TSDZ2 w/860C OSF Upgrade V20.1C.4 update 3 Features and configuration

CAUTION:

- Before flashing, if there is already an older version on the display, make a note of the Odometer value, so that it can be entered in the new version.
- Battery Setting. Do not exceed 15 Amps (36 Volts battery), 12 Amps (48 Volts battery), 10 Amps (52 Volts battery) or you run the risk of overheating your motor.
- Always use the same firmware version for both the TSDZ2 motor controller and display!
- Before using the TSDZ2 and display with new firmware, you must correctly configure the options on the display. For example, you should configure your battery's low voltage cut-off so as not to over-discharge the battery. Do set all other parameters also to ensure proper operation.
- When installing new firmware, always check that no unwanted functions have become enabled or disabled during the install process.
- It is recommended that when installing OSF V20.1C configuring the display and motor using this guide that you take safety precautions. You should have the rear wheel off the ground in case the motor activates. For extra precaution, you should install brake cutoffs and have them easily accessible as well as be ready to disconnect or cut off power to the battery.
- Each time the display is turned on, do not touch the pedals for at least 5 seconds, until the system finishes booting...
- Never connect or disconnect the charger from the battery with mains power applied. Always connect or disconnect mains power before connecting or disconnecting the battery.

860C Display Navigation

Main screen

NOTE: The display has 3 different main screens with customized numeric and graph fields on each main screen. You can change the information/variables shown on these customized fields.

- Turn on/off: POWER long-press,
- Change assist level: UP or DOWN click
- Change assist mode: At level 0, ON/OFF click to view the current mode, UP/DOWN click to change, ON/OFF click to confirm.
- Turn on/off the lights: UP long press
- Walk assist: Hold DOWN pressed (walk-assist is only enabled while DOWN button is pressed)
- Street mode on/off: While pressing DOWN, long-press POWER

- Motor max power: While pressing UP, long-press POWER
- Virtual throttle: in "Motor max power" mode, while pressing UP, long-press POWER
- Alternate main screen: POWER click, with assistance level greater than zero.
- Enter configurations screen: simultaneous POWER, UP and DOWN, long press
- To set a shortcut key to the 860C Configuration menu. Enter as above and go to the Display menu item. By enabling this function (yes), with an assistance level greater than zero, it is possible to directly access the configuration menu by pressing and holding the M key.
- Only with level = 0, long pressing of the M button activates the customization of the numerical fields and graphs in the 3 main screens.

Change variables on numeric fields or graph

- Select the variable: simultaneous UP and DOWN, long-press MENU, press
- Leave: POWER long press
- Choose new variable: UP or DOWN click
- Jump to next field: POWER click
- UP and DOWN long press to select on the graph the X-axis scale from 15m, 1h, 4h or automatic
- UP or DOWN click to change X axis scale
- POWER long-press to leave

Assist mode

There are 5 assistance modes available, the choice is on the main screen.

- POWER ASSIST assistance proportional to the power on the pedals
- TORQUE ASSIST assistance proportional to the torque on the pedals
- CADENCE ASSIST assistance subordinated to the movement of the pedals
- EMTB ASSIST assistance with a progressive percentage of the torque on the pedals
- HYBRID ASSIST combined torque + power assistance

At level 0, ON/OFF button to view the current mode, UP/DOWN button to change, ON/OFF button to confirm.

Assistance values for all modes from 1 to 254, for eMTB from 1 to 20.

"Hybrid assist" is a combination of the "Torque assist" and "Power assist" modes. The result is excellent low-cadence assistance typical of Torque mode, and the extension of high-cadence Power mode. The assistance parameters are the same used in the two modes, combined with the same level.

Available information to show on display

There are a few variables that can be selected to be shown on the customized numeric fields or graph. Note that only some of them are available to be shown on the graph. The underlined variables can be shown on the graph as well as in the numeric fields.

