

# UPS Solution General Handbook

Part no.  
**667/HB/47750/000**

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Preface

## SAFETY INFORMATION

### Safety of Installation and Maintenance Personnel



In the interests of health and safety, when installing, using or servicing this equipment the following instructions must be noted and adhered to:

- (1) Only skilled or instructed personnel, with relevant technical knowledge and experience, who are familiar with the safety procedures required when dealing with modern electrical/electronic equipment, are to be allowed to use and/or work on this equipment. All work shall be performed in accordance with the Electricity at Work Regulations 1989.
- (2) Such personnel must take heed of all relevant notes, cautions and warnings in this Handbook and any other Document or Handbooks associated with this equipment.
- (3) The equipment must be correctly connected to the specified incoming power supply.
- (4) Mains voltages may be present within traffic system. Before any maintenance work within the system is carried out, any mains supply to it must be isolated or switched off.
- (5) Mains voltages may still be present within traffic equipment even when the site mains supply has been isolated or switched off. The UPS Solution must be completely off to ensure no mains power is supplied to connected traffic equipment.
- (6) Only trained / competent persons should work on this equipment.
- (7) Surfaces within the associated traffic equipment get hot, e.g. lamp, lens and reflector. Therefore care should be taken when working in such areas.
- (8) Any power tools must be regularly inspected and tested.
- (9) Any ladders used must be inspected before use to ensure they are sound and not damaged.
- (10) When using a ladder, before climbing it, ensure that it is erected properly and is not liable to collapse or movement. If using a ladder near a carriageway, ensure that the work area is properly signed and coned.
- (11) Any personnel working on site must wear the appropriate protective clothing with high visibility jackets and safety boots as a minimum.

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### Safety of Road Users



It is important that all personnel are aware of the dangers to road users that could arise during repair and maintenance of traffic control equipment.

Ensure that the junction area is coned and signed as necessary to warn motorists and pedestrians of any dangers and to help protect the personnel working on the site.

### Precautions for Safe Battery Handling and Storage



Keep battery containers tightly closed when not in use.

If the battery case is broken, avoid contact with any internal components or materials.

Do not handle near heat, sparks or open flames.

Protect battery containers from physical damage to avoid leaks or spills.

Place cardboard or other insulating material between layers of stacked batteries to avoid damage and short circuits.

Do not allow conductive material to touch the battery terminals. A dangerous short-circuit may occur and cause battery failure, fire, arcing, flash burns, etc.

Keep away from combustible materials, organic chemicals, reducing substances, metals, strong oxidizers and water.

Batteries must be charged in a ventilated area. General ventilation is acceptable.

Insulated tools must be used at all times and cases involving batteries.

For further information on proper battery handling see the Lead Crystal Battery User Manual – 667/HB/47764/000.

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## MAINTENANCE PROVISION (MP)

### Product Reference

UPS Solution – 667/1/44750/ETC.

### Installation and Commissioning

Methods of installation, configuration and commissioning are described in this handbook. In addition, there are a series of documents which have more specific detail but are supplied by the OEM (Original Equipment Manufacturer). These documents are listed in section 1.2 below.

### Spares and Maintenance

The UPS system elements are designed for 'return to base' repair with the exception of battery replacement.

### Modifications

There are no approved modifications for this product.

### Warning



Use of components other than those indicated within this document or modifications or enhancements that have not been authorised by Siemens will invalidate Type Approval of this product.

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## CHANGE HISTORY

Version	Date	Author	Change
1 - 4	Jan 2014	Ore Oluwatudimu	Produce Document
5	Nov 2014	Ashley Thorpe	Section 15 - added black outer case variant to parts list

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# 1 Introduction

## 1.1 Scope

This handbook provides a general description of the Siemens UPS Solution and its key elements, outlining the detailed procedures for installation, commissioning and maintenance.

## 1.2 Related Documents

Reference	Title	Author/Contact
667/HB/47760/000	Alpha FXM Series UPS Installation and Operation Manual	Alpha Technologies Europe Ltd.
667/HB/47761/000	Alpha Universal Automatic Transfer Switch Installation Manual	Alpha Technologies Europe Ltd.
667/HB/47764/000	Lead Crystal Battery User Manual	Betta Batteries
667/US/47764/000	Lead Crystal Battery Material Safety Data Sheet	Betta Batteries
667/HE/45950/000	ST950 ELV Installation, Commissioning and Maintenance Handbook	Dave Martin
667/HE/46950/000	ST950 LV Installation, Commissioning and Maintenance Handbook	Dave Martin
667/HB/45040/000	Isolators and Feeder Pillars General Handbook	Peter Lings

## 1.3 Definitions

Abbreviation	Explanation
UPS	Uninterruptable Power Supply
UATS	Universal Automatic Transfer Switch
LC	Lead Crystal (refers to battery technology)
VRLA	Valve Regulated Lead Acid (refers to battery technology)
SOC	State of Charge
SNMP	Simple Network Management Protocol
LAN	Local Area Network
MCB	Miniature Circuit Breaker
LCD	Liquid Crystal Display
GUI	Graphical User Interface
OTU	Outstation Transmission Unit
OMU	Outstation Monitoring Unit
OEM	Original Equipment Manufacturer

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## 2 System Overview

### 2.1 Description

The UPS Solution has been designed to provide seamless battery support to a Siemens type traffic controller in the event of a loss of mains supply. The solution offers a line-interactive uninterruptable power supply unit to constantly monitor the status of the mains supply, maintaining a battery bank when power is present and switching to battery back up when it is not. The switch from mains power to battery back up, and back again, is almost instantaneous, ensuring that the traffic intersection controller sees no significant break in power and remains operational.

The UPS Solution can be scaled to suit a range of power and battery hold up time requirements. Hold up times can be extended further still with the connection of an external generator as described in section 2.4.

### 2.2 Cabinet Variants

The UPS solution has been designed to be housed within a standard Siemens traffic controller cabinet outer case to reduce its visual impact. When installed, the controller and UPS solution cabinets appear identical. Two cabinet variants are available, as described below.

**UPS Cabinet -** Houses the UPS system equipment and up to two 48V 55Ah battery banks.

**Battery Expansion Cabinet -** Houses up to three 48V 55Ah battery banks only. The Battery Expansion cabinet can be installed alongside the UPS cabinet, providing additional battery support in cases when an extended period of support time is required.



**WARNING:** No more than one Battery Expansion Cabinet can be connected to any one UPS Cabinet.

### 2.3 Supported Loads

The UPS solution is ideally suited to support **ELV/LV LED traffic controllers only**. It caters for intersection loads up to 2000W in two optimised steps via a choice of UPS unit:

UPS Unit	Max Power Output	Suitable for
Alpha FXM1100	1100W / VA	Loads up to and including 1000W
Alpha FXM2000	2000W / VA	Loads from 1000W to 2000W

**Table 2-1: UPS Load Suitability**



**WARNING:** Both units are subject to de-rating at high temperature. This must be considered when specifying each solution. See sections 4.1 and 12.5.1 for details. See section 5.2 for a solution sizing example.

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## 2.4 Generator Connectivity

The UPS solution offers the possibility of connecting up an external diesel generator through a specially design support product, the Generator Connect Feeder Pillar. This feeder pillar variant incorporates a lockable cable entry point, a 2P+E<sup>1</sup> IP44 rated appliance inlet connector and a 63A double-pole changeover switch for isolation and source selection.

Detailed information on the Generator Connect Feeder Pillar is available in the Isolators and Feeder Pillar General Handbook – 667/HB/45040/000. See section 7 for external cabling scheme.

## 2.5 Electrical Information

Parameter	Value
<b>Input:</b>	
Voltage	230Vac (150Vac – 328Vac without switching to battery support)
Frequency	50Hz / 60Hz Auto-detect (±5%)
Current (at max battery charging current)	FXM1100: 8A at 230Vac FXM2000: 15A at 230Vac
Mains Input Circuit Breaker Rating	20A at 230Vac
<b>Output:</b>	
Voltage	230Vac
Frequency	50Hz / 60Hz Auto-detect (±5%)
Maximum Power <sup>2</sup>	FXM1100: 1100 W/VA FXM2000: 2000 W/VA
Waveform	Pure Sine Wave
Switching Time	<5ms
Voltage Distortion	<3% THD
Efficiency	Normal mode (LINE): >98% Battery support mode (INVERTER): >82%
<b>Battery Charging:</b>	
Charge Current	10A
Temperature Compensation	-5mV/°C/Cell
Battery Type	12V 55Ah Valve Regulated Lead Crystal
<b>Environment:</b>	
Operating Temperature	-25°C to +74°C
Operating Altitude	12000ft
Operating Humidity	Up to 95%

Table 2-2: UPS Solution Electrical Information

<sup>1</sup> Two Pole and Earth

<sup>2</sup> Power output de-rates in high ambient temperatures. See sections 4.1 and 12.5 for details.

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## 3 Modular Overview

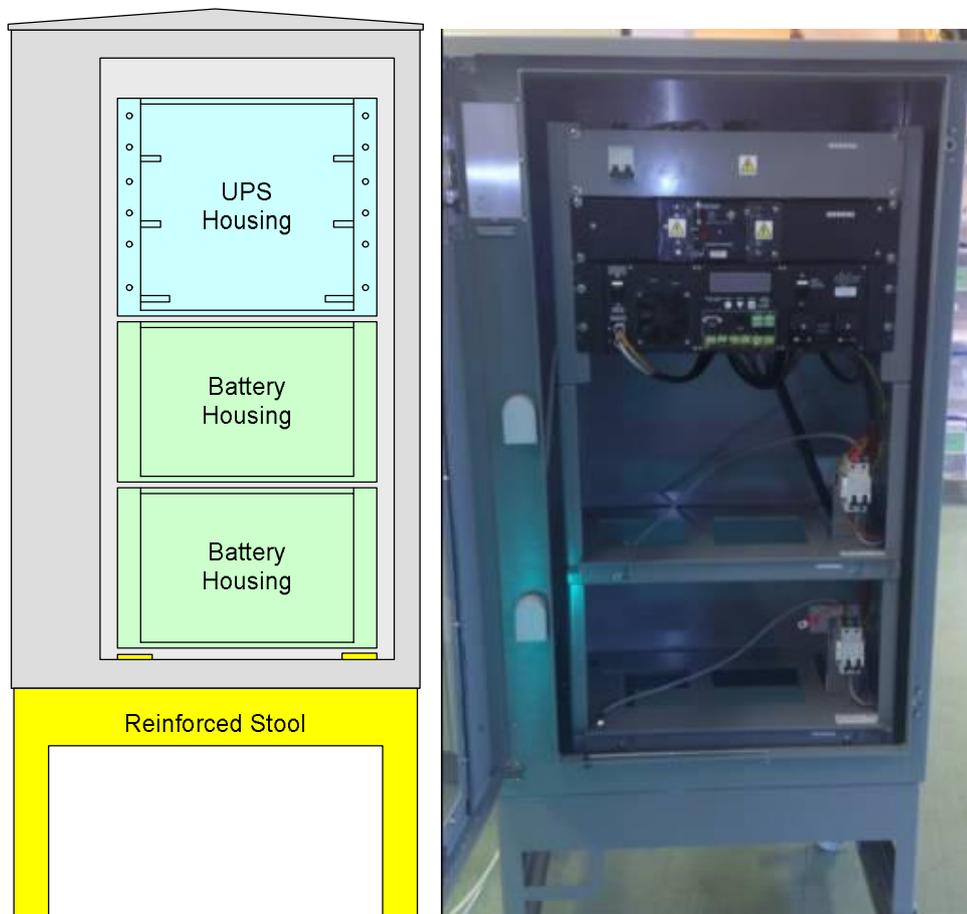
This section details the five key building blocks of the UPS Solution; the stool, cabinet outer case and three equipment housing modules.

### 3.1 UPS Cabinet Modules

Table 3-1 and Figure 3-1 show the modules involved in making up the UPS cabinet.

UPS Solution Modules	Quantity	Refer to
Reinforced Stool	1	Section 3.3.1
Vented Cabinet Outer Case	1	Section 3.3.2
Battery Housing	2 (maximum) <sup>3</sup>	Section 3.3.3
UPS Housing	1	Section 3.3.4
DC Housing	0	N/A

**Table 3-1: UPS Cabinet Module Quantities**



**Figure 3-1: UPS Cabinet Modules**

<sup>3</sup> The UPS Cabinet can be fitted with only 1 Battery Housing module in cases where reduced battery support is required.

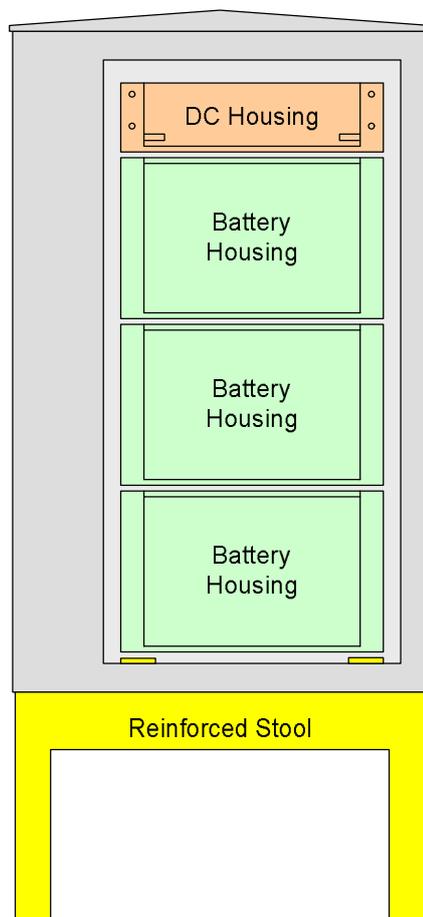
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## 3.2 Battery Expansion Cabinet Modules

Table 3-2 and Figure 3-2 show the modules involved in making up the Battery Expansion Cabinet.

UPS Solution Modules	Quantity	Refer to
Reinforced Stool	1	Section 3.3.1
Vented Cabinet Outer Case	1	Section 3.3.2
Battery Housing	3 (maximum) <sup>4</sup>	Section 3.3.3
UPS Housing	0	N/A
DC Housing	1	Section 3.3.5

**Table 3-2: Battery Expansion Cabinet Module Quantities**



**Figure 3-2: Battery Expansion Cabinet Modules (Cabinet removed)**

<sup>4</sup> The Battery Expansion Cabinet can be fitted with one, two or three Battery Housing modules allowing each solution to be tailored to the customer performance requirements.

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## 3.3 Modular Elements

### 3.3.1 Reinforced Cabinet Stool

#### UPS Cabinet and Battery Expansion Cabinet

The Reinforced Cabinet Stool is a load bearing replacement to the normal ST950 cabinet stool. It provides mounting points for the cabinet outer case and internal housing modules as well as a CET plate for cables entering and exiting the cabinet via underground ducting.

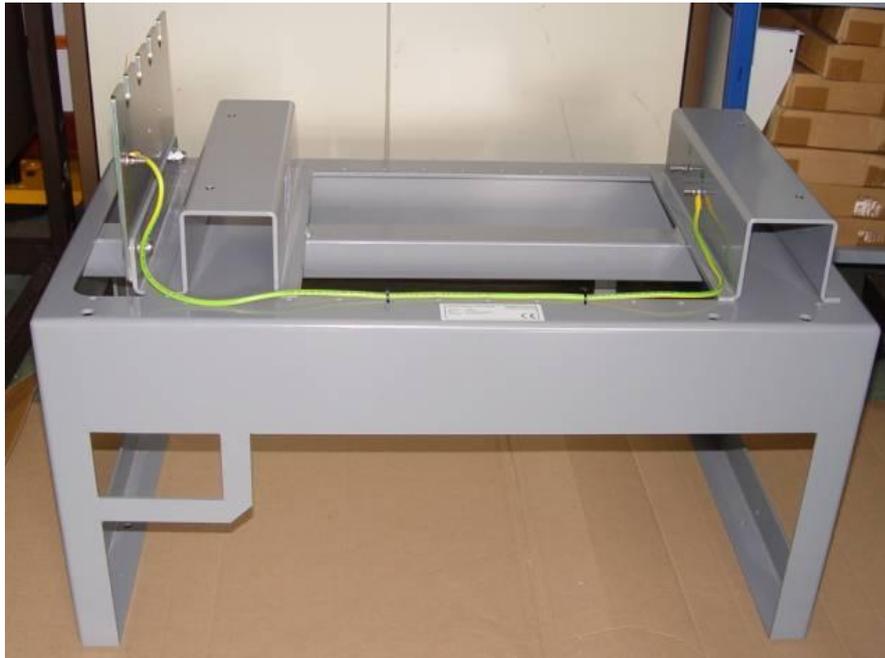


Figure 3-3: Reinforced Stool – FRONT VIEW (CET plate attached)

### 3.3.2 Vented Cabinet Outer Case

#### UPS Cabinet and Battery Expansion Cabinet

Plastic ventilation devices have been added to the ST950 outer case to provide the additional airflow required by UPS system equipment. The vents are fitted behind the cabinet's front door and are invisible when the door is closed.

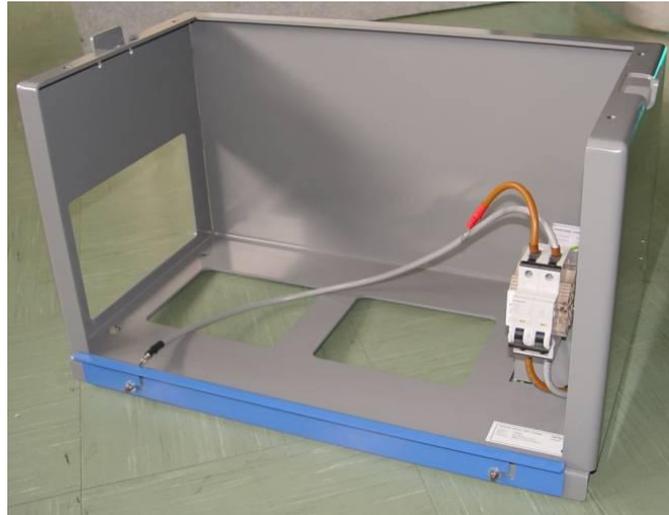
### 3.3.3 Battery Housing Module

#### UPS Cabinet and Battery Expansion Cabinet

The Battery Housing module is the main building block of the internal mounting frame. It provides mounting and connectivity for one 48V 55Ah battery bank, made up of four individual batteries. A 63A double-pole MCB on the right hand side provides isolation, allowing the batteries to be removed and replaced whilst the UPS Solution is still powering the intersection, and a simple battery connector gives easy plug-and-play connectivity to the rest of the system.

