STATIC SWITCH MTR 2U

TECHNICAL SPECIFICATION

SUMMARY

1) SYSTEM

GENERAL

The (MTR) static switch is an equipment allowing the uninterrupted automatically or manually controlled transferring of one or more electric load, from a single phase source (line A) to a second single phase source (line B) and vice versa. Should the source powering the loads fail, the transfer to the other source is automatic. The system is an efficient solution for the following needs:

- Complete separation of two sources and of the connected distribution,
- Redundancy in an existing plant,
- Separation of consumers to avoid any mutual disturbance (different voltage tolerance), or to comply to standards in the connection point with the public mains.

The equipment, whose structure specification are listed as follows, is located in a RACK 19” 2U tray which is divided into two sections, as shown in Picture 1; one section is integral to the board in which it is inserted, which includes all the connection devices and all the electromechanical equipments; the other section is removable and includes all the electronics. This configuration allows very quick maintenance response time. The rotary switch, located on the front of the tray, allows the user to select one of the two line as primary and to perform the manual bypass procedure.
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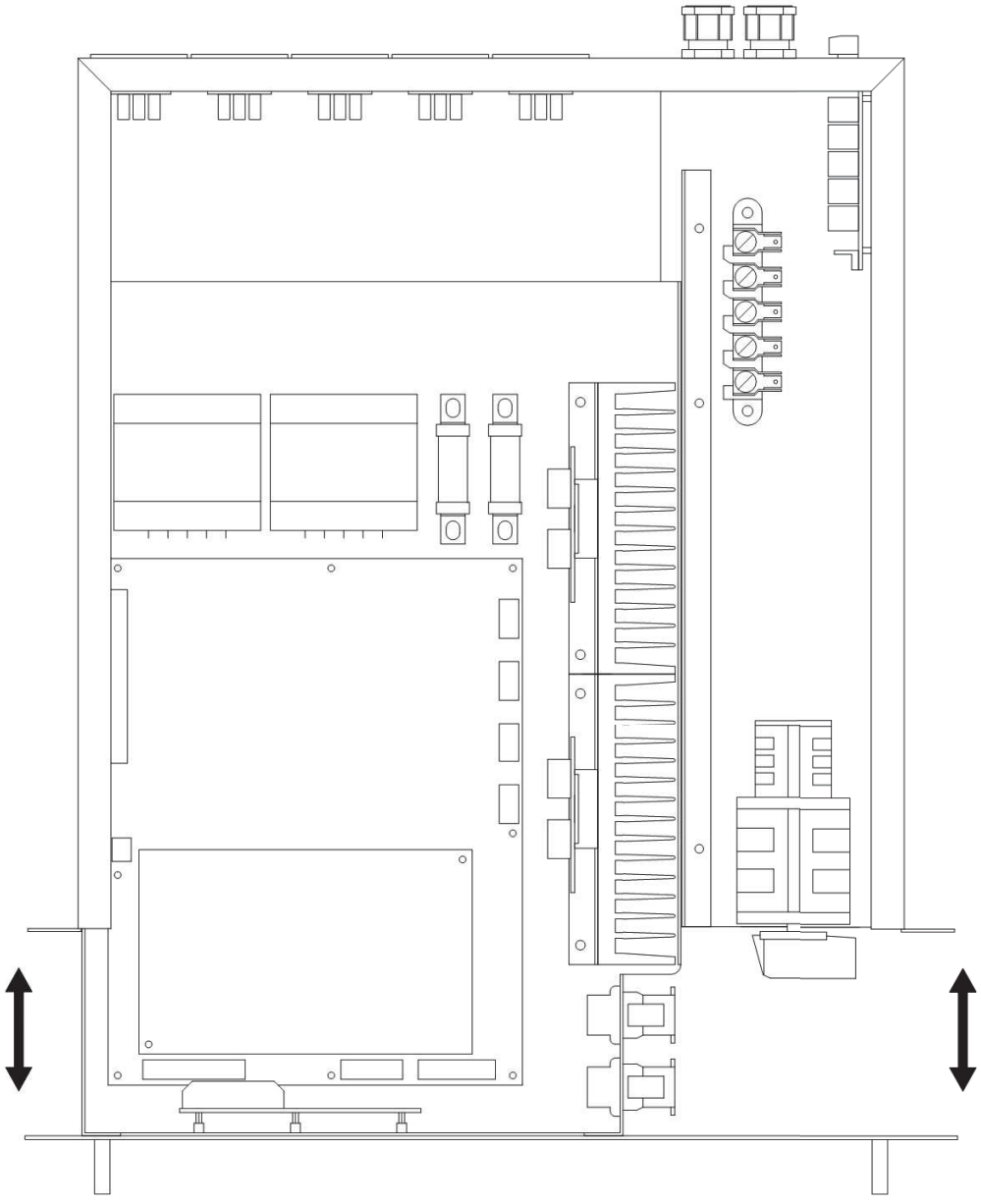