Variable	Description

speed	Tracking speed changes during trips.
trip distance	Amount of km/mi counted from the startup of the system.
cadence	Pedal cadence measured using the PAS sensor inside the TSDZ2 motor.
human power	Pedal human power. This is calculated with a torque sensor ADC value obtained from calibration with a weight in kg or lbs. pedal-torque in Nm is calculated as pedal-torque = weight Kgs on pedals * 9.81 (gravity) * 0.17 (0.17 is the arm cranks size) pedal power in watts is calculated as: pedal power = (pedal-torque * pedal cadence * 2 * pi) / 60
motor power	This value is calculated by multiplying the battery current by the battery voltage.
Wh/m	Battery power used by each mile.
batt voltage	Battery voltage measured by the TSDZ2 motor controller.
batt current	Battery current measure by the TSDZ2 motor controller.
battery SOC	Battery state of charge, based on counting the amount of power pulled from the battery to power the TSDZ2 motor.
motor current	Motor current. This value is calculated as: motor current = measured battery current / PWM duty-cycle. Note that PWM duty-cycle value varies between 0 and 1.
motor temp	Motor temperature. Note that if the temperature sensor is not installed, this value has no meaning.
motor speed	In ERPS (electric rotation per second) units. The motor has 8 pairs of magnets inside, meaning each 1 ERPs equal to one RPS (rotation per second).
motor pwm	Motor PWM duty-cycle. This value can fluctuate between 0% and 100% max. Where 0 means 0 battery voltage applied to motor coils while 100 means max battery voltage applied. When this value hits the max of 100, means that the motor max power possible is being applied.
motor foc	Angle calculated by FOC algorithm, between 0 and 30. Higher motor phase current and/or higher motor speed makes this value increase.

Navigating the Configuration Menu

- Enter Configuration Menu: Press and hold UP, DOWN, then immediately long-press POWER. (There is a shortcut key on the 860C that is a long press on MENU. This shortcut must be enabled in Display Menu below.)
- Exit: POWER long press to go back
- Scroll up or down: UP or DOWN click
- Edit item: MENU click
- Apply: MENU click

Configuration Menu

Trip Memories

Name	Recommended value	Description
A Auto Reset	Enable	This setting will auto-reset your trip A after the number of hours defined in " Auto Reset Hours".
A Auto Reset Hours	12h	The number of hours before reset.
B Auto Reset	Enable	This setting will auto-reset your trip B after the number of hours defined in "B Auto Reset Hours".
B Auto Reset Hours	0h	Reset at fully charged battery.
Reset Trip A	N	If you change this to Y, it clears Trip A.
Reset Trip B	N	If you change this to Y, it clears Trip B.

Bike
Replaces the Whell menu.
All parameters in this menu can be password protected.

Name	Recommended value	Description
Max speed	25 km/h 32 mph	Speed limit with motor assistance. As the speed approaches this value, the motor gradually reduces power until it stops. Find out about the legislative restrictions on the speed limit.

Circumference	2060	Enter your wheel circumference so that speed and distance are correctly calculated. Tip: Search on Google how to measure the wheel circumference. Below are approximate values for a quick setup. Remember to calibrate with GPS for finer adjustments. 20-inch wheel = 1595 mm 24-inch wheel = 1830 mm 26-inch wheel = 2060 mm 27-inch wheel = 2150 mm 27.5-inch wheel = 2215 mm 28-inch wheel = 2250 mm 29-inch wheel = 2300 mm
Max power limit	500	Maximum power supplied by the battery in Watts, it is also the maximum motor power limit that can be set in OFFROAD (Motor menu) and STREET (Street mode menu) modes.
Assist with error	0	Enabled / Disabled. The presence of an error disables assistance in all modes. It is however possible to force assistance even with an error if this is caused by a problem with a sensor. Torque, cadence or speed sensor. You will have to choose the assistance mode that does not involve the use of the faulty sensor. Use only in case of need, with this function enabled there are limitations in assistance. See error codes below.
Throttle	disabled	Enable / disable throttle if installed, choice: - disabled, throttle disabled. - pedaling, the operation of the throttle depends on the movement of the pedals. When you stop pedaling, the motor stops. - 6 km/h only, the throttle is only enabled up to 6 km/h, even without pedaling. - 6 km/h & pedaling, the throttle is enabled up to 6 km/h without pedaling, beyond 6 km/h pedaling is required. - unconditional, the throttle is always enabled, without conditions. Regarding the use, find out about the legislative restrictions of your country. The installation of brake sensors is recommended. At 0-OFF level the throttle is disabled. The choice also applies to the virtual throttle.

