SERVICE MANUAL

for

LABNET
SPECTRAFUGE 16M
MICROCENTRIFUGE

Labnet International, Inc.
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Contents

General Description of Operation

This centrifuge is generally used in biological and biochemical research laboratories where small samples must be subjected to high RCF (g-force) for relatively short time intervals (usually thirty minutes or less).

Designed to accept popular micro-test tubes with captive caps in a high speed rotor, this centrifuge will provide centrifugal forces as high as 16,000 times the power of the earth's gravity (16,000 x g)*

The major functional components of the centrifuge are as follows:

Motor	Brushless DC motor.
Printed Circuit Board	The "brain" of the centrifuge, the microprocessor based circuit board controls the lid lock, operation, speed and acceleration/deceleration rates of the unit.
Speed Control	Located on the left side of the front panel. Turn to set the desired speed. Speed is set directly with this knob, i.e. a setting of 4 corresponds to 4,000rpm, a setting of 10 corresponds to 10,000rpm, etc.
Timer	This knob is located on the right side of the front panel. It acts as both an on/off switch and a timer. The desired time is set by turning the knob. Time is set in 1 minute increments, to a maximum of 30 minutes. Turning the knob to the zero position starts the deceleration of the rotor to a stop. The timer can be bypassed by pressing the quick button. A hold position can be actuated by rotating the timer knob counterclockwise. The knob may be turned in either direction before or during a run without damaging the mechanism.
Lid Latch	This electronic mechanism prevents operation of the centrifuge when the lid is open. Driven by a solenoid and controlled by the circuit board, this latch keeps the lid locked until the rotor has almost come to a complete stop. An emergency lid latch release, located in the left side of the unit below the quick button, allows access to the rotor in case of a power failure or component malfunction.
Lid Switch	Located to the right of the front panel. Pressing this button opens the lid of the centrifuge. This switch is disabled while the centrifuge is in operation.
Lid Lock Indicator	Located above the speed control. Indicates that the unit is in operation. When lit, the lid switch is disabled.
Quick Button	For short or quick spins. The centrifuge will operate at the preset speed while this button is pressed and stop when it is released.

*Rotational speeds of this magnitude can be converted to "rim speeds" of nearly 300 miles per hour. Use extreme caution when working with this equipment. The technician should inspect the rotor periodically for visible signs of damage or stress. The rotor screw should be checked for tightness.

Specifications

Maximum speed ..... 14,000 rpm ±5%

Maximum RCF ..... 16,000 x g

Maximum capacity ..... 36 mL (18 x 2.0 mL)

Dimensions

- Width ..... 209.5mm/8.25 in.
- Depth ..... 226mm/8.9 in.
- Height ..... 193mm/7.6 in.
- Weight ..... 5.1kg/11.2 lbs.

Noise level (with full rotor) ..... Approx. 56 dB

Electrical Ratings

- 120V Version ..... 120V~, 50-60 Hz, 1.0A
  Fuse 250V,2.5AT
- 230V Version ..... 230V~, 50-60 Hz, 0.5A
  Fuse 250V, 1.25AT

Ambient operating range ..... +2.0ºC to +40.0ºC

Warranty Information

Limited Warranty
This warranty is valid in U.S.A. only

Repair or Replacement
The manufacturer warrants this equipment to be free of defects in material and workmanship for a period of 12 months from the original date of purchase. This warranty includes labor and parts, and excludes damage caused by abuse or neglect.

If defects occur during the warranty period, the manufacturer will, at its option, repair or replace the product. Proof of purchase is required.

In-Warranty Service
We will provide warranty service if you bring to our attention, within 12 months from date of original purchase, a defect covered by the warranty. **To obtain warranty service, you must do the following:**

1) Call the Customer Service number, printed below, to arrange for warranty service. The Customer Service Representative will give you a Return Authorization Number (RAN):
   Customer Service 732 417-0700
   Hours of operation: 8:30 am to 5:00pm, Eastern Standard Time
   Monday through Friday (excluding holidays)

2) Shipping instructions:
   Pack the unit in its original packaging or a protective carton, padded to avoid damage. Labnet will not be responsible for damage resulting from improper packaging.
   Include the following:
   a) All accessories originally included, unless otherwise instructed
   b) A copy of your proof of purchase
   c) Your name and shipping address
   d) Name and phone number of contact person
   e) A brief written description of the problem

   UPS is the preferred shipper.
   Send package postage prepaid and insured to:
   National Labnet Company
   162 Fernwood Ave
   Edison, NJ 08837
   (no collect shipments accepted)

Exclusions and Limitations
This warranty does not cover the following:
a) Damage caused by transit or improper packaging
b) Damage caused by accident, misuse, negligence, improper installation or maintenance, improper operation, damage resulting from dirt, water, lightening or other natural forces.
c) Damage caused by tampering, alteration or repair performed or attempted by anyone other than the manufacturer or its authorized repair agent
d) Damage to the finish or paint

Legal Rights and Limitation of Liability
ALL WARRANTIES, INCLUDING THE IMPLIED WARRANTY OF MERCHANTABILITY AND THE IMPLIED WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE ARE LIMITED IN DURATION TO 12 MONTHS FROM THE DATE OF ORIGINAL PURCHASE. REPAIR OR REPLACEMENT IS PROVIDED AS THE SOLE AND EXCLUSIVE REMEDY.

NATIONAL LABNET COMPANY IS NOT LIABLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGE, COMMERCIAL LOSS, OR ANY OTHER LOSS OR DAMAGE NOT SPECIFIED IN THIS WARRANTY.

Some states do not allow limitations on the length of implied warranties, or exclusions of limitation of incidental or consequential damages. The above limitations or exclusions may not apply to you. This warranty gives you specific rights. You may have other rights which vary from state to state.

No individual has the authority to extend this warranty period. No individual can accept for or on behalf of the manufacturer, any other obligation of liability in connection with the sale of this equipment.

This warranty is valid only in the United States of America and only for the original purchaser.

For out of warranty service, call our Customer Service Department for information: 732 417-0700.

Troubleshooting

Problem	Possible cause	Solution
Lid will not open (with power/rotation light on).	Rotor still turning.	Wait for rotor to stop.
	Internal electrical failure.	Requires service.
Lid will not open (with power/rotation light off).	No power supply.	Check plug connection on back of unit.
	No power supply.	Check/replace fuse.
	No power supply.	Check wall outlet.
	Internal failure.	Requires service.
Excessive vibration.	Debris lodged inside rotor.	Disassemble and clean out rotor.
	Rotor improperly loaded.	Load symmetrically/balance tubes.
	Rotor damaged.	Requires service or replacement.
	Centrifuge not on firm, level surface.	Relocate to appropriate surface.
	Motor damaged.	Requires service.
Rotor does not rotate.	Lid not properly closed.	Press down firmly on front of lid.
	Timer not set.	Select a timer interval.
	Speed not set.	Select a speed from 1,000 to 14,000rpm.
	No power supply.	Check plug connection on back of unit.
	No power supply.	Check/replace fuse.
	No power supply.	Check wall outlet.
Grinding or metallic rattle noise during acceleration or braking.	Rotor screw is not tight on motor shaft.	Tighten rotor screw as firmly as possible by hand. Then tighten an additional 1/8 turn using a wrench or other appropriate tool. Do not exceed 1/8 turn.
	Bottom shield of rotor is not properly secured to top part of rotor.	Check and tighten the three screws on bottom of rotor assembly.
Whistling noise (high-pitched) during acceleration or deceleration.	Rotor cover is off and rotor is less than 1/3 full.	Add extra tubes symmetrically and/or install rotor cover.
Power/rotation light does not illuminate.	Defective fuse.	Check/replace fuse.
Excessively noisy while rotating at maximum speed.	Rotor is poorly balanced.	Check with a well balanced load.
	Rotation is too fast.	Recalibrate speed.
Rotation light stays on after rotor has stopped.	Failure of electronic braking circuit.	Requires service.

Service Instructions

MAINTENANCE

Beginning after the first 300 hours of use, and periodically thereafter, a qualified electronics technician should inspect the centrifuge.

