

Chapter 1 Introduction

1.1 General

This manual covers user operation and installation of the WaveStar® Static Transfer Switch (STS) or STS/PDU Systems from 150 Amperes to 1600 Amperes. The manual also covers STS/PDU systems up to 300KVA.

For standalone STS 2000A systems, see *WaveStar® Static Transfer Switch 2000A 3-Pole, Installation and Operation*, Control Number DOC15139.

The PDI STS or STS/PDU System WaveStar units are designed to be an integral part of your power system, allowing easy relocation and expansion of your present system capacity requirements. This manual will help you install and operate your WaveStar STS or STS/PDU System.

1.2 What the STS or STS/PDU System Does

The site UPS (Uninterruptible Power Supply) removes power anomalies originating between the power station and the site. The WaveStar STS (or STS/PDU System) mitigates the effects of the anomalies between the UPS and the STS. These anomalies include:

- Circuit breaker nuisance tripping
- Loss of one upstream UPS source
- Faulty transformers In the System PDU Units

The purpose of the transfer switch is to allow a transparent load transfer from one source to another source in case of a failure of one source or when manually initiated for testing or maintenance.

1.3 Stand Alone and STS/PDU System configurations

The stand-alone WaveStar STS or WaveStar STS/PDU System can be connected between two sources, generally two UPSs. The stand-alone WaveStar STS has a single output load. The WaveStar STS/PDU System is generally an integrated system consisting of the STS unit and any normal PDU distribution system.

There are three configurations of WaveStar. One is a stand-alone STS and there are also two configurations of STS/PDU systems.

- A stand-alone STS has two input sources and the output supplies redundant power to down stream loads. Source voltage will vary depending on the application.
- A primary STS/PDU system contains a single PDU with an internal transformer and STS bolted together. The two input sources are connected the STS and the STS output is connected to the PDU input. The PDU distribution is connected to the site loads. In this configuration the STS unit is generally a 480V application feeding the PDU transformer to be stepped down to the 120/208V for distribution.
- A secondary STS/PDU system contains two PDU's with internal transformers and a STS, all bolted together. Each input source is connected to the one PDU. The input of the PDU is generally 480V and is stepped down to 208V for the output. Each of the two PDU outputs is connected to the STS inputs. In this configuration, the STS unit is generally a 208V application. The STS output is connected to the distribution, which is located in the PDU sections. Since the PDU units are redundant, one PDU can be made "electrically cold" for maintenance while the other PDU powers the load.

1.4 Features/Options

The WaveStar Static Transfer Switch (STS) and the WaveStar STS/PDU system have the following relevant features:

1. Two transfer algorithms:
 - a. POG: 4 Ms or less transfer time for outages; 2ms for manual transfers

- b. VSS: The Volt Second Synchronizing algorithm reduces the inrush of magnetic load; the transfer time can range from 4ms to 8 Ms depending on the phase shift between the sources.
 2. Security:
 - To reduce the possibility of issues with STS operation that may be factored to human input, there are several security options designed into the unit to protect the system.
 - No operations through the touch screen monitor can be completed without a valid login. A Password (PW) and PIN# are required by the operator in order to login. The PIN # identifies the operator and records their activities during the login period in the event log. There is also an optional fingerprint and/or swipe card device that can be installed for the auto entry of Password and the PIN #. Contact PDI Customer Support for information regarding these options.

