ALHART

ENTERPRISES

PRESENTS

THE

RANA

SYSTEMS 1000

REPAIR GUIDE

by: Paul V. Alhart

INTRODUCTION

You can't tell a book by its cover and that holds true for Rana
Systems 1000 disk drives as well. At first glance they all look the
same, but upon close inspection you will find that no two are exactly
alike. Rana bought their drive mechanisms from outside vendors. Some
of the early model runs used "No Name" drives from Japan. These
generally have lever operated disk doors (like the Rana pictured on
the box your drive came in). Later Ranas used MPI drives. These have
the spring loaded disk eject (you either love it or hate it). MPI
continued to upgrade their drives over the years, so even though
virtually all Ranas used the MPI drives you will still find variations
among them too. Rana appears to have stuck with their original
Drive/Controller Board to the end though. There were a few hand-wired
changes along the way, but the board layout remained unchanged. Best
of all, the board uses all "off the shelf" parts. The only SPECIAL
chip is the Operating System ROM. The O/S ROM can be copied to a 2732A
EPROM though, which is readily available. I have never come across a
bad Rana O/S ROM, but you may want to get yours backed-up just for
peace of mind.

Although Rana made what I feel is the best floppy drive available
for the 8-bit Atari they are no longer around to support you. Come to
think of it, they weren't much support when they were around were
they? That may have something to do with why they are no longer
around. After over a year of badgering Rana with letters, phone calls,
and visits to their factory, I got them to sell me their service kit
(complete with unreadable 15th generation photo-copies of the
Drive/Controller schematic). All the Rana dealers I talked to said
they never even got that much. Shortly after that, Rana was gone. I
have since drawn my own schematics of the Rana Drive/Controller using
all of the original mnemonics that were legible from the Rana prints.
As far as I know these are the only schematics available for the Rana
Drive from any source.

I have repaired and modified hundreds of Ranas with the help of
these schematics and have learned a lot about Rana disk drives in the
process. In this guide I will attempt to pass on to you what I have
learned. With this information and the schematics of the Rana
Drive/Controller Board you should be well on your way to many years of
being a satisfied Rana owner.

As I mentioned, each Rana is a little different from the next. I
believe this guide covers all the possible combinations. Should you
have one that is unique or just presents a special problem, feel free
to write for help or to just let me know. I will be glad to help in
any way I can.

ADDENDUM

ADDITION

At the top of page 5 (ELECTRICAL ALIGNMENT) add the following note.
NOTE: All four rear panel DIP Switches should be OFF (down position) before proceeding with the Electrical Alignment.

CORRECTION

On the Drive/Controller schematic (sheet 2 of 2) make the following corrections:
U10-1 should go to U7-9
U10-13 should go to U7-8

WRITE LIGHT MOD

A WRITE LIGHT similar to the one used on TRAK drives can be added to your RANA. This light will only light when data is actually being written to the disk. You might be surprised at how little time is actually required to write data to the disk.

Remove the drive mechanism and PCB from the chassis (see GOING INSIDE). Connect an LED in series with a 330Ω ½Watt resistor between +5 volts (VR2-2) and U7-8. The cathode, which is the longest lead of the LED, should be towards the U7-8 connection. The LED can be mounted wherever you choose.

An alternate method is to convert the POWER indicator to be a WRITE LIGHT indicator. To do this J8 will have to be unsoldered and removed from the PCB. Cut the two ground traces going to J8-11. Make sure that J8-11 is completely isolated from ground, replace J8 and connect a jumper wire between J8-11 and U7-8. To make the LED a little brighter and easier to see through the front panel, replace R1 (330Ω) with a 160Ω resistor. R1 is located on the front panel display PCB.

REPLACEMENT PARTS

DRIVE MOTOR (same as used in Atari 1050 with Tandon drive)
Atari P/N: FC100520

HEAD STEPPER MOTOR (same as used in Atari 1050 with Tandon drive)
Atari P/N: CB101145

HEAD BAND ASSY. (same as used in Atari 810 with MPI drive)
Atari P/N: FA100034

One source for all of the above parts is BEST Electronics. Call or write for a copy of their complete parts catalog.

BEST Electronics
2021 The Alameda, Suite 290
San Jose, Ca. 95126
(408) 243-6950›

Table of Contents

NOTE:
[ ] indicate parts located on the Drive/Controller PCB. ex. [R16]

< > reference items shown on the Drive Mechanism Illustration
    ex. READ/WRITE HEAD <9>

GOING INSIDE

Inside your Rana are many delicate and precision parts. BE GENTLE! To get inside your Rana, first disconnect the power and I/O cables. Turn the unit over and remove the four screws holding the cover. Remove the two screws holding the rear panel. Remove the rear panel and slide the cover to the rear and off the drive unit.

To remove the drive mechanism, first note the orientation of the three connecters going to [J2] of the PCB (printed circuit board) at the right-rear of the drive. Unplug these three connecters. Remove the four screws that hold the drive in the chassis (two in each side). Remove the two screws that hold the front panel to the chassis. Do not pull on the front panel as it is still connected to the PCB by a mylar ribbon cable that could easily be torn. Carefully tilt the front panel forward and lift the drive mechanism out of the chassis just far enough to expose the head connecter [J3] located on the center-right edge of the PCB. NEVER lift the drive by the head assembly <4>. Unplug this connecter and remove the drive. Carefully unplug the front panel from [J4] of the PCB.