Cruise	disabled	Enable / disable the cruise function, Walk assist must also be enabled, choice: - disabled, cruise function disabled. - pedaling, the operation of the cruise depends on the movement of the pedals. When you stop pedaling, the motor stops. - unconditional, the cruise function is always enabled, without conditions. Regarding the use, find out about the legislative restrictions of your country. The installation of brake sensors is recommended. At 0-OFF level the cruise mode is disabled. Use: by pressing and holding the DOWN button at speeds above 9 km/h and with the function enabled, the current speed is memorized and maintained for as long as the button is pressed. Speed may not be achieved due to limited motor power. The speed limit takes priority.
Password enable	no	No / Yes. Enable the use of the password. Irreversible choice after changing the password.
Password	0	Enter your password. The default one, to be used at the first access, is 1000. With the default password the parameters cannot be modified but only a new password can be entered. Valid passwords from 1001 to 9999. After entering the password, you need to confirm with l**ogin** or **change**.
Confirm	logout	Operation on the entered password, choice: - logout, closes access to password-protected parameters. Or the logout is automatic by exiting the configuration menu. - login, to confirm the entered password, if valid, the wording login is kept and the protected parameters can be modified or a new password entered, otherwise it changes to logout. - change, to confirm the password change, choice possible only after having logged in and entered the new password. After confirmation with change, login is automatic. This operation must be done at the first login. - wait, waiting for confirmation (login or change)

		after entering the password.
Reset	no	In case of forgotten password, set Reset = yes. Turn off the display within 10 seconds and update the firmware (re-flashing).

Battery

Name	Recommended value	Description
Max current	11 Amp	Set maximum allowable current to be pulled from the battery - this value is a technical characteristic of your battery, you need to find it on your battery user manual or ask the manufacturer. Also, the TSDZ2 has its own limit of the max current it can pull from the battery that is 18 amps so the TSDZ2 firmware limits this value (no point for you to set up a higher value than 18). Maximum recommended values: 15 Amps (36 Volts battery), 12 Amps (48 Volts battery), 10 Amps (52 Volts battery). If you set it above these values, do not run this motor above 450 watts for more than a few minutes without installing the temperature sensor..
Low cut-off	39 volts	The controller will reduce power to stay over this limit! NOTE: You should only use a battery with a BMS to avoid dangerous conditions. Calculate the Low cut-off limit by multiplying the number of cells in series with the safe cut-off-voltage per cell, which is usually between 2.8 - 3.0 volts. Example: 30.0 volts: 10 cells in series * 3.0 volts = 30.0 volts. 39.0 volts: 13 cells in series * 3.0 volts = 39.0 volts. 42.0 volts: 14 cells in series * 3.0 volts = 42.0 volts. Note that by setting a high Low cut-off limit you will make less deep discharging cycles of your battery meaning the battery life will be increased AND you will then have less power available to use and so less range.
Voltage cal %	100.0	Parameter to correct the voltage value shown on the display. Example, with a fully charged battery of nominal 36V, the voltage must be close to 42V, if it is lower try

		<mark>increasing the parameter one tenth at a time until reading 42V, vice versa if the displayed value is higher, the parameter must be decreased.</mark>
Resistance	200 milliohms	The battery SOC (State Of charge) indicator uses the battery resistance to consider the power loss inside the battery resistance and also the resistance on the cables. See Resistance set field instructions to know how you can get this value. See Resistance auto estimate to enter as this number.
Voltage auto estimate	-	Real-time battery voltage value that is filtered using the battery pack resistance. If the battery resistance value is correct, this voltage should almost not change when the motor is not running or when the motor is running and pulling a high current from the battery.
Resistance auto estimate	-	Battery resistance estimated value that is automatically calculated so you can assess his value and then configure the Resistance field. How to start the automatic battery pack resistance estimation: start with the battery already discharged, with any value between 75% and 25% • start pedaling for 10 consecutive seconds, make the motor pull high current value from the battery like 10 amps (use a high assist level). After 10 seconds you should see a value on the field. For battery pack of 14S3P 3500 mAh cells, I get a value near 200 milliohms. • repeat the previous step a few times to make sure you always get a similar value • set the measured value Resistance field (I always round up the value)
Power loss auto estimate	-	Power loss estimated value that happens inside the battery pack due to battery and cables resistance.

SOC

For correct configuration of SOC: 1. set battery Watt-hour value 2. set battery voltage to reset the SOC counter 3. set the battery internal resistance

The battery needs to be charged to at least the predefined battery voltage to reset the counter. You can set the reset voltage to any voltage you like.

