README for data's logging and telemetry transmission with Brain2/iKon2 (vers.4.6   2025 June 27):

Introduction:

With Electric models that use ESC able to send telemetric value to the Brain2/iKon2, many important data of the ESC can be transmitted to the TX like Consumed Current, Instantaneous Current, Battery Voltage, ESC Temperature, etc.
All kind of Radio that have telemetry capability, are today also able to log in his memory (usually SD) the data received (and with apposite and separate software is possible to graphical display and analyze), but the same data's can also be logged inside the Brain2/iKon2 Flight Logs memory at a higher rate (50Hz) along with other flight parameters.

With non-electric models (Nitro or Gasser) the transmitted data via telemetry is at least the **RPM** value and the **Servo Voltage** read by Brain2/iKon2 (that can correspond to the Rx Voltage already transmitted from some receivers except for small voltage drops due to cables / connectors). RPM value is read by Brain2/iKon2 from the motor RPM sensor connected to the Brain2/iKon2 "GOV" port and converted by Pulses for Rotation and Gear Ratio into main rotor RPM (sensor needed for telemetry transmission also if you don't use the Brain2/iKon2 as governor). You can also use a **Temperature** sensor attached to the motor. With some Radio System's (EG: Jeti) is also possible to transmit from Brain2/iKon2 to ground (Transmitter) also all other selectable and loggable Brain2/iKon2 parameters. Some Futaba and Spektrum receivers have also a voltage input that can be used to monitor the voltage of a backup system (like Optiguard or similar). With the majority of the telemetric bus systems (S.Bus, EX-Bus, HoTT, Smart.Port) you can connect in parallel to the telemetric bus other kind of sensor (EG: GPS, Altimeter, Variometer, etc.)

With Radio systems or receivers that are not enabled for telemetry transmission, it is still useful activate the ESC telemetry transmission to Brain2/iKon2 because Brain2/iKon2 can log all these useful data's in his Logs memory to be able to do a post flight analysis. If ESC telemetry and governor are either active Brain2/iKon2 can also reduce by ~15% the RPM when the "Battery Used mAh" value raise the tunable value "mAh Max Usable" so you can know when is needing to land also without telemetry.
You can consult only two pages of this document: the one related to your ESC model/kind/brand and the other related to your Radio System. For non-electric models (Nitro/Gasser) the ESC Kind section can be changed with the Temperature sensors section. For non-telemetric receiver/transmitter (PPM receivers, Spektrum sat's, X-Bus, M-Link, etc.) the Radio System section can be skipped.

Prerequisite:

Connect your Brain2/iKon2 unit to your PC via USB cable, open the Windows application, update Brain/iKon2 software and firmware to the last version.

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With Castle Creation ESC's (that have Castle "Link Live" protocol):

1) The flight pack must be disconnected from the Castle Creation ESC, the throttle cable of the Castle Creation ESC (EDGE, EDGE LITE, EDGE HV, ICE, ICE LITE, ICE2 HV, TALON series but TALON don't send battery current) must be disconnect from Brain2/iKon2 and connected to a Castle Link Adapter (pay attention to the correct polarity designed on the rear of the Castle Link Adapter), with the appropriate USB cable connected to the other side of Castle Link Adapter and to a USB connector of your Windows PC, launch Castle Link software (only for Windows), go to "Software" tab and, if needed, update the ESC firmware to the last version (at least 4.25), then go to the "Other" tab. Select "Link Live Enable" to Enabled (verify also that "Auxiliary Wire Mode" is set to "RPM Out").
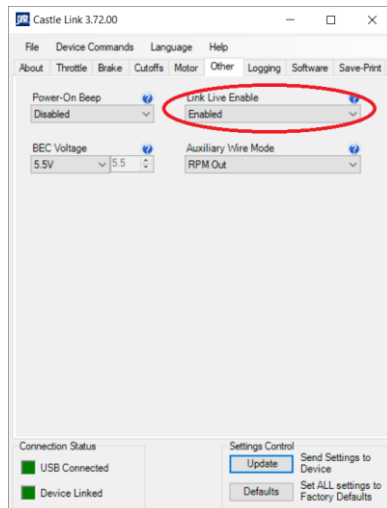
The following message appears:
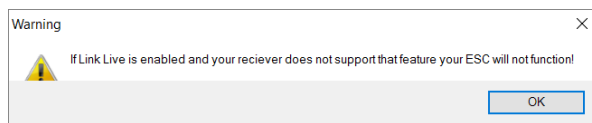
This means that you must activate also the Brain2/iKon2 for this function otherwise the throttle signal is no longer read/recognized from the ESC.
Before closing the program, remember to push the "Send Settings to Device" button, otherwise the new setting is not saved to the ESC.

2) Disconnect the ESC throttle cable from the Castle Link Adapter. Reconnect the ESC Throttle cable (with or without the red wire of the voltage of the internal BEC as was before) using the following "modified" extension cable in the middle, to the Brain2/iKon2 (pay attention to the polarity if the connector is the type without key):
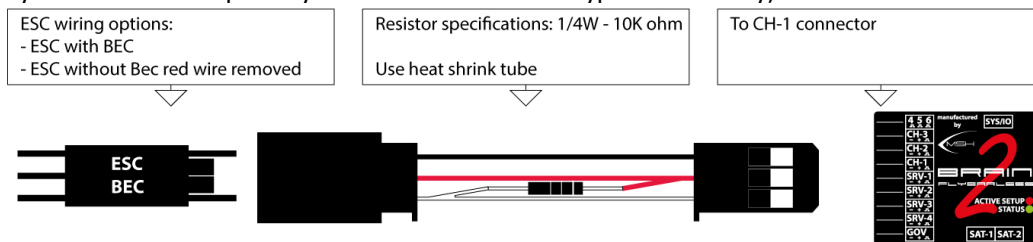
3) Connect your Brain2/iKon2 to the PC via USB cable. In the Windows PC, start the interface software "BRAIN" (see "Prerequisite" at pag. 0) and go to the panel 12 "Governor setup" of the wizard. In the "Telemetry Input" drop down, select "Castle Creation .... telemetry". Note: at this point the refresh rate of the throttle speed up going from 50Hz to 100Hz.
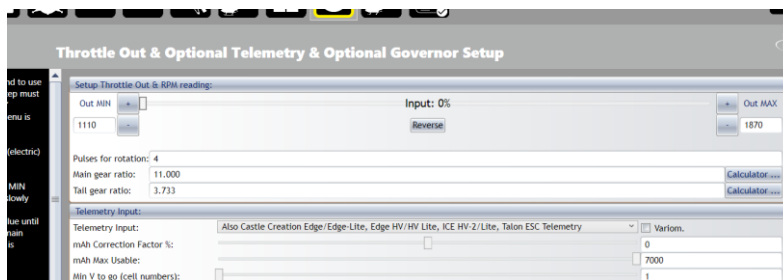
4) Now you can select in "Diagnostic" -> "Parameter setting", the ESC values you want monitor in real time or in recorded Flight Logs.

For the values read from Castle Creation ESC's, see the table at page 2.

With Hobbywing (V3/V4/V5 series) or Kontronik (JIVE series) or Scorpion (Tribunus series) or YGE (*VT series) or OMP ESC's:

1) With HOBBYWING PLATINUM V3/V4/V5, FLYFUN V5 or SCORPION TRIBUNUS or YGE *VT or OMP ESC: You must have the newest ESC firmware. For Hobbywing update to last "generic" firmware, **not brand specific like VBAR**, using Multifunction LCD program box and Hobbywing USB Link software. For Tribunus use Scorpion Software to set Communication to "Unsc Telem" and for firmware update. For YGE connection and protocol to select, read the last page of YGE ESC manuals.

For HobbyWing Platinum & Tribunus connect a std. 3 pole female/female cable to the ESC programming port marked "- + P" (or "- + S") and at the other end, connect only the signal wire (white or orange) to central pin5 of CH4-5-6 connector (see below image "A"). **The – and + wires coming from the Hobbywing ESC have the voltage required for the "MULTIFUNCTION LCD PROGRAM BOX" THIS VOLTAGE IS DIFFERENT FROM THE BEC VOLTAGE. Do not connect these wires to any pin of the unit or the receiver, otherwise Unit and/or ESC could permanently damaged!!! These wires must be left isolated and disconnected or removed**.

We suggest leaving the metal contacts unused in the standard 3-pin plastic connector to have a better mechanical seal.

Note: Align RCE-BLxxxA ESC's (Hobbywing rebranded) send telemetry data only if updated to the new firmware with the new ASBOX USB Link V1.0.5. software (or successive).

For Hobbywing FlyFun ESC, the yellow wire is RPM (to GOV port), white wire is the telemetric signal to pin 5 of 4-5-6 connector.

With old KONTRONIK JIVE / POWER JIVE / HELI JIVE ESC: Remove the jumper from the JMP port marked "|^^" and connect a female / female cable, at the other end connect only the central wire (red) to pin5 of 4-5-6 connector (see below image "A"). **Do not connect the remaining 2 lateral wires (black/brown and white/orange) coming from the ESC to other pin of the 4-5-6 connector (unit could permanently damaged!!!) or to other connectors. These 2 lateral wires are not the BEC voltage and must be left isolated and disconnected)**.

With KONTRONIK KOSMIK / JIVE PRO / KOLIBRI: Is needed at least the new ESC firmware version 4.12. Connect a special cable with on one side a single wire in the center pin of a 5 pin connector, in to the central 5 pin sockets of the ESC, at the other end connect only the wire to central pin 5 of "4-5-6" Brain2 servo connector (see below image "A"). **For OpenTX / EdgeTX** see pag.10

With OMP/ZTW connect a single wire to the TX pin of the 4-pin program connector (you can use a standard 3-pin plastic connector)

Image A: The **pin 5** of the Brain2/iKon2 connector "4-5-6" (the middle/central pin), and the special cable for YGE *VT.
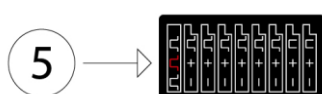

For OpenTX Read at Page 10 !!
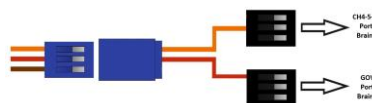
Suggestion: due to the high impedance of these telemetric ports, keep the telemetric and RPM wires far away from other cables (especially, from the motor and battery wires) to avoid electromagnetic field "coupling" (crosstalk). Use carbon frame as shield.

2) Connect your Brain2/iKon2 to the PC via USB cable. In the Windows PC start the interface software "BRAIN" (see "Prerequisite" pag.0), go to panel 12 "Telemetry" of wizard. In the "Telemetry Input" select "Hobbywing .. Telemetry" or "Kontronik Jive/PowerJive/Heli Jive Telemetry" or "Kontronik Kosmik/Jive Pro/Kolibri Telemetry" or "Scorpion Telemetry" or "YGE *VT Telem." or "OMP/ZTW Telemetry".
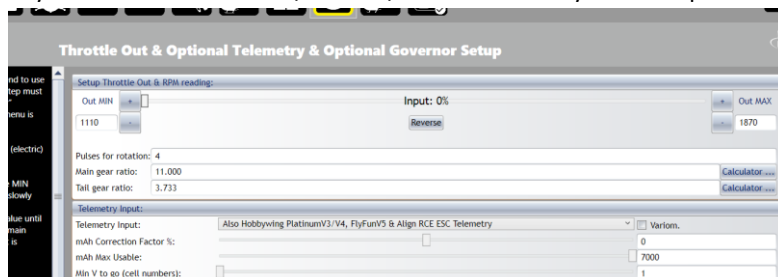
3) Now in "DIAGNOSTIC" -> "Parameter setting", you can select the following ESC values you want monitor in real time or in recorded Flight Logs.

Loggable Values	Unit	Castle Creation	Hobbywing V4/V5 (V3=•)	Kontronik Jive/Heli Jive	Kontronik Kosmik/Kolibri	Scorpion Tribunus	YGE *VT	OMP/ZTW/XDFLY
ESC Main Battery Volt	V	✓	✓	✓	✓	✓	✓	✓
ESC Main Battery Current	A	✓ (not Talon)	✓ (no if=<60A V4)	✓	✓	✓	✓	✓
ESC Main Battery mA used	mAh	✓calculated by Brain	✓ calculated by Brain	✓ calculated by Brain	✓calculated by ESC	✓calculated by ESC	✓calculated by ESC	✓calculated by ESC
ESC Power Out	%	✓	✓•(not V5)	✓	✓	✓	✓	✓
Temperature1	°C/°F	✓ESC Mosfet	✓ESC Mosfet	✓ESC Mosfet	✓ESC Mosfet	✓ESC Mosfet	✓ESC Mosfet	✓ESC Mosfet
Temperature2	°C/°F		✓only V4:ESC cap. & V5 BEC		✓BEC temperature		✓BEC temperature	
ESC Main Battery Ripple	V	✓		✓		✓calculated by Brain	✓	✓
ESC BEC Current	mA		✓only V5 versions		✓only Kosmik & Kolibri		✓only **H**VT versions	
ESC LS RPM(CC max 2500)	rpm	✓ Max 2500!	✓•	✓	✓	✓	✓	✓

Note1: The HOBBYWING PLATINUM V4 "OPTO" versions (100A OPTO, 130A OPTO and 200A OPTO) need the specific / special HOBBYWING double signal coupler module of HOBBYWING coded 30850200 (100A and 130A not OPTO versions don't need this adaptor). Only for 130A OPTO this signal coupler is needed also for the RPM connection to the Brain2/iKon2.

