XICOY®

INNOVATION & TECHNOLOGY

BY GASPAR

Telemetry adapter v5

V10 Fadec and Xicoy engines to JETI, Multiplex, Hott, Futaba, JR, PowerBox, FrSky and Spektrum radios

Users Guide

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Welcome!

Congratulations on the purchase of your new telemetry adapter. Xicoy are dedicated to the design and production of electronic controllers to the highest standards of quality and reliability to bring you the customer the very latest next generation designs.

Features:

The Xicoy telemetry adapter provides the protocol translation between the data from the engine collected by the Xicoy Fadec turbine controllers (from model 107K) and JetsMunt specific controllers to the RC systems. Currently it supports the JETI, Multiplex M-Link, Graupner HoTT, JR, Futaba, PowerBox-CORE, FRSKY and Spektrum protocols. Other protocols will follow.

Depending on the capabilities of each particular RC system, the features of the system are different.

In all cases the measures provided are:

> RPM
> EGT
> ECU Battery voltage
> Throttle position %
> Pump voltage
> Remaining fuel % (milliliters in Spektrum)

And the minimum adjustable parameters in all cases are:

> Tank capacity
> Pump flow factor

When used on a JETI or HoTT RC system, this system provides the full emulation of the FADEC data terminal, bidirectional. All information seen on the fadec data terminal is presented in the TX screen (trough the JetiBox emulator in JETI radios), and the key presses on the TX buttons are sent to FADEC, that allow the navigation trough all menus.

When used on a Multiplex M-Link TX, as this brand don't allow any configuration on the TX and only allow 16 measures to be transmitted, this adapter allow to customer to decide what measures are transmitted, and on which slot are they placed, so that this adapter can be used together with all other sensors in the market or to use two adapters for twin engine operation. Also it allow to define alarms for the parameters transmitted (minimum fuel, battery, etc.).

When used on a Futaba TX, this device provides same functionality as in Multiplex case regarding the measures, but adding two extra important measures, that are the received signal strength and the failsafe counter, enabling the possibility of to get real time data of the performance of the radio link and to get alarms if the signal becomes weak. Alarms are defined in the transmitter.

When used on a PowerBOX-CORE, this system provides half emulation of the FADEC data terminal, this means that, data terminal screen can be seen on the radio display but it's not possible to control it. Although it will be added on future updates, as the PowerBOX protocol does not support it right now.
It offers the standard measures plus the status and the minimum adjustable parameters. Alarms doesn't need to be configurated on the telemetry as the radio allows full configuration of them.

 When used on FRSKY radio, this system offers the standard measures plus the status and the minimum adjustable parameters. Alarms doesn't need to be configurated on the telemetry as the radio allows full configuration of them.
In order to display the information on the radio screen a custom *lua* script is provided, head to FRSKY setup section for more information.

Due at the nature of the **HoTT, JR and Spektrum and FrSky** systems, only **one engine is supported**. All other radios support multiengine operation, one adapter for each engine.

There are 2 different models of adapters. One suit to Jeti, Futaba, JR, HoTT, MPX, PowerBox and FrSky these systems are connected through a standard servo lead. The specific model for Spektrum has a 4-pin socket compatible with Spektrum telemetry.

Electrical connections:

Except the Spektrum unit, the adapter has a 2-wire lead finished in a 3 position JR connector to be connected on the RX socket "EXT" on Jeti Receivers, "Sensor" on MPX receivers, "T" on HoTT and "SBUS2" on Futaba receivers, Smart Bus on FrSky receivers and P^2-Bus on PowerBOX-CORE receivers. Brown lead oriented to negative pin. Please note that on Spektrum systems, you need to purchase the **TM1000** module and the connection lead **SPMA9579** to your spectrum dealer, the Spektrum receivers don't have a telemetry input like other brands.

On the other side of the adapter there is a connector for a JR connector that should be connected to the fadec at the data terminal port, using the provided lead. The adapter is powered from the fadec, no power is taken from receiver.

