



Liebert® CROSS RACK

User Manual



Liebert CROSS RACK

2 POLE - LV

COMPLETE RELIABILITY ON-LINE
STATIC SWITCH

User Manual
10H52241UM60 rev. 2



CONGRATULATIONS FOR HAVING CHOSEN LIEBERT CROSS RACK 2 POLE - LV!

With this innovative static switch system, VERTIV offers you a combination of maximum security and reliability even for the most critical applications. Liebert CROSS RACK provides rapid switching between two independent single-phase power supply sources, thus avoiding critical power line problems or damage to the load in the event of faults to the source providing the power supply. Liebert CROSS RACK employs a Break-Before-Make system and will not allow simultaneous current switching between the two separate input power supply sources under any operating conditions. In addition, Liebert CROSS RACK is configured so that the neutral conductors may be switched.

One of the input power supplies can be configured as the preferred source.

A block diagram with LED indicators on the Liebert CROSS RACK system enables immediate identification of operation status and all system information.

The static module (control logic and power electronics) can be extracted completely from the unit, without interrupting the supply to the load, thus reducing maintenance time to a minimum.

These and many other features make Liebert CROSS RACK a unique product in its category.

YOUR SAFETY CONSTANTLY UNDER CONTROL

Detailed research has shown that the application of maintenance programmes enables the performance of the static switch to be optimised, by improving reliability and prolonging its working life.

This is why VERTIV offers solutions specifically designed to satisfy your demands: from expert telephone consultancy, to 24-hour-a-day availability, 365 days of the year.

Wherever you are, whatever your business, whether your needs are small or large, you can always rely on VERTIV service quality.

PREFACE

This User Manual contains information required to install, start-up and use the static switch.



You are advised to keep this User Manual and refer to it before installation (to be done by specialist personnel), and before using Liebert CROSS RACK.

Liebert CROSS RACK may differ from the one displayed on the front cover.

DECLARATION OF CONFORMITY

The manufacturer: VERTIV SRL

HEREBY DECLARES THAT THE PRODUCT: Liebert CROSS RACK 2 POLE - LV

CONFORMS TO THE INTERNATIONAL STANDARDS LISTED BELOW:



IEC EN 62310-1
IEC EN 62310-2 (class C2)
IEC EN 60950

SAFETY



WARNING

VERTIV places personal safety above all other considerations. For this reason it is vital that the safety instructions are read before installation, and that they are followed.

Liebert CROSS RACK is powered by two alternating input power supply sources.

When using Liebert CROSS RACK, **the operator** must strictly observe the instructions shown in Chap. 4 and 5 (OPERATION and CONTROL PANEL).

Only **qualified technical personnel** are permitted to install the machine as described in Section 2, "Installation".

There are potentially dangerous voltages inside Liebert CROSS RACK. Any intervention requiring the removal of protective guards extractable components must be performed by **specialist personnel authorised by VERTIV**.

Liebert CROSS RACK corresponds to protection level IP20, with static module inserted, and is intended for installation in a specially-designed rack. In order to guarantee that the final configuration conforms to safety standards, Liebert CROSS RACK must be installed in accordance with the requirements of HD 384.4.42 S1/A2 chapter 42, and IEC 60364-4-482 chapter 482.



RADIO FREQUENCY INTERFERENCE

This unit is a Class C2 product. Liebert CROSS RACK may cause radio-interference. Liebert CROSS RACK should not be positioned near to any equipment that is particularly sensitive to electromagnetic disturbances (radio transmitters and receivers, radar, metal-detectors, videos).



EMERGENCY

In the event of an emergency, the power supply can be cut to all loads simply by turning OFF all the external switches upstream of both Liebert CROSS RACK input sources, and set the Bypass switch QS1, located on the front panel of Liebert CROSS RACK, to position 0 see Fig. 11.



LEAKAGE CURRENTS

Connect the PE earth cable before any other connection cable.

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1. RECEIPT AND STORAGE

1.1 DELIVERY

The equipment was carefully checked before dispatch. On receipt, check the packages and inspect the equipment. Inform the supplier of any damage or missing components **within 8 days** of the date of receipt.

1.2 UNPACKING

To remove Liebert CROSS RACK from its container, open the box – ensuring that it is the right way up – remove the mounting guides (see also para. 2.9 on page 12), and the protective packaging (see Fig. 1), then extract the unit from the box and remove it from its protective plastic wrapping.

Keep the equipment in a horizontal position where possible, and take maximum care when removing the packaging as any fall or violent impact may damage it. Take particular care with the control devices and tools. Check the packaging material before disposal to ensure that no supplied components are thrown away.

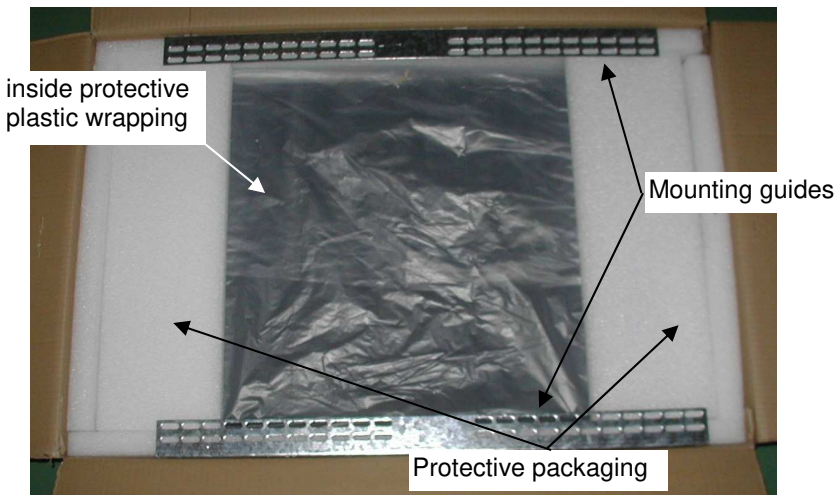


Fig. 1 – Removing the packaging

1.3 STORAGE

If Liebert CROSS RACK is not put into service within seven days of delivery, refer to the storage conditions shown on the plate on the packaging and on the equipment itself.

