



Liebert® STS2

Installer/User Guide

1200A - 1850A Chassis

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Technical Support Site

If you encounter any installation or operational issues with your product, check the pertinent section of this manual to see if the issue can be resolved by following outlined procedures.

Visit <https://www.vertiv.com/en-us/support/> for additional assistance.

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1 Important Safety Instructions

Save these instructions

This manual contains important instructions that should be followed during the installation and maintenance of the Vertiv™ Liebert® STS2.



WARNING! The unit is supplied by more than one power source. The unit contains hazardous voltages if any of the input sources are ON, even when the unit is in bypass. To isolate the unit, turn OFF and lock out ALL input power sources.

Verify that all input power sources are de-energized and locked out before making connections inside unit. Lethal voltages exist inside the unit during normal operation. Only qualified service personnel should perform maintenance on the static switch.

NOTE: Read the entire manual before installing or operating the system. Adhere to all operating instructions and warnings on the unit and in this manual.

NOTE: For permanently connected equipment, an appropriate and readily accessible disconnect device shall be incorporated in the fixed wiring.

NOTE: The backfeed protection control terminals inside this unit must be wired to the shunt-trip hardware fitted on each external upstream. Disconnect Breaker feeding Source 1 and Source 2 respectively.

Vertiv neither recommends nor knowingly sells this product for use with life support or other FDA-designated “critical” devices.

Protect the unit from excessive moisture and install the unit in an area free from flammable liquids, gases, or corrosive substances.

The unit is designed to operate from solidly grounded AC power sources only. Provide input over current protection in accordance with the unit ratings. Wire and ground the unit according to national and local electrical safety codes. All wiring should be installed by a qualified electrician.

Before unit is placed into service for the first time, after equipment relocation, or after the unit has been de-energized for an extended period of time, a thorough equipment inspection and supervised startup by qualified service personnel are strongly recommended.

NOTE: The Liebert® STS2 is suitable for indoor use only.



CAUTION: This unit complies with the limits for a Class A digital device, pursuant to Part 15 Subpart J of the FCC rules. These limits provide reasonable protection against harmful interference in a commercial environment. This unit generates, uses and radiates radio frequency energy and, if not installed and used in accordance with this instruction manual, may cause harmful interference to radio communications. Operation of this unit in a residential area may cause harmful interference that the user must correct at his own expense.

NOTE: The STS2 complies with EMC Directive EN55032:2015 and the published technical standards. Continued compliance requires installation in accordance with these instructions.



WARNING! Locate the center of gravity symbols  and determine the unit's weight before handling the cabinet.



WARNING! The installer must apply a warning label on each dedicated and immediately upstream power.



WARNING! The installer must apply a warning label on each dedicated and immediately upstream power isolator feeding the STS2, to warn electrical maintenance personnel. The warning label shall carry the following wording or equivalent.

ISOLATE STATIC TRANSFER SWITCH (STS) BEFORE WORKING ON THIS CIRCUIT.

1.1 Overview of Manual

The Vertiv™ Liebert® STS2 Installation, Operation and Maintenance Manual is organized in a logical progression so that you can follow the procedures in the order provided to get your Liebert® STS2 installed and running.

Read the entire manual before proceeding with the unpacking and installation of the Liebert® STS2.

The major sections are as follows:

Important Safety Instructions: review the instructions on the previous page before proceeding.

Safety Precautions: provides safety warnings that you must review before proceeding.

Unpacking and Inspections: provides instructions for inspecting, unloading, handling and removing the Liebert® STS2 from the shipping pallet.

Location Considerations: provides information regarding environmental considerations for where the Liebert® STS2 is installed.

Locating the Liebert® STS2: provides instructions for anchoring the unit to the floor, should that be required.

Power and Control Wiring: provides instructions wiring the Liebert® STS2 for power and control connections.

Options: lists the options available for the Liebert® STS2.

Installation Drawings: provides outline, seismic and electrical field connection drawings required for installing the Liebert® STS2.

Introduction to Liebert® STS2 Operations: provides a system description.

Theory of Operation—provides an overview of how the unit works, plus a brief overview of some of the components.

Operating Instructions for the Touchscreen Interface: provides instructions for turning the system On and Off, completing a maintenance bypass and selecting a preferred source.

Alarm and Faults: provides a list of event messages.

Communication Interfaces: discusses the communication ports and provides a list of commands.

Vertiv™ Liebert® STS2 Touchscreen Display: provides instructions for using the HMI touchscreen interface for monitoring and managing the Liebert® STS2.

Specifications: provides specifications for the Liebert® STS2.

Event Message Help Text: provides the help text for the various system event messages. This help is also available through the touchscreen interface.

Maintenance: briefly discusses routine maintenance, provides proper torque settings for nuts and bolts, and provides the Vertiv contact information for technical support.

1.2 Safety Precautions

NOTE: Read this manual thoroughly before working with the Liebert® STS2.

Be sure to review the warning under [Important Safety Instructions](#) on page 1.

See [Handling Considerations](#) on page 6 before attempting to move the unit.

Under typical operation and with the doors closed, only normal safety precautions are necessary. The area around the Liebert® STS2 must be kept free from puddles of water, excess moisture and debris. The vent grate in the front of the system must not be obstructed in order to ensure a smooth air flow through the unit for cooling.

ONLY qualified service personnel should perform maintenance on the Liebert® STS2. When performing maintenance on any part of the equipment under power, service personnel and test equipment should be located on rubber mats. The service personnel should wear insulating shoes for isolation from direct contact with the floor.

Unless all power is removed from the input sources to the unit, one person should never work alone. A second person should be on hand to assist and summon help, should an accident occur.

Three types of messages are used throughout this manual to stress important text. Carefully read the information below each Warning, Caution and Note and use professional skills and prudent care when performing the actions described in that text.

A Warning indicates the presence of a possible serious, life threatening condition. For example:



WARNING! The unit is supplied by more than one power source. The Unit contains hazardous voltages if any of the input sources is ON, even when the unit is in bypass. To isolate the unit, turn OFF and lock out ALL input power sources.

Verify that all input power sources are de-energized and locked out before making connections inside unit. Lethal voltages exist inside the unit during normal operation. only qualified service personnel should perform maintenance on the static switch.

A Caution indicates a condition that could seriously damage the equipment and possibly injure personnel. For example:



CAUTION: Risk of unit damage. the input sources to the static switch must be grounded-wye sources. Input sources other than solidly grounded-wye sources may cause damage to the switch.

A Note emphasizes important text. If the instructions are not properly followed, the equipment could be damaged or may not properly operate. For example:

NOTE: Read this entire manual before installing and operating the unit.

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2 Unpacking and Inspections

NOTE: Read the entire manual before installing and operating the unit. Upon receipt of the Vertiv™ Liebert® STS2, the installer should perform the following steps to ensure a high-quality installation.

A high quality installation begins on the receiving dock. The Liebert® STS2 and its packaging should be inspected when the unit is delivered. If the packaging is not damaged, unpack the unit and conduct an internal inspection before beginning the installation process. This section discusses the inspection and unpacking of the Liebert® STS2.

2.1 External Inspections

1. While the Liebert® STS2 is still on the truck, inspect the equipment and shipping container(s) for any signs of damage or mishandling. Do not attempt to install the system if damage is apparent.
2. Upon receipt and before unpacking, inspect the shipping crate for damage or mishandling.
 - If any damage as a result of shipping is observed, file a damage claim with the shipper within 24 hours and contact Vertiv at 800-543-2378 or your local Vertiv representative to inform them of the damage claim and the condition of the equipment.
3. Locate the bag containing the keys for the front access door. The bag is attached to the cabinet.
4. Compare the contents of the shipment with the bill of lading. Report any missing items to the carrier and to Vertiv immediately.
5. Check the nameplate on the cabinets to verify that the model numbers correspond with the one specified. Record the model numbers and serial numbers in the front of this installation manual. A record of this information is necessary if servicing is required.
6. If unit is to be stored before installation, store it in a dry environment with temperatures in the range of -4 °F to 131 °F (-20 °C to 55 °C). Use original packing materials or other suitable means to keep the unit clean. When opening the shipping crate, use care not to puncture the container with sharp objects.

2.2 Unloading and Handling



CAUTION: Risk of unit damage. When moving the unit by forklift, lift the unit from the rear so as to protect the front panel. Do not exceed a 15 degree tilt with the forklift. Also, if you are moving the unit by forklift or pallet jack after it has been removed from the pallet, be aware of the location of underside components so as not to damage them.

IMPORTANT! Because the weight distribution in the cabinet is uneven, use extreme care during handling and transporting.


NOTE: The unit can be moved by forklift or pallet jack.

See [Unit Preparation](#) on the next page for instruction on removing the Liebert® STS2 from the pallet.

2.2.1 Handling Considerations

The static switch is bolted to a wooden shipping pallet to allow handling by forklift equipment or a pallet jack.



WARNING! Exercise extreme care when handling static switch cabinets to avoid equipment damage or injury to personnel. The cabinet can be safely tilted 15 degrees in any direction by forklift. If moving the unit up a ramp on its casters or a pallet jack, ensure that the incline does not exceed fifteen (15) degrees. Locate the center of gravity symbols  and determine the unit's weight before handling the cabinet.

Check the unit size and weight: Refer to the cabinet drawings furnished with the unit for size and weight. Typical cabinet dimensions are see **Figure 7.1** on page 21. Typical unit weights are:

- 4P - 1590 lbs (721kg).
- 3P - 1429 lbs (648kg).

Plan the route: Review the route over which the unit will be transported to its installation location to ensure that all passages are large enough to accommodate the unit and support the weight. Check for any non-negotiable corners or offsets in hallways. Before moving the unit to the intended location, see [Location Considerations](#) on page 9.

2.2.2 Unit Preparation

The unit can be removed from the pallet before it is moved to its location.

Complete the following steps to properly remove the Vertiv™ Liebert® STS2 from the shipping pallet:

1. Set the pallet in a level area with enough room to maneuver and remove the unit.
2. Remove the bolts holding the unit to the shipping pallet (located in the base of the unit).
3. Remove the shipping blocks from under the frame of the unit.
4. Use a forklift to raise the unit off the pallet and onto the floor. Ensure that the forklift is clear of components on the underside of the unit. Lift the unit from the rear.
5. Conduct an internal inspection of the unit. See the list below of inspection items.

2.3 Internal Inspections

After the Liebert® STS2 has been unpacked, conduct an internal inspection:

1. Verify that all items have been received.
2. If spare parts were ordered, verify their arrival.
3. After the Liebert® STS2 has been removed from the pallet, open the door and remove cabinet panels to check for shipping damage to internal components.
4. Check for loose connections or unsecured components in the cabinet(s).
5. Check for any unsafe condition that may be a potential safety hazard.

After the Liebert® STS2 has been inspected and no problems are found, the unit can be moved to its installation location.

NOTE: If using a forklift, remember to lift the unit from the rear.

2.4 Chassis Handling and Installation – Vertiv™ Liebert® STS2 with Liebert® STS2 Switchboard

2.4.1 Forklift Handling Requirements

When transporting or positioning the Liebert® STS2 chassis for integration with the Liebert® STS2 Switchboard, adhere to the following procedures to prevent structural damage or component interference:

- **Front lifting:** Forks must not protrude through the front side of the chassis. Protrusion can result in mechanical damage to the seismic bracket on the rear of the Liebert® STS2.
- **Rear lifting restriction — Important deviation from standard manual guidance:** The standard installation instructs user to lift the chassis using a forklift from the rear. However, this method is not applicable when the Liebert® STS2 is configured for Liebert® STS2 Switchboard integration. In this application, a seismic bracket is mounted to the rear of the chassis, obstructing forklift access and risking structural damage if rear lifting is attempted. Rear forklifting is strictly prohibited in this configuration.
- **Side lifting:** If lifting from the side, the corresponding side panel must be removed in advance. This eliminates the risk of damaging the panel due to fork interference. Forks must not extend beyond the opposite side of the chassis during side lifting. Protrusion beyond the chassis width can damage the Liebert® STS2 Switchboard during installation.

2.4.2 Installation Considerations

D-cover installation sequence: Remove the front D-covers when installing the chassis to the Liebert® STS2 Switchboard and do not reinstall them until after the chassis has been fully positioned and secured to the Liebert® STS2 Switchboard. This ensures no damage to the D-covers.

Rear bolt installation: When securing the chassis to the Liebert® STS2 Switchboard, leave the rear seismic bracket bolt loose during the initial positioning. Once all mating surfaces are aligned and verified and front bolts are secure, the rear bolts may then be tightened to the specified torque.

Lifting planning: Due to the seismic bracket occupying the rear lifting zone, lifting must be done from the side or carefully from the front (with forks limited to avoid component interference). Ensure lift teams are informed of this restriction during planning.

Copper braid and hardware boxes: Remove the three boxes containing the braided bus and hardware from the front or top of the Liebert® STS2 through the D-cover opening.

NOTE: For the Liebert® STS2 to be integrated with the Liebert® STS2 Switchboard, the seismic brackets must be installed to secure the chassis to the Liebert® STS2 Switchboard. This does not imply that the Liebert® STS2 and Liebert® STS2 Switchboard is seismically rated. Consult the Liebert® STS2 Switchboard specification.

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3 Location Considerations

The Vertiv™ Liebert® STS2 should be placed in a clean, cool and dry location. The Liebert® STS2 requires only front access for installation and maintenance. Back or side access is not required.

Adequate space is required above the unit for conduit (if configured as such) and cooling air flow. This section provides specific information for these considerations.

The unit is designed with top and bottom control cable terminations to allow maximum flexibility in its installation. If bottom control cable entry is used, sufficient cable bending space must be provided by a raised floor.

For dimensions of each unit, see [Installation Drawings](#) on page 21.

3.1 Recommended Minimum Service Clearances

The recommended service clearances are at the front of the unit. The minimum front service clearance required is 42 in. (1067 mm). A site layout review is required to determine any additional clearance requirements. Clearance of at least 24 in. (610 mm) above the unit is required for cooling air flow.

3.2 Heat Output

The unit produces minimal heat during normal operation.

Switch Size	Heat Output BTU/Hr (kW)
1200 – 1850 amp	21,438 (6.28) Approximate

3.3 Operating Environment

The unit is designed to be installed indoors under the following environmental conditions:

- **Storage Temperature Range:** -30 °C to +70 °C max -4 °F to 131 °F (-20 °C to 55 °C).
- **Operating Temperature Range:** 0 °C to 40 °C (32 °F to 104 °F).
- **Relative Humidity:** 0 to 90% without condensation.
- **Operating Altitude:** Up to 4000 ft. (1200 m) above sea level without derating.

Above 4000 ft. (1200 m), output current is derated by 6% per 1000 ft. (18% per 1000 m).

- **Storage/Transport Altitude:** Up to 40,000 ft. (12192 m) above sea level.
- **Audible Noise:** Less than 72 dBA at 5 ft. (1.5 m) with audible alarm Off.

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4 Locating the Vertiv™ Liebert® STS2

This section provides instructions for leveling the Liebert® STS2 and anchoring the unit to the floor, should that be required.

4.1 Leveling and Anchoring the Unit to the Floor

The Liebert STS2 can be secured to a concrete floor using 4X M10 concrete anchors (field supplied).

The Liebert® STS2 can be anchored to the concrete floor to ensure stability for the unit in the event of seismic activity.

The seismic brackets are an option for the Liebert® STS2 and are shipped separately from the unit when ordered.

Refer to Submittal Drawing STS2-17-S001 for seismic bracket installation details.

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5 Power and Control Wiring

All power and control wiring should be installed by a qualified electrician. All power and control wiring must comply with applicable local codes. Unless otherwise labeled, use the recommended tightening torque as see **Table 16.1** on page 115

The busbars are accessible through the front of the Vertiv™ Liebert® STS2.

Control cables can be installed through the top or bottom of the unit through removable conduits plates.

See Submittal Drawings STS2-05-S020 and STS2-19-S020 for control wiring details.

NOTE: For permanently connected equipment, an appropriate and readily accessible disconnect device shall be incorporated in the fixed wiring.

5.1 Input and Output Power Connections

Input and output power connections are made through the side of the unit and connected to 3rd party switchgear or a Vertiv supplied switching cabinet.

See Submittal Drawing STS2-05-S020 for power connection details.

5.1.1 Grounding

The Liebert® STS2 operates from sources that are solidly grounded or impedance-grounded. The unit must not be used on corner-grounded delta systems.

The AC output neutral is electrically isolated from the Liebert® STS2 chassis. The Liebert® STS2 chassis shall have an equipment ground terminal.



WARNING! Risk of electric shock. Can cause equipment damage, injury and death. Verify that all input power and control circuits are de-energized and locked out before making connections inside unit.

The two input power feeds (sources) to the Liebert® STS2 should be from two independent sources to avoid a common source failure.

To ensure proper operation of the Liebert® STS2, the two input sources must be the same nominal voltage level and phase rotation.

For uninterrupted automatic transfer, the two input sources should be synchronized within 15 degrees.



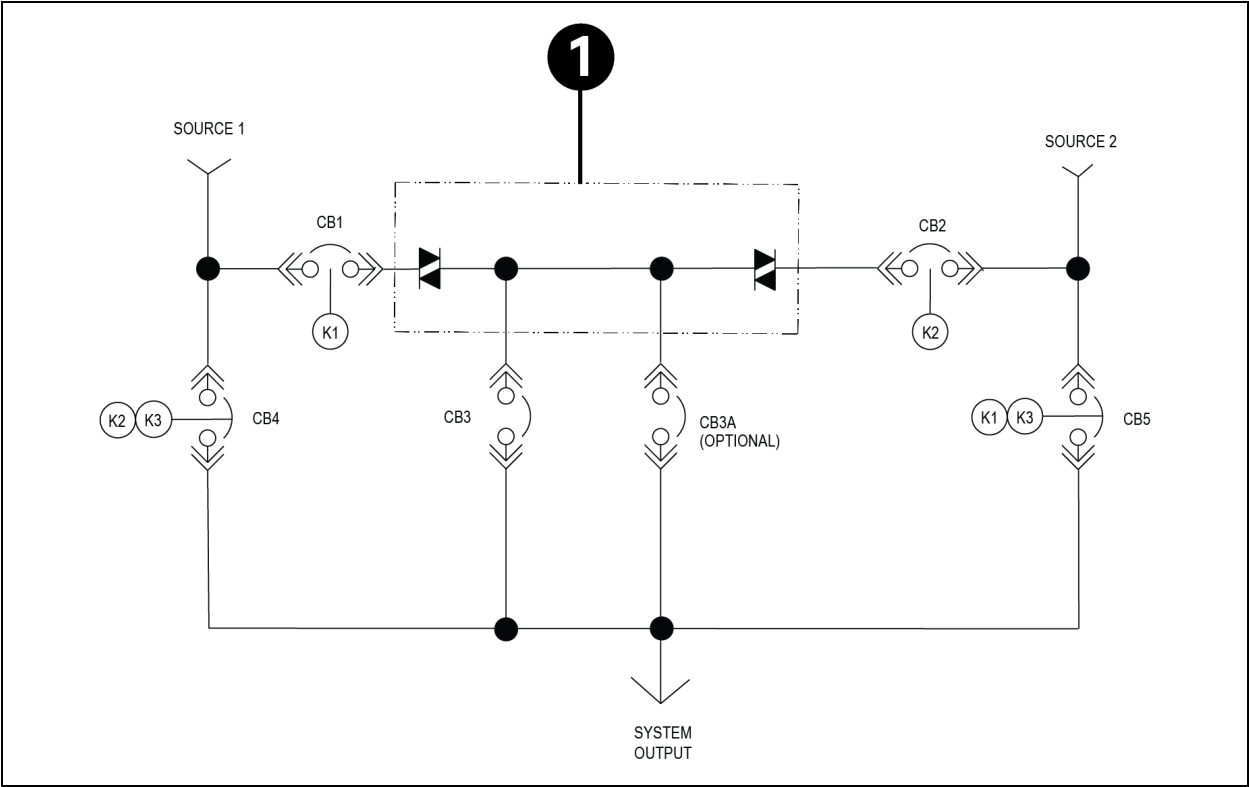
CAUTION: Risk of unit damage. The input sources to the static switch must be grounded-wye sources. Input sources other than solidly grounded-wye sources may cause damage to the switch.

The 1200A – 1850A STS2 is designed for solidly or impedance-grounded. The unit must not be used on corner-grounded delta systems.

The Vertiv™ Liebert® STS2 is designed for operation with 3-wire or 4-wire, solidly grounded sources only. For 4-wire operation of a 3-wire unit, the common source neutral must be connected to the Liebert® STS2. Circuit breaker cabinet specification shall be provided by original equipment manufacturer. Refer to the manufacturer's documentation for electrical field connections. See **Figure 5.1** on the next page for a typical system one line diagram.

The input and output power wire size should be based on the upstream overcurrent protection device, observing the local electrical codes.

Figure 5.1 Typical Static Transfer Switch One-Line Diagram



Item	Description
1	1200A - 1850A Vertiv™ Liebert® STS2 Chassis Cabinet

The molded case switches connected to the Liebert® STS2 are typically non-automatic circuit breakers that rely on the upstream and/or load overcurrent protection. Upstream overcurrent protection should be rated equal to or less than the rating of the Liebert® STS2 molded case switches.

5.2 System Grounding

Equipment Grounding: Grounding is primarily for equipment and personnel safety, although proper grounding also enhances equipment performance.

All input and output power feeds must include an equipment grounding means as required by local codes.

An insulated equipment ground conductor is recommended to run with each input and output power feed. The equipment ground conductors should be at least the minimum size conductor per local electrical code based on the upstream overcurrent protection device.

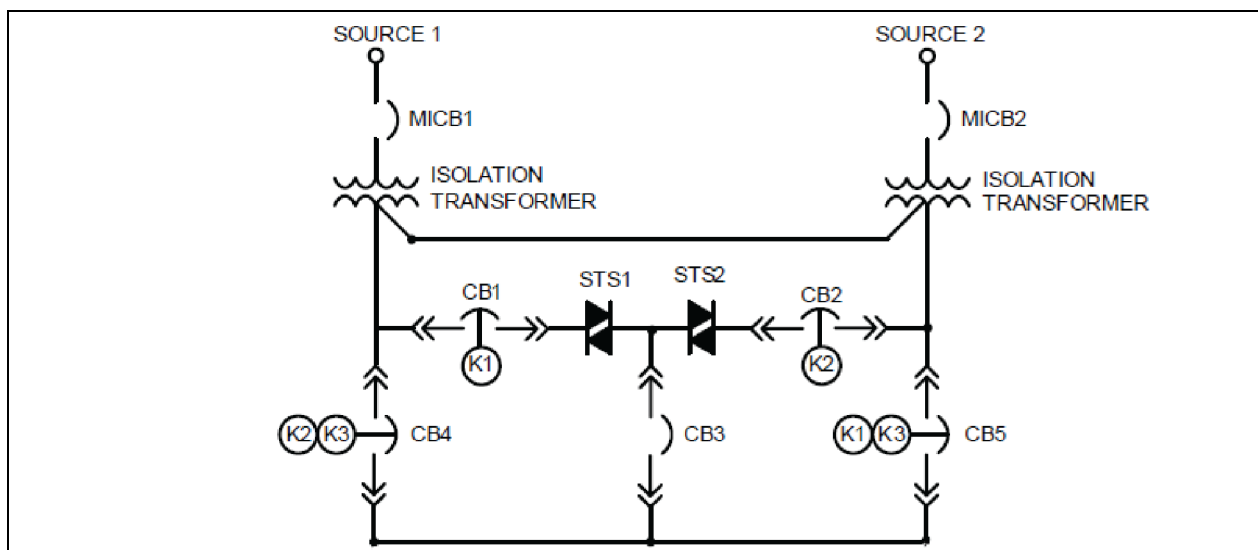


WARNING! If conduit is used as a grounding means, adequate electrical continuity must be maintained at all conduit connections. The use of isolating bushings with a metal conduit can be a safety hazard and is not recommended.

4-Wire-Plus-Ground Systems: When 4-wire-plus-ground input feeds are utilized in a 3 pole STS2, the input power sources must be properly grounded. The NEC prohibits grounding a power source at more than one point. Connecting the neutrals of two grounded power sources together effectively grounds each of the sources at more than one point, which allows neutral current to flow on the ground system, defeats ground fault protection, creates a safety hazard, and violates the NEC.

Where possible, the two power sources should be located in close proximity and a single neutral to-ground bond made (as see Figure 5.2 below or as is typical with a double-ended substation).

Figure 5.2 Typical One-line Diagram of Two PDUs and a Vertiv™ Liebert® STS2



5.3 Control Wiring Connections

No control wiring is needed on the 1200-1850A Liebert® STS2 when connected to Liebert® supplied switchgear. Refer to submittal drawing sts2-05-s020 for control wiring connections when not using Liebert® supplied switchgear. Certain options require external control wiring. See [Options](#) on page 17 for details.

NOTE: Backfeed protection control wiring is always required. The installer must interconnect control terminals J15 pins 1 and 2 for CB1/Source 1 Input and J15 pins 12 and 13 for CB2/Source 2 input to the respective shunt-trip hardware fitted on each external upstream isolator feeding Source 1 and Source 2 respectively. See also [SCR Failure](#) on page 36 for description of SCR Failure and backfeed protection.

5.4 Power Supply

The Liebert® STS2 is supplied with redundant power supplies that are designed to operate from a voltage range of 380V to 600V. The unit is set at the factory to match the nameplate voltage. Field adjustments are not necessary. If the unit needs to operate at a voltage other than what is listed on the nameplate, contact Vertiv or your local Vertiv representative.

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6 Options

This section discusses the options available for the Vertiv™ Liebert® STS2. The communications options are also discussed in [Communication Interfaces](#) on page 55

6.1 Programmable Relay Board

The Programmable Relay Board (PRB) provides a means to trigger an external device when an event occurs in the Liebert® STS2. Each PRB has eight channels. Each channel has one set of Form-C dry contacts.

Any alarm/event can be programmed to any channel or channels. Up to ten (10) events can be programmed to a relay. If multiple events are grouped to one relay, group the events logically to simplify troubleshooting when an event is triggered. The same alarm/event can be programmed to more than one channel. Up to two Programmable Relay Boards can be installed in the Liebert® STS2 for a total of 16 channels. Programming is performed through the touchscreen display.

See [Configuring the Programmable Relay Board Settings](#) on page 79 for default settings and instructions for reconfiguring the relays. Refer to Submittal Drawing STS2-19-S020 for location of the PRB(s). See **Figure 7.7** on page 27 for wiring details.

6.2 Optimized Transfer

NOTE: Optimized transfer is only available on 3P switching models and is not supported for 4P switching models.

When the Liebert® STS2 is used as a primary-side switch-on the primary of an isolation transformer-optimized transfer greatly reduces the transformer magnetization current during automatic transfers through a new, patented transfer control algorithm. The liebert algorithm optimizes the transfer timing so that the volt-seconds applied to the downstream transformer primary is balanced, minimizing peak saturation current.

The volt-second balance is achieved by directly computing the volt-second applied to the transformer during transfer events and determining the optimum time to turn on the alternate source SCRs in order to balance the volt-second within specified tolerance.

Optimized transfer also seeks to minimize the voltage disturbances while still maintaining transformer flux balance. This unique flux balance algorithm does not just wait for the balance point to occur, but will pulse fire the SCRs as soon as possible to minimize the voltage disruption. This results in far superior voltage waveforms applied to the load.

6.3 Input Contact Isolator Board

The Input Contact Isolator Board (ICI) provides an Liebert® STS2 module interface for up to eight external user alarm or message inputs to be routed through the Liebert® STS2 alarm network. The eight contacts are normally open dry contacts. When a contact closes, an event is triggered.

The Input Contact Isolator options are configured through the Input Contact Isolator dialog box, which is accessed from the Comm Option dialog box on the touchscreen display. You also can program the alarm messages through this dialog box. See [Configuring the Input Contact Isolator Settings](#) on page 77 for instructions on configuring the connections.

Refer to Submittal Drawing STS2-19-S020 for location of the ICI. See **Figure 7.8** on page 28 for wiring details.

6.4 Vertiv™ Liebert® IntelliSlot™ Unity-DP Card

A Liebert® IntelliSlot™ Unity-DP Card enables external communications with the Vertiv™ Liebert® STS2.

The Liebert® IntelliSlot™ Unity-DP Card enables SNMP, BACnet IP, BACnet MSTP, Modbus TCP, Modbus RTU, YDN23, and Web management capability to the Liebert® STS2. The card employs Ethernet and RS-485 networks to monitor and manage a wide range of operating parameters, alarms and notifications. The Liebert® IntelliSlot™ Unity-DP Card supports two of the third party protocols.

See Submittal Drawing STS2-19-S020 for location of the Unity-DP card. See **Figure 7.9** on page 29 control wiring information.

If you have questions about the Liebert® IntelliSlot™ Unity-DP Card, See the user guide, **SL-52645**, available at the Liebert Web site, www.Vertiv.com.

6.5 Remote Source Selection Wiring

An optional Remote Source Selection terminal block may be installed in your Liebert® STS2. Refer to Submittal Drawing STS2-19-S020 for location of the RSS terminal block. See **Figure 7.6** on page 26 for information on the control wiring for the Remote Source Selection option.

The Remote Source Selection allows you to choose the preferred input source from a remote location. Terminal connections allow the customer to remotely select a source to be the preferred source in the same process as the local source transfer selection.

The unit's preferred source selection and Remote Source Selection are active at the same time, with the Liebert® STS2 following the last request for a preferred source change, regardless of whether it was from the local or Remote Source Selection controls.