Battery Housings are stackable and are designed to slide into place on top of each other for ease of installation. A bar, fitted to the front of each module, can be raised to form a lip for battery retention.

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**Figure 3-4: Battery Housing Module**



**NOTE:** The Battery Housing Module **does not** come with batteries fitted. Batteries are shipped separately and should only be mounted at the end of installation.

### 3.3.4 UPS Housing Module

#### UPS Cabinet ONLY

The UPS Housing contains the key system hardware and is the main control and connectivity hub for the entire UPS solution. It contains the UPS unit and UATS (as described in sections 4.1 and 4.2) as well as a UPS Connection Panel that provides termination for internal and external cabling related to the entire UPS Solution, including mains input and output, Battery Expansion Cabinet connection and fault-monitoring relay contacts. A 20A double-pole MCB provides mains input isolation. Wiring of the UPS Connection Panel is detailed in sections 6.1 and 9.8.



**Figure 3-5: UPS Housing Module**

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### 3.3.5 DC Housing Module

#### Battery Expansion Cabinet ONLY

The purpose of the DC Housing provides a Connection Panel similar to that found within the UPS Housing. This DC Connection Panel allows for the termination of internal and external cabling related to the Battery Expansion Cabinet only. A 63A double-pole MCB can be used to isolate the Battery Expansion Cabinet from the rest of the UPS Solution.

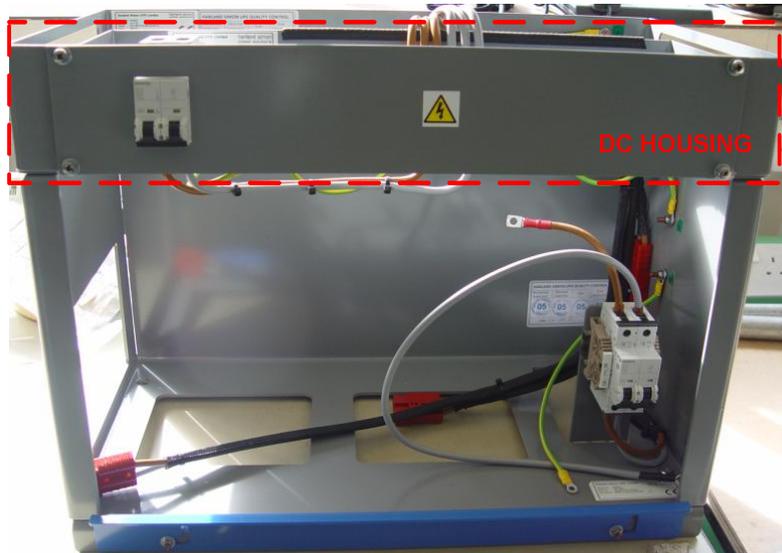


Figure 3-6: DC Housing Module (shown fitted on top of a battery housing module)

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## 4 Hardware Overview

### 4.1 Alpha FXM UPS unit

The Alpha FXM series from Alpha Technologies are outdoor, military grade, line-interactive Uninterruptible Power Supply units that have been selected for use within the Siemens UPS solution. The unit offers an extended operating temperature range and is well suited for use with ELV/LV LED type traffic controller equipment.



**Figure 4-1: Alpha FXM Series UPS Unit**

Each Siemens UPS solution uses one of two FXM series UPS units, depending on the power requirements of the traffic intersection to be supported.

**FXM1100** – Intersections up to 1kW

**FXM2000** – Intersections up to 2kW

Key information for each type of unit is listed here. For more detailed information, please see APPENDIX C – Hardware Datasheets or consult the FXM Series UPS Operating Manual – 667/HB/47760/000.

Parameter	FXM1100	FXM2000
Nominal Voltage	230VAC	
Nominal Frequency	50Hz / 60Hz	
Typical Efficiency	>98% (normal mode)	
Typical Transfer time	<5ms	
Operating Temperature	-40°C to +74°C	
<b>Power output:</b>		
At -40° to +50° (Nominal)	1100W/VA	20000W/VA
At 65° (UK Worst case)	962.5W/VA	1700W/VA
At 74° (Operating worst case)	838.75W/VA	1520W/VA
De-rating	1.25% per degree above 55°C	1.0% per degree above 50°C

**Table 4-1: FXM Series UPS – Key Electrical Information**



**NOTE:** Care must be taken when selecting a UPS unit if high temperatures are expected. See section 5 for a solution sizing information and 12.5.1 for further information on temperature de-rating.

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## 4.2 Universal Automatic Transfer Switch

The Universal Automatic Transfer Switch (UATS), also from Alpha Technologies, provides a manual bypass switch for maintenance purposes. It has been designed to work alongside the Alpha FXM UPS series and includes an automatic transfer facility that constantly monitors the output of the UPS unit and will switch the system to bypass if a fault is detected.



**Figure 4-2: Universal Automatic Transfer Switch**

Key information on the UATS is listed below. For further information on the unit, please see APPENDIX C – Hardware Datasheets or consult the UATS Installation Manual – 667/HB/47761/000.

Parameter	Value
Nominal Voltage	230Vac
Nominal Frequency	50Hz / 60Hz
Rated Input Current	16A
Rated Output Current	16A
Max. Output Power	3600W/VA (at +40°C)
Operating Temperature	-40°C to +74°C

**Table 4-2: UATS – Key Electrical Information**

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### 4.3 Lead Crystal Batteries

Battery back up within the Siemens UPS solution is provided by banks of 55Ah 12V front terminal Lead Crystal batteries. Each bank consists of 4 of these batteries, creating a 48V 55Ah pack. Lead Crystal batteries have a greatly extended operating temperature range and a longer life expectancy when compared to their Lead Acid equivalents.

For more detailed information, please see APPENDIX C – Hardware Datasheets or consult the Lead Crystal Battery User Manual – 667/HB/47764/000.



Specification		
Nominal Voltage	12V	
Rated Capacity (10 hour rate)	55AH	
Dimension	Total Height (Top of terminals)	225mm (8.86 inches)
	Height	222mm (8.74 inches)
	Length	277mm (10.90 inches)
	Width	106mm (4.17 inches)
Weight	Approx 18kg (39.65 lbs)	
Capacity (20°C)	120 hour rate(0.55A)	66AH
	20 hour rate(3.0A)	60AH
	10 hour rate(5.5A)	55AH
Internal Resistance	Fully charged Battery (20°C)	8mΩ
Self-Discharge (20°C)	Capacity after 3 month storage	95%
	Capacity after 6 month storage	85%
	Capacity after 12 month storage	80%
Max Discharge Current (20°C)	550A(5S)	
Terminal	Standard	F3
	Optional	
Charging (Constant Voltage)	Cycle	Initial Charging Current 16.5A or smaller 14.4V~14.8V/ (20°C)
	Float	13.5V~13.8V/ (20°C)

Figure 4-3: 6CNFT-55 Lead Crystal Battery with Key Electrical Information



**WARNING:** Great care must be taken when handling batteries. Ensure all relevant safety information has been read and understood before commencing any process involving the Lead Crystal batteries. See the safety information at the beginning of this document.

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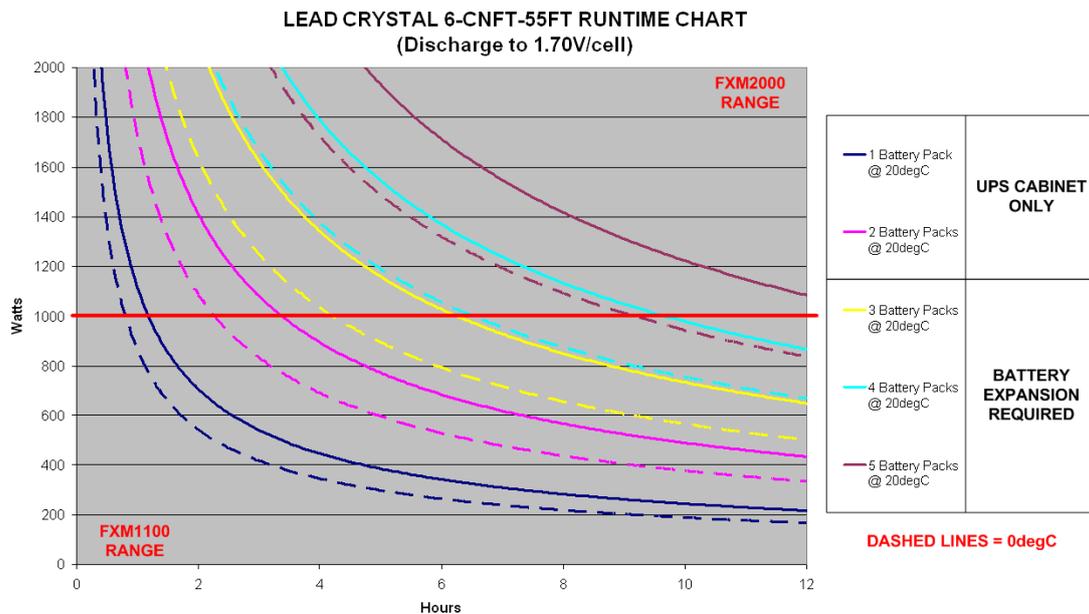
## 5 Sizing the UPS Solution

### 5.1 Key Considerations

There are two key factors to consider when sizing a UPS Solution for any one traffic intersection. These are the **junction power requirements** and the **desired battery hold up time**.

A traffic intersection's power requirements determine which of two Alpha FXM UPS units is to be installed. The required battery support hold up time determines the number of battery packs that will need to be installed within the UPS Solution. Extended hold up periods will require the installation of a Battery Expansion Cabinet alongside the UPS Cabinet.

Where cost or space is critical, a compromise between the junction power requirements and required hold up time must be reached. Reducing the required hold up time potentially decreases the number of battery packs to be installed. Reducing the junction power requirements, and therefore the UPS system output, will allow each battery pack to go further in terms of hold up time. Both options should be considered to meet installation requirements.



**Figure 5-1: Battery Hold up times at 20°C and 0°C**

Figure 5-1 displays a basic estimated battery hold up time chart for all options of the UPS Solution at nominal ambient temperature of 20°C. Dashed lines indicate the estimated hold up at 0°C. See APPENDIX A – Estimated Hold Up Times for a clearer view battery hold up against temperature.



**WARNING:** The chart shown in Figure 5-1 is a performance estimate based on manufacturer information to be used as a sizing guideline only.

Temperature extremes in both the hot and cold regions have detrimental effects on the performance of the UPS Solution. See section 12.5 for more information on temperature de-rating.

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## 5.2 Sizing Example

The following subsections give an example of sizing a UPS solution for a traffic intersection in the UK with the following requirements.

Required Junction Power: **900W**  
 Desired Hold up Time: **3.5 hours**



**WARNING:** For the majority of UK installations, it is reasonable to assume a worst case cabinet temperature range of **0°C to 65°C**. The UPS Solution **must be derated** to at least these values to help ensure correct operation.

### 5.2.1 Which UPS Unit Should be Installed?

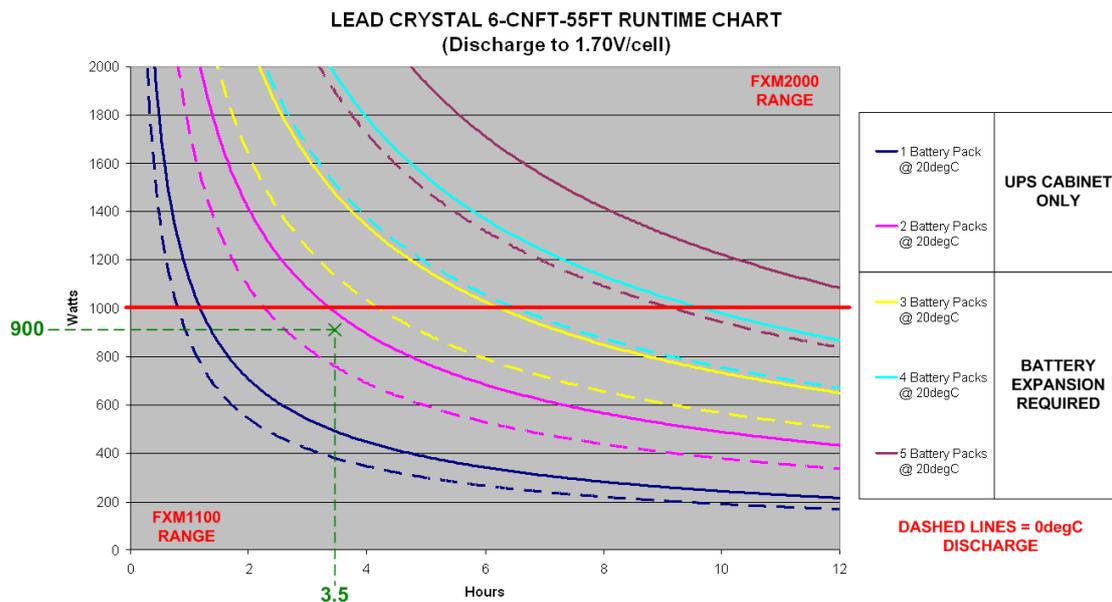
Derating the UPS units' power output to the reasonable UK worst case of **65°C** gives the following maximum output figures:

FXM1100 max. output at 65°C: **962.5W/VA**  
 FXM2000 max. output at 65°C: **1700W/VA**

A junction requiring 900W of power falls within the **FXM1100** range.

### 5.2.2 How Many Battery Packs are Required?

Derating the battery hold up performance to the reasonable UK worst case of **0°C**, two battery packs **are not** sufficient to support a 900W load for 3.5 hours. Three battery packs are required.



**Figure 5-2: Sizing Example – Battery Pack Selection**



**NOTE:** Any solution requiring 3 or more battery packs to achieve its desired hold up time will require the installation of a Battery Expansion Cabinet.

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## 6 Internal Cabling Scheme

The UPS Housing, DC Housing and Battery Housing modules all come fitted with pre-wired cable looms for ease of installation. The following subsections detail the internal wiring interconnecting key system elements in both the UPS and Battery Expansion cabinets.

### 6.1 UPS Cabinet Internal Wiring

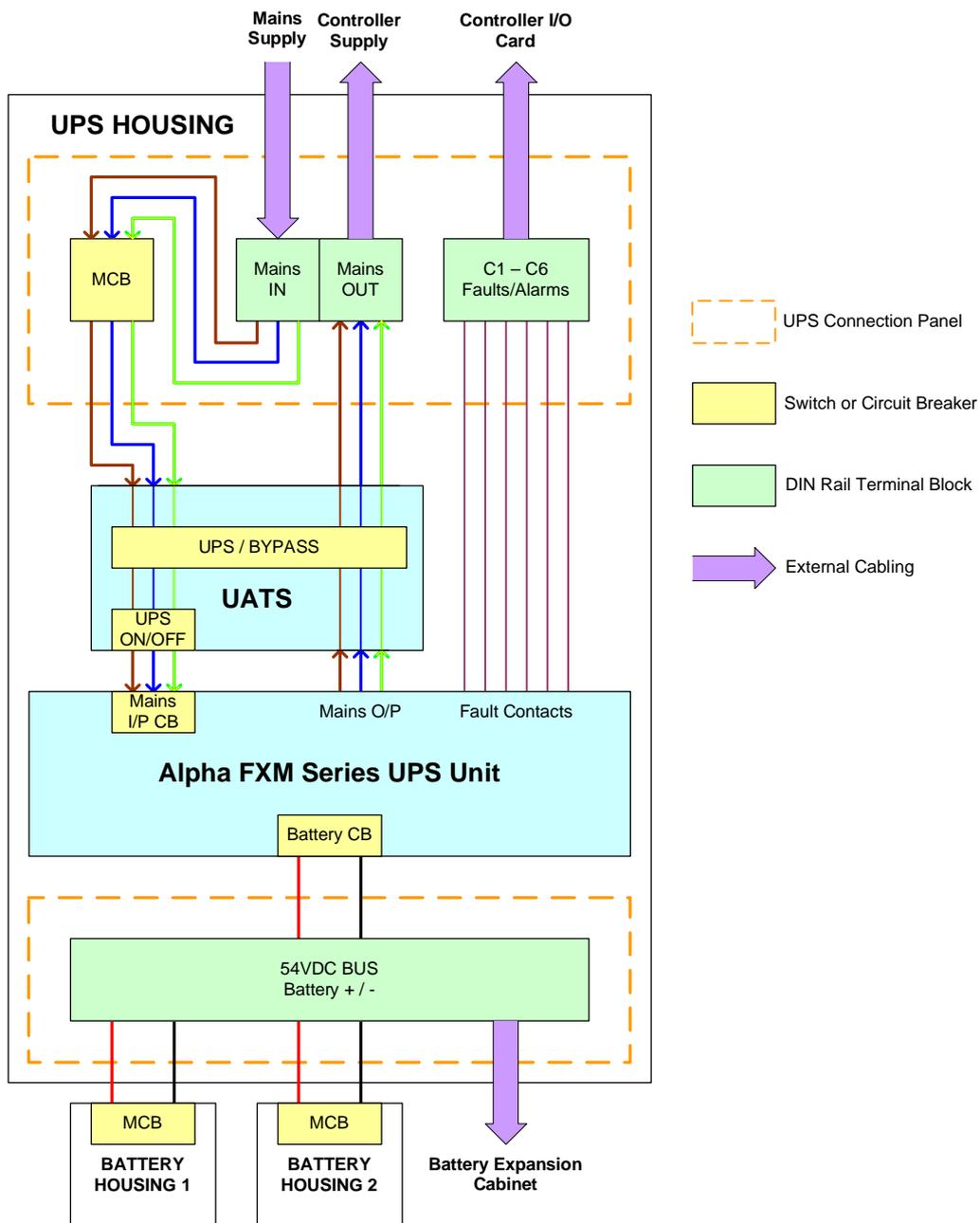


Figure 6-1: UPS Cabinet Internal Wiring Diagram

As stated in section 3.3.4, the UPS Housing module comes fitted and prewired with key system elements and all internal cabling. External cables are to be terminated within the UPS Connection Panel as part of the Installation process. See section 9.8 for details.

