EZ Kits by illumicon

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APRSTRACKER

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Contents

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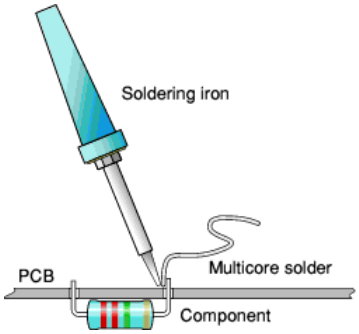
Please note that this document is preliminary in nature and may be subject to change without notice.

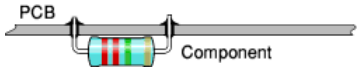
All feedback regarding this document is highly appreciated and can be sent to info@ezkits.eu

Introduction

APRS stands for: Automatic Packet Reporting System. It is possible to report your current position with a transceiver when it is connected to a suitable modem. The aprstracker2 is such a modem.

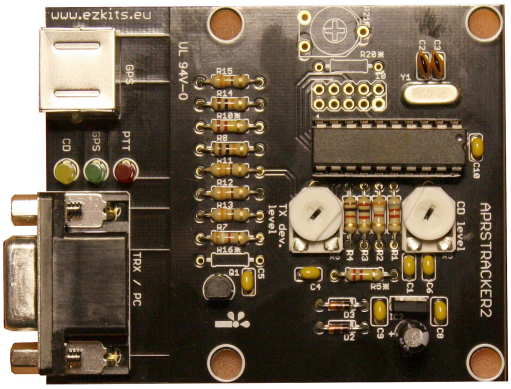
Soldering Tips





Soldering is not difficult. However, if you are completely unexperienced, or if it has been a long time ago since you've last soldered electronic components, you may wish to practice a bit on some old PCBs and components. If you still don't feel confident, ask an electronics hobbyist for assistance. There are many electronics enthusiasts around and most of them will be delighted to help you out. The PCB in the kit is of professional quality. It contains tracks on both sides and the holes are through plated. The latter is particularly useful as it will help the solder to flow better, resulting in a better connection. Use a good quality soldering iron with a small tip of about 25 to 40 Watt. If the iron is too hot, you are likely to damage the components. If it's too cold, it takes too long for the solder to start flowing, which may also cause damage. Wipe the tip often on a wet sponge or cloth to keep it clean. Then apply solder to the tip to give it a wet look. This will protect the tip, improve transfer of heat and enables you to to make good quality solder joints. Always use appropriate multi-core solder. Don't use solder paste or solvents. You may want to bend the leads of the component a little bit, to ensure that they stay in position when you turn the PCB upside down. Don't bend the leads too much! Some components get easily damaged when the leads are bent too far. Furthermore, it may result in badly soldered connections and may even lead to short circuits. You may also use a sponge to keep the components pressed to the PCB when turning the board. Please note that the PCB has two sides. One side has got the numbers of all components printed on it. This side is called the Component Side. Unless stated otherwise, all components must be fitted at the component side. The leads of each component must be soldered at the other side of the board (at the soldering side). Please note that some components, such as resistors, have no polarity and may be fitted either way around. Other components, such as diodes, transistors and ICs, MUST be fitted exactly in the way it is printed at the component side of the PCB.
Also, take extra care in identifying the resistors. Brown, orange, and sometime red color rings on the resistors may look alike. It is always a good idea to use a multimeter to verify resistance before mounting the resistors.

Assembly



Q'ty	ref.	description
1		Circuit board
7	C1, C4, C5, C6, C8, C9, C10	Capacitor, 100nF ceramic (marking 100n, or 104)
2	C2, C3	Capacitor, 22pF ceramic (marking 22J)
1	C7	Capacitor, electrolytic, 22 µF or 47 µF, radial
2	D2, D3	Diode, 1N4848 (marking 4148)
1	IC2	Voltage regulator 0.5A +5.0V, 78M05
1		IC socket, 20p (to be used for IC3)
1	IC3	Microcontroller PIC16F690-I/P
1	LED CD	LED 3mm yellow
1	LED GPS	LED 3mm green
1	LED PTT	LED 3mm red
1	Q1	Transistor, NPN TO-92, BC547, BC546
1	R1	Resistor, 0.25W 8.2kΩ (color-code grey red red gold)
4	R11, R12, R13, R15	Resistor, 0.25W 330Ω (color-code orange orange brown gold)
2	R8, R14	Resistor, 0.25W 10kΩ (color-code brown, black, orange, gold)
2	R2, R7	Resistor, 0.25W 3.9kΩ (color-code orange white red gold)
2	R3, R16	Resistor, 0.25W 2kΩ (color-code red black red gold)
1	R4	Resistor, 0.25W 1kΩ (color-code brown, black, red, gold)
2	R5, R10	Resistor, 0.25W 220kΩ (color-code red, red, yellow, gold)
2	R6, R9	Resistor, trimmer, 10kΩ 10mm pitch (marking 10k or 103)
1	X1	Connector, 6p mini-DIN
1	X2	Connector, 9p, sub-D
1	Y1	Crystal 20 MHz HC49/S
-	R20, R21, SV20	Not used