PICTURE 1

OPERATING PRINCIPLE

- Switching between two sources

MTR consists of two thyristor static switches, each connected to an input single phase line; one source can be selected as Primary and as a consequence the second one is set as Secondary source.

The common output of the static switches is connected to the machine output, attached to a critical load. Should a power failure occur, the System performs an automatic switching of the consumer from the out of tolerance source to the other, in less than a quarter of a cycle (5 msec.).

- Operating symmetry for the selection of the Primary and Secondary source

The structure and the operation of the system are totally symmetrical, i.e. the selection of the source A as Primary (source B = Secondary) and as Secondary (source B = Primary) can be made freely and can be changed any time by the operator by means of the rotary switch.

- Reversibility of switching

According to the operating condition of the plant, the system also allows to automatically perform the reverse switching (from the Secondary source to the Primary source) in the same conditions.

- Independence with regard to sources

The system can be used with sources of any kind (distribution networks, uninterrupted power supplies, generator sets). In order for the whole power system to function properly (sources, system, load) the sources should be normally balanced under voltage, synchronized and naturally phased, or by a specific synchronizing device.

- Switching technology

Each static switch is made up of 2 pairs of thyristors in antiparallel configuration, suitable for the rated load and to support the transient overloads specified as follows.

The switching technology used is of the "Break Before Make" type. This technology controls the switching off of the thyristors of the active switch before sending a command to the ones of the switch to turn on. This ensures the switching without parallel between the 2 power sources.

Thus, the MTR can be used for switching sources with different impedances and with different level of voltage, frequencies and phases; so, it prevents the propagation of failures from one source to the other. On the front of the tray, a complete synoptic shows the controlling devices and let the operator see the different statuses of the machine.

- Manual By-pass

The rotary switch allows to perform the manual by-pass in order to detach the removable section of the tray including electronics to perform maintenance and service operations, without any losses of load.

2) ELECTRICAL, MECHANICAL AND ENVIRONMENTAL SPECIFICATIONS

ELECTRICAL SPECIFICATIONS

	MTR 3000 1F 230/230 TT	**MTR 6000 1F 230/230 TT**
Operating rated voltage (Line A =Line B=Consumer)	230 V single phase	230 V single phase
Distribution system	TT	TT
Allowable voltage range	180 ÷ 265 V	180 ÷ 265 V
Rated frequency	50/ 60 Hz	50 / 60 Hz
Allowable frequency range	47 ÷ 63 Hz	47 ÷ 63 Hz
Maximum power	3 KVA	6 KVA
Max load current in continuous service (Temp. Max 40°C)	16A	26A
Max load current in continuous service (Temp. Max 25°C)	18A	32A
Switching time for operator command	≤ 2 msec.	≤ 2 msec.
Switching time with synchronous line	≤ 5 msec.	≤ 5 msec.
Switching time with asynchronous line	≤ 5 msec.	≤ 5 msec.
Max dissipated power at nominal load	60 W	110W
Efficiency	> 99%	> 99%
Overload 10 min.	125%	125%
Overload 1 min.	150%	150%
Overload 10 sec.	200%	200%
Overload 1 sec.	1000%	800%
Overload 100 msec.	1500%	1000%