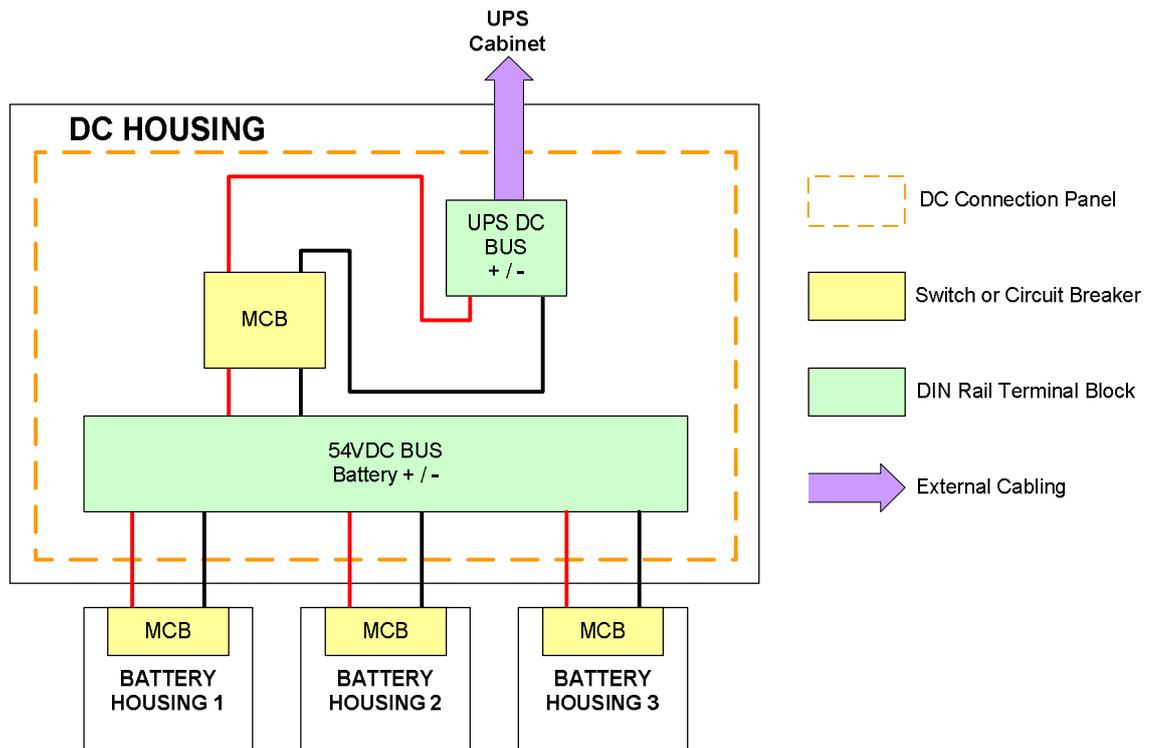
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Also shown within Figure 6-1 are the switches and circuit breakers used to isolate key parts of the solution. See section 10 for further information.



**WARNING:** The FXM Series UPS unit offers further connectivity not shown in Figure 6-1, some of which must be fitted for proper system operation. See section 8 for details.

## 6.2 Battery Expansion Cabinet Internal Wiring



**Figure 6-2: Battery Expansion Cabinet Internal Wiring Diagram**

As stated in section 3.3.3, the DC Housing comes prewired with all interconnecting wiring looms and the DC connection panel provides a termination point for all of these, as well as isolation from the UPS cabinet via a 63A double-pole MCB. Mains voltages are not present within the Battery Expansion cabinet.

Also shown within Figure 6-2 are the switches and circuit breakers used to isolate key parts of the solution. See section 10 for further information.

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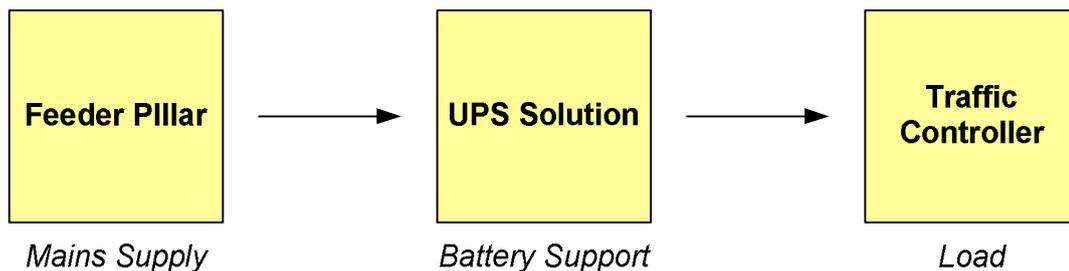
## 7 External Cabling Scheme

### 7.1 Mains Power Supply

All site installations should be designed in such a way that the controller cabinet, UPS cabinet, Battery Expansion cabinet (if required) and feeder pillar (generator connect or otherwise) are kept within the immediate vicinity of each other. Cable lengths between all pillars and cabinets should be minimized wherever possible.

3 core mains cable is to be used for the following connections:

- Mains supply within Feeder Pillar → UPS mains Input
- UPS mains output → ST950 Controller Mains input



**Figure 7-1: Mains Power Supply Chain**

Distances between all elements within the mains power supply chain should be kept to a minimum to reduce the impact of cable losses.

Cable size and length between the **feeder pillar** and **traffic controller** depend on the controller fusing and expected voltage drop, as dictated in the following document:

**667/HB/45040/000 – Isolators and Feeder Pillars General Handbook**

The UPS cabinet can be installed in any location between the feeder pillar and controller cabinet as long as the total cable length does not exceed the values specified in the above document.



**WARNING:** The same cable is to be used throughout the mains power supply chain from feeder pillar to controller.

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## 7.2 UPS Fault / Alarm Relay Contacts

A total of 18 relay contact termination points are made available via the UPS Connection Panel (Normally Closed, Normally Open and Common for six relay outputs). These can be cabled via ducting into the traffic controller for status and fault monitoring of the UPS Solution. See sections 9.8 and 12.2.1 for details.

Cable selection for this interconnection is dependant on the number of cores required to terminate all necessary contacts. Refer to Table 7-1 below.

Part Number	Description
998/4/70468/004	Armoured 1/1.13mm 8core PVC cable
998/4/70468/006	Armoured 1/1.13mm 12core PVC cable
998/4/70468/008	Armoured 1/1.13mm 16core PVC cable
998/4/70468/050	Armoured 1/1.13mm 20core PVC cable

**Table 7-1: Alarm Contact Cable Specification**

## 7.3 Ethernet Cable

When the FXM Series UPS unit's LAN interface feature is to be used, CAT5e cable is to be ducted into the controller cabinet and connected to an IP enable Ethernet connection.

Use the cable specified in Table 7-2 for this connection.

Part Number	Description
998/4/88384/000	Armoured CAT5E cable for duct installation

**Table 7-2: Ethernet Cable Specification**

See section 8.3 and 12.3.3 for LAN connection details.

## 7.4 Battery Expansion

Additional battery support from the Battery Expansion Cabinet is to be cabled into the UPS Cabinet using the following armoured cable.

Part Number	Description
998/4/88346/100	Armoured 10mm <sup>2</sup> 3core PVC Mains cable

**Table 7-3: Battery Expansion Cable Specification**



**WARNING:** This cable is to be clearly labelled to prevent confusion with Mains supply chain cabling. Only two of the three cores available are to be used for battery termination. The Green/Yellow core is to be used to link the main earth studs of the UPS and Battery Expansion Cabinets.

See sections 9.8 and 9.9 for installation details.

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## 8 Further UPS Connectivity

### 8.1 Battery Temperature Sensor

Each Alpha FXM UPS unit is fitted with a sensor that is used to monitor battery temperature. The sensor appears on a cable from the 'Battery Temp' port on the front of the FXM Series UPS unit and, when correctly applied to the battery support bank, enables temperature compensated battery charging.



**WARNING:** The Battery Temperature Sensor **must be fitted** for proper operation of the UPS solution.

For details on the proper installation of the battery temperature sensor, see section 9.12. See section 12.5.2 for more information on temperature compensated battery charging.

### 8.2 RS232 Interface

Alpha FXM UPS units are fitted with a female 9-way D-type connector for RS232 connectivity to a computer or laptop. Status information and configuration settings are made available via this interface and can be used to interrogate the UPS Solution when on site. See section 12.3.2 for more information on the RS232 interface.

### 8.3 LAN Interface

Alpha FXM series UPS units provide internet and intranet connectivity via an embedded SNMP (LAN) card and RJ45 connector. An IP based connection can be utilized for remote system configuration using the UPS unit's supporting software. See section 9.10 and 12.3.3 for more information on the fitting and using the UPS Solution's LAN Interface.



**NOTE:** The SNMP (LAN) card is fitted to all Alpha FXM UPS units within Siemens UPS Solutions **as standard**.

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## 9 Installation



**WARNING:** Ensure all power sources are switched off and safely isolated before installation commences. All switches and MCBs should be in the OFF or BYPASS position.

The UPS solution's modular sections have been designed with ease of installation in mind. Much of the solution comes prewired with simple plug and play interconnects between modules. The table below lists the steps required for installation of both the UPS cabinet and the Battery Expansion Cabinet.

Step No.	UPS Cabinet	Battery Expansion Cabinet	Refer to
1	Prepare and install the Reinforced Stool		Section 9.2
2	Pull and gland ducted cables		Section 9.3
3	Fit the Vented Cabinet Outer Case and seal the base		Section 9.4
4	Fit and connect the Battery Housing module(s)		Section 9.5
5	Mount and connect the UPS housing module	N/A	Section 9.6
6	N/A	Mount and connect the DC Housing module	Section 9.7
7	Terminate External cables into the UPS Connection panel	N/A	Section 9.8
8	N/A	Terminate External Cables into the DC Connection Panel	Section 9.9
9	Terminate and connect the Ethernet Cable	N/A	Section 9.10
10	Fit and connect the batteries		Section 9.11
11	Connect the Batt. Temp. sensor	N/A	Section 9.12

**Table 9-1: Installation Steps for the UPS and Battery Expansion Cabinets**

### 9.1 Required Tools and Consumables

- 14mm socket/spanner
- 10mm socket/spanner
- 10mm insulated spanner
- 5mm Alan key
- Terminal Screwdriver
- Cross-head screw driver
- RJ45 Crimp Tool
- Cable Ties
- Gorilla Tape<sup>5</sup>

<sup>5</sup> Or similarly industrial self-adhesive tape. Insulation or Electrical tape **is not acceptable**.

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## 9.2 Preparing and Installing the Reinforced Stool

Step No.	UPS Cabinet	Battery Expansion Cabinet	Refer to
1	Prepare and install the Reinforced Stool		Section 9.2



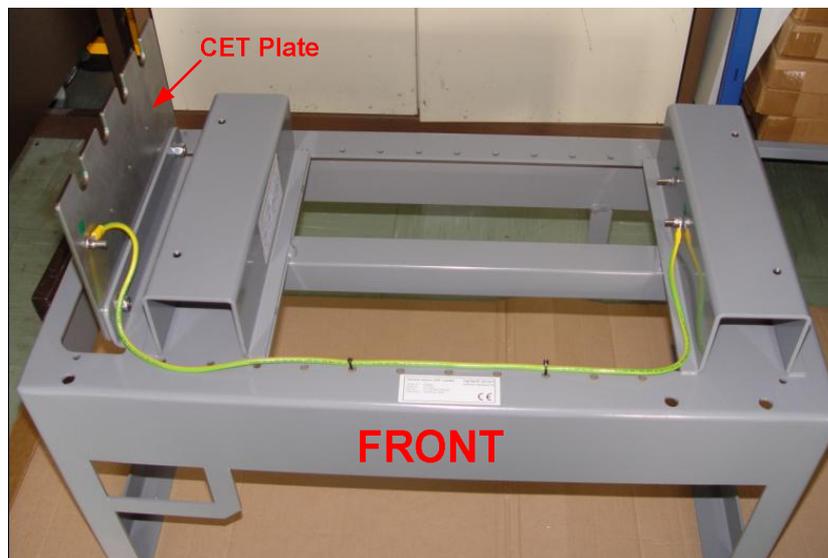
**WARNING:** Prior to installation of the Reinforced Stool, instruct the Civils Contractor as to the correct orientation of all cabinet stools, ensuring all cabinets on site will face the right way.

The reinforced stool is based on a normal controller cabinet stool and the installation process is much the same.



**WARNING:** Although similar, the normal ST800, ST900 or ST950 cabinet stool **must not** be used when installing the UPS Solution as it is not capable of supporting the total weight of all cabinet elements.

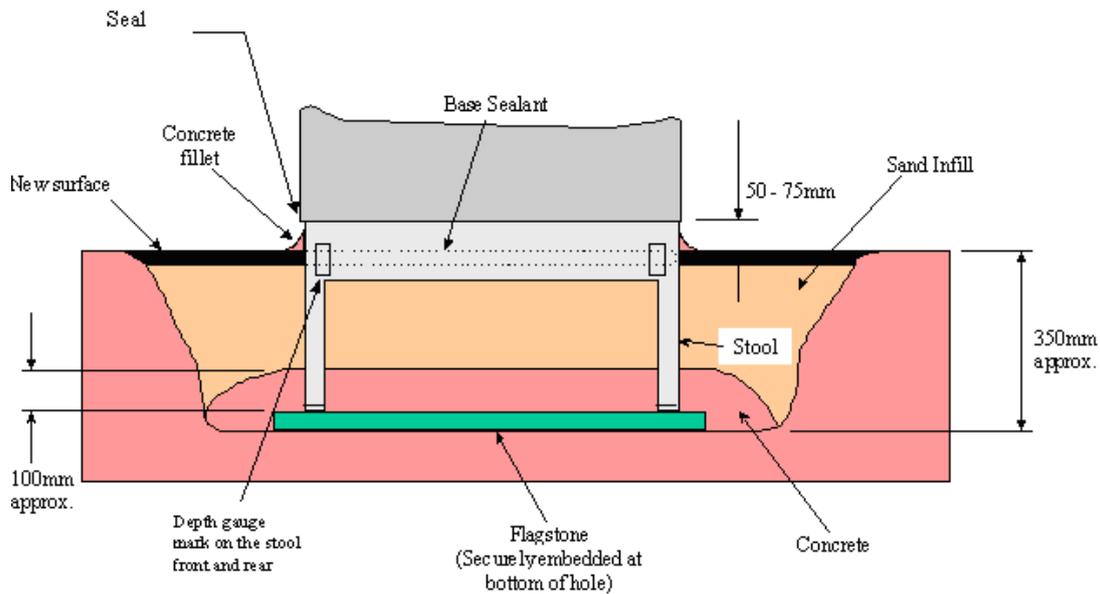
1. Prepare the Reinforced stool by fitting the CET plate to the upward fold in the top of the stool using the two bolts and fixings provided.



**Figure 9-1: Reinforced Stool and CET plate**

2. Have the stool concreted into place in site in accordance with 667/HE/45950/000. See Figure 9-2.

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**Figure 9-2: Stool Installation Diagram**

### 9.3 Pulling and Gland Ducted Cables

Step No.	UPS Cabinet	Battery Expansion Cabinet	Refer to
2	Pull and gland ducted cables		Section 9.3



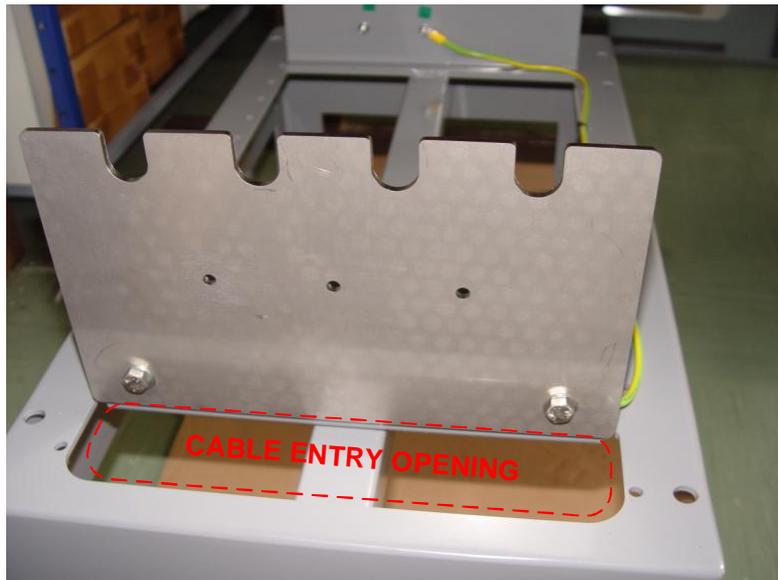
**NOTE:** It is recommended that the Ethernet cable, if fitted, is pulled through all conduits prior to attaching the RJ45 termination jack. This ensures the termination is not compromised in any way during the pulling procedure. See section 9.10 for termination details



**NOTE:** Sharp bends in all cables are to be avoided. A minimum bend radius of 4x the cable diameter should be observed where possible.

