# TRYSTAR

Troy, Michigan

# 3 CRITICAL LINKS FOR LIFE SAFETY


- Notification that an emergency condition exists
- Visibility created and maintained by Emergency Lighting & Power Equipment
- Directional placards establish path for safe egress
- The reliability of a life safety design is only as strong as the weakest link.

# DESIGN CRITERIA – CODE COMPLIANCE

## Minimum Life Safety Requirements

- UL 924 Emergency Lighting & Power Equipment
- ANSI/NFPA 101 “Life Safety Code”
- Article 700 of ANSI/NFPA 70
- Local Codes

## Code Compliant Solutions

- Generators, Diesel or Natural Gas
  - UL 924 Auxiliary Lighting & Power Equipment
- Individual Wall Packs / Battery Packs
- Emergency Ballasts
- Centralized Inverters

# ANSI / UL 924

## UL 924 Emergency Lighting & Power Equipment

- This category covers electrical emergency lighting and power equipment for use in accordance with ANSI/NFPA 101, “Life Safety Code”, Article 700 of ANSI/NFPA 70, “National Electric Code” and the “International Building Code”

## UL 924 Auxiliary Lighting Equipment

- This category covers equipment intended to be used in conjunction with a Facility Emergency Lighting & Power System. The equipment may consist of battery assemblies, unit equipment, remote light sources, illuminated signs or related devices. This equipment has not been investigated for compliance with the performance criteria of Article 700 of the ANSI/NFPA 70, National Electric Code”, ANSI.NFPA 101, “Life Safety Code” or the “Uniform Fire Code”.

# DOES ANSI / NFPA 111 APPLY?

Excerpts from NFPA 101

### 7.9.2.4

Emergency generators and related transfer switch equipment that provide power to emergency lighting systems shall be installed, inspected, tested and maintained in accordance with NFPA 110. Stored electrical energy systems, where required in this *Code*, other than battery systems for emergency luminaires in accordance with **7.9.2.5**, shall be installed, inspected, tested and maintained in accordance with NFPA 111.

### 7.9.2.5

Unit equipment and battery systems for emergency luminaires shall be listed to **ANSI/UL924**, Standard for Emergency Lighting & Power Equipment.

# ANSI / NFPA 101 PERIODIC TESTING

Facility owners are required to provide clients and occupants with a properly maintained Life Safety Egress system.

Non-compliance issues lead to liability concerns:

- Non-compliance with OSHA 29CFR1910 (1910.37 means of egress)
- Lawsuits – potential insurance policy violations
- Tickets and fines
- Facility lock-out conditions

# ANSI / NFPA 101 PERIODIC TESTING

7.9.3 Periodic Testing of Emergency Lighting Equipment

7.9.3.1 Required emergency lighting systems shall be tested in accordance with one of the three options offered by;

7.9.3.1.1

7.9.3.2.1

7.9.3.1.3

What level of Periodic Testing are you specifying?

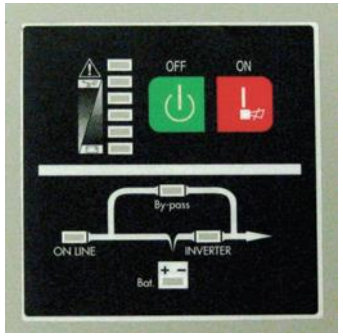
# ANSI / NFPA 101 PERIODIC TESTING

7.9.3.1.1 Testing of required emergency lighting systems shall be permitted to be conducted as follows:

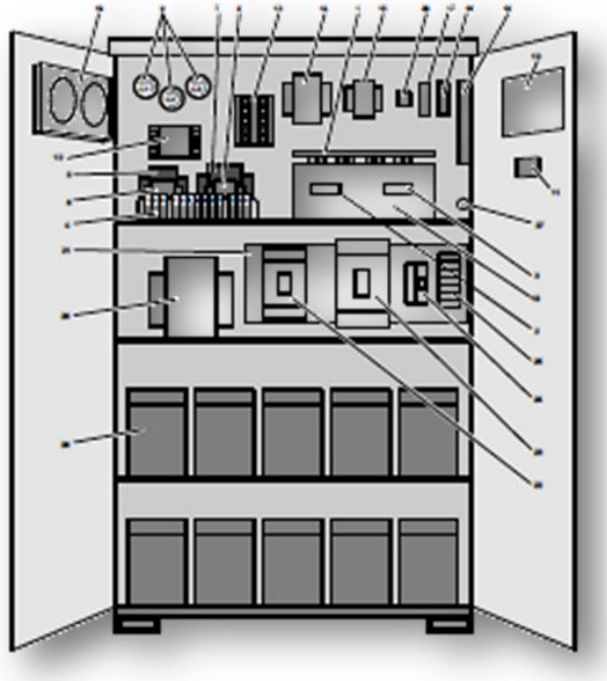
1) *Functional testing shall be conducted monthly*, with a minimum of 3 weeks and a maximum of 5 weeks between tests, for *not less than 30 seconds* except as otherwise permitted by 7.9.3.1.1(2).
2) *The test interval shall be permitted to extend beyond 30 days with the approval of the authority having jurisdiction.
3) *Functional testing shall be conducted annually* for a *minimum of 1 ½ hours* if the emergency lighting system is battery powered.
4) The emergency lighting equipment shall be fully operational for the duration of the tests required by 7.9.3.1.1 (1) and (3).
5) *Written records of visual inspections and tests shall be kept by the owner for inspection by the authority having jurisdiction.*

# ENGINEERED LIFE SAFETY

NFPA 101 Life Safety:  7.9.3.1.1 Compliant







# ANSI / NFPA 101 PERIODIC TESTING

7.9.3.1.2 Testing of required emergency lighting systems shall be permitted to be conducted as follows:

1) Self-testing / self-diagnostic battery-operated emergency lighting equipment shall be provided.

2) Not less than once *every 30 days*, self-testing / self-diagnostic battery-operated emergency lighting equipment shall *automatically* perform a test with a duration of a minimum of 30 seconds and a diagnostic routine.

3) Self-testing / self-diagnostic battery-operated emergency lighting equipment shall indicate failures by a status indicator.

4) A *visual inspection* shall be performed at intervals not to exceed *30 days*.

5) Functional testing shall be *conducted annually* for a minimum of *1 ½ hours*.

6) Self-testing / self-diagnostic battery-operated emergency lighting equipment shall be fully operational for the duration of the 1 ½ hour test.

7) *Written records of visual inspections and tests shall be kept by the owner for inspection by the authority having jurisdiction*.

