PowerSwitch 7000

User Manual

160 A to 630 A, 50/60 Hz

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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™ PowerSwitch 7000.

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.

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

The PowerSwitch 7000 is suitable for indoor use only. 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.

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 STS, 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™ PowerSwitch 7000 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 PowerSwitch 7000 installed and running.

Read the entire manual before proceeding with the unpacking and installation of the PowerSwitch 7000.

The major sections are as follows:

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

Support Information: A blank table in which you can enter pertinent data, such as the serial and part numbers, needed when calling Vertiv for technical support.

Programmable Relay Board (PRB) Settings Record: A blank table in which you can document your PRB settings.

Input Contact Isolator (ICI) Settings Record: A blank table in which you can document your ICI settings.

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

Unpacking and Inspections: Provides instructions for inspecting, unloading, handling and removing the PowerSwitch 7000 from the shipping pallet.

Location Considerations: Provides information regarding environmental considerations for where the PowerSwitch 7000 is installed.

Locating the PowerSwitch 7000: Provides instructions for anchoring the unit to the floor, should that be required.

Power and Control Wiring: Provides instructions wiring the PowerSwitch 7000 for power and control connections.

Options: Lists the options available for the PowerSwitch 7000.

Installation Drawings: Provides outline, seismic and electrical field connection drawings required for installing the PowerSwitch 7000.

Introduction to PowerSwitch 7000 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.

PowerSwitch 7000 Touchscreen Display: Provides instructions for using the HMI touchscreen interface for monitoring and managing the PowerSwitch 7000.

Specifications: Provides specifications for the PowerSwitch 7000.

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 Vertiv™ PowerSwitch 7000.

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 PowerSwitch 7000 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 PowerSwitch 7000. 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.

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

1.3 Physical Security

This product is designed and intended to be deployed and operated in a physically secure and network firewall-protected location. Vertiv recommends a review of the physical security and operating environment of the unit. Since an attacker or disgruntled user can cause serious disruption, below are some recommended best practices that include, but are not limited to:

- Restrict access to areas, racks, and units with encrypted card RFID/badges, unique multi-factor passcode authentication for access, man traps, and biometric scanners for physical access to the equipment.
- Have trusted and background-checked security guards with 24x7x365 physical presence and written logs to help document and note physical access to a data center, building, rack, and so on.
- Restrict physical access to telecommunications equipment and network cabling. Physical access to the telecommunications lines and network cabling should be restricted to protect against attempts to intercept or sabotage communications. Best practices include use of metal conduits for the network cabling running between equipment cabinets.
- All USB, RJ45, and/or any other physical ports should be restricted on the units.

- Do not connect removable media (such as USB devices, SD cards, and so on) for any operation (such as firmware upgrade, configuration change, or boot application change) unless the origin of media is known and trusted. Before connecting any portable device through a USB port or SD card slot, scan the device for malware and viruses.

2 Unpacking and Inspections

NOTE: Read the entire manual before installing and operating the unit. Upon receipt of the Vertiv™ PowerSwitch 7000, the installer should perform the following steps to ensure a high-quality installation.

A high quality installation begins on the receiving dock. The PowerSwitch 7000 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 PowerSwitch 7000.

2.1 External Inspections

1. While the PowerSwitch 7000 is still on the truck, inspect the equipment and shipping containers 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 -30 °C to 70 °C (-22 °F to 158 °F). 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.

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

See Unit Preparation on the next page for instruction on removing the PowerSwitch 7000 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 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 shown in Figure 7.1 on page 17. Typical unit weights are:

- 160 A to 630 A: 477 kg (1052 lbs).

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 7.

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™ PowerSwitch 7000 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 PowerSwitch 7000 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 PowerSwitch 7000 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 cabinets.
5. Check for any unsafe condition that may be a potential safety hazard.

After the PowerSwitch 7000 has been inspected and no problems are found, the unit can be moved to its installation location.

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

3 Location Considerations

The Vertiv™ PowerSwitch 7000 should be placed in a clean, cool and dry location. The PowerSwitch 7000 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 and Operation on page 17.

3.1 Recommended Minimum Service Clearances

The recommended service clearances are at the front of the unit. The minimum front service clearance required is 914 mm (36 in.). A site layout review is required to determine any additional clearance requirements. Clearance of at least 457 mm (18 in.) above the unit is required for cooling air flow.

3.2 Heat Output

The unit produces minimal heat during normal operation.

Table 3.1 Heat Output

Switch Size (A)	Heat Output BTU/Hr (kW)
160	3296.54 (0.97)
250	4376.02 (1.28)
400	6347.03 (1.86)
600	9471.07 (2.78)
630	9899.23 (2.9)

3.3 Operating Environment

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

Parameter	Range
Storage temperature	-40 °C to +70 °C (-40 °F to 158 °F) maximum
Operating temperature (convection cooled)	0 °C to 25 °C (32 °F to 77 °F)
Operating temperature (fan cooled)	0 °C to 40 °C (32 °F to 104 °F)
Relative humidity	0 to 95% without condensation
Operating altitude	Up to 1200 m (4000 ft.) above sea level without derating. Above 1200 m (4000 ft.), output current is derated by 6% per 1000 ft. (18% per 1000 m).
Storage/Transport altitude	Up to 12200 m (40000 ft.) above sea level
Audible noise	Less than 70 dBA at 1.5 m (5 ft.) with audible alarm Off

3.4 Altitude

The convection cooled units are designed for full load operation up to 1200 meters (4000ft) above sea level. Above 1200 meters, the output is derated by 1% per 1000 feet.

The fan cooled units are designed for full load operation up to 1200 meters (4000ft) above sea level. Above 1200 meters, the output is derated by 1.5% per 1000 feet.

Operation at full load at a higher temperature can be accommodated in ambient temperature less than 40°C (104°F) ambient for forced air units and 25°C (77°F) for convection cooled units. . Figure 3.1 below and Figure 3.2 on the facing page below shows the altitude derate charts for 40°C (104°F) ambient for fan cooled and 25°C (77°F) ambient for convection cooled.

Figure 3.1 PowerSwitch 7000 Forced Air Derate Curve at 40C Ambient

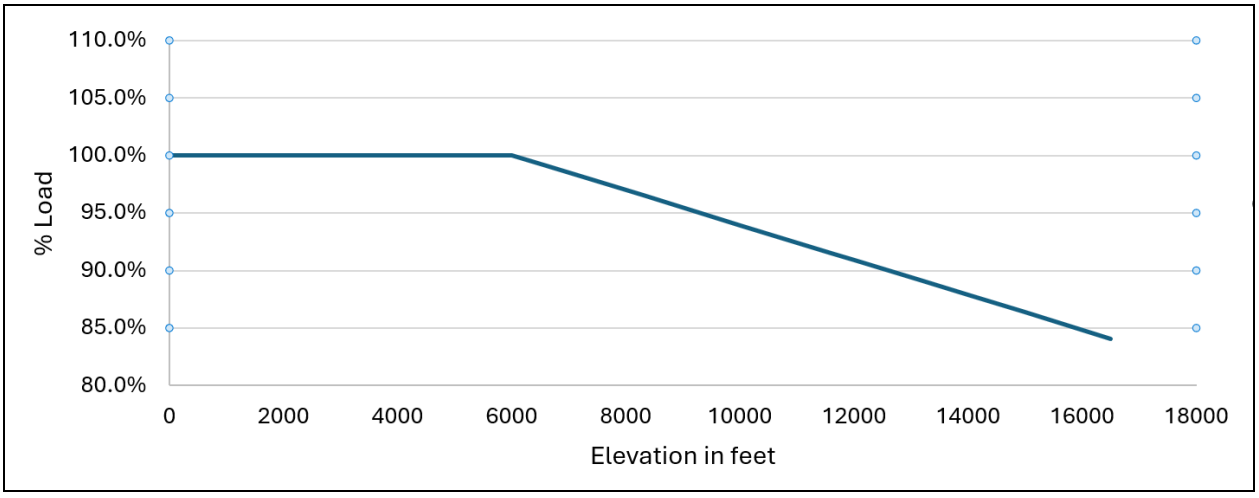
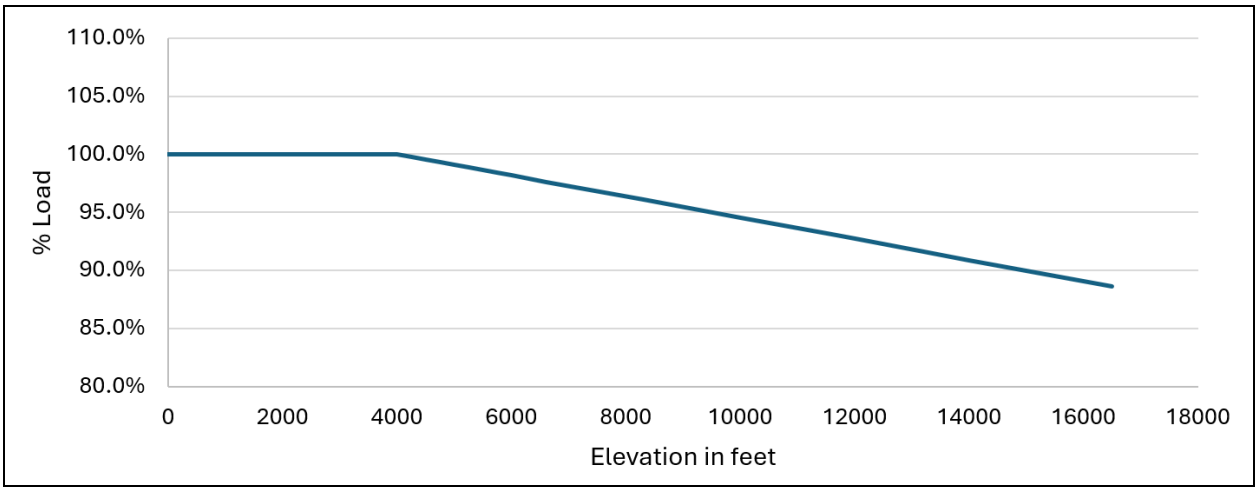


Figure 3.2 PowerSwitch 7000 Natural Convection Derate Curve at 25C Ambient



3.5 Withstand Rating

The Vertiv™ PowerSwitch 7000 achieves a perspective short circuit withstand rating of 65 kA RMS. The PowerSwitch 7000 achieves this stated withstand rating only with external fuses installed upstream that have the specified or lower let-through current rating. Refer to submittal drawing PS7-03-S001 and PS7-03-S002 for fuse details.

3.6 External Protective Devices

Circuit breakers with shunt trip are required to be installed upstream of the PowerSwitch 7000. The PowerSwitch 7000 relies on these circuit breakers for overcurrent protection and proper system functionality. Circuit breakers should have ampacity equal to or less than the ampere rating of the PowerSwitch 7000. Wire the shunt trip connections of the upstream circuit breaker to the external shunt trip terminal block of the PowerSwitch 7000. Refer to submittal drawing PS7-19-S008 for details.

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4 Anchoring the Vertiv™ PowerSwitch 7000

This section provides instructions for anchoring the PowerSwitch 7000 and anchoring the unit to the floor, should that be required.

4.1 Anchoring the Unit to the Floor

PowerSwitch 7000 shall be provided with optional seismic anchors to fasten the unit to a concrete floor to meet seismic IEC 693-2005 requirements.

Refer to submittal drawing PS7-17-S001 for instructions and details for installing seismic anchoring.

The PowerSwitch 7000 may be secured to a concrete using 4X M10 concrete anchors (field supplied).

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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 IEC 60364 and both national and local electrical code/normative.

The busbars are accessible through the front of the Vertiv™ PowerSwitch 7000.

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

Refer to submittal drawings PS7-05-S004, PS7-05-S006, PS7-05-S007, and PS7-19-S001 for control wiring details.

5.1 Input and Output Power Connections

Power connections are made to the busbars provided inside the unit. These busbars are accessible through the front of the unit.

Refer to submittal drawings PS7-05-S004, PS7-05-S006, and PS7-05-S007 for details on the busbars.

5.1.1 Grounding

The PowerSwitch 7000 operates from sources that are solidly grounded or impedance grounded. The unit must not be used on corner-grounded delta systems.

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 PowerSwitch 7000 should be from two independent sources to avoid a common source failure.

To ensure proper operation of the PowerSwitch 7000, 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 30 degrees.

Refer to submittal drawings PS7-01-S002 for typical STS one-line diagram.

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

The rotary switches connected to the Vertiv™ PowerSwitch 7000 are non-automatic switches that rely on the upstream and/or load overcurrent protection. Upstream overcurrent protection is required and should be rated equal or less than the rating of the PowerSwitch 7000 rotary 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 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 IEC 60364 normative and both local and national 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, the input power sources must be properly grounded. Because the neutral is not switched by the Vertiv™ PowerSwitch 7000, the neutrals of the two power sources are solidly interconnected. The national codes 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 national codes.

3-Wire-Systems: When 3-wire input feeds are utilized, the input power sources must be properly grounded. Because there is no neutral in a 3-wire system, each power source should be grounded at a single point in accordance with the national codes.

5.3 Control Wiring Connections

No control wiring is needed on the standard PowerSwitch 7000. Only certain options require external control wiring. See Options on page 15 for details.

5.4 Power Supply

The PowerSwitch 7000 is supplied with redundant power supplies that are designed to operate from a voltage range of 380 V to 415 V. 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.

6 Options

This section discusses the options available for the Vertiv™ PowerSwitch 7000. The communications options are also discussed in Communication Interfaces on page 45.

6.1 Programmable Relay Board

The PRB provides a means to trigger an external device when an event occurs in the PowerSwitch 7000. Each PRB has eight channels. Each channel has one set of Form-C dry contacts.

Any alarm/event can be programmed to any channel. One event can be programmed to a relay. The same alarm/event can be programmed to more than one channel. Up to two PRB can be installed in the PowerSwitch 7000 for a total of 16 channels. Programming is performed through the touchscreen control panel.

6.2 Input Contact Isolator Board

The ICI board provides an PowerSwitch 7000 module interface for up to eight external user alarm or message inputs to be routed through the PowerSwitch 7000 alarm network. The eight contacts can be configured as Form A or Form B contacts through the Touchscreen Control Panel. When a contact closes, an event is triggered.

The ICI options are configured through the ICI screen found under the setup menu on the display. The setting is found under Setup > Menu > Input Contacts.

Refer to submittal drawing PS7-19-S001 for location of the ICI. See Installation and Operation on page 17 for wiring details.

6.3 Vertiv™ Liebert® IntelliSlot™ RDU120

The PowerSwitch 7000 can be supplied with an optional Liebert® IntelliSlot™ RDU120 Card for remote communication using two of the following protocols: HTTP/HTTPS, Velocity Protocol, Email, SMS, SNMP v1/v2c/v3, BACnet IP/MSTP and Vertiv™ Liebert® Modbus TCP/RTU output. The Liebert® IntelliSlot™ RDU120 shall support a 1 GB ethernet network interface. A serial RS-485 two wire connector shall be supplied.

NOTE: Two of the 3rd party protocols (SNMP, Modbus, or BACnet) may be configured and used simultaneously. Vertiv™ Liebert® Modbus RTU and Vertiv™ Liebert® BACnet MSTP cannot both be enabled simultaneously.

6.4 Remote Source Selection Wiring

An optional Remote Source Selection (RSS) feature can be purchased. Refer to submittal drawing PS7-19-S001 for location of the RSS terminal block and PS7-19-S004 for control wiring information.

The RSS 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 RSS are active at the same time, with the PowerSwitch 7000 following the last request for a preferred source change, regardless of whether it was from the local or RSS controls.

A six pin terminal block provides the RSS 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.

RSS can be disabled through the Touchscreen Control Panel by going to Setup > Menu > Settings > Unit > Remote Source Select Enabled (No).

6.5 Transfer Inhibit

Transfer Inhibit prevents the PowerSwitch 7000 from transferring under certain conditions. When a customer-supplied closed dry contact is provided, the PowerSwitch 7000 will not transfer and remain on its present source even if the source is no longer supplying power.

