TECHNICAL SPECIFICATION STATIC TRANSFER SYSTEM

EXCHANGE SERIES 4 POLE

INDEX

GENERAL

This Specification defines the performance characteristics of the three-phase static switching system of the **EXCHANGE** series.

The transfer system provides an automatic or manually controlled transfer of one or more electrical loads from one power source (source 1) to a second power source (source 2) and viceversa. In the event that there is insufficient voltage in the source supplying the electrical load, the transfer to the second source will be effected automatically.

The system comprises the following design properties:
- Complete separation of the two sources and the system of distribution between them.
- Redundancy in an existing plant,
- Subdivision of uses in order to prevent any reciprocal interference, (different voltage tolerances), or to observe the terms of the relevant standards in connection with the public mains network.

DESCRIPTION OF THE EQUIPMENT

Transfer between the two sources

The static transfer system comprises two inputs designated Source 1 and Source 2. These are powered by two electrical circuits, designated the Priority Circuit and the Reserve Circuit respectively.
The output of the **System** is connected to a critical load. In the event of a power loss, the **System** will carry out an automatic transfer to the receiving source in less than a quarter of a cycle (5 ms).

Functioning symmetry for the selection of the Priority or Reserve circuits

The architecture and the operation of the **System** is totally symmetrical. That is to say that the selection of Source 1 as Priority (with Source 2 = Reserve) or alternatively as Reserve (with Source 2 = Priority) can take place as required and can be modified at any time.

This selection can be effected:
- Locally by appropriate action at the control panel or command desk,
- Remotely, using a remote control device.

Reversibility of the transfer processes

Depending upon the current operating conditions of the plant, the **System** will automatically allow the transfer process to be reversed (so that the transfer takes place from the Reserve circuit to the Priority circuit) under the same conditions.

Independence between the sources

The **System** can also be used with sources of any type (mains electricity network, UPS systems or generating-sets). For the correct operation of the system (sources, system, load etc) it is essential that the voltage levels are correctly calibrated, synchronized and in phase, either naturally or by means of a special synchronizing device.
The neutral is also commutated, to avoid insulation failure propagation between systems.

Static Technology
The static transfer system consists of two static four pole switches, one on Source 1 and the other on Source 2.
Each static switch (SS) consists of 4 pairs of thyristors; each SS sustains the full load.

Switching Technology
The switching technology employed is “Break Before Make”. This technique allows, phase by phase, the thyristors of the static switch turning off to be disconnected before connecting those of the static switch turned on. This ensures a non-parallel transfer between the 2 power sources. Because functional reasons an overlap of neutrals (Duration 10 millisecond) takes place during commutation.
This means that the System can be used for transfers between sources at different impedances, with different levels of voltage and frequency and different phases without any failures in the one source being transmitted to the other. On the front, a synoptic panel shows the control devices status, the sources availability and the load connection. Electric measurements and alarm / state visualizations are present on LCD panel.

By-passing the static switches
To enable repair and maintenance operations to take place, the system contains 3 isolating switches for the static switches and 2 isolating switches fitted with a locking mechanism enabling the static switches to be manually by-passed. All isolating switches are 4 pole.
These isolating switches are accessed from the lower front part of the control panel.

Reliability
With it’s two available sources, the system offers enhanced reliability of power supply for critical loads, thus guaranteeing a high level of operating reliability.
For this reason, particular care has been taken in respect to the following:

- redundancy of the ventilation system
- heat margin for the semi-conductors.

OPERATION

Monitoring the sources and the transfer conditions

The system includes an electronic control system upstream of the two sources when these are switched on and in phase. All detection thresholds and hysteresis values can be adjusted to match the configuration of the equipment. (See section: “Configuration”).
This system carries out the following checks on a permanent basis, which constitute the “condition of transfer”:

- Current voltage levels of the two sources (Priority and Reserve) and the authorized tolerance
  ranges; (see ‘regulation of the voltage bands’),
- Any phase differences between the Priority source voltage and the Reserve source voltage
  within the permitted tolerances,
- The absence of excessive loads or downstream short-circuits.