MECHANICAL SPECIFICATIONS

Tray dimensions (L x D x H) 483 x 480 x 88mm
Protection class IP20

CAUTION: With the removable tray extract, to perform any necessary maintenance works, on the fixed section the protection class IP20 isn't guaranteed. If the removable tray doesn't insert in short times, order the special protection J0000193.

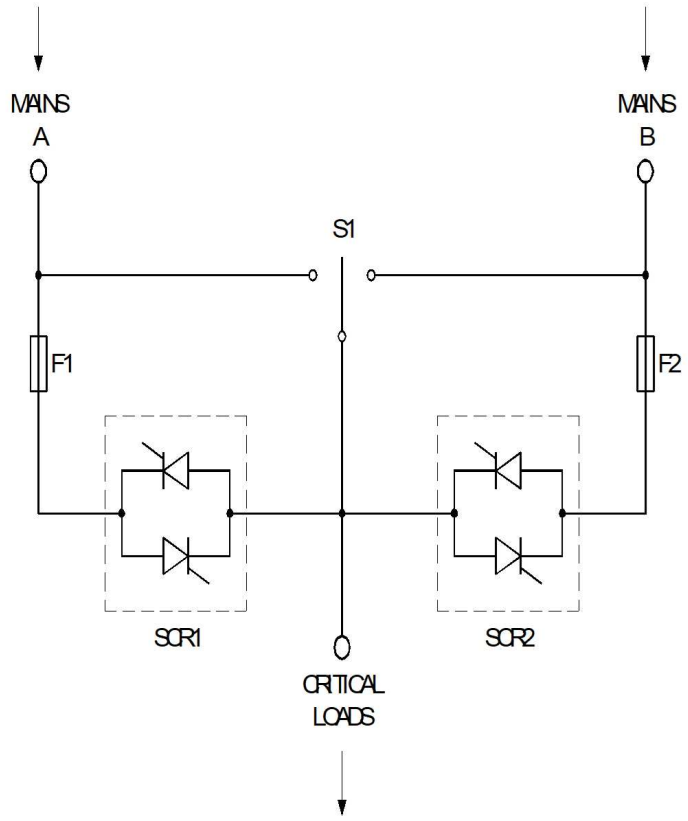
ENVIRONMENTAL CONDITIONS

Room temperature:
from 0 °C to 40 °C.
Storage temperature
from -10 °C to 70 °C.
Ventilation natural air (inlet from the bottom, outlet from the top).
Relative humidity:
0 - 95%, without condensation.
Height:
0 - 1000 m (derating above 1000 m).

Noise level:
(complies to ISO 3746) < 60 dBA.

3) BLOCK DIAGRAM

Picture 2 shows the static switch block diagram.
The equipment consists of the following units:
Protection fuses of static switches line A and line B, F1 and F2 respectively
Static switches Line A and Line B , SCR1 and SCR2 respectively
Rotary switch S1



