BYONICS

PicCon Owner's Manual
Version 2.08
http://www.byonics.com/piccon

Overview

PicCon is a small, inexpensive radio controller designed for hidden transmitter hunting. When combined with a radio transmitter, it will produce tone sequences and Morse code messages at user-programmed times. It is completely field programmable via DTMF tones, utilizes EEPROM for all programmed options so they are remembered when power is removed, and is quite compact.   PicCon interfaces to a radio transceiver like a packet radio TNC does. It is controlled by the audio it receives from the radio, in the form of DTMF tones, and operates the radio by controlling the Push To Talk (PTT) while sending audio in the form of tones and modulated CW Morse code.

PicCon includes an LED, to show which state the device is in, and a push-button switch, to allow the starting and stopping of a transmission without requiring a DTMF receiver. There is a jumper option on the board to activate PTT via the microphone line as is required by most hand-held radios. PicCon draws only a few milliamps, and runs off any 7-35VDC source, including a standard 9-volt battery. PicCon was created by Byon Garrabrant, N6BG. More information can be found at the Byonics web site at http://www.byonics.com.

Acknowledgments

Thanks must go to all those who helped test PicCon. Randy Holland, KO6KC; Brian Mileshosky, N5ZGT; Steve Carter, N7RKE; Terry Hudson, KT9V; John Munsey, KB3GK; Jeremy Reese, N8YP; Scott Currie, NS7C; and Tim Wade, N3WAS. In addition, thanks to the testers and users of the original PicCon and my wife, Lara Garrabrant, KD6AYO. Thank you to everyone for helping make PicCon all that it is.
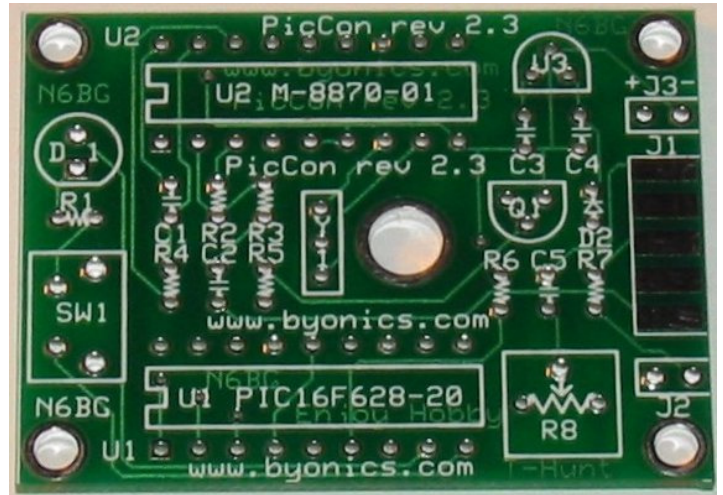
Construction

Schematic

Byonics
PicCon
Byon Garrabrant | Rev 1.0 5/8/2003 | Page 1
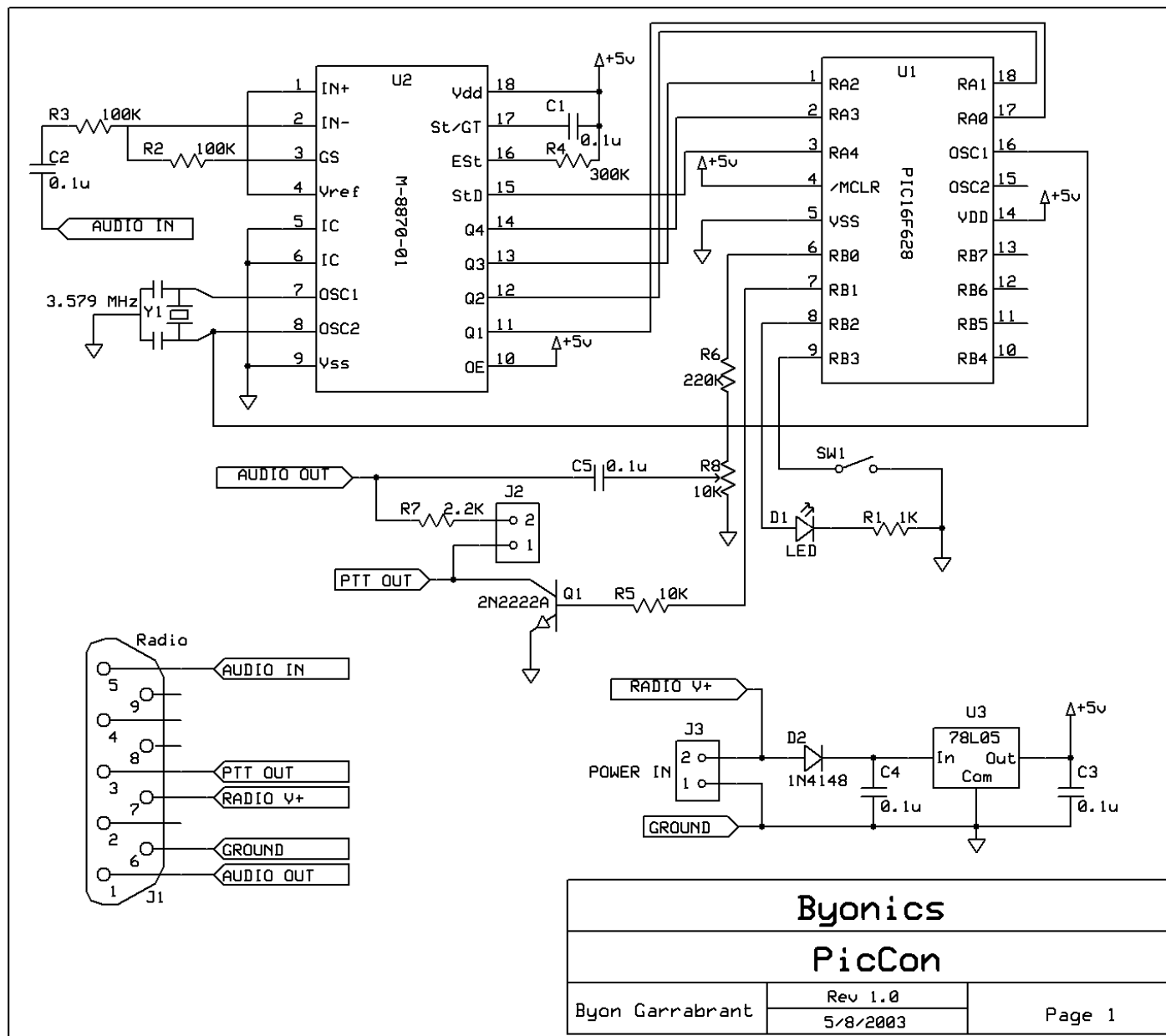
Parts List