To remove the PCB from the chassis, remove the four screws located in the corners of the PCB and the two screws holding the regulators (VR1 & VR2) to the chassis.

The drive has to be operated out of the chassis to gain access to the PCB. This is more easily done if extension cables are made for the three connecters that plug into [J2]. Use a 12" to 18" piece of ribbon cable. Wire-Wrap IC sockets can be used for connecters at the ends of the cable. Do not extend the head cable [J3] or electrical noise could hamper your adjustments.

Do not operate the drive with the PCB removed from the chassis. The chassis is used as a heat sink for the two voltage regulators [VR1 & VR2].

LUBRICATION

Do not get lubrication anywhere it might transfer to the disk or head. The stepper and drive motors are sealed and require no lubrication. On MPI drives a drop of light oil applied to the door latch will make its' operation smoother. A thin film of heavy grease on the head guide rails <5> will help dampen head movement and yield more reliable disk formatting, (see TRACK 0).

CLEANING

Many problems can be solved simply by cleaning. Head cleaning disks
are not always effective. The best way to clean your drive is with
cotton swabs and alcohol. Isopropyl alcohol is preferred to commercial
audio head cleaning solvents as these solvents may soften the epoxy
material used to hold your drives' head in alignment.
Remove the cover from the drive unit, (see GOING INSIDE). Blow out any
loose dust. Dust accumulation on the write protect photo sensor <14>
can cause it to think a disk is protected when it is not and keep the
drive from writing to the disk.

Moisten a clean swab with alcohol and shake off the excess. We want it
moist but not soggy. Carefully lift the head load pad assembly <6> so
you can get to the head <9> below. Do not force it. Wipe off the face
of the head with the swab. Inspect the swab for any signs of dirt or
oxide (usually rust colored). Discard the used swab and repeat till
you get no more dirt. Never reuse a swab as this will contaminate your
alcohol. Wait until all the alcohol has dried from the head before
inserting a disk or the alcohol will lift oxide and dirt off the disk
and put it right back on the head.

With a dry swab wipe off the head guide rails <5>. Do not touch the
"taut band" that is used to position the head assembly. It will tear
easily if nicked or bent.

SPEED

Rana, like all Atari compatible drives, spins the disk at 288 RPM. The
speed is adjusted with [R5] located on the right rear edge of the PCB.
For fine adjustment a Disk Speed utility is required. SmartDOS and
MyDOS include speed utilities and there are several stand-alone
programs like "SNAIL" that will check your drive's speed. Turn [R5] CW
to increase disk speed and CCW to decrease.

There is a Strobe Disk on the bottom of the disk spindle, but since it
is calibrated to the 300 RPM standard it is of little use except to
"rough set" the speed during initial set up. The drive mechanism will
have to be removed from the chassis to use the Strobe Disk, (see GOING
INSIDE). Put a scratch disk in the drive and turn the drive mechanism
upside down on the bench. Reconnect the drive cables to the PCB and
turn on the power. Using the Strobe Disk adjust [R5] for a speed of
300 RPM (strobes appear stationary). Then turn [R5] CCW until the
strobes just start moving. (about ¼ turn)

Head alignment is critical to the operation of your Rana. You will
need an oscilloscope, an alignment disk and software that will allow
you to READ from a specific sector or track. Alignment disks are
expensive and not readily available so you may have to fudge a little
here. A disk formatted on a KNOWN GOOD drive will generally give
acceptable results. Commercial software disks are also a good bet. I
recommend using SmartDOS (available from Astra Systems) because it
meets the above software requirements and has a Disk Speed utility
built in.

With the drive mechanism removed from the chassis and connected to the
PCB, (see GOING INSIDE), connect the drive to your computer. Connect
the scope to either side of [L5], located just forward of center on
the PCB. Connect the scope ground lead to the PCB [GROUND TP] located
near the edge of the PCB just forward of [R16]. Mount the front panel
back on to the chassis and plug its' ribbon cable back into [J4].

TRACK 0 ALIGNMENT

Track 0 is the reference your Rana uses to find all the other tracks
on the disk. It locates Track 0 when the drive is first powered on and
at the beginning of Format operations by running the head against the
Track 0 STOP. To be sure that the head made it all the way to the
STOP, several more pulses than are normally required are sent to the
head positioning motor. This causes the head carriage assembly <4> to
repeatedly bang up against the STOP and is what makes the "machine
gun"sound you hear at power up or when you Format a disk. The Rana
Drive/Controller does not apply a hold voltage to the stepper motor
after it positions the head and this is the reason for one of the most
common problems with the Rana's operation. The head carriage assembly
can literally bounce off the Track 0 STOP and come to rest on Track 1.
This usually shows up when you try to Format a disk and it takes two
or three tries to finally get a good Format. If the "bounce" occurs at
power up the drive will give you nothing but BOOT-ERRORs. I have found
that a thin film of heavy grease (automotive chassis lube or wheel
bearing grease) applied to the head carriage guide rails <5> will
effectively dampen this bounce and eliminate the problem. A side
benefit is that the "machine gun" will be much quieter. Be careful not
to get any grease where it might get transferred to the head or to a
disk.

