CLIQ Power supply design

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Topics

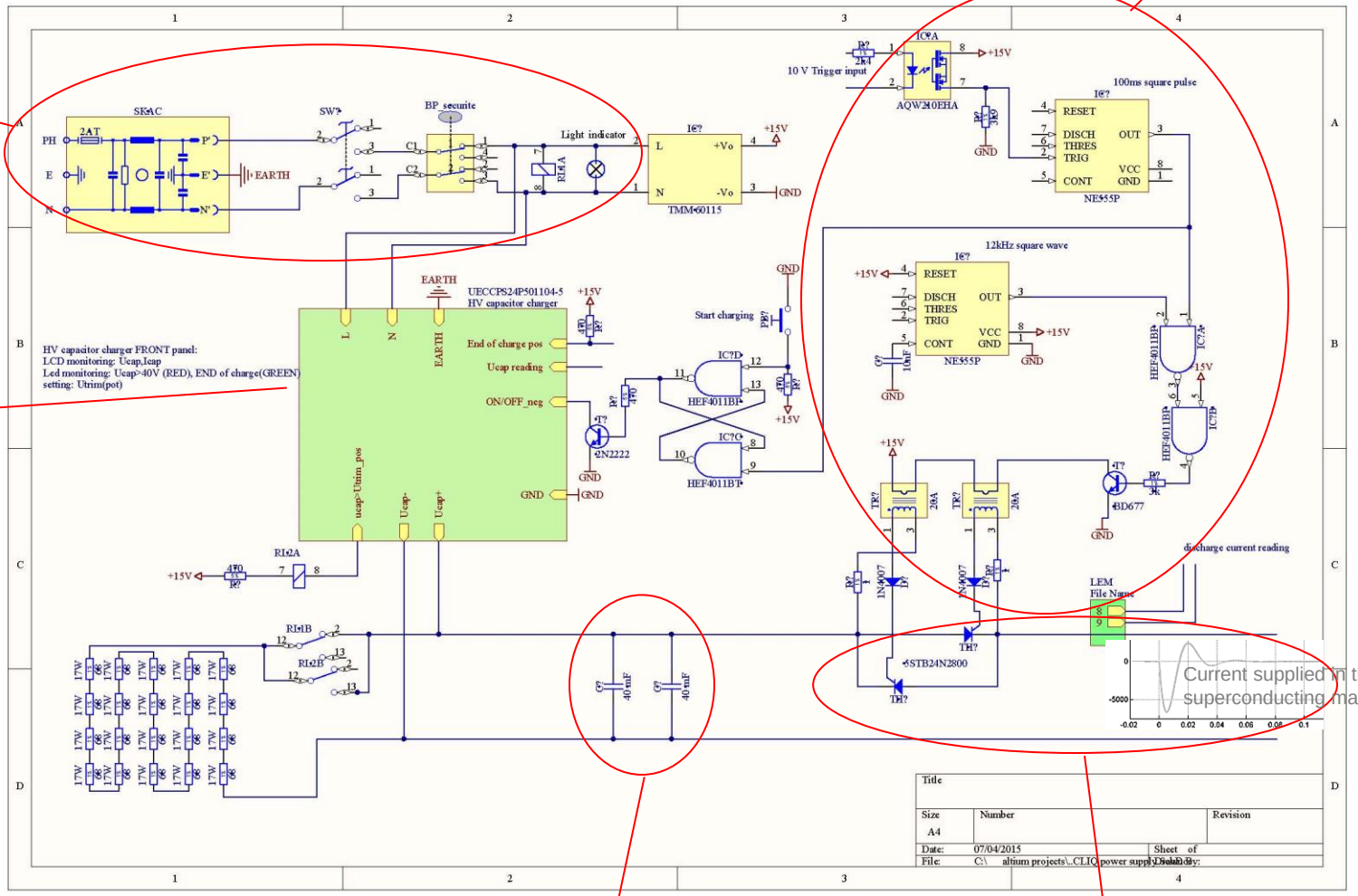
- CLIQ Power supply Electronic Design
  - Overview
  - HV capacitor charger
  - Trigger Circuit & Discharge circuit
  - Test of the trigger and discharge circuit
- User interface
- User Safety
- Design Status
- Production Status