6.6 Seismic Floor Anchors

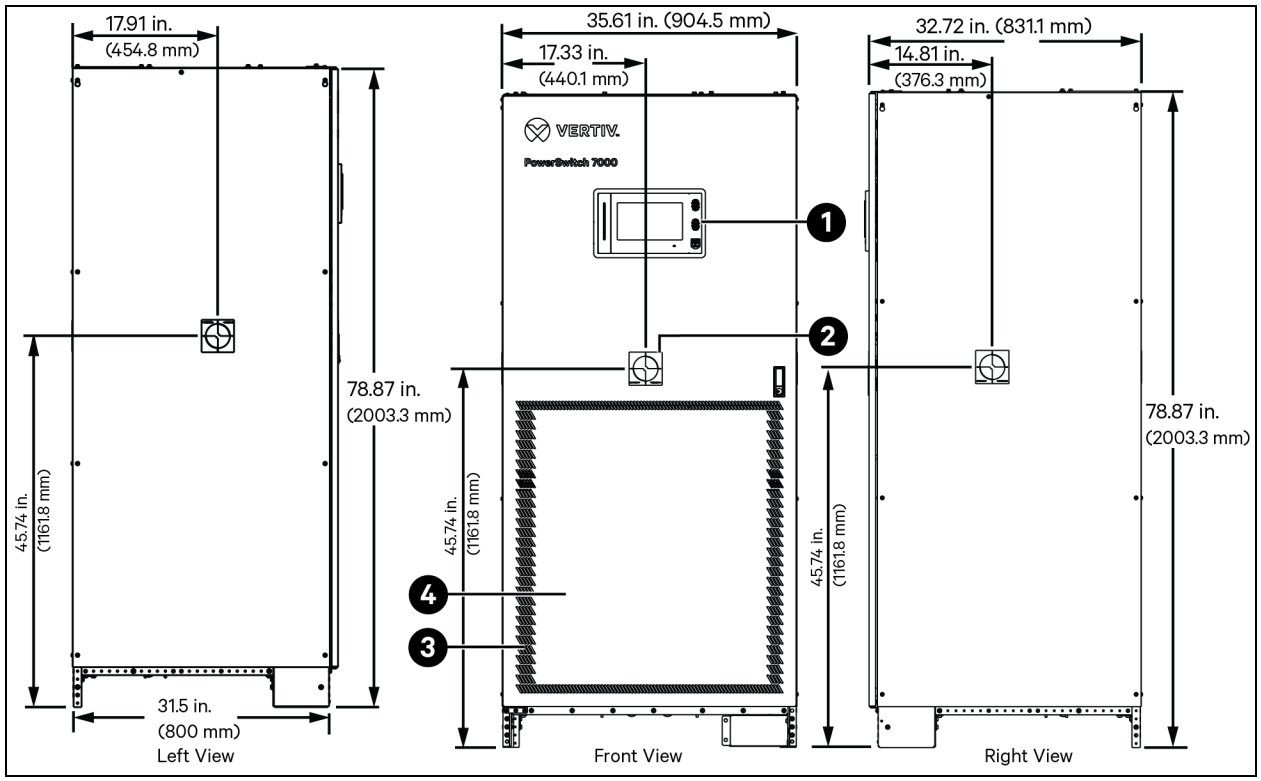
Seismic anchors are available for anchoring the unit to a concrete floor to meet seismic Zone 4 requirements. See Anchoring the Unit to the Floor on page 11 for more information.

6.7 Password Lockout

Password protection shall be used to lock out of the touchscreen display to prevent manual transfers and configuration changes. When locked out, the touch screen becomes a read-only display and a password is required to do manual transfers or change settings. The alarm silence button shall not be disabled when in the lockout position.

7 Installation and Operation

Figure 7.1 Outline Drawing: 160 A to 630 A Vertiv™ PowerSwitch 7000

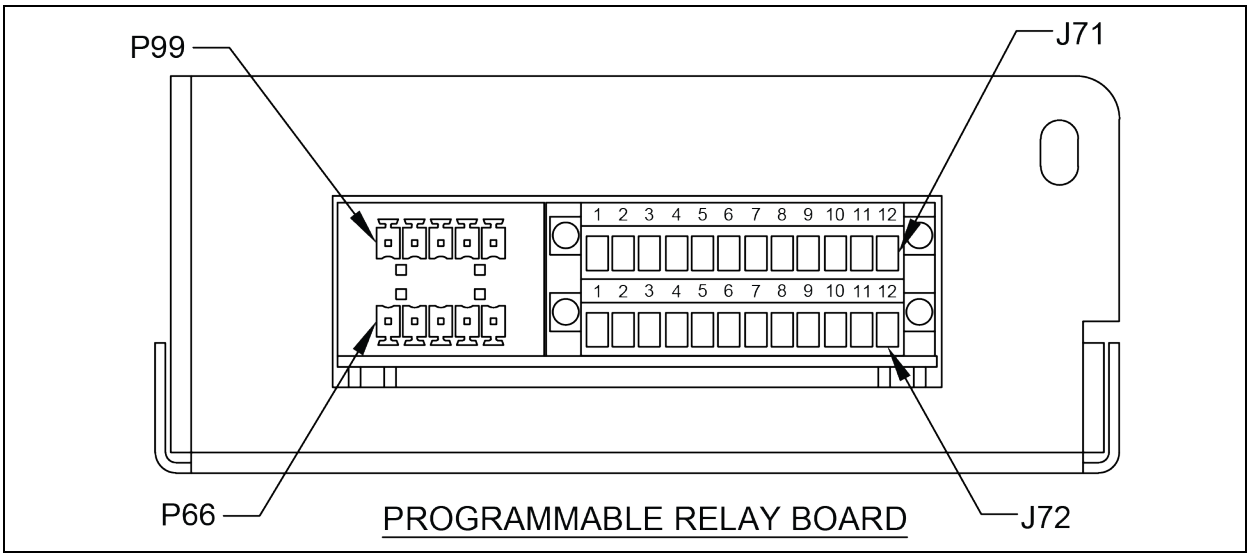


Item	Description
1	Display
2	Center of Gravity
3	Air intake area CAUTION: Do not block air filter.
4	Area filled with perforation

Note to Figure:

1. All Dimensions are in inches (mm).
2. 457 mm (18 in.) Minimum Clearance above unit is required for air exhaust.
3. 914 mm (36 in.) 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. Disposable type, size: 350 mm x 762 mm x 8 mm (14 in. x 30 in. x 0.3 in.)

Figure 7.2 Control Wiring for the Programmable Relay Board Option



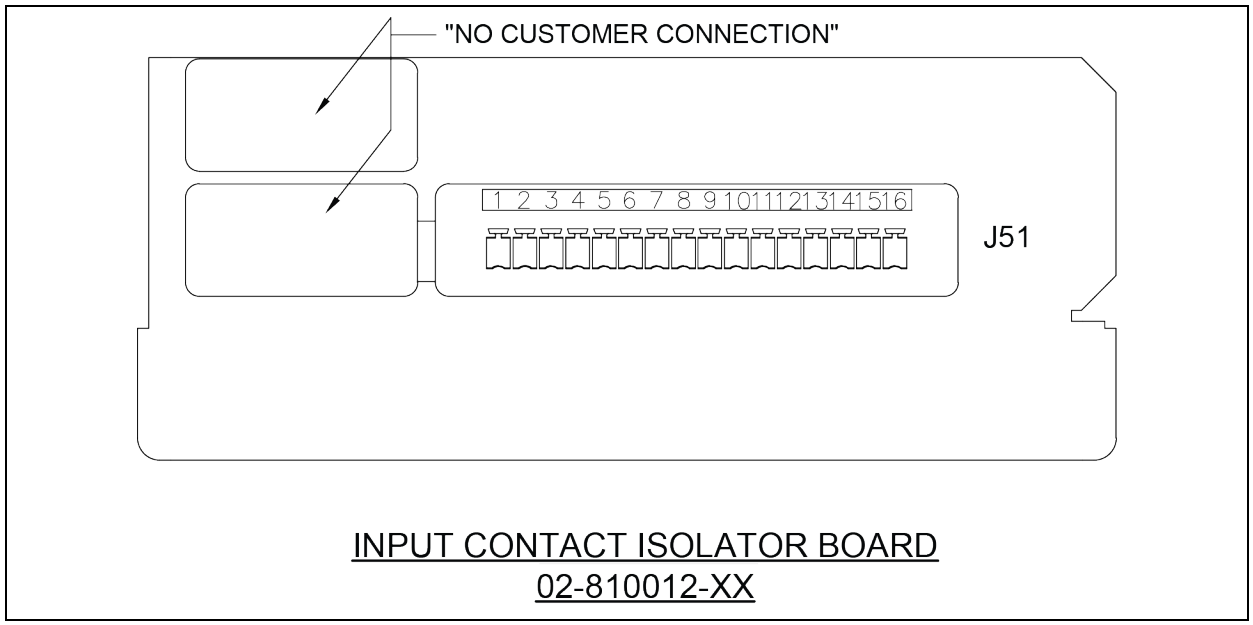
Note to Figure:

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. Refer to accompanying text to configure 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 program relay board option.
6. Contact ratings: 1 A at 30 VDC, 400 mA at 125 VAC.
7. Maximum cable length 152 m (500 ft.) 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 7.3 Control Wiring for the ICI Board Option



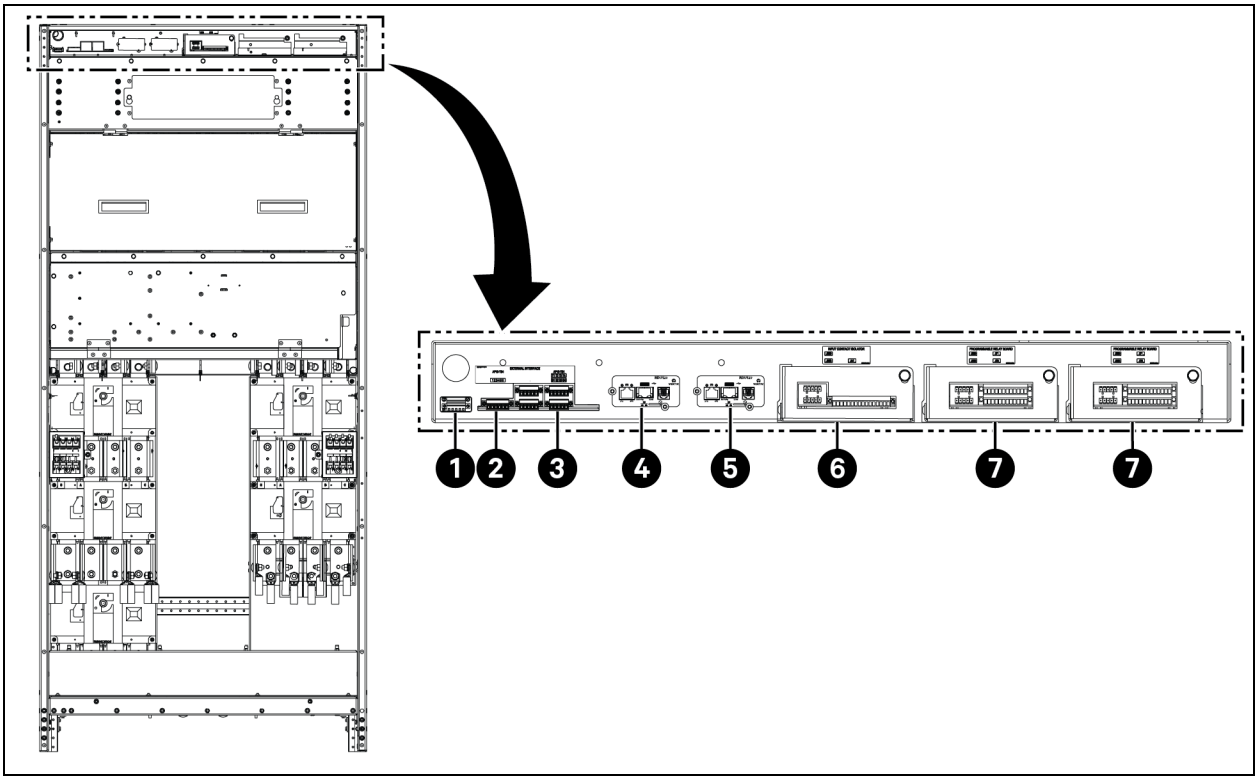
Note to Figure:

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. Refer to 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. Signal voltage: 100 mA at 12 VDC.
6. Maximum cable length 152 m (500 ft.) with #16 AWG flexible, stranded cable.
7. All wiring must be in accordance with national and local electrical codes.
8. 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
3	5	7	13
	6		14
4	7	8	15
	8		16

Figure 7.4 Control Connection Location Diagram: 800 A to 1000 A



Item	Description
1	External shunt trips (S1 and S2)
2	Remote controls package • RSS • Remote transfer inhibit
3	Remote EPO
4	RDU120 network/communication card #1. See note 3.
5	RDU120 network/communication card #2. See note 3.
6	ICI board
7	PRB #1. See note 2.

Notes to Figure:

1. Typical option are shown
2. Maximum of two PRBs may be used
3. Maximum of two RDU120 communication card may be used

Refer to submittal drawings PS7-05-S013 for conduit plate details.

Refer to submittal drawing PS7-19-S004 for information on the control wiring for the remote source select option.

Refer to submittal drawing PS7-19-S005 for information on the control wiring for the Vertiv™ Liebert® IntelliSlot™ RDU120.

Refer to submittal drawing PS7-19-S008 for information on the control wiring for the external shunt trip connections.

8 Introduction to Vertiv™ PowerSwitch 7000 Operations

8.1 System Description

A PowerSwitch 7000 provides an automatic, seamless transfer between input power sources to an output load. The PowerSwitch 7000 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 PowerSwitch 7000 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.

If a problem is detected with a primary (Preferred) input source and defined trigger points are reached, the PowerSwitch 7000 automatically switches the input to the other (Alternate) input source. The PowerSwitch 7000 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 PowerSwitch 7000 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 PowerSwitch 7000, active alarms, startup, and bypass instructions.

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 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 PowerSwitch 7000 through an Vertiv™ Liebert® IntelliSlot™ RDU120 card, a PRB, a contact isolator.

8.1.1 Redundancy

Redundancy within the Vertiv™ PowerSwitch 7000 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 PowerSwitch 7000 has two input sources, no single component failure can cause a loss of power to the load. There shall be two separate DC buses, one from each power supply, to provide redundancy throughout the controls.

The PowerSwitch 7000 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 web interface, if available.

If the STS Control board fails, the active source gate drive logic will maintain operation on the current source. But no transfers will occur.

If the GHMI fails, the control board and gate drive board will continue to operate as usual including transfers.

If the GHMI fails, the current state of the unit can be determined from either, the status LEDs on the control board or the active source LEDs on the gate drive boards.

8.1.2 Reliability and Agency Requirements

The Vertiv™ PowerSwitch 7000 is designed for high reliability and high availability with a critical bus Mean Time Between Failure (MTBF) exceeding 1000000 hours.

The PowerSwitch 7000, Control/Power Module and all its options are designed, tested, and certified, where applicable, to meet agency requirements as follows:

- Institute of Electrical and Electronics Engineers (IEEE)
- IEC 62310-1
- ISO 9001
- National Electrical Code (NEC)
- IEC 60364 series
- National Electrical Manufacturers Association (NEMA)
- National Fire Protection Association (NFPA 70)
- American National Standards Institute (ANSI)
- Electromagnetic Compatibility (EMC) emission limits for Category Class 3 computing devices and the emission limits of IEC 62310-2
- Withstand without mis-operation or damage the immunity levels for Category C3 disturbances of IEC 62310-2

The PowerSwitch 7000 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 PowerSwitch 7000 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 power sources to and from the PowerSwitch 7000 unit must be completely disconnected and secured using proper lockout tagout (LOTO) procedures before beginning any switch replacement work. 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 64. All power sources to and from the PowerSwitch 7000 unit must be completely disconnected and secured using proper LOTO procedures before beginning any switch replacement work.

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 PowerSwitch 7000 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+1 800 543 2378.

