

Code Practice Computer Assembly Instructions

Refer to The ARRL Handbook for details on soldering and CMOS (static sensitive) device handling and soldering. The solder mask on the printed circuit board should help reduce solder bridging. Heat just long enough to flow solder over the whole pad and around the component lead. Treat all semiconductors (IC's) as static sensitive. Wear cotton clothing while assembling. Discharge your body by touching a grounded surface (like your radio's chassis) before handling the component. Touch the leads of the semiconductors as little as possible.

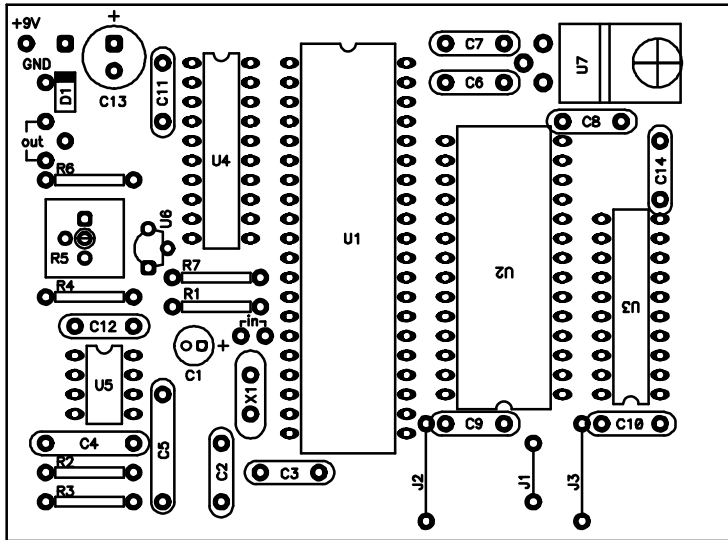
Tools required: soldering iron, rosin core solder, wire cutter, wire stripper

Complete Parts List

1	BATTERY CONNECTOR	9V	BC1
1	CAPACITOR	10 uF 25V	C1
2	CAPACITOR (27)	27 pF	C2,C3
1	CAPACITOR (121)	120 pF	C4
1	CAPACITOR (102)	0.001 uF	C5
8	CAPACITOR (104)	0.1 uF	C6,C7,C8,C9,C10,C11,C12,C14
1	CAPACITOR	100 uF 35V	C13
1	CRYSTAL	6.0 MHz	X1
1	80C31 Microcontroller		U1
1	27C512 EPROM, Programmed		U2
1	74HCT373 Octal Latch		U3
1	DAC0830 D/A Converter		U4
1	LM358 Dual Op-amp		U5
1	LM336 Reference		U6
1	LM7805T Voltage regulator		U7
1	STEREO PHONE JACK		J1 (<u>NOT</u> Jumper J1!)
1	N.O. PUSH BUTTON		S1
1	RESISTOR (BRN BLK ORG)	10K 5%	R1
2	RESISTOR (BRN BLU YEL)	160K 5%	R2,R3
1	RESISTOR (ORG ORG BLK)	33 5%	R4
1	POTENTIOMETER	500 5%	R5
1	RESISTOR (BRN BLU BLK)	16 5%	R6
1	RESISTOR (RED RED RED)	2.2K 5%	R7
1	28 Pin Dip Socket for EPROM		
1	1N4001 Diode		D1
1	Enclosure		
1	BATTERY	9V	BT1
	24" Wire for jumpers & hookup		

Parts not included with kit: enclosure, battery

Component Placement



General assembly sequence

- [1] Install the three jumpers at J1, J2, and J3.
- [2] Install all resistors.
- [3] Install all capacitors. Note polarity of C1 and C13.
- [4] Install the socket for the EPROM at U2.
- [5] Install the battery and headphone connectors and the mode switch. This involves cutting and stripping the wire to length to fit in your enclosure.

Option 1:

See schematic in detailed assembly section.

Turn the unit on/off by connecting the battery, or with an on/off switch in line with the red battery lead. The mode switch is connected to the pads labeled "in". The battery connector red lead connects to the pad labeled "+9", and the black lead connects to the pad labeled "GND". The stereo headphone jack connects to the pads labeled "out", preferably with the shield (ground) terminal connected to the "out" pad nearest the "GND" pad and the left and right channel terminals connected together to the "out" pad nearest R6.

Option 2:

See schematic in QST.

