LayerZero Power Systems, LLC.

The Foundation Layer

Series 70: eSTS

800 A 480 V 3-Pole Static Transfer Switch

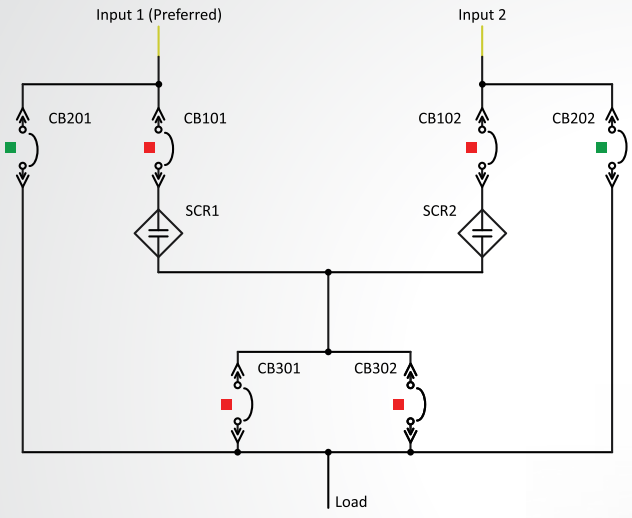
Product Brochure

The LayerZero eSTS Static Transfer Switch
Maximizes Power Reliability

eSTS Automatically Transfers Between Two or Three* Power Sources

LayerZero Power Systems designs and manufactures the world's ***most reliable*** static transfer switch. The Series 70 eSTS is a solid-state transfer switch that automatically or manually performs solid-state transfers between two in-phase AC sources in a quarter cycle. The eSTS conducts open-transition transfers in a manner that minimizes disruption to the connected load, never cross-connecting power sources. One source is designated as the preferred source. If it fails, the load is automatically and seamlessly transferred to the alternate source through an open-transition static transfer. For emergency transfers between asynchronous sources, the system employs dynamically phase-compensated transfers to minimize downstream transformer saturation in 3-phase, 3-wire configurations.

*Optional



eSTS Static Transfer Switch One Line Diagram

Controls Section Contains:

Power electronics

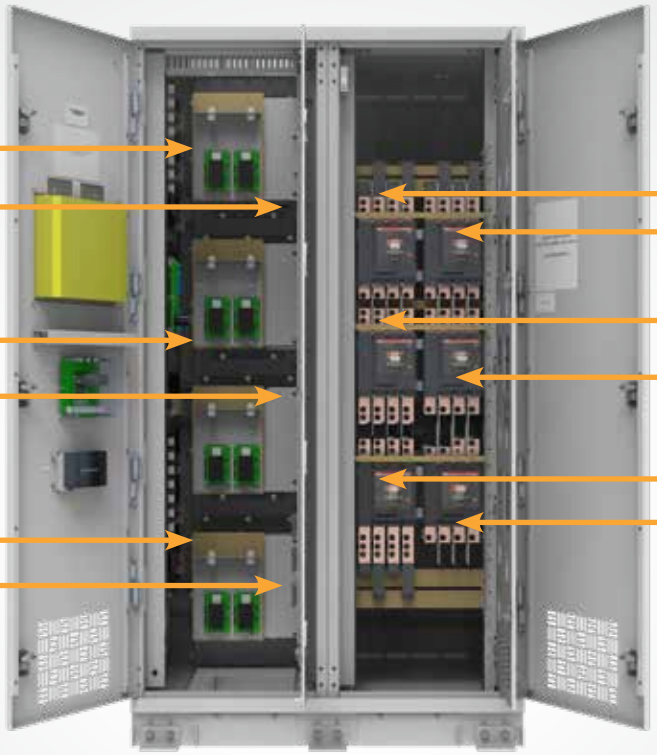
- SCRs (Silicon Control Rectifier) in Convection Cooled Heat Sinks

Control Electronics

- System Control & Data Acquisition Boards
- SCR Gate Drives
- Redundant Power Supply System
- I/O system; VPN Router

CB Section Contains:

Input isolation switches
Bypass isolation Switches
Output isolation switches
Source connection terminals
Load connection terminals



Standard Features

Every LayerZero Power Systems eSTS is equipped with a comprehensive suite of standard features designed to maximize reliability, enhance safety, and improve operational efficiency.

Reliability

Optional Triple Modular Redundancy:
Fully-independent control paths ensure no single point-of-failure.

Safe Bypass Procedure:
Mechanical bypass interlock prevents human errors during bypass procedures.

Voice Guided Bypass:
Audio-video guidance offers step-by-step instructions for operators.

Convection Cooling:
Natural cooling system is maintenance-free.

Epoxy Coated Buswork:
Eliminates potential bus-to-bus faults.

Silver Plated Terminals:
Superior conductivity for enhanced electrical performance.

Maintenance-Free Joints:
Permanent brazed joints ensure longevity.

Machined Hardware:
Constant torque throughout product life.

Optical Fiber Based Controls:
Noise and interferance free controls while ensuring high voltage isolation.

Serialized Critical Board Tracking:
Active database tracking for essential boards.

Safety

INSIGHT IR® Cameras:
Monitor bolted connections for temperature anomalies.

Sectionalized Components:
Allows safe de-energization for maintenance.

Polycarbonate Windows:
View critical board LEDs with closed dead-front door.

Front-Only Access:
Safe installation and maintenance without side/rear access.

Dead Front Hinged Doors:
Ensures a safe work environment with no exposed live parts.

Connectivity

Ethernet Connectivity:
Secure VPN router for remote monitoring.

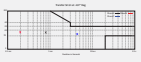
Modbus/TCP:
Connect to existing systems without proprietary restrictions.

