

# BORIS

## ELECTRONIC CHESS COMPUTER



## ASSEMBLY MANUAL

**BORIS**  
BORIS IS KING

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## GET READY TO ASSEMBLE

Perform the assembly of the BORIS kit in the order described in this book. Brackets [ ] are provided to help keep track of work as it is performed. As you perform each step, place a check mark [✓] in the adjacent bracket.

In addition to the parts provided in this kit, the following tools are required for assembly.

- Knife (Xacto or equivalent)
- Screwdriver, Phillips
- Soldering Iron, 25-35 watts
- Cutters
- Nutdriver, #2
- Resin Core Solder
- Pliers, needle nose

Before assembling, open all of the bags and check the parts against the parts list. Assembly will be faster if you familiarize yourself with all the parts so you will be able to identify them easily.

When you open the IC kit, leave the parts in the foil until you are ready to install them in the P.C. board. The IC's are tested at the factory before shipment. Static electricity from your body can destroy the IC's. Assemble the kit in a static free area such as kitchen, garage, or basement.

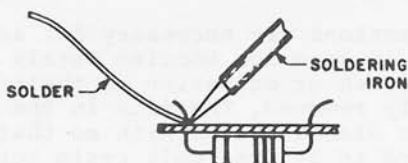
Good solder connections are necessary for successful assembly. Solder is used for bonding metals together. Metals have a tarnish or oxidation on their surface that is not easily removed. The flux in the center of resin core solder cleans the tarnish so that the molten solder will adhere to it. Use only resin core solder. DO NOT USE ACID CORE SOLDER OR PASTE FLUXES. Use a pencil type soldering iron of 40 watts or less. DO NOT USE A SOLDERING GUN. Keep the tip clean and tinned. To clean the tip, wipe it from time to time with a damp sponge or cloth. To tin the tip, apply a small amount of solder to it. SHAKING A SOLDERING IRON TO REMOVE EXCESS SOLDER IS NOT RECOMMENDED. FLYING SOLDER CAN BE DANGEROUS.

The soldering iron is ready when it is able to melt solder quickly. The following four(4) steps are recommended for making a good solder connection.

1. Apply the hot soldering iron to both metals to be soldered. Heat both metals for only a moment.

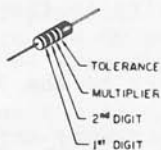
2. Apply the solder to the opposite side of the metal joint from the soldering iron; solder will flow towards the hot iron. Do not apply solder directly to the iron. If the solder does not flow quickly, the iron is either dirty or it is not touching the metal properly.
3. Feed solder until the entire connection is coated with solder, then remove the solder.
4. After removing the solder, remove the iron. Do not move or test the connection until the solder has cooled and hardened.

Inspect each solder connection as you go. A good connection is CLEAN, SMOOTH and BRIGHT. A bad connection looks dull and/or dirty.



When installing resistors and capacitors in the printed wiring board, bend the leads slightly to prevent them from falling off of the board while soldering. Trim the leads on the solder side of the board. Be careful not to bend a wire onto an adjacent connection.

It is recommended that the main P.C. board be cleaned with flux remover solvent after all soldering has been accomplished. When cleaning, be careful not to get the solvent into the IC sockets or on the display. Do not attempt to clean the display P.C. board.



# Tolerance

gold = 5%  
 silver = 10%  
 none = 20%

COLOR	FIRST/SECOND DIGIT	MULTIPLIER
Black	0	1
Brown	1	10
Red	2	100
Orange	3	1,000
Yellow	4	10,000
Green	5	100,000
Blue	6	1,000,000
Violet	7	
Grey	8	
White	9	

## ASSEMBLY PROCEDURE

Assemble the parts in the order given.

### 7805 Regulator Sub-Assembly

- [✓] Solder a 4", #24 gauge, yellow wire to the 7805 regulator as shown in Figure 1.
- [✓] Solder a 4", #24 gauge, black wire to the 7805 regulator as shown in Figure 1.
- [✓] Solder a 4", #24 gauge, brown wire to the 7805 regulator as shown in Figure 1.
- [✓] Install a piece of 3/32" shrink tubing, 3/4" long, over each of the solder connections on the 7805 regulator and shrink by placing a soldering iron very close to the tubing.

