

A dark space background featuring a large, dark planet on the left side and a smaller, cratered planet in the upper right. The background is filled with numerous small white stars.

# AnTrack – Pro

Antenna tracking system for EME,  
Radio-Astronomy and Amateur DSN  
with high precision absolute  
encoders...and more

by Alex Artieda, HB9DRI

# Agenda

- Introduction
- Evolution of Tracking Systems
- PC vs Stand alone
- The AnTrack-Pro
  - Definition and philosophy
  - Characteristics
  - Implementation
- Production, cost and deployment
- The AnTrack-Pro and high precision encoders

# Evolution of Tracking Sys.

- Amateurs create innovative solutions
- Tracking by hand, always welcome
- If you have a TV camera better....but....
  - **weather not always cooperate**
- Z80 processors, Atari, Commodore 64 and Apple II
- PC clones, 80286, 80386, 80486 and Pentium
- Stand alone PIC's and Microcontrollers
- Linux and open source
- Light platforms, Arduino, Red Pitaya, ODROID, Teensy, Beagle, Raspberry Pi and many more

# PC vs Stand alone

- Since the PC was introduced in our radio stations, computational Power in excess help to develop usefull programs.
- Log's, calculators, demodulators with the sound card, tracking systems (mainly for satellite operation), etc.
- Most of the tracking systems use the PC to run complex calculations
- The introduce of PIC's and dedicate microprocessors speed up the development and cut the dependency on the PC

**BUT.....**

- Those stand-alone systems lack in power full resources and had limited computational power, just basic floating-point calculations. No space for any extra functionality, poor user interface and complex to manage.

# The AnTrack-Pro

- Definition and philosophy
  - VERY SIMPLE, we move FROM THIS:



4x20 LCD display; 80 chr.

4 push buttons

**8bit with 10Mhz CPU**

**64KB flash data memory**

TO THIS:



TFT 480x320 = 153,600 pixels

Color Touch screen, no push buttons

**32bit Dual core 240Mhz CPU**

**up to 16MB flash data memory**

# The AnTrack-Pro

## Characteristics

- Stand alone antenna controller based on a ESP32 Dev 2 board
- Graphic interface design with GuiSlice under MIT Open License
- Dependency libraries are proprietary by LinkRF with some exceptions but always under the MIT License model  
FW is not an open-source software!!! **BUT, is not for sale, is FREE!!!**
- 4" Color Touch screen, 480x320 = 153,600 pixels
- Include support for a GPS module NEO M8N with concurrent reception of up to 3 GNSS, (GPS, Galileo, GLONASS, BeiDou)
- WIFI module and Web server for configuration and remote control.
- RTC (real time clock) with accuracy of 5ppm. Non-volatile up to 5 years

# The AnTrack-Pro



.....continue (characteristics)

- NTP Stratum 1 Server, based on the GPs with 15 uSec accuracy or better.  
(The fractional seconds accuracy depends on the ESP32 system clock)
- NTP client if internet is available but no GPS coverage available.
- You can track by predefine buttons: Sun, Moon, Sagittarius, Cassiopeia, Taurus, Cygnus, Leo and Pictor.
- Display your home echo frequency (when moon is selected)
- You can track any position entering RA and DEC
- Include a Tilt Correction table with 60 AZ positions (1 each 6 deg) specially for big dishes and setups where the verticality is not perfect.

# The AnTrack-Pro

.....continue (characteristics)

- Support 9-to-16-bit encoders, easy to interface with MAB25, ETS25, HH12, HH12-INC, AC-360 inclinometer and the new BAX-16 (16bit encoder with 0.01 deg accuracy) under development.
- Use of a dedicate encoder board with microprocessor and MAX485 transceivers to reach up to 1km distance over a twisted pair cable..
- Soft start and soft stop based on PWM.
- Support for DC electric engines, 20amps and 32VDC with IBT-2 bridges
- Predefine offsets for AZ and EL making easy to interface the encoders.
- OTA, Over the Air, firmware update from binary downloaded from [LinkRF.ch](http://LinkRF.ch). This feature is only available when using the web interface.



