README for data's logging and telemetry with BRAIN2 (Vers.1.7 2017 November 2):

Introduction:
With Electric models that use ESC able to send telemetric value to the Brain2, 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 log memory at a higher rate (50Hz).

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 (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 from the motor RPM sensor connected to the Brain2 "GOV" port and converted by Pole Count and Gear Ratio in to main rotor RPM (sensor needed for telemetry transmission also if you don't use the Brain2 as governor). With some Radio System's (EG: Jeti) is also possible to transmit from Brain2 to ground (Transmitter) also all other selectable and loggable Brain2 parameters.

With Radio systems or receivers that are not enabled for telemetry transmission, it is still useful activate the ESC telemetry transmission to Brain2 because Brain2 can log all these useful data's in his log memory to be able to do a post flight analysis. If ESC telemetry and governor are either active Brain2 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 skipped. For non-telemetric receiver/transmitter (PPM receivers, Spektrum sat's, X-Bus, M-Link, etc.) the Radio System section can be skipped.

INDEX:

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

Castle Creation, Hobbywing, Scorpion, Kontronik, Jeti, Spektrum, Futaba, S.Bus, FrSky, Smart Port, Open TX, 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 Brain 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;
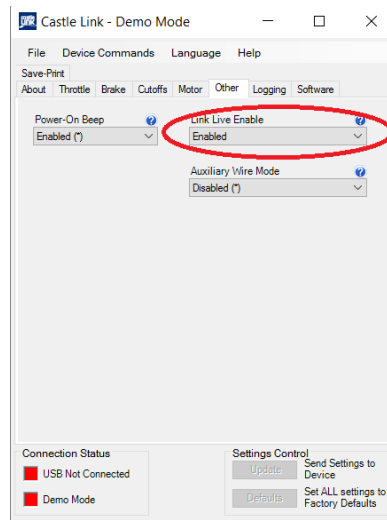

The following message appears:
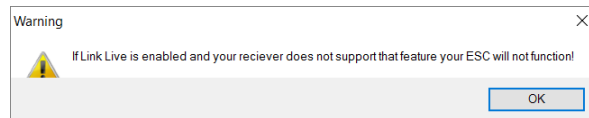
This means that you must activate also the Brain2 for this function otherwise the throttle signal is no more read/recognized from the ESC.
Before closing the program, remember to push the "Send Settings to Device" button, otherwise the new setting is not saved to the ESC;

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 (pay attention to the polarity if the connector is the type without key):
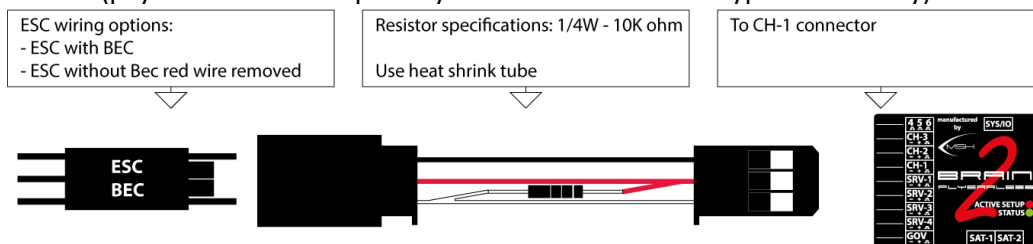
3) Connect your Brain2 to the PC via USB cable. In the Windows PC, start the interface software "BRAIN" and go to the panel 12 "Governor setup" of the wizard. In the "ESC Telemetry" drop down, select "Castle Creation telemetry". Note: at this point the refresh rate of the throttle speed up going from 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 (only V4 series) or Kontronik (JIVE series) or Scorpion (Tribunus series) or YGE (LVT series) ESC's:

1) With HOBBYWING PLATINUM V4, FLYFUN V5 or SCORPION TRIBUNUS or YGE LVT 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. With Tribunus ESC, set Communication to "Unsc Telem"). Connect a std. 3 pole female/female cable to the auxiliary ESC port marked "- + P" (or "- + S") and at the other end, connect only the signal wire (white or orange) to pin5 of 4-5-6 connector (seem 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 also if similar to the HW are not the same. Align ESC don't have currently any telemetry function. If you try to update an Align ESC using the HW software/firmware, is possible that your ESC brick.