Cleaning & Lubrication

The rotor, rotor chamber and centrifuge casing must be kept clean. Using a cloth damp with water or mild detergent, the casing and chamber should be wiped clean and kept in "like-new" condition. Clean all spills immediately, removing the rotor for best results. No routine lubrication is necessary.

Disconnect from power source before any cleaning procedure. No flammables or solvents are to be used, especially in the presence of electrical power or in a recently used (still warm) centrifuge.

Removing the rotor

1) Using an adjustable or 1/4 inch wrench, loosen the rotor screw and remove the rotor retaining screw/washer assembly by turning it counter-clockwise.

2) Lift the rotor straight up and out of the chamber.

3) To reinstall the rotor, reverse the above procedure. Be sure the cross pin on shaft lines up with slot on underside of rotor.

Maintaining the rotor

The rotor must be checked periodically (every 12 months or more often if required) for signs of wear, damage or misuse. Corrosive materials must be promptly cleaned and thoroughly removed. For best results, disassemble the rotor by removing the 3 screws at the bottom and pulling the upper and lower components apart. The rotor must be reassembled in the same orientation. The rotor can be autoclaved or wiped with radioactive decontaminant only when disassembled. It should not be soaked in decontaminant. When reassembling the rotor, be sure to return the upper and lower sections to their original orientation. Misalignment could result in a moderate imbalance and increased vibration during high and low speed operation. The three screws must be tightened firmly.

Any cracks, deep scratches, stress marks or other damage to the rotor should be reported immediately. Any rotor exhibiting any of the above indicators must be removed from service immediately. Failure to do so may result in injury.

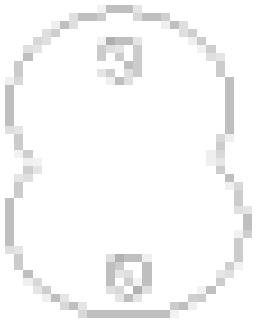
Rotor screw

The rotor screw must be kept tight enough that it cannot be removed by hand. If it has become loose, tighten it firmly, clockwise, by hand and subsequently torque an additional 1/8 turn using a wrench or other appropriate tool.

Speed calibration

After every 100 hours of use (or more frequently if required by other agencies) the maximum rotor speed should be verified using an external tachometer via the below procedure or another procedure as required by regulatory agencies. Speed calibration must be performed if the motor or circuit board has been replaced.

Tools required: insulated screwdriver, non-conductive
photo electric tachometer
reflective adhesive contrast dot/tape



Speed pot access

1) Remove metal chute (4 phillips screws) from bottom of unit. (See figure #3, pg 13.) This will expose a figure 8 shaped hole through which the speed adjust pots can be accessed. The rear-most is the high speed adjustment pot and the front-most is the low speed adjustment pot.

2) Elevate the unit in a normal upright operating position so that the adjusting pots can be accessed.

3) Install a small dot of reflective tape near the top outer edge of the rotor lid catch. Set the speed control on the front panel at maximum (#14), close the lid and turn on the unit using the timer.

4) Set up the tachometer through the clear window in the centrifuge lid to monitor rotor speed. Adjust the high speed pot (rear-most) so that the rotor speed measures approximately 14,000rpm on the tachometer.

5) Run the unit at this speed for a minimum of 5 minutes.

6) Adjust the high speed pot (rear-most) so that the rotor speed measures 14,000rpm, plus or minus 150rpm on the tachometer.

7) Rotate front panel speed control to #1 (1,000rpm) setting. Adjust low speed pot (front-most) so that the rotor speed measures approximately 1,000rpm.

8) Run the unit at this speed for a minimum of 5 minutes.

9) Adjust the low speed pot (front-most) so that the rotor speed measures 1,000rpm, plus or minus 100rpm on the tachometer.

10) Replace the metal chute

The unit is now calibrated.

SERVICE PROCEDURES

Take care when performing the following service procedures. Always disconnect the unit from power source before attempting any service operations.

Removing Upper Casing Shell

1) Remove rotor as outlined in the rotor section.

2) Remove the 4 phillips head screws that secure the upper casing shell to the baseplate. (See figure #1, pg 12 for exact location of screws.)

3) Lift the upper casing shell upward until it is clear of the motor. Lay the upper casing on its side to the right of the baseplate.

5) For reinstallation, reverse the above procedures.

Always disconnect centrifuge from power source before attempting any service procedures. Failure to do so may result in electrical shock and serious injury to personnel.

MOTOR

The motor used in the manufacture of this centrifuge is a brushless, DC motor. This motor requires no routine maintenance and is virtually problem free. Most operational problems will be attributable to the circuit board rather than the motor.

Replacing motor assembly

If it has been determined that the motor should be replaced, the following instructions should be followed.

Tools required: Phillips screwdriver
Nut driver (11/32") or small adjustable wrench

1) Remove the upper casing shell as previously described. Remove the metal chute as described in the speed calibration section.

2) Unplug the motor connection from the PCB.

3) Loosen the ground nut and remove the motor ground lead (figure #4, pg 14).

4) Remove the 4 motor nuts on the bottom of the base-plate (figure #5, pg 15). Remove motor assembly and 4 star washers under the isolators from unit, noting the orientation and routing of motor and ground leads.

5) Install new motor assembly (with star washers on isolator studs) in chassis in the same orientation as the old motor. Attach and tighten the 4 motor nuts on the bottom of the unit. Be sure the isolators are not twisted.

6) Plug the motor connector into the PCB and attach ground lead under ground nut and tighten securely.

7) Make sure air channels are installed down against foam.

8) Reinstall upper casing shell and tighten screws securely.

9) Calibrate speed as previously described on page 6.

10) After calibration, reinstall metal chute.

Speed must be recalibrated after replacing the motor. Failure to do so may result in serious injury.

PRINTED CIRCUIT BOARD (PCB)

The majority of failures that cannot be attributed to the motor can be traced to printed circuit board component failure. If the fault has been isolated to the PCB, it is recommended that a new board be installed. For those who prefer to troubleshoot to the component level, board diagrams are provided in Section 7.

Verifying Connections

All of the various centrifuge components are connected to the PCB. Depending upon the nature of the fault, the technician should verify that these connections are secure, while the unit is disconnected from the power source.

Replacing the PCB

Tools required: Phillips screwdriver

1) Remove the upper casing shell as previously described.

2) From the bottom of the unit, remove the 2 PCB mounting screws and nuts that secure the PCB brackets to the baseplate (see figure #6, pg 16).

3) One at a time, remove each of the 3 plug in connectors from the old PCB and install into the same location on the new PCB.

4) Position the new PCB so that the 2 mounting bracket holes are aligned with the two baseplate holes and reinstall the 2 PCB mounting screws and nuts.

5) Replace the upper casing shell as previously described. Tighten the 4 screws securely.

6) After reassembling the unit and reinstalling the rotor, the speed must be calibrated according to the instructions in the "Speed Calibration" section.

Speed must be recalibrated after replacing the PCB. Failure to do so may result in serious injury.

MISCELLANEOUS COMPONENTS

Timer & Momentary Switch

If the unit will not rotate when the timer is turned on, press the momentary switch. If the unit still does not rotate, the problem is not attributable to the timer or momentary switch. However, due to the fact that both switches are used for identical internal switching, a quick diagnosis is easy to perform. Any time that one of these two controls is operational and the other is not, the latter control is either the victim of a short circuit connection, or is defective and should be replaced.

Lid Latch Mechanism

The lid latch is disengaged by a DC solenoid and is essential to proper operation. For safety reasons, no attempt should be made to modify, tamper with or defeat the latch mechanism. To actuate the lid latch release, depress the "lid" button on the front panel. The release can only be actuated when the lid is completely closed and latched and the rotor is not turning. The technician should be aware of the interaction between these components at all times during the troubleshooting process.

In the event that the lid latch mechanism will not energize, power to the solenoid should be verified. To access the entire latch assembly, remove the upper casing shell as previously described.

After removing, turn the upper casing so that the inside of the front panel is visible (figure #7, pg 17). If power to the solenoid is present, but the solenoid does not move, it should be checked and/or replaced.

Other potential latch faults could be the result of poor wiring connections, poor alignment of the lid latch catch, sticking or jamming of the lid latch strike or no contact at the microswitch.

