ARTronic® STS

STATIC TRANSFER SWITCHES

Finance | Medical | Industry | IT

APPLICATION

Static Transfer Switches (STS) are designed to transfer supply between independent one-phase or three-phase AC power sources. Unlike traditional automatic transfer switches (ATS), STS provides 20 times faster load transfer (typically 1/4 of a cycle), which ensures the uninterrupted operation of even the most sensitive electronic equipment. Load retransfer to a preferred input source is virtually instantaneous (typically 100 μs). The basic applications of STS are in automatic systems for power industry, power supply systems for petrochemical industry, computer and telecommunication centres, operating theatres, intensive care units, automatic and security systems of 'intelligent' buildings as well as other equipment which is highly sensitive on supply interruption.
It's high overload capacity and transfer algorithm enables rapid fuse blow during short-circuits. In consequence voltage immediately returns to normal value to supply other loads. The built-in transient voltage surge suppression system for SCR switches provides additional protection against damage to supplied devices.

DEVICE TYPE	
2P	1-phase 1-pole static transfer switch
2PN	1-phase 2-poles static transfer switch
3P	3-phases 3-poles static transfer switch
4P	3-phases 4-poles static transfer switch

Static Transfer Switch STS 4A400

STANDARD FEATURES

- Ability to create systems with redundancy (switching between independent electrical supply lines, various UPS devices and generators)
- Short transfer time (typically 3 ms after line failure)
- Elimination of voltage swells, sags and interruptions on loads (switch-over)
- Protection against voltage variations out off range
- Switches are controlled by DSP
- Internal redundancy for power supply systems and SCR drivers (eliminating failures in single points)
- Easy to operate
- Easy to install
- Lowest MTTR (mean time to repair)
- Low installation and maintenance costs
- Bypass switches to provide continuous non-break operation during STS maintenance
- Remote switching of power sources
- Status indication for power supply system and STS

Options

- RS485 communications interface

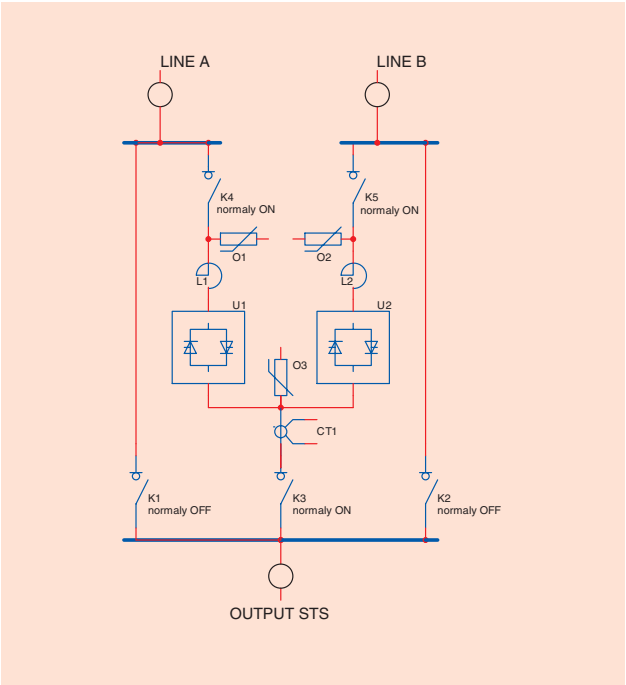


Fig. 1. Single line diagram of STS with maintenance bypasses.

ARTronic® STS

SCHEMATIC DIAGRAMS

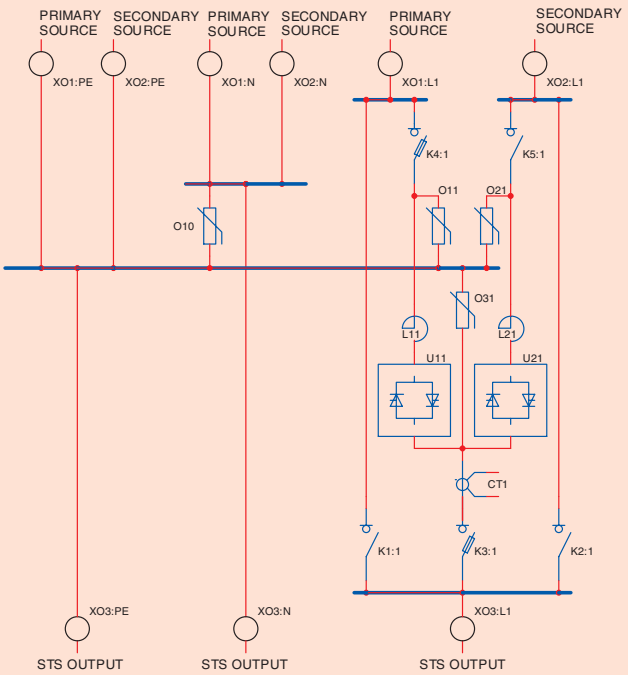


Fig. 4. Power stage circuit of 1-phase 1-pole switch 2P.