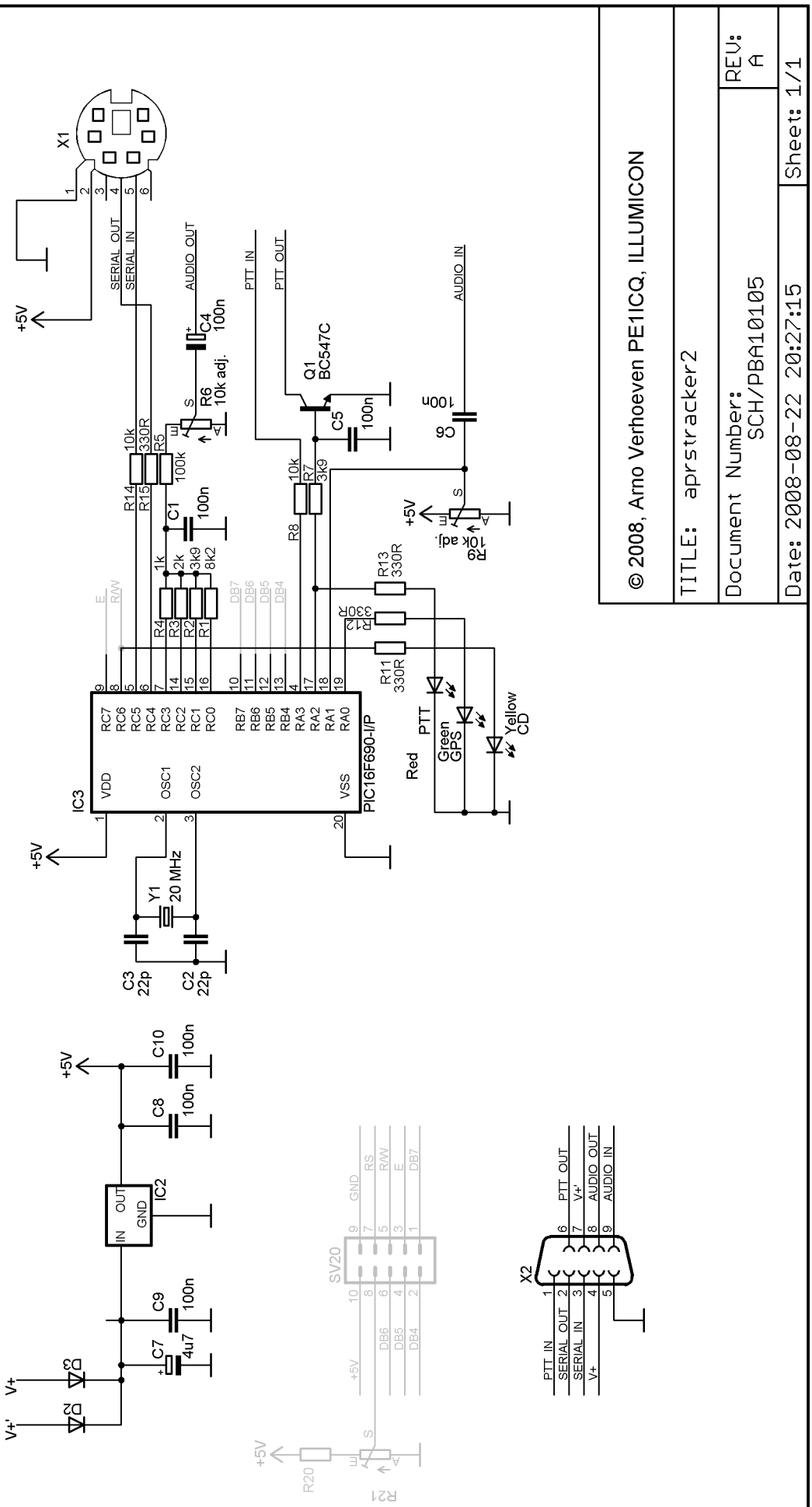
When assembling the tracker PCB it is recommended to mount the components in order of size. First mount the smaller components, followed by the slightly taller components.