If the front door is opened without a valid login, the unit alarms and the alarm is logged into the event log. All operation of the internal MCSW/MCCBs is tied in the event log to the operator's Login identification.
 3. Maintainability:
 - Hot swap ability - all logic Printed Circuit Boards (PCBs) can be hot swapped, without loss of basic function and without placing the STS unit in bypass. Molded Case Switches (MCSW)/Molded Case Circuit Breakers (MCCB) can be replaced as long as they are not conducting at the time (They are on the opposite source of the one that the unit is selected to). However, it should be noted that once a MCSW is removed, the unit cannot transfer. This will allow for component replacement on the non-conducting side of the STS unit and it does not require side or rear access.
-
- NOTE** Maintenance on the units should only be performed by a qualified technician.
-
- All connections can be IR scanned without access to the rear.
 4. Reliability
 - There is a redundant operator interface (ROI) using LED's and toggle switches in the event the graphic display/touch screen is not operable
 - The STS unit is very reliable through the use of dynamic redundancy of Tri-Redundant logic; Tri-Redundant power supplies; quad-redundant gate drivers and N+3 redundant fans on units including fans.
 5. Communication and Down Load capabilities:
 - Alarm and status data as well as waveform data can be transmitted to remote locations via Modbus RTU, WEB and E-mail as standard. Data can also be transferred via any of the following protocols as options: ModBus TCP/IP, SNMP, land line Modem or cell Modem.
 - This information can also be down loaded locally via, PC using USB port or Optional memory stick or using a PDA using IR. Contact the PDI Factory or your local Sales representative regarding this option.
 6. Human Engineering: To help assist the Human operators, the help system has been designed to provide support to perform basic tasks.
 - Voice over and text operating instructions are available through the help screen for various operations of a standard operating nature
 - The normal and redundant displays are visible with the door open. This allows the operator to continue viewing the instructions and or mimic while performing operations on the MCSW/MCCB.
 7. Graphics Monitor/touch screen has the following screen features:
 - Wave form capture of events
 - STS and PDU voltage and current screens

- Load trending screens
 - Voltage & current harmonics screens
 - Graphics one lines
 - Alarm and log screens
 - Operator controls
 - Optional distribution and BCMS Data
8. Built in test
 9. Using the optional built-in load bank the STS can be 100% tested. The Waveform capture capability can be used as a scope to allow the transfer waveforms to be observed while transferring with loads.

1.5 Features/ Options

1.5.1 Two transfer algorithms

1. POG: 4 Ms or less transfer time for outages; 2ms for manual transfers
2. VSS: The Volt Second Synchronizing algorithm reduces the inrush of magnetic load; the transfer time can range from 4ms to 8 Ms depending on the phase shift between the sources.

1.5.2 Security

- To reduce the possibility of issues with STS operation that may be factored to human input, there are several security options designed into the unit to protect the system.
- No operations through the touch screen monitor can be completed without a valid login. A Password (PW) and PIN# are required by the operator in order to login. The PIN # identifies the operator and records their activities during the login period in the event log. There is also an optional fingerprint and/or swipe card device that can be installed for the auto entry of Password and the PIN #. Contact PDI Customer Support for information regarding these options.
- If the front door is opened without a valid login, the unit alarms and the alarm is logged into the event log. All operation of the internal MCSW/MCCBs is tied in the event log to the operator's Login identification.

1.5.3 Maintainability

- Hot swap ability - all logic Printed Circuit Boards (PCBs) can be hot swapped, without loss of basic function and without placing the STS unit in bypass. Molded Case Switches (MCSW)/Molded Case Circuit Breakers (MCCB) can be replaced as long as they are not conducting at the time (They are on the opposite source of the one that the unit is selected to). However, it should be noted that once a MCSW is removed, the unit cannot transfer. This will allow for component replacement on the non-conducting side of the STS unit and it does not require side or rear access.



NOTE

Maintenance on the units should only be performed by a qualified technician.

- All connections can be IR scanned without access to the rear.

1.5.4 Reliability

- There is a redundant operator interface (ROI) using LED's and toggle switches in the event the graphic display/touch screen is not operable
- The STS unit is very reliable through the use of dynamic redundancy of Tri-Redundant logic; Tri-Redundant power supplies; quad-redundant gate drivers and N+3 redundant fans on units including fans.

1.5.5 Communication and Down Load capabilities

Alarm and status data as well as waveform data can be transmitted to remote locations via Modbus RTU, WEB and E-mail as standard. Data can also be transferred via any of the following protocols as options: ModBus TCP/IP, SNMP, land line Modem or cell Modem.

This information can also be down loaded locally via, PC using USB port or Optional memory stick or using a PDA using IR. Contact the PDI Factory or your local Sales representative regarding this option.

1.5.6 Human Engineering

To help assist the Human operators, the help system has been designed to provide support to perform basic tasks.

- Voice over and text operating instructions are available through the help screen for various operations of a standard operating nature
- The normal and redundant displays are visible with the door open. This allows the operator to continue viewing the instructions and or mimic while performing operations on the MCSW/MCCB.