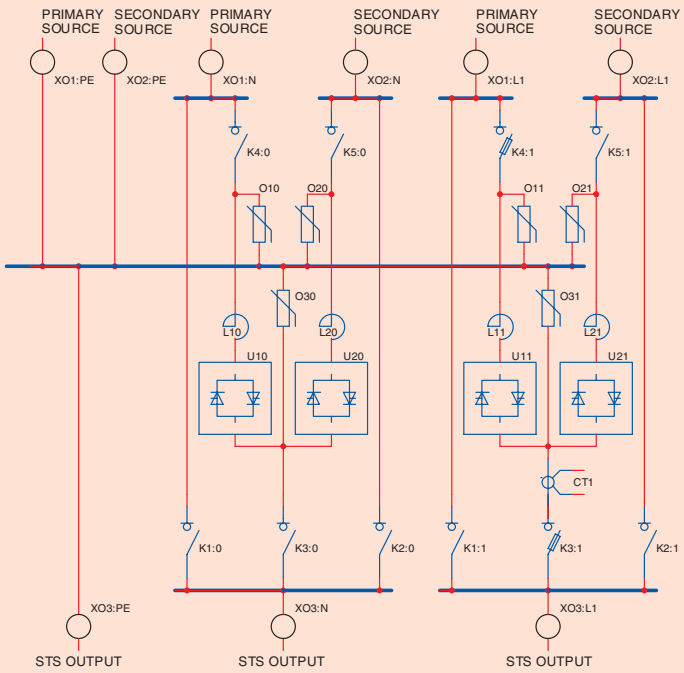


Fig. 5. Power stage circuit of 1-phase 2-poles switch 2PN.

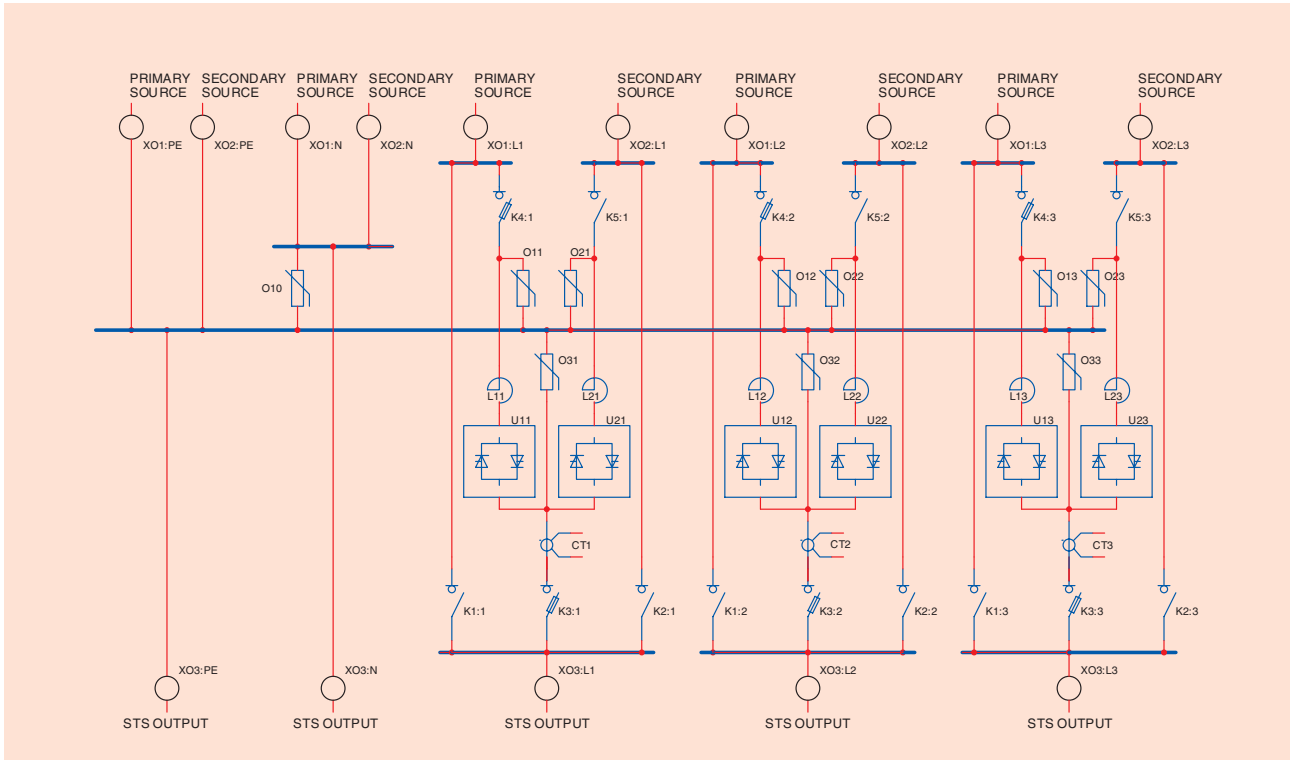


Fig. 6. Power stage circuit of 3-phases 3-poles switch 3P.

