

Introduction:

All ham radio operators are aware of the 10 minute ID requirement, this kit will make compliance with that regulation quite easy. However, this kit can also be used for many other timing needs since there are three separate timers and they can all be changed using the menus. The timers are best for “set once, use many” type of timing needs since it is a little tedious to set the delays. The user can rely on the tone output or use the keyed output to actuate another sound device, a relay or even a transmitter. The timer can be configured for use as a sleep timer with the addition of an external relay. It can also be used as a Morse Code beacon - and includes capability for QRSS (Very slow Morse code).

The timing is fairly accurate using a 32 kHz watch crystal. The kit is low power and doesn't require a power switch although it will work fine with a switch since all settings are kept in non-volatile EEPROM memory and won't be lost if the power is removed.

General notes on building the 10 Minute Timer

The integrated circuit (U1) and the output transistor (Q1) are MOS devices. This means that it should be handled as little as possible to prevent static damage. The builder should use a grounding strap and anti-static mat if available or at the very least, work on a grounded metal surface and be sure to touch ground prior to touching these parts.

One decision the builder should make before starting construction of the 10 Minute Timer kit is how the project will be mounted in the case. Ideally, the 10 Minute Timer should be mounted in an all metal case to minimize RF pickup - an Altoids tin will work fine. The circuit board can be mounted to the case with 4-40 (1/8 inch) sized hardware..

The 10 minute timer is built on a “universal” board for the 12F6xx PIC microcontrollers. There are several components that are not used in this circuit for which there are positions on the universal board.

The components should be inserted a few at a time, soldered in place and then clip the leads. The pads and traces are small and delicate - a small tipped, low power (25 watts or less) soldering iron should be used.

Building the 10 Minute Timer

Step 1) Get the parts together: All of the board mounted components have been supplied but you will still have to provide off-board items to fully implement the kit. These items include:

Output connector, optional to transmitter or external relay
metal case, an Altoids or other candy tin will work fine
mounting hardware, 4-40 sized
three momentary contact switches
piezo transducer, external drive type
3V battery holder, two AAA cells are fine

Step 2) Identify and orient the components: Most of the components should be fairly easy to identify and place - see the parts list and the parts placement diagram for descriptions. The diodes are the small glass axial components - the band indicates the cathode end of the diode. The MOSFET should be inserted as shown with the flat side away from the PIC device (U1). C1 and C4 are both small blue capacitors, C1 (marked 104) is bagged with the circuit board, C4 is bagged with the other parts.

step 3) Place and solder the components on the main circuit board: Use the parts placement diagram for information on the placement and orientation of the parts. Clip the leads after soldering. Here is a suggested sequence for installing the parts for the version 2 board:

- a) DIP socket - should be inserted with the notch towards the top of the board
- b) C1 - marked 104 - located on the left edge of the board near the top
- c) C2 - marked 15 - located on the left edge of the board below C1
- d) C3 - marked 15 - located on the left edge of the board below C2
- e) X1 - cylinder crystal - located to the right of C3
- f) R1 - brown, black, orange, gold - located just to the left of the 8 pin socket
- g) D2 - glass diode - located below R1, banded end towards the bottom edge of the board
- h) D1 - glass diode - located below and to the right of the socket, banded end towards the bottom of the board
- I) jumper - use a piece of wire or a component lead to connect the two pads above D1
- j) Q1 - marked 2n7000 - located to the top right of the 8 pin socket, flat side towards the top edge of the board

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k) C4 - marked 103 - located above Q1

Step 4) Check the board: Before proceeding, take the time to check the bottom of the board for solder bridges. Use the bottom view diagram as a guide to visually check for these shorts. It may help to clean the flux from the board and then use a strong light in conjunction with a magnifying glass to see these problems. Also, double check the orientation of the critical components such as the MOSFET. After you are convinced that the board is OK, form the leads of IC U1 to fit in the socket, insert the IC the socket, being sure to follow the parts placement diagram for proper orientation (pin 1 indicated by a notch or dimple should be towards the contact area of the board).