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 (seem 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 / KOLIBRI / JIVE PRO / KONTROL-X ESC: Is needed the new ESC firmware version 4.11. Connect the special cable with a single wire in the center pin of 5 pin connector on one side to one of the 5 pin sockets of the ESC, at the other end connect only the central wire to pin5 of 4-5-6 connector (seem below image "A").

Image A: The **pin 5** of the Brain2 connector "4-5-6" (the middle/central pin).
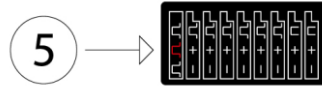
Suggestion: due to the high impedance of these telemetric ports, keep the telemetric and RPM wires far away from other cables (especially, from the motor wires) to avoid electromagnetic field coupling".

2) Connect your Brain2 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 "ESC Telemetry" select:
"Hobbywing telemetry" for Hobbywing ESC or "Kontronik telemetry" for Kontronik ESC or "Scorpion telemetry" for Scorpion ESC.
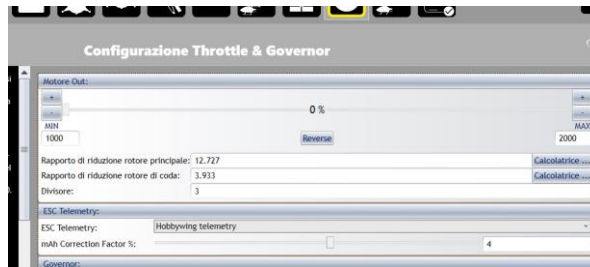
3) Now in "DIAGNOSTIC" -> "Parameter setting", you can select the following ESC values you want monitor in real time or in recorded logs.

Loggable Values	Unit	Castle Creation	Hobbywing	Kontronik Jive/Heli Jive	Scorpion Tribunus	Kontronik Kosmik/Kolibri
ESC Main Battery Volt	V	X	X	X	X	X
ESC Main Battery Current	A	X (not Talon)	X (not 60A V4)	X	X	X
ESC Main Battery mA used	mAh	calculated by Brain	calculated by Brain	calculated by Brain	calculated by ESC	calculated by ESC
ESC Power Out	%	X	X	X	X	X
ESC Temperature1	C°	X	ESC Mosfet	X	X	X
ESC Temperature2(only HW)	C°		ESC Capacitors			BEC temperature
ESC Main Battery Ripple(CC-KK)	V	X	X	X	X	X
ESC LS RPM(CC max 2500)	rpm	MAX 2500 !!	X	X	X	X
ESC BEC Current(only Kosmik)	mA					X

Note1: The HOBBYWING PLATINUM V4 "OPTO" versions (100A OPTO, 130A OPTO and 200A OPTO) need a specific / special HOBBYWING double opto isolator adaptor being released from HOBBYWING (100A and 130A not OPTO versions don't need this adaptor). Only for 130A OPTO this opto isolator is needed also for the RPM connection to the Brain2.

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 Tribunus ESC, start only after "at least" 10 seconds from power on.

Note5: ESC telemetry works only on the new Brain2 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 SRXL you can see ESC live data's in the transmitter and set alarms:

1) You must have a Spektrum telemetric receiver with a bidirectional SRXL port. Actually, the only working is SPM4649T (AR6600T, AR6270T don't have SRXL connector, AR8010T, AR9030T, AR9320T have SRXL connection but are not bidirectional). Transmitter enabled for all the new telemetry sensor are DX6E, DX6 G2/G3, DX8 G2, DX9, 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;

2) Your Transmitter must be updated at least with the last AirWare firmware and voices (actually firmware 1.20 and voices 1.09 released at 2017-July-11). Your SPM4649T must be updated at least to the 1.1rc9 firmware;

3) You must select "Spektrum SRXL" receiver type in the panel 3 "Receiver Selection" of the FBL configuration software wizard;

4) In panel 12 of the wizard ("Throttle & Governor Setup" panel) select 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;

6) Before binding to the receiver, in the Transmitter, the system type must be set to either "DSMX" and "11mS" frame rate;

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;

8) 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 Brain logs because they are redundant and received from ESC at low sample rate. In the Brain 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 pole count 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 measured on Servo Voltage rail which RX is connected.

