

# Static Transfer Switch

The **Model W** is the worlds smallest and fully functioned wall mounted point of distribution Static Transfer Switch (STS). The implementation features the high reliability and ruggedness of solid state Thyristor / SCR switching and full digital electronics control system. The Static Transfer Switch will protect your critical load by automatically switching to the alternate power source upon detection of a problem on one. To avoid the dangers of paralleling power sources, all switching is break-before-make, (the break is so small that it ensures that there will be no disruption to the operation of your connected equipments).

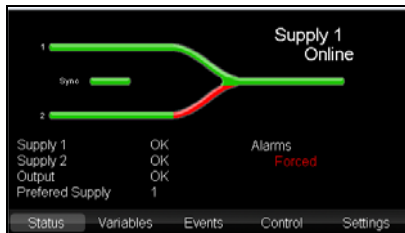


These units are extra rugged, naturally cooled and contain generously rated, high fault capacity solid state thyristors for installation into distribution systems with high fault current up to 20kA Short Circuit Capacity

## Maintenance Bypass

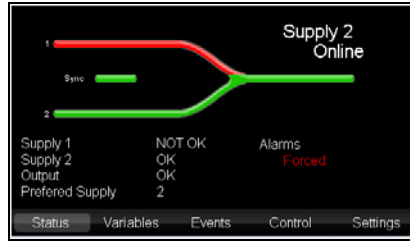
An integrated CAM Operated 3-position, interlocked, overlapping Maintenance Bypass facility provides a single operation make-before-break (overlapping contact) Maintenance Bypass to allow repair or removal of a faulty module without loss of power to the critical load. Complete STS power module isolation is available using incoming 3-phase, 4-pole isolators whilst safely powering the load and undertaking maintenance or repair functions.

**Simplicity Is The Key:** Color, back-lit, touch screen LCD provides the user with an easy to navigate hierarchical real time information and control interface.



Easily identify state changes from the mimic diagram showing system status and / or alarms (Default screen)

# MODEL W

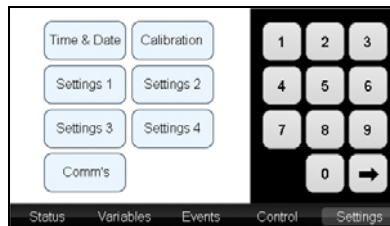


The LCD provides a full-color mimic, alarm / status indication and audible to provide instant recognition of the STS state. The backlit LCD further provides useful real-time information such as supply variables, power quality, event log via a 200 deep, real time, easily understandable event log to provide the user with informed operational information displays. In addition the control interface provides access to all essential parameters and set-up information for the time, Modbus & LAN.

	Red	White	Blue
Supply 1	243	240	241
Supply 2	235	237	241
Output	243	240	241
Current	10	9	13
CF	0.0	0.0	0.0
kW	0.0	0.0	0.0
kVA	0.0	0.0	0.0
PF	0.0	0.0	0.0
Frequency	1: 50Hz	2: 49.9Hz	
Sync	0		

Date	Time	Event	Target
24.05.2010	00:02:48	Synchronisation	LOS
24.05.2010	00:01:53	Heat Sink Temp	HI
24.05.2010	00:01:53	Override	3
24.05.2010	00:01:53	Preferred	3
24.05.2010	00:01:03	Warm Boot	
24.05.2010	00:01:03	Heat Sink Temp	HI
24.05.2010	00:01:03	Override	3
24.05.2010	00:01:03	Preferred	3
24.05.2010	00:01:03	Warm Boot	
24.05.2010	00:01:03	Synchronisation	LOS
24.05.2010	00:00:51	Heat Sink Temp	HI

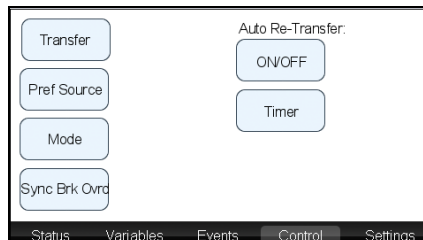
Password protected Setting of all operating parameters



## Control Functions

LCD control functions enable the user to:

- TRANSFER BETWEEN SOURCES
- SET SUPPLY SOURCE PRIORITY
- GAIN ACCESS TO ALL SETTINGS PARAMETERS (2 levels for each parameter => manual & automatic)
- MANUAL /AUTO Mode Selection
- SYNCH OVERRIDE/BREAK TIMER
- AUTO RETRANSFER ON/OFF
- AUTO RETRANSFER DELAY / TIMES TO LOCKOUT
- HELP – Text procedures



