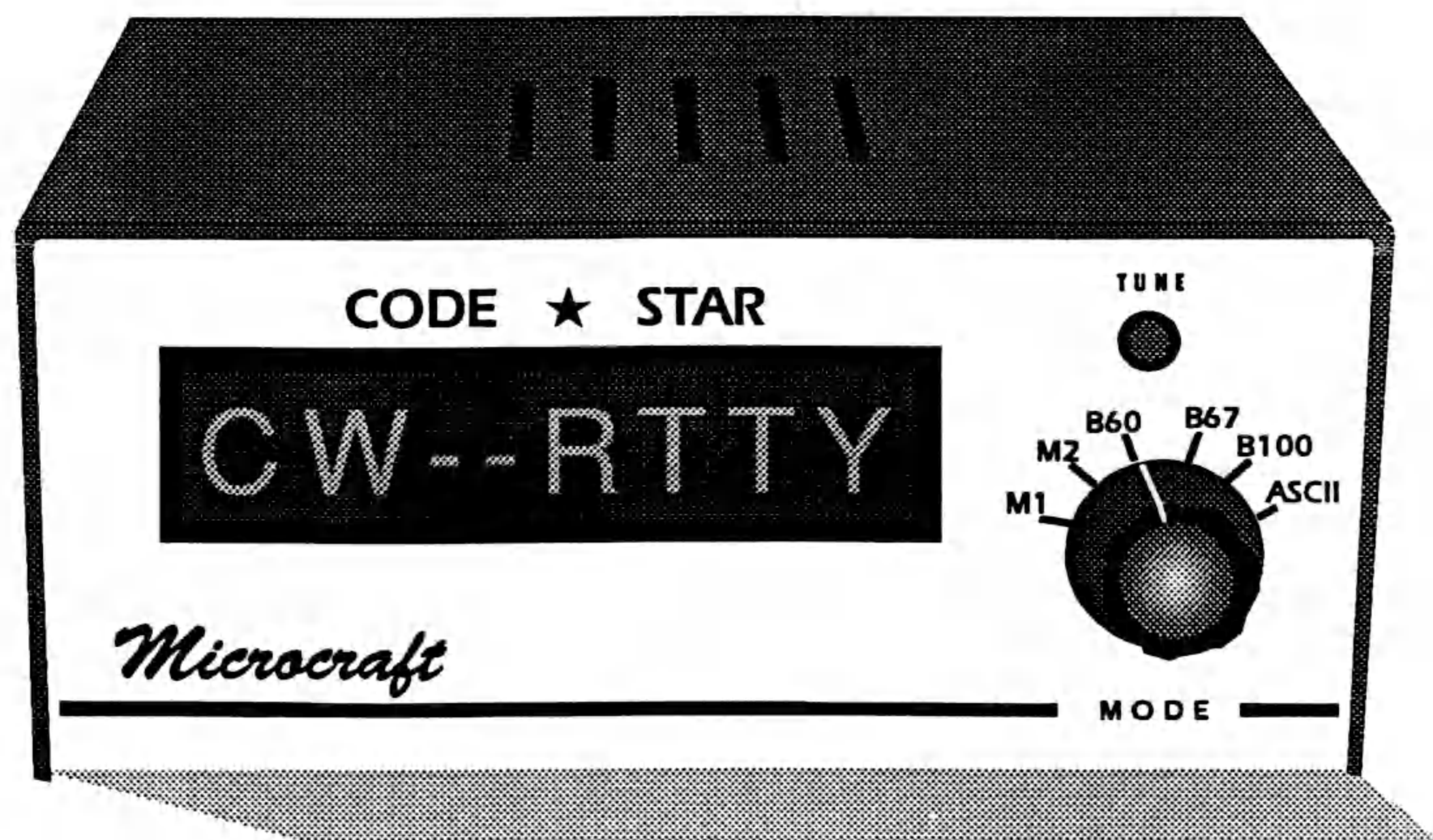


CODE * STAR
Instruction and Construction
Manual



Microcraft Corporation
P.O. Box 513 Thiensville, Wisconsin USA 53092
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CODE*STAR

INSTRUCTION MANUAL

INTRODUCTION.

Congratulations on your purchase of the CODE*STAR all-mode code reader. You now own one of the most sophisticated code readers ever designed. It can copy Morse code, RTTY code (Baudot), and ASCII computer code. You can connect it to your radio receiver for "off the air" reception or you can use it with a telegraph key for Morse code practice. With the optional ASCII output port you can directly drive a teleprinter or home computer.

CODE*STAR uses a custom designed microcomputer and specially designed analog circuitry. This circuitry employs a narrow bandpass filter to reject noise and QRM and an automatic gain control (AGC) to help minimize the effect of signal fading. The microcomputer uses a proprietary program that provides digital filtering and automatic tracking of Morse code. These features greatly reduce the errors from noise and cannot be found on other code readers at any price.

SPECIFICATIONS.

Mode M1:	Morse, 3-33 WPM, auto-track, heavy filtering.
Mode M2:	Morse, 3-70 WPM, auto-track, light filtering.
Mode B60:	Baudot, 5 level code, 60 WPM.
Mode B67:	Baudot, 5 level code, 67 WPM.
Mode B100:	Baudot, 5 level code, 100 WPM.
Mode ASCII:	ASCII, 8 level code, 110 Baud.
Readout:	Eight characters, 14 segment alphanumeric.
RTTY Characters:	Upper case letters, numbers and punctuation.
Morse Characters:	Letters, numbers, comma, period, question mark and slant bar. Special characters: SK = #, KN = !, AS = *, BT = -, and AR = +.
Receiver Input:	RCA jack, 50mV min., internal CW/RTTY filter with 800 Hz center frequency 1K ohm impedance, AGC 16 dB.
Key Input:	RCA jack, ground to key oscillator and produce tone.
Power:	12 VDC at 250 mA, 3.5 mm jack.
Dimensions:	7.75 in. wide x 5.75 in. deep x 3.375 in. high (18.73 x 14.6 x 8.57 cm.).
Weight:	2 lbs. (0.9 kg.).
Warranty:	Limited 90 day (see next page).

POWER REQUIREMENTS.

CODE*STAR is designed to operate from a well-filtered +12 volt DC power supply capable of producing 250 mA average current. Power is supplied through a 3.5 mm jack on the rear panel. A specially designed 120 VAC to 12/13 VDC power adapter is provided with CODE*STAR that meets this requirement. The adapter provides 12/13 volts DC (when loaded) on the "tip" of the plug with respect to the "sleeve" or ground return. Simply insert the 3.5 mm power plug of this adapter into the power jack on the rear panel of CODE*STAR. **DO NOT INSERT OR REMOVE THIS PLUG WHILE POWER IS APPLIED AS DAMAGE COULD RESULT TO CODE*STAR OR THE ADAPTER.**

CONNECTION OF CODE*STAR TO RECEIVER.

In order for CODE*STAR to decode signals from a receiver, a shielded audio cable (not furnished) must be connected between the receiver audio output and the CODE*STAR "RECEIVER" jack. This cable may be connected to the receiver's headphone jack, external speaker jack or directly to the two wires of the receiver speaker. Make sure the cable "braid" or "ground shield" is connected to the ground side of the receiver audio output.

OPERATION OF CODE*STAR--TUNING STATIONS.

In order for CODE*STAR to function properly, the receiver audio signal and power adapter must be connected as described above. Your receiver should be in the CW or SSB mode and no additional filters should be in line.

Apply power to CODE*STAR and select the type of code you wish to receive with the front panel mode switch. For example, mode M1 selects Morse code with strong filtering for use in heavy QRM situations.

Next, carefully tune in the signal while observing the front panel "TUNE" LED and listening to the CODE*STAR speaker. Tune the signal for maximum brightness on the TUNE LED and loudest tone on the speaker. CODE*STAR has a very selective band-pass filter (center frequency 800 Hz) so some care and patience is required in tuning stations. After some practice, you will find it easy to tune stations. If the station drifts out of tune, you may have to readjust your receiver tuning occasionally. Use only a normal or lower volume setting to minimize noise pickup.

MORSE OPERATION.

CODE*STAR has two mode positions for Morse code. Mode M1 has a range of 3 to 33 WPM and should be used for copy in heavy noise or QRM situations. It is initially set for 10 WPM and will auto-track speed changes within its range, usually within one or two characters.

