# BAFANG BBS SERIES ELECTRIC BICYCLE CONTROLLER PROGRAMMING

Connection

To connect to the controller of your electric bicycle from Bafang BBS series you need a PC, USB to Serial adapter and some wires with small female pin connectors at the end. You can also but an "original" USB programming cable but it is just overpriced USB to Serial adapter with the proper connector for the cable on your BBS controller.

The cable you need to connect to is the one between the motor (controller is inside the motor casing) and the LCD. When you disconnect it, you will see a green color inside (this might change in future). The picture on the left below shows how this connector looks like. You need to connect to the cable going to your motor, not the LCD.
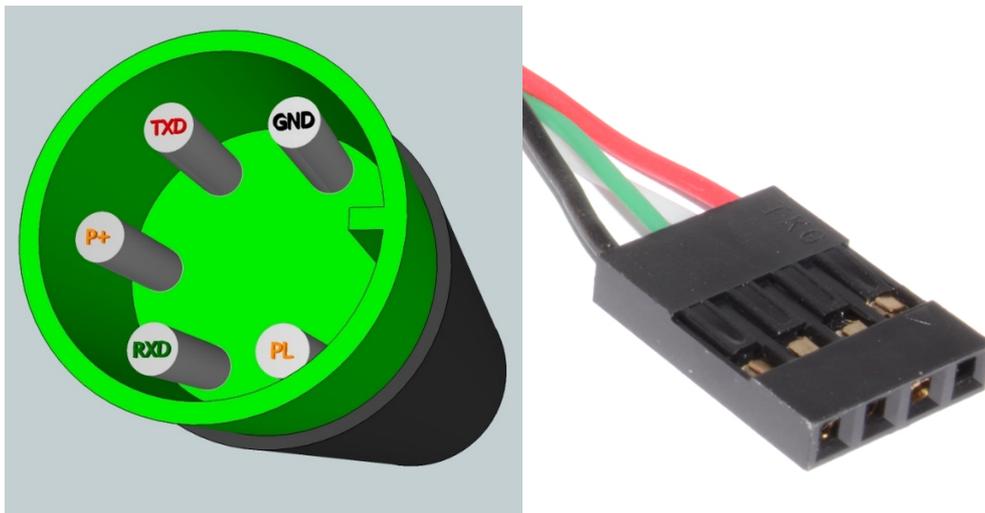
The picture on the right shows what kind of cable you need from your USB to Serial adapter. You need to remove the plastic header and insulate the individual pins preferably with a heatshrink. You will also need one short wire with the same pins on both ends, again insulated properly. Insulation is extremely important because P+ and PL pins will be

connected directly to your battery and its voltage is 36V or 48V, which will damage your USB to Serial adapter or even your PC if you are not careful.

The connection between the BBS controller (the green connector from the picture) and the USB to Serial adapter is the following:

Controller side		USB to Serial adapter side
GND	——	GND
TXD	——	RXD (Rx)
RXD	——	TXD (Tx)
P+		
PL		

Pay attention to the connection of TXD and RXD! TXD on the controller side is connected to RXD on adapter side and vice versa. Otherwise connection cannot be established.

Make sure to disconnect the battery before connecting the USB to Serial adapter to avoid any damage to it, to your PC and to your BBS controller. Before continuing use handheld multimeter to check if the wire between P+ and PL lines is shorted to any of the other wires. If it is, fix the short circuit.

After you are sure you connected safely your BBS controller to your PC check in Device Manager to make sure that your adapter is listed as a COM port. If it isn't install the proper drivers. If you use one of the common adapters, Windows automatically installs drivers for those since XP version.

Connect the battery to your BBS controller. Be careful with the throttle handle if you have one! The controller will be activated by the connection you made between P+ and PL lines. If you activate the throttle handle your bike will start moving, which can end with a lot of damage to your equipment.

Start BafangConfigTool.exe and select the correct COM port, then click on the Connect button. Connection should be established, some general information will be read and displayed at the right side of the program and you will be able to read the flash memory of your controller or write to it a configuration profile you created before.

BASIC Settings

This tab allows you to change the basic settings of your BBS controller.