8.2 Mode of Operation

8.2.1 Normal (Preferred Source)

Under normal operating conditions, the Vertiv™ PowerSwitch 7000 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 Alternate Source Transfer

Should the preferred source fail or be outside acceptable voltage limits, the PowerSwitch 7000 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 PowerSwitch 7000 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 PowerSwitch 7000 include key-interlocked maintenance bypass switches 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.

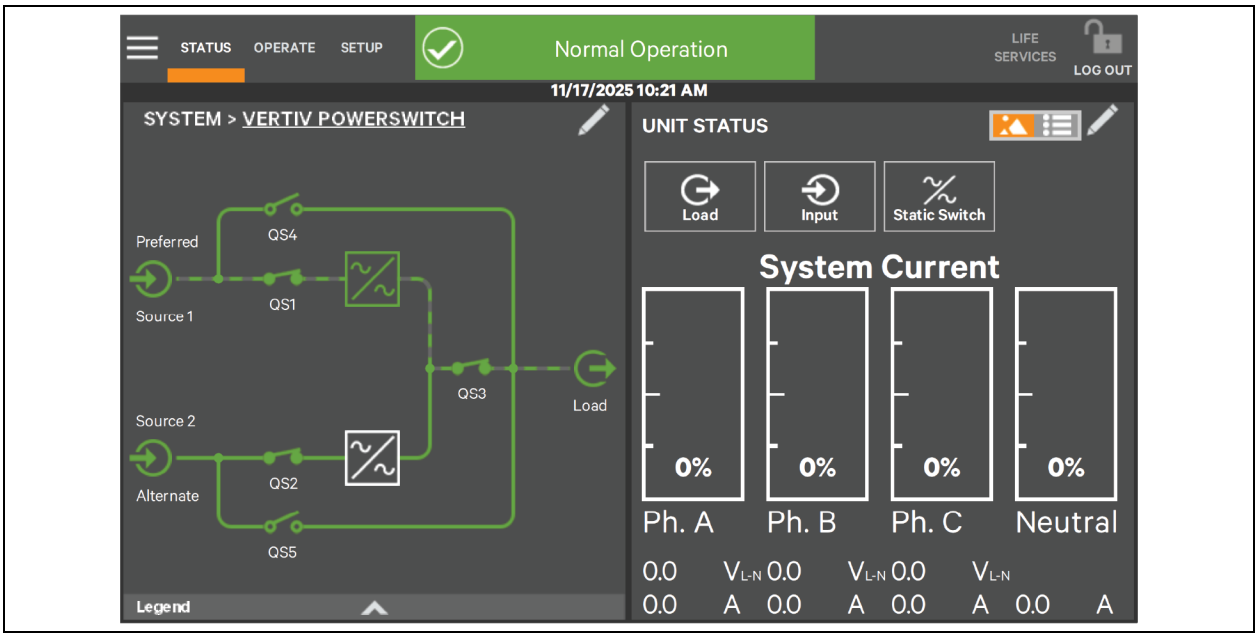
NOTE: The PowerSwitch 700 comes with spare interlock keys that should be kept in a safe location away from the unit. The keys are only to be used if the original key is lost or if a Vertiv service technician requires them for troubleshooting. Do not use the spare keys to defeat the interlock system for any reason.

WARNING! Using the spare keys to defeat the interlock system can cause equipment damage, injury and death.

8.3 Operator Controls

The PowerSwitch 7000 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 as well as events. See Figure 8.1 below. The touchscreen control panel menus allow the operator to initiate source transfers, view events and view bypass operational instructions.

Figure 8.1 Vertiv™ PowerSwitch 7000 Touchscreen Display



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

9 Theory of Operation

9.1 General Description

The Vertiv™ PowerSwitch 7000 contains all the equipment necessary to prevent an interruption in power flow to the AC load, should your primary source fail.

9.1.1 PowerSwitch 7000

The PowerSwitch 7000 is a 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 RSS. 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. Four 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. The interruption does not exceed the ITIC/CBEMA standard.

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 PowerSwitch 7000 allows manually initiated transfers between the two sources. A manual transfer is initiated by directing the unit to transfer sources by pressing the source select buttons in the OPERATE menu of the Touchscreen Control Panel or commanding a source change via RSS. This is only possible if the alternative source is qualified and withing the phase synchronization window. On a manual transfer, the unit shall not interrupt power to the load for greater than 1/8 cycle. 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 PowerSwitch 7000 until the two sources are within the defined phase synchronization window.

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

9.1.3 Automatic Transfer/Retransfer

When the active source becomes disqualified forcing the unit to transfer to a qualified non-active source. A source disqualification could be caused by a breaker tripping upstream. Automatic transfer can be inhibited through the Touchscreen Control Panel.

Provided that the other source is available, the PowerSwitch 7000 will complete an automatic transfer in 1/2 cycle or less overriding any retransfer time delay or other inhibits, except load overcurrent.

Automatic Retransfer

When the unit transfers back to the preferred source after it becomes qualified and free of critical events (such as voltage, frequency, or phase rotation issues).

9.1.4 Emergency Transfer

To ensure that power remains connected to the load, the PowerSwitch 7000 will conduct an emergency transfer if a critical fault is detected on the active source. An emergency transfer is triggered by critical faults such as hardware failures on the active source. The system immediately transfers the load to the alternate source, overriding any active transfer or retransfer inhibits. Speed is prioritized to protect the load, and the transfer typically completes within half a cycle or less.

9.1.5 Transfer Inhibit

The Vertiv™ PowerSwitch 7000 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, which can be cleared by pressing the reset fault button on the display. If so configured, the Load Current Transfer Inhibit is automatically reset 1 second 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. Only under open emergency transfer condition would the PowerSwitch 7000 automatically transfer with an I-Peak condition.

9.1.6 SCR Failure

Shorted SCR on active source

In the event of a shorted SCR on the active source powering the load, the PowerSwitch 7000 automatically triggers an alarm, inhibits transfers until the fault is cleared, and trips the other source isolation switch/breaker (if configured with trippable switches/breakers, if not, a trip signal is sent to the upstream switch/breaker).

Shorted SCR on inactive source

In the event of a shorted SCR on the inactive source, the PowerSwitch 7000 automatically triggers an alarm, inhibits transfers until the fault is cleared and trips the other source isolation switch/breaker (if configured with trippable switches/breakers, if not, a trip signal is sent to the upstream switch/breaker).

Open SCR on active source (emergency transfer)

In the event of an open SCR on the active source powering the load, the PowerSwitch 7000 automatically triggers an alarm, transfers to the alternate source (even if alternate source is unqualified) and inhibits further transfers until the SCR fault is cleared.

Open SCR on inactive source

In the event of an open SCR on the inactive source, the PowerSwitch 7000 automatically triggers an alarm and inhibits transfers to the inactive source until the fault is cleared.

9.1.7 Always On Control

The PowerSwitch 7000 contains no master On/Off push button control. When connected to the input sources, the unit's logic power On automatically. The touchscreen display is active as long as at least one input source is energized and the Control Power Fuses are closed/replaced.

9.2 Detailed Component Description

9.2.1 Controls

Operator interface

The Vertiv™ PowerSwitch 7000 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 lockout through the Touchscreen Control Panel is provided for security.

Hardware

- The PowerSwitch 7000 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 PowerSwitch 7000 unit is equipped with a color LCD touchscreen.
- The PowerSwitch 7000 can have optional communication ports installed. See Options on page 15 and Communication Interfaces on page 45 for more information on communication options.

Firmware

The Touchscreen Control Panel enables you to monitor and configure the PowerSwitch 7000. The firmware includes:

- View and set the preferred source.
- View and configure parameters.
- View alarms, faults, and status.
- View metering data.

Additionally, the Color Graphical Display unit provides:

- The mimic graphical representation of the systems operation.
- Menu driven monitoring and configuration.
- 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 37 for more information on events.

- 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.

9.2.3 Logic Control

The PowerSwitch 7000 uses an integrated control board that manages all transfer and protection operations once configured. It continuously monitors system conditions, executes transfer decisions, and initiates protective actions such as shunt trips without requiring external input. This design ensures reliable and independent operation under all circumstances, maintaining redundancy, and self-sufficiency.

9.2.4 Audible Alarm

An audible alarm is installed on the display assembly. This alarm is triggered by an alarm condition detected on the unit. The alarm can be turned Off from the Touchscreen Control Panel. Turning Off the audible alarm does not clear or reset the condition that triggered the alarm.

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™ PowerSwitch 7000 Touchscreen Control Panel on page 47.

10.1 Normal System Startup

1. Make sure that all PowerSwitch 7000 Switches QS1, QS2, QS3, QS3A (if supplied), QS4 and QS5 are in the OFF position.
    a. Ensure that the key interlocks for QS1 and QS2 have their bolts extended.
    b. Ensure that the key interlocks for QS4 and QS5 have their bolts extended, thus preventing QS4 or QS5 from being turned *ON*.
2. Source/input power should be applied to PowerSwitch 7000 inputs.
    a. The touchscreen control panel should become active and operate properly when at least one of the inputs is energized is closed.
3. Verify that nominal input voltages are applied to both inputs (Source 1 and Source 2).
    a. The input voltages, selected preferred source, switch status, and alarms are indicated on the Mimic screen.
4. Close QS1.
5. Verify that Source 1 voltages are nominal and QS1 switch status is correctly indicated on the Monitor/Mimic screen.
6. Close QS2.
7. Verify that Source 2 voltages are nominal and QS2 switch status is correctly indicated on the touchscreen display.
8. Verify that boxes for the preferred source and corresponding STS are highlighted on the touchscreen display, indicating which side of the PowerSwitch 7000 is on.
9. Close Output switch QS3 (and QS3A in redundant output configurations).
10. Verify QS3, the Output box, and the Load box are highlighted, indicating that QS3 is closed and the Output and Load are energized.

NOTE: For redundant output switch units, QS3 descriptions apply to QS3 and QS3A.

11. Press the RESET button on the touchscreen to reset any previous alarms.
12. Verify in the Event Display and the touchscreen display that there are no active alarms.

a. If any active alarms are displayed, see Alarm and Faults on page 37 for a description of the alarms and possible causes. All active alarm conditions should be corrected before proceeding.

13. Turn On the load equipment following the load equipment manufacturer's recommendations.

10.2 Enabling Remote Source Selection

If your system is equipped with the optional RSS option, it must be enabled:

1. Log in with OPERATOR level password.
2. Open the SETUP tab at the top of the screen.
3. Open the menu on the left side of the screen.
4. Go to Settings, then Unit.
5. Under Transfer Settings, change the Remote Transfer Lockout Enabled setting to YES.

10.3 Maintenance Bypass

The Vertiv™ PowerSwitch 7000 may be equipped with two key-interlocked, bypass switches, QS4 and QS5, 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 PowerSwitch 7000 one-line diagram, Refer to submittal drawings PS7-01-S002 while operating on maintenance bypass with fuses F1-F4 open, all voltages are removed from the PowerSwitch 7000 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 STS 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.

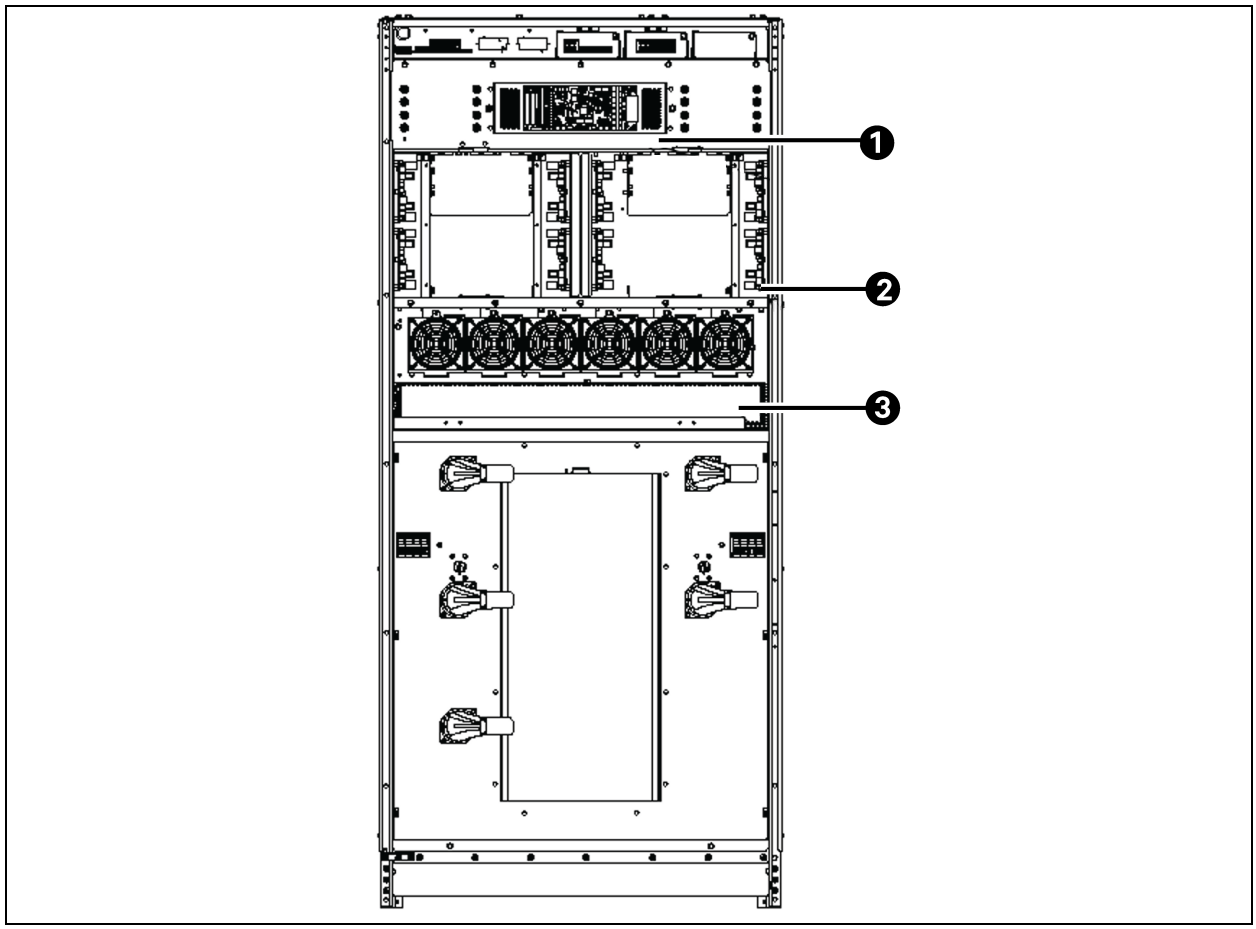
The display is used to guide the operator during the maintenance bypass procedure. To start, or return from, maintenance bypass navigate to the guided procedure on the Touchscreen Control Panel. This can be found by logging in with Administrator access level then OPERATE tab > Menu > Bypass Transfer, and following the guided prompts.

In the unlikely event that the Touchscreen Control Panel is not available, open the front door and locate the control board. The control board contains LEDs that mimic the one line diagram on the Touchscreen Control Panel. The LEDs will change colors to indicate the status of the input sources, the static switches, and the output. Green LEDs indicate normal operation. An amber LED on one of the middle LEDs indicates the active source. A red LED indicates a critical fault. The gate drive boards, located in the compartment below the control board, contain a bright LED that will also indicate the active source. A white LED indicates that the source 2 gate drive boards are active, and thus, source 2 is the active source. A blue LED on the gate drive boards indicates that source 1 gate drive boards are active, and thus, source 1 is the active source.

NOTE: The PowerSwitch 700 comes with spare interlock keys that should be kept in a safe location away from the unit. The keys are only to be used if the original key is lost or if a Vertiv service technician requires them for troubleshooting. Do not use the spare keys to defeat the interlock system for any reason.

WARNING! Using the spare keys to defeat the interlock system can cause equipment damage, injury and death.

Figure 10.1 Gate Board Viewing Slot Locations



Item	Description
1	Control Board
2	Gate Drive Boards
3	Fan Control Boards

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.

10.3.1 Bypass Procedures for Source 1—Double Key Interlock

To bypass the switch for Source 1:

1. Verify that Source 1 is supplying power via the display.

NOTE: To bypass the Source 1 STS when Source 2 is presently active, you must first transfer to Source 1. See Manual Transfer/Preferred Source Selection on page 35.

