Flying Neurons

Transponder cable

User's guide

Transformation of a mode S transponder into ADS-B out

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Document Status

Document	FLNO_001 version 1.0.EN			
Date	26/06/2022			
Author	Flying Neurons			
Status	Audience☒	Internal☐	nes☐	Draft☒

Amendments

Version	Date	Description
1.0	26/06/2022	First draft

Contents

This document explains how to connect the Neurone to your mode S transponder in order to transform it into an ADS-B out. The connections as well as the configuration of the transponder and the Neurone are detailed. The non-exhaustive list of eligible transponders is also included in the document.

Contents

1 Why converting your transponder? 4
1.1 How a Mode S Transponder Works 4
1.2 How ADS-B out transponders work 4
1.3 Transformation from S mode to ADS-B out mode 4
2 List of eligible transponders 5
3 Connection 5
3.1 Preparing the transponder cable 5
3.2 Connection to transponder 6
4 Transponder configuration 8
4.1 NMEA protocol 8
4.2 Transmission rate 8
4.3 Quality indicators 8
5 Neurone Setup 9
6 NeuroFly App Setup 10
7 Checking the installation 11
7.1 You have a NeuroADSB 11
7.2 You do not have a NeuroADSB 11
8 Technical characteristics 11

1 Why converting your transponder?

An **ADS-B out transponder** brings a considerable gain in security compared to a simple **mode S transponder** . It allows all other aircraft equipped with **ADS-B in** as well as many platforms such as **Flightradar24** to locate you permanently and precisely.

1.1 How a Mode S Transponder Works

A **Mode S transponder** only transmits when interrogated:

- Either by a **secondary radar** (SSR= Secondary Surveillance RADAR) ,
- Either by a **TCAS** (Traffic alert and Collision Avoidance System) .

The radio message transmitted includes:

- The **flight level** (vertical position above the 1013.25 hPa isobar),
- **The hexadecimal address** of the transponder.

The position of the aircraft is not transmitted by a Mode S transponder.

Secondary radars are few in number and located mainly near major airports. **Mode S** transponders are therefore **not always interrogated and therefore do not transmit continuously** . This is particularly true far from major airports, and in many valleys.
Only secondary radars or networks of receivers on the ground (by Multilateration MLAT) succeed in locating an aircraft from transmissions in mode S.

1.2 How ADS-B out transponders work

The **ADS-B out transponders** transmit continuously and automatically (The A in ADS-B stands for automatic) their full position determined by GPS. They do not need to be interrogated to issue. To function, they need to know the GPS position of the aircraft. They use the same protocol and radio frequency as **Mode S transponders** .

1.3 Transformation from S mode to ADS-B out mode

Most **mode S transponders** can transmit **ADS-B out** if position information is continuously communicated to them on their RS232 serial port. The Neurone completed with the **transponder cable** allows this transformation.

2 List of eligible transponders

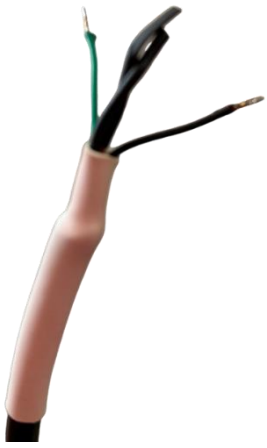
Here is a **non-exhaustive list of Mode S** transponders that can be transformed into **ADS-B out** . Contact Flying Neurons if your transponder is not in this list.

Mark	Model
TRIG	TT21, TT22
TRIG	TT31
Becker	BXP6401-1, BXP6401-2 (serial number > 2000)
Funke / Filser	TRT800, TRT800A, TRT800H
QT	KTX2-S
Garrecht	VT-01

3 Connection

3.1 Preparing the transponder cable

- Cut the cable to the desired length on the side of the USB Type A socket.



- Cut the sheath of the cable as well as the braid to reveal the wires. Be careful not to damage the wires.
- Strip then tin the green and black wires that will connect to the transponder and insulate the other 2 wires that are not used with heat shrink tubing.
- Place a heat shrink tubing around the cable as shown in the photo opposite.