The adapter has 2 small LED lights to show its working status, one green and one red. The green led blinks to confirm that there is traffic from ecu to adapter, and the red led blinks to signal the traffic from the adapter to the receiver (except on Spektrum systems).
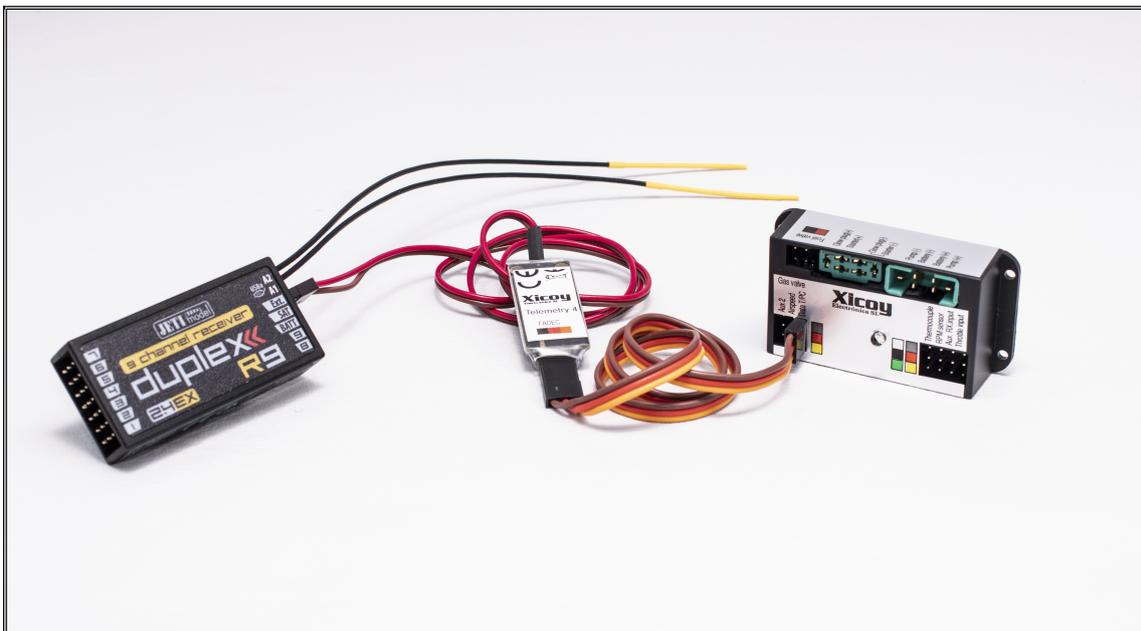
Picture 1

Since version 5 and higher it also supports the brand new X45 turbine. Telemetry module will automatically detect if it's a FADEC/Jets-munt engine or the new X45 system. As the communication protocol is completely different from the other FADEC it has its own connection. If you are using a X45 engine you should plug the telemetry on the Data Port of the Hub.

BASIC SETUP:

The adapters come from factory set for JETI radios. If you use in another radio brand, go to "Advanced setup" section

1. Connect the adapter to the Fadec and to the Jeti receiver, as described above.
2. Power the radio. Check that the Fadec is powered and that the green led on the adapter is blinking. This confirms that the data is being processed
3. On the Jeti TX, go to sensor setup menu. After 30-60s from Power up, you will see a new sensor group labelled "Turbine" with all 6 measures below it.
4. Select the measures you want to be displayed on the display and select JetiBox if you want the full screen of the data terminal of the fadec to be displayed on the TX screen. Check the manual of the TX for the customization of the display and recorded data
5. Set the alarms threshold, voice files, actions etc. you want through the Alarms menu on the TX.

   If you are using more than one engine, all parameters will be shown repeated, it is recommendable to connect first adapter, adjust the TX, and next the second.

ADVANCED SETUP:

With the help of the FADEC data terminal, it is possible to setup to change the current configuration of the adapter. You need a standard "Y" servo lead and a battery.

Connect the data terminal to the Fadec port on the telemetry adapter trough the "Y" servo lead. Connect a battery (4 to 8V) on the other port of the lead to power both devices. Connect the battery last, after both devices are already connected.

Picture 2

Note that **since version 5** and higher in order to be compatible with most of the receivers available on the market it will take up to 5 seconds to enter in this mode of operation.

The RED led on the adapter will lit, and the data terminal will display "Radio Model: JETI" when new from factory. Through the "+" button you can change to another supported brand.

