

# KEYLITE



**The Keylite keys your rig with paddles or an IBM compatible Keyboard.**

## Specifications:

**Power Requirements: 9V-14V**

**Maximum current draw: Less than 20ma plus Keyboard.**

**Keyboard input: Standard IBM (small) jack, 6 pin RA Mini-DIN.**

**LCD: 2 line, 16 1/4" Characters, backlit display**

**Buffer: 32 Characters.**

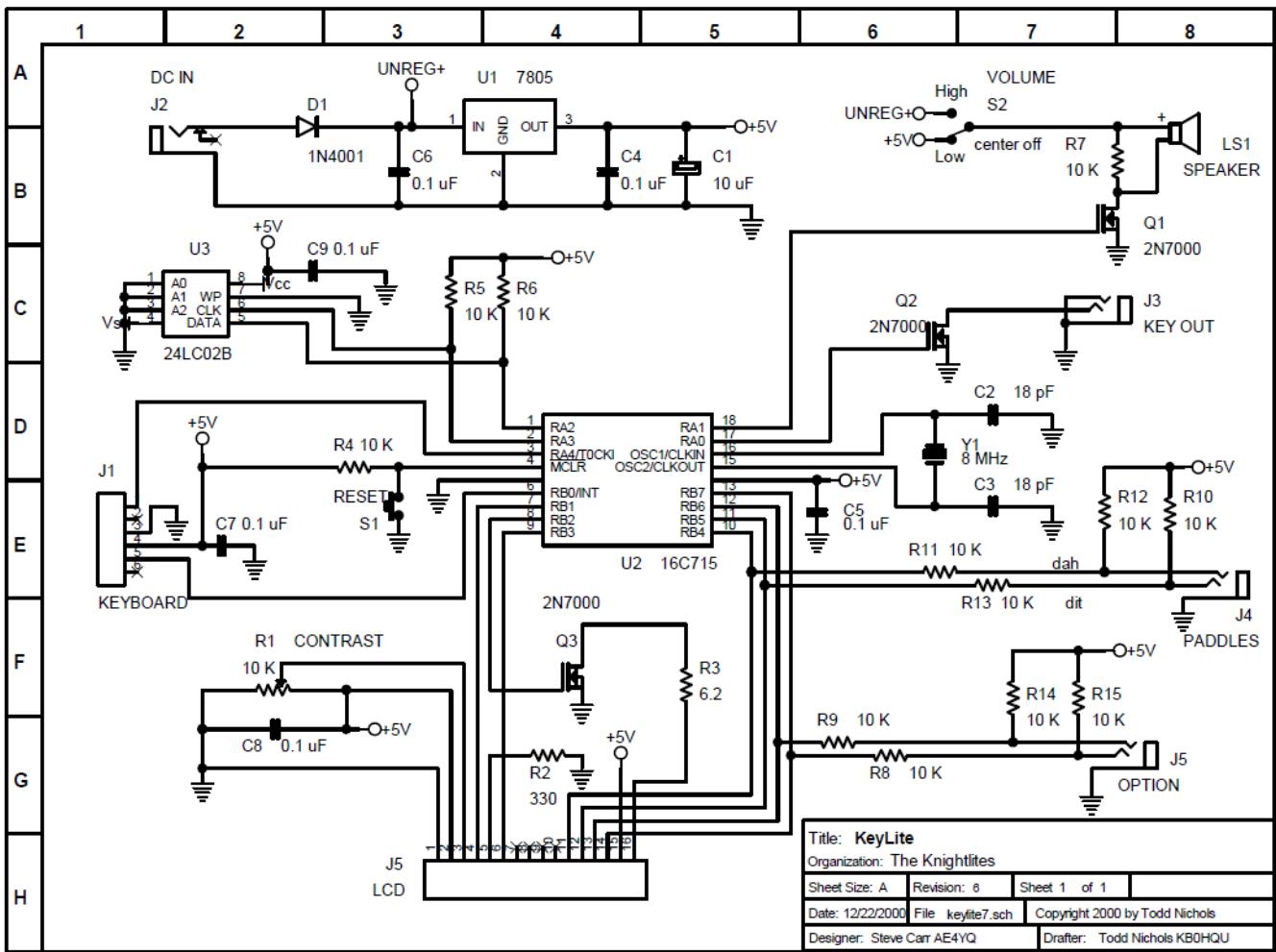
**Code Speed: 1-99 Words per minute, standard or Farnsworth.**

