Main Power A309
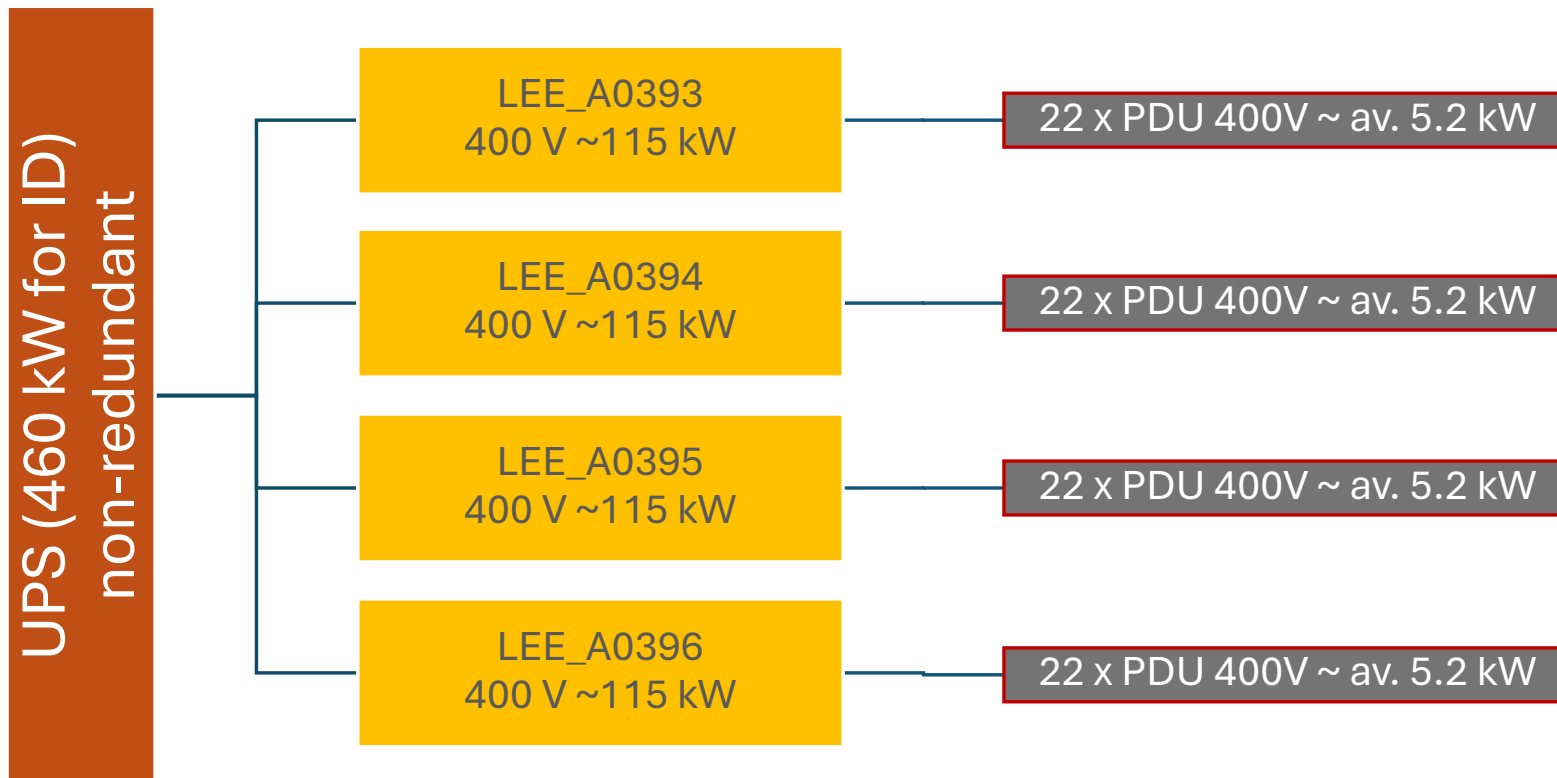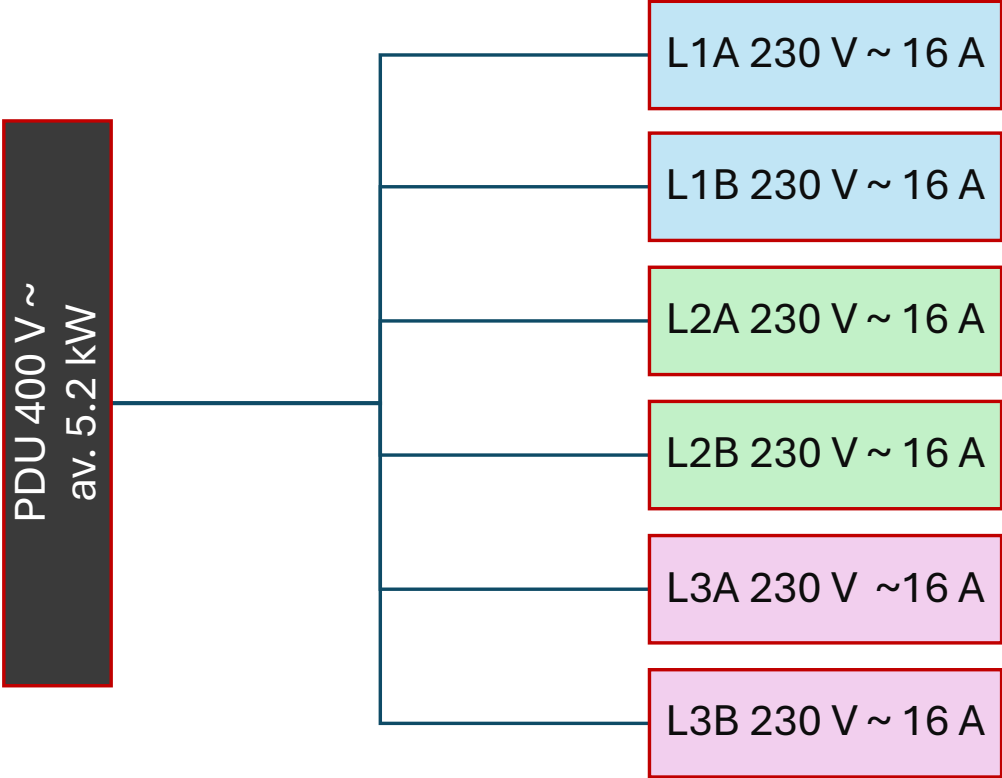