

README for data's logging and telemetry transmission with Brain2/iKon2 (Vers.2.3 2019 June 10):

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 log 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 Bus) 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 Flight Log memory to be able to do a post flight analysis. If ESC telemetry and governor are either active Brain2/iKon2 can also reduce by ~20% 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.

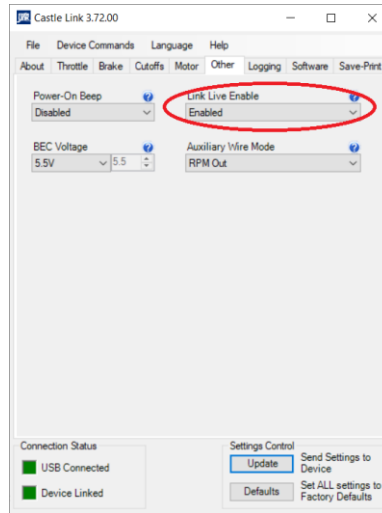
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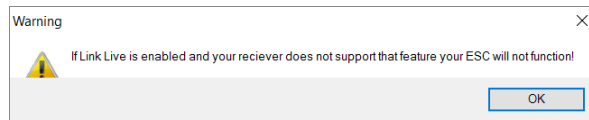
Castle Creation, Hobbywing, Scorpion, Kontronik, YGE, Jeti, Spektrum, Futaba, S.Bus, FrSky, Smart Port, Open TX, Multiplex, M-Link, MSB, are all trademark of the respective company.

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");



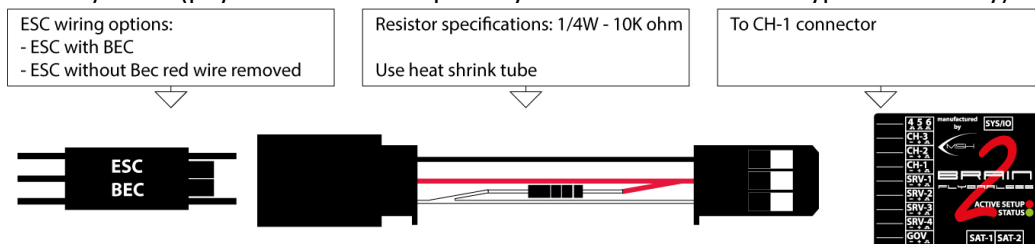
The following message appears:



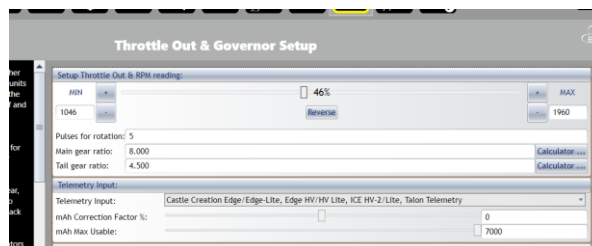
This means that you must activate also the Brain2/iKon2 for this function otherwise the throttle signal is no more read/recognized from the ESC.

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" 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 logs.

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

With Hobbywing (at least V4 series) or Kontronik (JIVE series) or Scorpion (Tribunus series) or YGE (*VT series) ESC's:

1) **With HOBBYWING PLATINUM V4, FLYFUN V5 or SCORPION TRIBUNUS or YGE *VT ESC:** You must have the newest ESC firmware (check and if needed update with Multifunction LCD program box and Hobbywing USB Link software for Hobbywing or use Scorpion Software for Tribunus. For YGE connection and protocol to select, read last page of YGE ESC manuals. **With Tribunus ESC,** set Communication to “Unsc Telem”). 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 4-5-6 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:**

Note: **Align ESC** send telemetry data only if updated with the new ASBOX USB Link V1.0.5. software to the new firmware. 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 conn. **With 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 remain 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).**

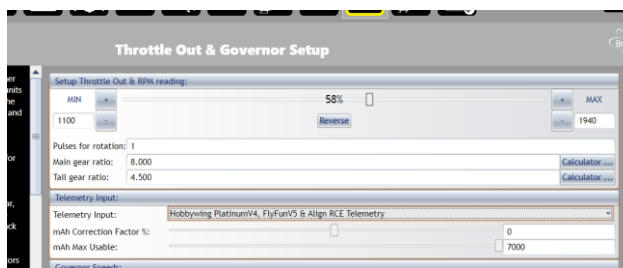
With KONTRONIK KOSMIK / JIVE PRO / KOLIBRI: Is needed at least the new ESC firmware version 4.12. Connect a special cable with on one side a single wire in the center pin of a 5 pin connector, in to the central 5 pin sockets of the ESC, at the other end connect only the wire to central pin 5 of “4-5-6” Brain2 servo connector (see below image “A”). For FrSky pag.8

Image A: The **pin 5** of the Brain2/iKon2 connector “4-5-6” (the middle/central pin).



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 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 “BRAIN”, go to the panel 12 “Governor setup” of the 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 Telemetry”.



3) Now in “DIAGNOSTIC” -> “Parameter setting”, you can select the following ESC values you want monitor in real time or in recorded logs.