U1	PIC16F628-20/P programmed with PicCon firmware
U2	M-8870-01 DTMF decoder
U3	78L05 +5V voltage regulator
Y1	3.579 MHz ceramic resonator
Q1	2N2222A NPN transistor
R1	1 K Ω resistor (brn-blk-red)
R2, R3	100 K Ω resistor (brn-blk-yel)
R4	300 K Ω resistor (org-blk-yel)
R5	10 K Ω resistor (brn-blk-org)
R6	220 K Ω resistor (red-red-yel)
R7	2.2 K Ω resistor (red-red-red)

R8	10 K Ω trimmer potentiometer (103)
C1, C2, C3, C4, C5	0.1 µf capacitor (104)
D1	Green T1-3/4 LED
D2	1N4148 diode
SW1	SPST switch (mom. cont.)
J1	DB9 female solder cup connector
J2	1x2 jumper header post
	Jumper shunt
	18 Pin DIP sockets (2)
PCB	PicCon Printed Circuit Board

Printed Circuit Board

The PicCon printed circuit board (PCB) is double sided, silk-screened, and solder masked. There are 4 mounting holes in the corners, and another mounting hole in the center.
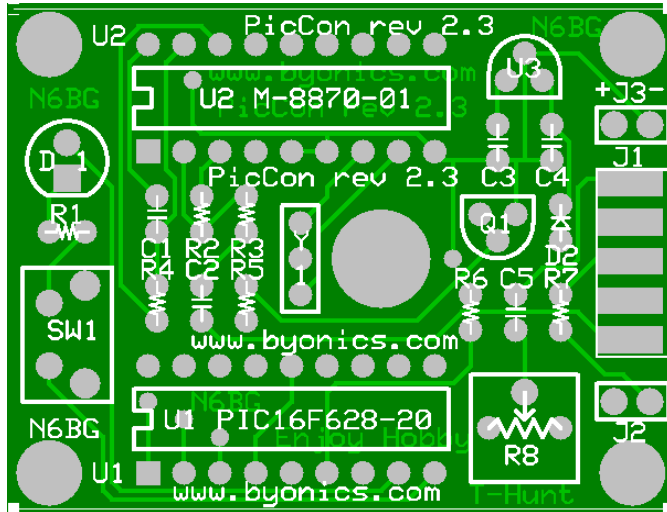
Case