NOTE: If the touchscreen display is not available, check the gate driver board LED's through the slots in the control panel. See Figure 10.1 above.

2. Remove the interlock key from QS5 and place it in the QS4 interlock.
3. Open the alternate source input switch QS2.
4. Rotate and remove the QS2 interlock key.
5. Insert the key in the QS4 bypass switch interlock.
6. Rotate the interlock keys in theQS4 bypass switch interlock to retract the interlock.
7. Close bypass switch QS4.
8. Verify the switch status on the display.
9. Open source input switch QS1.
10. Rotate the QS1 interlock key and remove it to lock out the switch.
11. Secure the key according to your site's LOTO procedure.
12. Open output switch QS3 and QS3A (if supplied) to remove power and isolate the static switch from the load.
13. Open/Remove fuses FU1-FU4 and FU5-FU8.

To return to normal mode:

1. Close/Replace fuses FU1-FU4 and FU5-FU8.
2. Insert the key in the QS1 switch interlock.
3. Rotate the key to retract the interlock.
4. Close source input switch QS1.
5. Verify Source 1 and QS1 switch status on the display.
6. Select the *Source 1 button* in the OPERATE menu, press Start to active the static switch.
7. Close output switch QS3 and QS3A (if supplied).
8. Verify QS3 and QS3A switch status.
9. Verify that STS SOURCE 1 and OUTPUT boxes are highlighted on the display.
10. Open bypass switch QS4.
11. Rotate the keys in the QS4 interlock to extend the interlock.
12. Remove the proper key from the QS4 interlock and insert it in the QS2 switch interlock.
13. Rotate the key to retract the QS2 switch interlock.
14. Close source input switch QS2.
15. Verify the STS Source 2 box and QS2 switch status on the display.
    - If the touchscreen 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.

10.3.2 Bypass Procedures for Source 2—Double Key Interlock

To bypass the switch for Source 2:

1. Check the display to verify that Source 2 is supplying power.

NOTE: To bypass the Source 2 STS when Source 1 is active, you must first transfer to Source 2. See Manual Transfer/Preferred Source Selection on page 35.

NOTE: If the touchscreen 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 QS4 and place it in the QS5 interlock.

3. Open the alternate source input switch QS1.
4. Rotate and remove the QS1 interlock key.
5. Insert the key in the QS5 bypass switch interlock.
6. Rotate the interlock keys in the QS5 bypass switch interlock to retract the interlock.
7. Close bypass switch QS5.
8. Verify the switch status on the display.
9. Open source input switch QS2.
10. Rotate the QS2 interlock key and remove it to lock out the switch.
11. Secure the key according to your site's LOTO procedure.
12. Open output switch QS3 and QS3A (if supplied) to remove power and isolate the static switch from the load.
13. Open/Remove fuses FU1-FU4 and FU5-FU8.

To return to normal mode:

1. Close/Replace fuses FU1-FU4 and FU5-FU8.
2. Insert the key in the QS2 switch interlock.
3. Rotate the key to retract the interlock.
4. Close source input switch QS2.
5. Verify Source 2 and QS2 switch status on the display.
6. Select the Source 2 button in the OPERATE menu, press START to active the static switch..
7. Clouse output switches QS3 and QS3A (if supplied).
8. Verify QS3 and QS3A switch statuses.
9. Verify that STS Source 2 and OUTPUT boxes are highlighted on the display.
10. Open bypass switch QS5.
11. Rotate the keys in the QS5 interlock to extend the interlock.
12. Remove the proper key from the QS5 interlock and insert it in the QS1 switch interlock.
13. Rotate the key to retract the QS1 switch interlock.
14. Close source input switch QS1.
15. Verify the STS Source 1 box and QS1 switch status on the display.
    - If the touchscreen display is not available, check the gate driver board LED's through the slots in the control panel. See Figure 10.1 on page 31.

10.3.3 Bypass Procedures for Source 1—Single Key Interlock

To bypass the switch for Source 1:

1. Verify that Source 1 is supplying power via the display.

NOTE: To bypass the Source 2 STS when Source 2 is presently active, you must first transfer to Source 1. See Manual Transfer/Preferred Source Selection on page 35.

NOTE: If the Touchscreen Display is not available, check the gate driver board LED's through the slots in the control panel. See Figure 10.1 on page 31.

2. Open the alternate source input switch QS2.
3. Remove the interlock key from QS5 and place it in the QS4 interlock.

4. Rotate the interlock key in the QS4 bypass switch interlock to retract the interlock.
5. Close bypass switch QS4.
6. Verify the switch status on the display.
7. Open source input switch QS1
8. Open output switch QS3 and QS3A (if supplied) to remove power and isolate the static switch from the load.
9. Open/Remove fuses FU1-FU4 and FU5-FU8.

To return to normal mode:

1. Close/Replace fuses FU1-FU4 and FU5-FU8.
2. Close source input switch QS1.
3. Verify Source 1 and QS1 switch status on the display.
4. Select SOURCE 1 button on the OPERATE menu and press start to active the static switch.
5. Close output switches QS3 and QS3A (if supplied).
6. Verify QS3 and QS3A switch status.
7. Verify that STS SOURCE 1 and OUTPUT boxes are highlighted on the display.
8. Open bypass switch QS4.
9. Rotate the key in the QS4 interlock to extend the interlock.
10. Remove the key from QS4 interlock and insert it in the QS5 switch interlock.
11. Close source input switch QS2.
12. Verify the STS SOURCE 2 box and QS2 switch status on the display.

- If the Touchscreen Display is not available, check the gate driver board LED's through the slots in the control panel. See Figure 10.1 on page 31.

10.3.4 Bypass Procedure for Source 2—Single Key Interlock

To bypass the switch for Source 2:

1. Verify that Source 2 is supplying power via the display.

NOTE: To bypass the Source 2 STS when Source 2 is presently active, you must first transfer to Source 1. See Manual Transfer/Preferred Source Selection on the facing page.

NOTE: If the Touchscreen Display is not available, check the gate driver board LED's through the slots in the control panel. See Figure 10.1 on page 31.

2. Open the alternate source input switch QS1.
3. Remove the interlock key from QS4 and place it in the QS5 interlock.
4. Rotate the interlock key in the QS5 bypass switch interlock to retract the interlock.
5. Close bypass switch QS5.
6. Verify the switch status on the display.
7. Open source input switch QS1.
8. Open output switch CB3 and CB3A (if supplied) to remove power and isolate the static switch from the load.
9. Open/Remove fuses FU1-FU4 and FU5-FU8.

To return to normal mode:

1. Close/Replace fuses FU1-FU4 and FU5-FU8.

2. Close source input switch QS2.
3. Verify Source 2 and QS2 switch status on the display.
4. Select SOURCE 2 button on the OPERATE menu and press start to active the static switch.
5. Close output switches QS3 and QS3A (if supplied).
6. Verify QS3 and QS3A switch status.
7. Verify that STS SOURCE 2 and OUTPUT boxes are highlighted on the display.
8. Open bypass switch QS5.
9. Rotate the key in the QS5 interlock to extend the interlock.
10. Remove the key from QS5 interlock and insert it in the QS4 switch interlock.
11. Close source input switch QS1.
12. Verify the STS SOURCE 1 box and QS1 switch status on the display.

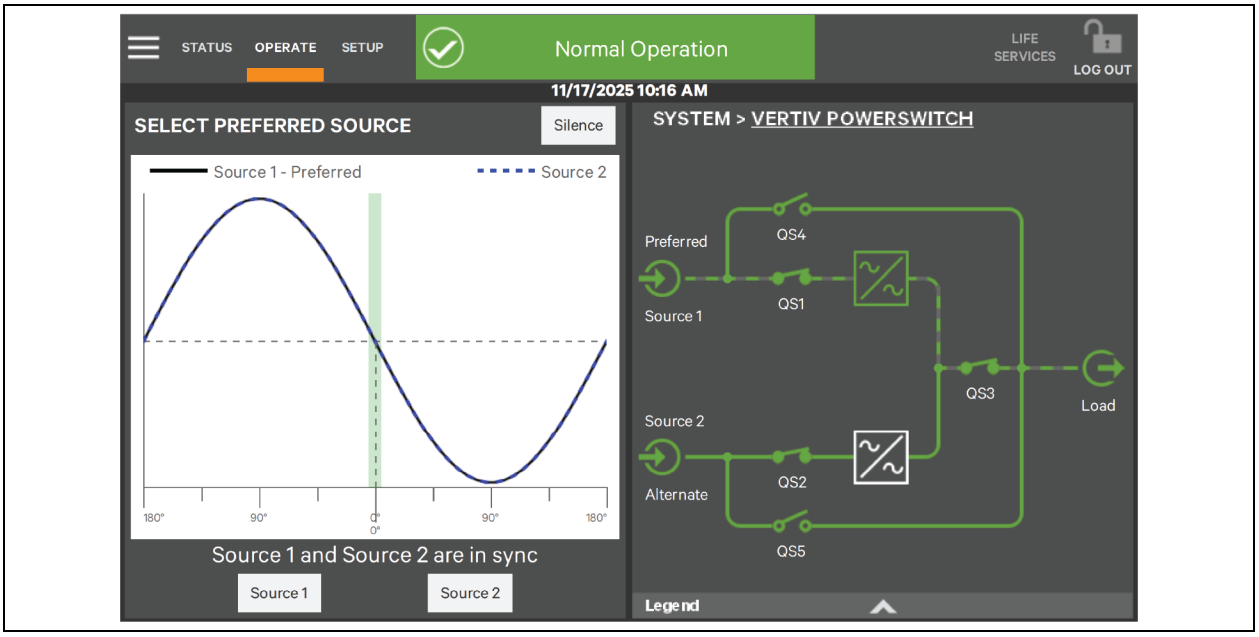
- If the Touchscreen Display is not available, check the gate driver board LED's through the slots in the control panel. See Figure 10.1 on page 31.

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 the proper operating range and the sources are synchronized. 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 below. 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™ PowerSwitch 7000 does not have a second source to switch to and the load would not receive power. See Maintenance Bypass on page 30 for bypass instructions.

Figure 10.2 Source Transfer Screen



To manually select the preferred source:

1. Verify that the input switches QS1 and QS2 are closed.
2. Select STATUS from the Menu Bar to verify that Source 1 and Source 2 input voltages are correct.
3. Select OPERATE from the Menu Bar to display the Select Preferred Source screen.
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 display.
5. Verify that the correct source is designated as the preferred source and that the input source changes to the desired source.

The display is updated to indicate the new preferred source. The source is now highlighted 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 RSS option, thereby initiating a transfer remotely.

10.4.1 Shut down in Maintenance Bypass Mode

When the Vertiv™ PowerSwitch 7000 is operating on bypass:

1. Turn Off the load equipment per manufacturer's recommendations.
2. Open the bypass switch (QS4 or QS5) to turn Off the STS output.
3. To completely de-energize the unit, turn OFF the power to both inputs to the PowerSwitch 7000.
4. Open/Remove fuses FU1-FU4 and FU5-FU8.

11 Alarm and Faults

Alarms and faults are events that are triggered when the operation of the Vertiv™ PowerSwitch 7000 falls outside the defined parameters. These events can also be triggered by: user actions, such as changing configurations and clearing logs; failed components such as, an SCR that is open or closed; and system status, such as open switches, load on alternate source. These events can provide a warning or trigger the system to make a change, such as switch sources. The PowerSwitch 7000 monitoring system detects and annunciates a comprehensive set of fault and alarm conditions. The Alarms and Faults can be viewed in the Events menu through the Touchscreen Control Panel.

On the Touchscreen Control Panel, the events are shown in the Events menu, through the STATUS tab, and written to the Event log. You can view active alarm messages by touching the status bar at the top of the screen to see Date/Time, event ID and a description of the event. See Vertiv™ PowerSwitch 7000 Touchscreen Control Panel on page 47 for more information on the touchscreen.

Faults: A fault indicates that a component of the PowerSwitch 7000 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 Status Bar, 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 is a latched event, the alarm messages remain active until the alarm condition has been corrected and the CLEAR button is pressed on the Touchscreen Control Panel. See Event Mask on page 1 for more information on latching.

11.1 Event Log

The events are tracked in sequence of occurrence. The sequence of occurrence is identified by date, time, and frame number. The last 2024 events are stored in a nonvolatile memory and can be exported by logging in with Administrator or Operator access level and going to SETUP > MENU > Logs > Event Logs and pressing the Export button. The last 1000 events are viewable in the same Event Log page.

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:

- **Message:** The event that occurred, such as Ambient Overtemp., Source 1 Fail.
- **Type:** Either a Fault or Alarm. See Alarm and Faults above for further details on these events.
- **ID:** The event identifier.
- **Date and Time:** When the event occurred.
- **Status:** Whether the event is still active or not.
- **Component:** The affected component.
- **SubComp:** The affected subcomponent.
- **Description:** A description of the event.

11.2 Event Notes

The PowerSwitch 7000 will display 3 different types of events in the Event log.

- **Status Messages:** Low Severity informational notifications about the system's conditions or operations.

- Alarm Messages: Medium Severity notifications that indicate abnormal but non-critical conditions that may require attention.
- Fault Messages: High Severity notifications that indicate critical failures or conditions requiring immediate action.

11.3 Event Messages

Some event names below may appear differently if a component was manually renamed through the touchscreen control panel. The event ID will still be the same.

A latched event remains visible until explicitly reset.

Key:

- Event ID: Event Name, Event Description, and Latched Event.

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

Press *Silence* on the STATUS page to turn Off the audible alarm.

Table 11.1 Event Entries Table

Event Code	Event Name	Description	Latch
1	CAN Communication Fail	CAN communication has been lost to this board for 4.1 seconds	No
2	FSI Communication Fail	FSI communication has been lost to this gate drive board for 100ms	Yes
3	Communication Bus Error	The condition is when TX or RX stops for 3 seconds. The event is detected at a board when the condition above occurs 5 times within a 24 hour sliding window. The event will clear when the occurrences are 3 or less in the 24 hour window.	No
7	Power Supply 1 Output Fail	Power Supply 1 Output is below 20V for this input of this board. Voltage must be return to above 22V before the detection is cleared.	Yes
8	Power Supply 2 Output Fail	Power Supply 2 Output is below 20V for this input of this board. Voltage must be return to above 22V before the detection is cleared.	Yes
9	Comms Misconfiguration	Unconfigured board is communicating on the CAN or FSI bus, or incorrect GDB ID on FSI port	No
100	System Shutdown - LEPO	LEPO has been pressed and system will shutdown.	Always
101	System Shutdown - REPO	REPO has been pressed and system will shutdown.	Always
102	Remote Transfer Lockout	Remote Transfer Lockout contact is asserted	No
103	Manual Select To Source 1	Source 1 was selected manually to be the preferred source	No
104	Manual Select To Source 2	Source 2 was selected manually to be the preferred source	No
105	Remote Select To Source 1	Source 1 was selected remotely to be the preferred source	No
106	Remote Select To	Source 2 was selected remotely to be the preferred source	No

Table 11.1 Event Entries Table (continued)