1. Pull all external cables through underground ducting and up into the cabinet via the aperture in the left of the stool by the CET plate. See section 7 for details on external cabling.

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**Figure 9-3: Reinforced Stool – LEFT HAND SIDE VIEW**

2. Working from back to front, gland these SWA cables to the CET plate, using the holes and notches provided, in the following order:
  - UPS Fault / Alarm relay contact cable (if required)
  - Battery Expansion 54Vdc cable (if required)
  - Controller 230Vac feed cable
  - DNO 230Vac supply cable
  - Ethernet cable (if required)



**NOTE:** Leave enough slack on all cables for termination at the top of the cabinet. Cables should extend a minimum of 1500mm from the glanding point.



**NOTE:** When fitting the Battery Expansion Cable, terminate the Green/Yellow core to the main earth stud on the CET plate.

## 9.4 Fitting the Vented Cabinet Outer Case and Sealing the Base

Step No.	UPS Cabinet	Battery Expansion Cabinet	Refer to
3	Fit the Vented Cabinet Outer Case and seal the base		Section 9.4

The Vented Cabinet Outer Case is simply a modified ST900 style controller cabinet and is fitted to the stool in exactly the same way.



**NOTE:** The Vented Cabinet is packaged with the fixings necessary for fitting the solutions housing modules (Battery, DC and UPS). Retain fixings until reaching the appropriate installation step.

1. Fit the Vented cabinet outer case to the reinforced stool using the appropriate M10 fixings as with the ST900 cabinet outer cases. Refer to 667/HE/45950/000.
2. The cabinet base should now be sealed. See 667/HE/45950/000 for details.



**NOTE:** Further installation from this point may involve work above un-cured base seal. It is therefore recommended to mask the openings stool top with cardboard or similar to prevent the loss of dropped fixings.

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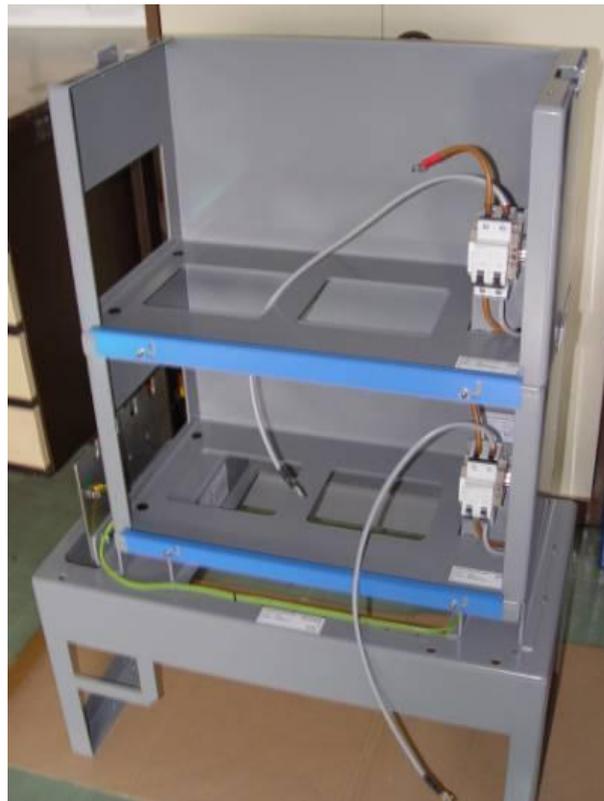
## 9.5 Fitting and Connecting the Battery Housing Module

Step No.	UPS Cabinet	Battery Expansion Cabinet	Refer to
4	Fit and connect the Battery Housing module(s)		Section 9.5

The Battery Housing Module design allows them to be stacked onto each other. A varying number of battery housing modules can be fitted depending on specific site requirements.



**WARNING:** Batteries **MUST NOT** be fitted within the Battery Housing module during installation.



**Figure 9-4: Two Battery Housing Modules stacked on the Reinforced Stool (Cabinet removed)**



**NOTE:** Secure external cables from the CET plate to the cable management holes in the left hand side of the Battery Housing modules as each module is installed

### Fitting the first Battery Housing Module:

1. Pass the first battery housing through the front door aperture of the cabinet outer case and place onto the raised box section 'top hats' of the reinforced stool.
2. Align the countersunk holes in the bottom of the battery housing with the threaded holes in the 'top hats', then secure into place using the Alan key and fixings provided.
3. Pass the loose earth wire from the right side of the battery housing through the opening in the housing bottom and secure to the marked earth stud on the box section 'top hat' below.

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**Fitting further Battery Housing Modules:**

1. Pass the Battery Housing module through the front door aperture in the cabinet outer case and place on top of the previously installed battery housing.
2. Using the back and side stops slide the Battery Housing into place, aligning the countersunk holes on the bottom surface with the threaded holes in the top of the Battery Housing module below. Secure using the fixings provided.



**Figure 9-5: Battery Housing module mount**

3. Pass the loose earth wire from the right side of the Battery Housing through the opening in the housing bottom and secure to the marked earth stud on the Battery Housing module below.



**Figure 9-6: Earth Connection between Battery Housing modules**

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## 9.6 Mounting and Connecting the UPS Housing Module

Step No.	UPS Cabinet	Battery Expansion Cabinet	Refer to
5	Mount and connect the UPS housing module	N/A	Section 9.6

The UPS housing module contains the UPS Solution equipment and is pre-wired with cable looms for connectivity with the Battery Housing Cable looms.



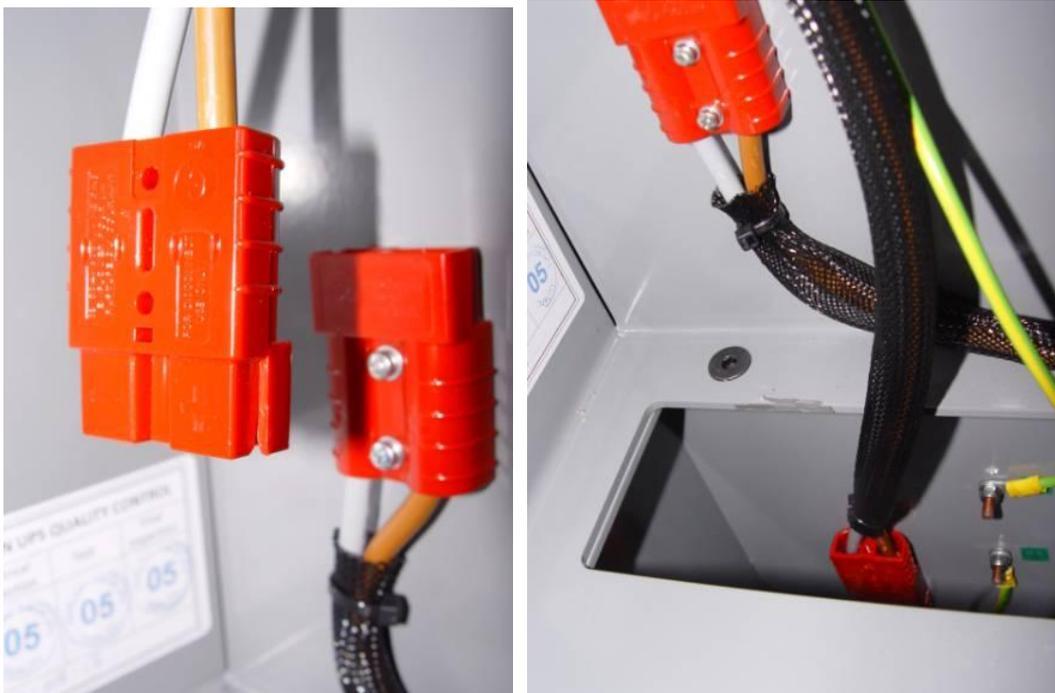
**WARNING:** The UPS Housing module weighs a total of 30.7kg. On a solo install, disconnect and remove the FXM UPS unit. This can then be replaced once the housing module is securely installed.



**Figure 9-7: UPS Housing mounted on Battery Housing within Cabinet**

1. Pass the UPS housing module through the front door aperture of the cabinet outer case and place on top of the previously installed Battery Housing module.
2. Using the side stops, slide the UPS Housing module into place, aligning the holes in the bottom flange with the threaded holes in the top of the Battery Housing module below. Secure into place using the bolts provided.
3. Secure the loose earth cable to the marked earth stud on the side of the Battery Housing module below.
4. Connect the loose battery connection cable looms to the red connector sockets on the right side of each Battery Housing module, using the right hand opening in the base of the Battery Housing module to reach the connector of the housing below.

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**Figure 9-8: Battery Cable Loom Connectors**



**NOTE:** in cases where only one battery housing is installed within the UPS cabinet, the longer of two battery cable looms can be removed and retained as a maintenance spare.

## 9.7 Mounting and connecting the DC Housing Module

Step No.	UPS Cabinet	Battery Expansion Cabinet	Refer to
6	N/A	Mount and connect the DC Housing module	Section 9.7

The DC housing provides a termination point for all batteries fitted within a Battery Expansion Cabinet.

1. Pass the DC Housing module through the front door aperture of the cabinet outer case and place on top of the previously installed Battery Housing module.
2. Using the side stops, slide the DC Housing module into place, aligning the holes in the bottom flange with the threaded holes in the top of the Battery Housing module below. Secure into place using the bolts provided.
3. Secure the loose earth cable to the marked earth stud on the side of the Battery Housing module below.



**NOTE:** The DC Housing module is sometimes fitted to a Battery Housing Module before shipping. If this is the case, check that the DC housing is secure and that the earth cable is properly connected, then follow the normal Battery Housing module installation steps (section 9.5) ensuring the DC Housing module is placed at the top of the stack.

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4. Connect the loose battery connection cable looms to the red connector sockets on the right side of each Battery Housing module, using the right hand opening in the base of the Battery Housing module to reach the connector of the housing below.



**NOTE:** in cases where less than three battery housing modules are installed within the Battery Expansion Cabinet, unused battery cable looms can be removed and retained as maintenance spares.

## 9.8 Terminating External Cables into the UPS Connection Panel

Step No.	UPS Cabinet	Battery Expansion Cabinet	Refer to
7	Terminate External cables into the UPS Connection panel	N/A	Section 9.8



**WARNING:** Ensure all power sources are switched off and safely isolated before installation commences. All switches and MCBs should be in the OFF or BYPASS position.

1. Remove the blanking plate from the top of the UPS housing revealing the UPS Connection Panel.
2. The DIN rail mounted terminal blocks on the panel are clearly labelled. Cables are to be terminated according to the following:
  - o 'MAINS INPUT' – Termination for a 3-core cable from the feeder pillar supply.
  - o 'OUTPUT' – Termination for a 3-core cable to the traffic controller.
  - o '54VDC BUS' – Termination for internal and Battery Expansion cabinet battery cables. Clearly labelled '+' and '-'.
  - o 'C1' to 'C6' – Termination for the UPS solution fault output contacts. Clearly labelled 'NO', 'C' and 'NC' for Normally Open, Common and Normally Closed respectively.



**Figure 9-9: UPS Connection Panel**

3. Replace the blanking plate.

See section 7 for further details on external cable specification details.

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## 9.9 Terminating External Cables into the DC Connection Panel

Step No.	UPS Cabinet	Battery Expansion Cabinet	Refer to
8	N/A	Terminate External Cables into the DC Connection Panel	Section 9.9



**WARNING:** Ensure all power sources are switched off and safely isolated before installation commences. All switches and MCBs should be in the OFF or BYPASS position.

1. Remove the blanking plate of the DC Housing module to reveal the DC Connection Panel.
2. The DIN rail terminal blocks are clearly labelled. Terminate the Battery cable from the UPS cabinet to the TBs marked 'UPS DC'.
3. Replace the blanking plate.

See section 7 for further details on external cable specification details.

## 9.10 Terminating and Connecting the Ethernet Cable

Step No.	UPS Cabinet	Battery Expansion Cabinet	Refer to
9	Terminate and connect the Ethernet Cable	N/A	Section 9.10

If the FXM UPS unit's LAN Interface feature is to be used, follow the instructions below to properly terminate the Ethernet CAT5e cable.

1. Terminate the CAT5e cable into RJ45 jacks (531/4/03461/000) as a standard straight-through Ethernet cable at both ends according the Table 9-2 below.

Pin	Colour
1	White – Orange stripe
2	Orange Solid
3	White – Green stripe
4	Blue solid
5	White – Blue stripe
6	Green solid
7	White – Brown stripe
8	Brown solid

**Table 9-2: RJ45 Interface Cable Connection**

2. Plug the RJ45 jack into the Ethernet socket marked 'LAN' on the FXM UPS unit.

See section 7.3 for cable specification details.

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## 9.11 Fitting and Connecting the Batteries

Step No.	UPS Cabinet	Battery Expansion Cabinet	Refer to
10	Fit and connect the batteries		Section 9.11



**WARNING:** All battery safety information must be read and understood before installation of the batteries begins. Refer to the safety information at the beginning of this document.



**WARNING:** Use the insulated spanner when adjusting battery terminal fixings. Terminals should not be exposed for extended periods. Replace the terminal covers whenever possible. This reduces the risk of an accidental short-circuit.



**WARNING:** Ensure all power sources are switched off and safely isolated before fitting the batteries. All switches and MCBs should be in the OFF or BYPASS position.

Each Battery Housing module takes four 12V LC batteries, forming a 48V battery pack. These will be referred to as Battery 1, 2, 3 and 4 from left to right respectively. Repeat the following steps for each Battery Housing module within UPS cabinet AND Battery Expansion cabinet.

1. Lower the battery retention bar of the Battery Housing module. Slide Battery 1 into the housing.
2. Connect the negative ring tag from the housing's MCB to the negative terminal on Battery 1. (grey cable)



**WARNING:** All battery terminals are to be made hand tight. **DO NOT OVERTIGHTEN** as battery terminals can easily be damaged.

3. Slide Battery 2 into the housing. Connect the positive of Battery 1 to the negative of Battery 2 using the terminal linking bar provided.



**NOTE:** When fitting batteries in the Battery Housing module directly below the UPS Housing module, the Battery Temperature sensor is to be fitted as this stage. Refer to section 9.12 before completing the following instructions.

4. Repeat this last step with Batteries 3 and 4.



Figure 9-10: Battery Terminals Connected with the Terminal Linking Bar

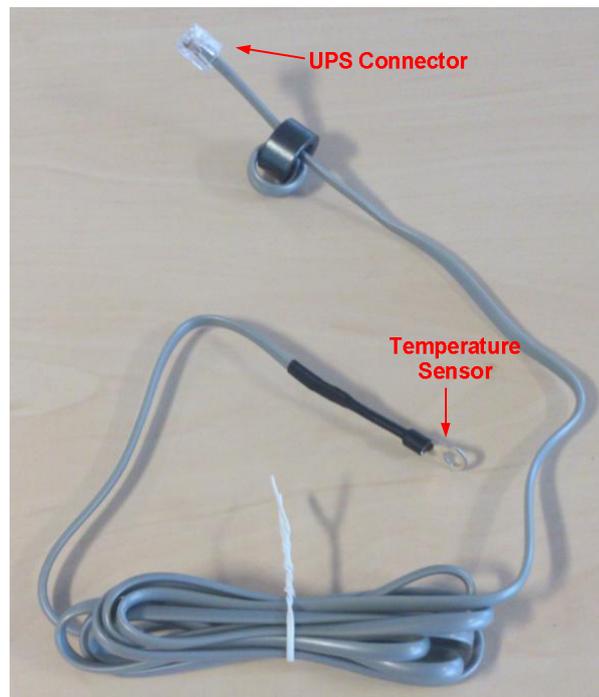
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5. Connect the positive ring tag from the housing MCB to the positive terminal of Battery 4. (brown cable)
6. Replace the battery retention bar.

## 9.12 Fitting the Battery Temperature Sensor

Step No.	UPS Cabinet	Battery Expansion Cabinet	Refer to
11	Connect the Batt. Temp. sensor	N/A	Section 9.12

This sensor allows the FXM UPS unit to temperature compensate its battery charging characteristics and is a vital part of the system installation. The sensor is to be fitted as follows to the battery pack housed directly below the UPS unit.



**Figure 9-11: Battery Temperature Sensor**

1. Ensure the temperature sensor connector is securely fitted into the 'BATTERY TEMP' socket of the FXM UPS unit.
2. Use tape to fix the sensor ring terminal to the exposed side of Battery 2.
3. On mounting Battery 3, ensure that it is flush with Battery 2 creating a secure fit for the battery temperature sensor.
4. Tidy away the Battery Temperature Sensor cable.

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## 10 Isolation Switches

This section gives the names and locations of various switches and circuit breakers throughout the UPS Solution that are used to isolate and switch on/off separate system elements. These switches are used as during commissioning, start up and maintenance of the UPS Solution and are referred to throughout the rest of this handbook by the names listed here.

### 10.1 Housing Module MCBs

- Mains Input MCB – UPS Connection Panel, UPS Housing, UPS cabinet
- Battery Expansion MCB – DC Connection Panel, DC Housing, Battery Expansion cabinet
- Battery Housing Isolation MCB – Battery Housing(s), UPS and Battery Expansion cabinets

### 10.2 Universal Automatic Transfer Switch (UATS)

The UATS is mounted within the UPS Housing module at the top of the UPS Cabinet.