If the equipment is stored, it must be kept in a **clean, dry place** and **not subject to extremes of temperature** (see paragraph 0 on page 7).

2. INSTALLATION

2.1 INSTALLATION DATA

Ambient temperature		0 °C to +40°C
Relative humidity level	(without condensation @ 20 °C)	90%
Maximum altitude	(without derating)	1000 m a. s. l.
Protection level	(with plug-in installed)	IP 20
Cable connections	at rear	
Ventilation	forced and redundant	
Air entry	from front and sides	
Air expulsion	from rear	

Table 1 – Installation data

Description	U.M.	Rating (A)		
		16	32	63
Input Phases		Single Phase		
Maximum dissipation	[W]	45	85	155
Max. noise level (@ 1 m)	[dBA]	45		
Width	[in]	19		
Height	[U]	2		
Depth (without handles)	[mm]	700		
Weight	[kg]	23		



WARNING

Liebert CROSS RACK must be installed in accordance with the requirements of HD 384.4.42 S1/A2 chapter 42, and IEC 60364-4-482 chapter 482.

Only personnel authorised to enter restricted locations may work on Liebert CROSS RACK

2.2 ENVIRONMENTAL CONDITIONS

Liebert CROSS RACK must be installed in premises that are not exposed to sources of excessive heat, humidity, water and conductive dusts (see para. 2.1 above).

Operating temperature 0°C to 40°C

Ideal ambient temperature 15°C to 25°C

The heat produced by Liebert CROSS RACK is dissipated by forced cooling (fans) and dispersed into the surrounding atmosphere. Intake is from the front and sides of the unit and outlet is from the rear.

N.B. It is of fundamental importance that the following installation instructions be adhered to:

1. Ensure that the air vents on the front, side and rear panels are not obstructed, as this can seriously compromise the correct operation of Liebert CROSS RACK, and, as a result, the power supply to the load.
2. Liebert CROSS RACK is provided with redundant ventilation fans; if a fan stops working for some reason, an alarm is activated, but the unit continues to operate normally.
3. Liebert CROSS RACK is also equipped with an internal temperature sensor, located on static switch heat sink, which provides an alarm when the temperature exceeds the limit, but does not interrupt the operation of the unit.

For more information refer to the Technical Specification for Liebert CROSS RACK or contact VERTIV technical personnel.

2.3 STORAGE DATA

Temperature limits -25°C to +55°C
 Relative humidity level from 0% to 95%

2.4 RECOMMENDED CABLE SIZES

The following tables show the recommended current and cable section values for the power connections.

The section values are provided for information purposes only and should only be considered valid where:

- 1) Copper conductors with PVC isolation are used (max. operating temperature = 70°C).
- 2) The cables are placed in different ducts for each line (inputs, output).
- 3) The air temperature in the ducts does not exceed 30°C.
- 4) The maximum number of cables for each duct is 4.

The recommended sections for the earth cables, shown in the tables below, are merely indicative. Their exact value can be calculated using the formula:

$$s = \sqrt{\frac{(I^2 \cdot t)}{k}}$$

where:

- s = minimum earth cable section (mm)
- $I^2 \cdot t$ = nominal $I^2 \cdot t$ of the protection device (inputs S1 and S2).
- k = coefficient dependent on isolating material (for PVC max. operating temperature = 70°C or 143 °K).

Under different installation conditions, the cable sections can be calculated on the basis of standard IEC 287.

If the length of the cable results in a voltage loss > 3%, then the next largest section should be used.

Table 2 – Cable sections

Description	U.M.	Rating (A)		
		16	32	63
Input/Output max. current	A	16	32	63
Recommended cable size for phase and neutral	mm ²	2.5	6	10
Recommended cable size for earth cables	mm ²	2.5	6	10

NB. In order to avoid interference with particularly sensitive equipment, it is recommended that Liebert CROSS RACK power supply and output cables be placed in earthed metal ducts. Otherwise, use cables fitted with a shield. Where possible, other equipment cables (power supply, communication, data) should be laid separately from Liebert CROSS RACK cables.

2.5 SCHEMATIC DIAGRAM

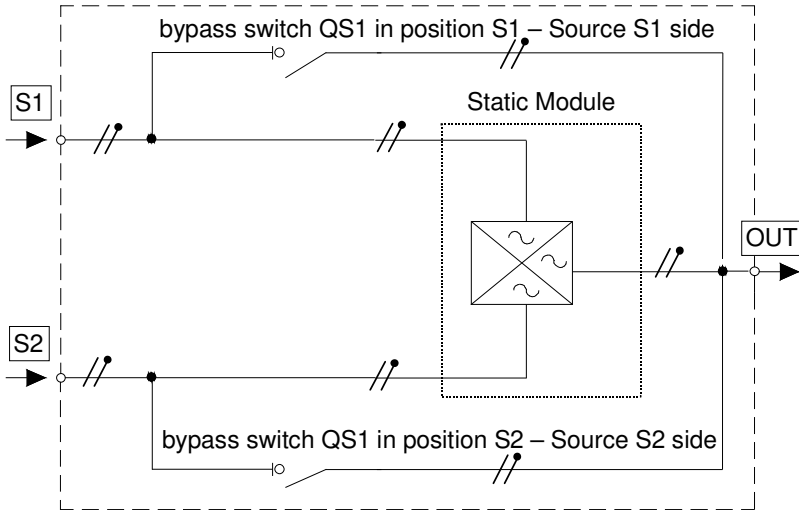


Fig. 2 – Schematic diagram

As can be seen in Fig. 2, Liebert CROSS RACK is not fitted with switches on the input supplies. The switches and input external protection devices must be installed in the external power distribution system, in accordance with the requirements described in para. 2.6. The only switch present on Liebert CROSS RACK is QS1: the bypass switch, which can supply the load directly from Source S1 or Source S2.