Name	Recommended	Description

	value	
Text	Volts	"SOC %" to show on the main screen, near the battery symbol, the value of SOC in percentage. Or "Volts" to show the battery voltage and "disable" to show nothing'

Calculation	Auto	Choice of the method for calculating the remaining battery percentage.
		Auto - soc% calculation with Wh used.
		   Automatic reset at power on when the soc% calculated with Wh consumed is different from that calculated with the voltage (+/- "Auto reset %"), useful when you put a not fully charged battery.
		Wh - soc% calculation with Wh used.
		   Reset only with fully charged battery (100%).
		   Or manual reset.
		Volts - soc% calculation with battery voltage.
		   It is less accurate than the other methods.
		   It can be useful if you have two batteries of different capacity. To obtain a correct correspondence between soc% and voltage, it may be necessary to adjust the values of "Reset at voltage" and "Low cut-off".

Reset at voltage / Reset at	54.0	Threshold voltage to reset the SOC watt-hour meter: when powering on the display this value is compared to the battery voltage. If the battery voltage is higher, then the battery is expected to be fully charged and the SOC watt-hour meter is reset, effectively resetting the SOC to 100%. Tip: To find a suitable value, fully charge the battery and measure the voltage on the display, use a slightly lower value for the threshold voltage. For example: 36V battery charge up to 42.0 volts, set threshold to 41.5. 48V battery charge up to 54.6 volts, set threshold to 54.1. 52V battery charge up to 58.8 volts, set threshold to 58.3.
Battery total Watt-hour / Battery total	500	Set the total capacity in watt-hours less 10% of what your battery has. Tip: fully charge the battery and then discharge it completely and use the measured value to input here. NOTE that you also need first to set up the correct value of your battery internal resistance as also the low cut-off voltage. Tip: the capacities stated by the suppliers are often too

Name	Recommended value	Description
		high, expect a value of around 80 % - 90 % of the stated value. Tip: roughly calculate the capacity by multiplying the nominal voltage with the nominal amp hours. For example a 52 Volt, 10 Ah battery has a nominal watt-hour capacity of 520 Wh.
Used Watt-hour	0	This value shows the SOC watt-hour meter value. You can change this value if you need, like in the event that the battery was not fully charged and this value is not accurate anymore.
Manual reset	no	Use when putting on an incompletely charged battery or at the first power on after the flashing. In this case, "Used Wh" is calculated with reference to voltage. When the battery is fully charged, the reset to 100% is automatic.
Auto reset %	15	Percentage difference (+/-) between socWh and socVolts for automatic reset at power on with "SOC Calculation" = Auto. Default 15%.
Charge cycles		Full battery charge cycles counter

Motor

Name	Recommended value	Description
Motor voltage	48V	Depending on the type of motor, set the appropriate value so that FOC calculations are correctly executed. The voltage of the battery does not matter, this value should always be set depending on the type of motor. Set "48V" for a 48V brushless motor (TSDZ2 52V version has a 48V brushless motor). Set "36V" for a 36V brushless motor.
Max motor power	450W	Maximum motor power, set an adequate value to contain the motor heating and compatible with the power that the battery can deliver. A maximum value of 450W is recommended. Attention, it does not have to be continuous! Maximum value that can be set = Max power limit (Bike menu).
Motor Acceleration	see table	Acceleration of the motor. As a first setting, use low values, then gradually

		increase if necessary. Consider the values in the table as maximum values. Set carefully, aware that setting a higher value than necessary can cause greater stress on the transmission. Recommended values: 36 Volt motor, 36 volt battery = 35 36 Volt motor, 48 volt battery = 5 36 Volt motor, 52 volt battery = 0 48 Volt motor, 36 volt battery = 45 48 Volt motor, 48 volt battery = 35 48 Volt motor, 52 volt battery = 30
Motor Deceleration	0	Set to zero, the default deceleration ramp is active, if set to 100% the minimum deceleration ramp (faster stop). Feature deactivated with "Motor fast stop" enabled.
Motor fast stop	no	Enabling the motor to stop immediately when you stop pedaling. If the motor stops too abruptly, disable and use the deceleration ramp
Field weakening	enabled	Enabled / Disabled. The field weakening function increases the motor cadence (up to 120 RPM when possible) but there is also a loss of efficiency. If enabled, field weakening is automatically activated when the PWM value is greater than 100%.