# ENGINEERED LIFE SAFETY

NFPA 101 Life Safety:  7.9.3.1.2
Compliant

(LED Monitor) Every 30 days a self testing / self-diagnostics will be activated. The system will log (store in memory) any alarms and make available through the front panel LED all information.

# ANSI / NFPA 101 PERIODIC TESTING

7.9.3.1.3 Testing of required emergency lighting systems shall be permitted to be conducted as follows:

1) Computer based self-testing / self-diagnostic battery-operated emergency lighting equipment shall be provided.

2) Not less than once *every 30 days*, emergency lighting equipment shall *automatically* perform a test with a duration of a minimum of 30 seconds and a diagnostic routine.

3) The emergency lighting equipment shall *automatically* perform *annually* a test for a minimum of 1 ½ hours.

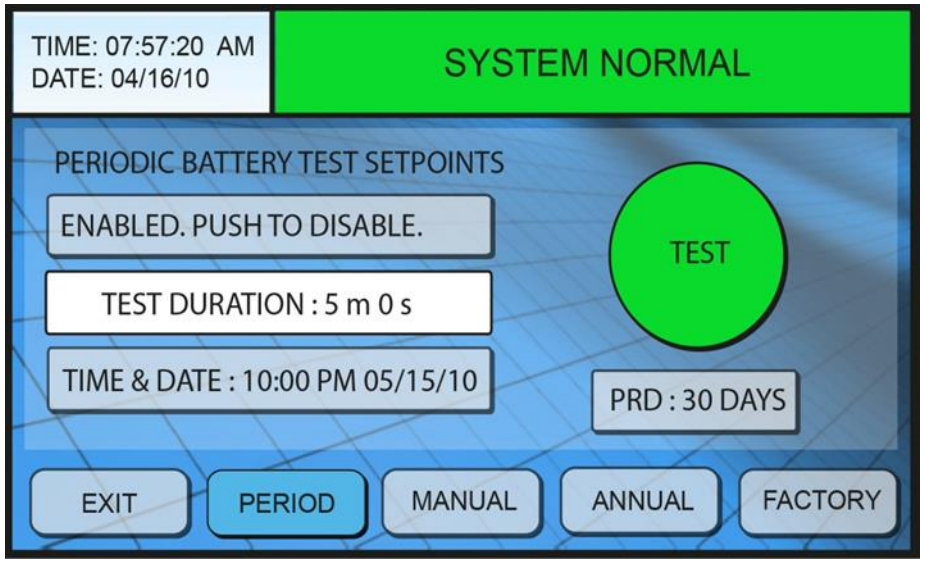
4) The emergency lighting equipment shall be fully operational for the duration of the tests required for 7.9.3.1.3(2) and (3).

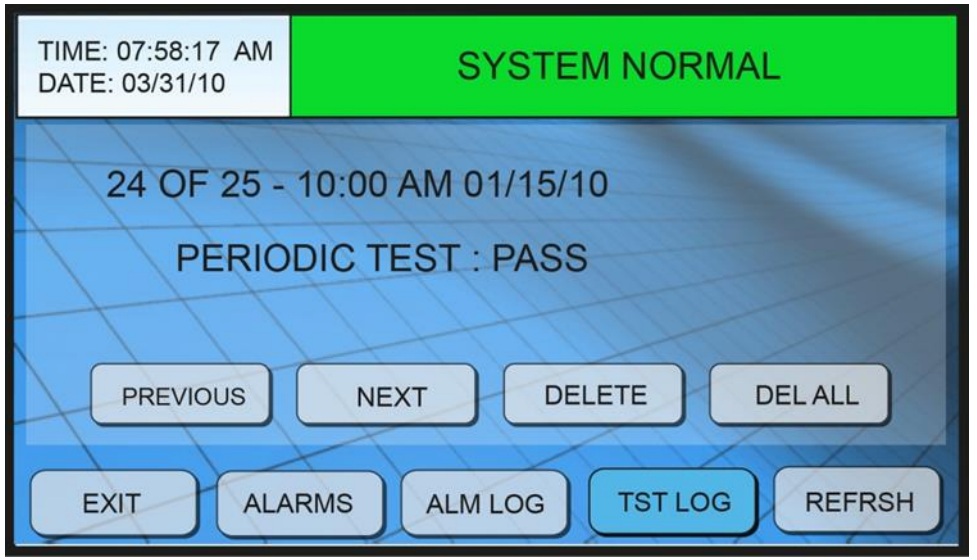
5) *The computer-based system shall be capable of providing a report of the history of tests and failures at all times*.

