The ESC (Electronic Speed Controller) is an essential part of every unmanned aerial vehicle (UAV) that uses BLDC (Brush-Less Direct Current) motors. ESC is used to deliver electrical energy from the battery to the coils of the BLDC motors. According to the input signal, rotation speed of BLDC motor is controlled with a timed three-phase electrical signal. The ESC microcontroller (MCU) has a pre-installed firmware. The vast majority of the ESCs uses BLHeli_S or BLHeli_32 firmwares. Each firmware version uses its dedicated configuration applications for parameter settings. In this case the BLHeliSuite and BLHeliSuite32 software tools are presented. First, the BLHeli USB programmer is needed to communicate ESC's MCU with PC or laptop. In Figure 1 the connection of the ESC and PC is schematically presented.

NOTE:

- disassembled propellers from the BLDC motors are recommended before any programming operation;

- connect GND of the USB programmer with GND of the ESC;

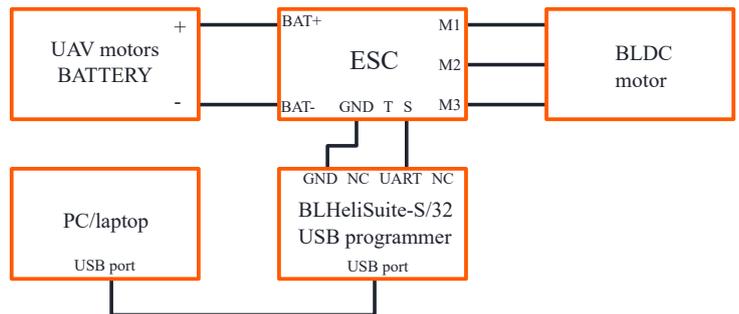- follow the recommended programming procedure below.

Figure 1: Schematic connection of the ESC and PC/laptop.

Figure 2 shows interface of the BLHeliSuite and BLHeliSuite32 configuration software. The software tools are accessible online for download. To connect and set parameters of an ESCs [a) BLHeli_32 | b) BLHeli_S]:

1. a) Select BLHeli_32 Interface – BLHeli32 Bootloader (USB/Com).

   b) Select ATMEL/SILABS Interface – SILABS BLHeli Bootloader (USB/Com).

2. Connect ESC to BLHeliSuite-S/32 USB programmer ports.

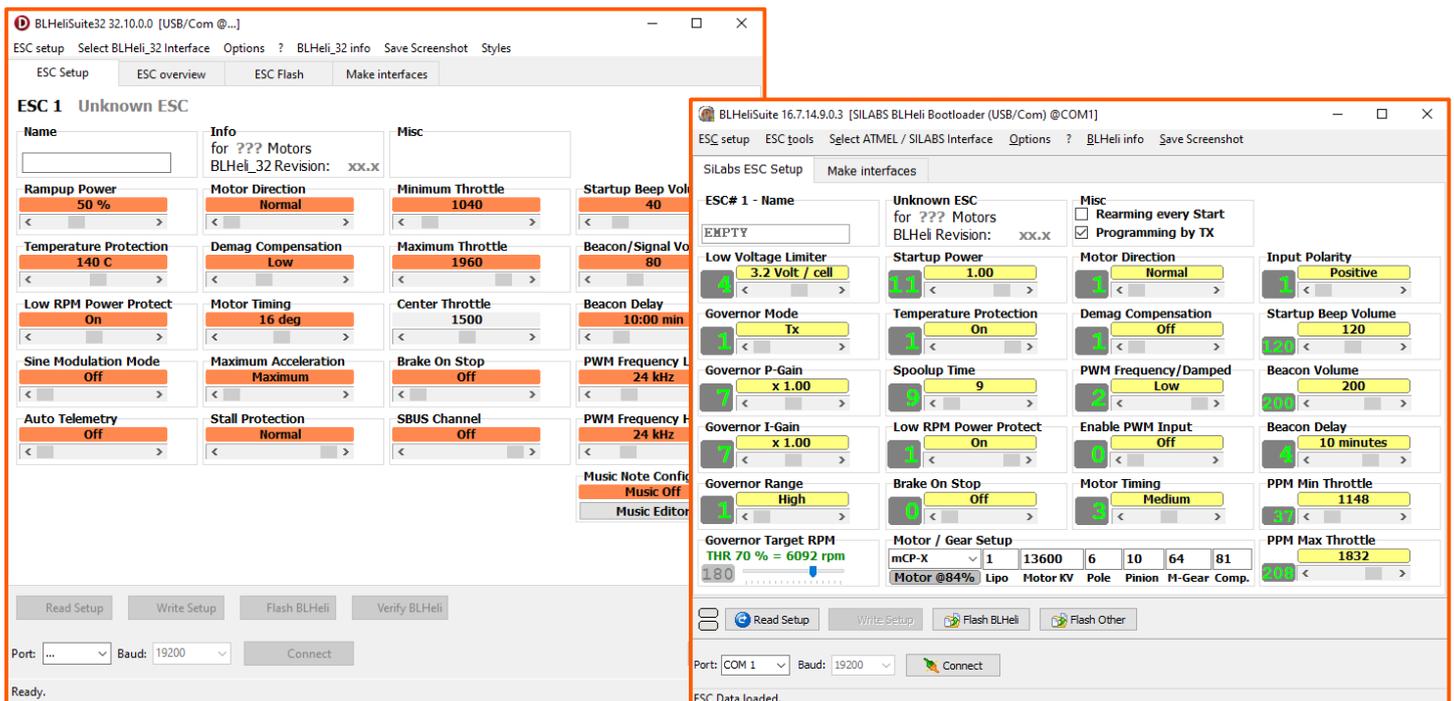3. Connect BLHeliSuite-S/32 USB programmer to the COM port of the PC.

