Portable ADS-B Ground Receiver
ADSB-RE1090

AvionixTech

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1. Introduction

ADSB-RE1090 is a high-performance, portable and user-friendly 1090MHz ADS-B ground receiver. Designed to meet the demands of modern aviation surveillance applications such as flight tracking, ADSB-RE1090 offers unparalleled performance and functionality in a compact package.

With its remarkable reception range, minimal loss of messages at the antenna end, and outstanding reliability, ADSB-RE1090 stands as a high-performance ADS-B ground receiver that allows you to track aircrafts equipped with 1090ES ADS-B transmitters as far as 200+ miles away. Whether you're monitoring aircraft on map or relying on ADS-B data for professional applications, ADSB-RE1090 exceeds expectations.

With its low power consumption, ADSB-RE1090 is designed for maximum convenience and usability, enabling you to use it effortlessly in any location. Along with built-in network connectivity of both RJ45 and WiFi, ADSB-RE1090 can seamlessly integrates into your network infrastructure and support remote operation.

Delivered with pre-installed software and all necessary accessories, ADSB-RE1090 simplifies setup and operation through its user-friendly web interface.

Complied with Mode-S and ADS-B standards, ICAO Annex 10 Volume IV, RTCA DO-260 version 0, 1 and 2, ED-102B, ED-129B, ADSB-RE1090 ensures compliance and compatibility with industry requirements. Moreover, ADSB-RE1090 offers the flexibility to output ADS-B data in various formats, simplifying integration into your professional applications. Whether you require specific ADS-B data formats for analysis, visualization, or integration with existing systems, ADSB-RE1090 accommodates your needs effortlessly.

With its advanced capabilities, ADSB-RE1090 serves as an ideal replacement for the once-renowned SBS-3 ADS-B ground receiver.

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ADSB-RE1090 package includes:
- ①、 ADSB-RE1090 unit *1
- ②、 Power adapter *1
- ③、 GPS antenna *1
- ④、 WiFi antenna *1

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⑤、 ADS-B antenna cable 10 meters *1 (please specify if you require a longer cable)

⑥、 ADS-B antenna clamp *2

⑦、 ADS-B antenna *1

2. Functions

2.1 Data Formats

➢ ADSB-RE1090 can output ADS-B messages via network cables or WiFi (please note 6.2) in different data format. Including CSV plaintext (decoded ADS-B data, you can easily get longitude, latitude, altitude, speed, flight ID…), Asterix Cat021, json (also decoded ADS-B data), DF17/18 raw messages and AVR.

➢ ADSB-RE1090 can also receive and output Mode-S messages and Mode A/C messages.

➢ ADSB-RE1090 can output ADS-B data with GPS timestamp.

2.2 Functions for your convenience

➢ ADSB-RE1090 can be connected via network cables or WiFi (please note 6.2).

➢ ADSB-RE1090 supports static IP address and DHCP.

➢ ADSB-RE1090 IP address can be configured for direct connection with a computer without the need for routers. However, ADSB-RE1090 can also be configured to connect with a computer via routers, offering flexibility based on your setup preferences.

➢ A single ADSB-RE1090 unit can transmit ADS-B data to multiple clients simultaneously, enabling efficient data distribution across multiple devices or systems.

➢ Compact and lightweight, ADSB-RE1090 can easily fit into a backpack for convenient transportation. It can be powered by a 12V rechargeable battery, making it ideal for mobile applications where portability is essential.

➢ Work with ADS-B display software adsbscope.

3. Specifications

➢ Frequency: 1090 MHz

➢ Sensitivity: better than -93 dbm

➢ Coverage: >350 km

➢ Power Supply: DC 12V, 2A

➢ Working temperature: -10℃~55℃

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➢ Physical Size: 24.1*15.3*6.5 cm (not include antenna connectors)
➢ Antenna Connector: N/F

4. Optional

➢ ADS-B antenna, GPS antenna and network surge protector.
➢ Seawater resistant ADS-B Antenna for off-shore use.
➢ Dual unit for high reliability.
➢ ATC display software, ADS-B data analysis software, ADS-B and radar coverage evaluation software.
➢ All our products can be supplied fully customized with your brand and logo. We can even do customized form factors, enclosures, functions and data formats on your requirement. This OEM/Customization service enables you to have your own unique product in minimal time with no risk.
➢ We can output and storage ADS-B IQ data for your analysis. Please don't hesitate to contact us with your specific requirement.
➢ Combining ADS-B, ACARS, and AIS reception capabilities into a single device, so-called 3A Receiver, offers comprehensive surveillance for aviation and maritime applications. With our expertise and technology, we can seamlessly integrate these functionalities into a unified system, providing enhanced situational awareness and data collection capabilities.
➢ IP67 waterproof version. We also provide ADSB-RE1090P with weather resistant enclosure, which is the IP67 waterproof version of ADSB-RE1090 for outdoor use. Please refer to ADSB-RE1090P manual.