- Manual Bypass Switch (SW1)
- UPS Supply Breaker (CB1)

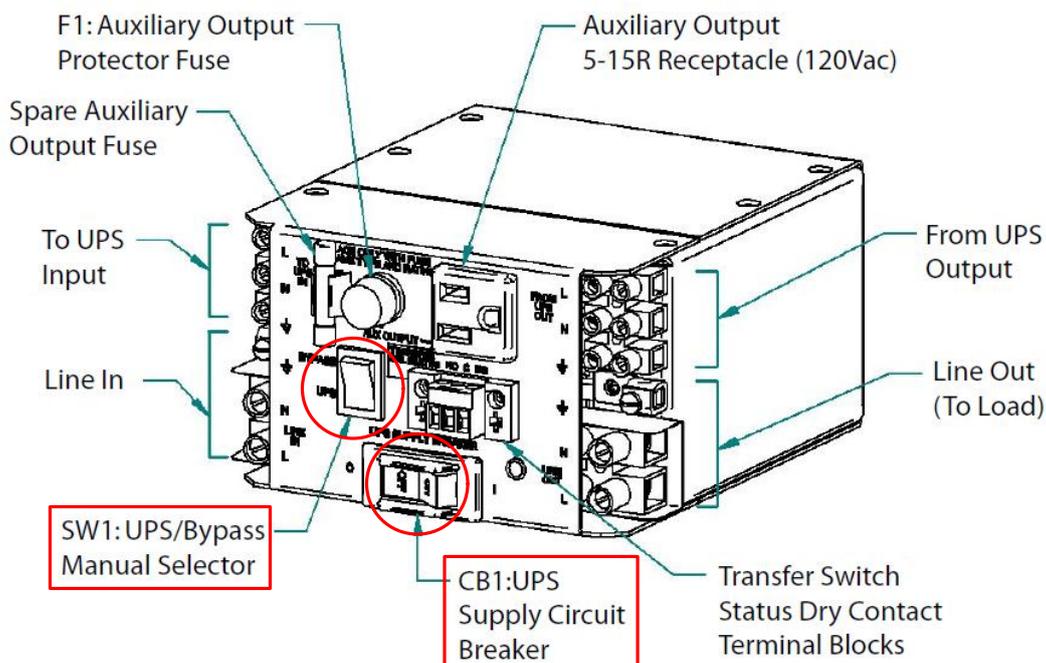


Figure 10-1: UATS Switches

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## 10.3 FXM UPS Unit

The UPS Unit is mounted within the UPS Housing module at the top of the UPS Cabinet.

- Battery Breaker
- Input Circuit Breaker

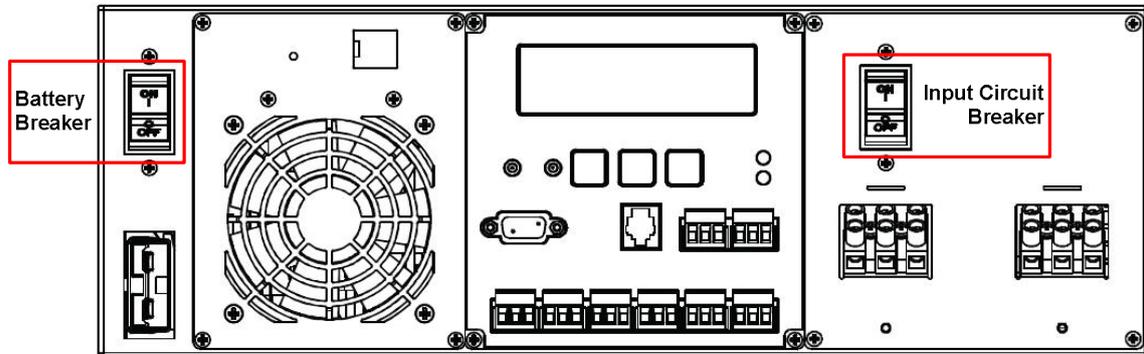


Figure 10-2: Alpha FXM UPS Circuit Breakers

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## 11 Commissioning

The following subsections detail the procedure required to commission and start up the UPS Solution. Refer to section 10 for details on isolation switch locations.



**NOTE:** In order to avoid unduly stressing the UPS Solution it is advisable to follow the switch on procedure set out below.



**WARNING:** Ensure all power sources are switched off and safely isolated before fitting the batteries. All switches and MCBs should be in the OFF or BYPASS position.

### 11.1 Electrical Safety Testing

Upon completion of UPS Solution installation, the following Electrical Safety Tests are to be carried out before the solution is powered or switched on.

Tests required are set out in the TS Traffic Installation Testing Document (667/HE/20664/000):

- 2.1 Test Gear Requirement
- 2.2 Core to Core Testing – This applies to all cables between Feeder Pillar and UPS Cabinet, UPS cabinet and Battery Expansion Cabinet, and UPS Cabinet and Traffic Control Equipment.
- 2.3 Visual Inspection
- 2.4 Circuit Protective Conductor Test – This applies to all cables between Feeder Pillar and UPS Cabinet, UPS cabinet and Battery Expansion Cabinet, and UPS Cabinet Traffic Control Equipment.
- 2.5 Basic Polarity Test
- 2.6 Site Insulation Test
- 2.7 Polarity Test
- 2.8 Earth Loop Impedance Tests

### 11.2 Putting the UPS Solution in BYPASS

1. Make sure **all switches listed in section 10** are in the **OFF** position and the **Manual Bypass Switch (SW1)** on the UATS is in the **BYPASS** position.
2. Switch the **Mains Input MCB** on UPS Housing to **ON**.

The UPS Solution is now in BYPASS mode. When present, power from the site's mains supply feeder pillar passes directly to the traffic intersection controller without interacting with the UPS unit.



**NOTE:** The UPS Solution is in BYPASS mode as long as long as the **Mains Input MCB** in the UPS Connection Panel and the **Manual Bypass Switch (SW1)** on the UATS are in the ON and BYPASS position respectively, no matter the state of other isolation switches within the solution.

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## 11.3 Powering and Commissioning the Controller

1. Commission the traffic intersection controller in accordance with its related Installation, Commissioning and Maintenance Handbook. See section 1.2.
2. Switch on mains power within the site's supply feeder pillar at the appropriate stage of controller commissioning.

The traffic intersection controller should now be fully operational.

## 11.4 Starting Up the UPS Solution

1. Switch **all Battery Shelf Isolation Switches** on the Battery Housing modules within the UPS Cabinet and Battery Expansion Cabinet, if installed, to **ON** in turn.
2. If a Battery Expansion Cabinet is installed, switch the **Battery Expansion MCB** in the cabinet's DC Housing module to **ON**. The Battery Expansion Cabinet can now be closed.
3. In the UPS Cabinet, switch the **Battery Breaker** on the UPS Unit to **ON**.
4. Ensure the UPS unit is now on and displays 'STANDBY'.
5. Switch the **UPS Supply Breaker** (CB1) on the UATS to **ON**.
6. Switch the **Input Circuit Breaker** on the UPS Unit to **ON**.
7. Wait for the UPS Unit to display 'LINE'.
8. Switch the **Manual Bypass Switch** (SW1) on the UATS to **UPS**.

The UPS Solution is now switched on and supporting the traffic Intersection. Mains power from the site supply feeder pillar is now fed through the UPS unit before being passed on to the controller.

## 11.5 Testing the UPS Battery Support Function

1. Switch the **Mains Input MCB** on the UPS Housing to **OFF**.
2. Ensure the UPS unit now displays 'INVERTER' and that traffic intersection is still fully operational.
3. Switch the **Mains Input MCB** on the UPS Housing to **ON**.
4. Wait for the UPS unit to display 'LINE'.
5. Ensure the traffic intersection is still fully operational.

Commissioning of the UPS Solution is now complete.

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## 12 UPS System Operation

### 12.1 Operating Modes

The UPS Solution has four main operating modes that are automatically selected by the Alpha FXM UPS unit depending on the state of the mains power supply to the site and battery pack SOC. These are listed and described in Table 12-1 below.

Operating Mode	Description
'LINE'	The normal operating mode of the UPS Solution. Mains power is available from the site supply feeder pillar and is being passed through the UPS to the traffic controller load. Batteries are being charged or maintained using the mains supply.
'INVERTER'	Mains power is unavailable from the site supply feeder pillar. The UPS Solution is providing battery backup power from all connected battery packs.
'RETRAN'	Mains power from the site supply feeder pillar has been restored. The UPS Solution assesses and qualifies the available mains supply before switching back to 'LINE' mode.
'SHUTDOWN'	Mains power from the site supply feeder pillar is unavailable and the batteries have been discharged to the UPS unit's over discharge threshold. The UPS Solution switches off. Power is no longer supplied to the traffic controller load. When mains power is restored at the site supply feeder pillar, the UPS solution will automatically switch to 'RETRAN' mode.

**Table 12-1: Key UPS Solution Operating Modes**



**NOTE:** The current mode of operation is shown on the Alpha FXM UPS Unit's LCD Display. Press any of the three buttons directly below the unit's display to activate the backlight

For more information on all UPS unit modes please refer to 667/HB/47760/000.

### 12.2 Fault Monitoring

The UPS Solution offers extensive fault monitoring options as described in the following subsections. More information on all available fault information is detailed in the Alpha FXM UPS Operating Manual – 667/HB/47760/000.

#### 12.2.1 Fault / Alarm Relay Contacts

The UPS Solution provides six relay outputs via the UPS Connection Panel that can be cabled directly to the traffic controller cabinet for fault monitoring with Siemens UTMC or RMS systems. See section 12.2.2 for details.

Each relay offers a Normally Closed (NC), Common (C) and Normally Open (NO) contact, making a total of 18 possible termination points.

Table 12-2 lists and describes the default names and settings for these contacts.

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Contact ID	Name	Voltage	Energised When:	Default Setting
C1	On Battery	Dry Contact	The UPS Solution is running on battery backup power rather than mains input	N/A
C2	Low Battery 1	Dry Contact	The battery voltage drops below the a configurable threshold	47Vdc (40% SOC)
C3	Low Battery 2	Dry Contact	Matches C2	47Vdc (40% SOC)
C4	Timer	Dry Contact	The UPS Solution has been running on battery backup for a user-defined length of time	5 minutes
C5	Alarm	Dry Contact	General Fault on UPS Unit <sup>6</sup>	N/A
C6 <b>DO NOT USE</b> (See warning below)	UPS On	<b>48Vdc at (500mA) from battery packs</b>	The UPS is providing a mains output independent of the power source	N/A

**Table 12-2: Default Fault Contact Settings**



**WARNING:** C6 is factory configured as a 48Vdc supply and is not to be used with Siemens traffic equipment.

Details of all other fault and alarm flags are available within the Alpha FXM UPS Operating Manual – 667/HB/47760/000.

All fault and alarm flags can be interrogated by any one of three UPS interfaces as described in section 12.3.

<sup>6</sup> All possible Alarm Contact triggers are listed in APPENDIX B – FXM UPS Faults and Alarms

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## 12.2.2 Fault Monitoring using Siemens RMS and UTMC Systems

The UPS Solution's fault / alarm relay contacts can be used to send indications back to the central office Instation via an OTU or OMU<sup>7</sup>. The following are the recommended naming conventions for bit and possible connection scenarios.

Bit	Description
ONBAT (C1)	On Battery support. UPS is in inverter mode. Site mains is off Usually HLD WARN (C4) below is recommended for this purpose.
LOWB1 (C2)	Low Battery Warning 1 – Urgent indication that the UPS is approaching its maximum support time and action should now be taken to either provide additional support or take other action (suitable site signing etc).
HLD WARN (C4)	Hold Up Warning. Triggered from the Timer alarm (5 minutes), Urgent indication that the UPS is powering the load (Avoids nuisance reports when short mains breaks occur).
UPS ALRM (C5)	UPS Alarm. Urgent – There is a fault with the UPS. Site visit or remote investigation required.

**Table 12-3: RMS Bit Labelling and Description**

### Example Scenario:

The LOWB1 (C2) contact can be used in two ways. The first is as an indication to the controller that the UPS has been running on battery power for some time, allowing special conditions or similar controller logic to perhaps dim lights or put the junction into a flashing state to prolong support.

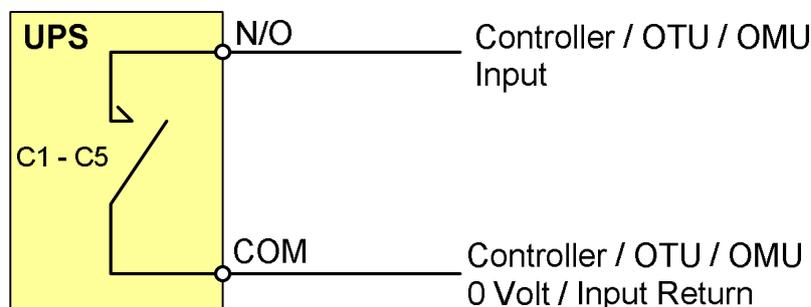


**NOTE:** Customers should decide on a site by site basis if the use of dimmed signals during the day is acceptable.

The second would be to pass this back through an OTU or OMU to a central office Instation to warn that the UPS has used more than half of its back up supply.

All contacts<sup>7</sup> can either be passed through the controller (i.e. controller input to output to OTU/OMU input to Instation) or may be connected directly to the OTU/OMU inputs for forwarding to the central office Instation.

Review the controller and any OTU/OMU configurations supplied by the customer to determine the connections that need to be made.



**Figure 12-1: Fault Monitoring Connectivity Example**

<sup>7</sup> C6 is not to be used with Siemens traffic Equipment. See section 12.2.1

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## 12.3 Communicating with the UPS Solution

### 12.3.1 Three-Button Interface

The Alpha FXM UPS unit includes a simple three-button interface and LCD display for basic system interrogation while present on site.

Using the three buttons, CANCEL, SCROLL and SELECT, it is possible to access the following menus:

- Control Menu -** Control, program and adjust a limited number of system options including forcing the UPS unit into 'INVERTER' mode.
- System Status Menu -** Measure various inputs, outputs and related system values including the current battery voltage and estimated support time available.
- Alarm and Fault -** Disabled unless the UPS unit has a fault, these menus display and fault or alarm flags that are currently active.
- Event Status Menu -** Allows the user to scroll through the last 25 items listed in the UPS units 100-event log.

For details on all the options available within these menus, please refer to the Alpha FXM UPS Operating Manual – 667/HB/47760/000.

Access to many more system settings can only be achieved through the RS232 or LAN interfaces as described in sections 12.3.2 and 12.3.3.

### 12.3.2 RS232 Interface

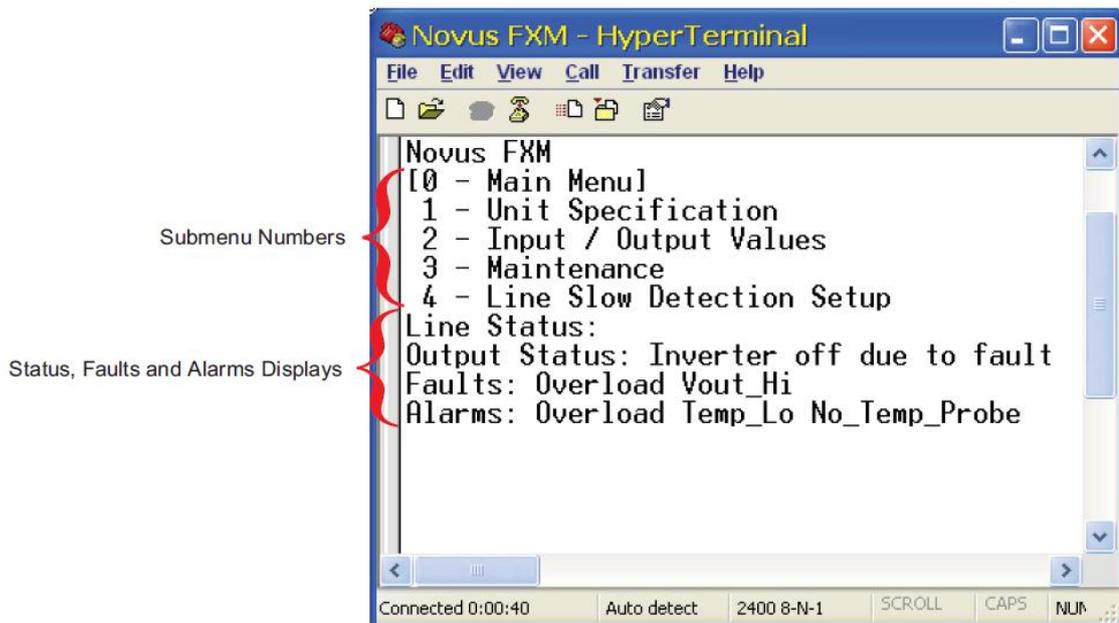
The Alpha FXM UPS unit's RS232 interface can be accessed via the female 9-way D-type connector on the unit itself. Table 12-4 below lists the necessary connection details.

Connection Parameters	Required Setting
Duplex Mode	Half Duplex
Handshaking	Software Handshaking
Baud Rate	2400 bps
Data Format	8-bit Data, No Parity, 1 Stop Bit, No Flow Control
Default Password	1111

**Table 12-4: RS232 Interface Connection Information**

The RS232 Interface's main menu screen gives the user access to four main subsections as well as displaying status and fault / alarm information in the following format.

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**Figure 12-2: Alpha FXM Series UPS RS232 Interface Screenshot**

Submenus 1, 2 and 4 are read-only and are used to view snapshots of input and output measurements (the RS232 interface does not auto-refresh) and Factory configured unit specification information.

The Maintenance submenu allows the user to adjust a limited number of UPS settings including changing the connection password and switching systems timers on or off.



**NOTE:** The connection password applies to all UPS communication interfaces described in section 12.3.

Special command prompts can be entered directly into the RS232 interface to configure more specific UPS settings such as reprogramming and reconfiguring the six relay contacts or viewing the 100-event log. Details of all available commands are available within the Alpha FXM UPS Operating Manual – 667/HB/47760/000.

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### 12.3.3 LAN Interface

The UPS Solution's LAN interface can be accessed via the Alpha FXM UPS unit's embedded SNMP (LAN) card using the RJ45 socket on the unit itself. If the solution's Ethernet Cable is fitted and a TCP/IP based network connection is available within the traffic controller, the LAN interface can be accessed remotely from any other active network device.

To connect to the LAN interface, type the Alpha FXM UPS unit's IP address into a web browser. Individual unit's IP addresses can be configured to match networking required. The default IP address and password for all UPS units are shown in Table 12-5.