Mode M2 has a wider speed range of 3 to 70 WPM and is ideal for high speed CW. Its initial speed is set for 18 WPM and it will normally auto-track speed changes in its range within a few characters.

When tuning CW stations allow a few characters for CODE*STAR to lock on. Do not expect perfect copy from CW stations. Many CW stations use abbreviations or special codes. It is important to realize that radio reception of Morse code is fraught with many problems due to sloppy sending, signal fading, noise pulses, and poor receiving conditions. CODE*STAR has the most advanced features to help reduce the effects of these problems and with some care and diligence you should be able to copy a large number of CW stations.

RTTY OPERATION.

During RTTY operation the display will appear to flicker slightly. This is normal and due

to the scanning of the microcomputer. CODE*STAR has four mode positions for radio-teletype which cover all the common Baudot speeds and 110 Baud ASCII. RTTY is usually transmitted as a frequency shift keyed (FSK) signal with separate "mark" and "space" frequencies. CODE*STAR is designed to demodulate only the "mark" frequency which is assumed to be 800 Hz. Because of this feature CODE*STAR can copy practically any frequency shift combination from narrow shift through wide shift.

Since the "mark" frequency may be transmitted as a high tone or low tone, you will have to tune your receiver through each of the tones until legible copy is obtained. If copy cannot be obtained on either tone, it may be that the incorrect mode is selected or that the signal is not RTTY.

Amateur radio operators generally use 60 WPM (B60) or 100 WPM (B100). Commercial stations often use 67 WPM (B67) or 100 WPM (B100).

Of considerable challenge is DXing of RTTY stations. The main problem is that you cannot tell the mode of the signal by listening to it. For the serious DXer, books are available which list the frequencies and modes of press and commercial stations. However, trial and error with CODE*STAR and your receiver can be more fun.

There are "RTTY sounding" stations that you cannot copy. Some use the Cyrillic alphabet or special encryption. Weather stations and the military often use special characters and five letter groups. Also a number of stations transmit in foreign languages. There are even strange signals like twinplex that may sound like RTTY but are really something else. Never-the-less, there are a large number of RTTY stations that can be copied on CODE*STAR.

Another point to remember is that it is easy to copy code from a keyboard at 20-30 WPM but copying RTTY at 60 WPM or higher does require concentration. If you are interested in hard copy or a video display, you should inquire about the ASCII serial/parallel output port option which can provide the required interface.

KEY INPUT-MORSE CODE PRACTICE.

CODE*STAR makes an excellent code learning and practice device when used with a telegraph key or keyer. The jack on the back panel labeled "KEY" is for this purpose. Grounding the center terminal of this jack should key CODE*STAR and produce a tone from its speaker. In other words "ground" corresponds to key-down and "open" corresponds to key-up. Use either M1 or M2 modes.

CODE TAPES.

You can practice your Morse code by playing your pre-recorded tapes through CODE*STAR. (Tapes should produce a tone of about 800 Hz.) Simply connect your recorder's speaker (using the external jack) to the CODE*STAR "RECEIVER" input with a shielded audio cable. Select either M1 or M2 modes.

RADIO STATIONS.

There are literally thousands of CW and RTTY stations on the air daily. One excellent source of code material is amateur radio station W1AW operated by the American Radio Relay League. The station transmits several code practice sessions daily as well as ham news bulletins, propagation forecasts and satellite information. Morse code is sent on 3.58, 7.08, 14.08 and 21.08 MHz while RTTY is sent on 3.65, 7.095, 14.095 and 21.095 MHz. For complete W1AW schedule send SASE to ARRL, 225 Main Street, Newington, CT 06111.

Amateur radio operators can be found on the same frequencies noted for W1AW. In addition some commercial CW stations can be found near 4.3, 8.5, 13.0 and 16.9 MHz. RTTY stations can be found near 4.0, 4.8, 5.4, 6.3, 7.4, 8.1, 9.0, 10.2, 12.2, 14.5, 16.37 MHz and other frequencies.

OPTIONAL ASCII OUTPUT PORT.

An optional ASCII serial/parallel output port can be added to CODE*STAR. The parts mount on the main PC board and derive all signals and power from it. The port produces standard ASCII code at 110 Baud and can directly drive an ASR33 teleprinter or home computer. It can be configured for 20 mA current loop or TTL. Contact factory for more details.

LIMITED 90 DAY WARRANTY.

KITS. All parts (except the microcomputer IC) are warranted to be free of defect for 90 days after purchase. Parts found defective within this period will be replaced promptly without charge upon receipt for inspection at the factory. DO NOT SEND entire unit. Send defective part only with note of explanation. (The custom micro-computer IC in the kit is 100% tested and burned-in. However, it can be damaged by mishandling and incorrect voltages and, therefore, is not included in the warranty.) Microcraft Corporation cannot be held responsible for faulty workmanship during assembly or damage/harm caused by construction or installation errors. Units misused or modified are not covered by this warranty.

FACTORY WIRED UNITS. All parts and labor are warranted for a period of 90 days after purchase. Should a difficulty occur, please call or write the factory. Some situations are minor and can be handled by a letter or call. Should the unit need to be returned to the factory for servicing, pack carefully, insure and enclose a note of explanation. Microcraft Corporation will service the unit at no charge and pay for the return shipping. Units misused or modified nullify this warranty and require a \$30.00 fee for service. Units out of warranty also require the \$30.00 service fee. (See REPAIR SERVICE.)

REFUNDS.

Unassembled kits and factory assembled units may be returned within 10 days of their original shipping date for refund of the purchase price minus the shipping and handling fee--provided they have not been abused or damaged. Contact factory BEFORE shipping.

REPAIR SERVICE.

Assembled CODE*STAR kits (or factory assembled units out of warranty) may be returned for repair and calibration for a fee of \$30.00. Please enclose a note of explanation AND the fee of \$30.00. This covers minor repair, adjustment, return shipping and a service report. Units with major defects will be subject to an additional charge. Owners will be notified before additional work is performed. If repairs are minor, a refund will be issued.

Units assembled with paste flux, acid core solder, or solder guns will not be accepted. Microcraft Corporation reserves the right to refuse repair on unreasonably constructed units.

SHIPPING ADDRESSES:

Pack all returns adequately and insure for your protection.

For UPS:

Microcraft Corporation
9957 N. River Road
Mequon, WI 53092

For US Post Office:

Microcraft Corporation
P. O. Box 513
Thiensville, WI 53092.

CONSTRUCTION OF CODE*STAR KIT

INTRODUCTION. The CODE*STAR kit is intended for intermediate to advanced kit builders. Its construction requires good workmanship and attention to detail. Please look over the entire manual **before** proceeding. If after reading the manual, you feel you do not wish to build the kit, you may wish to return the unassembled kit for a refund (less handling charges) or for credit on a wired and tested unit.

Use a small tipped soldering iron of 25-30 watts. **DO NOT USE A SOLDER GUN!** Use a good grade of rosin core solder. Do NOT use acid core solder. Good soldering techniques are important. Take your time and check your work carefully. Construction begins with the main PC board and ends up with the final wiring of the chassis.

MAIN PC BOARD. This is a single-sided board. Components are mounted on the top and soldered on the foil side. Refer to the diagrams and notes in this manual for parts placement as well as the silk screened legend on the board itself. *(Note: The section of PC board labelled OPTION-01 is reserved for the optional ASCII port and no parts should be placed in that section.)*

1. Install the sockets for IC2, IC3 and IC4 and solder. (ICs will be installed later.)
2. Install all fixed resistors and solder. Save scrap leads.
3. Use four scrap leads to form jumper wires. Install jumpers in place of D3 and D4 and solder. Also install jumpers in J1 and J2 and solder.
4. Install rectifiers D1, D2, D5 and D16. Make sure cathode end (band) corresponds to layout. Solder.
5. Install diodes D6-D15. Make sure cathode (band) corresponds to layout. Solder
6. Install all of the ceramic capacitors and solder.
7. Install the mylar capacitors and solder. Do NOT mix up C33 with the others.
8. Install the electrolytic capacitors and solder. Observe the polarity markings.
9. Install the small transistors and solder. Carefully observe the orientation of the emitter (e), base (b) and collector (c) to correspond to layout. Do NOT mix up the 2N3906 with the 2N3904 types.

