Operating and Installation manual for

STATIC TRANSFER SWITCH
IMPORTANT

This users manual contains setup, operation and maintenance information for STS1 Series Static Transfer Switch.

Before starting setup and operation of the equipment, complete users manual should be read carefully.

Before operation, the Static Transfer Switch should be prepared by an authorized technical personnel approved by Inform. The warranty will be void, if this direction is not followed.

Please contact Inform customer service, if you see any problem about any process described in this users manual.

The manufacturer reserves the right to change the design of the equipment without notice.

HIGH LEAKAGE CURRENT

Because of the high leakage current, this equipment should be operated only after it is earthed.

ELECTROMAGNETIC COMPABILITY

This equipment if compatable to EMC directive 89/336/EEC and to conditions in released technical specifications. The compability remains only if related directions are followed and only if the equipment is used with accessories approved by the manufacturer.

IMPORTANT

In custom designs, there can be minor differences between this manual and the equipment.
CAUTION

1. There are no user servicable parts inside.

2. Even after the equipment is disconnected from input and output connections, a
treatment to the interior of the equipment contains risk of electric shock.

3. Ventilation holes should be kept open and no objects should be inserted.

4. In the environment where the equipment will be operated, the temperature and
humidity should be relevant.

5. The equipment can not be operated in an environment having flammable and
explosive devices.

6. Setup, maintenance and repair of the equipment should be performed only by trained,
experienced and authorised technical personnel.

7. When working on live equipment a second person who is aware of all safety
precautions and emergency actions should be present at all times.

8. It is the responsibility of each individual to be aware of national legislation, local
legislation and site rules governing safety and working practices.

9. Use only good quality insulated tools and accessories, properly maintained and
calibrated instruments, and suitable and adequate supports and lifting equipment.

10. Electrical energy can be supplied from the AC supply or the external alarm or
auxiliary control terminals.
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1. GENERAL INTRODUCTION

1.1 SYSTEM DESCRIPTION

Static Transfer Switch is a single phase, two pole semiconductor power switch, which can switch between to syncronious AC sources without interrupting the output power less than ¼ cycle. Because it is fully static, it doesn’t have any moving parts like fans and relays, and can transfer the power via thyristors.

1.2 OPERATION THEORY

The primary task of a Static Transfer switch is to continiously supply the output with uninterrupted energy, even when one of the feeding input sources fails. One source of the Static Transfer Switch is called as preferred source, where the other source is called as alternate. Supplying the output through the preferred source has the priority, it means, if bout sources are available and withing acceptable limits, preferred source will be chosen. If any problem is detected on the preffered source, the load is transferred to the alterna
te source within less than ¼ cycle. It is adjustable, which source is designated as preferred and which is alternate.

There source be no back-feed during the supply of the load, it means, in any transfer, sources should not be allowed to clash. Otherwise, it is possible that both sources will be unavailable. (example, shorting outputs of two independent operating UPS’s)

![Figure 1-1 Static Transfer Switch Basic Block Diagram](image)

Operation and transfer modes of the Static Transfer Switch can be summarised as follows:

**Normal mode** : During this mode, load is feeded through the preferred source.

**Emergency transfer** : When the preferred source voltage value falls beyond acceptable limits, the Static Transfer Switch switches the output to the alternate source within less than ¼ cycle. In emergency transfer, the synchronism of two sources are not observed, because the main and critical goal is not to interrupt the load energy. But even though, is sources are not in synchronism, special transfer and timing algorithms are used to avoid any damage to the load, sources and Static Transfer Switch itself. After the emergency
transfer, a reverse transfer to the preferred source takes place, when the preferred source is again available and within acceptable limits. The retransfer itself (automatic or manual) and retransfer delay are adjustable.

**Manual transfer**: The chosen source is switched to the output, after the preferred source is changed by the user. If two sources are not in synchronism, (like case between utility and standby generator), the manual transfer is delayed unless sources are not synchronisation window.

Detail diagram of the Static Transfer Switch is given below.

