BYONICS

PicCon v3 Manual

Version 3.3 – September 15, 2020

Overview

The Byonics PicCon is a radio controller designed for hidden transmitter hunts, also called T-hunts, foxhunts, and ARDF. When connected to a radio transceiver via the microphone and speaker jacks. it will produce tone sequences and Morse code messages at user-programmed times. It is completely field programmable and controllable via DTMF tones, can also be configured with a computer, and is quite compact.

PicCon includes an LED, to show the device state, and a push-button switch to allow the starting and stopping of a transmission without requiring a DTMF receiver. The latest version adds the ability to configure via Windows software freely available at the PicCon website, http://byonics.com/piccon PicCon can be customized with many tones, durations, and duty cycles, draws only a few milliamps, and runs off any 7-18VDC source, including a standard 9-volt battery.

The transmissions consist of a looping sequence as follows:
- **an off the air pre-tones delay** to support multiple sequenced transmitters
- **a looping tones transmission** is user configurable and played during the majority of the hunt
- **a Morse code message** or ID to legally identify the transmitter
- **an off the air delay** to allow DTMF control, lower duty cycle, or other transmitters to be heard

In addition to the sequence above, it also supports:
- **an initial delay** to start the transmitter when the hider is not present
- **a total runtime** to limit the length of the hunt

Interfacing

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

J1 - Radio and Power interface

Female DB-9 connector J1 is used to interface PicCon to a radio transceiver and power. Premade cables for many radios can be found at http://byonics.com/cables J1 is compatible with the radio / power interface on the Byonics TinyTrak3 and TinyTrak4. Connect AUDIO OUT (J1 pin 1) to the radio's mic input. If the transmitter doesn't have a separate PTT input (Yaesu and Icom HTs for example), short jumper J4 on the underside of the PCB, and PTT OUT (J1 pin 3) will not need to be connected to the transmitter. For all other transmitters, PTT OUT should be connected to the transmitter's PTT input and jumper J4 should be left open / unshorted. PTT OUT is grounded when the transmitter is to be keyed. Connect the receiver's audio out (earphone/speaker) jack to the AUDIO IN (pin 5). Connect J1 GROUND (pin 6) to the radio's ground. Refer to the transceiver's manual for more information. J1 is also used to supply PicCon's power, via pin 7 (+7 - 18V) and pin 6 (ground).

J1 Pin	Function
1	AUDIO OUT (radio microphone)
3	PTT OUT
5	AUDIO IN (radio earphone)
6	Ground (radio and power)
7	Power (+7 to +18V DC)

J2 - 2.5mm serial interface

The PicCon now supports a serial interface to a computer, which allows for the configuration of all settings by the MicroFox Config program version 1.97 or later. J2 provides for an RS-232 level serial connection. The Byonics USB-2.5 cable can be used and is found at http://byonics.com/cables This interface does not power the PicCon, so power must be supplied via J1. Note that the first time the J2 jack is used, a little extra force may be needed to insert the plug all the way in.

J3 - 1x4 serial interface

In addition to the J2 serial interface, J3 provides an alternate TTL level serial interface. J3 can be used with the Byonics USB-TTL cable, which can power the PicCon as it configures it.

J4 - Radio PTT type selector (underside of the board)

Jumper J4 connects the Radio PTT line to the Radio microphone with a resistor as required for some 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 (usually Yaseu and Icom HTs). In this case, PTT OUT (J1 pin 3) does not need to be connected to the radio. For mobile radios, and Kenwood compatible radios, J4 should be left off (open), and PTT OUT (J1 pin 3) should be connected to the transmitter. The jumper shunt can be stored on a single post when not needed.

J5

The five holes under U1 are intended to factory program the microcontroller and are not for the user.

Adjustments

There are only a few adjustments required for proper operation of PicCon. First, the transmit audio level should be adjusted at R1 for proper deviation. Potentiometer R1 controls the outgoing microphone audio level. Adjust so that audio tones are comfortable when heard on a second receiver.

The other adjustment point is the receiver volume level. It should be adjusted for best DTMF tone decoding. Green LED D1 will flash quickly when DTMF is heard.

Quick Start

Connect the PicCon to the radio/power interface cable and connect the others ends to the radio microphone and earphone jacks, and a 7-18V power source. The LED should flash three times. 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 will need to be pressed by hand to generate DTMF tones. 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 controlled and configured with the commands below.

Computer Configuration

The PicCon settings can be configured via DTMF tones or with a USB serial cable and the Windows MicroFoxConfig program version 1.97 or later. The cables and software are available from http://byonics.com/piccon PL2303 USB drivers can be found at www.prolific.com.tw. The configuration program can only be used within 3 seconds powering the PicCon.