2.6 EXTERNAL PROTECTION DEVICES

The electrical protection devices inside Liebert CROSS RACK have the sole function of protecting the subsystems and devices inside the unit itself from permanent short circuits on the output to the Liebert CROSS RACK.

Therefore, thermal protection devices should be installed up and downstream of the Liebert CROSS RACK, in order to safeguard both the unit internal and external cable and the load.

These devices should be automatic switches, or fuses and switches, and selected in conformity with the Liebert CROSS RACK current rating, the overload performance, as declared in the technical specification, and the devices described in Table 3 as well as any devices that may be connected to the Liebert CROSS RACK output.

Table 3 – Load capacity of the thyristor, fuses and switches inside Liebert CROSS RACK

DESCRIPTION	Rating	I_{TSM} @ $T_J=125^\circ\text{C}$ $\times 8,3...10\text{msec}$	TOTAL I^2t @ $T_J=125^\circ\text{C}$
SCR: SEMIKRON SKKT 92 16/E	150A _{rms} /1600V	1750A	15000 A ² .sec

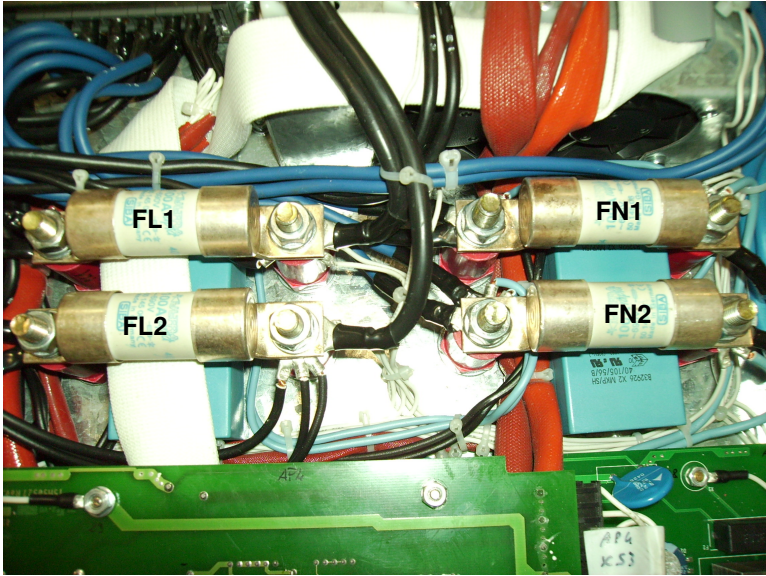


Fig. 3 – Power fuse positions and descriptions (refer to Liebert CROSS RACK schematic diagrams)

FUSE	TYPE	RATING	I ^{2t} pre-arc	TOTAL I ^{2t} @ 230V
SIBA	50 145 06	100A/660V	2050 A ² .sec	3740 A ² .sec

SWITCHES	QS1
KRAUS & NAIMER	CA 25



For info. on backfeed protection devices, refer to par. 7.5. It is necessary position the following label upstream of each Liebert CROSS RACK supply switch in order to advise electrical maintenance personnel:

***DISCONNECT THE STATIC SWITCH (Liebert CROSS RACK)
BEFORE WORKING ON THIS CIRCUIT***

An additional two-pole disconnection device must be provided in the building installation if the equipment is used where identification of the Neutral in an AC mains supply is not possible.



WARNING

If an emergency interruptor device is fitted, it must be installed in the external distribution system, and upstream of both Liebert CROSS RACK input sources. See also para. 7.4 EMERGENCY POWER OFF.



WARNING

The backfeed protection control must be installed upstream of both input sources. See BACKFEED PROTECTION on page 27 for more information.

PROTECTION DEVICES ON THE INPUTS

These must be capable of protecting the power supply system, with regard to the maximum power demands shown below:

7 I_n for 30 cycles
1.5 I_n for 1 minute
1.25 I_n for 10 minutes,

where:

$$I_n = \frac{P_n}{\sqrt{3} \cdot V_n}$$

P_n = output power [kVA]

V_n = output voltage [V]



WARNING

Devices for protection against electrical shock (differential current breakers) can be installed upstream of both Liebert CROSS RACK input breakers. But delayed type breakers only may be used.

Minimum requirements: CLASS A – selective type 0,3A

PROTECTION DEVICES ON THE OUTPUT LINE

Given that the load can be powered under different conditions using the Static Switch, the protection system on the output line must take into consideration the following types of power supply:

1) Power supply from static switch:

7 I_n for 30 cycles
1.5 I_n for 1 minute
1.25 I_n for 10 minutes,

2) Power supply using bypass switches:

In this status the input is connected directly to the output terminals and the maximum current is equal to the source short-circuit current in input to Liebert CROSS RACK.

The protection device should be adjusted for this short-circuit current.

2.7 ACCESS TO THE ELECTRICAL CONNECTION AREA



WARNING

Check that the two input lines to Liebert CROSS RACK are disconnected from the power supply before making the power connections inside the machine.

To access the area envisaged for the electrical connection, it is necessary to remove the protection present on the input and output terminals at the rear of Liebert CROSS RACK (see Fig. 5), which is held in place by four screws. Once the signal and power connections have been made replace the terminal protection.