There are two types of Track 0 STOPs found on Ranas. Earlier drives
have a pin <12> in the head positioning taut band pulley <11>. The pin
bangs up against an adjustable metal plate which acts as the STOP. On
later models there is an adjustable Set-Screw <13> located in the
pillow block <8> at the rear of the head guide rail assembly. The head
assembly bangs up against this Set-Screw STOP. The "Plate" STOP can be
very frustrating to adjust as it always seems to move when you are
tightening up the screw to lock it in place. I recommend that you
remove and discard the plate, carefully drill and tap the guide rail
pillow block, and install a Set-Screw. You will then have the updated
(much easier to adjust) Track 0 STOP. Be sure to keep the drillings
out of the drive and off the PCB.

Turn on power and BOOT the system. If your drive will not READ you
will need another drive to BOOT the system with first. Insert the
"Alignment" disk and direct the drive to READ continuously from Track
0. This is easily accomplished by running the Speed utility from
SmartDOS. When the head is actually at Track 0 you should hear the
familiar "Beep-Beep" from your monitors' speaker. With your finger,
gently push the head assembly back against the Track 0 STOP. When the
STOP is set correctly the signal amplitude seen on the scope should
decrease by about 30% from maximum with the head assembly against the
STOP. Find the maximum by moving the head assembly back and forth
slightly with your finger. Adjust the Track 0 STOP accordingly.

HEAD CARRIAGE ALIGNMENT

For this adjustment the head stepper motor is moved to align the head
<9> to the center of the individual tracks on the "Alignment" disk. If
not centered, the head output will be low and operation of READ/WRITE
operations will not be reliable. Compatability of this drive to other
drives will be affected as well.
With the scope still connected to [L5], cause the drive to READ from
the alignment disk. This can be accomplished by using the TEST SECTORS
utility from SmartDOS or by using the "d1" diagnostic built into your
Rana and accessed through the rear panel dip-switches.
Loosen the stepper motor mounting screws so that they are just finger
tight. Move the motor back and forth slightly and note the maximum
output obtained. Position the motor for the maximum output and tighten
the motor mounting screws. Recheck after tightening the screws.

HEAD PRESSURE

As on most floppy drives, head pressure is set by a spring that
applies downward pressure to the head load pad assembly <6> which in
turn flexes the disk down against the head <9>. Although the spring is
non-adjustable, there are a couple of other things that can affect
head pressure.

On some Ranas there is a set-screw <10> located in the head load pad
lifter arm <7>. This set-screw should be set so that when the head is
loaded on a disk the set-screw just clears the contact area beneath.
Check this clearance for the entire travel of the head assembly. If
the set-screw touches at any point it will tend to lift the head
causing head pressure to drop and disk to head contact to become
unreliable.

Also affecting head pressure is the head load pad itself. The pad
material can take a set, become compressed, worn, or even torn with
use. In many cases rotating the pad 90° is all that is required. If the
pad is torn it will have to be replaced. It just snaps into place and
can be removed for inspection or replacement by gently pushing it out
from above. These pads can be found at most disk drive service centers
as either just the material that will self-stick on to the old pad
holder or as the whole snap-in pad assembly.

4

ELECTRICAL ALIGNMENT

Electrical Alignment of the Drive/Controller requires an oscilloscope, a blank scratch disk formatted in single density, and a short clip lead jumper. With the drive mechanism removed from the chassis and connected to the PCB, (see GOING INSIDE), connect a short clip lead jumper between the two test-pins located on the PCB just forward of [R16]. This will place a GROUND on [U4-6]. The test-pin nearest the edge of the PCB is GROUND. Insert the scratch disk into the drive and turn on power. "AL" will be displayed on the front panel and the drive motor will run continuously as long as power is applied. Refer to the Waveform Diagrams for the following adjustments.

DATA PULSE WIDTH

Connect the scope to [TP-1]. Adjust [R16] for a pulse width of 1μ sec.

PRE COMPENSATION

Connect the scope to [TP-4]. Adjust [R15] for a pulse width of 0.15μ sec.

VOLTAGE CAPACITY OSCILLATOR (VCO)

Connect the scope to [TP-5]. Adjust [C4] for a symmetrical square wave that is 7.6μ sec. per cycle. (The positive and negative going portions of the cycle should each be 3.8μ sec. in duration.)
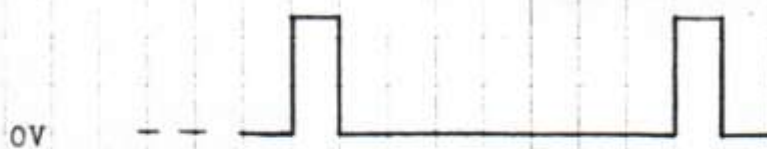
READ CHANNEL

Connect the scope to [TP-2]. Adjust [R40] for the waveform shown in the diagram. The negative going pulse width should be 0.5μ sec. and the time of one complete cycle should be 4μ sec.

