PicoAPRS

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DB1NTO

Instruction Manual

Contents

1. PicoAPRS

"The world's smallest APRS transceiver including TNC" with a wide range of applications. Size like matchbox, built-in GPS receiver.

The transceiver can be used not only as an APRS tracker and receiver for APRS data but also as a TNC (KISS protocol) for the computer.The graphic OLED display (128x64 pixel) displays incoming APRS packets such as position messages, APRS messages (similar to SMS), and status messages. For position messages, the distance and the direction of the sky are also displayed. The four stations, including the distance and the cardinal direction, as well as received messages, are stored and can be queried via the menu.

The own GPS coordinates can be displayed and the Pico-APRS can also be used as a GPS receiver, e.g. for geocaching.
If desired, the GPS position can be stored permanently in the device. This is used when no GPS position can be determined. The stored position is then only used to display the distance and the cardinal direction of received stations. With the two control buttons and the versatile menu, the Pico APRS can be configured and used entirely without a PC. In the default state, the device is almost completely preconfigured. All you have to do is to enter the own call sign. The transmission power is about 1 Watt (switchable to approx. 0.5 Watt). The position data are compressed in the MIC-E format, in order to minimize the frequency as much as possible and to save the battery. Of course, both received packets with MIC-E compression as well as uncompressed APRS packets can be decoded and displayed.

With the built-in 850mAh LiIon battery, the device can be operated up to 10 hours depending on the configuration. Depending on how frequently the position data is to be sent, whether APRS packets are to be received, the GPS receiver should be switched off automatically when not in use, and how often the screen can be switched off.

The receiver can be deactivated to significantly extend the operating time so that the Pico APRS functions as a pure APRS tracker. In order to further extend the runtime, the built-in GPS receiver is cyclically switched off and the screen saver is used (configurable).

The built-in Micro-USB connector not only allows the built-in rechargeable battery to be charged and the firmware upgraded, the transceiver can also be used as a USB GPS mouse or TNC on a computer. This allows you to run your own APRS Digipeater or iGate!

The transmitter has a 7-pole harmonic filter for the suppression of unwanted sub-transmissions. The main processor used is an ATmega processor (ATmega1284p) which is popupar on Arduino. The current software occupies about half of the available memory space of the main processor. Thus, there is still a lot of memory space for possible future function extensions available!

With a size of only 33 mm x 58 mm x 24 mm, the PicoAPRS resembles a matchbox. It weighs just 52 grams (without antenna).

Ideal to have the device always with you, e.g. Hiking, biking, motorcycling, skiing, on a boat or in the air.

The unit is supplied as a kit.

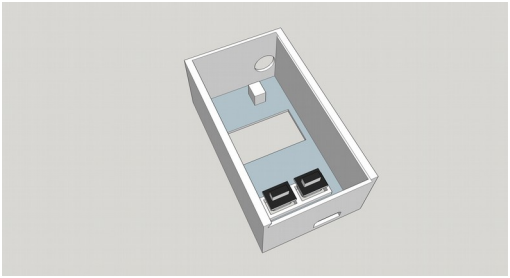
The two circuit boards must be mounted on each other and installed in the housing. The circuit boards themselves are completely equipped and tested.

Delivery:
•Housing with keys
•Circuit board set, tested and tested
•instruction manual
•LiION battery
•Pinheader for GPS board

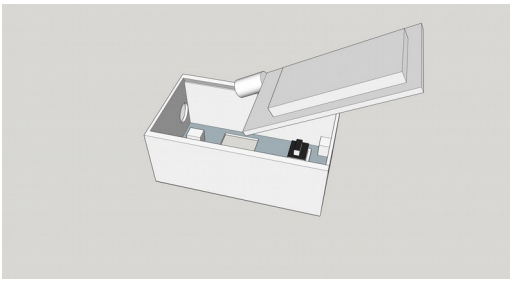
1.1 Assembly

No effort is required for the assembly! All components can be used very easily. If something is difficult, please check the cause and do not try with "violence" to protect the parts from damage!

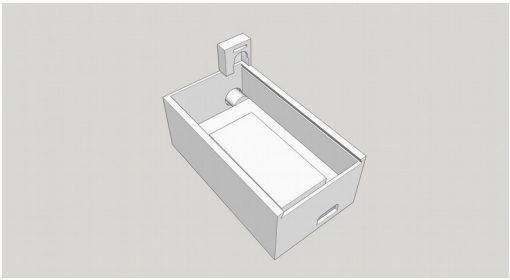
1. Insert the two buttons.