Event Code	Event Name	Description	Latch
	Source 2		
107	Transferring To Source 1	Transfer to Source 1 has started	No
108	Transferring To Source 2	Transfer to Source 2 has started	No
124	Latched Events Reset	The board received a command to reset latched events	No
125	System Clock Set	The time or date has been set by the user (not time sync) or a time source change (i.e. NTP. Unity card). Event log entry time is the new time of the system.	No
126	Sources Out of Sync	Sources are outside of the sync window.	No
127	Transfer Inhibited	No transfer allowed because of existing faults or preventative conditions.	No
128	Auto Retransfer Inhibit	System automatic retransfers are disabled/inhibited. STS has performed too many retransfers to the preferred source.	Always
140	Fan 1 Speed Failure	Fan RPM measurement below RPM threshold	Yes
141	Fan 2 Speed Failure	Fan RPM measurement below RPM threshold	Yes
142	Fan 3 Speed Failure	Fan RPM measurement below RPM threshold	Yes
143	Fan 4 Speed Failure	Fan RPM measurement below RPM threshold	Yes
144	Fan 5 Speed Failure	Fan RPM measurement below RPM threshold	Yes
145	Fan 6 Speed Failure	Fan RPM measurement below RPM threshold	Yes
146	Fan 7 Speed Failure	Fan RPM measurement below RPM threshold	Yes
147	Fan 8 Speed Failure	Fan RPM measurement below RPM threshold	Yes
148	Fan Power Input 1 Fail	Power Supply Output is below 40V for input 1 of this board. Voltage must return to above 44V before the detection is cleared.	Yes
149	Fan Power Input 2 Fail	Power Supply Output is below 40V for input 2 of this board. Voltage must return to above 44V before the detection is cleared.	Yes
160	Input Contact 1 Type Setting	External input contact 1 on the ICI asserted	Yes
161	Input Contact 2 Type Setting	External input contact 2 on the ICI asserted	Yes
162	Input Contact 3 Type Setting	External input contact 3 on the ICI asserted	Yes
163	Input Contact 4 Type Setting	External input contact 4 on the ICI asserted	Yes
164	Input Contact 5 Type Setting	External input contact 5 on the ICI asserted	Yes
165	Input Contact 6 Type Setting	External input contact 6 on the ICI asserted	Yes

Table 11.1 Event Entries Table (continued)

Event Code	Event Name	Description	Latch
166	Input Contact 7 Type Setting	External input contact 7 on the ICI asserted	Yes
167	Input Contact 8 Type Setting	External input contact 8 on the ICI asserted	Yes
170	Internal Input Contact 1 Type Setting	Internal alarm 1 is active.	Yes
171	Internal Input Contact 2 Type Setting	Internal alarm 2 is active.	Yes
172	Internal Input Contact 3 Type Setting	Internal alarm 3 is active.	Yes
173	Internal Input Contact 4 Type Setting	Internal alarm 4 is active.	Yes
174	Internal Input Contact 5 Type Setting	Internal alarm 5 is active.	Yes
175	Internal Input Contact 6 Type Setting	Internal alarm 6 is active.	Yes
176	Internal Input Contact 7 Type Setting	Internal alarm 7 is active.	Yes
177	Internal Input Contact 8 Type Setting	Internal alarm 8 is active.	Yes
180	Input 1 Fail	The source 1 input to this power supply has fallen below hardware threshold and source is still qualified	Yes
181	Input 2 Fail	The source 2 input to this power supply has fallen below hardware threshold and source is still qualified	Yes
200	Slow Undervoltage	One of the VLN (4 pole configuration) or VLL (3 pole configuration) RMS phases of the source input is below the undervoltage setpoint for the delay set period.	No
201	Overvoltage	One of the VLN (4 pole configuration) or VLL (3 pole configuration) RMS phases of the source input is above the overvoltage, setpoint for the delay set period.	No
202	Invalid Phase Rotation	The input phases are not in the normal A-B-C sequence.	No
203	Summary	At least 1 enabled unacknowledged alarm or fault is active.	No
300	Fast Undervoltage	One or more of the VLL phases of the static switch input has an instantaneous undervoltage	No
301	Slow Undervoltage	One of the VLN (4 pole configuration) or VLL (3 pole configuration), RMS phases of the STS input is below the undervoltage setpoint for the delay set period.	No

Table 11.1 Event Entries Table (continued)

Event Code	Event Name	Description	Latch
302	Overvoltage	One of the VLN (4 pole configuration) or VLL (3 pole configuration), RMS phases of the STS input is above the overvoltage, setpoint for the delay set period.	No
303	Frequency Deviation	The measured frequency has fallen outside the range specified by the frequency deviation set point	No
304	Phase Overcurrent	One Phase RMS of the STS Input is above the phase overcurrent warning setpoint for the delay set period.	No
305	Phase Overcurrent	One Phase RMS of the STS Input is above the phase overcurrent fault setpoint for the delay set period.	Yes
306	Neutral Overcurrent	Neutral RMS of the STS Input is above the neutral overcurrent warning setpoint for the delay set period.	No
307	Neutral Overcurrent	Neutral RMS of the STS Input is above the neutral overcurrent fault setpoint for the delay set period.	Yes
308	Phase Peak Overcurrent	One of the phases of the STS Input is above the peak current setpoint for the delay set period.	Yes when I-peak manual reset is set to Manual
309	Summary	At least 1 enabled unacknowledged alarm or fault is active.	No
400	Fast Undervoltage	One or more of the VLL phases of the static switch output has an instantaneous undervoltage	No
401	Slow Undervoltage	One of the VLN (4 pole configuration) or VLL (3 pole configuration) RMS phases of the STS output is below the undervoltage setpoint for the delay set period.	No
402	Overvoltage	One of the VLN (4 pole configuration) or VLL (3 pole configuration) RMS phases of the STS output is above the overvoltage, setpoint for the delay set period.	No
403	Summary	At least 1 enabled unacknowledged alarm or fault is active.	No
500	SCR Phase Backfeed Voltage	SCR Backfeed Voltage exceeds threshold.	No
501	Open Phase A SCR	One or more phase A SCRs are Open.	Non-recoverable, requires controls reset to clear
502	Open Phase B SCR	One or more phase B SCRs are Open.	Non-recoverable, requires controls reset to clear
503	Open Phase C SCR	One or more phase C SCRs are Open.	Non-recoverable, requires controls reset to clear
504	Open Neutral SCR	One or more neutral SCRs are Open.	Non-recoverable, requires controls reset to clear
505	Shorted Phase A SCR	One or more phase A SCRs are shorted.	Non-recoverable, requires controls reset to clear
506	Shorted Phase B SCR	One or more phase B SCRs are shorted.	Non-recoverable, requires controls reset to clear

Table 11.1 Event Entries Table (continued)

Event Code	Event Name	Description	Latch
507	Shorted Phase C SCR	One or more phase C SCRs are shorted.	Non-recoverable, requires controls reset to clear
508	Shorted Neutral SCR	One or more neutral SCRs are shorted.	Non-recoverable, requires controls reset to clear
509	SCR Ph A Overtemperature	Phase A heatsink temperature measurement over warning threshold.	No
510	SCR Ph A Overtemperature	Phase A heatsink temperature measurement over fault threshold.	Yes
511	SCR Ph B Overtemperature	Phase B heatsink temperature measurement over warning threshold.	No
512	SCR Ph B Overtemperature	Phase B heatsink temperature measurement over fault threshold.	Yes
513	SCR Ph C Overtemperature	Phase C heatsink temperature measurement over warning threshold.	No
514	SCR Ph C Overtemperature	Phase C heatsink temperature measurement over fault threshold.	Yes
515	SCR Neutral Overtemperature	Neutral heatsink temperature measurement over heatsink warning threshold.	No
516	SCR Neutral Overtemperature	Neutral heatsink temperature measurement over fault threshold.	Yes
600	Load on Alt Source	STS load is powered from the alternate source.	No
601	Load On Bypass	Load is being powered by the source 1 bypass	No
602	Load On Bypass	Load is being powered by the source 2 bypass	No
700	Breaker Open	The CB1/QS1 breaker/switch is reporting open	No
701	Breaker Open	The CB2/QS2 breaker/switch is reporting open.	No
702	Breaker Open	The CB3/QS3 breaker/switch is reporting open.	No
703	Breaker Open	The CB3A breaker/switch is reporting open.	No
704	Breaker Open	The CB4/QS4 breaker/switch is reporting open.	No
705	Breaker Open	The CB5/QS5 breaker/switch is reporting open.	No
706	Breaker Closed	The CB1/QS1 breaker/switch is reporting closed.	No
707	Breaker Closed	The CB2/QS2 breaker/switch is reporting closed.	No
708	Breaker Closed	The CB3/QS3 breaker/switch is reporting closed.	No
709	Breaker Closed	The CB3A breaker/switch is reporting closed.	No
710	Breaker Closed	The CB4/QS4 breaker/switch is reporting closed.	No
711	Breaker Closed	The CB5/QS5 breaker/switch is reporting closed.	No

Table 11.1 Event Entries Table (continued)

Event Code	Event Name	Description	Latch
712	Breaker Acc Error	The breaker sensing is an erroneous state. Parametric data logged with this event will indicate the nature of the first cause. Error Type: 1 = Form C position (Aux) sensing is not complimentary.	No
713	Breaker Acc Error	The breaker sensing is an erroneous state. Parametric data logged with this event will indicate the nature of the first cause. Error Type: 1 = Form C position (Aux) sensing is not complimentary.	No
714	Breaker Acc Error	The breaker sensing is an erroneous state. Parametric data logged with this event will indicate the nature of the first cause. Error Type: 1 = Form C position (Aux) sensing is not complimentary.	No
715	Breaker Acc Error	The breaker sensing is an erroneous state. Parametric data logged with this event will indicate the nature of the first cause. Error Type: 1 = Form C position (Aux) sensing is not complimentary.	No
716	Breaker Acc Error	The breaker sensing is an erroneous state. Parametric data logged with this event will indicate the nature of the first cause. Error Type: 1 = Form C position (Aux) sensing is not complimentary.	No
717	Breaker Acc Error	The breaker sensing is an erroneous state. Parametric data logged with this event will indicate the nature of the first cause. Error Type: 1 = Form C position (Aux) sensing is not complimentary.	No
800	No Initial Comms	No communication recorded with configured CAN board	No
801	Firmware Incompatible	There is a Display to Control schema incompatibility. The user can view the display and control firmware versions and perform updates to either the display or the control in order to make them compatible	No
802	Configuration Sync Error	HMI failed to retrieve configuration from STSC	No

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12 Communication Interfaces

Several communications options are available. Those options are located in the Communications compartment above the touchscreen display front panel and are accessible when the front panel door is open. See Installation and Operation on page 17 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™ PowerSwitch 7000:** 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 PowerSwitch 7000 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).

  Refer to submittal drawing PS7-19-S005 for more information on the PowerSwitch 7000 . If you have questions about the card, refer to the **User Guide, AV-50006,** available at the Vertiv Website, *www.Vertiv.com.*

- **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 **Figure 7.3** on page 19 for wiring details.
- **PRB (optional):** up to two PRB's can be installed in the PowerSwitch 7000 to route events to external devices.

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13 Vertiv™ PowerSwitch 7000 Touchscreen Control Panel

The integrated display of touchscreen control panel of the PowerSwitch 7000 simplifies monitoring and managing single the system. The display collects a profusion of information about the health of the system and presents it in a standardized format. This simple, dynamic interface speeds operator response to events and faults.

Most of the settings will be made during initial configuration. Other settings and customizations will be made in various menus of the touchscreen display. The PowerSwitch 7000 touchscreen display will show data either graphically or in text. The status scroll bar at the top of the touchscreen shows the system conditions. The bar changes color to indicate status and includes an icon matched to the status. The status page displays details such as a one line, load levels, and input voltage.

The PowerSwitch 7000 touchscreen display shows the comprehensive system information that the operator needs, like: Is input power connected? Are there any alarms? Which switches are open and which are closed?

Checking a particular component is as simple as touching it on the mimic display—detailed data appears, allowing the operator to respond. Visual and audible alarms alert personnel to the faults and alarms requiring immediate attention. Passcodes for each level of access—Operator and Administrator—secure the STS against unauthorized changes. Personnel without a passcode can view PowerSwitch 7000 status but cannot change any functions or the appearance of the display.

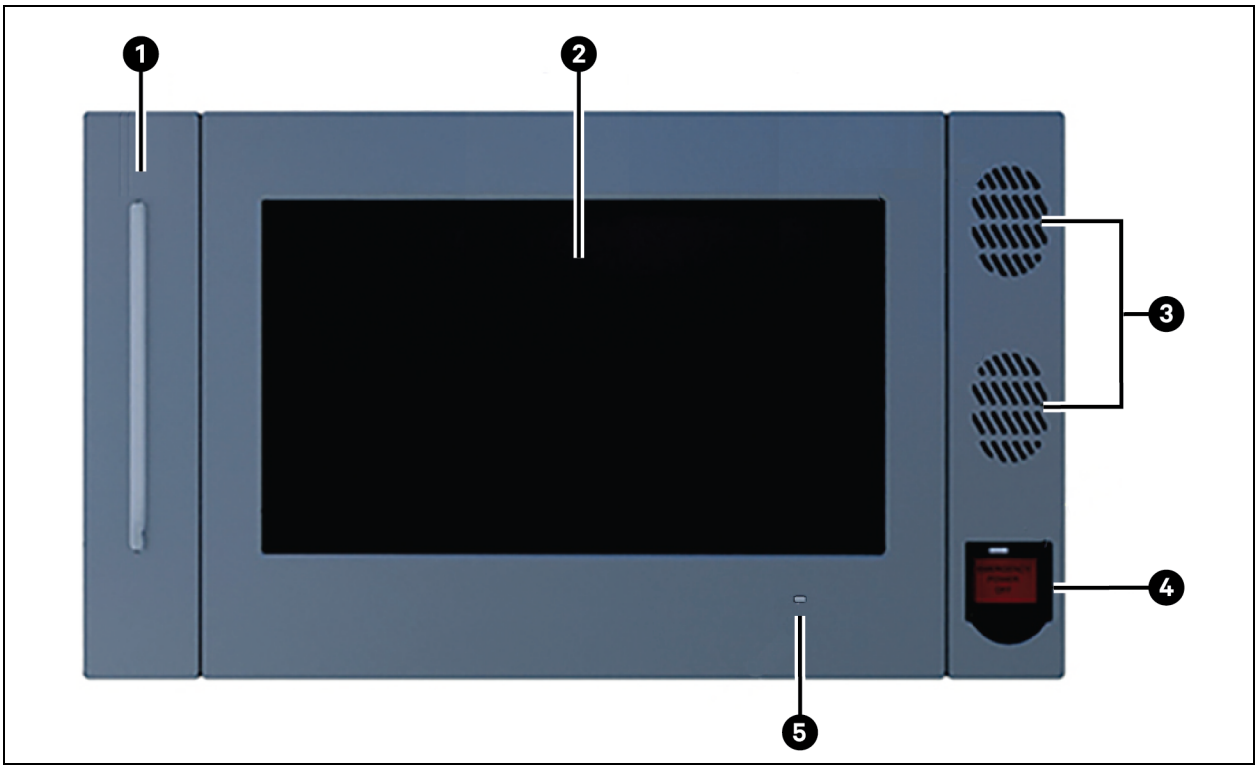
13.1 Display Overview

The Vertiv™ PowerSwitch 7000 touchscreen display is active when the STS has input power. The Touchscreen on the front of the STS permits:

- Login to the Vertiv™ PowerSwitch 7000 Touchscreen Control Panel on page 53.
- To customize the user interface, see Customizing the Display on page 54.
- Silencing alarms—Silence an Alarm.
- Transferring between sources.
- Guiding the user through maintenance bypass procedure.
- Resetting faults—Reset Fault.

The PowerSwitch 7000 touchscreen display default view is two panes: One line graphic screen and UNIT STATUS. The appearance can be changed to multiple panes that show other data. Customizing the appearance is detailed in Customizing the Display on page 54.

Figure 13.1 PowerSwitch 7000 Touchscreen Control Panel



Item	Description
1	Status LED
2	Touchscreen LCD
3	Speakers
4	EPO Switch
5	Status LED

13.1.1 Access Level Login

The PowerSwitch 7000 touchscreen control panel provides security by limiting the authority to change how the PowerSwitch 7000 operates. The 4 access levels offer different authority:

- **Observer:** Viewing permission only, can view one line and unit status. No PIN is required.
- **Operator:** Permission to start the PowerSwitch 7000, reset faults and change parameters. PIN is required.
- **Administrator:** All functions of Operator plus permission to change PINs for Operator and Administrator level. PIN is required.

Vertiv Tech Services provide PINs when setting up the PowerSwitch 7000. These default PINs may be changed by those with Administrator.

Default PINs are:

- **Operator:** 1234

- Administrator: 2345

CAUTION: Risk of unauthorized changes to operational settings. Can cause equipment damage. The default PIN numbers should be changed immediately to prevent unauthorized personnel from changing PowerSwitch 7000 operation or even shutting down the unit. The PINs for Operator and Administrator may be changed by logging in with Administrator level access.