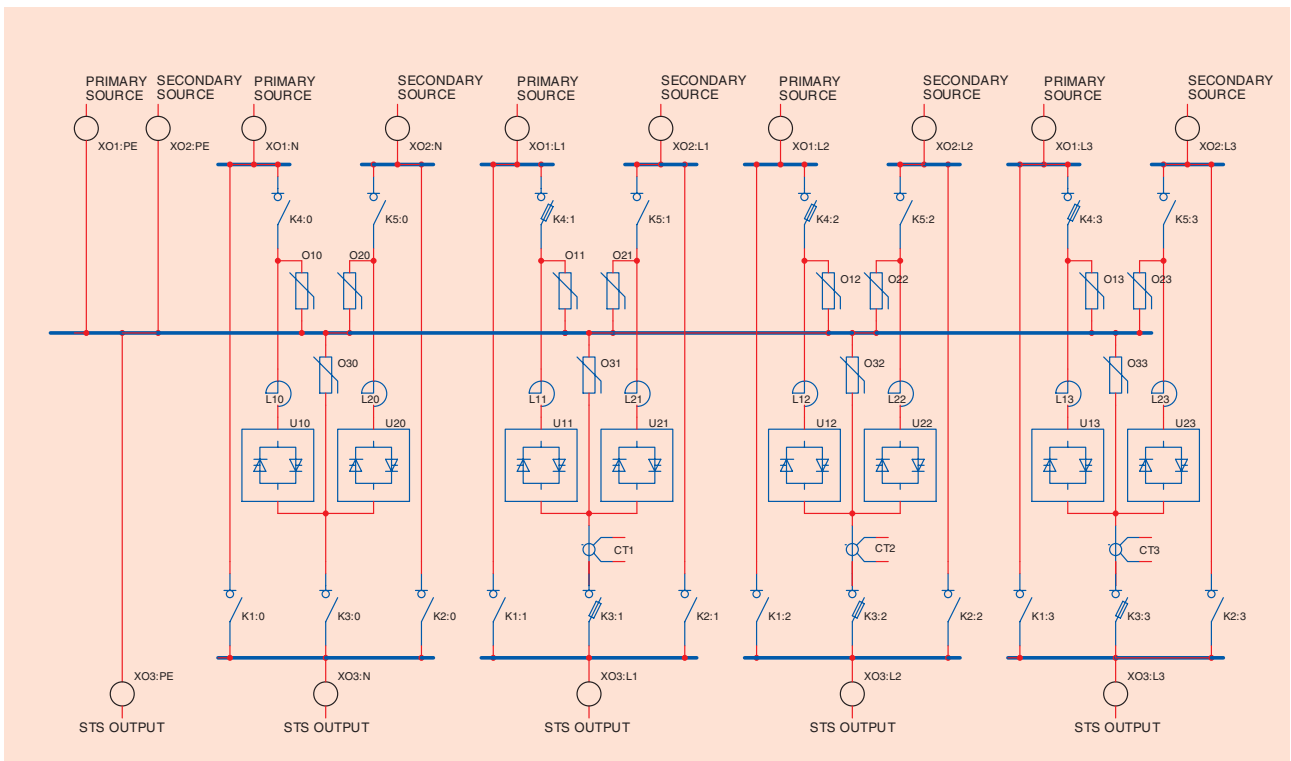


Fig. 7. Power stage circuit of 3-phases 4-poles switch 4P.

PRINCIPLE OF OPERATION

The 2P (1-phase 1-pole) Static Transfer Switch consists of two bidirectional thyristor switches equipped with control and protection system. The 2P (1 - phase 2 - poles) switch has an additional neutral line switch. Control system is based on the fail-safe CMOS logic. Input source and output line are protected by transient voltage surge suppression varistors.
After failure of preferred source, STS checks the state of the alternate power source and transfers load to the source that provides better quality power.
Many modes of operation and many additional settings are provided to meet site-specific requirements.

Transfer may be triggered by:
- Disturbance of preferred source voltage
- Overcurrent in source
- Manual change of preferred source
- Remote change of preferred source

Transfer is not allowed in the event of:
- Incorrect voltage in the alternate source
- Excess output current (in load dedicated STS installation)

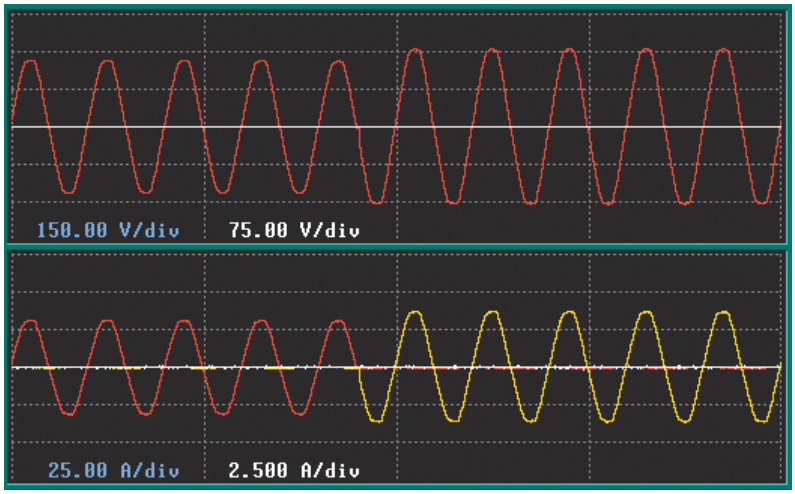
Transfer is delayed in the event of:
- No synchronization between preferred and alternate source
- Exceeding of the phase shift limit between the two sources.