PicCon was designed to fit in a Serpac brand C6 plastic case (2 1/4" x 1 5/8" x 3/4"). Pre-cut cases are available from www.byonics.com. There are 4 flanges on the case lower center post, which should be cut off to allow the PCB to fit.
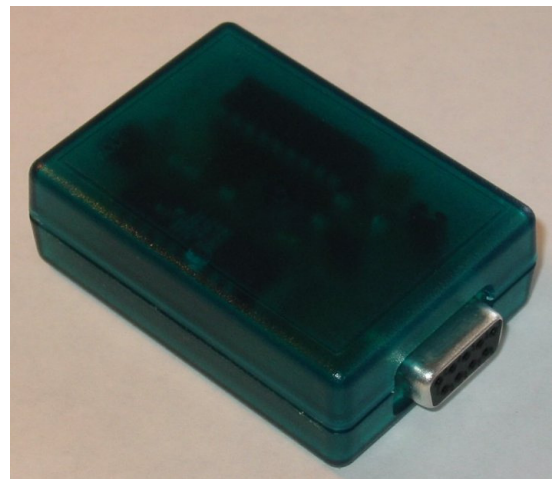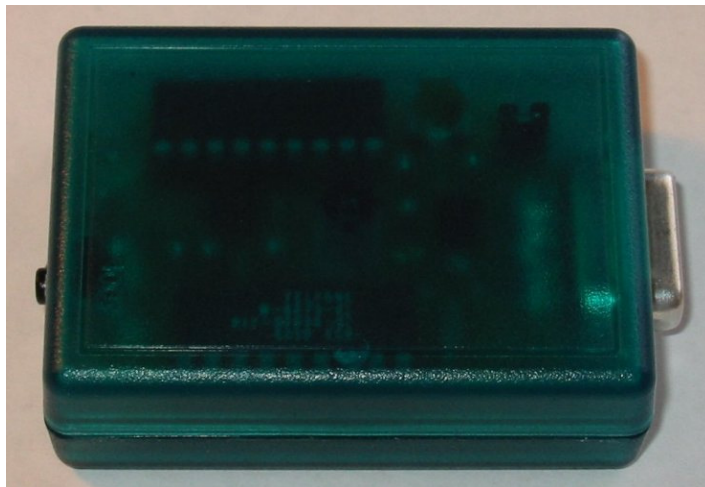
Assembly Instructions

PicCon is a fairly simple construction project that can usually be built in less than an hour. You will need a low wattage pencil-type soldering iron with a small tip, some thin solder, and a pair of diagonal cutters. The integrated circuits (U1 & U2) are static sensitive, so use standard precautions. For each item, insert on the component side (white silk-screened side), then turn the board over and solder the leads to the pads on the trace side. Be sure to only solder the correct pad, and do not let any solder touch any other pad or trace. Trim any excess leads with diagonal cutters after soldering each component. The following checklist will be useful to insure all components are properly assembled.

- ❑ Install the two 18-pin IC sockets, one for U1, and one for U2. Be sure to align the notched end of the socket with the marked end on the silk screen. First solder just two diagonally opposite pins of a socket, and check that the socket sits flat on the PCB. Then solder the remaining socket pins. Do not insert the chips into the sockets at this time.

- ❑ Install capacitors C1 – C5. (0.1uf, 104). Direction does not matter. Bend the leads apart slightly after insertion to prevent them from falling out when the PCB is upside-down for soldering.

- ❑ Install resistors R1 (1K, brn-blk-red), R2 & R3 (100K, brn-blk-yel), R4 (300K, org-blk-yel), R5 (10K, brn-blk-org), R6 (220K, red-red-yel), and R7 (2.2K, red-red-red). For each resistor, bend one of the leads 180 degrees at the bulb of the resistor so that both leads are parallel and 0.1 inch apart. Install vertically on the board. Polarity does not matter. Bend the leads apart once inserted to hold in place and insert all 7 resistors before soldering.

- ❑ Install transistor Q1 (2N2222A) Be sure to orient flat side to match the flat side shown on the silk-screen pattern.

- ❑ Install voltage regulator U3 (78L05). Be sure to orient flat side to match the flat side shown on the silk-screen pattern.

- ❑ Install ceramic resonator Y1 (3.579 Mhz), which provides the clock oscillation for the chip. Direction does not matter.

- ❑ Install glass diode D2. (1N4148). Bend like resistors. The black stripe should be nearest the top edge of the board, electrically closest to the pad just below C4.

- ❑ Install potentiometer R8, (10K, 103),

- ❑ Install LED D1 (green). Be sure to align the flat side of the LED with the shape on the silk-screen. If the LED does not have a flat side, insert the anode (long lead) into the round pad closest to top edge of the board and the cathode (short lead) into the square pad next to R1.

- ❑ Install switch SW1. Leads may need to be bent a bit. Switch should snap into place.

- ❑ Install 1x2 jumper post J2. Insert short side through the board.

- ❑ Install female DB-9 radio connector J1. Wedge the board in between the two rows of solder cups, with the 5 pins aligned with the 5 pads on the PCB. Solder just one pin first, and insure the connector is on straight. Then solder on both sides of the PCB, all nine cups to the pads.

Assembly Completion

After all components have been installed, inspect the solder side of the board for poor or cold solder joints. All pads should be shiny and smooth. Inspect for any undesired solder bridges. Use an ohmmeter or multimeter to be sure power (socket pin 14) and ground (socket pin 5) on U1 are not connected. It would even be a good idea to power the board (see below), and confirm +5 volts between U1 socket pins 14 and 5. If the board looks ready, complete the assembly as follows.