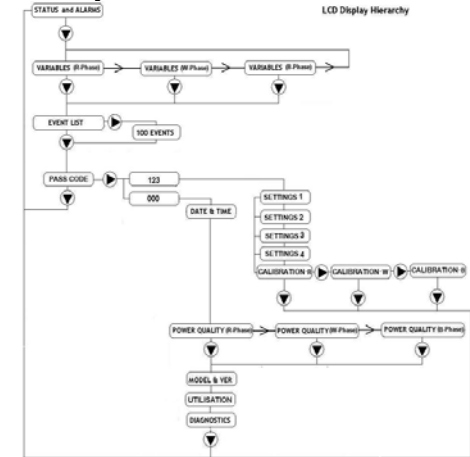
# i - STS

Clear Indication of ALARM Visual Prompt and Audible Alarm (Alarm Silence and Status display by touching screen)



Alternating visual display of ALARM Condition

## Hierarchy



**Maximum Reliability:** The Model W STS features a high reliability, surface mount technology, low maintenance, robust design with redundant circuitry. The units use DSP high speed digital sampling for stable, reliable and predictable operation

Redundant control functions / Manual /Auto functionality is provided using an internal OVERRIDE and PRIORITY switch.

Redundant power supplies, independent power rails and fail safe circuitry techniques and through the use of digital circuitry and redundant and independent controls MTBFs of 800,000 Hrs are able to be realized.

Load fault protection assures that the fault is not transferred to the alternate supply even if this results in voltage degradation of the on line source. This feature ensures that the alternate source and their connected loads remain protected against degradation caused by the overloading or by connected equipment faults.

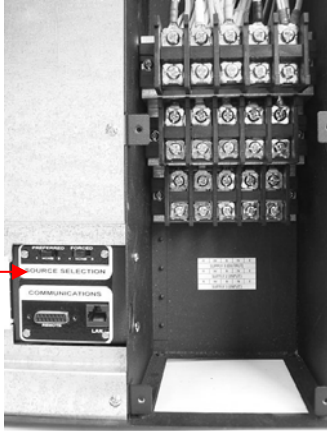
SCR Short circuit and Open Circuit Protection, reporting and control lockouts ensures that the critical load is always safe.

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## Connection

Power to and from the STS are via fixed wiring to 3 sets of screw terminals suitable for cables to 35mm<sup>2</sup> (50 mm<sup>2</sup> for 80 & 100 amp units). With a cable way at the rear of the unit cables can come from either the top or the bottom.



Override, Priority and User I/O termination

(Cover for access to incoming terminals removed for clarity)

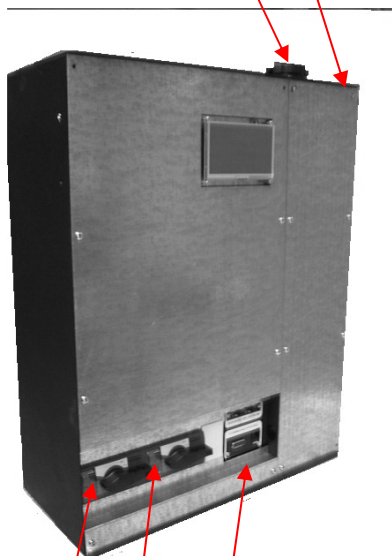
## Maintainability

For normal operation no access to the internal componentry is needed. Hardware override controls (Manual / Auto and Priority setting) is provided for by removing the outer cover. This allows a qualified operator access to voltage, measurements, the override and priority controls and the isolation of the static portion.

Access for maintenance is provided by the removal of interior covers

Cover for access to incoming terminals

Maintenance Bypass Switch



Override, Priority and User I/O terminations

Supply 1 Isolator Supply 2 isolator

## Top View



## How it works

While the function of the Static Transfer Switch is fairly clear – detect supply faults and act appropriately to keep power available – its operation is not so obvious. So what goes on inside the unit?

### 1. Detection

To take an action on a fault we must first detect the fault, to do this we take a close look at the supplies. This detection process involves attenuating the three waveforms we are interested in – supply 1, supply 2 and output supply. The signal is attenuated from the incoming nominal 3-phase AC voltage 400/230 (or similar) to 1.5V AC. This provides the STS with the waveforms it requires at a reasonable level for analysis by the three sets of Digital Signal Processors (DSPs). Each supply and phase has its own DSP, where the AC waveforms are continuously sampled at 64 times per cycle and compared to real time maximum and minimum values. If an error is detected (by say 2 or 3 consecutive 300 usec samples above or below the limit) the DSP returns an output to the CPLD (which handles actions, explained below). While these 'transient' variations are being monitored, the DSPs are also computing the three supplies RMS values and comparing them to an averaged value, where an output will be returned should any average value fall out of tolerance. These processes are the same and independent, for supply 1, supply 2 and supply 3. For additional reliability, the supply 3 DSP provides redundant detection for supply 1 and supply 2, and also detects power loss at the output in case there is an internal failure.