5. Special use case

Special use cases often require specific features or accessories that not every standard ADS-B ground receiver on market can accommodate. Besides standard ADS-B ground receiver use cases, our ADS-B ground receiver solution can be customized with optional accessories to meet below unique applications effectively.
➢ Requires WiFi connection.
➢ Off-shore use, with optional seawater resistant ADS-B Antenna.
➢ On ship, with optional seawater resistant ADS-B Antenna.
➢ Areas that have a lot of thunders, with optional ADS-B antenna, GPS antenna and network surge protectors.
➢ In the field. ADSB-RE1090 is small in size and light in weight. It can be easily put in a backpack. ADSB-RE1090 can be powered by a 12V rechargeable battery. It is easy to carry and use.
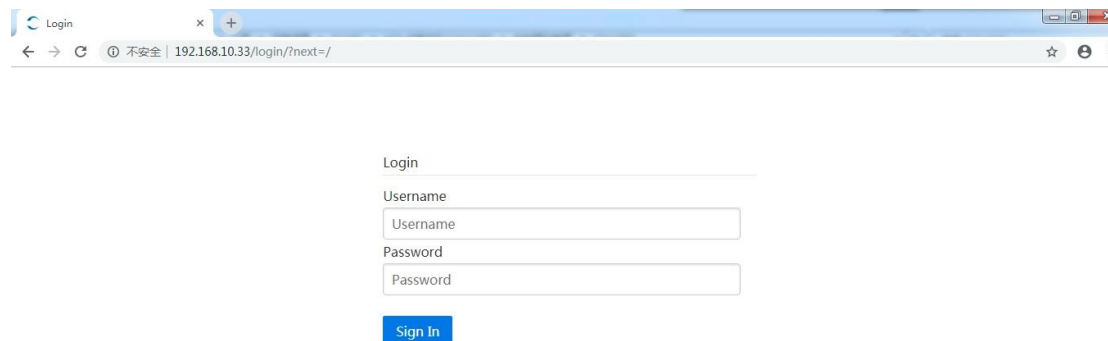
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6. Configuration

The default cable network IP address of ADSB-RE1090 is: 192.168.10.33 The default Wifi IP address is DHCP.

6.1 Log in and Start

6.1.1 Power on ADSB-RE1090 and connect ADSB-RE1090 to computer via network cable, and set the IP of the computer to the same network segment as the ADSB-RE1090.

6.1.2 Enter the ADSB-RE1090 IP address 192.168.10.33 in browser
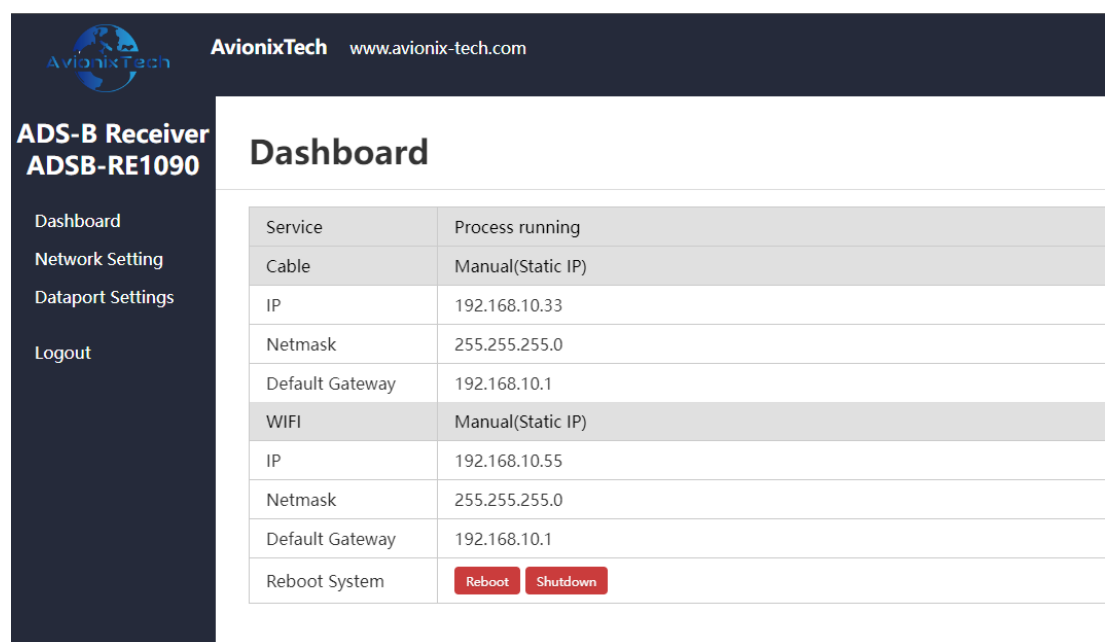
6.1.3 Enter user name and password:
User name: admin
Password: aaareceiver

6.1.4 Enter ADSB-RE1090 control page Dashboard

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The status of <Service> should be <Process running>, otherwise click <start> to start service.

6.2 Network configuration

Important note:

➢ **Please first use cable to login and set your WiFi, this might help if you forgot your static IP address.**

➢ **Considering WiFi instability and complexity, WiFi is just for supplementary, not guaranteed and in warranty.**

➢ **When you change ADSB-RE1090 to static IP, please make sure the IP address, subnet mask and gateway are correct. And make sure you remember all these configurations. Otherwise, you may not be able to access ADSB-RE1090. Well, if you do forget and you did set WiFi the first place, WiFi DHCP might, might help you.**

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➢ **Cable and WiFi can't work at the same time. If you want to use WiFi, disconnect your RJ45 cable.**

Click Network Settings:

Click Cable to configure Cable network. Enter the IP address, subnet mask, gateway to configure. Click WiFi to configure WiFi network. Enter the SSID and PSK (password).

Click Change Network Settings:

(Pleae note, when you Click Change Network Settings, both cable and WiFi settings would be changed.)