10. Install the trimmer resistors R30 and R53 and solder. Sometimes the trimmers are hard to solder. Before installing, sand or file the trimmer leads to help the solder adhere.
11. Attach the heat sink to IC1 with a 4-40 screw and nut. Install IC1 vertically on the board and solder. It should be oriented with its backside toward the rear panel.
12. Install the crystal CR1 and solder. Do NOT overheat it.
13. Cut an insulated length of wire to 8 inches. Strip and tin each end 1/8 inch. Install this jumper wire on the top side of board between point marked "+8" near IC1 and point marked "+8" near C26.
14. Solder lengths of insulated wire to the board at the locations noted below for connection to the off-board parts. Wire goes in top of board and is soldered on foil side. The specific wire needed and a suggested color code and length follows:
 - a. GND wire, color green, length 6 inches.
 - b. G wire, color green, length 4 inches.
 - c. +12 wire, color red, length 6 inches.
 - d. RECEIVER wire, any color, length 5 inches.
 - e. KEY wire, any color, length 7 inches.
 - f. LED + wire, any color, length 4 inches.
 - g. LED - wire, any color, length 4 inches.
 - h. SPEAKER (2 wires), any color, length 8 to 9 inches each.
 - i. Rotary switch wires marked on board as L,M,N,O,Q,T,W (7 wires). Use any color, length 7 to 8 inches each.
15. Give the board a good inspection. Check for possible solder bridges. Trim off excess component lead lengths on foil side.

THIS COMPLETES CONSTRUCTION OF THE MAIN PC BOARD. SET IT ASIDE FOR NOW AND CONTINUE WITH THE DISPLAY BOARD.

DISPLAY PC BOARD. This is a double sided board with plated through holes and only needs to be soldered on the bottom. Refer to the diagram in this manual for parts placement as well as silk screening on the board itself.

1. Install the four IC sockets and solder. (The ICs will be installed later.)
2. Install the Molex soldercons for DIS1 through DIS4. The soldercons should be cut into strips of nine, inserted into the top of the board, and soldered on the bottom of the board. After soldering, the top connecting piece of the soldercon may be bent and broken off. Some care should be used in lining up the soldercons before soldering to insure a good fit for the IEE 3785R displays.

3. Install the resistors on the board and solder. Note that they are installed in an upright position.
4. Install the ceramic capacitors on the board and solder.
5. Install solid wire jumper wires in the holes marked H, C, P, G, D, J, K, U, V, X, Y, Z, A, B, F and E. The jumpers are made from scrap leads (about 1/2") saved from components. They should be bent in the shape of an "L" and installed in the top (front) of the main board. The jumpers should extend parallel to the display board and point downward.
6. Carefully install the IEE 3785R displays in the Molex soldercons observing the proper orientation, making sure all leads are properly inserted, and seeing that there are no shorts between adjacent leads. If the leads on the 3785R displays are too long, trim them to the necessary length. Check photo of front panel for proper orientation. The decimal points should be down and on the right side as viewed from the front.
7. Give the board a good visual inspection. Check for possible solder bridges and poor solder connections. Trim off all excess lengths.

THIS COMPLETES CONSTRUCTION OF THE DISPLAY PC BOARD.

MATING THE MAIN AND DISPLAY PC BOARDS. The main PC board and the display PC board must be connected together. The solid wire jumpers previously soldered to the display board are for this purpose. (See photo of front panel.)

1. Insert the solid wire jumpers from the display board to the corresponding holes on the main PC board. The display board should be at right angles to the main board. With the solid wires inserted into the proper holes on the main board, push the display board down until it is in contact with the main board. Hold it in position and solder the jumper leads on the bottom of the main board. Trim off excess lead lengths.

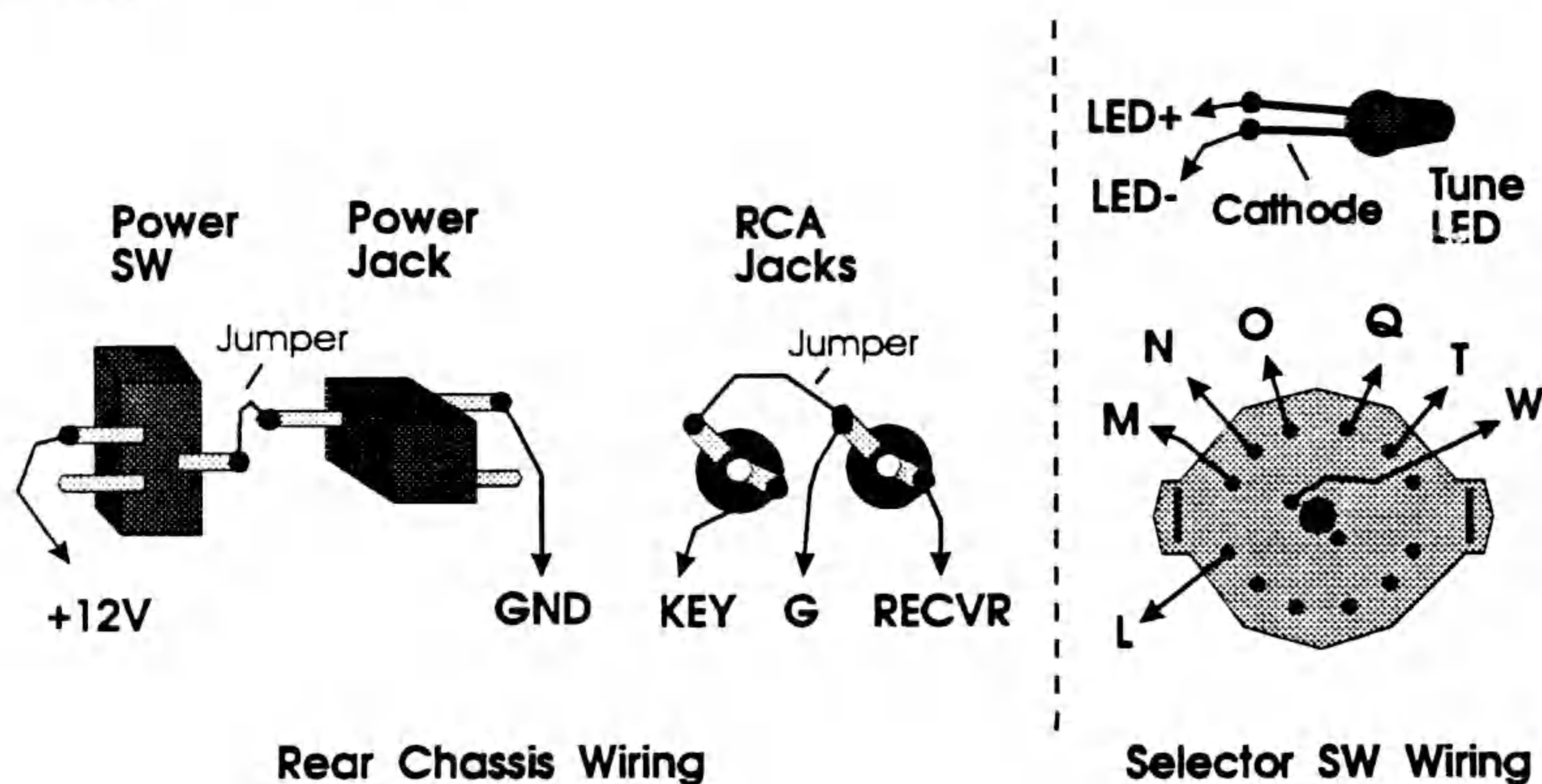
THIS COMPLETES THE MATING OF THE MAIN AND DISPLAY BOARDS.

CABINET AND CHASSIS. The cabinet consists of the chassis, the front panel and the cover.

1. Install the four 1/4 inch main PC board standoffs using the holes in the chassis. The screws are inserted from the bottom of chassis and threaded into the standoff. The screws should extend out of the standoff so a nut can be added later on.
2. Install the loudspeaker in the top cover using the black 4-40 screws and nuts provided.