13.1.2 Vertiv™ PowerSwitch 7000 Touchscreen Display Components

The main areas of the PowerSwitch 7000 touchscreen display are shown in Figure 13.2 below. The display arrangement and the information displayed can be changed. At login for all access levels, the PowerSwitch 7000 touchscreen display opens to the STATUS screen in graphic display. The STATUS screen will show the graphic screen and system status readings at each login level. The appearance will differ only in the function menus displayed, see Figure 13.3 on the next page.

Figure 13.2 PowerSwitch 7000 Touchscreen Display

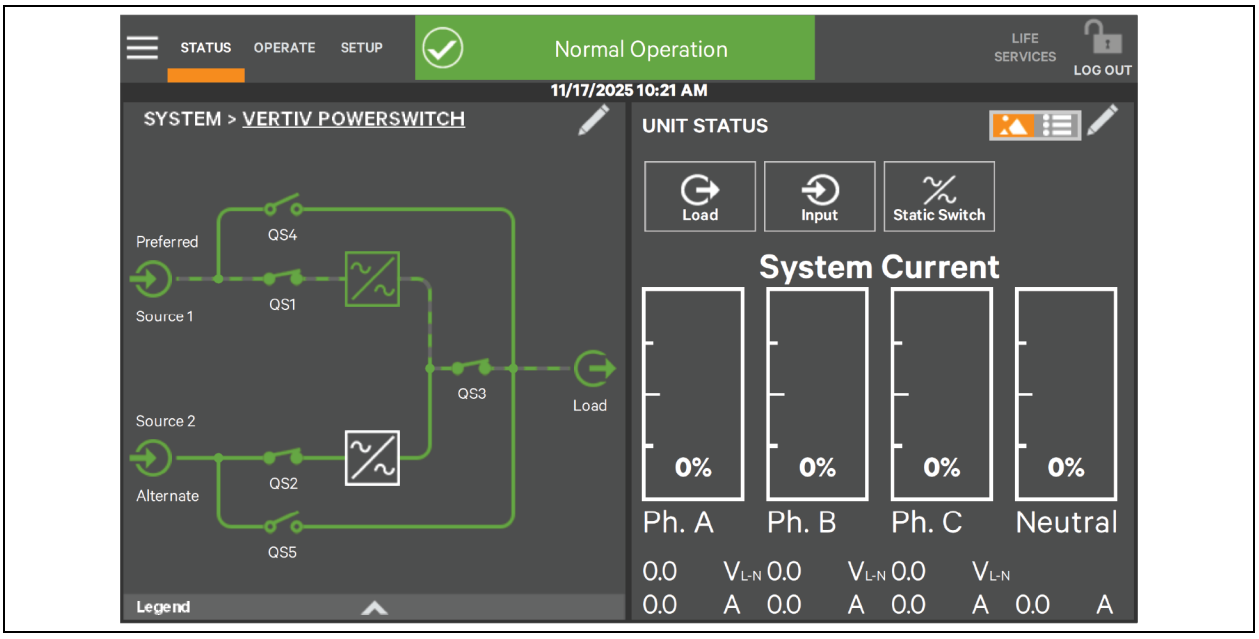
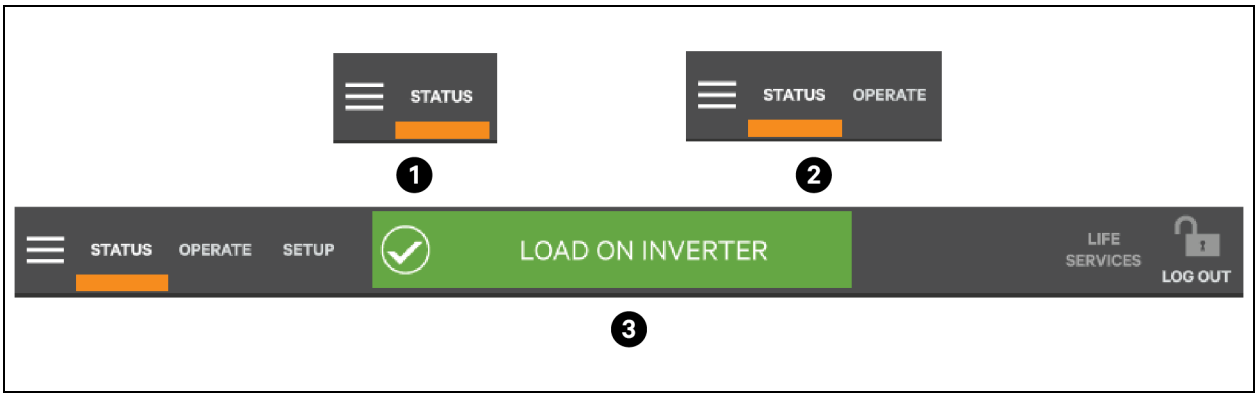


Figure 13.3 Control Display by Access Level



Item	Description
1	Observe level (or no login)
2	Operator level
3	Administrator level

Information and control are different under each Function Menu. The Function Menus displayed are specific to the access level.

- STATUS: Condition of the PowerSwitch 7000 components and data affecting operation and performance. Visible to all access levels.
- OPERATE: PowerSwitch 7000 controls, such as source select and parameter changes. Visible to Operator and Administrator access levels.
- SETUP: Manage permissions through PINs. Visible to Administrator access level.

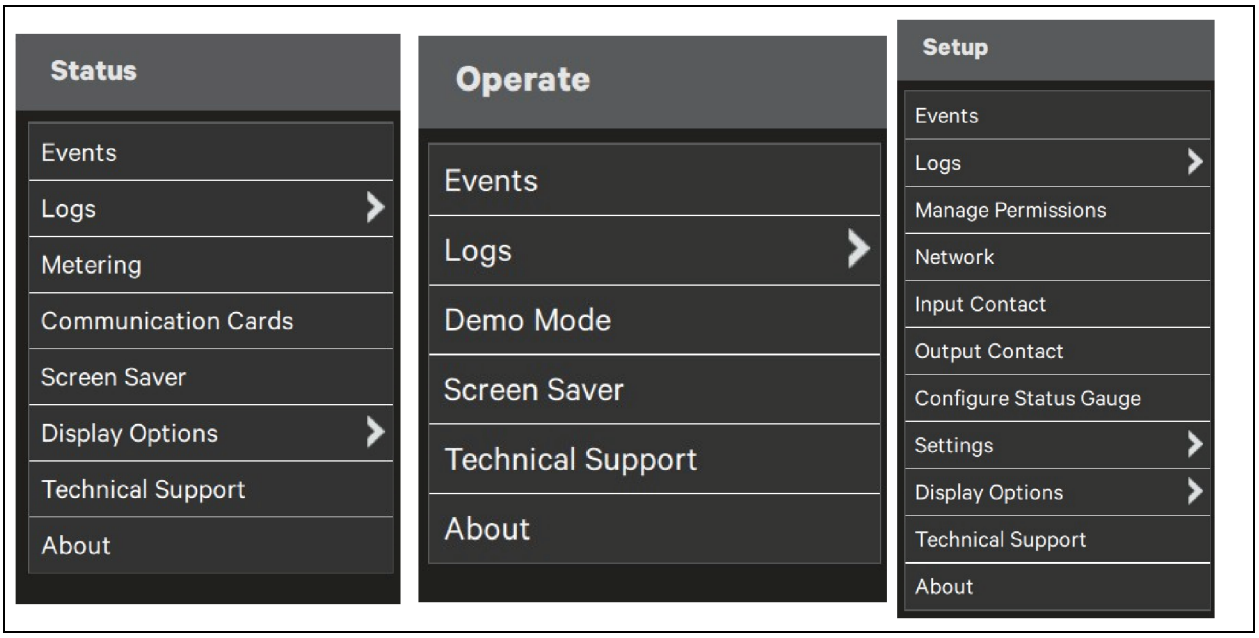
13.1.3 Menu

Context menu

The Context Menu, available at the top left corner of the interface, displays information about the STS and permits changing various settings. The functions possible through the Context Menu are determined by the user's access level and on the Function Menu that is active, see **Figure 13.4** on the facing page.

The menus under Display Options on STATUS, for example, differ for each access level. Some information available through the Context Menu, is alarms and run hours, are available through other areas of the Vertiv™ PowerSwitch 7000 touchscreen control panel.

Figure 13.4 Context Menus



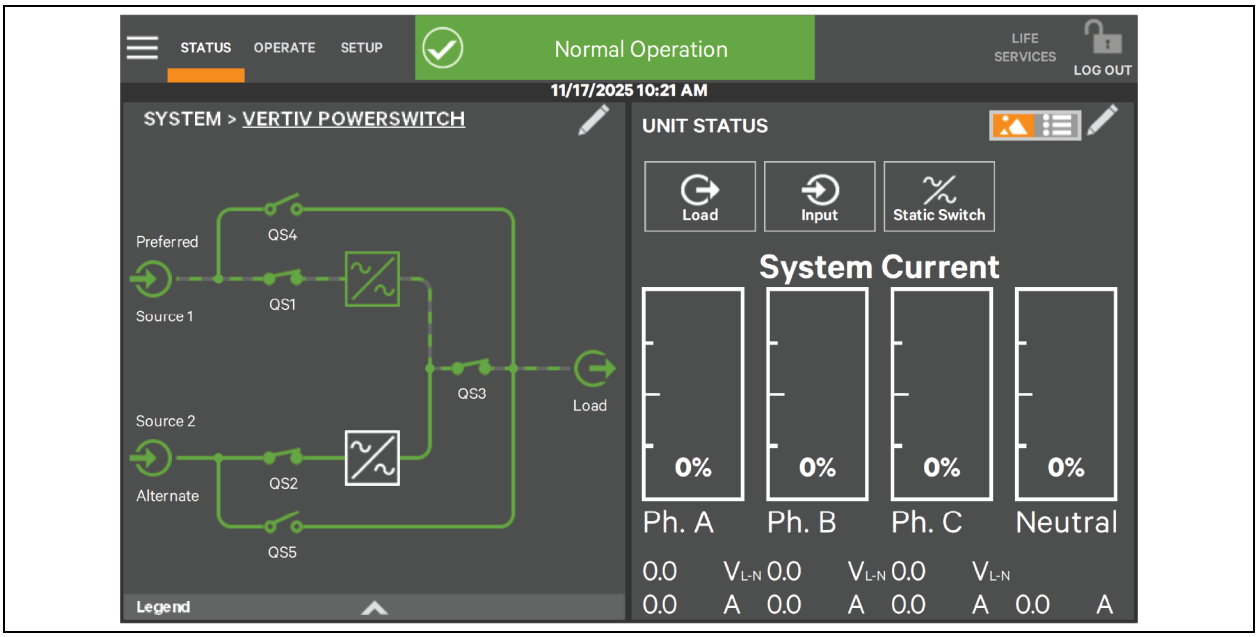
The menu will either show the data or expand the menu to show additional options.

- **Alarms**: Date and time of occurrence, type of alarm, Event ID, component affected and description—see Using the Edit Icon to Customize Layout on page 56. The same options are available for all access levels, except that Observers cannot acknowledge alarms.
- **Logs:** Event Log with date and time of occurrence, type of event, Event ID, status. component affected and description—see Using the Edit Icon to Customize Layout on page 56. The same options are available for all access levels.
- **Screen Saver:** Display Sleep Mode notification (immediate entry into screen saver)—screen goes dark and user is logged off. Interface reactivated by touching the screen. The same options are available for all access levels.
- **Components:** Component status, name, and details.
- **Display Options:** Changes affect view for all access levels.
- **Customize Layout:** Change panel content and layout. See Customizing the Display on page 54. Not available to Observer.
- **Display Properties:** Language, backlight timer, alarm timeout, auto log out timer, display brightness, status indicator brightness and touchscreen calibration. See Customizing the Display on page 54. Language and display brightness only are available to Observer.
- **Date and Time**: Drop down lists for time zone, date, local time and UTC time (Coordinated Universal Time). See Customizing the Display on page 54. Not available to Observer.
- **Formats:** Drop down lists for date and time format and measurement system (metric or imperial). See Customizing the Display on page 54.
- **Technical Support:** Manufacturer's support: website, e-mail address, and telephone numbers.
- **About:** Information about the PowerSwitch 7000 and its Model, rating, configured capacity, model number, serial number, and individual component firmware versions.

Graphic display components

The graphic display shows each configured major component of the STS system. The graphic display is the same for all access levels. The power path is shown by animated lines and the moving dashes show the active power path.

Figure 13.5 Graphic Display, Normal Operation



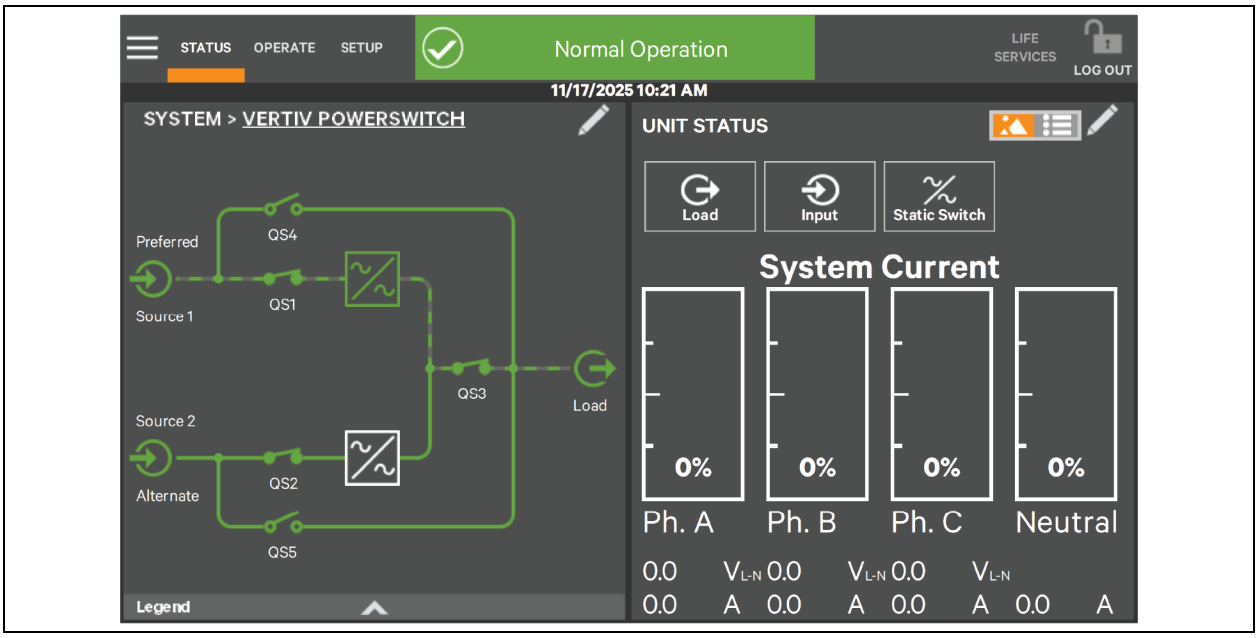
UNIT STATUS pane components

The UNIT STATUS pane is identical for all PIN access levels, see Figure 13.6 on the facing page. Viewers will not have the Edit icon. In the default graphic view, the UNIT STATUS pane shows:

- Load levels for each phase showing connected load as a percentage of capacity, voltage and current for each phase.
- Input Detail Icon
- Static Switch Detail Icon
- Load Detail Icon

Touching any of the detail icons will show additional data about that selection in the opposite pane. The data pane is closed by touching the Close radio button or by touching the same or another detail icon. The read only information is available to all access levels, see Figure 13.6 on the facing page.

Figure 13.6 Unit Status Panel Components Graphic Display



13.2 Operation

13.2.1 Login to the Vertiv™ PowerSwitch 7000 Touchscreen Control Panel

The PowerSwitch 7000 touchscreen control panel is ON when the STS has control power. It is inactive and appears dark, depending on its settings. Touch the touchscreen to turn it ON.