Step 5) Solder connecting wires from the board to the piezo, switches, output jack and battery holder. Powerup the 10 minute timer by inserting the cells into the battery holder. The 10 minute timer should respond with an FB played through the piezo. If the FB is not heard, power should be removed immediately and all the connections should be re-checked. Soldering problems are the main source of most problems with kits.

Operation:

There are three separate count down timers, one for each of the three buttons (Switch, UP, DOWN). Start the timer by a Press And Release (PAR) of the desired button. The seconds will start to tick (if the TCK option is ON) through the piezo speaker. When the delay is complete, the recorded message will play. If any of the buttons is PAR during a count down, the ticking will cease and the programmed delay for the timer will be sent via the sidetone. This is a quick and easy way to check how the timer is programmed.

The various timer parameters can all be changed using one of the three menus (one menu per button). Enter the menu with a Press And Hold (PAH) of the desired button. After about 2 seconds the timer will respond with the first menu item: MIN? X (where X is the current number of minutes (up to 99) programmed into the timer. Since the minute and second delay programmed into each of the three timers can be different, the MIN? and SEC? menu items appear on all three menus.

Switch Menu item	PAR UP button	PAR DOWN	Default
MIN? set minute delay for Switch timer	increases the delay 1 minute	decreases the delay 1 minute	10
SEC? delay, seconds for Switch timer	increases the delay 1 second	decreases the delay 1 second	0
DL? Dit Length set	increases speed (dit length f/QRS)	decreases speed (dit length f/QRS)	20
RTG? Retrigger mode on / off	turns on the retrigger mode	turns off the retrigger mode	OFF
TCK? second Tick mode on / off	turns on the tick for each second	turns off the tick for each second	ON
DONE			

MIN? - after the Switch button is held for 2 seconds, the 10 minute timer will send MIN? and then it will send the current setting for the delay minutes. PAR UP to increase the minute delay or PAR DOWN to decrease the minute delay. The new delay will be played through the sidetone after the button is released. The range of values is 0 to 99 minutes. The delay will “wrap around” from 0 to 99 if the DOWN button is PAR or 99 to 0 if the UP button is PAR. The sidetone will increase slightly in frequency as the delay is changed. If either the UP or DOWN buttons are PAH, the 10 minute timer will enter a fast set mode and a click will be sent through the sidetone to signify an increase or decrease of one minute - after the button is released the user may or may not hear the present setting. Either button can then be PAR to determine where the delay is. Skip to the next menu item with a PAR of the Switch button. Exit the menu with a PAH of the Switch button (DONE will be sent after 2 seconds).

SEC? - if the Switch button is PAR after MIN?, the 10 minute timer will send SEC? and then it will send the current setting for the delay seconds. PAR UP to increase the second delay or PAR DOWN to decrease the second delay. The range of values is 0 to 59 seconds. The delay will “wrap around” from 0 to 59 if the DOWN button is PAR or 59 to 0 if the UP button is PAR. The sidetone will increase slightly in frequency as the delay is changed. If either the UP or DOWN buttons are PAH, the 10 minute timer will enter a fast set mode and a click will be sent through the sidetone to signify an increase or decrease of one second - after the button is released the user may or may not hear the present setting. Either button can then be PAR to determine where the delay is. Skip to the next menu item with a PAR of the Switch button. Exit the menu with a PAH of the Switch button (DONE will be sent after 2 seconds).

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DL? - if the Switch button is PAR after SEC?, the 10 minute timer will send DL? and then it will send the current setting for the Morse code speed of the timer. This number sent is either the speed in words per minute (with menu item QRS off) OR the dit length in seconds (with menu item QRS on). PAR UP to increase the DL or PAR DOWN to decrease the DL. The range of values is 1 to 60. The delay will “wrap around” from 1 to 60 if the DOWN button is PAR or 60 to 1 if the UP button is PAR. If either the UP or DOWN buttons are PAH, the 10 minute timer will enter a fast set mode and a click will be sent through the sidetone to signify an increase or decrease of one speed unit - after the button is released the user may or may not hear the present setting. Either button can then be PAR to determine where the delay is. Skip to the next menu item with a PAR of the Switch button. Exit the menu with a PAH of the Switch button (DONE will be sent after 2 seconds). Note that the wpm settings below 8 wpm are actually 8 wpm, they are included for use with the QRS setting.