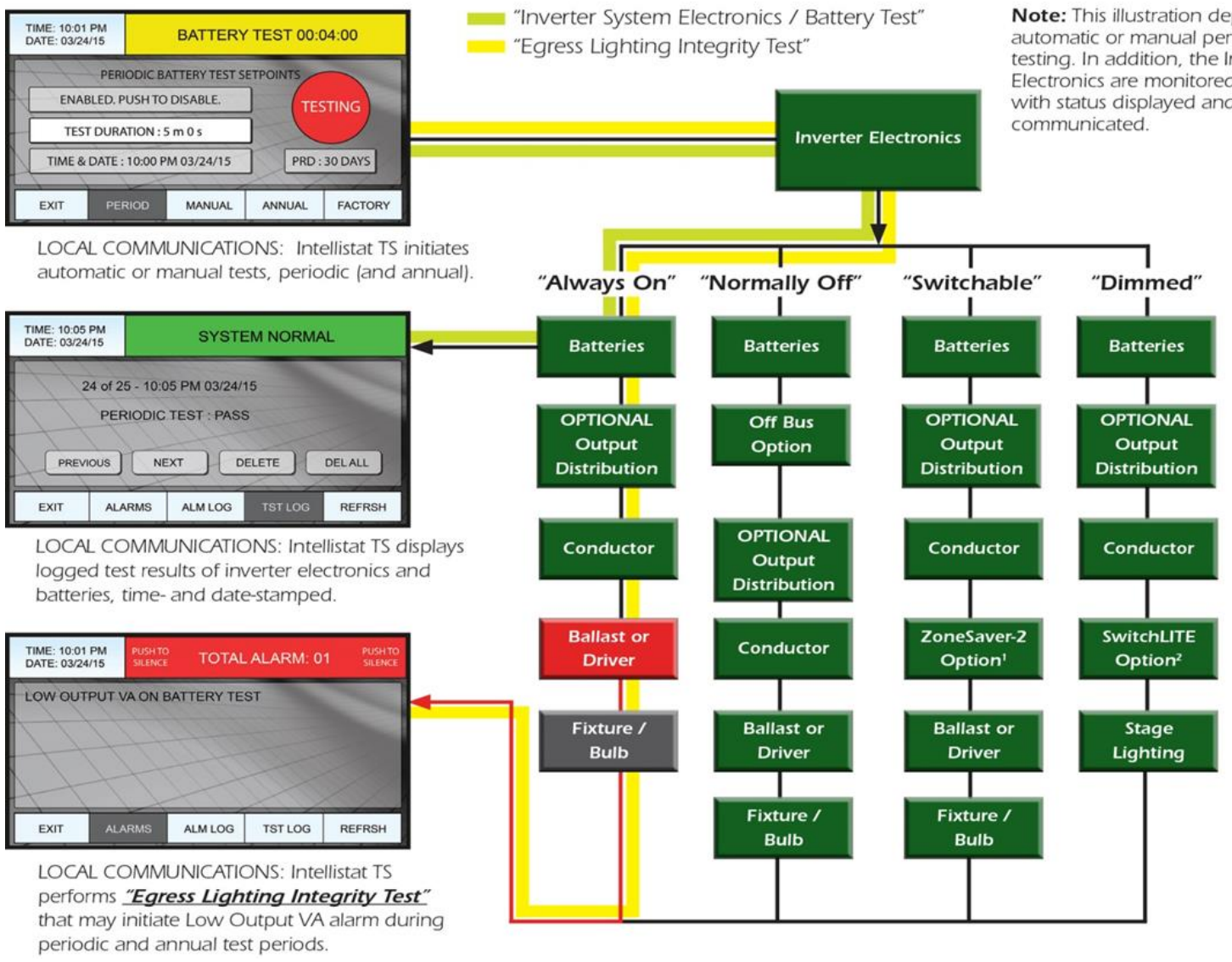
# ENGINEERED LIFE SAFETY

## Advanced Local Monitoring: NFPA 101 Life Safety:  7.9.3.1.3 Compliant

- Programmable, *Automatic Monthly* Battery Test per NFPA 101
- Programmable, *Automatic Annual* Battery Test per NFPA 101
- *Logged Events*, Including Automatic Test Results





# NFPA 70

NEC 2011 – Article 100

Definition:

Coordination (Selective). Localization of an overcurrent condition to restrict outages to the circuit or equipment affected, accomplished by the choice of overcurrent protection devices and their ratings or settings.

# NFPA 70

NEC 2014 – Article 100

Definition:

Coordination (Selective). Localization of an overcurrent condition to restrict outages to the circuit or equipment affected, accomplished by the ~~choice~~ **selection and installation** of overcurrent protection devices and their ratings or settings **for the full range of available overcurrents, from overload to the maximum available fault current, and for the full range of overcurrent protective device opening times associated with those overcurrents.**

**Reflects 2014 definition change**

**No change in 2020**

# NFPA 70

NEC 2014 – Article 700

Definition:

700.28 Selective Coordination. Emergency system(s) overcurrent devices shall be selectively coordinated with all supply-side overcurrent devices. Selective coordination shall be selected by a licensed professional engineer or other qualified persons engaged primarily in the design, installation, or maintenance of electrical systems. The selection shall be documented and made available to those authorized to design, install, inspect, maintain, and operate the system

*Exception: Selective coordination shall not be required between two overcurrent devices located in series if no loads are connected in parallel with the down stream device.*

# NFPA 70

NEC 2017 – Article 700

Definition:

700.32 Selective Coordination. Emergency system(s) overcurrent devices shall be selectively coordinated with all supply-side overcurrent devices. Selective coordination shall be selected by a licensed professional engineer or other qualified persons engaged primarily in the design, installation, or maintenance of electrical systems. The selection shall be documented and made available to those authorized to design, install, inspect, maintain, and operate the system

*Exception: Selective coordination shall not be required between two overcurrent devices located in series if no loads are connected in parallel with the down stream device.*

*No Change in 2020.*

# NFPA 70

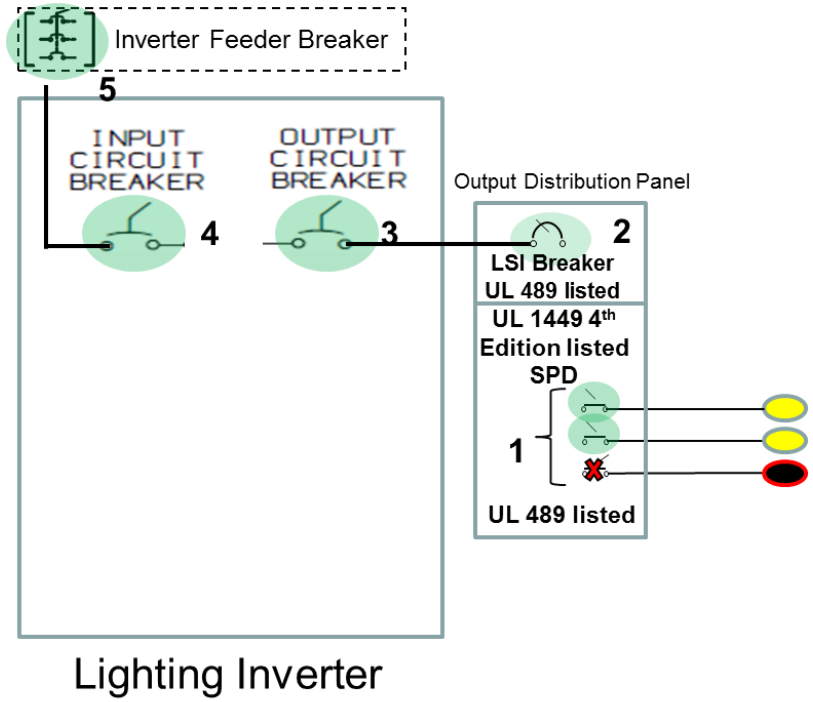
NEC 2017 – ARTICLE 700

Definition:

700.8 Surge Protection. A listed SPD shall be installed in or on all emergency switchboards or panelboards.

# NFPA 70

FOR EXAMPLE,




Selective Coordination is achieved only when the appropriate emergency system overcurrent device is opened due to a downstream overcurrent condition. In this case, a branch breaker from group 1 opened before any of supply side overcurrent devices - 2,3,4 or 5.