READ CHANNEL SYMMETRY

Connect the scope to [U8-10]. Adjust [R57] for minimum jitter. The jitter will be seen on the rise and fall of the second displayed pulse when the display is in sync.

Turn off power and remove the clip lead jumper.

OV — — ⎍   ⎍   TP-1 Adj. R16
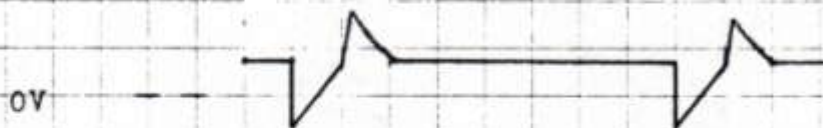lu sec./cm

OV — —   TP-4 Adj R15
0.05u sec./cm

OV — —   TP-5 Adj. C4
lu sec./cm

OV — —   TP-2 Adj. R40
0.5u sec./cm

Jitter   U8-10 Adj. R57
0.5u sec./cm

OV — —

The following are factory updates to the original drive/controller PCB.

Cut the copper etch on the PCB as follows:
(1) U10-1 to U6-13 & U11-13
(2) U10-13 to U6-12 & RN4-4
(3) U7-9 to U16-4
(4) U3-1 to U3-40

Run jumpers on the PCB as follows:

(1) U7-9 to U10-1
(2) U7-8 to U10-13
(3) U3-1 to U13-38

Replace components on the PCB as follows:

	OLD	NEW
R47	100k	47K
R27	1K	1.2K-1%
C32	.022µf	.1µf
R33	2Ω	.5Ω or short jumper

The replacement of C32 & R33 will give your drive much better speed regulation over a wider range of operating loads.

WRITE PROTECT DEFAULT

When your RANA is first powered on it will default to the Unprotected
mode. The front panel PROTECT light will be OFF. If you would like
your drive to default to the Protected mode at power up, (PROTECT
light ON) cut PCB [JUMPER 1] at B-C. Connect a new jumper at A-B.
[JUMPER 1] is located component side of the PCB near U6.

WRITE PROTECT PHOTO SENSOR DEFEAT

The WRITE PROTECT Photo Sensor Circuit can be disabled by cutting PCB
[JUMPER 3]. [JUMPER 3] is located on the component side of the PCB
between U5 & U6 and connects to U6-4. This will allow you to WRITE to
the backside of disks without having to notch the disks. The front
panel PROTECT switch will still function normally. A switch added
across the cut [JUMPER 3] will let you switch back and forth between
NORMAL and DEFEAT operation. I have found that mounting a switch so
that it just protrudes through a vent hole in the cover will keep it
hidden from the kids as well as out of the way.
To add the switch: Scribe a line on the chassis through the second
vent hole (counting from the rear) in the top row of vent holes on
the right side of the unit. Remove the cover. Remove the drive
mechanism and PCB from the chassis, (see GOING INSIDE). Scribe a
second line, crossing the first, ¼" down from the top of the chassis.
Drill a ¼" hole at the intersection of the two lines. Cut PCB [JUMPER
3] and solder a 6" piece of wire to each side of the cut jumper.
Solder the other ends of these wires to a Submini SPST switch (such as
a Radio Shack #275-612). Reinstall the PCB into the chassis. Mount the
switch in the drilled hole so that up is DEFEAT and down is NORMAL.
When The unit is assembled the switch should protrude from the vent
hole when in the DEFEAT mode and be almost undetectable when in the
NORMAL mode.

FRONT PANEL POWER SWITCH

The power switch is usually the first thing to give trouble on a RANA.
It is supported only by its' leads and tends to break apart from
normal use. A little RTV forced between the switch body and the PCB
will add needed support to the switch. If your switch breaks or (like
me) you would prefer to have it up front, read on. The RANA Logo
symbol located on the left-front face of the drive mechanism is held
on by rubber cement. Peal it off and you will find a pre-drilled
switch mounting hole beneath. Stick the Logo back on the right side
and install a Mini Push ON/Push OFF switch, (such as Radio Shack
#275-1555), in this hole. Connect the switch in parallel to or in
place of the rear panel power switch. Route the wires so they do not
interfere with the operation of the drive motors or head assembly
movement.

DISK EJECT SPRING

Sooner or later drives with the spring loaded disk eject mechanism
will fail to eject disks due to a broken eject spring <1>. When this
happens you should IMMEDIATELY TURN OFF THE POWER. Your first priority
is to find and remove the broken piece of spring BEFORE it falls onto
the PCB and causes smoke,fire, and destruction to the Drive/Controller
PCB. That being done, run down to your local hardware store and pick
up a ¼" Molly Bolt. The spring used in the Molly Bolt is just the size
you need. Pry the Molly Bolt nut assembly apart and remove the spring.
Remove the screw, washer, and the remains of your broken spring from
the Eject Arm Pivot Post <3>. Install your new spring using the coils
of the broken spring as a "spacer" and reinstall the screw and washer.

DRIVE MOTOR EMI (ELECTRO-MAGNETIC INTERFERENCE)

This common and hard to diagnose problem is found in many of the early
RANAS with belt driven spindles using "Minebea" or "No-Name" drive
motors. Its' symptoms include:

Won't FORMAT - Won't READ - READS INTERMITTENTLY - ERRORS 1 & 8 (read
on front panel LED digits) - Disk SPEED seems to wander.