![Statik Transfer Switch detail diagram](image)

**Figure 1-2 Statik Transfer Switch detail diagram**
1.3 GENERAL FEATURES

|------------------------|--------------------|-------------------|---------------------|---------------------|-----------------------|------------------|------------------------|

<table>
<thead>
<tr>
<th>Alarm &amp; Warning Messages</th>
<th>Output Fail</th>
<th>Source1 Fail (Fast and Slow)</th>
<th>Source2 Fail (Fast and Slow)</th>
<th>Alternate Source Active</th>
<th>Retransfer Inhibit</th>
<th>Over Current</th>
<th>Sources Not Sync</th>
<th>Thyristor Fail</th>
<th>Over Temperature</th>
<th>Memory Error</th>
<th>Maintenance CB1 Closed</th>
<th>Maintenance CB2 Closed</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Led Indications</th>
<th>Source1 OK / Fail</th>
<th>Source2 OK / Fail</th>
<th>Output OK / Fail</th>
<th>Synchronisation</th>
<th>Source1 Active</th>
<th>Source2 Active</th>
<th>Manual Bypass CB1 Closed</th>
<th>Manual Bypass CB2 Closed</th>
<th>Common Alarm</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>COMMUNICATION and REMOTE MONITORING</th>
<th>Modbus Communication over RS232 Serial Port</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>PHYSICAL FEATURES</th>
<th>Modbus Communication over RS232 Serial Port</th>
</tr>
</thead>
</table>

| Dimensions – 50A | 19 inch rack cabinet, Height : 2U, Depth : 360mm |
| Dimensions – 100A| 19 inch rack cabinet, Height : 4U, Depth : 360mm |

| Weight – 50A | 9 kg |
| Weight – 100A| 17 kg |

<table>
<thead>
<tr>
<th>Operation Temperature</th>
<th>-0°C to + 40°C</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Storage Temperature</th>
<th>-20°C to + 50°C</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Relative Humidity</th>
<th>%0 - %90 (non condensing)</th>
</tr>
</thead>
</table>

| Operation Altitude    | 2000 meter maximum      |

<table>
<thead>
<tr>
<th>ELECTRICAL FEATURES</th>
<th>110V / 120V / 220V / 230V / 240V</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Source Voltages</th>
<th>110V / 120V / 220V / 230V / 240V</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Output Voltage</th>
<th>50A / 100A</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Frequency</th>
<th>50 / 60 Hz ± %10</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Power Factor</th>
<th>0.7 to 1.0 (leading or lagging)</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Acceptable Source Voltage Distortion</th>
<th>10 % Maximum</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Crest Factor</th>
<th>3 : 1</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Transfer Time</th>
<th>&lt; 5ms @ 50 Hz</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Efficiency</th>
<th>&gt; %98</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Overload Capability</th>
<th>150 % continuous</th>
</tr>
</thead>
</table>
2. SETUP

2.1 OPENING PACKAGE
When the equipment is delivered to you, first to be examined is a possible damage during transport. Therefore, examine the equipment carefully.

2.2 CHOOSING PROPER PLACE
1. Place your equipment to your rack cabinet and tighten it to your rack cabinet via screws placed at the front plate.
2. Choose a place with proper temperature and humidity.
3. Do not choose any place which can cause dust and corrosion.
4. The place chosen should not have direct sunshine and shouldn't be near any heating source.
5. Operating the equipment in proper conditions will increase its lifetime.

2.3 ELECTRICAL CONNECTION
All electrical connections of the Static Transfer Switch are placed on the rear of the equipment. All required connections to connection panel of Static Transfer Switch should be made by Inform service personnel or by the approval of Inform service personnel. Before making the connections, all power switches, isolators and circuit breakers must be in OFF position. The terminal description is shown below.

![Diagram of Static Transfer Switch connections]

<table>
<thead>
<tr>
<th>Source1 - Phase</th>
<th>Source1 - Neutral</th>
<th>Source2 - Phase</th>
<th>Source2 - Neutral</th>
<th>Output - Phase</th>
<th>Output - Neutral</th>
<th>Safety Earth</th>
</tr>
</thead>
</table>

**CAUTION**
Connect and control ground (PE) connection. Definitely, the equipment should not be operated without ground connection.

**CAUTION**
3. OPERATION

3.1 OPERATING WHEN BOTH SOURCES ARE AVAILABLE

1. Switch SOURCE1 and SOURCE2 circuit breakers into 1 position.
2. Front panel and LEDs will be energized and the following welcome message will be displayed on the LCD screen.

```
<table>
<thead>
<tr>
<th>STS Series</th>
<th>5 seconds later...</th>
<th>Output Voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Version 3.XX</td>
<td></td>
<td>220 V</td>
</tr>
</tbody>
</table>
```

3. Within 10 seconds, the source designated as preferred will be switched to the output, if the source designated as preferred source is available. If the preferred source is not available, but the alternate source is, the alternate source will be switched to the output.