# NFPA 70

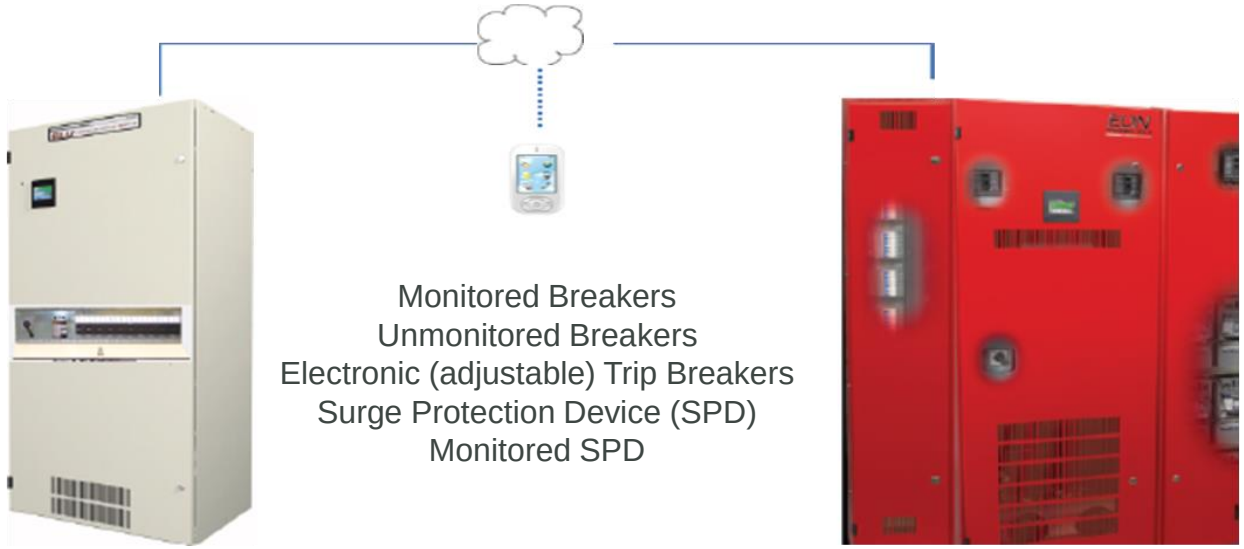
## INTEGRAL BRANCH CIRCUIT BREAKER OPTIONS

*Design requirement*

Inverter Feeder Breaker

*Design requirement*

Inverter Feeder Breaker

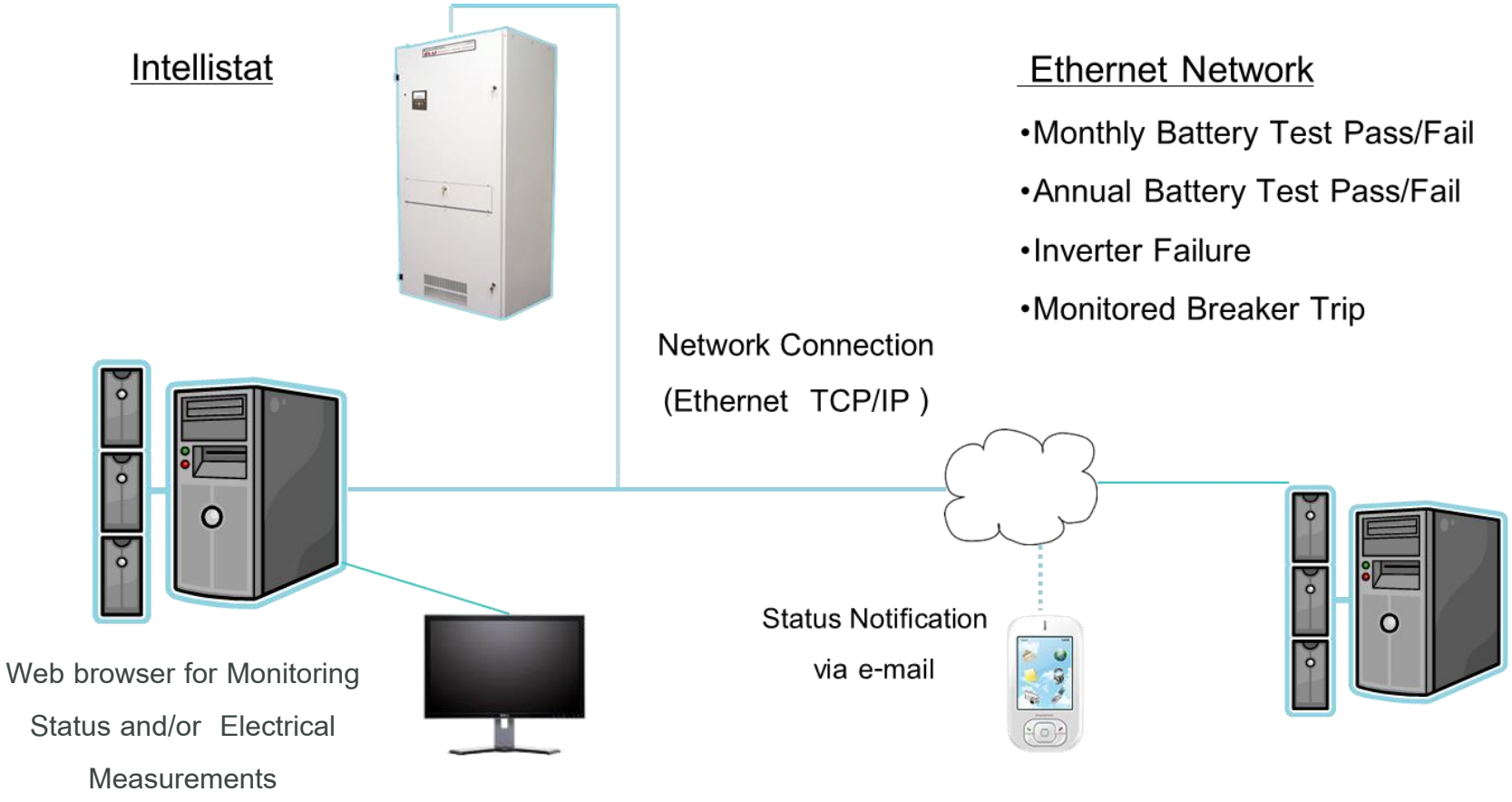


Monitored Breakers
Unmonitored Breakers
Electronic (adjustable) Trip Breakers
Surge Protection Device (SPD)
Monitored SPD

# IMPROVED LIFE SAFETY DESIGN

WITH TECHNOLOGICALLY ADVANCED REMOTE MONITORING

# ADVANCED REMOTE MONITORING, ETHERNET



# ADVANCED REMOTE MONITORING, BACNET

Network Connection

BACnet / IP

BACnet MS/TP

Building Management System

- Monthly Battery Test Pass/Fail
- Annual Battery Test Pass/Fail
- Inverter Failure
- Monitored Breaker Trip