### 2. Action

Now that we are aware of any faults, we can take appropriate action.

Once a fault is identified, a Combinational Programmable Logic Device (CPLD) decides what actions to take and how to perform them. The CPLD is a fast, simple and reliable hardware digital logic controller which uses combinational logic and a state machine to handle all the actions, sequences and timings required to safely and reliably transfer the connected critical load.

The program loaded on the CPLD is designed by in-house engineers specifically for use on the range of Static Transfer Switches. When the fault signals have been processed and the CPLD has decided what action to take, a signal is sent straight to the switching devices. While

the STS is capable of high level analysis of power supplies and intelligent interpretation of the results it acquires, it's main function is still achieved through a simple two step process – detect and act.

### 3. Reporting

Displaying the state of the system brings the user into the picture.

The reporting, where necessary, is achieved by interrogating the "User Local LCD microprocessor". This is a separate, independent device and does not partake in any control function. Information gathered by this microprocessor is organized and displayed on the front panel LCD. This information is also made available to the LAN WEB Server processor, which is again separate and plays no part in the operation of the STS, except to provide access for remote interrogation. The simple display of state through the LED mimic is a more direct process, interfacing only with CPLD.

### 4. Control

With knowledge of the state, the user can decide how to control the STS.

Control pushbuttons, user relays and remote transfer inputs also interface directly with the CPLD, independently from the LCD or any microprocessors. Control inputs can be seen to directly initiate an action in the case of user input, or influence an action in the case of fault input. More involved inputs, such as tolerance settings, are achieved through the LCD or LAN WEB server.

### 5. Protection

The Static Transfer Switch incorporates many failsafe measures to ensure more reliable operation.

The power semiconductors used within the Static Transfer Switches are SCRs (Thyristors) and are manufactured by Semikron, a world leader in the supply of power electronic components. They are very rugged and overrated. Each source and neutral is protected by a 100 Ampere fuse. These fuses ensure that the STS is safe, even when installed into distribution systems with extremely high fault currents. Even though the STS contains fuses, it is capable of very high overload and fault capability. For safety reasons there needs to be some protection between the source and the load – the fuses are for final STS protection only. We would expect that the down stream fuses in the faulty equipment will clear first, thus loss of output due to internal STS failure is not likely to occur except for the most arduous operating conditions. The STSs contain fuses that ensure safe installation for supply capacities up to 20 kA.

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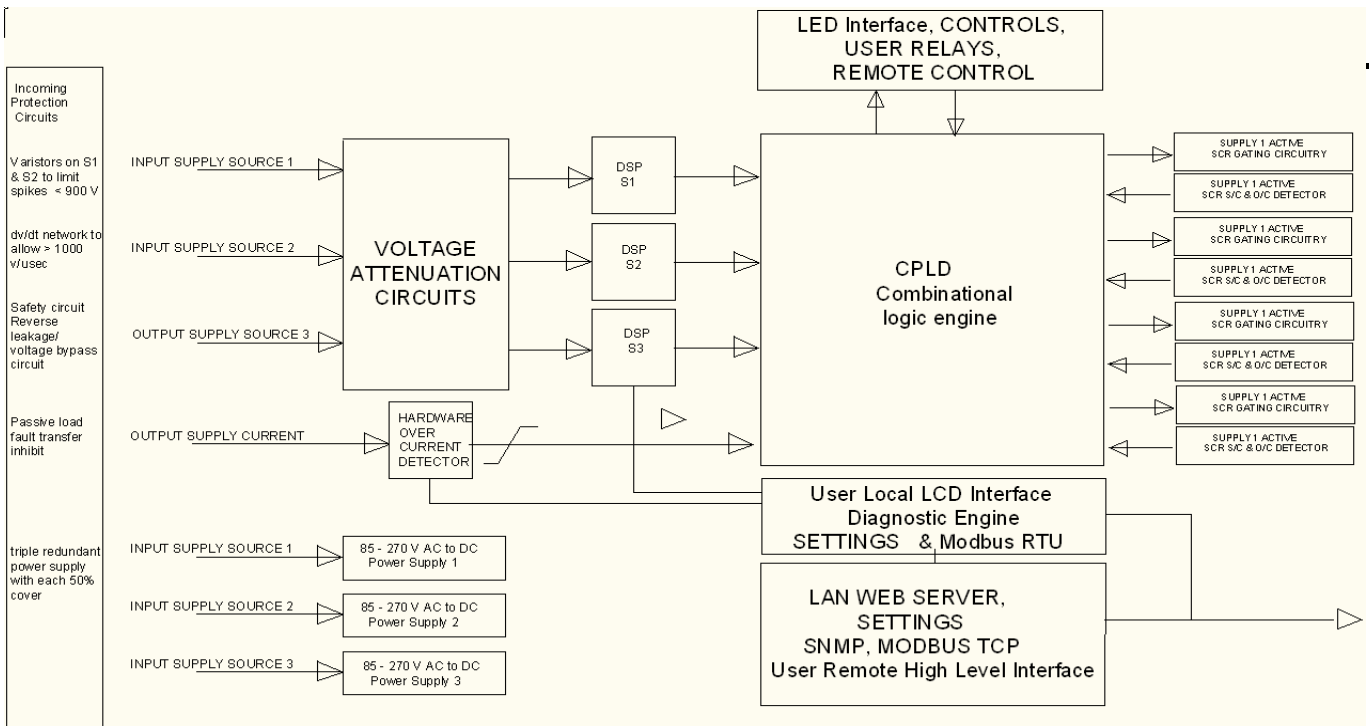