1.5.7 Graphics Monitor/touch screen has the following screen features

- Wave form capture of events
- STS and PDU voltage and current screens
- Load trending screens
- Voltage & current harmonics screens
- Graphics one lines
- Alarm and log screens
- Operator controls
- Optional distribution and BCMS Data

1.5.8 Built in test

Using the optional built-in load bank the STS can be 100% tested. The Waveform capture capability can be used as a scope to allow the transfer waveforms to be observed while transferring with loads.

1.6 PDI Background

PDI designs and manufactures redundant power and distribution products for the power quality market. The WaveStar STS and STS/PDU system is completely self-contained, factory-tested unit designed to transfer critical load between multiple power sources without interruption. Additionally the STS/PDU systems provide distribution systems.

PDI was founded in 1978 as a Virginia corporation with the corporate offices and factory located in Richmond, VA. Since its inception, PDI has strived to provide quality products to meet the demanding needs of our industry. PDI's roots are in the computer power distribution and voltage regulation market. As this market has evolved and the need for quality power has grown, PDI has developed innovative solutions to meet the power quality needs of new technologies. Our patented harmonic cancellation systems and the UL listed STS or STS/PDU Systems, line regulators, and harmonic mitigation products are prime examples of our innovation.

PDI was awarded the Frost & Sullivan 2004 award for Market Leadership and the 2005 award for Customer Value Enhancement. This document will describe the operation and configuration of a three phase, two input STS or STS/PDU System.

The appendices contain spare parts, warranty data, and equipment drawings.

An installation drawing is included in the Appendix. The installation supervisor should review the drawing prior to installation. Questions pertaining to this manual, the installation or operation of the STS or STS/PDU System (STS) should be directed to the PDI service department @ 1-800-225-4838.

PDI Service contact information: Power
Distribution Inc. 4200 Oakleys Court Toll Free: (800)-225-4838 Phone: (804) 737-9880
Richmond, Virginia 23223
service@pdicorp.com



1.7 Using This Manual

Read this manual thoroughly and make sure you understand the procedures before you attempt to install, set up, operate or carry out any maintenance work on this Eaton product.

Read through each procedure before beginning the procedure. Perform only those procedures that apply to the unit being installed or operated.

1.8 Conventions Used in This Manual

This manual uses these type conventions:

	NOTE Some conventions only apply to display screens (if installed).
<hr/>	
<ul style="list-style-type: none">• Bold type highlights important concepts in discussions, key terms in procedures, and menu options, or represents a command or option that you type or enter at a prompt.• <i>Italic type</i> highlights notes and new terms where they are defined.• <code>Screen type</code> represents information that appears on the screen or LCD.	
<hr/>	
Icon	Description
	Information notes call attention to important features or instructions.
[Keys]	Brackets are used when referring to a specific key, such as [Enter] or [Ctrl].

1.9 Symbols, Controls, and Indicators

The following are examples of symbols used on the UPS or accessories to alert you to important information:



RISK OF ELECTRIC SHOCK - Observe the warning associated with the risk of electric shock symbol.



CAUTION: REFER TO OPERATOR'S MANUAL - Refer to your operator's manual for additional information, such as important operating and maintenance instructions.



This symbol indicates that you should not discard the UPS or the UPS batteries in the trash. This product contains sealed, lead-acid batteries and must be disposed of properly. For more information, contact your local recycling/reuse or hazardous waste center.



This symbol indicates that you should not discard waste electrical or electronic equipment (WEEE) in the trash. For proper disposal, contact your local recycling/reuse or hazardous waste center.

1.10 Getting Help

If help is needed with any of the following:

- Scheduling initial startup
- Regional locations and telephone numbers
- A question about any of the information in this manual
- A question this manual does not answer

Please call the Eaton Help Desk at:

United States: **1-800-843-9433** or **1-919-870-3028**

Canada: **1-800-461-9166 ext 260**

All other countries: **Call your local service representative**

Please use the following e-mail for manual comments, suggestions, or to report a technical error in this manual.

E-ESSDocumentation@eaton.com

1.11 Warranty

To view the warranty please click on the link or copy the address to download from the Eaton website:

[UPS Product Warranty](https://www.eaton.com/content/dam/eaton/products/backup-power-ups-surge-it-power-distribution/backup-power-ups/portfolio/eaton-three-phase-ups-warranty.pdf)

<https://www.eaton.com/content/dam/eaton/products/backup-power-ups-surge-it-power-distribution/backup-power-ups/portfolio/eaton-three-phase-ups-warranty.pdf>