3.2 Connection to transponder

The signal from the 2 wires respects the RS232 protocol:

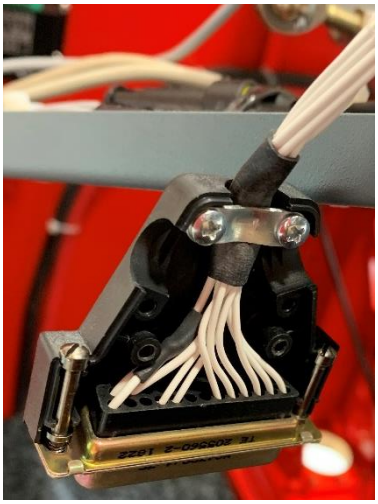
Wire function	transponder cable
TX_GPS (GPS signal)	green wire
GND (Ground)	**black wire**

The 2 wires **TX_GPS** and **GND** must be connected to the terminals of a transponder connector. The table below details, for each type of transponder, the connector to be connected to and the connection pins:

Transponder	Connector	TX_GPS	GND
TRIG TT21/TT22	DB25 25 pin	pin 5	Pin 4
TRIG TT31	pin Molex connector (the smaller of the 2)	Pin 3	Pin A
Becker BXP6401-1, BXP6401-2	25-pin DB25: top connector (named P9)	pin 9	Pin 13 Connect pins 2.8 and 13
Funke/ Filser TRT800, TRT800A, TRT800H	DB15 15 pin	Pin 12	Pins 1 or 9
TQ KTX2-S	DB15 15 pin	Pin 13	Pins 1 or 9
Garrecht VT-01	DB9 9 pin	Pin 3	Pins 5 or 9

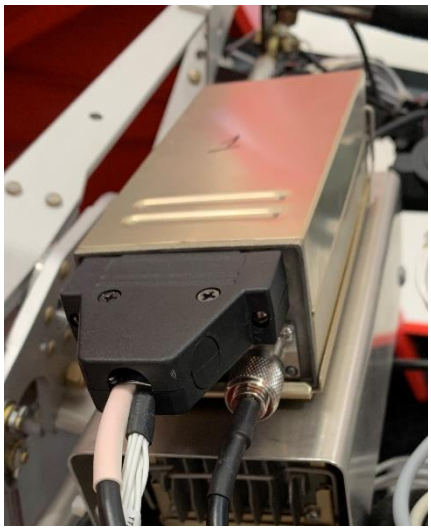
Proceed according to the following steps:

- Disconnect the transponder connector.



- Open the connector.

- the **TX_GPS** and **GND wires** to the connector pins as shown in the previous table. Insulate the welds with heat shrink tubing.



- Close the connector and reconnect it to the transponder.

4 Transponder configuration

Configuring the transponder consists of informing the transponder that it will continuously receive a GPS position on its RS232 port and describing the protocol used as well as the transmission speed.

The parameters to be defined depend on the transponder but are included in this list:

- NMEA protocol
- Transmission rate
- GPS quality indicators (SIL, SDA, NACp)

Refer to your transponder manual to configure these settings.

4.1 NMEA protocol

Most transponders offer several protocols for receiving position information. The Neurone uses the **NMEA** protocol . You must therefore choose this protocol from the proposed list.

4.2 Transmission rate

The bit rate can be imposed by the transponder or chosen from a list. It often varies from 4800 bps to 57600 bps. Choose the highest speed allowed by the transponder.

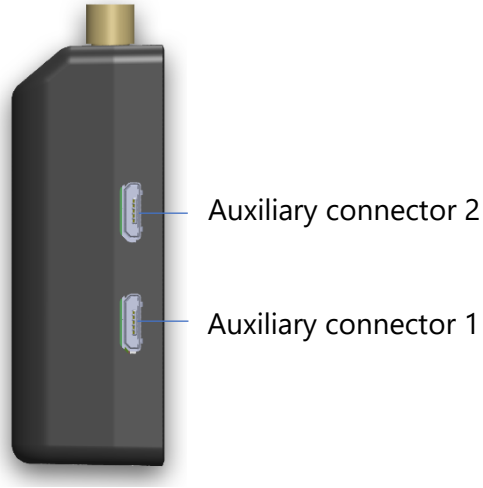
4.3 Quality indicators

Some transponders ask to define quality indicators of the GPS position provided. Since the Neurone is not a certified system, you must specify the lowest level of quality.