Overview

Trigger Circuit

Mains Input

HV capacitor charger



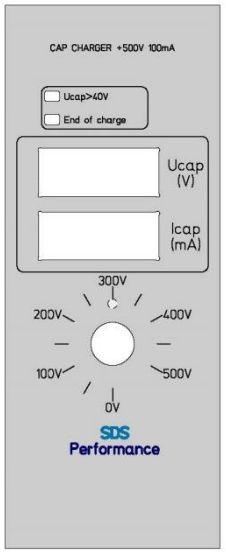
Capacitor Bank (non polarized) :
- 80[mF] charged at max. 500V
- max. stored energy 10 [KJoule]

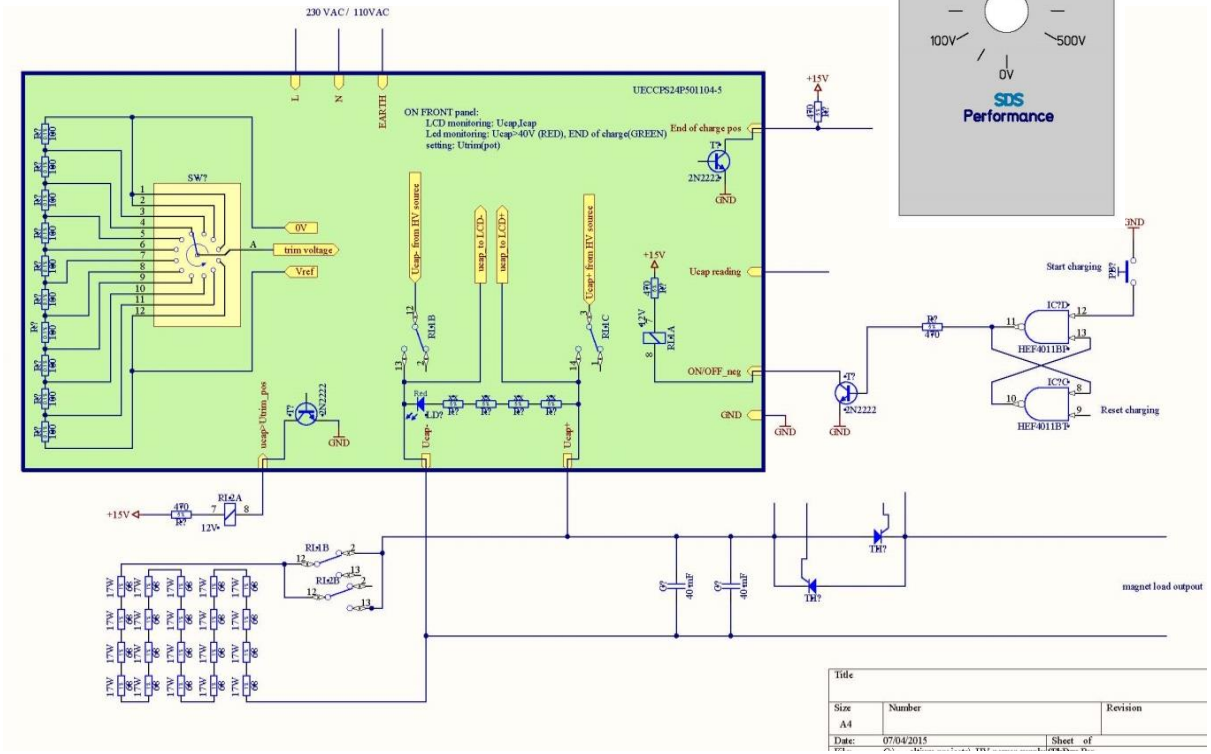
Discharge circuit

HV capacitor charger

- Currently being designed & manufactured by SDS Performance
- technical specification:
  - **Boxed in a 3U/10TE Europe cassette (220mm deep)**
  - **100[mA] charging current to charge the 80[mF]capacitor bank to 500V in 6 minutes**
  - **Front panel:**
    - **2 LCDs (Ucap, Icharge)**
    - **2 LEDs (end of charge, remaining capacitor Voltage > 40VDC)**