Note2: The ESC Telemetry will not work with standard receivers because all input connections of the unit are used for each receiver channels and the ESC throttle channel is connected to the receiver, not to the unit.

Note3: The ESC telemetry was developed and tested: For CASTLE CREATION with ESC Phoenix Edge Lite 100 with firmware 4.25 and Castle Link software V3.68. For HOBBYWING with ESC Platinum 120A and 130A with firmware ver. 04.0.04, with 160A with firmware ver. 04.0.06 using Multifunction LCD program box with firmware 3.2.31 and Hobbywing USB Link software V4.0.3. For KONTRONIK with a POWER JIVE 120+HV 6N13. For SCORPION with Tribunus 120A with firmware 42.

Note4: The telemetry transmission of data's from ESC, start only after "at least" 8/10 seconds from power on.

Note5: ESC telemetry works only on the new Brain2/iKon2 units that have more power and more usable memory for the large amount of FW code added and the required presence of the integrated FPU.

With Spektrum ESC's using Smart Throttle (AVIAN / FIRMA):

The Throttle cable of these ESCs can be connected to the standard PWM output of the Throttle (CH1 connector) of the FCU and in this way the proactive governor of the Brain2/iKon2 controllers can also be used (an external RPM sensor must be used), but telemetry does not work (to use Brain2/iKon2 proactive governor, the ESC parameter "Flight Type" must be set to "Fixed Wing" with "Brake", "Cutoff Voltage" and "Active FreeWheel" set to "Disabled").

WARNING: to avoid unwanted motor starts, choose, and make the desired type of connection (PWM Standard or Smart Throttle) before powering the ESC. Never change the connection type while the ESC is powered on.

1) To activate telemetry, the throttle cable of these ESCs must be connected to the SRXL**2** bus managed by the receiver (EG: SPM4651T with 2.44 FW) and the CH1 PWM output remain unused. In this way the proactive governor of the Brain2/iKon2 control units cannot be used because throttle is controlled directly by the receiver signal (the ESC parameter "Model Type" must be set to "Helicopter" to use the ESC Governor). Anyway, you can use an external RPM sensor to connect to Brain2 GOV input connector. You must connect SRXL**2** receiver and AVIAN / FIRMA Throttle/BEC connector together with an Y cable connected to the CH3 Brain2/iKon2 connector (pay attention to the ESC connector polarity, between black and grey wires the dark black is the ground, and the grey wire is the signal that normally on other devices is white or yellow). Because BEC voltage coming from ESC pass through this "Y" cable use a good quality cable with gold plated contacts and possibly the shortest possible.

   Suggestion: due to the high impedance of these telemetric ports, keep the wires far away from other cables (especially, from the motor and main battery wires) to avoid electromagnetic field "coupling" (crosstalk).

2) Connect your Brain2/iKon2 to the PC via USB cable. In the Windows PC start the interface software (see "Prerequisite" pag.0), go to panel 12 "Governor setup" of the Wizard. In the "Telemetry Input" select "Also Spektrum Avian / Firma ESC telemetry".
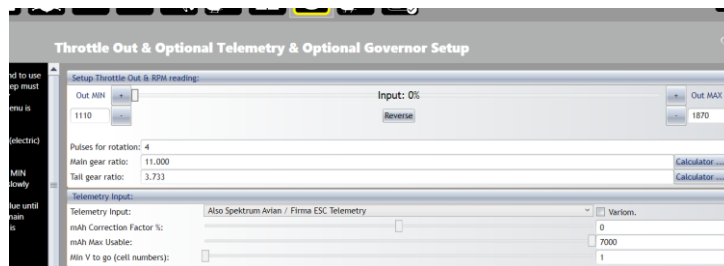
3) Now in "DIAGNOSTIC" -> "Parameter setting", you can select the following ESC values you want monitor in real time or in recorded Flight Logs:

Loggable Values	Unit	Spektrum Avian / Firma
ESC Main Battery Volt	V	✓
ESC Main Battery Current	A	✓
ESC Main Battery mA used	mAh	✓ calculated by Brain
ESC Power Out	%	✓
Temperature1	C°	✓ ESC Mosfet
Temperature2	C°	✓ ESC Capacitors
ESC Main Battery Ripple	V	✓
ESC BEC Current	mA	(only FIRMA)
ESC LS RPM(CC max 2500)	rpm	✓

On your transmitter automatically appear in to the "Flight Log" telemetry page the BEC voltage (Receiver voltage) other than Fades, Holds, Frame Losses, RSSI.

Going into transmitter Function List, then into the Telemetry section you can activate (using Auto-Config or manually):
Flight Pack mAh, 2) Amps, 3) Volts, 4) Temperature, 5) RPM, 6) Text Gen, 7) PowerBox, 8) ESC, other than the usual default receiver telemetry.

Note1: With new firmware's released in the last year for iX12, automatic discover do not work anymore correctly compared old firmware's and other transmitters and there are also some problems with some sensor. EG: "Flight Pack mAh" doesn't work anymore and you must use "PowerBox" for used current telemetry.

Note2: Since unlike other ESCs, the RPMs are not the RPMs read by the GOV port and processed by Brain2, but the RPMs read by the ESC from the connected motor and then transmitted directly from the ESC to the receiver, the correct "Poles" and "Gear Ratio" values must be entered on the transmitter on the ESC telemetry page to read the Rotor RPMs instead of the motor RPMs.

Note3: RPM: without an external RPM sensor connected to the GOV port, you can receive on the TX only the low sampling rate RPM telemetry transmitted by ESC loggable as "ESC LS RPM". With an external RPM sensor connected to the GOV port you can also log the filtered RPM value on log channel 11 and the unfiltered "Main rotor RPM 0-3000" or "Main rotor RPM 0-6000"

Note4: Note that in this configuration (throttle managed directly by the receiver signal), the "Throttle Failsafe" is managed directly by the receiver and not by the flight control unit. So, you "can" have Throttle Cut without any indication of this on Brain2/iKon2 "Events" logs.

Note5: By connecting the Throttle connector to the PWM Throttle out connector on the Brain2 (CH1) the ESC works with any radio brand / model / type / system but without telemetric data transmission.

Note6: The ESC telemetry was developed and tested with AVIAN 60A (FW 04.0.17), SPM4651T (FW 2.44), DX9 (Airware 2.05) and iX12 (Airware 1.13.07).

Note7: With new Firmware released this year (2021) for Avian/Firma ESC, the internal parameters of the ESC's can be modified using the same "Text Gen" used by Brain2/iKon2 and either don't work together. So Brain2/iKon2 Integration has been disabled. (To enter into Avian/Firma programming keep cyclic stick Up-Left for Step2, then Up-Right for final Step. For exit use menu Exit.)

Note8: ESC telemetry works only on the new Brain2/iKon2 units that have more power and more usable memory for the large amount of FW code added and the required presence of the integrated FPU.

For Nitro/Gasser, the engine temperature transmitted by telemetry using a Jeti or Futaba digital temperature sensor:

Question: Why is it needed to use a "digital" sensor like **MT300EX** or **SBS-01T** connected to the Brain2/iKon2 instead of using a cheaper analog sensor connected to the telemetric bus of the receiver? Answers:

a) Because with this solution you are also able to log inside the Brain2/iKon2 the engine temperature along with the many other data parameters of the Flight Controller during the flight and at higher sample rate (50Hz) compared to the usually lower sample rate of transmitter logs.

b) Because for Futaba and Jeti there is not any analog temperature sensor compatible with S.Bus2 or EX Bus but only digital sensors.

c) Because actually with SPM4649T receiver there is any other possibility to log and transmit also the engine temperature together the other data's (RPM, Servo Voltage Frame Losses, Holds, RSSI), other than an analogic temperature sensor when using a full size Receiver + TM1100 or one of the new "ARXXX0T" receivers but with these solutions you totally lose "Spektrum Integration" function and the ability to log connected sensors (temperature) in the Brain2/iKon2 Log memory.

d) Because for Graupner HoTT receivers there is no other temperature sensor directly compatible with HoTT telemetric bus but is needed other than the analogic temperature sensor, also an old "Graupner General Air Module 2-6S Vario Gr-HoTT" or a "General Engine Module 2-6S Vario Graupner-HoTT" or a new "General Air Module 2-6S, Vario Gr-HoTT (Successor of No. 33609)" or an "Electric Air Module2-14S, Vario HoTT".

e) Because for FrSky X-series receivers there is no other temperature sensor directly compatible with the Smart.Port. Using a receiver not compatible with the Smart.Port other than the receiver, the analogic sensor, is needed also the FrSky Sensor Hub (FSH-01).

Setup:

1) Is needed the Brain2/iKon2 firmware 3.1.028 or successive.

2) For Futaba **SBS-01T** temperature sensor: it must be programmed to work in the Futaba telemetry Slot number 1 (it is the factory default setup when purchased).

3a) Only with Futaba S.Bus2 receivers, using the Futaba **SBS-01T** temperature sensor, simply connect it together Brain2 directly to the S.Bus2 connector of the receiver (using an "Y"). Brain2/iKon2 read the temperature sensor value from the S.Bus2 bus and can log the "Temperature1" value in the Brain2/iKon2 Flight Logs memory. In this way, you can skip step 4.
Using Jeti sensors, remember that telemetry values are transmitted only if your receiver is connected to the Brain2/iKon2 using the S.Bus2 port (using S.Bus there is any transmission), and sensor must be connected as explained in the point 3b.

3b) With all other kind of receiver, must be used a manually modified extension cable: In the male of the extension must be inserted the female connector of the digital temperature sensor, from the female connector of the extension cable the "Signal" connector (that with white/Yellow wire) must be removed from the female case (lifting the plastic tab) and inserted in a different and separate female plastic case connector. The "Signal" connector must be inserted in the **CH5** of the Brain2/iKon2 CH4-5-6 connector (to **CH6** when FrSky Smart.Port telemetry is used with MT300EX sensor, see at pag.10, point 2 and also note2 below). The other "power" connector with only black/brown and red wires must be connected into a free connector of Brain2/iKon2 (EG: CH2) or in to a free connector of the receiver (EG: the spare male connector of the SPM4649T receiver) or using an "Y" on one of the servos connected to the Brain2/iKon2.

4) Connect your Brain2/iKon2 to the PC via USB cable. In the Windows PC start the interface software "BRAIN" (see "Prerequisite" pag.0), go to the panel 12 "Governor setup" of the wizard. In the "Telemetry Input" select "Futaba Temperature Sensor" for **SBS-01T** sensor or "Jeti Temperature Sensor" for **MT300EX** sensor.
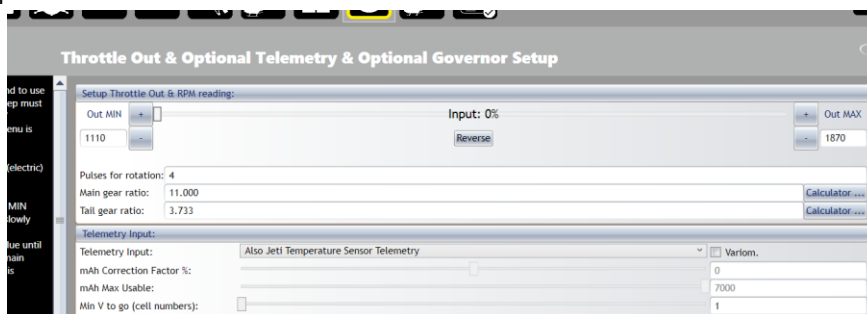
Now you can log inside the Brain2/iKon2 Flight Logs also the engine temperature selecting in DIAGNOSTIC->Parameter Settings the "Temperature 1" and this value is also telemetric sent to ground (to the transmitter).

Note1: The **SBS-01T** Futaba sensor has only one sensor ring & don't work with FrSky receivers. The JETI **MT300EX** temperature sensor have 2 separate & independent sensor ring that can measure two different motor zones or as redundant

Note2: The **SBS-01T** Futaba sensor cannot work with all standards "INVERTED" FrSky protocols. Only the JETI **MT300EX** temperature sensor can be used. But **SBS-01T** can be used with the UNINVERTED F.Port/F.Port2 protocols.

Note3: With "HoTT + Telemetry" protocol, when a Temperature Sensor is selected, The Voltage MIN alarm value is automatically set to 0 to avoid repeated false ESC battery voltage alarms.

Note4: With non-telemetric protocols selected (PPM,SUMO,Spektrum satellites,X-Bus,M-Link,HoTT,SRXL) the temperature value is not transmitted but anyway logged in the Brain2/iKon2 Flight Logs memory together the other parameters selected.

Note5: Temperature telemetry works only on the new Brain2/iKon2 units that have more power and more usable memory for the large amount of FW code added and the required presence of the integrated FPU.

Second loggable electric RPM sensor and/or loggable PWM signal coming from an external device:

In models with tail motor driven where the tail blades pitch is fixed and the tail motor RPM changes, it can be useful to also monitor the tail motor RPM.

A second RPM monitor can be also useful on models with two motors (EG: Velos).

The RPM of the Tail motor can be logged by Brain2/iKon2 together with the RPM of the main rotor.

For this purpose, any one of the many electric motor RPM sensors on the market can be used. Either the one with two wires to be connected to two of the three motor wires (EG: Hobbywing) or the one with only one wire to be connected to only one of the motor wires (EG: Hyperion).