Depending on the radio brand selected, more or less options will we offered.

Using the navigation buttons (on the left side) you can move through the different adjustments. In all cases you can adjust:

Tank capacity: using +/- buttons set the tank capacity on your model in milliliters. (1Oz=29,6ml)

Pump factor: The unit calculates the fuel used from the pump power supplied the ecu. Different pump models move different amounts of fuel at same voltage, so this factor should be set to suit your particular engine+pump+installation. Usual values are around 300 units, except for small engine like W44 that is around 80.

The recommended calibration process is:

Enter the fuel capacity of your plane in the "tank capacity" menu. Leave the pump factor at the default 400 unit, unless you know a more accurate figure for your engine model.

1) Do a normal flight; use your usual timer to determine the length of the flight. Ignore on this flight the % of fuel in the tank displayed by the telemetry on landing.
2) After landing, before to shut down the receiver, check the % of remaining fuel displayed on the telemetry screen.
3) Measure the real quantity of fuel left. If you use a regular shape tank (cylindrical, square, etc) them you can measure the height of the remaining fuel in respect to total capacity of the tank.
4) Once you know the % displayed on the radio and the real % of fuel in the tank, you can calculate the correct pump factor in your plane.

Example: You have a tank of 2.000ml (67Oz) and have set the pump factor at default 400. After the flight you see that telemetry show a remaining fuel quantity of 18% (360ml on Spektrum). Then you measure the tank, and you have a tank of 20cm long of a regular shape and the fuel level arrives to 5cm height of the total of 20cm.

Your remaining fuel is 5/20*100= 25% (500ml)
The indicated fuel as per telemetry is 18% (360ml on Spektrum telemetry)
The error is 18/25= 0,72. (360/500=0,72 for Spektrum systems) Then, the new pump factor should be the initial value of 400 multiplied by 0,72= 288. Enter 288 on pump factor and calibration is done.

Picture 3

JETI Alarms setup: (only available in adapters from version 2)

After the fuel related menus, the options for the alarms will be displayed. You can set in these menus the threshold of the alarm for each measure. By default all are set to 0 (disabled). When a read value is lower than the threshold, the display on the TX will display the alarm and a sound played. We recommend using these alarms only when used on Jeti modules (JetiBox profi), if you use it is a DS/DC transmitters use the alarms settings on the TX. All alarms are disabled until the tank capacity is below 98% to avoid the alarms of Low RPM and Low pump voltage to be triggered during startup phase.

Multiplex Measures Setup:

Multiplex M-Link telemetry can send up to 16 measures from all sensors on board. These measures are organized as "slots" and displayed on the TX only identified by the slot number. From factory the data is sent on slots 4 to 9. In order to combine the telemetry adapter with other sensors on board, even a second engine using another telemetry adapter, then it is possible to assign each measure to a particular slot in the MPX system, and also is possible to disable the transmission of some of the measures to save slots for other sensors.

Scrolling through the menus, you will see all available measures and the current assigned slot for transmission by the MPX system. You can change the slot where the measure is transmitted through the +/- buttons, if you want to disable this measure, set to slot 0. **PLEASE NOTE: Only one measure is allowed to each slot. You should check that the slot you want to use is not used by another measure in the same or another sensor in the system.**

Multiplex Alarms setup:

After the slot assignment menus, the menus to setup the alarms will be displayed. You can set in these menus the threshold of the alarm for each measure. By default all are set to 0 (disabled). When a read value is lower than the threshold, the display on the TX will be set on inverse video and a sound played. Alarms are disabled until the tank capacity is below 98% to avoid the alarms to be triggered during startup phase.

Note: In the case that the RPM reading is wrong over 60.000rpm, you should update the firmware of your MPX radio; there is a bug on old M-Link systems.

Futaba Measures Setup:

For older versions than telemetry 5:

This adapter emulates RPM and Temperature sensors on Futaba, so the setup should be done manually, **not automatic** by connecting the sensor to the TX.

Futaba telemetry can send up to 32 measures from all sensors on a system. These measures are organized as "slots". Each sensor on a system should be assigned to a unique slot (or ID) so that the receiver knows the origin of the data and the transmitter display the data in correct place. If two sensors have same ID number, this will produce a collision and the data of both sensors will be lost, so it is very important to assign correctly the slots. Slot 0 is always used by the receiver for the rx voltage, so the user can only use slots 1 to 31.