Adjusting the voltage bands

Maximum voltage levels for the Priority and Reserve sources can be adjusted by an operator within a wide margin and according to the following principles:

- Control of the **mean value** by means of two voltage windows: a positive window that can be set from +5 to +20% of the nominal value, and a negative window that can be set from –5 to –35% of the nominal value. Within the range of values chosen as being acceptable, the source is regarded as being “in tolerance”, otherwise it is regarded as being “out of tolerance” and the switch for the second source is activated, without any overlapping, thus avoiding temporary parallel between the two networks.
- Control of the **instantaneous value** by a voltage band that has been set outside the predetermined values for the positive and the negative windows as described above.
- Once this limit has been exceeded as an instantaneous value, the source is considered as “out of tolerance” and an instantaneous transfer to the second source is activated, without any overlapping, thus avoiding parallel conection between the two networks.

Phase difference between the two sources

The difference in the voltage amplitude and the phase difference between the power sources is conventionally monitored in such a way as to ensure that the transfer operations take place without limitations only in the presence of limited differences between the two networks.
In the event of the tolerance for the value of the difference being exceeded (as a result of major drifts of the amplitude and/or the phase) – for example, as a result of the phase lag of a network the transfer is only effected at a fixed time-lag of 5 milliseconds.

Automatic transfer to the Reserve source

Under normal conditions, the system supplies the loads from the Priority source, but it will generate a transfer to the Reserve source if the Priority source is out of tolerance and the Reserve source is in tolerance.
If both sources are out of tolerance, the power source supplying the load is disconnected.

Manual transfer to the Reserve source
A manual transfer can be initiated at any time and can be effected by the user from the front of the control panel. However, the automatic functioning will remain permanently active in the event that the Priority source is out of tolerance.

Re-transfer (return to the Priority source after transfer)
After a transfer to the Reserve source, and as soon as the Priority source enters into tolerance, the re-transfer mode of the load to this source can be selected by the user.
This mode can be:

- Automatic, if the system has been set for the “FIXED PRIORITY” operating mode (assigned to the user).
The system will thus re-transfer the load to the Priority source as soon as it returns to tolerance and after a sufficient period of time to ensure that the return to tolerance is permanent and that stability has been verified.

- No re-transfer is (unless this is effected manually) if the system is set for the “VARIABLE PRIORITY” operating mode (assigned by the user). In this way, the user will be able to generate the re-transfer by activating the relevant controls on the front of the control/command panel.

If the system has been set for “VARIABLE PRIORITY” operation, and unless any manual re-transfer command is given by the operator, the system will continue to supply the load via the source that is in use at that moment.
Conversely, the system will generate the transfer to the source that, until that moment, had been acting as the reserve source.
Moreover, in the manual mode, the return can be effected even if the sources are de-synchronized and unstable in respect of each other, by means of a sequence known as the “Rolling Synch” (an instantaneous transfer where the passage of the two voltage waves to zero takes place at the same time).

Transfer time
The transfer time is defined as being the total duration between the event taking place that initiates the transfer function and the moment at which the three phases of the load are completely switched to the Reserve source.
Under normal operating conditions (with the sources synchronized before the event) and with loads of the computer type or with a low inductance level, the transfer time will be less than a maximum of 5 ms.
Under certain installation conditions or in cases of failure, such as a short-circuit on open line of the Priority source upstream of the system with a very inductive charge, this value may be greater.

Transfer with phase displacement of the sources
If the condition of phase displacement between the voltage levels of the Priority source and the Reserve source is not respected (phase displacement outside the authorized tolerances), a phase/module difference 'not OK' signal is sent. In this case, the transfer is automatic but is effected at a time-lag of 10 milliseconds.

Blocking the transfer
Blocking the transfer because of a failure downstream.
If an overload occurs, or if a short-circuit is detected downstream, the transfer will be locked on the source where the instantaneous current reading at the output exceeds a certain predetermined threshold. (Factory default setting 2xIn).

PROTECTION AGAINST INTERNAL FAILURES

The design of the system is of the type "without reliability focus", which means that in the event of a malfunction of any internal component, the system will be switched into the operating condition (transfer effected or transfer blocked) that provides the best guarantee of the load continuing. At the same time, the operator will be alerted by an alarm signal. Moreover, the supply and ventilation functions will be brought to a halt.

Controlling the thyristors detecting excess temperature
In order to improve the availability of the power supply to the load a facility of detecting excess internal temperatures is duplicated. Any anomaly detected by the system will trigger an alarm signal without switching the static transfer switch off. The static transfer switch is not switched off (although this configuration can be included if required) so as not to compromise the reliability of the power supply to the load.

