Elektro-Automatik

Operating Guide
Cabinet

3 x PSI 8500-90
1 x EL9000 HP 7.2kW
500V / 270A / 45kW

PSI Rack 34U: 09 114 607

Technical specifications

Type: Rittal TS8 34U

Dimensions (WxHxD): 600mm x 1600mm x 800mm

Variant: no front door, no rear door

Input connection: 3-phase (L1+L2+L3+N+PE)

Fusing:

- 9x 32A (char. K) input breakers for the power supplies
- 1x 16A (char. C) input breaker for the electronic load
- 1x 16A (char. C) input breaker for the contactor's aux. supply

Input voltage: 340...460V AC

Function overview:

- Up to 3 units of PSI 8500-90 3U or similar
- Prepared for up to 1 unit of EL 9000 HP 7.2kW in 9U
- Share Bus wiring between the power supplies and the one electronic load preconfigured
- DC output 500V / 270A on copper bars

Important notes

- *Do not change the internal wiring or replace wires with ones with less cross section!*
- *Series operation of the power supplies not allowed!*
- *The power grid connection has to be fused externally.*

Installation of the cabinet

In order to ensure sufficient airflow, it is required to leave at least 20-30cm space behind the cabinet.

The AC supply connection is done on the input terminal inside the cabinet, which is located in the lower part. A three-phase supply with PE (earth) is required. The AC input terminal can be accessed when removing the lower 6U front cover (see cabinet layout drawing below). For the assignment of the phases see the labelling on the input terminal.

Equipping the units

The cabinet is prepared for up to three units of 3U power supplies (PSI 8000 3U or similar) and up to one unit of 9U electronic load. In order to equip the devices, they're simply inserted or removed while sliding on top of the mounting rails. Before mounting the units finally, by tightening the mounting screws on the front, make sure the AC input and DC output connection has been made properly, as described below. After the units have been equipped, connected and mounted correctly, you can reconnect the Share Bus connection (only if used) and any other connections, for example to a PC.

For the additional electronic load, the AC input is a standard IEC 320 plug which is just plugged into the corresponding socket on the rear of the device.

AC input connection of the PSUs

In case of first installation or adding additional units, the AC input should be wired first. When adding a unit, first disconnect the cabinet from the power grid. For safety reasons, it is not sufficient to just switch off the line breakers.

Details about AC input connection can be found in the PSU operating guide.

Note

In order to achieve a current balance in the three-phase supply, it is recommended to install and always operate all three power supply units.