If necessary the lid may be opened manually:

1. Disconnect the power cord from the wall socket power supply.
2. Remove the plastic plug, located on the left side of the unit, below the quick button.
3. Pull the cord (attached to the plug) to open the lid lock manually.

Stepdown Transformer

The stepdown transformer supplies 24 VAC to the PCB. If power is not present, check the primary and secondary windings for opens or shorts. To replace the transformer, follow these instructions.

Always disconnect centrifuge from power source before attempting any service procedures. Failure to do so may result in electrical shock and serious injury to personnel.

Tools needed: Phillips head screwdriver

1) Remove the outer casing as previously described.

2) Remove the two mounting screws and nuts holding the transformer in place (see figure #8, pg 18).

3) Remove the wire connectors one at a time from the old transformer and transfer to the same positions on the new transformer.

4) Line the new transformer up over the mounting holes and secure the two mounting screws and nuts.

5) Replace the outer casing.

Illustrations

Figure 1
Spectrafuge 16M

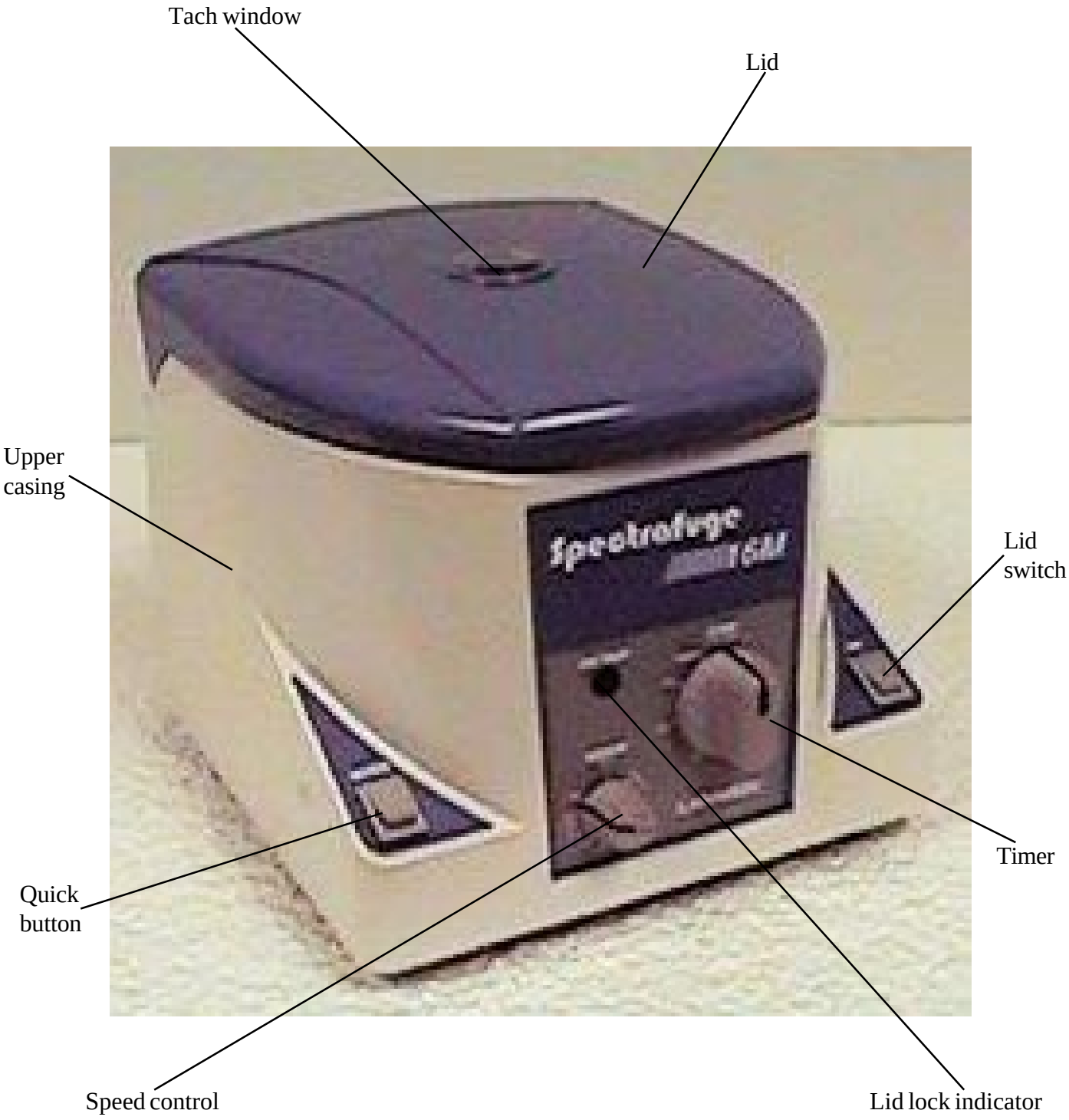


Figure 2
Position of screws holding upper casing to baseplate
(shown from bottom of unit)

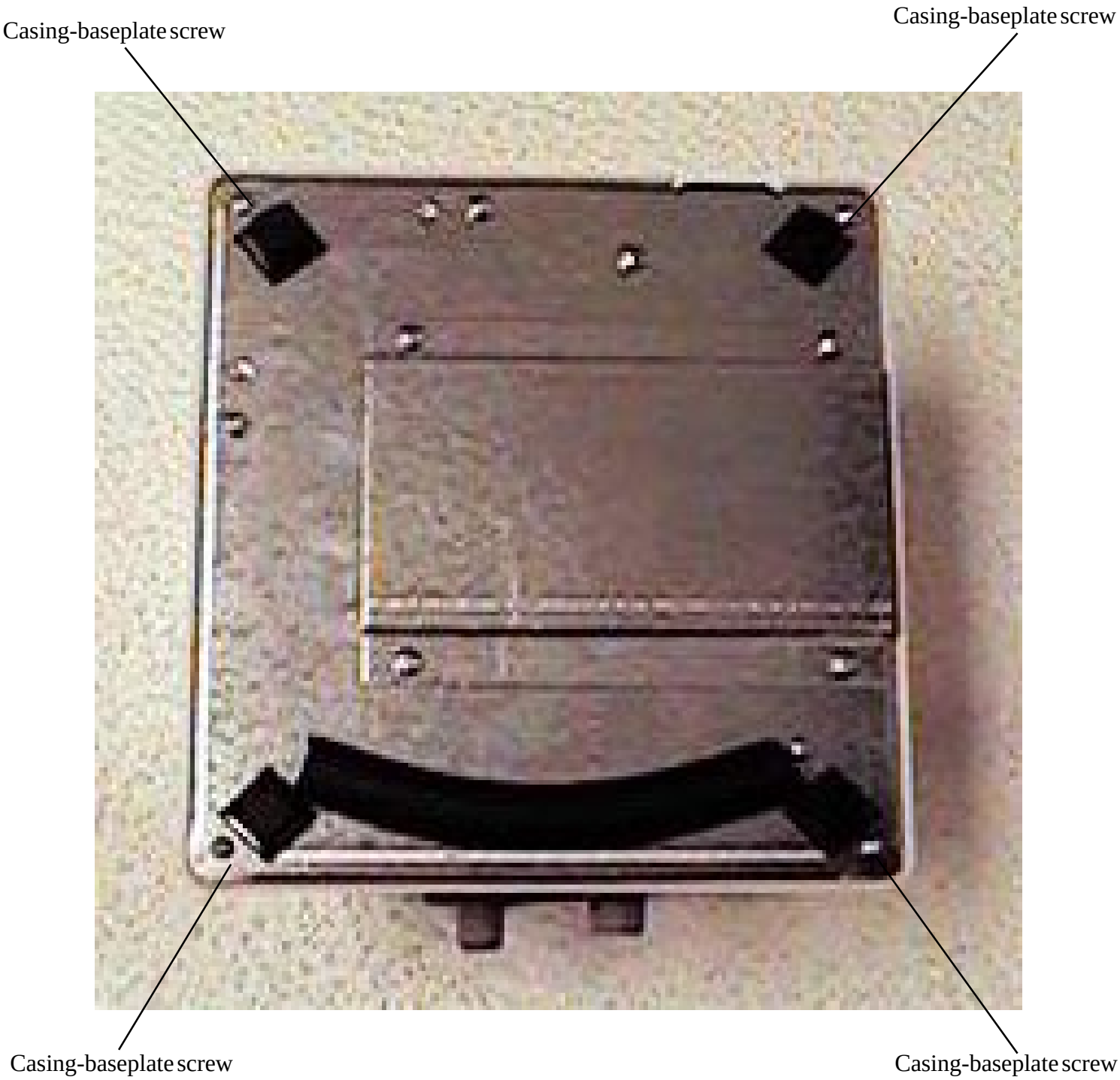


Figure 3
Position of metal chute and attachment screws
(view from bottom of unit)