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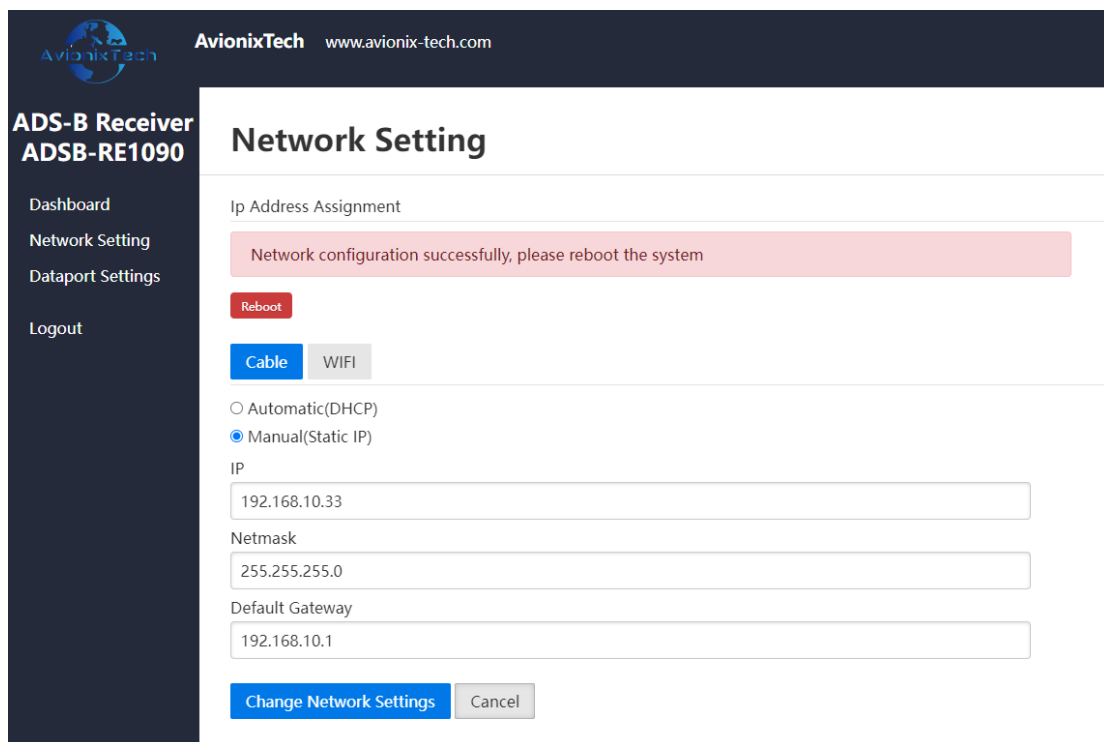
Click Reboot:
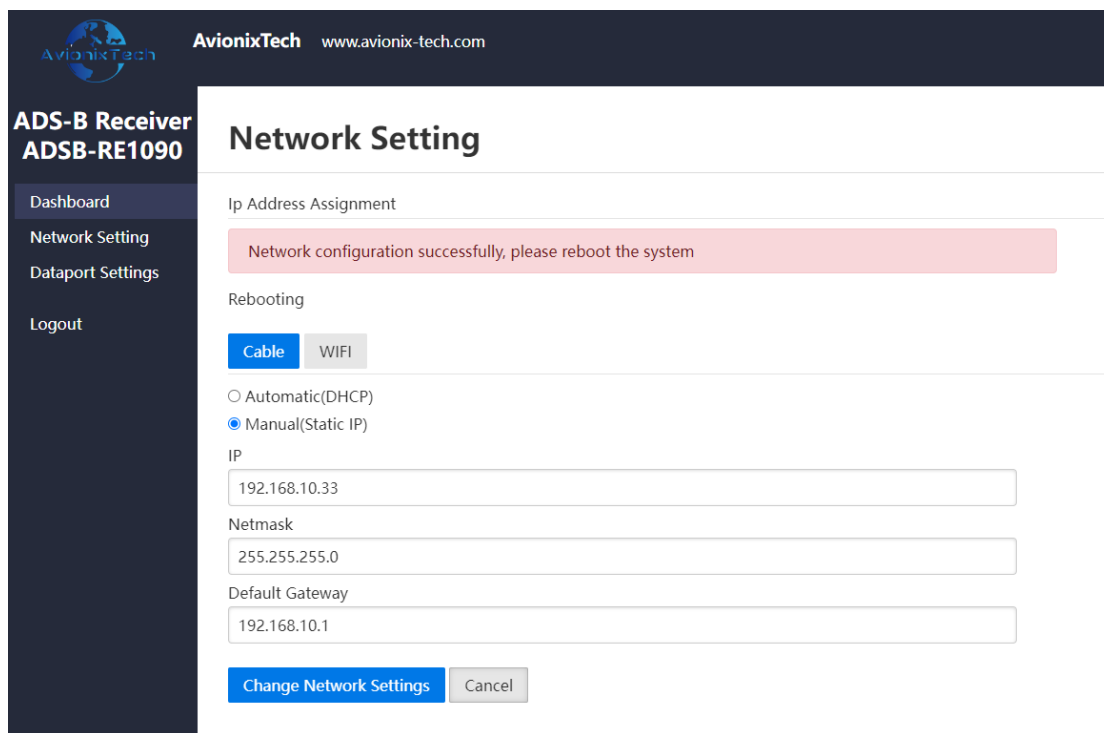
New IP address is valid after reboot.
It's the same for WiFi network configuration.

ADSB-RE1090 supports DHCP for cable and WiFi. Open the router configuration page DHCP client list, you can see the IP address of ADSB-RE1090 (host name: receiver). As long as the computer is in the same network with ADSB-RE1090, you

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can access the IP address obtained by ADSB-RE1090 through DHCP.