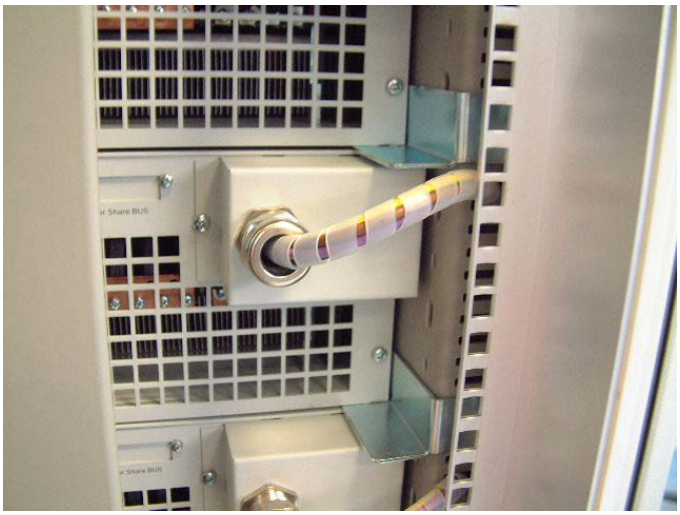


Figure 1: AC input connection of single PSU

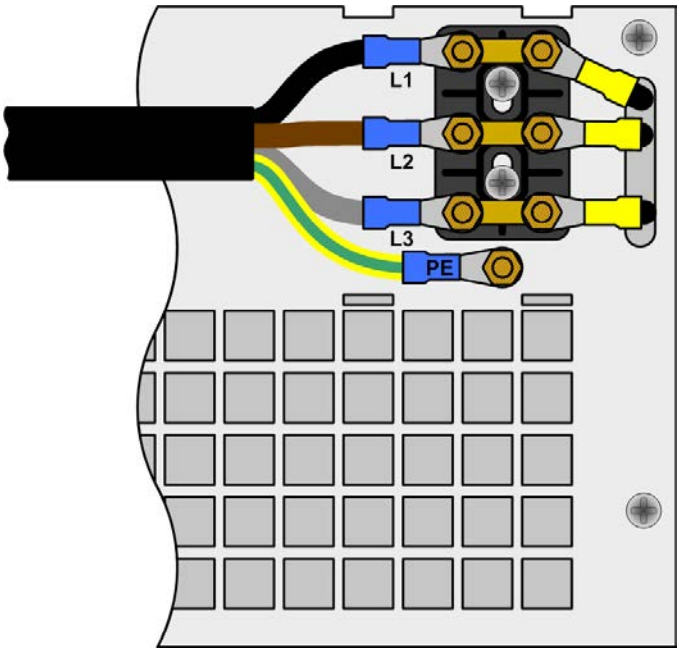


Figure 2: Three-phase AC input terminal

DC output/input connection

The DC outputs of the power supplies and the DC input of the additional electronic load are already internally wired. The DC connection to the outside is done on the DC connection terminal on the lower part of the cabinet, accessible from the rear side. It is a combined input/output. As output, it can deliver up to 500V and up to 270A while providing max. 45kW. As input, it can take max. 500V and max. 150A at a max. power of 7.2kW. Using the standard connection scheme and with all units equipped, all units are connected in parallel.

Note

For the DC connection to any outside sink or source, make sure to use cables with proper cross section, according to max. current.

The DC load cables are directly screwed to the M8 connection terminals on the DC copper bars.

Note

Use 8mm ring lugs on the load cable ends to connect to the DC terminal.

Danger!

Risk of electric shock

Make sure to switch off the devices or even disconnected from AC supply before connecting any DC source/sink. Remove the plastic cover on the DC copper bars cautiously!

After the DC connection is done, mount the plastic cover again!

Share Bus connection between power supplies

The power supply units in the cabinet are connected in parallel on their DC output and also with their Share Bus connection, in order to gain a load current balance. The Share Bus connection between the up to three PSUs can be permanent.

A big difference is the Share Bus connection between the power supplies and the additional electronic load. This connection must only be plugged if two-quadrants operation is.

For Share Bus operation of the power supplies only it applies:

- No Master-Slave characteristic
- The unit with the highest output voltage determines the output voltage of the parallel connection
- If one units fails due to a defect or overheating, the other power supplies continue to work a short interrupt of about 3-4 seconds.

Share Bus connection between power supplies and loads

For Share Bus operation between PSI 8000 3U power supply units and any electronic load of EL 9000 series it applies:

- As long as the Share Bus of the electronic load is connected to the Share Bus of the power supplies, the system works in two-quadrant operation and has to be treated accordingly.
- Do not plug the Share Bus plug of the electronic load if...
  - you don‘t intend to use two quadrants operation
  - you plan to leave the electronic load switched off and only work with the power supplies
- Always set the overvoltage threshold value „Uovp“ on all three power supply units to the same value and to a voltage level which the connected load can take

For two-quadrants operation in connection with power supplies of series PSI 8000 3U special conditions apply. See below for details.

Operation

Emergency off feature

The cabinet has a built-in emergency off feature. In case of an emergency, either hit the red breaker contact on the front of the cabinet or use an external breaker contact which has been connected to the corresponding terminal (see cabinet wiring schematic below) on the front of the cabinet. The AC supply of all units in the cabinet is then cut off.

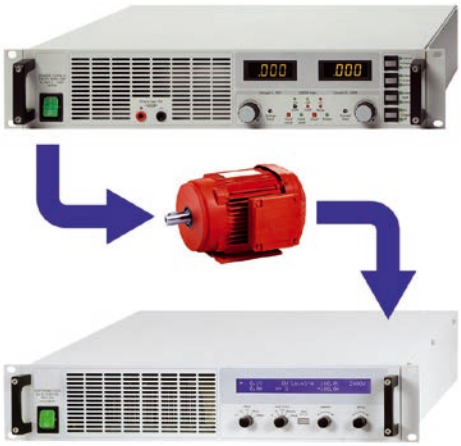
Danger!

Risk of electric shock

When switching the cabinet off due to an emergency, there still can be dangerous voltage present on the DC output.