With both sources correct and synchronised (phase error within the acceptable range), manual or remote transfer is performed in less than 200 μs. Transfers initiated by fault conditions on the preferred source depend on the status of the alternate source. For synchronised power sources with phase error within the limits, switching to an alternate source is obtained within 6 ms delay. Lack of synchronisation causes delay before transfer. It is possible to set delay time with dipswitches (11 ms, 15 ms, 23 ms or 48 ms). Total transfer time is equal to the sum of 2 ms detection time and the alternate source thyristor delay time (so 13, 17, 25 or 50 ms respectively).

The 3P (3 - phases 3 - poles) Static Transfer Switch consists of a set of three 1-phase switches. The 4P (3-phases 4-poles) Switch has an additional neutral line switch. For both switches, load capacity of neutral line is rated to 200% of phase line load capacity.
Internal mechanical bypasses enable correct servicing. Transfer for maintenance mode is performed without interrupting the load with delay (less than 200 μs). As an option, a maintenance bypass may be equipped with mechanical interlocks to avoid short circuit during manipulation.

Internal redundancy for power supply systems and for cooling systems, with internal system monitoring ensure extremely high reliability of the STS.

OSCILLOGRAMS

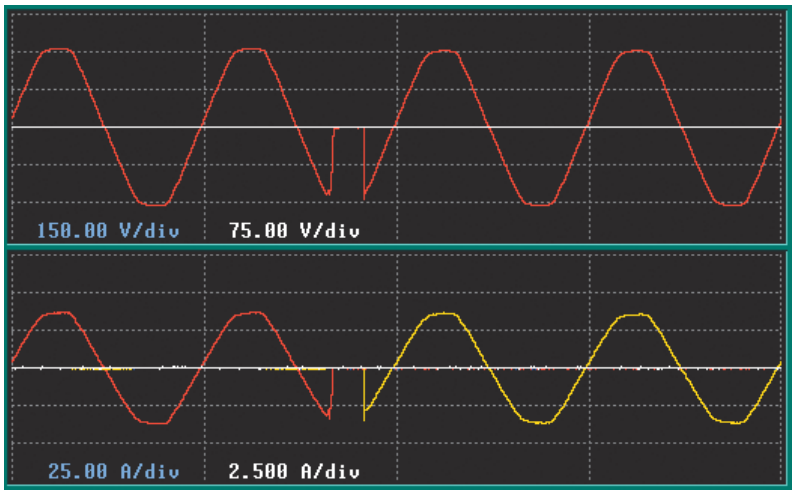


OUTPUT VOLTAGE

PRIMARY SOURCE CURRENT

SECONDARY SOURCE CURRENT

Fig. 9. 2P transfer to redundant power source initiated by change of preferred input source.

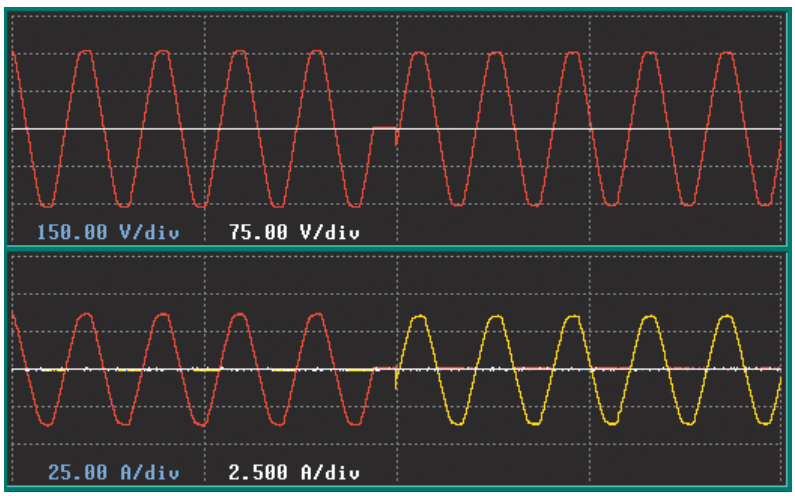


OUTPUT VOLTAGE

PRIMARY SOURCE CURRENT

SECONDARY SOURCE CURRENT

Fig. 10. 2P transfer to redundant power source caused by power interruption on preferred input source.