- ❑ Insert programmed microprocessor U1 (PIC16F628). The chips is static sensitive, so ground yourself by touching a large metal object before touching the chip. The rows of pins may need to be bent slightly. Be sure to align the notch on the chip with the notch on the socket, as well as the notch on the silk-screen. Be sure that the chips are in their correct sockets. An improperly inserted chip may become permanently damaged.

- ❑ Insert DTMF Decoder U2 (M-8870-01). Follow the instructions for U1 above.

Interfacing

The following are the interface connections for the PicCon, which are needed before operation.

Radio / Power – J1

Female DB-9 connector J1 is used to interface PicCon to a radio transceiver and power. It is compatible with the radio connector on Kantronics TNCs, such as the KPC-3. Connect AUDIO OUT (J1 pin 1) to the radio's mic input. If the transmitter transmits when the microphone input is grounded (most handheld (HT) radios do, except the Kenwood brand), short jumper J2, and PTT OUT (J1 pin 3) will not need to be connected to the transmitter. For all other transmitters, PTT OUT (pin 3) will be needed, and should be connected to the transmitter's PTT input. PTT OUT is grounded when the transmitter is to be keyed. Connect the receiver's audio out (earphone) jack to the AUDIO IN (pin 5). Also connect J1 GROUND (pin 6) to the radio's ground. Refer to the transceiver's manual for more information, and look for a section on installing a terminal-node controller (TNC) for packet operation, as PicCon is interfaced in a similar manner. J1 can also be used to supply PicCon's power, via pin 7 and pin 6.

Pin	Function
1	AUDIO OUT (radio mic)
3	PTT OUT
5	AUDIO IN (radio earphone)
6	Ground (radio and power)
7	Power (+7 to +35V DC)

PTT mode – J2

Jumper J2 connects the Radio PTT to the Radio MIC with a resistor as required for most hand held radios. This post should be closed with the jumper shunt if using a radio that keys by passing current through the mic input (mostly all HTs except Kenwood brand). In this case, PTT OUT (J1 pin 3) does not need to be run to the radio. For mobile radios, and Kenwood radios, J2 should be left off, and PTT OUT should beconnected to the transmitter.

Power – J3

PicCon should be powered with 7-35 volts DC. Power can be applied via J1 or J3. J1 is the most common way to power the PicCon. To use J1, connect pin 7 to positive voltage and pin 6 to ground. To use J3, apply positive voltage to the plus (+) hole and ground to the minus (-) hole. Only one of J1 and J3 should be used to supply power. At 12 volts, current draw is 9ma when running, 5.5ma when idle.

Adjustments

There are only a few adjustments required for proper operation of PicCon. First, the transmit audio level should be adjusted at R8 for proper deviation. Potentiometer R8 controls the outgoing MIC audio level. Adjust so that audio tones are comfortable when heard on a second receiver. PicCon was designed for hand held radios. Some mobile radios require more audio drive than PicCon puts out. If audio levels are too low, even with the R8 pot set to maximum, consider replacing the 220K R6 with a 100K resistor, or even less. This should allow for about double the audio range.

The other adjustment point is the receiver volume level. It should be adjusted for best DTMF tone decoding.

Green LED D1 will flash 2 times when power is first applied.

Operations Overview

Basic PicCon operation is simple. When started, PicCon will send a transmission sequence to a radio transmitter over and over again. A transmission sequence consists of between two and eight of the following: off-the-air delays, tone sequences, and Morse code IDs (although typically, only a tone sequence and a Morse code ID are needed). After the transmission sequence is sent, it will restart, either immediately, or, after a pre-programmed delay. The transmission sequence can optionally be programmed with an initial delay of over 100 hours and the sequence can optionally be programmed to stop running after up to 100 hours. The transmission sequence can be started, stopped, or re-started at any time. All parameters for the transmission can be pre-programmed, including the tones, speed, and duration of the tone sequence, speed and tone of the Morse code ID, delay duration, the transmission sequence order and loop time, initial delay and total run time.

There are also several special modes which can be applied if desired. These include random tone sequences, random tone durations, random Morse code ID frequency, various LED modes, a CW mode and a one-shot mode. There is also a special mode to comply with IARU International T-Hunting Rules. PicCon can also be locked and unlocked via DTMF to prevent unwanted controlling.

Timings

There are five timing parameters which can be adjusted to configure PicCon. The tone sequence timer controls how long the tone sequence will run, each time it is included in the transmission sequence. The transmission delay controls how long PicCon will delay without transmission, each time it is included in the transmission sequence. The transmission loop time controls how often to restart the transmission sequence. The initial delay controls a one-time off-the-air delay before starting transmissions, and the total run time controls how long to send transmissions before stopping.