Intellistat

Internet

Status Notification via e-mail

Lighting Controllers

HVAC





TRYSTAR

# ADVANCED REMOTE MONITORING, MODBUS

Network Connection

MODBUS TCP

MODBUS RS485

Building Management System

- Monthly Battery Test Pass/Fail
- Annual Battery Test Pass/Fail
- Inverter Failure
- Monitored Breaker Trip

Intellistat

Internet

Status Notification via e-mail

Lighting Controllers

HVAC





TRYSTAR

# ENGINEERED LIFE SAFETY

## UNIVERSAL COMMUNICATIONS PROTOCAL

The Intellistat Monitor with Remote Communications capability is field programmable to accept any of the following;

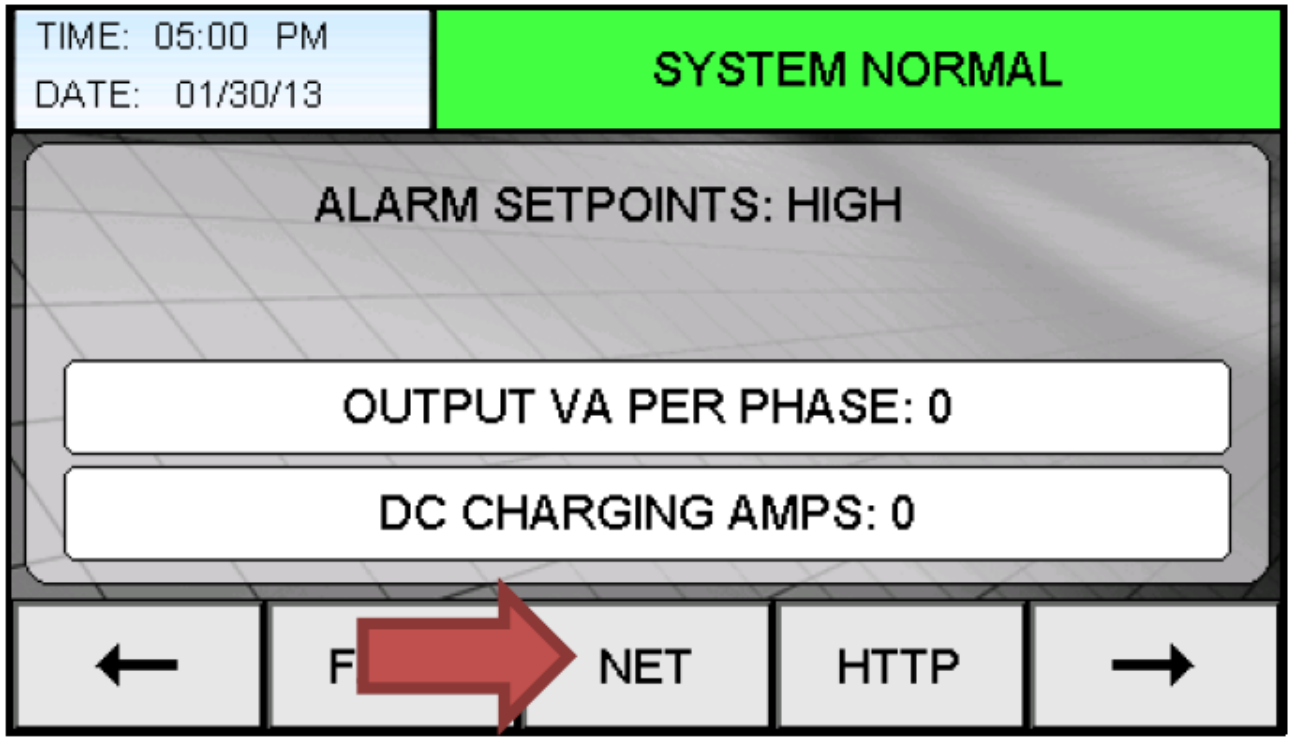
TCP/IP

MODBUS TCP or TCP/IP

MODBUS RS485 (RTU or ASCII)