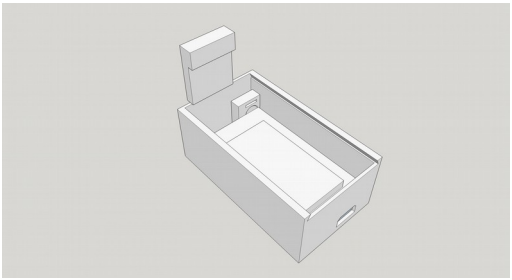
2. Insert the board with the antenna socket in advance. Then slide the board down so that the USB socket is inserted into the housing.



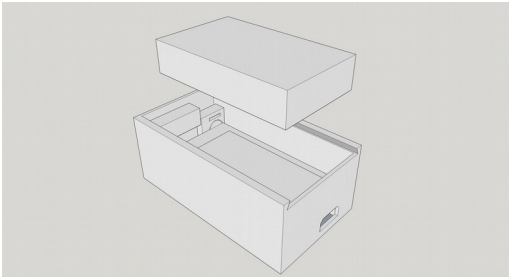
3. Insert the spacer.



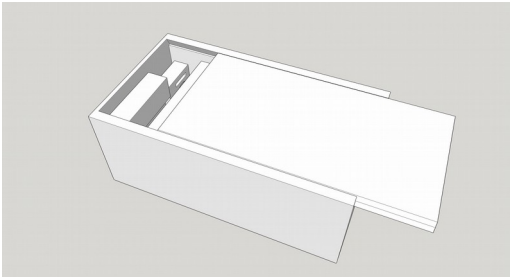
4. Insert the GPS module.



5. Install the battery and fold the cable one time to the left of the battery.



6. Slide the cover from below. Place the groove on the bottom of the unit.



1.2 Security Notes

- The unit is not waterproof and is not protected against splash water. Please use it only in a dry environment.

- Do not expose the appliance to excessive heat (for example, a parked vehicle in high sunlight).

- Do not use any damaged components.

The used battery stores energy with a high density. Incorrect handling of the battery can lead to dangerous situations. Please observe the following precautions regarding the handling of the battery.

- Do not open or attempt to repair the battery
- Do not short-circuit the connections
- Do not expose the battery to high temperatures or burn it
- Do not expose or dispose of the battery
- Do not charge the battery when the battery is warmed or near sources of heat.
- Do not use a defective or damaged battery
- Do not charge the battery with other chargers
- Do not place the unit on a flammable base

Notes on battery disposal

In connection with the distribution of batteries or with the delivery of devices containing batteries, the supplier is obliged to inform the customer of the following:

The customer is legally obliged to return used batteries as end users. It can return old batteries, which the supplier has as a new battery in the assortment or led, free of charge at the dispatch warehouse (dispatch address) of the offerer. Batteries and accumulators must not be disposed of in household waste.

The symbol according to §17 paragraph 1 BattG (german laws) and the signs according to §17 paragraph 3 BattG have the following meaning:
Pb = Battery contains more than 0.004% weight of lead
Cd = battery contains more than 0.002% cadmium
Hg = battery contains more than 0.0005 mass% of mercury

2. Usage

2.1 General

The transceiver has only two buttons due to the very small dimensions. With these two buttons, PicoAPRS can be fully operated and configured. The operation is very simple.

PicoAPRS can only be operated with the battery connected.

Switching On

To **switch on**, press one of the buttons for **at least 2 seconds**.

2.2 Mainscreen

To enter the menu, press the left button (labeled "Menu") while PicoAPRS displays the main screen. See the following illustration:

Left Button

The left button is used within the menu to jump to the next menu item or to the next character to be changed (for example, for call sign input). In this case, the button in the display is labeled **"next"** (see menu items below).

Right Button

Use the right button to change the currently displayed setting (for example, changing the character on which the cursor is currently located) within the menus.

On the main screen, the right button is used to send a position message (labeled **"beacon"**). PicoPARS sends the position message as soon as a GPS position has been found. If GPS has previously been deactivated automatically (GPS status display **"OFF"**), GPS is activated automatically.

If mycalll has not been set to MyCall, **"mycall"** appears instead of **"beacon"**. By pressing the **"mycall"** key, you are taken directly to the menu item for setting your call sign.

The following information is displayed on the main screen:

First line, from left to right: battery charging, TX / RX status, GPS status, battery voltage
Second line: Time (time zone can be set via the menu).
Third line: speed in km / h (updated only while GPS is active)
4th line: Label for the left and right buttons
Example screen:

Explanation of the above example main screen display:

- the built-in lithium-ion battery is fully charged. The **battery symbol** is completely white filled and is permanently embedded.