# The AnTrack-Pro DIY

As a DIY project the Antrack-Pro will be available based on Pre-DIY kit, this kit will include:

- PCB's (almost populated)
- The main MCU (ESP32) with the latest FW uploaded
- The auxiliary MCU for the encoder hub with the FW uploaded

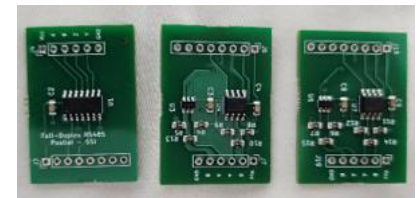
**The DIY pre-kit will have a cost of  
70.00 USD+shipping**

# The AnTrack-Pro DIY

Having the DIY pre-kit you will need to buy some additional parts in eBay, Aliexpress or in your local electronic store of your preference:

Additional parts:

- 4inch LCD touch screen 480x320 w/resistive touch screen using a ST7796S
- uBlox M8N GPS Module w/GPS antenna
- W5500 Ethernet module (optional)
- 2 ITB-2 H bridges based on the BTS7960B
- 2 encoders interface (PCBs w/pre-kit included, parts non populated, you will populate according to your encoders)



# The AnTrack-Pro DIY

Estimated cost:

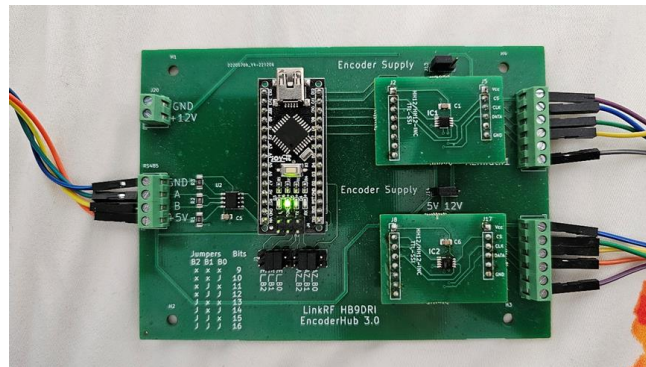
- DIY pre-kit (FW is included for free) :	70.00
- 4inch LCD touch screen :	15.00
- uBlox M8N GPS module :	13.00
- GPS antenna :	3.00
- W5500 Ethernet module (optional) :	5.00
- 2 x ITB-2 H bridges :	20.00
- 2 encoders interface :	25.00

**T O T A L (USD) : 151.00**

# The AnTrack-Pro DIY

## The ON4CDU encoder hub

We adopt the concept of an encoder board based on the work done by ON4CDU, this approach made much easy to interface any kind of encoder, absolute or incremental, from 9 to 16 bits, if necessary, SSI, SEI, binary etc.



The ON4CDU FW was slightly modify and is available to adapt and include the encoder of your preference.

The connection between the AnTrack-Pro and the encoder hub is done via RS-485 with 2 cables twisted pairs up to 1.2km

# The AnTrack-Pro Web Interface for remote Op.

You can connect the Web server inside the AnTrack-Pro  
To manage remotely the entire controller, your PC and the controller must be on the  
same network, using your browser you just need to point to their AnTrack-Pro IP  
address:

<http://192.168.1.152>

**AnTrack-Pro HB9DRI** George Boudreau

Home Echo

Azimuth  Elevation

UTC  
17:19:07  
Tue, Jun 07, 2022

[ General settings ]

**Some configuration changes require a reboot of controller**

NetAccess  WIFI  eNET  GPS  NTPs  NTPc

Band:  Target:

GridCode:  Lat:  Lon:

NTP Client Server:

[ Antenna / Encoder related settings ]

**Minimum antenna movement window ( between 0.0° and 2.0° )**

Window width:

**Encoder correction input**

Azimuth:  Elevation:

**Select a 'parking' slot to adjust settings**

Park1  Park2  Park3  Park4

Azimuth:  Elevation:

[ Manual Position Setup ]

**Entered values are NOT persistent between controller reboots**

Azimuth:  Elevation:

[ DSN Target Setup ]