3. Install the TUNE LED in the front panel. It is installed by first placing the black plastic insert into the panel hole. Next insert the LED and carefully but firmly push on the plastic band to secure it. Note which lead of the LED is the cathode for later reference.
4. Attach the red plastic bezel to the inside of the main cutout in the front panel. Use a good adhesive. Be careful not to scratch the plastic or get unnecessary glue on it as this will detract from the overall appearance of your CODE*STAR.
5. Install the DC jack in the rear panel.
6. Snap in the hole plug in the rear panel.
7. Install the rotary switch in the front panel with hardware provided. See sketch in manual for orientation.

FINAL ASSEMBLY. The main PC board will now be installed and the final wiring completed. Refer to the diagram below for wiring of the selector switch and rear panel wiring.



1. Install the main PC board in the chassis on the four previously installed standoffs. Use 4 nuts to hold it in place.
2. Install and solder a short insulated wire jumper between the power switch and power jack as shown. Also install jumper between RCA jack grounds.

3. Connect and solder the remaining wires from the main PC board to rear panel as shown.
4. Connect and solder the wires to the selector switch as shown. Check these wires carefully before soldering.
5. Connect and solder the two wires to the TUNE LED as shown.
6. Connect the remaining two wires to the speaker terminals. DO NOT overheat terminals or you may damage the speaker.

POWER SUPPLY CHECKOUT. THE POWER SUPPLY VOLTAGES MUST BE CHECKED OUT BEFORE THE ICS ARE INSTALLED. A DC VOLTMETER IS REQUIRED.

1. Plug the power adapter plug into the power jack on rear panel. With the power switch "off" plug the adapter into a 120 VAC source.
2. Turn on the power switch and measure the +5 VDC source with respect to ground. (A +5 VDC source can be found on the LED + wire.) It should measure in the range of +4.75 to 5.25 volts. If there is no voltage or it is incorrect, remove the adapter and try to find the source of the problem. DO NOT PROCEED until the +5 VDC source is operating properly as serious damage could occur to the ICs.
3. The other voltages on the board will be higher than normal because there is no load. Typical values are: +8 VDC ~ 15 to 18 VDC; +12 VDC ~ 16 to 20 VDC. These voltages will drop when the ICs are installed.

IC INSTALLATION. Carefully check the orientation of the ICs when installing.

1. Install the 4 ICs on the display board.
2. Install IC2 and IC3 on the main board.
3. Carefully install the custom 40 pin microcomputer IC. Make sure it is oriented properly with no bent under pins. THIS IC IS NOT COVERED BY WARRANTY AS IT CAN BE DAMAGED BY INCORRECT VOLTAGES OR MISHANDLING. IT IS 100% TESTED AND BURNED-IN AT THE FACTORY.

FINAL CHECKOUT. Carefully check over everything done thus far for possible loose connections or poor solder joints. If everything done thus far looks okay, proceed.

1. Plug in the power adapter and turn on the power switch. After 1 or 2 seconds the display should come on and indicate the mode selected.
2. Rotate the mode switch. Each of the modes should be displayed. The display will flicker when in the RTTY modes. This is normal and is due to the microcomputer scanning the input.
3. Connect a telegraph key to the KEY jack. When keyed, a tone should be heard in the speaker. Adjust R53 for maximum sound and maximum brightness on the TUNE LED. At this point you should be able to test your "fist" by sending Morse code to CODE*STAR via the key.
4. Adjust the VOLUME trimmer for your preference.
5. To complete your CODE*STAR, attach the top cover with the screws provided.

Congratulations On Successfully Building Your CODE*STAR!

CODE*STAR PARTS LIST

BAG 1 MAIN PC BOARD AND CHASSIS

- 17- C1,C2,C4,C5,C8,C12,C13,C14,C16,
C17,C18,C19,C20,C21,C26,C29,C35--
0.047uF or 0.05uF ceramic disc capacitor
- 3 - C3,C27,C30--100uF, 16V electrolytic
capacitor
- 6 - C6,C7,C10,C11,C31,C32--0.0022uF mylar
capacitor
- 1 - C9--22uF, 10V electrolytic capacitor
- 3 - C15,C22,C25--0.2uF ceramic disc
- 2 - C28,C34--10uF, 10V electrolytic capacitor
- 1 - C24--47pF ceramic disc capacitor
- 1 - C23--27pF ceramic disc capacitor
- 1 - C33--0.022uF mylar capacitor

- 2 - R1,R37--1.5K ohm (brown-green-red)
- 1 - R2--1.8K ohm (brown-gray-red)
- 1 - R3--470K ohm (yellow-violet-yellow)
- 3 - R4,R14,R43--2.2 meg (red-red-green)
- 6 - R5,R32,R49,R51,R55,R57--10K ohm
(brown-black-orange)
- 4 - R6,R22,R27,R39--6.8K ohm (blue- gray-red)
- 3 - R7,R18,R20--150K ohm (brown-green-yellow)
- 2 - R8,R21--1K ohm (brown-black-red)
- 8 - R9,R23,R28,R29,R33,R41,R42,R47--
1 meg ohm (brown-black-green)
- 1 - R10--6.8 meg ohm (blue-gray-green)
- 2 - R11, R40--47K ohm (yellow-violet- orange)
- 4 - R12,R13,R15,R44--4.7 meg ohm
(yellow-violet-green)
- 3 - R16,R17,R45--1.3meg ohm
(brown-orange-green)
- 4 - R24,R25,R26,R54--4.7K ohm (yellow-violet-red)
- 1 - R31--27 ohm (red-violet-black)
- 2 - R34,R35--2.2K ohm (red-red-red)
- 1 - R36--68 ohm (blue-gray-black)
- 1 - R38--470 ohm (yellow-violet-brown)
- 1 - R46--220K ohm (red-red-yellow)
- 1 - R48--680K ohm (blue-gray-yellow)
- 1 - R50--68K ohm (blue-gray-orange)
- 2 - R52,R19--33K ohm (orange-orange-orange)
- 1 - R56--100 ohm (brown-black-brown)
- 2 - R30,R53--20K ohm or 25K ohm trimpot

- 1 - IC4--40 pin microcomputer
- 2 - IC2,IC3--LM3900 Quad Amp
- 1 - IC1--78M05, 5v regulator