**Memories: Four 64 character memories. May be chained.**

**Beacon mode: Keyboard entry disables beacon.**

**Paddles: Standard paddle input**

**Case Size: 4-3/4" X 2-1/2" X 1-1/2"**



## KeyLite Schematic

# KEYLITE SOFTWARE DESCRIPTION

## INTRODUCTION

The **Keylite** is a very flexible little device developed by the Knightlites QRP Association. It is a memory keyer, it is a beacon keyer, it will operate with an IBM keyboard or Paddles. It sends special characters with a single keystroke. Its internal speaker allows code practice or listening to memories without transmitting. The memories can be chained together or used independently. The Keylite makes it easy for any ham to send perfect code.

The kit is easy to assemble and fun to use. The LCD gives the user a clear view of what has been typed, and the buffer allows time to make keyboard corrections before the message is completed. The Beacon Mode and many other features make the Keylite a flexible tool. Its small size allows it to go anywhere. The current draw is minimal, controlled mostly by the keyboard used.

The Knightlites development team, Steve, AE4YQ, and Todd, AG4AY were assisted by John, WB4OFT, Randy, WJ4P, Gary, N3GO and Bob, AE4IC in putting the package together.

## NORMAL OPERATION

Most of the time the user will type the desired text via the keyboard into the KeyLite's buffer and the keyer will convert the buffered keystrokes into Morse code and send it out the speaker and key outputs. This mode supports the keys '0'-'9', 'a'-'z', and several special characters. Shift keys are ignored. The special keys are as follows:

Key	Character	Morse	Displayed Character
.	.	....-	.
,	,	-...--	,
?	?	...-..	?
-	-	-.....	-
\	/	...-	/*
+	AR	...-	+
<enter>	BT	-...-	=
]	SK	...-.-	]
[	AS	-...-	[
<bksp>	Removes key from buffer or sends HH .....		

- Since the shift key is not supported and the "/" and "?" share the same key, the Keylite uses the "\/" key to generate the forward stroke (-...-).

## FUNCTION KEYS

The function keys are used for accessing the memories or making various setting changes. Following is a summary of the various function key operations.

F1 read/write memory 1

F2 read/write memory 2

F3 read/write memory 3

F4 read/write memory 4

F5 set WPM (default 20)

F6 set Farnsworth (default 20)

F7 set beacon interval in seconds (default 00)

F8 set backlight power (default 1)

F9 toggle key enable (default on)

F10 toggle speaker enable (default on)

F11 toggle beacon enable (default off)

F12 toggle backlight enable (default on)

## STRINGING CHARACTERS TOGETHER

Morse code characters can be paired as needed to create non-alphanumeric codes such as AR, BT, and SK. To do this, press the <left Ctrl> key followed by the two characters. NOTE: you must enter the second character before the first character is done keying to prevent spacing added between characters.

## SETTING CODE SPEED

There are two speed settings that can be made. Pressing F5 followed by two digits will set the character speed from 1-99 WPM. Pressing F6 followed by two digits will set the word speed from 1-99 WPM. Entering a word speed greater than the character speed will disable Farnsworth operation.

While adjusting the code speeds, the F9 key can be used to disable/enable the key out to the transmitter. Also, the F10 key can be used to disable/enable the sound to the speaker.

## MEMORY OPERATION

To enter a message into the memory press the <left Ctrl> key followed by one of the four memory function keys (F1-F4). Set the speaker (F10) enable if needed. While entering to memory, the F9 key can be used to disable/enable the key out to the transmitter. Type in the desired message and press the <Esc> key to end the memory entry operation.

Press the F1-F4 key to load pre-recorded data from memory into the key buffer. There are 4 memories of 64 bytes each, however one byte is required as an end of message indicator. Messages longer than 64 bytes are allowed to overflow into the next memory, so the user could store four 63 character messages or one 255 character message. All single keystroke characters require storage of one byte.

## BACKLIGHT CONTROL

If enabled, the backlight turns on whenever there is data in the buffer. The F12 key is used to enable/disable the backlight. The F8 key allows adjustment of the backlight power from 10% to 100%.