Low Battery Protection [V] – This is the voltage at which the controller will stop the motor to keep your battery safe from over-discharge. It should be set by the manufacturer properly and you don't need to change it. For 13S battery packs 41V is the default.

Current Limit [A] – This is the maximum current allowed the flow through the motor. It your motor is 25A for example you can set it to 20A to keep it safe if you want. It is not recommended to set higher current than the nominal. Even set at 25A the peak current will be higher so you better not set more than that.

Assist 0 ÷ Assist 9 – Those are all possible assist settings (both for pedal assist and throttle handle using one of those). It is important to mention the Assist 0 current and speed limits must be set to 1 if you want to be able to use your throttle handle with PAS0 selected on

your LCD. Usually Assist 0 is set to 0 so you can use your bicycle without assistance if you want. Be careful setting these levels. If you set the current too low the motor won't be able to move the bicycle and it might suffer some damage. If you set the first assist level current too high then the acceleration at start will be significant. This might damage the internal gears or make you fall of your bicycle. The speed limit sets at what speed (% of the maximum speed set from your LCD) the motor will reduce its power and just keep that speed instead of accelerating more.
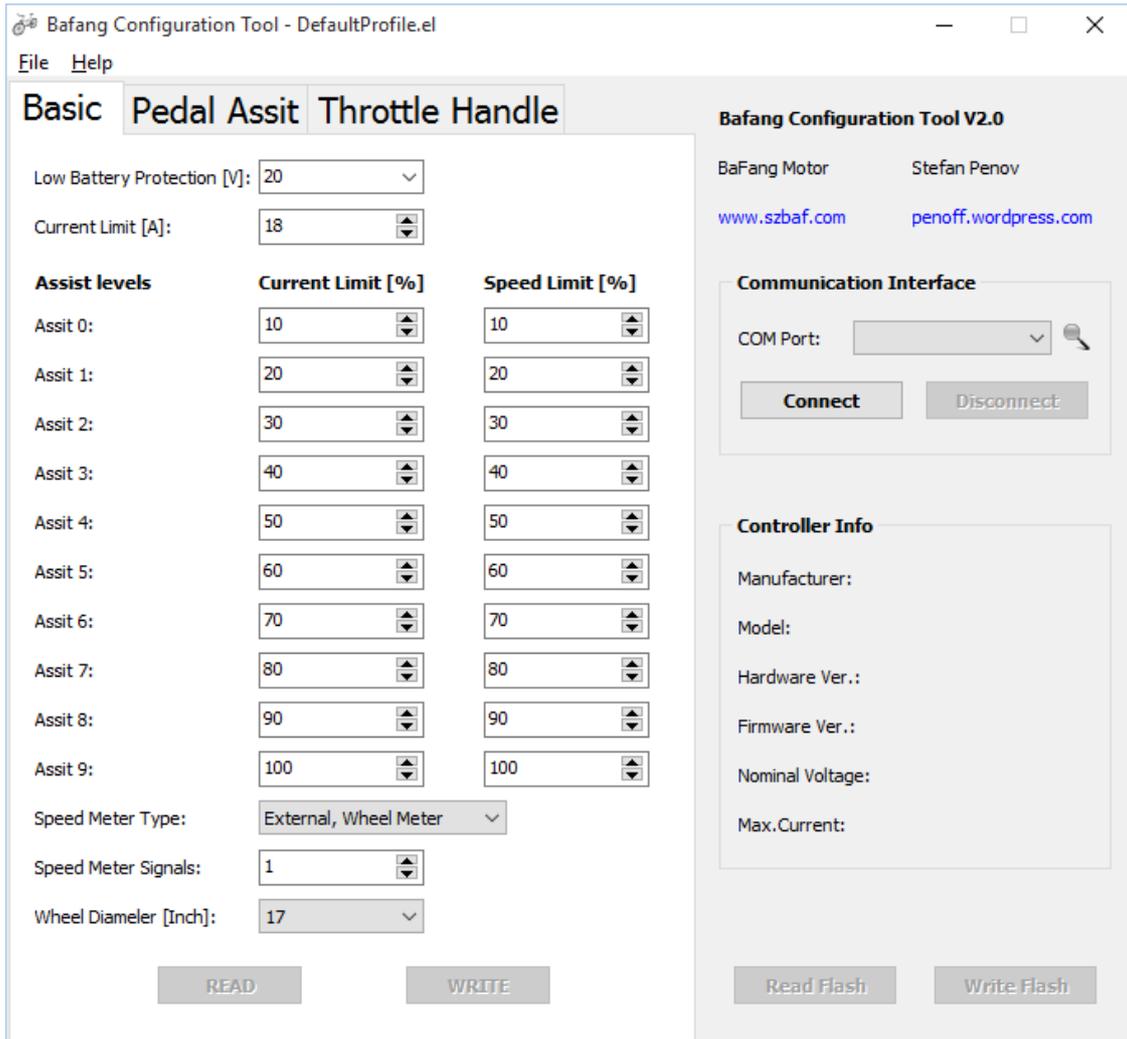
Speed Meter Type – This one selects the speed meter used on your bicycle. For BBS kits it is external. This parameter is set by the manufacturer and if your setup is not custom then you don't need to change it.

