Temp Probe Unplug	The temperature probe is unplugged.	Plug it back into the Alpha FXM or change the probe.
User Input Alarm	When the user input is shorted. See "UPS Maintenance > User Input" on page 46	Check the user input parameters.
In Freq Out Of Range	The line frequency is outside of the Alpha FXM allowable range. The Alpha FXM goes into Inverter mode.	Info only.
Weak Battery	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.
Battery Test	The Alpha FXM is performing a battery test.	Info only.
Batt Breaker Open	The battery breaker is opened.	Ensure the battery breaker is functioning.
DC_Overload	Batteries lose their ability to store power as they age. When a battery string is charging, the status of the battery voltage is checked every three minutes. An alarm is generated if the battery voltage continues to drop while the batteries are charging.	Info only.
Keep Alive Failure	The Alpha FXM failed to restore communication by resetting power using keep alive feature	Turn off keep alive feature to clear the alarm.
AC Breaker Open	The AC breaker is open.	Ensure the AC breaker is functioning.

Table Q — Fault Submenu		
LCD Shows	**Problem Description**	**What To Do**
Overload Fault	The load draws more power than the Alpha FXM can provide. This can lead to an automatic Alpha FXM shutdown.	Remove excess loads.
Short Circuit	The load has a short.	Check the output. Remove the faulty load if necessary.
Intl Temp Fault	The Alpha FXM 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.
Output Over Voltage	The output voltage is above or below the Alpha FXM specifications.	Info only.
Output Voltage Low		
Battery Fail	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.
Backfeed	A relay inside the Alpha FXM has failed. It cannot be fixed in the field.	**DANGER:** Do NOT touch the AC input terminals. Contact Alpha Technical Support.
Battery Over Voltage	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.
Batt Volt Low	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.

Table R — Problems Not Reported by System		
LCD Shows	**Problem Description**	**What To Do**
No LCD display even when the Alpha FXM is powered on	The LCD may not function below -15ºC. This does not affect the normal operation of the Alpha FXM.	Bring the operating temperature above -15ºC and the LCD display will gradually resume operation.
Date and time reset to 00:01:00 and 00:00:00	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. **Caution**: This must be performed by a qualified service personnel. Dispose of used batteries according to your local laws and jurisdictions.

9. Specifications

Table S — Mechanical Specifications

Parameter	Value			
Dimensions H x W x D mm (in)	FXM 1100-2000: 5.22 x 15.5 x 8.75 (133 x 394 x 222) FXM 650: 3.47 x 17 x 9 (89 x 432 x 229)			
Weight without batteries kg (lb)	FXM 650: 25 (11.3) FXM 1100-2000: 35 (15.9)			
Color	Black			
Mounting	Shelf, rack or wall; horizontal or vertical mount.			
Humidity	Operating (non-condensing): Up to 95% Storage: Up to 95%			
Cooling	Method of cooling: forced convection (fan cooled) Maximum heat release: see table below			
		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/ft² (155 W/m²) / 105.5 W/ft² (3723 W/m²)
	FXM650-48	9 W	143 W	4.4 W/ft² (155 W/m²) / 69.5 W/ft² (2452 W/m²)
	FXM1100-48	22 W	242 W	7.3 W/ft² (258 W/m²) / 78.4 W/ft² (2775 W/m²)
	FXM2000-48	41 W	439 W	13.2 W/ft² (469 W/m²) / 142.5 W/ft² (5046 W/m²)
	* Based on installation in an equipment rack with 26” overall width and 12” depth, with 30" maintenance aisle and 24" wiring aisle.			
Sound power level	LWAd = 59 dBA with fan at maximum speed.			
Mounting	Shelf, rack or wall; horizontal or vertical mount.			
Temperature Range[1, 2], °C **FXM 650** **FXM 1100/2000**	Operating: -40 to 55 Storage: -40 to 75 Operating: -40 to 50 [3] for 120 Vac unit, -40 to 50 for 230 Vac unit Storage: -40 to 75			
Altitude, m (ft) **Operating** **Storage**	Operating: Up to 3700 [4] (12,000) Storage: Up to 4600 (15,000)			
AC input and output connectors	Terminal block, Weco p/n 324-HDS/03 or equivalent (max 10 AWG)			
Dry contact connectors	Terminal block, mating plug JITE p/n PTB750B-03-1-03-3 or equivalent (max 16 AWG)			
RS-232 connector	DE-9 Female			
Ethernet connector	Optional, factory installed RJ-45			
Dry contacts	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: C1: On Battery C2, C3 [5]: Low Battery C4: Load Shed Timer1 C5: Alarm C6: 48 Vdc for an external fan, can be factory configured as a dry contact			