RTG? - if the Switch button is PAR after DL?, the 10 minute timer will send RTG? and then it will send the current setting (on or off) of the retrigger mode. When RTG is on, the timer will automatically restart the delay after it has played the message at the end of the initial delay. This is useful for Morse beacons. PAR UP to turn on the retrigger mode or PAR DOWN to turn off the retrigger mode. PAR switch to advance to the next menu item.

TCK? - if the Switch button is PAR after RTF?, the 10 minute timer will send TCK? and then it will send the current setting (on or off) of the second tick mode. When TCK is on, the timer will automatically send a tick-tock sound via the piezo at each second of the delay. PAR UP to turn on the tick sound or PAR DOWN to turn off the tick sound. PAR switch to advance to the next menu item.

UP Menu item	PAR UP	PAR DOWN	Default
MIN? set minute delay for UP timer	increases the delay 1 minute	decreases the delay 1 minute	0
SEC? delay, seconds for UP timer	increases the delay 1 second	decreases the delay 1 second	30
KEY? output keying on/off	turns on output keying	turns off output keying	ON
POL? output polarity	output ON (low) during delay	output OFF (high) during delay	OFF
QRS? Very slow speed beacon	turns on QRSS beacon mode	turns off QRSS beacon mode	OFF
DONE			

MIN? - after the UP button is held for 2 seconds, the 10 minute timer will send MIN? and then it will send the current setting for the delay minutes. PAR UP to increase the minute delay or PAR DOWN to decrease the minute delay. The new delay will be played through the sidetone after the button is released. The range of values is 0 to 99 minutes. The delay will “wrap around” from 0 to 99 if the DOWN button is PAR or 99 to 0 if the UP button is PAR. The sidetone will increase slightly in frequency as the delay is changed. If either the UP or DOWN buttons are PAH, the 10 minute timer will enter a fast set mode and a click will be sent through the sidetone to signify an increase or decrease of one minute - after the button is released the user may or may not hear the present setting. Either button can then be PAR to determine where the delay is. Skip to the next menu item with a PAR of the Switch button. Exit the menu with a PAH of the Switch button (DONE will be sent after 2 seconds).

SEC? - if the Switch button is PAR after MIN?, the 10 minute timer will send SEC? and then it will send the current setting for the delay seconds. PAR UP to increase the second delay or PAR DOWN to decrease the second delay. The range of values is 0 to 59 seconds. The delay will “wrap around” from 0 to 59 if the DOWN button is PAR or 59 to 0 if the UP button is PAR. The sidetone will increase slightly in frequency as the delay is changed. If either the UP or DOWN buttons are PAH, the 10 minute timer will enter a fast set mode and a click will be sent through the sidetone to signify an increase or decrease of one second - after the button is released the user may or may not hear the present setting. Either button can then be PAR to determine where the delay is. Skip to the next menu item with a PAR of the Switch button. Exit the menu with a PAH of the Switch button (DONE will be sent after 2 seconds).

KEY? - if the Switch button is PAR after SEC?, the 10 minute timer will send KEY? and then it will send the current setting (on or off) of the Output keying mode. When KEY is on, the timer will key the output in time to the message being sent through the sidetone. When KEY is off, the timer will just go key down (or up, depending on the state of POL?) during the message send. This can be useful for actuating a PTT type of arrangement when feeding audio tones into a transmitter. PAR UP to turn on the keying or PAR DOWN to turn off the keying. PAR switch to advance to the next menu item.