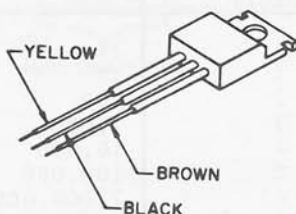


Figure 1

### 7812 Regulator Sub-Assembly

- [✓] Solder a 4", #24 gauge, yellow wire to the 7812 regulator as shown in Figure 1.
- [✓] Solder a 4", #24 gauge, black wire to the 7812 regulator as shown in Figure 1.
- [✓] Solder a 4", #24 gauge, brown wire to the 7812 regulator as shown in Figure 1.
- [✓] Install a piece of 3/32" shrink tubing, 3/4" long, over each of the solder connections on the 7812 regulator and shrink by placing a soldering iron very close to the tubing.

### Slide Switch Sub-Assembly

The slide switch (SW1) is a three(3) position switch.

It has an OFF position, ON position and RESET position. The RESET position is spring loaded so that the switch returns to the ON position when it is released. See Figure 2 to wire the slide switch.

- [✓] Connect a 4" long, #24 gauge, orange wire to the switch terminal shown in Figure 2. Observe the switch positions to be sure of proper wiring.
- [✓] Connect a 4" long, #24 gauge, green wire to the switch terminal shown in Figure 2.
- [✓] Connect a 4" long, #24 gauge, red wire to the switch terminal shown in Figure 2.
- [✓] Connect a 4" long, #24 gauge, blue wire to the switch terminal shown in Figure 2.
- [✓] Straighten the two(2) metal tabs adjacent to the mounting holes as per Figure 2. Use a pair of pliers and bend the tabs until they are flush with the top surface of the switch.

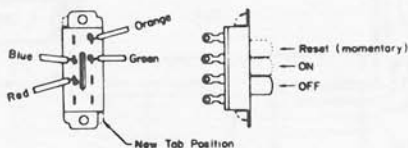


Figure 2

### Display P.C.B. Sub-Assembly

- [✓] Install and solder two(2) DL-416 displays onto the display P.C.B. See Figure 6. Observe the location of Pin 1 of each DL-416 indicated by a colored dot. Do not attempt to remove flux from this P.C.B. after soldering. Chemicals can damage the plastic lens on the display.

- [✓] Install and solder six(6), #24 gauge, white, 3" long, stranded wires to the six(6) pads on the display P.C.B. as shown in Figure 6. Notice that the wires enter the pads from the same side as the DL-416 displays. Cut off excess wire length that passes through the P.C.B. Do not attempt to remove the flux from the solder joints. Chemicals can damage the display.
- [✓] Install and solder eighteen(18), #24 gauge, white, 2" long, stranded wires to the eighteen(18) pads on the display P.C.B. shown in Figure 6. Notice that these wires enter the pads from the opposite side as the DL-416 displays. Cut off excess wire length that passes through the P.C.B. Do not attempt to remove the flux from the solder joints. Chemicals can damage the display.



## Main P.C.B. Assembly

Assemble the main P.C.B. assembly in the order of the steps given. After each component has been installed and soldered in place, cut off excess wire leads from the solder side. Refer to Figure 3 during this assembly.