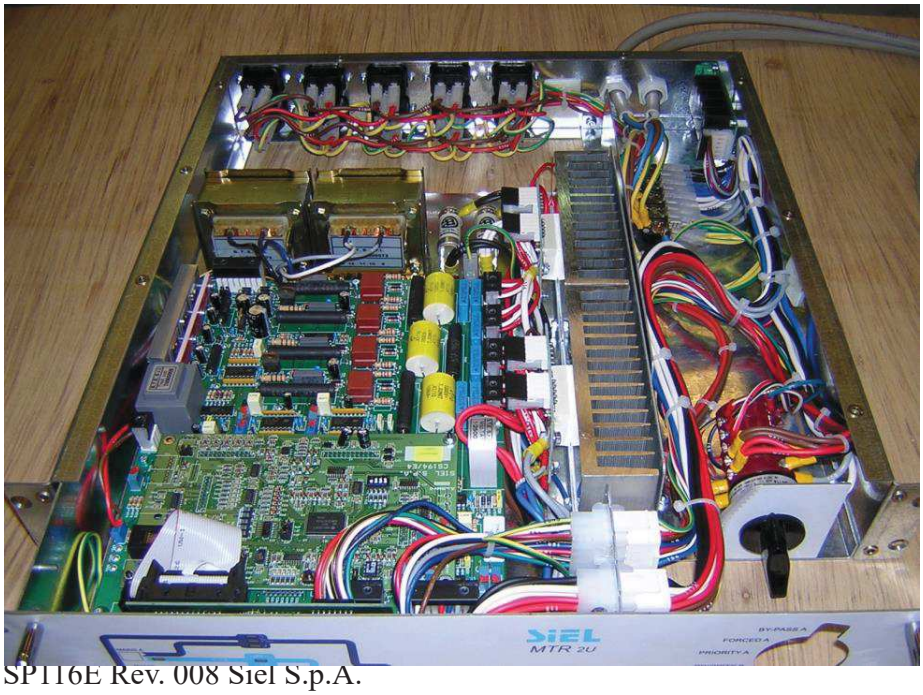
PICTURE 2

4) DESCRIPTION OF THE EQUIPMENT

The static switch is shown on the wiring diagrams attached to this document.

Picture 3 shows the closed tray of the switch, while Picture 4 shows the tray without the top cover.
In Picture 4, in the fixed section of the tray you can clearly see the input cables of line A and line B, the rotary switch and the output connectors; in the removable section you can see the static switches, the fuses of line A and line B connected in series and the power electronics.

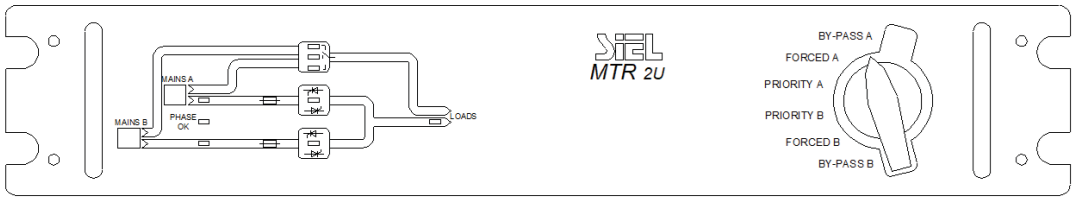
PICTURE 3



PICTURE 4

DESCRIPTION OF CONTROL PANEL AND SIGNALS

The control panel, which is the front section of the RACK tray, is clearly shown in Picture 5.
The panel includes the rotary switch which allows to perform the manual by-pass procedure and the synoptic corresponding to the function diagram of the static switch and which through the lighting up of LEDs allows an immediate visualization of the operational status of the many assemblies of the equipment.



PICTURE 5

ROTARY SWITCH

The rotary switch allows to perform the following commands:

Priority A / Priority B
Forced A / Forced B
By-Pass A / By-Pass B

The Priority function allows to prioritize one of the two input line.
For example, if you move the switch on "Priority A", the Line A is primary one while Line B is the backup one. In this case, the static switches of Line A are controlled and the load is powered by Line A. If in such conditions Line A fails, the system switches automatically on Line B without interruption.
The Forced function allows to force one of the two input sources. For example, if you move the switch on "Forced A", you force the turning on of static switches of Line A so that the load is powered by this line. If in such conditions Line A fails, the system does not switch to Line B. As a general rule, the Forced procedure is performed before performing the manual by-pass command in order to avoid any parallels between the two source lines.
The By-Pass function allows to perform the manual by-pass.
For example, if you move the switch to "By-Pass A", the load is switched to Line A directly by the rotary switch, bypassing the static switches and allowing the detachment of the removable section of the tray to perform maintenance work.