For example, assume the transmission delay is set to 0, the tone sequence timer is set to 10 seconds, and the transmission loop time is set to 30 seconds. Also assume the transmission sequence is set to delay - tones - ID and that the initial delay and total run time are both set to 0 (off). When started, PicCon would send the tone sequence for 10 seconds, send the Morse ID (about 5 seconds depending on speed and duration), and then delay off the air for about 15 seconds. Then the sequence would start over again with the tone sequence for 10 seconds, starting exactly 30 after the last time it started.

LED modes

The LED serves multiple purposes for PicCon. In the normal LED mode, the LED will flash quickly when receiving DTMF or when the switch SW1 is pressed. It will be on without flashing when PTT is active. It will flash 3 times per second when it is being programmed, and will flash once per second when running, but not currently transmitting. When in the alternate LED mode, the LED will be solid when receiving DTMF or when the switch SW1 is pressed, and will flash when it is being programmed. The LED can also be completely disabled.

Normal mode	Alternate mode	Meaning
ON	-	PTT active
Fast Flash	ON	Receiving DTMF or SW1 pressed
Medium Flash	Medium Flash	Programming
Slow Flash	-	Running, but not PTT

Quick Start

After assembling PicCon and the interface cable, connect to the radio and battery/power supply. The LED should flash twice if all is working correctly. When PicCon is initially started or after it has been reset, the only programming that must be done before operation is setting the Morse ID to the operator's callsign. This is done with the C1 command. A remote transmitter can be used, or the radio connected to PicCon. To use the connected radio, PTT may need to be pressed by hand while DTMF is sent. Most radios will send the DTMF tones out the radio's earphone jack when it transmits them, so PicCon should be able to use them. To program the Morse ID, send DTMF "C", then DTMF "1", followed by a number of two-digit codes, each representing a letter or number in the desired callsign. The letter "A" is entered with the code 01, "B" with 02, and so on. The numerals 0 to 9 are entered as DTMF "3" followed by the DTMF of the numeral itself. The callsign entry is completed with a DTMF "#". (For example, to enter the callsign N6BG, send the following DTMF digits: "C1 14 36 02 07 #".) Modify the example and enter the correct callsign now. After the callsign is entered, operations can begin by pressing SW1 or sending a DTMF "1". This will start PicCon transmitting with the default tone sequence and transmission sequence and timing. It can be stopped by pressing SW1 again. Operation can be then further configured with the commands below.

Control Commands

PicCon can be controlled via either a single DTMF tone command or a manual switch (SW1). "Controls" consist of starting and stopping a transmission, locking, unlocking and resetting PicCon. When a transmission is started, or re-started if already running, all delay and loop timers are reset, and the transmission begins with the first item in the transmission sequence. If a transmission delay has been programmed, that time must pass before the transmission will begin. The transmission will continue to run until controlled to stop, power is removed, or total run time is reached, if programmed. Pressing the manual switch (SW1) has the same function as DTMF "2".

1	Start transmission
2	Toggle transmission on/off
3	Stop transmission
4	Lock DTMF control
0	Reset PicCon EEPROM
SW1	Toggle transmission on/off

Start Transmission (1)
This command is used to begin a transmission. If no initial delay is programmed, and the transmission sequence starts with tones or the Morse ID, radio transmissions should begin immediately. All timers are reset when a transmission is started. If a transmission is already running, it will be restarted.

Toggle Transmission ON/OFF (2 or SW1 press)
This command will function like the Start Transmission if no transmission is running, or like the Stop Transmission if a transmission is running or if PicCon is in the initial delay mode.

Stop Transmission (3)
This command is used to stop the currently running transmission. If no transmission is running, this has no effect.

Lock DTMF Control (4)
This command is used to lock out further DTMF controlling and programming. It can be unlocked by entering a '#', followed by the DTMF unlock code (set with A6xxxx). The default unlock code is 0000. When locked, the LED will not flash with received DTMF, however SW1 will continue to function.

Reset PicCon EEPROM (0)
This command is used to reset PicCon's EEPROM to the original settings. This may be required if parameters get programmed to improper values. To activate, press and hold switch SW1 and send DTMF 0. This will clear all previously programmed options, including Morse code ID. LED D1 will flash twice after reset.

Programming Commands

PicCon can be programmed via short DTMF tone sequences. All programming begins with a DTMF A, B, C, or D, and most options can be set with 4 or 6 tones. The DTMF '#' will cancel any incomplete programming command that starts with A or B, and is used to complete any programming command that starts with C. Programming can be done while PicCon is transmitting, although timing may be slightly affected. The following chart shows the programming commands.

