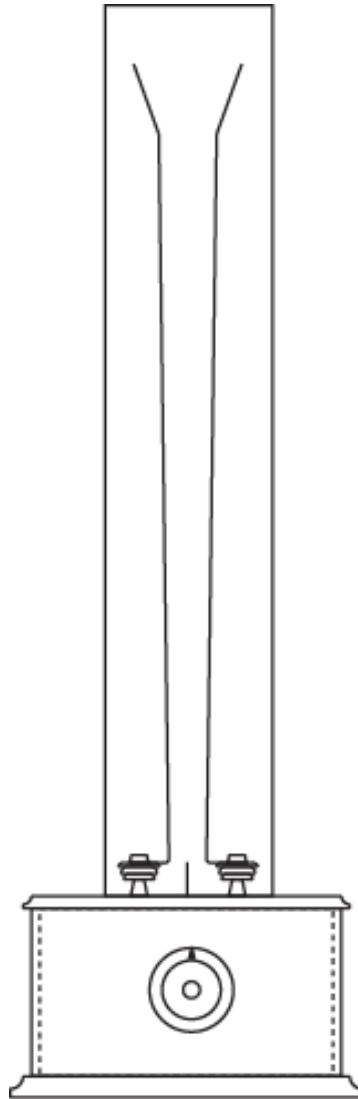


JLA Technical Manual



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1. General

The JLA is a Jacob's Ladder intended for educative purposes and composed by (see Figure 1):

- a base block
- two main electrodes
- an acrylic, transparent shield.

The main electrodes can be easily separated from the base block by removing a few screws for transportation of the JLA or for their replacement if damaged.

The JLA base block is made of wood and contains an heavy iron core neon sign transformer (NST) providing 8kV and current limited to 50 mA output current. The base block is also provided with openings for air circulation and cooling.

A main switch block, including the mains fuses, is placed on the back side of the base. On the front side, a rotary knob has the function of the operation switch. Both of these switches must be closed for the JLA to be operational.

Electrical discharges are generated between the two main electrodes, starting from their lower part and moving up to their top edges in a repetitive manner.

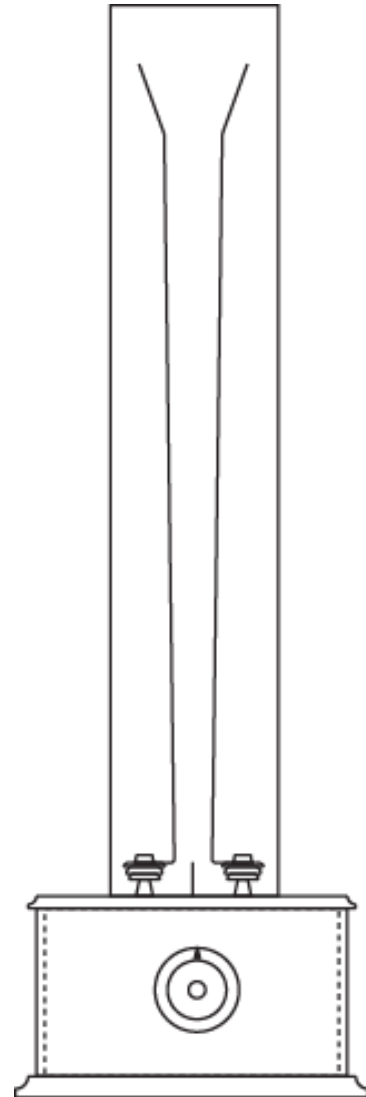


Figure 1. JLA components.

2. Technical details

2.1. Base block

The JLA base block contains the following components:

- an iron core neon sign transformer (NST) providing 8 kV (4 kV + 4 kV referred to ground) and current limited to 50 mA output current. The transformer current consumption is 230 VAC 2 A.
- a 20 uF 305 VAC capacitor for power factor correction
- a multistage EMI filter
- an operation (rotary) switch
- a main (rocker) switch including (double) 3A medium fuses

2.2. Electrodes

The two JLA main electrodes are 4 mm thick, about 100 mm long and made of brass. Their distance from each other is variable to ensure the best performance. The electrodes are fixed to the base block using two porcelain insulators.

In the middle of the two main electrodes a third one, shorter electrode is featured. The purpose of this auxiliary electrode is to facilitate the start of the electrical discharge between the two main electrodes. The auxiliary electrode is kept at the same potential than the left main electrode through a 5 Mohm resistor. Electrical discharges will typically start between the auxiliary and the right electrode, then extending also to the left electrode and eventually rising up and abandoning the auxiliary electrode.