The removable section of the tray can only be extract if the rotary switch is in the By-Pass A or By-Pass B position. In all the other positions, the handle of the rotary switch activates a mechanical lock which does not allow the removal of the tray.

SYNOPTIC CHART

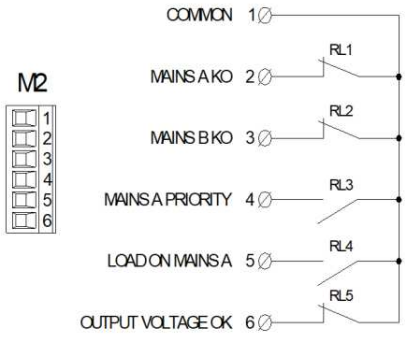
On the synoptic chart you can find the following light (LED):

S1 MANUAL BY-PASS SWITCH STATUS (green if closed / off if open / orange if not selected)
LINE A ACTIVE (green if the line is active / red if a failure is present)
LINE B ACTIVE (green if the line is active / red if a failure is present)
SYNCHRONIZED SOURCES (PHASE OK) (green, phase ok / orange, no synchronism)
LINE A STATIC SWITCH STATUS (green if closed / off if open / orange if forced by manual by-pass)
LINE B STATIC SWITCH STATUS (green if closed / off if open / orange if forced by manual by-pass)
PRESENCE OF CONSUMERS VOLTAGE (green if voltage is present / red if consumer's voltage is missing)

5) DESCRIPTION OF THE REMOTE SIGNALLING SYSTEMS

All the signals exchanged between the generator set and the outside pass through the relay board whose terminal board M2 can be accessed from the back of the RACK tray. This board lets you monitor the MTR, reading the zero voltage relay contacts.
Picture 6 shows the diagram of the above mentioned contacts.

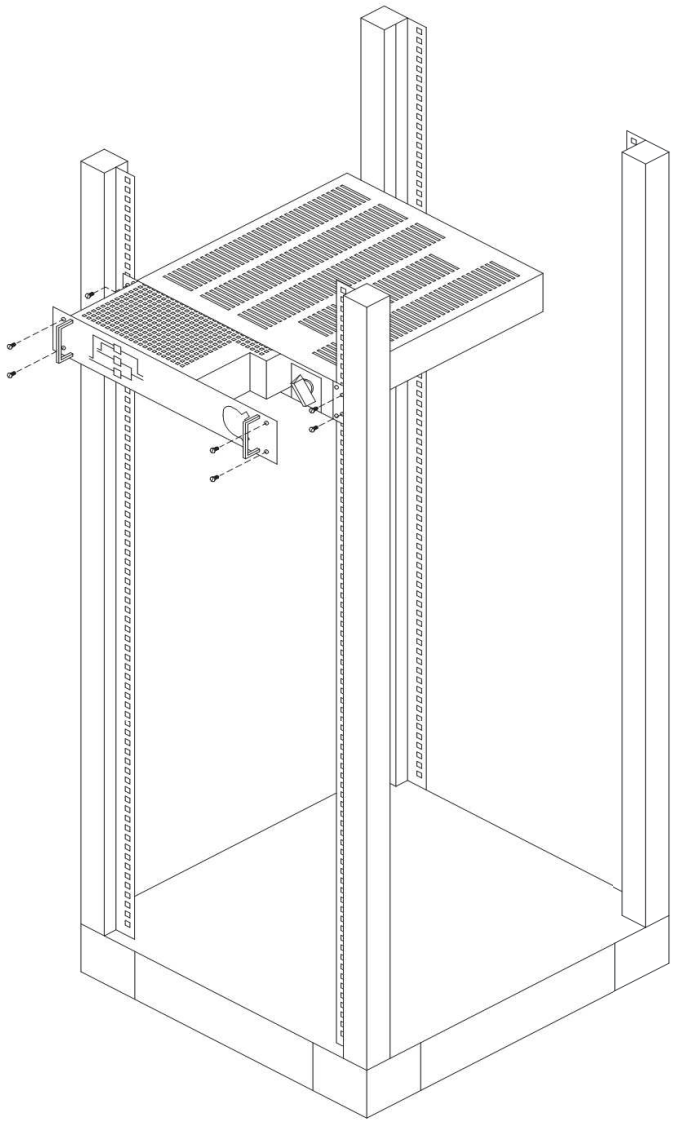
Note: Relays are shown in off position.
The event takes place when the relay contact is closed.