Before any work on the DC output/input terminal make sure that the cabinet is not supplying power anymore.

Two-quadrants operation

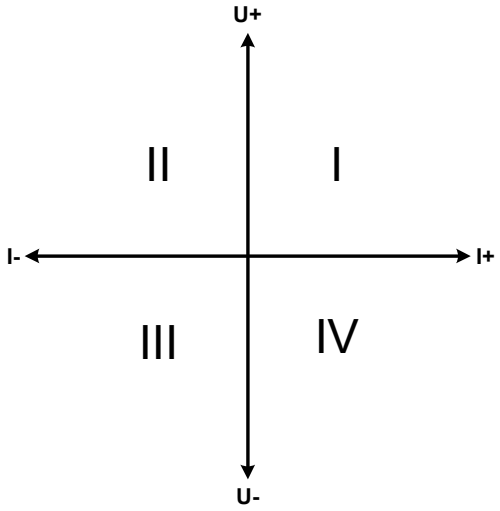


This operation mode is related to the connection of a power supply as voltage source and an electronic load as current sink. The source and the sink are alternatively in operation in order to test a component or application (E.U.T), like for example a battery.

The user can decide whether to control the system manually, to control only the load, which is the master unit in this case, or both devices. We recommend to use the load as master and to connect the power supply via the Share bus, which will define the output voltage of the power supply.

Two-quadrants operation is only applicable for constant voltage operation (CV).

Illustration:



When combining a source and a sink, only quadrants I + II can be realised. It means, only positive voltage and current are possible. The positive current comes from the source (quadrant I), or in some cases it might come from the E.U.T, and the negative current flows into the sink (quadrant II).

The power supply, being slave in this connection, is normally adjusted to a maximum output voltage and current, which could also be done via analog or digital interface. The electronic load is recommended to run in CV operation. The load will then control the power supply via the Share bus.

Typical areas of application:

- Test of fuel cells
- Capacitor tests
- Tests of applications with motors
- Electronic device and component tests, where a higher voltage dynamics is required

Special notes about this cabinet and PSI 8000 3U

The PSI 8000 3U units, as equipped in this cabinet, can be used in Share Bus connection with an electronic load, but for safety reasons it requires to take some measures:

Attention!

- Always adjust the **overvoltage protection** level of **all** source units (Uovp, see power supply operating guide) to the max. voltage level the sources shall provide, else the connected equipment might be damaged by the output voltage rising unintentionally, because...
  - in Share Bus connection the electronic load will be in control and has to be operated correctly
  - of switching off the electronic load (mains switch).
- Do not use fast regulation (“FastReg”) mode on the electronic load (see operating guide of electronic load regarding “System Bus” terminal)
- Voltage overshoot of >200V can occur due to regulation delay of the electronic load (see below)

Application example

Charging and discharging of a battery with 24V/400Ah (as depicted below, see figure 3)

Power supply PSI 8500-90 3U, adjusted to: Umax = 28.5V, Imax = 50A, Pmax = 15000W

Electronic load EL 9500-150, adjusted to: Imax = 100A, Pmax = 7200W, U = variable (PC controlled)

Assumption: the battery has an idle voltage of 26V before the test

1. Discharging the battery down to 24V --> Set voltage of the load to 24V, power supply output and load input are on

Reaction: the electronic load will discharge the battery with max. 100A resp. 2400W, in order to get the voltage down to 24V. During this period, the power supply won't provide output current, because the electronic load sets the power supply output voltage via Share bus to the battery voltage. The e-load will step down the discharge current in order to keep the 24V constant.

Once the battery voltage reaches 24V with the discharge current being 0A, the adjusted 24V battery voltage is held constant. If necessary, also by charging the battery from the power supply.

2. Charging the battery to 27V --> Set the voltage on the e-load to 27V

Reaction: the power supply will now charge the battery with max. 50A. The charging current will go down while the battery voltage rises, as an reaction to the internal resistance of the battery, which changes. During this period, the e-load will draw no current. Once the battery voltage reaches 27V, the power supply will only provide trickle charge current for the battery.

3. Set e-load to 40V

Reaction: the power supply will now charge the battery up to max. 28.5V, because the power supply setting still is 28.5V. This demonstrates how important it is to know the allowed parameters for the E.U.T and to adjust the values on both devices, power supply and e-load accordingly and thoroughly, in order to avoid damage to the E.U.T.