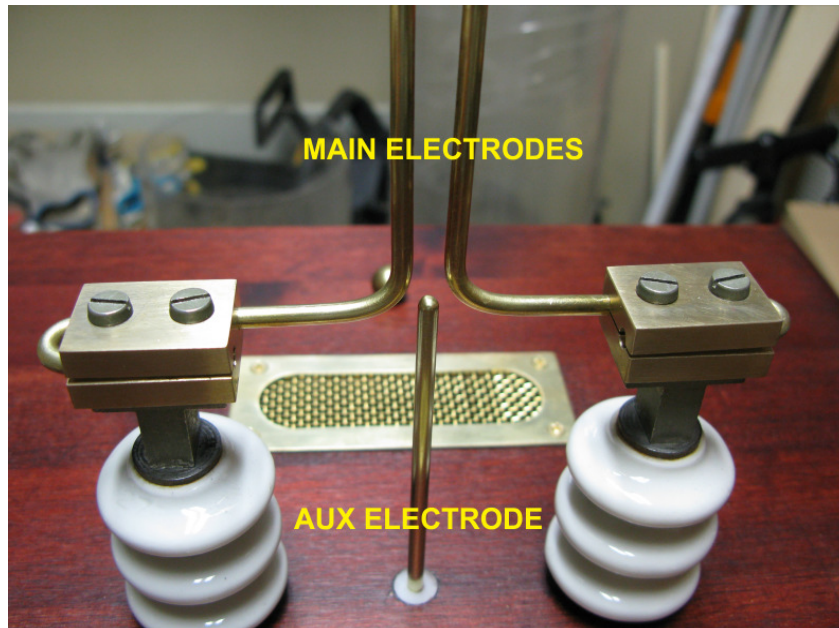


Figure 2. The three electrodes.

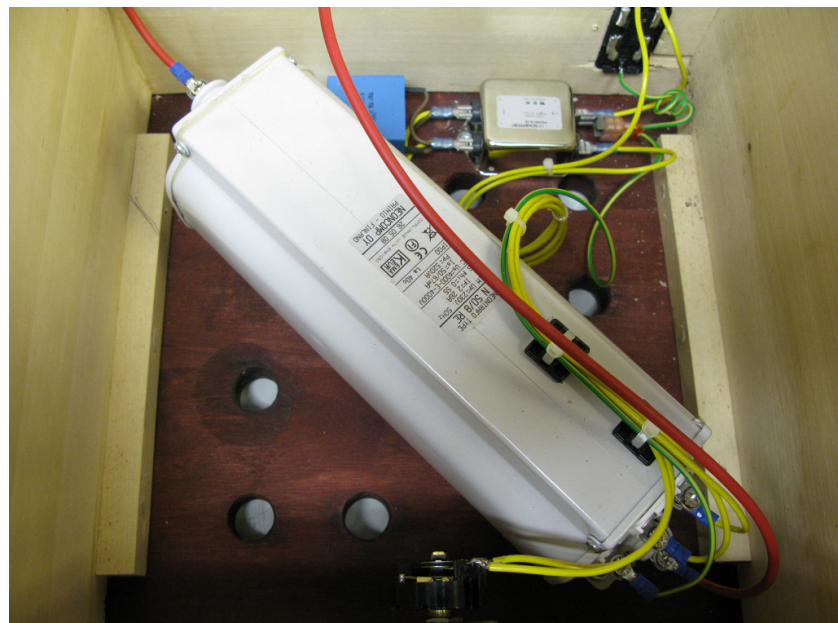


Figure 3. Base block internal view.

2.3. Shield

The electrodes are shielded by a clear acrylic tube, which is kept in place by four small brass balls. The shield can be optionally removed for installations where security is ensured by other means (e.g. a windowed room with no access).

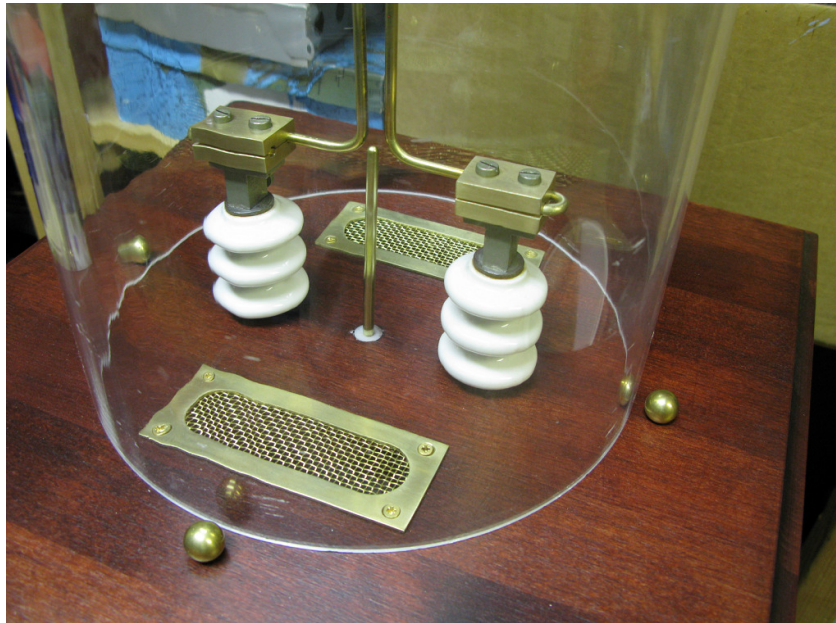


Figure 4. Shield in place.