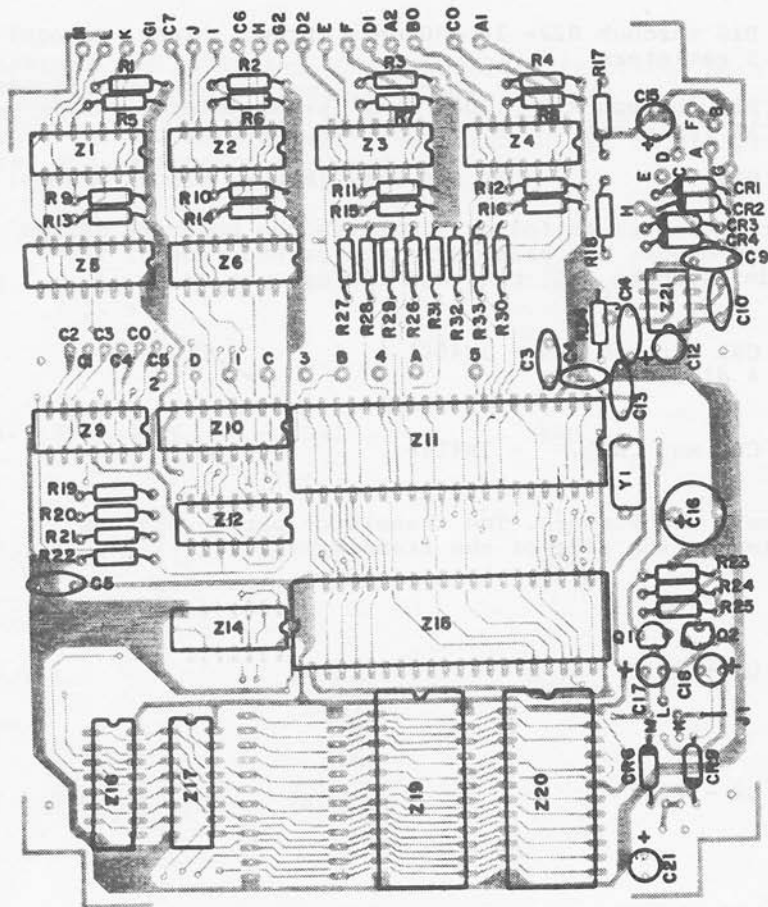


Figure 3

Install the following resistors. All resistors are carbon film type, 1/4 watt, 5% tolerance.

[✓] R1 through R16 - 220 ohms (red, red, brown)  
16 resistors

[✓] R17 - 1,000 ohms (brown, black, red)

[✓] R18 through R22- 10,000 ohms (brown, black, orange)  
5 resistors

[✓] R23 through R33- 1,000 ohms (brown, black, red)  
11 resistors

[✓] R34 - 10,000 ohms (brown, black, orange)

Install diodes as follows. Observe the polarity marked on the diode. The band marks the cathode end of the diode. Symbols CR5, CR7, and CR8 are not used.

[✓] CR1 through CR4 - 1N4001  
4 diodes



[✓] CR6 and CR9 - 1N4148



Install transistors. The transistor part number is marked on the side of the transistor.

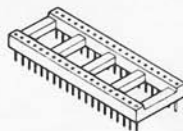
[✓] Q1 - 2907



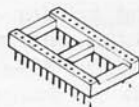
[✓] Q2 - 2222

Install the IC sockets. Note that one end of each socket has a notch. Orient the notch as shown in Figure 3.

[✓] 40 pin sockets - Z11 and Z15



[✓] 24 pin sockets - Z19 and Z20



[✓] 16 pin sockets - Z16 and Z17



Install the following IC's and solder in place. Note the orientation of each IC. There is a dot on the top of the IC next to Pin 1. Some IC's have a notch on this end. Install each IC with the notch or dot on the proper end. Reference Figure 3.

[✓] Z1 through Z4 - 75491  
4 IC's



[✓] Z5 and Z6 - 4042



[✓] Z9 and Z12 - 75492



[✓] Z10 - 4028



[✓] Z14 - 74LS00



[✓] Z21 - 555



Install and solder the smaller capacitors. These are not polarized and may be installed with the leads in either of the two(2) mounting holes.

[✓] C3, C4, C5, C9 - .01uf disc  
Marked 103



[✓] C13, C14 - 10pf disc  
Marked 10



[✓] C10 - .01uf mylar(green)  
Marked .01



[✓] Identify the solder side (side with 009-5000-00) of the printed circuit board. Using the knife, cut the copper etch in one place as shown in Figure 4. Scrape and remove the green solder mask from the etch in the location shown in Figure 4. Do not add jumpers yet.

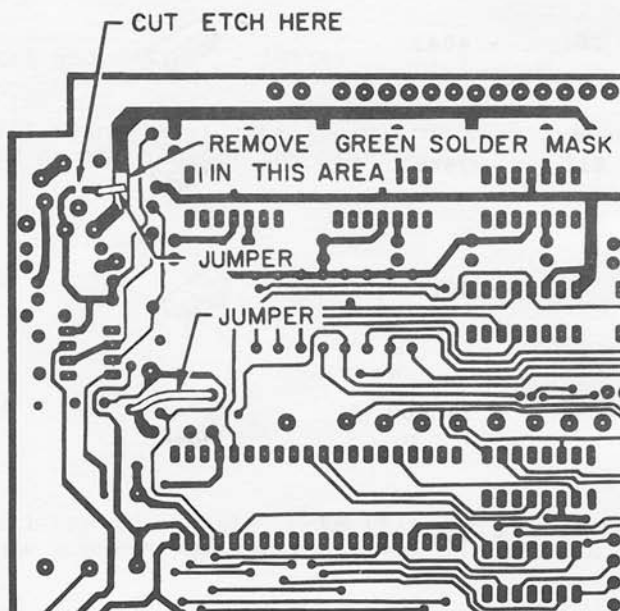


Figure 4

Install the electrolytic capacitors. These capacitors are polarized and are marked showing the negative lead wire. The other lead (opposite the - lead) is positive + and belongs on the pad labeled + in Figure 3. Observe this polarity when installing. After soldering, cut off the excess lead wires on the solder side of the P.C.B.