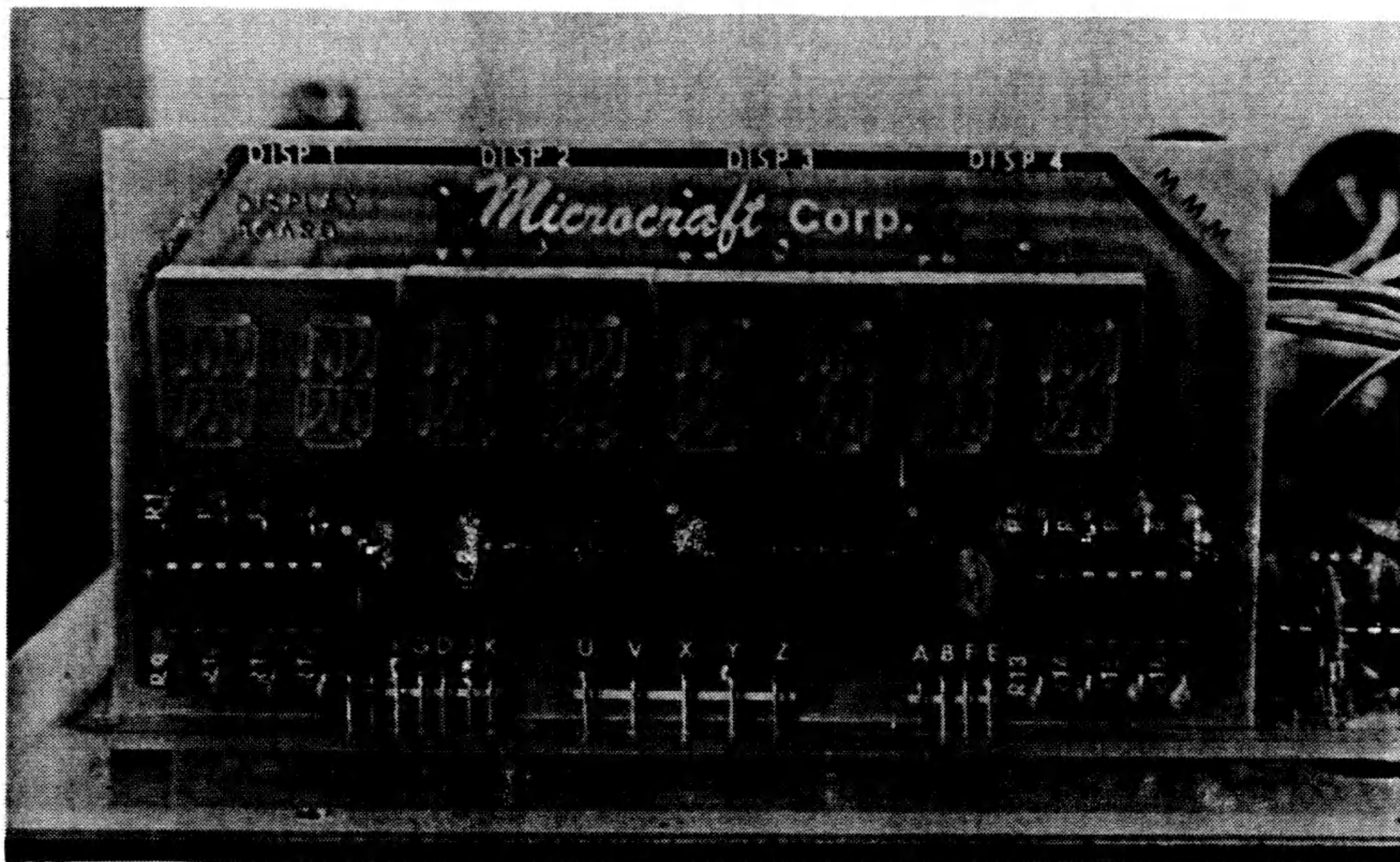
- 5 - Q1,Q2,Q4,Q5,Q6--2N3904
- 1 - Q3--2N3906
- 4 - D1,D2,D5,D16--1N4001 rectifier
- 2 - D3,D4--substitute wire jumpers
- 10 -D6 thru D15--1N914 or 1N4148
- 2 - 14 pin IC socket
- 1 - 40 pin IC socket
- 1 - CR1--3.579 MHz crystal
- 1 - heat sink with 4-40 screw + nut
- 1 - SW1--6 position, 2 pole rotary switch
- 1 - LED and holder
- 1 - DC power jack, 3.5mm
- 1 - 8 ohm speaker
- 4 - 4-40 screws + nuts for speaker
- 1 - knob
- 4 - 4-40 screws + nuts for main pc board
support
- 4 - 1/4 inch standoffs for main pc board
support
- 1 - hole plug (5/8 inch for rear panel)

BAG 2 DISPLAY PC BOARD

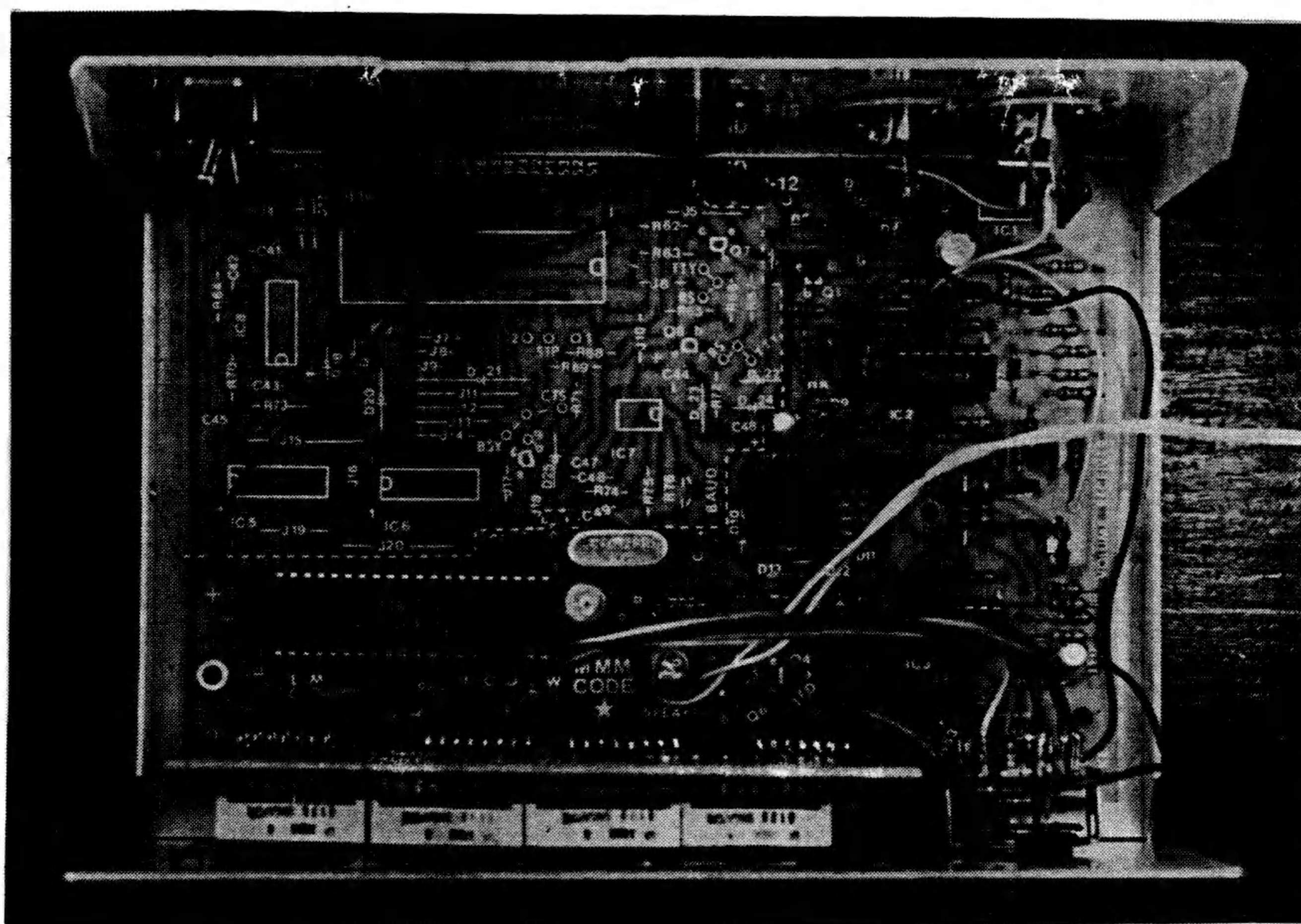
- 2 - C1,C2--0.047uF or 0.05uF ceramic capacitor
- 4 - DIS1 thru DIS4--IEE 3785R LED display
- 2 - IC1,IC4--75491 or ITT 491
- 2 - IC2,IC3--7445 or 74145
- 2 - 16 pin IC socket
- 2 - 14 pin IC socket
- 8 - R1,R4,R5,R8,R9,R12,R13,R16--1.8K ohm
(brown-gray-red)
- 8 - R2,R3,R6,R7,R10,R11,R14,R15--47 ohm
(yellow-violet-black)
- 2 - Molex soldercons (strip of 36)