IC1 should be mounted with the metal tab facing C1 (see photo).

Be certain that the short leg of the LEDs go into the pads closest to the sub-D connector (X2). The LEDs should be touching the PCB.

R16 should only be mounted if the tracker will be connected to a transceiver that activates PTT via the microphone audio input line. This is the case with most handheld transceivers.

Schema



Shaded components (shown in gray) are not used/not mounted in this tracker version.

Connections

Terminals V+ en V+' are used to feed the power supply voltage (+9 to +12V) to the tracker. You can connect connect both V+ and V+', or only use one of the two. The ground connection (pin 5) is the connection for the negative terminal of the power supply.

The PTT_IN terminal can be used to force the tracker to transmit a position beacon. When this terminal is grounded a position bacon will be transmitted within one second. The PTT-switch of most (all?) transceivers is a switch to ground, meaning that in most cases PTT_IN can be connected to the PTT_OUT terminal.

The PTT_OUT terminal is an open-collector switch to ground. With most transcevers this terminal can be connected to the PTT input. Handheld transceivers usually switch PTT with a risistive load on the microphone audio input line. R16 needs to be mounte to facilitate switching PTT via the microphone audio line.

The AUDIO_OUT terminal carries the packet modem AFSK signal. It can be conencted to the microphone or line-input of a transceiver.

The AUDIO_IN terminal should be connected to the speaker output of the transceiver. The tracker listens if the radio-channels is free to avoid collisions. The tracker detects any type of audio (including noise) as a busy channel. This means that you have to adjust and activate the squelch of your transceiver. Make certain that you feed enough ausio signal in the tracker, With most transceivers you can set the volume to maximum setting.

To configure the tracker with your callsign (and other settings) you need to connect the tracker to a PC. To conenct the tracker to a PC a standard straight trough DB-9 extention cable can be used. Most Pcs have a serial port that is able to provide enough power for the tracker during configuration. This means that in most cases it is not necessary to apply external power to the tracker.
Instead if true RS-232 signal levels (-12 & +12V) the tracker uses TTL level (0 & 5V) signals for serial communation. Most PCs accept these TTL level voltages, but in few cases it may be needed to insert a non-inverting RS-232 level converter between tracker and PC.

A GPS receiver can be connected to the mini-DIN conenctor. This connector carries the communications lines and also 5V power supply for the tracker. You can connect a GPS which drwas 140 mA or less. Most modern GPS receivers draw 50 to 80 mA. The pin-out of the mini-DIN connector accepts direct plug-in of a Navilock NL-303P GPS receiver.

The GPS receiver should be disconnected while the tracker is connected to a PC for configuration.

Adjustments

The adjustment procedure of R9 is simple.

1. Turn audio volume of conencted transceiver to minium. Or make certain that squech is activated and no audio is fed into the tracker. (also no noise).
2. Turn R9 completely counter-clockwise.
3. Slowly turn R9 clockwise until the yellow LED comes on.
4. Then slightly turnback R9. This is to avoid too critical setting. Temperature changes (especially when mounted in a car) can cause a shift of the set threshold.
5. Done.

Now, if audio is fed into the tracker (e,g, an APRS audio signal), the yellow LED should come on. The tracker knows that the radio channel is occupied and will wait transmitting until the channel is free again.

Software

An important part of the functionality is implemented in software. We distinguish 2 main parts.

- Firmware
- Configuration software

Aprstracker Firmware

Firmware is the embedded software that controls the PIC micro-controller. The PIC micro-controller that is included with the KF163-Tracker has been pre-programmed with firmware. We chose to use the open source Aprstracker firmware which provides all functions that you expect of a tracker. This firmware understands GPRMC, GPGGA and GPVTG GPS data, does smart beaconing, proportional pathing, is configurable via a serial null-modem cable, and rapports course, speed and height.

Aprstracker is originally written by Jeroen/PE1RXQ. Version 0.7 was the first public release of aprstracker. Currently, aprstracker is being maintained by Arno/PE1ICQ. At time of writing of this document the current release of aprstracker is version 0.11. Recent and up-to-date information can be found on the aprstracker project web-page.

Aprstracker Configuration Software

Initially the tracker will contain the default configuration data. You will at least need to configure it with your own call-sign. Configuring the tracker can be done by connecting it to the serial port of a PC.

Refer to the Aprstracker documentation for configuration instructions and information about firmware options.

http://sharon.esrac.ele.tue.nl/~pe1icq/projects/aprstracker.shtml

Test set-up with Navilock NL-303P GPS mouse and old IC2e.