[✓] C16 - 1,000uf, 16V

[✓] C12, C17, C18, C21 - 10uf, 25V



[✓] C15 - 100uf, 16V

Note that the positive lead of C15 is to bend over to form a jumper and solder to the adjacent etch as shown in Figure 4.

[✓] Install a jumper wire between C3 and ground on the solder side of the main P.C.B. as shown in Figure 4. Use a piece of lead wire cut off a resistor or capacitor. Be careful not to let the jumper touch any other connections than those shown.

[✓] Install and solder a short piece of wire for jumper J1 near the 1N4148 diodes. Reference Figure 3.

[✓] Install and solder crystal Y1 in place. Reference Figure 3.

Refer to Figure 5. The display sub-assembly mounts at an angle of approximately 30°. The eighteen(18) stranded wires provide some mechanical support until final assembly is complete.

[✓] Insert and solder the eighteen(18) 2" white stranded wires from the display P.C.B. sub-assembly into the eighteen(18) holes along the edge of the main P.C.B. assembly as shown in Figure 5. Do not cross any of the wires.

[✓] Insert and solder the six(6) 3" white stranded wires from the display P.C.B. sub-assembly into the six(6) holes (C1 through C5) on the main P.C.B. assembly. C1 through C5 are shown in Figure 3.

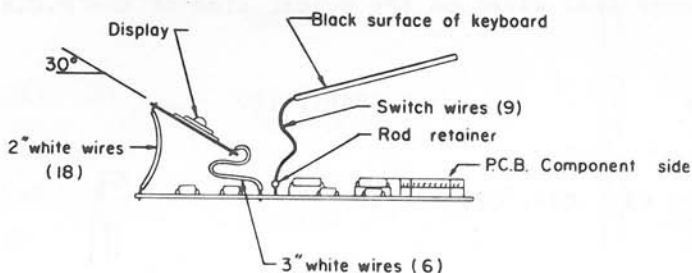
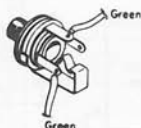


Figure 5

P.C.B. PAD	WIRE COLOR	DESTINATION
A	Green	AC - Jack
B	Green	AC - Jack
C	Yellow	7805 - In
D	Black	7805 - Gnd
E	Brown	7805 - Out
F	Blue	Switch - AC In
G	Orange	Switch - Gnd
H	Red	Switch - AC Out
J	Green	Switch - Reset
K	Yellow	7812 - In
L	Black	7812 - Gnd
M	Brown	7812 - Out

TABLE 1

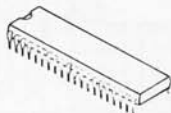
- [✓] Fold the six(6) stranded wires and adjust the position of the display P.C.B. to about 30° as shown in Figure 5.
- [✓] Install and solder the three(3) wires from the 7805 regulator sub-assembly in the main P.C.B. assembly next to the 1N4001 diodes. Refer to Table 1 and Figure 3 to determine which color wire goes into which pad.
- [✓] Install and solder the three(3) wires from the 7812 regulator sub-assembly in the main P.C.B. assembly next to the two(2) transistors. Refer to Table 1 and Figure 3 to determine which color wire goes into which pad.
- [✓] Install and solder four(4) wires from the slide switch sub-assembly in the main P.C.B. assembly near the 1N4001 diodes. Refer to Table 1 and Figure 3 to determine which color wire goes into which pad.
- [✓] Install the keyboard assembly. Reference Figure 5. Push the keyboard wires through Pads 2, D, 1, C, 3, B, 4, A and 5 of the P.C.B. until the plastic rod retainer is seated with about 1/8" protruding through the P.C.B. Solder each wire to it's pad. Cut off excess wire on the solder side.  
NOTICE the orientation of the keyboard so that it is not connected backwards.
- [✓] Solder two(2) green, #24 gauge, 5 1/2" long wires to the power jack as shown below.



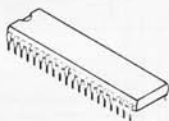
- [✓] Install and solder the other end of the green wires which connect to the power jack to the AC input pads (A and B) on the main P.C.B. assembly. Note that it does not matter which wire goes in which pad.

Install the following IC's into their sockets. Note that there is a dot or notch at one end of each IC. Install each IC with the notch or dot on the proper end. Reference Figure 3.