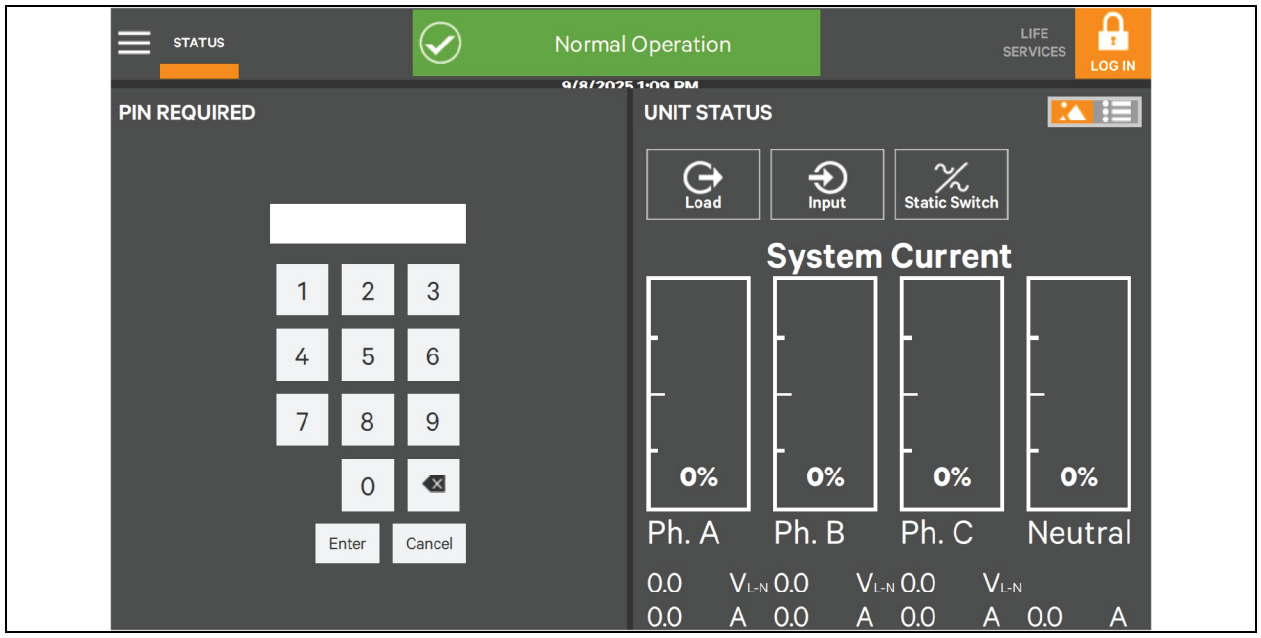
To log in to the PowerSwitch 7000 touchscreen control panel:

1. Touch the login icon 

at the top right of the screen. The lock and background will change color and open the PIN REQUIRED screen, which has a keypad.
2. Enter a PIN at the screen below.
3. Touch Enter.

NOTE: If you enter an incorrect PIN, a screen stating the number is invalid is displayed.

Figure 13.7 Login Screen

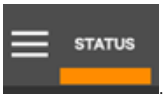


13.2.2 Customizing the Display

The Vertiv™ PowerSwitch 7000 touchscreen control panel's default appearance is adequate for most installations, but the Status panels can be altered to show additional or different data. Layouts may be chosen by a user with Operator or Administrator. The layout chosen is applied to all users. Layouts may be created or altered only with Administrator.

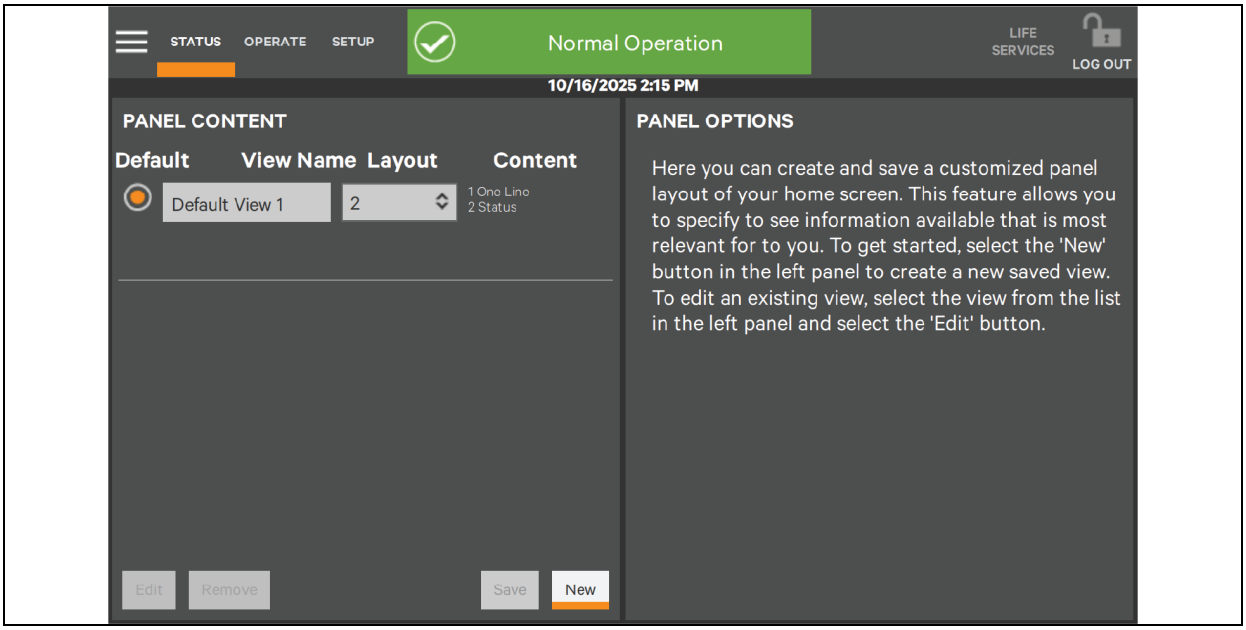
NOTE: The original configuration, Default View 1, cannot be deleted. New views can be created by customizing the appearance using the instructions provided below. The Default View 1 can be modified with the Edit icon shown in the upper right of the display, see Using the Edit Icon to Customize Layout on page 56.

To customize the display's appearance:

1. Login to the PowerSwitch 7000 touchscreen control panel as Administrator detailed in Login to the Vertiv™ PowerSwitch 7000 Touchscreen Control Panel on the previous page.
2. In the STATUS view, touch the Context Menu icon in the top left corner (shown at right) 

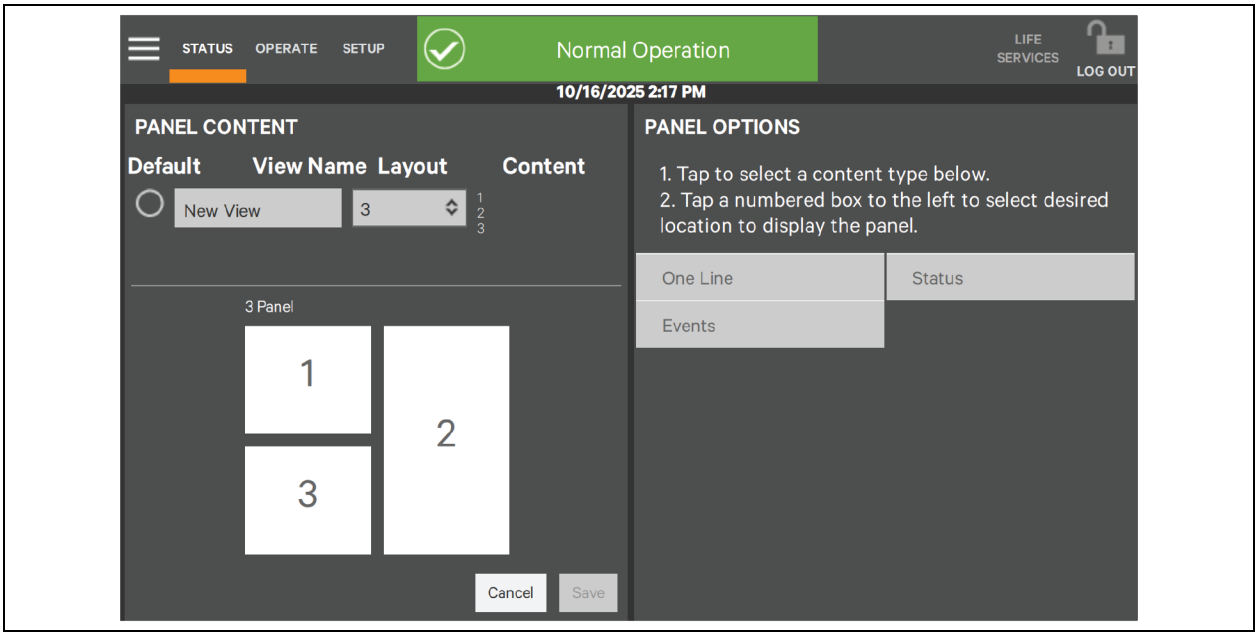
.
3. In Display options, select Customize layout and then to edit or create view touch Edit a view icon on the screen.
4. Touch a view to highlight it or touch Edit to change that view. Create a View.
5. Touch the New button to create a view.

Figure 13.8 Customizing the Display



6. Either accept the generated name (New View) or touch the view's name to rename it using the on screen. keyboard (maximum length is 14 characters). Touch the Enter key on the on screen keyboard after entering the new name.
7. From the drop down list in the Layout heading, select the number of panes to be placed in the new or edited view. The maximum is 4.
8. Choose the data to be displayed in each pane by touching a choice in the Panel options and then touching the appropriate panel. Repeat for each panel.
9. Touch the Save button to keep the changes or touch the Cancel button to exit the screen without saving.

Figure 13.9 Set Number of Panels and Choose Data



10. When the window returns to two screens **Panel content** and **Panel options**, touch the radio button beside the new view to activate it (this puts a dot inside the circle).
11. Touch Save.
12. Touch the STATUS menu icon to see the new appearance.

To choose an existing layout, navigate to the **Panel content** screen and touch the radio button beside the layout, then touch the STATUS menu icon.

Remove a Layout

To delete a layout, Log in with Administrator Operator access level.

Using the Edit Icon to Customize Layout

The Vertiv™ PowerSwitch 7000 touchscreen control panel layout can also be changed with the Edit icons on the screen for a user logged in as Administrator Operator access level. The Edit icon can be used to add or remove panels, resize panels, rearrange panels and change monitored parameters.

To use the Edit icon:

1. Touch the Edit icon  on the panel to be edited and hold it until a Change content button appears on the panel (about 1 second).
2. Touch an icon to choose the data to be displayed in the panel. See **Figure 13.10** on the facing page. Choices are:
   - One Line Run Hours
   - Status Event Log
   - Alarms Battery Cycle Monitor Summary
   - Change UNIT STATUS Panel Content
3. To change the UNIT STATUS data displayed in panel:

a. Touch the Edit icon on the UNIT STATUS panel and hold it until the Change Content button and X's appear beside the parameters.

b. Touch the X beside the parameter to be removed from the panel. The Add Parameter icon (+) will appear in the panel if another parameter can be added. The number of parameters possible is based on whether the Status Gauge is showing.

c. Touching the Add Parameter icon  brings up a window to add parameters not already shown on the UNIT STATUS panel.

d. Touch a parameter's icon to add it to the UNIT STATUS panel.

4. To resize or remove a panel, touch and hold the Edit icon again while the Change content button is displayed.
5. Release the icon. Resize handles will appear around the panel and a large X will appear at the top right corner.
6. Pull on a handle to resize the panel, or touch the large X to delete the panel.
7. To rearrange the panels, with the resize/remove handles visible, touch the circle in the center of the panel and drag the panel to its new position.
8. To exit edit mode, it will deactivate after some changes. If all changes have been made and Edit Mode is active, touch the panel's header area.

Figure 13.10 Change Panel Content or Resize/Remove a Panel

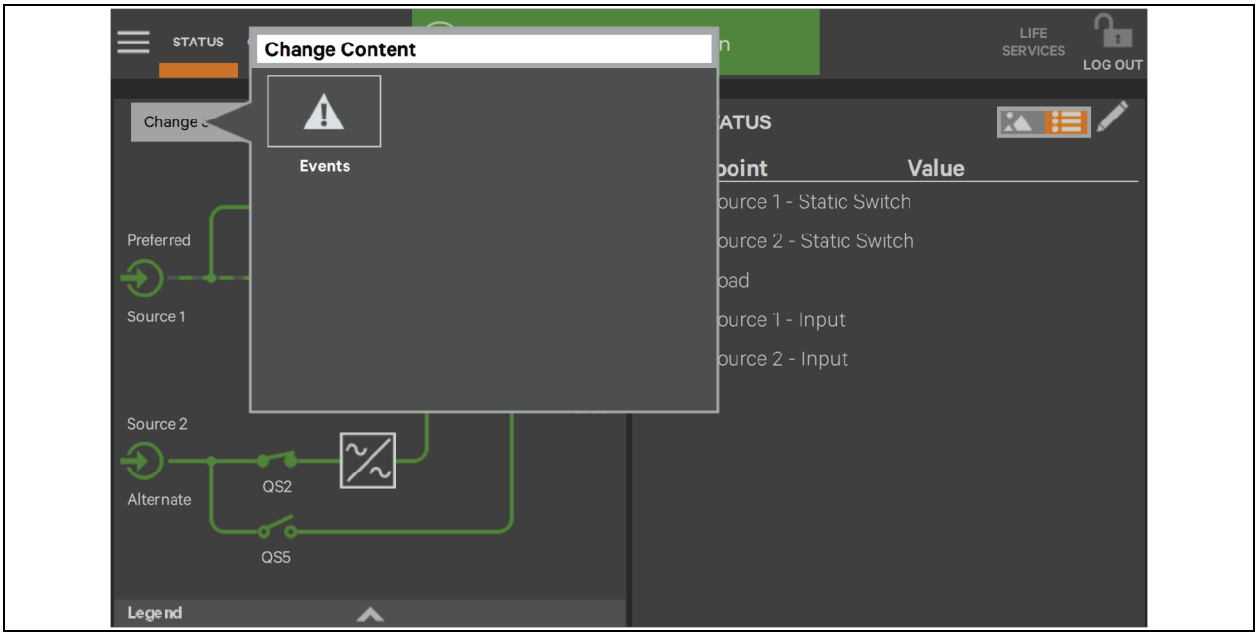
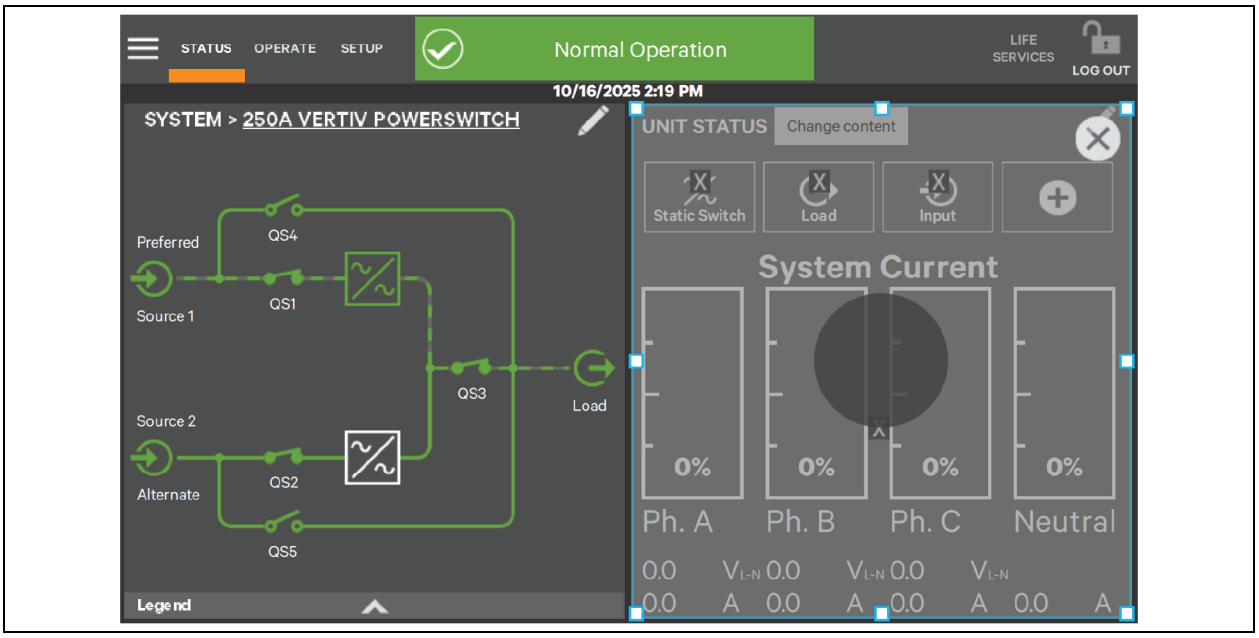


Figure 13.11 Resize or Remove a Panel



Edit UNIT STATUS Panel with the Edit Icon

The UNIT STATUS panel may be changed to add or remove data. The panel has four default parameters. Any or all can be deleted or replaced with the Editing icon.