- **"TX"** – unit is transmitting. The **TX** indicator remains active for a short time, even if the transmission has already been completed. Since transmissions can sometimes only have a very short duration, this helps for better detection of transmissions. When receiving data, an **"RX"** appears at this point.
If neither transmitting nor receiving a data packet, nothing appears here.

- Currently **7** satellites are used for the position determination.
- The battery voltage is approx. **4.1V** (the voltage measurement is not calibrated!)
- Time **19:48:34** (hours: minutes: seconds)
- The speed is **1km / h**

Further possible examples on the main screen:

In this example, the built-in battery is charging.
The battery symbol with arrow **flashes during charging**.

The "*****" symbol flashes during the GPS search.
If the GPS receiver has been temporarily deactivated for energy saving **("GPS Powersave")**, **nothing** appears at this point!
→ If the GPS receiver has been permanently deactivated after several unsuccessful GPS searches for energy saving reasons, **"OFF"** is shown!

Automatic display of received APRS packets

When an APRS packet is received, the package is displayed automatically, unless you are within the menu.

- Received position message

First line: call sign, SSID and APRS Symbol of the received station

Second line: Distance in km as well as direction to indicated station in degrees. Unless a valid GPS position is known (for example inside buildings or when the GPS is deactivated due to energy saving functions), a "~" appears in front of the distance indication.

Third line: If a status text has been sent, this is displayed here as running text.

- Received staus message

If a pure status packet without position data is received, will display:
Status from:
Call sign
SSID
Status text

- Received message („SMS“)

First line: Note "MessageFrom"
Second line: sender of the message
Third line: Message text. (Circulation).

All kinds of received APRS packets can be deleted by pressing one of the two buttons! If a time has been set in the "Autoclose" menu, all received messages (with the exception of messages) are automatically closed after this time has elapsed!

2.3 Menu structure (overview)

- Power OFF
- Last Heard
- Messages
- APRS Symbol
- GPS Status
- USB Mode (OFF / GPS / KISS TNC)
- Save Home pos
- TX Power (High / Low)
- TX Interval
- Timezone

- MyCall
- MySSID
- Receiver (ON / OFF)
- Frequency
- Autoclose
- Screensaver
- GPS Powersave
- Contrast
- Comment
- Info
- Reboot

After the last menu point "Reboot" you get back to the main screen!

If you do not press any button for 10 seconds in the Settings menu, the changes are saved automatically and the menu will be exited. This does not apply if you want to display the last heard, received messages, GPS position or while saving your home position!

2.4 Menu details

Power OFF

Press the right button to **turn off** the transceiver.

Last Heard

Here, the last received four stations with distance in km and direction in degrees are displayed. Stations already received are updated when they are received again. Press **"close"** to exit the menu immediately.

Messages

The last received four messages incl. Sender are displayed here. The text is displayed as a **scrolling** text. Messages received twice are only displayed once. Press **"close"** to exit the menu immediately.

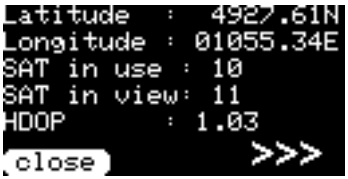
APRS Symbol

Here you set your own APRS symbol which should be displayed for other receivers.

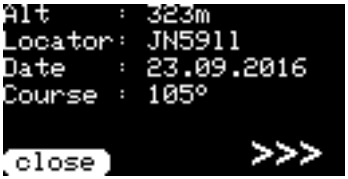
For the most frequently used symbols, a "=" and the corresponding symbol are displayed and these are located at the "beginning", so that very quickly between e.g. Cars and pedestrians. An ASCII character is displayed for all other symbols. PicoAPRS always use the primary table!
A translation table is included in the package.
The most recent version is availible at http://wa8lmf.net/aprs/APRS_symbols.htm.

GPS Status

Pressing the right **"ok"** button will take you to the GPS data displayed on the following page



Pressing the right button **">>>"** will take you to the next page of the GPS information as shown in the figure below.



The setting of the "Timezone" has no effect on the displayed date!

USB Mode

With USB mode, you determine how the device should behave on the PC There are the options Config, GPS or. KISS TNC.
The USB interface always works with **115200 baud!**

Config: The PicoAPRS transceiver does not send any data to the PC. However, you can use a terminal program to send commands to the PicoAPRS to get informations or to change configurations. E.g. your comment text for APRS position messages can be configured here via the PC keyboard.