[ ] Z11 - Microprocessor, MK3850



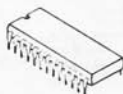
[✓] Z15 - Memory Interface, MK3853



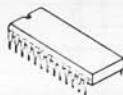
[✓] Z16 and Z17 - RAM, 2112



[✓] Z19 - ROM0, 007-7020-00



[✓] Z20 - ROM1, 007-7021-00





### Chassis Sub-Assembly

- [✓] Place plastic electrical tape(not supplied) or scotch tape on both lips of the support plate and on the end of the keyboard as shown in Figure 6. This prevents the keyboard wires from touching the support plate.
- [✓] Pass the slide switch through it's cutout in the support plate.
- [✓] Fasten the slide switch to the top of the support plate using two(2) 4-40, 1/4" long screws and two (2) 4-40 KEPS nuts. See Figure 6. Install with the momentary switch position towards the display.
- [✓] Fasten the 7812 regulator to the support plate using a 4-40, 1/4" long screw and a 4-40 KEPS nut. See Figure 6.
- [✓] Position the support plate over the main P.C.B. assembly and slip the keyboard through the cutout in the support plate. Lower the support plate.
- [✓] Fasten the support plate to the main P.C.B. assembly with two(2) spacers, two(2) 4-40, 1-1/2" long screws, and two(2) 4-40 KEPS nuts as shown in Figure 6. Be careful not to pinch any wires while tightening.
- [✓] Position and fasten the display P.C.B. to it's cutout in the support plate. Use the two(2) Hex head #4 screws. Reference Figure 6 and 8.
- [✓] Attach the double-sided tape to the support plate as shown in Figure 6.
- [✓] After removing the paper backing from the tape, rotate and press the keyboard to be flat against the support plate.
- [✓] Fasten the 7805 regulator to the support plate using a 4-40, 1/4" long screw and a 4-40 KEPS nut. Reference Figure 6.

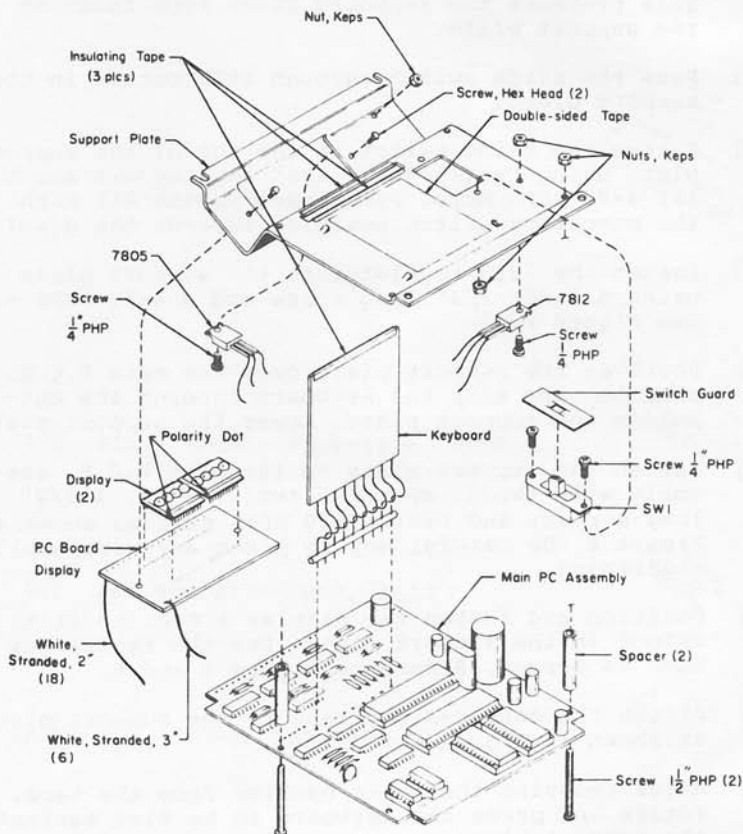


Figure 6

## Front Panel Assembly

- [✓] After locating the panel front and the overlay, remove the paper backing from the overlay and stick it to the painted surface of the panel. Carefully align the hole cutouts of the two(2) pieces before pressing down the overlay. Reference Figure 7.
- [✓] Take the panel front and suspend upside down on two(2) blocks. The blocks prevent the keybuttons from touching the work table during assembly.
- [✓] Install all sixteen(16) keybuttons as shown in Figure 7.
- [✓] Place the foam rubber over all the keybuttons as shown in Figure 7.
- [✓] Attach the foam rubber to the panel with the single sided clear tape provided. The tape, when properly installed, should hold the foam without letting the keybuttons slip out of position.