2.8 APPEARANCE



Fig. 4 – Front panel

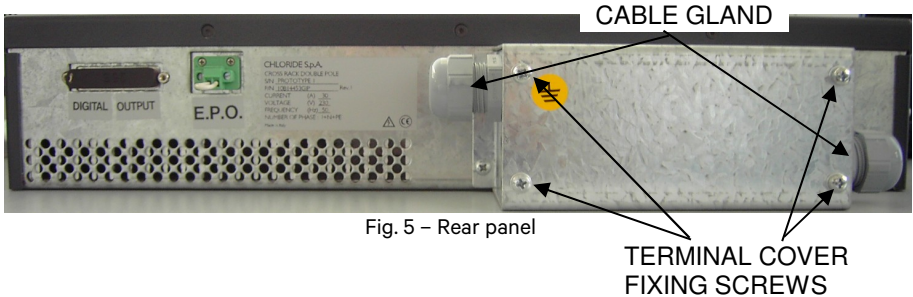


Fig. 5 – Rear panel

2.9 RACK-MOUNTING

Liebert CROSS RACK can easily be mounted in an equipment rack using the two guides provided (see Fig. 6). Place the unit on the guides and secure it to the chassis using two M5 screws (see Fig. 7), ensuring that they do not stop the static module from being extracted – (see also para. 6 - MAINTENANCE)

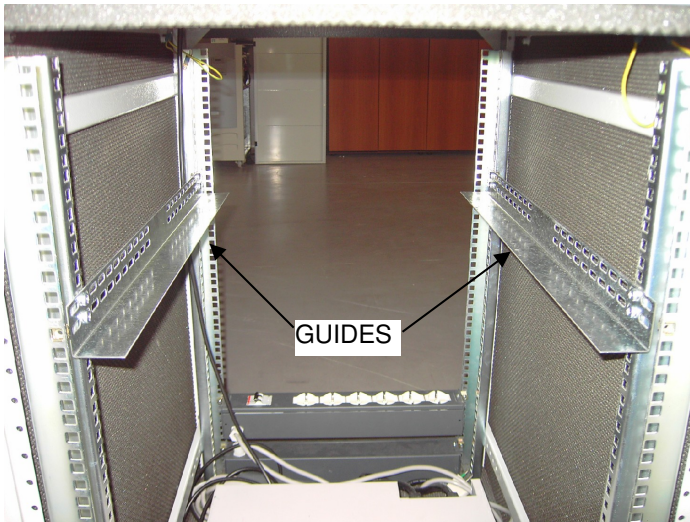


Fig. 6 – Mounting guides



FIXING
SCREW

Fig. 7 – Securing Liebert CROSS RACK to the chassis



Fig. 8 – Liebert CROSS RACK mounted on guide

3. POWER CONNECTIONS – INPUT/OUTPUT

The Liebert CROSS RACK static switch is a two-way single phase automatic switch powered by two independent synchronous or asynchronous AC power supplies.

A good earth connection is required to guarantee the equipment safety. Fig. 9 shows the connections for the 2 input power supply sources - source S1: L1 (phase), N1 (Neutral 1), source S2: L2 (phase), N2 (Neutral 2) - the output - Lout (phase), Nout (Neutral output) - and the earth connection.



Fig. 9 – Power and signal terminals (cover removed)

3.1 NEUTRAL CONNECTION

The connections for the two input neutral cables and load are shown in Fig. 9.

N.B. It is essential that the two neutral cables of both power supply sources and the Load neutral connection be connected to Liebert CROSS RACK.

The installation of Liebert CROSS RACK in a system does not modify the existing neutral conditions (earthing method).

This equipment is not designed for use in grounding systems with isolated neutral (IT system).



WARNING

Check that the two input lines to Liebert CROSS RACK are disconnected from the power supply before making the power connections inside the machine.



WARNING

Ensure that the power connectors do not obstruct heat dissipation from the rear of the equipment.



Ensure that the wires are secured using cable glands (see Fig. 5)

4. OPERATION

4.1 DESCRIPTION OF THE SYSTEM

The Liebert CROSS RACK Static Switch is a two-way, single phase automatic switch powered by two independent synchronous or asynchronous AC power supply sources. The switching devices are SCR. Under no operation conditions is simultaneous current switching between the two sources possible (Break Before Make).

The Static Switch makes a rapid switch from one source to the other in the event of a fault to the power supply used to power the load, or carry out tests/maintenance. In addition, Liebert CROSS RACK is configured so that the neutral conductors may be switched. One of the two sources can be designated as the preferred power supply, to which the Static Switch will transfer the load. It remains there until different designations or faults require it to be switched to the other source. The Static Switch is fitted with a manual bypass for each source to enable correct maintenance of the system. The type of bypass switches employed by Liebert CROSS RACK make it impossible to connect the two supplies in parallel. The Liebert CROSS RACK Static Switch is fitted with a block diagram with LED indicators, capable of providing all information concerning equipment operation status, which, together with the power source priority selection button enable trained operators to make full use of the apparatus. (See Fig. 12 and para 5.1)

Furthermore, to ensure maintenance time is kept to a minimum, the entire static module (logic and power sections) may be extracted without interrupting the supply to the load, simply by switching the unit to manual bypass.

N.B. The static module may be extracted only by VERTIV authorised technical personnel and in accordance with the procedure at para 6.1)

4.1.1 POWER SOURCE PRIORITY SELECTION

Pushbutton P on the front panel of Liebert CROSS RACK (see Fig. 12) selects one of the two input sources as the priority one. Press and hold the button for at least 1 second to ensure that the priority is accepted.

The LED associated with the selected source S1 or S2 switches on, (see Fig. 12). The other source then becomes the reserve power source. The load will be supplied from the preferred source all the time provided it is within acceptance parameters. When a power failure occurs the load is transferred to the reserve power source. When the preferred source returns within acceptance parameters, the load is automatically re-transferred to it after a delay of 5 seconds. See also para. 4.1.3.

4.1.2 SWITCHING DUE TO POWER FAILURE

Switching occurs if the characteristic parameters of the active power source (preferred or reserve) supplying the load go outside defined limits. The parameters tested are the root mean square (rms) and instantaneous values of the voltage, which must remain within a defined acceptance window. Once the parameters of the power source have returned to normal, if the load is supplied by the source selected as the reserve, it is automatically see also transferred back to the priority source (see also para. 4.1.3.)

Where switching occurs while sources are unsynchronised, it is possible to chose between transferring in as short a period as possible, as if the sources were synchronised, and introducing a delay (selectable) in transfer time (default condition).