NTP Time Clock Synchronization:
Enables timeline-based event logging.

SNMP Connectivity:
Remote management via SNMP.

Power Quality Monitoring

Real-Time Waveform Capture:
Captures a picture of the power three-cycles before and after every event.



ITIC Plotting:
Analyze if equipment was affected by power quality events.

Local Touch-Screen Interface:
Secure interface for local STS operations.

Waveforms Automatically Emailed:
Send waveforms to designated individuals post-transfer.

Reliability Overview

LayerZero eSTS Reliability Overview

The LayerZero eSTS Provides Many Dimensions of Reliability:

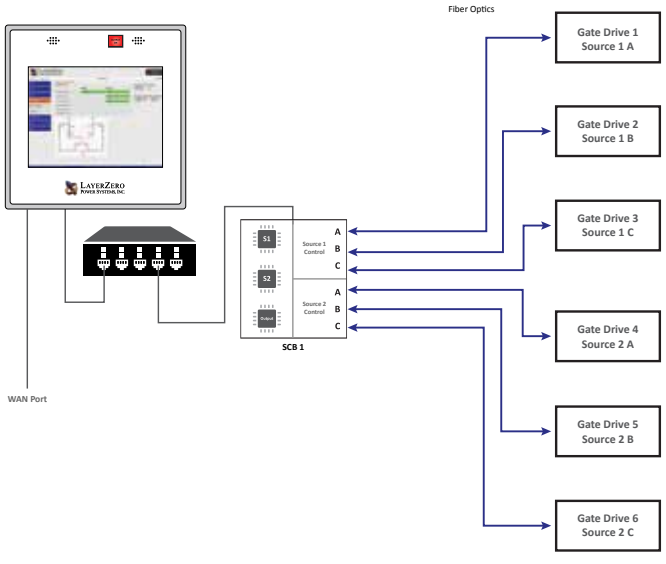
- **Control System Reliability:**
  - **SMR (Single Module Redundancy, Standard):** Our foundation system ensures consistent and reliable operation in all conditions.
  - **TMR (Triple Modular Redundancy, Optional):** LayerZero's TMR architecture goes beyond SMR with 3 independent control systems. Each operates in complete isolation, independently assessing and acting on voltage and current data. Even if one co fails, the eSTS continues operation seamlessly.
  - **Control Power Supply Reliability:** Provides consistent, isolated power delivery to critical components to prevent unforeseen interruptions.
  - **Signal Reliability:** Designed for clear and precise signal transmission, minimizing the risk of noise or error in system communication.
  - **Operator Procedural Reliability:** User-focused features prioritize intuitive, error-free operations, protecting both personnel and system integrity.

The Series 70: eSTS is designed for maximum reliability

Single Module Redundancy (SMR) Reliability (Standard)

Single Module Redundancy (SMR) is a cost-effective topology that delivers redundant power paths for mission-critical equipment. In SMR systems, each source is supported by triple redundancy of processors, with every phase managed by a dedicated gate drive board.

LayerZero's SMR topology is unique in that it is fail-safe, maintaining full switching functionality even if a critical board were to fail. This design ensures that mission-critical operations remain stable, reliable, and uninterrupted.



Redundant Control Paths of LayerZero SMR Gate Drives

Reliability Features: Triple Modular Redundancy (TMR) *Optional

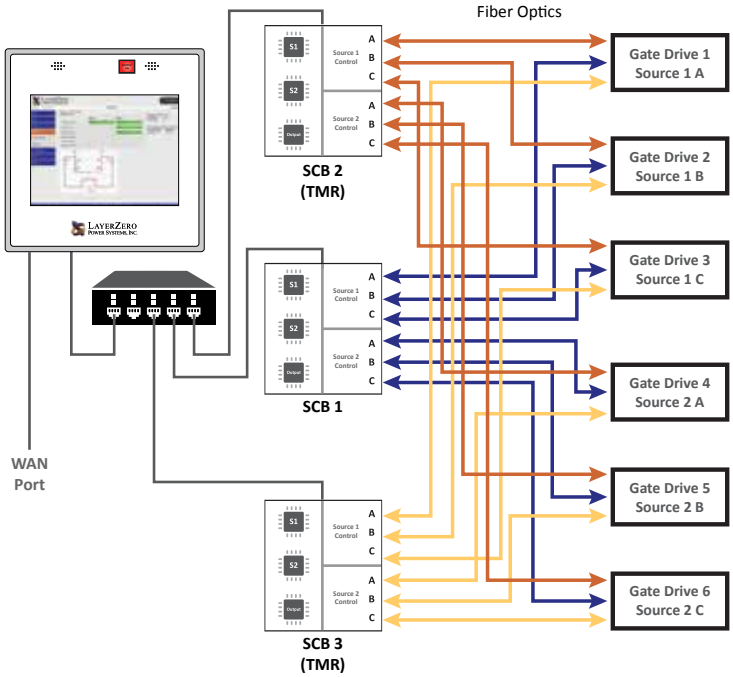
Triple Modular Redundancy (TMR) Reliability (Optional)

LayerZero TMR includes all the redundancy features of SMR, plus three independent sets of analog and digital data and control systems. There is no direct communication between these systems, and they do not even share a common system clock.

Each control system independently acquires voltage and current data, determines whether a source is acceptable or faulty, and makes transfer decisions autonomously. Even if an entire control path or subcomponent fails, followed by a failure of the active power source, the STS can still complete its mission of transferring to the alternate source.

Triple Modular Redundancy is based on proven statistical models and rigorous mathematics.