    - **1 commutator to select Charging voltage by steps of 50[V]**
  - **Rear connector (din41612, H15 Male):**
    - **Mains input 110/220 VAC**
    - **On/Off command controlling the output stage**
    - **2 digital outputs for(end of charge, Ucap>Utrim)**
    - **Analog reading of Ucap**

Front Panel:





Trigger Circuit & Discharge circuit

To trigger the Power supply, the user as to release the 10VDC that he was continuously supplying

12 [KHz] square Wave

Two thyristors assembled in a single box. ABB (5STB24N2800) serie)

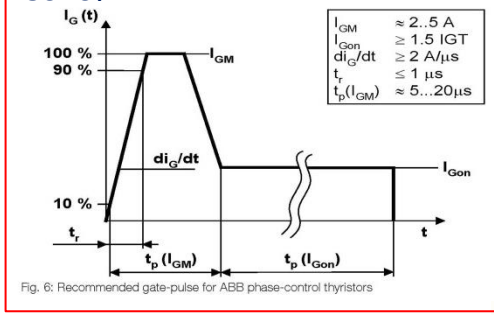
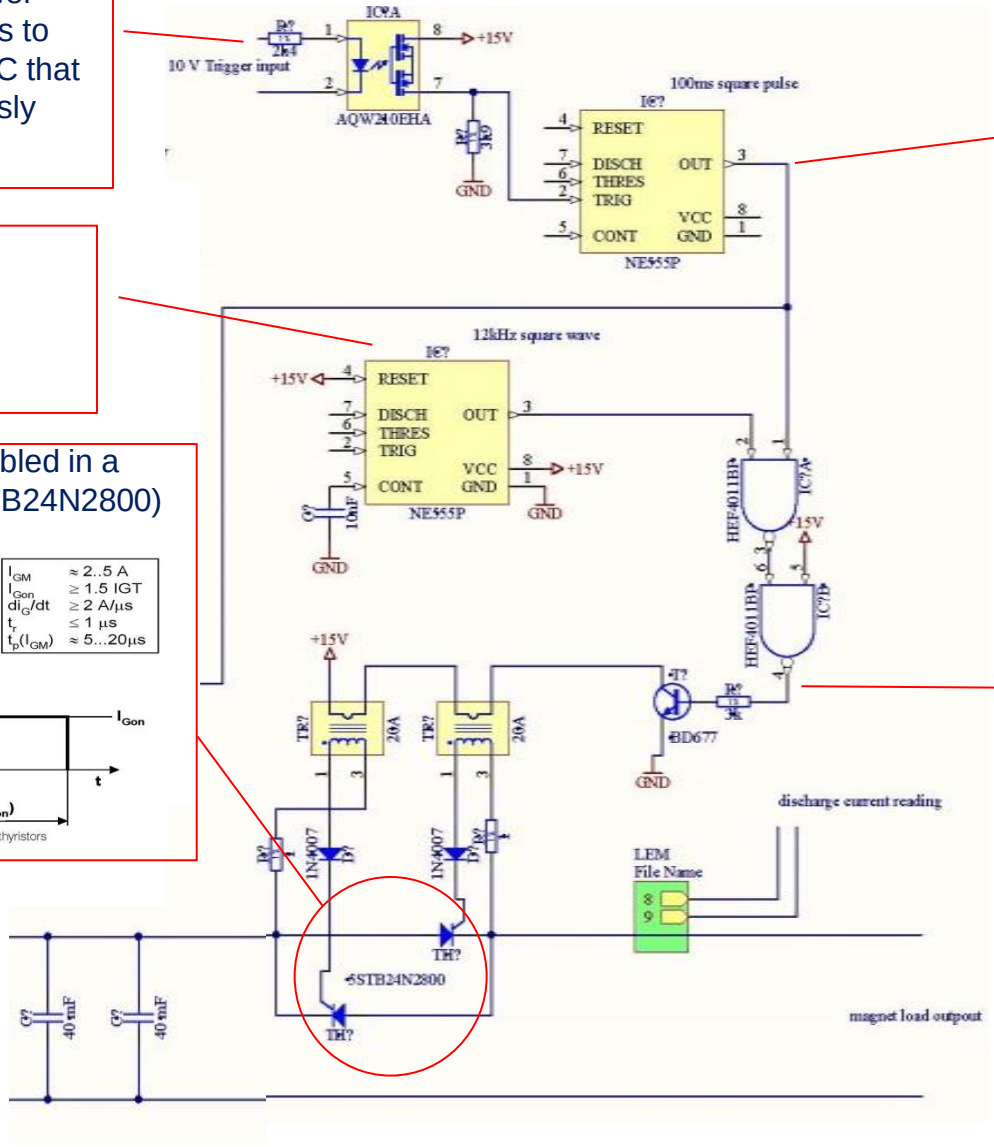