Table S — Mechanical Specifications	
Parameter	**Value**
User inputs	Three optically-isolated and powered inputs are located on the front panel. When they are shorted, their functions are: S1: Starts the self-test. S2: Activates an alarm. S3: Unit shutdown.
User interface[6]	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 T — Electrical Specifications	
Parameter	**Value**
Input	
Voltage (nominal), Vac	120 or 230, optional 208, 210, 240 for FXM 2000, 120 only for FXM 650-48
Frequency, Hz, ±5%	60/50 (auto-detection), Output frequency = Input frequency
Current, Amps (@ nominal Vin and max battery charging current)	FXM 650-24: 8.7/4.5 @120/230 Vac FXM 650-48: 10.5 @120 Vac FXM 1100: 15.5/8 @120/230 Vac FXM 2000: 20/12 @120/230 Vac
Input Circuit Breaker Ratings, Amps	FXM 650-24: 15/10 @120/230 Vac FXM 650-48: 15 @120 Vac FXM 1100: 20/10 @120/230 Vac FXM 2000: 25/15 @120/230 Vac
Battery Circuit Breaker Ratings, Amps	FXM 650-48/1100: 50 FXM 650-24/2000: 80
Output	
Voltage (nominal), Vac	120 or 230, optional 208, 210, 240 for FXM 2000, 120 only for FXM 650-48
Frequency, Hz, ±5%	60/50 (output frequency = input frequency.)
Power, W/VA	FXM 650: 650 FXM 1100: 1100 FXM 2000: 2000
Waveform	Pure sine wave
Load Crest Factor	3:1 (load dependent)
Output Voltage Distortion	< 3% THD (resistive load)
Efficiency[7] **Normal Mode** **Backup (Inverter) Mode**	 > 98% > 82% (48 Vbatt), >75% (24 Vbatt)
Transfer Time, mS **AVR to Backup** **Backup to AVR**	 5 (typical) 5 (typical)
Line Qualification Time	3 seconds (factory default), user adjustable in increments of 1 sec until 1 minute, and then in increments of 1 minute to 15 minutes max.
Battery String Voltage	FXM 650 - 24: 24 Vdc FXM 650 - 48/1100/2000: 48 Vdc

Table T — Electrical Specifications	
Parameter	**Value**
Battery Charger Current, Amps	FXM 650: 10 FXM 1100/2000: 15.
Battery Charger Temperature Compensation [8]	-5 mV/°C/Cell (factory default), user adjustable from 0 to -6 mV/°C/Cell in increments of 0.5.
Battery type	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.

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

Table U — Regulatory	
Parameter	**Value**
Electrical Safety	UL 1778, CSA 107.3, EN 62040-1-2, EN60950-1.
Emission	FCC Part 15, Subpart B, Class A, CSPR22, EN55022 Level A.
Marks	C CSA US, CE (230 Vac versions only).
Packaging	Designed to meet requirements for ISTA program.

10. Warranty

Alpha Technologies Ltd warrants all equipment manufactured by it to be free from defects in parts and labor, for a period of three 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.

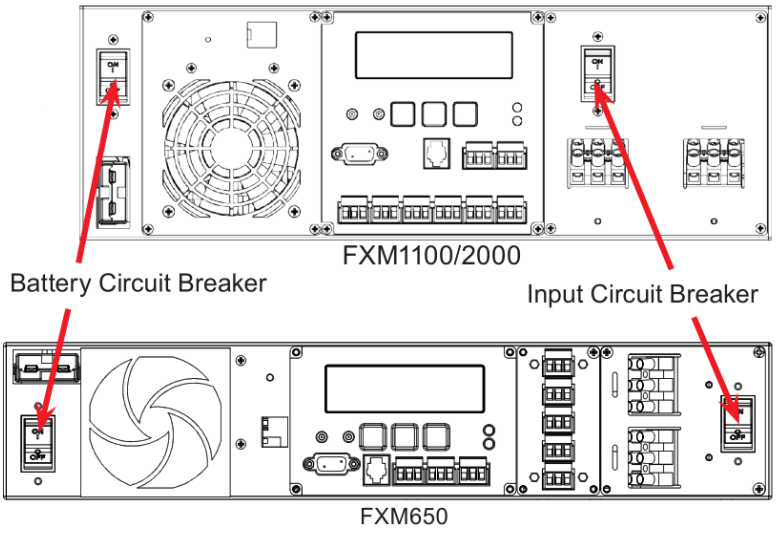
The customer is responsible for all shipping and handling charges. Where products are covered under warranty AOE will pay the cost of shipping the repaired or replacement unit back to the customer.

For details see the Alpha website www.alpha-outback-energy.com

11. Emergency Shutdown Procedure

The Alpha FXM UPS contains more than one live circuit. In an emergency, line power may be disconnected at the UPS 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 _____

Appendix A - Peukert Number and Battery Capacity

A.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.

