MODEL 110 Twin-Jet Electropolisher
General Instructions

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1.0 SET-UP

1. Plug the Connecting Cable into the socket located on the back of the Power Control.

2. Insert the Motor Plug into its socket on the Connecting Cable. For proper pump rotation, ensure that the wires are connected to their corresponding colors.

3. Insert the Light Socket and Photocell Socket into their respective Holder Slides.

4. Tighten the common cathode leads under the Acorn Nuts on the Jet Assemblies.

5. Connect the anode lead clip onto the Specimen Holder Rod.

WARNING Shock Hazard. With the Power Control and the Polishing Voltage energized, never simultaneously touch the cathode leads and any uninsulated part of the anode lead or Specimen Holder Rod.

6. If it is required, cooling with tap water circulation can be accomplished by threading the Cooling Hose Fittings into the Box. If further cooling is required, it is recommended to place the polishing cell into the optional Low Temp Container (Part Number 220) whereby dry ice and methanol or liquid nitrogen and methanol can be used as the media to reduce the temperature of the electrolyte. A hole is provided in the lid of the Low Temp Container for easy thermometer or thermocouple access.

2.0 ALIGNMENT PROCEDURE

1. To adjust the spacing between the Jet Assemblies, simply loosen the Thumb Screws, reposition the Jet Assemblies then retighten the Thumb Screws. Experience has indicated that with a total jet separation of 1.5 cm, subsequent adjustment of motor speed and polishing voltage will provide optimum results.

2. The Light Conduits are factory adjusted so that the protruding ends are level with the opening in the Nozzle of the Jet Assembly. If readjustment is required, loosen the Set Screw in the Holder Slide, reposition the Light Conduit, then retighten the Set Screw. Separation of the Light Conduits should be such that the protruding ends do not interfere with the flow of electrolyte.

NOTE: Care should be taken when handling the glass Light Conduits. Bumping or overtightening into the Holder Slide may result in Light Conduit breakage.

3. The position of the Specimen Holder should be adjusted so that the exposed specimen area is aligned with the Jet Assemblies and Light Conduits. The Specimen Holder should be perpendicular to the Jet Assemblies.

4. Fill the Glass Dish with electrolyte until the level is just above the specimen area and below the top of the Specimen Holder Insert.

IMPORTANT: Always follow the electrolyte manufacturers' safety procedures for proper handling and ventilation.

5. For final Specimen Holder adjustment, immerse the Specimen Holder into the electrolyte. Remove the Photocell Socket from its Holder Slide and turn the light source "ON". (For the Model 120 the light is activated by the Alarm Switch. For the Model 140, the Polish Switch will activate the light in either the AUTO or CONT mode.). When using the Model 120 it is necessary to cover the photocell with a piece of black tape to silence the audible alarm. The Alarm Silent Switch on the Model 140 should be used to silence the audible alarm.

6. While looking into the Photocell Holder Slide, observe the light transmitted by the Light Conduits and perform the necessary vertical and lateral adjustments to center the Specimen Holder.

7. The Specimen Holder may be positioned even more precisely by placing a specimen with a centrally located hole (approximately 100 μm in diameter) into the Specimen Holder and repeating Step 6. A used electron microscope condenser aperture is ideal for this purpose.

8. With the Specimen Holder positioned correctly and the Photocell Socket in place, the sensitivity should be reduced to a minimum setting such that the alarm is still activated when the light is turned on. Too high a sensitivity setting may in some cases result in a premature alarm.

9. Adjust the Motor Speed Control to the lowest setting that enables the electrolyte to impinge upon the specimen. This should be observed by raising the unit until the Jet Assemblies and electrolyte flow are visible.

3.0 SPECIMEN PREPARATION

1. For best results, begin specimen preparation with an initial specimen thickness between 25 and 50 μm.

2. Disks may be obtained by using a suitable metal punch (The Fischione Instruments Model 550 Specimen Punch is recommended for this application).

3. Insert the disk into the Specimen Holder and ensure that electrical contact has been made with the Platinum Contact.

4.0 ELECTROPOLISHING

1. With the specimen installed and all connections and adjustments made, the polishing process can begin.

2. To begin current flow, turn the Polish Switch to the "ON" position for the Model 120.

2a. For the Model 140 with the Polish Select Switch in the "AUTO" position, the photocell circuitry immediately stops the current flow by latching the internal relay "OFF" at the first sign of light penetration through the specimen. With the Polish Select Switch in the "CONT" position, the photocell shut-off circuitry is inhibited.

The push buttons on the Polish Select or Pump Select on the Model 140 work in this fashion: To select either AUTO or CONT, depress the button that is next to the desired mode. To turn off that mode, depress the same button. Depressing the opposite button will activate the opposite mode. For example, to operate the Polish Select Switch in AUTO mode, depress the button next to the word AUTO. To turn it off, depress the same button, the one next to the word AUTO. Depressing the button next to the word CONT will put the Polish Select Switch into CONT mode.