To connect the electric RPM sensor to Brain2/iKon2 without modify the sensor connector, a manually modified extension cable can be used: In the male of the extension cable the female connector of the electric RPM sensor must be inserted, from the female connector of the extension cable the "Signal" connector (the one with white/yellow wire) must be removed from the female housing (lifting the plastic tab) and inserted in a different and separate female plastic housing. The "Signal" connector must be inserted into **CH6** (on top) of the Brain2/iKon2 connector CH4-5-6.

The other "power" connector with only black/brown and red wires must be connected into a free Brain2/iKon2 connector (EG: CH2) or to a free receiver connector (EG: the spare male connector of the SPM4649T receiver) or using an "Y" on one of the servos connected to the Brain2/iKon2.

Connect the Brain2/iKon2 to your PC via USB cable. On the Windows PC start the "BRAIN" interface software (see "Prerequisite" pag.0), go to panel 12 "Governor setup" of the Wizard.

For tail motor RPM sensors, the "Tail gear ratio" field is used to enter the INTEGER value of the number of poles (divided by 2) of the tail motor (decimal values entered are automatically discarded).

Now it is possible to record in the Brain2/iKon2 Flight Logs memory also the RPM2 value coming from the tail motor selecting in DIAGNOSTIC -> Parameter Settings tab, the "Tail Motor RPM2".

This second RPM2 value could be sent telemetrically to the transmitter. However, since with the current firmware of the vast majority of transmitters there is no telemetry of two different and distinct RPM values, for now this value is not transmitted via telemetry.

On the same **CH6** connector, you can also read and eventually record in the Flight Logs memory the value of an external standard PWM signal ("Ext. std. PWM input %" parameter is for PWM signal with center pulse 1520uS) coming from an external device using the loggable parameter "Ext. Std. PWM input".

CH4 can remain free or used as a PWM output (controlled by B-Aux3) and **CH5** can remain free or a wire coming from an ESC telemetry output or from a digital temperature sensor that can be connected to CH5 (see precedent pages for ESC telemetry or Temperature sensor).

Note1: Also in this case, using a standard receiver it is not possible to connect a second RPM sensor or the PWM signal coming from an external device to Brain2/iKon2 when because with standard receivers all the Brain2/iKon2 connectors are used as input for each individual radio channels (PWM) signal.

Note2: With "OpenTX" / "EdgeTX" / "Ethos" using the F.Port or F.Port2 or F.Bus protocol, telemetry from ESCs or Temperature Sensors can be active at the same time as "Tail Motor RPM2" or "External PWM Input" telemetry. Instead using the older Smart.Port + S.Bus protocol, the "Tail Motor RPM2" or "External PWM Input" can be read only when "Basic Telemetry: RPM (from GOV port), QOS, Servo Voltage, Global Vibration" is selected. "Tail motor RPM2" & "External PWM Input" cannot be read together with ESC telemetry or temperature sensors.

Note3: For all other protocols, even with selected non-telemetric protocols (PPM, SUMO, Spektrum satellites, X-Bus, UDI, M-Link, HoTT, Multiplex SRXL, S.Bus) the RPM2 of the tail motor or the PWM signal coming from an external device is ever automatically active and can be recorded in the Brain2/iKon2 Flight Logs memory together all the other selected parameters.

Note4: The average value of Tail Motor speed is 3 / 5 times higher than the value of the main rotor speed. Therefore, the vertical scale of RPM2 in the logs is higher than Main Rotor speed. The RPM2 value of the tail motor is different than RPM value of main rotor, is an integer without decimals.

Note5: The reading of a second RPM sensor has been developed and tested with Hyperion and Hobbywing RPM sensor and with an external device with a PWM output signal with center pulse of 1520uS.

Note6: The second RPM and the possibility to log a PWM signal coming from an external device works only on the new Brain2/iKon2 units that have more power and more useable memory for the large amount of FW code added and the required presence of the integrated FPU.

Altitude and Vertical Speed logged and transmitted by telemetry using variometric sensor's:

Brain2/iKon2 Flight control units can read the relative altitude and the vertical speed from external sensors and log these two values ("Rel.Altitude", "VSpeed" parameters) in the flight log memory to be able to analyze data after flight other than have these two values transmitted via telemetry to the (telemetric) transmitters.

Setup:

1) It is needed the Brain2/iKon2 firmware & software 3.4.093 or successive. If needed, update FW & SW.
2) For the following protocol Smart.Port, F.Bus, S.Bus/S.Bus2, HoTT, P2Bus, X-Bus a:
   - FrSky "VARI ADV" sensor can be connected only directly in parallel to the F.Bus or Smart.Port.
   - FrSky "VARIOMETER SENSOR" can be connected only directly in parallel to the Smart.Port.
   - Robbe "Vario Sensor" or Futaba "SBS-01A" sensor can be connected only directly in parallel to the S.Bus2 using a simple "Y" cable.
   Note: For Robbe and Futaba, sensor must be set to slot n°1 (see in your transmitter manual how to change sensor slot) and F1712 sensor kind must be selected and used.
   - Graupner GPS sensor can be connected only directly in parallel to the telemetry bus connected to the CH3 connector using a simple "Y" cable.
   - PowerBoxSystem "PBS VARIO" can be connected only directly in parallel to the P2Bus.
   - JR "TL VARIO SENSOR TLS1-VRO" can be connected only directly in parallel to the X-Bus-A telemetry bus connected to the CH3 connector using a simple "Y" cable.
3) For all other protocol (Std. Receiver, PPM+/-, SUMO receiver, SRXL2 receiver, JETI EX Bus receiver, F.Port inverted and un-inverted, SRXL Multiplex, SRXL Spektrum, I-Bus FlySky, X-Bus b JR, Crossfire TBS/ELRS, DSM2 sat Spektrum, DSMX sat Spektrum), a Jeti "Mvario 2" can be connected to the SAT2 connector using an JST to JR/Futaba adapter like MSH51605 (90mm) or MSH51606 (150mm).
   Note1: With Jeti receivers if the Jeti "MVario 2" sensor is connected on a secondary EX-Bus port of the receiver, The flight control unit don't receive the values and cannot use and log them.
   Note2: With Jeti receivers if the Jeti "MVario 2" sensor is connected directly in parallel to the main EX-Bus port of the receiver, The "MVario 2" sensor don't work.
   Note3: This option cannot be used on Micro Brain2 that don't have SAT2 connector.
4) Connect your Brain2/iKon2 to the PC via USB cable. In the Windows PC start the interface software "BRAIN" (see "Prerequisite" pag.0), go to the panel 12 "Throttle Out & Telemetry & Governor Setup" of the Wizard, "Variom." checkbox must be selected.
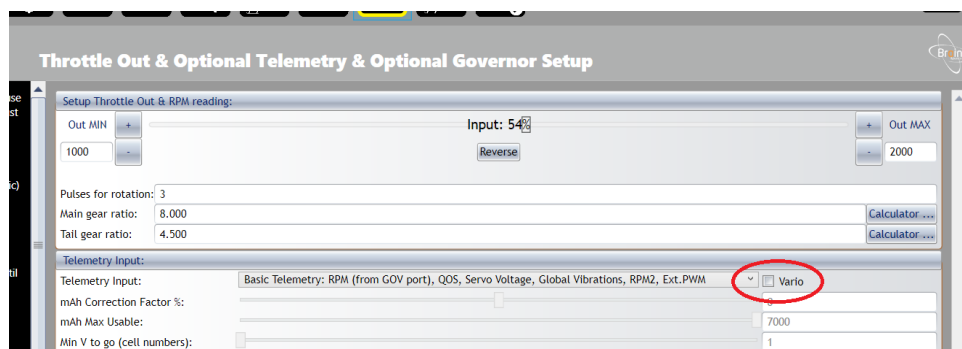
4a) Note that when "Variom." checkbox is selected a second Spektrum satellite connected on SAT2 port don't work anymore.
5) Altitude read from some sensor is already a relative altitude (zero at power on). For the other sensor the absolute altitude is read before throttle raises 20% and used as offset to obtain the relative altitude.
6) Variometer sensor read altitude and speed via air pressure changes. To avoid high interferences due to the air flow generated from main and tail blades, it is suggested to place this kind of sensor in the bottom place of the model between skids.

Now you can log inside the Brain2/iKon2 Flight Logs also the "Rel.Altitude" and "VSpeed" selecting in DIAGNOSTIC => "Parameters setting" tab these two values and with telemetric transmitters & telemetric receivers these two values are also telemetric sent to ground (to the transmitter).

Note1: With non-telemetric protocols selected (PPM+/-, SUMO, Spektrum satellites, X-Bus b, M-Link, HoTT, SRXL) the variometric values are not transmitted but anyway logged in the Brain2/iKon2 Flight Logs memory together the other parameters selected in the "Parameters setting" tab of the DIAGNOSTIC section.

Note2: Variometer's logging and telemetry works only on the new Brain2/iKon2 units that have more power and more useable memory for the large amount of FW code added and the required presence of the integrated FPU.

Using Spektrum RX with bidirectional SRXL2/SRXL you can see RPM & ESC live data's in the transmitter and set alarms:

1) You must have a Spektrum telemetric receiver with a bidirectional SRXL port (only SPM4649T) or SRXL2 port like SPM4650/1, AR6610T, AR8020T or AR410, AR620 via Smart Throttle CH1 (AR6600T, AR6270T don't have SRXL connector, AR8010T, AR9030T, AR9320T have SRXL connection but are not bidirectional). Transmitters enabled for all the new telemetry sensors are DX6E, DX6 G2/G3, DX8 G2, DX9, DX18 G1/G2, and DX20 DX7G2 and DX10t DX18t and QQ variants and iX & NX series. No telemetry with "EU" G2 DX6 and DX7 that work only at 22mS, DX6i and all other non-LCD transmitters such as DXe, DX5e, DX4e (for old DX8 see Note6).

2) Your Transmitter must be updated at least with the AirWare firmware 1.20 released at 2017-July-11 and voices 1.09. Your receiver must be updated to the last firmware to avoid problems (SPM4649T: 1.1rc10, SPM4650/4651: 2.44, etc.).

3) Connect your Brain2/iKon2 unit via a USB cable to your PC, open the Windows application, on the panel 3 "Receiver Selection" of the Wizard, for SPM4649T select the "Spektrum SRXL" icon, or SRXL2 icon for all other SRXL2 receivers (do not confuse the 2).

4) If you want to transmit the ESC values, in panel 12 "Throttle Out & Governor Setup" must be selected the ESC you are using.

5) You must connect the "SRXL" port of your telemetric receiver to the CH3/S-BUS connector of the FBL with a standard female/female three wire cable. If you want to have redundancy, you can also connect a DSMX satellite to the SAT1 & SAT2 ports.

6) Before binding to the receiver, if it is possible in your Transmitter, is preferable set system type to "DSMX" & "11mS" frame rate.

7) Click on the "Spektrum Bind" checkbox of "Receiver Protocol Selection" page, the FBL configuration software close, disconnect the USB from the FBL unit so that it powers down. Now power on your model from the flight pack.

8) Bind TX to RX. During Bind process be sure that "Telemetry" appear on the TX screen otherwise means that only Sats was binded.

9) To enable telemetry in your Transmitter, select "System Setup" -> "Telemetry" -> ("Settings" ->) "Auto-Config". This will automatically allocate the sensor values emulated and sent by receiver to your transmitter where the sensor emulated, and their transmitted parameters are in the following table:

Sensor name ->	Volts	RPM	Temperature	Amps	Flight Pack mAh	ESC	PowerBox	Fuel Status
Battery Current				A	A	A		
Battery Capacity					mAh		mAh	
ESC Temp			°C / °F		°C / °F	°C / °F		
RPM		RPM **				RPM *		
Battery Volts	V					V	V	
Power Output						%		
Throttle Input						%		
BEC Temperature						(caps of HW)		
BEC Current						-		
BEC Volts						V *	V **	
Global Vibs								% ***

* read from ESC sensor	*** Not with iX TX	Note_a: HW not send BEC voltage, used Servo Voltage instead	
** read from Brain sensor		Note_b: CC was able to read for RMP a max value of ~2500	

Note1: BEC Voltage and ESC RPM read from ESC, are only transmitted to the Transmitter using Spektrum telemetry. These values are not selectable and loggable in the Brain2/iKon2 Flight logs because they are redundant and received from ESC at low sample rate. In the Brain2/iKon2 Flight Logs they are already present as parameters "Servo Voltage" and "Main Rotor RPM" with a higher sample rate compared to that received from ESC (RPM sensor must be connected to the GOV connector of the unit also if the unit governor is not used but is used that of the ESC, and gear and Pulses for rotat. must be set in the unit).

Note2: SPM4649T due to his small dimension have not implemented and don't transmit RX voltage value. The displayed value for RX voltage is the "Servo Voltage" of Brain2/iKon2 measured on Servo Voltage rail which RX is connected.

Note3: For RPM, because ratio and sensing divisor (Pulses for rotation) are yet elaborated from Brain2/iKon2 and also because Brain2/iKon2 send RPM with a decimal, but Spektrum don't display decimals, in Transmitter Telemetry menu, **for both** "RPM" and "ESC" sensors set the "Ratio" to 10.00 (to remove the decimal) and let Poles to "Inh".

Note4: When a 12S or 14S battery pack composed by two more little 6S/7S pack are recharged, normally the recharging process is done in parallel from the charger for the two packs. In this case, the really recharged value of each pack must not be summed because on the model when the battery pack is connected to the ESC is connected series and the telemetry value read from the esc is a series measurement of the current absorbed from the battery pack. You can sum the two values and then divide by two to obtain a medium value if there are significant differences between the two recharged values (Obviously, you cannot recharge a mAh value bigger than the nominal pack value).