## BEACON OPERATION

To set up the beacon, enter the desired message into memory 1 and use the F7 key to enter the number of seconds the beacon waits between sends. The F11 key is used to enable/disable beacon mode. As a safety the default wait time of 00 also disables the beacon in the event the user accidentally presses the enable.

Beacon is disabled at the end of the current message on keyboard entry. <Esc> disables immediately.

## **PAUSING AND CLEARING**

The <scroll lock> key pauses keying of characters from the buffer. The <Esc> key clears the buffer. The <Esc> key is also used for clearing other operations, such as setting parameters using F5-F8 and the 'control' flag.

## **PADDLE OPERATION**

The KeyLite supports the use of paddles when the buffer is empty or paused. Keying speed is the same speed as with the keyboard.

# KEYLITE ASSEMBLY INSTRUCTIONS

The Keylite is a relatively simple device to assemble due to the power of the PIC processor to reduce the number of discrete parts required to make it work. However, we suggest the following sequence of steps to simplify the assembly process. We will assemble the KeyLite starting with the parts lowest to the board and work our way "up" from there.

1. Install R2, a 330 ohm (orange, orange, brown) resistor.
2. Install R3, a 6.2 ohm (blue, red, gold) resistor.
3. Install the remaining resistors, R4 through R15, all 10K ohm (brown, black, orange).
4. Install the 1N4001 diode. Match the banded end of the diode to the marking on the circuit board.
5. Install Y1, the 8 MHz crystal.
6. Install the two 18pF capacitors at C2 and C3, near the 8 MHz crystal.
7. Install the .1uF capacitors at locations C4 through C9.
8. Install the three 2N7000 FET transistors at Q1, Q2, and Q3. Push them down to within 1/8" of the printed circuit board.
9. Install the IC sockets at U2 and U3. Match the notched ends to the marking on the circuit board. A trick to make sure the socket is mounted flush with the printed circuit board is to initially solder only two pins on opposite corners of the socket. Then apply some pressure with a finger on the socket top, re-heat the two connections and the socket will "seat". Once you are sure the sockets are flush against the board, solder the rest of the pins. Make sure your finger is not on the pins you are heating!
10. Install C1, the 10uF electrolytic capacitor. Pay attention to the polarity of this part.
11. Install J3, J4, and J5. Initially solder one pin on each connector, then use a slight pressure while re-heating the connection to make sure the jacks are flush with the board. Note: J5, is unused.
12. Install S1. Because it is wider in one dimension, it will fit correctly in one plane only.
13. Install J1 and J2. Make sure they are flush with the board.
14. Install the speaker, LS1.
15. Install U1, the 7805 regulator. A "dry fit" is the best way to make sure the leads are bent at the right points. Typically, the bend point is right at the transition from the wide part to the narrow part of the leads. Install U1 with the heat-sink between the 7805 and the circuit board using the 4-40 hardware supplied. Use a little heat sink compound under the 7805. Solder the leads.
16. Install the male portion of the headers on the main circuit board. These six position headers are installed at each end of the header location, leaving four holes open in the center. It is important to install them as perpendicular to the pcb as possible. To do this easily, solder only one pin initially and re-heat it as many times as required to set the header vertically with the circuit board. Once you are satisfied that it is accurately vertical, solder the remaining pins.
17. Clamp the shaft of R1, the contrast control, in a vise and saw the end off, shortening the shaft about 3/8". Then install R1, soldering one pin first, re-heating it with some pressure applied to make sure it is flush against the circuit board. Note: Some KeyLite assemblers desire to have the contrast control (R1) accessible through the front panel and do not shorten the shaft. (**See "Installing the Keylite in its Case", below**)
18. Some KeyLite assemblers have elected to not install the S2, the volume switch. They used a short jumper wire to connect the "low volume" contacts permanently. (These are the two holes closest to the LCD position.) This results in one less hole to drill in the front panel/top cover. S2 is included in the kit, and if you install it, make sure it is mounted flush and vertically.
19. Install the female portion of the headers on the LCD board assembly at the connections labeled "17" through 32". Solder one pin first as with the male portions of the headers. It is important to have them as square as possible to the LCD pcb. The two six position headers are installed at each end of the header location with four holes left empty in the center between the two header pieces.
20. Install the 1/2" spacers to the top (component side) of the main circuit board using the 4-40 hardware provided.
21. Install three of the .01uF bypass capacitors on the bottom of the board, tack soldering them to the Key Out socket **J3** and the Paddles socket **J4**. See **Figure 1**. Note: Caps are included to bypass Keyboard socket **J1** pins 1 and 5. Do not install them at this time. See **Troubleshooting Section – RFI Issues**.