The use of these fuses:

- Allows the STSs to be part of installations with extremely high fault current capability (up to 20 kA)
- Allows currents of up to 150 Amperes for in excess of 30 seconds and 200 Amperes for 25 cycles, (1/2 second).
- Provides overload and fault withstand capacities of at least 400A for 100msec without rupture of internal 100A fuse and without damage to the STS semiconductors.
- Provides fault current characteristics for safe and fast rupturing of fuses where fault current exceeds 2000 Amperes.
- At a fault current between 2kA and 20kA, the internal 100A fuse will rupture safely and the STS semiconductors will fail safely.

The fault current values indicated above are seldom found in rack mounted arrangements as the cables interconnecting the source and the load limit the fault currents to very low values, below that which would cause the fuse to rupture. In reality, downstream protective devices are always smaller and operate well before the internal fuses operate near these levels. In the rare event that one of the SCR/Thyristors fail, the unit incorporates protection circuitry and reporting of SCR / Thyristor failures as Open Circuit or Short Circuit. Even when this occurs your load is fully protected – the functionality of the STS is impaired but not the continuity of power to the load. In fact there is no logic or process that disrupts power to the load. Events such as over-temperature, overcurrent and overload only raise an alarm. If unattended to a SCR/Thyristor failure may result but this does not result in loss of power to the

load. Finally in case of a load fault the STS will not transfer the load fault to the other source (in fear that both sources may then see the fault and be affected), even if this load fault condition results in loss of power to the faulted equipment (because the source has failed). However, usually the source (say if it's a UPS) will transfer to its internal bypass and will have the extra capacity to clear the fault. All other STSs (assuming there are others) will see the transient on the original source and safely transfer to the alternate source without affecting their connected loads.



These specifications refer to typical standard, 20 – 100 Ampere, Model W, 3-Phase, 3 or 4 Pole Static Transfer Switch

Rating, 3-Phase / phase	20 / 32 / 50 / 63 / 80 & 100 Amperes RMS
Voltage Rating	400 V / 230 ± 20% (115 V AC or Auto ranging available)
Permissible Voltage Distortion	15% THDV
Frequency	50 Hz ± 5% (60 Hz or Auto ranging available on request)
Type	3 Phase + N (true 4-pole, 4 x AC Static Switches /source)
Efficiency	98.9%
Transfer Type	Thyristor (break-before-make, no source overlap, zero current, neutral overlapping)
Detection	Digital (< 1 msec)
Break time	Normal; (< ½ msec), Max < ¼ cycle (5msec).
MTBF	> 800,000 Hrs
Device Ratings	100 Amperes RMS, 1600 Volts, 2 kA 10msec, 20kA A <sup>2</sup> S
Fault rating	20 kA
dV/dt	1000 V/µsec
Minimum Current	0 Amperes
Fault Current Setting	Approx. 160 Amperes peak (transfer lock-out)
Protection	Internal 100 Ampere fuses
Overload Capacity	Up to 120 % for 30 seconds 200 % for 0.5 second 400 Amperes for 100 msec 2000 Amperes for 10 msec
User Interface	Hierarchical, Color, backlit, touch screen real-time monitoring (internal manual override controls)
Remote I/O	5 x Voltage free contacts (50 V DC, 1 Ampere N/O) + 2 Transfer Controls
LAN Browser	Standard
SNMP	Standard
Modbus	Standard,
Operating Temperature	0 - 40 °C
Cooling	Natural (except for 50 Ampere and above, redundant forced)
Physical Size	440 W x 200 D x 550H
Environmental Rating	IP41
Weight	25 kg (typical)
Color	Black Powder Coat / Black front panel (or as specified)
Compliance	IEC 62310-1,2 & 3 (for STSs), CE Approval
Inlet / Outlet Connections	Bolt in terminals suitable for up to 35 mm <sup>2</sup> cables @ 20-63 Amps, 50mm <sup>2</sup> for >63

Contents Subject to change without notice

## Static Transfer Switches

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