Note3: For RPM, because ratio and sensing divisor (pole count) are yet elaborated from Brain and also because Brain send RPM with a decimal, 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 sensor and PowerBox 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 in to 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: Development and test are done with DX9 Black with AirWare 1.20, voices 1.09 & SPM4649T receiver with 1.1rc9 fw.

Note10: Spektrum telemetry work only on the new Brain2 units that have more power and more useable memory for the large amount of FW code added.

Using Futaba T-FHSS or FASSTest & S.Bus2 you can see 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, 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, only "CASTLE-TL0" sensor isn't available in the TX sensor list;

2) In the FBL configuration software wizard, select "S.Bus/S.Bus2" receiver type in the panel 3 "Receiver Selection";

3) In panel 12 of the wizard ("Throttle & Governor Setup" panel) select 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;

6) In your transmitter, after binding to the receiver, you must see the receiver serial number or "Receiver ID" in the display. This data is found in your 14SG transmitter by double tapping "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) With T10J transmitter, that with actual old FW don't have "CASTLE TL0", other than the "CURR-1678", you can also enable "TEMP125" sensor in slot27 for ESC temperature and "SBS-01R/O in slot28 for RPM (leave POLE set to 1 as default);

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 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 Brain logs because they are redundant and received from ESC at low sample rate. In the Brain 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 pole count must be set in the unit).

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, BEC Current, or Main Battery Ripple. So, these parameters always display "0.00/----" and are disabled.

Note6: 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.

Note7: 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.

Note8: For temperatures, to change the displayed values from Celsius to Fahrenheit, go in to the transmitter menu SYS -> DISPLAY -> UNIT SYS.: here is possible to change from "METRIC" (Celsius) to "YARD/PUND" (Fahrenheit) and vice versa.

Note9: 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.

Note10: The FUTABA telemetry was developed and tested with FUTABA transmitter T14SG firmware 6.00 Nov 10 2015, with a R7008SB receiver.

Note11: Futaba telemetry work only on the new Brain2 units that have more power and more useable memory for the large amount of FW code added.

**With JETI, you can also see these ESC live data's in the main screen of your transmitter and set alarms:**

You can use the telemetry sent by Brain (included that of ESC) and the integration with every kind of Ex-Bus Receiver, otherwise if you want to use other sensor than that emulated by Brain and also the Jeti Integration, is necessary to use a REX receiver. For Integration, see the "Jeti Integration instructions" pdf document;

1) 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 Brain 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);

2) Connect your Brain2 unit via USB cable to your PC, open the Windows application, update Brain software and firmware to the last version;

3) In "Receiver Selection" wizard, select "EX Bus" receiver type;

4) If you want to transmit also the ESC values, go in panel 12 of the wizard ("Throttle & Governor Setup" panel) and select the ESC you are using;

5) You can send to your transmitter up to 10 data parameters which may be selected in "DIAGNOSTIC" -> "Parameter setting" (excluded: Servo Voltage yet transmitted by default by the receivers and DSMX fades);

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;
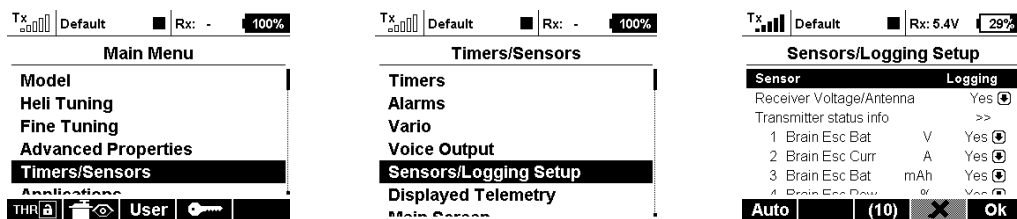
Note: Lacking in the Jeti protocol a command to delete the transmitter recorded sensors, if you change the logged values or also only their position in the "Diagnostic" -> "Parameter setting" of the software/app, or with the Jeti integration itself, you must manually redo the AUTO/discover procedure;