BACnet I/P

BACnet MS/TP

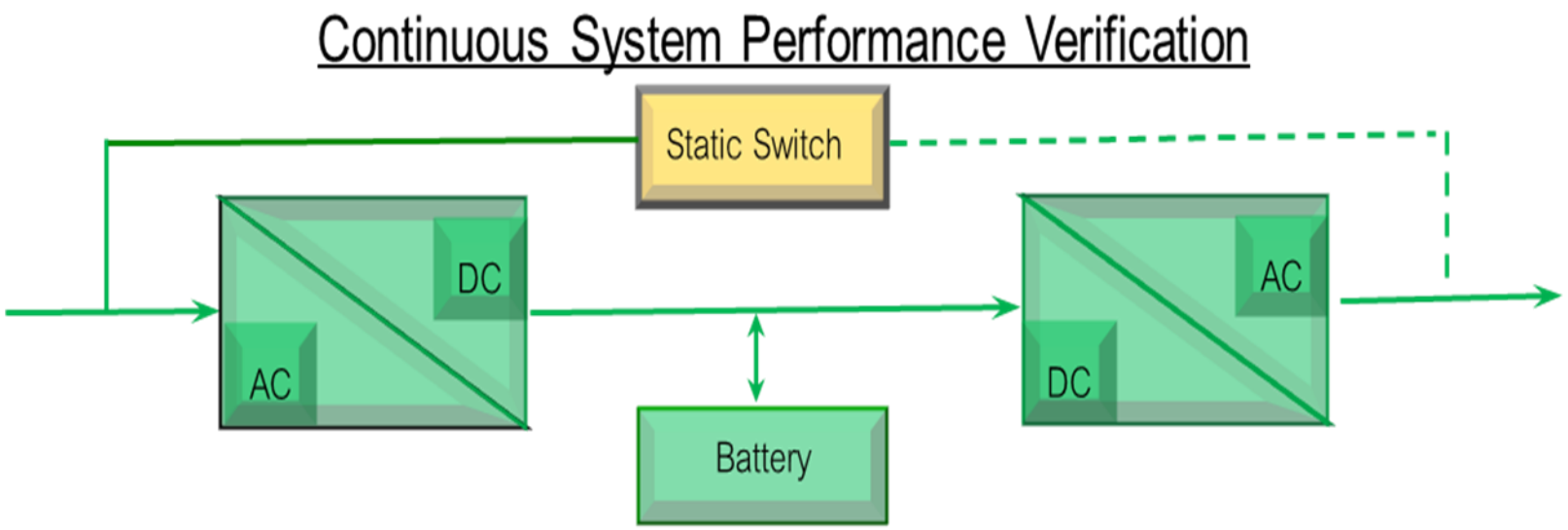


# IMPROVED LIFE SAFETY DESIGN

WITH CONTINUOUS SYSTEM PERFORMANCE VERIFICATION

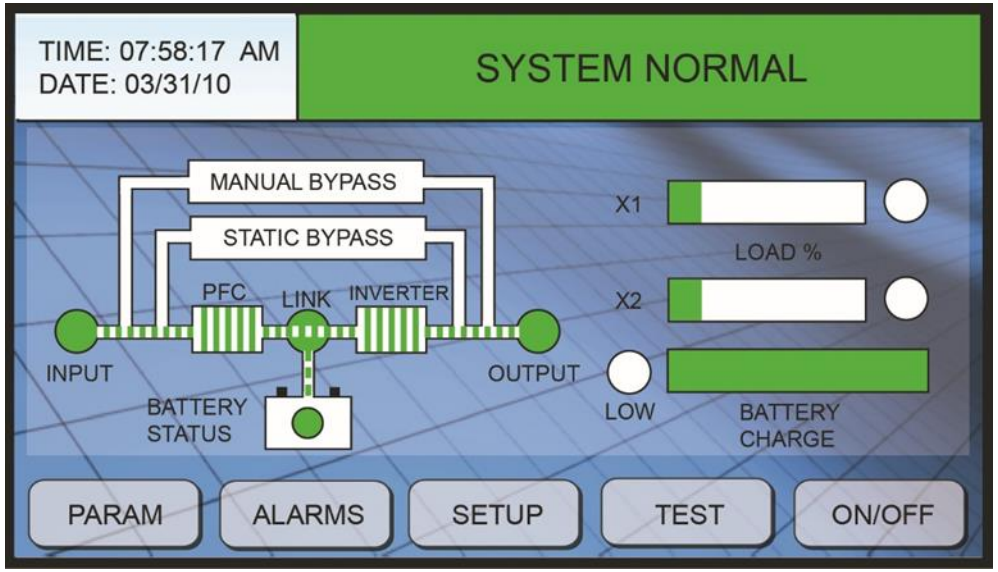
# ENGINEERED LIFE SAFETY

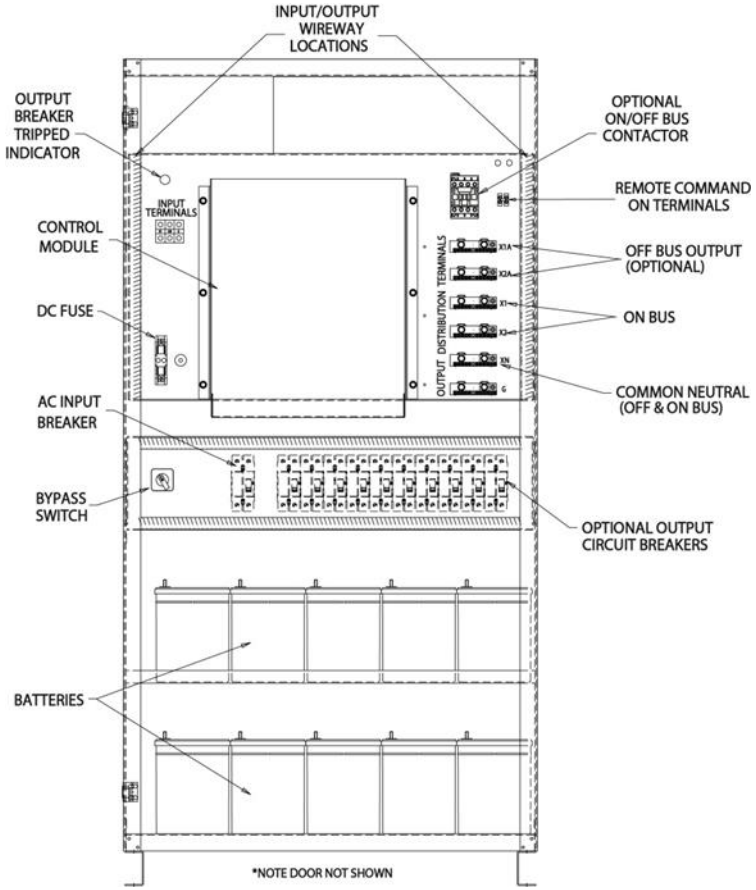
CONTINUOUS SYSTEM PERFORMANCE VERIFICATION



# ENGINEERED LIFE SAFETY

CONTINUOUS SYSTEM PERFORMANCE VERIFICATION



# ENGINEERED LIFE SAFETY

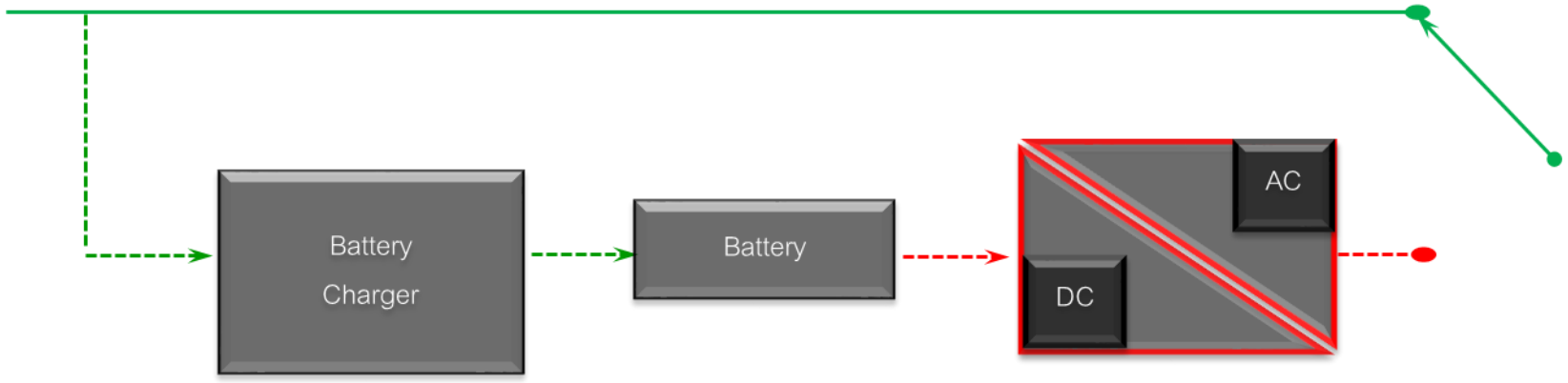
CONTINUOUS SYSTEM PEFORMANCE VERIFICATION

How confident am I that the Life Safety System will perform when occupants safety depends on it?

Extremely confident.  The engineered solution will run performance tests every second of every day.