A1mmss	Set transmission delay to mm minutes and ss seconds
A2mmss	Set tones duration to mm minutes and ss seconds
A3mmss	Set transmission loop time to mm minutes and ss seconds
A4hhmm	Set initial delay time to hh hours and mm minutes
A5hhmm	Set total run time to hh hours and mm minutes
A6xxxxx	Set DTMF unlock code to xxxx
B1xx	Set tone sequence speed (00-99)
B2xx	Set Morse code speed in words per minute (05-30)
B3xx	Set Morse code tone (01-99)
B4xx	Set Operation Mode A Flags
B5xx	Set Operation Mode B Flags
C1....#	Set Morse code message
C2....#	Set simple tone sequence (1 digit per tone)
C3....#	Set detailed tone sequence (2 digits per tone)
C4....#	Set transmission sequence
Dx	Set IARU Mode

Set Transmission Delay (A1mmss)
This command is used to set an off-the-air delay time of between 0 seconds and over 100 minutes. To be used, this delay must be placed in the transmission sequence. This delay will not be needed for typical operations, and should only be used when offsetting multiple PicCons which will be started simultaneously, or for a non-trivial transmission sequence. Typical transmissions should use the transmission loop time (A3mmss) for setting off-the-air delays. DTMF format is "A1" followed by 2 digits for number of minutes, and then 2 digits for number of seconds.
Examples: A10000 - no delay
      A10030 - 30 second delay
      A10210 - 2 minute 10 second delay

Set Tones Duration (A2mmss)
This command is used to set the amount of time that the tone sequence is transmitted. Valid range is between 0 seconds and over 100 minutes. The radio PTT is keyed and the tone sequence is repeated during this time. To be used, the tone sequence must be placed in the Transmission Sequence. DTMF format is "A2" followed by 2 digits for number of minutes, and then 2 digits for number of seconds.
Examples: A20000 - no tone sequence
      A20030 - 30 seconds of tones
      A20210 - 2 minute 10 seconds of tones

Set Transmission Loop Time (A3mmss)
This command is used to set how often the transmission sequence loops. Valid range is between 0 seconds and over 100 minutes. When set to 0000, the transmission restarts as soon as it ends. When set to something other than 0000, the controller goes into a waiting state when it completes a transmission, until the designated time has elapsed since the transmission was started. At this time, the transmission restarts. If the transmission has not yet completed, it will still be restarted. DTMF format is "A3" followed by 2 digits for number of minutes, and then 2 digits for number of seconds.
Examples: A30000 - loop upon completion of transmission
      A30030 - loop transmission every 30 seconds
      A30210 - loop transmission every 2 minutes 10 seconds

Set Initial Delay Time (A4hhmm)
This command is used to set a one-time initial delay. When a transmission is started, either via DTMF or switch press, PicCon will wait for the specified amount of time before beginning the transmission. If set to 0000, the transmission will begin without delay. Valid range is between 0 minutes and over 100 hours. DTMF format is "A4" followed by 2 digits for number of hours, and then 2 digits for number of minutes.
Examples: A40130 - Set Initial delay to 1 hour 30 minutes
      A40000 - Do not use an initial delay

Set Total Run Time (A5hhmm)
This command is used to set a total transmission run time. When set to 0000, the transmission will only stop when commanded via DTMF or switch press. When set to something other than 0000, the transmission will stop after the specified amount of time. The Initial Delay Time (A4) is not included in the total run time. DTMF format is "A5" followed by 2 digits for number of hours, and then 2 digits for number of minutes.
Examples: A50130 - Set run for a total of 1 hour and 30 minutes
      A50000 - Run until commanded to stop

Set DTMF Unlock Code (A6xxxx)
This command is used to set a code to unlock PicCon when it has been DTMF locked. PicCon is locked via a DTMF "4" command. To unlock a locked PicCon, enter the pound sign (#), followed by the DTMF unlock code programmed with this command (xxxx). While PicCon is locked, the LED will not flash with received DTMF commands, as it normally does when unlocked. DTMF lock state will be cleared if power is removed. Default unlock code is 0000. DTMF format is "A6" followed by a 4 digit number.
Examples: A61234 - Set DTMF unlock code to 1234

Set Tone Speed (B1xx)
This command is used to set the how fast the tone sequence tones are played. Valid range is between 00 (very slow) and 99 (very fast). DTMF format is "B1" followed by 2 digits for speed.
Examples: B102 - play tones slowly
      B195 - play tones quickly

Set Morse Code ID Speed (B2xx)
This command is used to set how fast the Morse code ID is sent in words per minute. Valid range is between 05 (wpm) and 30 (wpm). DTMF format is "B2" followed by 2 digits for speed.
Examples: B208 - play Morse code at 8 words per minute
             B227 - play Morse code at 27 words per minute

Set Morse Code ID Tone (B3xx)
This command is used to set the tone frequency of the Morse code ID. Valid range is between 01 (low) and 99 (high). The specific frequency used is
[27965 / (110 - tone)] Hz. DTMF format is "B3" followed by a 2 digit tone.
Examples: B375 - play Morse code ID at 799Hz [27965/(110-75)Hz]
             B354 - play Morse code ID at 499Hz [27965/(110-54)Hz]
             B382 - play Morse code ID at 999Hz [27965/(110-82)Hz]

Set Operation Mode A Flags (B4xx)
This command is used to set the first group of miscellaneous mode options, which are shown below.