The adapter can use up to 8 slots to transmit the 8 measures available. In order to coexist with other sensors that use fixed slots, each of these measures can be assigned freely to any available slot, or disabled if you don't want some measures being transmitted to save slots for other sensors or a second adapter in a twin-engine plane.

Once the setup of tank capacity and pump factor is done, the next menu displayed on the data terminal is the selection of the slot for the turbine RPM. By default is the 4, but it can be changed to any other free slot or disabled using the +/- buttons.

If you have other sensors in your system, first identify which slots are used, then decide which measures you want to transmit and assign a free slot to each of them, taking care to not assign the same slot to two measures on the adapter or on another sensor. We recommend annotating the measure and slot number assigned to ease later the setup on the TX. In twin engine airplanes, you can use two adapters, but you should take care of to assign different slots, for example, slot 5 for RPM of engine1, slot 6 for RPM of engine 2, etc. A good practice in twins is to assign odd slot numbers to the measures from one engine and even to the measures from the other, so the source would be easily identified in the TX.

After setting the RPM slot, you can set the slots to all other measures, or disable any by setting its slot number to zero.

PLEASE NOTE: Only one measure is allowed to each slot. You should check that the slot you want to use is not used by another measure in the same or another sensor/adapter in the system.

Once the slots are assigned, you should save the data. Now you should connect the adapter in the normal working way, the lead labelled "Fadec" to the data terminal socket in the ecu, and the other 2 wire lead to the "SBUS2" port on the RX. Always connect the battery last so that all devices are properly initialized.

For telemetry 5 and above:

For the last updates of the telemetry system we have changed significantly how the adapter works on Futaba radios.

The adapter is now emulating the JetcatV10 sensor, which occupies 14 slots and has the correct units for everything. The main difference is that the user does not have to assign each variable to a slot the only thing that has to be done is to manually assign the jetcatv10 sensor to a particular slot.

For doing that a new menu has been created (advanced configuration) that allows the user to choose between the 8th (default) slot or the 16th. After that, just assign the JetCatV10 sensor to the slot chosen and you are done with the configuration.

Please note that the sensor itself occupies 14 slots so be sure that the slots that are occupied by the sensor are free and not used by any other sensors.

Once the sensor slot is assigned, you should save the data. Now you should connect the adapter in the normal working way, the lead labelled "Fadec" to the data terminal socket in the ecu, and the other 2 wire lead to the "SBUS2" port on the RX. Always connect the battery last so that all devices are properly initialized.

Setting the Futaba TX:

At the time of writing, this adapter is not officially supported by Futaba. This means that there are limitations on how the data is presented on the display of the transmitter. This adapter emulates the standard Futaba RPM and temperature sensors that are defined in the TX software, so the measures of voltage, failsafe counter, % of tank capacity and RSSI (Radio signal Strength) always will appear with the "°C" symbol. You should setup one "rpm sensor" for the measure of the turbine RPM in the same slot as you have assigned this measure on the adapter. All other measures are displayed using a virtual temperature sensor, so you should select a temperature sensor in the TX on all other slots you have annotated.

Once this assignment is done, you should see the data on the screen, with the limitations of units explained above, 100% percentage will display as 100°C, 7,4V of battery voltage will display as 74°C. Failsafe counts will display as °C. Failsafe condition is evaluated 75 times each second, so 1 second in failsafe will display a count of 75°C.