It should be noted that when using the Model 140 Digital Power Control the Polish Select Switch and the Pump Select Switch interact identically with the photocell shut-off circuitry.

With either the Pump Select or Polish Select Switch in the "AUTO" position, and the Digital Power Control in an alarm state, it is necessary to momentarily depress the Reset Pushbutton to resume the polishing process. A reset will only take effect when the photocell is no longer exposed to light.

3. The optimum voltage for polishing may be determined by examining the foil surface using an optical microscope. It etching is apparent, the voltage should generally be increased. The voltage required for best polishing conditions will vary with the electrolyte employed and the material being polished.

4. When the optimum polishing conditions have been determined, polishing may be continued until specimen perforation occurs. After perforation, the specimen should be removed to a rinse solution as quickly as possible to minimize contamination.

DO NOT USE ACETONE

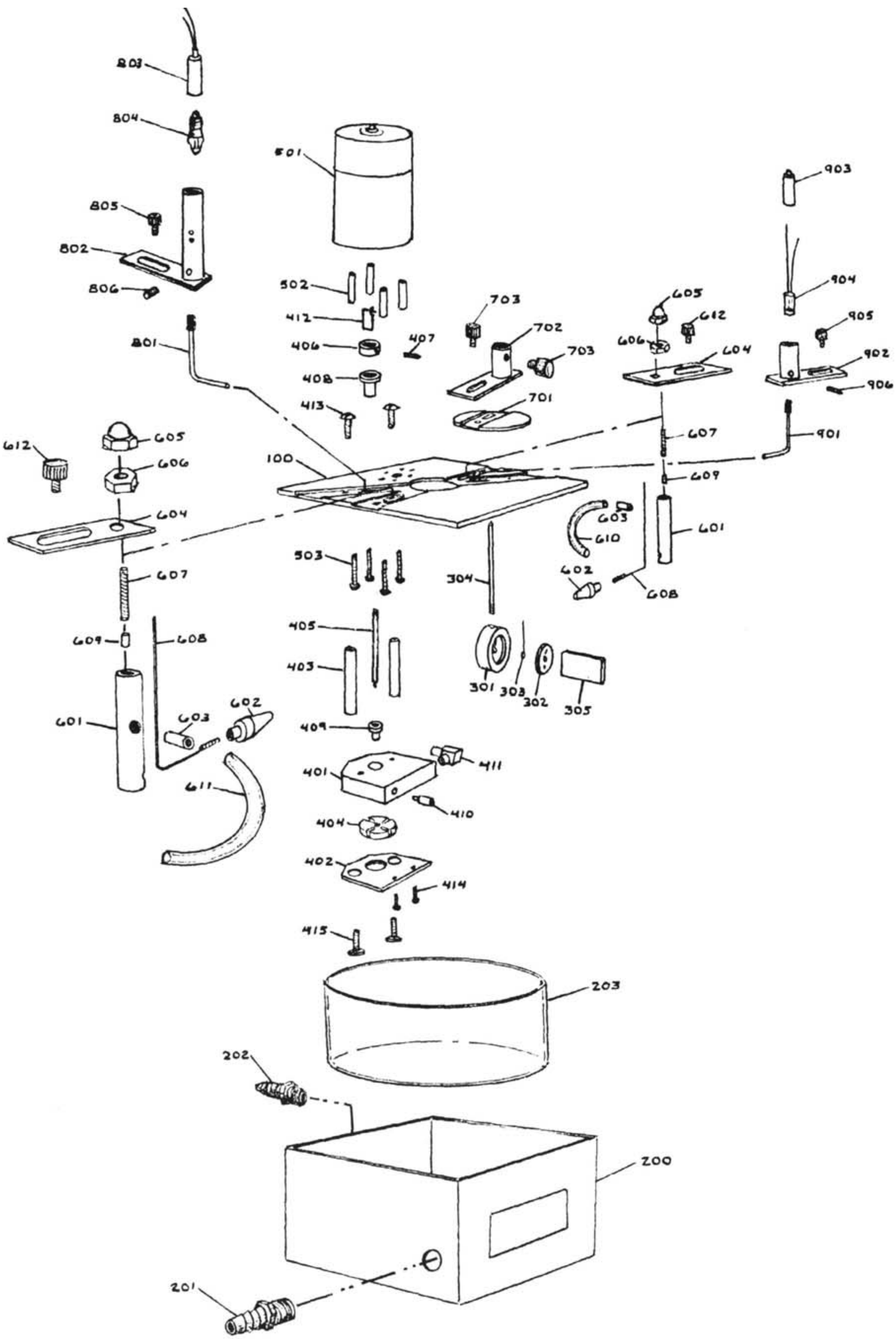
After each day's use, it is advisable to flush the Electropolisher with water and allow to dry overnight. (For best results, the Electropolisher should always be kept clean.)