1	Random Tone Sequence
2	Random Tone Speed
4	Random Morse Code Tone
8	Use alternate LED mode
16	Disable LED
32	Auto-Start on Power-Up

Random Tone Sequence (1)
When this mode is set, the programmed tone sequence is ignored and a random tone sequence is used.

Random Tone Speed (2)
When this mode is set, the programmed tone speed is ignored and a random tone speed is used.

Random Morse Code Tone (4)
When this mode is set, the Morse Code ID will play at a random tone each time.

Use Alternate LED mode (8)
When this mode is set, an alternate LED mode will be used. The LED will be on when DTMF is received or the switch is pressed, and will flash when in programming mode. This mode does not show PTT or running state.

Disable LED (16)
When this mode is set, the LED will not light or flash.

Auto-Start on Power-Up (32)
When this mode is set, PicCon will automatically start the transmission when power is applied.

To set the operation mode A flags, add the codes of the desired option. Valid range is between 00 and 63. DTMF format is "B4" followed by a 2 digit "sum code".
Examples: B400 - Use no special A operation modes
             B403 - Play random tones at random speeds (03 = 2 + 1)
             B433 - Auto-Start transmission and play random tones at the programmed speed. (33 = 32 + 1)

Set Operation Mode B Flags (B5xx)
This command is used to set the second group of miscellaneous mode options, which are shown below.

1	Only run once
2	CW mode

Only run once (1)
When this mode is set, PicCon will stop running after one iteration of the C4 transmission sequence. This is useful for "one-shot" transmissions or Ids.

CW mode (2)
When this mode is set, the PTT is keyed only when audio is generated. This mode is intended for 80-meter CW hunts and other non-FM based transmitters. It is recommended for use during a Morse ID only hunt, or when using the IARU mode. The audio is still present on the audio out line, but should not be needed.

To set the operation mode B flags, add the codes of the desired option. Valid range is between 00 and 03. DTMF format is "B5" followed by a 2 digit "sum code".
Examples: B502 - Run in CW mode

Set Morse Code ID (C1xxxx…#)
This command is used to set the Morse code ID. The ID may be up to 42 characters. All characters are entered as 2 digit numbers. The letters are entered as an ordinal number (A = 01, B = 02, Z = 26). The numbers are entered as "3" followed by the number (1 = 31, 9 = 39). A space is entered as 00. A complete chart is below. DTMF format is "C1" followed by up to 42 two-digit character codes, and completed with a "#".
Example: C1 14 36 02 07 00 20 31 # - set ID to "N6BG T1"

A 01	G 07	M 13	S 19	Y 25	0 30	5 35	? 40
B 02	H 08	N 14	T 20	Z 26	1 31	6 36	BT 41
C 03	I 09	O 15	U 21	/ 27	2 32	7 37	AR 42
D 04	J 10	P 16	V 22	, 28	3 33	8 38	SK 43
E 05	K 11	Q 17	W 23	. 29	4 34	9 39	
F 06	L 12	R 18	X 24			SPACE 00	

Set Simple Tone Sequence (C2xxx…#)
This command is used to set the tone sequence. Up to 64 tones can be entered, each one being 1 of 9 tones or silence. All tones are entered as a single DTMF digit from 0 to 9 where 0 is silence, 1 is the lowest tone, and 9 is the highest. The sequence loops for the tone duration time and speed is set with the "set tone speed" command. This command is simpler to use than the Set Detailed Tone Sequence Command because only one DTMF digit per tone is needed, but it only allows the use of 9 different tones. **Only one tone sequence can be stored, so this command clears a detailed tone sequence.** DTMF format is "C2" followed by up to 64 single-digits, and completed with a "#".
Example: C2123045607890# - set the tone sequence to rising groups of three

Set Detailed Tone Sequence (C3xxxx…#)
This command is used to set the tone sequence. Up to 64 tones and be entered, each one being 1 of 99 tones or silence. All tones are entered as a 2 DTMF digits from 00 to 99 where 00 is silence, 01 is the lowest tone, and 99 is the highest. The frequency of each tone is [27965/(110-tone)] Hz. The sequence loops for the tone duration time and speed is set with the "set tone speed" command. This command is more difficult to use than the Set Simple Tone Sequence Command because two DTMF digits per tone are needed, but it allows the use of 99 different tones. **Only one tone sequence can be stored, so this command clears a simple tone sequence.** DTMF format is "C3" followed by up to 64 double-digits, and completed with a "#".
Example: C3 10 20 30 00 40 50 60 00 # - set the tone sequence to rising groups of three

The following chart gives the PicCon two-digit tone equivalent to common musical notes starting with middle C.