Speed Meter Signals – Here you can set how many signal per revolution your sensor generates. If you use the external sensor with magnet it generates one signal per wheel revolution. This parameter is set by the manufacturer and if your setup is not custom then you don't need to change it.

Wheel Diameter [inch] – The wheel diameter should match the size of your drive wheel (hence your bicycle could have two different sized wheels). Setting the diameter to a smaller size than it really is will increase your speed but also can easily lead to motor damage.

When you are finished with tuning your Basic settings you can use the WRITE button in this tab of the program to write them to your controller. You can also use the READ button at any time to read those (this will replace all values at the Basic tab). This will not overwrite any other settings. If you use the buttons on the right – Read Flash and Write Flash, those read and write the full list of settings (Basic, Pedal Assist and Throttle Handle) so be careful.

Pedal Assist settings

Pedal Assist system assists you while you are pedaling. At this tab you can tune its performance. Some of those you shouldn't change as they are specific to your kit. Those are set by the manufacturer.

Pedal Sensor Type – This parameter selects the pedal rotation sensor type. It is set by the manufacturer and should not be changed.

Designated Assist Level – You have two type of operation selected with this parameter. First is "By Display's Command". This means that the assist level (the one from the Basic settings tab) will be selected from your LCD. The second option is to choose a specific assist level which will be fixed and you will not be able to change that from the LCD. For this you can select any assist level from 0 to 9.

Speed Limit – This is the maximum speed at which the motor will provide additional acceleration. When the speed is reached it will only keep it but won't accelerate more. If you set this parameter to "By Display's Command" you will be able to set the speed from your LCD. Keep in mind that some LCDs allow you to set speed of 99km/h which is not possible at least with the current BBS kits. As far as I have tested the maximum speed without pedaling is 40km/h (when the wheel size is set correctly). This setting is used for all assist levels you see in the Basic tab. If you set this to 40km/h (in this program or from your LCD) and your Assist 5 level is set to 50% speed then you will be able to reach 20km/h at that assist level.

Start Current [%] – This is the startup current when you start rotating the pedals. It is good to set this to at least 10% to make sure the bicycle will start moving and the motor won't be stalled. Setting this to very high value will make the bicycle accelerate very fast at start which might damage its internal gears and also the motor. Recommended value is one between 10% and 30%. You should also make sure you don't start pedaling at a too high gear which will load the motor too much.