MISCELLANEOUS

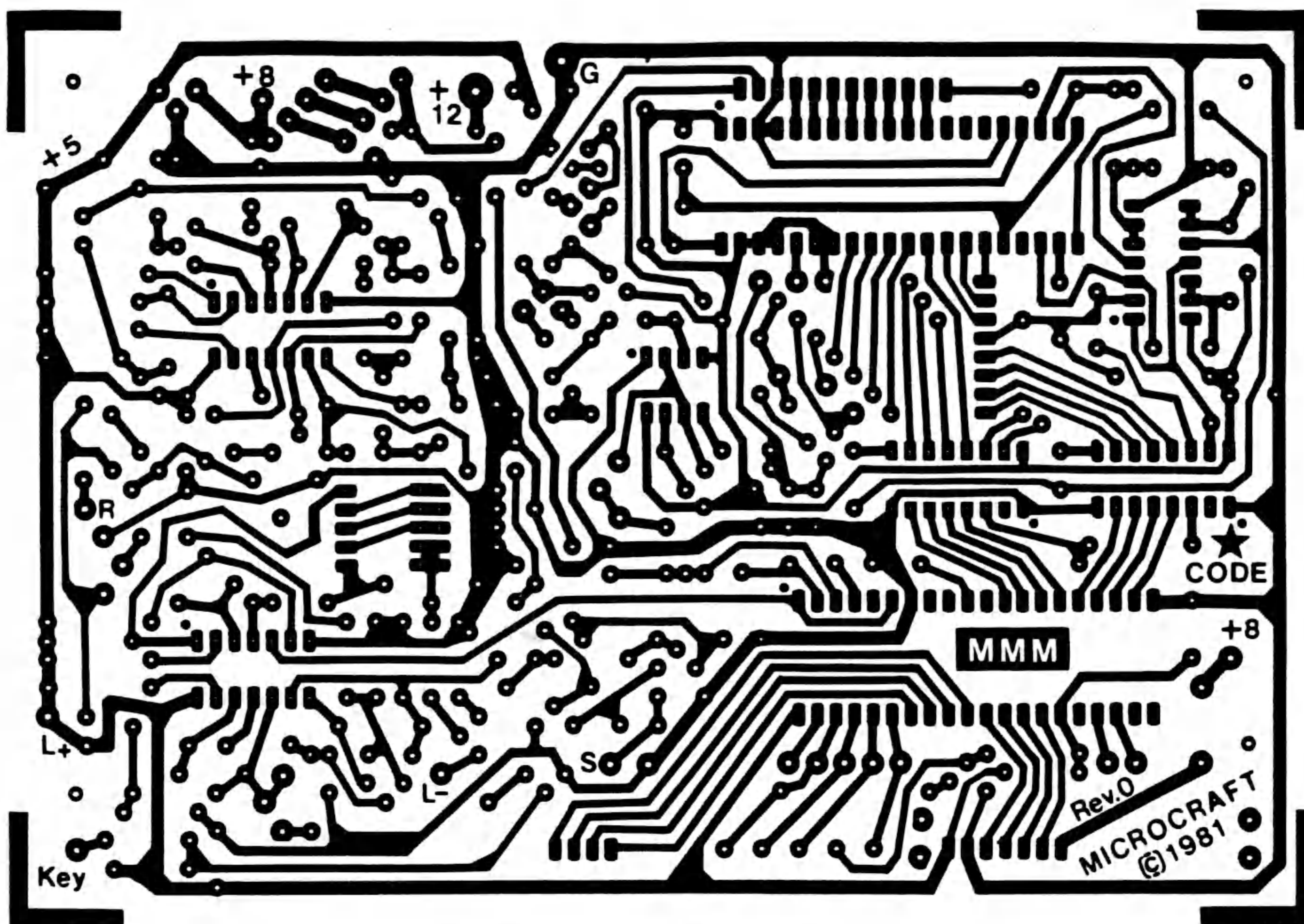
- 1 - wire
- 1 - custom metal cabinet
- 1 - main pc board
- 1 - display pc board
- 1 - 12/13 VDC power converter
- 1 - construction manual
- 1 - red bezel



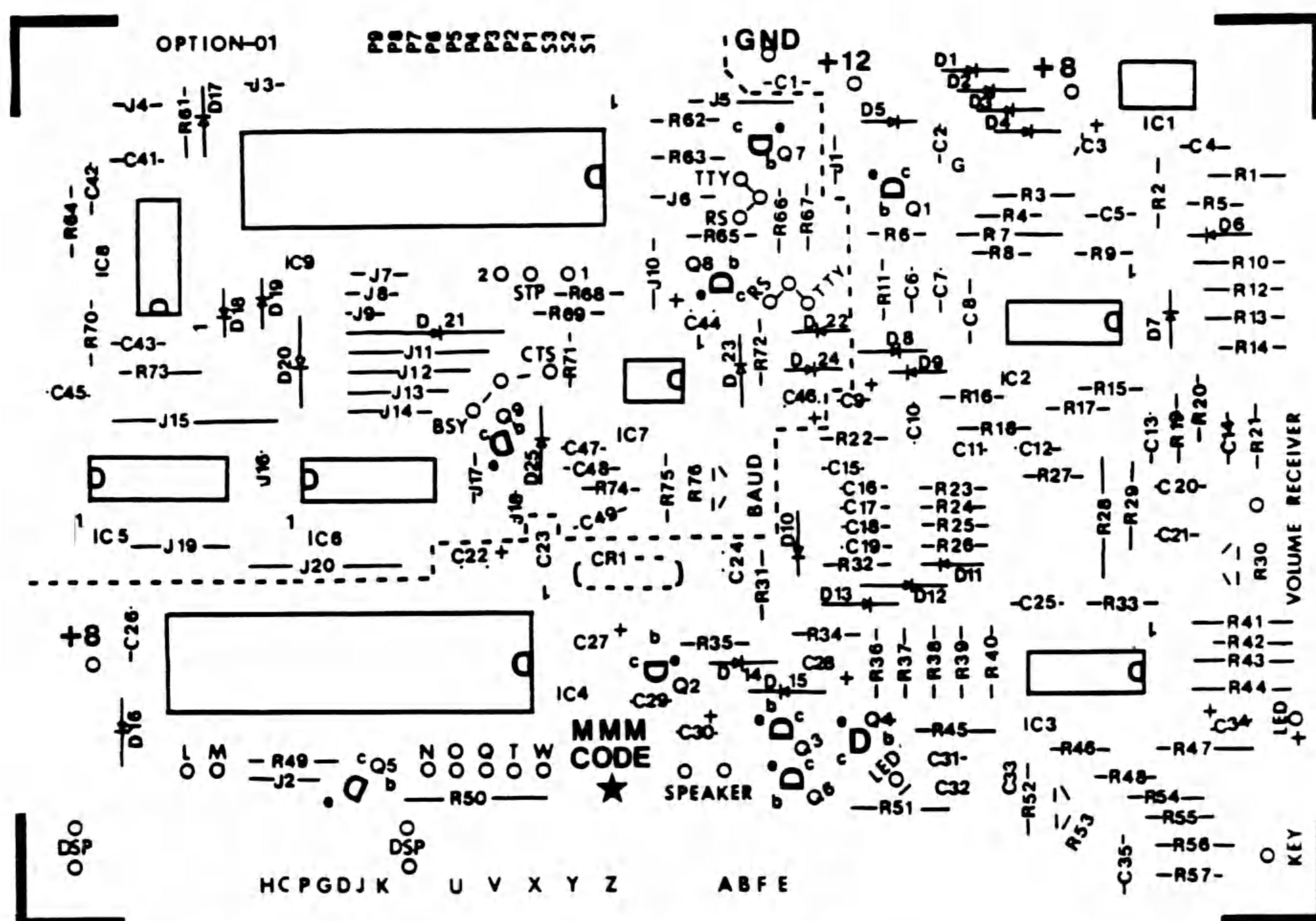
CODE*STAR Front View: Front Panel and Cover Removed.



CODE*STAR Top View: Cover Removed.