22. Install a short jumper wire on the power connector, J2, as shown in **Figure 1**.
23. Install the integrated circuits into the IC sockets. The leads of the IC's tend to flare a bit making insertion difficult. Working on a static safe area, re-form the flare of the leads by pushing the IC leads flat against a flat surface and slightly rolling the IC to form them a bit more square to the IC. Do this to both sides. Pay attention to match the notched end of the IC with the notched end of the IC socket.
24. Install the LCD to the main circuit board, carefully matching the header connections and pressing the two circuit boards together until the LCD board assembly meets the spacers. Install 4-40 screws at the four corners of the LCD assembly.
25. Fasten the 4 1/4" nylon spacers to the bottom of the board. Insert 6-36 screws through the corner holes in the board and into the spacers. A couple of drops of glue may be necessary to hold them in place.

The circuit boards are now completed and ready for testing. Set the contrast control fully clockwise. Using the power plug supplied with the kit, wiring positive to the center connector and ground to the sleeve, apply 9 to 12 volts DC to the KeyLite.

The KeyLite will momentarily show its firmware version number and the backlight should also come on momentarily. The Keylite then goes into sleep mode until a key is pressed.

Attach the keyboard connector to J1 on the KeyLite and as you type letters, the KeyLite will display the letters and send them immediately.

#### **Installing the Keylite in it's case:**

The original Keylite case design allowed access to all controls through holes in the top panel. Some users discovered that once set, the controls were rarely changed. Therefore the holes in the cover were unnecessary. **Figure 2**, the Case Drilling Guide, indicates hole positions so the builder may choose either method. Note that the holes on the sides of the box are oversized in order for the plug bodies to fit past the case and be fully inserted into the jacks. The builder may have to modify hole size and shape to accommodate his particular plugs. Note: J5 is unused at present. No need for a hole in the case for J5.

The Keylite board assembly is a snug fit inside it's case, and is not fastened in place. If it seems loose, use thin strips of foam tape or cardboard to shim it to a tight fit.

# Keylite Troubleshooting Section

If your KeyLite doesn't function properly, take a moment to make doubly sure that you have the correct parts in the correct places. Most of the resistors are 10K ohm values, so the critical ones will be R2 and R3. The same can be said for the capacitors, with C2 and C3 being the critical parts to verify correct placement. Verify that the IC's, U2 and U3, are inserted correctly. Last but not least, look at the solder joints. Systematically scan the board comparing your board to **Figure 1**. Look for solder bridges between traces. Focus on each and every connection to verify that you actually soldered them ALL.

## **NO DISPLAY ON POWER UP**

Turn R1, the contrast control, fully clockwise and press the reset button. Try to see if the backlight is operating momentarily on power up or reset. The KeyLite re-sets its backlight level to "1" on power up and reset. This is the lowest level of illumination.

## **NO BACKLIGHT ON POWER UP (And no display, either!)**

- 1) Verify the polarity of your input voltage. (Plus to the center pin of the connector.)
- 2) Verify that you installed the jumper on the power connector.
- 3) Verify that U1, the 7805 regulator is inserted correctly.
- 4) Using a voltmeter, verify that there is 5 volts DC at pin 3 of U1.
- 5) If no voltage is present at pin 3 of U1, measure voltage at pin 1 of U1. This should be at least 8 volts DC.
- 6) Verify that D1 is inserted correctly.
- 7) Verify that U2 an U3 are inserted correctly.
- 8) Verify that all connections to the LCD are soldered.

## **NO BACKLIGHT (display works fine)**

- 1) Verify that Q3 is inserted correctly.
- 2) Verify that R3 is a 6.2 ohm resistor.
- 3) Verify that all connections to the LCD are soldered.