Slow-start Mode (1-8) – This setting controls how quickly the start current is reached. You can make your bicycle accelerate smoothly and make it respond quickly. A value around 4 usually works well for normal cycling. If you are mountain-biker then setting to a low value will make the acceleration faster which might be useful but you should be careful not to fry your controller and motor.
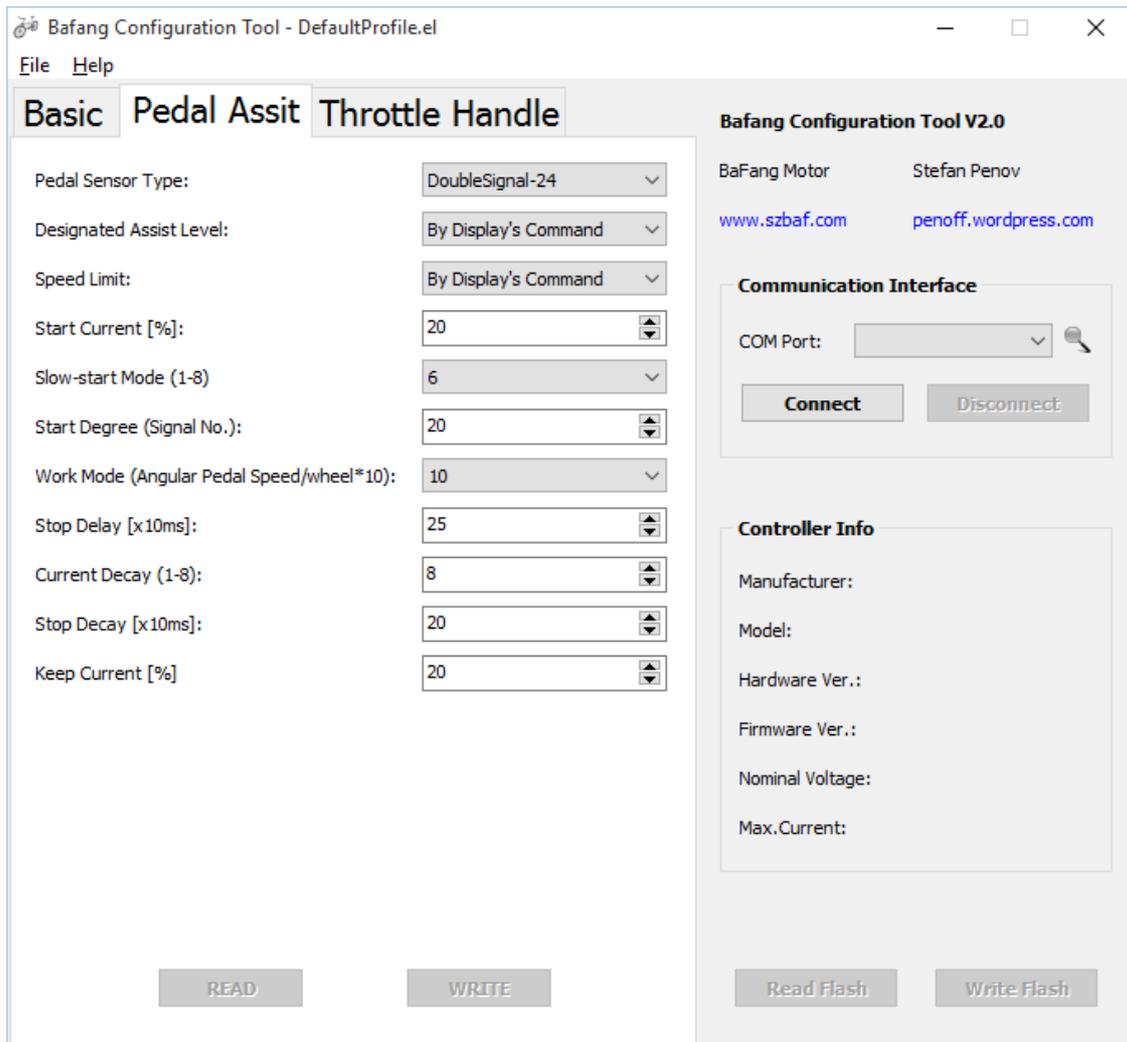
Start Degree (Signal No.) – This parameter sets how many pulses from the pedal sensor are needed before the motor starts. Full pedal revolution on BBS kits generates 24 pulses. Setting this to 0 or 1 will not work. A value around 4 works well as it doesn't start with just a small move and also doesn't require too much rotation.

Work Mode (Angular Pedal Speed / Wheel * 10) – This parameter's purpose is not very clear. It is supposed to control the power according to pedal rotation speed. The value set by manufacturer seems to work just fine so you don't need to change it.

Stop Delay [x10ms] – This is the delay after you stop pedaling before the motor stops. Keep in mind the x10. If you set it to 100 this will lead to 1 second delay. Value of 25 (250ms) works well.