The default settings that appear when the configuration program is started are recommended for a basic hunt with the PicCon transmitting tones for 15 seconds, and then a Morse code ID. It then will stop transmitting, and repeats every 30 seconds. The only setting users must change is the Morse Code ID text to be their assigned amateur radio callsign.
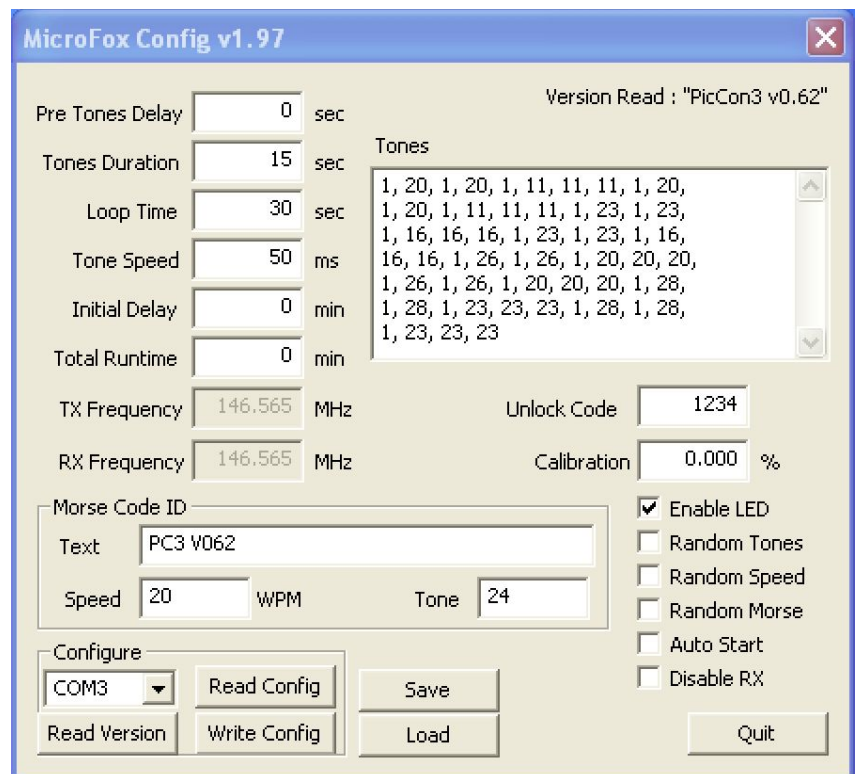
The TX Frequency, RX Frequency, and Disable RX settings are not applicable to the PicCon, as the RF frequencies are set on the connected radio. The Calibration option is available in the Config program but not via DTMF commands. It can be used to tweak the long term timing of a PicCon. Positive calibration numbers make the unit run faster. If you determine that the PicCon is running 0.03% slow, set the calibrate to +0.03% to correct.

The PicCon will work with a TTL or RS232 serial cable. The cable must be connected to J2 via a 2.5mm plug, or J3 via a 1x4 0.1" pitch header in the following order:

Pin	Function	Typical Color
1 (square pad)	Ground	black
2	Serial In	green
3	+3V to +5V power	red
4	Serial Out	white

After installing the USB drivers, inserting the USB cable, and setting the desired options in the configuration program, select the connected cable COM port, cable to the PicCon jack, apply power if using J2, quickly press Read Version, then Write Config to apply the settings. The TTL serial cable will power the PicCon. The program can only communicate to the PicCon within the first 3 seconds of it getting power.

Note: When using a TTL serial cable, the PicCon will not operate until it receives the first serial command from the config program, so do not be surprised when the LED doesn't flash on powerup.

DTMF Configuration and Control

The PicCon can be remote controlled and configured by sending DTMF tones from either the connected radio, or a separate radio on the same frequency. The transmitting radio needs to be able to send all 16 DTMF tones : 0-9, *, #, and A-D. On some radios, the A-D keys may not be labeled. The receiver volume may need to be adjusted for best DTMF decoding. Sending DTMF 3 and watching the LED is a good way to find a suitable volume level. The LED will flash quickly while DTMF tones are being decoded and at a medium speed during configuration. The PicCon can be DTMF locked to prevent other DTMF controls or configuration until it receives the unlock code, default 1234.

DTMF Control Codes

DTMF tone	Function
1	Start transmission
2	Toggle transmission (or SW1)
3	Stop transmission
D	Lock DTMF control

DTMF Configuration Codes

DTMF configuration is divided into 3 command sets. The A commands take 6 DTMF digits, the B commands take 4 DTMF digits, and the C commands are a variable length, and terminate with the # tone.