A six pin terminal block provides the Remote Source Selection connections. Two pairs of wires are used from the switch to trigger the source selection. You can select the type of switch used for this remote control. Connections are made to four of the connections, using Form A dry contacts. The contacts are numbered left to right:

Table 6.1 Remote source selection terminal block

Contact	Connection	Contact	Connection
1	Source 1	4	Isolated Ground
2	Isolated ground	5	DO NOT USE
3	Source 2	6	DO NOT USE

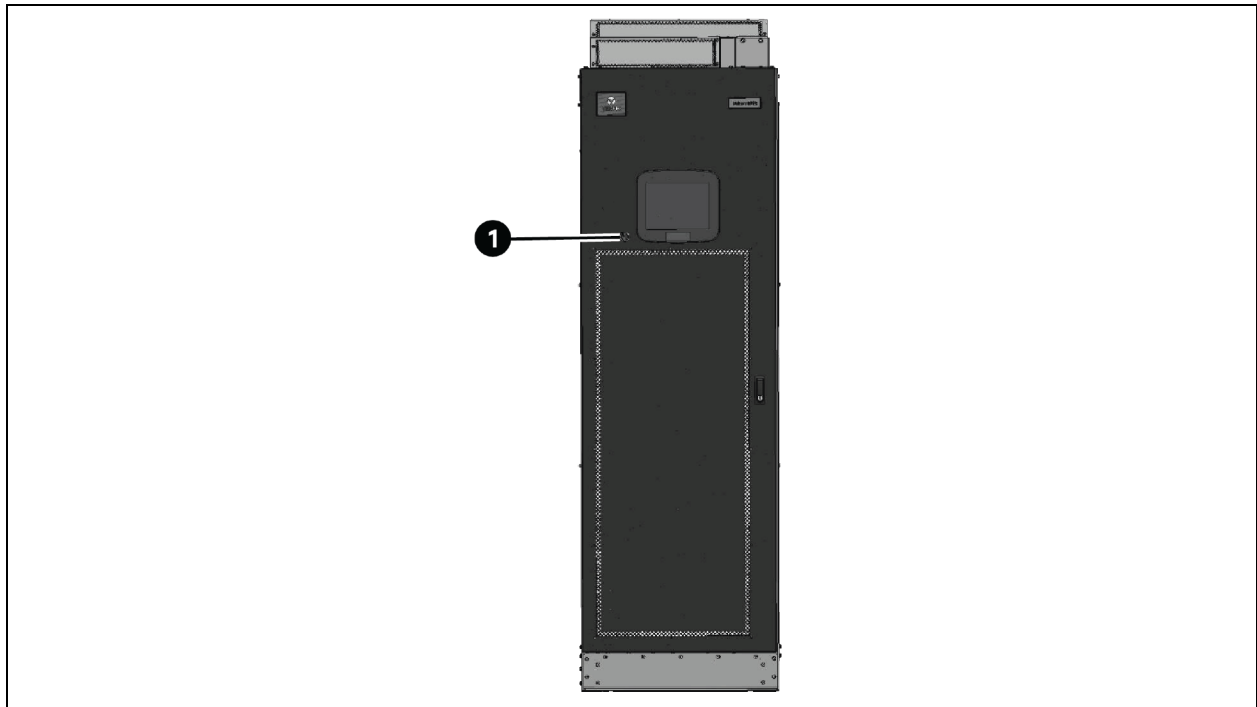
See [Enabling Remote Source Selection](#) on page 45 for instructions on enabling the Remote Source Selection option.

6.6 Key Lockout Switch

The key lockout switch activates a software lockout of the touchscreen display to prevent manual transfers and configuration changes. When locked out, the touchscreen becomes a read only display. A key is needed to do manual transfers or change settings.

The alarm silence button is not disabled when in the lockout position.

The switch is located behind the front door but can be operated without opening the front door.

Figure 6.1 Keylock

Item	Description
1	Optional keylock

See section [Security](#) on page 68 for key lockout switch operation with the LCD touchscreen.

6.7 Transfer Inhibit

Transfer Inhibit prevents the Vertiv™ Liebert® STS2 from transferring under certain conditions. When a customer-supplied closed dry contact is provided, the Liebert® STS2 will not transfer and remain on its present source even if the source is no longer supplying power.

This option requires an Input Contact Isolator board see [Input Contact Isolator Board](#) on page 17.

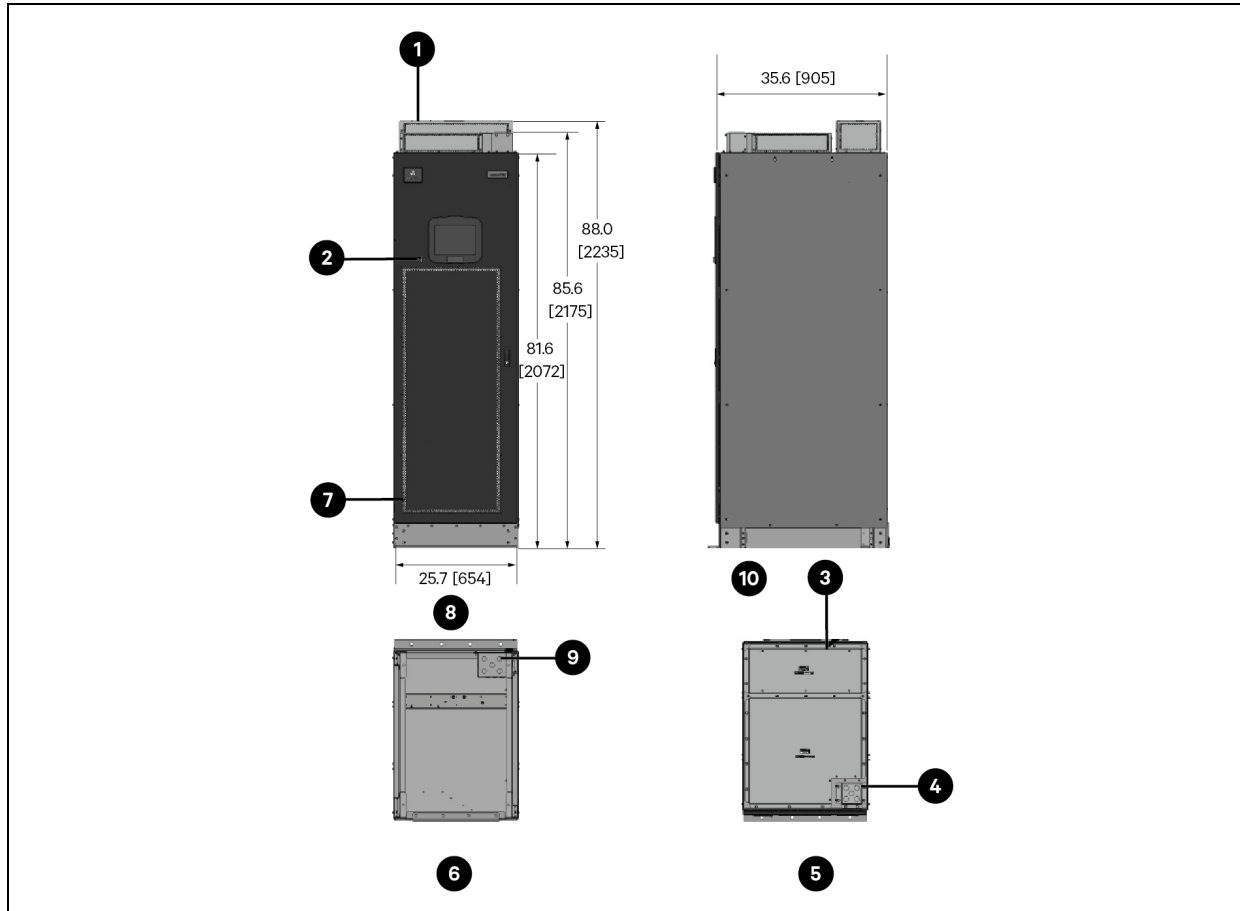
6.8 Seismic Floor Anchors

Seismic anchors are available for anchoring the unit to a concrete floor to meet seismic Zone 4 requirements. See [Leveling and Anchoring the Unit to the Floor](#) on page 11 for more information.

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7 Installation Drawings

Figure 7.1 Outline Drawing: 1200 Amp – 1850 Amp Vertiv™ Liebert® STS2



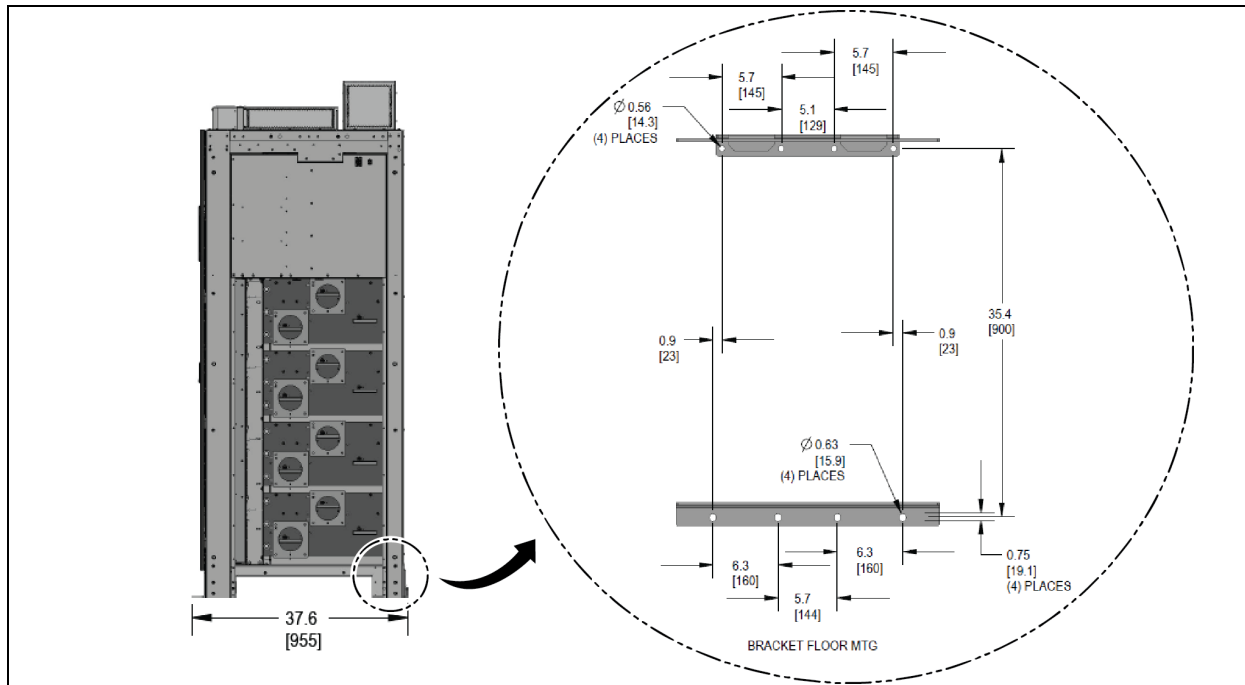
Item	Description	Item	Description
1	Removable Tophat	6	Bottom View
2	Optional Keylock	7	Air Intake Area Do Not Block Air Filter
3	Air Exhaust	8	Front View
4	Control Cable Top Entry	9	Control Cable Bottom Entry
5	Front Top View	10	Side View

Notes to Figure:

1. All Dimensions are in inches and (millimeters).
2. 24 in. (610 mm) Minimum Clearance above unit is required for air exhaust.
3. 42 in. (1067 mm) Minimum Clearance is required in the front only for installation and service access.
4. Unit bottom is structurally adequate for forklift handling.
5. Keep cabinet within 15 Degree of vertical while handling.

6. Color-Black gray Matte.
7. Open door to replace air filter, refer to user manual for filter specifications.

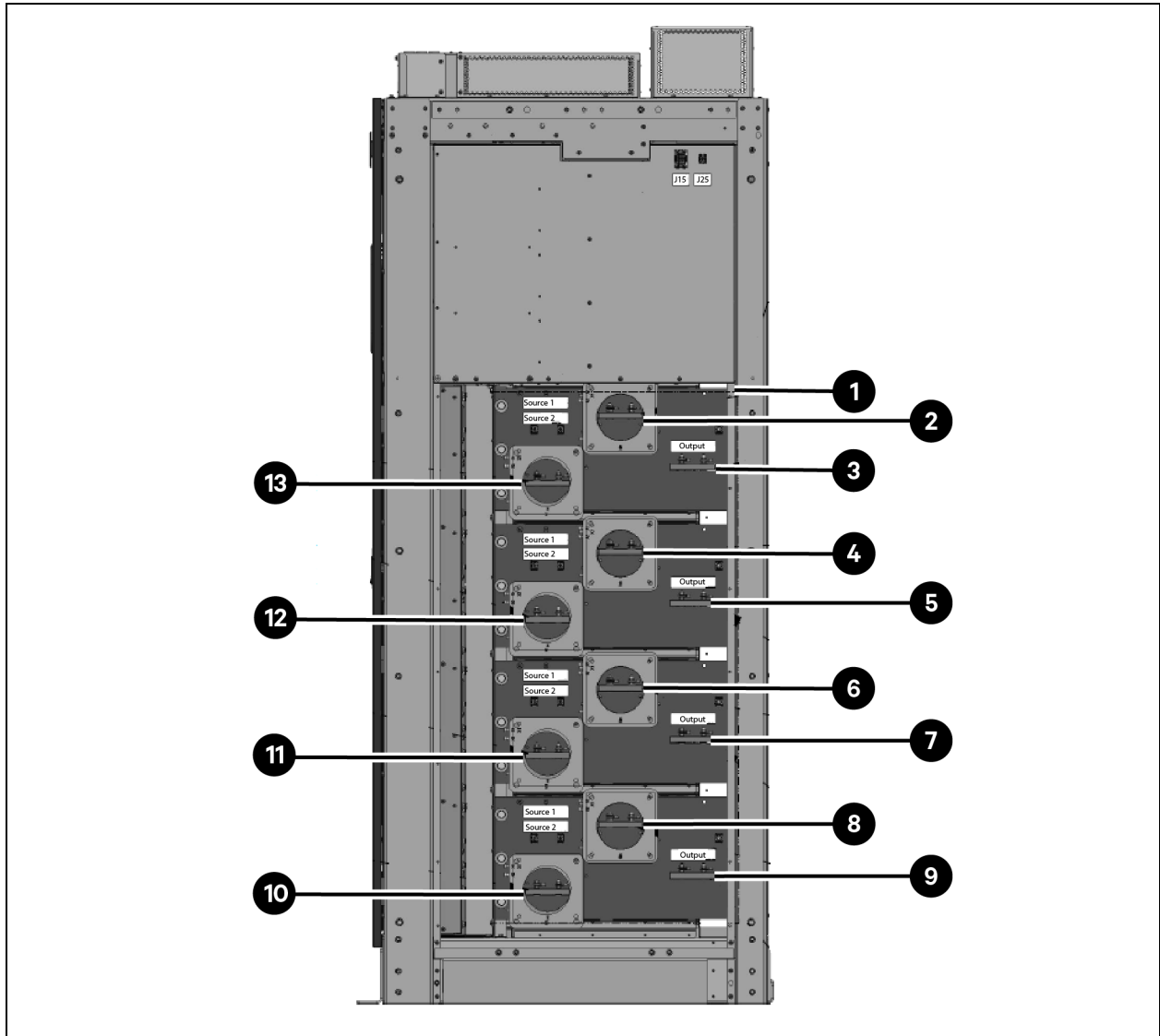
Figure 7.2 Outline Drawing: 1200 Amp - 1850 Amp Vertiv™ Liebert® STS2 with Seismic Bracket Anchor Kit



To Install the Brackets:

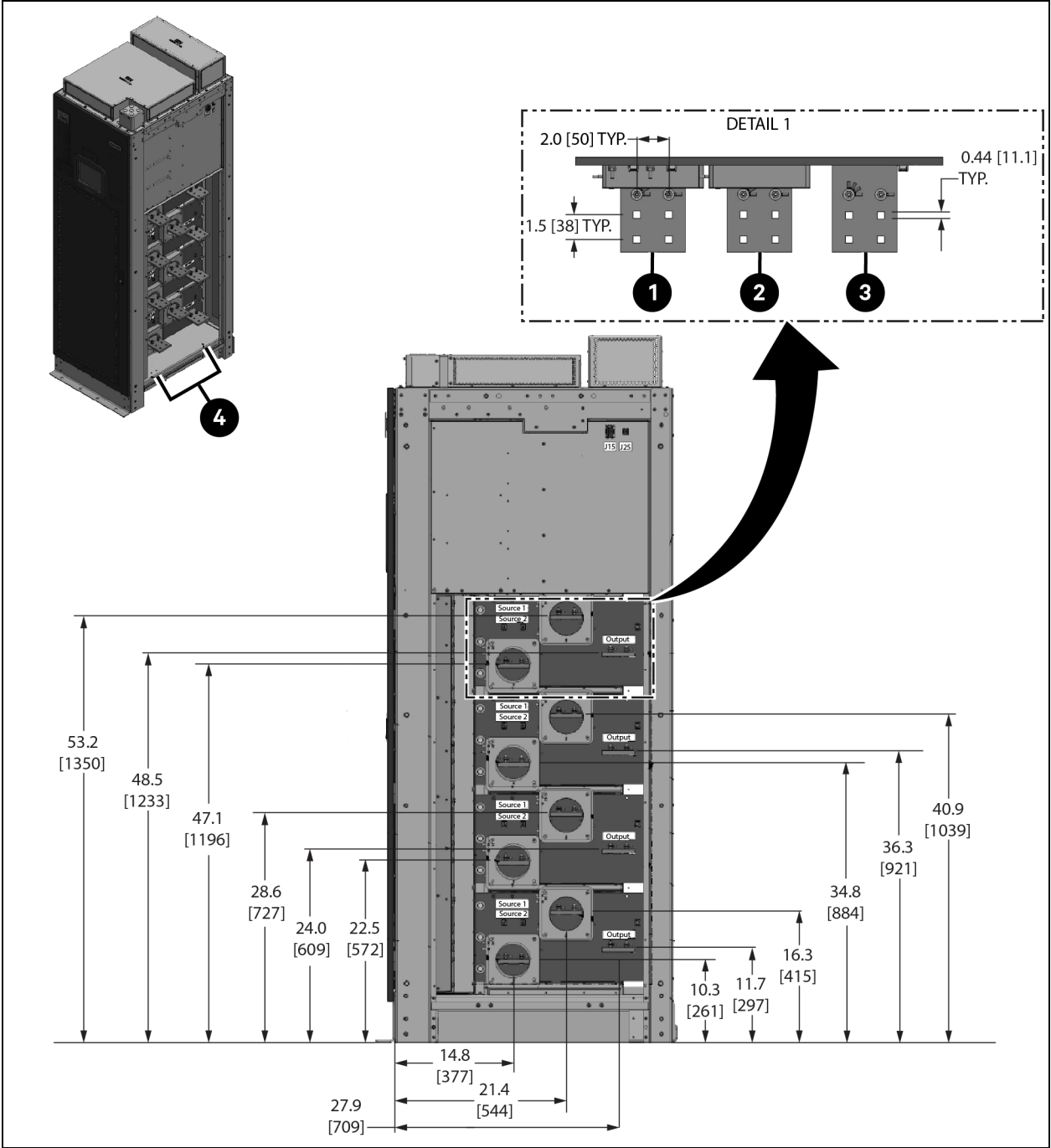
1. The installation location must be a minimum of 6 in. (153 mm) from the rear of the unit for cooling air flow.
2. Install the bracket foot rear STS2 (P/N 60028202P1) to the concrete floor using (4) grade 8 1/2 in. Bolts (field supplied).
3. Install the bracket slot rear STS2 (P/N 60028199P1) to the rear of the STS2 using the provided screws, 13 per bracket (P/N 09-05BZ0Z-09) torque to 53 in-lbs (6 nm).
4. Put the STS2 into position and slide the unit back such that the foot bracket slots into the slot bracket. Verify that the foot brackets slide smoothly into the slots.
5. Install bracket front anchor STS2 (P/N 60028143P1) to the front of the STS2 using provided screws, 13 per bracket (P/N 09-05BZ0Z-09) torque to 53 in-lbs (6 nm).
6. Secure the front bracket to the concrete floor using 4 grade 8 1/2 in. Bolts (field supplied).

Figure 7.3 Main Components Area 1200-1800 A Chassis Vertiv™ Liebert® STS2



Item	Description	Item	Description
1	Customer Connection Area	8	Source 1 Input Neutral If Equipped
2	Source 1 Input A-Phase	9	Output Neutral If Equipped
3	Output A-Phase	10	Source 2 Input Neutral If Equipped
4	Source 1 Input B-Phase	11	Source 2 Input C-Phase
5	Output B-Phase	12	Source 2 Input B-Phase
6	Source 1 Input C-Phase	13	Source 2 Input A-Phase
7	Output C-Phase		

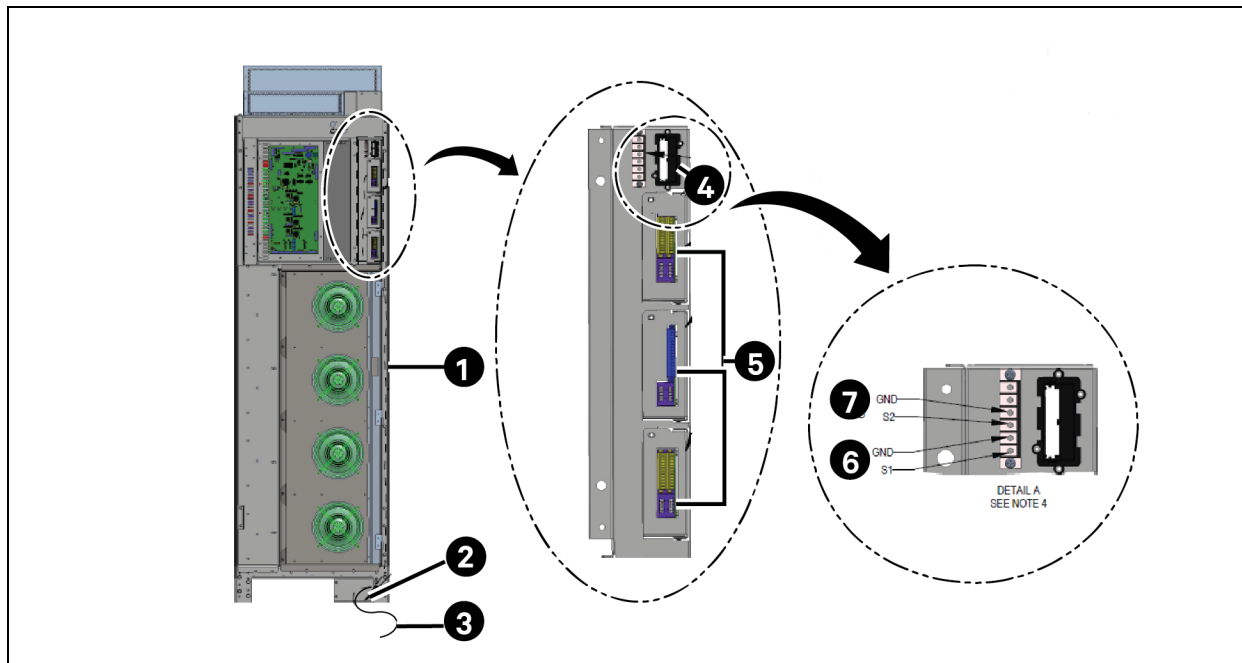
Figure 7.4 Electrical Connections 1200-1800 A Chassis Vertiv™ Liebert® STS2



Item	Description
1	Source 2 Input
2	Source 1 Input
3	Output

Item	Description
4	Ground M6 Hex Insert
NOTE: All Dimensions are in inch (mm).	

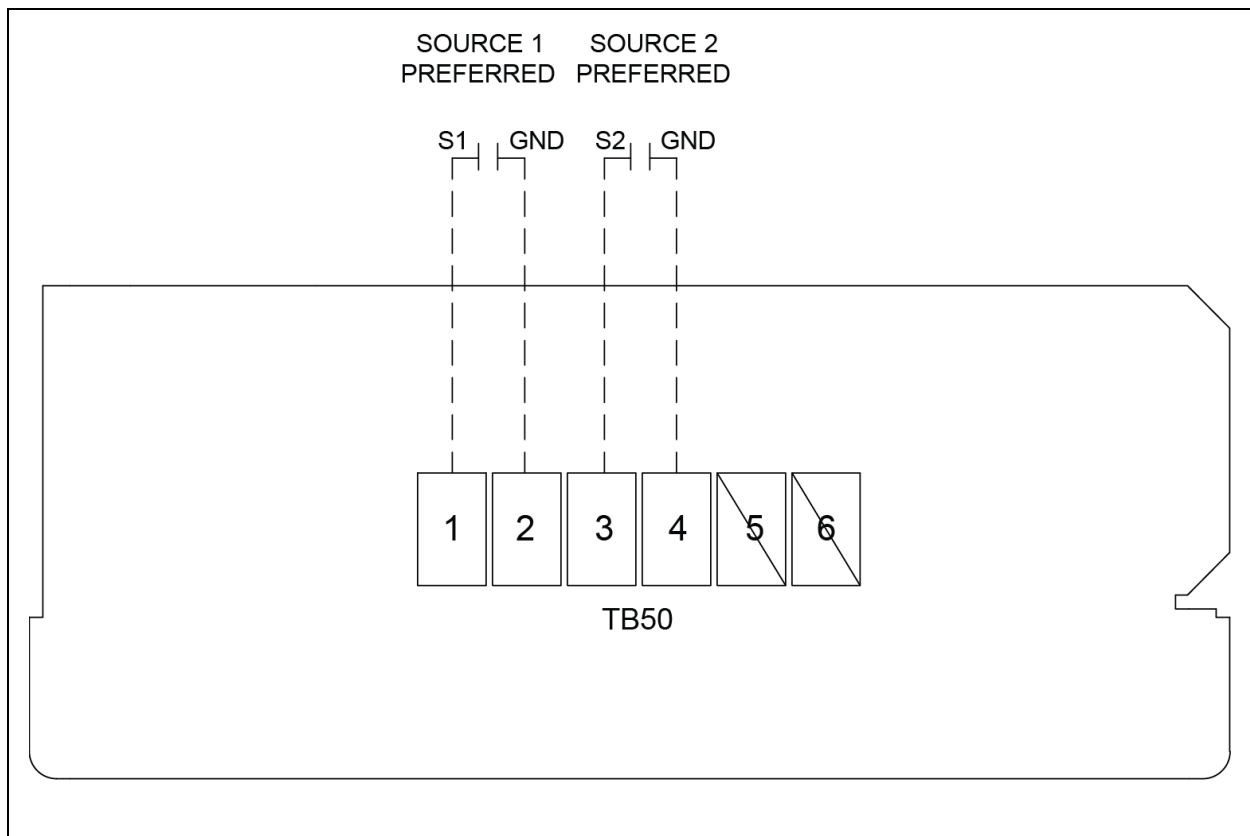
Figure 7.5 Control Connection Location Diagram



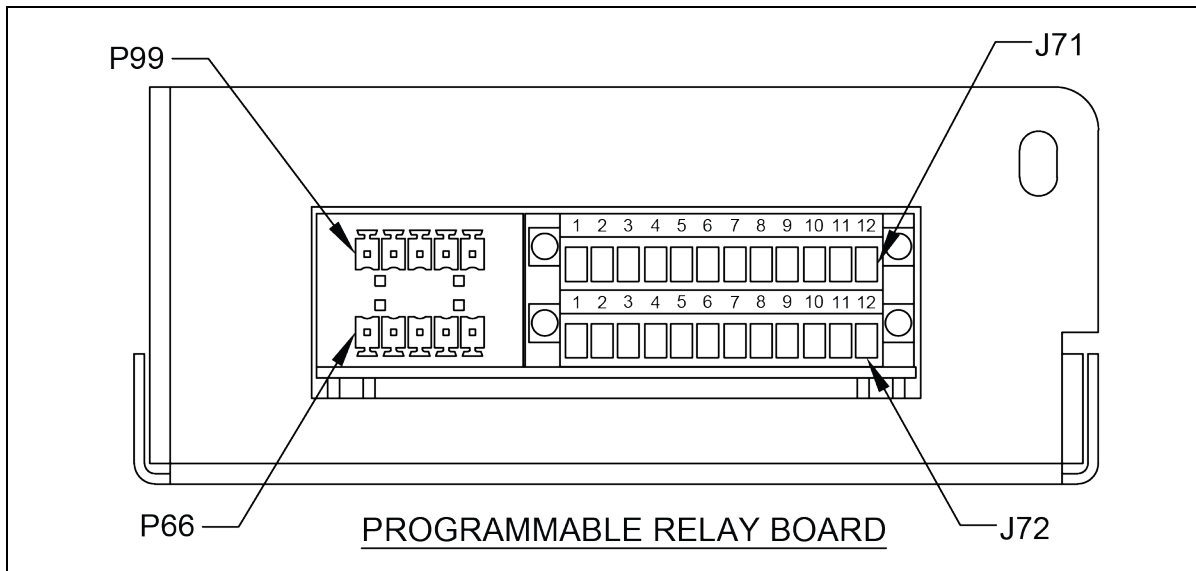
Item	Description	Item	Description
1	Low voltage wiring through	5	Optional Communication Cards include IS-UNITY-DP card (Max. Qty. 1) Input Contact Isolator (Max. Qty. 1) Programmable relay board (Max. Qty. 2)
2	Bottom entry low voltage wiring through	6	Source 1 preferred
3	Customer provided cable	7	Source 2 preferred
4	Remote source selection (Option)		

Notes to Figure:

1. Typical options are shown.
2. A maximum of (2) programmable relay boards may be used.
3. Maximum cable length 500 ft. (152 meters) with 16 AWG 300V minimum, flexible stranded cable.
4. Customer provided normally open dry contacts rating 10 mA at 30 VDC.