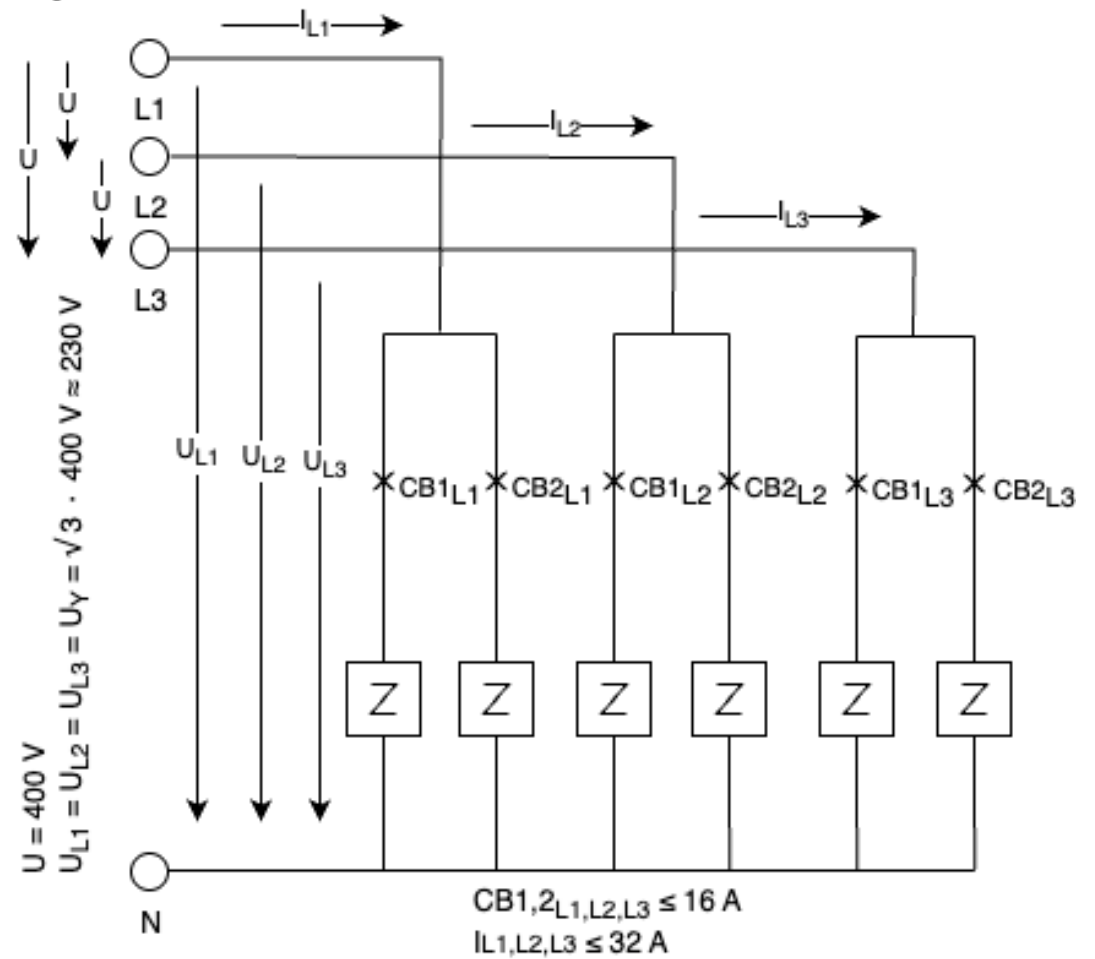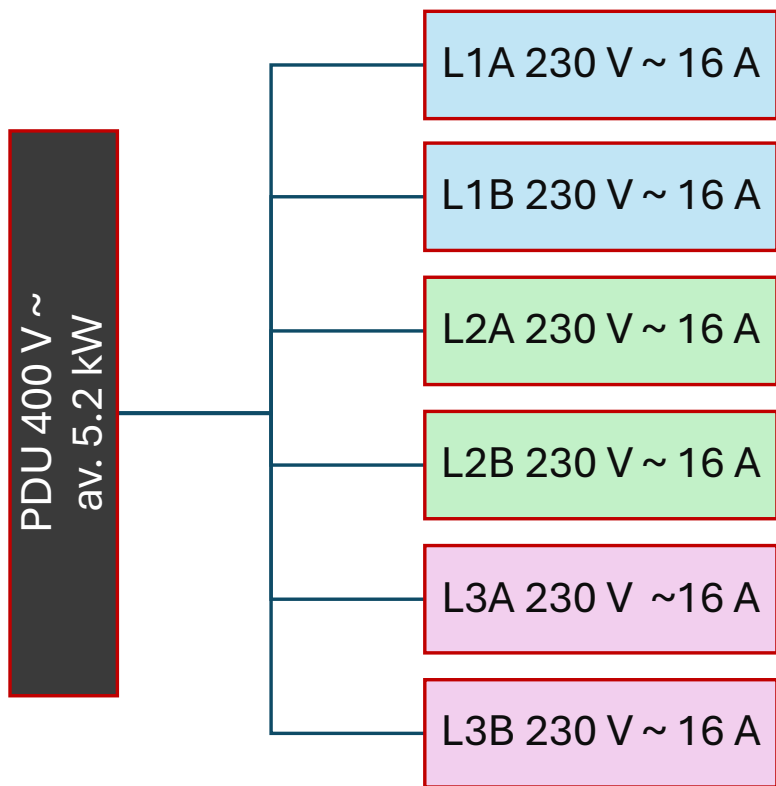
PDU connection