Current Decay (1-8) – This parameter sets how fast the current drops when you are pedaling fasted and are reaching the maximum speed at the selected assist level. Lower value means the current will start to drop at lower speed.

Stop Decay [x10ms] – The amount of time it takes the motor to stop.

Keep Current [%] – This setting controls the percentage of the maximum current at the selected assist level which will be flowing through the motor when you reach the maximum

speed and keep pedaling. So if your maximum current is 25A and you use PAS5 set to 50% current then you will have maximum current of 12.5A for this assist level. Then if Keep Current is set to 50% when the maximum speed is reached and you continue pedaling the current will be kept at 6.25A. This ensures smooth transition to assist power when you reduce the pedaling speed and the moving speed drops below the maximum.

When you are finished with tuning your Pedal Assist settings you can use the WRITE button in this tab of the program to write them to your controller. You can also use the READ button at any time to read those (this will replace all values at the Pedal Assist tab). This will not overwrite any other settings. If you use the buttons on the right – Read Flash and Write Flash, those read and write the full list of settings (Basic, Pedal Assist and Throttle Handle) so be careful.

Throttle Handle settings

If your kit is equipped with throttle handle than this tab allows you to configure its operation. Make sure that Assis 0 is set to 1 (both current and speed) if you want to use it when PAS0 is selected on your LCD.