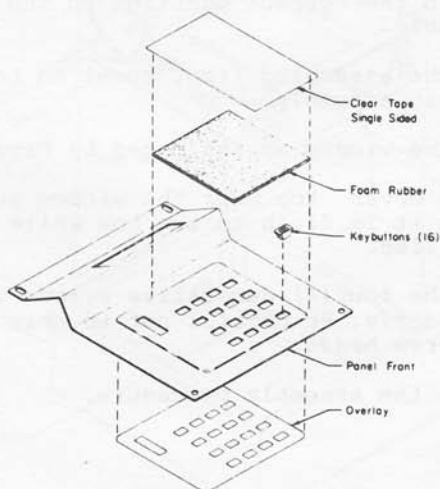


Figure 7

### Final Box Assembly

This procedure only applies if this kit included a walnut box assembly. If the customer supplies his own enclosure, the procedure may change. It is recommended that the BORIS unit be checked for proper operation before proceeding into Final Box Assembly. Refer to check out procedure.

- [✓] Install the switch guard over the black button on slide switch mounted on the chassis sub-assembly. Reference Figure 8. This is used for decorative purposes.
- [ ] Install the power jack J1 in the recessed hole in the rear of the walnut box. Refer to Figure 8. Fasten with the washer and nut supplied. Tighten the nut with pliers while holding the jack by hand.
- [ ] Drop the tested chassis into the walnut box. Slope the unit to clear the jack while installing. Make sure all wires clear the box and are not pinched.
- [ ] Check to insure that the keyboard is securely mounted in the correct position on the chassis sub-assembly.
- [ ] Install the assembled front panel on top of the chassis sub-assembly.
- [ ] Install the window as indicated by Figure 8.
- [ ] Mount the cover top over the window and adjust such that it is flush to the box while the screws are installed.
- [ ] Install the four(4) decorative screws into the wood standoffs. Be careful not to chip the paint on the screw heads.

This completes the assembly procedure.

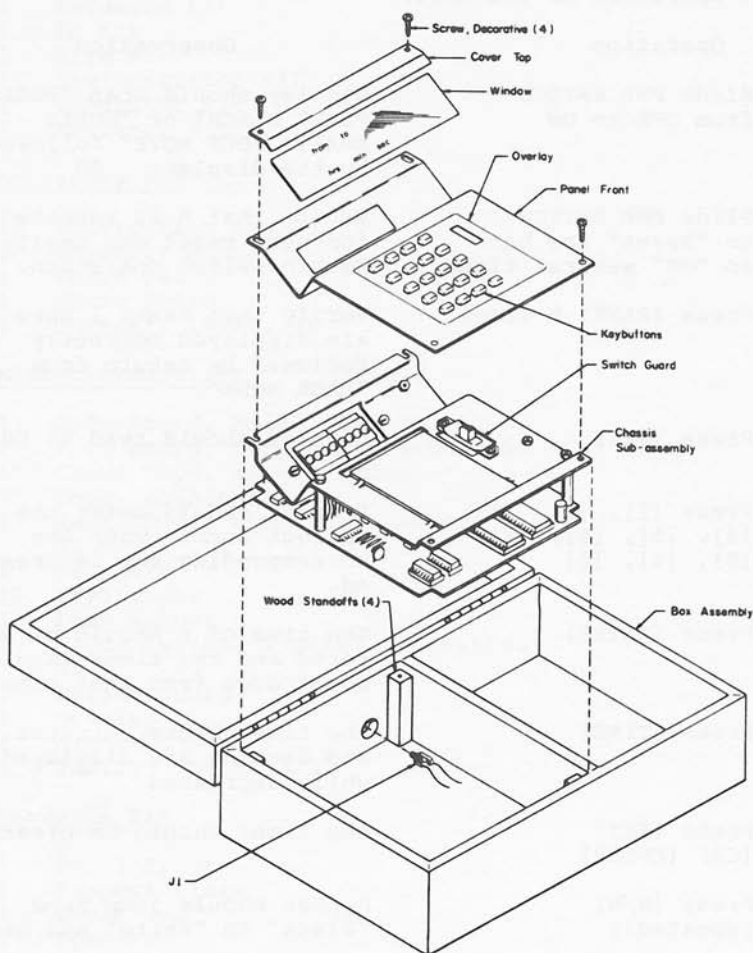


Figure 8

### Check-Out Procedure

Before the chassis sub-assembly is installed in the box, the unit should be thoroughly checked for correct operation. It is suggested that the operator become thoroughly familiar with the normal operations of BORIS by reading the Instruction Manual that is included.