A1mmss	**Set the pre-tones off the air delay to mm minutes and ss seconds.** The default is off, and can be set with A10000.
A2mmss	**Set the tones duration to mm minutes and ss seconds.** The default is 15 seconds, and can be set with A20015.

A3mmss	**Set the loop time to mm minutes and ss seconds.** This should be set to at least the duration of the tones, plus the time to send the morse ID. The default is 30 seconds, and can be set with A30030.
A4hhmm	**Set the initial delay to hh hours and mm minutes.** The default is off, and can be set with A40000.
A5hhmm	**Set the total runtime to hh hours and mm minutes.** The default is off, and can be set with A50000.
A6xxxx	**Set the transmit frequency to 14x.xxx MHz. Not supported in PicCon**.
A7xxxx	**Set the receive frequency to 14x.xxx MHz. Not supported in PicCon**.
A8xxxx	**Set the 4 digit unlock code.** The default is 1234 and can be set with A8 1234.
B1xx	**Set tone duration in 5 ms units.** This controls the tone sequence speed. The default is 50 ms and can be set with B110.
B2xx	**Set morse code speed in words per minute.** Valid settings are between 03 and 31 wpm. The default is 20 wpm and can be set with B220.
B3xx	**Set morse tone to tone code xx.** This sets the audio frequency of the morse code ID. Refer to the DTMF Tone Codes table below. The default code is 24 (784 Hz) and can be set with B324.
B4xx	**Set flags bits to xx.** This sets various on/off options. The possible flags codes are: ● 1 for Random tones, instead of the C2 sequence. ● 2 for Random tone speed, instead of the B1 setting. ● 4 for Random morse tone, instead of the B3 setting. ● 8 for Auto-Start right after powerup, rather than waiting for a DTMF 1 or 2. ● 16 for Disable LED, to make the transmitter more difficult to visually see. To set more than 1 flag, just add the codes together, for example, to enable random tone speed and auto-start (2+8=10), send B410. The default flags are just auto-start and can be set with B408.
C1 xx xx xx .. #	**Set the morse code message/callsign.** Use the DTMF Morse Codes table below. To keep the transmissions legal, a valid amateur radio callsign should be included in this message. Each character is entered as a 2 digit code and the message is terminated with a #. Maximum message length is 60 characters. For example, to set to N6BG enter C1 14 36 02 07 #.
C2 xx xx xx .. #	**C2 xx xx xx .. # - Set the tone sequence.** This sets tones that are repeated during the tone sequence. Each note is entered as a 2 digit code from the chart below and the sequence is terminated with a #. Maximum tone sequence length is 160 notes. The default tone sequence can be set with C2 01 20 01 20 01 11 11 11 01 20 01 20 01 11 11 11 01 23 01 23 01 16 16 16 01 23 01 23 01 16 16 16 01 26 01 26 01 20 20 20 01 26 01 26 01 20 20 20 01 28 01 28 01 23 23 23 01 28 01 28 01 23 23 23 #.

DTMF Morse Codes

code	char	code	char	code	char	code	char	code	char	code	char	code	char	code	char
00	space	07	G	14	N	21	U	28	.	35	5	42	SK	51	,
01	A	08	H	15	O	22	V	29	/	36	6	43	$		
02	B	09	I	16	P	23	W	30	0	37	7	45	AS		
03	C	10	J	17	Q	24	X	31	1	38	8	46	'		
04	D	11	K	18	R	25	Y	32	2	39	9	47	(		
05	E	12	L	19	S	26	Z	33	3	40	!	48	)		
06	F	13	M	20	T	27	-	34	4	41	"	50	AR		

SK, AS, and AR are procedural signs.