PICTURE 6

6) INSTALLATION

The static switch is implemented in a RACK 19" tray which can be placed in a cabinet; since the machine is cooled by **Natural convection** we recommend to place the device correctly allowing an appropriate ventilation, with air featuring a temperature within the above mentioned ranges. If more trays come installed in the same cabinet, leave between a tray and the other a space of 2 unit for facilitate the ventilation. In option could be given the KIT J0000198 included a baffle to insert between a MTR and the other.
As previously stated, the tray is mechanically divided into a fixed section, and one removable section. The fixed section must be attached to the board on anterior stands with n. 4 screws M6; the removable section is inserted in the fixed section and is blocked on the front with n. 4 screws M4. (Picture 7)



PICTURE 7

CHOOSING THE INSTALLATIONLOCATION

For successful installation, the following rules must be observed:

- The area where the static switch is installed must be kept clean and dry to prevent any solid or liquid material from getting into the device.
- A free space of about 1 m must be kept from the front of the MTR to allow all normal and maintenance operations

VISUAL INSPECTION

Prior to delivery, every MTR is carefully checked both electrically and mechanically. Always visually check the machine after delivery for any transit damage.

ENVIRONMENTAL CONSIDERATION

Temperature and humidity

The premises where the MTR is to be installed must be able to dispose of the kW dissipated by the machine during operation so as to keep the temperature at between 0°C ÷ 40°C; however, to achieve utmost reliability and life-span, the average temperature of the environment should be around or below 25°C, with a humidity percentage between 0÷90% as shown on the technical specifications table.

HANDLING OPERATION

The MTR is not particularly heavy and the handling does not require any special equipment.

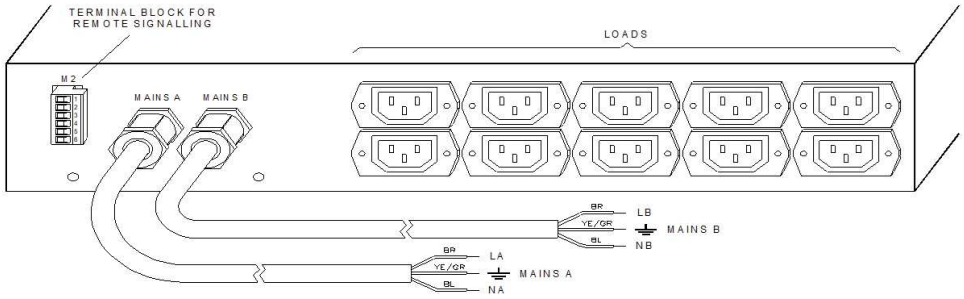
SAFETY CONSIDERATIONS

To reduce accidents, Health and Safety rules must be observed. We recommend that walls, ceilings and floors and everything surrounding the MTR should not be made of inflammable materials; moreover, the area around the machine should be kept particularly clean so that metal dusts, iron filings or miscellaneous metals do net get into the MTR as these could cause short circuits.
It is advisable to keep a mobile fire extinguisher within easy reach.
Access to the MTR room should be restricted to machine service and maintenance personnel; the doors of the MTR room must be kept locked and the keys kept under suitable supervision.