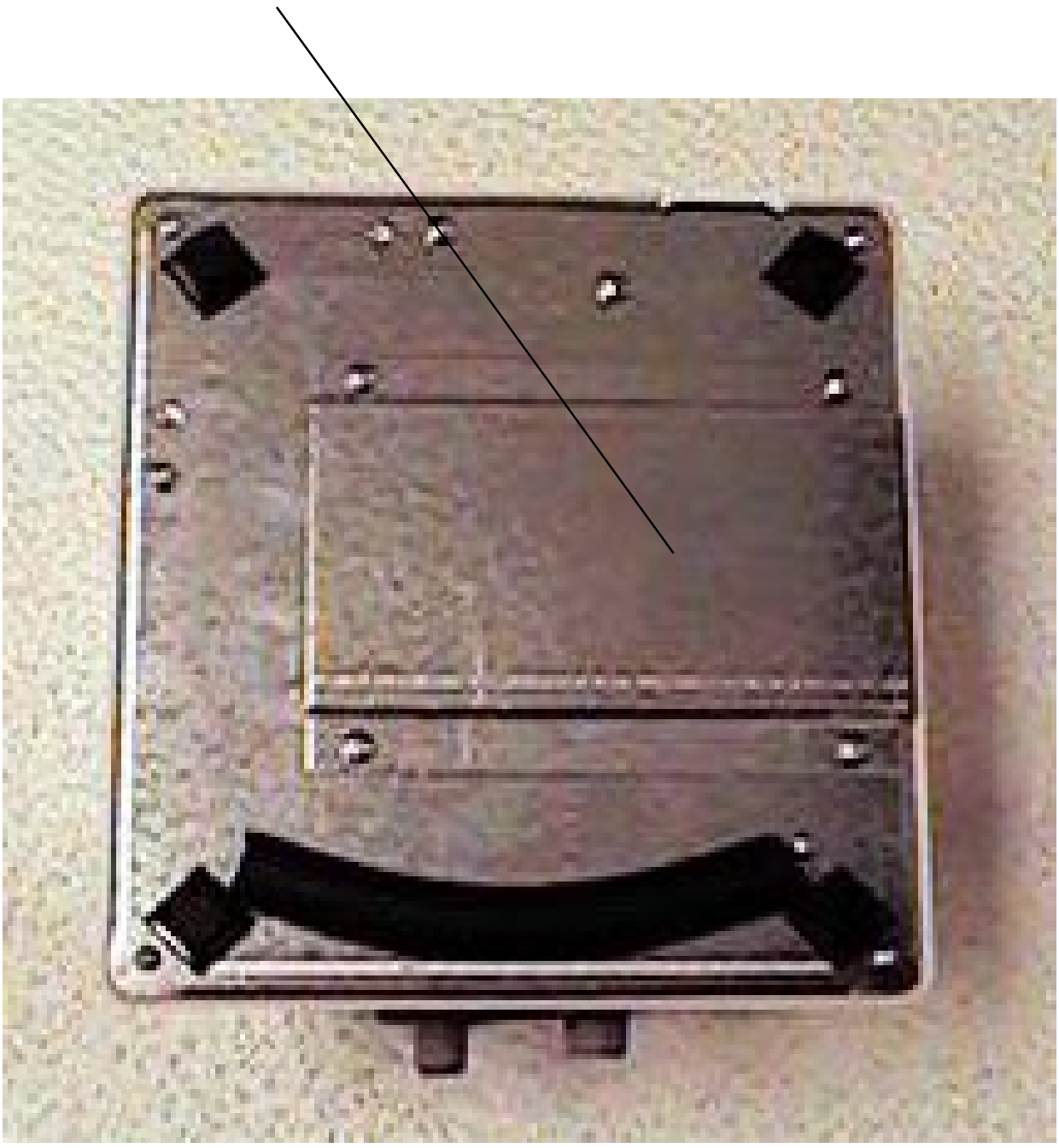


Figure 4
Location of motor and motor ground nut

Figure 5
Location of nuts holding motor in place
(bottom view of unit)