4.1.3 SWITCHING DUE TO RE-TRANSFER OF LOAD TO PRIORITY SOURCE

In conditions where the priority source is not the one supplying the load (switching due to fault condition or change of priority via button P) Liebert CROSS RACK will automatically transfer the load to the priority source as soon as possible. Specifically, automatic switching to the priority source will occur only when the parameters of this last are within acceptable limits and when synchronisation is established. If the priority source is out of limits, transfer will be effected only after it has remained stable and within limits for a preset period (5 seconds). In

the case of loss of synchronisation, transfer will only take place when the phase difference between the two sources is less than a preset value (10° by default).

In any event, such switching occurs only when both sources are within tolerance and synchronised (transfer is also effected during the zero current crossing control in optimum conditions).

N.B. All settings and operating modes of Liebert CROSS RACK can easily be modified or enabled in accordance with the instructions in para. 4.2 – SETTINGS.

4.2 SETTINGS

In order to better satisfy the requirements of individual installations, certain operational parameters of Liebert CROSS RACK may be modified through configuration of the dip-switches located on the two control boards in the removable static module (see Fig. 9). The following settings are possible:

SET NOMINAL VOLTAGE

Nominal Voltage	SW4.2	SW4.3	SW4.5	SW4.6	SW2.7	SW2.8
110V	ON	ON	ON	ON	ON	ON
115V	OFF	ON	OFF	ON	OFF	ON
120V	OFF	OFF	OFF	OFF	OFF	OFF

SET PHASE SYNCHRONIZATION TOLERANCE: (Default = +/-10°)

SW2.1	SW2.2	@50Hz
OFF	OFF	±15°
OFF	ON	±10°
ON	ON	±7.5°

SET ADDITIONAL COMMUTATION DELAY FOR OUT OF SYNCH. CONDITION: (Default = 10mS)

SW3.2	SW3.5	SW3.1	SW3.3	Delay (msec)
OFF	OFF	Indifferent	Indifferent	0
ON	ON	ON	ON	10±2
ON	ON	OFF	OFF	20±2

SELECT STATIC SWITCH TO BE CLOSED WITH BOTH SOURCES OUT OF TOLERANCE: (Default = S1)

SW3.6	SW3.7	Status
OFF	OFF	Output Open
ON	OFF	S1 Static closed
OFF	ON	S2 Static closed
ON	ON	NOT PERMITTED

EPO SETTINGS: See para. 7.4 - EMERGENCY POWER OFF

Operation at 50/60Hz:

Cross frequency	SW4.1	SW4.4	SW2.6
50Hz	ON	ON	ON
60Hz	OFF	OFF	OFF

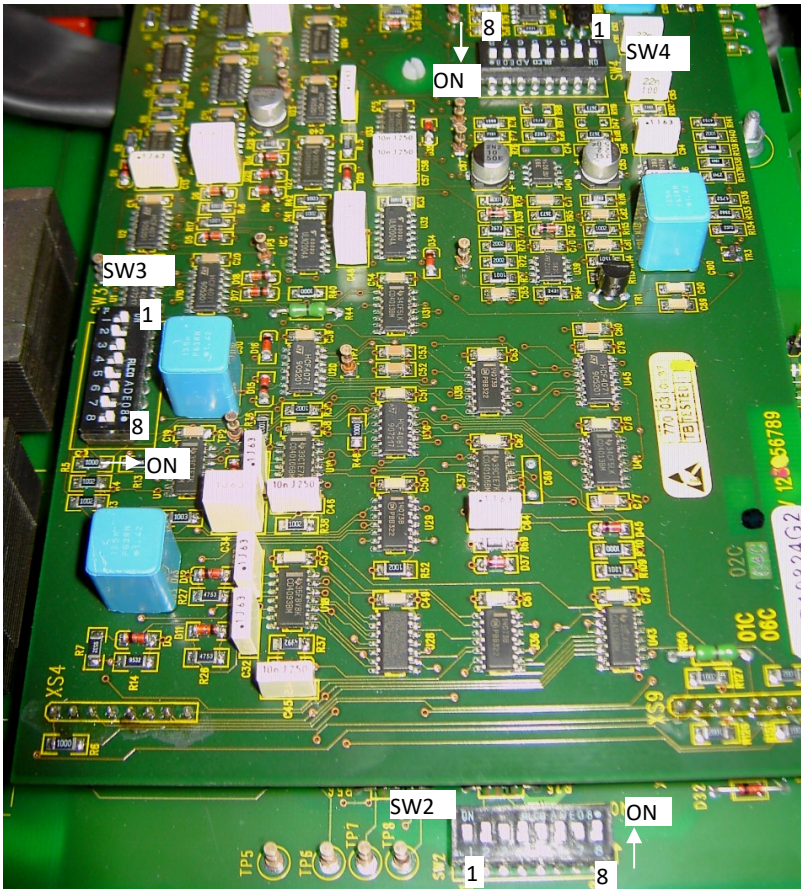


Fig. 10 – Position of dip-switches

4.3 PRELIMINARY CHECKS

Before starting Liebert CROSS RACK and therefore before powering the load, the following checks must be carried out:

- Check that the ventilation grills are not obstructed and that the regulations described in para 0 have been observed.
- Check that the earth connection is present.
- Check that all power connections have been effected in accordance with para 2 INSTALLATION and para 3 POWER CONNECTIONS – INPUT/OUTPUT
- Check that all signal connections have been effected in accordance with Chap. 7
- Once the correct settings have been made, ensure that the static module has been re-inserted properly and is held in place with the retaining screws.
- Check the digital output, EPO, Summary Alarm, BKF1, BKF2 output signal connections (see Fig. 14 on page 24), and ensure that they are configured correctly, if used.
- Check that the “load” switches are **OFF (0)**.
- Check that Liebert CROSS RACK Bypass switch **QS1** is in **OFF (0)** (see Fig. 11)

N.B. If the above instructions are not observed correctly, problems may be experienced with the electrical supply to the load.