Connection Parameters	Default Settings
IP Address	192.168.0.90
Password	1111

**Table 12-5: LAN Interface Connection Information**



**NOTE:** The connection password applies to all UPS communication interfaces described in section 12.3.

Connecting to the LAN interface presents the user with a simple GUI that gives access to the greatest number of system settings and configurations under the following top level page menu.

- UPS Specification
- UPS Monitoring
- UPS Maintenance
- Event Manager
- Upgrade Files
- Configure Site Information
- Communications
- Keep Alive

The UPS Solution's operating mode and fault / alarm flags are always displayed at the top of each page for easy system monitoring.

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The screenshot displays the Alpha Technologies FXM Communication Module LAN interface. At the top, there is a status bar with 'UPS MODE Line' and 'Alarms Faults' indicators. The main interface is divided into a left-hand navigation menu and two main configuration panels.

**Relay Configuration Panel:**

Relay	Current	Action		New
Relay C1	Off	<input type="button" value="On"/>	<input type="button" value="Off"/>	On Battery
Relay C2	Off	<input type="button" value="On"/>	<input type="button" value="Off"/>	Low Battery
Relay C3	Off	<input type="button" value="On"/>	<input type="button" value="Off"/>	Low Battery
Relay C4	Off	<input type="button" value="On"/>	<input type="button" value="Off"/>	Timer 1
Relay C5	Off	<input type="button" value="On"/>	<input type="button" value="Off"/>	Alarm
Relay C6	On	<input type="button" value="On"/>	<input type="button" value="Off"/>	External VDC
Fan on Temperature		40°C		40

**Load Shed Timer Configuration Panel:**

Timer	Time Remaining	Time Set		
Timer 1	0hr 5min 0sec	00	05	00
Timer 2	2hr 0min 0sec	02	00	00
Timer 3	2hr 0min 0sec	02	00	00

The left-hand navigation menu includes sections for UPS Specification, UPS Monitoring, UPS Maintenance, Event Manager, Upgrade Files, Configure Site Information, and Communications.

**Figure 12-3: LAN Interface Screenshot – Relay Contact Configuration**



**NOTE:** A similar, though slightly restricted GUI can be used with the UPS Solution via the use of the Alpha UPS Monitor software package, available for free download from the Alpha Technologies website<sup>8</sup>.

In depth information on the use of the Alpha UPS Monitor Software and the LAN interface GUI is available within the Alpha FXM UPS Operating Manual – 667/HB/47760/000.

<sup>8</sup> <http://www.alpha.ca/web2/service-and-support/support/software-firmware-downloads>

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## 12.4 Battery Charging

The Alpha FXM UPS unit has four specific modes for battery charging that are automatically cycled according to the battery pack voltage and State of Charge. These are described below.



**NOTE:** All values given in the descriptions below apply to a UPS Solution operating at an ambient temperature of 25°C. See section 12.5.2 for details on temperature compensated battery charging.

### Bulk Charging -

**Used to recharge the batteries after discharge.** The charger within the FXM UPS unit operates in constant current mode with an upper limit of 10Amps. The target battery voltage is set to 54Vdc (2.25V per cell). The battery voltage rises steadily as the batteries charge. As the battery voltage approaches its target voltage value, the current drawn starts to decrease. The charger voltage is then held at 54Vdc and the charger moves into Absorption mode.

### Absorption -

**Used to complete the final stage of battery recharge.** The charger is now in constant voltage mode and holds the battery voltage at 54Vdc. The battery pack is allowed to draw current based on its capacity and chemistry. The current drawn continues to decrease as the battery charges.

### Float -

**Used to maintain fully charged batteries.** As the battery pack nears full charge, the current drawn drops to roughly 1A. The battery voltage is held at 54Vdc. If the current drawn is roughly 1A or less for 10 to 20 minutes, the FXM UPS Unit's battery charger moves to the next state.

### Charger Off -

**Used to monitor the battery pack and check for any faults.** The battery charger switches itself off on leaving Float mode. If the battery pack is bad or faulty, its voltage will drop rapidly and the FXM UPS unit's 'Bad Battery' alarm is triggered. If the battery pack is in good condition, the battery voltage will drop slowly. When the battery voltage drops to 52.6Vdc, the charger switches back on and enters Bulk Charging mode.

Figure 12-4 displays the battery charging cycle in terms of voltage and charging current.



**WARNING:** Even with no battery packs connected, if mains power is available a voltage of 32Vdc is normally present at the Alpha FXM UPS Unit's battery terminals. This voltage is periodically raised to 56Vdc or above as the UPS unit looks for a battery connection.

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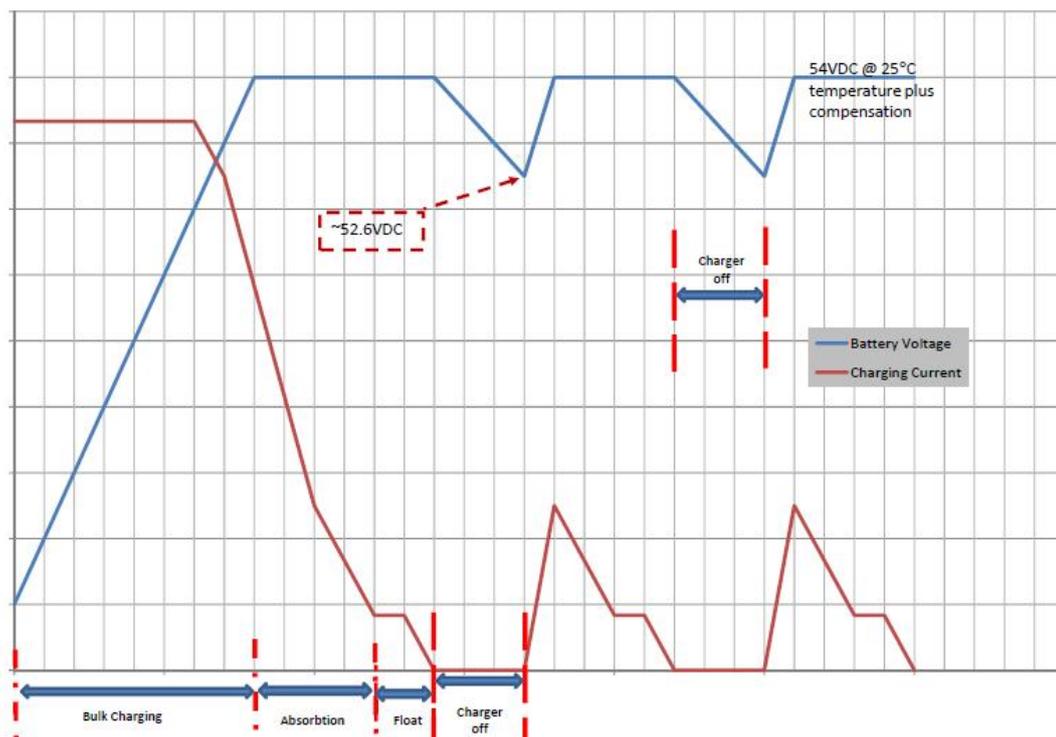


Figure 12-4: Battery Charging Cycle

## 12.5 Temperature De-Rating



**WARNING:** For the majority of UK installations, it is reasonable to assume a worst case cabinet temperature range of **0°C to 65°C**. The UPS Solution **must be derated** to at least these values to help ensure correct operation.

### 12.5.1 Power output

The Alpha FXM1100 and FXM2000 UPS units offer a maximum power output of 1100VA and 2000VA respectively. See section 4.1. In high ambient temperatures, the maximum power available decreases as the FXM UPS units reach the limits of their operating range.

The **FXM1100** UPS unit is de-rated by **1.25% for every degree above 55°C**. The **FXM2000** UPS unit is de-rated by **1.0% for every degree above 50°C**. Table 12-6 below gives specific figures showing how this affects the maximum power output available.

Ambient Temperature	FXM1100 Max. O/P	FXM2000 Max. O/P
-40°C	1100 W/VA	2000 W/VA
0°C	1100 W/VA	2000 W/VA
25°C	1100 W/VA	2000 W/VA
50°C	1100 W/VA	2000 W/VA
55°C	1100 W/VA	1900 W/VA
60°C	1031.25 W/VA	1800 W/VA
65°C (UK worst case)	962.5 W/VA	1700 W/VA
70°C	893.75 W/VA	1600 W/VA
74°C	838.75 W/VA	1520 W/VA

Table 12-6: Maximum Output Power against Ambient Temperature

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## 12.5.2 Battery Charging

The UPS Solution offers temperature compensated battery charging to help keep all battery packs in optimum condition across its extended operating ambient temperature range. The battery charging voltage is adjusted by **-5.0mV/°C/cell**.

## 12.5.3 Battery Support Hold Up Times

Ambient temperature plays a big part in determining how much a battery support hold up time is available. As temperature decreases, the available capacity of each battery pack is reduced as battery chemistry becomes increasingly inert. This becomes very apparent and extremely low ambient temperatures.

APPENDIX A – Estimated Hold Up Times shows battery hold up runtime charts (such as in section 5) adjusted for ambient cabinet temperatures of +20°C, 0°C and -25°C.

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## 13 Maintenance

This section gives a brief description of some key maintenance routines necessary for upkeep of the UPS Solution. For detailed information see the UPS Method Statement and hardware operating manuals listed in section 1.2.



**WARNING:** Ensure the safety information at the beginning of this document before beginning any maintenance procedures

### 13.1 Periodic inspection

Note any faults or alarms flagged by the Alpha FXM UPS unit. Clear faults and alarms wherever possible in accordance with UPS Operating Manual – 667/HB/47760/000. Report **ALL** faults and alarms to Line Manager.

Switch off mains supply during at the beginning of normal junction periodic inspection. Observe the battery voltage via the UPS 3-button interface. Wait for voltage to settle and note. Also note time.

Carry out junction periodic inspection as normal. Refer to 667/HA/45950/000 for details.

Observe the battery voltage. Note alongside the time.

Restore the mains supply

Note down other key figures from the UPS unit including:

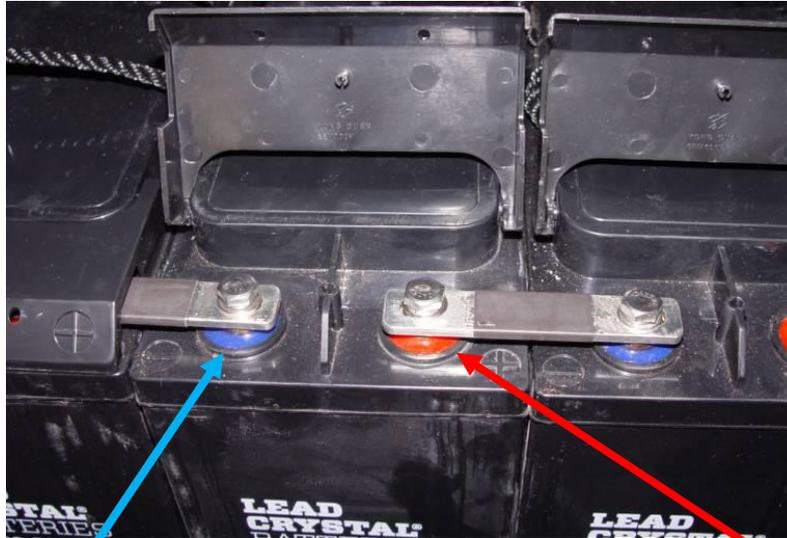
- Number of mains failures
- Cumulative inverter time
- Cumulative kWh output
- Estimated battery support

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## Check the individual Battery Voltages:

For each Battery Shelf:

1. Switch the Breaker on the Battery Shelf (Battery Housing Assembly) to the **OFF** position



2. On each Battery (four per shelf) measure the voltage between the Positive and Negative Terminals (there is no need to remove the linking bars). Note these voltages on the PI sheet.
3. Switch the Breaker on the Battery Shelf back to the **ON** position

When all shelves are complete, please check that all of the Battery Breakers are set back to the ON Position

## 13.2 Maintenance Bypass Switching

The Maintenance Bypass feature allows maintenance personnel to connect the controller load directly to the mains supply from the site feeder pillar via the Alpha UATS bypassing the FXM UPS unit and its connected battery packs. See section 10 for isolation switch information.

Flip SW1 on the UATS from 'UPS' to 'BYPASS' to instantly set the UPS Solution to Bypass mode. The controller load will not experience a break in power.



**WARNING:** When set to Bypass in this fashion, mains powers is still being used by the UPS unit to charge connected battery packs and all terminals directly connected to the UPS unit are live. To isolate and switch off the UPS unit, see section 13.3.



**NOTE:** Use of the BYPASS Switch may cause the attached control equipment to restart, it should only be used when replacement of the FXM unit is required (Please see Section 13.4.3).

See section 4.2 for more information on the UATS.

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## 13.3 Switching Off the UPS Solution



**WARNING:** This will stop all equipment connected to the UPS from being supplied Mains power. **Ensure all traffic control equipment is safely switched off before switching off the UPS.**

To switch off the UPS completely, follow these steps (see section 10 for isolation switch information):

1. Switch the UATS to **BYPASS**
2. Switch all Breakers on the Battery Shelves (Battery Housing Assemblies) in both cabinets (UPS and Battery Expansion Cabinets) to the **OFF** position
3. Switch the Battery Breaker on the Front left of the FXM UPS unit to the **OFF** position
4. Switch the UPS Supply Breaker (CB1) on the front of the UATS to the **OFF** position
5. Switch **OFF** the Input Circuit Breaker on the front right of the FXM unit
6. **Unplug** the 48V Battery Connector from the front (left) of the FXM unit to disconnect the battery circuits completely.
7. Switch **OFF** the Main Breaker on the UPS Connection Panel (at the top of the rack)
8. Open the Feeder Pillar and Isolate the UPS Cabinet

The UPS Solution will now be completely isolated from Mains and Batteries.

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## 13.4 First Line Maintenance

### 13.4.1 Replacing the Alpha FXM UPS unit

The following Steps can be carried out to replace a faulty Alpha FXM unit while still supplying Mains Power to the Traffic Control Equipment. If it's not necessary to keep the Traffic Control Equipment Energised, please follow section 13.3 to fully isolate the UPS Solution before following steps 7 onwards below. See section 10 for isolation switch information.



**THESE INSTRUCTIONS NEED TO BE FOLLOWED CAREFULLY, FAILURE TO DO SO MAY RESULT IN ELECTRIC SHOCK.**

1. Switch the UATS to **BYPASS** (the Junction will now only run from the Mains Supply)
2. Switch all Breakers on the Battery Shelves (Battery Housing Assemblies) in both cabinets (UPS and Battery Expansion Cabinets) to the **OFF** position
3. Switch the Battery Breaker on the Front left of the Alpha FXM UPS unit to the **OFF** position
4. Switch the UPS Supply Breaker (CB1) on the front of the UATS to the **OFF** position
5. Switch **OFF** the Input Circuit Breaker on the front right of the FXM unit
6. **Unplug** the 48V Battery Connector from the front (left) of the FXM unit to disconnect the battery circuits completely.
7. Remove the covers from the Mains Input and output cables on the front right of the FXM unit
8. **Using a Multi Meter set to AC (check it's working using the mains supply in the UPS Connection Panel), check that both the input and output cable looms are no longer energised.**
9. Remove both Input and output cable looms labelling them so you know where they came from. Use Insulation tape to cover the ends of the cables
10. Unplug the alarm cable looms C1 – C6 and the Battery Temperature Sensor
11. The FXM Unit can now be removed from the 19" Rack.
  
12. Install the Replacement FXM unit, Switching **OFF** the Input Circuit Breaker **AND** the Battery Circuit Breaker.
13. **Plug** alarm cable looms C1 – C6 into the FXM unit
14. **Reconnect** the Input and Output Mains Looms onto the FXM Unit, Replace the Covers.
15. **Plug** the Battery Temperature Sensor into the FXM unit
16. **Plug** The 48V Battery Connector into the FXM unit
17. Switch all Breakers on the Battery Shelves (Battery Housing Assemblies) in both cabinets (UPS and Battery Expansion Cabinets) to the **ON** position
18. Switch **ON** the Input Circuit Breaker on the front right of the FXM unit
19. Switch **ON** the Battery Breaker on the front left of the FXM unit
20. Switch the UPS Supply Breaker (CB1) on the front of the UATS to the **ON** position
21. Switch the UATS to **UPS**
22. Check the UPS goes into **LINE** mode and check the alarms.

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## 13.4.2 Replacing a Battery Pack

If a Battery in a Battery Pack (string) has been found to be faulty, all four batteries in that pack will need to be replaced together. Follow the Instructions below to safely replace a battery pack. See section 10 for isolation switch information.



**WARNING:** All battery safety information must be read and understood before installation of the batteries begins. Refer to the safety information at the beginning of this document.



**WARNING:** Use the insulated spanner when adjusting battery terminal fixings. Terminals should not be exposed for extended periods. Replace the terminal covers whenever possible. This reduces the risk of an accidental short-circuit.



**WARNING:** Batteries must **NOT** be shorted to earth at any time, Risk of explosion and/or burning due to High Current. Do not attempt this process without the correct 1000V Insulated Spanner.

### Before Disconnecting the Battery Pack:

1. Switch all Breakers on the Battery Shelves (Battery Housing Assemblies) in both cabinets (UPS and Battery Expansion Cabinets) to the **OFF** position
2. Switch the Battery Breaker on the Front left of the Alpha FXM UPS unit to the **OFF** position
3. **Unplug** the 48V Battery Connector from the front (left) of the FXM unit to disconnect the battery circuits completely.