Figure 7.6 Control Wiring for Remote Source Selection Option**Notes to Figure:**

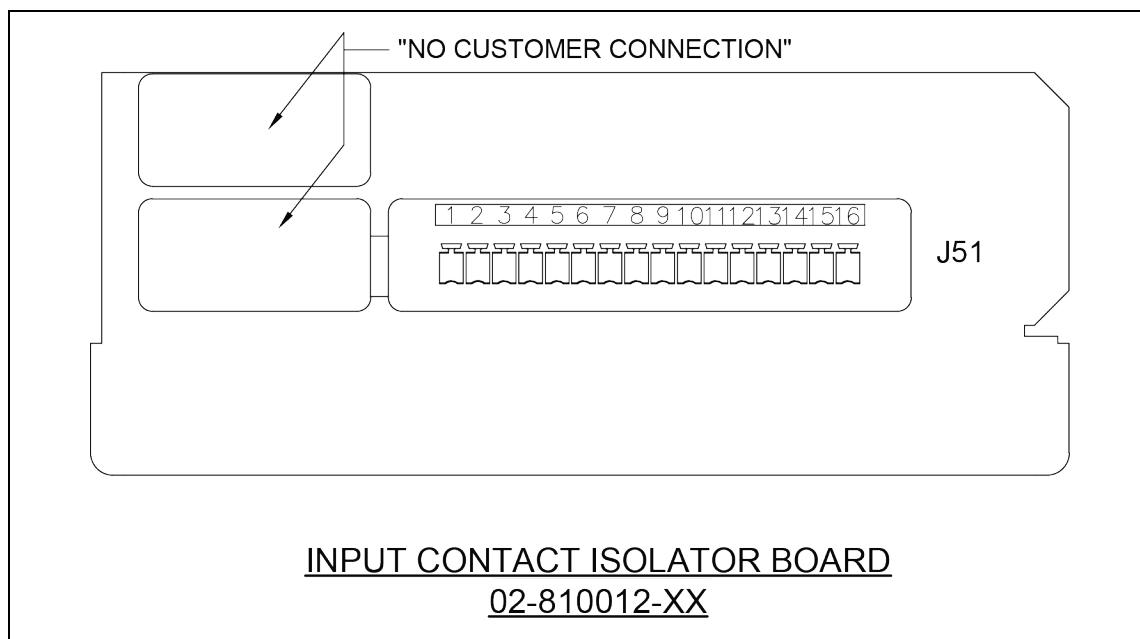
1. Customer provided normally open dry contacts. Rating 10 mA at 30 VDC.
2. Maximum cable length 500 ft. (152 m) with 16 AWG, 300 V minimum, flexible stranded cable.
3. All control wiring, by others, must be run separately from power wiring. Control wiring runs should not be combined in the same conduit.
4. See **Figure 7.6** above for location of remote source selection option. All wiring must be in accordance with national and local electrical codes.

Figure 7.7 Control Wiring for the Programmable Relay Board Option**Notes to Figure:**

1. Customer control wiring connection points are Terminal Blocks 1 through 12.
2. Programmable relay board option includes eight signal channels with one Form-C dry contact per channel. See table. C = Common; NC = Normally Closed; NO = Normally Open
3. See **Figure 7.7** above the programmable relay board option.
4. All control wiring (by others) must be run separately from power wiring. Control wiring runs should not be combined in the same conduit.
5. Refer to static switch control connection diagram for location of programmable relay board option.
6. Contact ratings: 1 A at 30VDC, 400 mA at 125 VAC.
7. Maximum cable length 500 ft. (152 m) with 16 AWG flexible stranded cable.
8. All wiring must be in accordance with national and local electrical codes.

Table 7.1 J71 and J12

Terminal Block	Channel	Pin	Common	Normally Closed	Normally Open
J71	Ch1	1 - 3	1	2	3
	Ch2	4 - 6	4	5	6
	Ch3	7 - 9	7	8	9
	Ch4	10 - 12	10	11	12
J72	Ch5	1 - 3	1	2	3
	Ch6	4 - 6	4	5	6
	Ch7	7 - 9	7	8	9
	Ch8	10 - 12	10	11	12

Figure 7.8 Control Wiring for the Input Contact Isolator Board Option**Notes to Figure:**

1. Customer control wiring connection points are Terminals 1 through 16 see **Table 7.2** below.
2. Customer provided, normally open, dry contacts for user alarm messages.
3. See installation, operation and maintenance manual for configuring the Input Contact Isolator board option.
4. All control wiring (by others) must be run separate from power wiring. Control wiring runs should not be combined in the same conduit.
5. Refer to static transfer switch control connection diagram for location of Input Contact Isolator board option.
6. Signal voltage: 100 mA at 12 VDC.
7. Maximum cable length 500 ft. (152 m) with 16 AWG flexible, stranded cable.
8. All wiring must be in accordance with national and local electrical codes.
9. When the Transfer Inhibit option is supplied, connect a N.O. dry contact (customer supplied) to Input Contact 8 (Pins 15 and 16). When the customer contact closes, transfers will be inhibited as long as the contact remains closed. Input Contact 8 is factory set so no setup is required. The Transfer Inhibit option prevents Input Contact 8 from being used for any other input.

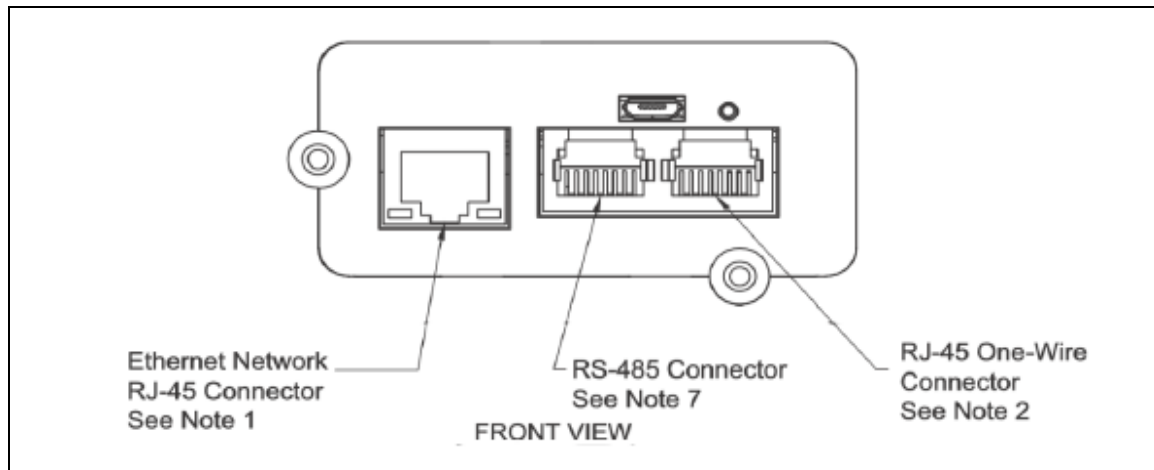
Table 7.2 J51

Input Contact	Pin No.	Input Contact	Pin No.
1	1	5	9
	2		10
2	3	6	11
	4		12
		7	13

Table 7.2 J51 (continued)

Input Contact	Pin No.	Input Contact	Pin No.
			14
4	7	8	15
	8		16

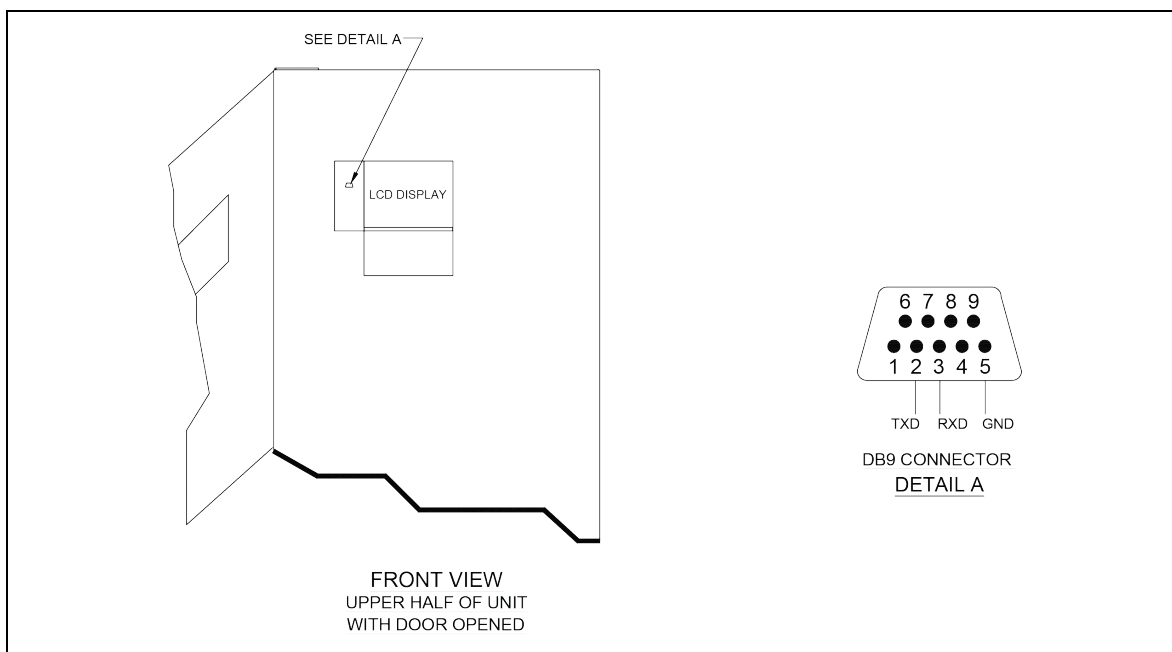
Figure 7.9 Control Wiring for the Vertiv™ Liebert® Intellislot™ Unity-DP Card



Notes to Figure:

1. **Wire size and type:** Standard category 5e cable with RJ-45 connector. Maximum length is 328 ft. (100 m).
2. Liebert integrated one-wire sensor cable or 2 m Cat 5e to modular one-wire sensor. Maximum length 65.6 ft. (20 m).
3. See Liebert® Intellislot™ Unity-DP Card installation, operation, and maintenance manual for configuring the card.
4. All control wiring (by others) must be run separate from power wiring. Control wiring runs should not be combined in the same conduit.
5. See control connection location diagram of static transfer switch for location of Liebert® Intellislot™ Unity-DP Card option.
6. All wiring must be in accordance with national and local electrical codes.
7. RS-485 requires the use of the RJ-45 adapter provided with the Liebert® Intellislot™ Unity-DP Card (P/N RJ-45-2POS). Refer to the Liebert® Intellislot™ Unity-DP Card's manual for details.

Figure 7.10 Control Wiring for the RS-232 Port



Notes to Figure:

1. RS-232 communication through DB9 connector.
2. Connector accessible with front door open. The cable must be removed before closing door.

8 Introduction to Vertiv™ Liebert® STS2 Operations

8.1 System Description

A Liebert® STS2 provides an automatic, seamless transfer between input power sources to an output load. The Liebert® STS2 monitors the input sources, to ensure each source is operating within set parameters, as well as ensure that each source is within acceptable tolerances for a transfer between sources to be completed.

The Liebert® STS2 contains two static transfer switches in one enclosure to allow the unit to transfer its load between the two input sources without an interruption of power to the load longer than 1/4 cycle when utilizing the standard transfer algorithm. When utilizing the Optimized transfer option the interruption does not exceed the ITIC/CBEMA standard. Please See **SL-20610 (Liebert® STS2 Guide Specification)** for more information.

If a problem is detected with a primary (Preferred) input source and defined trigger points are reached, the Liebert® STS2 automatically switches the input to the other (Alternate) input source. The Liebert® STS2 continues to monitor both sources and can automatically transfer the load back to the preferred source, if so configured, when that source returns to acceptable operating parameters.

The system control logic automatically monitors the input sources and power output to ensure that they are operating within acceptable tolerances. The system logic manages the transfer between sources.

The Liebert® STS2 front panel contains a Color Graphical Display on an LCD touchscreen.

The Color Graphical Display provides a menu-driven operator interface, and a display of system information, status information, a one-line diagram (Mimic) of the Liebert® STS2, active alarms, and alarm history information.

The menu selections provide control of the preferred source and manual transfer initiation. Buttons provide for audible alarm silence and reset.

Through the touchscreen, specific voltage, current, and environmental parameters can be configured to trigger events that can sound an alarm, write to a history log and either transfer sources or inhibit a transfer.

Preferred input source selection, alarm reset, and alarm silencing are done through buttons on the touchscreen.

Communication options can be installed in the Color Graphical Display (LCD) unit only. These options provide external communication with the Liebert® STS2 through a network card, a programmable relay board, a contact isolator, or an RS-422 port to Liebert® STS2.

8.1.1 Redundancy

Redundancy within the Liebert® STS2 prevents one component from being a single point of failure, should a problem occur. Redundant circuits and components are used to eliminate single points of failure.

Since the Liebert® STS2 has two input sources, no single component failure can cause a loss of power to the load. Redundant power supplies are provided which feed a DC dual-bus used throughout the unit to prevent any single-point power supply failure modes.

Three separate redundant control logic modules are built into the system. Each contains the logic necessary to run the Liebert® STS2 and control all transfers.

The Liebert® STS2 is designed to remain fully operational for any single fan failure.

Should the front panel interface fail the control logic continues to operate and the unit would transfer should a problem be detected on the preferred source. Information on the monitoring parameters would be available through the remote communication options, if available, or the DB9 (RS-232) connector located next to the LCD display behind the front door. See **Figure 7.10** on page 30 for details.

8.1.2 Reliability and Agency Requirements

The Vertiv™ Liebert® STS2 is designed for high reliability and high availability with a critical bus Mean Time Between Failure (MTBF) exceeding 1,000,000 hours.

The Liebert® STS2, Control/Power Module and all its options are designed, tested, and certified, where applicable, to meet agency requirements as follows:

- **IEC62310-1:** General and safety requirements
- **IEC62310-2:** Electromagnetic Compatibility (EMC) requirements
- **UL 1008S:** Standard for Solid State Transfer Switches
- NEC
- FCC Part 15 EMI emission limits for Class A computing devices.

NOTE: Some regions may not maintain all listed agency ratings. Check with the local Vertiv representative for details.

The Liebert® STS2 uses conservatively rated components, minimizing the need to go to maintenance bypass. All maintenance and repair work can be done through the front panel of the unit. This access makes repairs and maintenance easier.

Gating and control logic are partitioned so that failure of one source's gating or sensing logic does not prevent the switch from transferring to the other source.

All control and logic components are mounted separate from the power components. The Liebert® STS2 is designed to minimize the exposure of hazardous voltages to allow safe servicing of the unit while the load is energized.

All electrical components requiring normal maintenance are replaceable without de-energizing the load, as long as one source is available. Solid-state switching devices are packaged to allow safe repair of those devices without having to de-energize the load. All non-automatic switches or circuit breakers are the plug-in or draw-out type to allow replacement without de-energizing the load. All solid-state power switching devices are rated to prevent hazardous device failure in power systems with available fault currents up to the defined limits, as listed in [Electrical Requirements](#) on page 88.

8.1.3 Factory Backup and Service Assistance

Because improper installation can cause a system to fail, a Vertiv technician should inspect the unit to ensure that it is properly installed and that its operating parameters are properly configured.

Once the Liebert® STS2 is properly installed, you, as the on-site operator, can easily monitor the unit's operation utilizing the touchscreen.

If you need assistance, or have questions, contact Vertiv at 800-543-2378.

8.2 Mode of Operation

8.2.1 Normal (Preferred Source)

Under normal operating conditions, the Vertiv™ Liebert® STS2 routes power from the preferred input source to the output load. The unit monitors the voltage current and phase of each source to ensure that both are operating within set tolerances, and that the alternate source is available, should a transfer be required.

8.2.2 Transfer

Should the preferred source fail or be outside acceptable voltage limits, the Liebert® STS2 transfers the input to the alternate source until the problem is rectified in the preferred source. The unit can be set to automatically transfer the input back to the preferred source, or only allow the transfer to be done manually.

8.2.3 Transfer Inhibit

For a transfer to be completed between input sources, the sources must meet certain parameters, or the transfer cannot take place. Uninterrupted transfer between sources is inhibited due to input source failure, sources out of sync, switch failure, or the unit is in bypass mode.

8.2.4 Bypass

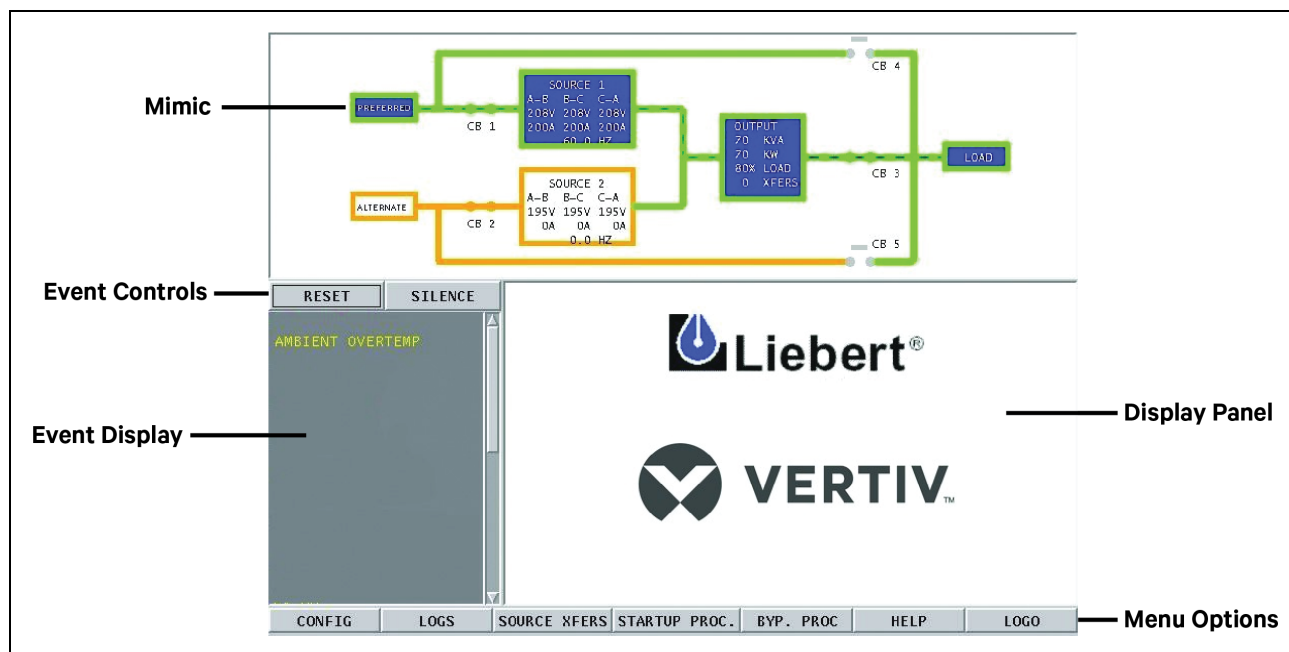
The static transfer switch can be manually bypassed to allow the power from a source to directly flow to the output load. This bypass allows the unit's electronics to be serviced without dangerous voltages being present.

The Liebert® STS2 may include key-interlocked maintenance bypass breakers that allow either input source's electronics to be bypassed for maintenance without interruption of power to the load. The maintenance bypass allows all electronics to be isolated from the input, output, and bypass connections. Bypass instructions are available from the touchscreen and are discussed later in this manual.

8.3 Operator Controls

The Liebert® STS2 is equipped with an interface to configure and monitor the unit either locally or remotely. The Color Graphical Display is a touchscreen LCD that provides a color diagram (Mimic) that displays the current status of the unit. System parameters are displayed and help is available to define events. See **Figure 8.1** on the next page. The touchscreen menus allow the operator to initiate source transfers, view event and history logs, and view bypass and other operational instructions.

Figure 8.1 Liebert® STS2 Touchscreen Display



Touchscreen control buttons allow you to reset alarms, silence the audible alarm, review configurations, event and history logs, preferred source, startup and bypass procedures, and the help menu. Qualified personnel, with a password, can use these menus to configure parameters, select a preferred source, and do manual source transfers.

Touchscreen units can be accessed from a terminal, or a PC running terminal emulation software, that is attached to the unit. Through the RS-232 access, you can monitor and configure the unit, plus remotely select a preferred source. See [Using the RS-232 Port](#) on page 56 for instructions on using the RS-232 interface.

9 Theory of Operation

9.1 General Description

The Vertiv™ Liebert® STS2 contains all the equipment necessary to prevent an interruption in power flow to the AC load, should your primary source fail.

9.1.1 Liebert® STS2 (Static Transfer Switch)

The Liebert® STS2 is a 3 or 4-pole, double-throw, solid state automatic transfer switch that is fed from two sources. The Preferred source is the input source that normally carries the load when both sources are available. The preferred source is selectable by the user from the LCD panel or an optional Remote Source Selection. The unselected source is referred to as the Alternate source and carries the load if the preferred source should fail or if a manual transfer is initiated.

The unit uses Silicon Controlled Rectifiers (SCRs) connected in parallel, opposing pairs to function as an AC switch configuration. Three pairs of SCRs connect the AC load to the selected preferred input source as long as the preferred source is available. A second set of SCRs stands ready to transfer the AC load to the alternate input source should the preferred source fail. The switching action is very fast, with a typical power interruption to the load of 1/4 cycle or less. When utilizing the Optimized transfer option the interruption does not exceed the ITIC/CBEMA standard. Please refer to **SL-20610 (Liebert® STS2 Guide Specification)** for more information.

During static switch transfers and retransfers, the conduction state of the SCRs is carefully monitored and controlled to prevent a current path from one source to the other. This technique prevents a faulted source from feeding into the other good source.

9.1.2 Source Transfer

The Liebert® STS2 allows manually initiated transfers between the two sources. On units without the Optimized Transfer option the alternate source must be within acceptable voltage limits and phase tolerances with the preferred source. You begin a manual transfer by selecting the inactive source as the preferred source. On a manual transfer, the Liebert® STS2 transfers between the two sources with less than 1/8 cycle typical interruption of power to the load. The transfer can only be completed when both sources are available and synchronized within the user-adjustable phase synchronization window. For sources where the two frequencies are not exactly in phase, manually initiated transfers are delayed by the Liebert® STS2 until the two sources are within the defined phase synchronization window.

Source selection can also be done remotely using the Remote Source Selection option, if installed.

9.1.3 Automatic Transfer/Retransfer

If the preferred source is out of voltage and/or frequency limits, the load is automatically transferred to the alternate source. The default transfer voltage limits comply with the limits of the IEEE Std. 446-1995 computer voltage tolerance envelope.

If the unit is so configured, the load is retransferred automatically to the preferred source after the preferred source returns to within the acceptable voltage and frequency limits for at least the defined retransfer time delay, and is in phase with the alternate source. You can enable and disable automatic retransfer to the preferred source through a user configuration setting.

9.1.4 Emergency Transfer

To ensure that power remains connected to the load, the Vertiv™ Liebert® STS2 automatically performs an emergency transfer from one input source to the other when an outage occurs on the existing source. The automatic transfer takes place if the other source's voltage is within acceptable limits, and regardless of the phase difference between the two sources.

Emergency transfers occur with a minimal interruption of power to the load when utilizing the standard transfer algorithm. When utilizing the Optimized transfer option the interruption does not exceed the ITIC/CBEMA standard. See **Liebert® STS2 Guide Specification_SL-20610** for more information.

Emergency transfers from the alternate source to the preferred source are not affected by the Auto Retransfer Enabled/Disabled or Retransfer Delay user settings.

9.1.5 Load Current Transfer Inhibit

The Liebert® STS2 senses the load current. If the load current exceeds the preset level deemed to represent a load inrush or fault condition, the unit's logic disables manual and automatic transfers, even if the selected source's input voltage is outside the acceptable limits. This event triggers an I-Peak alarm. If so configured, the Load Current Transfer Inhibit is automatically reset 100 milliseconds after the current and voltage return to within normal parameters. This reset provides continued protection against a source failure. The Load Current Transfer Inhibit also can be programmed to require a manual reset. See [Step 14](#) under the Source Set Points heading for details. Only under open SCR condition would the Liebert® STS2 automatically transfer with an IPeak condition.

9.1.6 SCR Failure

The Liebert® STS2 continuously monitors the status of the SCR switching devices for proper operation. In the event of a shorted SCR on the input source powering the load, the Liebert® STS2 automatically triggers an alarm and trips open the other source isolation breaker if equipped with shunt trip hardware. In the event of a shorted SCR on the other input source, the Liebert® STS2 automatically triggers an alarm and trips open the other source isolation breaker if equipped with shunt trip hardware.

In the event of an open SCR, the switch automatically triggers an alarm and transfers the load to the other source. All open and shorted SCR alarm conditions are latched and require the system to be repaired and reset to restore normal operation.

NOTE: If the user has the new style circuit board, the firmware can be updated to fix the false SCR alarms.

NOTE: If the user has the older style circuit board then the load level charts below will apply.

STS2 current range to avoid SCR open alarms

See **Table 9.1** below for the current range required on STS2 systems with older style control boards (02-804960-xx) to avoid false SCR open alarm conditions.

Table 9.1 STS2 Current Range To Avoid SCR Open Alarms

System Rating (Amps)	RMS Current Present Threshold (Amps)	% of Nominal Rating
100	9.39	9.39%
250	9.39	3.76%
400	23.48	5.87%
600	23.48	3.91%

Table 9.1 STS2 Current Range To Avoid SCR Open Alarms (continued)

System Rating (Amps)	RMS Current Present Threshold (Amps)	% of Nominal Rating
800	37.56	4.70%
1000	37.56	3.76%
1200	37.56	3.13%
1250	37.56	3.00%
1200	58.69	4.89%
1250	58.69	4.70%
1400	58.69	4.19%
1600	82.16	5.14%
2000	82.16	4.11%

9.1.7 On/Off Sequence

The Liebert® STS2 contains no master On/Off push button control. When connected to the input sources, the unit's logic power comes On automatically. The touchscreen display is active as long as at least one input source is energized and the Control Power Disconnect is On.

9.2 Detailed Component Description

9.2.1 Controls

Operator Interface

The Vertiv™ Liebert® STS2 Color Graphical Display unit contains a touchscreen color LCD to provide the operator interface to control and configure the operation of the unit and quickly diagnose problems. A password and an optional keylock, if installed, are provided for security.

Hardware

- The Liebert® STS2 operator interface in the Color Graphical Display unit is designed to provide all of the information required to configure and monitor the unit's operation.
- The control logic performs automatic operations with minimal operator interface.
- Each Liebert® STS2 unit is equipped with a color LCD touchscreen.
- The Liebert® STS2 can have optional communication ports installed. See [Options](#) on page 17 and [Communication Interfaces](#) on page 55 for more information on communication options.

Firmware

The operator interface enables you to monitor the Liebert® STS2, to configure set points for transfers, monitor system parameters and access event and history logs. The firmware is accessible through the LCD touchscreen or the RS-232 interface. The firmware includes:

- View and set the preferred source.
- View and configure setpoints.
- View alarms, faults, and status.

Additionally, the Color Graphical Display unit provides:

- The mimic graphical representation of the systems operation.
- Menu driven monitoring and configuration.
- Step-by-step instructions to assist you in the startup, shutdown, and bypass operations.
- Help on event messages.
- Touchscreen alarm reset and silence buttons.

Events in the system, both faults and alarms, are detected and displayed on the LCD. See [Alarm and Faults](#) on page 49 for more information on events.

- A set of event masks can be configured through the LCD to trigger a system response to an event. See [Event Mask](#) on page 49.
- Report event conditions from other components of the system.
- Monitor and report changes in event condition states. If the event condition's state changes from inactive to active, a new event is detected. If the transition is from active to inactive, the event condition has cleared.
- Process new faults and alarms, and clear inactive alarms.
- Provide the alarm reset and silence options.

9.2.2 SCR's

The unit uses puck style SCRs rated to carry the full load. Because the unit is a fuseless design with non-automatic or automatic circuit breakers, overcurrent protection is provided by upstream circuit breakers.

9.2.3 Logic Modules

The logic contains three separate redundant logic modules. Each module contains the logic necessary to run the Vertiv™ Liebert® STS2 and control transfers and shunt trips under all circumstances, without any outside assistance, once set up and started properly.

9.2.4 Audible Alarm

An audible alarm is installed on the control board. This alarm is triggered by an alarm condition detected on the unit. The alarm can be turned Off from the touchscreen (Color Graphical Display units). Turning Off the audible alarm does not clear or reset the condition that triggered the alarm.

9.2.5 RS-232 Port

An RS-232 serial port is provided to allow an external terminal to be connected as another user interface. See [Using the RS-232 Port](#) on page 56 for more information on using the RS-232 port.

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10 Operating Instructions for the Touchscreen Interface



CAUTION: Before the unit is placed into service for the first time, after equipment relocation, or after the equipment has been de-energized for an extended period of time, a thorough equipment inspection and supervised startup by qualified personnel are strongly recommended. Contact your local Vertiv representative or Vertiv at 800-543-2378 to arrange for equipment inspection and startup.

After the initial equipment startup, the following operating guidelines can be used for standard equipment operation. These guidelines should be reviewed for any special equipment modifications, special site conditions, or company policies that may require changes to the standard equipment operation.

All programmable functions are preset at the factory to enable the unit to be brought up without the need to enter all selectable parameters.

This section refers to the LCD touchscreen display. This display is discussed in more detail later in the manual. See [Vertiv™ Liebert® STS2 Touchscreen Display](#) on page 65.

10.1 Normal System Startup

NOTE: If your Liebert® STS2 is connected to a PDU with a Wye configuration, enable the Wye Output Transformer before starting the system. This setting can be made from the touchscreen. Refer to [Wye Output Transformer](#) on page 83 for instructions.

1. Ensure that all Liebert® STS2 breakers CB1, CB2, CB3, CB3A (if supplied), CB4, and CB5-are in the *OFF* position.
 - a. Ensure that the key interlocks for CB1 and CB2 have their bolts extended.
 - b. Ensure that the key interlocks for CB4 and CB5 have their bolts extended, thus preventing CB4 or CB5 from being turned *ON*.
 - c. verify fuses F1-F4 are closed.
2. Source/input power should be applied to both Liebert® STS2 inputs.
 - a. The touchscreen control panel should become active and operate properly when at least one of the inputs is energized is closed.
 - b. Follow procedure on HMI or manual to place unit in Bypass mode.
 - c. Follow procedure on HMI or manual to place the unit online.

NOTE: For redundant output switch units, CB3 descriptions apply to CB3 and CB3A.

3. Press the *RESET* button on the touchscreen to reset any previous alarms.
4. Verify in the Event Display and the Mimic that there are no active alarms.
 - a. If any active alarms are displayed, See [Alarm and Faults](#) on page 49 for a description of the alarms and possible causes. All active alarm conditions should be corrected before proceeding.
5. Turn *On* the load equipment following the load equipment manufacturer's recommendations.