Turn the unit on/off by inserting a monophonic headphone plug into the stereo jack. The mode switch is connected to the pads labeled "in". The battery connector red lead connects to the pad labeled "+9", and the black lead connects to the stereo headphone jack shield (ground) terminal. The stereo headphone jack's right channel terminal (which is the one that connects to the collar on the plug) is connected to the pad labeled "GND". The stereo headphone jack's left channel terminal (which is the one that connects to the tip of the plug) is connected to the pad labeled "out" nearest R6. There is no connection to the pad labeled "out" that is nearest the pad labeled "GND".

- [6] Install diode D1. Note polarity.
- [7] Install crystal X1.
- [8] Install the integrated circuits one at a time - note orientation of the IC's! They don't all have pin #1 pointing the same direction.

Detailed assembly sequence

[1] Install jumpers

- Cut J1 to 9/16" length. Strip 1/8" insulation off each end. Solder in place.
- Cut J2 to 3/4" length. Strip 1/8" insulation off each end. Solder in place.
- Cut J3 to 3/4" length. Strip 1/8" insulation off each end. Solder in place.

[2] Install Resistors

- Solder RESISTOR (BRN|BLK|ORG) 10K ohm 5% at R1
- Solder RESISTOR (BRN|BLU|YEL) 160K ohm 5% at R2
- Solder RESISTOR (BRN|BLU|YEL) 160K ohm 5% at R3
- Solder RESISTOR (ORG|ORG|BLK) 33 ohm 5% at R4
- Solder POTENTIOMETER 500 ohm at R5
- Solder RESISTOR (BRN|BLU|BLK) 16 ohm 5% at R6
- Solder RESISTOR (RED|RED|RED) 2.2K ohm 5% at R7

[3] Install Capacitors

- Solder CAPACITOR 10 uF 25V at C1. Note Polarity. The long lead is inserted through the hole nearest the "+".
- Solder CAPACITOR 27 pF at C2
- Solder CAPACITOR 27 pF at C3
- Solder CAPACITOR 120 pF at C4



C4 Lead Form Example

- Solder CAPACITOR 0.001 uF (1000 pF) at C5



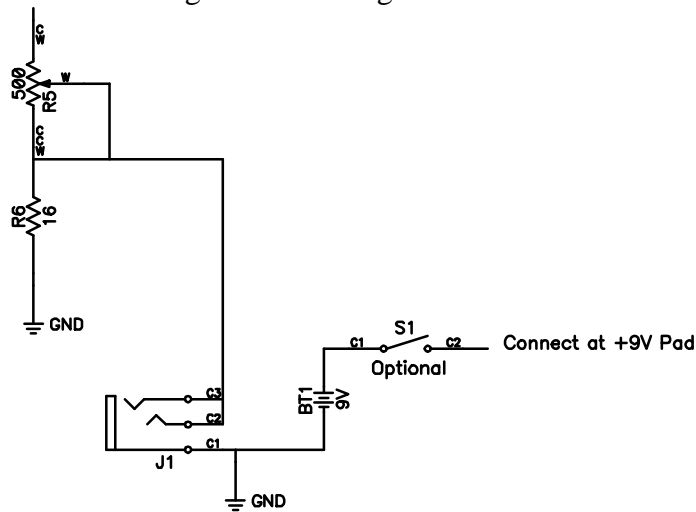
C5 Lead Form Example

- Solder CAPACITOR 0.1 uF at C6
- Solder CAPACITOR 0.1 uF at C7
- Solder CAPACITOR 0.1 uF at C8
- Solder CAPACITOR 0.1 uF at C9
- Solder CAPACITOR 0.1 uF at C10
- Solder CAPACITOR 0.1 uF at C11
- Solder CAPACITOR 0.1 uF at C12
- Solder CAPACITOR 0.1 uF at C14. This part was omitted in the QST schematic.
- Solder CAPACITOR 100 uF 35V at C13. Note Polarity. The long lead is inserted through the hole nearest the "+".

[4] Install the battery and headphone connectors and the mode switch. This involves cutting and stripping the wire to length to fit in your enclosure.

Option 1:

Illustrated in the following schematic fragment:



Turn the unit on/off by connecting the battery, or with an on/off switch in line with the red battery lead. The mode switch is connected to the pads labeled "in". The battery connector red lead connects to the pad labeled "+9", and the black lead connects to the pad labeled "GND". The stereo headphone jack connects to the pads labeled "out", preferably with the shield (ground) terminal connected to the "out" pad nearest the "GND" pad and the left and right channel terminals connected together to the "out" pad nearest R6.