### Removing the Battery Pack:

1. Remove the Brown cable form the +ve (right hand side) of the Battery Pack, insulate the ring crimp using electrical tape.
2. Remove all three linking bars from between the batteries in the pack.
3. Lower the battery retention bar of the Battery Housing module.
4. Remove the three batteries from right to left leaving the furthest left battery until last
5. Remove the Grey -ve cable form the final battery
6. Remove the last Battery from the Battery Housing Assembly

### Install the new batteries:

1. Slide Battery 1 into the housing.
2. Connect the negative ring tag from the housing's MCB to the negative terminal on Battery 1. (grey cable)



**NOTE:** All battery terminals are to be made hand tight. **DO NOT OVERTIGHTEN** as battery terminals can be easily damaged.

3. Slide Battery 2 into the housing. Connect the positive of Battery 1 to the negative of Battery 2 using the terminal linking bar provided.



**NOTE:** When fitting batteries in the Battery Housing module directly below the UPS Housing module, the Battery Temperature sensor is to be fitted as this stage. Refer to section 9.12 before completing the following instructions.

4. Repeat this last step with Batteries 3 and 4.

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**Figure 13-1: Battery Terminals Connected with the Terminal Linking Bar**

5. Connect the positive ring tag from the housing MCB to the positive terminal of Battery 4. (brown cable)
6. Replace the battery retention bar.

**After Replacing the Battery Pack:**

1. Plug the 48V Battery Connector back into the FXM Unit
2. Switch all Breakers on the Battery Shelves (Battery Housing Assemblies) in both cabinets (UPS and Battery Expansion Cabinets) to the **ON** position
3. Switch the Battery Breaker on the Front left of the Alpha FXM UPS unit to the **ON** position

Finally check that there are no alarms active on the UPS and that the UPS is in Line mode.

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### 13.4.3 Replacing an Alpha UATS unit

The UPS Cabinet needs to be Isolated before carrying out any work on the UATS or UPS connection shelves. Please Isolate the cabinet by following the instructions in Section 13.3

Once the Cabinet is Isolated and the UPS is completely switched off, the following steps can be followed:

1. Test the input and output terminals to ensure that the unit is completely isolated from Mains and UPS



2. Remove the Covers from both sides of the UATS Shelf
3. Remove the four cable looms from the UATS, ensuring that you know where they came from.
4. Replace the UATS Shelf
5. Wire the Cable looms into the replacement UATS and replace all of the covers.
6. Switch the UPS back on and check that it's working properly.

### 13.5 Second Line Maintenance

It is recommended that undamaged parts are reused where possible.

All other parts must be sent for repair or disposal. Further details are held in the 'Global Service Support Plan (ref. 667/PA/47750/000).



**NOTE:** Observe Anti-static Precautions at all times.

Faulty parts being returned must always be sent back in the original packaging if available or in an approved anti-static packaging, along with a fully completed fault label, to;

#### Logistics Spares Returns Centre

Siemens Mobility,  
Traffic Solutions,  
Coalfield Way,  
Ashby Park,  
Ashby de la Zouch,  
LE65 1JD

Any queries should be directed to the Service Logistics Manager on (01530) 258181.

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## 14 Disposal

### 14.1 Under Maintenance Contract

All items that have been replaced under a maintenance contract are sent back for replacement. The items will either be sent to the OEM or Registered Distributor for repair/replacement/disposal.

All Traffic Solutions, Siemens depots operates an **Environmental Management System (EMS)**.

In accordance with its **Environmental Policy** Siemens applies the **Waste Hierarchy** when managing waste, **segregating waste** into a number of waste streams to optimise the re-use/recycling carried out by the approved waste contractors that take the waste away.

### 14.2 End of Life and Scrapping

End of life items and items involved in RTAs will normally be disposed of locally. In this situation the local depot will dispose of all elements under the local EMS policy.

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## 15 Part Numbers / Spares List

### 15.1 Hardware Spares

Part Number	Description
667/7/47760/110	Alpha FXM1100 UPS unit
667/7/47760/200	Alpha FXM2000 UPS unit
667/7/47761/000	Alpha UATS
667/6/47754/000	Lead Crystal Battery 4 pack

### 15.2 Housing Modules

Part Number	Description
667/6/47780/000	Battery Housing Assembly
667/6/47781/110	1100VA UPS Housing Assembly
667/6/47781/200	2000VA UPS Housing Assembly
667/6/47782/000	DC Housing Assembly

### 15.3 Outer Case and Stool

Part Number	Description
667/6/47784/000	Vented Cabinet Outer Case - Grey
667/6/47784/500	Vented Cabinet Outer Case - Black
667/6/47785/000	Reinforced Cabinet Stool - Grey
667/6/47785/500	Reinforced Cabinet Stool - Black

### 15.4 Connection Panel and MCB Spares

Part Number	Description
667/7/47762/000	20A Mains MCB
667/7/47762/002	63A Battery MCB
667/7/47763/000	DIN Rail Terminal Block 2.5mm <sup>2</sup> BEIGE
667/7/47763/100	DIN Rail Terminal Block 6.0mm <sup>2</sup> BEIGE
667/7/47763/110	DIN Rail Terminal Block 6.0mm <sup>2</sup> GREEN/YELLOW
667/7/47763/200	DIN Rail Terminal Block 10.0mm <sup>2</sup> BEIGE
667/7/47763/500	DIN Rail End Bracket

### 15.5 Connection Accessories

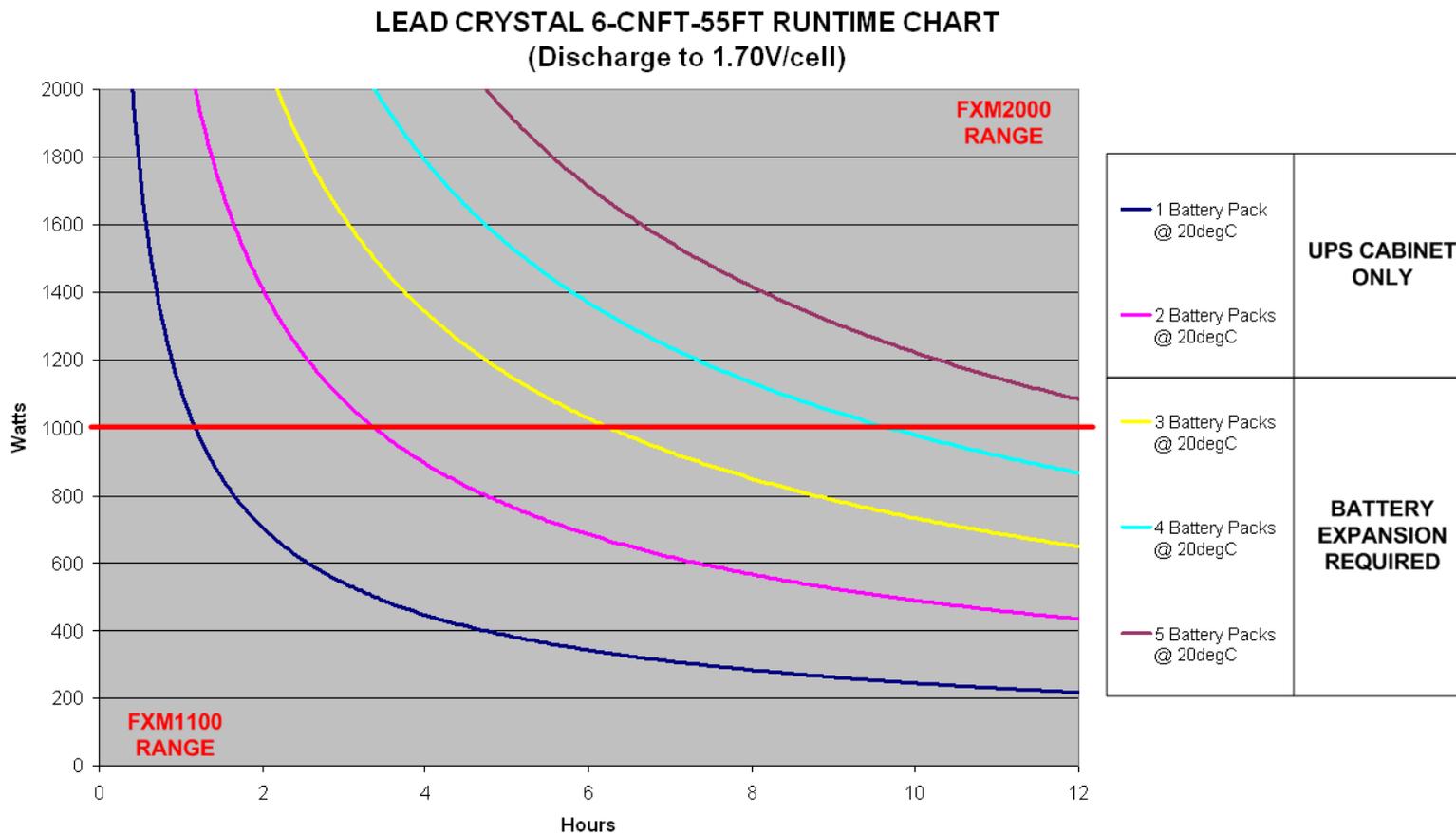
Part Number	Description
531/4/04012/000	RJ45 Connector Jack

### 15.6 Generator Connect Feeder Pillar

Part Number	Description
667/7/45043/000	Generator Connect Feeder Pillar – GALVANIZED
667/7/45043/100	Generator Connect Feeder Pillar – GREY
667/7/45043/200	Generator Connect Feeder Pillar – BLACK

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## APPENDIX A – Estimated Hold Up Times



**Figure A-1: Estimates of UPS Solution Performance at +20°C**

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## LEAD CRYSTAL 6-CNFT-55FT RUNTIME CHART (Discharge to 1.70V/cell)

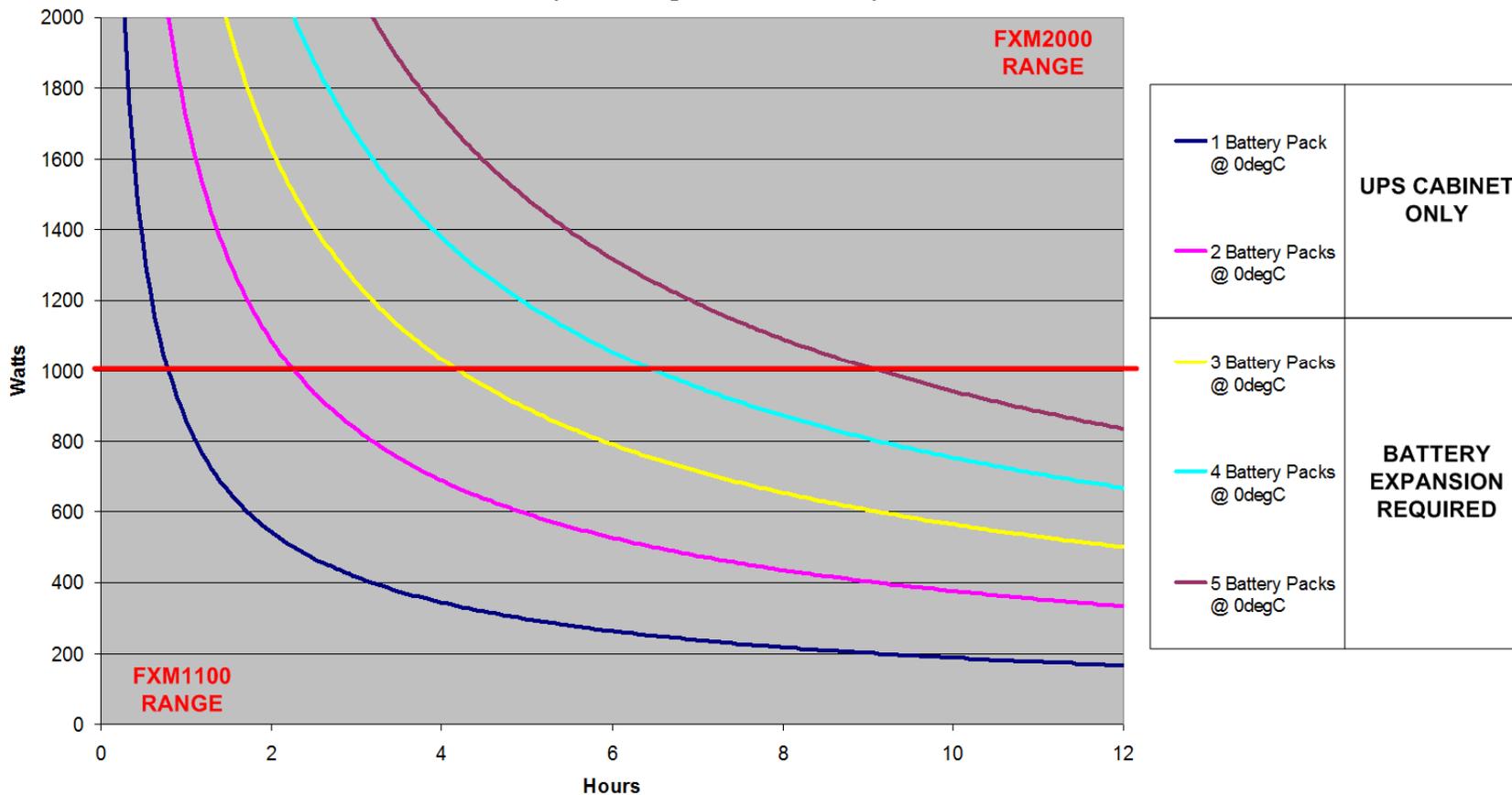


Figure A-2: Estimates of UPS Solution Performance at 0°C

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## LEAD CRYSTAL 6-CNFT-55FT RUNTIME CHART (Discharge to 1.70V/cell)

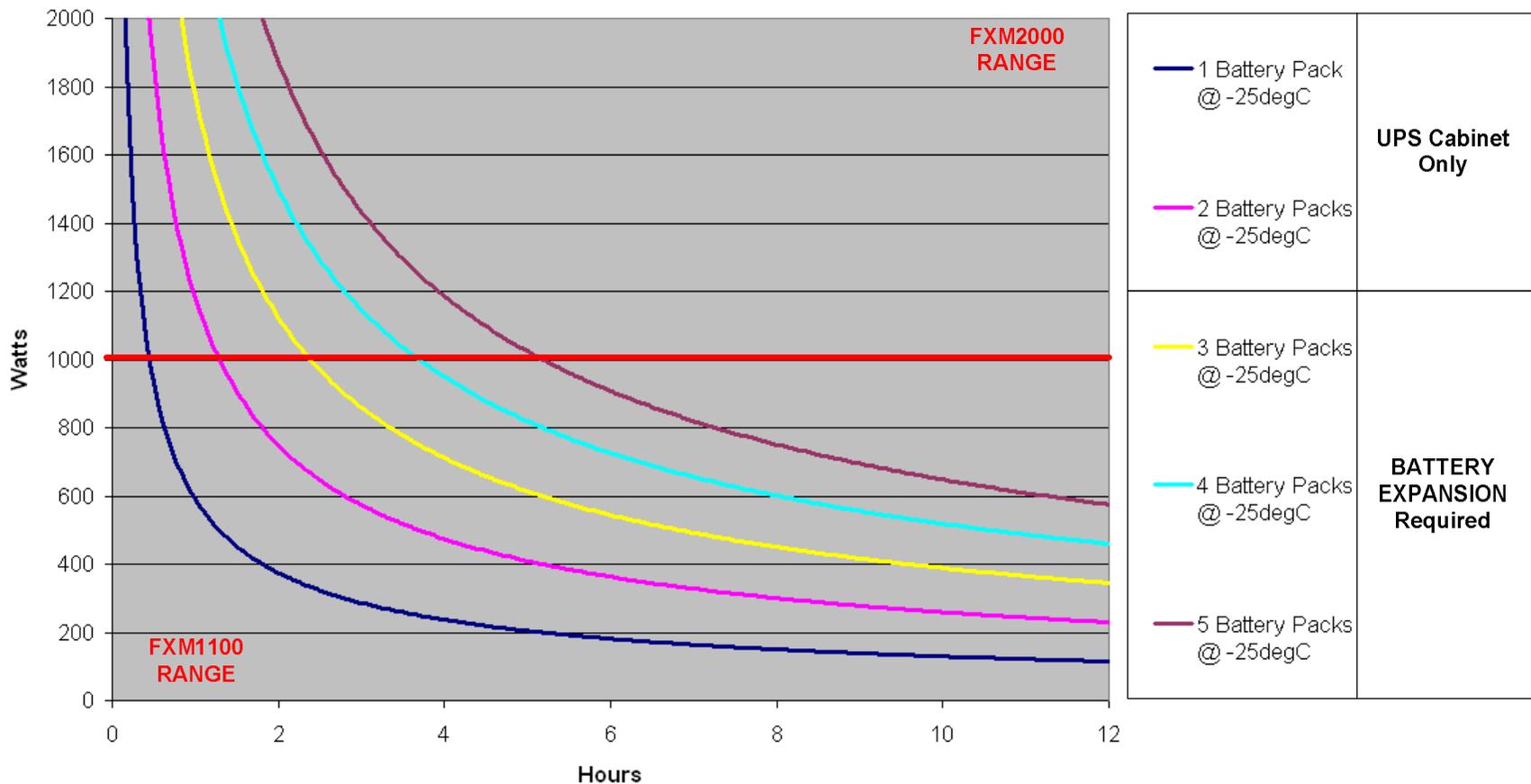


Figure A-3: Estimates of UPS Solution Performance at -25°C

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## APPENDIX B – FXM UPS Faults and Alarms

Table B-1 below lists all the faults and alarms associated with the Alpha FXM UPS unit.

The relay UPS unit's 'Alarm' contact C5, by default, will trigger when any of the faults or alarms listed in Table B-1 occur.

**Any one of the faults listed will cause the FXM UPS unit to cease operation.**

Alarms do not affect UPS operation but give warnings that a fault may be imminent.