All service and maintenance personnel must be trained in emergency procedures.
Periodic training is advisable to keep technicians updated.
New personnel must be trained before being authorised to operate the MTR.
Il nuovo personale deve essere sottoposto a training prima di poter operare su MTR.

7) ELECTRICAL CONNECTIONS

All the connections, inputs, outputs and auxiliaries are accessible from the rear of the tray without removing any protection, as shown in Picture 8.



PICTURE 8

POWER CONNECTIONS

Mains A, mains B connections:
Connect the two mains using the two cables mains A and mais B, of length around four meters, present on the rear of the tray.
Doing attention to the color wires inside the cables, connect the two mains according to the following table:

CABLE	COLOR WIRES	CONNECTIONS
Mains A	Brown	Phase mains A
	Blue	Common mains A
	Yellow/Green	Ground
Mains B	Brown	Phase mains B
	Blue	Common mains B
	Yellow/Green	Ground

Loads connections:
The output load is divided on 10 three-pole connectors on two rows (Row 1, Row 2)

Caution:
Each single connector carries a maximum load of 10A.
Each connector row carries a maximum total current of 16A.
Thus, connect each single connector to a load which does not exceed 10A and each row of connectors to a total load which does not exceed 16A, taking care not to exceed the maximum load capacity of the system which is 32A for MTR 6000 and 18A for MTR 3000.

CONNECTION TO THE RELAY BOARD

All the signal connections refer to the relay board located inside the device on the right side of the fixed section. Even if this board does not feature any dangerous voltage, perform all the connections with MTR switched off.
The insulation between the different contacts is recommended for voltages lower than 230Vac (30Vdc); the switching of mains voltage is not recommended, even though it is possible.

8) SPECIAL OPERATING CONDITIONS

❖ Presence of synchronized lines
If both lines are present, the line selected as primary by the operator is automatically connected to the output, through the rotary switch.
If the selection is changed in a later moment, after a delay of a few second, the switching on the new primary line is performed.
The switching always takes place if the load current goes to zero.

❖ Switching between two asynchronous lines
In case of a switching caused by a failure of the primary line, the load is transferred on the other line without any delay, also on asynchronous lines. In case of a switching caused by a change in the setting by the operator, the control waits until the two lines are in phase and then performs the switching without any interruption.
If the 2 lines do not become synchronous and you want to force the switching, you have to set the rotary switch on Forced for the line on which you want to switch.

❖ Primary line failure
If the primary line fails, the load is automatically switched to the backup line without any delay. When the primary line returns in the allowed range, after a few seconds, the automatic switching from backup line to primary line is performed.

❖ Failure of the secondary line
If the secondary line fails, the system continuous to operate normally; on the synoptic diagram the LED corresponding to the failed line lights up red and the green LED of Phase OK lights up orange.

❖ The load is powered by the backup line, exceeding the limits (primary line is not present)
In this case, since the primary line is not available, even though the backup line falls below the designated limits, it remains connected to the load.

❖ Output overload
Should an output overload occur, to such extent that it causes a decrease of the primary line below the limits, the switching to the other line is locked for all the duration of the overload; this prevents the backup line to be involved in possible consequences on its consumers.

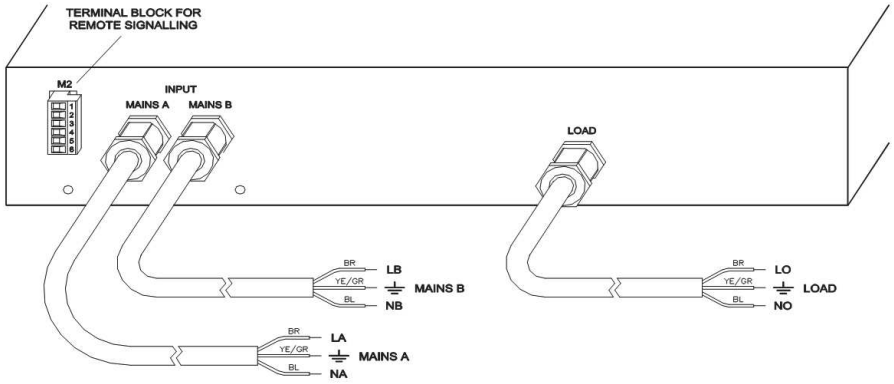
❖ Start-up failure of SCR
Should a diode controlled on the primary line side fail, the load is immediately switched to the backup line, the switching is locked and the failure on the primary line is signalled. If the backup line is not available, the load remains without power.