Fig. 11 – Bypass switch QS1

4.3.1 BYPASS SWITCH

To enable correct maintenance of the unit both sources are equipped with a manual bypass. The bypass switch (QS1) has been designed to avoid any possibility of connecting the two sources in parallel.

QS1 may be switched to any of three positions:

Position 0 = both bypasses are open; neither BKF1 nor BKF2 contacts are bypassed

Position S1 = S1 bypass closed (S2 bypass open); BKF1 contact bypassed (closed)

Position S2 = S2 bypass closed (S1 bypass open); BKF2 contact bypassed (closed).

When QS1 is switched to one of the two sources, the extractable module is bypassed and the corresponding backfeed contact is held in the closed position. This prevents any backfeed protection devices installed upstream of the source from tripping. See also Chap. 6 and 7



Refer to the System Bypass Procedure (para 4.6) before carrying out **any** operation on this switch. Failure to do so may compromise the supply to the load and the correct operation of the unit.

4.4 SWITCH-ON PROCEDURE

4.4.1 FIRST SWITCH-ON FROM SOURCE S1

1. Check that all switches are OFF and check Liebert CROSS RACK signal connections.
2. Switch ON the external S1 input switch.
3. Wait for several seconds until the logic is enabled and the following LEDs on the display are switched ON (see Fig. 12)
 - Priority LED N°1
 - LED N°8
 - LED N°4
 - LED N°11
 - LED N°10
4. Switch ON the external S2 input switch.

4.4.2 FIRST SWITCH-ON FROM SOURCE S2

1. Check that all switches are OFF and check Liebert CROSS RACK signal connections.
2. Switch ON the external S2 input switch.
3. Wait for several seconds until the logic becomes intelligent and the following LEDs on the display are switched ON (see Fig. 12)
 - Priority LED N°1
 - LED N°9
 - LED N°4
 - LED N°12
 - LED N°10
4. Switch ON the external S1 input switch.

N.B. The first time Liebert CROSS RACK is switched on, it is set-up for operation with S1 as the priority source, therefore, when powered up from Source S2, Liebert CROSS RACK switches the Load to Source S1 a few seconds after having verified that this last is present and within tolerance.

4.5 SWITCH-OFF PROCEDURE

N.B. When this procedure is carried out the Load is no longer supplied by Liebert CROSS RACK

1. Ensure that the Bypass switch QS1 is OFF.
2. Switch the external S1 input switch to OFF.
3. Switch the external S2 input switch to OFF.
4. Wait until all LEDs are OFF.

4.6 MANUAL BYPASS PROCEDURE

N.B. All procedures start assuming the load to be supplied by the priority SOURCE. Therefore, in order to switch to By-pass on the reserve source, before starting one of the following procedures, set the priority status to this source (see para. 4.1.1) and wait for the load to be transferred (see para 4.1.3). If only one source is present, ensure that this is selected as the priority source before switching to By-pass.

4.6.1 MANUAL BYPASS ENABLE FROM SOURCE S1

1. Ensure that the Load is supplied by source S1
2. Switch OFF the external source S2 input switch.
3. Switch the manual bypass switch (QS1) to position S1.
4. If present and enabled, disconnect the 25-pin Digital Output and 2-pin EPO connectors on the rear of the unit.
5. It is now possible to extract, if necessary, the Liebert CROSS RACK static module (see para 6.1)

4.6.2 MANUAL BYPASS ENABLE FROM SOURCE S2

1. Ensure that the Load is supplied by source S2
2. Switch OFF the external source S1 input switch.
3. Switch the manual bypass switch (QS1) to position S2.
4. If present and enabled, disconnect the 25-pin Digital Output and 2-pin EPO connectors on the rear of the unit.
5. It is now possible to extract, if necessary, the Liebert CROSS RACK static module (see para 6.1)

4.7 START-UP PROCEDURE FROM BYPASS

4.7.1 MANUAL BYPASS DISABLE FROM SOURCE S1

1. Ensure that Manual By-pass switch QS1 is in position S1 (By-pass closed on source S1)
2. Ensure that the static module is inserted correctly and that the fixing screws are in place

3. If present and enabled, ensure that the 25-pin Digital Output and 2-pin EPO connectors on the rear of the unit have been reinserted correctly
 4. Wait for several seconds until the logic becomes intelligent and the following LEDs on the display are switched ON (see Fig. 12)
 - Priority LED N°1
 - LED N°8
 - LED N°11
 - LED N°4
 - LED N°10
 - LED N°7
 5. Switch the Manual By-pass switch (QS1) to position 0
 6. Switch ON the external source S2 input switch.
- 4.7.2 MANUAL BYPASS DISABLE FROM SOURCE S2
1. Ensure that Manual By-pass switch QS1 is in position S2 (By-pass closed on source S2)
 2. Ensure that the static module is inserted correctly and that the fixing screws are in place
 3. If present and enabled, ensure that the 25-pin Digital Output and 2-pin EPO connectors on the rear of the unit have been reinserted correctly
 4. Wait for several seconds until the logic becomes intelligent and the following LEDs on the display are switched ON (see Fig. 12)
 - Priority LED N°1
 - LED N°9
 - LED N°4
 - LED N°12
 - LED N°6
 - LED N°10
 5. Switch the Manual By-pass switch (QS1) to position 0
 6. Switch ON the external source S1 input switch).

N.B. Whenever the unit is switched on, it is set up for operation with Priority Source S1. Refer to para. 4.1.1 if it is necessary to change this setting when returning from Bypass operation.

5. CONTROL PANEL

5.1 CONTROLS AND SIGNALS

Liebert CROSS RACK is fitted with a control panel on the front part of the unit. This includes a mimic panel and warning lights (LED) to indicate the operating status of the unit in real time. In fact, the status of the sources, the static switches and the By-pass, the load condition and the maximum operating temperature are all monitored continuously.