For easy reading, we recommend to change the name of each sensor (18MZ only) to an understandable reading including the units and scale, like the picture below.
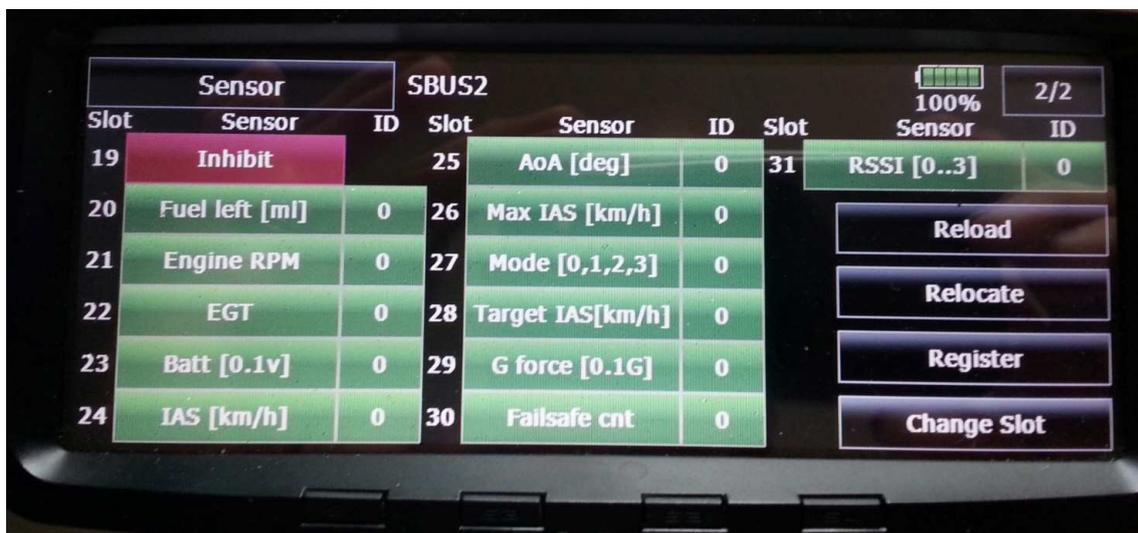
Picture 4

Hott setup (supported from Tele02 an newer models):

This adapter emulates the "General Air Module" (GAM). Due at that the HoTT system only allow one module of each type present in the system, this mean that only one adapter can be connected, not allowing multiengine operation, nor a genuine GAM installed on the system at same time as the Xicoy adapter. The radio should use the latest HoTT V4 firmware.

Measures are displayed on the GAM module screen.

Battery1: Ecu battery voltage

Battery2: Pump voltage

Temperature1: Exhaust temperature. Maximum temperature displayed by HoTT system is 250ºC, so the temperature of the exhaust is presented divided by 10, a reading of 40 mean 400ºC.

Temperature 2: Throttle (0-100%)

Fuel: Hott Gauge

RPM: Bottom/Right side

Besides the data displayed on telemetry screens, On the menus of "telemetry/sensors data" you can have the fadec data screens in plain text, plus you can navigate trough all fadec menus using the navigation keys on the TX.

Alarms for the RPM, fuel, Battery and pump voltage can be set using the data terminal, after the setup of the tank capacity. You can set in these menus the threshold of the alarm for each measure. By default all are set to 0 (disabled). When a read value is lower than the threshold, a distinctive sound will be played on the TX. Alarms are disabled until the tank capacity is below 98% to avoid the alarms to be triggered during startup phase.

JR setup (only in V4 models):

The telemetry support on JR radios is very limited. The setup of the adapter is limited to select JR on the radio setup menu. Supported measures are EGT, Battery voltage, Fuel consumed (in mAh, 1mAh -> 1 ml) and RPM. Some radios have a bug in the display of the RPM that can display over 65.000RPM. Also, in this radio you should enter the tank

capacity on the TX, as if it was the electric pack capacity, the radio discount automatically the fuel consumed reported from the ecu from the value entered in the radio, ignoring the value entered in the setup of the telemetry adapter. Procedure to adjust the pump factor is the same.

Spektrum setup (only on Spektrum adapters):

Connect the Spektrum SPMA9579 lead (not supplied) on the socket of the adapter, taking care of the proper alignment, and connect the other end of the lead to the TM1000 module (not supplied). If there are more sensors in the system, the turbine adapter should be the last on the chain.
Bind the TM1000 to the TX, check the Spektrum instructions for binding. You should see that the TX confirms the binding including telemetry. The turbine telemetry is supported only in high end Spektrum radios (from DX10).

Once the system bound, activate the turbine telemetry on the TX (check TX instructions). On old firmware, the turbine telemetry is displayed as "JETCAT", newer firmware displays "TURBINE".

You will have the readings of RPM, Throttle, EGT, pump voltage, ecu battery and remaining fuel in ml.