5 Neurone Setup

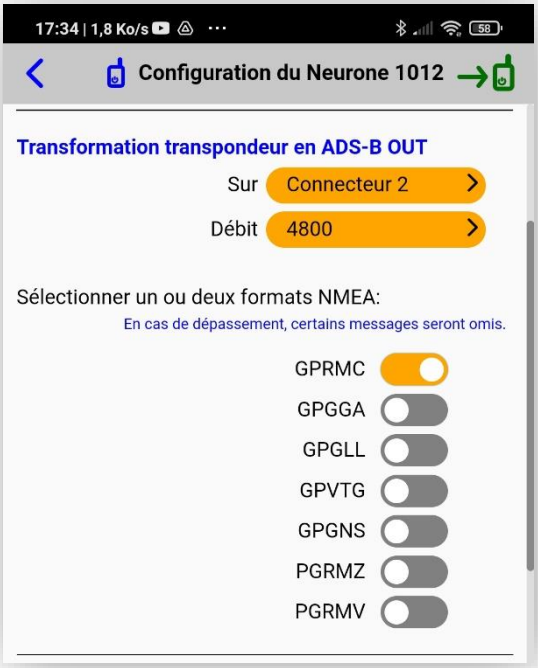
- The **transponder cable** can be connected to one of the two auxiliary connectors. However, it is recommended to use the auxiliary connector 2 since the **NeuroADSB peripheral** can only be connected to the auxiliary connector 1.

- If you have the **NeuroFLARM peripheral** , you can connect the **transponder cable** to the female micro USB socket of the **NeuroFLARM** .



Connect to the Neurone from the **NeuroFly app** :

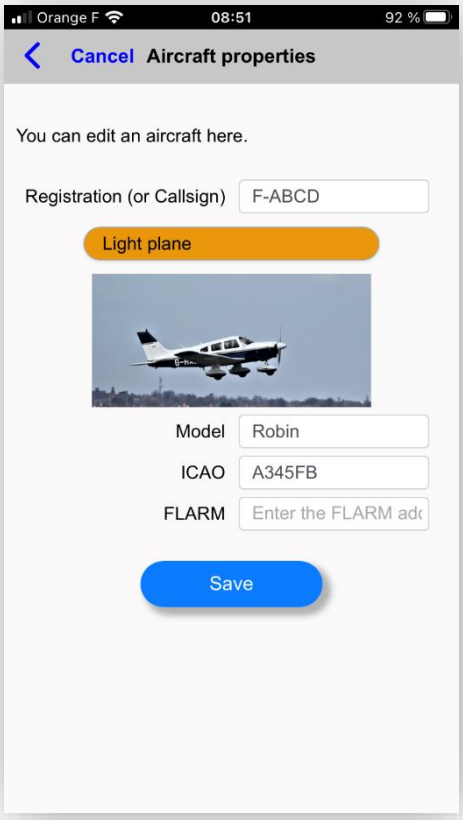
- In the menu, select " **Neurone Configuration** ".
- In the " **Transponder to ADS-B OUT** " section, select the auxiliary connector used by the **transponder cable** . If the **transponder cable** is connected to the **NeuroFLAM** , select the auxiliary connector of the **NeuroFLARM** .
- Select the transmission rate you have configured in your transponder. If the bit rate is imposed by the transponder, consult its installation manual to know this bit rate.
- Select the NMEA messages recognized by your transponder. They are listed in the following table for information only.
- Validate the Neurone configuration by clicking on the green validation icon.



Transponder	Authorized debits	NMEA messages required
TRIG TT21/TT22	4800, 9600, 19200, 38400	GPRMC
TRIG TT31	Select port #2 4800, 9600, 19200, 38400, 57600	GPRMC
Becker BXP6401-1, BXP6401-2	4800	GPGGA, GPVTG
Funke/ Filser TRT800, TRT800A, TRT800H	4800	GPRMC
TQ KTX2-S	4800, 9600, 38400	GPRMC
Garrecht VT-01	4800	GPRMC, GPGGA,

6 NeuroFly App Setup

Thanks to this installation, your aircraft will transmit **ADS-B out** in addition to the transmission by the **Neurone** itself. It is therefore necessary to inform the community that these two emissions correspond to the same aircraft so that you are not seen twice.



To do this, in the **NeuroFly application menu** :

- Select " **My Aircraft** ".
- Select your aircraft.
- Click the edit (stylus) icon.
- Enter **the ICAO hexadecimal address** of your transponder. It is composed of 6 characters.
- Click Edit
- Exit menu

7 Checking the installation

To check if your installation is working, you have two options:

7.1 You have a NeuroADSB

Temporarily remove your transponder's hex address from your aircraft configuration. After a few minutes, if your installation is correct, you will see your plane duplicated in **NeuroFly** .

Don't forget to re-enter the hexadecimal address afterwards.

7.2 You do not have a NeuroADSB

Check after a flight that Applications such as **Flightradar24, Radarbox , Flightaware** have recorded your flight and that it is well recorded in ADS-B.

8 Technical characteristics

Electrical protocol	RS232, 8 bits, no parity, 1 stop bit
Baud rate	4800 to 921600 bps
Frames transmitted	GPRMC, GPGGA, GPGLL, GPVTG, GPGNS, PGRMZ, PGRMV
Periodicity of positions	1 second