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;
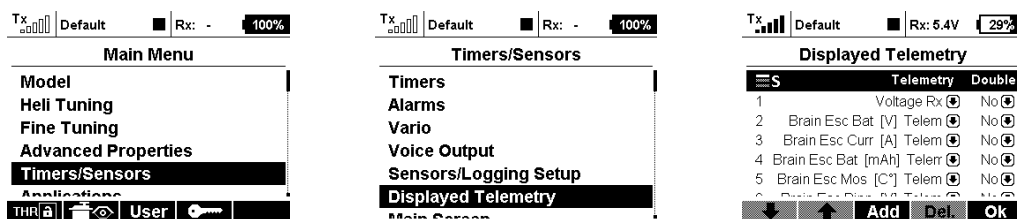
8) You can also set alarms (sound-voice and/or vibration) when the received telemetry values excess of the thresholds you set. For example, when the current consumed by the main battery has exceeded a certain value, or if the temperature has exceeded a certain value or if the battery voltage has fallen 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 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.

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 in to 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 units that have more power and more useable memory for the large amount of FW code added.

With Graupner, you can also see these ESC live data's in the main screen of your transmitter and set alarms:

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

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 unit via a USB cable to your PC, open the Windows application, and update the Brain2 software and firmware to the latest version (leave the software open);

3) With the Windows application, on the panel 3 ("Receiver Selection") of the wizard, select the "HoTT + Telemetry" receiver type icon;

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

5) Using another standard 3-pole female/female cable like that supplied with the Brain2 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 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 a 3-pole female/male cable **WITH THE RED WIRE CUT** with MSH51623);

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 GOV adapter cable to the lateral SAT1 connector of the Brain2;

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 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 (11 channels are sufficient to use all the Brain2 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 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 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 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.

README for BRAIN2 TELEMETRY on FrSky/OpenTX transmitters:

You can use the telemetry sent by the Brain2 (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, it is necessary to use one "Y" cable on the "- + S" connector of the receiver.

Compatible Transmitters are FrSky Horus (X12S and X10S and X10), Taranis Q X7 and Q X7S.

1) Transmitters must use OpenTX (at least the first official version 2.2.0) firmware. This is not a guide for installing, update and use OpenTX on transmitter, for this purpose, instructions, software and drivers download and firmware update, refer to either the FrSky and OpenTX websites). Using the OpenTX program "Companion", after it updates itself (Help -> Check for Updates), verify that your transmitter is updated with the latest version of the OpenTX (is needed a 2.2.0 version with LUAC checkbox activated). Check also from FrSky website that your receiver is updated with last firmware;

2) Connect your Brain2 unit via a USB cable to your PC, open the Windows application, and update the Brain2 software and firmware to the latest version (leave the software open);

3) With the Windows application, on the panel 3 ("Receiver Selection") of the wizard, select the "OpenTX" receiver kind icon;

4) Per the schematic in panel 4 ("Connections"), connect a standard 3-pole female/female cable like that supplied with the Brain2 to the CH3/S-REC connector of the Brain2 and the other end in the Smart Port "- + S" of your "X" receiver;

5) Using ONLY the adapter cable **MSH51645**, connect the small JST connector of the adapter cable to the lateral SAT1 connector of the Brain2, connect to the other end of the adapter cable to the SBUS port of your FrSky "X" receiver;
   ### *** DON'T USE OTHER CABLE, OTHERWISE, YOU MAY BURN YOUR BRAIN2 UNIT AND/OR YOUR RECEIVER!!!! ***

6) 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;

7) Power your transmitter and your receiver. With the Brain2 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";

8) With the Brain2 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;

9) Go in the transmitter "MDL" with "PgUp" select the last submenu "TELEMETRY", here select "Discover new sensors" to discover values sent by Brain2 (and the other eventually connected on the Smart Port bus);

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

11) To activate the ESC telemetry, select the ESC you are using in panel 12 (under "MANUALS" see the ESC pdf document that explain how connect your ESC to the Brain2 and to activate the reception of the ESC telemetry) **note that with OpenTX protocol the ESC telemetry cable must be connected to pin 6 of port 4-5-6 and not to pin 5**.

Now you are ready to see OpenTX telemetry values that you have selected in step 12 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: Telemetric data's can be also recorded and saved in the SD card of your transmitter.

Note4: 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.

Note5: Due to the big amount of FW code to load and use, OpenTX telemetry works only on the new Brain2 units that have more memory for the additional FW code and more power to execute.