Note5: Each ESC (depending on the model and brand) has a threshold below which it does not recognize and does not transmit any current. This threshold varies between 2 and 8 amperes. A brushless motor with no load (no blades) use/consumes current values below this threshold, and therefore is quite normal that at bench and without blades, ESC doesn't read any current value and also any mAh can be calculated.

Note6: With old DX8 radios you can receive only data's of the old sensor that exist at the time of the last Spektrum Firmware released (2014), so you can see RPM, Main Battery Volts, Servo Voltage, Temperature, Amps (instantaneous) and with PowerBox sensor used capacity. Sensors that are recognized automatically. With new radio, PowerBox is not automatically recognized. If you want, you can select it manually and after, change in the setup page the "Display:" from "Inh" to "Act".

Note7: For temperatures, to change the displayed values from Celsius to Fahrenheit, go into the transmitter menu Telemetry->Settings->Units: here is possible to change from "Metric" (Celsius) to "US" (Fahrenheit) and vice versa.

Note8: Use transmitter button "CLEAR" to reset the displayed values in "Min / Max" page.

Note9: For SPM4649T registration on "My Spektrum" or firmware update is needed a SPMA3065 accessory and the latest version (V1.3) of the "Spektrum Updater" SW (http://spektrumrc.cachefly.net/apps/updater_instructions.html).

Note10: Development and test was done with DX9 Black with AirWare 1.20, voices 1.09 & SPM4649T receiver with 1.1rc10 FW

Note11: Spektrum telemetry works only on the new Brain2/iKon2 units that have more power and more useable memory for the large amount of FW code added and the required presence of the integrated FPU.

<u>Using Futaba T-FHSS or FASSTest & S.Bus2 you can see RPM & ESC live data's in the transmitter and set alarms:</u>

1) You must have a Futaba transmitter and receiver able to use a bidirectional RF protocol like T-FHSS or FASSTest e.g., T6K_v2, T10J, T14SG, T16SZ, T18SZ, T18MZ, T18MZ_WC transmitters and a receiver with same protocol and Sbus2 connector e.g., R300*SB or R700*SB. NOTE: With actual T10J firmware, "CASTLE-TL0" sensor isn't available in the TX sensor list (see note 10).

2) Connect your Brain2/iKon2 unit via a USB cable to your PC, open the Windows application (see "Prerequisite" pag.0), on the panel 3 ("Receiver Protocol Selection") of the wizard, select the "S.Bus/S.Bus2" receiver kind icon.

3) If you want to transmit the ESC values, in panel 12 "Throttle Out & Governor Setup" must be selected the ESC you are using.

4) You must connect the "Sbus2" port of your (T-FHSS or FASSTest) receiver to the CH3/S-BUS connector of the FBL with a standard 3 pole female/female cable (The regular S.Bus port is not bidirectional and will not pass telemetry).

5) Before binding to the receiver, the transmitter system type must be set to either "T-FHSS" on the T10J or "FASSTest 14CH" (the higher FASSTest selectable) on the 14SG or "FASSTest 18CH" (the higher FASSTest selectable) on the 18SZ. With other system type, telemetry will not work. When using the S.Bus2 output for telemetry, never use FASTest 12CH.

6) In your transmitter, after binding to the receiver, you must see the receiver serial number or "Receiver ID" in the display. This is found in your 14SG transmitter in "LNK" -> "SYSTEM", or in the 18SZ by touching "Linkage Menu" -> "System type".

7) Close the FBL configuration software and disconnect the USB from the FBL unit so that it powers down. Now power on your model from the flight pack.

8a) To enable telemetry in your T14SG transmitter select "LNK" - (page 2) -> "SENSOR" - (page 4) -> then select …

8b) To enable telemetry in your T18SZ transmitter select "Linkage menu" -> "Sensor" - (page 2) -> tap the "-----------" ….

9) For electric models in **slot 16** select "CASTLE TL0" as the sensor. This will automatically allocate the next 7 slots to "Castle TL0" for a total of 8 slots for VOLTAGE, CURRENT, PWR-OUT, RPM, BEC-VOLT, BEC-CRNT, RIPPLE-V, ESC-TEMP.

10) For electric models to also enable mAh used capacity telemetry, use the same process as above to select **slot 24** and choose "CURR-1678" as the sensor. This will automatically allocate the next two slots to the virtual current sensor for a total of 3 slots for CURRENT, VOLTAGE and CAPACITY (note that the max manageable Current value of "CURR-1678" sensor is 163.8A).

11) For RPM, you can also in **slot 28** enable RPM-Sensor (SBS-01RO, SBS-01RB, SBS-01RM, BPS-1. Leave POLE set to minimum value) and for temperature in **slot 27** enable sensor "TEMP125" (or "TEMP-F1713"). this can be useful on Nitro/Gasser/Turbine models (for RPM & a separate temperature sensor) or if you are using T10J transmitter, that with actual old FW don't have "CASTLE TL0".

12) There are 4 selectable telemetry pages, and in each page the values of 4 different telemetry parameters can be selected and displayed. It is accessible directly from the home screen by pressing the HOME/EXIT button on either the 14SG or the 18SZ.

Note1: Each FASSTest receiver can be programmed with different "MODE". In some MODE the port labelled S.Bus2 can be set as a different channel/port and will no longer function as S.Bus2. Check the mode of your receiver by following the corresponding Futaba instruction for your particular receiver to be sure you know which port is actually set as Sbus2.

Note2: Some receivers, i.e., R7006SB, can be programmed to operate as a different system type (FASST vs FASSTest). FASSTest is the only system type that is bidirectional, none of the other variations of the "FASST" system type will work with telemetry. Please ensure your receiver is programmed only to the FASSTest system type by following the Futaba instruction manual for your particular receiver.

Note3: Futaba has implemented CASTLE-TL0 telemetry to provide all the data that Castle ESCs can send via Link Live protocol. At this time, no Castle ESC can read or send BEC Current data. So, this value with Castle ESC will always display "0.00/----" and is disabled. Value is for now displayed only with Kontronik Kosmik and Kolibri plus YGE-HVT ESC's.

Note4: BEC Voltage and ESC RPM read from ESC, are only transmitted to the Transmitter using Futaba telemetry. These values are not selectable and loggable in the Brain2/iKon2 Flight Logs because they are redundant and received from ESC at low sample rate. In the Brain2/iKon2 Flight Logs they are already present as parameters "Servo Voltage" and "Main Rotor RPM" with a higher sample rate compared to that received from ESC (RPM sensor must be connected to the GOV connector of the unit also if the unit governor is not used but is used that of the ESC, and gear and Pulses for rotation must be set in the Brain2/iKon2).

Note5: Hobbywing ESC sensor has been added by Futaba only in recent TX firmware's, but we sent Hobbywing's ESC data the same as Castle data. But please be aware that Hobbywing does not read nor send BEC voltage and BEC Current. So, these parameters always display "0.00/----" and are disabled.

Note6: For RPM, because gear ratio and sensing divisor (Pulses for rotation) are yet elaborated from Brain2/iKon2, in the Transmitter set gear ratio to 1 and leave POLE set to the minimum value (as default).

Note7: When a 12S or 14S battery pack composed by two more little 6S/7S pack are recharged, normally the recharging process is done in parallel from the charger for the two packs. In this case, the really recharged value of each pack must not be summed because on the model when the battery pack is connected to the ESC is connected series and the telemetry value read from the ESC is a series measurement of the current absorbed from the battery pack. You can sum the two values and then divide by two to obtain a medium value if there are significant differences between the two recharged values (Obviously, you cannot recharge a mAh value bigger than the nominal pack value).

Note8: Each ESC (depending on the model and brand) has a threshold below which it does not recognize and does not transmit any current. This threshold varies between 2 and 8 amperes. A brushless motor with no load (no blades) use/consumes current values below this threshold, and therefore is quite normal that at bench and without blades, ESC doesn't read any current value and also any mAh can be calculated.

Note9: For temperatures, to change the displayed values from Celsius to Fahrenheit, go into the transmitter menu SYS -> DISPLAY -> UNIT SYS.: here is possible to change from "METRIC" (Celsius) to "YARD/PUND" (Fahrenheit) and vice versa.

Note10: To be able to read the maximum spikes values is suggested to raise the transmitter "INTERVAL" period to the fastest possible (0 second or at max 1 second). You can find this parameter into LNK->TELEM.SET. -> INTERVAL menu.

Note11: The FUTABA telemetry was developed and tested with FUTABA transmitter T14SG firmware 6.00 Nov 10, 2015, with a R7008SB receiver.

Note12: Futaba telemetry works only on the new Brain2/iKon2 units that have more power and more useable memory for the large amount of FW code added and the required presence of the integrated FPU.

Using JETI EX Bus RX, you can see RPM & ESC live data's in the main screen of your transmitter and set alarms:

You can use the telemetry sent by Brain2/iKon2 (included that of ESC) with every kind of Ex-Bus Receiver, otherwise but only if you want to use other sensor than that emulated by Brain2/iKon2, is necessary to use a REX receiver.

For Integration, see the "Jeti Integration instructions" pdf document.

1) Using the Jeti software JETI Studio for Windows, after it updates itself (About -> Checking for Update), verify that your transmitter and your receivers are updated with the latest version of the firmware (for software download, instructions for the use, and for the firmware update, refer to the Jeti instructions).

2) Connect your Brain2/iKon2 unit via a USB cable to your PC, open the Windows application (see "Prerequisite" pag.0), on the panel 3 ("Receiver Protocol Selection") of the wizard, select the "EX Bus" receiver kind icon.

3) If you want to transmit the ESC values, in panel 12 "Throttle & Governor Setup", must be selected the ESC you are using.

4) As schematic in panel 4 "Connections" of the wizard, connect a standard 3 pole female/female cable to the CH3/S-BUS connector of the Brain2/iKon2 and the other end in the port "EXT" of your "R.." receiver or in one of the port E1, E2, E.. (not the EXT) of your REX receiver (yet binded to the transmitter).

5) You can send to your transmitter up to 11 data parameters which may be selected in "DIAGNOSTIC" -> "Parameter setting" (excluded: Servo Voltage yet transmitted by default by the receivers).

6) Close program and disconnect USB cycling power. Power on your model from the flight pack. Go with the JETI menu to "Timers/Sensors" -> "Configuration" -> "Transmit frequency" and select "AUTO" (discover). Note that for a complete "discover" process, it can take up to ~14 seconds.
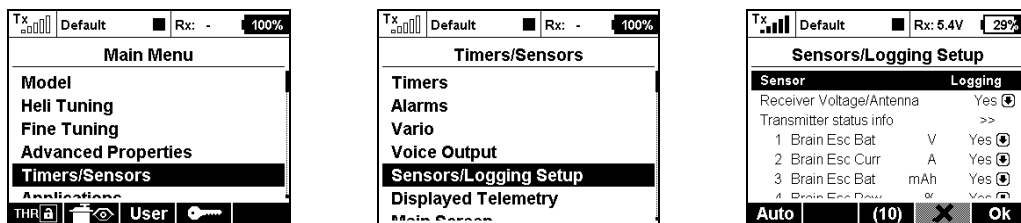
Note: Lacking in the Jeti protocol a command to delete the transmitter recorded sensors, if you change the logged values or also only their position in the "DIAGNOSTIC" -> "Parameter setting" of the software/app, or with the Jeti integration itself, you must manually redo the AUTO/discover procedure.

7) In the JETI transmitter menu, go to " Timers/Sensors " -> "Displayed Telemetry", select value you want display. Remember that you can have "S"eparated displayed data different for each idle up or a "G"lobal displayed data common for each idle up and you can change this, selecting the first row.
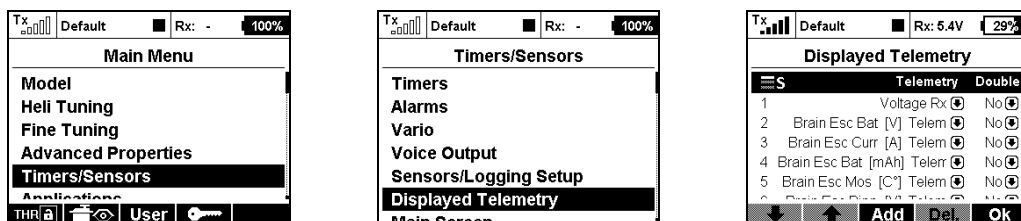
8) You can also set alarms (sound-voice and/or vibration) when the received telemetry values excess of the thresholds you set. For example, when the current consumed by the main battery has exceeded a certain value, or if the temperature has exceeded a certain value or if the battery voltage has fallen below certain values. For these features, see the transmitter instructions.

Note1: When a 12S or 14S battery pack composed by two more little 6S/7S pack are recharged, normally the recharging process is done in parallel from the charger for the two packs. In this case, the really recharged value of each pack must not be summed because on the model when the battery pack is connected series to the ESC and the telemetry value read from the esc is a series measurement of the current absorbed from the battery pack. You can sum the two values and then divide by two to obtain a medium value if there are significant differences between the two recharged values (Obviously, you cannot recharge a mAh value bigger than the nominal pack value).

Note2: Each ESC (depending on the model and brand) has a threshold below which it does not recognize and does not transmit any current. This threshold varies between 2 and 8 amperes. A brushless motor with no load (no blades) use/consumes current values below this threshold, and therefore is quite normal that at bench and without blades, ESC doesn't read any current value and also any mAh can be calculated.