9) OPTIONS

OPTION 1: OUTPUT WHIT SINGLE CABLE

With this option, in output, is possible have a single tri-pole cable of lenght around 4 meters, as shown in Picture 9 .
Doing attention to the color wires inside the cables, connect the output according to the following table.

CABLE	COLOR WIRES	CONNECTIONS
OUTPUT	Brown	Phase
	Blu	Common
	Yellow/Green	Ground



PICTURE 9

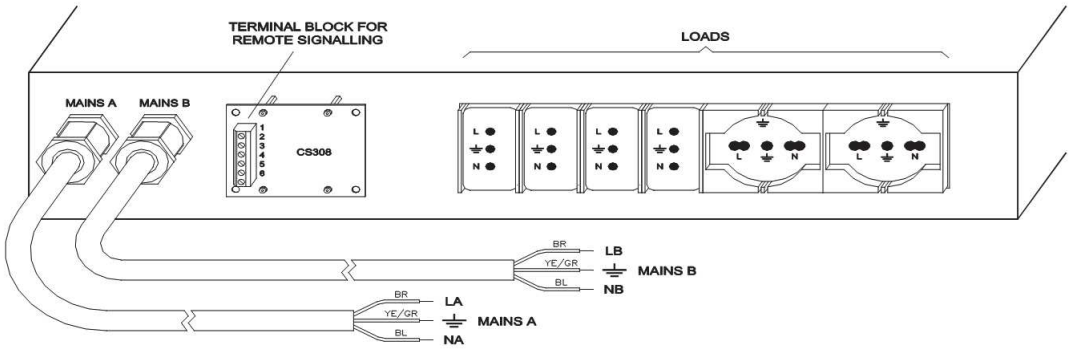
OPZION 2: OUTPUT WITH N°4 ITA CONNECTORS 2P+T AND N° 2 SCHUKO CONNECTORS

With this option, in output, is possible have n°4 italian connectors 2P+T 10A and n°2 schuko connectors16A as shown in Picture 10.

CAUTION: Each single italian connector carries a maximum load of 10A and each single schuko connector carries a maximum load of 16A.

Thus, connect each single italian connector to a load which does not exceed 10A and each single shucko connector to a load which does not exceed 16A taking care not to exceed the maximum load capacity of the system which is 32A for MTR 6000 and 18A for MTR 3000.

For the loads connections, respect the polarities as shown in Picture 10.



PICTURE 10

10) REFERENCE NORMS

The applicable standards are: EN62310-1: 2005 “Static Transfer System (STS) Part 1: General and safety requirement” and EN62310-2: 2006 “Static Transfer System (STS) Part 2: Electromagnetic compatibility (EMC) Requirement”.

Siel STS's are also conforms with the following directives:

2014/30/UE “EMC- Electromagnetic Compatibility”

2014/35/UE “Low Voltage”

Siel Company operates a Quality Management System certified to ISO 9001/2015 (Certification No. CERT-005SGQ04 ITALCERT) covering all company functions from design and manufacture to after sales services.

The environmental Management System implemented by Siel Company is in compliance with the standard UNI EN ISO 14001:2015 (ISO 14001:2015) (Certification N° 005SGA02 ITALCERT)

Siel Company is also in compliance with the standard UNI ISO 45001:2018 Occupation Health and safety management System (Certification N° 005SCR04 ITALCERT)