ELECTRICAL CHARACTERISTICS

INPUT CHARACTERISTICS

RATING (Amps)	63	2x63	100	200	300	400	600	800	1200
1) Nominal Voltage	400V +20% -35%								
2) Nominal frequency	50/60Hz ±5%								
3) Number of phases	3+N	3+N	3+N	3+N	3+N	3+N	3+N	3+N	3+N

OUTPUT CHARACTERISTICS

RATING (Amps)	63	2x63	100	200	300	400	600	800	1200
1) Efficiency at In	>98%	>98%	>99%	>99%	>99%	>99%	>99%	>99%	>99%
2) Mode of transfer	Break Before Make								
3) Overload - 10 minutes	125%	125%	125%	125%	125%	125%	125%	125%	125%
4) Overload - 1 minute	150%	150%	150%	150%	150%	150%	150%	150%	150%
5) Overload - 10 seconds	200%	200%	200%	200%	200%	200%	200%	200%	200%
6) Overload - 1 second	1000A	1000A	1500A	3000A	6000A	6000A	8000A	10000 A	10000 A

GENERAL CHARACTERISTICS

RATING (Amps)	63	2x63	100	200	300	400	600	800	1200
1) Functioning mode	Fixed priority / No priority (selectable)								
2) Electromagnetic Compatibility (EN50081-2 EN50082-2)	Class A	Class A	Class A	Class A	Class A	Class A	Class A	Class A	Class A
3) Neutral rating	1,5 In	1,5 In	1,5 In	1,5 In	1,5 In	1,5 In	1,5 In	1,5 In	1,5 In
4) Sensore SCR	SCR open SCR short	SCR open SCR short	SCR open SCR short	SCR open SCR short	SCR open SCR short	SCR open SCR short	SCR open SCR short	SCR open SCR short	SCR open SCR short
5) Dimension (mm) : EXCHANGE module (guide only)	800x 830x 1400	800x 830x 2000	800x 830x 1400	800x 830x 2000	800x 830x 2000	800x 830x 2000	1350x 1000x 2000	1350x 1000x 2000	1350x 1000x 2000
6) Temperature	0 - 40° C	0 - 40° C	0 - 40° C	0 - 40° C	0 - 40° C	0 - 40° C	0 - 40° C	0 - 40° C	0 - 40° C

RATING (Amps)	63	2x63	100	200	300	400	600	800	1200
REMOTE SIGNALING	Sinottico con LED Porta RS232 – Porta a contatti liberi								

MECHANICAL CHARACTERISTICS

Modularity

The system is housed in sheet steel enclosures placed on or secured to the ground and supplied with the degree of protection IP 20 in accordance with IEC standard 529. The mechanical structure of each module is in the form of a sufficiently robust and non-deformable frame to ensure that repair and maintenance work can be safely carried out.
The installation is such that maintenance of the electronic equipment can be carried out under conditions of absolute safety.
A distance of 500mm behind the rear of cabinet has to be provided for correct ventilation and maintenance access.
All sub-assemblies are constructed in such a manner that all parts are easily accessible

and replaceable.
The apparatus will be set up in such a manner that all electrical components can be replaced if necessary without the need of special tools.

Execution
To facilitate maintenance and repairs in the event of failures, a fault-finding system with an LCD display is provided.
The system has an integrated man/machine interface with an LCD display and control buttons in order to monitor voltage, current, frequency, operating status and the alarm system.

Resistance to short-circuiting
The components that are used and the manner in which they are assembled guarantee complete resistance to short-circuiting within the system under the parameters indicated (including all electromechanical or electronic equipment, interconnections, cables and bars).

Apparatus
The switches that guarantee safety of operation and the input and output isolating switches are connected in such a manner that they can be removed and replaced easily when necessary or when they need to be calibrated or tested without any need for interruption to the operation of the critical load.
Appropriate steps have been taken to prevent the possibility of any temporary connection between the two networks during the emergency operations using the manual by-pass.
Logical protection circuits are provided, so that in the event of an inadvertent closure of the maintenance cut-out on the opposite side, the system is automatically transferred to the side on which the user has closed the switch.
The aim is to prevent the user's error, provided that he so wishes, from inadvertently connecting the two circuits.