It is recommended that at least one of cable and Wifi be reserved for DHCP to avoid forgetting your static IP.

6.3 Dataport configuration
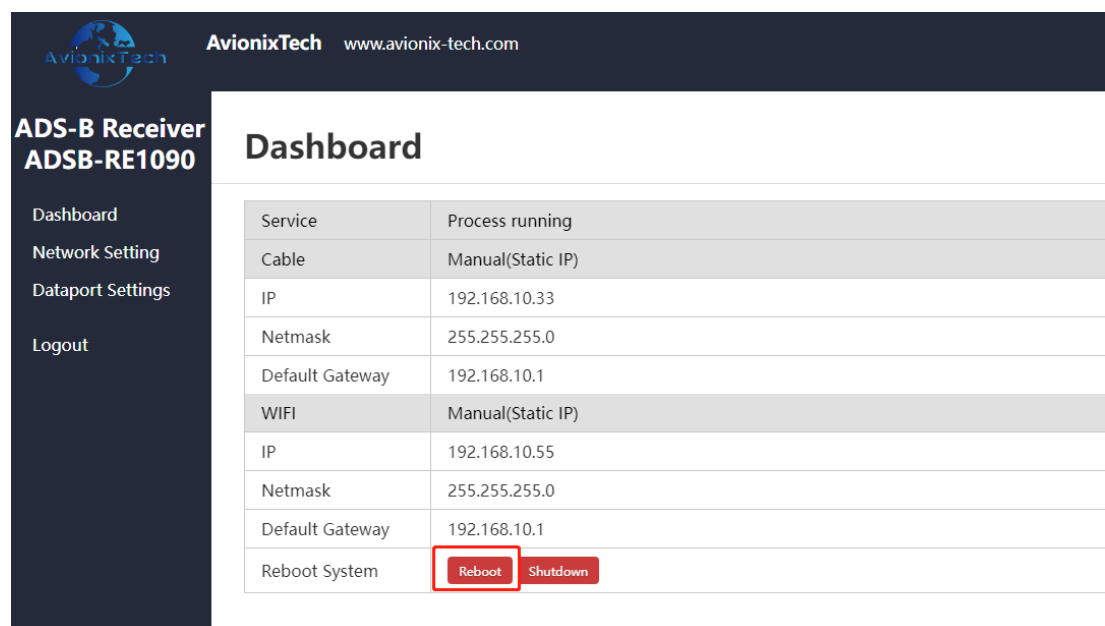
Click Dataport Settings:

ADSB-RE1090 support five different output data format:
- ASTERIX CAT021
- CSV plaintext Data
- JSON
- ADS-B, Mode-S and Mode A/C messages
- AVR

Different data format are configured separately and output simultaneously.

Note: After configuration, you need to return to Dashboard and reboot the system for the configuration to take effect.

ASTERIX CAT21 data

ADSB-RE1090 supports output Asterix CAT021 data in accordance with EUROCONTROL ASTERIX standard format, in binary format. The original binary data and the decoded data format as below (the decoded data is just to show you what it is, not real output):