Torque sensor

Name	Recommended value	Description
Assist w/o pedal rotation	Enable	Enable to get motor assistance once you press the pedals even without rotating them. Recommended keeping disabled if you do not have brake sensors installed. Attention, if you set "Pedal torque ADC offset adjustment" to a value lower than 20, this feature is disabled (safety).
Torque s ADC threshold	10	Works in addition to the initial assistance with just the push on the pedals - without rotation for an immediate start. Now, this function is also activated with the bike in motion, when you resume pedaling after a break. CAUTION: By enabling the BOOST function at the

		same time, the effect increases! This can cause greater transmission stress.
Coast brake	Enable	Needs to be enabled if you have a TSDZ2 coast brake version.
Coast brake ADC	10	The sensitivity of the coaster brake in ADC steps when pushing pedals backward. Low value takes less strength, high value takes more strength. See for yourself the optimal value. Limits from 5 to 40
Calibration	Enable	Enable only after having entered the actual values of "Pedal torque ADC offset" and "Pedal torque ADC max", obtained from the calibration. Enabling without having entered the correct values can lead to unpredictable operations. Calibration procedure: see "ADC torque sensor" in the "Technical" menu, enter the ADC value of the torque sensor without any push on the pedals in "Pedal torque ADC offset". Enter the ADC value of the torque sensor with the maximum thrust applied to the pedal (cyclist standing on the right pedal in horizontal position) in "Pedal torque ADC max". Torque sensor calibration is required if the working range is limited. "Pedal torque ADC max" - "Pedal torque ADC offset" Caution. The ADC values of the torque sensor over time may change, check periodically.
Torque sensor ADC step	67	Torque conversion factor applied to the pedal with calibration disabled. It is used to calculate the correct ratio between the assistance factor and the human power (only in "Power assist") and for the calculation of the human power to be shown on the display, the actual value obtained from the calibration can be entered. **Warning**: enter the "ADC torque step calc" value with calibration disabled. The "Torque adc step" value is inversely proportional to the ADC range of the torque sensor
Torque adc step adv	34	Torque conversion factor applied to the pedal with calibration enabled. It has the same function as the previous parameter, but only with calibration enabled. In the calculation of human power, "Torque offset adj" and "Torque range adj" are also evaluated. Do not use to change the amplification of the assistance levels, for this purpose use "Torque range adj". An optional weight calibration is also provided for this

		parameter. Warning: enter the "ADC torque step calc" value with calibration enabled. The value of "Torque adc step adv" is constant, independent of the ADC range of the torque sensor.
Torque offset adj	20	Parameter for adjusting the ADC offset of the torque sensor. Values from 0 to 34, default value 20 (neutral). When you need to increase the sensitivity at the start, for example with a hand-bike, set a value lower than 20. Warning, a value that is too low can cause an undesired start and / or a delayed stop of the motor. If, on the other hand, you want to decrease the sensitivity at the start, set a value greater than 20. With a value less than 20 it is recommended to disable "Assist without pedaling" and "Startup boost".
Torque range adj	20	Parameter for adjusting the ADC range of the torque sensor. Values from 0 to 40, default value 20 (neutral). A value below 20 decreases the amplification of the range, a value greater than 20 increases it. This variation has an effect at all levels in torque sensing modes. Necessary first, enable the torque sensor calibration and enter the actual values of "Torque ADC offset" and "Torque ADC max". The range value is fixed at 160 (133 with 0, 186 with 40).
Torque angle adj	20	Parameter for adjusting the initial angle of the torque sensor curve. Value from 0 to 40, default value 20 (neutral). Try 20, then adjust to "feel". With a value below 20, more gradual response and less consumption. With a value greater than 20, more reactive but with higher consumption. See the explanatory chart. This variation has an effect at all levels in torque sensing modes. It is necessary to first enable the torque sensor calibration and enter the actual values of "Pedal torque ADC offset" and "Pedal torque ADC max". With a value greater than 20, it is advisable to disable "Startup boost".
Torque sensor ADC offset		ADC value of the torque sensor without any push on the pedals. It is obtained from the calibration procedure to be carried out on the display. Do not use to modify the sensitivity of torque sensor on startup, for this purpose use "Torque offset adj".
Torque ADC max		ADC value of the torque sensor with the maximum thrust applied to the pedal (cyclist standing, on the right pedal in horizontal position).