10.2 Maintenance Bypass

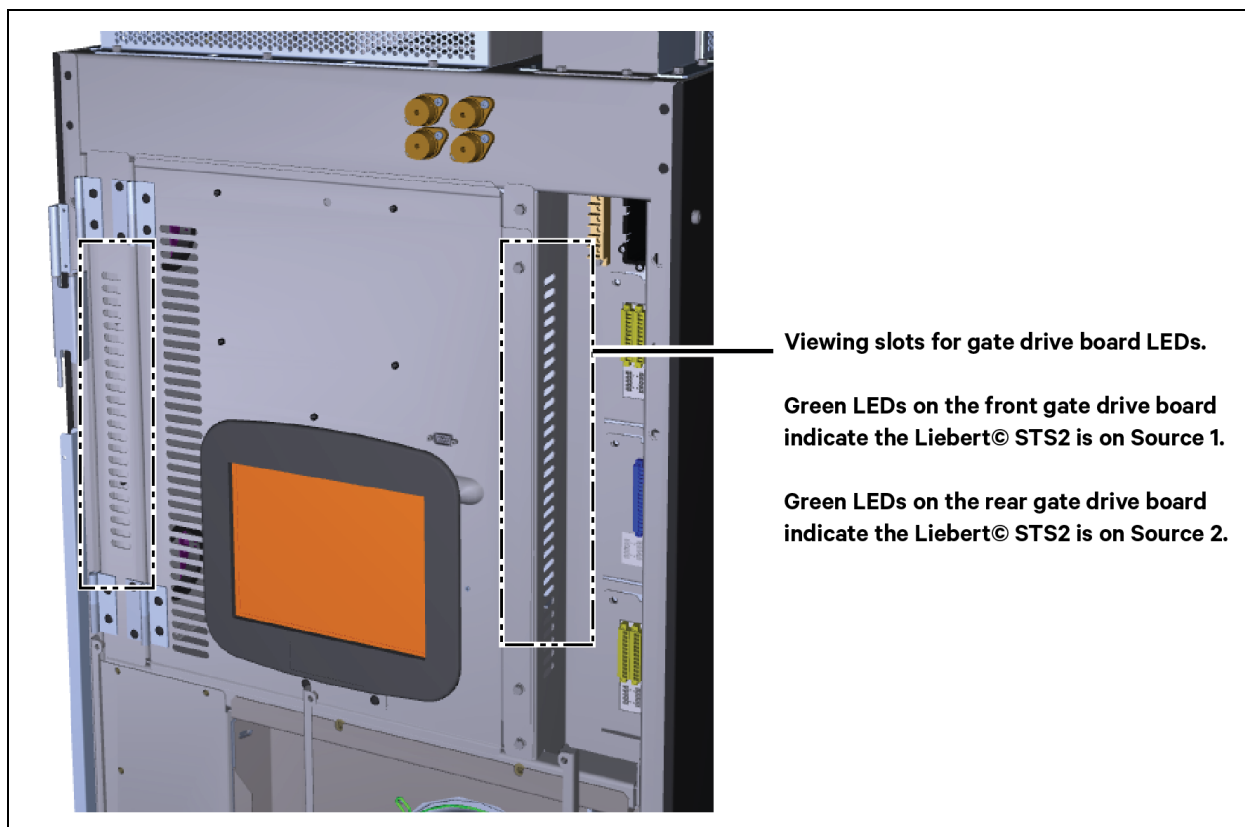
The Vertiv™ Liebert® STS2 may be equipped with two key-interlocked, bypass breakers, CB4 and CB5, to allow manual bypass of the switch electronics for either input source in the event of switch failure or for maintenance of the switch. Refer to the static transfer switch one-line diagram, **Figure 5.1** on page 14. While operating on maintenance bypass with fuses F1 - F4 open, all voltages are removed from the Liebert® STS2 electronics to facilitate safe repair, without de-energizing the load using a make-before-break switching sequence.

However, the unit can be bypassed using a make-before-break switching sequence only to the same source to which that the switch is connected, as indicated by the highlighted static transfer switch box on the Mimic screen.

In the event of source or switch failure, the unit should be bypassed only to the current input source. For convenience, instructions for the bypass procedure can be displayed on the touchscreen by selecting the BYP. PROC option from the menu bar.

The Mimic is used to verify the status of the unit during the bypass procedures. In the unlikely event that the Color Graphical Display is not available, open the front door and look through the slots in the control door. If you can see green LED's on the gate driver board through that slot, then the unit is connected to the source referenced on the label below that slot. See **Figure 10.1** below

Figure 10.1 Gate Board Viewing Slot Locations



If the Color Graphical Display is not available, you can still use the following bypass procedures, ignoring the steps to check the display and check the LED's.

10.2.1 Bypass Procedures for Source 1

NOTE: If Vertiv™ Liebert® STS2 uses rotary switches, the operation of opening/closing a switch must be no longer than 2 seconds. Failure to complete the switch operation in less than 2 seconds may result in an erroneous SCR fault alarm.

To bypass the switch for Source 1:

To bypass the Source 1 static transfer switch when Source 2 is presently active, you must first transfer to Source 1. See [Manual Transfer/Preferred Source Selection](#) on page 45.

1. Verify that Source 1 is supplying power via the Mimic.
 - If the Color Graphical Display is not available, check the gate driver board LED's through the slots in the control panel. See **Figure 10.1** on the previous page.
2. Remove the *interlock key* from CB5 and place it in the CB4 interlock.
3. Open the *alternate source input breaker CB2*.
4. Rotate and remove the *CB2 interlock key*.
5. Insert the key in the CB4 bypass breaker interlock.
6. Rotate the *interlock keys* in the CB4 bypass breaker interlock to retract the interlock.
7. Close *bypass breaker CB4*.
8. Verify the breaker status on the Mimic screen.
9. Open *source input breaker CB1*.
10. Rotate the *CB1 interlock key* and remove it to lock out the breaker.
11. Secure the key according to your site's lockout/tagout procedure.
12. Open *output breakers CB3* and *CB3A* (if supplied) to remove power and isolate the static switch from the load.
13. Open the *control fuses F1-F4* to remove *control power* if necessary.

To return to normal mode:

1. Close the *F1-F4* to apply *control power*
2. Insert the key in the CB1 breaker interlock.
3. Rotate the key to retract the interlock.
4. Close *source input breaker CB1*.
5. Verify *Source 1* and *CB1 breaker* status on the Mimic screen.
6. Select the *SOURCE 1 button* in the SOURCE XFERS menu.
7. Close *output breakers CB3* and *CB3A* (if supplied).
8. Verify *CB3* and *CB3A* breaker status.
9. Verify that *STS SOURCE 1* and *OUTPUT* boxes are highlighted on the Mimic screen.
10. Open *bypass breaker CB4*.
11. Rotate the keys in the CB4 interlock to extend the interlock.
12. Remove the proper key from the CB4 interlock and insert it in the CB2 breaker interlock.
13. Rotate the key to retract the CB2 breaker interlock.
14. Close *source input breaker CB2*.
15. Verify the *STS SOURCE 2* box and *CB2* breaker status on the Mimic screen.

- If the Color Graphical Display is not available, check the gate driver board LED's through the slots in the control panel. See **Figure 10.1** on page 42.

10.2.2 Bypass Procedures for Source 2

To bypass the switch for Source 2:

NOTE: To bypass the Source 2 static transfer switch when Source 1 is active, you must first transfer to Source 2. See [Manual Transfer/Preferred Source Selection](#) on the facing page.

1. Check the *Mimic* to verify that Source 2 is supplying power.
 - If the Color Graphical Display is not available, check the gate driver board LED's through the slots in the control panel. See **Figure 10.1** on page 42.
2. Remove the *interlock key* from CB4 and place it in the CB5 interlock.
3. Open the *alternate source input breaker CB1*.
4. Rotate and remove the *CB1 interlock key*.
5. Insert the *key* in the CB5 bypass breaker interlock.
6. Rotate the *interlock keys* in the CB5 bypass breaker interlock to retract the interlock.
7. Close *bypass breaker CB5*.
8. Verify the breaker status on the Mimic screen.
9. Open *source input breaker CB2*.
10. Rotate the *CB2 interlock key* and remove it to lock out the breaker.
11. Secure the key according to your site's lockout/tagout procedure.
12. Open *output breakers CB3* and *CB3A* (if supplied) to remove power and isolate the static switch from the load.
13. Open the *control fuses F1-F4* to remove *control power* if necessary.

To return to normal mode:

1. Close the *F1-F4* to apply *control power*.
2. Insert the *key* in the CB2 breaker interlock.
3. Rotate the *key* to retract the interlock.
4. Close *source input breaker CB2*.
5. Verify Source 2 and CB2 breaker status on the Mimic screen.
6. Select the *SOURCE 2 button* in the SOURCE XFERS menu.
7. Close output breakers CB3 and CB3A (if supplied).
8. Verify CB3 and CB3A breaker status.
9. Verify that *STS SOURCE 2* and *OUTPUT* boxes are highlighted on the Mimic screen.
10. Open *bypass breaker CB5*.
11. Rotate the *keys* in the CB5 interlock to extend the interlock.
12. Remove the proper *key* from the CB5 interlock and insert it in the CB1 breaker interlock.
13. Rotate the *key* to retract the CB1 breaker interlock.
14. Close *source input breaker CB1*.
15. Verify the *STS SOURCE 1 box* and *CB1 breaker* status on the Mimic screen.

- If the Color Graphical Display is not available, check the gate driver board LED's through the slots in the control panel. See **Figure 10.1** on page 42.

10.3 Enabling Remote Source Selection

If your system is equipped with the optional Remote Source Selection option, it must be enabled.

If you your system includes the Color Graphical Display:

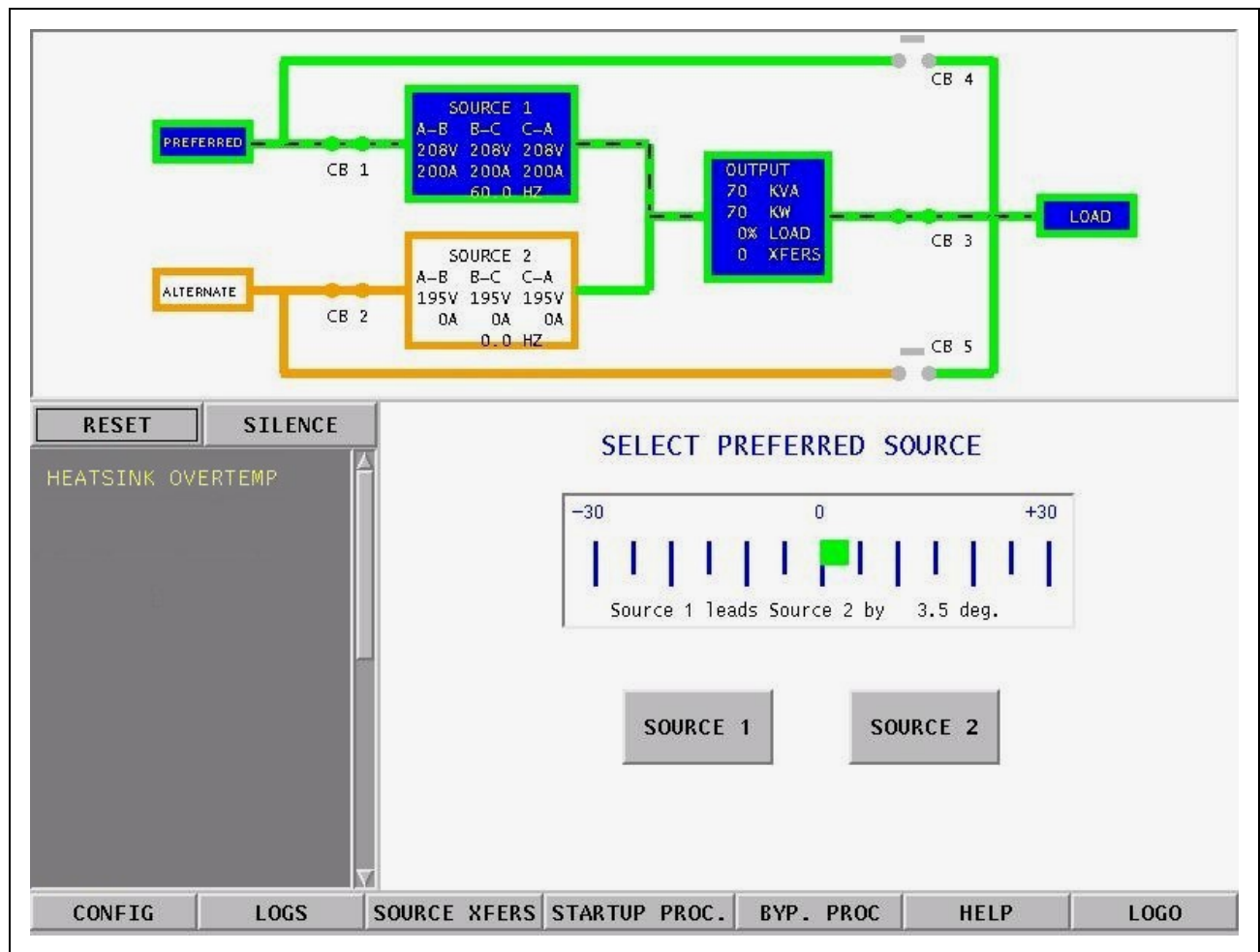
1. Select *CONFIG* from the menu bar.
2. Select *SYSTEM SETTINGS* from the Configuration menu.
3. Select *SYSTEM OPTIONS* from the System Settings menu.
4. Select *YES* for the REMOTE SOURCE SELECT choice.

10.4 Manual Transfer/Preferred Source Selection

The Source Transfer option (Source Xfers) in the touchscreen menu allows you to select a preferred source. Transfers are only permitted when the voltage and current are within their proper operating range and the sources are synchronized on units without Optimized Transfer. Units with the Optimized Transfer option do not require the sources to be synchronized to make a manual transfer. The Source Transfer screen indicates the synchronization between the two sources, while the voltage and frequency are displayed on the Mimic. See **Figure 10.2** on the next page. Transfer is inhibited if the deviation exceeds the parameter set in the Source.

NOTE: If one source will be de-energized for an extended period (hours or days), set the unit to bypass mode for the remaining source. Without using bypass, if a failure occurs in the switch components for remaining source, the Vertiv™ Liebert® STS2 does not have a second source to switch to and the load would not receive power. See **Maintenance Bypass** on page 42 for bypass instructions.

Figure 10.2 Source Transfer Screen

**To manually select the preferred source**

1. Verify that the input breakers CB1 and CB2 are closed.
2. Select SOURCE XFERS from the menu bar.
The Select Preferred Source screen is displayed in the Event Display.
3. Check the Mimic to verify that Source 1 and Source 2 input voltages are correct.
4. Select SOURCE 1 or SOURCE 2 as your preferred source.

When conditions are correct, the switch transfers the load to the alternate source by selecting the alternate source as the preferred source.

This source is now monitored as the preferred source throughout the various configurations set up through the touchscreen.

5. Verify that the correct source is designated as the preferred source and that the input source changes to the desired source.

The Mimic is updated to indicate the new preferred source. The source is now highlighted with blue and that source is labeled as the preferred source.

If the Transfer Inhibit message is displayed, check for alarm messages on the Active Status window. Correct alarm conditions before attempting a source transfer.

NOTE: The preferred source may also be changed via the optional Remote Source Selection option, thereby initiating a transfer remotely.

10.5 Shutdown in Maintenance Bypass Mode

When the Vertiv™ Liebert® STS2 is operating on bypass:

1. Turn Off the load equipment per manufacturer's recommendations.
2. Open the bypass switch (CB4 or CB5) to turn Off the static transfer switch output.
3. To completely de-energize the unit, turn OFF the power to both inputs to the Liebert® STS2.

10.6 Normal System Shutdown

The Liebert® STS2 can be shut down from either the static switch mode or the bypass mode.

10.6.1 Shutdown in Static Transfer Switch Mode

When the Liebert® STS2 is operating on static transfer switch mode (not maintenance bypass mode).

1. Turn Off the load equipment per manufacturer's recommendations.
2. Open CB3 to turn Off the static switch output.
3. Open CB3A if the static transfer switch has a redundant output configuration.
4. Open the input switches CB1 and CB2.
5. To completely de-energize the unit, turn OFF power to both inputs to the Liebert® STS2.

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11 Alarm and Faults

Alarms and faults are events that are triggered when the operation of the Vertiv™ Liebert® STS2 falls outside the defined parameters. These events can also be triggered by: user actions, such as changing configurations, clearing logs, etc.; failed components such as a fan failure, an SCR that is open or closed, etc.; and system status, such as open circuit breakers, load on alternate source, etc. These events can provide a warning or trigger the system to make a change, such as switch sources or the recording of a history log. The Liebert® STS2 monitoring system detects and annunciates a comprehensive set of fault and alarm conditions. Faults and alarm messages are can be viewed on the LCD touchscreen or via the RS-232 port.

On the LCD touchscreen, the events are shown in the Status Display panel in the lower left corner of the touchscreen and written to the Event log. You can touch a message to view a definition of an event and a tip for troubleshooting. See [Vertiv™ Liebert® STS2 Touchscreen Display](#) on page 65 for more information on the touchscreen. If you are monitoring the system through the RS-232 port, See **Table 12.1** on page 56 for the commands to view event logs, and alarm and fault lists. Event actions can be triggered by the settings configured from the Event Masks. See [Event Mask](#) below for more information.

Faults: A fault indicates that a component of the Liebert® STS2 has failed or has been damaged. In the Event Display, faults are indicated in red.

Alarms: An alarm is an event caused by a significant abnormal system condition. In the Event Display, alarms are indicated in yellow. The setpoints for many of the alarms are configurable through the User Settings. Many alarms clear themselves when the condition is resolved. If an alarm event mask is set to latch, the alarm messages remain active until the alarm condition has been corrected and the RESET button is pushed. See [Event Mask](#) below for more information on latching.

11.1 Event Mask

The Liebert® STS2 gathers, processes and reports faults and alarms, collectively referred to below as events. The Event Mask dialog box allows you to set the system's response for specific alarms and faults that are generated.

The following mask types are available for each event:

- **Latch:** If a latch is enabled for the selected event, that event remains active even if the originating event condition clears. A latched event may only be cleared by pushing the RESET button.
- **Event Log:** The selected event is date/time stamped and recorded to the Event Log when the event is triggered.
- **Audible:** If the selected event is triggered, an audible beeper or horn is sounded by the Liebert® STS2. The beeper continues while this event is active or latched, or until the SILENCE button is pushed.

See [Event Mask](#) above for instructions on setting the mask type via the touchscreen display. See the [Setting Event Masks with the Terminal](#) on page 63 for instructions on configuration using the RS-232 port.

11.2 Event and History Logs

The system tracks events through the Events Log and tracks significant events through the History Logs. These logs allow you to quickly spot trends or diagnose problems that the unit may have had. Both logs are written in nonvolatile memory.

The logs can be accessed from the touchscreen menu or the RS-232 port. See [Logs](#) on page 83 for more instructions on viewing the logs from the touchscreen. See **Table 12.1** on page 56 for the RS-232 interface commands used to access the logs.

11.2.1 Event Log

The events are tracked in sequence of occurrence. The sequence of occurrence is identified by date, time, and frame number. The last 512 events are stored in a nonvolatile memory and can be viewed from the Event Log.

Event logs wrap, meaning when the log is full, the oldest event is deleted when a new event is written to the log.

The Event Log tracks:

- **#:** the sequence number in which the event occurred since the log was last cleared.
- **Message:** The event that occurred, such as Ambient Overtemp., Source 1 Fail.
- **Type :** either a Fault or Alarm. See [Alarm and Faults](#) on the previous page for further details on these events.
- **ID:** the event identifier.
- **Date and Time:** when the event occurred.
- **Faults:** the number of fault events logged.
- **Alarms:** the number of alarm events logged.
- **User Alarms:** the number of alarm events logged that were triggered by user-created alarms, such as those alarms created with the Input Contact Isolator settings.
- **Total:** the sum of all the events currently logged.

11.2.2 History Log

When a designated major alarm occurs, the History Status buffer is frozen, capturing 64 sequential frames before and after the alarm condition. When the History Status buffer is frozen, a History Log is created.

Two History Logs are available to track major alarms. This log includes the triggering event plus the surrounding events, and the system voltages, currents, frequency, power, source selection and breaker positions at the time of the event. The History Log displays the 64 sequential frames, in 4-millisecond intervals, of the Present Status screens surrounding the event.

If you are viewing the log from the touchscreen, the Mimic and the Event Display show the data that was present as the alarm was triggered. The data is displayed as frames are played.

The History Log allows you to replay the events leading up to the alarm and the events right after the alarm to see the status of the switch at that time and diagnose the cause of the alarm. The History Log is triggered when certain events are tripped that have the Freeze option enabled.

You can run through the frames sequentially. The sequence of the events is identified by date, time, and frame number. The History Log frames are stored in a nonvolatile memory buffer that is continuously overwritten until a designated fault condition occurs. When the fault occurs to trigger a freeze, the History Log stores the next 23 frames, then freezes until it is reset. The History Log then keeps 40 frames before the fault, the frame where the fault occurred, plus the next 23 frames.

The History Log should not be reset until the fault condition that caused the buffer to freeze is reviewed and investigated by a qualified service technician. After the alarm condition has been corrected, the History Log can be cleared. The History Log has the following fields:

- **Replay Rate:** indicates how long it takes for the replay to play. Use the UP and DOWN buttons to set the time.
- **Status:** the status of the Vertiv™ Liebert® STS2 at the point of the current frame in the replay. The History log has three statuses: Frozen, Not Frozen, and Retrieving Data.
- **Critical Event:** The event which triggered this log to be written. The event is indicated in red on the bar graph.
- **Frame Number:** the current frame in the replay. A negative number indicates the replay is at a point before the triggering event occurred.

11.3 Alarm Notes

The I-PK on Source 1 and I-PK on Source 2 alarms inhibit automatic transfer due to an overload or load fault. These alarms can be set for either auto or manual alarm reset.

In the auto reset mode, the alarm is reset 100 milliseconds after the load current and source voltage return to normal, and transfers are no longer inhibited. In manual mode, the alarm remains active and transfers are inhibited until the conditions return to normal and the user manually presses the *RESET* button. In either case, the cause of the Source 1 or Source 2 I-Peak overload should be investigated and resolved (such as by reducing the overload condition or clearing the output fault) before returning the switch to normal operation.

SCR fault events indicate a device failure. The device must be replaced and the system must be restarted for the fault to clear. A shorted SCR automatically trips open a source input switch (CB1 or CB2) to prevent transfers in the event of an SCR failure. The SCR failure must be investigated and repaired before returning the switch to normal operation. Both source input switches must be opened (such as when the unit is placed in maintenance bypass for servicing) before a shorted or open SCR alarm can be reset.

NOTE: When operating switchgear equipped with rotary switches, ensure the switching action is completed in under 2 seconds. Due to the mechanical nature of the rotary switches, delays longer than 2 seconds may result in a false SCR short alarm.

11.4 List of Messages

Table 11.1 below lists available event messages, a definition of the event, and the functions that are activated with the event by default. The functions are indicated as follows:

A: The indicated event activates the Audible alarm.

F: The indicated event triggers a Freeze of the History Log.

L: The indicated event Latches. A latched alarm remains displayed until the alarm condition has cleared and the RESET (ALRM_RST) button has been pressed.

E: By default, all faults and alarms are written to the Event Log.

All of these functions, except Freeze, can be reconfigured to trigger for each event, using the Event Mask option. See [Event Mask](#) on page 49. The Freeze function is hard-coded and cannot be changed for an event.

Table 11.1 Event Messages

ID	Alarm Message	Description/Cause	Action
001	S1 SCR SHORT	One or more of the SCRs for Source 1 have shorted and failed.	L, F, A, E
002	S2 SCR SHORT	One or more of the SCRs for Source 2 have shorted and failed.	L, F, A, E
003	S1 SCR OPEN	One or more of the SCRs for Source 1 is open.	L, F, A, E
004	S2 SCR OPEN	One or more of the SCRs for Source 2 is open.	L, F, A, E
005	PRIMARY FAN FAIL	A primary cooling fan has failed and the unit is now being cooled by a secondary fan, which is not monitored.	L, A, E
006	CONTROL MODULE FAIL	Control logic module has failed.	L, A, E
007	PWR SPLY DC A FAIL	Power supply DC bus A has failed.	L, A, E
008	PWR SPLY DC B FAIL	Power supply DC bus B has failed.	L, A, E

Table 11.1 Event Messages (continued)

ID	Alarm Message	Description/Cause	Action
009	PWR SPLY S1 AC FAIL	Power supply Source 1 AC has failed.	L, A, E
010	PWR SPLY S2 AC FAIL	Power supply Source 2 AC has failed.	L, A, E
011	PWR SPLY LOGIC FAIL	A power supply module has failed.	L, A, E
012	OUT VOLT SENSE FAIL	The output volt sense module failed.	L, A, E
013	S1 VOLT SENSE FAIL	The Source 1 volt sense module failed.	L, A, E
014	S2 VOLT SENSE FAIL	The Source 2 volt sense module failed.	L, A, E
015	S1 SCR SENSE FAIL	The Source 1 SCR sense module failed.	L, A, E
016	S2 SCR SENSE FAIL	The Source 2 SCR sense module failed.	L, A, E
017	S1 CURR SENSE FAIL	The Source 1 SCR current module failed.	L, A, E
018	S2 CURR SENSE FAIL	The Source 2 SCR current module failed.	L, A, E
019	S1 GATE DRIVE FAIL	The Source 1 gate drive module failed.	L, A, E
020	S2 GATE DRIVE FAIL	The Source 2 gate drive module failed.	L, A, E
021	INTERNAL COMM FAIL	Internal CAN communications failed.	L, A, E
022	EXTERNAL COMM FAIL	Options CAN communications failed.	A, E
023	CB1 SHUNT TRIP FAIL	CB1 shunt trip failed.	A, E
024	CB2 SHUNT TRIP FAIL	CB2 shunt trip failed.	L, A, E
030	NEUTRAL 1 SCR SHORT	S1 Neutral SCR Short.	L, F, A, E
031	NEUTRAL 2 SCR SHORT	S2 Neutral SCR Short.	L, F, A, E
032	NEUTRAL 1 SCR OPEN	S1 Neutral SCR Open.	L, F, A, E
033	NEUTRAL 2 SCR OPEN	S2 Neutral SCR Open.	L, F, A, E
034	NEUT. SNUBBER FAIL	Neutral Snubber Board Fail.	L, A, E
064	HEATSINK OVERTEMP	Heatsink has exceeded the recommended temperature.	A, E
067	S1 UV	Source 1 under voltage, fast detection.	A, E
068	S1 UV (RMS)	Source 1 under voltage, slow detection.	L, A, E
069	S1 OV	Source 1 over voltage.	A, E
070	S1 OF/UF	Source 1 over frequency/under frequency.	A, E
071	S1 FAIL	Source 1 failure.	A, E
072	S2 UV	Source 2 under voltage, fast detection.	A, E
073	S2 UV (RMS)	Source 2 under voltage, slow detection.	A, E
074	S2 OV	Source 2 over voltage.	A, E
075	S2 OF/UF	Source 2 over frequency/under frequency.	A, E
076	S2 FAIL	Source 2 failure.	A, E

Table 11.1 Event Messages (continued)

ID	Alarm Message	Description/Cause	Action
077	S1 OVERCURRENT	Source 1 over current.	A, E
078	S2 OVERCURRENT	Source 2 over current.	A, E
079	S1 I-PEAK	I-PK on Source 1.	A, F, E
080	S2 I-PEAK	I-PK on Source 2.	A, F, E
081	SOURCES OUT OF SYNC	Source 1 and Source 2 are out of synchronization.	A, E
082	LOAD ON ALT SOURCE	The output load is running on the alternate source.	A, E
083	AUTO REXFER INHIBIT	Automatic retransfer is inhibited.	A, E
084	CB1 (S1) OPEN	Source 1, Circuit Breaker 1 is open.	A, E
085	CB2 (S2) OPEN	Source 2, Circuit Breaker 2 is open.	A, E
086	CB4 (S1 BYP) CLOSED	Source 1 on bypass, Circuit Breaker 4 is closed.	A, E
087	CB5 (S2 BYP) CLOSED	Source 2 on bypass, Circuit Breaker 5 is closed.	A, E
088	CB3 (OUTPUT) OPEN	Output circuit breaker (CB3) is open.	A, E
089	CB3A (OUTPUT) OPEN	Output circuit breaker (CB3A) is open.	A, E
090	S1 PHASE ROT ERROR	Source 1 phase rotation error.	A, E
091	S2 PHASE ROT ERROR	Source 2 phase rotation error.	A, E
092	TRANSFER INHIBITED	Transfer inhibited.	A, E
093	OUTPUT UV	Output is under voltage.	L, F, A, E
108	NEUT. 1 OVERCURRENT	Source 1 Neutral Over Current.	A, E
109	NEUT. 2 OVERCURRENT	Source 2 Neutral Over Current.	A, E
120	INPUT CONTACT 1	Input Contact X is an optional alarm input. The alarm name can be programmed with an alarm name from the Input Contactor Isolator settings option under the Comm Options. See Configuring the Input Contact Isolator Settings on page 77. The alarm is sent to Monitor DSP. The LCD logs the alarm with the programmed name. Monitor DSP logs it with the generic name which is how it is reported to the SVT query.	A,E
121	INPUT CONTACT 2		
122	INPUT CONTACT 3		
123	INPUT CONTACT 4		
124	INPUT CONTACT 5		
125	INPUT CONTACT 6		
126	INPUT CONTACT 7		
127	INPUT CONTACT 8		
128	CONFIG MODIFIED	A set point configuration has changed.	A, E
129	PASSWORD CHANGED	The password for touchscreen access has been modified and saved.	A, E
130	TIME REPROGRAMMED	The system's time has been reset and saved.	A, E
131	DATE REPROGRAMMED	The system's date has been reset and saved.	A, E

Table 11.1 Event Messages (continued)

ID	Alarm Message	Description/Cause	Action
132	EVENT LOG CLEARED	The event log has been erased.	A, E
133	HIST LOGS CLEARED	Both History Logs have been erased.	A, E
134	HIST LOGS FULL	Both History Logs have been written and no more history logs can be written without clearing one of the logs.	A, E

12 Communication Interfaces

The Vertiv™ Liebert® STS2 monitoring system offers several choices for communications.

The RS-232 terminal port is standard on all units. The port is located inside the front door, to the left of the touchscreen front panel mounting see **Figure 7.10** on page 30. This port is primarily used as an alternate user interface to configure, control, and diagnose the system, especially for systems that do not include the HMI touchscreen. Commands for the RS-232 port are shown in **Table 12.1** on the next page.

Several other communications options are also available. Those options are located a Communications compartment to the right of the touchscreen front panel and are accessible when the front panel door is open. See [Installation Drawings](#) on page 21 for the location of the communications options.

Connections to the communication ports are made by wiring to terminal boards located in the Communications compartment. The communications options listed below reference the control wiring drawing for each option.