Ventilation and cooling
A suitable ventilation system ensures that the various components function at their optimum temperatures. A sufficient number of ventilators is supplied to ensure that the system can continue operating without any excessive overtemperatures, even when working at high loads.
If a ventilator is opened inadvertently, its air outlet is closed again by the appropriate action of a minimum pressure valve.
The design of the ventilation system is such that the unit can continue operating at an ambient temperautre of 40°C and a humidity level of 95%.
All ventilation fans are easily accessible from the rear of the cubicle and can be replaced without the need to halt the operation of the apparatus.

Operating conditions:
- Ambient temperature: 0 °C to 40 °C.
- Storage temperature: - 25 °C to +70 °C.
- Ventilation: ducted air

- Relative humidity: 0 to 95%, without condensate.
- Altitude: 0 to 1000 m (to be downgraded above 1000 m).
- Noise level: (according to ISO 3746) < 60 dBA.
- Degree of protection: IP 20.

USER INTERFACES

Control panel
The system control panel is located on the front of the unit and comprises the standard operating controls and the status indicators on a single line – 80 characters LCD, which gives a synoptic description of the status levels of the system. All indications relating to the status of the switchgear are displayed in LED form.

Alarms and status indicators
The integrated alarm systems and status indicators will enable the following status levels to be unambiguously identified:

- The presence and the status (within tolerance or otherwise) of Source 1 and Source 2.
- The phase difference between Sources 1 and 2 are within tolerance.
- Source 1 has been selected as Priority.
- Source 2 has been selected as Priority.
- Source 1 is active (CS 1 looped).
- Source 2 is active (CS 2 looped).
- Power source applied to load.
- Alarm (general).
- Operating mode (set) at “FIXED PRIORITY”.
- Operating mode (set) at “VARIABLE PRIORITY”.

Controls
The following actions can be carried out by activating the appropriate control switches:

- Select Source 1 as Priority (= manual transfer control to Source 1).
- Select Source 2 as Priority (= manual transfer control to Source 2).
- Select “Variable Priority“.

COMMUNICATION

Remote control using:

- A terminal board with remote control facility with isolated Volt free contacts.
- A connection via RS232 serial communication Gate.

The following signalling facilities are available via isolated Volt free A/C contacts (relay 24 Vdc. 1A) for remote operation:

- Failure (out of tolerance) of the Priority Source,
- Failure (out of tolerance) of the Reserve Source,
- Overloading
- Alarm (general).

SAFETY STANDARDS

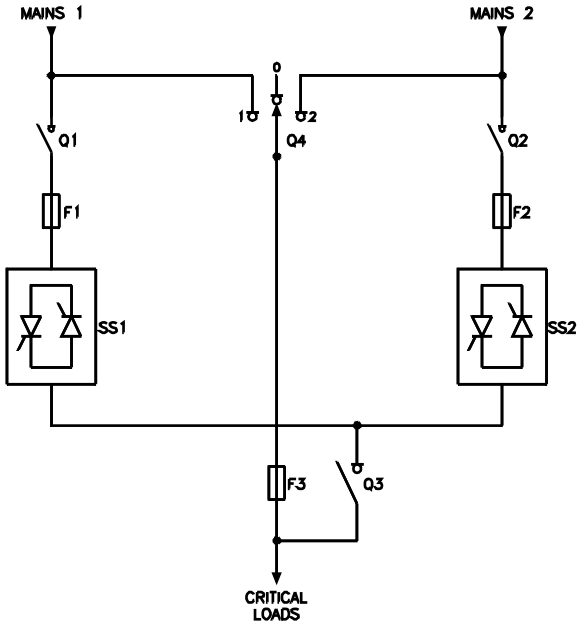
The static transfer system (“the system”) satisfies the terms of the following standards:

- Design: **EN60439-1**
- Construction and safety **EN 50091-1.** The system satisfies the terms of current standards governing compatibility (EMC) in order to prevent any interference with the operation of electronic equipment, and in particular:

- European Directive **89/336/CEE**
- **EN 55011**
- **EN 61000-4-3 / CEI 1000-4-3**

Block Diagram

EXCHANGE Block Diagram



EXCHANGE with N.R.E. and automatic switch Block Diagram