# ENGINEERED LIFE SAFETY

"HIGH EFFIENCY" SYSTEMS:  OFF-LINE OR STAND-BY TECHNOLOGY



# ENGINEERED LIFE SAFETY

"HIGH EFFIENCY" SYSTEMS:  OFF-LINE OR STAND-BY TECHNOLOGY

How confident am I that the Life Safety System will perform when occupants safety depends on it?

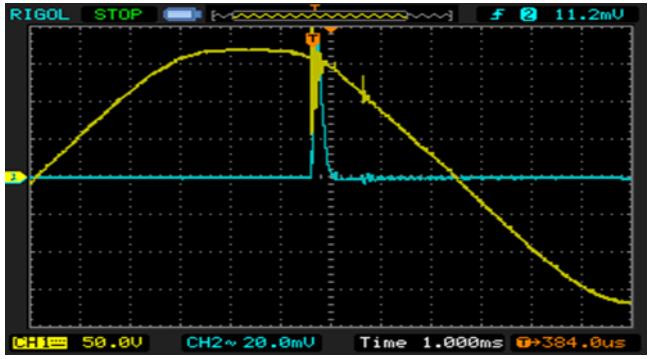
I only know if it works when I test it, or when there is an emergency

I know that it worked when I tested it 3 weeks ago

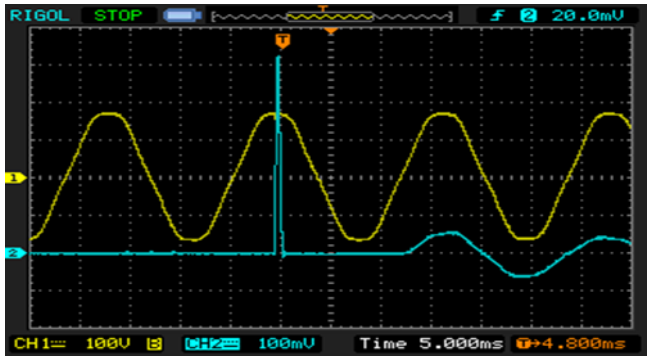
# ENGINEERED LIFE SAFETY

# LED INRUSH CHARACTERISTICS

LAB TEST PERFORMED AT TRYSTAR




Bench Test, LED Driver wired directly to source 73 amp peak inrush for 384uS (micro-second) typical per LED data sheet.




Bench Test, LED Driver connected to source with 100’ of #12 AWG conductor.  52 amp peak inrush for 1-2mS (milli-second)

Blue=I, Yellow = V, Orange = T

# ENGINEERED LIFE SAFETY

## DESIGN ELEMENTS

- Improved Code Compliance / Reduced Liability
- Adjustable Electronic Trip Breakers Available
- Universal Networking Capabilities
- Continuous System Performance Verification
- Designed To Handle LED Inrush Capacity
- Small Footprint

# ENGINEERED LIFE SAFETY

## IMPROVED MAINTENANCE

- Automatic, Unattended Code Compliance & Record Storage
  - (NFPA 101 Level 3 only)
- Reduced Liability
- Single Point of Maintenance
- Advanced local & Remote Communications
- Unit Will Notify If In Distress

# END OF PRESENTATION

ANY QUESTIONS?

# Life Safety Shelters

Excerpts from 2020 ICC 500/NSSA Standard Storm Shelter

### 701.2 Protection of Storm Shelter Critical Support Systems

*Storm shelter critical support systems* **shall remain functional for the design storm event** and minimum period of *storm shelter* occupancy (24 hours for hurricane shelters, **2 hours for tornado shelters**). *Storm shelter critical support systems* located outside of the *storm shelter* areas shall be protected by a means that meet the wind loads and impact requirements of Chapter 3, and, as applicable, the flood resistance requirements of Chapter 4.

# Life Safety Shelters

Excerpts from 2018 International Building Code (IBC)

### 2702.1.7 Interchangeability

Emergency Power Systems shall be an acceptable alternative for installations that require Standby Power Systems.

# Life Safety Shelters

Excerpts from 2020 ICC 500/NSSA Standard Storm Shelter

### 702.4.2 Mechanical Ventilation

*Tornado Shelters* that rely on mechanical ventilation shall be provided with the minimum mechanical ventilation rate of required outdoor air at a minimum rate of 5 cubic feet per minute per occupant for the *design occupant capacity.* The mechanical ventilation system shall be connected to a **standby power system.**

# Life Safety Shelters

Excerpts from 2020 ICC 500/NSSA Standard Storm Shelter

### 702.5 Standby Power

Where required by Section 702.4 or 702.8, *community tornado shelters* shall be provided with a **standby power system**. The standby power system shall support *occupied storm shelter areas* and *occupant support areas.*

### 702.5.2 Duration

The standby power system shall be designed to provide continuously the required output capacity for a **minimum of 2 hours**.

# Life Safety Shelters

Excerpts from 2020 ICC 500/NSSA Standard Storm Shelter

### 702.7 Exit Signs & Emergency Lighting

In community tornado shelters, in the event of a power failure, an **emergency power system** shall supply power for the exit signs and emergency exit lighting in accordance with the International Building Code.