- **Vertiv™ Liebert® Intellislot™ Unity-DP Card (optional):** the card provides connectivity to any TCP/IP-based Ethernet network to allow the device to communicate with Network Management Systems (NMS) via SNMP/Web(HTTP). Events can be transmitted to the NMS to provide remote status monitoring, plus fault and alarm detection. The card includes an RJ-45 port for an Ethernet connection, via Category 5 cable.

The Liebert® Intellislot™ Unity-DP Card can also integrate the system with an existing Building Management System (BMS) or out-of-band monitoring, using Modbus, a standard multi-drop protocol. The card has redundant communication paths that make it possible to connect to a BMS using Modbus while simultaneously communicating to an NMS through SNMP/Web (HTTP).

See **Figure 7.9** on page 29 for more information on the Liebert® Intellislot™ Unity-DP Card. If you have questions about the card, refer to the **User Guide, SL-52645**, available at the Vertiv Website, www.Vertiv.com.
- **Input Contact Isolator (ICI) Board (optional):** provides an interface for up to eight user inputs. External messages and alarms can be routed to the unit, via the ICI.

See [Configuring the Input Contact Isolator Settings](#) on page 77 for instructions on configuring the connections. See **Figure 7.8** on page 28 for wiring details.
- **Programmable Relay Board (PRB) (optional):** up to two PRB's can be installed in the Liebert® STS2 to route Liebert® STS2 events to external devices.

See [Configuring the Programmable Relay Board Settings](#) on page 79 for default settings and instructions for reconfiguring the relays. See **Figure 7.7** on page 27 for wiring details.

Data link requirements are Full Duplex Asynchronous RS-232 format. Communications options are also discussed in [Options](#) on page 17.

12.1 Using the RS-232 Port

The RS-232 port is configured with a baud rate of 9600 with 8 data bits, 1 stop bit, no parity, and no hardware handshaking.

12.1.1 Connecting and Using a Terminal

An RS-232 connection can be used to connect the Vertiv™ Liebert® STS2 to either a terminal or a PC running terminal emulation software. If you are unsure of the cable pin out, See [Terminal Port Connections](#) on page 91.

1. Connect the terminal to the Liebert® STS2 by plugging the cable from the terminal into the RS-232 port. This connection can be made at any time.
2. After making the connection, verify the communications link by pressing <ENTER> on the terminal keyboard.

The interface communications system responds as indicated below:

Repeating command --> Illegal command!

<?> or <HELP?> displays the RS-232 command set

<?> <command> or <HELP?> <command> displays specific help for the command SVTP-Control >

The SVTP-Control > prompt indicates that RS-232 communications are established.

- If you receive no response or prompt, verify that the connector is properly plugged into the port and the PC or terminal serial interface is working properly.
3. Enter the desired commands, as listed in **Table 12.1** below.

For additional help type <?> <command> or <HELP?> <command>

See the corresponding menu options in [Vertiv™ Liebert® STS2 Touchscreen Display](#) on page 65 for more details about the commands.

Some terminal commands require a password to function. Use the PWD command and a valid password to gain access.

Table 12.1 Terminal Commands

Keys	Function
?	Displays this help menu or specific help with a command.
AA?	Displays active alarms.
AF?	Displays active faults.
CEL	Clears the event log.
CHL	Clears the history logs.
DATE?	Displays current system date.
DATE	Sets system date.
EL?	Displays the entire event log.
HELP?	Displays this help menu or specific help with a command.
HLn?	Displays the history log n, if frozen.
LOGOUT	Logs user out of unprotected mode.

Table 12.1 Terminal Commands (continued)

Keys	Function
PS?	Displays the preferred source.
PS n	Sets the preferred source to n.
PWD	Allows users to access protected commands.
SH	Silences the horn.
SPT?	Displays all current setpoints.
SPTx	Displays current setpoints for group x. See Configuring the Vertiv™ Liebert® STS2 via the Terminal below via the Terminal for a description of groups.
SR?	Displays status reports.
TIME?	Displays current system time.
TIME	Sets system time.
UPMDR? Displays	Displays metering data.
VER? Displays	Displays firmware versions.

12.1.2 Configuring the Vertiv™ Liebert® STS2 via the Terminal

The SPT command is used to configure the systems setpoints. The SPT syntax for the setpoints consists for four parameters:

SPT [group] [item] [value] where the parameters are:

- **SPT:** is the terminal command that is used to configure setpoints.
- **group:** the group under the setpoint command which contains the desired settings.
- **item:** the item number within the selected group.
- **value:** the desired value for this item.

Only the specific options words listed in this section use a hexadecimal value. Other settings, depending on what they are, use other input types. For example, System ID uses a text string, nominal voltages, and currents use standard numeric integers.

NOTE: Spaces are placed between each parameter, but not between characters or numbers in a parameter. Using an underline here to represent a space, an example of a the syntax is: SPT_2_6_0081. 0081 is the value parameter.

This section provides instructions for setting these parameters, with an example of building an SPT command for System and User settings.

Groups Parameter

The setpoints are grouped for ease of configuration. For example, Event Masks are Group 4 and System Settings are Group 2. The numbers shown below are entered for the group parameter. For example, start of a System Settings command is SPT 2. The group parameters are:

1. System Ratings
2. System Settings
3. User Settings
4. Event Mask Settings

For example, the start of a System Settings command is SPT 2, where SPT is the system setpoints command and 2 is the group parameter for System Settings.

See [Setting Event Masks with the Terminal](#) on page 63 for instructions on configuring Event Mask parameters.

Item Parameter

Each setting within the group is indexed by an item number as shown below in **Table 12.3** below. These item numbers are also displayed on the terminal when you list the configuration setting for a particular group.

Continuing with the example, to configure an Options_1 setting under System Settings, the command would begin with SPT 2 6 where 6 is the value Options_1.

NOTE: The space between each parameter.

Value Parameter

Item settings, depending on what they are, use various value types. See **Table 12.2** below provides a list of the possible value types and their description.

Table 12.2 Value Types

Type	Definition
Numeric	An integer numeric value in the units indicated by the item name. For example, a System Voltage Rating of 480 would indicate 480 volts.
Scaled	Similar to the Numeric, this value type is an integer that has been scaled, usually to remove decimal points that would normally appear within the value. In this case, a value of 2.5 may actually be input as simply 25. For all Scaled types, the scaling appears in Configuring the Vertiv™ Liebert® STS2 via the Terminal on the previous page
String	Certain settings are represented by alphanumeric character strings, such as setting the System Model Number to Vertiv™ Liebert® STS2
Enumeration	This type uses an indexed list to represent possible choices.
Bit-packed	This type of value uses a hexadecimal binary word, where each of the sixteen bits in the word has the value of 1 (True) or 0 (False). Although somewhat difficult to use, it packs a large amount of data within a single entry. A detailed description of this type appears in Setting Event Masks with the Terminal on page 63.
Event Masks	This type is a specially formatted and is used to customize the behavior of each fault and alarm in the system. See Setting Event Masks with the Terminal on page 63 for instructions on configuring Event Mask parameters.

Table 12.3 below shows the various groups, the settings contained within, and the type of value it requires.

Table 12.3 Groups Settings and Values

Group	Item	Description	Value Type	Value Notes
Group 1: System Ratings	1	Input Volts (PDU)	Integer	Set per system spec.
	2	Volts	Integer	Set per system spec.
	3	Current	Integer	Set per system spec.
	4	Frequency	Scaled	Desired freq. x 10 (500 = 50 Hz)

Table 12.3 Groups Settings and Values (continued)

Group	Item	Description	Value Type	Value Notes
Group 2: System Settings	1	Language	Enumeration	[Not supported at this time].
	2	System Model Number	String	14 character max.
	3	System ID Number	String	8 character max.
	4	System Tag Number	String	8 character max.
	5	System Order Number	String	8 character max.
	6	Options_1	Bitpacked	14 character max.
	7	Autodial Primary Line	String	20 character max.
	8	Autodial Secondary Line	String	20 character max.
	9	Autodial Pager Number	String	20 character max.
	10	Autodial Pager PIN	String	10 character max.
	15	Comms Options 1	Bitpacked	See section Setting Bitpacked Options with the Terminal on the next page.
	16	Comms Options 2	Bitpacked	See section Setting Bitpacked Options with the Terminal on the next page.
Group 3: User Settings	1	SCR1 Fast Undervoltage Setpoint	Integer	In % of nominal below nominal.
	2	SCR1 Slow Undervoltage Setpoint	Integer	In % of nominal below nominal.
	3	SCR1 Slow Undervoltage Detect Delay	Integer	In number of lines cycles.
	4	SCR1 Overvoltage Setpoint	Integer	In % of nominal above nominal.
	5	SCR1 Overvoltage Detect Delay	Integer	In 1/4 lines cycles.
	6	SCR1 I peak Transfer Setpoint	Integer	x 10.
	7	SCR2 Fast Undervoltage Setpoint	Integer	In % of nominal below nominal.
	8	SCR2 Slow Undervoltage Setpoint	Integer	In % of nominal below nominal.
	9	SCR2 Slow Undervoltage Detect Delay	Integer	In number of lines cycles.
	10	SCR2 Overvoltage Setpoint	Integer	In % of nominal above nominal.
	11	SCR2 Overvoltage Detect Delay	Integer	In 1/4 lines cycles.
	12	SCR2 I peak Transfer Setpoint	Integer	x 10.
	13	Max. Transfer Phase Angle	Integer	In degrees.
	14	Output Frequency Deviation	Integer	Freq. in Hz x 10.
	15	Retransfer Delay Time	Integer	In seconds.
	16	Horn Volume	Integer	Range: 1-10.

Table 12.3 Groups Settings and Values (continued)

Group	Item	Description	Value Type	Value Notes
	17	Critical Option Enabling	Bitpacked	See section Setting Bitpacked Options with the Terminal below.
	18	Non-Critical Option Enabling	Bitpacked	See section Setting Bitpacked Options with the Terminal below.
Group 4: Event Mask Settings	1 to 63	Event Mask settings for faults	Event Mask	See section Setting Event Masks with the Terminal on page 63.
	64 to 143	Event Mask settings for alarms	Event Mask	See section Setting Event Masks with the Terminal on page 63.

12.1.3 Setting Bitpacked Options with the Terminal

Five sets of options and features settings are available through the terminal to control the system operation.

Under System Settings for the SPT command, these items denote which options are INSTALLED:

- 6 Options 1.
- 14 Comms Options 1.
- 15 Comms Options 2.

Under User Settings, for the SPT command, these items denote which features are ENABLED:

- 17 Critical Option Enabling.
- 18 Non-Critical Option Enabling.

The value parameter settings are in the form of a bit-packed word (in hexadecimal notation). In other words, each bit indicates a particular setting for the option or feature. The bit assignments for the options and features are as follows:

Options_1

bit0: HasDualOutputBreaker.

bit1: HasPDU.

bit2: Has4PoleTransferSwitch.

bit3: HasShuntTrip.

bit4: HasWyeOutputXfmr.

bit5: HasExternalPrecisionTimeSource.

bit6: HasSFA.

bit7: HasRemoteSourceSelect.

bit8 through bit15: not used (set to 0).

Comms Options 1

bit2: HasNIC bit3: not used (set to 0).

bit4: HasSiteScan.

bit5: not used (set to 0).

bit6: not used (set to 0).

bit7: HasOpenCommsDigitalInputBrd.

bit8: HasOpenCommsDigitalOutputBrd_1.

bit9: HasOpenCommsDigitalOutputBrd_2.

bit10: HasRemoteStatusPanelBrd_1.

bit11: not used (set to 0).

bit12: not used (set to 0).

bit13: not used (set to 0).

bit14: EnableDialIn.

bit15: EnableDialOut.

Comms Options 2

bit0: EnablePager.

bit1: EnableOCDINormallyClosed.

bit2-3: OCDO1Assignment (0=User Defined, 1=Standard Set or 2=AS400).

bit4-5: OCDO2Assignment (0=User Defined, 1=Standard Set or 2=AS400).

bit6 through bit15: not used (set to 0).

Critical Option Enabling

bit0: EnableManual_IPeakReset.

bit1: EnableAutoRestart.

bit2 through bit15 - not used (set to 0).

Non-Critical Option Enabling

bit0: EnableAutoReXfer.

bit1 through bit15: not used (set to 0).

The bits are set in reverse order, from bit 15 on the left to bit 0 (zero) on the right. The bits are grouped in four sets of four bits each, as such:

- 0000 0000 0000 0000
- |.....|
- bit 15.....bit 0

Since each bit represents a setting, a bit can be enabled or disabled:

- 1 Installed option or enabled feature.

– or –

- 0 Option not installed or feature not enabled.

Enabling or disabling the bits in each group creates a binary value for that group. For example, if the fourth bit in a group is set to 1, the group's binary value is 0001.

Each group is translated into a hexadecimal equivalent. The group with the value of 0001 has a hex equivalent of 1.

Use **Table 12.4** below to help with the conversion:

Table 12.4 Value Conversions

Binary Value	Hex Equivalent	Binary Value	Hex Equivalent
0000	0	1010	A
0001	1	1011	B
0010	2	1100	C
0011	3	1101	D
0100	4	1110	E
0101	5	1111	F
0110	6		
0111	7		
1000	8		
1001	9		

The hex value for each group is entered in the command as four digits.

To summarize the procedure:

1. Set each bit position.
2. Convert the binary value each group into its hex equivalent.
3. Enter the hex values for each group, in order, into the command for the value parameter. The following example explains how the conversion is completed.

Putting the Terminal Command Together

For example, a unit only has the Remote Source Selection and Dual-Output Breaker options installed.

Checking the bits list under [Options_1](#) on page 60, bits 7 and 0 each must be set to 1 to indicate that these options are installed.

The bit setting is as follows, starting with bit 15 on the left and going down to bit 0:

0000 0000 1000 0001

With the bits combined in groups of four, the binary settings can be translated into hexadecimal values.

The first two groups in the sample equal zero (0). In the third group, 1000 in binary translates to 8 in hex. In the fourth group, 0001 in binary translates to 1 in hex.

In hex this equates to (digits in the value parameter cannot have spaces between them):

0081

So your command to indicate that the Remote Source Selection and the Dual-Output Breaker are installed would be:

SPT 2 6 0081

12.1.4 Setting Event Masks with the Terminal

The event masks can be customized via a terminal. The command SPT4?<ENTER> displays all faults and alarms, along with their associated event masks. A plus sign (+) means that particular event mask is enabled, while a minus sign (-) means that mask is disabled.

See [Event Mask](#) on page 49 for more information on event masks and their associated flags.

Unlike the System and User Settings, mask values are set by designated letters, not hex values.

However, as with other RS-232 interface settings, four parameters are passed. See [Configuring the Vertiv™ Liebert® STS2 via the Terminal](#) on page 57 for more details about the parameters.

The syntax for configuring event masks is:

SPT 4 ID ±D±L±S±E±A

- **SPT:** is the terminal command used to configure setpoints.
- **4:** setting (group parameter) for event masks, under System Settings.
- **ID:** event ID. The ID is the item parameter for this command. The ID numbers for each event are listed with the events in [Event Messages](#) on page 51.
- **D,L,S,E,A:** the event masks: Dial, Latch, Summary, Event log, and Audible. The masks are the value parameter for the command.

Each mask type must be preceded by a plus sign (+) to enable it, or a minus sign (-) to disable it.

NOTE: NO spaces are placed between each mask listed above.

Only the mask that is passed (enabled) is applied when the event occurs.

Examples of Event Mask Settings:

- To latch event 001, S1 SCR SHORT, use SPT 4 1 +L.
- To disable event 128, CONFIG MODIFIED, from sounding the horn, use SPT 4 100 -A.
- To enable event 012, OUT VOLT SENSE FAIL, to Dial and go into the Event Log, use SPT 4 12 +D+E.
- To disable all masks for event 120, INPUT CONTACT 1, use SPT 4 120 -D-L-S-E-A.

To breakdown this syntax for the last example:

- SPT-SVT command.
- 4-group parameter, identifying System Setting group under which the Event Mask settings reside.
- 120-item parameter. In this command, that is the event ID.
- -D-L-S-E-A —value parameter. In this case, the minus sign (-) disables all masks for the INPUT CONTACT 1 event.

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13 Vertiv™ Liebert® STS2 Touchscreen Display

The Liebert® STS2 can be configured with a Color Graphical LCD touchscreen that allows you to quickly check the status of the unit and identify problems.

A touchscreen LCD is available through the front of the Liebert® STS2. This screen provides a graphical (Mimic) display of the switch's operation, plus system information including system parameters, alarms and faults.

The LCD provides a color, back-lit touchscreen as a user interface. In addition to the Mimic and the system parameters, the screen provides a series of menus to allow you to configure the Liebert® STS2, including the control of the preferred source, auto/manual retransfer selection, alarm notification, and other system setpoints. The touchscreen also provides buttons to reset alarms and turn Off audible alarms, such as a horn.

Delete this text and replace it with your own content.

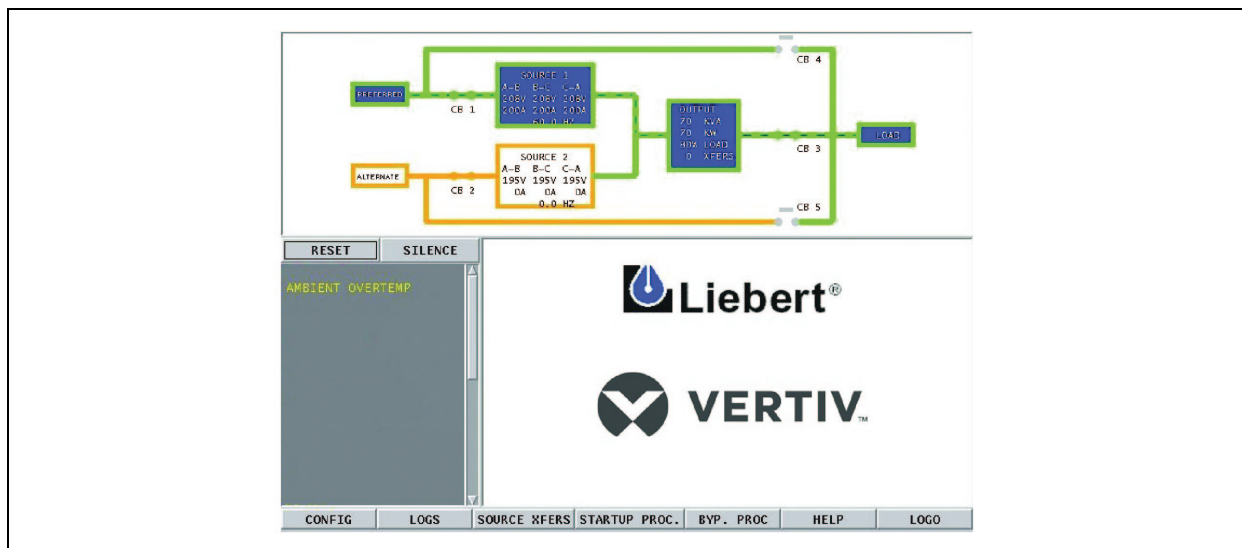
13.1 Display Overview

The Liebert® STS2 Color Graphical Display provides three areas of information, plus buttons and a series of menu choices.

The Color Graphical Display contains the following features:

- **Mimic:** a graphical diagram of the status of the unit.
- **Event controls:** allow you to reset alarms and turn Off audible alarms.
- **Event Display:** displays any active alarm or fault condition, in real-time.
- **Menus:** provide choices and configuration settings in dialog boxes or information in the display panel.
- **Display panel:** provides additional information, depending on the menu choice that was last selected. This information includes event help text and startup and bypass procedures.

Figure 13.1 Liebert® STS2 Touchscreen Display



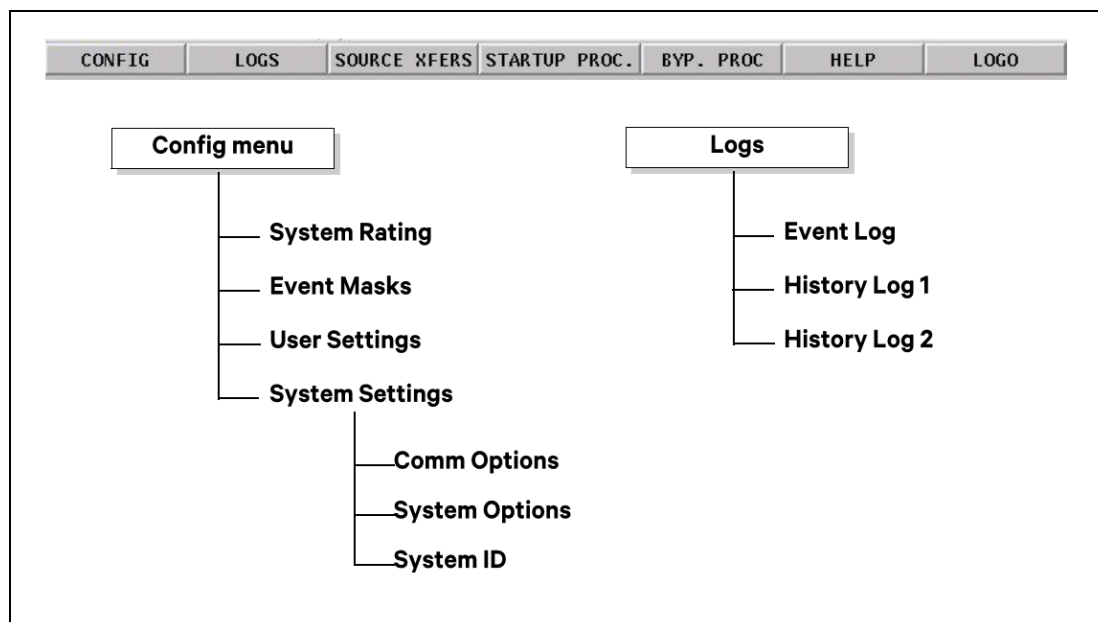
13.2 Menu Overview

The touchscreen menu provides access to configuration settings and more device information.

The CONFIG (Configuration) and LOGS menus provide multiple choices through pop-up menus. The SOURCE XFER menu selection allows you to select the preferred source. The other menu choices provide information in the display panel. The menu choices are discussed later in this manual.

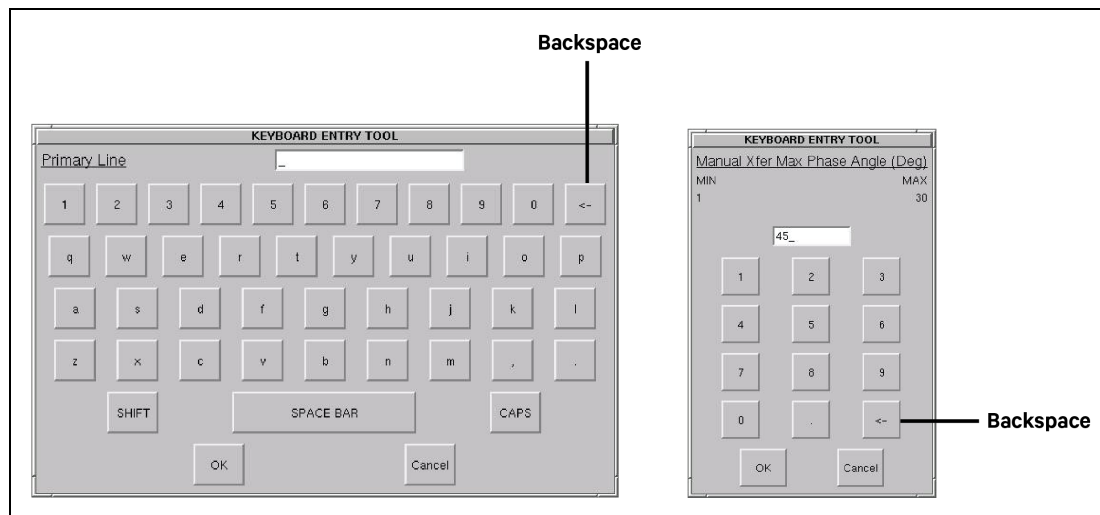
All programmable functions are preset at the factory to default settings. These settings enable the unit to be brought up without the need to enter all selectable parameters. The menus allow the settings to be customized.

Figure 13.2 Menus



NOTE: Some menu choices display a keyboard or keypad on the touchscreen. Enter data on the touchscreen. Click **OK** to save the data that you have entered. Use the back arrow button (<-) to delete unwanted characters. This button functions like a backspace key on a keyboard.

Figure 13.3 Keyboard and Keypad Displays



13.2.1 Security

Because the Vertiv™ Liebert® STS2 Color Graphical Display provides access to various configuration and monitoring choices, a password or key lockout switch may be used to protect access to certain changes, including:

- Change configuration settings.
- Clear logs.
- Make a source transfer.
- Reset an alarm.

Without entering the password or enabling changes with the key lockout switch, you still can:

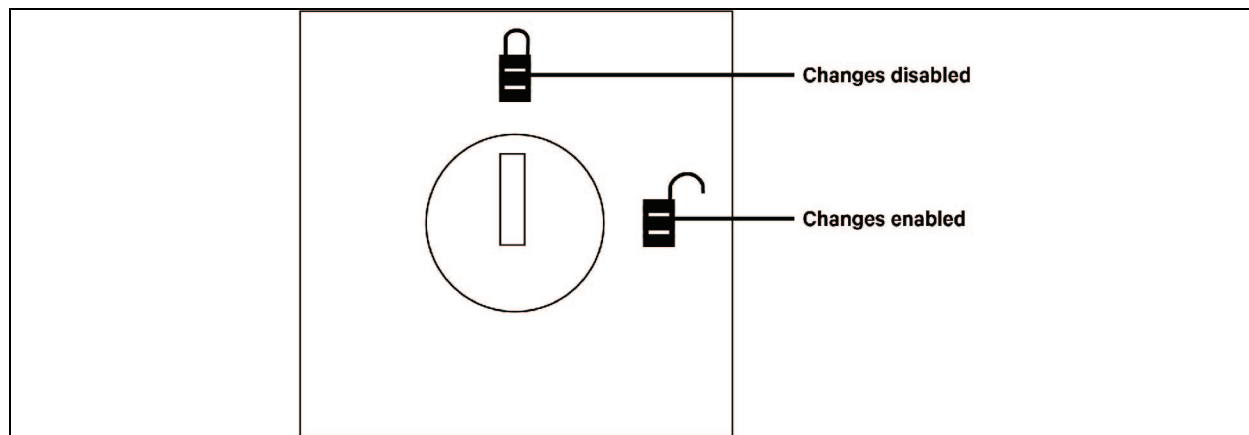
- View the display, including the mimic, status, and event help.
- View logs.
- View the startup and bypass procedures.
- Use the SILENCE button to turn Off the audible alarm.

Using the Optional Key Lockout Switch

An optional key lockout switch for the Liebert® STS2 enables or disables the ability to make changes on the Liebert® STS2. The key lockout switch is mounted on the front door. See **Figure 7.1** on page 21 for location of the key lockout switch.

- To disable the changes, turn the key to the top of the switch, toward the closed padlock.
- To enable changes turn the key to the horizontal position, toward the open padlock.

Figure 13.4 Key Lockout Switch



Using the Password

If the unit is not equipped with a keylock, a password is required when you attempt to:

- Save changes in the CONFIG menu choices.
- Transfer sources.
- Reset active alarms.
- Clear logs.

When a password is requested, a keyboard is displayed on the touchscreen. After you enter the password, select OK.

The password is case-sensitive. Password access times out after ten (10) minutes, and must be re-entered to save changes. The time-out period cannot be changed.

To set or reset the password:

1. Select *SYSTEM SETTINGS* from the CONFIG menu.
2. Select *SYSTEM ID* from the SYSTEM SETTINGS menu.
3. Click *PASSWORD*.

A keyboard is displayed.

4. Enter a password.

The password must be four (4) alpha-numeric characters and is case sensitive.

5. Click *OK*.

13.3 Mimic Display

The Mimic display provides a color diagram of the operation of the Vertiv™ Liebert® STS2. This display imitates the power flow through the static transfer switch and indicates source status, breaker status, switch status, source voltage and current readings, output power measurements, and active alarm messages. See **Figure 13.1** on page 65.

13.4 Event Controls

The Liebert® STS2 detects events when certain thresholds are passed or certain problems occur. The alarm controls allow you to acknowledge the existence of these events.

- **RESET:** All latched events whose conditions have cleared are removed from the Event Display. Faults and alarms that remain active, or are not recoverable, are not affected when this button is selected. This button is also used to perform manual I-Peak resets and manual re-transfers.
- **SILENCE:** turns Off the audible alarm (horn or beeper) without resetting the triggering event. This setting does not permanently turn Off the horn. The alarm sounds again when the next event with an audible alarm setting is triggered.

Active events are shown in the Event Display, whereas cleared events can be reviewed via the Event Log.

13.5 Event Display

The Event Display lists the condition of the Liebert® STS2 in real-time. Both nominal system parameters and alarm messages are displayed in the Event Display. You can touch any message in the Event Display to display more information in the Display Panel to the left. The selected status is displayed in bold type.

13.6 Menu Bar

As previously mentioned, the menu bar provides both configuration choices and information. The choices under the Config and Log menus access additional dialog boxes, while the other menu choices only show information in the display panel.

13.7 Configuration Menu

When you select the CONFIG (Configuration) menu choice, a pop-up menu is displayed with four choices.

- **System Ratings:** used to configure frequency, voltage and currents settings for the Vertiv™ Liebert® STS2.
- **Event Mask:** allows you to configure system's response for events.
- **User Settings:** allows you to configure operations for the Liebert® STS2.
- **System Settings:** accesses another pop-up menu to configure communication and system choices and the system ID.

Each choice accesses a separate dialog box.

13.7.1 System Ratings

The System Ratings menu is used to set the nominal line frequency, nominal voltage and nominal current at which the system operates when it is installed. These settings are configured when the system is initialized at the factory or under maintenance and should not be changed by the user.