Fig. 6: Recommended gate-pulse for ABB phase-control thyristors

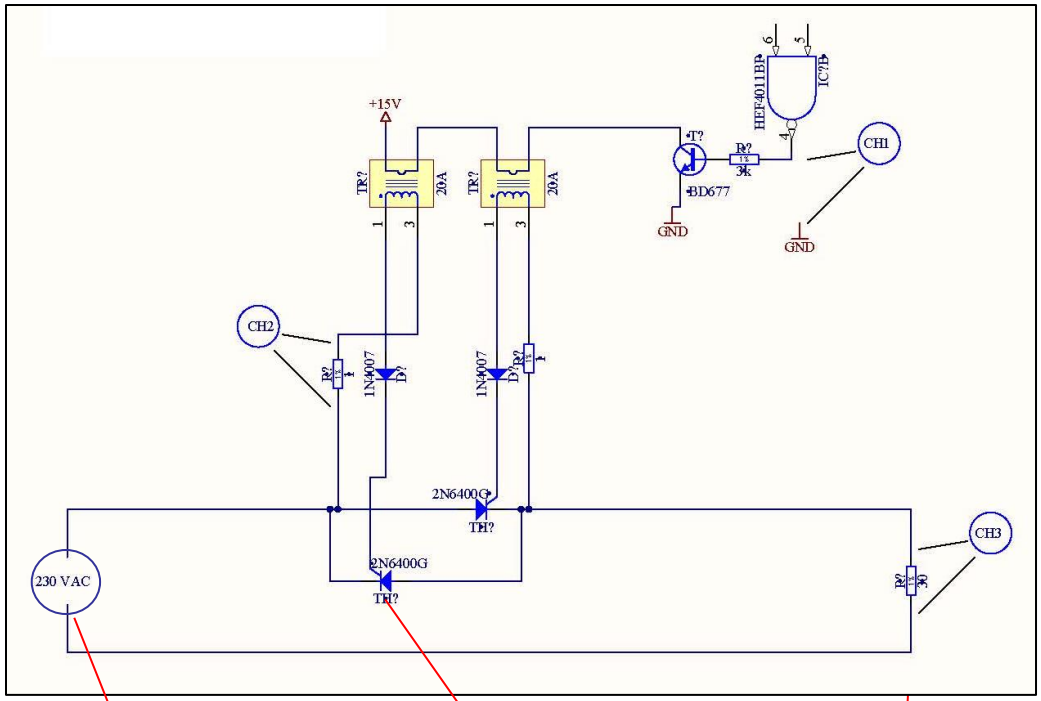


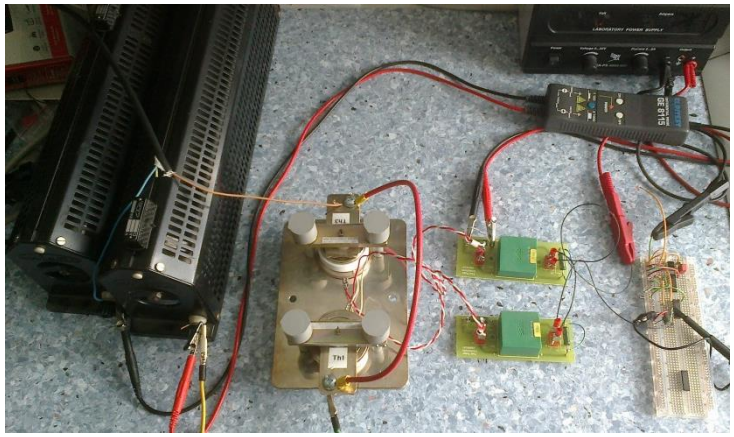
100[ms] pulse generator

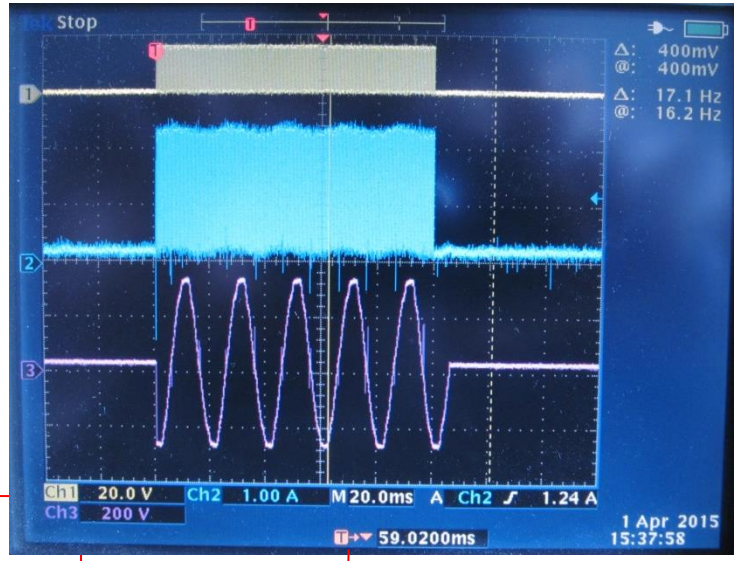
100ms positive pulse train