DTMF Tone Codes

code	note	freq	code	note	freq	code	note	freq	code	note	freq	code	note	freq
01	silence		11	$F^{\#}_4$	370	21	E_5	659	31	D_6	1175	41	C_7	2093
02	A_3	220	12	G_4	392	22	F_5	698	32	$D^{\#}_6$	1244	42	$C^{\#}_7$	2218
03	$A^{\#}_3$	233	13	$G^{\#}_4$	415	23	$F^{\#}_5$	740	33	E_6	1318	43	D_7	2350
04	B_3	247	14	A_4	440	24	G^5	784	34	F_6	1397	44	$D^{\#}_7$	2489
05	C_4	262	15	$A^{\#}_4$	466	25	$G^{\#}_5$	831	35	$F^{\#}_6$	1480	45	E_7	2636
06	$C^{\#}_4$	277	16	B_4	494	26	A_5	880	36	G_6	1568	46	F_7	2793
07	D_4	294	17	C_5	523	27	$A^{\#}_5$	932	37	$G^{\#}_6$	1661	47	$F^{\#}_7$	2960
08	$D^{\#}_4$	311	18	$C^{\#}_5$	554	28	B_5	987	38	A_6	1760	48	G_7	3136
09	E_4	330	19	D_5	587	29	C_6	1046	39	$A^{\#}_6$	1864	49	$G^{\#}_7$	3323
10	F_4	349	20	$D^{\#}_5$	622	30	$C^{\#}_6$	1109	40	B_6	1975			

LED

The LED will show the various states of the PicCon. It flashes 3 times on powerup. If a TTL serial connection is found, it flashes 3 more times (but only after the first serial data is received). If it is jumpered for a system restore, it will flash 3 more times. The LED can be disabled to make the fox more difficult to find. The list below shows the LED meaning during operation.

- **LED on Solid** - Transmitting
- **LED Fast Flash (20Hz)** - Receiving DTMF
- **LED Medium Flash (5 Hz)** - Receiving configuration tones
- **LED Slow Flash (1 Hz)** - In a transmit sequence but currently off the air.
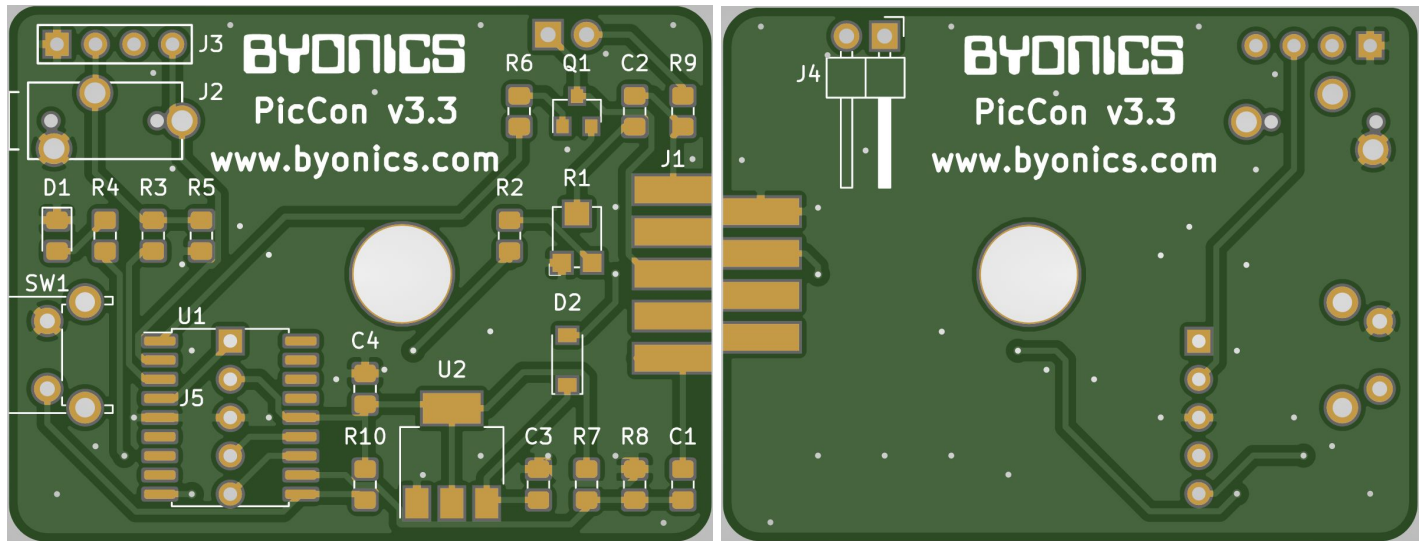- **LED Off** - Not in a sequence

Restore

The PicCon can be restored to factory settings by temporarily shorting pins 5 and 6 of U1 together and applying power. There will be 3 extra LED flashes to show the settings have been restored. Starting the config program, and writing all the default values is an additional way to restore settings.

Notes

- If the assigned COM port is not showing in the config software, it can be manually entered, or the COM port can be changed with Windows Device Manager.
- Disabling the FIFO buffer in the Com Port settings may improve serial communication.
- We recommend leaving a note with the transmitter identifying it as an Amateur Radio, and listing a contact telephone number. These days, your transmitter may cause undue alarm if found by a member of the public and outside agencies are contacted.

PCB

Schematic