The following is a short test designed to verify correct operation of the unit:

Operation	Observation
A. Slide PWR SWITCH from OFF to ON	Display should scan "BORIS PLAYS BLACK" or "BORIS AWAITS YOUR MOVE" followed by the display: _ 00
B. Slide PWR SWITCH to "Reset" and back to "ON" several times	Verify that A is repeated for each reset and verify smooth switch operation.
C. Press [RANK] 9 times	Verify that ranks 1 thru 8 are displayed correctly followed by return from "RANK MODE".
D. Press [SET]	Display should read 00_00_ 00.
E. Press [1], [2], [3], [4], [5], [6], [7], [8], [9], [0]	Display should enter the correct number when the corresponding key is press- ed.
F. Press [ENTER]	The time of E should be en- tered and the timer should count down from that time.
G. Press [TIME]	The timer Hours, Minutes, and Seconds are displayed while depressed.
H. Press [SET] [CE] [ENTER]	The timer should be cleared.
I. Press [B/W] repeatedly	Hyphen should jump from "Black" to "White" and back.
J. Press [_] repeatedly	Hyphen should step across the display.

## PARTS LIST

The following is the parts list for BORIS. The kit consists of nine(9) sub-kits.

- 1 Box Assembly (only if ordered)
- 1 Accessory Kit
- 1 Miscellaneous Kit
- 1 Hardware Kit
- 1 IC Kit
- 1 Wire Kit
- 1 Semiconductor Kit
- 1 Capacitor Kit
- 1 Resistor Kit

### Accessory Kit

- 1 Instruction Manual
- 1 Assembly Manual
- 1 Chess Set
- 1 Chess Board
- 1 Charger, 10VAC, 1A

### Miscellaneous Kit

- 1 P.C. Board, Main, 009-5000-00
- 1 P.C. Board, Display, 009-5001-00
- 4" Clear Tape, single-sided
- 2" Tape, double-sided
- 1 Jack, Power w/nut and washer  
J1
- 1 Keyboard
- 16 Keybuttons
- 1 Foam Rubber
- 1 Slide Switch, 2 pole, 3 position  
S1
- 1 Switch Guard
- 1 Overlay
- 1 Window
- 6" Tubing, Shrink 3/32

### Hardware Kit

- 1 Panel Front
- 1 Support Plate
- 1 Cover Top
- 2 Spacers
- 6 Nut, 4-40, KEPS
- 2 Screw, 4-40, 1 1/2", PHP
- 4 Screw, Decorative, #4 x 1/2", PHP
- 4 Screw, 4-40, 1/4", PHP
- 2 Screw, #4 x 1/4", Hex Head

### IC Kit

- 1 IC, Microprocessor, MK3850  
Z11
- 1 IC, Memory Interface, MK3853  
Z15
- 2 IC, 256 x 4, RAM, 2112 AM91L12  
Z16, 17
- 1 IC, 3/8 Decoder, 4028  
Z10
- 2 IC, Quad Latch, 4042  
Z5, 6
- 4 IC, Segment Driver, 75491  
Z1, 2, 3, 4
- 2 IC, Digit Driver, 75492  
Z9, 12
- 1 IC, Timer, 555  
Z21
- 1 IC, Voltage Regulator, 7805
- 1 IC, Quad Nand Gate, 74LS00  
Z14
- 1 IC, Voltage Regulator, 7812
- 1 IC, 8 x 2K, ROM 0  
Z19
- 1 IC, 8 x 2K, ROM 1  
Z20
- 2 Socket, 40 pin
- 2 Socket, 24 pin
- 2 Socket, 16 pin
- 2 Display, DL-416

### Wire Kit

- 6 Wire, stranded, 3", white
- 2 Wire, stranded, 5.5", green
- 2 Wire, stranded, 4", black
- 2 Wire, stranded, 4", brown
- 1 Wire, stranded, 4", red
- 1 Wire, stranded, 4", orange
- 2 Wire, stranded, 4", yellow
- 1 Wire, stranded, 4", green
- 1 Wire, stranded, 4", blue
- 18 Wire, stranded, 2", white

### Semiconductor Kit

- 1 Transistor, NPN, 2222  
Q2
- 1 Transistor, PNP, 2907  
Q1
- 4 Diode, 1N4001  
CR1, 2, 3, 4