Name	Description
<b>Faults:</b>	
Short_Circuit	The load (controller) has a short
Vout_Hi	The output voltage is above unit specifications
Batt_Hi	Battery packs cannot be charged
Batt_Lo	Battery over-discharge threshold reached
Vout_Lo	The output voltage is below specification
Overload	The UPS unit is overloaded. Switch off excess loads
Backfeed	A relay inside the UPS unit has failed causing a backfeed risk
Bad_Battery	Battery pack voltage is extremely low
Temp_Hi	The UPS Unit is operating above its internal temperature range
<b>Alarms:</b>	
Overload	The UPS unit is overloaded. Switch off excess loads
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 <sup>9</sup>
Line_Freq	The line frequency is outside the UPS unit's input specification
No_Temp_Probe	The Battery Temperature Sensor is disconnected or has failed <sup>10</sup>
Weak_Battery	Battery pack has failed the background scan in Line mode <sup>9</sup>
Batt_Low	Battery pack voltage is low <sup>11</sup>
Batt_Brkr_Open	The UPS unit's Battery Breaker is open <sup>12</sup>
Self_Test	The UPS Unit is performing a self test
Fan_Fail	The UPS unit's internal fan has failed
Wrong_Software	The Alpha UPS Monitor software package is invalid <sup>13</sup>
AC_Brkr_Open	The UPS unit's Input Circuit Breaker is open

**Table B-1: FXM UPS Unit Fault and Alarms**

<sup>9</sup> Refer to 667/HB/47760/000

<sup>10</sup> See sections 8.1 and 9.12 for details on the Battery Temperature Sensor

<sup>11</sup> Default value of 47V relating to 40% SOC. Triggers C1. See section 12.2.1

<sup>12</sup> See section 10.3

<sup>13</sup> See section 12.3.3

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## APPENDIX C – Hardware Datasheets

### Alpha FXM Series UPS Unit

# Power

## Novus FXM UPS Series

Outdoor UPS with 650, 1100, or 2000 W/VA Output



- Clean, uninterruptible backup power
- Wide range Automatic Voltage Regulation (AVR) without going to batteries
- Remote communications via RS-232 port or optional SNMP Ethernet interface
- Six independently programmable control and report relays
- Temperature-compensated programmable battery charger
- Event and alarm logging with time/date stamping
- Wide operating temperature range of -40 to 74°C

The Novus FXM UPS series provides backup power ideal for computer, telecommunications, traffic, manufacturing and security applications. The Automatic Voltage Regulator (AVR) offers power stability, reliability, and certainty during unpredictable environmental states and creates voltage equilibrium during varied power conditions. As well, the Novus FXM series of power modules are designed to instantly switch to emergency backup power during any utility power failures or interruptions. The standard input and output voltage is either 120VAC or 230VAC, with an optional 220VAC unit available.



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## Novus FXM UPS Power Modules

### Nominal Specifications

Power Module:	FXM 650**	FXM 1100**	FXM 2000***
Nominal Voltage:	120VAC/230VAC	120VAC/230VAC	120VAC/230VAC
Nominal Frequency:	60Hz/50Hz	60Hz/50Hz	60Hz/50Hz
Input Current*:	8.7A/4.5A	15.5A/8.0A	20A/12A
Output Current:	5.5A/2.8A	9.4A/4.9A	17A/8.9A
Output Power:	650WVA	1100WVA	2000WVA
Output Power at 74°C:	500WVA	850WVA	1500WVA
Battery String Voltage:	24VDC	48VDC	48VDC
<b>Mechanical</b>			
Width (in/mm):	17/432	15.5/394	15.5/394
Height (in/mm):	3.5/89	5.2/133	5.2/133
Depth (in/mm):	9/229	8.75/222	8.75/222
Weight (lb/kg):	25/11	35/16	39/18

**Notes:**

- \* At nominal V in and 10A battery charger
- \*\* Output power for the FXM 650, and FXM 1100 is de-rated by 1.25% per every degree Celsius above 55°C
- \*\*\* Output power for the FXM 2000 is de-rated by 1.0% per every degree Celsius above 50°C

### General Specifications

#### Output

Input Voltage Range (120VAC): 85 to 175VAC without going to batteries  
 Input Voltage Range (230VAC): 150 to 328VAC without going to batteries  
 Output Voltage Regulation: ±10% over full input voltage range  
 Max. Charge Current: 10A – user adjustable to 3, 6 or 10A  
 Waveform: Pure sine wave  
 Typical Efficiency: >98% (normal mode)  
 Typical Output Voltage THD: <3%  
 Typical Transfer Time: <5ms  
 Audible Noise at 1m: 45dBA

#### Environment

Operating Temperature: -40 to 55°C\*  
 Storage Temperature: -40 to 75°C  
 Operating Altitude: 12000ft (3658m)  
 Humidity (operating): Up to 95%

\* Capable of operating to 74°C at de-rated output power.

#### Connections

AC Input and Output: Terminal block (max. 10AWG)  
 Dry Contacts: Terminal block (max. 16AWG)  
 RS-232 Interface: DE-9 female  
 Ethernet Interface: Optional, factory installed RJ-45

### Standard Features

Automatic Voltage Regulation (AVR)  
 Automatic frequency sensing (60Hz/50Hz)  
 Remote monitor and control communications options:  
 Standard RS-232 serial port or optional internal SNMP Ethernet interface  
 Novus User Software: A user friendly Windows™ based GUI  
 Emergency Power Off (EPO) input  
 Variable speed fan with fan failure alarm  
 Circuit breaker protection on the input and external battery input  
 Three mounting configurations: wall, shelf or rack  
 Generator-ready for extended runtime option  
 Three user inputs: self test, alarm, shutdown  
 100 historical events logged with time/date stamping  
 24 month warranty

### Agency Compliance

Electrical Safety: UL1778, CSA 22.2 No 107.3-03, NEMA 3R  
 Marks: cCSA,UL,ICE  
 EMI: Class A FCC/CISPR [EN 50091-2:1995]



The power connection panel and the control panel can be rotated for ease of connection and use in any mounting position.



FXM 650

For more information visit [www.alpha.com](http://www.alpha.com)

#### Alpha Technologies

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## Alpha Universal Automatic Transfer Switch (UATS)

# Power

## Alpha Transfer Switches

Outdoor Solutions



- > Alpha Universal Automatic Transfer Switch (UATS)
- > Fail safe and manual operation ensures critical load is protected
- > Optional dry contact for monitoring transfer switch status: know exactly what your transfer switch is doing
- > Auxiliary output can be used to power items such as battery heater mats eliminating the need for additional complex wiring

The UATS ensures continuous operation of your systems either with conditioned line power, battery backup power or power direct from the line should the UPS require maintenance.



- > Alpha Universal Generator Transfer Switch (UGTS)
- > Automatic and manual operation for complete control over generator transfers
- > Optional dry contact for generator transfer switch monitoring

The UGTS automatically transfers the input to the UPS from the utility line to a portable AC generator. The UGTS allows the generator to recharge the batteries and power your systems during extended power outages.

For a full set of configurations, see the UATS and UGTS manual (Document# 020-165-80)

Your Power Solutions Partner



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## Alpha Transfer Switches

### Electrical

#### > North America

Input voltage: ..... 120V nominal, 102V minimum for auto transfer  
Output voltage: .....Matches Input

#### > International

Input voltage range: ..... 230V nominal, 196V minimum for auto transfer  
Output voltage range: .....Matches Input

#### > Power Module

##### North America:

Part Number: .....020-165-21  
Nominal voltage: .....120V  
Nominal frequency: .....60Hz  
Input current: .....30A  
Output current: .....30A  
Output power at 40°C: ...3600W/VA

##### International:

Nominal voltage: .....230V  
Nominal frequency: .....50Hz  
Input current: .....16A  
Output current: .....16A  
Output power at 40°C: ...3600W/VA

### Mechanical

#### Dimensions:

mm: .....81H x 135W x 152D  
in: .....3.25H x 5.3W x 6.0D

Weight: .....1.6kg (3.5lbs)

Unit weight: .....11kg (25lbs)

### Performance / Features

Generator/line manual selector  
Easy installation convenience outlet (UATS only)  
Spare fuse and mount

### Environmental

Operating temperature: ....-40 to 74°C (-40 to 165°C)

### Options

- Dry contact indication status mode
- Wall/Shelf mounting bracket
- Single side mounting bracket

### Agency Compliance



CAN/CSA C22.2 No.107.3-05  
UL1778 4th Edition Uninterruptible power systems  
CE: As component type for FXM UPS family and Micro UPS family  
(when enclosed in a box)  
EMC: Not applicable



Universal Automatic Transfer Switch (UATS-far right) and Universal Generator Transfer Switch (UGTS-center) shown with surge protection (TVSS-left) in a 19" rack mount bracket (23" rack mount bracket also available).

Alpha Technologies Ltd.

For more information visit [www.alpha.ca](http://www.alpha.ca)

Canada: Burnaby, British Columbia Tel: 604 436 5900 Fax: 604 436 1233  
United States: Bellingham, Washington Tel: 360 647 2360 Fax: 360 671 4936

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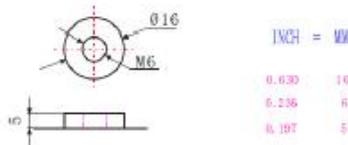
## Betta Batteries 6CNFT-55 12V 55Ah Front Terminal Lead Crystal Battery

**LEAD  
CRYSTAL<sup>®</sup>  
BATTERIES**

6-CNFT-55 FT  
12V/55Ah

POWERED BY

**Betta Batteries**



Discharge current and end voltage	
Discharge current (A)	End voltage (V)
0.05C or below or Intermittent discharge	11.4
0.05C of current close to it	11.1
0.1C of current close to it	10.8
0.2C of current close to it	10.5
From 0.2C to 0.5C	10.2
From 0.5C to 1C	9.8
From 1C to 3C	9.0
Current in excess of 3C	7.8

Specification		
Nominal Voltage	12V	
Rated Capacity (10 hour rate)	55AH	
Dimension	Total Height (Top of terminals)	225mm (8.88 inches)
	Height	222mm (8.74 inches)
	Length	277mm (10.90 inches)
	Width	106mm (4.17 inches)
Weight	Approx. 18kg (39.65 lbs)	
Capacity (20°C)	120 hour rate(0.55A)	66AH
	20 hour rate(3.0A)	60AH
	10 hour rate(5.5A)	55AH
Internal Resistance	Fully charged Battery (20°C)	8mΩ
Self-Discharge (20°C)	Capacity after 3 month storage	95%
	Capacity after 6 month storage	85%
	Capacity after 12 month storage	80%
Max Discharge Current (20°C)	550A(5S)	
Terminal	Standard	F3
	Optional	
Charging (Constant Voltage)	Cycle	Initial Charging Current 18.5A or smaller 14.4V ~ 14.8V/ (20°C)
	Float	13.5V ~ 13.6V/ (20°C)

Betta Batteries 12V Battery Temperature compensation guide		
Charging (Constant Voltage)		
Temp	Cycle	Float
20°C - 30°C	14.4V - 14.8V	13.5V - 13.8V
31°C - 40°C	14.25V - 14.65V	13.35V - 13.65V
41°C - 45°C	14.1V - 14.5V	13.2V - 13.5V

Constant Current Discharge Characteristics: Units Amperes (20°C)															
End voltage per cell	5min	15min	30min	45min	1h	2h	3h	4h	5h	6h	8h	10h	12h	20h	24h
1.60V	148.63	94.82	62.48	47.03	38.45	22.94	16.87	12.95	11.00	9.46	7.15	5.78	4.87	3.04	2.55
1.67V	127.93	85.97	57.92	44.55	37.24	21.89	15.84	12.82	10.45	9.35	7.04	5.67	4.87	3.04	2.55
1.70V	122.21	83.33	56.10	44.00	35.97	21.56	15.51	12.71	10.40	9.30	6.99	5.61	4.87	3.04	2.54
1.75V	111.10	77.99	53.90	42.30	34.82	20.74	15.07	12.38	10.07	9.08	6.88	5.56	4.82	3.04	2.54
1.80V	98.23	71.45	51.87	40.76	33.33	20.02	14.85	12.16	9.85	8.86	6.71	5.50	4.72	3.03	2.52
1.83V	85.75	65.29	47.91	37.98	31.52	19.14	14.30	11.66	9.41	8.53	6.49	5.34	4.59	3.01	2.45
1.85V	73.31	59.13	44.00	35.04	29.76	18.32	13.75	11.22	9.02	8.25	6.27	5.19	4.46	3.01	2.38

Discharge Data with Constant Power Units: Watts per cell (20°C)															
End voltage per cell	5min	15min	30min	45min	1h	2h	3h	4h	5h	6h	8h	10h	12h	20h	24h
1.60V	246.45	165.94	113.57	86.57	71.72	43.78	31.90	24.80	21.12	18.53	14.02	11.43	9.57	5.94	4.98
1.67V	220.16	154.72	106.32	82.83	69.85	42.42	31.13	24.69	20.46	18.31	13.75	11.16	9.57	5.94	4.98
1.70V	213.06	150.70	103.40	81.95	67.87	41.31	29.86	24.53	20.07	18.20	13.70	11.05	9.57	5.94	4.98
1.75V	196.68	141.68	99.99	79.42	66.00	39.93	29.15	24.14	19.58	17.93	13.42	10.94	9.57	5.94	4.97
1.80V	178.31	130.57	96.58	76.89	63.52	38.61	28.82	23.71	19.08	17.65	13.20	10.84	9.29	5.88	4.96
1.83V	157.47	120.89	90.20	72.05	60.33	37.18	27.83	22.93	18.42	17.16	12.76	10.56	9.07	5.88	4.83
1.85V	136.62	111.21	83.82	67.21	57.20	35.75	26.84	22.11	17.71	16.66	12.32	10.29	8.85	5.83	4.71



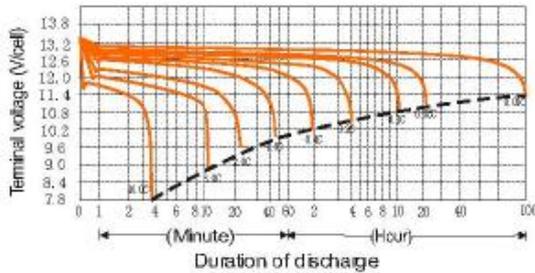
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## LEAD CRYSTAL<sup>®</sup> BATTERIES

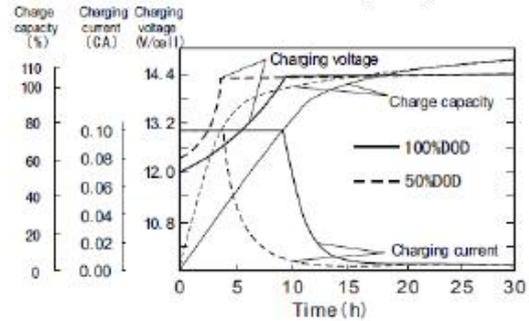
6-CNFT-55 FT  
12V/55Ah

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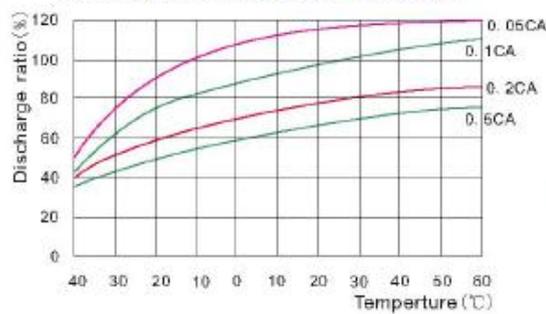
Discharge characteristics (25°C)



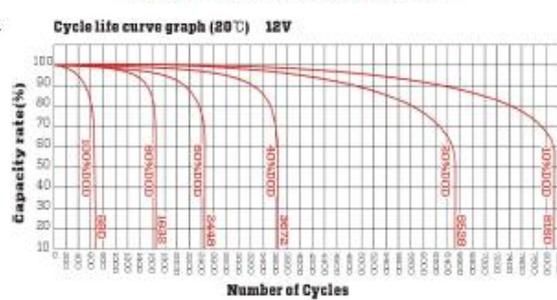
Charge Characteristics (25°C)



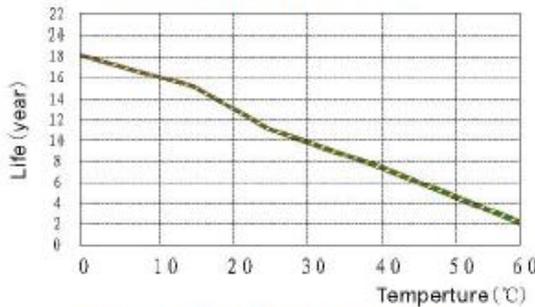
Temperature and discharge capacity



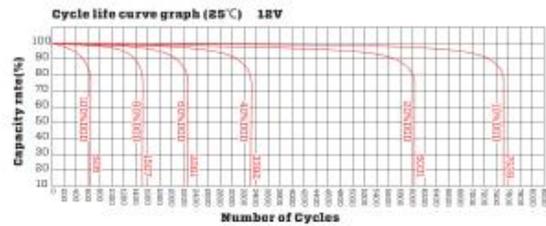
Cycle life curve graph (20°C)



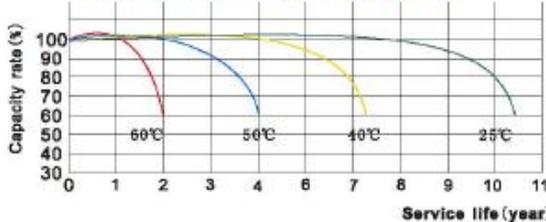
Float service life curve graph



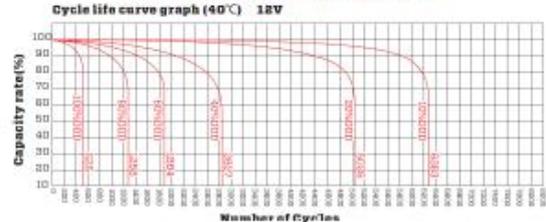
Cycle life curve graph (25°C)



Temperature and float service life



Cycle life curve graph (40°C)



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