PowerBOX setup (only on Tele4 or higher models):

At the time of writing, the PowerBox protocol is not fully developed, so we may update the telemetry once it gets the final version.

If just one engine is going to be used it is a complete plug and play. But two things have to be considered. As how the P^2-Bus is designed the radio will not SCAN automatically for new sensors, it does it on start up or if you force a Rescan. So, if the transmitter is already plugged in, consider to force a Rescan or a complete reset.

Once the sensor is found it will be shown as Xicoy ECU 1, inside it a couple of submenus will appear, they represent the available measures, the state, the first and the second line of the smart data screen.

The configuration of the alarms and how it's going to be displayed are totally decided by the user.

If two or more engines are going to be used, each telemetry module has to be changed to not share the same ID. To do so, connect the system as shown on the advanced setup section. Select PowerBox as the brand and after the minimum adjustable parameters, the Assign Device ID menu appears.

Just use the buttons "+" and "-" to manually change the ID of the device. For example, if ID 3 is chosen the unit will appear as Xicoy ECU 3.

FrSky setup (only on Tele5 or higher models):

As FrSky uses open source transmitter software known as OpenTX is the brand that has more manual configuration and the one that could be trickier to make it work. For this reason, please read carefully this part of the manual and take into account that you may need to download third party software, which Xicoy Electronica does not have anything related to. Last but not least, you will need a micro SD card.

WARNING: Before you keep reading this guide, be sure that your radio has the OpenTx version of 2.2.3 or higher. Otherwise the lua script and the .otx files may not work. Also, make sure that your version of OpenTx can USE lua scripts.

The first step would be to prepare the micro SD card to be operated by the FrSky radio. OpenTx provides a guide and a template of all the files needed on their website.

After following the guide, the SD card has to look like the following image:

Nombre		Fecha de modifica...	Tipo	Tamaño
CROSSFIRE		04/10/2018 8:34	Carpeta de archivos	
EEPROM		06/05/2019 11:53	Carpeta de archivos	
FIRMWARE		06/05/2019 10:51	Carpeta de archivos	
IMAGES		15/05/2019 13:18	Carpeta de archivos	
LOGS		04/10/2018 8:34	Carpeta de archivos	
MODELS		06/05/2019 12:00	Carpeta de archivos	
SCREENSHOTS		04/10/2018 8:34	Carpeta de archivos	
SCRIPTS		04/10/2018 8:34	Carpeta de archivos	
SOUNDS		04/10/2018 9:12	Carpeta de archivos	
SxR		04/10/2018 8:34	Carpeta de archivos	
opentx.sdcard.version		04/10/2018 8:34	Archivo VERSION	1 KB

At this point you will have to download the files that Xicoy Electronica provides and include them on the SD card folders. Include the Lua scripts inside the folder SCRIPTS/TELEMETRY. Once done the TELEMETRY folder should look like:

Nombre	Fecha de modifica...	Tipo	Tamaño
readme	04/10/2018 8:34	Documento de tex...	1 KB
Tel5.lua	15/05/2019 13:18	Archivo LUA	5 KB
Tel5.luac	15/05/2019 13:18	Archivo LUAC	5 KB

After loading the lua scripts the same procedure has to be done in order to include the bitmaps that are used by Xicoy scripts. Just copy the files inside our IMAGES folder and paste them on the IMAGES folder that is inside the SD. Make sure that at least the following files are included:

logo   readme   rpm   temp
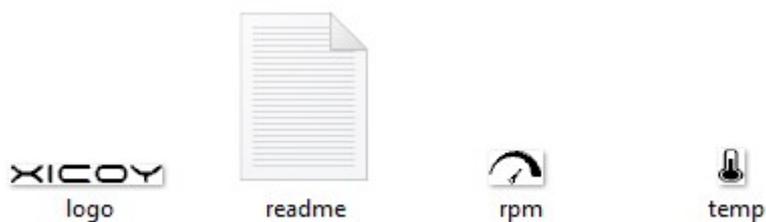
The next step would be to configure the telemetry settings on the radio. This step is also crucial because every measure has a name and a personal ID. If the name or the Id does not match it won't work properly.