Loggable Values	Unit	Castle Creation	Hobbywing	Kontronik Jive/Heli Jive	Kontronik Kosmik/Kolibri	Scorpion Tribunus	YGE *VT
ESC Main Battery Volt	V	X	X	X	X	X	X
ESC Main Battery Current	A	X (not Talon)	X (no if=<60A V4)	X	X	X	X
ESC Main Battery mAh used	mAh	calculated by Brain	calculated by Brain	calculated by Brain	calculated by ESC	calculated by ESC	calculated by ESC
ESC Power Out	%	X	X	X	X	X	X
Temperature1	C°	ESC Mosfet	ESC Mosfet	ESC Mosfet	ESC Mosfet	ESC Mosfet	ESC Mosfet
Temperature2	C°		ESC Capacitors		BEC temperature		BEC temperature
ESC Main Battery Ripple	V	X	X	X	X	X	X
ESC BEC Current	mA				only Kosmik & Kolibri		only HVT versions
ESC LS RPM(CC max 2500)	rpm	MAX 2500 !!	X	X	X	X	X

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 useable memory for the large amount of FW code added and the required presence of the integrated FPU.

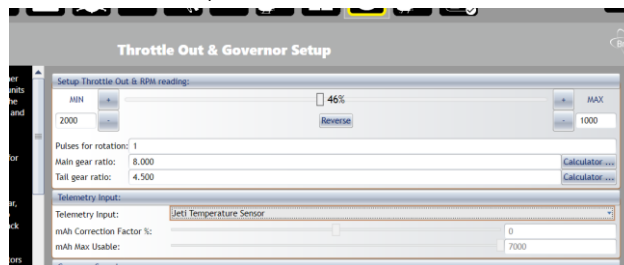
For Nitro/Gasser, the engine temperature transmitted by telemetry using a Jeti or Futaba digital temperature sensor:

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 “ARXXXOT” 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.Bus. Using a receiver not compatible with the Smart.Bus 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) Only with the 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 value in the Brain2/iKon2 log 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 (CH4 and CH6 must remain free). The other “power” connector with only (black/brown and red wires) must be connected in to 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”, 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 “ESC Temperature 1” and this value is also telemetric sent to ground (to the transmitter).

Note1: The **SBS-01T** Futaba sensor have 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: With “FrSky” protocol, only the JETI **MT300EX** temperature sensor can be used (the **SBS-01T** Futaba sensor cannot work because any FrSky actually don't have a S.Bus2 telemetric port to connect the sensor to, but only the S.Bus port).

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-Sum, Spektrum satellites, X-Bus/M-Link/HoTT/SRXL) the temperature value is not transmitted but anyway logged in the Brain2/iKon2 log memory together the other parameters selected.

Using Spektrum RX with bidirectional 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 or SRXL v2 port. Actually, the only working are SPM4649T & SPM4650 (AR6600T, AR6270T don't have SRXL connector, AR8010T, AR9030T, AR9320T have SRXL connection but are not bidirectional). Transmitters enabled for all the new telemetry sensor are DX6E, DX6 G2/G3, DX8 G2, DX9, iX12, DX18 G1/G2, and DX20 DX7G2 and DX10t DX18t and QQ variants. 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 SPM4649T must be updated at least to the 1.1rc10 firmware;
- 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, select the "Spektrum SRXL" receiver kind icon for SPM4649T or SUMD/UDI/Xbus-B/SRXLv2 icon for SPM4650;
- 4) If you want to transmit the ESC values, in panel 12 ("Throttle & 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.rec connector of the FBL with a standard female/female three wire cable. If you want have redundancy, you can also connect a DSMX satellite to the SAT1 & SAT2 ports.;
- 6) Before binding to the receiver, in the Transmitter, the system type must be set to either "DSMX" and "11mS" frame rate;
- 7) Click on the "Spektrum Bind" checkbox of "Receiver 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
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 **
* read from ESC sensor			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 logs because they are redundant and received from ESC at low sample rate. In the Brain2/iKon2 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 "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 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.

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

- 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, on the panel 3 ("Receiver 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 & Governor Setup") must be selected the ESC you are using;
- 4) You must connect the "Sbus2" port of your FASSTest receiver to the CH3/s.rec 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 FASSTest 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) -> Select slot 16 and choose "CASTLE-TL0" as the sensor. This will automatically allocate the next 7 slots to "CASTLE-TL0" for a total of 8 slots;
- 8b) To enable telemetry in your T18SZ transmitter select "Linkage menu" -> "Sensor" - (page 2) -> tap the "-----" in slot 16 and 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;
- 9) To enable additional 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);
- 10) Other than the "CURR-1678", you can also enable "TEMP125" (or "TEMP-F1713") sensor in slot27 for ESC temperature and "SBS-01R/O in slot28 for RPM (leave POLE set to 1 as default). It can be useful on Nitro/Gasser/Turbine models (for RPM) or if you are using T10J transmitter, that with actual old FW don't have "CASTLE TL0";
- 11) There are 4 selectable telemetry parameters 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 logs because they are redundant and received from ESC at low sample rate. In the Brain2/iKon2 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: Futaba has not yet implemented a Hobbywing ESC sensor, so 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 ratio and sensing divisor (Pulses for rotation) are yet elaborated from Brain2/iKon2, in the Transmitter leave POLE set to 1 (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 in to 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.