3.2 CHANGING THE PREFERRED SOURCE (MANUAL TRANSFER)

1. The correct password should be entered to the Password domain inside the Functional submenu, before changing to preferred source setting. Following steps should be performed to enter the password:

```
Output Voltage 220 V → Functional <Group> → Password Disabled
```

```
Password [0000] → Password Enabled
```

NOTE

Default (factory setting) password is 0000.
2. Preferred source setting is placed inside the Setup submenu under the Main menu. Following steps should be performed to modify the preferred source setting:

```
Output Voltage
220 V
Functional <Group>
Setup <Group>

Preferred Source
Source1

Preferred Source
Source2

Preferred Source
Source1
```

The new preferred source will be switched to output, after the setting is modified.

### 3.3 Switching the Device to Maintenance Bypass When the Load Is Powered

1. Switch the maintenance bypass circuit breaker into desired source position, when the device is in operation.
2. The device will display the maintenance bypass message and continue to feed output both through the chosen sources thyristor switches and maintenance bypass circuit breaker.
3. Source1 and / or Source2 circuit breaker may be switched off, if desired.

### 3.4 Switching the Device to Maintenance Bypass, When the Load Is Not Powered

1. Switch the maintenance bypass circuit breaker into desired source position.
2. The device will power the load through the maintenance bypass circuit breaker.

---

**CAUTION**

The load is not protected against power failures, when maintenance bypass switch is position 1 or position 2.

---

**CAUTION**

If one source will be de-energized for an extended period (hours or days), set the unit to maintenance bypass mode for the remaining source. Without using bypass, if a failure occurs in the switch components for remaining source, the static transfer switch does not have a second source to switch to and the load would not receive power.
4. FRONT PANEL

4.1 STRUCTURE OF FRONT PANEL

The front panel of the Static Transfer Switch contains a 2x16 character LCD (Liquid Crystal Display), keypad and leds. Via LCD, measurements and status / alarm messages are displayed in a format, which can be easily understood. Parts in front panel and their functions are given below.

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>RS232 Port</td>
<td>This port allows the equipment to communicate to PC via RS232 communication.</td>
</tr>
<tr>
<td>2</td>
<td>Esc Button</td>
<td>This button is used to get back from a submenu or to escape from adjustment without validating.</td>
</tr>
<tr>
<td>3</td>
<td>Up Button</td>
<td>In menus, this button is used to see the previous item (up). In adjustments, this button is used to increase the adjusted quantity.</td>
</tr>
<tr>
<td>4</td>
<td>Down Button</td>
<td>In menus, this button is used to see the next item (down). In adjustments, this button is used to decrease the adjusted quantity.</td>
</tr>
<tr>
<td>5</td>
<td>Enter Button</td>
<td>This button is used to enter a submenu or to validate a setting performed.</td>
</tr>
<tr>
<td>6</td>
<td>LCD Display</td>
<td>Measured values, status and alarm messages of the equipment are displayed in this 2x16 character LCD display.</td>
</tr>
<tr>
<td>7</td>
<td>Led Displays</td>
<td>These leds provide instantenaous information about the status of the equipment.</td>
</tr>
</tbody>
</table>

Figure 4-1 Static Transfer Switch Front Panel
4.2 MEASUREMENTS MENU

LCD display remains in MEASUREMENTS MENU, after the STS has started its operation. UP and DOWN buttons can be used to move ahead this menu. Measured values of the STS are displayed on the LCD display.

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output Voltage</td>
<td>[V] Output voltage value (RMS)</td>
</tr>
<tr>
<td>Output Current</td>
<td>[A] Output current value (RMS)</td>
</tr>
<tr>
<td>Source1 Voltage</td>
<td>[V] Source1 voltage value (RMS)</td>
</tr>
<tr>
<td>Source2 Voltage</td>
<td>[V] Source2 voltage value (RMS)</td>
</tr>
<tr>
<td>Difference Voltage</td>
<td>[V] Difference voltage between Source1 and Source2 (RMS)</td>
</tr>
<tr>
<td>Active Source</td>
<td>[-] Current active source switched to output</td>
</tr>
<tr>
<td>Operation Period</td>
<td>[hours] Operation period since the production of the unit. This value is resetted, when the device is switched off and again switched on.</td>
</tr>
</tbody>
</table>

There is password protection to avoid unauthorised access to system parameters. A LOCK sign is displayed on the right bottom of the LCD display, when the password is active (prevents unauthorised Access)
Alarm and warning messages are displayed timely on the LCD display. Audible alarm is also provided at the mean time. Possible alarm and warning messages are listed below.