In many cases the problem will go away altogether or be greatly
reduced if the cover is removed from the drive unit. The Rana people
discovered this and switched to Copal drive motors which have better
shielding for reduced EMI. About 75% of the drives with this problem
can be SAVED by tightly wrapping the drive motor with 3 or 4 layers of
aluminium foil. This will act as an EMI shield around the motor. Don't
let any foil touch or fall onto the PCB. Wrap the foil with tape just
to be sure.
If the foil shield does not solve the problem, the drive motor will
have to be replaced. The direct replacement Copal part number is
LC-177J. This model may be hard to locate. Not to worry. Atari to the
rescue. The Atari 1050 Disk Drive (with Tandon drive mechanism) uses a
Copal motor also. It carries a Copal part number of LC-177E. (Atari
part number FC100520). The Indus GT drive uses this motor as well.
This is exactly the same motor but the motor leads are reversed at the
connecter. Swap the red & blue leads at the connecter before
installation or your disks will be spun backwards.

NOTE: The pan-cake style head stepper motor used in the Atari/Tandon
1050 Drive can be used in the Rana/MPI Drive as well. CHECK the
connecter wiring before installation.

PARTS LIST

```
CR1-CR3     1N4150
CR4         1N5400
CR5         1N914
CR6-CR10    1N5400

F1-F2       J175

Q1-Q3       2N3904           NPN
Q4-Q6       2N3906           PNP
Q7          TIP 110          NPN
Q8          MPS U51          PNP
Q9-Q10      2N3906           PNP

U1          555C             TIMER
U2          7406 or 74LS05   HEX INVERTER-OPEN COLLECTOR
U3          2797             FLOPPY DISK FORMATTER/CONTROLLER
U4          8031             8-BIT MCU
U5          ULN2003          HIGH CURRENT DRIVER