Three System Control Boards (SCBs) in a TMR Configuration



Redundant Control Paths of a TMR Configuration

Reliability Features: Single Module Redundant (SMR) Redundancy

eSTS SMR Triple Redundant Power Supply Architecture

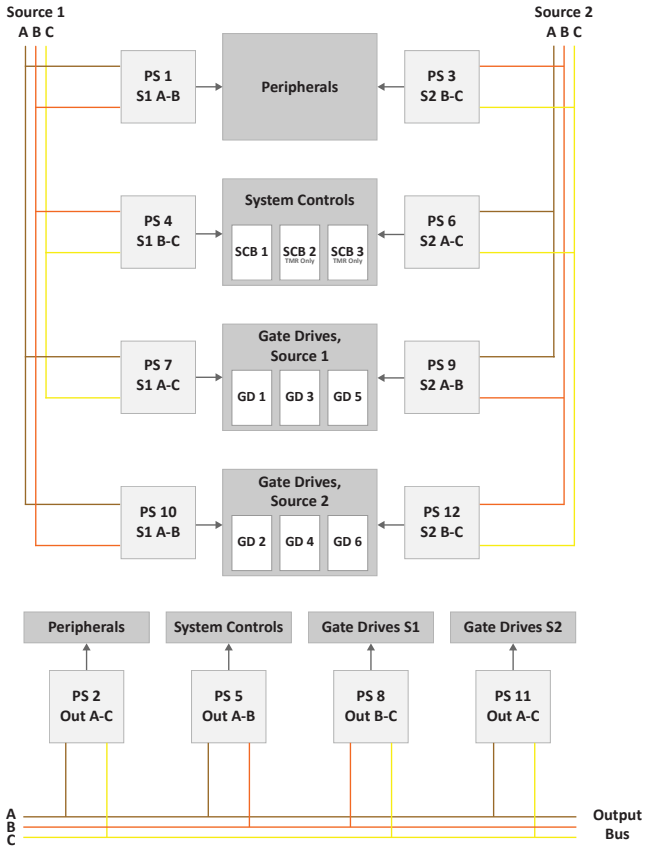
Divided into four (4) logical failure groups:

- System controls
- Source 1 gate drives
- Source 2 gate drives
- Peripherals.

The three (3) available source of power from which to supply control power to each failure group are:

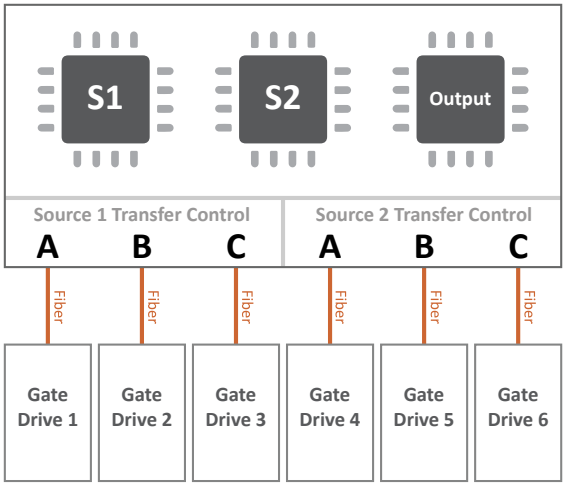
- Source 1
- Source 2
- STS Output.

LayerZero's STS design incorporated 12 power supplies (3 power sources x 4 failure groups). This architecture utilizes every possible power path to the 4 logical STS failure groups; and is the most comprehensive and redundant power supply system in existence.



eSTS SMR Triple Redundant Processors

- Separate/independent processors for Source 1, Source 2 and Output power quality analysis
- If Source 1 processor malfunctions then system is able to be commanded to transfer to Source 2; & vice versa.
- If main control system fails then STS continues to conduct power to the load from the existing source of power. (However STS is unable to transfer to the other source)
- Each phase of each source is controlled with a separate gate drive circuit board.



Reliability Features

Mechanical Bypass Interlock

In order to minimize the possibility of operator error during equipment bypass operations, LayerZero provides:

1. Interlocked breakers
2. Mechanisms to ensure that a source cannot be bypassed without the STS on the correct source.
3. Safeguards to make certain that sources cannot be connected to each other inadvertently.
4. A voice-prompted bypass procedure that guides the operator through the sequence.
5. A step-wise pictorial & video presentation is provided on the touch-screen display during bypass.

Mechanical Bypass Interlock “Goalpost” Design

Voice Guided Bypass

Operator error during maintenance bypass is a known reliability risk. To reduce the likelihood of an out-of-sequence operation, the eSTS features a voice-prompted bypass procedure. This system provides clear, step-by-step voice and visual instructions, with only one operation presented per screen. Audio and visual cues ensure operators follow the correct sequence, significantly reducing the probability of human error.

The Voice Guided Bypass Screen in the LZA GUI

No Fans, Dust Filters, or Fan Fuses

The Series 70 eSTS Static Transfer Switch utilizes a natural convection cooling system for heat dissipation. Fans and fan sensors are among the most common failure points in electronic systems. For maximum uptime, LayerZero’s eSTS design eliminates these vulnerabilities, with no fans, dust filters, or fan fuses to replace.

The heat sink arrangement is staggered between sources and phases to minimize extreme thermal gradients between heat sink columns when conducting on either source.

Convection-Cooled Design in an eSTS, showing perforated vents on the cabinet bottom

Reliability Features

Epoxy Coated Buswork/Maintenance Free Joints

LayerZero's use of epoxy-coated buswork enhances both safety and reliability by eliminating the possibility of bus-to-bus faults. All bus joints are permanently brazed, creating a maintenance-free system that ensures long-term durability and performance.