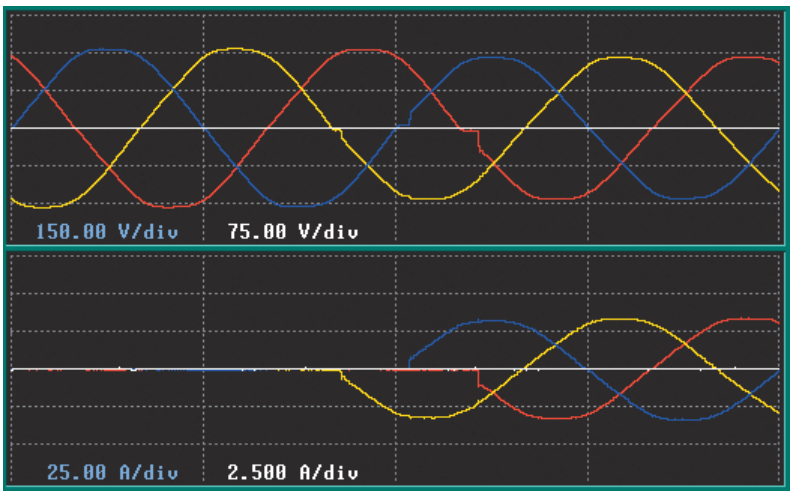


OUTPUT VOLTAGE

PRIMARY SOURCE CURRENT

SECONDARY SOURCE CURRENT

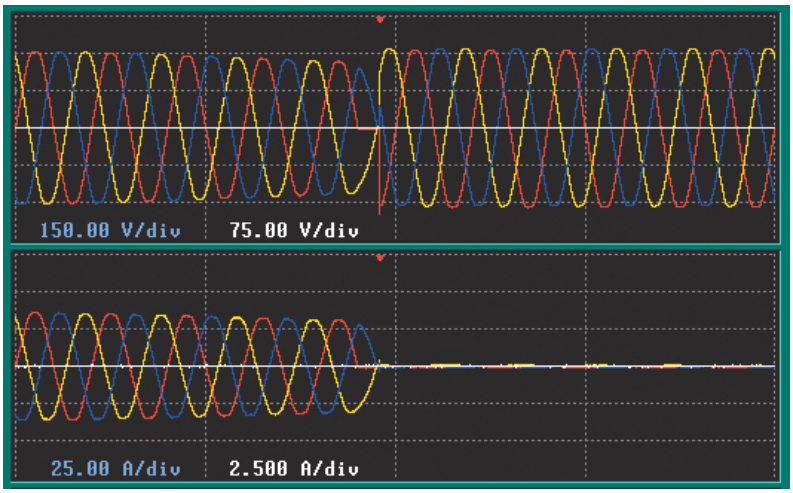
Fig. 11. 2P transfer to redundant power source – unsynchronised lines.



OUTPUT VOLTAGES

SECONDARY SOURCE CURRENTS

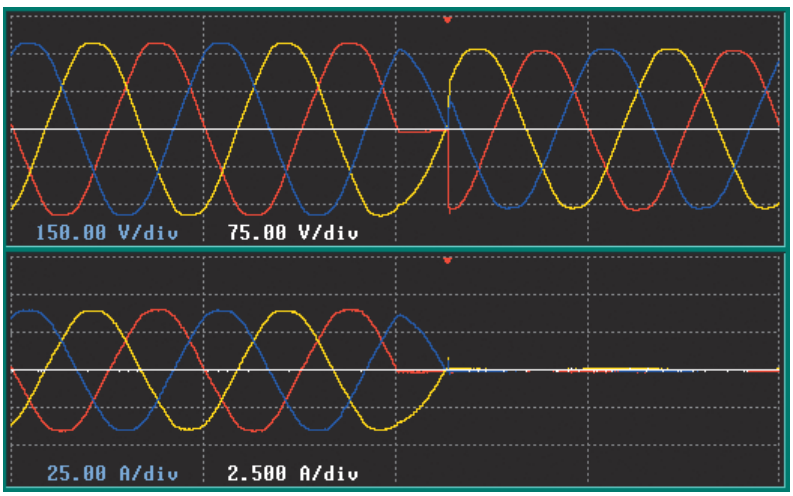
Fig. 12. 3P transfer to redundant power source initiated by change of preferred input source.



OUTPUT VOLTAGES

PRIMARY SOURCE CURRENTS

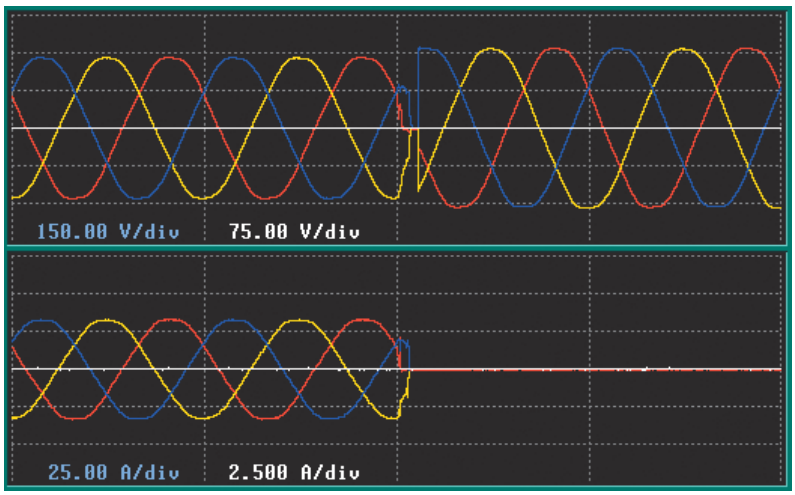
Fig. 13. 4P transfer to redundant power source caused by power sag on preferred input source.