POL? - if the Switch button is PAR after KEY?, the 10 minute timer will send POL? and then it will send the current setting (on or off) of the timer output polarity. When POL is on, the timer will turn on the output during the delay. When POL is off, the

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timer will turn off the output during the delay. PAR UP to turn on the polarity or PAR DOWN to turn off the polarity. PAR switch to advance to the next menu item.

QRS? - if the Switch button is PAR after POL?, the 10 minute timer will send QRS? and then it will send the current setting (on or off) of the QRS mode. When QRS is on, the timer will send the message very slowly, the speed set in DL? will be changed from words per minute to seconds per dit. The minute and second delay is ignored when QRS is on. The only delay between beacon message sends is contained within the message (embedded word spaces). The sidetone is turned off during the message send when QRS is turned on. Only the second ticks will be heard while the beacon is operating. PAR UP to turn on the QRS mode or PAR DOWN to turn off the QRS mode. PAR switch to advance to the next menu item.

DOWN Menu item	PAR UP	PAR DOWN	Default
MIN? minute delay for DOWN timer	increases the delay 1 minute	decreases the delay 1 minute	1
SEC? second delay for DOWN timer	increases the delay 1 second	decreases the delay 1 second	0
FST? Fast set menu mode	turns on single letter menu	turns off single letter menu	OFF
MSG? set the message	moves up through the char table	moves down through the char. table	5
CS? set the command speed	increase command speed by 1 wpm	decrease command speed by 1 wpm	16
DONE			

MIN? - after the DOWN button is held for 2 seconds, the 10 minute timer will send MIN? and then it will send the current setting for the delay minutes. PAR UP to increase the minute delay or PAR DOWN to decrease the minute delay. The new delay will be played through the sidetone after the button is released. The range of values is 0 to 99 minutes. The delay will “wrap around” from 0 to 99 if the DOWN button is PAR or 99 to 0 if the UP button is PAR. The sidetone will increase slightly in frequency as the delay is changed. If either the UP or DOWN buttons are PAH, the 10 minute timer will enter a fast set mode and a click will be sent through the sidetone to signify an increase or decrease of one minute - after the button is released the user may or may not hear the present setting. Either button can then be PAR to determine where the delay is. Skip to the next menu item with a PAR of the Switch button. Exit the menu with a PAH of the Switch button (DONE will be sent after 2 seconds).

SEC? - if the Switch button is PAR after MIN?, the 10 minute timer will send SEC? and then it will send the current setting for the delay seconds. PAR UP to increase the second delay or PAR DOWN to decrease the second delay. The range of values is 0 to 59 seconds. The delay will “wrap around” from 0 to 59 if the DOWN button is PAR or 59 to 0 if the UP button is PAR. The sidetone will increase slightly in frequency as the delay is changed. If either the UP or DOWN buttons are PAH, the 10 minute timer will enter a fast set mode and a click will be sent through the sidetone to signify an increase or decrease of one second - after the button is released the user may or may not hear the present setting. Either button can then be PAR to determine where the delay is. Skip to the next menu item with a PAR of the Switch button. Exit the menu with a PAH of the Switch button (DONE will be sent after 2 seconds).

FST? - if the Switch button is PAR after SEC?, the 10 minute timer will send FST? and then it will send the current setting (on or off) of the Fast set menu mode. When FST is on, the timer will only send the first letter of the menu item to save a little time. Also, when FST is on, the timer will send N for ON and F for OFF when annunciating the on/off menu items. When FST is off, the timer will send all 3 (or 2) letters of the menu item. PAR UP to turn on the Fast set menu mode or PAR DOWN to turn off the Fast set menu mode. PAR switch to advance to the next menu item.