Option 2:

Illustrated in the schematic in the QST article.

Turn the unit on/off by inserting a monophonic headphone plug into the stereo jack. The mode switch is connected to the pads labeled "in". The battery connector red lead connects to the pad labeled "+9", and the black lead connects to the stereo headphone jack shield (ground) terminal. The stereo headphone jack's right channel terminal (which is the one that connects to the collar on the plug) is connected to the pad labeled "GND". The stereo headphone jack's left channel terminal (which is the one that connects to the tip of the plug) is connected to the pad labeled "out" nearest R6. There is no connection to the pad labeled "out" that is nearest the pad labeled "GND".

[5] Install Diode

Solder Diode D1. Align banded end with silk screen.

[6] Install Crystal

Solder 6.0 MHz crystal at X1.

[7] Install Integrated Circuits

Note 1: All Integrated Circuits must be oriented correctly! Position pin 1, which is indicated by a dot and/or a notched end of the IC, towards the notch on the silk screen.

Note 2: The leads of the Integrated Circuits may have to be formed to insert in the circuit board. Use an IC insertion tool like Radio Shack 276-1581, or hold the IC with one row of pins on a flat surface and *carefully* press down on the body until the pins are nearly perpendicular to the package. The same applies to the EPROM (U2) leads before inserting in the socket.

- Solder socket for U2. Align notched end of socket with notch on silk screen.
- U7. Form leads. The metal tab should lay against circuit board. The mounting hole may not line up. Solder in place.



U7 Lead Form Example.

- U5. Solder in place.
- U6. The flat side of the component should be aligned with the flat on the silk screen.
- U4. Solder in place.
- U1. Solder in place.
- U3. Solder in place.
- Insert U2 in its socket. Position pin 1, which is indicated by a dot and/or a notched end of the IC, towards the notch on the silk screen.

Debugging Suggestions

Turn the CPC on. Connect a battery, or insert a monophonic headset, depending on how you have wired the audio output and power connectors. Double check this wiring.

Use a volt meter to measure the voltage on the battery. It should nominally be whatever the battery is (9V, 12V, etc.). Anything substantially less indicates a weak battery, or a short on the CPC. Make sure D1 is installed correctly. D1 protects the CPC from reverse battery connections, but if it is installed backwards, it will look like a short to the battery. Measure the voltage between pins 10 and 20 on U3, the latch. It should be 5V. If it isn't there is a problem with U7, the 5V regulator.

Listen for the oscillator with a general coverage receiver at 6 MHz and at the harmonics (12 MHz, 18 MHz, etc.). This should correlate with the unit being turned on and off. You can also listen with an AM broadcast radio tuned to the low end of the band. Try tuning around 750 KHz. You should hear static bursts that form Morse code characters separated by long static bursts that correspond to the digitized speech. If you hear this, but still don't hear anything in your earphones, focus your attention on the circuit from the DAC through to the earphones.

Double check the orientation of the semiconductor components. The IC's are the only parts that will keep the CPC from doing anything if they are improperly installed. Of course, the components in the audio path will keep the unit from making sounds if they aren't installed (R2, R4 for instance)! Make sure you soldered all of the component leads. If you've soldered an IC in backwards, your best bet is to use braided solder wick to remove the solder, then install a socket before trying that part correctly installed, since ICs frequently don't like being soldered three times (1-backwards; 2-removal; 3-correctly), and the socket makes it easy to install a replacement part if the backwards installation destroyed the original part.

Operating Instructions

Operation is simple. The headphone jack is a stereo jack, but it is intended to be used with a monophonic headset. Use an adapter if you have stereo headphones. The shield conductor of the mono plug makes contact between the battery's ground and the circuit ground. Plugging in the head phone jack turns the unit on. The default mode is set to random characters at Farnsworth 5@16. Pushbutton switch S1 is used for changing operating modes. Pressing the switch cycles through a verbal menu, speaking "G", "R", "S", "T", "5", "1", "2", "X". Releasing the switch during or immediately after the desired mode is spoken selects that mode. The modes are: "G" = five character Groups, "R" = Random characters, "S" = characters in Sequence, "T" = Toggle speech on/off, "5" = Farnsworth 5@16, "1" = Farnsworth 13@18, "2" = Farnsworth 20@23, "X" = eXit with no mode change.