13.7.2 Event Masks

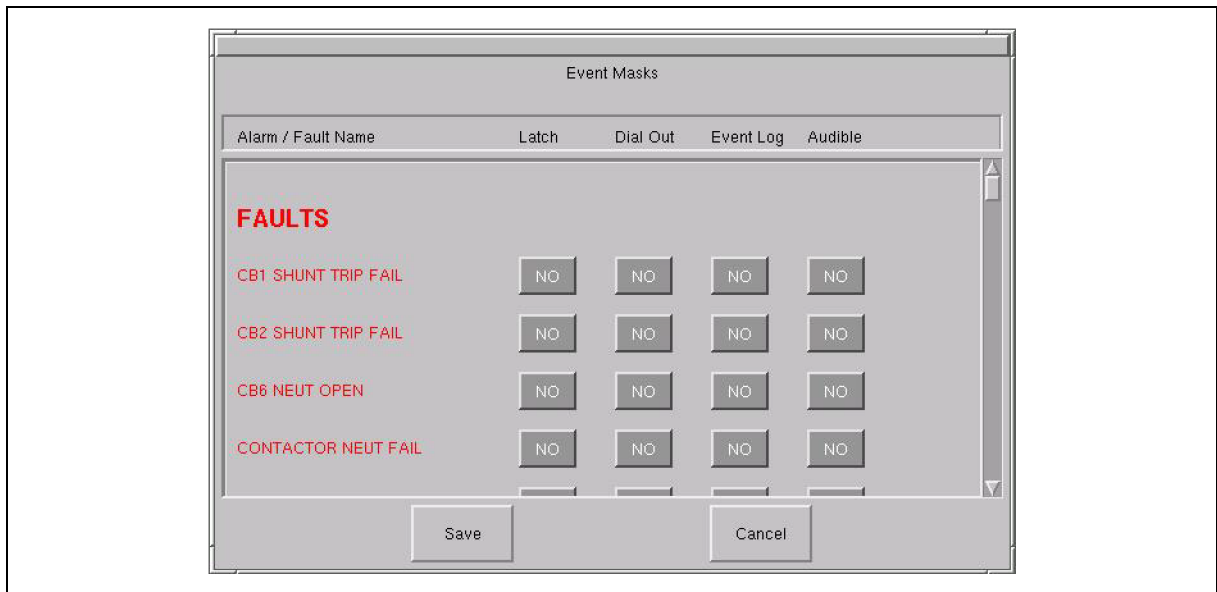
The Liebert® STS2 gathers, processes and reports faults and alarms, collectively referred to below as events. The Event Mask dialog box allows you to set the system's response for specific alarms and faults that are generated. See [Alarm and Faults](#) on page 49 for more information on events and [Event Mask](#) on page 49 for the definitions of the Event Mask types. To set the event masks:

1. Access the Event Mask dialog box:
 - a. Select *CONFIG*.
 - a. Select *EVENT MASK* from the pop-up menu.

The Event Mask dialog box is displayed. See **Figure 13.5** on the facing page.

2. Select the mask settings for each fault and alarm.
 - a. Select *YES* to enable the setting,
– or –
 - b. Select *NO* to disable the setting.
3. Select *SAVE* to keep the settings.



Figure 13.5 Event Mask Dialog Box

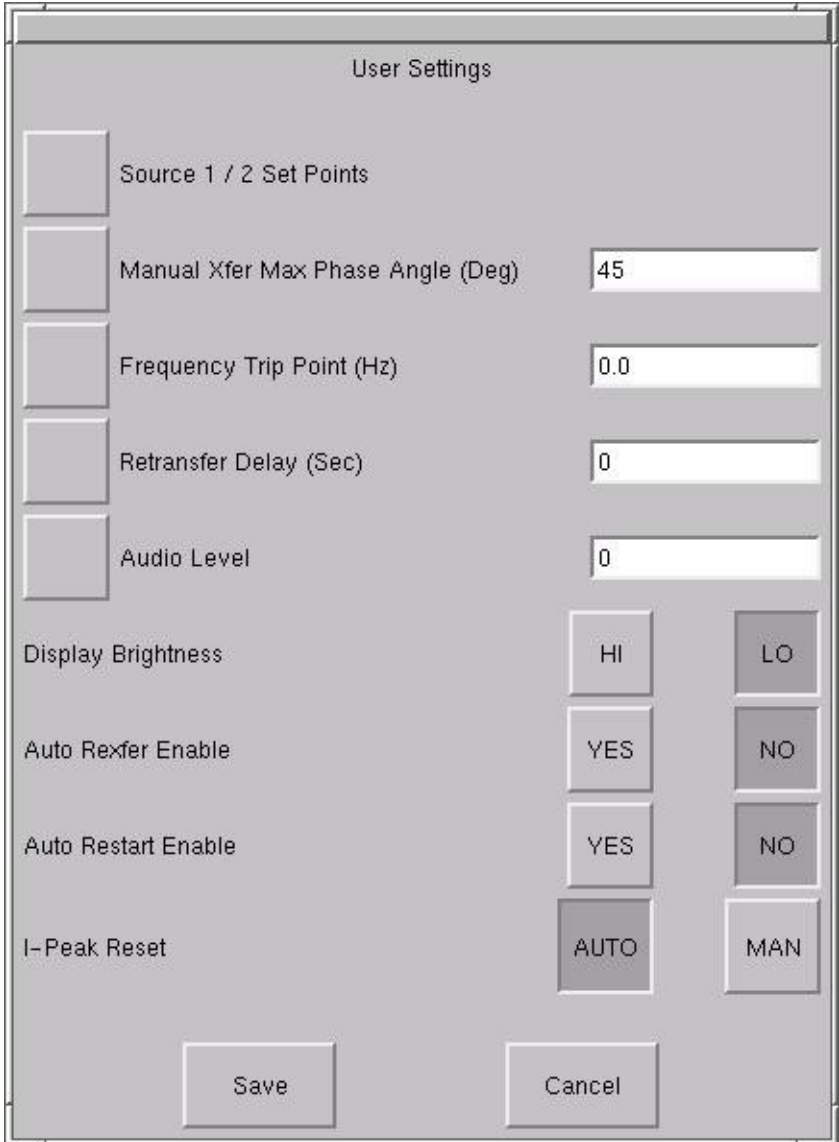
13.7.3 User Settings

The User Settings choice allows you to adjust the user-accessible switch settings. Access is limited to qualified personnel via system security. To access the User Settings dialog box:

1. Select *CONFIG*.
2. Select *USER SETTINGS* from the pop-up menu.

The User Settings dialog box is displayed. See **Figure 13.6** on the next page. The top six buttons access a series of secondary dialog boxes to configure the various settings.

Figure 13.6 User Settings Dialog Box



The User Settings dialog box is a rectangular window with a title bar labeled "User Settings". It contains several settings, each with a small square icon to its left. The settings are:

- Source 1 / 2 Set Points**: A button with no numerical value.
- Manual Xfer Max Phase Angle (Deg)**: A text input field containing the value "45".
- Frequency Trip Point (Hz)**: A text input field containing the value "0.0".
- Retransfer Delay (Sec)**: A text input field containing the value "0".
- Audio Level**: A text input field containing the value "0".
- Display Brightness**: Two buttons labeled "HI" and "LO".
- Auto Rexfer Enable**: Two buttons labeled "YES" and "NO".
- Auto Restart Enable**: Two buttons labeled "YES" and "NO".
- I-Peak Reset**: Two buttons labeled "AUTO" and "MAN".

At the bottom of the dialog box are two large buttons: "Save" on the left and "Cancel" on the right.

Source Set Points

The Source 1/2 Set Points allows you to configure trigger points for each input source (1 or 2) for the Vertiv™ Liebert® STS2 via a keypad dialog or HI/LO dialog box. The source numbers do not designate the source as the preferred or alternate source. The numbers simply identify the input source. See [Manual Transfer/Preferred Source Selection](#) on page 45 to set the preferred source.

The setpoints are based on values in relation to the nominal voltage required for the Vertiv™ Liebert® STS2. UV refers to under voltage, meaning the amount of voltage below the nominal voltage. OV refers to over voltage, or the amount of voltage over the nominal voltage.

- **Fast UV Setting (%)**: if the voltage drops below this set percentage of the nominal voltage, the Liebert® STS2 transfers from the current source to the opposite source.

- **Slow UV Setting (%):** if the voltage remains this set percentage below the nominal voltage for the period of the slow detection delay, the Liebert® STS2 transfers from the current source to the opposite source.
- **Slow UV detection delay:** the number of cycles that the source must remain below the Slow UV Setting before the Liebert® STS2 transfers.
- **OV Setting (%):** if the voltage exceeds this set percentage of the nominal voltage for the period of the OV detection delay, the Liebert® STS2 transfers from the current source to the opposite source.
- **OV Detection Delay:** the number of cycles that the source must remain above the OV Setting before the Liebert® STS2 transfers sources.
- **I-PK Xfer Lockout:** if current from the source exceeds this threshold, the Liebert® STS2 disables source transfers, and has to be reset either manually or automatically. The type of reset is configured under the User Settings.
- **Neutral Overcurrent (%):** if the Neutral current exceeds this set percentage of the nominal current, a warning is generated.

To configure the setpoints for each source

1. Select SOURCE 1/2 Set Points from the User Settings dialog box. The Source 1/2 Set Points dialog is displayed.

Figure 13.7 Source Setpoints

Source 1 / 2 Set Points	
Select Source	1 2
<input type="checkbox"/> Fast UV Settings (%)	0
<input type="checkbox"/> Slow UV Settings (%)	0
<input type="checkbox"/> Slow UV Detection Delay (cycles)	0
<input type="checkbox"/> OV Settings (%)	0
<input type="checkbox"/> OV Detection Delay (1/4 cycles)	
<input type="checkbox"/> I-PK Xfer Lockout	0.0
<input type="checkbox"/> Neutral Overcurrent (%)	0
Save Cancel	

2. Select 1 to configure the settings for Source 1.
3. Configure the settings using the keypad or dialog box that is displayed when you touch a button.

Table 13.1 Setpoint Parameters

Button	Range	Default	Comments
Fast UV Setting (%)	-10% to -30% of Nominal voltage rating	-20%	Set in increments of 1%.
Slow UV Setting (%)	-5% to -20%	-10%	Set in increments of 1%.
Slow UV detection delay	1-60 cycles	5 cycles	Units: Line Cycle.
OV Setting (%)	+5% to +20%	+10%	Set in increments of 1%.
OV Detection Delay	1-255 cycles	3 cycles	Units: Line Cycle.
I-PK Xfer Lockout	0 – 3.0 multiplied by the unit current rating.	1.5 * Unit Current Rating	I-peak Xfer lockout detection point. Units: Amps RMS. Select the HI or LO buttons to configure your setting.

4. Select 2 for Source 2.
5. Configure the settings, as described in [Step 3](#).
6. Select SAVE to keep the settings for both sources.

The Set Points dialog is closed and the User Settings dialog is displayed.

7. Select *MANUAL MAX XFER PHASE ANGLE*.

A keypad is displayed.

This setting configures the maximum allowed phase difference between the sources and applies to all manual transfers as well as any auto re-transfer.

- a. Configure this setting with a range of ± 1 -30 degrees.

The default setting is ± 15 degrees and the resolution is 1 degree.

- b. Select OK to save the setting.

The setting is now displayed in the adjacent field in the User Settings dialog box.

8. Select *FREQUENCY TRIP POINT*.

A keypad is displayed.

This choice verifies that the source is running at the proper frequency. This choice sets the frequency deviation in the frequency that triggers the frequency trip point alarm. The frequency deviation setting is the allowable frequency variation from nominal (50.0 Hz) before activating the frequency deviation alarm. The frequency setting applies to both input sources.

- a. Configure this setting with a range of 0.1 Hz – 3.0 Hz The default setting is 3 and the resolution is 0.1.
- b. Select OK to save the setting.

9. Select *RETRANSFER DELAY*.

A keypad is displayed.

With the secondary source being used, this setting sets the length of time the switch waits until attempting to transfer back to the preferred source.

- a. Configure this setting with a range of 1 to 60 seconds.

The default setting is three (3) seconds and the resolution is 1 second.

- b. Select *OK* to save the setting.

The setting is now displayed in the adjacent field in the User Settings dialog box.

10. Select *AUDIO LEVEL*.

A dialog box is displayed with HI and LO settings.

This choice sets the loudness of the horn or beeper that is sounded for audible alarms. a.

- a. Configure this setting with a range of 1–10 (ten).

The default setting is 5. The settings have an increment of 1 (one).

- b. Select *OK* to save the setting.

The setting is now displayed in the adjacent field in the User Settings dialog box. You can select *TEST* to briefly sound the alarm to judge its volume.

11. Select *DISPLAY BRIGHTNESS*.

A dialog box is displayed with HI and LO settings. This choice sets the brightness for the touchscreen.

- a. Configure the Contrast and Brightness settings with a range of 1 – 10 (ten).
- b. Select *OK* to save the settings.

12. Set the *AUTO REXFER ENABLE* choice.

The auto retransfer enable setting determines whether the switch automatically returns the preferred source after that source is restored.

- Select *YES* to enable the automatic transfer.
- Select *NO* to disable the automatic transfer. The setting requires transfers be done manually.

13. Set the *AUTO RESTART ENABLE* choice.

This setting determines whether the Vertiv™ Liebert® STS2 can be started automatically when power is restored after it has been lost.

- Select *YES* to enable the automatic restart.
- Select *NO* to disable the automatic restart. This settings requires a manual restart of the Liebert® STS2

14. Select a setting for the *I-PEAK RESET*.

- Select *AUTO* to configure the Liebert® STS2 to automatically reset when a fault clears and the voltage and current are normal.
- Select *MAN* to require a manual reset of the Liebert® STS2 when fault clears and the voltage and current are normal.
- The default setting is Auto.



CAUTION: Risk of equipment damage and personnel injury. Use of Auto Restart is site specific. Do not enable auto restart unless the infrastructure is designed for unattended operation and there is no chance of equipment or personnel harm by automatic re-energizing of the system. Consult with your Vertiv site engineer as to whether Auto restart should be enabled.

13.7.4 System Settings

The System Settings choice under the Config menu displays another pop-up menu with three choices:

- Comm Options (See [Comm Options](#) below).
- System Options (See [System Options](#) on page 81).
- System ID (See [System ID](#) on page 83).

To access the System Settings menu:

1. Select *CONFIG* from the menu bar.
2. Select *SYSTEM SETTINGS* from the Config menu.

13.8 Comm Options

The Comm Options dialog box allows you to configure the communications settings for the Vertiv™ Liebert® STS2:

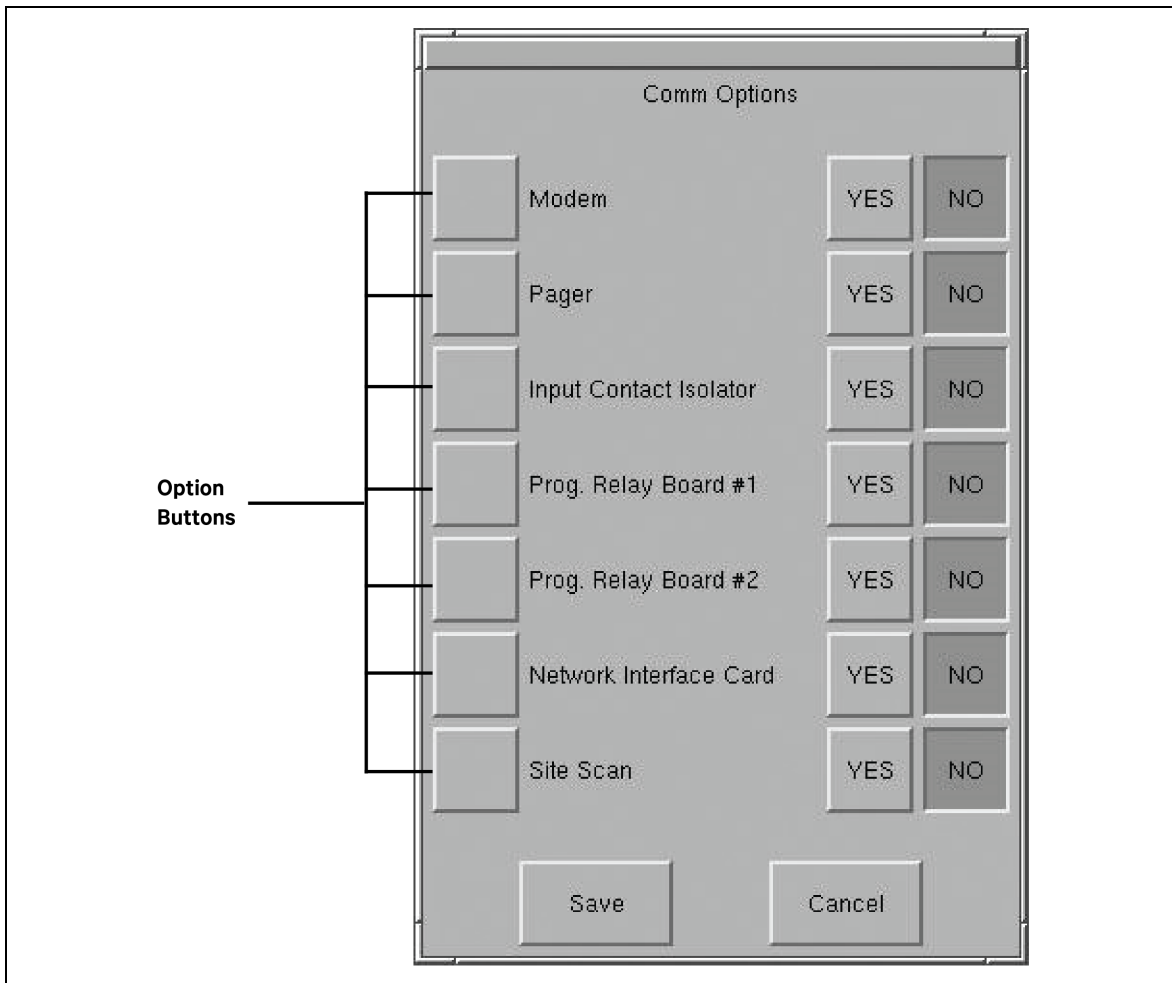
- Select *COMM OPTIONS* from the System Settings Menu. (If needed, See [System Settings](#) above to access the System Settings menu.)

The Comm Options dialog box is displayed. See **Figure 13.8** on the facing page.

- An option can be enabled by selecting YES.
- An option can be disabled by selecting NO.
- An option can be configured by selecting the adjacent option button to display a separate configuration dialog box.

The instructions for configuring the communications options are provided in this section:

Option	Refer to:
Input Contact Isolator	Configuring the Input Contact Isolator Settings on the facing page
Prog. Relay Board	Configuring the Programmable Relay Board Settings on page 79
Network Interface Card	Configuring the Vertiv™ Liebert® Intellislot™ Unity-DP Card on page 81
Site Scan	Saving Your Communication Configurations on page 81

Figure 13.8 Comm Options Dialog Box

13.8.1 Configuring the Input Contact Isolator Settings

The Input Contact Isolator (ICI) is an optional, eight-channel input board for up to eight external user alarm or message inputs to be routed to the Vertiv™ Liebert® STS2's alarm network. If the Transfer Inhibit option is supplied, the ICI will accommodate up to seven external user alarm or message inputs.

The contact is set to normally open. When a contact closes or opens, an event is triggered. See [Input Contact Isolator Board](#) on page 17 for more information on the ICI.

The Input Contact Isolator options are configured through the Input Contact Isolator dialog box, which is accessed from the Comm Options dialog box. The Input Contact Isolator dialog box contains eight choices to match the eight channel input board. You can label each button to identify the event associated with the contact. When the dialog box is accessed, each button flashes to display the Input Contact Isolator number and the user entered label. This label also appears in the Display Panel when an event related to an Input Isolator Connector is triggered. The Input Contact Isolator dialog box allows you to:

- Label the input contact assignments for your setup.
- Set the delay for an external event triggering an alarm.
- Review the isolator contact assignments, once the labels are entered.

The delay allows you to set the number of seconds which a condition needs to persist to trigger an alarm.

These input alarms can also be configured to activate a programmable relay output, which is discussed in [Configuring the Programmable Relay Board Settings](#) on the facing page.

When the Transfer Inhibit option is supplied, connect a N.O. dry contact (customer-supplied) to Input Contact 8 (Pins 15 and 16). When the customer contact closes, transfers will be inhibited as long as the contact remains closed. Input Contact 8 is factory-set so no setup is required. The Transfer Inhibit option prevents Input Contact 8 from being used for any other input.

To configure the Input Contact Isolator relays:

1. Select *INPUT CONTACT ISOLATOR* from the Comm Options menu. The Input Contact Isolator dialog box is displayed.

Figure 13.9 Input Contact Isolator Dialog Box

Channel	Custom	Pre-assigned	Input Contact Label	Delay
Ch #1	Custom	Pre-assigned	INPUT CONTACT #1	0.0
Ch #2	Custom	Pre-assigned	INPUT CONTACT #2	0.0
Ch #3	Custom	Pre-assigned	INPUT CONTACT #3	0.0
Ch #4	Custom	Pre-assigned	INPUT CONTACT #4	0.0
Ch #5	Custom	Pre-assigned	INPUT CONTACT #5	0.0
Ch #6	Custom	Pre-assigned	INPUT CONTACT #6	0.0
Ch #7	Custom	Pre-assigned	INPUT CONTACT #7	0.0
Ch #8	Custom	Pre-assigned	INPUT CONTACT #8	0.0

Buttons: Save, Cancel

2. Select *INPUT CONTACT 1*.
A keyboard is displayed to allow you to enter the name of the alarm.
3. Enter the name of the alarm set for that input. For example, a fan problem could be indicated by naming the button FAN.
4. Select OK on the keyboard to keep your label.

5. Select *DELAY*.
A keypad is displayed prompting you for a delay time, in seconds, for a condition to exist before the alarm is triggered.
6. Enter the delay value. The range for the values are from 0 (zero) to 99.9 seconds.
7. Select *OK* on the keypad to keep your setting.
The value you entered is displayed in the field adjacent to the corresponding input contact.
8. Repeat [Step 2](#) to [Step 7](#) for each input contact.
9. Select *SAVE* after you have configured all input contacts.
Be sure to select Save even if you have accessed this dialog only to change a setting.
10. Enter the settings in [Configuring the Input Contact Isolator Settings](#) on page 77 This information is not saved if control power is removed.
11. Select *OK* in the Comm Options dialog box to activate the settings.

13.8.2 Configuring the Programmable Relay Board Settings

The Vertiv™ Liebert® STS2 can contain up to two Programmable Relay Boards (PRB) that can trigger an external device when an event occurs in the Liebert® STS2. For example, if Source 1 fails, an external light flashes.

See [Programmable Relay Board](#) on page 17 for more information on the PRB's.

The Programmable Relay Board dialog box with two options: STANDARD SET and USER DEFINED SET. The STANDARD SET are the factory-configured settings.

The STANDARD SET for the Programmable Relay Board settings are:

Table 13.2 Standard Settings for Programmable Relays

Relay	Setting	Definition
1	SOURCE 1 FAIL	Source 1 failure.
2	SOURCE 2 FAIL	Source 2 failure.
3	BYPASS CB4 CLOSED	Switch (CB4) is closed, Source 1 is bypassed.
4	BYPASS CB5 CLOSED	Switch (CB 5) is closed, Source 2 is bypassed.
5	TRANSFER INHIBIT	A transfer between Source 1 and Source 2 is being restrained.
6	OUT OF SYNC	The phase difference between sources 1 and 2 exceeds the allowable threshold for transfer.
7	EQUIP OVER TEMP	The ambient temperature of the Liebert® STS2 exceeds the recommended threshold for operation.
8	Blank	No setting.

The USER DEFINED SET allows you to assign faults and alarms to each contact on the relay boards.

Utilizing the USER DEFINED SET, you can also select Input Contact Isolators to associate with a programmable relay.

In addition individual events, three other assignment choices are available:

- SELECT ALL sends a summary event to the selected relay whenever any event occurs. If this setting is selected for a relay, no other event needs to be assigned for that relay.
- ON SOURCE 1 or ON SOURCE 2 can be assigned to a relay to send a notification when that source is being used by the load.

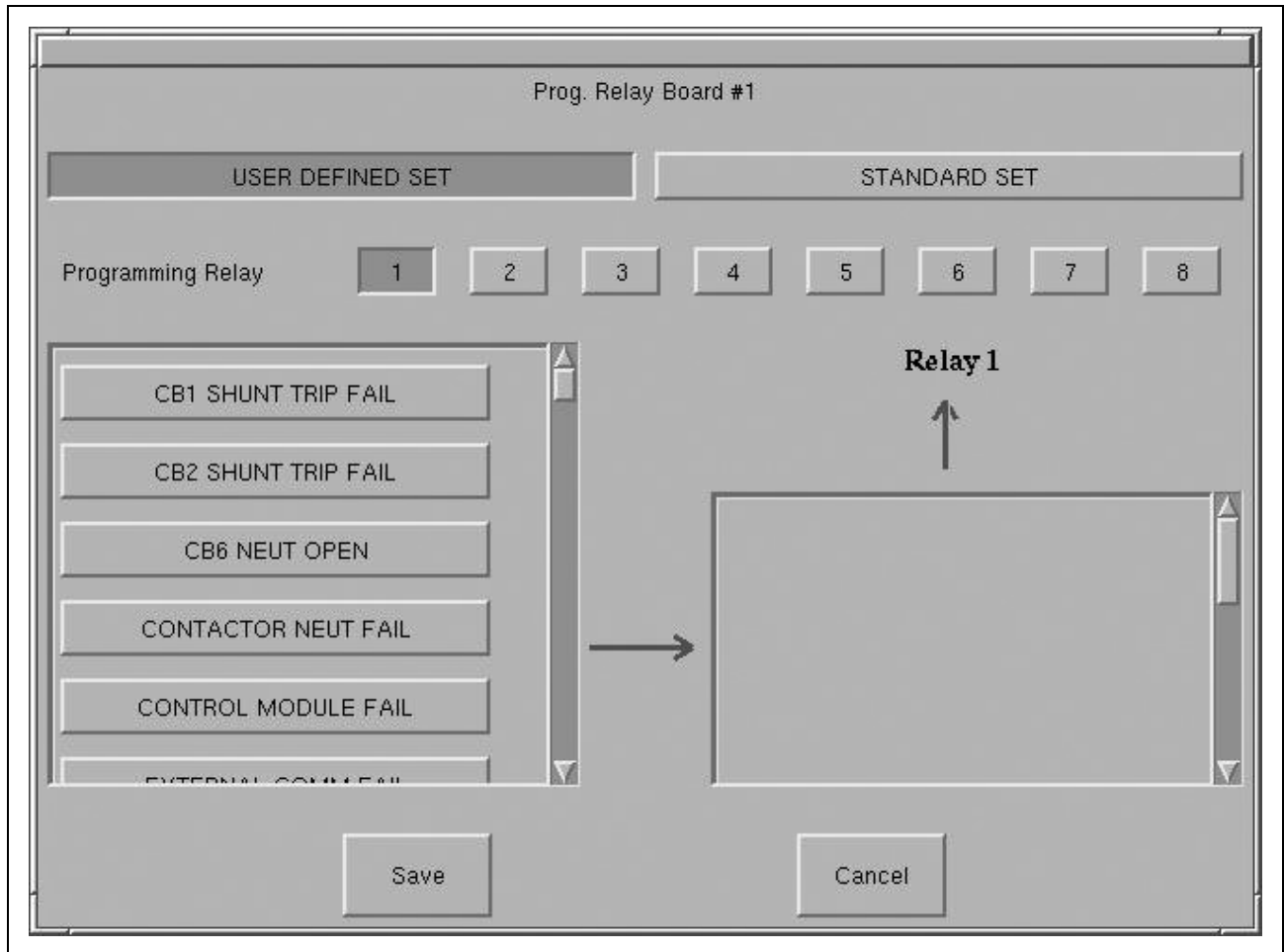
Once configured, the Vertiv™ Liebert® STS2 continuously checks the status of the items defined for each contact and updates the state of the relay.

To configure your programmable relay boards for user defined settings:

1. Select *PROG. RELAY BOARD x* from the Comm Options dialog box, where x is the corresponding board number.

The Prog. Relay Board dialog box is displayed.

Figure 13.10 Programmable Relay Board Dialog Box



2. Select your configuration settings.
 - Select *STANDARD SET* to use the settings configured at the factory. See Go to [Step 4](#).
 - Select *USER DEFINED SET* to configure your own settings. Go to [Step 3](#).

If you enter a user-defined setting, record the setting in [Programmable Relay Board Dialog Box](#) above. If for some reason the control board is replaced, it will be necessary to reprogram the Programmable Relay Board with this information.

3. To define your relay board settings:
 - a. Select a *Programming Relay*.
 - b. Select an event you want associated with the relay. That fault is placed in the Relay column.

You can associate up to 10 events with one relay. If you do so, you should group the events logically to simplify troubleshooting when an event is triggered.

4. Select *SAVE* to keep the settings.
5. Select *OK* for the applicable Programmable Options Board option in the Comm Options dialog box to activate the settings.

13.8.3 Configuring the Vertiv™ Liebert® Intellislot™ Unity-DP Card

An optional Liebert® Intellislot™ Unity-DP Card can be installed in the Vertiv™ Liebert® STS2 to provide Ethernet connectivity via an RJ-45 port.

Ethernet cabling is the responsibility of the customer. Category 5 cabling is required.

See [Vertiv™ Liebert® IntelliSlot™ Unity-DP Card](#) on page 18 for more information on the Liebert® Intellislot™ Unity-DP Card. See the card's user guide, SL-52645, for configuration instructions. The guide is available at the Vertiv™ Website, www.Vertiv.com.

If the optional Liebert® Intellislot™ Unity-DP Card is installed in the Liebert® STS2

- Select *YES* for the Network Interface Card option in the Comm Options dialog box to activate the card.

13.8.4 Saving Your Communication Configurations

To save your communications configuration settings:

1. When you have completed the Comm Options configuration, ensure you have selected *YES* for all the settings that you want activated.
2. Select *SAVE* to keep the settings.

Whenever you make modifications to any of the Comm Options, select *SAVE* to keep the changes.

13.9 System Options

Most System Options are configured at the factory. However, you may need to set two of the choices after the unit is installed: Wye Output Transformer and Remote Source Selection.

- Select *SYSTEM OPTIONS* from the System Settings Menu. (If needed, see **Figure 13.11** on the next page to access the System Settings menu.)

The System Options dialog box is displayed.

- An option is enabled by selecting *YES*.
- An option is disabled by selecting *NO*.

Figure 13.11 System Options

The screenshot shows a 'System Options' dialog box with the following settings:

Option	YES	NO
Dual Output Breaker	YES	NO
PDU	YES	NO
4 Pole Transfer Switch	YES	NO
Shunt Trip	YES	NO
Wye Output Transformer	YES	NO
Remote Source Select	YES	NO

At the bottom of the dialog are two buttons: 'Save' and 'Cancel'.