Silver-Plated, Epoxy Coated Customer Inputs for Source 1 and Source 2

Silver Plating

All bus joints and terminals are silver-plated to deliver the highest electrical performance. Silver provides exceptional conductivity and minimal resistance, resulting in highly efficient and reliable contact

Machined Hardware

LayerZero's bolted connections utilize precision-machined cap screws and engineered disc springs. This design produces a flat pressure-versus-deflection profile, ensuring that all bolted connections maintain consistent torque throughout the product's lifetime.

These technologies have been extensively tested in diverse environmental conditions and temperature ranges to guarantee that, once tightened, connections remain secure and stable for years of

Machined Cap Screws and Engineered Disc Springs Utilized in LayerZero Power Systems Products

Fiber Optic Controls Increase System Reliability

Fiber optic-based control architecture eliminates electrical noise and interference while isolating low-voltage control components from high-voltage power circuits. In the eSTS design, gate drives operating at power circuit voltage receive control signals via optical fibers, ensuring precise communication, improved noise immunity, and enhanced overall system reliability.

Fiber Optic Connections (highlighted) in a Gate Drive

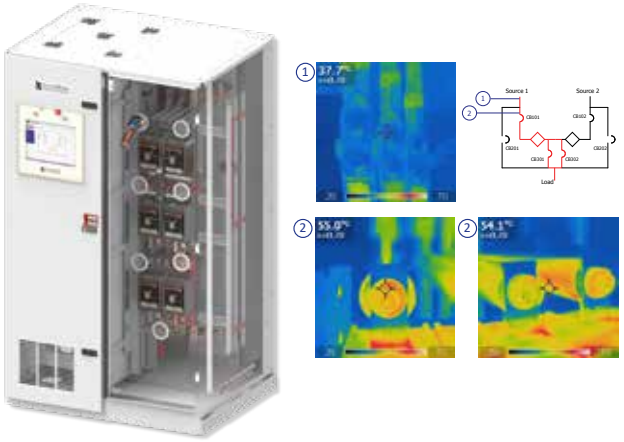
Safety - Ease of Maintenance

INSIGHT IR® Portholes Permit Scanning of Bolted Connections with Dead-Front Doors Closed

Strategically positioned IR-scan portholes allow for safe thermal scanning of all bolted connections with the dead-front doors closed, eliminating operator exposure to power circuit voltage. Thermal scans can be performed entirely from the front of the unit, without ever opening the dead-front door.

Each IR window swivels upward and unlocks with keyhole access, revealing a protective mesh. This enables operators to point and shoot thermal cameras directly through the mesh to obtain accurate readings.

INSIGHT IR® Porthole mounted on a polycarbonate window.



An IR Camera Scanning an INSIGHT IR Porthole for Source 1 Input (Door and side panel hidden for visibility)

INSIGHT IR® Cameras Provide Early Detection

The INSIGHT IR® Thermal Monitoring System continuously monitors the temperature of critical components using a network of fixed infrared cameras. The system provides live imaging of each connection's temperature in real time, with the ability to view readings by individual phase.

By detecting abnormal heat signatures early, maintenance teams can proactively address issues before they escalate into failures, preventing downtime and improving equipment reliability.

INSIGHT IR® live images can be viewed on a local or remote display.

INSIGHT IR® Camera Housing

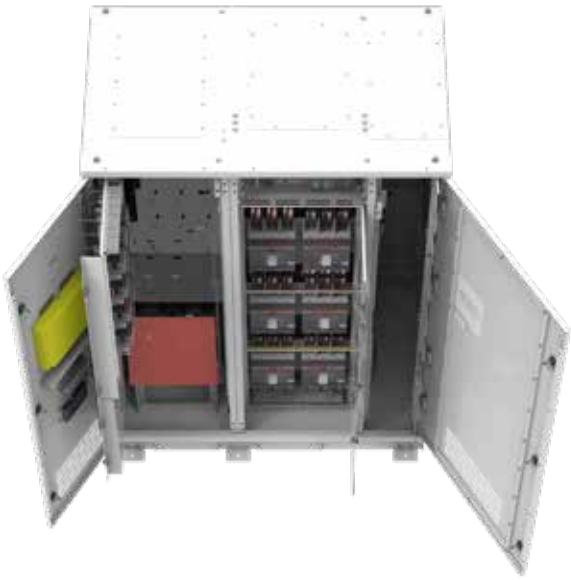
INSIGHT IR® Cameras are installed near bolted connections and critical components, and generates a hybrid heat map over a visible image

Safety

Sectionalization Maximizes Operator Safety

Operator safety is built into the foundation of every LayerZero eSTS. The system is divided into separate sections for normal operations (breakers and switches), power electronics, and control electronics.

This physical separation ensures that maintenance can be safely performed on one section while others remain energized. If service is required, the power can be bypassed to another section, allowing for safe, continuous operation.



eSTS with the Outer Doors Open, showing physical separation between the power electronics and control sections

View Status LEDs and Distribution CB Positions With Dead-Front Doors Closed

The Series 70 product line was inspired by NFPA-70E, helping data centers significantly reduce the risks associated with energy distribution.

Operators can safely view diagnostic status LEDs and SafePanel® circuit breaker positions with the dead-front doors fully closed, enabling visibility without exposure to energized components.

Polycarbonate Window on the Power Electronics Section, allowing visibility of status LEDs.