C 03	F 30	B 53	E 68	A 78	D 86	G 92
D 15	G 39	C 57	F 70	B 82	E 89	A 94
E 25	A 46	D 62	G 74	C 83	F 90	B 96

Set Transmission Sequence (C4xxxx…#)
This command is used to set the transmission sequence. Up to 8 sequence elements can be entered, consisting of an off-the-air delay (DTMF "1"), a tone sequence (DTMF "2"), and a Morse code ID (DTMF "3"). Each element is entered as a single DTMF digit between 1 and 3. The chart below also shows the which DTMF digit to use for each element. DTMF format is "C4" followed by up to 8 DTMF digits, and completed with a "#".
Examples: C4 2 3 # - set a transmission sequence to tones and Morse ID.   This make a good simple sequence.
                 C4 2 1 3 1 # - set transmission sequence to tones, delay, Morse code ID, delay.

1	off-the-air delay
2	tone sequence
3	Morse code ID

Set IARU Mode (Dx)
This command is used to enable IARU mode. In IARU mode, the tone sequence is replaced by Morse Code "MOE" for T 1, "MOI" for T2, etc. Switch SW1 must be pressed and held while activating this mode . The digit after the D is the T number, between 1 and 9. When this mode is set, tone speed (B1xx) should be updated by the user to a value between 04 and 20. The tone sequence duration (A2) determines how long the sequence will run. To clear IARU mode, reprogram the tone sequence with C2 or C3. DTMF format is "D" followed by a DTMF digits 1 to 9 while holding down SW1.
Examples: D3 will set IARU mode with tone sequence "MOS"

Default settings
The following are the default settings, set when PicCon is powered for the first time, and after a reset.

A1 00 00
A2 00 15
A3 00 00
A4 00 00
A5 00 00
A6 00 00
B1 88
B2 20
B3 75
B4 00
B5 00
C1 16 09 03 03 15 14 27 32 29 30 # (PICCON/2.0)
C2 7 7 8 5 5 6 3 3 4 2 2 0 4 4 3 6 6 5 8 8 7 1 1 0 #

Troubleshooting

Problem	Possible Solutions
The green LED does not flash twice at powerup.	Be sure the LED and chips are inserted in the proper direction. Check for shorts or opens on the solder side of the PCB. Check for 5 volts across socket pins 5 and 14 with the PIC removed.
The green LED does not flash with received DTMF.	Check for shorts or opens on the solder side of the PCB. Check the radio interface cable. Adjust receiver volume.
No audio is heard on a receiver.	Check for shorts or opens on the solder side of the PCB. Check the radio interface cable. Raise transmit audio level with R8. If R8 doesn't give enough range, try lowering the value of R6, or even shorting it.
PicCon never transmits. or The transmitter keys up, even when no power is applied to PicCon	Check for shorts or opens on the solder side of the PCB. Perhaps the radio does or doesn't key via current through the microphone line. Check J2. Be sure the cable is built correctly. Grounding PTT should make the radio transmit. Check the radio manual. Perhaps a different value of R7 is needed.
PicCon keys the transmitter, but fails to un-key the transmitter when it should. Audio tones sound distorted	PicCon may be receiving too much local RF energy. Lower transmitter power, move the transmitting antenna further away, use short, shielded audio cables, or try shielding the PicCon in a metal case.
A tone sequence is not being transmitted.	Be sure it is set with the C2 or C3 command. Check duration (A2) and transmission sequence (C4). Remove initial delay (A4). Reset PicCon.

Frequently Asked Questions

Is the firmware .HEX file available so I can burn my own chips?
No. The only way to get a PicCon chip is preprogrammed from www.byonics.com.

What language is PicCon written in?
PicCon was written in PIC assembly.

Can I replace the ceramic resonator Y1 with a crystal?
Sure. You should add two small capacitors (about 6 pf) from each lead to ground, also.

I have other questions. Where do I go?
Questions can be addressed to byon@byonics.com

Hints, Tricks, & Notes

- When using a single band radio, remote DTMF control commands will not be received while the radio is transmitting.   It is a good idea to have some off-the-air time in a transmission to allow controlling in such a situation.
- When PicCon is first powered up or reset, the Morse code ID contains the firmware version number. (i.e. PicCon/2.0)
- Entering undefined commands (i.e. A7, B9, etc.) will affect normal operation and is not recommended. Also, entering parameters outside the specified range (i.e. B299) will not give the desired results and is not recommended
- A 9-volt battery connection can be added to the PicCon board to provide power when it is not supplied via the interface jack J1. Connect the cathode (stripe side) of a second (not included) 1N914 diode to the cathode of D2. Connect the anode of the second diode to the positive side of the 9-volt and any ground point of the PicCon board to the negative side of the battery.
- PicCon was designed for hand held radios. Some mobile radios require more audio drive than PicCon puts out. If outgoing audio level is too low, even with R8 adjusted to the maximum, R6 can be changed to a lower value (100K or less) to give more range.
- PicCon can be affected by local RF energy. To avoid this, run the transmitter at low power and keep PicCon3 away from the transmitting antenna. It may also help to use shielded cables and case, and toroid filters.
- Some durations can be stored in multiple ways. For example, A20230 is the same as A20190.