OUTPUT VOLTAGES

PRIMARY SOURCE CURRENTS

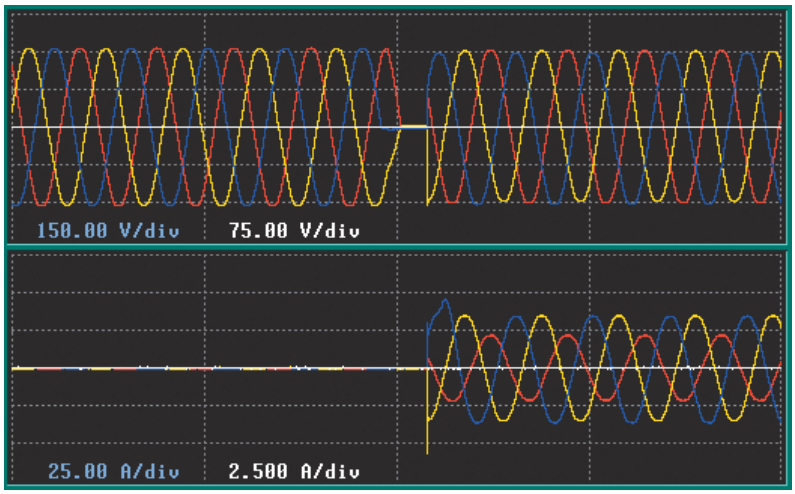
Fig. 14. 4P transfer to redundant power source caused by power swell on preferred input source.



OUTPUT VOLTAGES

PRIMARY SOURCE CURRENTS

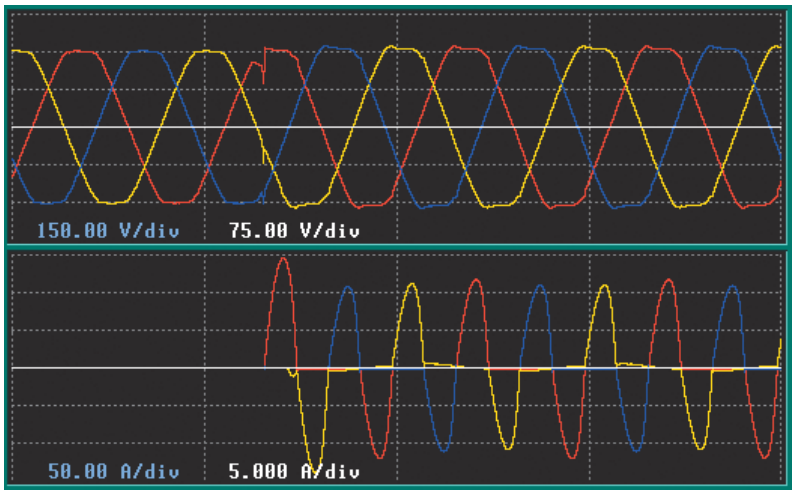
Fig. 15. 4P transfer to redundant power source initiated by power interruption on preferred input source.



OUTPUT VOLTAGES

SECONDARY SOURCE CURRENTS

Fig. 16. 4P transfer to redundant unsynchronised power source initiated by change of preferred input source – asymmetrical load.



OUTPUT VOLTAGES

SECONDARY SOURCE CURRENTS

Fig. 17. 4P transfer to redundant synchronised power source – computer load.

CONFIGURATIONS

STS SETS FOR POWER DISTRIBUTION UNIT (PDU)

STS sets for power distribution unit (PDU) are produced by leading international companies. During production, simple PDU monitoring system based on STS control unit may be applied. Transfer to redundant source is caused by faulty operation of preferred source, for example when voltage range exceeds beyond acceptable range. It is possible to transfer “connection” on demand UPS system, for example when the state of batteries is getting too low. An instantaneous transfer is performed even before the preferred UPS voltage drops under acceptable value.

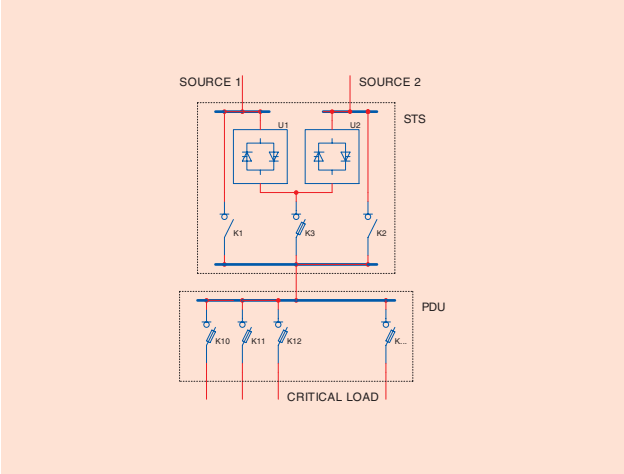


Fig. 18. STS set for power distribution unit.

TWO-STS SET FOR TWO-SECTION POWER DISTRIBUTION UNIT WITH A TIEBREAKER

Two-STS set for two-section power distribution unit with a tiebreaker allows independent operation of two STS-PDU section sets. It is possible to transfer both sections to one STS unit without interruption. The tiebreaker is switched on after prior maintenance-related transfer of both STS units to one of the power sources. When one of the STS units is switched off, the remaining STS provides independent redundancy power for the two PDU sections.