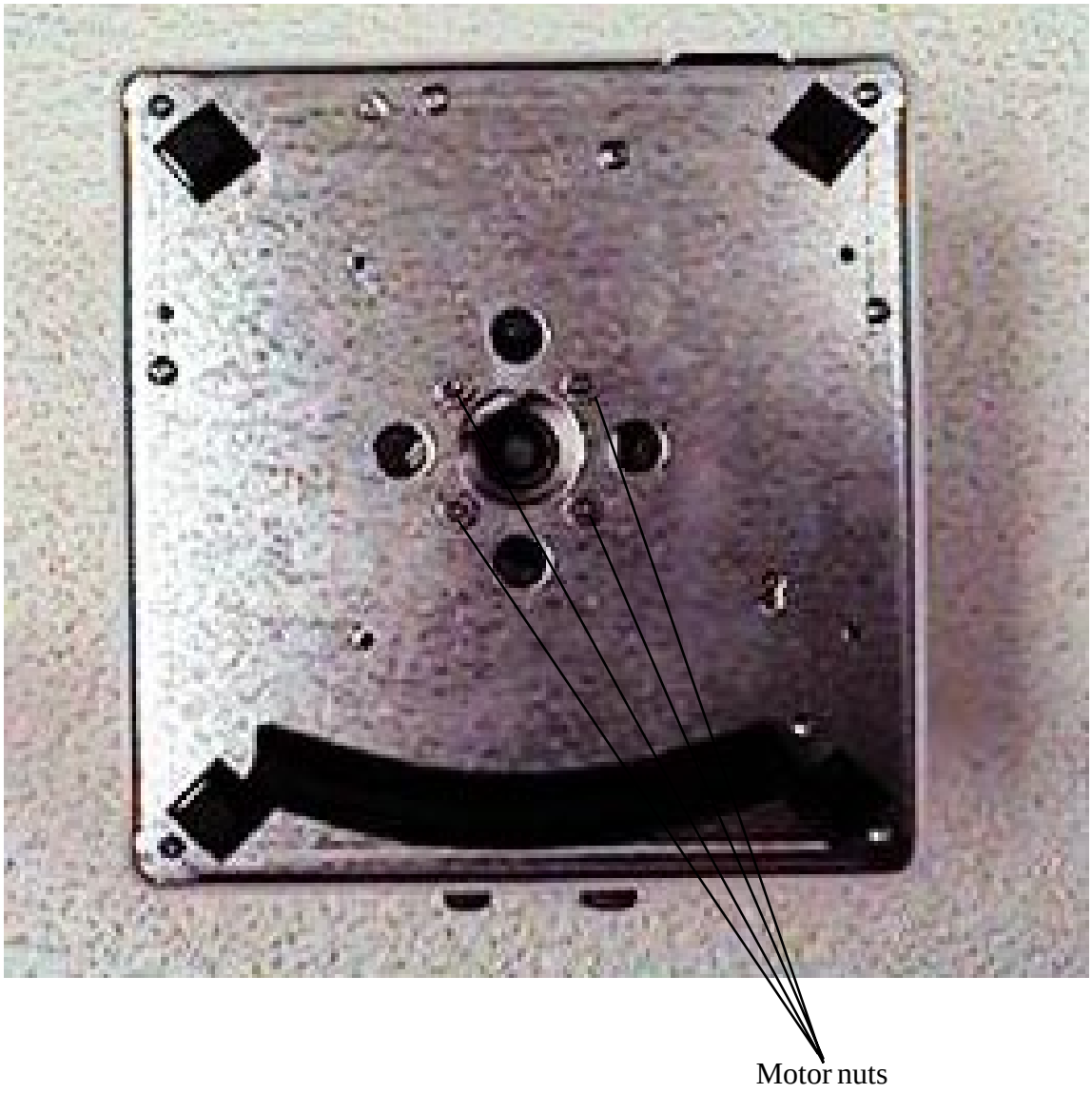


Figure 6
Location of PCB and its mounts

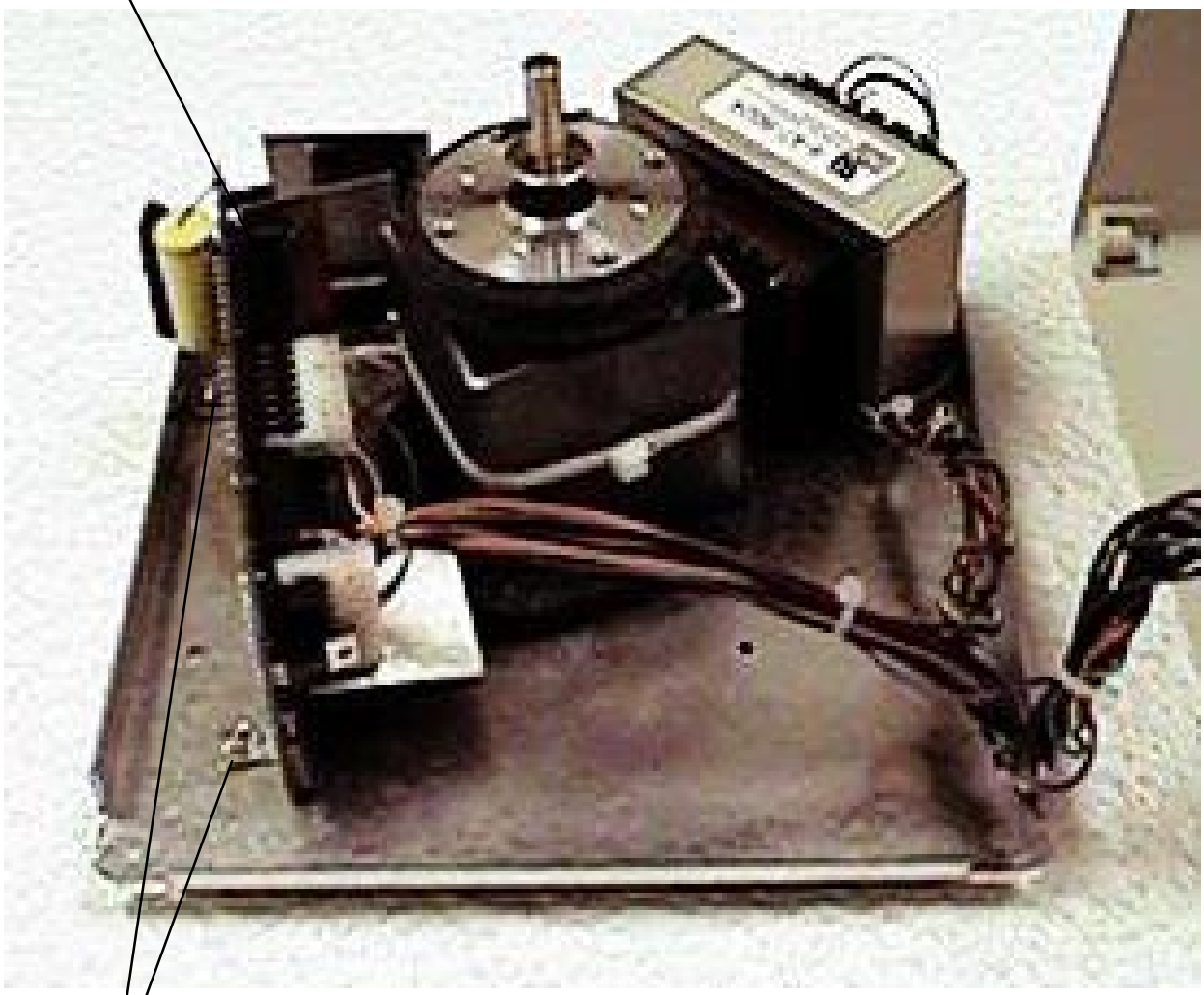


Figure 7
View of front control panel electronics

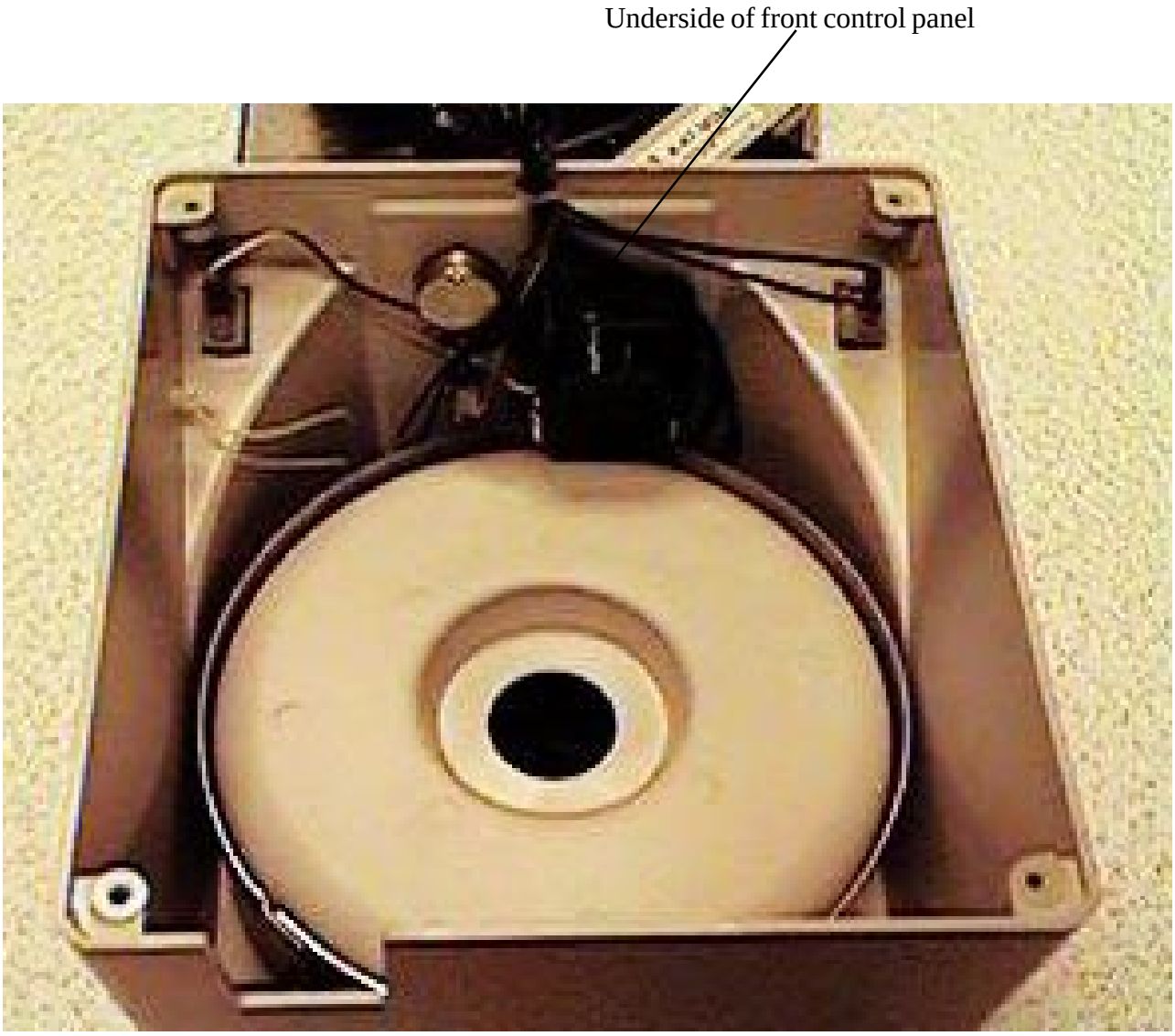
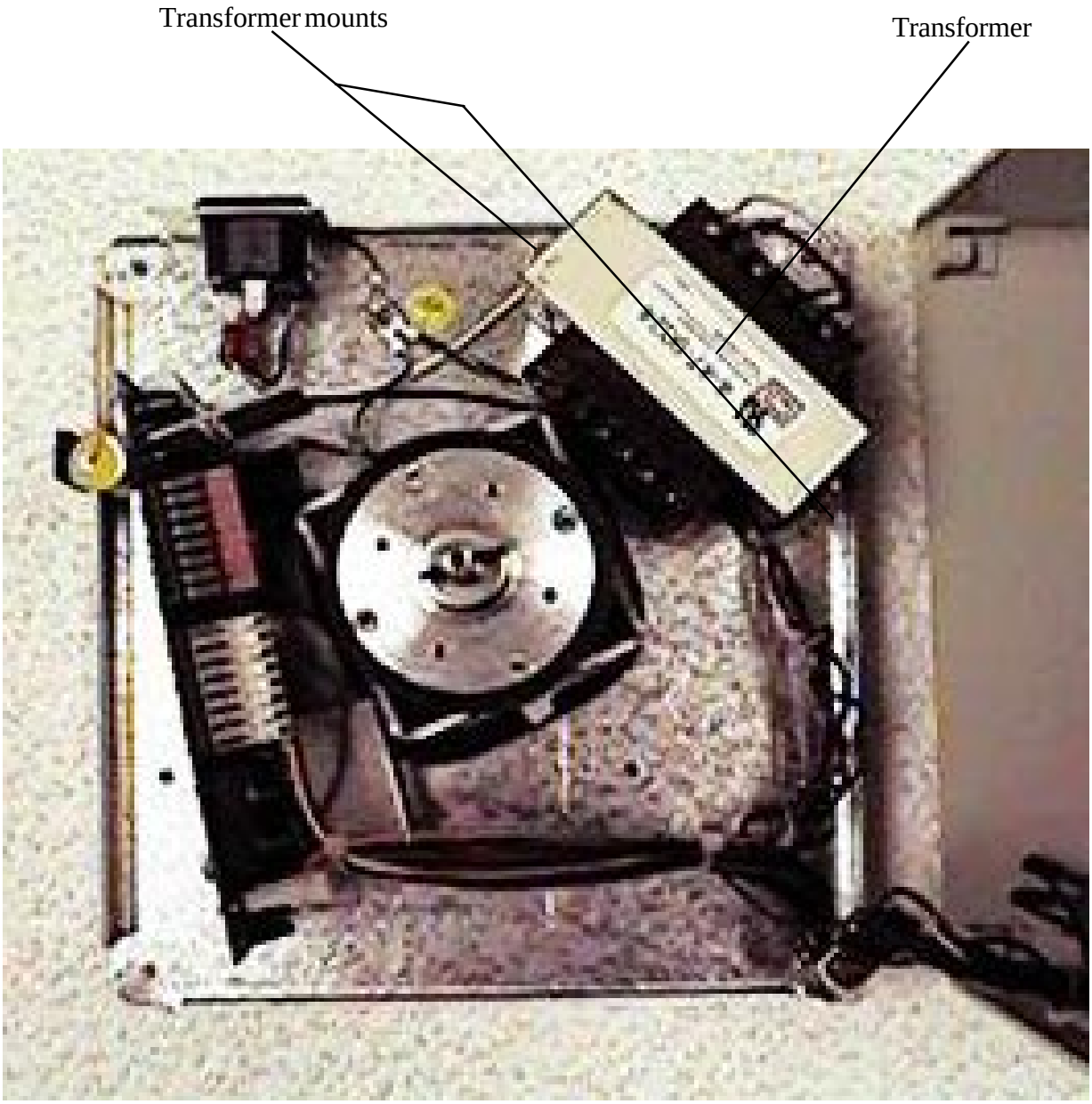


Figure 8
Location of transformer and transformer mounts



Spare Parts

Catalog #	Description	Price
C0160-CB	Circuit board	$270.00
C0160-E	Motor, complete	295.00
C-0160-F	Feet, set of 4	12.00
C0160-FUSE	Fuse, 2.5amp (120V version)	1.75
C0160-FUSE1	Fuse, 1.25amp (230V version)	1.75
C0160-I	Isolator	3.00
C0160-LB	Centrifuge lid, Blue	80.00
C0160-LG	Centrifuge lid, Grey	80.00
C0160-LL	Lid latch	48.00
C0160-LP	Centrifuge lid, Purple	80.00
C-0160-LR	Centrifuge lid, Red	80.00
C0160-LT	Centrifuge lid, Teal	80.00
C0160-MS	Momentary switch	6.00
C0160-RC1	Rotor cover and clasp	30.00
C0160-SK	Speed knob	6.00
C0160-TF	Transformer	50.00
C0160-TK	Timer knob	6.00
C0230-T30	Timer, 30 minute	73.00
C02300-P2	Motor crosspin	3.00
C1236-M	Rotor screw	3.00

Please specify serial number when ordering parts.

Prices effective May 1999. Subject to change without notice.