Start Voltage [x100mV] – This is the throttle handle output voltage at which the motor will start. The minimum at which the controller responds is 1.1V so you should set this parameter to 11 (11x100mV=1.1V).
End Voltage [x100mV] – This is the throttle handle output voltage at which the motor will reach its maximum power (limited by other settings). The maximum accepted from the controller is 4.2V (42x100mV=4.2V). You need to play a little with this parameter as the throttle handle maximum can be different depending on model. If you set this parameter too low you will get almost no response from the throttle handle. When you set it to the maximum that the handle can produce you will get the widest possible range of control over motor power.
Mode – This is the operation mode of the throttle handle. You have two options: speed and current. When set to speed it the controller uses the moving speed to set the motor power according to the position of the throttle handle. Unfortunately there is significant delay because of the way the speed is measured and the response is pretty bad in this mode. When set to current, the handle controls the motor current according to its position. This mode works better and similar to a car operation.
Designated Assist Level – You can set this to "By Display's Command" or select a fixed level. The first option uses the PAS setting from your LCD. This means that the maximum power output and speed depend on the PAS level selected and the position of the throttle handle. So if a low PAS is selected the maximum current and speed will be low too even if you push the throttle to maximum. If a fixed assist level is selected for this parameter the throttle handle will use its maximum current and speed. Be careful if you set this to level 9 not to push the throttle to max when stopped because the high current and the power could damage you controller and motor.
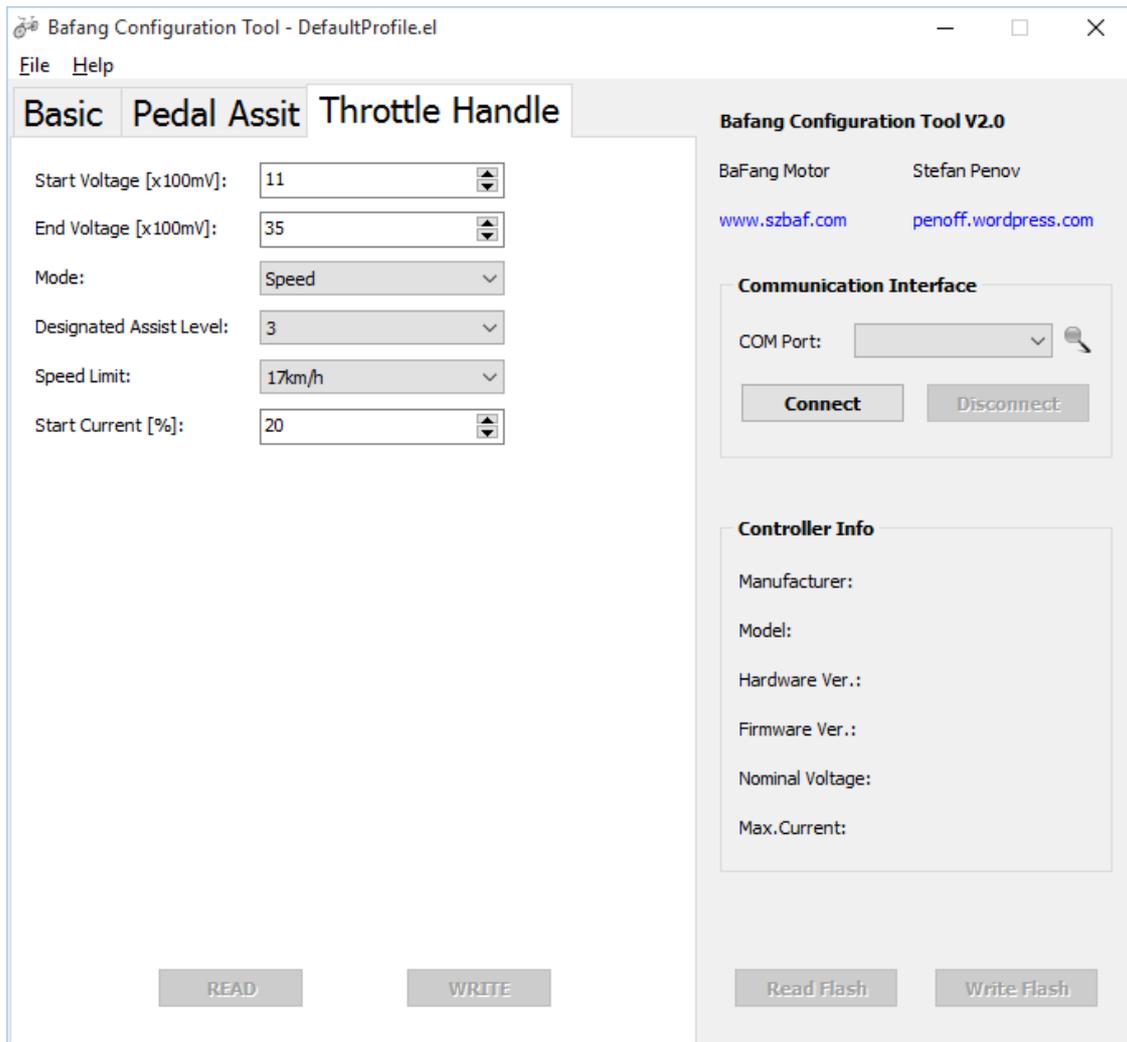
Speed Limit – With this parameter you can limit the maximum speed when using the throttle handle. This overwrites the designated assist level maximum speed if it is higher.
Start Current [%] – This is the percentage of maximum current applied to the motor when the throttle handle generates the minimum accepted voltage. Usually value of 10% or 20% works well. If your maximum current at the Basic tab is set to 25A and Start Current is set to 10% you will get 2.5A start current. This will lead to smooth start and will not load the internal gears too much. If you set this parameter to very high value you can damage the internal gears and the motor.

When you are finished with tuning your Throttle Handle settings you can use the WRITE button in this tab of the program to write them to your controller. You can also use the READ button at any time to read those (this will replace all values at the Throttle Handle tab). This will not overwrite any other settings. If you use the buttons on the right – Read Flash and Write Flash, those read and write the full list of settings (Basic, Pedal Assist and Throttle Handle) so be careful.

Other functions

From the File menu you have the option to save profiles currently edited, also save them to new files or load already existing profiles. Those are fully compatible with the original Bafang software.

From the Help menu you can reach this file you are reading at the moment and some information about the program.

Final words

This program is provided as it is. I am not responsible for the damage you could do to your bicycle, to yourself, to your PC or anything else if you don't use it properly or make mistakes. You are free to improve the program if you like but keep sharing it as an open source and keep the information about my work visible to users.

Future versions of Bafang's kits might be supported but since I have no way of testing that I cannot confirm any compatibility besides the current BBS kits (BBS01 and BBS02).

Cycle safe and take care for other on the roads!