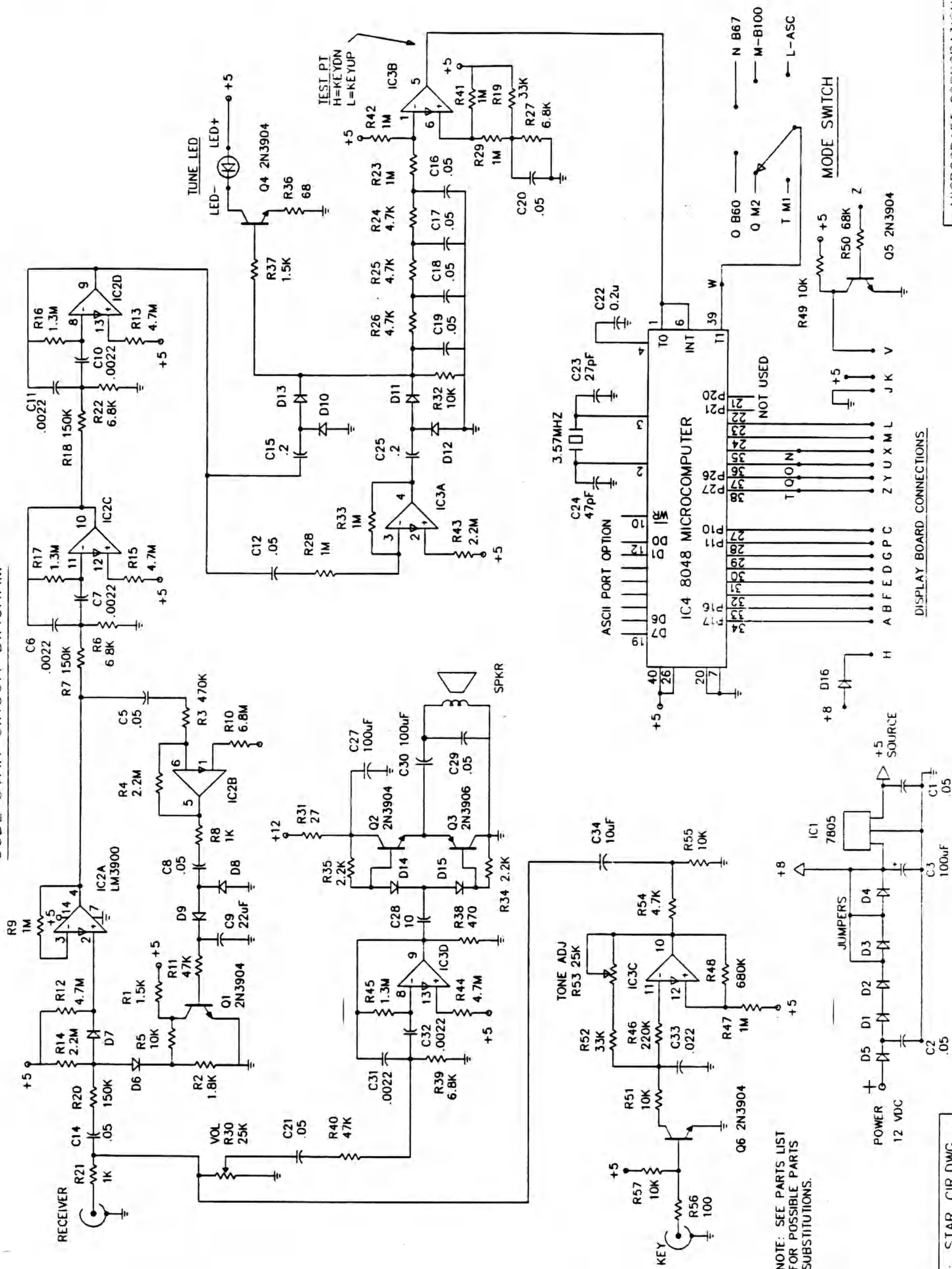


Foil Side - Main PC Board



Legend Side - Main PC Board

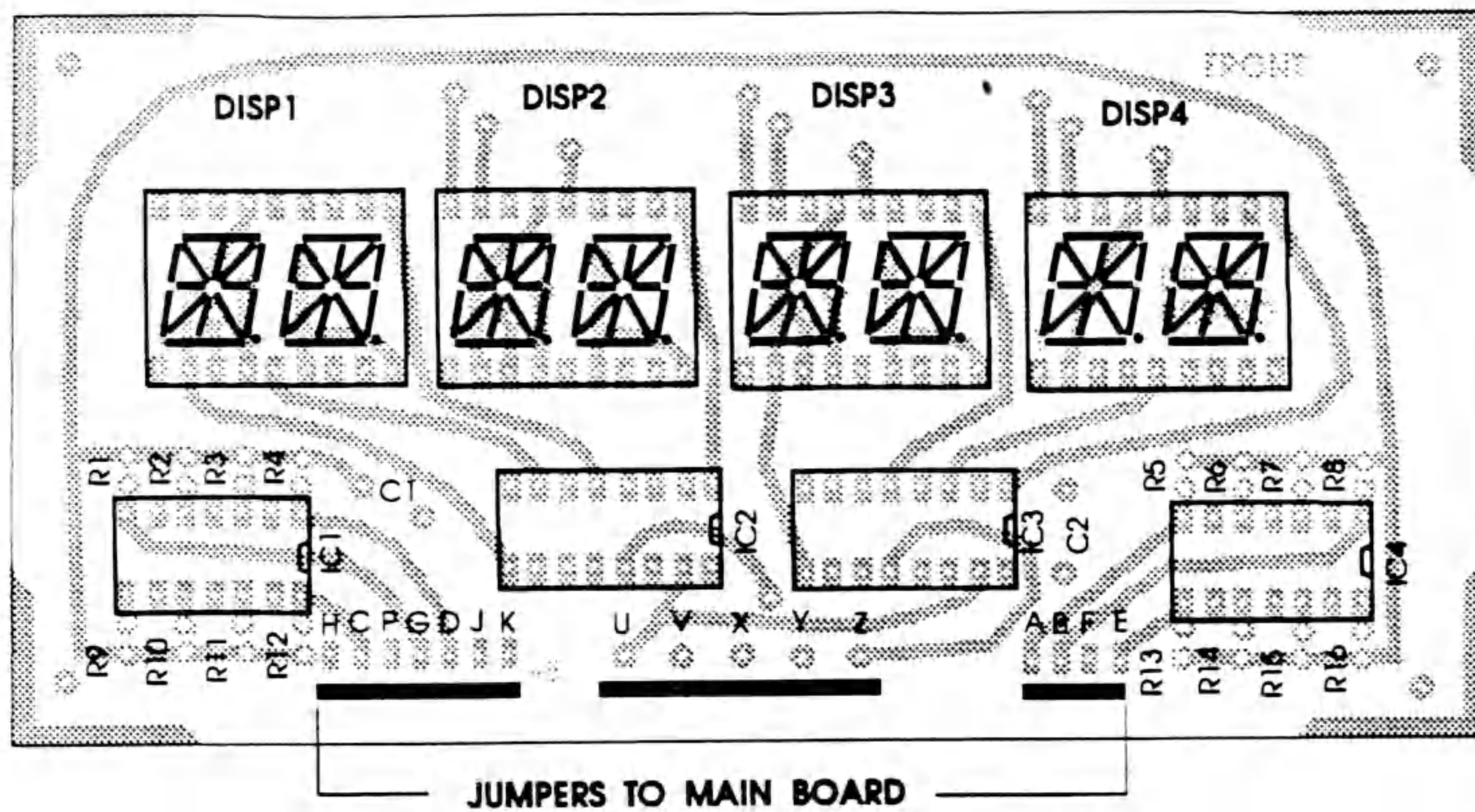
CODE*STAR CIRCUIT DIAGRAM



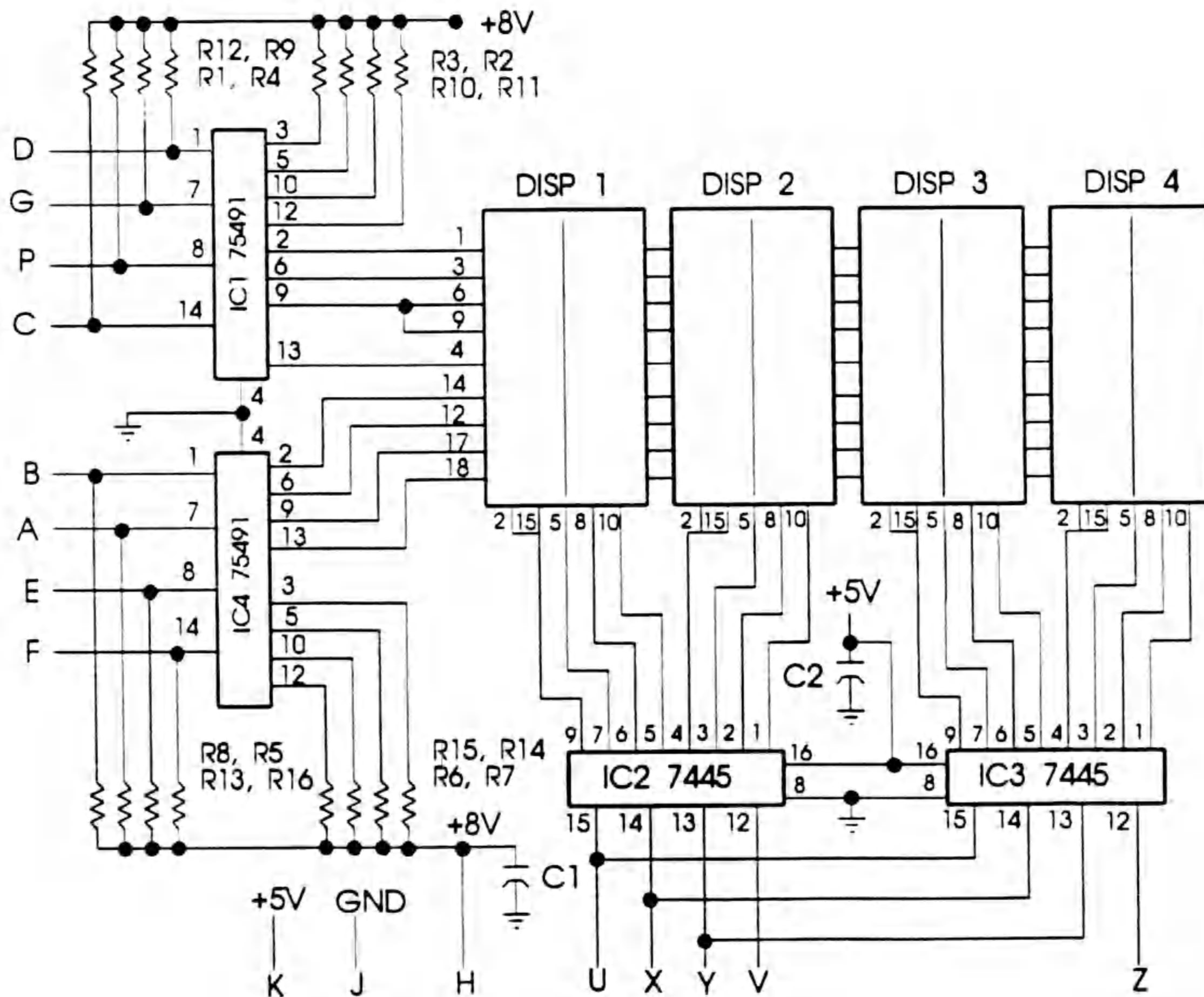
NOTE: SEE PARTS LIST FOR POSSIBLE PARTS SUBSTITUTIONS.