Schematics and drawings

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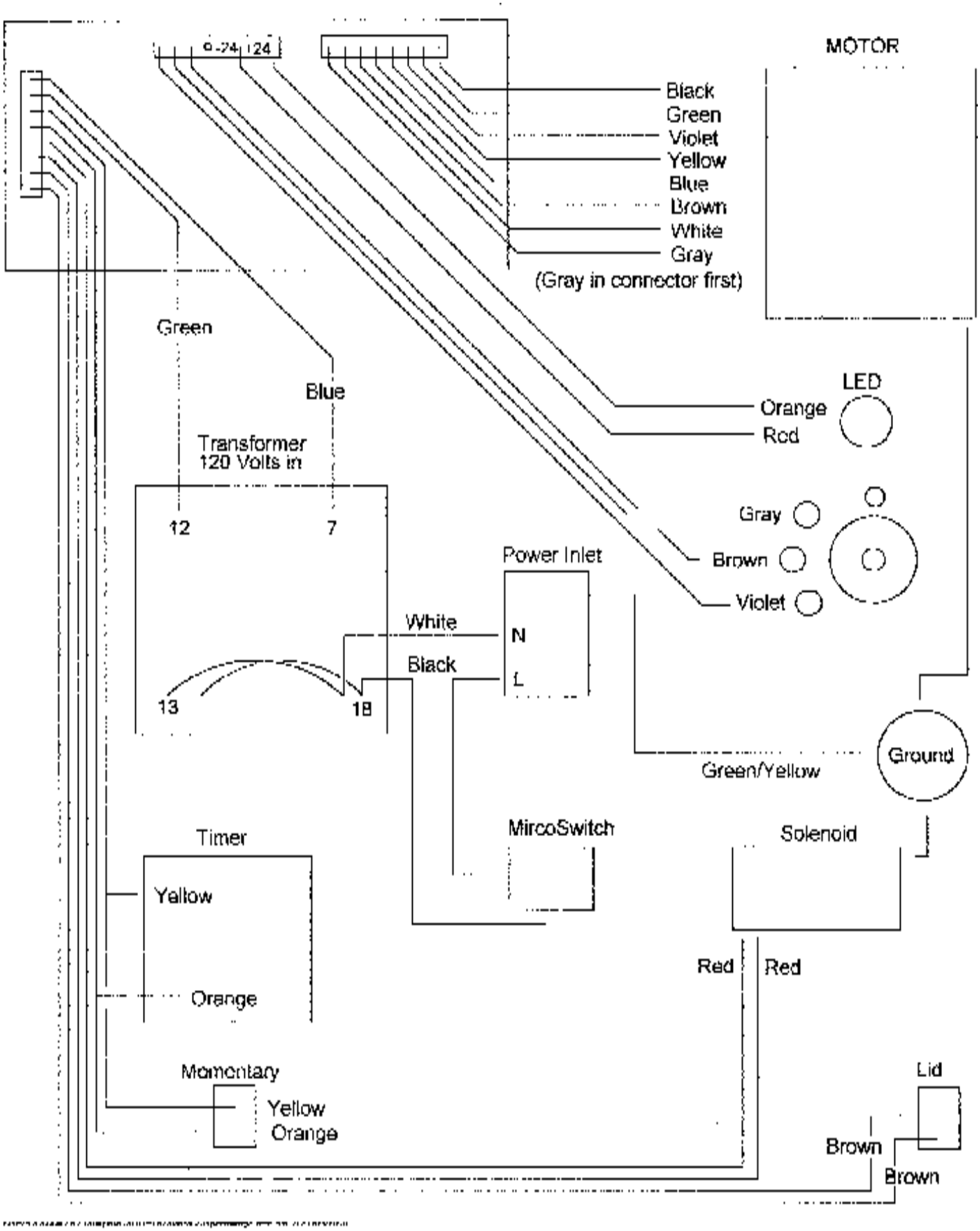
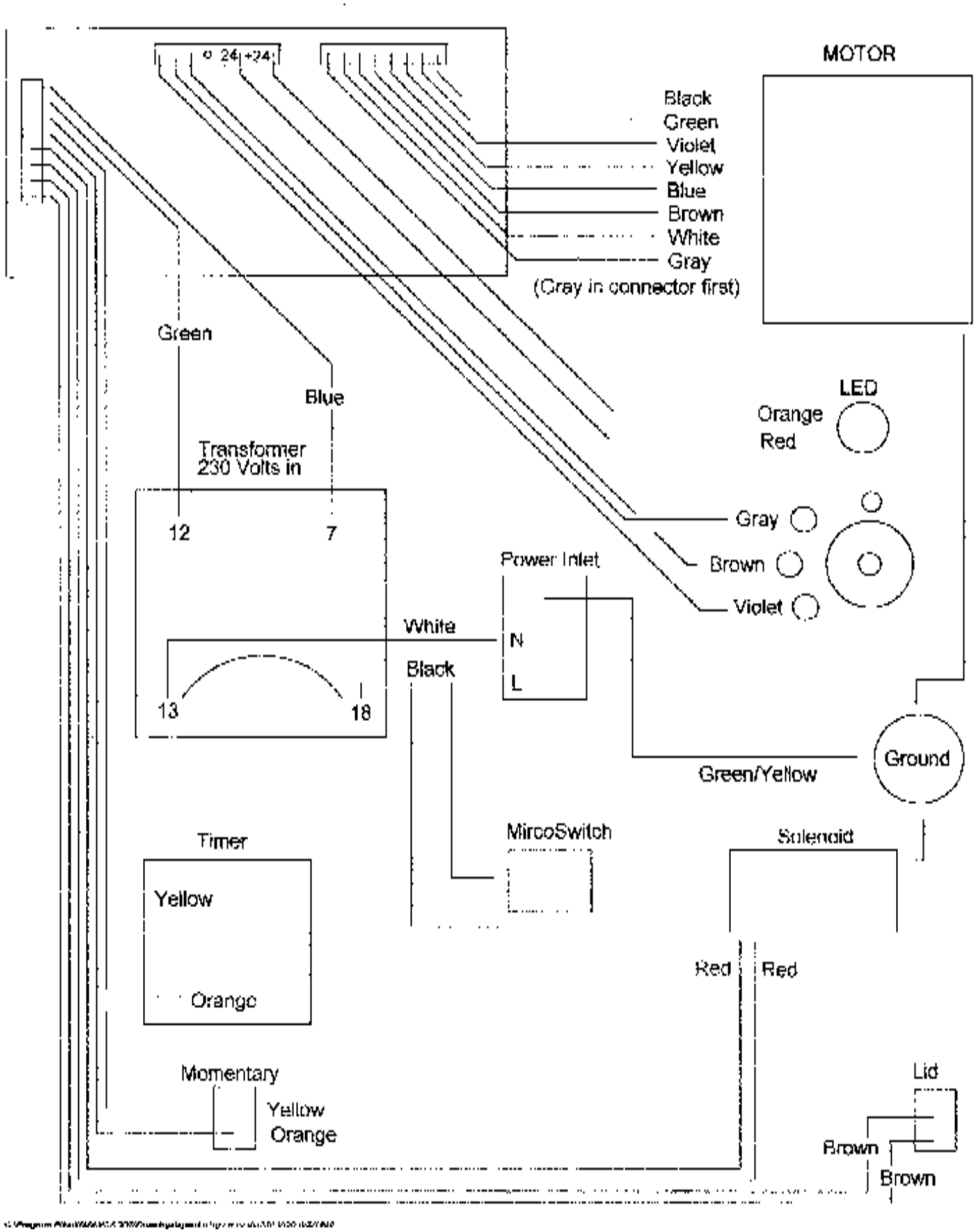
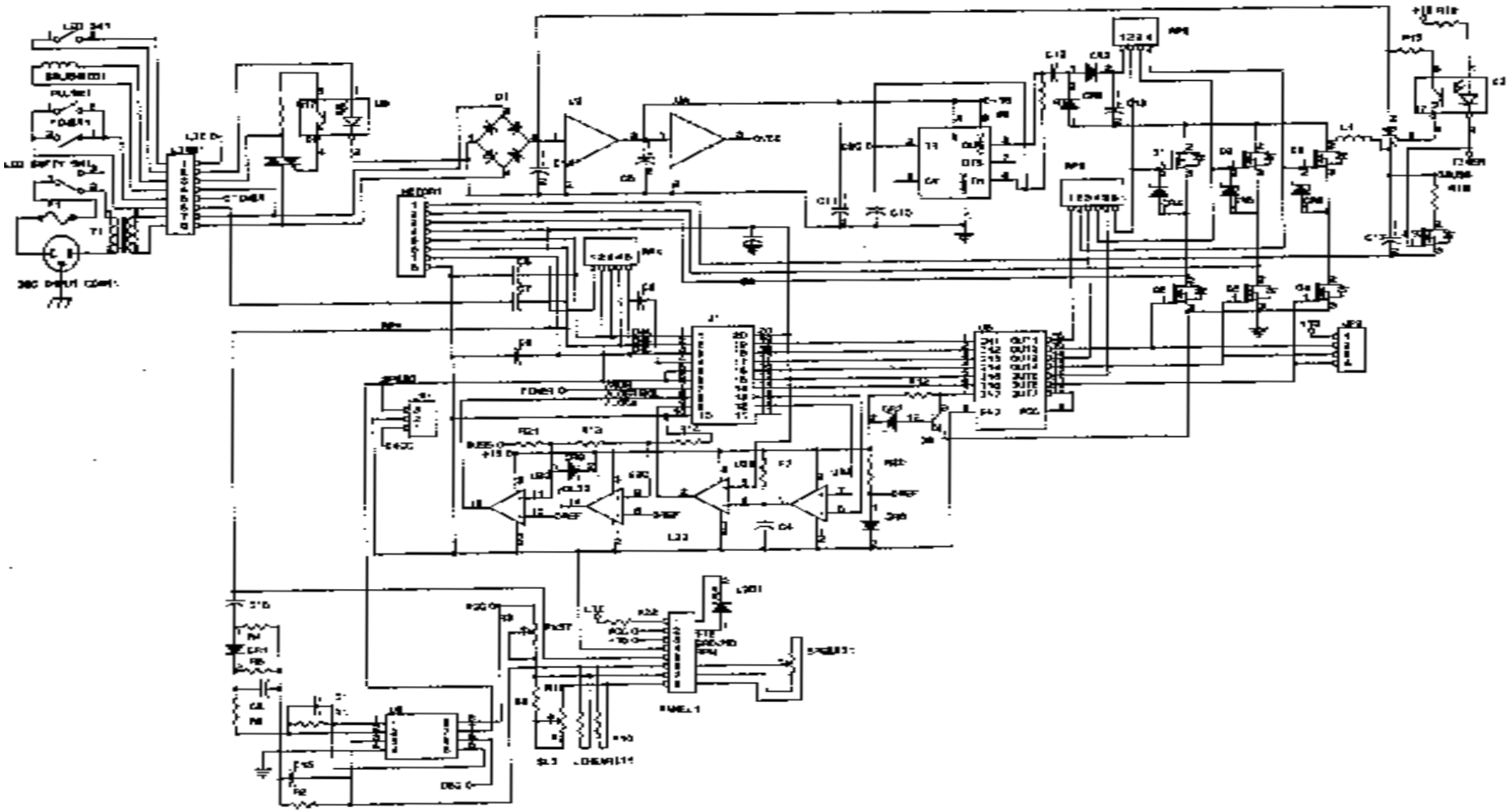
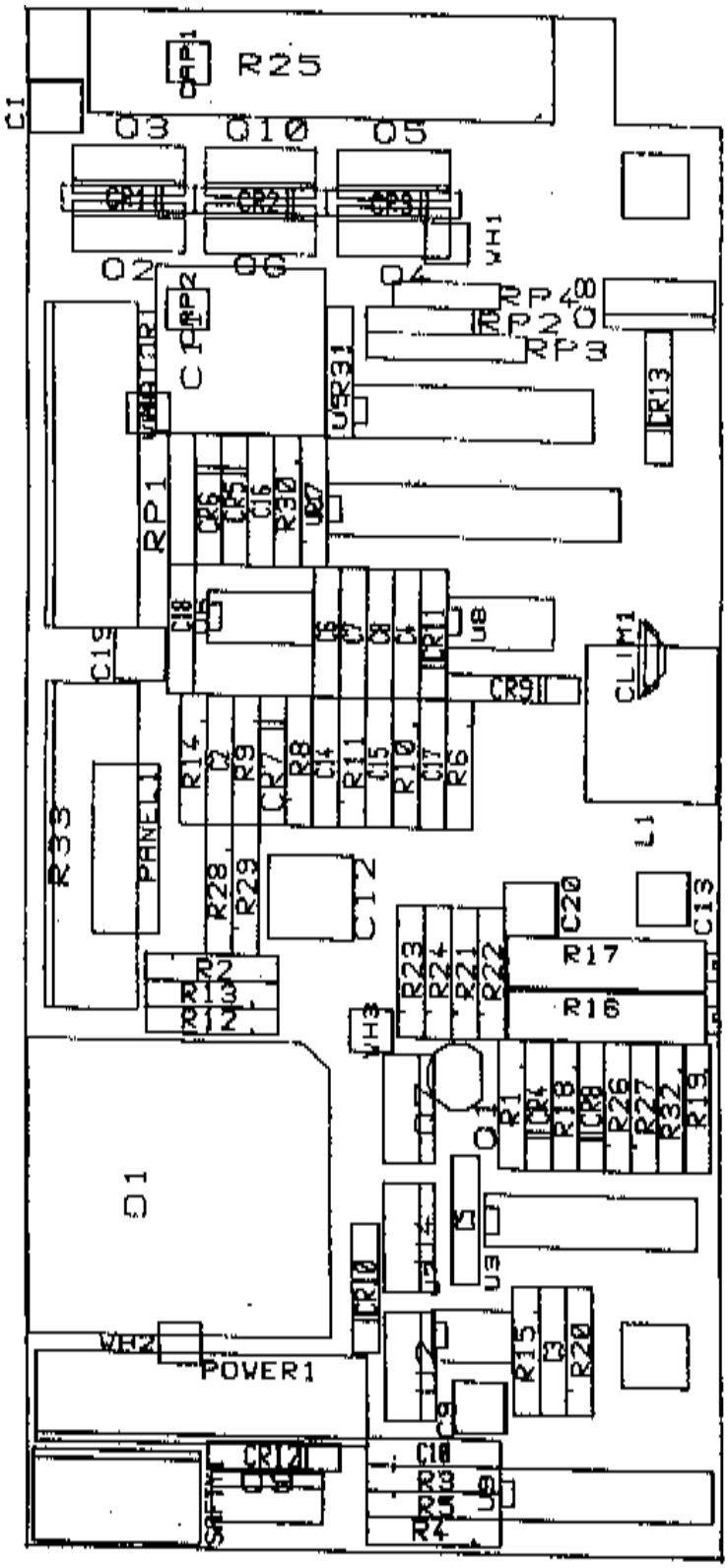