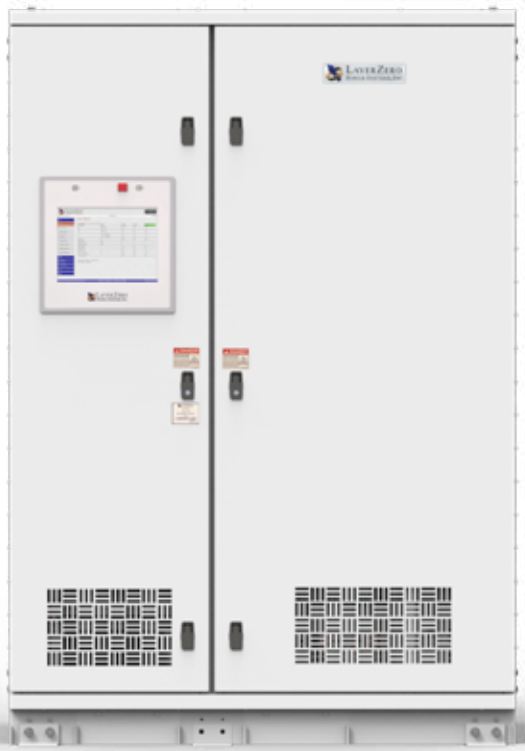
Ease of Maintenance/Connectivity Options

Front Only Access Saves Space

The Series 70: A eSTS is designed to be installed, operated, diagnosed and maintained only from the front. The dead-front panels are hinged, and side or rear covers never have to be removed.

Unhinged covers can be bulky and unwieldy, and operator error during removal and replacement of covers has been known to cause mishaps and compromise load reliability. A safe, non-invasive operation and maintenance regime results in a higher reliability of the critical load.

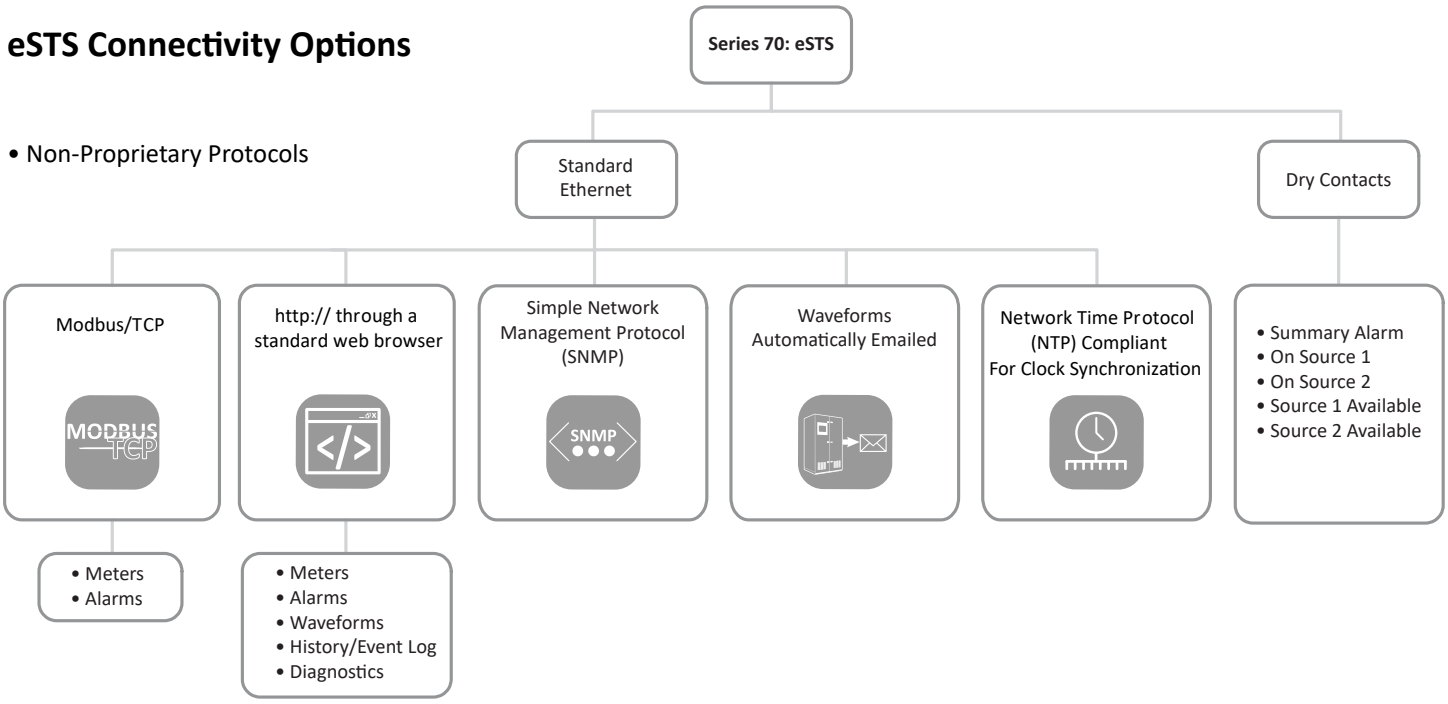
The Series 70: eSTS utilizes dead-front hinged doors. An alarm notifies when an outer door has been opened.