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```
1  15 00 34 f5 1b 2b 2b c1 20 80 80 04 00 02 01 1c
2  b4 0a 52 c4 c0 78 07 c4 41 44 e4 41 44 97 00 05
3  6b 05 02 01 3d 06 e0 ac 67 41 44 e4 0d 33 b6 cb
4  7d e0 00 6e
```

Dataitem	Name	Size	Summary
I021/010	Data Source Identifier	02	SAC:128 SIC:128
I021/040	Target Report Descriptor	01	TARGET:NORMAL
I021/161	Track Number	02	TRACK_NUM:0002
I021/015	Service Identification	01	SVC_ID:001
I021/130	Position in WGS84 Coordinates	06	WGS84:402150N1162336E
I021/080	Target Address	03	ADDR:7807C4
I021/073	Time of Message Reception for Position	03	TOD:09:16:57.781
I021/075	Time of Message Reception for Velocity	03	TOD:09:16:57.179
I021/090	Quality Indicators	01	NUCR:0 NUCP:0
I021/070	Mode-3/A Code in Octal Representation	02	MODE_3/A:2553
I021/145	Flight Level	02	LEVEL:320.50FL
I021/155	Barometric Vertical Rate	02	VR:1981.25FT/M
I021/160	Ground Vector	04	SPD:386.72KT AGL:242.44DEG
I021/077	Time of ASTERIX Report Transmission	03	TOD:09:16:57.781
I021/170	Target Identification	06	ACID:CSN6277
I021/020	Emitter Category	01	EMITTER:NO_INFO
I021/132	Message Amplitude	01	AMP:110

Configurable parameters as below:

Adsb Output Asterix

Cat021 Data Output Network Protocol

udp_broadcast

Cat021 data output multicast address

224.0.5.13

Cat021 data output multicast port

5000

Cat021 data output UDP address

255.255.255.255

Cat021 data output UDP port

5000

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Cat021 data output mode

event ▼

Cat021 data output time period

500 ▼

Cat021 data version

2.4 ▼

SAC

128

SIC

128

Configurable parameters	illustration
Cat021 Data Output Network Protocol	The network protocols used for data output, including UDP unicast, UDP multicast, UDP broadcast and shutdown
Cat021 data output multicast address	Recipient address when output using UDP multicast
Cat021 data output multicast port	Recipient port when output using UDP multicast
Cat021 data output UDP address	Recipient address when output using UDP unicast or broadcast
Cat021 data output UDP port	Recipient port when output using UDP unicast or broadcast
Cat021 data output mode	Data output modes, including data driven mode and periodic mode. In data driven mode, ADSB-RE1090 automatically output data whenever ADS-B track is updated. In periodic mode, each time period, ADSB-RE1090 automatically output data for all tracks, regardless of whether they have been updated or not.
Cat021 data output time period	In periodic mode, the period time in

	milliseconds.
Cat021 data version	ASTERIX CAT021 data version, support V0.23, V0.26, V2.1 and V2.4.
SAC	
SIC	

CSV plaintext data

ADSB-RE1090 supports plaintext track data output in CSV format, and the units of plaintext data can be imperial or metric.

Each line of plaintext data is formatted as "@CSV plaintext #\r\n"

Each line of CSV plaintext contains below data items.

data item	Metric	Imperial
Track number	digit	
Time stamp	In ISO 8601 format in the format yyyy-MM-ddTHH:mm:ss.zzzZ	
ICAO address	in hexadecimal	
Callsign	No more than 8 characters and numbers	
SSR code	in octal	
latitude	in degrees; north is positive and south is negative	
longitude	in degrees; east is positive and west is negative	
Altitude	meter	foot
Ground speed	Km/h	Knot
Heading	in degrees. clockwise to true north	
Vertical speed	meter/min	Feet/min
Air/Ground Indication	GND stands for ground; AIR stands for air	

Below are examples of output data:

@3,2020-12-28T20:16:05.539Z,780A29,CPA087,7233,39.7389,116.826,36100,450.504,200.124,,AIR#
@2,2020-12-28T20:16:05.590Z,7807C4,CSN6277,2553,40.4189,116.531,32175,390.021,242.515,2496,AIR#
@1,2020-12-28T20:16:05.590Z,780D74,CQH8903,4157,40.3892,117.128,26600,392.237,19.8209,960,AIR#

Configurable parameters as below:

Adsb Output Csv

CSV plaintext data output network protocol

[udp_broadcast ⌄]

CSV plaintext data output UDP address

[255.255.255.255]

CSV plaintext data output UDP port

[5100]

Metric or Imperial

[imperial ⌄]

Configurable parameters	illustration
CSV plaintext data output network protocol	The network protocols used for data output, including UDP unicast, UDP broadcast and shutdown
CSV plaintext data output UDP address	Recipient address when output is on UDP unicast or UDP broadcast.
CSV plaintext data output UDP port	Recipient port when output in UDP unicast or UDP broadcast.
Metric or Imperial	

JSON plaintext track data

ADSB-RE1090 supports plaintext track data output in JSON format. JSON plaintext data use standard HTTP protocol, in standard JSON format. When an HTTP request is received from client, ADSB-RE1090 sends all track information in JSON format. Each track is a JSON object.

ADSB-RE1090 also support JSON plaintext data use TCP. ADSB-RE1090 is TCP server and TCP port is 48887.

Each json object contains below data items.

data item	content	Example
track_id	Track number	84
last_update	Track last update time	2019-10-28T03:04:00.177Z
icao_addr	ICAO 24-bit address	79A053
acid	Call sign	CSN6467

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acid_last_update	call sign last update time	2019-10-28T03:03:06.657Z
acid_last_change	Call sign last change time	2019-10-28T03:03:43.978Z
emitter_category	Emitter Category	0
emitter_category_last_update	The Emitter Category last update time	2019-10-28T03:03:06.657Z
emitter_category_last_change	Emitter Category last change time	2019-10-28T03:03:43.978Z
squawk	In octal	7350
squawk_last_update	Squawk last update time	2019-10-28T03:03:33.264Z
latitude	Latitude (degrees)	36.26815020027807
longitude	Longitude (degrees)	120.3369335418052
position_last_update	Position last update time	2019-10-28T03:04:00.177Z
signal_amplitude	Signal amplitude	0
signal_amplitude_last_update	Signal amplitude last update time	2019-10-28T03:04:00.177Z
altitude_baro	Pressure Altitude (ft)	32125
altitude_baro_last_update	Pressure Altitude last update time	2019-10-28T03:04:00.177Z
ground_speed	Ground speed (kn)	464.4588248704076
ground_speed_last_update	Ground speed last update time	2019-10-28T03:03:58.911Z
heading	Heading (degrees)	166.17319186904027
heading_last_update	Heading last update time	2019-10-28T03:03:58.911Z
vertical_rate_baro	Vertical rate (ft/min).	1472
vertical_rate_baro_last_update	Vertical rate last update time	2019-10-28T03:03:58.911Z
ground	Ground Indication	false
ground_last_update	Ground indication last update time	2019-10-28T03:04:00.177Z

Illustration:

1. All timestamps use ISO8601 in format yyyy-MM-ddTHH:mm:ss.zzzZ
2. Multiple JSON objects are combined into an array of JSON objects

Below is an example of output data:

```
[
    {
        "acid": "CSN6467",
        "acid_last_change": "2019-10-28T03:03:06.657Z",
        "acid_last_update": "2019-10-28T03:03:43.978Z",
        "altitude_baro": 32125,
        "altitude_baro_last_update": "2019-10-28T03:04:00.177Z",
        "emitter_category": 0,
        "emitter_category_last_change": "2019-10-28T03:03:06.657Z",
        "emitter_category_last_update": "2019-10-28T03:03:43.978Z",
        "ground": false,
        "ground_last_update": "2019-10-28T03:04:00.177Z",
```