Note3: For temperatures, to change the displayed values from Celsius to Fahrenheit, go into the transmitter menu System->Configuration->Temperature units: here is possible to change from Celsius to Fahrenheit and vice versa.

Note4: The JETI telemetry was developed and tested with JETI transmitter DS-16 firmware 4.00 Dec 11, 2015, with R9 firmware ver.03.24, Rsat2 ver.03.25, REX3 ver.01.02 receivers.

Note5: JETI telemetry work only on the new Brain2/iKon2 units that have more power and more useable memory for the large amount of FW code added and the required presence of the integrated FPU.

With Graupner HoTT RX, you can see RPM & ESC live data's in the main screen of your transmitter and set alarms:

You can use the ESC telemetry sent by the Brain2/iKon2, with every kind of HoTT Receiver. If you want to use sensors other than that emulated by the Brain2/iKon2, it is necessary to use one or more "Y" cables on the "T+-" RX connector.

For Integration, under "MANUALS" see the HoTT "Integration" pdf document that explain how to activate and use it.

1) Using the Graupner software GrStudio for Windows, after it updates itself (About -> Checking for Update), verify that your transmitter and your receivers are updated with the latest version of the firmware (for software download, instructions for the use, and for the firmware update, refer to the Graupner instructions).

2) Connect your Brain2/iKon2 unit via a USB cable to your PC, open the Windows application (see "Prerequisite" pag.0), on the panel 3 ("Receiver Protocol Selection") of the wizard, select the "HoTT + Telemetry" receiver kind icon.
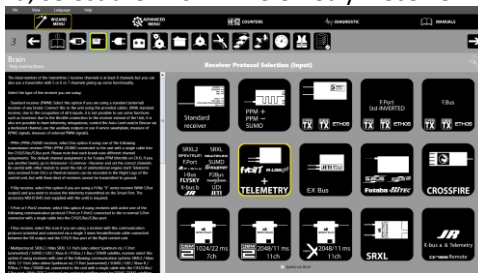
3) If you want to transmit the ESC values, in panel 12 "Throttle Out & Governor Setup", must be selected the ESC you are using.

4) Per the schematic in panel 4 ("Connections"), connect a standard 3-pole female/female cable like that supplied with Brain2/iKon2 to the CH3/S-BUS connector of Brain2 and the other end in the port "- + T" of your HoTT "GR-.." RX.

5) Using another standard 3-pole female/female cable like that supplied with the Brain2/iKon2 units, cut away 5mm of the central red wire near either the two connectors (the remaining red wire only keeps the black and white wires together, but you can also totally remove the red wire and twist black and white wires together).

***** IF YOU DON'T DO THIS, YOU MAY BURN YOUR Brain2/iKon2 UNIT AND/OR YOUR RECEIVER!!!! *****

6) Connect one end of the cable to a GOV adapter cable (like MSH51606, MSH51605, or MSH51626. or you can instead use the MSH51623 accessory cable **WITH THE RED WIRE CUT)**.

7) Connect the standard connector of this modified cable to the SUMD port of your HoTT receiver (e.g., port 8 on GR-24L / GR-16, port 6 on GR-12L).

8) Connect the small JST connector of the adapter cable to the lateral SAT1 connector of the Brain2/iKon2.

9) Power your transmitter and your receiver. On the transmitter, go in the menus to "Base" -> "TX ctl" -> "BIND ON/OFF" and bind while holding down the bind button on the receiver.

10) Go in the transmitter menus to "Function" -> "Telemetry" -> "SETTING & DATA VIEW", select the "RECV" receiver button, and find the page with "CH OUT TYPE:" using the ENT button. Set it to SUMD, then OF (fail safe=OFF, keeps the Brain2/iKon2 in charge this situation), then the effective number of channels usable with the transmitter (for example, with a MZ-18, set it to 8) or the maximum number of channels you can use with the Brain2/iKon2 (13 channels are sufficient to use all the Brain2/iKon2 functions). This is to avoid having to transmit, receive and decode many channels unnecessarily. With some receivers, you can only set the row "SUMD at CHX" to YES. In this case, remember to set in the transmitter menu: Base -> Fail Safe (F/S) to 000% for the throttle channel (usually CH6 in Heli mode). With GR-12, to have telemetry and Integration, "SENSOR at CH5:" must be set to "Yes".

11) With the Brain2/iKon2 software, verify in panel 5 ("Transmitter setup") the correct direction of each channel as explained in the side bar instructions. If necessary, correct it in the transmitter, reversing the channel in the transmitter menu "Base" -> Rev/Slow.

12) With Brain2/iKon2 software, verify in panel 5 ("Transmitter setup") that you are able to obtain full travel of all control channels. If necessary, correct them in transmitter, raising or lowering the "Travel" in the menu "Base" -> "E.P.A".

Now you are ready to use HoTT <-> Brain2/iKon2 telemetry selecting the "T" (Telemetry) button (or pushing either "<" and ">" together for 0,5 seconds) and the top "NEXT" button.

In "Integration" (pushing the "F" button from the main screen and then pushing "Telemetry" -> "SETTING & DATA VIEW", in the first menu "HoTT Emulation Setup" you can set the threshold values of: mAh, Instantaneous Current, Voltage and Temperature alarms.

Note1: At Transmitter power-on, the HoTT system needs at least 30 seconds to discover all the sensors connected to the receiver that transmit telemetric data other than that transmitted by the receiver.

Note2: To change from Celsius to Fahrenheit and vice versa, the "Voice2_English_Imperial.vdf" audio file must be downloaded from the Graupner USA website for Fahrenheit or the "Voice2_English.vdf" audio file must be downloaded from the Graupner EUROPE website for Celsius and loaded in the transmitter with GrStudio Windows software.

Note3: It is possible to display telemetry values with big graphics and small numbers, or without graphics but with big numbers, by changing the "System" -> "Display" -> "Glaring sun" setting in the transmitter between OFF/ON.

Note4: Telemetric data's can be also recorded and saved in the folder "LogData" of the SD card inserted in your transmitter and after the flight, replayed using in GrStudio the "File Log" -> "File Log View" utility. To start the recording, the Timer1 must start and run. Remember that the setup for Timer1 allows only to activate the start and the reset of Timer 1. To stop the timer1 you must use the lateral physical "ESC" key.

Note5: Development and test was done with MZ-18 with 1.50FW & 2.00FW (PRO) GR-12L, GR-16, GR-24L receivers.

Note6: Graupner telemetry work only on the new Brain2/iKon2 units that have more power and more useable memory.

With OpenTX / EdgeTX transmitters+Smart Port & S.Bus RX, you can see RPM & ESC live data's in the transmitter and set alarms:

You can use the telemetry sent by the Brain2/iKon2 (included that read from a connected ESC), with Receiver that use Smart.Port for telemetry (EG: FrSky X series receivers). If you want to use sensors other than that emulated by the Brain2/iKon2, it is necessary to use one "Y" cable on the Smart.Port connector of the receiver. Compatible Transmitters are all the FrSky ACCST and ACCESS and RadioMaster transmitters (Note: With proper RX firmware's it is also possible to use F.Port or F.Bus single wire connections).

In the ZIP file for OpenTX/EdgeTX Integration, there are some examples of transmitter configurations from which to start.

1) Connect your Brain2/iKon2 unit via a USB cable to your PC, open the Windows application, on the panel 3 ("Receiver Protocol Selection") of the Wizard, select the "Smart Port" receiver kind icon or "F.Port INVERTED" protocols or "F.Bus" (if the receiver can handle them).
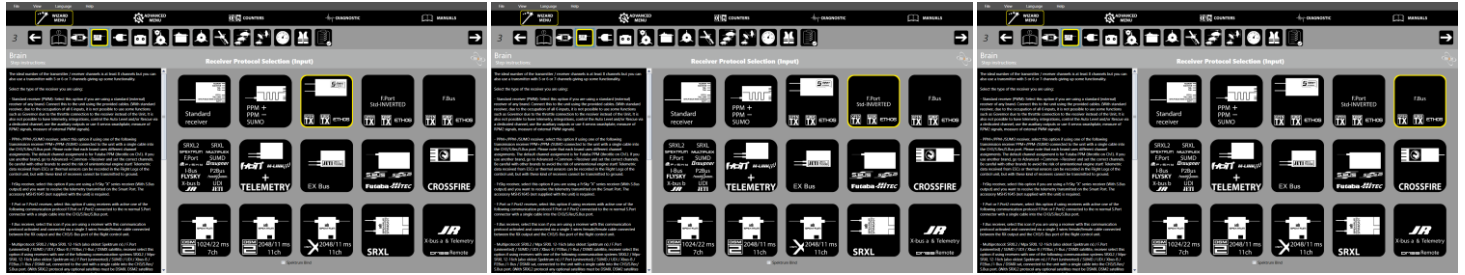
2) If you want to transmit the ESC values, in panel 12 "Throttle Out & Telem. & Governor Setup", must be selected the ESC you are using. **Note that using Smart.Port protocol, the ESC (or the temperature) telemetry cable must be connected to top pin CH6 of port CH4-5-6 of Brain2/iKon2 and not to pin 5 (only for ESC not "Castle Creation")**. With F.Port & F.Bus protocol use the usual pin 5.

3) With receivers that have standard 3 poles connectors like RX8R, X8R & X6R: Per the schematic in panel 4 ("Connections"), connect a standard 3-pole female/female cable, like that supplied with the Brain2/iKon2, to the Smart.Port "- + S" of your "X" receiver and the other end in the CH3/S-BUS connector of the Brain2/iKon2 that work as TELEMETRIC IN/OUT port.

4) For Smart.Port protocol, using ONLY the adapter cable **MSH51645**, connect the standard connector of the adapter cable to the SBUS port of your receiver and connect the JST connector of the adapter cable to the lateral SAT1 connector of the Brain2/iKon2 that with this protocol active become the S.Bus signal input port. Note: Power to receiver come from S.Port.

***** DON'T USE OTHER CABLE, OTHERWISE, YOU MAY BURN YOUR Bran2/iKon2 UNIT AND/OR YOUR RECEIVER!!!! *****

5) With receiver that handle F.Port or F.Bus protocols, a standard cable like that supplied with each unit can be connected to CH3.

6) Power your TX, go to MDL, MODEL SETUP, Internal RF, Mode=D16, Receiver No.=01, for ACCST TX/RX select "Bind", for ACCESS TX/RX select "Register". Keeping pushed the "f/s" key, power your receiver to Bind / Register it to the transmitter model that is active in the transmitter. Cycle power of RX (With ACCESS you must now select one of the listed Receiver and "Bind" it).

7) In the menu "MDL"->"OUTPUTS" the Center Pulses must be set to 1520 for ALL channels, then the FCU needs to be re-energized.

8) Re-Power your transmitter and your receiver. With the Brain2/iKon2 software, verify in panel 5 ("Transmitter setup") the correct direction of each channel as explained in the side bar instructions (default channel order like S.Bus: Futaba "AETR") If necessary, correct it in the transmitter, reversing the channel in the transmitter menu "MDL", "OUTPUTS", "Direction".

9) With the Brain2/iKon2 software, verify in panel 5 ("Transmitter setup") that you can obtain the full -100/+100 travel of all control channels. If necessary, correct them in the transmitter, raising or lowering in the menu "MDL" -> "OUTPUTS" the Min/Max values (the "extended limits" checkboxes must be selected and for RadioMaster select also "Enable max. throw").

10) Go in the transmitter "MDL" with "PgUp" select the last submenu "TELEMETRY", here select "Discover new sensors" to discover values sent by Brain2/iKon2 (and the other eventually connected on the Smart.Port bus). As soon as all sensors have been detected, turn off the "Discover New Sensors" option to prevent disturbances from creating false sensors that can cause false alarms or manually delete all false sensors discovered. Note that with OpenTX the discovered **VFAS** sensor display the actual Voltage of main battery, **RB1C** sensor display the mAh consumed current by main battery. **RB2C** sensor discovered together RB1C (same ID number) is used only for ESC that transmit BEC current (Kosmik, Kolibri, YGE HVT).

11) Go in the transmitter "TELE" menu, select "Setup widgets" to display in the main screen the telemetric values you want to see.

12) Check the correct Failsafe configuration, before fly (turning off the transmitter, swashplate must hold, and throttle go off)!

Now you are ready to see OpenTX / EdgeTX telemetry values that you have selected in step 10 for main screen or go in "TELEMETRY" page to see all.

Note1: At Transmitter power-on, the OpenTX / EdgeTX system needs at least 30 seconds to discover the sensors connected to the receiver that transmit telemetric data other than that transmitted by the receiver.

Note2: To change from Celsius to Fahrenheit and vice versa, in SYS -> RADIO SETUP, change "Units" from "Metric" to "Imperial".

Note3: Other than the RX sensor ID 24 for **RSSI** & **RxBt**, to emulate S.Port sensors the following sensor ID's are used: **Curr**=2, **RPM**=4 **RB1C** & **RB2C**=11, **Tmp1**=12, **Tmp2**=16, **VFAS**=17, **FUEL**=18, **GRPc**=15. When Kosmik or Kolibry or YGE ESC are selected, the sensor **022F**=19 appear, it is the BEC current, rename it to **BCur** and set Unit to mA. If you connect other external sensors on the Smart.Port, and one or more of the sensors uses one of these ID, change their ID to an unused (EG: 1, 3, 5, ..) to avoid data conflict.