Front of the eSTS Static Transfer Switch

eSTS Connectivity Options

- Non-Proprietary Protocols



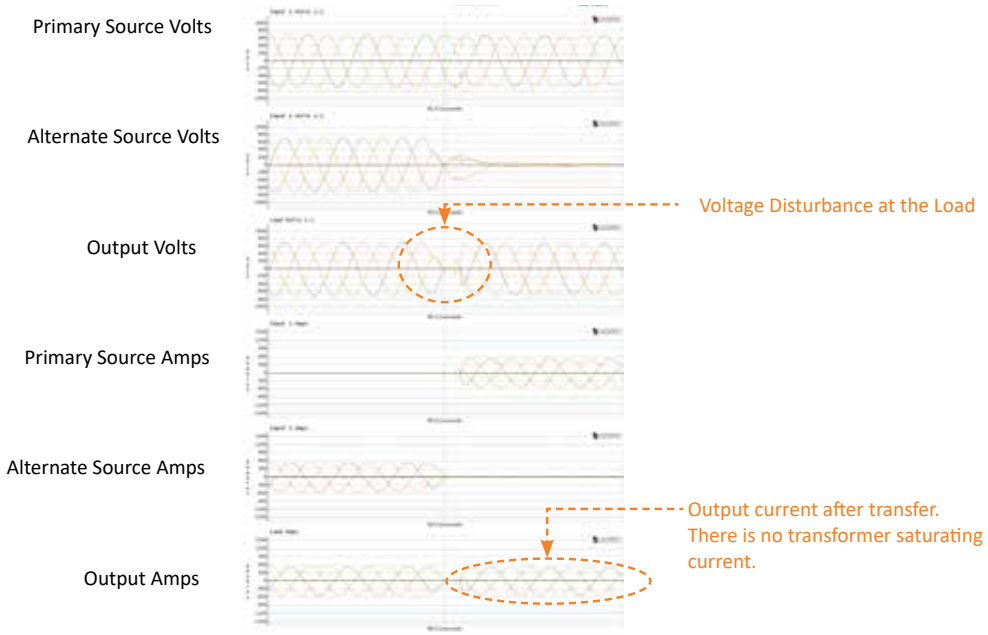
Generate Easy-To-Understand Power Quality Reports with ITIC Plotting

All LayerZero Power Systems products include on-board power quality analyzers that continuously sample and evaluate both power sources. If a source's power quality falls outside specification, the eSTS automatically transfers to the alternate source, simultaneously capturing waveform data and generating ITIC curves using the Voltage Disruption Analysis Tool (VDAT).

VDAT represents a significant advancement in power systems analysis. Using advanced algorithms, it converts complex waveform data into clear, actionable insights. Unlike traditional waveform captures that require expert interpretation, ITIC-based plots are intuitive and easy to understand.

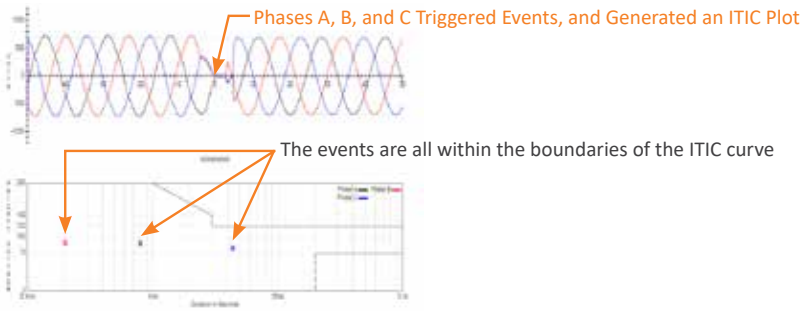
In a test where the STS was connected to two sources 150° out of phase, the Source 2 breaker was opened, prompting an automatic transfer to the primary source. A delayed transfer on Phases A, B, and C triggered the generation of corresponding ITIC plots, offering immediate clarity on the event without the need for specialized analysis.

Example Waveform Capture of Source 2 to Source 1 Transfer Event, 150 Degrees Out-of-Phase



Source 2 to Source 1 Transfer Event, 150 Degrees Out-of-Phase - WFC & ITIC Plot

Dynamic Transfer was enabled during these tests in order to mitigate transformer inrush while completing the transfer within the boundaries set by the Information Technology Industry Council (ITIC).

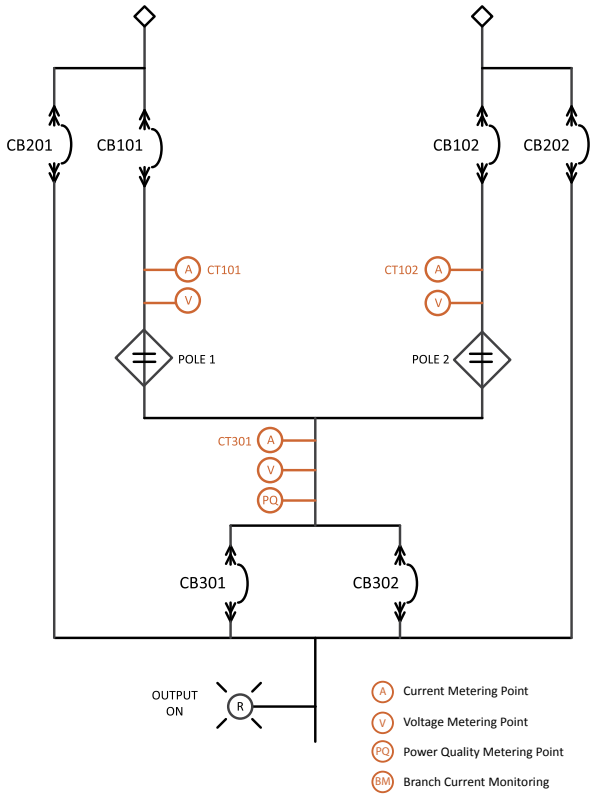


The ability to keep the transfers within the ITIC limits was verified through the Voltage Disturbance Analysis Tool (VDAT) plot shown above in the captured waveform.

Features/Power Quality Monitoring

LayerZero Power Quality Monitoring

LayerZero PQM (Power Quality Monitoring) provides comprehensive visibility into your entire critical power distribution network. Designed for both local and remote access, PQM delivers real-time data, event tracking, and detailed power quality insights, ensuring that operators are always informed and in control.