```
        "ground_speed_last_update": "2019-10-28T03:03:58.911Z",
        "groupd_speed": 464.4588248704076,
        "heading": 166.17319186904027,
        "heading_last_update": "2019-10-28T03:03:58.911Z",
        "icao_addr": "79A053",
        "last_update": "2019-10-28T03:04:00.177Z",
        "latitude": 36.26815020027807,
        "longitude": 120.3369335418052,
        "position_last_update": "2019-10-28T03:04:00.177Z",
        "signal_amplitude": 0,
        "signal_amplitude_last_update": "2019-10-28T03:04:00.177Z",
        "squawk": "7350",
        "squawk_last_update": "2019-10-28T03:03:33.264Z",
        "track_id": 84,
        "vertial_rate_baro": 1472,
        "vertial_rate_baro_last_update": "2019-10-28T03:03:58.911Z"
    },
    {

        "altitude_baro": 875,
        "altitude_baro_last_update": "2019-10-28T03:03:58.152Z",
        "ground": false,
        "ground_last_update": "2019-10-28T03:03:58.152Z",
        "ground_speed_last_update": "2019-10-28T03:03:58.656Z",
        "groupd_speed": 133.6637572418193,
        "heading": 344.82007256547377,
        "heading_last_update": "2019-10-28T03:03:58.656Z",
        "icao_addr": "7802F4",
        "last_update": "2019-10-28T03:04:00.177Z",
        "latitude": 36.20199947033898,
        "longitude": 120.39484551612368,
        "position_last_update": "2019-10-28T03:03:58.152Z",
        "signal_amplitude": 0,
        "signal_amplitude_last_update": "2019-10-28T03:03:58.656Z",
        "squawk": "0761",
        "squawk_last_update": "2019-10-28T03:03:57.387Z",
        "track_id": 85,
        "vertial_rate_baro": -576,
        "vertial_rate_baro_last_update": "2019-10-28T03:03:58.656Z"
    },
    {
        "acid": "CES9928",
        "acid_last_change": "2019-10-28T03:03:51.062Z",
        "acid_last_update": "2019-10-28T03:03:57.136Z",
        "altitude_baro": 7550,
```

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```
        "altitude_baro_last_update": "2019-10-28T03:03:59.926Z",
        "emitter_category": 0,
        "emitter_category_last_change": "2019-10-28T03:03:51.062Z",
        "emitter_category_last_update": "2019-10-28T03:03:57.136Z",
        "ground": false,
        "ground_last_update": "2019-10-28T03:03:59.926Z",
        "ground_speed_last_update": "2019-10-28T03:03:59.672Z",
        "groupd_speed": 224.50167037240502,
        "heading": 176.16894863894333,
        "heading_last_update": "2019-10-28T03:03:59.672Z",
        "icao_addr": "79A03F",
        "last_update": "2019-10-28T03:03:59.926Z",
        "latitude": 36.32762145996094,
        "longitude": 120.34303665161133,
        "position_last_update": "2019-10-28T03:03:59.926Z",
        "signal_amplitude": 0,
        "signal_amplitude_last_update": "2019-10-28T03:03:59.926Z",
        "squawk": "3105",
        "squawk_last_update": "2019-10-28T03:03:50.807Z",
        "track_id": 87,
        "vertial_rate_baro": -64,
        "vertial_rate_baro_last_update": "2019-10-28T03:03:59.672Z"
    }
]
```

The parameters of the JSON plaintext track output are fixed parameters and cannot be configured. Parameters as below:

parameters	illustration
JSON plaintext track HTTP address	ADSB-RE1090 IP address
JSON plaintext track HTTP port	48888
JSON plaintext track URL	http:// [ADSB-RE1090 IP Address]: 48888/
JSON plaintext TCP port (ADSB-RE1090 is TCP server).	48887

ADS-B and Mode-S raw message data

ADSB-RE1090 supports output of raw, unprocessed DF data received, which can be output in binary or text. The content of the binary format and the text format are exactly the same, the binary format packet is smaller; the text format packet is larger but convenient for direct reading and analysis.

Below is an example of output data:

112-bit long message

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8d780dd199440eb86004194d4662

Short message of 56 bits
02e1909819fdb0

Configurable parameters as bellow:

Adsb Output Modes

ADS-B and Mode-S raw data output network protocol

udp_broadcast

ADS-B and Mode-S raw data output UDP address

255.255.255.255

ADS-B and Mode-S raw data output UDP port

5110

ADS-B and Mode-S raw data format

binary

Configurable parameters	illustration
ADS-B and Mode-S raw data output network protocol	The network protocols used for data output, including UDP unicast, UDP broadcast and shutdown
ADS-B and Mode-S raw data output UDP address	Recipient address when output using UDP unicast or UDP broadcast
ADS-B and Mode-S raw data output UDP port	Recipient port when output using UDP unicast or UDP broadcast
ADS-B and Mode-S raw data format	binary or text

AVR Data

The AVR format contains timestamp in addition to the raw DF data. The AVR format parameters are fixed and cannot be configured. As below:

parameters	illustration
AVR format raw data output network protocol	TCP server
AVR format raw data output TCP port	7000
AVR format raw data output time-stamp switch	open

