“Mission Critical Power – What and How

Dustin J Becker
Technology Business Leader
Emerson Network Power
Agenda
- Introduction
- Mission Critical Areas
- Threats
- System Elements
- System Architecture
- Data Centers as an Example
Mission-critical operations demand assurance of 24/7 uninterrupted power availability. Mission critical power systems are highly designed to be fault-tolerant with increased reliability and monitoring functions to maintain facility uptime in the event of a utility outage, an internal fault, or scheduled maintenance.
What is “Mission Critical”? 

Mission critical refers to any factor of a system (equipment, process, procedure, software, etc.) whose failure will result in the failure of business operations.

That is, it is critical to the organization's "mission." As a rule in disaster management, if a triage-type decision is made in which certain elements must be eliminated or delayed, e.g. because of constraints, the mission critical ones are excluded from consideration.

Mission Critical systems have four attributes: availability, reliability, performance and security.
Where is Mission Critical?

Types of Mission Critical Facilities

Private - Business Continuity
- Business Enterprise Data Centers
- Financial Data Centers and Trading
- Internet Companies

Public Safety
- Emergency Call Centers
- Police & Fire Stations
- Hospitals
- National Security

CFE Media™

Telecom

Aerospace
Military
What is “Mission Critical”? 

- **What is the Need?**
  - **Availability**
    - System MUST function when needed
  - **Reliability**
    - System must be resilient if not immune to failure
    - If failure does occur, recovery must be fast
  - **Security**
    - System must be protected against detrimental influence
      - Human
      - Natural
What is “Mission Critical”? 

What is the threat? 

– Natural Disasters 
  • Weather 
  • Earthquake 
  • Flood 
  • Fire 

– Improper Maintenance 

– Equipment Failure 

– Human Error 

– Terrorism
There's no such thing as "set and forget" power protection for mission-critical networks. To be sure, every component of your power protection system is reliable...you wouldn't have it any other way. But how those components work together -- and how power protection grows with your network, and how well the equipment is maintained -- all have an impact on the degree to which you are protected.
What is “Mission Critical”?  

The Elements of Mission Critical Systems

- Payload Hardware and Software
  - Server Systems
  - Data Switches
  - Control actuators

- Infrastructure Hardware and Software
  - Power Generation
  - Power Conversion and Management
  - Energy Collection and Storage
  - Power Distribution
  - Heating and Cooling
Mission Critical Power

Power Generation

Power Conversion and Management

Energy Collection and Storage

Power Distribution

Thermal Management

Monitor, Control, & Maintenance
Mission Critical Power

- Power Conversion and Management
  - AC/AC
  - AC/DC
  - DC/DC
  - DC/AC
  - Asset Management – can extend to other assets- DCIM for example
Mission Critical Power

- Energy Collection and Storage
  - Battery
    - Lead Acid
    - Lithium
    - Sodium
    - Zinc
  - Flywheel
  - Super-Cap
  - Flow Battery
Mission Critical Power

- Power Distribution
  - AC
  - DC
  - Centralized
  - Distributed
  - Transfer Switches
  - PDUs
  - Electro-mechanical
  - Solid State
Mission Critical Power

- Thermal Management
  - Natural Convection
  - Forced Air
  - Fluid
  - Heat Pump
  - Immersion
  - Conduction
  - “Free” Air
Mission Critical Power

- Uses some or all of the listed elements, coupled with a power architecture design approach to yield:

  - Availability
  - Reliability
  - Security
Mission Critical Power

Architectures

- Single power chain
- Single power chain with Energy back-up
- Single power chain with Parallel Elements (N+N)
- Single power chain by-pass capability
- Multiple Power chain systems
Mission Critical Power

Data Centers as Examples
Class F0 Basic Data Center

Class F0 – Single Path; No UPS

AC

DC

Grid Or Utility
AC Power Input

TVSS

Service Entrance
Switchgear

Generator

ATS

Computer Load
Switchboard

PDU

IT Load

UPS Input
Switchboard

“N” Rect

No Batt

Computer Load
Switchboard

PDU

IT Load
Class F1 Basic Data Center

Class F1 – Single Path with UPS

AC
- Grid Or Utility AC Power Input
- TVSS
- Service Entrance Switchgear
- UPS Input Switchboard
- UPS
- Bypass Cabinet
- Computer Load Switchboard
- PDU
- IT Load

DC
- Grid Or Utility AC Power Input
- TVSS
- Service Entrance Switchgear
- Generator
- ATS
- UPS Input Switchboard
- N+1 Rectifiers; Modular or Monolithic
- Fully, Partial or non-redundant battery
- DC Energy Source
- Computer Load Switchboard
- PDU
- IT Load
Class F2 Redundant Components

Class F2 – Single Path UPS with Redundant Components

AC

- Grid or Utility AC Power Input
- TVSS
- Service Entrance Switchgear
- Power Control SWGR
- ATS
- UPS Input Switchboard
- Sys Control Cab.
- Bypass Cab.
- DC Energy Source
- Computer Load Switchboard
- PDU
- IT Load

DC

- Grid or Utility AC Power Input
- TVSS
- Service Entrance Switchgear
- Power Control SWGR
- ATS
- UPS Input Switchboard
- N+m Rectifiers; Modular or Monolithic
- Fully, Partial or non-redundant battery
- DC Energy Source
- Computer Load Switchboard
- PDU
- IT Load
Class F3 Concurrently Maintainable

**AC**

**DC**

- Grid or Utility AC Power Input
- TVSS
- Service Entrance Switchgear
- **N+m Rectifiers; Modular or Monolithic**
- UPS Input Switchboard
- Computer Load Switchboard
- PDU
- IT Load
- Dual or single Cord IT Loads

- Grid or Utility AC Power Input
- TVSS
- Service Entrance Switchgear
- **N Rect Mod or Mono**
- UPS Input Switchboard
- Computer Load Switchboard
- PDU
- IT Load
- Dual or single Cord IT Loads
Class F4 Fault Tolerant

Class F4 – Dual Path; Fault tolerant

Diagram showing an electrical system design with dual paths and fault tolerance features.
Class F4 Fault Tolerant

Class F4 – Dual Path; Fault tolerant

- **Utility AC Power Input**
- **TVSS**
- **Service Entrance Switchgear**
- **Power Control SWG1**
- **ATS**
- **Building Distribution Switchgear**
- **UPS Input Switchgear**

**N+m Rectifiers; Modular or Monolithic**

- Fully, Partial or non-redundant battery

**DC Energy Source**

- **Computer Load Switchboard**
- **PDU**
- **IT Load**

- Fully, Partial or non-redundant battery

- **Dual or single Cord IT Loads**