U6          74LS05           HEX INVERTER-OPEN COLLECTOR
U7          74LS74           DUAL D-TYPE +EDGE TRIGGERED FLIP-FLOP
U8          MC3470           FLOPPY DISK READ AMPLIFER
U9          LM2917           FREQUENCY TO VOLTAGE CONVERTER
U10         74LS26           QUAD 2-INPUT POSITIVE NAND GATE
U11         74LS367          HEX BUS DRIVER
U12         2732A            32K ROM (RANA OPERATING SYSTEM)
U13         8155             2K STATIC RAM & I/O
U14         ULN2003          HIGH CURRENT DRIVER
U15         7406 or 74LS05   HEX INVERTER-OPEN COLLECTOR
U16         74LS367          HEX BUS DRIVER
U17         74LS373          OCTAL D-TYPE LATCH
U18         7404             HEX INVERTER
```
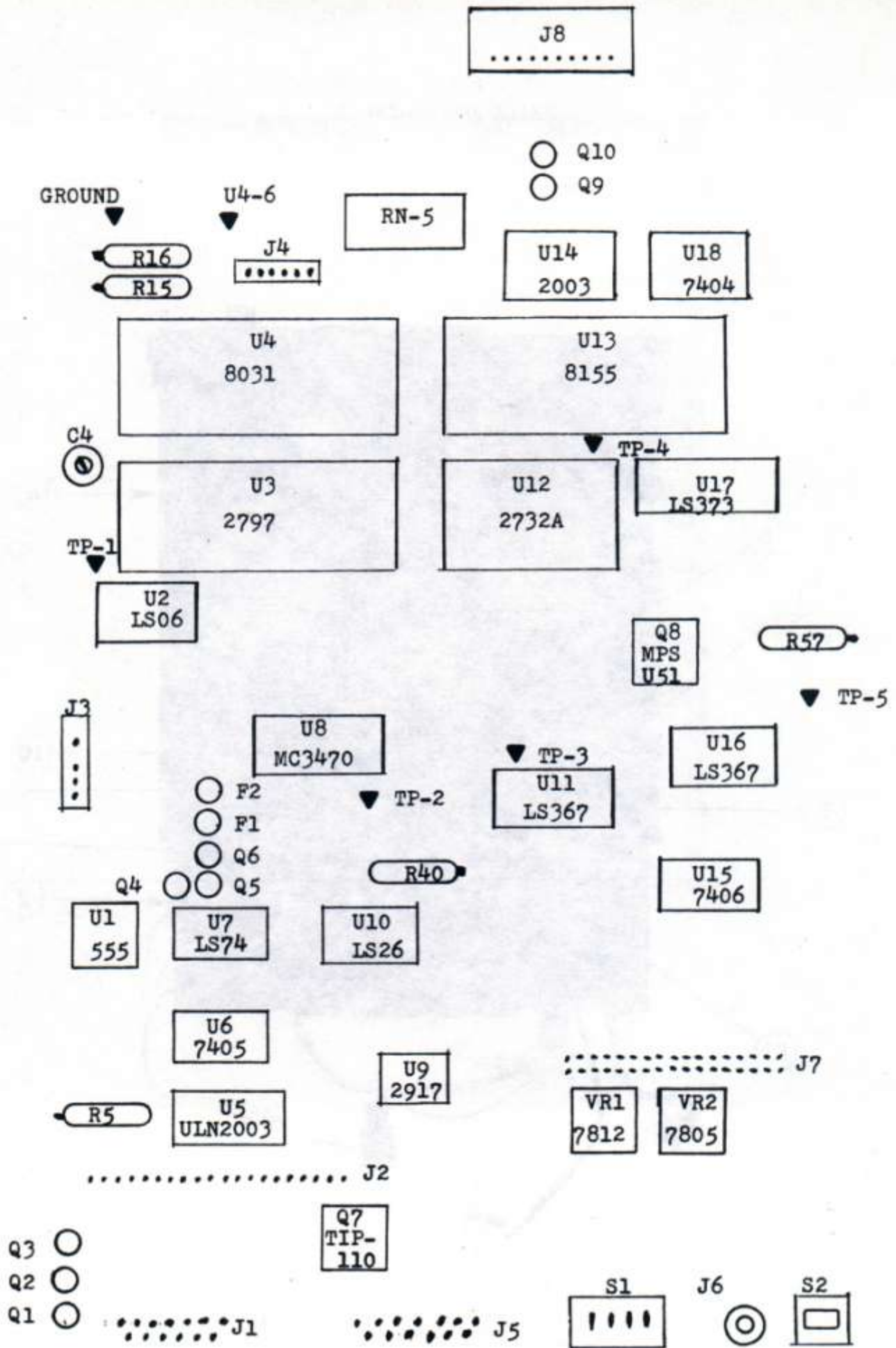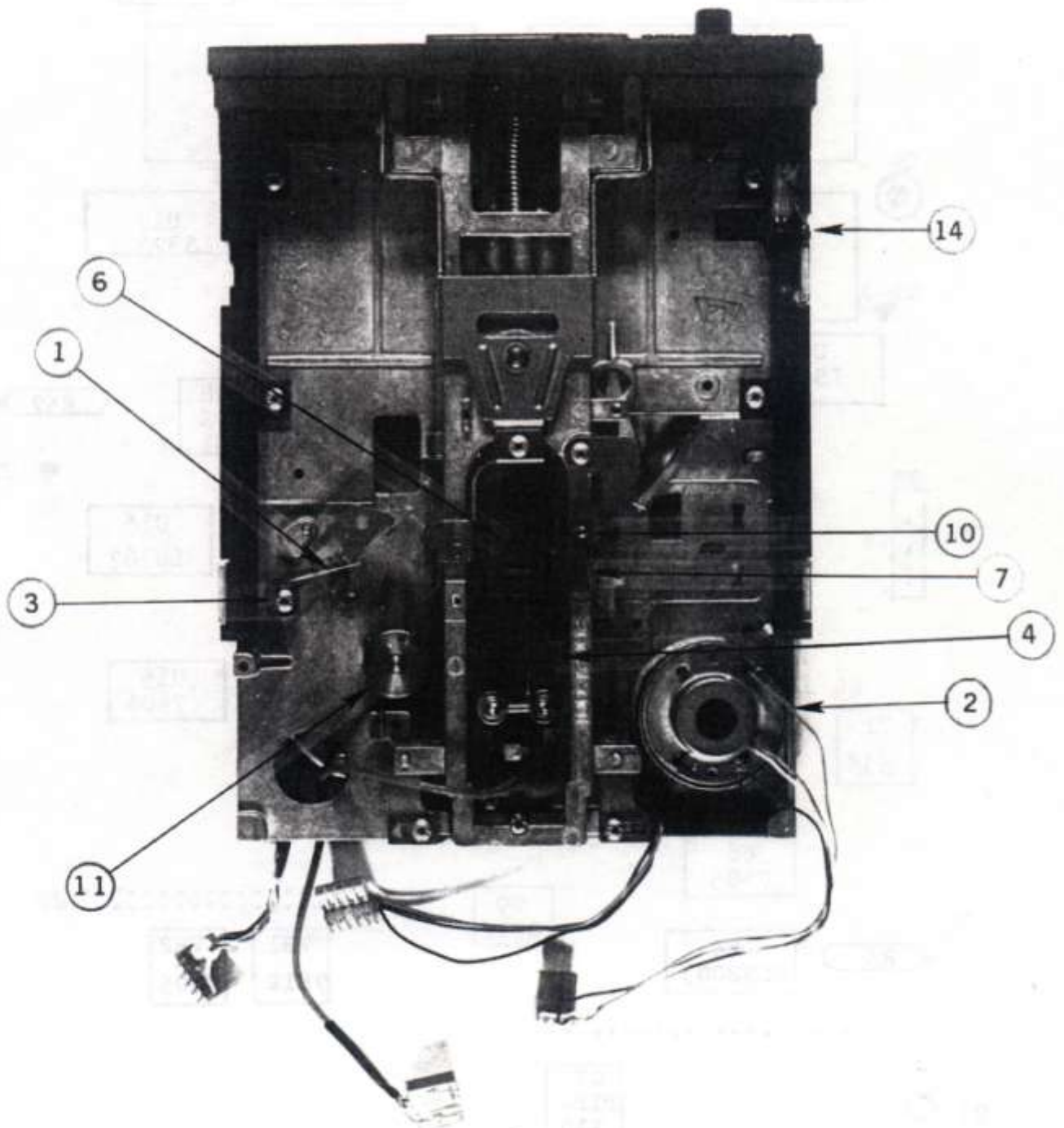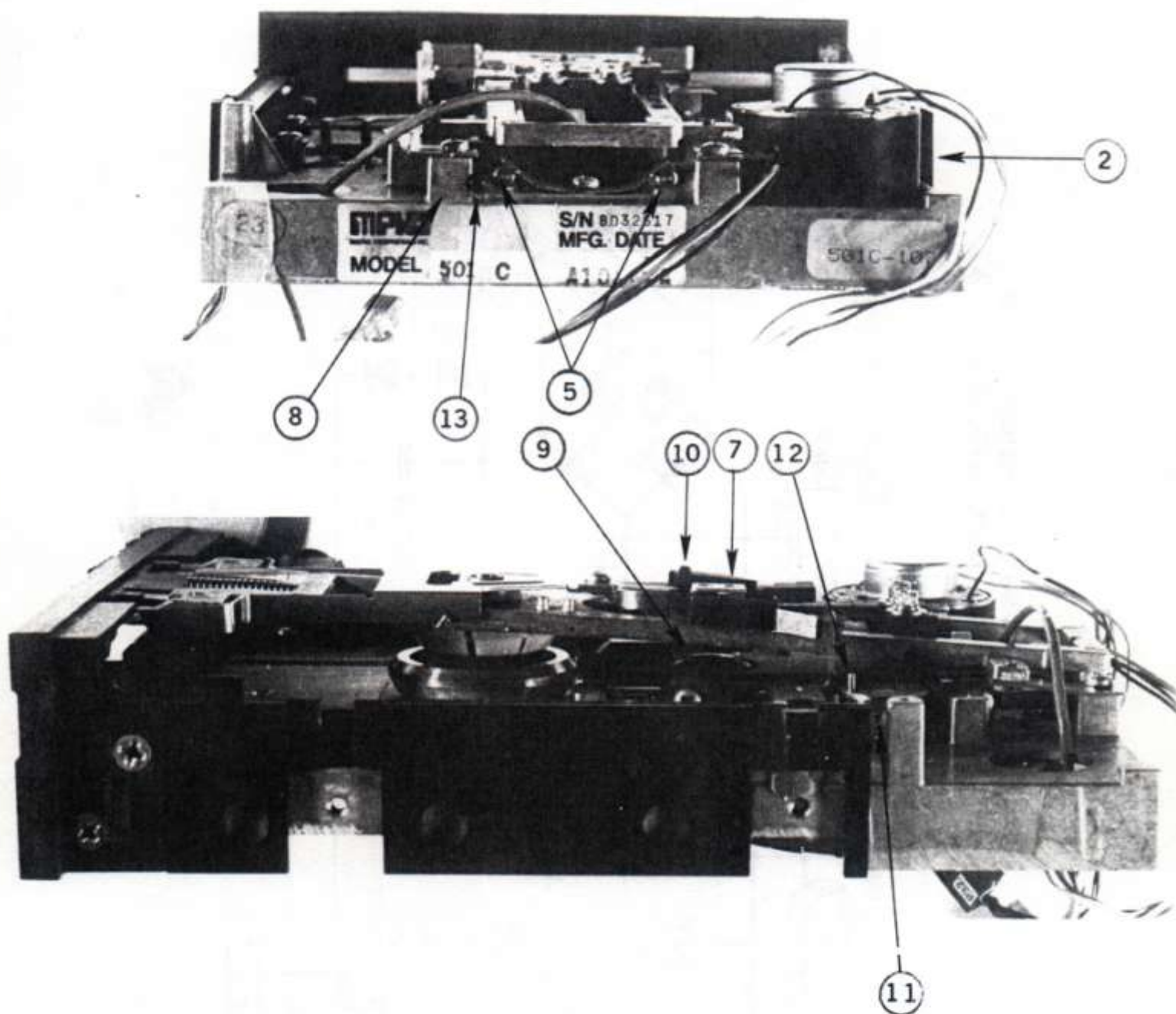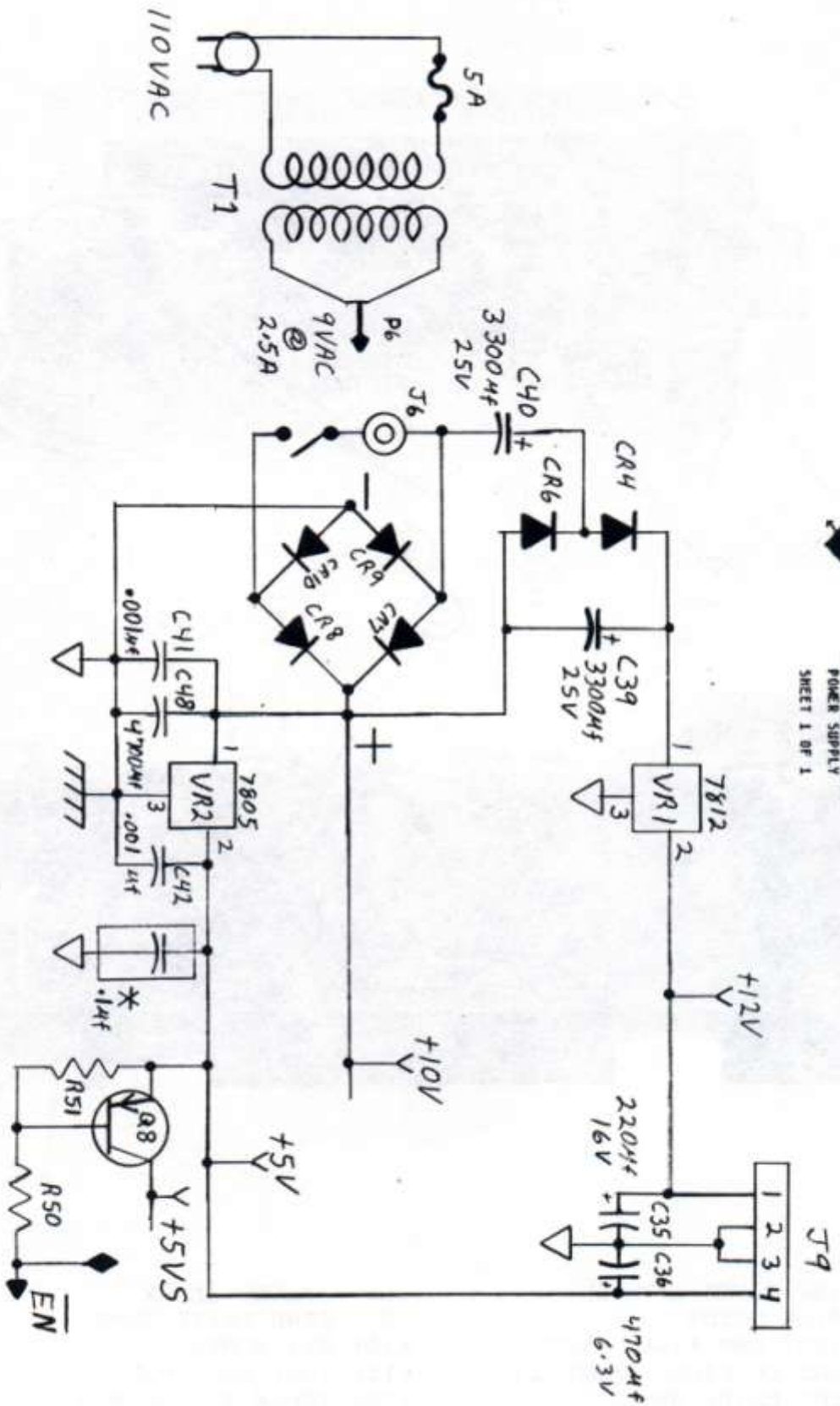
J8