The above example can also be used for „Battery" mode of the e-load:

4. Both devices set up as before, but Ulow value on the e-load set to 24V

Reaction: with the battery fully charged at the start, the e-load will discharge the battery down to 24V and then stop by switching the input off. The power supply will then become active, charging the battery again to the adjusted 28.5V. The e-load won't automatically start to discharge the battery again, in this case.

Note about the voltage overshoot and reaction times

When running the power supplies and the electronic load in two-quadrants operation, the load controls the power supplies's output voltage. Running in CV mode, the load tries to hold the adjusted voltage constant by drawing current from the voltage source. When changing the voltage setting on the load, it needs some milliseconds to react and to start to regulate. During this time, the connection between load and power supplies, called Share bus, can cause the power supplies to increase their output voltage for a short time, resulting in an overshoot. This overshoot can be very high (>200V), but is limited to what the power supplies can put out at maximum. Since the power supplies are in control by the load, no voltage setting on the power supplies or any adjustment limit will prevent the voltage from rising, except for the overvoltage protection (OVP, Uovp).

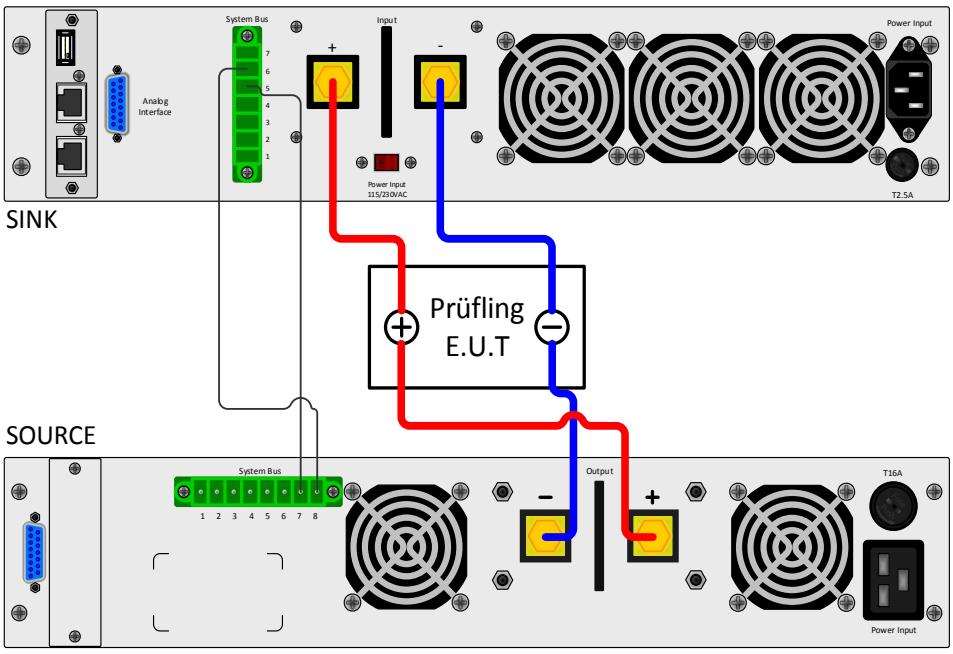
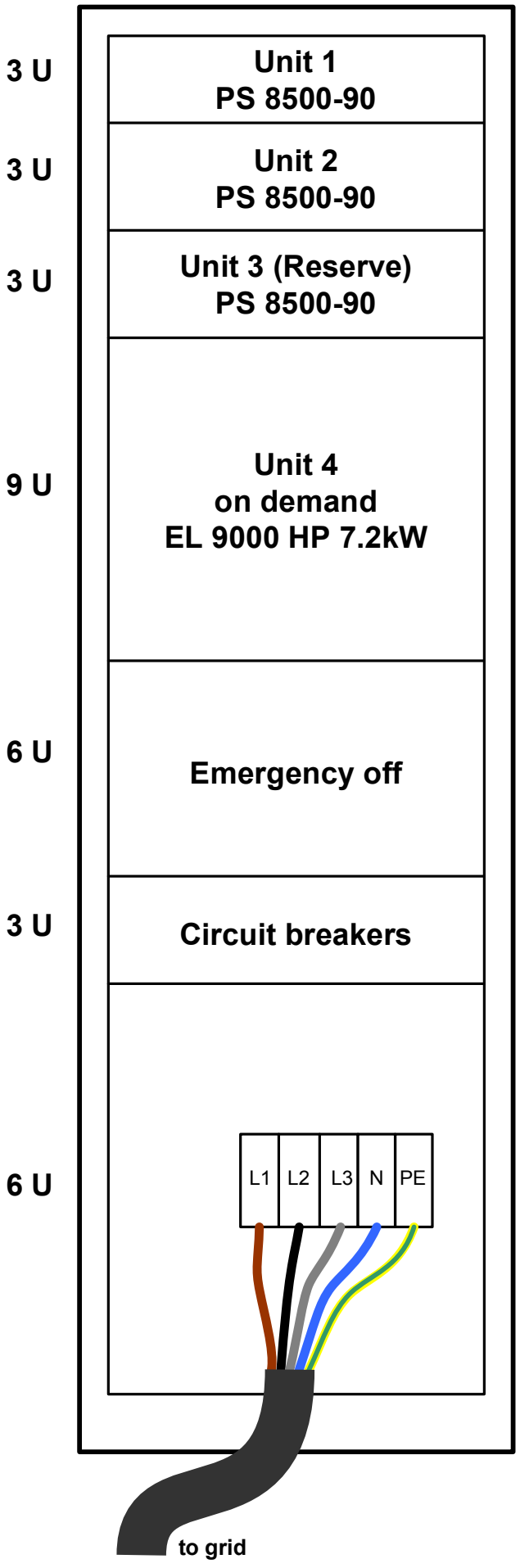
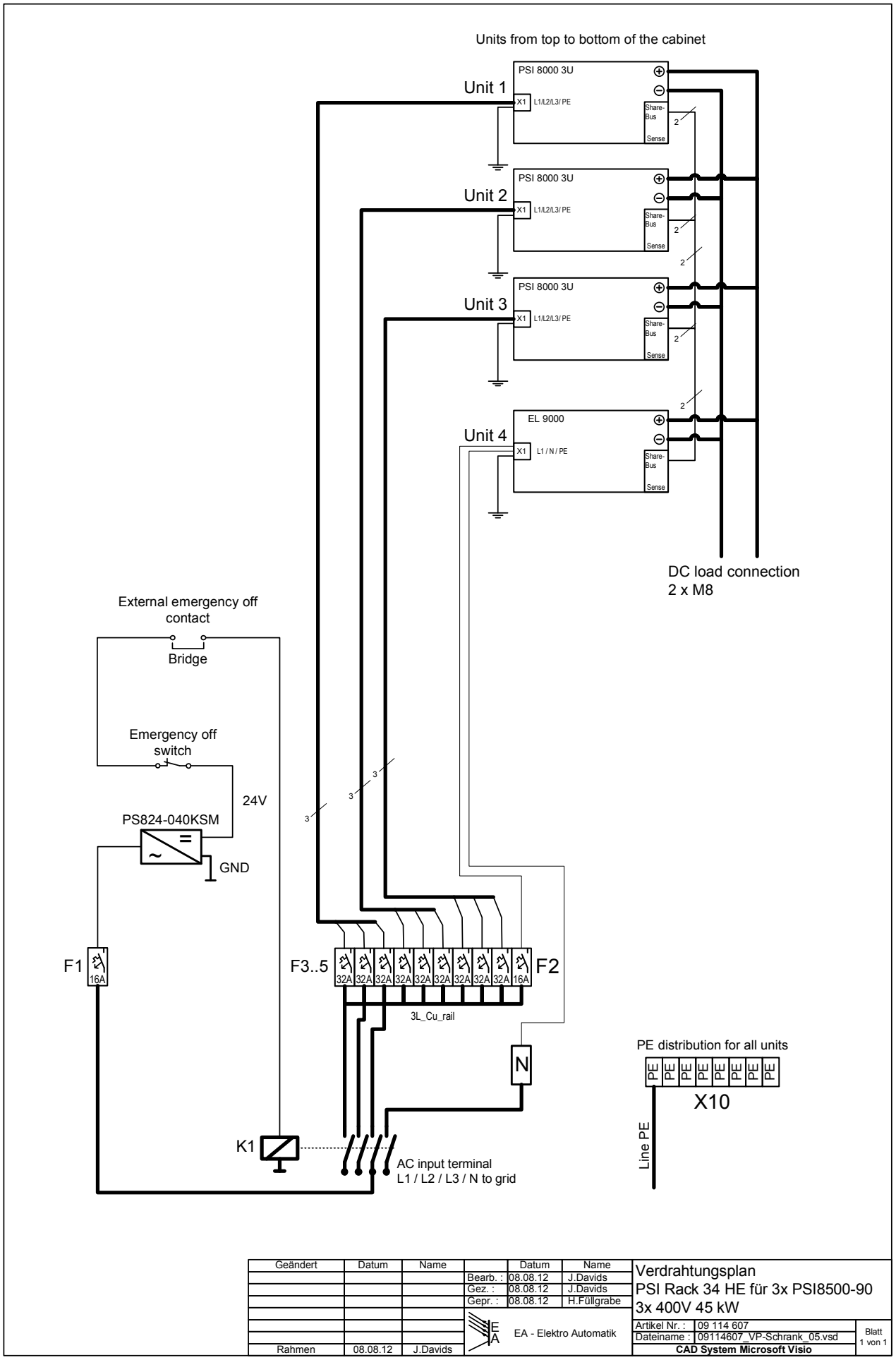