<table>
<thead>
<tr>
<th>Message</th>
<th>Message Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>OUTPUT FAIL</td>
<td>Output voltage is out of acceptable limits.</td>
</tr>
<tr>
<td>SOURCE1 FAIL (F)</td>
<td>The instantaneous value of source 1 voltage (fast measurement) if out of acceptable limits.</td>
</tr>
<tr>
<td>SOURCE2 FAIL (F)</td>
<td>The instantaneous value of source 2 voltage (fast measurement) if out of acceptable limits.</td>
</tr>
<tr>
<td>SOURCE1 FAIL (S)</td>
<td>The RMS value of source 1 voltage (slow measurement) if out of acceptable limits.</td>
</tr>
<tr>
<td>SOURCE2 FAIL (S)</td>
<td>The RMS value of source 1 voltage (slow measurement) if out of acceptable limits.</td>
</tr>
<tr>
<td>ALTERNATE SOURCE ACTIVE</td>
<td>The source set as alternate source is active and switched to output.</td>
</tr>
<tr>
<td>RETRANSFER INHIBIT</td>
<td>Reverse transfer from the alternate source to preferred source is disabled. In this case, after any emergency transfer, the equipment will NOT automatically transfer from alternate source to preferred source, even when the preferred source is recovered.</td>
</tr>
<tr>
<td>OVERCURRENT</td>
<td>The output current is above the equipment limits.</td>
</tr>
<tr>
<td>SOURCES NOT SYNC</td>
<td>There is a voltage difference between source1 and source2, above the limits and sources are not considered in synchronism.</td>
</tr>
<tr>
<td>THYRISTOR FAIL</td>
<td>Any of the static thyristor switches is failed.</td>
</tr>
<tr>
<td>OVER TEMPERATURE</td>
<td>The temperature of the thyristor switch heatsink is above the considered limits.</td>
</tr>
<tr>
<td>MEMORY ERROR</td>
<td>Indicates, that the DSP control unit can not load the saved parameters properly. In this case, the system will return to factory set values.</td>
</tr>
<tr>
<td>MAINT CB1 CLOSED</td>
<td>Indicates that maintenance bypass circuit breaker is switched to source1 position.</td>
</tr>
<tr>
<td>MAINT CB2 CLOSED</td>
<td>Indicates that maintenance bypass circuit breaker is switched to source2 position.</td>
</tr>
</tbody>
</table>
4.3 CONTROL ve SETTING MENUS

Adjustable items inside the control and setting menus are described below.

**Functional**

**Password**
This item is the password required to modify other adjustable parameters. The equipment is shipped with default password 0000.

**New Password**
After the correct password is entered, the password can be modified using this item.

**Language**
Defines the language selection for front panel. Front panel language can be chosen as English or Turkish. Default language after factory test is English.

**Serial Link**
This setting is used to select, which application will occupy the serial link of the Static Transfer Switch. FreeMaster communication for factory settings or Modbus communication for user purposes can be chosen.

**Modbus**
This submenu contains items to setup the Modbus communication.
- **Comm. Mode**
- **Baud Rate**
- **Slave No**
- **Parity**
- **Permission**

**Audible Alarm**
This setting is used to enable or disable audible alarm in an alarm condition. In environments like hospitals, disabling the audible alarm is preferred.

**Setup**

**Preferred Source**
Determines the preferred source switched to the output. The control logic will choose this source to switch to the output, when both sources are available. The unchosen source acts as alternate source and will be switched to output only in emergency transfer.

**Auto Retransfer**
This setting enables / disables auto retransfer back to the preferred source, when preferred source is recovered after any emergency transfer.

**Retransfer Delay**
This setting determines the delay for the auto retransfer back to the preferred source, after when preferred source is recovered after any emergency transfer.

**Low Voltage Limit**
Acceptable low voltage limit value for sources and output. If the voltage value of a source is below this value, it will be supposed as fail.

**High Voltage Limit**
Acceptable high voltage limit value for sources and output. If the voltage value of a source is above this value, it will be supposed as fail.

**Synch. Voltage**
This setting determines the upper limit of voltage difference between sources to be assumed as synchronous. If the voltage difference between two sources are above this value, the control logic considers that sources are not synchronious. Manual transfer is inhibited when sources are not synchronious.