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Below is an example of output data:
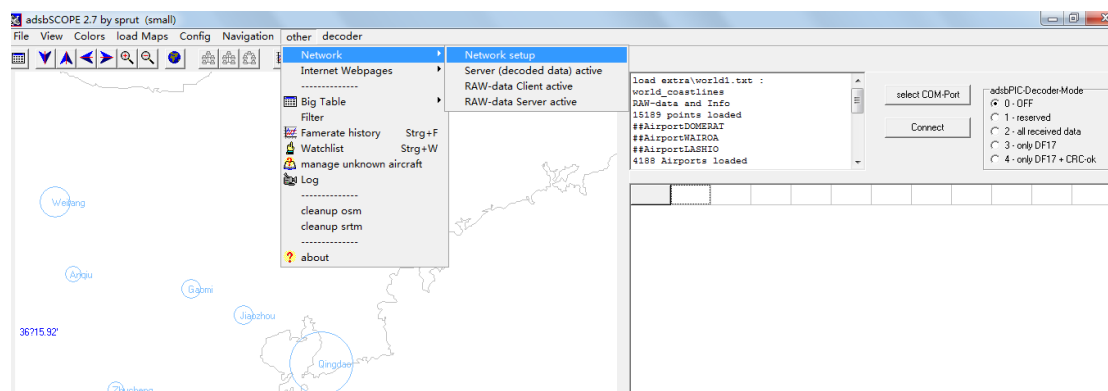
AVR format

@9D66000226C88D780426585D62E094FD878F4E10;

@9D66000D9878280007838ABD3C;

7. ADS-B display software ADSBScope

ADSB-RE1090 can use the display software adsbscope

Double-click to open adsbscope.

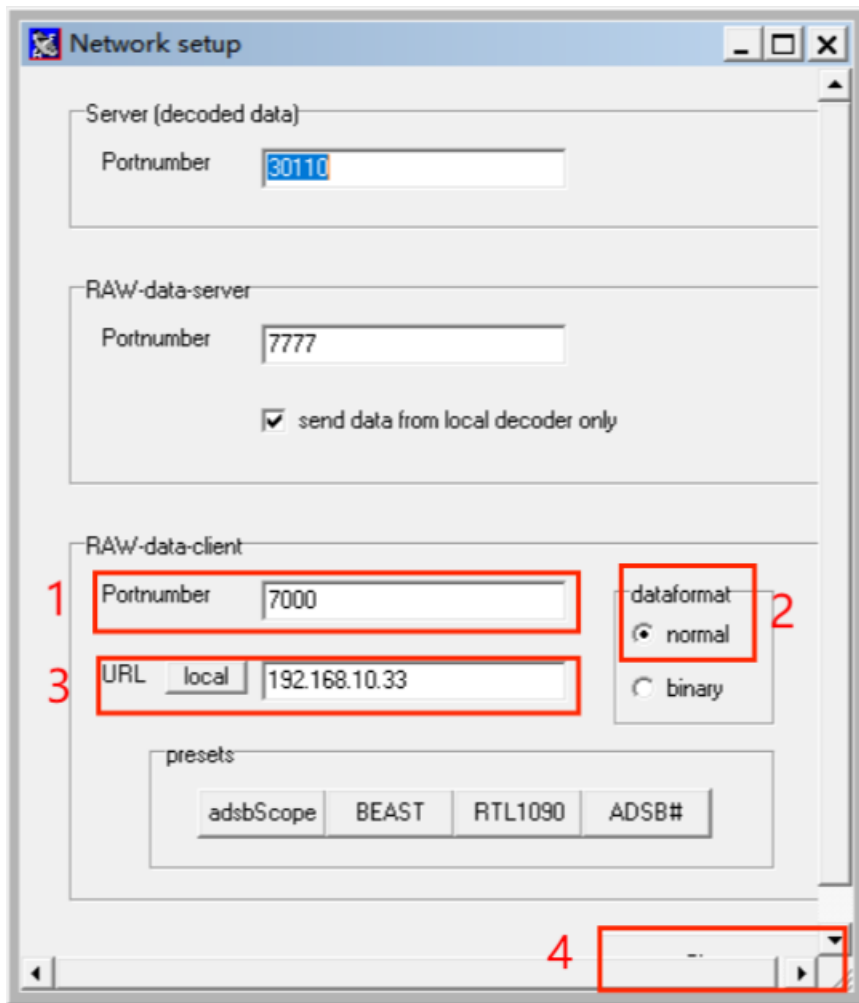Click other in the menu bar, and then click Network setup under Network, as shown in the figure below.

Set <RAW-data-client>, <Portnumber> is 7000.
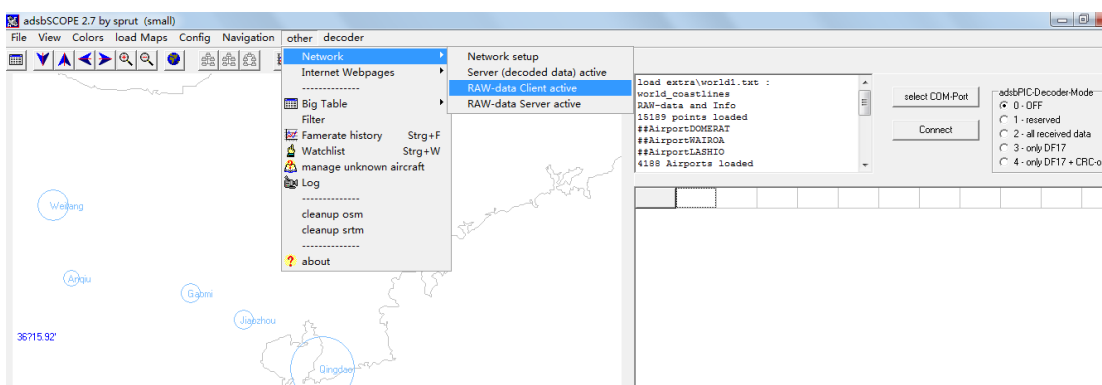
<dataformat> selects <normal>.