FILE: STAR_CIR.DWG
DWG: GRS 12-21-91

MICROCRAFT CORPORATION
THIENSVILLE, WI 53092



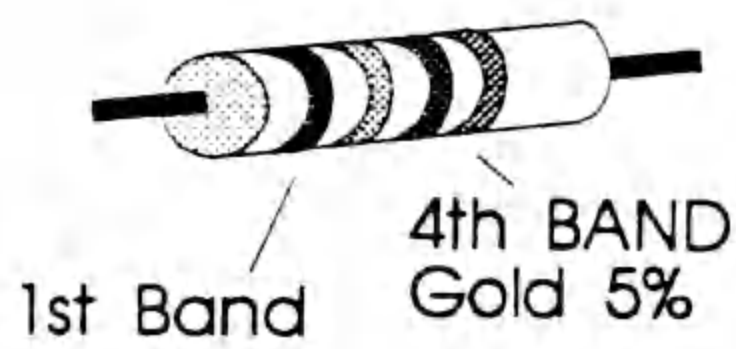
Parts placement for display board.



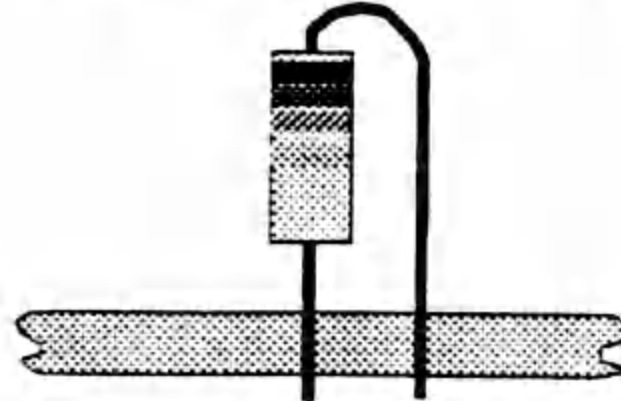
Circuit diagram for display board.

PARTS IDENTIFICATION AND NOTES

Resistor



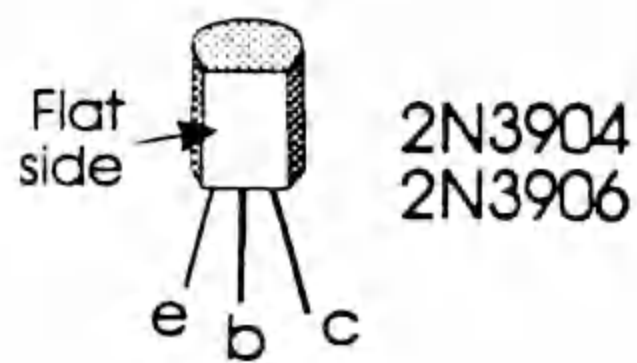
Upright Mounted Resistor



Trimmer Resistor

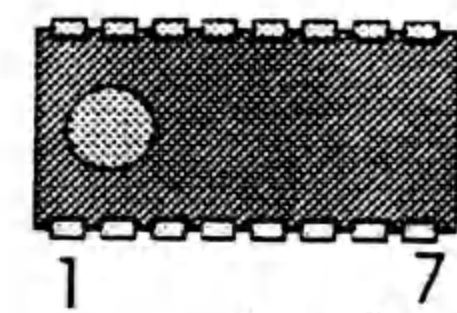
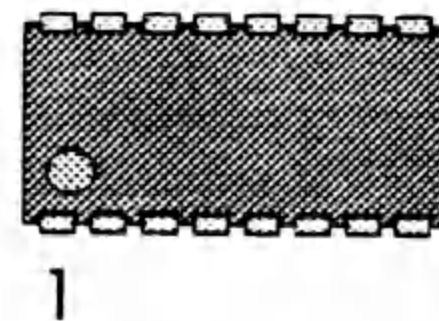
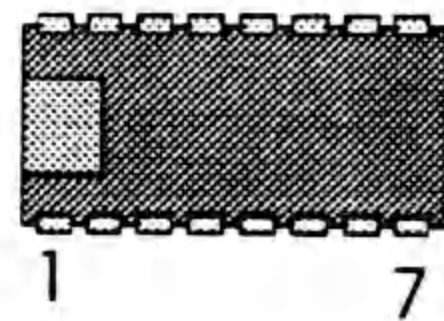


Transistor



IC Pin1 Identification: Top View (14, 16, or 40 pins)

14 (or 16 or 40)

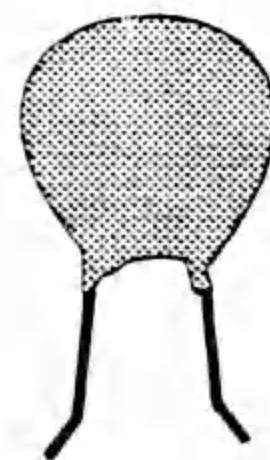


(or 8 or 20)

Electrolytic Capacitor



Ceramic Disk



0.047 uF
0.05 uF
0.2 uF (204Z)

Mylar Capacitor



0.0022 uF (2A222)
0.022 uF (2A223)

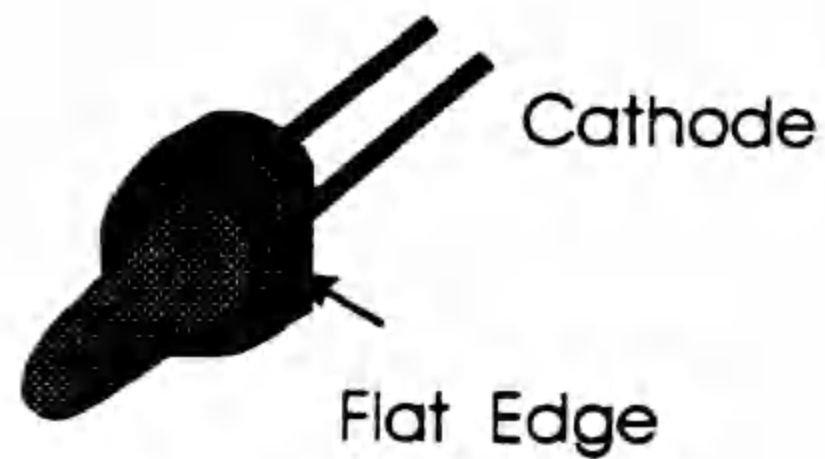
Diode



Cathode Anode



LED



Power Regulator IC



7805
or
78M05