**Peak Current Limit**
Static Transfer Switch monitors the load current and if the load current exceeds an adjustable preset level deemed to represent a load inrush or fault condition, emergency transfer is disabled even if the voltage on the selected source exceeds the transfer limits. This setting enables / disables this mechanism.

**Frequency Pulse Tune**
When the setup in needed, the STS broadcasts a frequency pulse at the nominal frequency, to synchronise the independent and free running upstream devices to avoid alarm regarding that the sources are not sync. This way, upstream sources are synchronised to this frequency pulse and hence to each other. This setting is used to tune the frequency of the distributed pulse.

**Calibration**
This menu block allows the user to fine tune the measured values of the static transfer switch, without any intervention to the electronic hardware of the equipment. Using this menu only by authorized personnel is recommended.

**About**
Items in this submenu shows software versions and nominal values of the device.

**DSP Version**
DSP software version.

**uC Version**
Microcontroller software version.

**V Nominal (V)**
Nominal voltage (nameplate value) of the device.

**I Nominal (A)**
Nominal current (nameplate value) of the device.

**f Nominal (Hz)**
Nominal frequency (nameplate value) of the device.
4.4 MENU TREE

Output Voltage
220 V

Output Current
25.1 A

Source1 Voltage
220 V

Source2 Voltage
221 V

Diff. Voltage
3 V

Active Source
Source1

Operation Period
4064 hrs
5. ADDITIONAL FEATURES

5.1 DRY CONTACT OUTPUT
Static Transfer Switch provides 1 dry contact dedicated to common alarm status. Dry contact remain energized, when common alarm condition is not occoured. When any common alarm is detected, dry contact is releases and switches to unenergized state. Dry contact output is provided to the user in four pole connector at the rear of the Static Transfer Switch.

| NOTE |
| Maxmum 220Vac or 24Vdc voltage should be applied to dry contacts. Dry contacts are for signaling purposes and can carry maximum 0.5A current. |

5.2 RS232 COMMUNICATION
This feature provides Modbus communication over RS232 connection, for remote control and monitoring.

![Diagram of Static Transfer Switch / PC Connection](image)

Figure 5-1 Static Transfer Switch / PC Connection
For RS232 communication, 9 pin female DSUB connector on the front panel of the Static Transfer Switch. Pin connections of the necessary cable for STS connection is given in the table below:

<table>
<thead>
<tr>
<th>STS side cable (DSUB9 Male)</th>
<th>PC side cable (DSUB9 Female)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pin No</td>
<td>Function</td>
</tr>
<tr>
<td>2</td>
<td>RX</td>
</tr>
<tr>
<td>3</td>
<td>TX</td>
</tr>
<tr>
<td>5</td>
<td>GND</td>
</tr>
</tbody>
</table>

| NOTE |
| Contact Inform for Modbus addresses. |

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6. SERVICE AND MAINTENANCE

CAUTION

There are no by the user servicable parts inside the equipment, therefore DO NOT OPEN THE COVER OF THE EQUIPMENT. Because of possible input and output connection and dry contact relay outputs, THERE MAY BE HIGH VOLTAGE INSIDE THE EQUIPMENT, EVEN WHEN THE STS IS TURNED OFF. Do not permit unauthorized persons to intervent any failure, otherwise, the warranty will be void and moreover, significant injury may occur.

Under normal operating conditions only preventative maintenance is required. The intervals between maintenance actions will vary according to the level of remote monitoring and the standard of cleanliness of the equipment room.

6.1 PERIODICAL MAINTENANCE

The Static Transfer Switch equipment is designed for a very minor maintenance requirement. It does not contain moving parts like fans and relays. Only fulfil conditions described below.
1. Clear the dust piled up in ventilation holes of the equipment.
2. You may clean the cover of the equipment with a moist cloth.
3. Record all abnormal occurrences in the service log.
4. Visually check electrical connections and component for signs of overheating or corrosion. Rectify as necessary.

6.2 FAILURES

As mentioned before, only authorized personnel may perform maintenance of the equipment. In any abnormal situation, before calling service, check the points described below.

6.3 BEFORE CALLING SERVICE

1. Did you read the users manual carefully and followed all directions written ?
2. Is there energy in the distribution panel, to which the Static Transfer Switch is connected ?
3. Is any of the alarm leds on the front panel active ?
4. Is there a recent change in the load connected to the Static Transfer Switch ?
5. Was there an overload condition ?