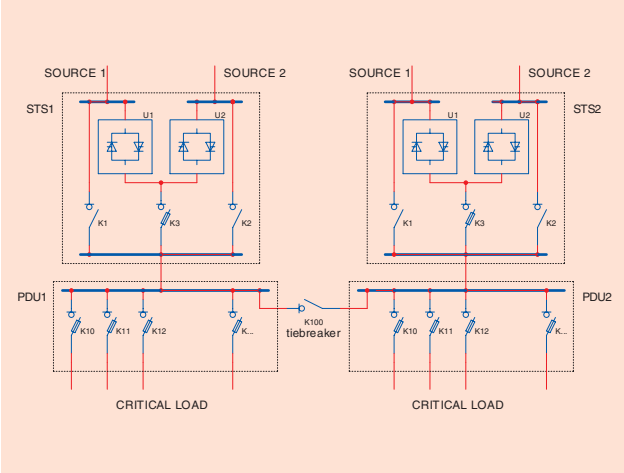


Fig. 19. Two-STS set for two-section power distribution unit with tiebreaker.

STS SET FOR VOLTAGE INVERTERS

STS set for voltage inverters. Independent voltage inverters with limited output current are susceptible to short-circuits and overloads caused by sags and outages in output current. An additional bypass through the STS unit to inverter output eliminates voltage outage. Transfer to redundant source is triggered by faulty operation of inverter, for example when voltage value or current value are not in acceptable range.

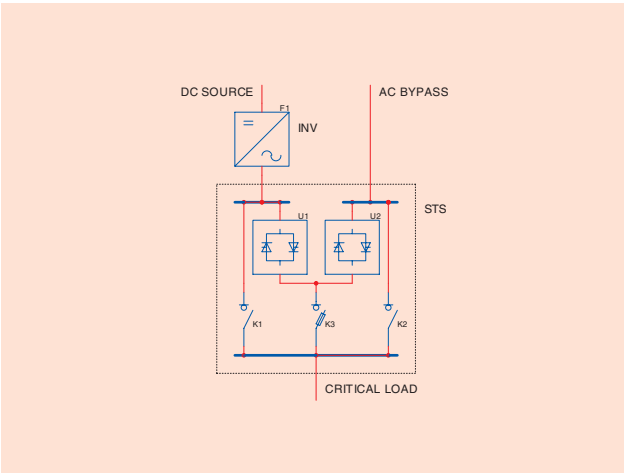


Fig. 20. STS set for voltage inverters.

LOCAL STS INSTALLATION WITH DUAL AC POWER SYSTEM

Local STS installation with dual AC power system. Conventional power systems are susceptible to voltage outages which are transferred to all loads placed below the short-circuiting or below high overloaded site. This phenomenon is seen especially in systems with low current limitation, for example in UPS systems. The dual AC power system eliminates voltage outage effects. Transfer of local STS units to redundant source is caused by faulty operation of preferred source, for example when voltage range exceeds beyond acceptable range. Transfer is not performed if overcurrent in load occurs. Faulty load is disconnected from the system by its STS unit (it keeps running on the disrupted line while the remaining STS units perform transfers to efficient power source). The installation is highly recommended for complex power supply networks.

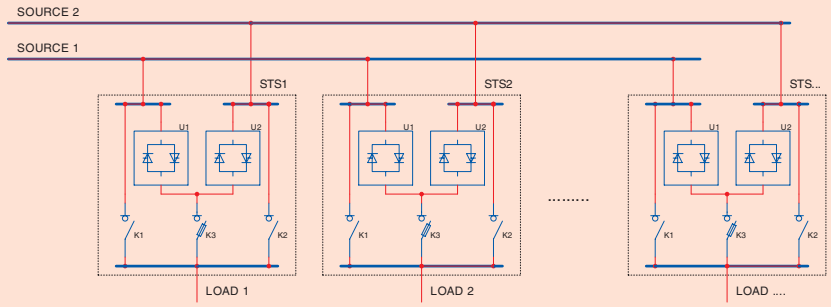


Fig. 21. Local STS installation with a dual AC power system.

UPS SUPPLY SYSTEM WITH REDUNDANCY

UPS supply system with redundancy and with disconnection ability for one line are power supply systems frequently used in computer centres. It enables proper mating of different UPS devices and provides continuous non-stop operation even during periods of scheduled maintenance. It eliminates single point failure. UPS synchronisation is required.

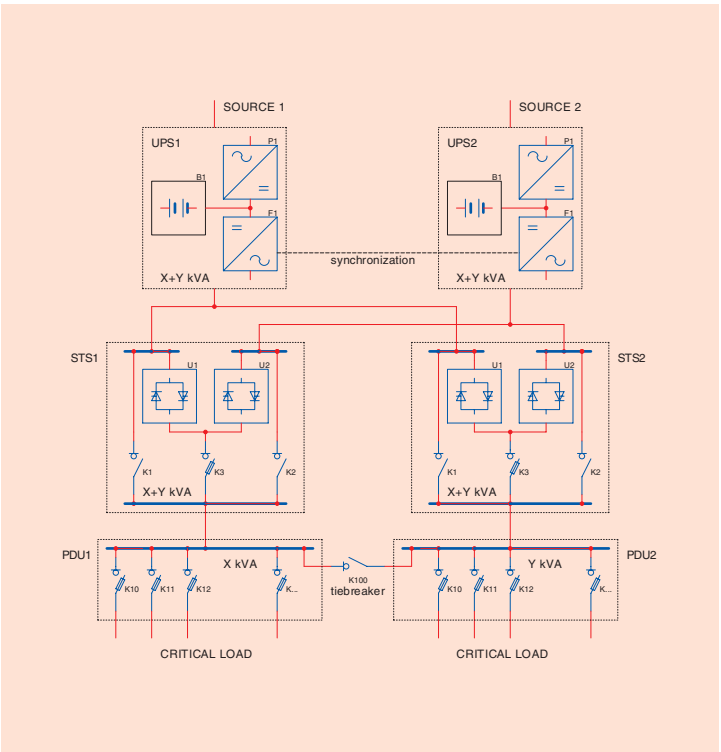


Fig. 22. Redundancy provided UPS powered installation with available failure disconnection.