Note4: For **RPM**, because gear ratio and sensing divisor (Pulses for rotation) are yet elaborated from Brain2/iKon2, in the Transmitter leave Blades/Poles & Multiplier of RPM sensor set to the minimum value of 1 (as default).

Note5: RSSI value can be logged by flight controller via activation (or deactivation) on S.Bus channel16 by pressing bind button on receiver for more than 5 second.

Note6: Telemetric data's can be also recorded and saved in the SD card of your transmitter.

Note7: The OpenTX telemetry was developed and tested with FrSky HORUS (X12S) with OpenTX firmware version 2.2.0 (85863358) of 2017-05-30, Companion 2.2.0 of May-30-2017 and with FrSky receiver X8R with firmware version 151118. New ACCESS protocol was tested with FrSky TARANIS X9D+ SE 2019 and RXSR receiver with Access firmware.

Note8: OpenTX / EdgeTX telemetry works only on the new Brain2/iKon2 units that have more power and more useable memory for the large amount of FW code added and the required presence of the integrated FPU.

With Multiplex M-Link TX/RX, you can see RPM & ESC live data's in the main screen of your transmitter:

You can use the ESC telemetry sent by the Brain2/iKon2, with every telemetric M-Link Receiver. If you want to use sensors other than those emulated by the Brain2/iKon2, it is necessary to use one or more "Y" cables on the "S" RX connector.

1) Using the "Multiplex Launcher" software for Windows, after it updates itself (About -> Checking for Update), verify that your transmitter and your receivers are updated with the latest version of the firmware (for software download, instructions for the use, and for the firmware update, refer to the Multiplex instructions) and set receiver to SRXL.

2) Connect your Brain2/iKon2 unit via a USB cable to your PC, open the Windows application (see "Prerequisite" pag.0), on the panel 3 ("Receiver Protocol Selection") of the wizard, select the "M-LINK + Telemetry" receiver kind icon.
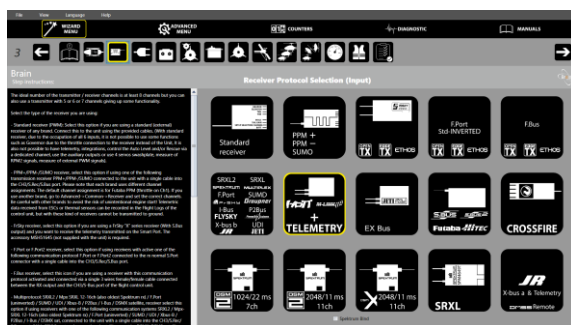
3) If you want to transmit the ESC values, in panel 12 "Throttle Out & Telemetry & Governor Setup", must be selected the ESC you are using in the "Telemetry" curtain.

4) Per the schematic in panel 4 ("Connections"), connect a standard 3-pole female/female cable like that supplied with Brain2/iKon2 to the CH3/S-BUS connector of Brain2 and the other end in the port "S" of your Multiplex receiver.

5) Using another standard 3-pole female/female cable like that supplied with the Brain2/iKon2 units, cut away 5mm of the central red wire near either the two connectors (the remaining red wire only keeps the black and white wires together, but you can also totally remove the red wire and twist black and white wires together).

***** IF YOU DON'T DO THIS, YOU MAY BURN YOUR Brain2/iKon2 UNIT AND/OR YOUR RECEIVER!!!! *****

6) Connect one end of the cable to a GOV adapter cable (like MSH51606, MSH51605, or MSH51626; or you can instead use the MSH51623 cable **WITH THE RED WIRE CUT**).

7) Connect the standard connector of this modified cable to the B/D port of your Multiplex receiver.

8) Connect the small JST connector of the GOV adapter cable to the lateral SAT1 connector of the Brain2/iKon2.

9) Holding down the "Setup" key on the TX, power on your Transmitter and your Receiver, with a new receiver, binding automatically start. If you need to Bind a RX already binded to other transmitter, push shortly the SET button on the receiver.

10) Assign in the TX the channels as follow: Aileron ch2, Elevator ch3, Tail ch4, Pitch ch1, Tail Gain ch7, Setup selection ch5, Motor ch6, Aux ch8. Otherwise, you must go in Advanced -> Common -> Receiver and set the channel assigned in the TX to the correct function of Brain2/iKon2.

11) With the Brain2/iKon2 software, verify in panel 5 ("Transmitter setup") the correct direction of each channel as explained in the side bar instructions. If necessary, correct it in the transmitter, reversing the channel in the transmitter menu "Base" -> "Rev/Slow".

12) With Brain2/iKon2 software, verify in panel 5 ("Transmitter setup") that you are able to obtain full travel of all control channels. If necessary, correct them in transmitter, raising or lowering the "Travel" in the menu "Base" -> "E.P.A".

Now you are ready to receive Brain2/iKon2 telemetry values and see on the main screen of your transmitter pushing the "Up/Down" buttons.

In the emulated sensor n° 3 you can see "Main Battery Voltage", in emulated sensor n° 4 you can see "Main battery instantaneous current", in emulated sensor n° 5 you can see the "Main Rotor RPM", in the emulated sensor n° 6 you can see the "ESC Temperature", in emulated sensor n° 7 you can see the "Temperature 2", in emulated sensor n° 8 you can see the "Main Battery used mAh".

Note1: Development and test were done with ROYAL SX Elite 16 with 3.56FW & RX-7 M-LINK 2,4GHz receiver.

Note2: Multiplex telemetry works only on the new Brain2/iKon2 units that have more power and more usable memory for the large amount of FW code added and the required presence of the integrated FPU.

With FlySky i-BUS RX, you can see RPM & ESC live data's in the main screen of your transmitter:

You can use the telemetry sent by the Brain2/iKon2 (included that read from a connected ESC or a temperature sensor), with Receiver that use i-BUS for telemetry (EG: FlySky FS-IA6B receiver). Compatible Transmitters are all the FlySky and RadioMaster multiprotocol transmitters.

1) This is not a guide for installing, update and use OpenTX, EdgeTX, Multiprotocol modules, for this purpose, refer to the Transmitters and/or OpenTX and/or EdgeTX and/or MULTI-Module websites. You must check from your transmitter website that your Transmitter, and internal or external Multimodule and the Receiver are all updated with the latest firmware & software (for multimodule the "AIR" FW must be used because EU-LBT FW don't have the "FlSky2A" protocol).

2) Connect your Brain2/iKon2 unit via a USB cable to your PC, open the Windows application (see "Prerequisite" pag.0), on the panel 3 ("Receiver Protocol Selection") of the Wizard, select the "Multiprotocol" icon.

3) If you want to transmit the ESC values, in panel 12 "Throttle Out & Governor Setup" must be selected the ESC you are using. **Note that using i-BUS protocol, the ESC (or the temperature) telemetry cable must be connected to central pin CH5 of port CH4-5-6 of Brain2/iKon2 (this only if the ESC is not a "Castle Creation" ESC)**.

4) Connect the i-BUS "SERVO" output ports to the CH3/S-BUS port of the flight controller unit, put the Bind plug in to the B/VCC connector of the receiver, and power the receiver. The RX led flashes. Power your RadioMaster TX with EdgeTX, go to MDL, MODEL SETUP, Internal RF, Mode=MULTI, RF Protocol FlSky2A & PWM.IBUS, and for channel range select CH1 - CH16. Now select the "Bind" button. On successful bind the RX Led stop flashing and stay on. Remove Bind Plug from receiver. Unpower FCU.

5) Connect together by means of a special "Y" cable, (with all three male connectors), the two i-BUS "SERVO" & "SENS" ports of the receiver. The signal coming out of the "Y" cable should then be connected to the CH3/S-BUS port of the flight controller unit.

6) In the menu "MDL"->"OUTPUTS" the Center Pulses must be set to 1520 for ALL channels, then the FCU needs to be re-energized.

7) Re-Power your FCU. With the Brain2/iKon2 software, verify in panel 5 ("Transmitter setup") the correct direction of each channel as explained in the side bar instructions (the default channel order is like S.Bus: Futaba "AETR") If necessary, correct it in the transmitter, reversing the channel in the transmitter menu "MDL", "OUTPUTS", "Direction" or "Inverted".

8) With the Brain2/iKon2 software, verify in panel 5 ("Transmitter setup") that you are able to obtain the full -100/+100 travel of ALL control channels. If necessary, correct them in the transmitter, raising or lowering in the menu "MDL" -> "OUTPUTS" the Min/Max values (the "extended limits" checkboxes must be selected and for RadioMaster select also "Enable max. throw" if present).

9) Go in the transmitter "MDL" with "PgUp" select the last submenu "TELEMETRY", here select "Discover new sensors" to discover values sent by Brain2/iKon2. With OpenTX the discovered sensor 1 is **RPM** that, as name say, display the Main Rotor RPM, the discovered sensor 2 is **Tmp1** that display the value of the Temperature sensor or the value of ESC Mosfet temperature, the discovered sensor 3 is **Cels** that display the actual Voltage of the main battery connected to the ESC, the discovered sensor 4 is **Curr** that display the instantaneous current, the discovered sensor 5 is **Capa** that display the mAh consumed current from main battery.

10) Go in the transmitter "TELE" menu, select "Setup widgets" to display in the main screen the telemetric values you want to see.

11) Check the correct Failsafe configuration, before fly (turning off the transmitter, swashplate must hold, and throttle go off)!

Now you are ready to see OpenTX / EdgeTX telemetry values that you have selected in step 9 for main screen or go in "TELEMETRY" page to see all.

Note1: VERY IMPORTANT!!! The FlySky i-Bus communication protocol with FCU does not provide a Fail Safe bit/byte in case of RF signal loss. Therefore, it is imperative to configure the Fail Safe (on the transmitter or receiver) so that in case of signal loss, power is removed from the motor by bringing the throttle to zero so that the blades do not do harm to people or property.

Note2: At Transmitter power-on, the OpenTX / EdgeTX system may need up to 30 seconds to discover all the sensors connected to the receiver that transmit telemetric data other than that transmitted by the receiver.

Note3: To change from Celsius to Fahrenheit and vice versa, in SYS -> RADIO SETUP, change "Units" between "Metric" and "Imperial".

Note4: Telemetric data's can be also recorded and saved in the SD card of your transmitter.

Note5: The i-BUS telemetry was developed and tested with RadioMaster (TX16S) with EdgeTX firmware version 2.7.0 (F79978b6) of 2022-04-16 and internal Multimodule with AIR firmware version 1.3.3.7, and with FlySky receiver FS-IA6B with factory firmware (EU-LBT Firmware don't have the "FlSky2A" protocol).

Note6: i-Bus telemetry works only on the new Brain2/iKon2 units that have more power and more usable memory for the large amount of FW code added and the required presence of the integrated FPU.

With TBS/ELRS TX module & RX using Crossfire output you can see some ESC live data's in the main screen of your TX

You can use the telemetry sent by the Brain2/iKon2 (included that read from a connected ESC), with Receiver that use Crossfire as protocol (EG: TBS MICRO/NANO or ELRS RP1/2/3 receiver). Compatible Transmitters are all the FrSky and RadioMaster transmitters with OpenTX or EdgeTX. Crossfire protocol decoding was implemented for TX / RX set at 416.666bps and Packet/Frame Rate 50, 150, 250, 333, 500 Hz.

1) Transmitters can use a TBS MICRO/NANO TX module or ELRS MICRO/NANO module. This is not a guide for installing, update and use TBS or ELRS TX/RX, for this purpose, instructions, software, and drivers download and firmware update, refer to the TBS (Team-BlackSheep) website or ELRS website. For TBS, using the "TBS Agent Desktop", after it updates itself (if needed), connect via USB to your TX module and verify that your TX module is updated with the latest version of the firmware and the same for your receiver (if already binded). For ELRS using "ExpressLRS Configurator" update transmitter module and receiver to the latest version.

2) Check from your transmitter website that your transmitter is updated with latest firmware & software.

3) Follow the bind procedure described by TBS or ELRS for your TX module and Receiver type. TBS: First power up the receiver, if it's LED stays red, press the bind button on the RX. Power up the TX and set in Bind mode with TBS Agent or via a single push on the rear button. ELRS: cycle RX power three times until led fast blink, then using elrsV3.lua use the BIND function.

4) Connect your Brain2/iKon2 unit via a USB cable to your PC, open the Windows application, on the panel 3 "Receiver Protocol Selection" of the Wizard, select the "CROSSFIRE" icon.

5) In Electric model, to transmit the ESC values, in panel 12 ("Throttle Out & Telemetry & Governor Setup") must be selected the ESC you are using. Read here the page related to your ESC. **Note that using Crossfire protocol, the single ESC telemetry wire must be connected to central pin CH5 of port CH4-5-6 of Brain2/iKon2 (this only if the ESC is not a "Castle Creation" ESC)**.

6a) Using the "TBS Agent" connected via USB to your TX module or using the LUA app "TBS Agent Lite" installed in your transmitter assign to a physical output of your receiver the "CRSF TX" signal and on another physical input of your receiver assign the "CRSF RX" signal. In RX "General" set Telemetry to "ON" and Batt. Sensor to "Off". **VERY IMPORTANT TO AVOID LOW FRAME RATE** despite selecting 150Hz!!!.

6b) For ELRS with the TX LUA app "ExpressLRS" (elrsV3.lua) set as **preferred setup:** Packet Rate = **333Hz Full (16ch)**, Telem Ratio = **1:8**, Switch Mode **16ch Rate/2**, Dynamic Power set to **Off.** Never use Packet Rate F1000 because with this value telemetry (and LUA Integration) cannot work correctly!