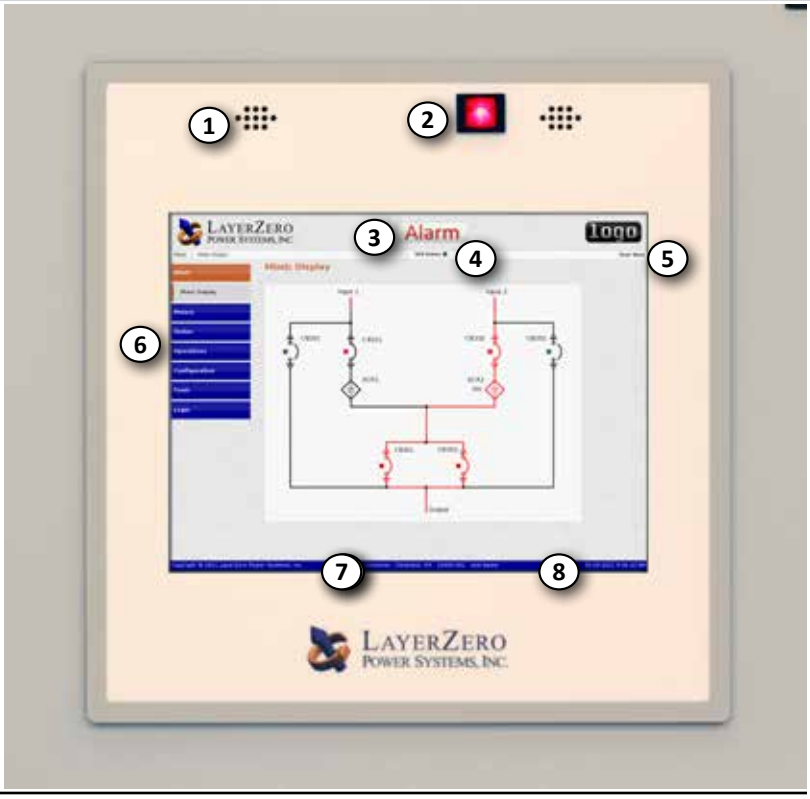


From basic system monitoring and alarm notifications to advanced power quality analysis, LayerZero PQM offers a full suite of capabilities to help maintain the highest levels of uptime and reliability. The system provides a vendor-neutral “Bird’s Eye” view of your entire infrastructure, clearly identifying:

When a source experiences a power quality issue
When a UPS output deviates from specification
When alarms or events occur within the system

In addition to real-time monitoring, PQM allows operators to retrace the exact sequence of historical events, providing an unparalleled ability to analyze and understand past

15” Color Touch Screen (Standard)



1. Stereo Speakers for Guided Bypass Prompts
2. Output On Light (Remains Lit in Bypass Isolate Mode)
3. Alarm & Bypass Indicator
4. SCB Status Indicator
5. Logged In User
6. Navigation Menu
7. Customer & Project Information
8. Date & Time

Power Quality Monitoring

Static Switch Power Quality Monitoring

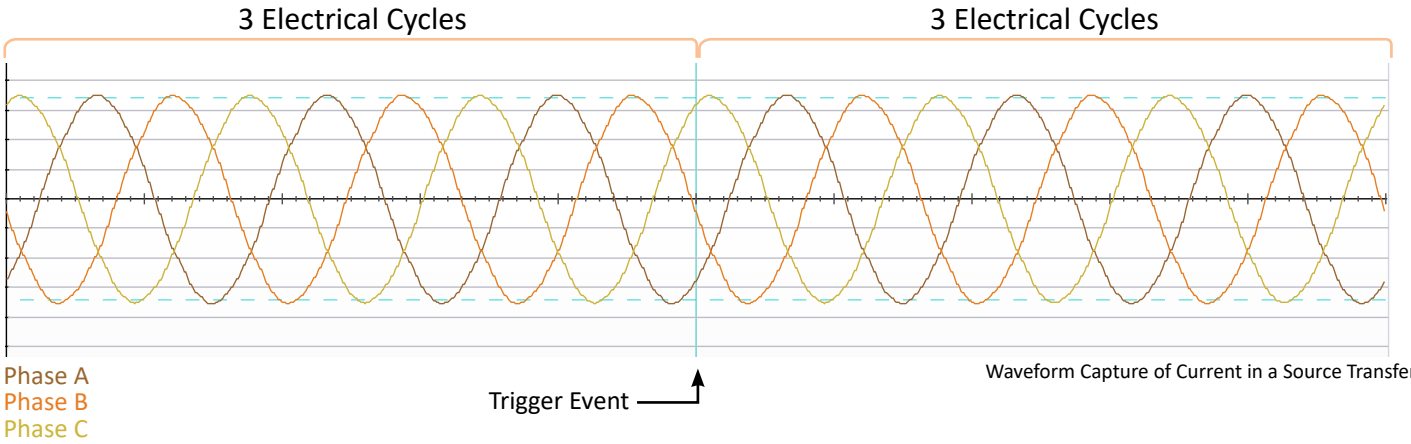
The Series 70 eSTS comes standard with LayerZero SSQM (Static Switch Quality Monitoring), a comprehensive monitoring platform designed to deliver total visibility into power transfer operations.

With both local and remote communication options, SSQM integrates seamlessly with facility monitoring systems to track performance across multiple dimensions. From alarm reporting to deep power quality analytics, SSQM helps operators stay aware, stay vigilant, and stay proactive in maintaining safe and stable operations.

eSTS Touch Screen GUI showing Real Time Waveform Capture

LayerZero's SSQM Provides Answers

LayerZero SSQM captures timestamped waveform data before and after every event, giving the operators the ability to trace the full sequence of electrical activity. These detailed visualizations enable teams to methodically identify and correct the root causes of issues. LayerZero's integrated monitoring architecture captures power quality data across all key distribution points, including the Static Transfer Switch (STS), Power Distribution Unit (PDU), and Remote Power Panel (RPP), enabling comprehensive post-event analysis and long-term performance insight.