### Semiconductor Kit (con'td)

- 2 Diode, 1N4148  
CR6, 9
- 1 Crystal, 2.0MHz  
Y1

### Capacitor Kit

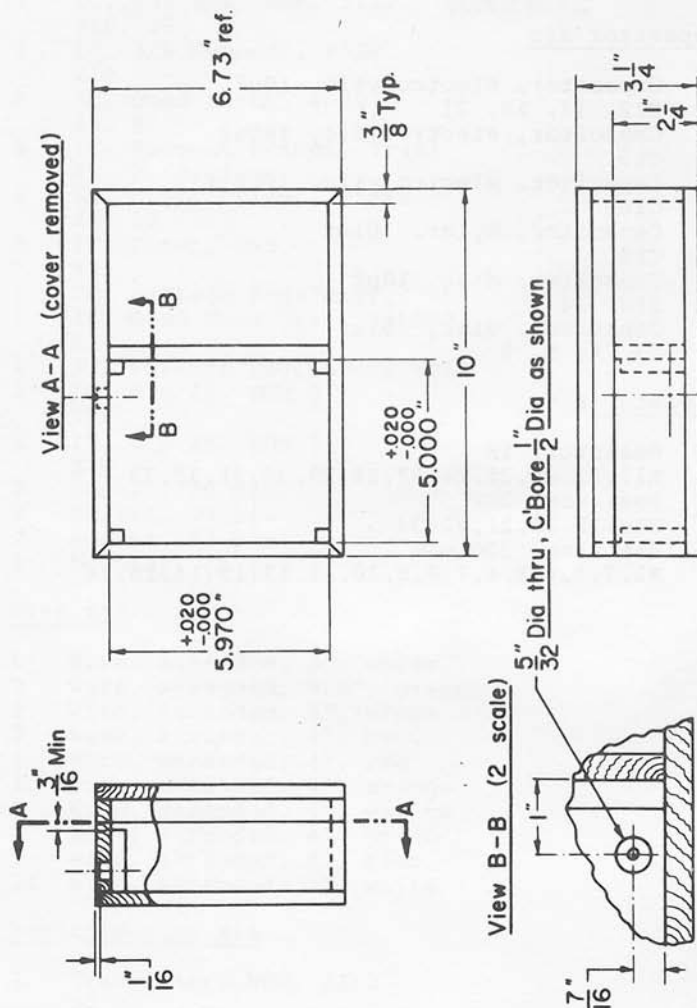
- 4 Capacitor, electrolytic, 10uf  
C12, 17, 18, 21
- 1 Capacitor, electrolytic, 100uf  
C15
- 1 Capacitor, electrolytic, 1000uf  
C16
- 1 Capacitor, mylar, .01uf  
C10
- 2 Capacitor, disc, 10pf  
C13, 14
- 4 Capacitor, disc, .01uf  
C3, 4, 5, 9

### Resistor Kit

- 12 Resistor, 1K  
R17, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33
- 6 Resistor, 10K  
R18, 19, 20, 21, 22, 34
- 16 Resistor, 220 ohm  
R1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16

# BOX BLUEPRINT

If you desire to build your own box, use the dimensions shown in the drawing below.



## WARRANTY

This product warranty extends to the original purchaser of the BORIS kit. For a period of ninety(90) days after purchase, we will replace free of charge any parts that are defective. You can obtain parts by writing us at the address below or by telephoning (214) 494-6942. We will pay return shipping charges. 3463

You may receive free consultation on any problem you might encounter in the assembly or use of your BORIS kit. Just drop us a line or give us a call. Sorry, we cannot accept collect calls.

This warranty does not cover and we are not responsible for damage caused by the use of corrosive solder, defective tools, incorrect assembly, misuse, fire, or by unauthorized modifications to or uses of BORIS for purposes other than as intended.

If after assembly, your BORIS fails to function, you have the option, for a service fee of \$35.00 to return BORIS postage prepaid and insured to the service facility listed below for check-out and service. The \$35.00 service fee does not cover any damage to components during assembly.

This warranty covers only the BORIS kit and is not extended to allied equipment or components used in conjunction with assembly of the BORIS kit. We are not responsible for incidental or consequential damages. Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you. This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

Limited Factory Service Program:

Also available is a unique service program which extends protection after the ninety(90) day warranty period. If service is required under this program, the unit must be returned to the factory, shipping charges prepaid, for check-out and service. There is a \$35.00 service and handling charge per return. Your unit will then be covered by a new limited ninety(90) day warranty. When returning your unit for out of warranty service, please remember to enclose \$35.00 to cover the service charge.

SERVICE:

For service, send prepaid and insured to:

BORIS Service Center  
207 Kirby Street  
Garland, Texas 75042

Phone: (214) 494-6942

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