There are two ways to configure the radio telemetry settings. One is using the third-party software Companion (make sure that Companion's version matches the OpenTx version loaded on the radio) the other option would be manual configuration.

If you decide to use Companion. Open the Xicoy_Telemetry5.otx file with it and then double click the preset model, a window will appear, open the telemetry menu and something like the following image should appear:
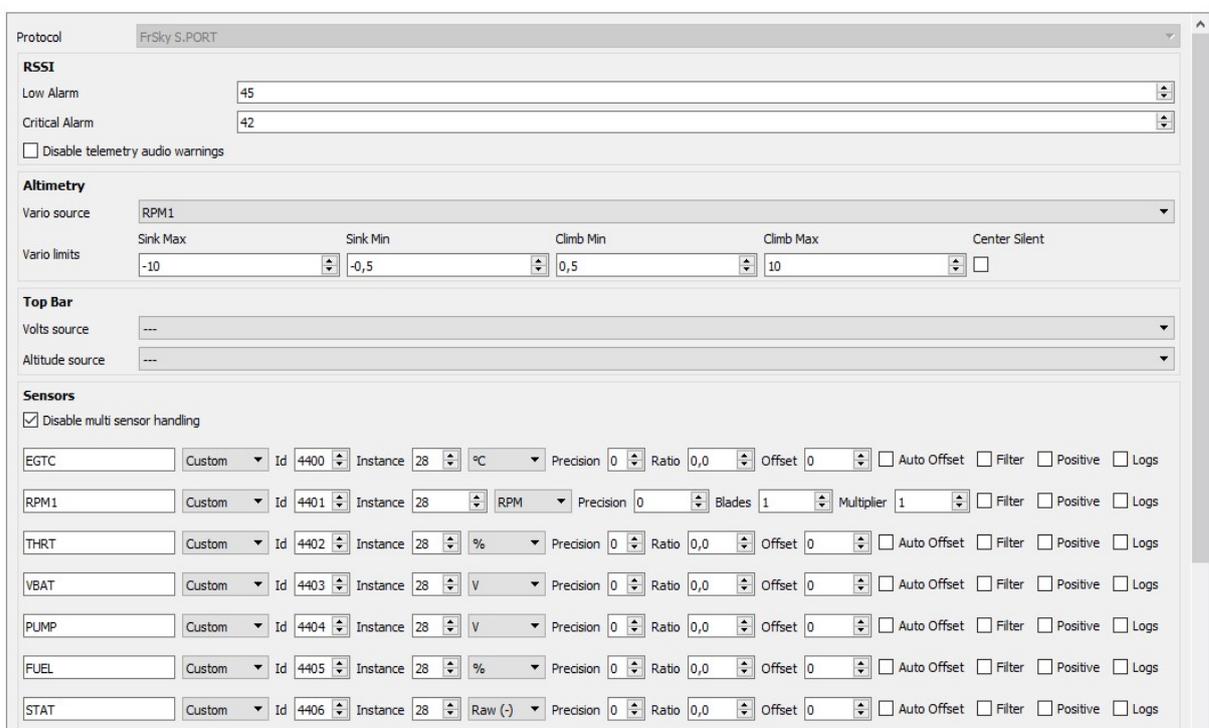
These are how the telemetry settings have to look like. Sensor name, Id and Instance must match these values, otherwise it won't work. At the end of the file you should have it like this:

This part indicates that our script is going to be used and that it will be shown on Telemetry screen 1.

If you don't have any model nor settings on your radio you can load this preset model into it. But if you are already using a model/setting don't load this file directly to the radio, otherwise it will **erase your current model and settings**. If that is your case, read the model that is on your radio via Companion and change the telemetry settings to match our preset, and then just upload it again to the transmitter.