Q10
Q9

GROUND   U4-6

RN-5

R16
R15

J4

U14
2003

U18
7404

U4
8031

U13
8155

C4

TP-4

U3
2797

U12
2732A

U17
LS373

TP-1

U2
LS06

Q8
MPS
U51

R57

TP-5

J3

U8
MC3470

U16
LS367

TP-3

U11
LS367

F2

F1

TP-2

Q6

R40

Q4   Q5

U15
7406

U1
555

U7
LS74

U10
LS26

U6
7405

U9
2917

J7

R5

U5
ULN2003

VR1
7812

VR2
7805

J2

Q3

Q7
TIP-
110

Q2

Q1

J1

J5

S1

J6

S2

<1>	DISK EJECT SPRING	<8>	PILLOW BLOCK
<2>	DRIVE MOTOR	<9>	READ/WRITE HEAD
<3>	EJECT ARM PIVOT POST	<10>	SET-SCREW
<4>	HEAD CARRIAGE ASSEMBLY	<11>	TAUT BAND PULLEY
<5>	HEAD GUIDE RAILS	<12>	TRACK Ø STOP PIN
<6>	HEAD LOAD PAD	<13>	TRACK Ø STOP SET-SCREW
<7>	HEAD LOAD PAD LIFTER ARM	<14>	WRITE PROTECT PHOTO SENSOR

ALHART ENTERPRISES
PRESENTS

RANA SYSTEMS 1000
POWER SUPPLY

SHEET 1 OF 1

110VAC

5A

T1

P6
9VAC @ 2.5A

C40
3300uf
25V

J6

CR6
CR4

CR10
CR9
CR8
CR7

C39
3300uf
25V

C41 .001uf
C48 4700uf
VR2 7805
C42 .001uf
.14f

* .14f

R51
Q8
R50
EN

+5VS

+5V

+10V

VR1 7812

+12V

220uf
16V

C35 C36
470uf
6.3V

J9
1 2 3 4

* BYPASS CAPS .14f
C 2,3,14,29,30,37,43,44,45,46

ALMART ENTERPRISES
PRESENTS

ROMA 1000 DRIVE/CONTROLLER
SCHEMATIC

SHEET # 2 of 2