7) Connect the receiver power (GND, V+) and the CRSF RX signal assigned to a receiver's input pins to the CH3/S-BUS port of the flight unit.

8) Connect the single wire of CRSF TX signal assigned to a receiver output pins to the signal pin of an adapter cable connected to the SAT1 connector (like MSH51606, MSH51605, or MSH51626; or you can instead use the MSH51623 cable **WITH THE RED WIRE CUT**). **To avoid flight control unit and/or receiver damage NEVER connect RX power voltage to SAT1 !!!**. Possibly you can connect a second ground signal coming from the receiver.

9) In the menu "MDL"->"OUTPUTS" the Center Pulses must be set to 1520 for ALL channels, then the FCU needs to be re-energized.

10) Re-Power your transmitter and your receiver. With the Brain2/iKon2 software, verify in panel 5 ("Transmitter setup") the correct direction of each channel as explained in the side bar instructions (the default channel order is like S.Bus: Futaba "AETR") If necessary, correct it in the transmitter, reversing the channel in the transmitter menu "MDL", "OUTPUTS", "Direction" or "Inverted".

11) With the Brain2/iKon2 software, verify in panel 5 ("Transmitter setup") that you are able to obtain the full -100/+100 travel of ALL control channels. If necessary, correct them in the transmitter, raising or lowering in the menu "MDL" -> "OUTPUTS" the Min/Max values (the "extended limits" checkboxes must be selected and for RadioMaster select also "Enable max. throw" if present).

12) Go in the transmitter "MDL" with "PgUp" select the last submenu "TELEMETRY", here select "Discover new sensors" to discover values sent by receiver and Brain2/iKon2. With OpenTX / EdgeTX the Brain2/iKon2 transmitted sensor values are 4: **RxBt** = Main Battery Voltage (it is advised to change the name to **MBat**), **Curr** = Main Battery Instantaneous Current, **Capa**: Main Battery Current Consumed from Last Power On, **Bat% =** Remaining Battery Percentage. The percentage is calculated based on the mA rating of the used battery entered in the "**mAh Max Usable**" field of Wizard panel 12 and the "**Capa**" value of mAh consumed. If no ESC is used and selected (Nitro / Gasser model) the **RxBt** value is the "**Servo Voltage**" value, **Curr** & **Capa** stay at zero and **Bat%** remain at 100%.

ELRS "Attitude" telemetry (pitch, roll, yaw) are "reused" for other purposes. Pitch is Main rotor RPM sensor, modify: Name=>**RPM**, Unit=>rpm, Precision=>0.-. Roll is Temperature, modify: Name=>**Temp,** Unit=>°C, Precision=>0.0, Ratio=>2550. Yaw is Servo Voltage, modify: Name=>**SVol**, Unit=>V, Ratio=>255. Flight Mode (FM) is Global Vibrations, modify: Name=>**Vibs**.

With a Variometer connected and related checkbox activated also the **VSpd** (Vertical Speed) & **Alt** (Relative Altitude) are recognized.

13) Go in the transmitter "TELE" menu, select "Setup widgets" to display in the main screen the telemetric values you want to see.

14) Check the correct Failsafe configuration, before fly (turning off the transmitter, swashplate must hold, and throttle go off!).

Now you are ready to see telemetry values that you have selected in step 13 for main screen or go in "TELEMETRY" page to see all.

Note1: At Transmitter power-on, the OpenTX / EdgeTX system may need up to 15 seconds to discover all the sensors connected to the receiver that transmit telemetric data other than that transmitted by the receiver.

Note2: Telemetric data's can be also recorded and saved in the SD card of your transmitter.

Note3: With some ESC also using the "mAh Correction" factor the value of **Capa** (& consequently the **Bat%**) can be not repetitive.
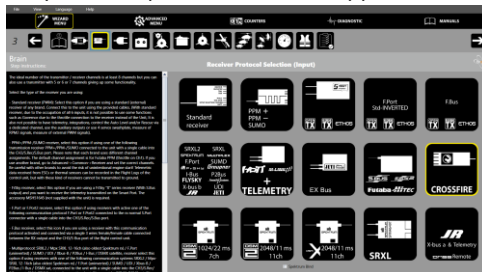
Note4: The telemetry with Crossfire protocol was developed and tested with RadioMaster (TX16S) with EdgeTX firmware version 2.7.0 (F79978b6) of 2022-04-16 and for TBS an external "TBS CROSSFIRE MICRO TX V2" module with HW 2.03 BL 2.05 firmware 6.19, and with TBS CROSSFIRE NANO receiver HW 1.33 BL 2.06 firmware 6.19 and TBS CROSSFIRE MICRO receiver firmware 6.19. For ELRS an external "Ranger Micro 2.4GHZ ELRS" module with FW 3.2.1 CE_LBT and with RP1 & RP2 receivers with FW 3.2.1.

Note5: TBS & ELRS telemetry with Crossfire protocol works only on the new Brain2/iKon2 units that have more power and more useable memory for the large amount of FW code added and the required presence of the integrated FPU.

Use of SRXL2 receivers with OpenTX / EdgeTX transmitters with external or internal MULTI protocol module

You can send the Brain2/iKon2 telemetry (included that read from a connected ESC or a Temperature sensor) and also use Integration, via Receiver that use SRXL2 protocol like SPM4650/1, AR6610T, AR8020T or AR410, AR620 via Smart Throttle CH1 (AR6600T, AR6270T don't have SRXL connector, AR8010T, AR9030T, AR9320T have SRXL connection but are not bidirectional) to any Transmitters brand using OpenTX or EdgeTX OS and an internal or external MULTI-Module.

1) This is not a guide for installing, update and use OpenTX, EdgeTX, Multiprotocol modules, for this purpose, instructions, software, and drivers download and firmware update, refer to the Transmitters and/or OpenTX and/or EdgeTX and/or MULTI-Module websites.

2) Check from your transmitter website that your Transmitter, internal or external Multimodule and Receiver are all updated with latest firmware & software.

3) Select the Internal or external MULTI module to DSM mode and X 2F protocol and 11ms update rate.

4) Connect your Brain2/iKon2 unit via a USB cable to your PC, open the Windows application (see "Prerequisite" pag.0), on the panel 3 "Receiver Protocol Selection" of the Wizard, select the multiprotocol icon with SRXL2 protocol (not the icon with "SRXL" without "2"!!).

5) You must connect the "SRXL2" port of your telemetric receiver (for SPM4650/1 see FAQ#26) to the CH3/S-BUS connector of the FCU with a standard female/female three wire cable (like that supplied with the flight control unit). If you want to have redundancy, you can also connect one or two DSMX satellite to the SAT1 & SAT2 ports.

6) Select the Bind checkbox and follow the bind procedure described in the windows that appear, then, when RX/SAT leds blinks, press the BIND button in the internal or external RF page of the transmitter.

7) In Electric model, to transmit the ESC values, in panel 12 ("Throttle Out & Telemetry & Governor Setup") must be selected the ESC you are using. Read here the page related to your ESC.

8) In the menu "MDL"->"OUTPUTS" the Center Pulses must be set to 1520 for ALL channels, then the FCU needs to be re-energized.

9) Re-Power your transmitter and your receiver. With the Brain2/iKon2 software, verify in panel 5 ("Transmitter setup") the correct direction of each channel as explained in the side bar instructions (the default channel order is like S.Bus: Futaba "AETR") If necessary, correct it in the transmitter, reversing the channel in the transmitter menu "MDL", "OUTPUTS", "Direction" or "Inverted".

10) With the Brain2/iKon2 software, verify in panel 5 ("Transmitter setup") that you are able to obtain the full -100/+100 travel of ALL control channels. If necessary, correct them in the transmitter, raising or lowering in the menu "MDL" -> "OUTPUTS" the Min/Max values (the "extended limits" checkboxes must be selected and for RadioMaster select also "Enable max. throw" if present).

11) Go in the transmitter "MDL" with "PgUp" select the last submenu "TELEMETRY", here select "Discover new sensors" to discover values sent by receiver from Brain2/iKon2. With the actual versions of OpenTX / EdgeTX two kind of the same sensors are recognized. The Spektrum sensors and the ACCST Smart.Port sensors. Everyone can choose to use the ones they prefer and delete the others. Sensors recognized are: **EVIN = RB1V**: Main Battery Voltage, **A2 = RB2V**: Servo Voltage, **Curr = RB1A**: Main Battery Instantaneous Current, **RB1C**: Main Battery Current Consumed from Last Power On, **TFET = RB1T**: ESC Mosfet temperature, **Erpm**: Main rotor RPM (see Note 2), **EOUT**: ESC Power Output that without ESC Governor active is equal to ETHR, **ETHR**: Throttle Input percent, **VBEC**: Only with Kontronik ESC, **CBEC**: Only with Kontronik ESC, **TBEC**: Only with Kontronik ESC. Other sensor are also discovered (2200, 2202, 2204, 2206, 2208, 220A, 220C) but these can be deleted.

12) Go in the transmitter "TELE" menu, select "Setup widgets" to display in the main screen the telemetric values you want to see.

13) Check the correct Failsafe configuration, before fly (turning off the transmitter, swashplate must hold, and throttle go off!).

Now you are ready to see telemetry values that you have selected in step 12 for main screen or go in "TELEMETRY" page to see all.

You can use the last version of open source LUA app "DSM_SmartRX_Tel" to better see Spektrum telemetry and use Integration via TEXT-GEN

You can also use the other LUA app "Brain2 FwdPrg" to use Integration via Spektrum "Forward Programming".

A copy of these LUA app can be found in the "Brain2OpenTX-EdgeTX.zip" package inside the "_SRXL2_MULTI" folder.

Note1: At Transmitter power-on, the OpenTX / EdgeTX system may need up to 15 seconds to discover all the sensors connected to the receiver that transmit telemetric data other than that transmitted by the receiver.

Note2: For RPM, because ratio and sensing divisor (Pulses for rotation) are yet elaborated from Brain2/iKon2 and also because Brain2/iKon2 send RPM with a decimal, but Spektrum don't display decimals, in Transmitter Telemetry menu, for "RPM" and "ESC" sensors set the "Ratio" to 10.00 (to remove the decimal) and let Poles to "Inh".

Note3: Telemetric data's can be also recorded and saved in the SD card of your transmitter.

Note4: With some ESC also using the "mAh Correction" factor the value of Capa (& consequently the Bat%) can be not repetitive.

Note5: The telemetry with SRXL2 protocol was developed and tested with RadioMaster (TX16S) with EdgeTX firmware version 2.9.3 and MULTI module with 1.3.3.20 FW and a SPM4651T receiver with 2.44 FW.

Note6: The last version of the open source LUA app "DSM_SmartRX_Tel" can be found here: DIY-Multiprotocol-TX-Module/Lua_scripts at master · pascallanger/DIY-Multiprotocol-TX-Module (github.com). The LUA "Brain FwdPrg" was released from the same source.

Note7: Telemetry with SRXL2 RX & OpenTX/EdgeTX transmitters with MULTI protocol module works only on new Brain2/iKon2 units that have more power and more memory for the large amount of FW code added and the required presence of the integrated FPU.

Use of HoTT receivers with OpenTX / EdgeTX transmitters with external or internal MULTI protocol module

You can send the Brain2/iKon2 telemetry (included that read from a connected ESC) and use Integration, via Receiver that use HoTT SUMD protocol like GR12, GR-16, GR24 to any Transmitters brand using OpenTX or EdgeTX OS and an internal or external MULTI-Module.

1) This is not a guide for installing, update and use OpenTX, EdgeTX, Multiprotocol modules, for this purpose, instructions, software, and drivers download and firmware update, refer to the Transmitters and/or OpenTX and/or EdgeTX and/or MULTI-Module websites. You must check from your transmitter website that your Transmitter, and internal or external Multimodule and the Receiver are all updated with the latest firmware & software (for multimodule the "AIR" FW must be used because EU-LBT FW don't have the "HoTT" protocol).

2) Set the Internal or external MULTI module Mode to "HoTT" and RF Protocol to "Sync".

3) Connect your Brain2/iKon2 unit via a USB cable to your PC, open the Windows application (see "Prerequisite" pag.0), on the panel 3 "Receiver Protocol Selection" of the Wizard, select the HoTT+ Telemetry icon.
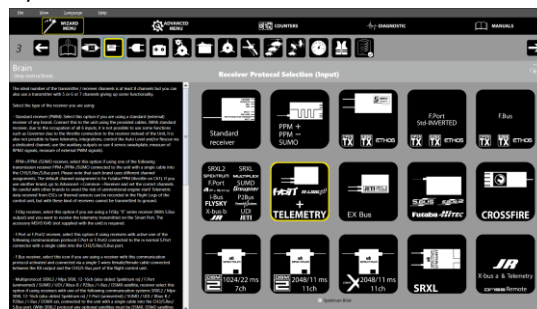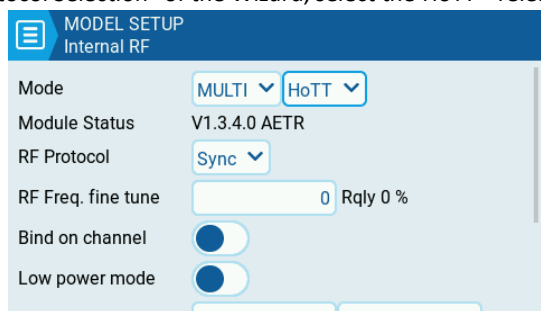
4) See paragraph 4 on page 10 of this document.
5) See paragraph 5 on page 10 of this document.
6) See paragraph 6 on page 10 of this document.
7) See paragraph 7 on page 10 of this document.
8) See paragraph 8 on page 10 of this document.