A.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 W / 24 V = 6.25 A.

3. Find the current discharge ratings table in the data sheet. From the table, pick two current discharge values (I1 and I2) that are closest to the calculated load current and look up the two discharge hours (R1 and R2).
4. Use the following formula to calculate Peukert's number and capacity:

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

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

A.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:

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

A.4 Example

The following example shows how to calculate Peukert's number and capacity from a configured battery string. Consider four Alpha 195GXL 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.

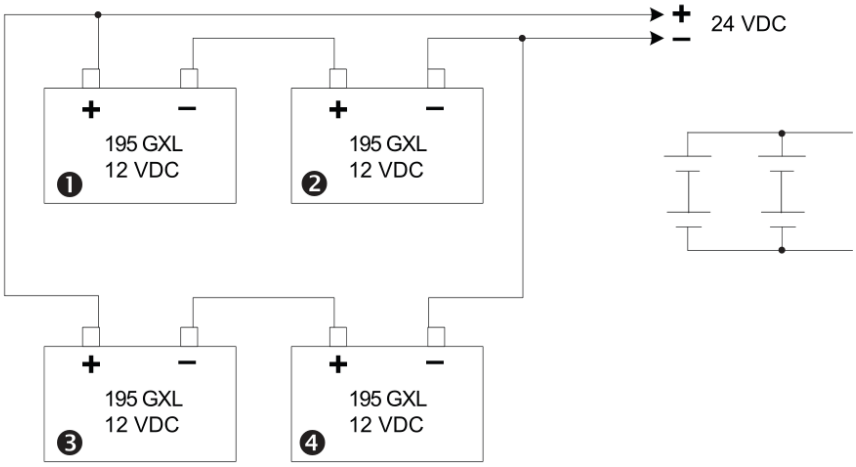


Figure 58 — Battery string example

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 Table in Amps (End Voltage 1.75VPC)

Hours:	1	2	3	4	6	8	10	12	20	24	48	72	100
195 GXL-FT:	69.2	38	26.8	21.1	15.2	12	9.9	8.5	5.5	4.60	2.31	1.56	1.13
225 AGM-FT:	81	43.1	30.3	23.7	16.7	12.9	10.4	8.9	5.7	4.80	2.43	1.62	1.18

3. From the table, I1 = 15.2A, I2 = 12A, R1 = 6 hrs, R2 = 8 hrs.

From Equation (1) earlier:

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

$$n = \frac{\text{Log}\,(8/6)}{\text{Log}\,(15.2) - \text{Log}\,(12)} = 1.217$$

From Equation (2) earlier

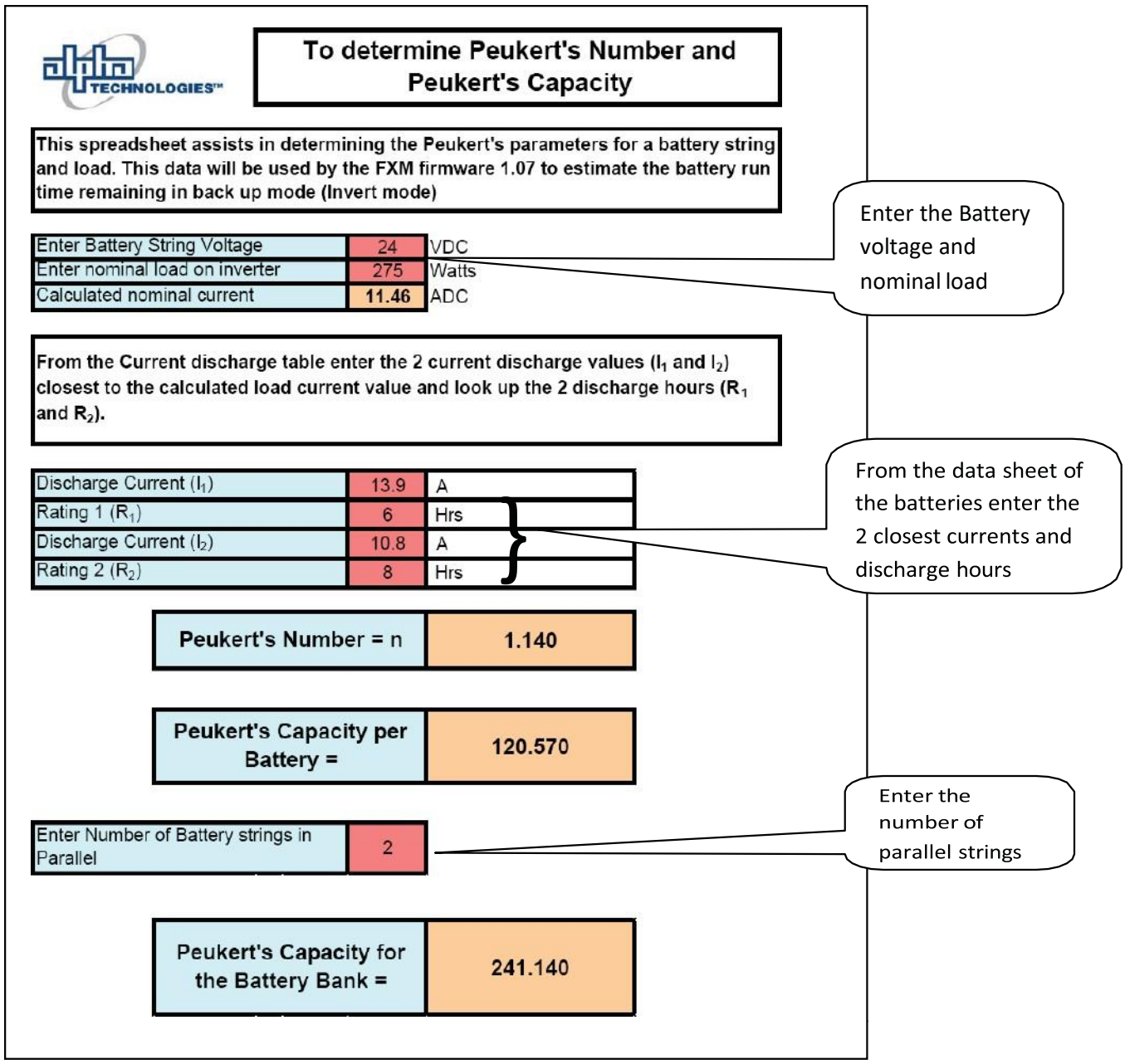
$$\text{Peukert's capacity} = (I_1)^n \times R_1 \quad \text{per battery}$$