Remark: the100 ms we be changed to 1[s]

Test of the trigger and discharge circuit (1/2)







Use of mains to simulate the Oscillating effect of ta superconductive magnet load

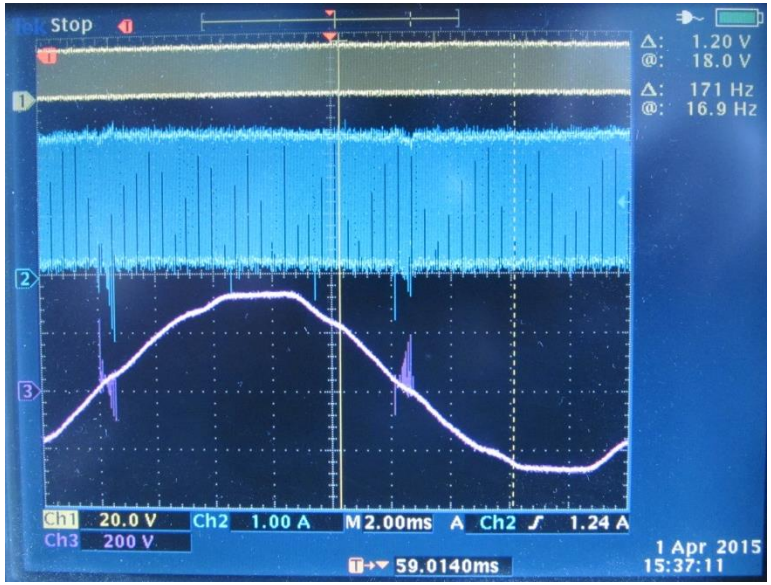
Two Thyristor used in the 13kA EE BCMs (ABB 5STF06D1220)