PDU – a star connection

Calculating the maximum current on the CBs

- As show, the UPS delivers a maximum of 115 kW per switchboard cabinet.

- Before this threshold is reached a warning will be issued.

- Based on this the maximum current can be computed, as shown on the next slides.

- This can be done either by using the inner voltage (U_Y, 230 V 1ph AC) or the outer voltage (U, 400 V 3ph AC).

- The outer voltage is the geometrical sum of the inner voltage, therefore $U = \sqrt{3} \cdot U_Y$

Power calculus for one switchboard cabinet

- Simplifications
  - Think of computers as resistive loads
  - Avoiding complex power
  - Observed power factors $0.90 > cos\varphi > 0.98$
- Effective Power $P = 3\, U_Y \cdot I_Y \cdot \cos\varphi$
  - $=> I_Y = \frac{P}{3 \cdot U_Y \cdot \cos\varphi}$
  - For $P \leq 115\, kW, U_Y = 230\, V$ and $\cos\varphi > 0.90$
  - $I_Y \leq \mathbf{185.2\ A}$
- Conclusion: Even with a rather bad power factor of 0.9 it is not possible to release a 200 A CB in the cabinet.

Power calculus for one cabinet outer voltage

- Simplifications
  - Think of computers as resistive loads
  - Avoiding complex power
- Effective Power $P = \sqrt{3} \cdot U \cdot I \cdot \cos\varphi$
  - => $I = \dfrac{P}{\sqrt{3} \cdot U \cdot \cos\varphi}$
  - For $P \leq 115\,kW, U = 400\,V$ and $\cos\varphi > 0.90$
  - $I \leq \mathbf{184.4\ A}$ (rounding difference to previous slide)

Conclusion

- The limiting factor on the electrical power is the power delivered by the UPSs which is at maximum 115 kW per cabinet (460 kW total).

- With the available power it is not possible to release the cabinet's 200 A CB by overload. The CBs are designed to protect the wires not to limit the available power (germ. "Leitungsschutzschalter")

- It is not possible to release the 32 A CBs in the cabinets by overload unless there is a malfunction of the 16 A CBs in the PDU.

- **Bottom line**: LEE A309 is electrically well engineered – no availability issues reaching the limits of the UPSs possible.

Measures

- Ensure that the UPS alerting is working and that we get a warning when 80% of the power budget is being consumed (not necessarily automated).

- Get a regular energy consumption bill by FM (quarterly or monthly).

- Check the Riedo power concentrator output monthly to avoid unbalanced installations.

- Decide if an additional UPS is needed to uphold a n+1 redundancy.

- Decide on further development on LEE A on ITS GL level.