Send an "Enter" (line break) via a terminal program and you will receive a response with the possible commands.

GPS: In this setting, GPS data is output in NMEA format via USB. So you can use PicoAPRS like a "GPS mouse".

KISS-TNC: In this mode, PicoAPRS behaves like a KISS-TNC. You can use this mode, among other things, to use PicoAPRS for APRS PC software, such as use UIView32. Thus, it is possible to install your own APRS digipeater or gateway.
In the KISS-TNC mode, there are **no initialization commands** necessary.

Save Home pos

In the **"Save Home pos"** menu, you can save your current position as "Home" position in the device. This is used only for the calculation of the distance from received APRS position messages, if no GPS position is known (for example: after a reboot of the PicoAPRS).

If the GPS position is unknown, the second line shows **"Wait for GPS"**. The position can only be saved by pressing the right button **"ok"** when **"Ready for save"** appears in the second line.

TX Power

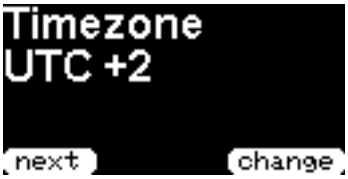
Here the transmission power can be switched between "High" and "Low".

The transmission power in **High is about 1 Watt** and in **Low about 0.5 Watt**.

TX interval

Specify the intervals at which position messages are to be sent. Please note that the interval set here only takes effect if your position has changed by a fixed distance defined in the software!

Timezone



By adjusting the "Timezone", you can adjust the time displayed on the main screen to your local conditions. If you set this to "0", the main screen will display UTC time.

MyCall

Here you set your own **callsign**. **<u>This is the most important setting you need to make!</u>**
It is used to send position messages and **to receive personal messages**.

The currently set call sign is displayed here.
To change, press the right button ("change").

A **"underscore" ("_")** will appear at the position you are changing (see figure above). Repeatedly press the change key to change the underlined position until the desired character appears. There are only **LETTERS** from **A** to **Z** and numbers from **0-9** available.

To complete your input, please use the **"Check"** as shown in the figure above and then press **"next"**. Your setting will be saved.

MySSID

Set your SSID here with the **"change"** key. Values from 0-16 are available. The SSID is used to distinguish the different APRS station types.

The convention for the SSID is (Source: http://aprs.org/aprs11/SSIDs.txt)

-0 Your primary station usually fixed and message capable
-1 generic additional station, digi, mobile, wx, etc
-2 generic additional station, digi, mobile, wx, etc
-3 generic additional station, digi, mobile, wx, etc
-4 generic additional station, digi, mobile, wx, etc
-5 Other networks (Dstar, Iphones, Androids etc)
-6 Special activity, Satellite ops, camping or 6 meters, etc
-7 walkie talkies, HT's or other human portable
-8 boats, sailboats, RV's or second main mobile
-9 Primary Mobile (usually message capable)
-10 internet, Igates, echolink, winlink, AVRS, APRN, etc
-11 balloons, aircraft, spacecraft, etc
-12 APRStt, DTMF, RFID, devices, one-way trackers*, etc
-13 Weather stations
-14 Truckers or generally full time drivers
-15 generic additional station, digi, mobile, wx, etc

Receiver

Receiver **"ON"** or **"OFF"** switches the built-in **receiver** on or off. Position beacons will be also sent in the switched-off state! The receiver is only used to receive APRS packets and personal messages. If you use PicoAPRS as KISS-TNC, the receiver is automatically activated.

Frequency

Set the APRS transmit and receive frequency to be used here.

The frequency is preset to the frequency of 144,800 MHz usual in Europe and must not be changed in the normal case. In analogy to the input of your call sign, set the frequency here. The first two digits (14) and the decimal point are given!

The following frequencies are used in other parts of the world for 1200 baud FM APRS:

USA:	**144.390 MHz**
Japan:	**144.740 MHz**
Europe:	**144.800 MHz**
Australia:	**145.175 MHz**
Thailand:	**145.525 MHz**
ISS (Space Station):	**145.825 MHz**
OSCAR44 (Uplink):	**144.828 MHz**

Autoclose

Autoclose automatically closes position and status messages displayed on the main screen after the set time. The position messages can still be retrieved in the **"Last heard"** menu.

Autoclose can be deactivated with **"OFF"** or a time between **10 and 300** seconds can be set.

Received personal messages will not automatically closed!