$$= 15.2^{\,1.217} \times 6$$
$$= 166.00 \text{ Ah per battery}$$

4. The Peukert's capacity for the series combination (Batteries #1 and #2) is 166.00 Ah.
5. The Peukert's capacity for the parallel combination (Batteries #1, #2 and #3, #4) is 2 x 166.00 Ah = 332.00 Ah.

A.5 Using the Spreadsheet

Download the spreadsheet “Peukert’s Parameters Calculator.xls” from www.alpha.ca website.

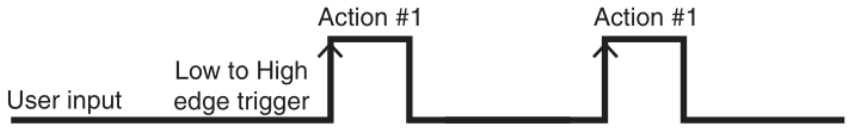


Appendix B - Types of Triggers

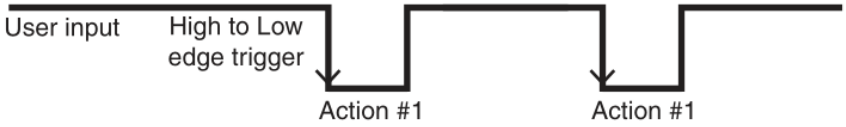
There are 3 types of trigger:

B.1 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).



(a) Level = High
User Input = Low to High, Action #1 is triggered
User Input = High to Low, no action triggered

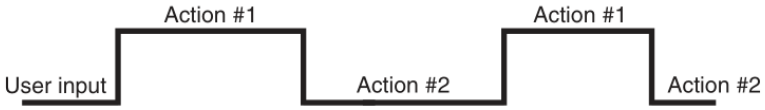


(b) Level = Low
User Input = High to Low, Action #1 is triggered
User Input = Low to High, no action triggered

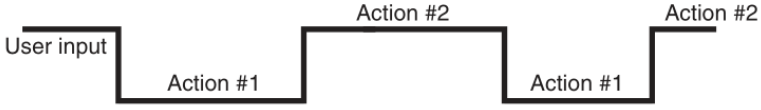
Figure 59 — Edge Trigger

B.2 Level Toggle

When the Level is set to High, the Alpha FXM is triggered to perform the other action when the user input chang- es 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.



(a) Level = High
User Input = Low to High, Action #1 is triggered
User Input = High to Low, Action #2 is triggered

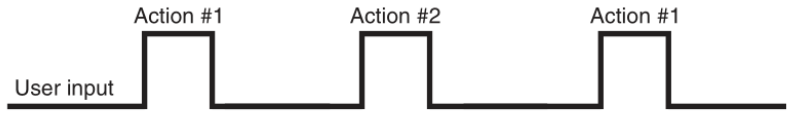


(b) Level = Low
User Input = High to Low, Action #1 is triggered
User Input = Low to High, Action #2 is triggered

Figure 60 — 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 61 — Level Alternative

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