SPECIFICATIONS*

Power supply			
Nominal input voltage	220 V 230 V	3x 380 V 3×400 V	For TN-C, and TN-S networks
Acceptable voltage range	-20 % ÷ +20 %		Operation
Frequency	50/60 Hz	50/60 Hz	
Frequency tolerance	-10 % ÷ +10 %		
Transient voltage surge suppression level	<1.5 kV		For Iimp 15 kA 8/20us
	<1.0 kV		For Iimp 5 kA 8/20us
Dielectric strength test	AC 2 kV		
Efficiency	>98 %	>99 %	for cos(ϕ) > 0,8
Output			
Nominal output current	16, 25 A, 32, 50 A 100 A, 150 A 200 A, 250 A 300 A, 400 A, 500 A, 630A		Available configurations: ● 1-phase 1- pole ● 1-phase 2-poles (neutral line switch) ● 3-phases 3-poles ● 3-phases 4-poles (neutral line switch)
Crest factor	3.0		
Power factor cos (ϕ)	0.5 ÷ 1		Inductive, capacitive
Transient voltage surge suppression level	<1.5 kV		For Iimp 15 kA 8/20us
	<1.0 kV		For Iimp 5 kA 8/20us
Overload capacity	150 % 200 % > 200 %		t = 1 min t = 10 s t = 250 msec
Switching			
Selection of preferred input source	L1 / L2		With or without retransfer after restoring preferred input source power
Remote selection of preferred input source	L1 / L2		Two-state input for L1 / L2 line
Setting range for upper input voltage limit	+6 % ÷ +20 % by 3 %		Switching to alternative source on exceeding the limit
Setting range for lower input voltage limit	-8 % ÷ -24 % by 4 %		
Phase error limit for synchronised lines	±8° ÷ ±24° by 4°		Setting by DIPSWITCH
Switching interlock for output over current	3 In 6 In 9 In no interlock		Setting by DIPSWITCH
Manual transfer time for synchronised lines of a phase error within the limits	< 0.2 ms		
Automatic transfer time for synchronised lines of a phase error within the limits	< 6 ms		
Manual or automatic transfer time for not synchronised lines	12 ms 17 ms 25 ms 50 ms		Setting by DIPSWITCH
Retransfer time	1 s 8 s 25 s		Setting by DIPSWITCH (both lines healthy)

* Possibility for unique configurations depending on customer needs. Please contact us by phone or e-mail.

Measurement of		
Inputs sources voltage	±1 % ±1 V	Optional equipment
Output currents	±2 % ±1 A	
Active power P	±3 % ±0,1 kW	
Apparent power S	±3 % ±0,1 kVA	
Alarms		
Failure	Relay	Overload Overtemperature Fuse failure Internal STS failure
Disturbance	Relay	Primary source not healthy Secondary source not healthy Lack of synchronisation Transient voltage surge suppression alarm Manual control ON Automatic retransfer switched OFF
Manual ON	Relay Options	Service operation
Retransfer OFF	Relay Options	Retransfer to preferred source is not perform
Primary source OK.	Relay Options	Indicating if primary source is healthy
Secondary source OK.	Relay Options	Indicating if secondary source is healthy
Primary line ON.	Relay Options	Indicating if primary source is active
Secondary line ON.	Relay Options	Indicating if secondary source is active
Alarm connectors parameters		
Max operating voltage	300 V= or 250 V~	
Max load capacity	4 A for 220 V~	
	0.3 A for 220 V=	
Communications interface		
Optional	RS232 / RS485	
Ambient conditions (storage and operation)		
Operating temperature	0÷40 °C	
Storage temperature	0÷40 °C	
Relative humidity (noncondensing)	max 98 %	
Installation Site Altitude	below 1000 m	
Air cooling	Natural	For In=25, 40, 63 A
	Forced with built-in fan redundancy	For In=100, 150, 250, 400, 630 A
Options	Relay Contacts and Communication	
Enclosure		
Degree of protection	IP20	
Dimensions (H × W × D)	See detailed information table	

RULES FOR MARKING STATIC TRANSFER SWITCHES

ART-STS 4A 200

INPUT VOLTAGE
220= 220V / 50 / 60Hz
230 = 230V / 50Hz
400 = 3×400V / 50Hz
480 = 3×480V / 60Hz

DEVICE NAME	
2A	1-phase 1-pole static transfer switch
2AN	1-phase 2-poles static transfer switch
3A	3-phases 3-poles static transfer switch
4A	3-phases 4-poles static transfer switch

OUTPUT CURRENT (NOMINAL PHASE LINE CURRENT)	
25 = 25A	40 = 40A
63 = 63A	100 = 100A
150 = 150A	250 = 250A
400 = 400A	630 = 630A

ARTronic® STS

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The art of electronics

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