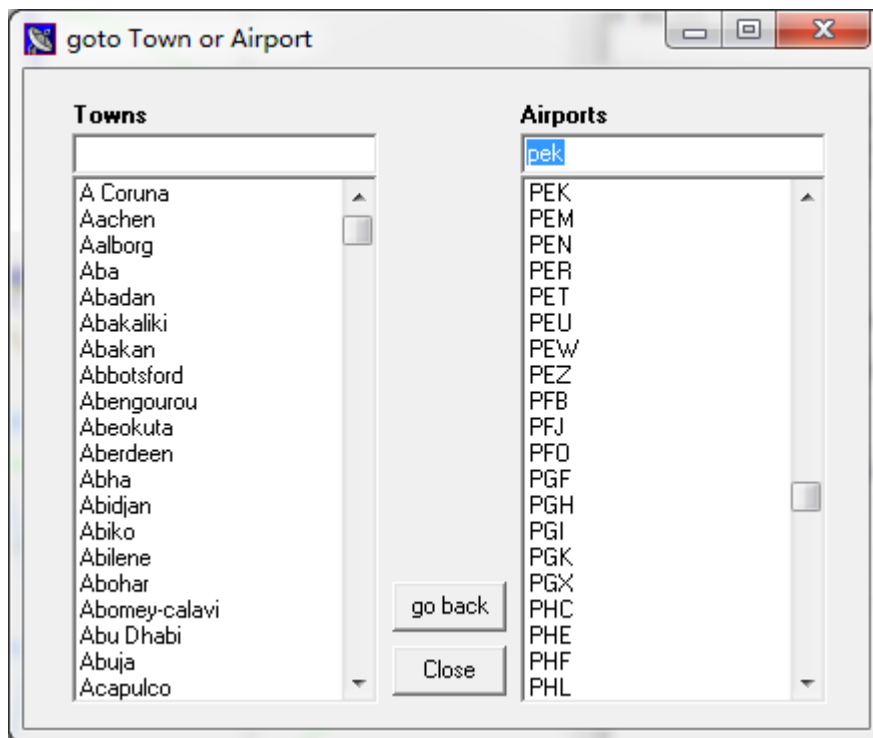<URL> should be the IP address of ADSB-RE1090.
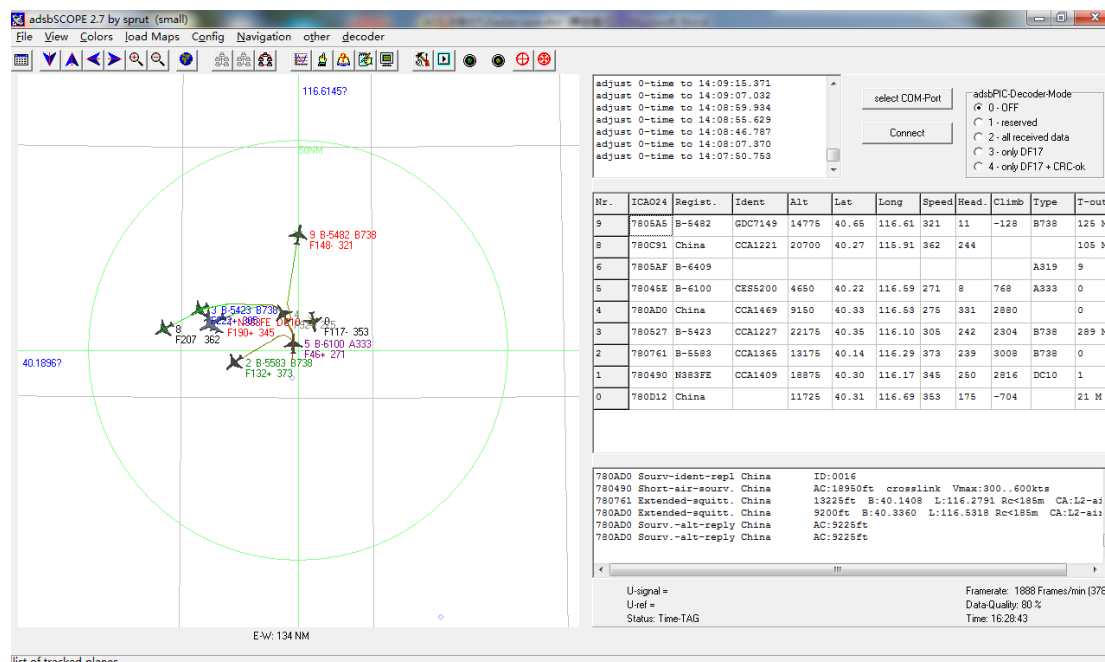
Click <Close>.

Click other in the menu bar, and then click RAW- Data Client active under Network, as shown in the figure below.

To see the aircrafts, set up an airport close to yourself. Goto town or airport under navigation, as shown in the figure below. PEK is Beijing airport, as an example.

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Done!

8. **Antenna**

- ➢ Omnidirectional
- ➢ Frequency: 1060-1120MHz
- ➢ Bandwidth: 60MHz
- ➢ Gain: 6 dBi

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- VSWR: <1.5
- Impedance: 50 ohms
- Polarization: Vertical
- Length: 60 cm
- Weight (Without mast clamp): 360 g
- Weight (With mast clamp): 510 g
- Connector: N Female
- Operating Temperature: -40 to +85 degrees
- Rated Wind Velocity: 60 m/s

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