Figure 3

Cabinet layout



Cabinet wiring scheme



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			Gez. :	08.08.12	J.Davids	3x 400V 45 kW		
			Gepr. :	08.08.12	H.Füllgrabe			
			EA - Elektro Automatik			Artikel Nr. :	09 114 607	Blatt 1 von 1
						Dateiname :	09114607_VP-Schrank_05.vsd	
Rahmen	08.08.12	J.Davids				CAD System Microsoft Visio		

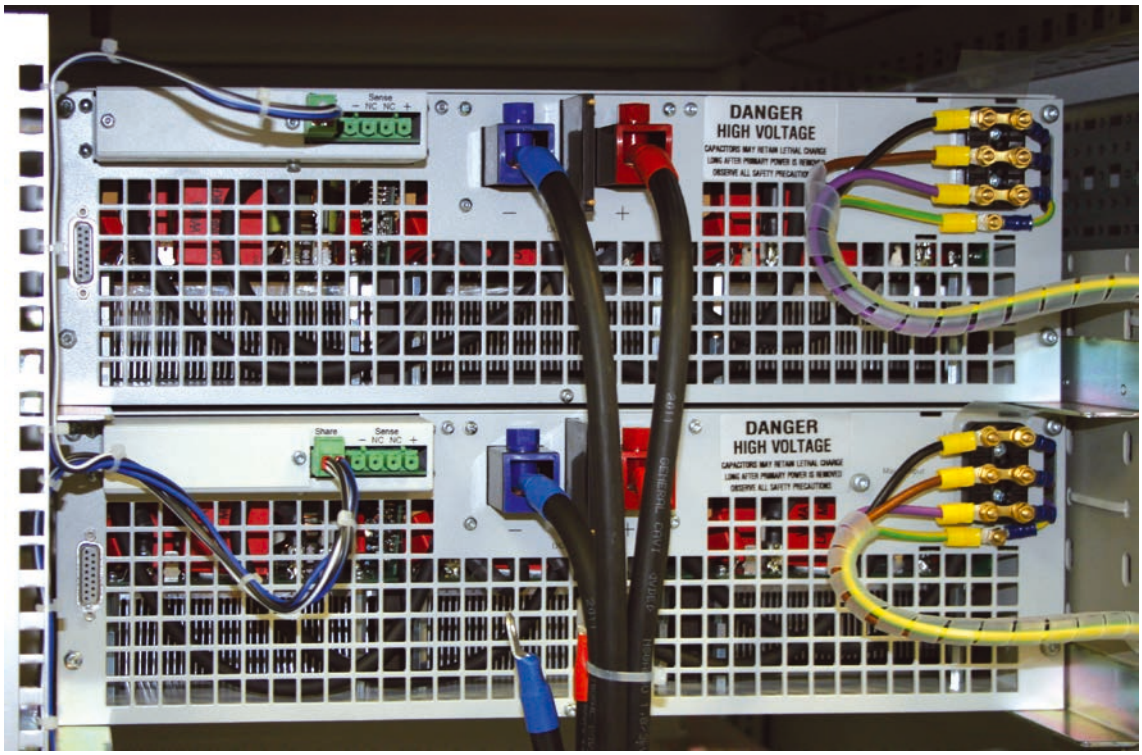

Figure 4. Power supply unit wiring

Figure 5. Spare AC input cables for power supply

Figure 6. Spare AC power connector for load

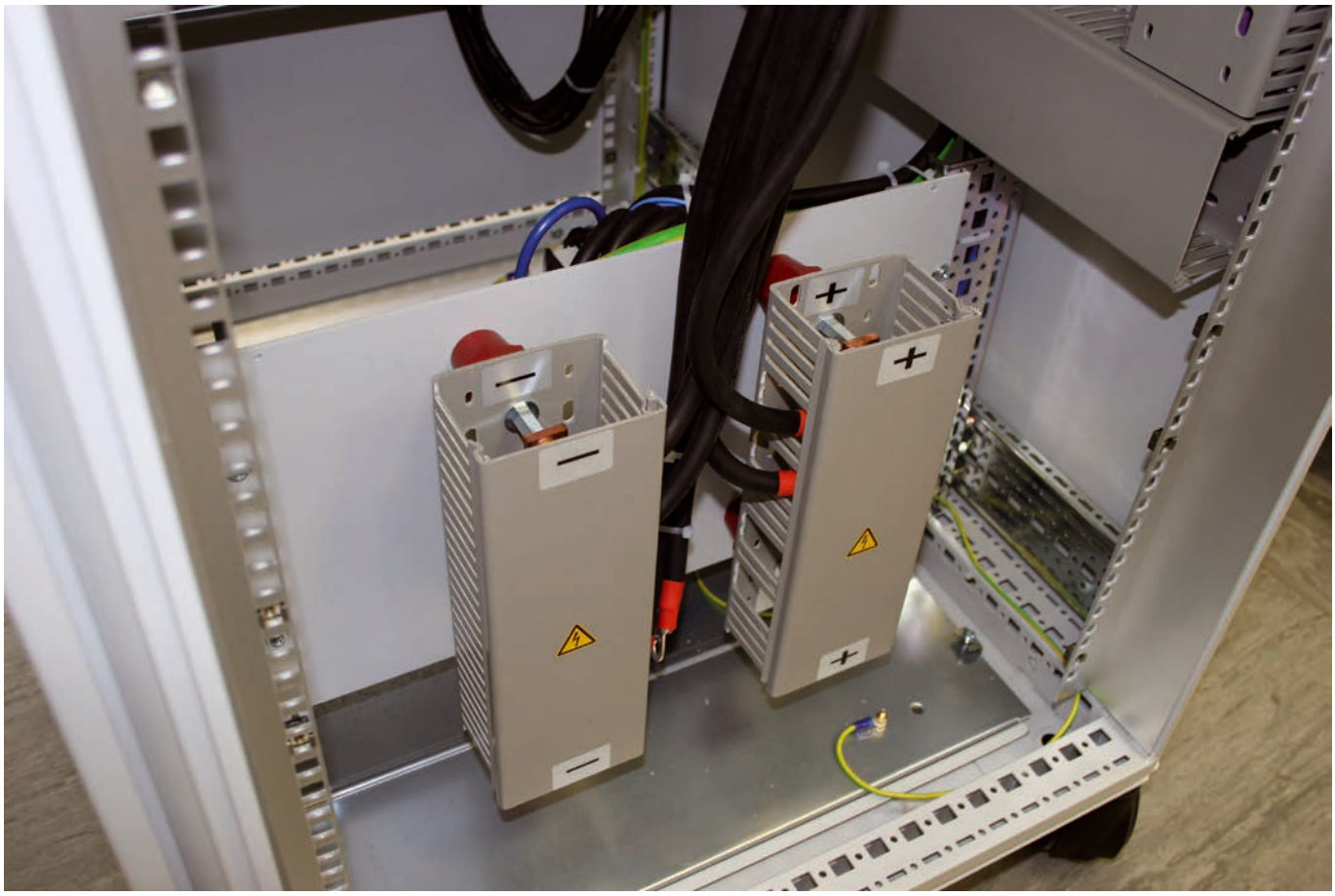

Figure 7. Covered DC connection terminal

Figure 8. Front with input breakers and external emergency off contact

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