 **Jet Propulsion Laboratory**  
California Institute of Technology

**DSN target information, description and frequency for each entry**

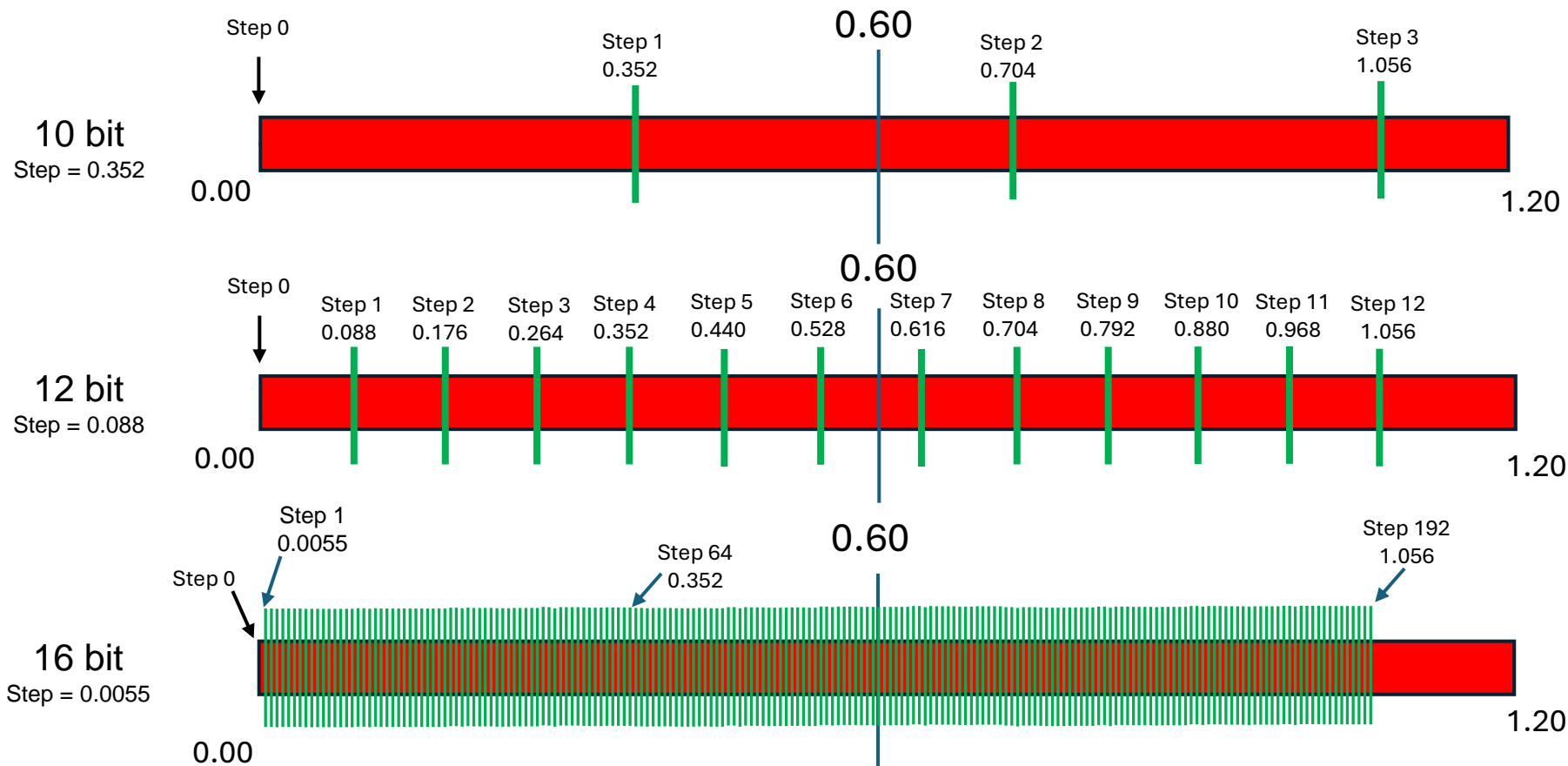
# The AnTrack-Pro and high precision Absolute Encoders



Encoder Bits	Steps x rev.	Deg. / Step	Visualization
10	1024	0.352	0.35
12	4096	0.0879	0.09
14	16384	0.0219	0.02
16	65536	0.0055	0.01

Encoder Bits	10	12	14	16	
Steps x Rev.	1024	4096	16384	65536	
Deg. / Step	0.35	0.09	0.02	0.01	
45.25	45.00	45.18	45.24	45.25	

# The AnTrack-Pro and high precision Absolute Encoders



# Additional information

<https://www.linkrf.ch>  
[info@linkrf.ch](mailto:info@linkrf.ch)



A dark space background featuring a large, dark planet on the left side and a smaller, dark planet in the upper right corner. The background is filled with numerous small, white stars and a subtle reddish-pink nebula-like glow.

# Questions?