Wiring Diagram - 120V



Wiring Diagram - 230V




R25
Q3
Q10
Q5
Q2
Q6
Q4
WH1
RP4
RP2
RP3
C1
RP1
USR31
CR13
C18
C19
U8
CR9
CLK1
R14
R9
CR7
R8
R11
R10
R6
R33
PANEL1
R28
R29
CT2
L1
C20
C13
R17
R16
R23
R24
R21
R22
WH3
Q7
Q1
R1
CR4
R18
CR8
R26
R27
R32
R19
Q1
U3
CR10
R15
R20
WH2
POWER1
CR12
C16
R3
U5
R4

Control Board Reference

Reference	Part
C1, C9, C19, C20	NIC NRSA 100 M 35V 5X11 TR
C2, C4, C6, C7, C8, C10, C18	NIC NCMA10 Z5U 103 M 100 TR
C3, C14, C16, C17	NIC NCMA30 Z5U 105 M 50 TR
C5	NIC NCMA20 Z5U 104 M 50 TR
C11	NIC NRSA 222 50V 18X36 TR
C12	NIC NRSA 101 50V 8X11.5 TR
C13	NIC NRSA 330 35V 5X11 TR
C15	CAP NOT NEEDED
C21	NIC NRM 105 K 100
CAP1, CAP2	EXT
CLIM1	MELEXIS US5881UA NON-LATCHED HALL SENSOR
CR1, CR2, CR3	P6KE15CA
CR4	1N5240B
CR5, CR6, CR7, CR8, CR9, CR10, CR11, CR12, CR13	DIODE UF4002
D1	GBPC2501W
F1	REAR PANEL FUSE 2 AMP
IEC INPUT CONN1	REAR PANEL LINE CONN.
L1	5 TURNS ON TORROID
LED1	FRONT PANEL LED
LID SAFTY SW1	LID SAFTY SW.
LID SW1	FRONT PANEL LID OPEN SW.
MOTOR1, PANEL1, POWER1	MOLEX 26-48-1086
PULSE1	FRONT PANEL PULSE SW.
Q1	2N7000
Q2, Q3, Q4, Q5, Q6, Q10	IRFZ46n
Q7	TECOR S2015L
Q8, Q9	IRFZ34N
R1, R19, R29	4.7K 1/4W 5%
R2	470 OHM 1/4W 5%
R3, R4, R9, R11	10K 1/4W 5%
R5	390 OHM 1/4W 5%
R6	47K 1/4W 5%
R7, R26, R28	100K 1/4W 5%
R8	1MEG 1/4W 5%
R10	2.2 MEG 1/4W 5%
R12	39K 1/4W 5%
R13	NOT USED
R14, R24	1.5K 1/4W 5%
R15	1K 1/4W 5%
R16, R17	3006P-102 BOURNS
R18	180K 1/4W 5%
R20, R30	3.3K 1/4W 5%
R21	2K 1/4W 5%
R22	200 OHM 1/4W 5%
R23	820 OHM 1/4W 5%
R25	1 OHM 10W 5%
R27	68K 1/4W 5%
R31	82 OHM 1/4W 5%
R32	82 OHM 1/4W 5%
R33	130 OHM 1W
RP1	BUSSBOURNS 4605-101-102
RP2	BOURNS 4604-101-103
RP3	BOURNS 4606-102-681
RP4	BOURNS 4604-101-272

Control Board Reference - continued

Reference	Part
SAFTY1	HEADER 4 PIN NOT USED
SOLENOID1	LID OPEN SOLENOID 24 VAC
SPEED1	FRONT PANEL POT 100K
T1	TRANSFORMER
TIMER1	FRONT PANEL TIMER SW.
U1	ATF16V8BQL-25PC
U2	LM7815T
U3	LM339CN
U4	LM7805T
U5	ULN2003N
U6	LM555CN
U7	MOC3010
U8	MAX954EPA
U9	CD4093BCN
WH1, WH2, WH3, WH4	PAD