Waveform Capture of Current in a Source Transfer

LayerZero SSQM Technical Specifications

LayerZero SSQM Parameters		Mains
Voltage Inputs and Output	Voltage (Volts)	✓
	Voltage Average of Phases (Volts)	✓
	Frequency (Hertz)	✓
	Total Harmonic Distortion (Percent VTHD)	✓
	Phase Rotation	✓
Current Inputs	Current (Amps)	✓
	Current Average of Phases (Amps)	✓
	Current Imbalance (Percent)	✓
	Real Power (kilowatts)	✓
	Apparent Power (kilovolt-amperes)	✓
	Reactive Power (kilovolt-amperes reactive)	✓
	Power Factor	✓
	Crest Factor	✓
	Crest Factor Average of Phases	✓
	Phase Difference Between Sources	✓
	Phase Difference Between Sources and Output	✓
Alarms	Summary Alarm	✓
	On Source (1/2/3)	✓
	Source Fail (1/2/3)	✓
	Source Preferred (1/2/3)	✓
	Source 1st Alternate (1/2/3)	✓
	Source Over/Under Voltage (1/2/3)	✓
	Source Over/Under Frequency (1/2/3)	✓
	Source Not Available (1/2/3)	✓
	Output Failure	✓
	Source Overcurrent (1/2/3)	✓
	Source Exceeds Manual Limit (1/2/3)	✓
	Source Exceeds Automatic Limit (1/2/3)	✓
	Bypassed to Source (1/2/3)	✓

Technical Specifications: 3-Pole Static Transfer Switch

Mechanical Characteristics *	
Current/Voltage/Number of Poles	800 A 480 V 3-Pole
Heat Dissipation	11,500 Btu/Hr
Weight	2150 lbs (975kg)
Dimensions	80” x 57” x 36” (2040 mm x 1146 mm x 920 mm)
Clearances	Front: 42” (1070 mm) Rear: 0” Sides: 0” Top: 18” (460 mm)
Frame Construction	Welded Frame
Electrical Connections	Silver-Plated Solid Busbar
Color	Textured Powder Coat White (RAL 7035), Blue (RAL 5017), Black, Custom
Floor Stands	Optional
Seismic floor stands	Optional
Junction Boxes	Optional
Sectionalization	Engineered Composite Insulation, Dead Front Doors
Electrical Characteristics	
Number of Inputs	2, 3 (3 optional)
Number of Output CBs	1, 2
Frequency	50 Hz, 60 Hz
Poles	3-pole
Phases	3 Phase, 3 Wire, 4 Wire + Ground
Neutral Rating	100%, 150%, 200%
Transfer Time	Nominal 1/4- cycle for in-phase sources
Redundancy	Single Module Redundancy, Triple Modular Redundancy (Optional)
Circuit Breaker Type	Molded Case Switch (Standard), Electronic Trip (Optional)
Circuit Breaker Mounting Type	Plug-In up through 600 A; Draw-out 800 A, 1200 A
TVSS	Standard
Power Quality Monitoring	
Power Quality Monitoring Technology	LayerZero PQM (Static Switch Quality Monitoring)
Waveform Capture	Local Display, Remote Display via Web Browser, Waveforms Automatically Emailed
Voltmeter	Input sources and Output, for each phase
Ammeter	Input sources and Output, for each phase
Frequency Meter	Both Sources
Synchroscope	Phase Angle Meter Between Sources
Metering	Apparent Power, Real Power, Power Factor, Output Total Harmonic Distortion
Time Stamped Transfer Count	From First Day Use, From Last Reset
CB Status Indicator	Open/Closed/Tripped Circuit Breaker
Source Indicator	Preferred Source
Power Path Indicator	On Live Mimic

*Dimensional & weight data is only valid for 2-source.

All product specifications are subject to change without notice.

Technical Specifications

Operational Characteristics	
Transfer Modes	Automatic; Manual (via Preferred Source Selection)
Inrush Mitigation Technology	Patented Dynamic Phase Compensation Algorithm (U.S. Patent 7,589,438 B2)
Cooling	Convection Cooling
Cable Access	Top/Bottom
Service Access	Front Only
Bypass Interlock Mechanism	Mechanical
Noise & Interference Isolation	Optical Fiber in Critical Control Paths
IR Scan Port Type	INSIGHT IR® Portholes
SCR Type	Puck
Display Type	15” Color Touch Screen
Display Resolution	1024x768
Bypass Assistance	Voice-Guided Bypass
Audio	Bezel-Mounted Stereo Speakers
Languages	English, French
Mimic Panel	Digital
Setpoints Control	Digital
Power Supplies	Redundant (4 Failure Groups. Triple Redundant Supplies. 12 Power Supplies Provided.)
Connectivity	
Meters	Local Display, Ethernet, Modbus/TCP, http via Web Browser (Non-Proprietary)
Alarms	Local Display, Ethernet, Modbus/TCP, http via Web Browser (Non-Proprietary)
Summary Alarm	Dry Contacts; Local Display; Modbus/TCP; Web Browser
Waveforms	Local Display, Ethernet, http via Web Browser (Non-Proprietary)
History/Event Log	Local Display, Ethernet, http via Web Browser (Non-Proprietary)
Diagnostics	Local Display, Ethernet, http via Web Browser (Non-Proprietary)
Time Synchronization	Network Time Protocol (NTP)
Standards Conformance	
CSA	ETL Listed to C22.22 No 107.
UL	ETL Listed to UL 1008S

All data tables above are for 3-pole only. Contact LayerZero for custom sizes and designs.

All product specifications are subject to change without notice.

Learn more at www.LayerZero.com

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