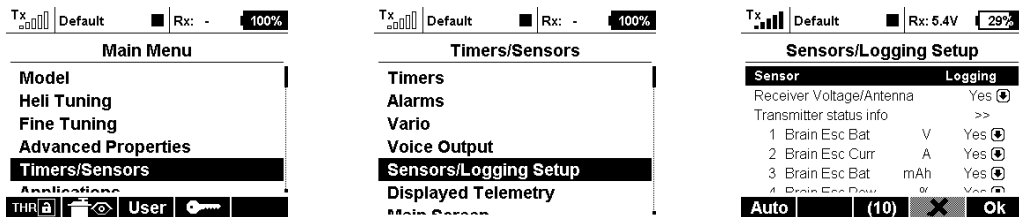
Note12: Futaba telemetry work only on the new Brain2/iKon2 units that have more power and more useable memory for the large amount of FW code added and the required presence of the integrated FPU.

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.

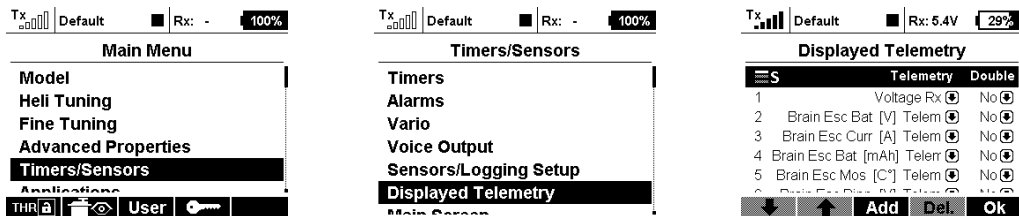
For Integration, see the "Jeti Integration instructions" pdf document;

- 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, on the panel 3 ("Receiver 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-REC 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, on the panel 3 ("Receiver Selection") of the wizard, select the "HoTT + Telemetry" 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) 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-REC 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 "RCV" 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 (11 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);
- 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.

With FrSky transmitters + FrSky RX with Smart Port, 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 FrSky Receiver that use Smart Port for telemetry (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 "- + S" connector of the receiver. Compatible Transmitters are the FrSky transmitters.

- 1) 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, select the "FrSky" receiver kind icon;



- 2) If you want to transmit the ESC values, in panel 12 ("Throttle & Governor Setup") must be selected the ESC you are using. **Note that with FrSky protocol the ESC (or temperature) telemetry cable must be connected to pin 6 of port 4-5-6 and not to 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-REC connector of the Brain2/iKon2 that work as TELEMETRIC IN/OUT port;

- 4) Using ONLY the adapter cable **MSH51645**, connect the standard connector of the adapter cable to the SBUS port of your FrSky "X" receiver and connect the small 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 Brain2/iKon2 UNIT AND/OR YOUR RECEIVER!!!! *****

- 5) Power your TX, go to MDL, MODEL SETUP, Internal RF, Mode=D16, Receiver No.=01, select Bind. Keeping pushed the "f/s" key, power your receiver to Bind it to the transmitter model that is active in the transmitter. Cycle power of RX;

- 6) 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 "MDL", "OUTPUTS", "Direction";

- 7) 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;

- 8) 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). 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 unused, and can be deleted after the discover;

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

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

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

Note1: At Transmitter power-on, the OpenTX 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" between "Metric" and "Imperial".

Note3: Other than the RX sensor ID 25 for **RSSI & RxBt**, to emulate sensors the following sensor ID's are used: 12 for **RB1C & RB2C**, 13 for **Tmp1**, 17 for **Tmp2**, 18 for **VFAS**, 3 for **Curr**, 5 for **RPM**. If you connect other external sensors on the Smart Bus, change their ID if one or more of the sensors uses one of these ID to avoid communication conflict.

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

Note5: The FrSky 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.

Note6: FrSky 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:

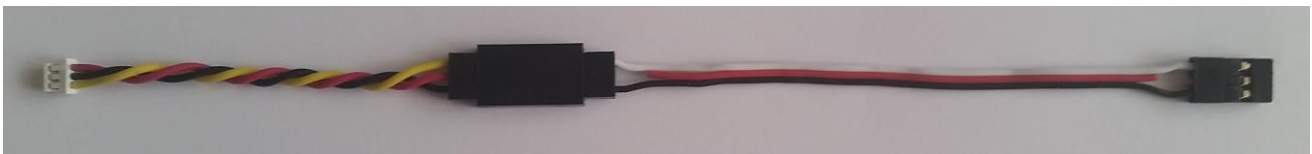
You can use the ESC telemetry sent by the Brain2/iKon2, with every telemetric M-Link Receiver. If you want to use sensors other than that emulated by the Brain2/iKon2, it is necessary to use one or more "Y" cables on the "S" RX connector.

- 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, on the panel 3 ("Receiver 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 & 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-REC 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".

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