Possible parameters for the UNIT STATUS panel are:

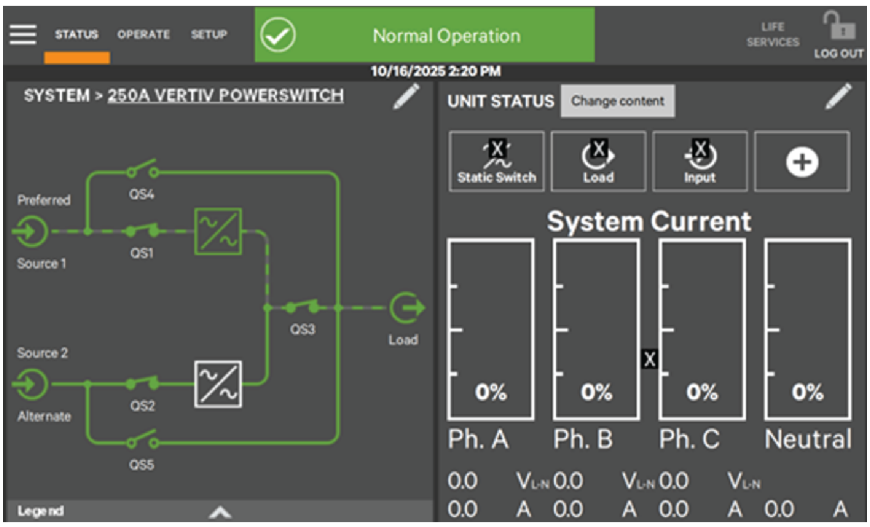
- Input
- Static Switch
- Load

NOTE: Changes made to the UNIT STATUS panel will be applied to all views using the panel.

To edit the UNIT STATUS panel:

1. Touch and hold the Edit icon on the UNIT STATUS panel, to activate the editing mode.
2. Touch the large X by a parameter icon to delete it or touch the + icon at the bottom right of the panel to add a parameter icon.
3. Touch the header area to deactivate the edit mode.

Figure 13.12 Edit UNIT STATUS Panel



13.2.3 Operator Controls

The Operator login enables control of STS functions:

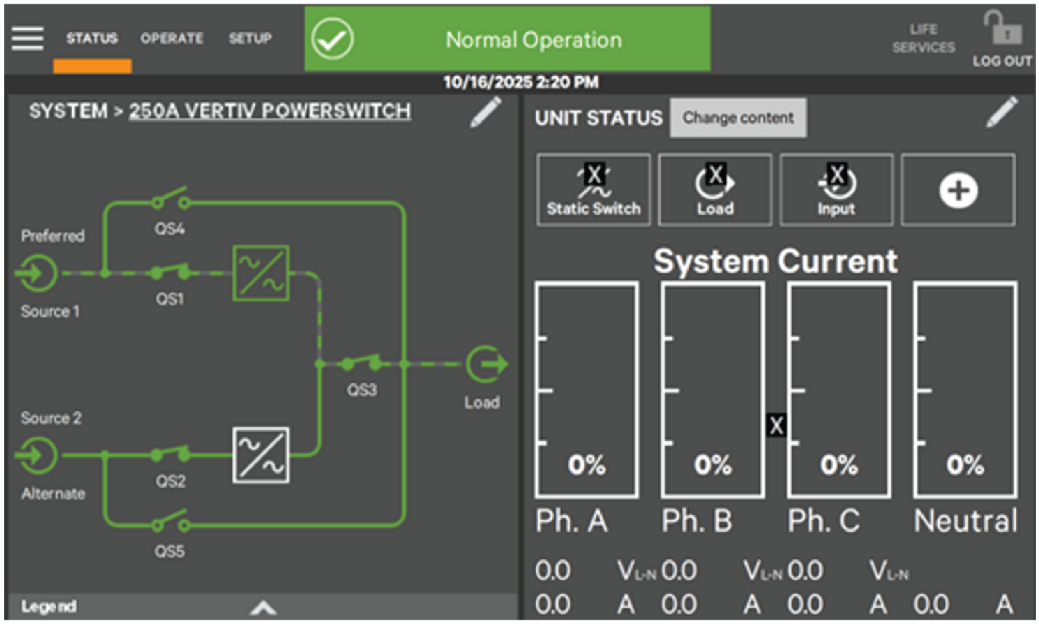
- Silence (Alarm)
- Select Source

Each command is available under the OPERATE menu. The OPERATE menu may be used by logging in with Administrator or Operator access levels.

Operate menu commands

All Operator commands are available from the OPERATE menu. The menu is available when the STS has input power. The STS need not be supplying power to the load for the menu to be available. The graphic screen is not linked to data in this view—touching a component will not cause it to display data.

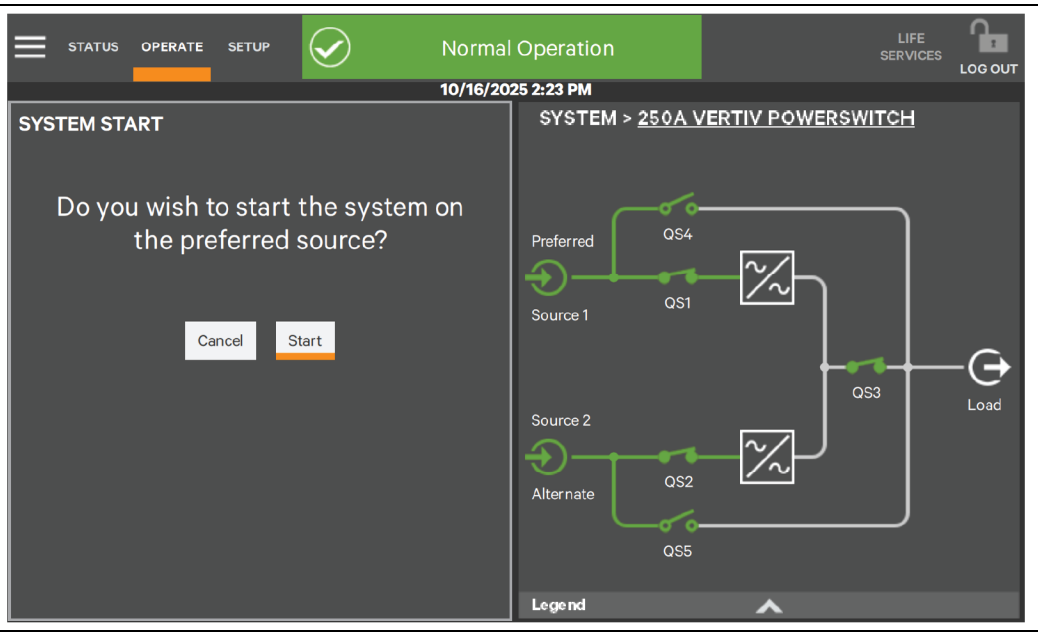
Figure 13.13 OPERATE Menu—Operator Login



Silence an Alarm: To silence an alarm, touch the Silence radio button at the top of the panel.

Select Preferred Source: The Select Preferred Source menu is available when the STS has input power. Verify that the STS is prepared for the static switch to start. When the operator access is shown, commands are the same for all access levels. The Vertiv™ PowerSwitch 7000 touchscreen control panel displays a message asking for confirmation. Click OK to confirm, see Figure 13.14 below.

Figure 13.14 STS Operate Screen



STS Start: The STS start command is available through the OPERATE menu whenever the STS starts up from a powered off state. This command can be disabled by configuring the RESTART MODE setting through the Unit Settings Menu. Log in as Administrator and go to SETUP > Menu > Settings > Unit > Restart Mode.

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14 Specifications

This section provides the specifications for the Vertiv™ PowerSwitch 7000.

14.1 System Configuration

The PowerSwitch 7000 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.

14.1.1 Frequency

The PowerSwitch 7000 accepts frequencies of 50 Hz or 60 Hz depending on unit configuration. The frequency shall be within ± 3 Hz of the nominal frequency.

14.1.2 Input/Output Voltage

The PowerSwitch 7000 models are available to handle various voltages.

The input voltage must be three-phase AC (3 or 4 wire-plus-ground). The PowerSwitch 7000 is designed to accept an input neutral from each source. The neutral is switched in the 4-pole PowerSwitch 7000 only.

The voltage shall be within ± 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

V (L-L)
415 V
400 V
380 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.

NOTE: System current ratings preconfigured at the factory.

Table 14.2 System Current Ratings

Current Rating
160 A
250 A
400 A
600 A
630 A

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	630 A
Load Power Factor Range	0 to 1, leading or lagging
Source Voltage Distortion	Up to 3.5% THD with notches and ringing transients
Overload Capability	125% for 10 minutes*
	150% for 1 minute*
	200% for 10 milliseconds*
*Actual duration may be shorter depending on the upstream over current protection devices.	

14.1.6 Input Surge Suppression

The Vertiv™ PowerSwitch 7000 is equipped with transient voltage surge suppression on each input for maximum surge suppression. The surge suppression is capable of protecting the PowerSwitch 7000 from operating outside of tolerances due to surges as defined by IEC 6100-4-5 (1.2/50 uS surge, 2 kV CM and 1 kV DM) as required under ANSI C62.41 Category B3 (6 kV).

14.1.7 Response Time

The slow input undervoltage and input overvoltage parameters are user adjustable (Delay, Threshold, Enabled/Disabled). The default is 10% of nominal voltage for 5 cycles before the undervoltage or overvoltage event is triggered.

14.1.8 Environmental Requirements

See Location Considerations on page 7 for details concerning environmental requirements for the PowerSwitch 7000.

14.2 System Components

All PowerSwitch 7000 models provide two STS within one enclosure, with the ability to transfer between two input sources to a single output.

All PowerSwitch 7000 are configured with a Touchscreen Control Panel 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 PowerSwitch 7000 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, mm (in.)	Depth, mm (in.)	Height, mm (in.)
160 A to 630 A 3/4 Pole	904.5 (35.61)	831.1 (32.72)	2003.3 (78.87)

The distributed floor weight for PowerSwitch 7000 is less than 660 kg/m² (150 lb./ft²).

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

The PowerSwitch 7000 can be tipped 15 Degrees 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 Anchoring the Vertiv™ PowerSwitch 7000 on page 11.

14.2.3 Cooling

The 160 A to 630 A units can be either fan cooled or convection cooled depending on current rating. 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. By opening the front door, the filter can be changed easily without exposing personnel to high voltage. The air filter dimensions are 350 mm x 762 mm x 8 mm (13.78 in. x 30 in. x 0.32 in.). The air exhaust is through the top of the unit.

14.2.4 Access

The Vertiv™ PowerSwitch 7000 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 switch 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, switches bases, and so on. are replaceable from the front 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 Switches

The PowerSwitch 7000 is equipped with five (or six) molded-case, plug in, non-automatic switches. The switches are CE-Listed for use up to 600 VAC and CE-marked. the plug-in feature of the switch includes an interlock, which prevents the switch from being unplugged without being in the OFF (open) position.

Mechanical interlocks are provided on the switches to prevent improper maintenance bypassing of the solid-state switch. A bypass switch cannot be closed unless the solid-state switch is connected to the same input source and only one bypass switch can be closed at a time. All switches are equipped with N.O. and N.C. auxiliary switches for monitoring of the switch positions. Rotary type switches are not equipped with shunt trips. The PowerSwitch 7000 system provides auxiliary shut trip signals to disconnect devices upstream. Refer to submittal drawing PS7-19-S008 for wiring details.

NOTE: The handle of the switches should be operated using the palm of the hand to apply downward pressure, rotating the handle. Operators should wear A3 gloves.

14.2.6 Cable Entrance

Removable conduit termination plates are provided in the top bottom of the Vertiv™ PowerSwitch 7000 for termination of the two source input conduits or raceways and/or the output conduit or raceways. Bottom conduit box is installed inside the unit for shipping. Remove conduit box and install underneath unit for bottom cable entry.

14.2.7 Doors

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

14.2.8 Touchscreen Control Panel

The display is located in the front of the unit. The LCD touchscreen control panel is used for monitoring and configuring the unit.

See Figure 8.1 on page 24 for a drawing of the touchscreen display.

14.2.9 Emergency Power Off

The Vertiv™ PowerSwitch 7000 includes a remote emergency power off (EPO) terminal block. It also offers an optional local EPO button next to the touchscreen control panel. Because the PowerSwitch 7000 uses non-automatic switches, the EPO sends a trip signal to the required upstream circuit breakers.

14.2.10 USB Port

The unit is equipped with and USB port for data export/import and firmware updates.

14.2.11 Monitoring Cards

The PowerSwitch 7000 supports the Vertiv™ Liebert® IntelliSlot™ RDU120 Card. The Liebert® IntelliSlot™ RDU120 Network Card enables communication such as Vertiv™ Environet™ Alert, Vertiv™ Power Insight, and Vertiv™ Power Assist and LIFE™ Services. It provides web access, data via SNMP, Modbus, and BACNet. Using this card allows you to have real-time view of parametric data and system statuses.

14.2.12 Maintenance Bypass

The PowerSwitch 7000 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 PowerSwitch 7000 is furnished with key-interlocked maintenance bypass switches to configure the bypass.

PowerSwitch 7000 units have all electronics isolated from the input, output, and switches 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 30 for instructions using the touchscreen control panel as well as instructions for Maintenance Bypass if the display is not available.

14.2.13 Options

The following options are available for the PowerSwitch 7000:

- PRB
- RSS
- ICI board
- IP31 Kit Option
- Redundant output switch
- Transfer inhibit
- Seismic kit
- Seismic floor anchors
- Vertiv™Liebert® Intellislot™ RDU120
- Local emergency power off (LEPO)

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15 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.

Minimal periodic maintenance of the Vertiv™ PowerSwitch 7000 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.

15.1 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 15.1 Torque Tightening

Bolt Shaft Size	Hex Head Size	Grade 5 - Imperial Grade 8.8 - Metric, in-lb		Electrical Connections With 1 Belleville Washers		Electrical Connections With 2 Belleville Washers	
		In-lb	Nm	In-lb	Nm	In-lb	Nm
10-32 (M5)	8	3	25	—	—	62	7
1/4-20 (M6)	10	6	53	40	4.5	80	9
5/16-18 (M8)	13	12	107	90	10	180	20
3/8-16 (M10)	17	22	192	120	13.5	240	27
1/2-13 (M12)	19	48	428	480	54	—	—

15.2 Testing the PowerSwitch 7000

The PowerSwitch 7000 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 35.

15.3 Changing the Air Filter

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.

The size of filter is 350 mm x 762 mm x 8 mm (13.78 in. x 30 in. x 0.32 in.).

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Appendices

Appendix A: Technical Support and Contacts

A.1 Technical Support/Service in the United States

Vertiv Group Corporation

24x7 dispatch of technicians for all products.

1-800-543-2378

Liebert® Thermal Management Products

1-800-543-2778

Liebert® Channel Products

1-800-222-5877

Liebert® AC and DC Power Products

1-800-543-2378

A.2 Locations

United States

Vertiv Headquarters

505 N Cleveland Ave

Westerville, OH, 43082, USA

Europe

Via Leonardo Da Vinci 8 Zona Industriale Tognana

35028 Piove Di Sacco (PD) Italy

Asia

7/F, Dah Sing Financial Centre

3108 Gloucester Road, Wanchai

Hong Kong

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