At this point if you power up the transmitter and head to the telemetry screen. The following should appear:
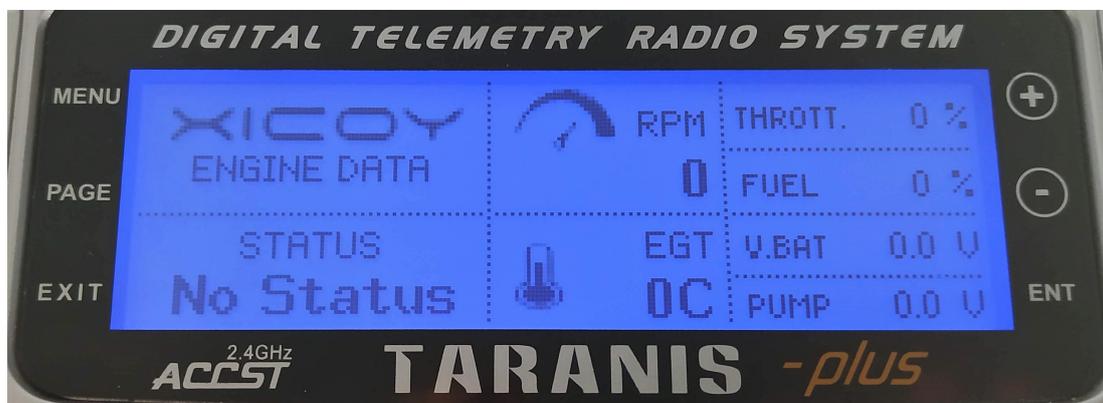
The next section will be dedicated to explain how to dot it manually, without the need of communicating the radio with the PC. Before trying these steps make sure that you have the SD card ready as shown as the start of this section.

Once ready, plug the transmitter and press "Menu" button, navigate through the menus with the "Page" button until you find the Telemetry screen.

At the telemetry screen press "+" or "-" buttons until you find the "add new sensor function", then press "ENT".

The sensor screen will be loaded, this screen is extremely important because the name and ID fields just have one correct option.

EGTC	Custom ▼	Id	4400 ⬍	Instance	28 ⬍	°C ▼	Precision	0 ⬍	Ratio	0,0 ⬍
RPM1	Custom ▼	Id	4401 ⬍	Instance	28 ⬍	RPM ▼	Precision	0 ⬍	Blades
THRT	Custom ▼	Id	4402 ⬍	Instance	28 ⬍	% ▼	Precision	0 ⬍	Ratio	0,0 ⬍
VBAT	Custom ▼	Id	4403 ⬍	Instance	28 ⬍	V ▼	Precision	0 ⬍	Ratio	0,0 ⬍
PUMP	Custom ▼	Id	4404 ⬍	Instance	28 ⬍	V ▼	Precision	0 ⬍	Ratio	0,0 ⬍
FUEL	Custom ▼	Id	4405 ⬍	Instance	28 ⬍	% ▼	Precision	0 ⬍	Ratio	0,0 ⬍
STAT	Custom ▼	Id	4406 ⬍	Instance	28 ⬍	Raw (-) ▼	Precision	0 ⬍	Ratio	0,0 ⬍

The table illustrates the name of each displayable value and also the ID that is assigned to it. We will explain with an example how it has to be done.

For example, if we pick the THRT row. The Name field has to be THRT, with capital letters. On the ID field we will have to put "4402" and "28" on the right part of the same field, and on units "%". Once done the sensor screen will be as follows.

Repeat the process for the other variables and make sure that you type the name and the ID correctly.

Once this step is done you will have a list of sensors from "EGTC" to "STAT". The next step would be to set up the Display screen.

For doing that, just go back to the telemetry screen and then keep navigating with the "page" button until you find the DISPLAY screen. Head to screen 1 and then select "Script" as the first option and if the SD card part is done correctly the Tel5 script should appear to be selected, just as the image shows:

After that head to the main screen and long press the "Page" button. If all the process is done correctly the Xicoy telemetry screen should appear.

At this point you are done with the configuration, just plug the telemetry (make sure that is configured as a FrSky) on the smart bus port of your receiver and it should start communicating immediately.

Disposal

Electrical equipment marked with the cancelled waste bin symbol must not be discarded in the standard household waste; instead it must be taken to a suitable specialist disposal system.

In the countries of the EU (European Union) electrical equipment must not be discarded via the normal domestic refuse system (WEEE - Waste of Electrical and Electronic Equipment,directive 2002/96/EG). You can take unwanted equipment to your nearest local authority waste collection point or recycling centre. There the equipment will be disposed of correctly and at no cost to you.

By returning your unwanted equipment you can make an important contribution to the protection of the environment.