APPENDIX. ELECTROPOLISHING SOLUTIONS AND CONDITIONS

Material	Electrolyte	Voltage	Temp
Aluminum	20-25% HNO_3 balance methanol Add LN_2 to electrolyte until ice forms. Begin polish as soon as it reliquifies.		
Bi_2Te_3	400 ml NaOH (10% in H_2O) 85 ml tartaric acid (40% in H_2O)		
Cobalt alloys	20% perchloric acid 80% acetic acid		
Cobalt-Nickel	25% perchloric acid 75% acetic acid	25V	-30°C
	10% perchloric acid 90% acetic acid	80V	
Copper and alloys	30% H_3PO_4 70% distilled H_2O increase voltage until bubbles form on specimen surface, then reduce voltage until bubbles just disappear.		
Fe	50% chromic acid 50% acetic acid	27V	
Fe alloys, Steel	10% perchloric acid 90% acetic acid		
Low Carbon Steel	100 g anhydrous Na_2CrO_4 (sodium chromate) 500 ml glacial acetic acid		
Stainless Steel	40% H_2SO_4 60% H_3PO_4		
420 Stainless Steel	15% perchloric acid 85% ethanol	18V	Room temp
	60% H_3PO_4 40% H_2SO_4	10V	60°C
Glass	10 ml HCl 90 ml HF Chemical polish only		

Molybdenum	20 ml HF 80 ml H_2SO_4	
Niobium and alloys	5 ml HF 10 ml H_2SO_4 600 ml methanol	-50°C
Titanium	30 ml perchloric acid 295 ml methanol 175 ml butyl alcohol	
	30 parts methanol 1 part HCl 1 part H_2SO_4	Dry ice
Titanium and alloys	6 ml perchloric acid 60 ml methanol 35 ml Butylcellusolve	-30°C
Titanium-Germanium	30 parts methanol 1 part HCl 1 part H_2SO_4	
Tungsten	2% NaOH in H_2O Very slow electrolyte flow	
Zirconium alloys	20% perchloric acid 80% acetic acid	
Ni-Mo Cu Cu-Ti Cu-Be Al-Cu Fe-Al	33% HNO3 66% methanol	-40° to -50°C

CAUTION: Perchloric acid salts can be very explosive. Only use electrolytes containing perchloric acid in a safety fume hood capable of handling perchlorics.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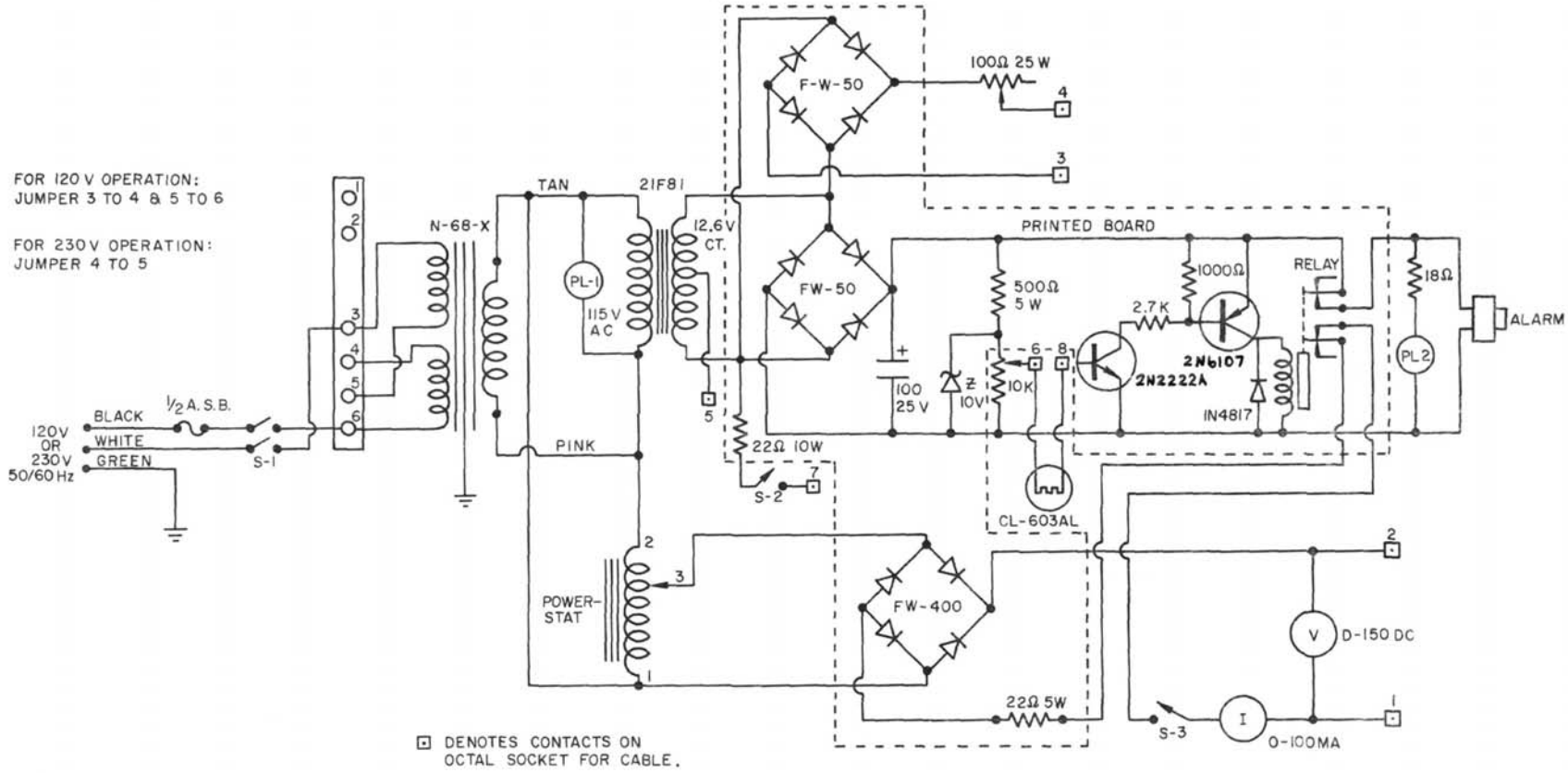
MODEL 120
AUTOMATIC POWER CONTROL