9) Power your transmitter and your receiver. On the transmitter, push MDL key, go in the menus MODEL SETUP => Internal RF (or External RF (if your multimodule is external), with "HoTT" protocol selected, then press on the receiver the BIND button, when RX leds blinks, press the BIND button in the internal RF (or external) MULTI module of the transmitter.

10) In Electric model, to transmit the ESC values, in panel 12 ("Throttle Out & Telemetry & Governor Setup") must be selected the ESC you are using. Read here the page related to your ESC.

11) In the menu "MDL"->"OUTPUTS" the Center Pulses must be set to 1520 for <u>ALL</u> channels, then the FCU needs to be re-energized.

12) Re-Power your transmitter and your receiver. With the Brain2/iKon2 software, verify in panel 5 ("Transmitter setup") the correct direction of each channel as explained in the side bar instructions (with a multimodule "AETR" firmware, the default channel order is like Graupner HoTT) If necessary, correct it in the transmitter, reversing the channel in the transmitter menu "MDL", "OUTPUTS", "Direction".

13) With the Brain2/iKon2 software, verify in panel 5 ("Transmitter setup") that you can obtain the full -100/+100 travel of ALL control channels. If necessary, correct them in the transmitter, raising or lowering in the menu "MDL" -> "OUTPUTS" the Min/Max values (it is not required to activate the "extended limits" checkbox).

14) Go in the transmitter "MDL" with "PgUp" select the last submenu "TELEMETRY", here select "Discover new sensors" to discover values sent by receiver from Brain2/iKon2. Other than the Receiver sensors (Rxxx with **Rbt**: that correspond to the BEC & Servo Voltage), there are also the ESC sensors (ESxx). Everyone can choose to use the ones they prefer and delete the others. Sensors recognized are: **ESu1**: Main Battery Voltage, **ESi1**: Main Battery Instantaneous Current, **EScp**: Main Battery Current Consumed from Last Power On, **ESt1**: ESC MosFET temperature, **ESrp**: Main rotor RPM (see Note 2), **EOUT**: ESC Power Output that without ESC Governor active is equal to Throttle value. Other sensors are also discovered (ESu2, ESi2, ESt2, ESt3) but these can be deleted.

15) Go in the transmitter "TELE" menu, select "Setup widgets" to display in the main screen the telemetric values you want to see.

17) Check the correct Failsafe configuration, before flying (turning off the transmitter, swashplate must hold, and throttle go off!).

Now you are ready to see telemetry values that you have selected in step 15 for main screen or go in "TELEMETRY" page to see all.

You can use the last version of open-source LUA app "Graupner HoTT" to use Integration. Refer to the "HoTT Integration" document.

For HoTT, there is also the Lua application "Multi channels namer" with its required file "MultiChan.txt" and the "Graupner HoTT Model Locator" Lua application to help to find the model position.

A copy of these LUA apps can be found in the "Brain2OpenTX-EdgeTX.zip" package inside the "_HoTT_MULTI" folder.

Note1: At Transmitter power-on, the OpenTX / EdgeTX system may need up to 30 seconds to discover all the sensors connected to the receiver that transmit telemetric data other than that transmitted by the receiver.

Note2: For Main Rotor RPM, because motor pulses divisors (Pulses For Rotation & Main Gear Ratio) are yet elaborated from Brain2/iKon2, in Transmitter Telemetry menu, for "**ESrp**" sensor set the "Blades/Poles" and "Multiplier" to 1.

Note3: Telemetric data's can be also recorded and saved in the SD card of your transmitter.

Note4: With some ESC also using the "mAh Correction" factor the value of "**EScp**" can be not precise and repetitive.

Note5: The telemetry with HoTT protocol was tested with RadioMaster (TX16S) with EdgeTX firmware version 2.10.5 and MULTI module with "AIR" 1.3.4.0 AETR FW (EU-LBT FW don't have the "HoTT" protocol), and a GR-16 receiver with 7070 FW.

Note6: The last version of the open source LUA app "Graupner HoTT" "Multi channels namer" with his required file "MultiChan.txt" and the "Graupner HoTT Model Locator", can be found here: DIY-Multiprotocol-TX-Module/Lua_scripts at master · pascallanger/DIY-Multiprotocol-TX-Module (github.com).

Note7: Telemetry with HoTT RX & OpenTX/EdgeTX transmitters with MULTI protocol module works only on new Brain2/iKon2 units that have more power and more memory for the large amount of FW code added and the required presence of the integrated FPU.

With JR Xbus A, you can see RPM & ESC live data's in the main screen of your transmitter and set alarms:

You can use the ESC telemetry sent by the Brain2/iKon2, with every kind of JR standard Receiver. Telemetry don't work with DMSS remote receiver. If you want to use JR sensors other than that emulated by the Brain2/iKon2, it is necessary to use one or more "Y" cables on the "BAT" connector of the RX.

1) Verify on the JR web site that your transmitter and your receivers are updated with the latest version of the firmware (for software download, instructions for the use, and for the firmware update, refer to the JR instructions).

2) Connect your Brain2/iKon2 unit via a USB cable to your PC, open the Windows application (see "Prerequisite" pag.0), on the panel 3 ("Receiver Protocol Selection") of the wizard, select the "JR Xbus A" receiver kind icon.
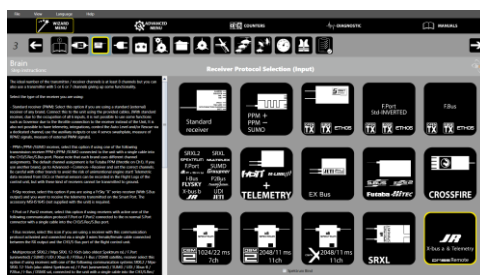
3) If you want to transmit the ESC values, in panel 12 "Throttle Out & Governor Setup", must be selected the ESC you are using.

4) Per the schematic in panel 4 ("Connections"), connect a standard 3-pole female/female cable like that supplied with Brain2/iKon2 to the CH3/S-BUS connector of Brain2 and the other end in the "BAT" port of your JR receiver.

5) Using another standard 3-pole female/female cable like that supplied with the Brain2/iKon2 units, cut away 5mm of the central red wire near either the two connectors (the remaining red wire only keeps the black and white wires together, but you can also totally remove the red wire and twist black and white wires together).

*** IF YOU DON'T DO THIS, YOU MAY BURN YOUR Brain2/iKon2 UNIT AND/OR YOUR RECEIVER!!!! ***

6) Connect one end of the cable to a GOV adapter cable (like MSH51606, MSH51605, or MSH51626. or you can instead use the MSH51623 accessory cable **WITH THE RED WIRE CUT)**.

7) Connect the small JST connector of the adapter cable to the lateral SAT1 connector of the Brain2/iKon2.

8) Connect the standard connector of this modified cable to the "XBUS" port of your JR receiver.

9) For bind of the receiver with your transmitter follow the JR instructions of your receiver and transmitter. For recent JR receiver with XBUS & EZ Bind function: Power your transmitter, go in the "XBUS SETTING" menu and select MODE A, then go to in the "BIND & RANGE" menus and select "BIND" then you can power your receiver (via the Flight control unit powering) for automatic binding via EZ Bind System. If your receiver need a bind plug for binding, first verify that it is an XBUS receiver.

10) With the Brain2/iKon2 software, verify in panel 5 ("Transmitter setup") the correct direction of each channel as explained in the side bar instructions. If necessary, correct it in the transmitter, reversing the channel in the transmitter menu "REVERSE SWITCH".

11) With Brain2/iKon2 software, verify in panel 5 ("Transmitter setup") that you are able to obtain full travel of all control channels. If necessary, correct them in transmitter, raising or lowering the percentage values in the "TRAVEL ADJUST" menu.

Now you are ready to use JR <-> Brain2/iKon2 telemetry.

Note1: Differently from other brands, the consumed current telemetry work subtracting the consumed current of the model from a maximum value that must be set in the transmitter.

Note2: Note that differently from other brands, the RPM displayed is divided by 1000, so not very useful for model helicopter RC.

Note3: At Transmitter power-on, the JR system needs at least 5 seconds to discover all the sensors connected to the receiver that transmit telemetric data other than that transmitted by the receiver.

Note4: To change from Celsius to Fahrenheit and vice versa, change this in TX Setup.

Note5: Development and test were done with JR MATRIX transmitter with FW VER:0001-0008 & RG012BX receiver.

Note6: JR telemetry works only on the new Brain2/iKon2 units that have more power and more usable memory.

Use of PowerBox PBR-xx receivers with Core / Atom transmitters

You can send the Brain2/iKon2 telemetry (included that read from a connected ESC) and use Integration, via Receiver that use P^2Bus protocol like PBR-9D, PBR-10SL, PBR-5S/XS or PBR-7S, PBR-26D/S, PBR-12X, via P^2Bus. If the transmitter has the Multiplex M-Link module option added, you can also use Multiplex receivers (for this refer also to page 11).

1) This is not a guide for use PowerBox Transmitters and receivers, for this purpose, instructions, software, and drivers download and firmware update, refer to the Transmitters and/or PowerBoxSystem / Multiplex websites.

2) Check from your transmitter website that your Transmitter and Receiver are all updated with the latest firmware & software.

3) Select the Internal module to P^2Bus mode.

4) Connect your Brain2/iKon2 unit via a USB cable to your PC, open the Windows application (see "Prerequisite" pag.0), on the panel 3 "Receiver Protocol Selection" of the Wizard, select the multiprotocol icon with P^2Bus protocol.

5) As explained in the schematics of successive panel 4 of the wizard, you must connect the "P^2Bus" port of your telemetric receiver to the CH3/S-BUS connector of the FCU with a standard female/female three wire cable (like that supplied with the flight control unit).

6) Power on the transmitter and swipe down on the screen and select the first left icon (main menu), then select the Receiver icon, then select "Bind" and when displayed, power on the Receiver powering the Flight Control Unit from the Servo Bus.

7a) In Electric models, to transmit the ESC values, in panel 12 of the wizard ("Throttle Out & Telemetry & Governor Setup") must be selected the ESC you are using. Read here the page related to your ESC.

7b) In Combustion models, to transmit the Motor temperature, in panel 12 of the wizard ("Throttle Out & Telemetry & Governor Setup") must be selected the Temperature sensor you are using. Read here the page 4 related to your Temperature sensor

8) In the "Servos" menu the Center Pulses must be left to 0 for ALL channels (= 1520us).

9) Re-Power your transmitter and your receiver. With the Brain2/iKon2 software, verify in panel 5 ("Transmitter setup") the correct direction of each channel as explained in the side bar instructions. If necessary, correct it in the transmitter, reversing the channel in the transmitter menu "Servos" ("Norm" or "Rev").

10) With the Brain2/iKon2 software, verify in panel 5 ("Transmitter setup") that you can obtain the full -100/+100 travel of ALL control channels. If necessary, correct them in the transmitter, raising or lowering in the menu "Servos" the Min/Max values

11) Go to Home main page and keep selected a free zone of the display, a menu appears where you can select the "Telemetry" icon. With "+" you can add a telemetry value: As "Sensor" you must select "Brain2 sensors A", and as value you can choose one of the lists of values sent by receiver from Brain2/iKon2. Everyone can choose to display on the main screen the ones they prefer. Sensors recognized are: **Main Battery Voltage**, **Main Battery Instantaneous Current**, **Main Battery Current Consumed from Last Power On**, **Main Battery Ripple, ESC Power Output** (that without ESC Governor active is equal to Throttle input %), **Temperature1** (from ESC or Temperature sensor), **Temperature2** (from ESC, BEC or Temperature sensor), **BEC Current** (Only with Kontronik & YGE ESC), **Servo Voltage** (the same of BEC voltage), **Main rotor RPM** (see Note 2), **Global Vibrations**, **Tail Rotor RPM**, **External PWM**. Then for each sensor you can set an alarm (EG: max temperature, max current, min Voltage, max consumed mAh, etc.).

12) Return to Home screen to display in the screen the telemetric values you have added, move it, delete it or add another sensor.

13) Check the correct Failsafe configuration, before flying (turning off the transmitter, swashplate must hold, and throttle go off!).

Now you are ready to see telemetry values that you have selected in step 12 for home screens.

Note1: At Transmitter power-on, the PowerBoxSystem may need up to 2 minutes to scan and discover all the sensors connected to the receiver that transmit telemetric data other than that transmitted by the receiver.

Note2: For Main rotor RPM, sensing divisors ("Pulses For Rotation" of motor and "Main Gear Ratio") are elaborated from Brain2/iKon2.

Note3: Telemetric data can be also recorded and saved in your transmitter (Telemetry logging function).

Note4: With some ESC, also using the "mAh Correction" factor, the value of mAh can be not repetitive and precise.

Note5: The telemetry with P^2Bus protocol was developed and tested with Atom transmitter with OS 1.0, Application 3.20, CoreStart script 5, Transcriver 1.44, Stickcontroller 1.7 and a PBR-9D receiver with 4.1 FW.

Note6: Telemetry with P^2Bus RX & PowerBoxSystem transmitters works only on new Brain2/iKon2 units that have more power and more memory for the large amount of FW code added and the required presence of the integrated FPU.