Dual Output Breaker

This selection is set at the factory. The choice is set to YES to enable both output breakers (CB3 and CB3A) when two are installed in the unit. If only one output breaker (CB3) is installed, the setting is set to NO.

PDU

This selection is set at the factory. This setting allows the LCD to draw the Mimic accordingly and display PDU specific metering and alarm information.

4-Pole Transfer Switch

This option is available only in certain markets (factory-set to No).

Shunt

This selection is set at the factory.

Wye Output Transformer

The Wye Output Transformer controls the firing of the SCRs on startup, which minimizes the inrush into PDU transformers. Output breakers and PDU input breakers have to be closed when you start up the system. Based on whether the input side of the PDU transformer is configured as a Wye or Delta changes the firing sequence of the SCRs.

If the Vertiv™ Liebert® STS2 is connected to a PDU configured as a Wye:

- Select **YES** for the Wye Output Transformer choice in the System Options dialog box.

Remote Source Selection

If your system is configured with the optional Remote Source Selection, it must be enabled from the System Options menu. See [Remote Source Selection Wiring](#) on page 18 for more information. If the system is utilizing Remote Source Selection:

- Select **YES** for the Remote Source Selection choice in the System Options dialog box to activate the option.

13.10 System ID

Most of the settings for System ID are set by Vertiv either at the factory or when the unit is installed.

Order No., System Tag No., System ID No., and Model No. are the numbers used to identify and track the system.

Language, Time, and Date are synchronized with the location of the unit.

The only configurable field is the Password. See [Using the Password](#) on page 68 for more information on configuring and using the password.

13.11 Logs

Two types of logs are kept by the Liebert® STS2:

- Event Log.
- History Log.

13.11.1 Event Log

The Event Log tracks the alarms and faults of the Liebert® STS2.

See [Alarm and Faults](#) on page 49 for more information on these events and See [Event Log](#) on page 49 for more information on the Event Log and definitions of the fields displayed in the Event Log screen.

Figure 13.12 Event Log

The Event Log screen displays a table with the following columns: #, Message, Type, ID, Date, and Time. The table is currently empty. To the right of the table are summary statistics:

Faults	Alarms
0	0
User Alarms	Total
0	0

Navigation buttons (UP and DOWN) are located to the right of the table. At the bottom, there are buttons for OK and Clear Event Log.

To use the Event Log:

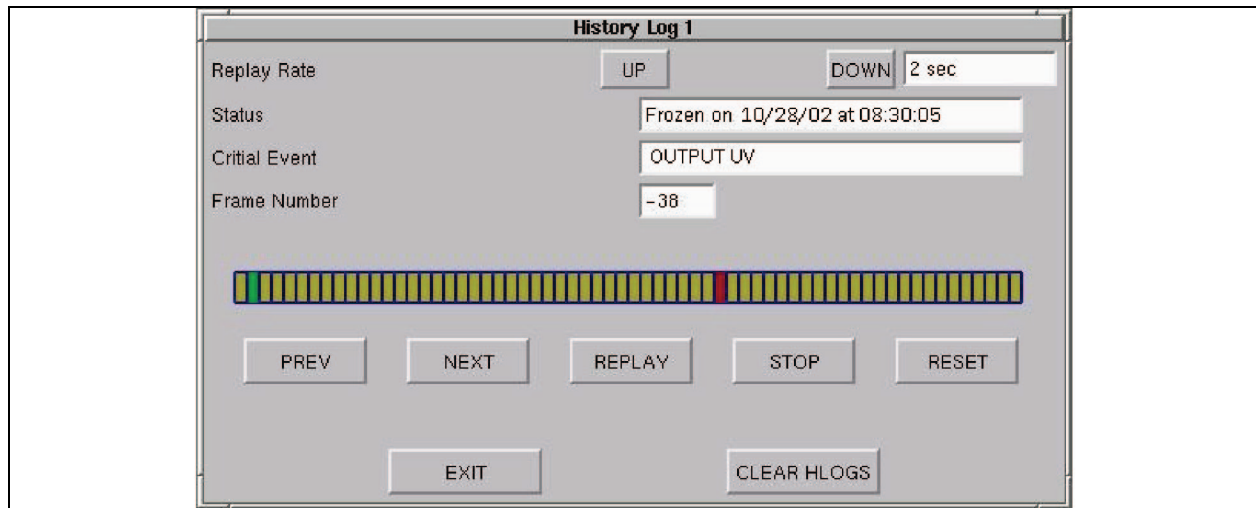
1. Select *LOGS* from the menu bar to open the Logs menu.
2. Select *EVENT LOG* from the menu.
3. Use the UP and DOWN buttons to scroll through the event list.
4. Select OK to close the Event Log. The data remains in the log.

13.11.2 History Log

Two History Logs are available to track major alarms. If so configured, an alarm freezes the history buffer. When the History Status buffer is frozen, a History Log is created that can be accessed from the HISTORY LOG x choices in the LOGS menu.

See [History Log](#) on page 50 for more information on the History Logs and definitions of the fields displayed in the History Log screen.

Figure 13.13 History Log



To use the History Log:

1. Select *LOGS* from the menu bar to open the Logs menu.
2. Select either *HISTORY LOG 1* or *HISTORY LOG 2* from the menu.
3. Select the appropriate buttons to replay the log:
 - Select *PREV* to go to the previous frame in the sequence.
 - Select *NEXT* to go to the next frame in the sequence.
 - Move the green cursor to the location from which you would like to play the sequence of events.
 - Select *REPLAY* to play the frames automatically from the point of the cursor.
 - Select *STOP* to halt the replay.
 - Select *RESET* to return to the first frame in the log.
4. Select *EXIT* to close the History Log. The data remains in the log.
 - Use *CLEAR HLOGS* to remove the data from both history logs.

NOTE: Event and History Logs are protected by security. The password or a disabled key lockout is required on such equipped units to clear these logs.

13.12 Source Transfers

The Source Transfer choice (SOURCE XFERS) allows you to manually select a preferred source.

To switch the primary source, refer to the instructions in [Manual Transfer/Preferred Source Selection](#) on page 45

13.13 Startup Procedure

You can access instructions for starting the Vertiv™ Liebert® STS2 from the menu bar.

- From the menu bar, select *STARTUP PROC.*

These instructions are also provided on [Normal System Startup](#) on page 41 for Color Graphical display units.

13.14 Bypass Procedure

You can access instructions for bypassing the static transfer switch from the menu bar.

- From the menu bar, select *BYP. PROC.*

The instructions are provided in the display panel.

Bypass procedures are also discussed in [Maintenance Bypass](#) on page 42 for Color Graphical display units.

13.15 Help

You can select an event in the Event Display to display more information about that event in the Display Panel. This same help is also available in [Event Message Help Text](#) on page 93.

13.16 Logo

The Logo menu choice shows the Vertiv™ logo in the display panel.

13.17 Cleaning the LCD Touchscreen

If the touchscreen requires cleaning, use a pre-moistened towelette designed for cleaning computer monitors, or dampen a soft, non-abrasive cloth with a very mild cleaning solution.

Do not spray the cleaner directly onto the touchscreen, as drips may run down into the screen, and damage the equipment.

Close all menus and dialog boxes before cleaning the touchscreen.

14 Specifications

This section provides the specifications for the Vertiv™ Liebert® STS2.

14.1 System Configuration

The Liebert® STS2 can be set in several different configurations, according to the model and location. The configuration is set at the factory and does not need to be changed by the customer. These configurations apply to both units, the Color Graphical Display.

14.1.1 Frequency

The Liebert® STS2 accepts input frequencies of 50 Hz or 60 Hz. The frequency shall be within ± 3.0 Hz of the nominal frequency.

14.1.2 Input/Output Voltage

The Liebert® STS2 models are available to handle various voltages.

The input voltage must be three-phase AC (3 or 4 wire-plus-ground). The Liebert® STS2 is designed to accept an input neutral from each source. The neutral is switched in the 4-pole Liebert® STS2 only.

The voltage shall be within $\pm 10\%$ of the nominal voltage.

The output voltage shall be three-phase AC (3 or 4 wire-plus-ground). Nominal output voltage shall be same as input voltage.

The following table provides nominal voltages, listed according to frequency.

Table 14.1 Input/Output Voltage

[L-L/L-N]
380/220 V
400/230 V
415/240 V
480/277 V
575/332 V
600/346 V

14.1.3 System Current Ratings

These ratings are based upon continuous switch current rating. These ratings are for all voltages and frequencies. All units are 100% continuous current rated.

Table 14.2 System Current Ratings

Current, A
1200
1250
1400
1600
1800
1850

14.1.4 Grounding

See [System Grounding](#) on page 14 for specifications and instructions regarding grounding.

14.1.5 Electrical Requirements

Table 14.3 Electrical Requirements

Item	Requirement
Maximum Continuous Current	1200 amps 1250 amps 1400 amps 1600 amps 1800 amps 1850 amps
Load Power Factor Range	0.5 to 1.0, leading or lagging
Source Voltage Distortion	Up to 10% THD with notches and ringing transients
Overload Capability	125% for 30 minutes *
	150% for 2 minutes*
	500% for 250 milliseconds*
*Actual duration may be shorter depending on the upstream over current protection devices.	

14.1.6 Input Surge Suppression

The Vertiv™ Liebert® STS2 is equipped with transient voltage surge suppression on each input for maximum surge suppression. The surge suppression is capable of protecting the Liebert® STS2 from operating outside of tolerances due to surges as defined by IEC 6100-4-5 (1.2/50uS surge, 2kV CM and 1kV DM) as required under ANSI C62.41 Category B3 (6kV).

14.1.7 Response Time

A dual level fast/slow transfer threshold is used for under voltage detection to allow the Vertiv™ Liebert® STS2 to be compatible with UPSs and generators. The voltage thresholds and the slow transfer delay time is user-adjustable. The fast transfer delay time is less than 4 ms.

The over voltage detection uses a single threshold, with programmable level, and delay time. See [User Settings](#) on page 71 for instructions on configuring these settings.

14.1.8 Environmental Requirements

See [Location Considerations](#) on page 9 for details concerning environmental requirements for the Liebert® STS2.

14.2 System Components

All Liebert® STS2 models provide two static transfer switches within one enclosure, with the ability to transfer between two input sources to a single output.

All Liebert® STS2s are configured with either an LCD Color Graphical Interface touchscreen display for monitoring and configuring the unit.

This section lists the common components and the differences for both types of units.

14.2.1 Frame and Enclosure

The complete Liebert® STS2 is housed in a freestanding enclosure. The cabinet is a NEMA type 1 enclosure and meets IP20 requirements. The cabinet is structurally designed to handle lifting from the base. The frame is designed to accommodate floor stands.

Table 14.4 Frame Sizes

Rating	Width, in. (mm)	Depth, in. (mm)	Height, in. (mm)
1200A - 1850A	25.7 (653)	35.7 (906)	81.5 (2070) without top hats
			88.0 (2236) with top hats

The distributed floor weight for Liebert® STS2 is less than 150 lb./ft² (660kg/m²).

The required service access is only from the front of the unit.

The Liebert® STS2 can be tipped 15° in any direction without falling over.

14.2.2 Seismic Anchoring

The unit also can be fastened to the floor using optional seismic anchors to meet seismic Zone 4 requirements. See [Locating the Vertiv™ Liebert® STS2](#) on page 11.

14.2.3 Cooling

The Liebert® STS2 is fan cooled. All fans are redundant so that a single fan failure cannot cause temperatures to increase beyond acceptable limits.

Air intake is through screened protective openings in the front of the unit. The air filter dimensions are 535 mm X 1310 mm or 21.1 in. X 51.6 in.

By opening the front door, the filter can be changed easily without exposing personnel to high voltage.

The air exhaust is through the top of the unit.

14.2.4 Access

The Vertiv™ Liebert® STS2 is designed so all repairs and maintenance can be done from the front or top of the unit. All components that may need repair or replacement during routine field maintenance are safely accessed with the units in bypass without removing power from the unit. These components include:

- All electronic PCB assemblies.
- Power supply assemblies.
- All fuses.
- All circuit breaker plug-in modules.
- Fans.
- SCRs.

All power connections are designed to maintain proper connection torque over the lifetime of the unit without any maintenance.

All other components including power cables and connections, circuit breaker bases, etc. are replaceable from the front or top of the unit only, but this requires all power to be removed from the unit for safety. Although routine re-torquing of the power connections is not required, if maintenance of these connections is needed, complete removal of power is required from the unit for safety reasons.



WARNING! Lethal voltages exist inside the unit during normal operation. Only qualified service personnel should perform maintenance on the static switch. The unit is supplied by more than one power source. The unit contains hazardous voltages if any of the input sources is ON, even when the unit is in bypass. To isolate the unit, turn OFF and lock out ALL input power sources. Verify that all input power sources are de-energized and locked out before making connections inside unit.

14.2.5 Circuit Breakers

The Liebert® STS2 may be equipped with five or six molded-case, plug-in, automatic circuit breakers in external 3rd party, or Vertiv supplied switchgear. On Vertiv supplied switchgear the breakers are UL-listed for use up to 600 VAC and CE-marked. The plug-in feature of the breaker includes an interlock, which prevents the breaker from being unplugged without being in the OFF (open) position.

On Vertiv supplied switchgear mechanical interlocks are provided on the breakers to prevent improper maintenance bypassing of the solid-state switch. A bypass breaker cannot be closed unless the solid-state switch is connected to the same input source and only one bypass breaker can be closed at a time. All breakers are equipped with N.O. and N.C. auxiliary switches for monitoring of the breaker positions. The two input breakers for the solid-state switching devices also are equipped with 48 VDC shunt trips to allow for control by the Liebert® STS2 logic.

14.2.6 Doors

A removable key lock hinged front door provides access to the controls.

14.2.7 Color Graphical Display

The display is located in the front of the unit. Front panel display is either an LCD touchscreen display for monitoring and configuring the unit.

See **Figure 8.1** on page 34 for a drawing of the touchscreen display.

14.2.8 RS-232 Port

The unit is equipped with an RS-232 port for connecting a terminal or PC. See **Figure 7.10** on page 30 for the port's location.

See [Using the RS-232 Port](#) on page 56 for instructions on using a PC terminal with the unit.

14.2.9 Terminal Port Connections

The system has an asynchronous serial port configured as Data Terminal Equipment for terminal access only (half duplex). The CPU services the terminal port with no handshaking. The serial port conforms to RS-232 levels. The serial port is 1000 VDC isolated (non-SELV) and ESD protected to 15kV air discharge. The connector is a 6-pin MTA plug with connections shown below.

Table 14.5 MTA Plug Pin-out

Pin	Signal Name	Function / Comments
1	ISO_GND	Isolated service terminal ground.
2	ISO_TXD	Isolated service terminal transmit output.
3	ISO_RXD	Isolated service terminal receive input.
4	NC	No Connection.
5	NC	No Connection.
6	NC	No Connection.

A DB9 male connector is added and connected parallel to the 6-position header. It is configured as DTE.

Table 14.6 DB9 Pin-out

Pin	Signal Name	Function / Comments
1	NC	No Connection.
2	ISO_RXD	Isolated service terminal transmit output.
3	ISO_TXD	Isolated service terminal receive input.
4	NC	No Connection.
5	ISO_GND	Isolated service terminal ground.
6	NC	No Connection.
7	NC	No Connection.
8	NC	No Connection.
9	NC	No Connection.

14.2.10 RS-232 Interface Parameters

The service terminal interface parameters are the following settings and cannot be changed.

Table 14.7 RS-232 Settings

Parameter	Setting
Interface	RS-232 Using EIA Voltage Levels
Baud Rate	9600
Parity	None
Number of Data Bits	8
Number of Stop Bits	1
Hardware Flow Control	Off
Terminator	<CR> <LF>
Handshaking	Not supported
Structure	Full duplex
Local Echo	Off

14.2.11 Maintenance Bypass

The Vertiv™ Liebert® STS2 is configured to allow the unit's electronics to be bypassed to either input source for maintenance without interruption of power to the load.

The Liebert® STS2 is furnished with key-interlocked maintenance bypass breakers to configure the bypass.

Liebert® STS2 units have all electronics isolated from the input, output, and bypass connections to allow safe servicing of any components without access to hazardous voltages when the unit is in maintenance bypass.

See [Maintenance Bypass](#) on page 42 for instructions using the Color LCD Graphical Display unit.

14.2.12 Fuseless Design

All Liebert® STS2 units are fuseless and rated for use with upstream circuit breakers only.

14.2.13 Options

The following options are available for the Liebert® STS2.

Programmable Relay Board	Remote Source Selection
	Key Lockout Switch
Input Contact Isolator Board	Redundant Output Breaker
Comms Board (external switchgear) with Vertiv™ Liebert® SiteScan™ and Input Junction Boxes and Cable Interface	Transfer Inhibit
Vertiv™ Liebert® Intellislot™ Unity-DP Card	Seismic Floor Anchors

15 Event Message Help Text

Key:

ALL CAPS: Event message displayed in the Event Display panel in the lower left corner of the LCD display.

Indented text: help text shown in the Display Panel in the lower right corner of LCD display.

BOLD: commands that are sent through the RS-232 port.

S1 SCR SHORT

Source 1 SCR Short.

One or more of the SCRs for Source 1 has shorted. Transferring between sources has been inhibited.

Contact Vertiv for technical support at 800-543-2378.

Press **SILENCE** on the touchscreen to turn Off the audible alarm, if so configured. If you are accessing the

Vertiv™ Liebert® STS2 system from a terminal, type SH and press **RETURN** on your keyboard to turn Off the audible alarm.

This event and the system status surrounding it have been written to a History Log if the History Logs were not already full. This event was also written to the Event Log, if so configured.

S2 SCR SHORT

Source 2 SCR Short.

One or more of the SCRs for Source 2 has shorted. Transferring between sources has been inhibited.

Press **SILENCE** on the touchscreen to turn Off the audible alarm, if so configured. If you are accessing the

Liebert® STS2 system from a terminal, type SH and press **RETURN** on your keyboard to turn Off the audible alarm.

This event and the system status surrounding it have been written to a History Log if the History Logs were not already full. This event was also written to the Event Log, if so configured.

S1 SCR OPEN

Source 1 SCR Open.

One or more SCRs on Source 1 is open. Transferring between sources has been inhibited.

Contact Vertiv at 800-543-2378.

Liebert® STS2 output has been transferred to Source 2.

Press **SILENCE** on the touchscreen to turn Off the audible alarm, if so configured. If you are accessing the

Liebert® STS2 system from a terminal, type SH and press **RETURN** on your keyboard to turn Off the audible alarm.

This event and the system status surrounding it have been written to a History Log if the History Logs were not already full. This event was also written to the Event Log, if so configured.

S2 SCR OPEN

Source 2 SCR Open.

One or more SCRs on Source 2 is open. Transferring between sources has been inhibited. Vertiv™ Liebert® STS2 output has been transferred to Source 1.

Contact Vertiv at 800-543-2378.

Press **SILENCE** on the touchscreen to turn Off the audible alarm, if so configured. If you are accessing the Liebert® STS2 system from a terminal, type SH and press **RETURN** on your keyboard to turn Off the audible alarm.

This event and the system status surrounding it have been written to a History Log if the History Logs were not already full. This event was also written to the Event Log, if so configured.

PRIMARY FAN FAIL Primary Fan Failure.

One of the primary cooling fans for the Vertiv™ Liebert® STS2 has failed. The alternate fans are now running. The alternate fans are not monitored.

Contact Vertiv for technical support at 800-543-2378.

Press **SILENCE** on the touchscreen to turn Off the audible alarm, if so configured. If you are accessing the Liebert® STS2 system from a terminal, type SH and press **RETURN** on your keyboard to turn Off the audible alarm.

This event was written to the Event Log, if so configured.

CONTROL MODULE FAIL

Control logic module has failed.

One of the control modules on the control board has failed.

Contact Vertiv at 800-543-2378.

Press **SILENCE** on the touchscreen to turn Off the audible alarm, if so configured. If you are accessing the Liebert® STS2 system from a terminal, type SH and press **RETURN** on your keyboard to turn Off the audible alarm.

This event was written to the Event Log, if so configured.

If configured to be a latching alarm, press **RESET** on the display. If you are accessing the unit from a terminal, type CA and press **RETURN** on your keyboard.

PWR SPLY DC A FAIL

Power Supply DC Bus A Failed.

The primary power supply is no longer providing DC power to the control board and the touchscreen.

Contact Vertiv™ at 800-543-2378.

Press **SILENCE** on the touchscreen to turn Off the audible alarm, if so configured. If you are accessing the Liebert® STS2 system from a terminal, type SH and press **RETURN** on your keyboard to turn Off the audible alarm.

This event was written to the Event Log, if so configured.

If configured to be a latching alarm, press **RESET** on the display. If you are accessing the unit from a terminal, type CA and press **RETURN** on your keyboard.

PWR SPLY DC B FAIL

Power Supply DC Bus B Failed.

The secondary power supply is no longer providing DC power to the control board and CAN options.

Contact Vertiv at 800-543-2378.

Press **SILENCE** on the touchscreen to turn Off the audible alarm, if so configured. If you are accessing the Vertiv™ Liebert® STS2 system from a terminal, type SH and press **RETURN** on your keyboard to turn Off the audible alarm.

PWR SPLY S1 AC FAIL

Power Supply Source 1 AC Failed.

The AC input power to the power supplies from Source 1 has failed. The power supplies are now operating on AC power from Source 2. The AC input from Source 1 is still good.

Contact Vertiv at 800-543-2378.

Press **SILENCE** on the touchscreen to turn Off the audible alarm, if so configured. If you are accessing the Liebert® STS2 system from a terminal, type SH and press **RETURN** on your keyboard to turn Off the audible alarm.

This event was written to the Event Log, if so configured.

If configured to be a latching alarm, press **RESET** on the display. If you are accessing the unit from a terminal, type CA and press **RETURN** on your keyboard.

This event was written to the Event Log, if so configured.

If configured to be a latching alarm, press **RESET** on the display. If you are accessing the unit from a terminal, type CA and press **RETURN** on your keyboard.

PWR SPLY S2 AC FAIL

Power Supply Source 2 AC Failed.

The AC input power to the power supplies from Source 2 has failed. The power supplies are now operating on AC power from Source 1. The AC input from Source 2 is still good.

Contact Vertiv at 800-543-2378.

Press **SILENCE** on the touchscreen to turn Off the audible alarm, if so configured. If you are accessing the Liebert® STS2 system from a terminal, type SH and press **RETURN** on your keyboard to turn Off the audible alarm.

This event was written to the Event Log, if so configured.

If configured to be a latching alarm, press **RESET** on the display. If you are accessing the unit from a terminal, type CA and press **RETURN** on your keyboard.

PWR SPLY LOGIC FAIL

Power Supply Module Failed.

The power supply logic module contained in the primary power supply has failed.

Contact Vertiv at 800-543-2378.

Press SILENCE on the touchscreen to turn Off the audible alarm, if so configured. If you are accessing the Vertiv™ Liebert® STS2 system from a terminal, type SH and press RETURN on your keyboard to turn Off the audible alarm.

This event was written to the Event Log, if so configured.

If configured to be a latching alarm, press RESET on the display. If you are accessing the unit from a terminal, type CA and press RETURN on your keyboard.

OUT VOLT SENSE FAIL

Output Voltage Sense Module Failed.

The module contained on the snubber monitoring the output voltage has failed.

Press SILENCE on the touchscreen to turn Off the audible alarm, if so configured. If you are accessing the Liebert® STS2 system from a terminal, type SH and press RETURN on your keyboard to turn Off the audible alarm.

Contact Vertiv at 800-543-2378.

This event was written to the Event Log, if so configured.

If configured to be a latching alarm, press RESET on the display. If you are accessing the unit from a terminal, type CA and press RETURN on your keyboard.

S1 VOLT SENSE FAIL

Source 1 Voltage Sense Module Failed.

The module contained on the snubber monitoring the input voltage from Source 1 has failed.

Press SILENCE on the touchscreen to turn Off the audible alarm, if so configured. If you are accessing the Liebert® STS2 system from a terminal, type SH and press RETURN on your keyboard to turn Off the audible alarm.

Contact Vertiv at 800-543-2378.

This event was written to the Event Log, if so configured.

If configured to be a latching alarm, press RESET on the display. If you are accessing the unit from a terminal, type CA and press RETURN on your keyboard.

S2 VOLT SENSE FAIL

Source 2 Voltage Sense Module Failed.

The module contained on the snubber monitoring the input voltage from Source 2 has failed.

Press SILENCE on the touchscreen to turn Off the audible alarm, if so configured. If you are accessing the

Vertiv™ Liebert® STS2 system from a terminal, type SH and press RETURN on your keyboard to turn Off the audible alarm.

Contact Vertiv at 800-543-2378.

This event was written to the Event Log, if so configured.

If configured to be a latching alarm, press RESET on the display. If you are accessing the Liebert® STS2 system from a terminal, type CA and press RETURN on your keyboard.

S1 SCR SENSE FAIL

Source 1 SCR Sense Module Failed.

The module contained on the snubber monitoring the SCRs for Source 1 has failed.

Press SILENCE on the touchscreen to turn Off the audible alarm, if so configured. If you are accessing the

Liebert® STS2 system from a terminal, type SH and press RETURN on your keyboard to turn Off the audible alarm.

Contact Vertiv at 800-543-2378.

This event was written to the Event Log, if so configured.

If configured to be a latching alarm, press RESET on the display. If you are accessing the Liebert® STS2 system from a terminal, type CA and press RETURN on your keyboard.

S2 SCR SENSE FAIL

Source 2 SCR Sense Module Failed.

The module contained on the snubber monitoring the SCRs for Source 2 has failed.

Press SILENCE on the touchscreen to turn Off the audible alarm, if so configured. If you are accessing the Liebert® STS2 system from a terminal, type SH and press RETURN on your keyboard to turn Off the audible alarm.

Contact Vertiv at 800-543-2378.

This event was written to the Event Log, if so configured.

If configured to be a latching alarm, press RESET on the display. If you are accessing the Liebert® STS2 system from a terminal, type CA and press RETURN on your keyboard.

S1 CURR SENSE FAIL

Source 1 Current Sense Failure.

The module monitoring the current from Source 1 has failed. This module is contained on the left side gate driver board.

Press SILENCE on the touchscreen to turn Off the audible alarm, if so configured. If you are accessing the Liebert® STS2 system from a terminal, type SH and press RETURN on your keyboard to turn Off the audible alarm.

This event was written to the Events Log, if so configured.

If configured to be a latching alarm, press RESET on the display. If you are accessing the Liebert® STS2 system from a terminal, type CA and press RETURN on your keyboard.

S2 CURR SENSE FAIL

Source 2 Current Sense Failure.

The module monitoring the current from Source 2 has failed. This module is contained on the right side gate driver board.

Press **SILENCE** on the touchscreen to turn Off the audible alarm, if so configured. If you are accessing the Vertiv™ Liebert® STS2 system from a terminal, type SH and press **RETURN** on your keyboard to turn Off the audible alarm.

This event was written to the Events Log, if so configured.

If configured to be a latching alarm, press **RESET** on the display. If you are accessing the Liebert® STS2 system from a terminal, type CA and press **RETURN** on your keyboard.

S1 GATE DRIVE FAIL

Source 1 Gate Drive Failure.

The gate drive module for an SCR for Source 1 has failed. This module is contained on the right side gate driver board.

Press **SILENCE** on the touchscreen to turn Off the audible alarm, if so configured. If you are accessing the Liebert® STS2 system from a terminal, type SH and press **RETURN** on your keyboard to turn Off the audible alarm.

Contact Vertiv at 800-543-2378.

This event was written to the Event Log, if so configured.

If configured to be a latching alarm, press **RESET** on the display. If you are accessing the Liebert® STS2 system from a terminal, type CA and press **RETURN** on your keyboard.

S2 GATE DRIVE FAIL

Source 2 Gate Drive Failure.

The gate drive module for an SCR for Source 2 has failed. This module is contained on the left side gate driver board.

Press **SILENCE** on the touchscreen to turn Off the audible alarm, if so configured. If you are accessing the Liebert® STS2 system from a terminal, type SH and press **RETURN** on your keyboard to turn Off the audible alarm.

Contact Vertiv for technical support at 800-543-2378.

This event was written to the Event Log, if so configured.

If configured to be a latching alarm, press **RESET** on the display. If you are accessing the unit from a terminal, type CA and press **RETURN** on your keyboard.

INTERNAL COMM FAIL

Internal CAN Communications Failed.

Communications have failed in the CAN bus between the control board and the touchscreen control.

Press **SILENCE** on the touchscreen to turn Off the audible alarm, if so configured. If you are accessing the

Vertiv™ Liebert® STS2 system from a terminal, type SH and press **RETURN** on your keyboard to turn Off the audible alarm.

Contact Vertiv at 800-543-2378.

This event was written to the Event Log, if so configured.

If configured to be a latching alarm, press **RESET** on the display. If you are accessing the unit from a terminal, type CA and press **RETURN** on your keyboard.

EXTERNAL COMM FAIL

External Communications Failed.

Communications have failed between the control board and the CAN options.

Press **SILENCE** on the touchscreen to turn Off the audible alarm, if so configured. If you are accessing the unit from a terminal, type SH and press **RETURN** on your keyboard to turn Off the audible alarm.

Contact Vertiv at 800-543-2378.

This event was written to the Event Log, if so configured.

If configured to be a latching alarm, press **RESET** on the display. If you are accessing the unit from a terminal, type CA and press **RETURN** on your keyboard.

CB1 SHUNT TRIP FAIL

Circuit Breaker 1 Shunt Trip Failure.

Circuit Breaker 1 failed to trip open when the control issued a command for the circuit breaker to trip.

Press **SILENCE** on the touchscreen to turn Off the audible alarm, if so configured. If you are accessing the

Liebert® STS2 system from a terminal, type SH and press **RETURN** on your keyboard to turn Off the audible alarm.

Contact Vertiv at 800-543-2378.

This event was written to the Event Log, if so configured.

If configured to be a latching alarm, press **RESET** on the display. If you are accessing the unit from a terminal, type CA and press **RETURN** on your keyboard.

CB2 SHUNT TRIP FAIL

Circuit Breaker 2 Shunt Trip Failure.

Circuit Breaker 2 failed to trip open when the control issued a command for the circuit breaker to trip.

Press **SILENCE** on the touchscreen to turn Off the audible alarm, if so configured. If you are accessing the

Liebert® STS2 system from a terminal, type SH and press **RETURN** on your keyboard to turn Off the audible alarm.