Screensaver

Screensaver switches the OLED display off after a set time in minutes, if no button has been pressed in the set time. PicoAPRS also works normally with the display off. When one of the two buttons is pressed while the display is off, the display is reactivated. In this case, the keystroke does not any further action.

The life of the display is extended when the display is turned off more frequently. In addition, the recharge time is slightly extended as energy is saved as soon as the display is deactivated.

GPS Powersave

"GPS Powersave" defines whether the GPS receiver should be switched off automatically when GPS is not required.

"OFF" deactivates the energy saving function and **"ON"** activates this function.

If the external power supply is connected via USB, GPS will be permanently activated regardless of this setting!

If the GPS receiver is cyclically deactivated, the energy saved and the battery life extended. In return, the GPS speed may not be displayed correctly on the main screen. In addition, the distance to other stations is then calculated and displayed only with the last known GPS position.

Contrast

Contrast adjusts the display brightness. **"HIGH"** for high and **"LOW"** for low brightness.

A low brightness lowers the power consumption slightly, thus extending the battery life slightly. In addition, a low brightness has a positive effect on the life of the OLED display.

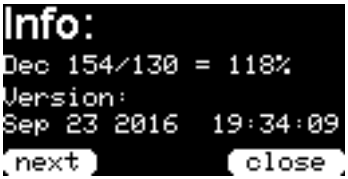
Comment

Under "Comment", you set up a comment text, which is **sent as a comment with every 10th position package**. The text is limited to 50 characters. The input is analogous to the entry of the call sign under the menu point MyCall. However, you have all ASCII characters as well as uppercase letters, numbers and characters here.

The first line shows you which position you are currently editing. In the example on the left, this is the location **8** of the maximum possible **50**.

To finish, please set the "check" as shown above. Any preceding and longer text will be truncated at this point.

Info



Under "Info" you will see some Information.
The line "Dec" x / x indicates how many APRS data packets were successfully decoded and how often a data transmission was received.
If the sender sends several data packets at once, the value can go beyond 100%! See example image on left.
The version means when the installed software was created.

Reboot

If your PicoAPRS does not behave as usual, you can restart the device via this menu item. No settings are deleted!
If a "reboot" does not help, disconnect the internal battery and, if connected, the PicoAPRS USB cable for a few seconds and reconnect the battery.

3. Specifications

Frequency range:	144.000 MHz – 146.000 MHz
Transmission power:	Maximum 1 Watt
Modulation:	FM / AFSK
Baudrate APRS:	1200 Baud
Baurate USB (virtual serial):	115200 Baud
Operating voltage via USB:	5.0V DC
Battery:	3,7V - 850mAh Li-Ion
Power consumption at the USB port:	500mA
Dimensions: Approx.	33 mm x 58 mm x 24 mm
Weight:	approx. 52 grams

4. Troubleshooting

- PicoAPRS display flashes, the unit restarts permanently

→ Battery voltage too low. Please charge the battery.

- In the main screen you will see the GPS status - "ERR"

→ No data from the GPS receiver, please check if the GPS module has been correctly plugged in.

- In the main screen, GPS status - "OFF"

→ GPS receiver was switched off after several unsuccessful attempts without GPS cover for energy saving. There are several ways to re-enable GPS reception:

A) Press "beacon" on the main screen to send a position message. GPS is reactivated.

B) turn the unit off and on again via the menu.

- In the main screen, "TNC is in use"

→ The TNC function is active and a USB cable is connected. In this case, PicoAPRS only functions as TNC, no position data are sent from the device and the GPS receiver is deactivated.

Accessories

Order. Nr.	
40074.06	USB/Micro-USB Cable, 60cm
40074.1	USB/Micro-USB Cable, 100cm
42854.02	Adapter SMA-Connector/BNC-Connector, ultrashort black
35050	Secondary battery LiPo 3,6V/850mAh

Recommended plug-on and magnetic foot antennas

Order. Nr.	
17027	DIAMOND SRH-1 Plug-in antenna, Length 2,5cm
17023	DIAMOND SRH-805 Plug-in antenna, Length 4,5cm
17021	DIAMOND SRH-815S Plug-in antenna, Length 15 cm
17022	DIAMOND SRH-36 Plug-in antenna, Length 36 cm
20117.SMA	DIAMOND MR-77S Magnetic mount antenna, 4m Cable, feet 65mm diameter
20119.SMA	DIAMOND MR-75S Magnetic mount antenna, 3m Cable, feet 30mm diameter
20111.SMA	No-Name Magnetic mount antenna, 3m Cable

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