The functions of the LED are described in para 0

Also present on the control panel is a push-button which allows the priority to be switched between the sources and a LED which indicates the current priority

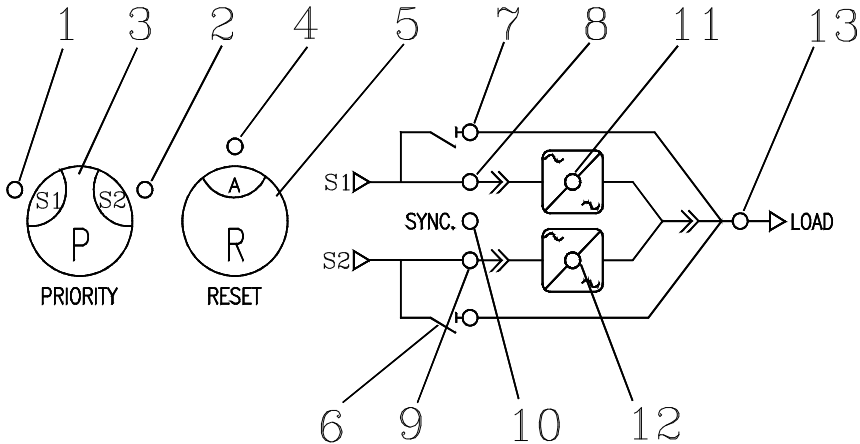


Fig. 12 – A view of the display and control panel

5.2 LOAD CONTROLS

The load controls are located on the front panel (see Fig. 4 and Fig. 12).

- **LED 1 & 2 – Priority Source Indicator**

LED 1 ON and LED 2 OFF = Priority on S1

LED 1 OFF and LED 2 ON = Priority on S2

- **LED 4 Summary Alarm**

This LED is illuminated under the following alarm conditions:

- If at least one source is out of tolerance
- If there is a loss of synchronisation between the sources
- If the Bypass switch is closed
- If the system is in Over-temperature
- If there is an Output short circuit
- If there is a general SCR fault
- If there is a blocked fan
- If the EPO is active
- If the Backfeed Detector is active

- **LED 6 & 7 – By-pass Switch Status Indicators**

LED ON = By-pass Switch CLOSED

LED OFF = By-pass Switch OPEN

- **LED 8 & 9 – Source S1 and S2 Status Indicators**

LED ON = Source OK

LED OFF = Source OUT OF TOLERANCE

- **LED 10 – Loss of Synchronisation Indicator**

LED ON = Sources NOT SYNCHRONISED

LED OFF = Sources SYNCHRONISED

- **LED 11 & 12 – Static Switch Status Indicator**

LED ON = Static Switch CLOSED

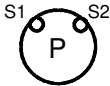
LED OFF = Static Switch OPEN

- **LED 13 – Output Alarm**

LED13 ON = Switching Inhibited due to Output short circuit and/or SCR open fault

5.3 CONTROL PANEL

Priority selection button



Press to select system priority Source S1 or S2 for at least one second.

Refer to para 4.1.1 and 4.1.3 for more information about the behaviour of Liebert CROSS RACK during Priority Selection

PRIORITY



Reset button – Press to reset permanent block (SCR Open Fault Alarm only)

N.B. The reset command is accepted only if both sources are within tolerance and are synchronised

RESET

6. MAINTENANCE

6.1 PRECAUTIONS

- Carefully follow all instructions and information plates.
- Only specialist personnel should remove protective parts and extract the static module (see Fig. 13). It should be recalled that the safety procedures described in para. 4.6 and 4.7 must be followed when extracting and reinserting the module, which is held in place by four screws (see Fig. 14).



It is important to remember to check the Digital Output signals and EPO connections on the rear of the unit (see Fig. 15 on page 25) in accordance with the Bypass procedures 4.6 and 4.7 on pages 19 and 19, before extracting or reinserting the module. Otherwise it will not be possible to remove it, and the load supply may not be guaranteed during Liebert CROSS RACK operation.

This is particularly important:

- if the EPO is enabled (see paras. 7.3 and 7.4), as the load supply will be interrupted if the 2-pin EPO connector on the rear of the unit is removed without the Bypass enabled
- if the 25-pin Digital Output is connected, as this prevents the module from being extracted
- if backfeed protection is enabled; see para 7.5 on page 27
- when the module has been extracted; in this case, ignore the Summary Alarm signals
- Remove all watches, rings and any other metal objects before carrying out any activity requiring the removal of the protection panels.
- Use electrician's isolated rubber gloves.

Only use insulated tools.

Place a mat made from insulating material in front of Liebert CROSS RACK before carrying out any operation on the equipment.

Never work alone, but ensure that someone is on hand who can provide immediate assistance in the event of accidents.



Fig. 13 – Removing the static module



Fig. 14 – Module fixing screws (2 of 4)

7. SIGNAL CONNECTIONS



For reasons of safety, Liebert CROSS RACK external signal wiring must be routed separately from the input and output power cables

7.1 DIGITAL OUTPUT

Liebert CROSS RACK is equipped with a full set of digital, optically isolated output contacts, which can be accessed via the 25-pin connector on the rear panel of the unit; see Fig. 15.