3. Safety measures

The JLA can produce electrical discharges that extend to a maximum length of about 10 cm. **Coming into contact with such discharges produces a current flow in the human body that may be deadly.** In order to avoid this unfortunate event, the insulating shield must be used. The audience must avoid touching the shield while the JLA is in operation as the shield may get unbalanced and bend the JLA electrodes.

The two main electrodes become rapidly hot already during a few minutes of operation. A maximum uninterrupted operation time of 5 minutes is recommended. Avoid touching the electrodes right after operation not to get burns.

The JLA produces limited amounts of ozone gas while in operation. A minimum of ventilation is recommended.

4. Electrical schematic diagram

The JLA complete schematic diagram can be found in Figure 5. Mains power feed (MF1) supplies the main switch SW1, which features two protection fuses. Line filter LF1 feeds capacitor C1, used for power factor correction.

When also the rotary operation switch SW2 is closed, neon lights transformer T1 gets powered, producing 4 kV + 4 kV AC in phase opposition in respect to ground. The central (auxiliary) electrode is connected to one of the main ones through 5 Megaohms of resistance, in order to start the electrical discharge without sustaining it.

5. Periodical maintenance and servicing

Keep the main electrodes, the auxiliary electrode and the top of the base block clean from dust and dirt. No other maintenance is required.

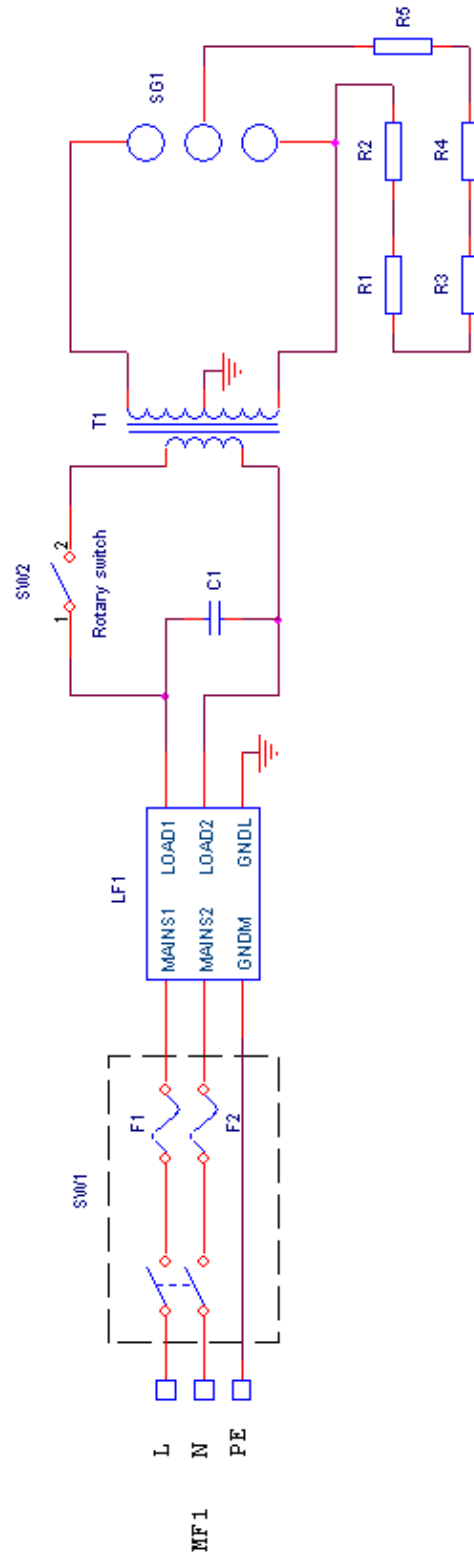


Figure 5. JLA electrical schematic diagram.

6. Replacement part list

Ref.	Part n.	Description
C1	Digi-Key 495-3839-ND	CAP 20UF 305VAC X2 EMI
F1	Digi-Key 507-1280-ND	FUSE 3A MED UL GLASS 5X20
F2	Digi-Key 507-1280-ND	FUSE 3A MED UL GLASS 5X20
LF1	Digi-Key 817-1289-ND	FILTER 1-PHASE MULTI-STAGE 6A
R1	Vishay VR37000000105JR500	Resistor 1 Mohm 2500 VAC 0.5 W metal glazed
R2	Vishay VR37000000105JR500	Resistor 1 Mohm 2500 VAC 0.5 W metal glazed
R3	Vishay VR37000000105JR500	Resistor 1 Mohm 2500 VAC 0.5 W metal glazed
R4	Vishay VR37000000105JR500	Resistor 1 Mohm 2500 VAC 0.5 W metal glazed
R5	Vishay VR37000000105JR500	Resistor 1 Mohm 2500 VAC 0.5 W metal glazed
T1	Neoncomp N 50/8 RE	Neon transformer 2 x 4 kV 50 mA
SW1	Digi-Key Q307-ND	MODULE POWER ENT FUSED DPST PLAS
SW2	Digi-Key HS13X-ND	SW ROTARY SP 6A