Part No.	Qty.	Description
05-01-01	1	Audible Alarm --- Mallory SNP428
09-01-01	1	Bracket Res. Mtg.---H.H. Smith 1445
11-01-01	1	Bushing, St. Rel.---H.H. Smith 939
12-01-01	39"	Cable, Multi-Cond.---Alpha 1828
12-02-01	1	Power Cord --- Grainger's 2WO50
14-01-01	1	Cabinet --- Premier SCC-3001
15-01-01	1	Capacitor --- Sprague TE1211
17-01-01	1	Connector, Cable w/clamp---Amphenol 86-PM8-11
18-02-01	1	Diode, Silicone --- RCA lN4002
18-03-01	1	Diode, Zener --- 10v. 1 watt 5% or 10%
21-01-01	1	Fuse. Slo-Blow 1/2amp --- Littlefuse 313.500
22-01-01	1	Fuseholder---Bussman HKP
23-01-01	1	Gasket, Mallory --- PW 3
31-01-01	2	Knob --- H.H. Smith H2393
33-01-01	1	Lamp, Incandescent --- 1815
33-01-02	1	Lamp, Incandescent---222
33-02-01	1	Lamp,Pilot --- Lee Craft 36N2311-6
33-03-01	1	Lamp, Lens Cap --- Dialco 95-0931
35-01-01	1	Meter, Milliamp --- Jewell MS-2T-0/100MADC
35-02-01	1	Meter, Volt--- Jewell MS-2T-0/15OVDC
40-01-01	1	Photocell --- Clairex CL603AL
43-01-01	1	Potentiometer 1OK/10turn---Spectrol 43PlO3
44-01-01	1	Powerstat --- Superior 10C
46-01-01	3	Rectifier --- Mallory FW200
48-01-01	1	Relay --- Potter Brumfield KA-11DG-12VDC
49- -02	1	Resistor, BWH-18.2., 5w, 5%
49- -04	2	Resistor, BWH-22SL, 5w, 5%
49- -06	1	Resistor, BWH-510.2, 5w, 5%
49- -07	1	Resistor, 1K. 1/4w, 5%
49- -09	1	Resistor, 2.7K. 1/4w, 5%
50-01-01	1	Rheostat --- Mallory 25KI00P
52-01-01	4	Rubber Feet --- Bud F7264A
56-01-01	1	Socket --- Amphenol 77-MIP-8
56-02-01	1	Socket, Lamp Base --- Dialco 502-8136-102
60-01-01	3	Standoff, 1/2"long 1/4"OD 6-32
63-02-01	2	Switch, SPST --- JBT ST42A
63-02-02	1	Switch, DPST --- JBT ST52K
65-02-01	1	Terminal Strip (2 pin) --- H.H. Smith 816
65-02-02	1	Terminal Strip--- (6 pin)H.H. Smith 3006
69-01-01	1	Transformer --- Triad N68-X
69-01-02	1	Transformer --- Stancor P8130
70-01-01	1	Transistor, Power --- RCA 2N6107
70-01-02	1	Transistor, Silicone --- 2N2222A



AUTOMATIC POWER CONTROL

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