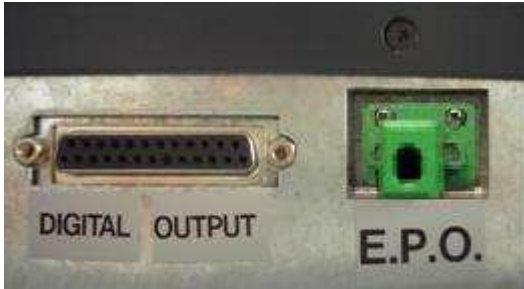


Fig. 15 – Digital output and EPO connectors

See the table below for the individual alarm connections, referred to Pin1 (COM):

Pin 14 - Open = S1 Out of tolerance	Pin 5 Closed = Out of sync.
Pin 2 - Open = S2 Out of tolerance	Pin 17 - Closed = S2 Preferred source
Pin 15 - Open = S1 Static Switch Open	Pin 18 - Closed = Summary Alarm active
Pin 3 - Open = S2 Static Switch Open	Pin 6 - Closed = System over-temperature
Pin 16 - Closed = Bypass S1 closed	Pin 19 - Closed = Output short circuit
Pin 4 - Closed = Bypass S2 Closed	Pin 7 - Closed = SCR general fault
Pin 8 - Closed = Fan fault	Pin 20 - Closed = EPO active
Pin 9 - Closed = Backfeed S1 active	Pin 21 - Closed = Backfeed S2 active

N.B. Digital outputs are opto-isolated signals (phototransistors), the power supply must be provided externally (max. current 3mA, max. DC voltage +15V) between each output contact pin and pin 1 (COM) – (see Fig. 15)



WARNING

If it is necessary to remove the module (see PRECAUTIONS on page 23), the 25-pin Digital Output connector **must** be disconnected first. When the module has been reinserted, reconnect the connector.

7.2 SUMMARY ALARM

There is a NO/NC max 1A, 240V_{AC}, voltage free SUMMARY ALARM contact located on the rear panel of Liebert CROSS RACK (see fig. 16).

The summary alarm is activated under the same conditions as described for LED4 in para. 0.

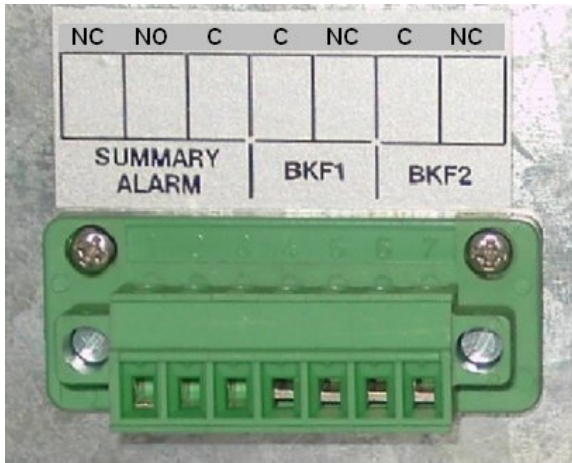


Fig. 16 – Summary alarm

N.B. If the module has been extracted, disregard the signals from the Summary Alarm.



If the customer wishes to apply a voltage in excess of 42V_(peak), or 60V_{DC} to the SUMMARY ALARM contact, in the interests of electrical safety it is important to note that the insulation between the SUMMARY ALARM, BKF1, BKF2 and DIGITAL OUTPUT is only effective up to a maximum voltage of 240V_{AC}.

7.3 INPUT CONTACTS

The Emergency Power Off (EPO – see Fig. 15) if used **MUST BE ENABLED** (see also para. 7.4).



WARNING

If it is necessary to remove the module (see PRECAUTIONS on page 23), **first** switch the unit to Bypass, in accordance with para. 4.6, then remove the 2-pin E.P.O. connector, if present. Otherwise the load supply will be interrupted, and it will not be possible to extract the module. When the module has been reinserted, insert the E.P.O. connector then open the Bypass switch QS1.

7.4 EMERGENCY POWER OFF

The Liebert CROSS RACK EPO can be enabled remotely if safety conditions make it necessary. This input is available via the 2-pin connector on the rear of the unit (see Fig. 15). Connect pins 1 and 2 to a switch having the characteristics of an emergency pushbutton, normally **ON**, and having a mechanism which holds it in the **OFF** position. When the EPO is activated, all the static switches are opened, and the load is not supplied.

N.B. This input must be enabled, otherwise the EPO cannot be activated. To enable the input the following dip-switch, located on the rear of the static module (see Fig. 10) must be configured:

SW3.8	Status
OFF	EPO Enabled
ON	EPO Disabled



The EPO may be connected by authorised technical personnel only. The operator may only handle the isolated connector during operations carried out in Manual Bypass mode.



WARNING

When the E.P.O. is enabled, the unit must be switched to Bypass mode before disconnecting the E.P.O. connector, otherwise the load supply will be interrupted, see also para. 6.1 and 7.3.

7.5 BACKFEED PROTECTION

This feature prevents potential electric shock hazards on the alternative Liebert CROSS RACK mains supply terminal (the source that is not currently supplying the load) in the event of a static switch SCR failure. The control includes 2 voltage free contacts (BKF1, BKF2 – see Fig. 16) for customer use. These are used to activate an external isolating device (only electromechanical relays, with or without minimum voltage threshold control may be used) when backfeed fault is detected. The two external isolating devices are not included with Liebert CROSS RACK (in conformity with Standards), and must be 2-pole, air-gap isolator devices as defined by IEC/EN 62040-1+A1:2013 Clause 4.1.4.

N.B.: Tripping coil protection breakers do not guarantee complete isolation in the event of a fault.

BKF1 refers to a backfeed fault on S1, and BKF2 refers to a backfeed fault on S2; both contacts are Normally Closed (C, NC 1A, 240V_{AC})

For more information, contact VERTIV technical personnel.



If the customer wishes to apply a voltage in excess of 42V_(peak), or 60V_{DC} to the BKF1 and BKF2 contacts, in the interests of electrical safety it is important to note that the insulation between the SUMMARY ALARM, BKF1, BKF2 and DIGITAL OUTPUT is only effective up to a maximum voltage of 240V_{AC}.



The contacts BKF1 and BKF2 are held closed when the Manual Bypass switch QS1 (see para. 4.3.1 on page 18) is switched to S1 or S2 respectively. In this way, when the module is extracted, the source in Bypass mode will not cause any breakers installed upstream of the unit to trip, while those on the other source will open.

NOTICE TO EUROPEAN UNION CUSTOMERS: DISPOSAL OF OLD APPLIANCES

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