MSG? - if the Switch button is PAR after FST?, the 10 minute timer will send MSG? and then it will wait for one of the three buttons to be pressed. PAR switch to skip to the next menu item. PAR UP or DOWN to enter the message set routine. The first character of the message will be sent. Then PAR UP to select the character adjacent (“above”) to the current character (6 instead of 5). PAR DOWN to select the character adjacent (“below”) the current character (4 instead of 5). The possible characters for the message are listed in the table below. Note that the character selection will “wrap around” from 0 to Z if the DOWN button is PAR or Z to 0 if the UP button is PAR. The sidetone will increase slightly in frequency during this menu item. If either the UP or DOWN buttons are PAH, the 10 minute timer will enter a fast set mode and a click will be sent through the sidetone to signify an increase or decrease of one character - after the button is released the user may or may not hear the present setting. Either button can then be PAR to determine what the character is. Note that certain characters (like the word space) must be entered into the message using a special character from the table (SP run together for a word space). Skip to the next character with a PAR of the Switch button. Exit the menu with a PAH of the Switch button (DONE will be sent after 2 seconds). The PAH of the Switch will also write the end of message character at the end of the message. The message can be up to 117 characters long.

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Message characters (where * is a dit and - is a dah):

character	Morse equivalent
-----	-----
0 to 9	----- to ----*
.	period *-*--
,	comma -- **--
END	end of message, END run together *--**
// aka BT	-***-
/	-**-*
?	**__**
SP	word space ****--*, SP run together
A-Z	*- to --**

CS? - if the Switch button is PAR after MSG?, the 10 minute timer will send CS? and then it will send the current setting for the Morse command code speed of the timer. This number sent is either the speed in words per minute. PAR UP to increase the CS or PAR DOWN to decrease the CS. The range of values is 1 to 60. The delay will “wrap around” from 1 to 60 if the DOWN button is PAR or 60 to 1 if the UP button is PAR.. If either the UP or DOWN buttons are PAH, the 10 minute timer will enter a fast set mode and a click will be sent through the sidetone to signify an increase or decrease of one speed unit - after the button is released the user may or may not hear the present setting. Either button can then be PAR to determine what the speed is. Exit the menu with a PAR of the Switch button. Note that the wpm settings below 8 wpm are actually 8 wpm. The Command Speed affects only the non-message Morse sent by the timer. The message speed is controlled by the DL and QRS menu items.

Notes:

The 10 minute timer can be reset to the defaults if power is removed, then PAH the Switch, then restore power and release Switch when FB is played.

The 10 minute timer can be put into a sleep mode to save power. Normally the 10 minute timer defaults to an always on mode that uses about 20 uA at 3V. This current can be reduced to zero (when the timer or beacon is not active) by invoking the sleep mode by first, removing power to the kit, then PAR Switch to discharge the power supply capacitor, then PAH the UP switch, then restore power and release the UP switch when an S (for sleep) and then the FB are played. The downside to the sleep mode is that it may make the switch response slow, sometimes a switch may be PAR but the timer may not recognize this in sleep mode. An alternative to sleep mode is to use the 10 minute timer in the default always on mode and add an SPST power switch to the +3V input to the kit to turn off power to the timer when not in use.

Please feel free to email with any questions, comments, suggestion or problems with this kit. My email address is:
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Thanks for choosing the 10 Minute Timer kit and Best Regards,

Chuck Olson, WB9KZY

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List of parts included with the 10 Minute Timer kit

Ref	marking	Description
C1	.1M or 104	.1 uf multilayer ceramic capacitor
C2	15J	15 pF disc ceramic capacitor
C3	15J	15 pF disc ceramic capacitor
C4	103	.01 uf multilayer ceramic capacitor
D1	1n4148	1n4148 switching diode
D2	1n4148	1n4148 switching diode
R1	brown black orange-gold	10 k ohms 1/4 watt resistor
Q1	2n7000	2n7000 n channel MOSFET transistor
U1	PIC12F629	8 pin DIP, programmed PIC microcontroller
X1	unmarked cylinder	32 kHz watch crystal
		8 pin machined pin socket (for U1)
		circuit board

Items you'll need to provide to complete the 10 Minute Timer kit

Metal case (an Altoids tin is fine)
4-40 sized (1/8 inch) mounting hardware
output jack
two or three momentary contact normally open SPST switches
piezo speaker, external drive type
solder, wire