Resistive load 30 [ohms] to create a 8 A rms current in the thyristors

A 100 [ms] pulse train triggers the two thyristors

Test of the trigger and discharge circuit (2/2)

- 13Khz pulse train
- 40[us] ON / 35[us] OFF
- Max. gate current 2.4 [A]



- When the current crosses the zero region, a high frequency noise is observed in a resistive load !?

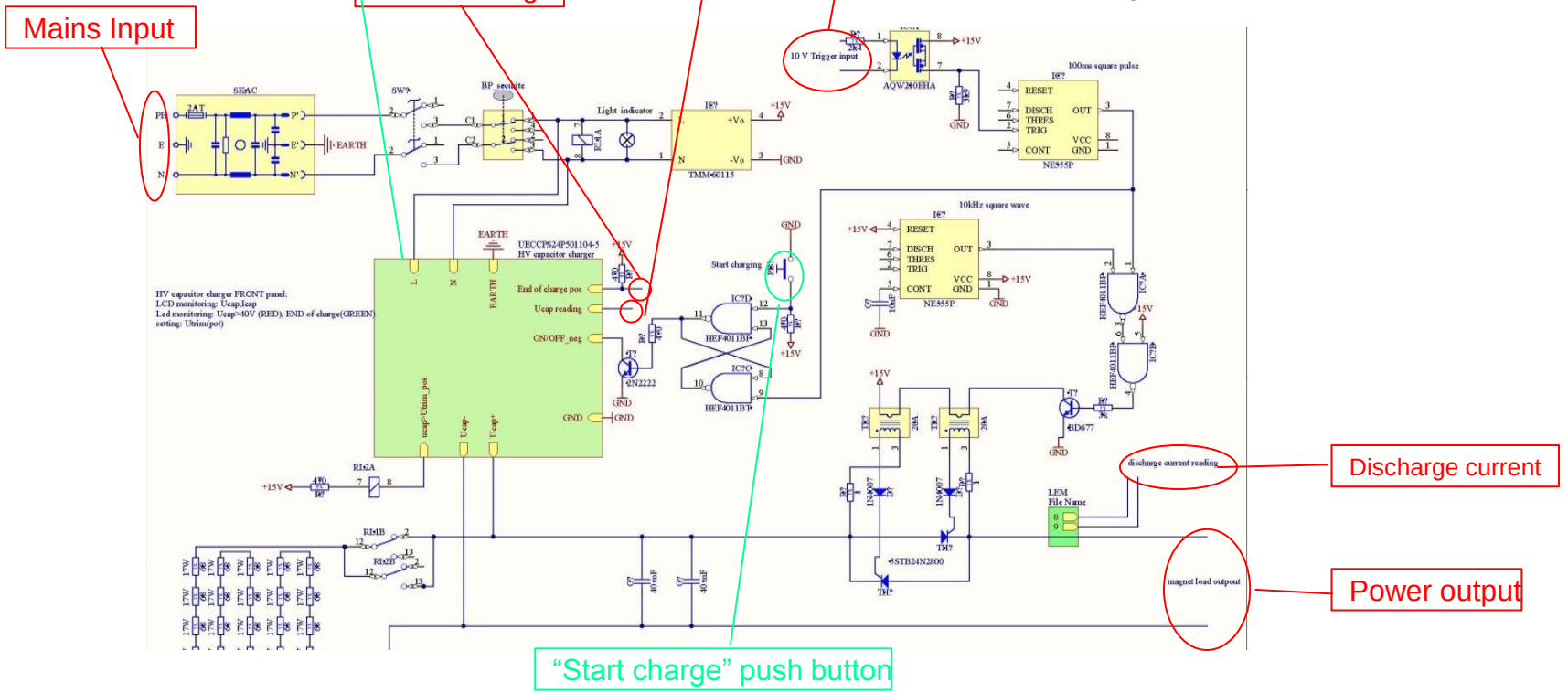
User interface

➔ Front panel:

- LCD monitoring: Ucap, Icap(charge current)
- Led monitoring: Ucap>40V (RED), END of charge(GREEN)
- Voltage setting: 0-500VDC by steps of 50 VDC (commutator)
- “Start charge” push button

➔ Rear panel:

- Mains input (Burndy VDE)
- Power output (Socapex SL61)
- Signal Inputs:
  - Trigger input signal (10 VDC)
- Signal outputs:
  - Capacitor voltage (1:100)
  - Discharge current
  - End of charge

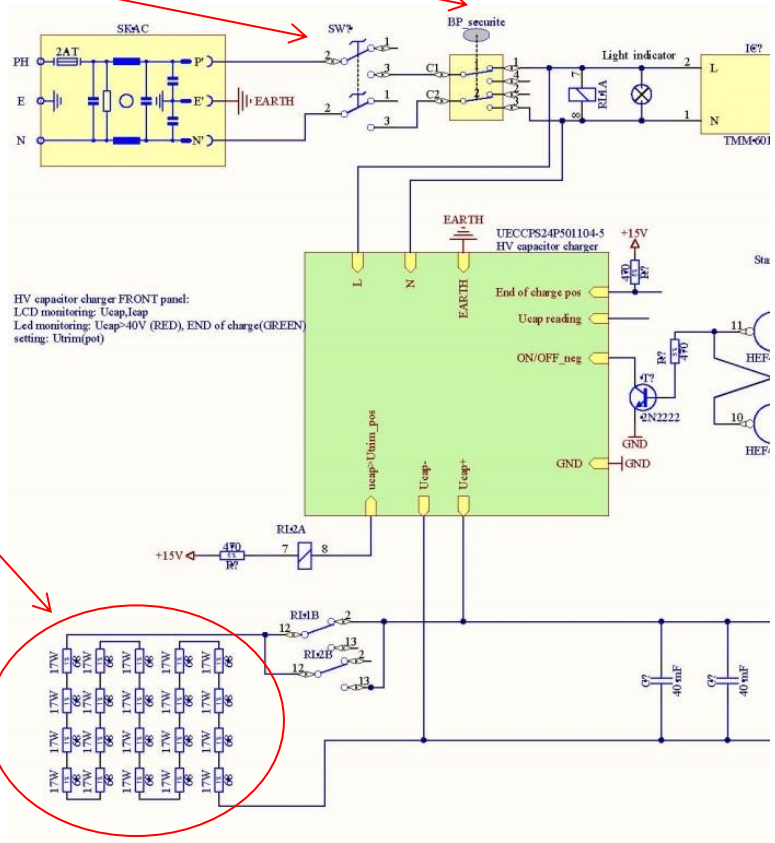


User safety

- Emergency stop on the front panel of the unit
- Separation switch (lockable with a padlock) (on the back panel of the unit)
- Automatic capacitor discharge when mains is turned off/ disconnected
  - Discharge Time constant = 109[s]

    After 3 time constants Ucap< 5% of initial voltage.

    In the worst case(initial ucap 500V)-> After 6 [min] Ucap< 25VDC



1.36[kohm]/ 340W Resistor bank. To discharge the capacitors bank in 6 min

Design Status

- Has to be completed in the design domain :
  - "Fine-tune" the trigger circuit
    - Chose a transistor that can drive more current in the pulse transformer
    - Add a function to inhibit the trigger input if these one stay at zero more than 100[ms] (to avoid a continuous pulse train)
    - Check that the AC/DC power supply can handle both function (power supply for Pulse transformer and trigger electronics) without EMC problems!
  - Drawing of the PCBs (trigger board, discharge board, capacitors board)
  - Find the LEM for the discharge current measurement

Production Status

➔ Production of the 3 CLIQ power supply units schedule