Figure 2: View on the BLHeliSuite32 configurator (left) and BLHeliSuite configurator (right) after oppening specific program.

4. Select 'Port' and select 'Baud' (set to same baud as is specified in Device Manager – Port Settings).

5. Click on 'Connect' button.

6. Click on 'Read Setup' (factory settings of connected ESC will appear).

7. Change needed parameters, possibly Flash ESC to newest firmware (i.e. see settings in Table 1 and in Figure 3).

8. Click on 'Write Setup'.

9. Click on 'Save Screenshot' to save configuration for later modifications.

10. Click on 'Disconnect' and disconnect ESC from USB programmer.

Table 1 shows some of the relevant ESC parameters and their factorials, as well as the DRONTECHLAB default settings. In this case, two different ESCs mostly used by DRONTECHLAB are presented.

Table 1: Some of the factory and DRONTECHLAB default ESC parameters settings.

Parameter name (BlHeli32|BlHeliS)	ESC parameter value			
	SKYSTARS SL40A (BlHeli32)		GRAUPNER UC 30A (BlHeliS)	
	Factory	DRONTECHLAB	Factory	DRONTECHLAB
Motor Direction	Normal	Normal/Reversed[1]	Normal	Normal/Reversed[1]
Motor Timing	16 deg	24 deg	Medium	MediumHigh
Minimum Throttle| PPM Min Throttle	1040	1018[2]	1148	1016[2]
Maximum Throttle| PPM Max Throttle	1960	2007[2]	1832	2008[2]
PWM frequency Low	24 kHz	72 kHz	-	-
PWM frequency High	24 kHz	72 kHz	-	-
LED Control	Off|Off|Off	Off|On|Off	Off|Off|Off	Off|On|Off

[1] Motor Direction has to be set according to UAV motor location and acctual rotation direction.
[2] Minimum and maximum Throttle PPM will be set automatically during calibration procedure.
NOTE: Parameters vary according to the used ESC, motor and propeller!
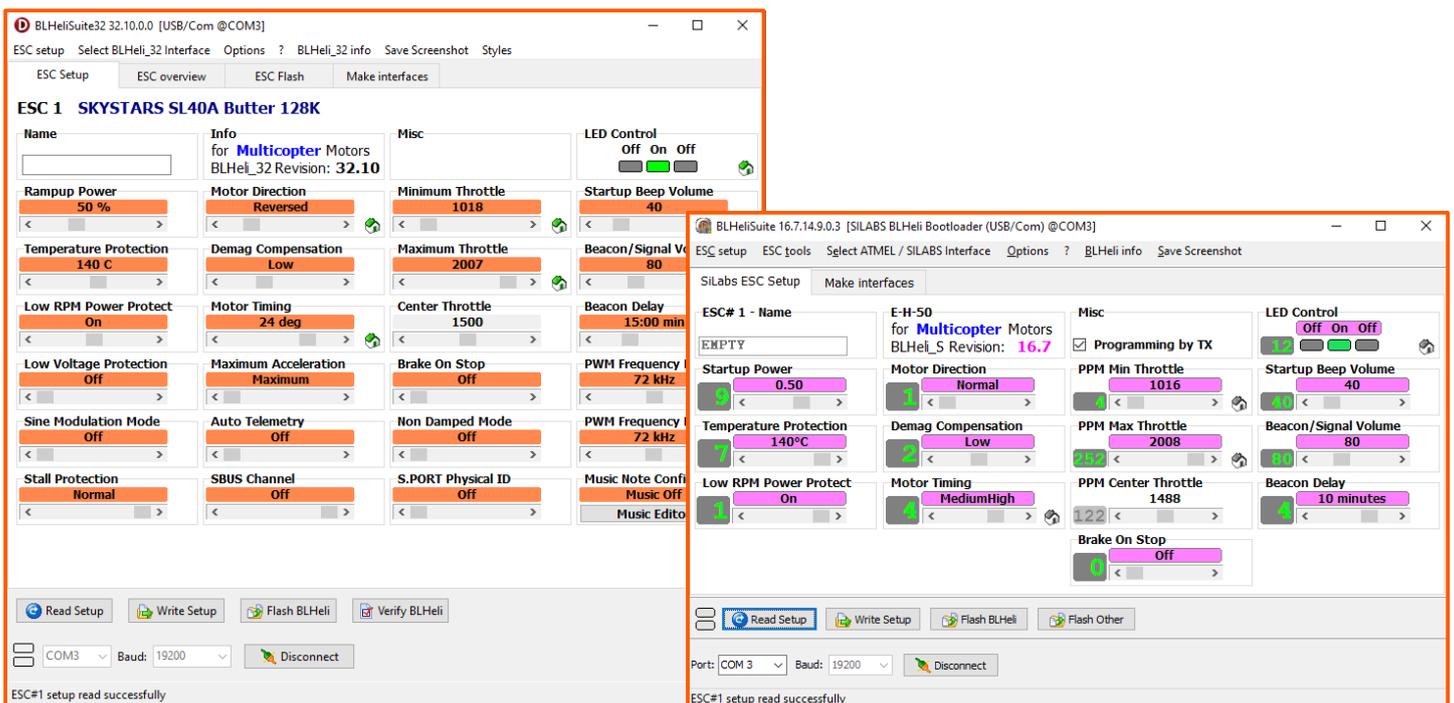

Figure 3: ESCs' settings set by DRONTECHLAB in BLHeliSuite32 configurator (left) and BLHeliSuite configurator (right).