## **TRANSMITTER DOES NOT KEY USING THE KEYLITE**

- 1) Verify that F9 (Key On/Off) is not toggled to "off".
- 2) Verify that Q2 is inserted correctly.
- 3) Verify that J3 connections are soldered to the PCB.

4) Double check the connecting plug and wire to the transmitter.

## **NO SIDETONE FROM THE KEYLITE**

- 1) Verify that F10 is not toggled to "Speaker off".
- 2) Verify that Q1 is inserted correctly.
- 3) Verify that LS1 is soldered.
- 4) Verify that S2 is soldered.

## **RFI ISSUES - Keyboards**

The KeyLite can be susceptible to RFI in some cases, primarily due to the type of keyboard that is used. It has been our experience that some types or brands of keyboards are more prone to RFI than others. If you have a choice of keyboards available to you, select one with low current draw.

If you are having trouble with the keyboard, first verify that the Keylite operates correctly without transmitting. Then, if the KeyLite demonstrates RF sensitivity while transmitting, try another keyboard. Or, try grounding the internal metal frame around the keys and any other metal parts of the board. Some keyboards may require bypassing (.01uF) at their power connections. The optional bypass capacitors on J1 in the KeyLite may be used to resolve RFI in some cases, but they cause operating problems for some keyboards.

## **WHEN ALL ELSE FAILS**

For further help with your KeyLite, check the Knightlites Web Site at [www.Knightlites.org](http://www.Knightlites.org) or contact Gary, N3GO, at n3g0@us.ibm.com for specific problem solving help.

# Bill of Materials

## **WQ4RP Knightlite Keylite Kit BOM**

Qty	Designators	Description	Vendor	Part Number
1	R1	10K Potentiometer	Digi-Key	CT2265-ND
1	R2	330 1/4W Resistor	Digi-Key	330QBK-ND
1	R3	6.2 1/4W Resistor	Digi-Key	6.2QBK-ND
13	R4-R15	10K 1/4W Resistor	Digi-Key	10KQBK-ND
1	C1	10 uF 50V Electrolytic Capacitor	Digi-Key	P5178-ND
2	C2, C3	18 pF 100V Capacitor	Digi-Key	1329PH-ND
6	C4-C9	0.1 uF 50V Capacitor	Digi-Key	P4525-ND
5	C10-C14	0.01 uF 50V Capacitor	Digi-Key	P4582-ND
3	Q1, Q2, Q3	2N7000 FET	Digi-Key	2N7000-ND
1	D1	1N4001	Digi-Key	1N4001MSCT-ND
1	U1	16C715 PIC Processor	Digi-Key	PIC16C715-20I/P-ND
1	U2	7805 Regulator	Digi-Key	NJM7805FA-ND
1	U3	24LC02B EEPROM	Digi-Key	24LC02B/P-ND
1	Y1	8 MHz Crystal in HC/18	Digi-Key	X021-ND
1	LS1	Speaker	Digi-Key	P9924-ND
1	J1	6-pin RA Mini-DIN Keyboard Connector	Digi-Key	CP2460-ND
1	J2	2.5 mm DC Power Connector	Digi-Key	CP-202B-ND
3	J3, J4, J5	3.5mm Stereo Open Circuit Jack	Digi-Key	CP-3523N-ND
1	S1	Pushbutton Switch	Digi-Key	CKN9010-ND
1	S2	SPDT Center Off Toggle Switch	All-Electronics	MTS-50PC
1	LCD1	16X2 Liquid Crystal Display Module	Mouser	PRD250LPW-ND
1		8-pin IC Socket	Digi-Key	ED3108-ND
1		18-pin IC Socket	Digi-Key	ED3118-ND
2		6-pin Male Header		
2		6-pin Female Header		
1		Printed Circuit Board		
4		Spacers Round F/F 4-40x0.500"		
4		Spacers Round Nylon .250"		
8		Screws Phillips 4-40x1/4"		
4		Screws Phillips 6-32x1/4"		
1		Screws Phillips 4-40x3/8"		
1		4-40 Hex Nuts		
1		6-32 Internally-toothed Lock Washers		
1		TO-220 Heat Sink	Digi-Key	HS106-ND
1		Case 4.7" x 2.6" x 1.4"	Digi-Key	HM104-ND
1		External Power Plug	Digi-Key	CP-004B-ND