# Life Safety Shelters

Excerpts from 2020 ICC 500/NSSA Standard Storm Shelter

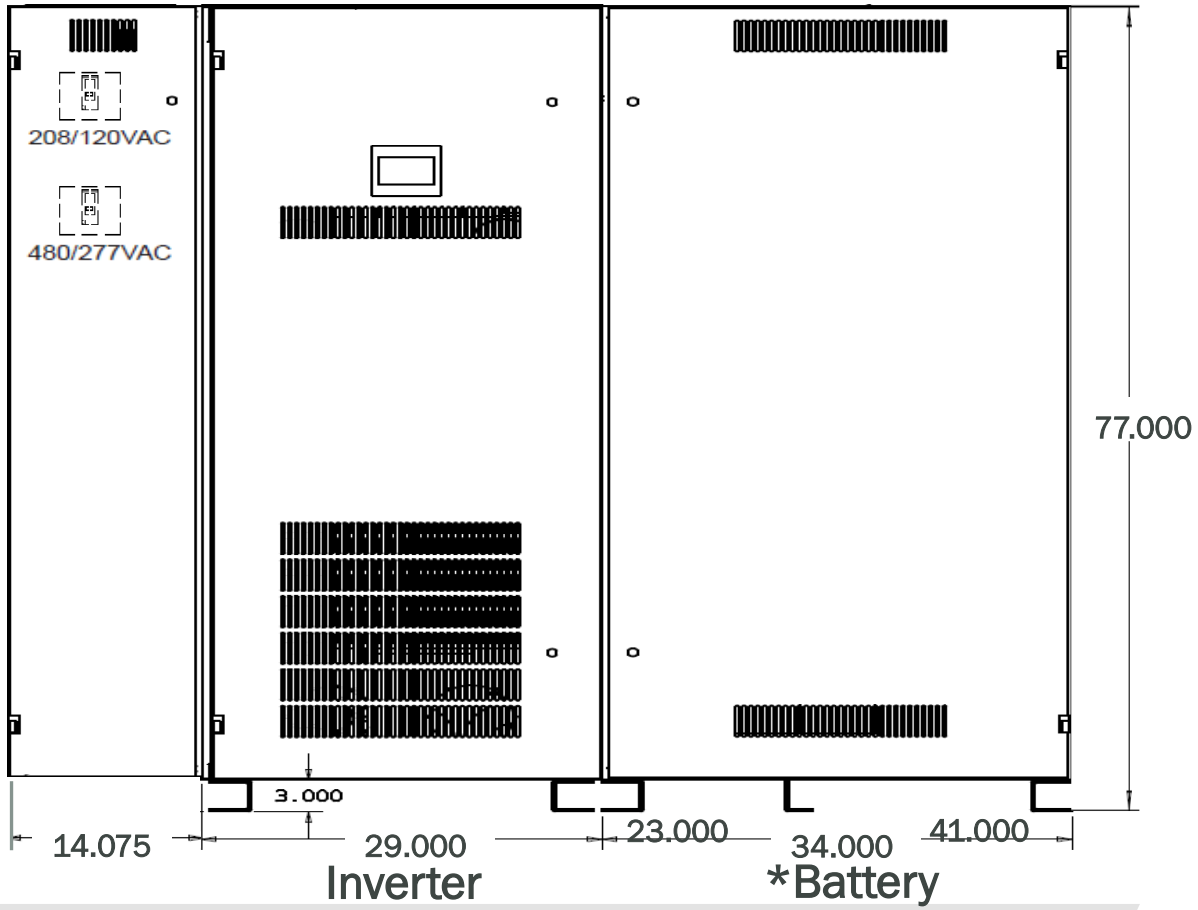
### 702.8 Standby Lighting

*Community tornado shelters* shall be provided with a standby lighting system. The standby lighting system shall provide illumination levels of not less than 1 foot-candle (11 lux) at the walking surface in *occupied storm shelter areas* and *occupant support areas.* The standby lighting system shall be connected to a **standby power system**.

**Exception:** Personal-use lighting devices such as flashlights with a minimum of 150 lumens or *approved* equivalent lighting devices shall be permitted for *tornado shelters* with a *design occupant capacity* of less than 50. Lighting devices shall be provided at a quantity not less than one per 10 occupants and readily available within the *storm shelter*

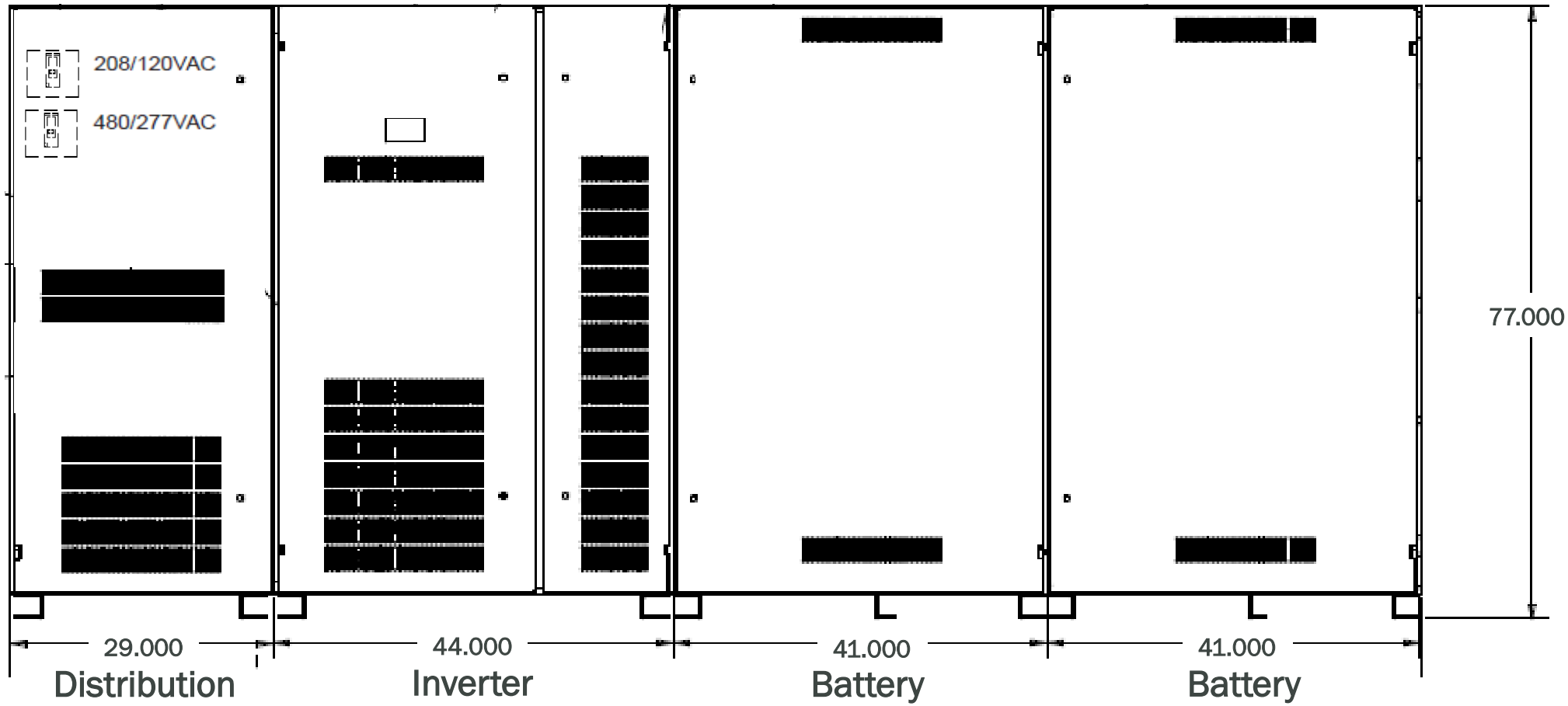
# Life Safety Shelters

10KW to 33KW
(1) 208/120V Output Main
(1) 480/277V Output Main



# Life Safety Shelters

40KW to 55KW
(1) 208/120V Output Main
(1) 480/277V Output Main



# END OF PRESENTATION

ANY QUESTIONS?