Contact Vertiv at 800-543-2378.

This event was written to the Event Log, if so configured.

If configured to be a latching alarm, press **RESET** on the display. If you are accessing the unit from a terminal, type CA and press **RETURN** on your keyboard.

HEAT SINK OVERTEMP

Heat Sink Over Temperature. The system heat sink temperature has exceeded the design limits. Take immediate steps to cool the unit. Remove obstructions from the air inlet in the front of the unit. Remove and replace the air filter behind the front door. A standard furnace filter can be used. Press **SILENCE** on the touchscreen to turn Off the audible alarm, if so configured. If you are accessing the Vertiv™ Liebert® STS2 system from a terminal, type SH and press **RETURN** on your keyboard to turn Off the audible alarm. This event was written to the Event Log, if so configured.

S1 UV

Source 1 Under Voltage (fast detection).

The input voltage from Source 1 dropped below a set percentage of the nominal voltage, as set in the Fast UV set point under the User Settings. An S1 Fail alarm was also issued and source transfer has been inhibited. The load of the Liebert® STS2 has been transferred to Source 2.

Press **SILENCE** on the touchscreen to turn Off the audible alarm, if so configured. If you are accessing the Liebert® STS2 system from a terminal, type SH and press **RETURN** on your keyboard to turn Off the audible alarm. This event was written to the Event Log, if so configured. If configured to be a latching alarm, press **RESET** on the display. If you are accessing the unit from a terminal, type CA and press **RETURN** on your keyboard.

S1 UV (RMS)

Source 1 Under Voltage (slow detection).

The input voltage from Source 1 remained below a set percentage of the nominal voltage for a designated period, as set in the Slow UV Setting and Slow UV Detection Delay set points configured under the User Settings. An S1 Fail alarm was also issued and source transfer has been inhibited.

The load of the Liebert® STS2 has been transferred to Source 2.

Press **SILENCE** on the touchscreen to turn Off the audible alarm, if so configured. If you are accessing the

Liebert® STS2 system from a terminal, type SH and press **RETURN** on your keyboard to turn Off the audible alarm.

The alarm is latched and must be reset after the voltage returns to the nominal voltage. If the Reset option is not configured for AUTO (automatic reset), then the reset action must be done manually. When the voltage is within acceptable parameters, touch the **RESET** button on the touchscreen. If you are accessing the unit from a terminal, type CA and press **RETURN** on your keyboard. This event was written to the Event Log, if so configured.

S1 OV

Source 1 Over Voltage.

The input voltage from Source 1 exceeded a set percentage of the nominal voltage, as set in the OV Setting and OV Detection Delay set points configured under the User Settings. An S1 Fail alarm was also issued and source transfer has been inhibited.

The load of the Liebert® STS2 has been transferred to Source 2.

Press **SILENCE** on the touchscreen to turn Off the audible alarm, if so configured. If you are accessing the

Liebert® STS2 system from a terminal, type SH and press **RETURN** on your keyboard to turn Off the audible alarm. This event was written to the Event Log, if so configured.

If configured to be a latching alarm, press **RESET** on the display. If you are accessing the unit from a terminal, type CA and press **RETURN** on your keyboard.

S1 OF/UF

Source 1 Over Frequency/Under Frequency.

The frequency for Source 1 is running outside the acceptable operating range, as set in the Frequency Trip Point under User Settings. An S1 Fail alarm was also issued and source transfer has been inhibited.

Press **SILENCE** on the touchscreen to turn Off the audible alarm, if so configured. If you are accessing the Liebert® STS2 system from a terminal, type SH and press **RETURN** on your keyboard to turn Off the audible alarm.

This event was written to the Event Log, if so configured. If configured to be a latching alarm, press **RESET** on the display. If you are accessing the unit from a terminal, type **CA** and press **RETURN** on your keyboard.

S1 FAIL

Source 1 Failure.

Source 1 has failed due to under voltage (UV), over voltage (OV), or running over or under frequency (OF/UF). This alarm is a companion to S1 UV, S1 UV (RMS), S1 OV and S1 OF/UF.

The load of the Liebert® STS2 has been transferred to Source 2.

Press **SILENCE** on the touchscreen to turn Off the audible alarm, if so configured. If you are accessing the

Liebert® STS2 system from a terminal, type SH and press **RETURN** on your keyboard to turn Off the audible alarm.

This event has been written to the Event Log, if so configured.

If configured to be a latching alarm, press **RESET** on the display. If you are accessing the unit from a terminal, type CA and press **RETURN** on your keyboard.

S2 UV

Source 2 Under Voltage (fast detection).

The input voltage from Source 2 dropped below a set percentage of the nominal voltage, as set in the Fast UV setpoint under the User Settings. An S2 Fail alarm was also issued and source transfer has been inhibited.

The load of the Liebert® STS2 has been transferred to Source 1.

Press **SILENCE** on the touchscreen to turn Off the audible alarm, if so configured. If you are accessing the Liebert® STS2 system from a terminal, type SH and press **RETURN** on your keyboard to turn Off the audible alarm.

This event was written to the Event Log, if so configured. If configured to be a latching alarm, press **RESET** on the display. If you are accessing the unit from a terminal, type CA and press **RETURN** on your keyboard.

S2 UV (RMS)

Source 2 Under Voltage (slow detection).

The input voltage from Source 2 remained below a set percentage of the nominal voltage for a designated period, as set in the Slow UV Setting and Slow UV Detection Delay set points configured under the User Settings. An S2 Fail alarm was also issued and source transfer has been inhibited.

The load of the Vertiv™ Liebert® STS2 has been transferred to Source 1.

Press **SILENCE** on the touchscreen to turn Off the audible alarm, if so configured. If you are accessing the

Liebert® STS2 system from a terminal, type SH and press **RETURN** on your keyboard to turn Off the audible alarm.

The alarm is latched and must be reset after the voltage returns to the nominal voltage. If the Reset option is not configured for AUTO (automatic reset), then the reset action must be done manually. When the voltage is within acceptable parameters, touch the **RESET** button on the touchscreen. If you are accessing the unit from a terminal, type CA and press **RETURN** on your keyboard. This event was written to the Event Log, if so configured.

S2 OV

Source 2 Over Voltage.

The input voltage from Source 2 exceeded a set percentage of the nominal voltage, as set in the OV Setting and OV Detection Delay set points configured under the User Settings. An S2 Fail alarm was also issued and source transfer has been inhibited.

The load of the Liebert® STS2 has been transferred to Source 1.

Press **SILENCE** on the touchscreen to turn Off the audible alarm, if so configured. If you are accessing the Liebert® STS2 system from a terminal, type SH and press **RETURN** on your keyboard to turn Off the audible alarm.

This event was written to the Event Log, if so configured.

If configured to be a latching alarm, press **RESET** on the display. If you are accessing the unit from a terminal, type CA and press **RETURN** on your keyboard.

S2 UF/OF

Source 2 Under Frequency/Over Frequency.

The frequency for Source 2 is running outside the acceptable operating range, as set in the Frequency Trip Point under User Settings. An S2 Fail alarm was also issued and source transfer has been inhibited.

Press **SILENCE** on the touchscreen to turn Off the audible alarm, if so configured. If you are accessing the

Liebert® STS2 system from a terminal, type SH and press **RETURN** on your keyboard to turn Off the audible alarm.

This event was written to the Event Log, if so configured.

If configured to be a latching alarm, press **RESET** on the display. If you are accessing the unit from a terminal, type CA and press **RETURN** on your keyboard.

S2 FAIL

Source 2 Failure.

Source 2 has failed due to under voltage (UV), over voltage (OV), or running with an over or under frequency (OF/UF). This alarm is a companion to S2 UV, S2 UV (RMS), S2 OV and S2 OF/UF.

The load of the Liebert® STS2 has been transferred to Source 1.

Press **SILENCE** on the touchscreen to turn Off the audible alarm, if so configured. If you are accessing the Liebert® STS2 system from a terminal, type SH and press **RETURN** on your keyboard to turn Off the audible alarm.

This event was written to the Event Log, if so configured.

If configured to be a latching alarm, press **RESET** on the display. If you are accessing the unit from a terminal, type CA and press **RETURN** on your keyboard.

S1 OVERCURRENT

Source 1 Overcurrent.

Vertiv™ Liebert® STS2 is running on Source 1 and an overload condition has occurred on one or more phases.

Note: The overload setpoint is a single fixed number--101%. An overload condition is detected when the measured load current is equal to or greater than the setpoint.

Press **SILENCE** on the touchscreen to turn Off the audible alarm, if so configured. If you are accessing the

Liebert® STS2 system from a terminal, type SH and press **RETURN** on your keyboard to turn Off the audible alarm.

This event was written to the Event Log, if so configured.

If configured to be a latching alarm, press **RESET** on the display. If you are accessing the unit from a terminal, type CA and press **RETURN** on your keyboard.

S2 OVERCURRENT

Source 1 Overcurrent.

Liebert® STS2 is running on Source 2 and an overload condition has occurred on one or more phases. Note: The overload setpoint is a single fixed number--101%. An overload condition is detected when the measured load current is equal to or greater than the setpoint.

Press **SILENCE** on the touchscreen to turn Off the audible alarm, if so configured. If you are accessing the Liebert® STS2 system from a terminal, type SH and press **RETURN** on your keyboard to turn Off the audible alarm.

This event was written to the Event Log, if so configured.

If configured to be a latching alarm, press **RESET** on the display. If you are accessing the unit from a terminal, type CA and press **RETURN** on your keyboard.

S1 I-PEAK

Current Peak on Source 1.

The peak current from Source 1 has exceeded the set point as defined in the I-PK Xfer Lockout setting under User Settings. Transferring to Source 2 has been inhibited.

Press **SILENCE** on the touchscreen to turn Off the audible alarm, if so configured.

If you are accessing the Liebert® STS2 system from a terminal, type SH and press **RETURN** on your keyboard to turn Off the audible alarm.

This event and the system status surrounding it have been written to a History Log if the History Logs were not already full. This event was also written to the Event Log, if so configured.

If this alarm is configured to automatically reset under the set points for User Settings, the alarm clears itself when the I-Peak condition clears.

If this alarm is set for manual reset mode, the alarm continues to show as active after the current returns to nominal, still inhibiting transfers. You will need to manually reset the alarm. If configured to be a latching alarm, press **RESET** on the display. If you are accessing the unit from a terminal, type CA and press **RETURN** on your keyboard.

S2 I-PEAK

Current Peak on Source 2.

The peak current from Source 2 has exceeded the set point as defined in the I-PK Xfer Lockout setting under User Settings. Transferring to Source 1 has been inhibited.

Press **SILENCE** on the touchscreen to turn Off the audible alarm, if so configured. If you are accessing the Liebert® STS2 system from a terminal, type SH and press **RETURN** on your keyboard to turn Off the audible alarm.

This event and the system status surrounding it have been written to a History Log if the History Logs were not already full. This event was also written to the Event Log, if so configured.

If this alarm is configured to automatically reset under the set points for User Settings, the alarm clears itself when the I-Peak condition clears.

If this alarm is set for manual reset mode, the alarm continues to show as active after the current returns to nominal, still inhibiting transfers. You will need to manually reset the alarm. If configured to be a latching alarm, press **RESET** on the display. If you are accessing the unit from a terminal, type CA and press **RETURN** on your keyboard.

SOURCES OUT OF SYNC

Sources out of synchronization.

The phase difference between Source 1 and Source 2 has exceeded the deviation as set for MANUAL MAX XFER PHASE ANGLE under User Settings.

A manual transfer cannot take place while the sources are not synchronized.

Press **SILENCE** on the touchscreen to turn Off the audible alarm, if so configured. If you are accessing the Liebert® STS2 system from a terminal, type SH and press **RETURN** on your keyboard to turn Off the audible alarm.

The event was written to the Event Log, if so configured.

If configured to be a latching alarm, press **RESET** on the display. If you are accessing the unit from a terminal, type CA and press **RETURN** on your keyboard.

LOAD ON ALT SOURCE

Vertiv™ Liebert® STS2 load on the alternate source.

The static transfer switch is running on the alternate power source. Check the Event Log to determine the reason for the transfer from the preferred source.

Another event has caused the system to transfer to the alternate source. The system returns the load to the preferred source either automatically or manually, depending on how the system is configured.

In automatic reset mode, the Liebert® STS2 automatically retransfers to the preferred source after the causal condition clears.

In manual reset mode, the system remains on the alternate source after the causal event clears until you select **RESET** from the touchscreen, or enter CA (Clear Alarms) from a service terminal.

Pressing the **RESET** button returns the unit to the preferred source. Ensure that the condition that triggered the switch has been rectified before returning to the preferred source.

Press **SILENCE** on the touchscreen to turn Off the audible alarm, if so configured. If you are accessing the

Liebert® STS2 system from a terminal, type SH and press **RETURN** on your keyboard to turn Off the audible alarm. This event was written to the Event Log, if so configured.

AUTO REXFER INHIBIT

Automatic Retransfer Inhibited.

The system made five transfers from the preferred source to the alternate source in the last five minutes.

As a result, automatic retransfers back to the preferred source is now disabled.

To clear this alarm condition, assign the alternate source as the preferred source.

This alarm also is cleared if the unit transfers to the preferred source due to an alternate source AC volt failure (i.e., an emergency transfer).

Press **SILENCE** on the touchscreen to turn Off the audible alarm, if so configured. If you are accessing the

Vertiv™ Liebert® STS2 system from a terminal, type SH and press **RETURN** on your keyboard to turn Off the audible alarm.

The event was written to the Event Log, if so configured. If configured to be a latching alarm, press **RESET** on the display. If you are accessing the unit from a terminal, type CA and press **RETURN** on your keyboard.

CB1 (S1) OPEN

Circuit Breaker 1 (for Source 1) Open.

Circuit Breaker 1 is not closed.

Check that the Circuit Breaker 1 switch is in the desired position. Press **SILENCE** on the touchscreen to turn Off the audible alarm, if so configured. If you are accessing the Liebert® STS2 system from a terminal, type SH and press **RETURN** on your keyboard to turn Off the audible alarm.

This event was written to the Event Log, if so configured.

If configured to be a latching alarm, press **RESET** on the display. If you are accessing the unit from a terminal, type CA and press **RETURN** on your keyboard.

CB2 (S2) OPEN

Circuit Breaker 2 (for Source 2) Open.

Circuit Breaker 2 is not closed.

Check that the Circuit Breaker 2 switch is in the desired position.

Press **SILENCE** on the touchscreen to turn Off the audible alarm, if so configured. If you are accessing the Liebert® STS2 system from a terminal, type SH and press **RETURN** on your keyboard to turn Off the audible alarm.

This event was written to the Event Log, if so configured.

If configured to be a latching alarm, press **RESET** on the display. If you are accessing the unit from a terminal, type CA and press **RETURN** on your keyboard.

CB4 (S1 BYP) CLOSED

Circuit Breaker 4 (Source 1 Bypass Breaker) Closed.

Circuit breaker 4 is not open. The input from Source 1 is bypassing the static transfer switch.

Press **SILENCE** on the touchscreen to turn Off the audible alarm, if so configured. If you are accessing the Liebert® STS2 system from a terminal, type SH and press **RETURN** on your keyboard to turn Off the audible alarm.

This event was written to the Event Log, if so configured.

If configured to be a latching alarm, press **RESET** on the display. If you are accessing the unit from a terminal, type CA and press **RETURN** on your keyboard.

CB5 (S1 BYP) CLOSED

Circuit Breaker 5 (Source 2 Bypass Breaker) Closed.

Circuit breaker 5 is not open. The input from Source 2 is bypassing the static transfer switch.

Press **SILENCE** on the touchscreen to turn Off the audible alarm, if so configured. If you are accessing the Liebert® STS2 system from a terminal, type **SH** and press **RETURN** on your keyboard to turn Off the audible alarm.

This event was written to the Event Log, if so configured.

If configured to be a latching alarm, press **RESET** on the display. If you are accessing the unit from a terminal, type **CA** and press **RETURN** on your keyboard.

CB3 (OUTPUT) OPEN

Circuit Breaker 3 (Output breaker) Open.

Circuit breaker 3 is not closed. This circuit breaker is assigned to the output load. The power flow to the load cannot flow through the static transfer switch.

Press **SILENCE** on the touchscreen to turn Off the audible alarm, if so configured. If you are accessing the Liebert® STS2 system from a terminal, type **SH** and press **RETURN** on your keyboard to turn Off the audible alarm.

This event was written to the Event Log, if so configured.

If configured to be a latching alarm, press **RESET** on the display. If you are accessing the unit from a terminal, type **CA** and press **RETURN** on your keyboard.

CB3A (OUTPUT) OPEN

Circuit Breaker 3A (Output breaker) is Open (Optional).

Circuit breaker 3A is not closed. This circuit breaker is assigned to the output load. The power flow to the load cannot flow through the static transfer switch.

Press **SILENCE** on the touchscreen to turn Off the audible alarm, if so configured. If you are accessing the Vertiv™ Liebert® STS2 system from a terminal, type **SH** and press **RETURN** on your keyboard to turn Off the audible alarm.

This event was written to the Event Log, if so configured.

If configured to be a latching alarm, press **RESET** on the display. If you are accessing the unit from a terminal, type **CA** and press **RETURN** on your keyboard.

S1 PHASE ROT ERROR

Source 1 Phase Rotation Error.

A phase rotation error condition exists on Source 1. Check the phase sequence (ABC) of Source 1. Transferring to Source 1 has been inhibited.

Press **SILENCE** on the touchscreen to turn Off the audible alarm, if so configured. If you are accessing the Liebert® STS2 system from a terminal, type **SH** and press **RETURN** on your keyboard to turn Off the audible alarm.

This event was written to the Event Log, if so configured. If configured to be a latching alarm, press **RESET** on the display. If you are accessing the unit from a terminal, type CA and press **RETURN** on your keyboard.

S2 PHASE ROT ERROR

Source 2 Phase Rotation Error.

A phase rotation error condition exists on Source 2. Check the phase sequence (ABC) of Source 2.

Transferring to Source 1 has been inhibited.

Press **SILENCE** on the touchscreen to turn Off the audible alarm, if so configured. If you are accessing the

Liebert® STS2 system from a terminal, type SH and press **RETURN** on your keyboard to turn Off the audible alarm.

This event was written to the Event Log, if so configured.

If configured to be a latching alarm, press **RESET** on the display. If you are accessing the unit from a terminal, type CA and press **RETURN** on your keyboard.

TRANSFER INHIBITED

Transfer Inhibited.

Uninterrupted transfer between sources is inhibited due to input source failure, sources out of sync, switch failure, or the unit is in bypass mode.

Check the Event Log for the event or events that may have caused the alarm.

Press **SILENCE** on the touchscreen to turn Off the audible alarm, if so configured. If you are accessing the Vertiv™ Liebert® STS2

system from a terminal, type SH and press **RETURN** on your keyboard to turn Off the audible alarm.

This event was written to the Event Log, if so configured.

If configured to be a latching alarm, press **RESET** on the display. If you are accessing the unit from a terminal, type CA and press **RETURN** on your keyboard.

OUTPUT UV

Output Undervoltage.

The voltage being supplied to the load has dropped below the acceptable nominal voltage. Check the input voltage from both sources.

This event and the system status surrounding it have been written to a History Log if the History Logs were not already full. This event was also written to the Event Log, if so configured.

Press **SILENCE** on the touchscreen to turn Off the audible alarm, if so configured. If you are accessing the

Liebert® STS2 system from a terminal, type SH and press **RETURN** on your keyboard to turn Off the audible alarm.

If configured to be a latching alarm, press **RESET** on the display. If you are accessing the unit from a terminal, type CA and press **RETURN** on your keyboard.

INPUT CONTACT 1

Input Contact Isolator 1. Occurrence of the indicated external event has been detected by Input Contact Isolator 1 of the Open Comms Digital Input option board.

Press **SILENCE** on the touchscreen to turn Off the audible alarm, if so configured. If you are accessing the Liebert® STS2 system from a terminal, type SH and press **RETURN** on your keyboard to turn Off the audible alarm.

The event, with its assigned name, was written to the Event Log, if so configured. If configured to be a latching alarm, press **RESET** on the display. If you are accessing the unit from a terminal, type CA and press **RETURN** on your keyboard.

INPUT CONTACT 2

Input Contact Isolator 2.

Occurrence of the indicated external event has been detected by Input Contact Isolator 2 of the Open Comms Digital Input option board.

Press **SILENCE** on the touchscreen to turn Off the audible alarm, if so configured. If you are accessing the Vertiv™ Liebert® STS2 system from a terminal, type SH and press **RETURN** on your keyboard to turn Off the audible alarm.

The event, with its assigned name, was written to the Event Log, if so configured.

If configured to be a latching alarm, press **RESET** on the display. If you are accessing the unit from a terminal, type CA and press **RETURN** on your keyboard.

INPUT CONTACT 3

Input Contact Isolator 3.

Occurrence of the indicated external event has been detected by Input Contact Isolator 3 of the Open Comms Digital Input option board.

Press **SILENCE** on the touchscreen to turn Off the audible alarm, if so configured. If you are accessing the Liebert® STS2 system from a terminal, type SH and press **RETURN** on your keyboard to turn Off the audible alarm.

The event, with its assigned name, was written to the Event Log, if so configured.

*If configured to be a latching alarm, press **RESET** on the display. If you are accessing the unit from a terminal, type CA and press **RETURN** on your keyboard.*

INPUT CONTACT 4

Input Contact Isolator 4.

Occurrence of the indicated external event has been detected by Input Contact Isolator 4 of the Open Comms Digital Input option board.

Press **SILENCE** on the touchscreen to turn Off the audible alarm, if so configured. If you are accessing the Liebert® STS2 system from a terminal, type SH and press **RETURN** on your keyboard to turn Off the audible alarm.

The event, with its assigned name, was written to the Event Log, if so configured.

If configured to be a latching alarm, press **RESET** on the display. If you are accessing the unit from a terminal, type CA and press **RETURN** on your keyboard.

INPUT CONTACT 5

Input Contact Isolator 5.

Occurrence of the indicated external event has been detected by Input Contact Isolator 5 of the Open Comms Digital Input option board.

Press **SILENCE** on the touchscreen to turn Off the audible alarm, if so configured. If you are accessing the Liebert® STS2 system from a terminal, type SH and press **RETURN** on your keyboard to turn Off the audible alarm.

The event, with its assigned name, was written to the Event Log, if so configured.

If configured to be a latching alarm, press **RESET** on the display. If you are accessing the unit from a terminal, type CA and press **RETURN** on your keyboard.

INPUT CONTACT 6

Input Contact Isolator 6.

Occurrence of the indicated external event has been detected by Input Contact Isolator 6 of the Open Comms Digital Input option board.

Press **SILENCE** on the touchscreen to turn Off the audible alarm, if so configured. If you are accessing the Vertiv™ Liebert® STS2 system from a terminal, type SH and press **RETURN** on your keyboard to turn Off the audible alarm.

The event, with its assigned name, was written to the Event Log, if so configured.

If configured to be a latching alarm, press **RESET** on the display. If you are accessing the unit from a terminal, type CA and press **RETURN** on your keyboard.

INPUT CONTACT 7

Input Contact Isolator 7.

Occurrence of the indicated external event has been detected by Input Contact Isolator 7 of the Open Comms Digital Input option board.

Press **SILENCE** on the touchscreen to turn Off the audible alarm, if so configured. If you are accessing the Liebert® STS2 system from a terminal, type SH and press **RETURN** on your keyboard to turn Off the audible alarm.

The event, with its assigned name, was written to the Event Log, if so configured.

If configured to be a latching alarm, press **RESET** on the display. If you are accessing the unit from a terminal, type CA and press **RETURN** on your keyboard.

INPUT CONTACT 8

Input Contact Isolator 8.

Occurrence of the indicated external event has been detected by Input Contact Isolator 8 of the Open Comms Digital Input option board.

Press **SILENCE** on the touchscreen to turn Off the audible alarm, if so configured. If you are accessing the Liebert® STS2 system from a terminal, type SH and press **RETURN** on your keyboard to turn Off the audible alarm.

The event, with its assigned name, was written to the Event Log, if so configured.

If configured to be a latching alarm, press **RESET** on the display. If you are accessing the unit from a terminal, type CA and press **RETURN** on your keyboard.

CONFIG MODIFIED

Configuration Modified.

A set point has been updated and saved.

Press **SILENCE** on the touchscreen to turn Off the audible alarm, if so configured. If you are accessing the Vertiv™ Liebert® STS2 system from a terminal, type SH and press **RETURN** on your keyboard to turn Off the audible alarm.

The event was written to the Event Log, if so configured.

If configured to be a latching alarm, press **RESET** on the display. If you are accessing the unit from a terminal, type CA and press **RETURN** on your keyboard.

PASSWORD CHANGED

Access Password Changed.

The password for accessing the HMI (touchscreen) options has been updated and saved.

Press **SILENCE** on the touchscreen to turn Off the audible alarm, if so configured. If you are accessing the Liebert® STS2 system from a terminal, type SH and press **RETURN** on your keyboard to turn Off the audible alarm.

The event was written to the Event Log, if so configured.

If configured to be a latching alarm, press **RESET** on the display. If you are accessing the unit from a terminal, type CA and press **RETURN** on your keyboard.

TIME REPROGRAMMED

System Time Reprogrammed.

The system's time setting has been updated and saved.

Press **SILENCE** on the touchscreen to turn Off the audible alarm, if so configured. If you are accessing the Liebert® STS2 system from a terminal, type SH and press **RETURN** on your keyboard to turn Off the audible alarm.

The event was written to the Event Log, if so configured.

If configured to be a latching alarm, press **RESET** on the display. If you are accessing the unit from a terminal, type CA and press **RETURN** on your keyboard.

DATE REPROGRAMMED

System Date Reprogrammed.

The system's date setting has been updated and saved.

Press **SILENCE** on the touchscreen to turn Off the audible alarm, if so configured. If you are accessing the Liebert® STS2 system from a terminal, type SH and press **RETURN** on your keyboard to turn Off the audible alarm.

The event was written to the Event Log, if so configured.

If configured to be a latching alarm, press **RESET** on the display. If you are accessing the unit from a terminal, type CA and press **RETURN** on your keyboard.

EVENT LOG CLEARED

Event Log Cleared.

All past alarms and faults are no longer recorded in the system's event log.

Press **SILENCE** on the touchscreen to turn Off the audible alarm, if so configured. If you are accessing the

Vertiv™ Liebert® STS2 system from a terminal, type SH and press **RETURN** on your keyboard to turn Off the audible alarm.

This event was written to the Event Log, if so configured.

If configured to be a latching alarm, press **RESET** on the display. If you are accessing the unit from a terminal, type CA and press **RETURN** on your keyboard.

HIST LOGS CLEARED

History

Logs Cleared.

Both History Logs have been erased and the logs are now available to record future events.

Press **SILENCE** on the touchscreen to turn Off the audible alarm, if so configured. If you are accessing the Liebert® STS2 system from a terminal, type SH and press **RETURN** on your keyboard to turn Off the audible alarm.

The event was written to the Event Log, if so configured.

If configured to be a latching alarm, press **RESET** on the display. If you are accessing the unit from a terminal, type CA and press **RETURN** on your keyboard.

HIST LOGS FULL

History Logs Full.

The history buffer has reached its capacity for both history logs. No further history logs can be written until the logs are cleared. The History Logs were frozen by the occurrence of two designated faults or alarms.

Both history logs have been frozen by significant events. These logs contain valuable diagnostic data regarding those events which may be useful if service is required. Once the logs have been analyzed and the causes for freezing them have been resolved, the history logs should be cleared to make them available for capturing future events.

To clear the History Logs, select the *CLEAR HLOG* button under the LOGS > HISTORY LOG 1 or LOGS > HISTORY LOG 2 menus to clear the History Status buffer after the alarms have been resolved.

If you are accessing the unit from a terminal, type CHL and press **RETURN** to clear the History Logs.

Press **SILENCE** on the touchscreen to turn Off the audible alarm, if so configured. If you are accessing the Liebert® STS2 system from a terminal, type SH and press **RETURN** on your keyboard to turn Off the audible alarm.

The event was written to the Event Log, if so configured.

If configured to be a latching alarm, press **RESET** on the display. If you are accessing the unit from a terminal, type CA and press **RETURN** on your keyboard.

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16 Maintenance



WARNING! Only properly trained and qualified service personnel should perform maintenance on the static switch. Lethal voltages exist inside the unit during normal operation. The unit is supplied by multiple AC power sources. Disconnect and lock-out all power sources before working inside unit.

NOTE: While the unit is energized use Snubber Board LEDs DS1-6 (Source 1) and DS12-17 (Source 2) are lit to verify status of the preload/surge fuse prior to working on the unit or on upstream equipment without isolating the STS2.

Minimal periodic maintenance of the Vertiv™ Liebert® STS2 is required. As with all electrical distribution components, the system should be regularly inspected for electrical connection integrity, signs of excessive temperatures, dirt accumulation, and proper system operation.

16.1 Proper Tightening of Nuts and Bolts

The recommended tightening torque for all nuts and bolts is as shown below, unless otherwise labeled. All power connections are designed to remain at proper torque throughout the lifetime of the unit.

Table 16.1 Torque Tightening

Bolt Shaft Size	Grade 5 - Imperial Grade 8.8 - Metric, In-lb (Nm)	Electrical Connections With Belleville Washers, lbf/in (Nm) *	
		One Belleville Washer	Two Belleville Washers
10-32	25 (3)	—	—
1/4-20	53 (6)	40 (4.5)	80 (9.0)
5/16-18	107 (12)	80 (9.0)	160 (18.0)
3/8-16	192 (22)	120 (13.6)	240 (27.1)
1/2-13	428 (48)	480 (54.2)	—
* Torque values are ±10%.			

16.2 Testing the Liebert® STS2

The Liebert® STS2 includes comprehensive system alarms and fault detection to identify operational problems. To increase the degree of confidence of proper system operation, periodic transfer tests can be easily performed. For instructions for changing the preferred source and switching sources:

For a Color Graphical Display unit, See [Manual Transfer/Preferred Source Selection](#) on page 45.

16.3 Changing the Air Filter

A standard furnace filter is installed behind the air intake in the front door. The air filter dimensions are 535 mm X 1310 mm or 21.1 in. X 51.6 in. The air intake allows air to circulate to cool the unit. Replace the filter when it becomes dirty and impedes air flow. The frequency of changing or cleaning the filter depends on the location in which the unit is located.

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SL-70775_REVH_07-25