		It is obtained from the calibration procedure to be carried out on the display. ==Do not use to change the amplification of the torque sensor range, for this purpose use "Torque range adj".==
==Weight on pedal==	==25 kg or 55 lb==	Weight to be applied to the pedal for the calibration of the ADC value of the torque sensor used for the calculation of the human power to be shown on the display. Use a weight of 25 Kg. or 55 lb. It is not essential, it does not affect the operation of the motor, it only serves for a correct display of human power.
Torque ADC on weight		ADC value of the torque sensor for the calculation of human power to be shown on the display, it is not used for the calculation of the assistance factor. It is obtained from the calibration procedure with a weight, to be carried out on the display.
==ADC torque step calc==		==Conversion factor of the torque applied to the pedal obtained from the calibration with the weight or from the calculation of the estimated value.== ==It can be used for the calculation of the human power shown on the display and for a correct ratio in the assistance calculation (only in "Power assist").== ==Warning: with calibration enabled or disabled, the calculated value is different.== ==With calibration disabled, enter the value in the "ADC torque step" parameter.== ==With calibration enabled, enter the value in the "ADC torque step adv" parameter.==
Default weight	no	After having entered the calibration values in "Torque ADC offset" and "Torque ADC max", with this function it is possible to calculate an estimated value of "Torque ADC on weight" for a weight of 25Kg. The value is less accurate than that obtained with real calibration, but it is adequate for the purpose.

Assist level / Assist

Name	Recommended value	Description
Number of assist levels / Num levels	5	Select the desired number of assist levels from a minimum of 1 to a maximum of 9. If you choose for instance 5, only the first 5 levels will be available.
Power Assist	I use 1-5	"Power assist" is an assistance mode proportional to the power on the pedals.

		Levels available from 1 to 9. Set assistance levels according to your needs. Value% / 2, maximum 254. For example, applying 100 Watt to the pedals, with 150 assist level, the motor delivers 300 Watt. These assistance parameters are also used in the hybrid mode. DEFAULTS: Level 1: 25 Level 2: 50 Level 3: 75 Level 4: 100 Level 5: 130 Level 6: 160 Level 7: 190 Level 8: 220 Level 9: 250
Torque Assist	I use 1-5	"Torque assist" is an assistance mode proportional to the torque on the pedals. Levels available from 1 to 9. The power delivered by the motor is proportional to the applied torque and the set assistance values. Set assistance levels according to your needs. Relative values, maximum 254. These assistance parameters are also used in the hybrid mode. DEFAULTS: Level 1: 50 Level 2: 70 Level 3: 90 Level 4: 120 Level 5: 140 Level 6: 160 Level 7: 190 Level 8: 220 Level 9: 250
Cadence Assist	I don't use	"Cadence assist" is an assistance mode that uses cadence only and does not use the torque sensor. Levels available from 1 to 9. The power supplied by the motor depends partly on the assistance values set and partly on the cadence of the pedals. Relative values, maximum 254. It is recommended to use this assistance mode with the brake sensors installed and enabled. DEFAULTS Level 1: 100 Level 2: 120 Level 3: 130

		Level 4: 140 Level 5: 160 Level 6: 180 Level 7: 200 Level 8: 220 Level 9: 250
eMTB assist	L9: 18	"eMTB assist" is an assistance mode with a progressive percentage of the torque on the pedals. Levels available from 1 to 9. The power delivered by the motor is progressively proportional to the applied torque. There are 1-20 predefined sensitivities. Higher values correspond to more responsive assistance, quicker to reach maximum motor power. DEFAULTS Level 1: 2 Level 2: 4 Level 3: 6 Level 4: 8 Level 5: 10 Level 6: 12 Level 7: 14 Level 8: 16 Level 9: 18

Walk assist

Name	Recommended value	Description
Feature	enable	Enable or disable the walk assist function.
Speed	5	DEFAULTS: Speed 1: 2.5 km/h or 1.6 mph Speed 2: 2.5 km/h or 1.6 mph Speed 3: 3.0 km/h or 1.9 mph Speed 4: 3.0 km/h or 1.9 mph Speed 5: 3.5 km/h or 2.2 mph Speed 6: 3.5 km/h or 2.2 mph Speed 7: 4.0 km/h or 2.5 mph Speed 8: 4.5 km/h or 2.8 mph Speed 9: 5.0 km/h or 3.1 mph For each level, you set the speed to reach and maintain, in km / h x10 or in mph x10. Maximum value 60 (6.0 km / h) or 37 (3.7 mph). Try low values and gradually increase. Recommended values from 25 to 45 (2.5 to 4.5 km / h) or 15 to 28 (1.5 to 2.8 mph).

		Starting "Walk assist" there will be an overrun of the set speed, this is an auto calibration.
		It is used to define the ratio between wheel speed and motor revs, and to calculate the maximum power required in those conditions of use (gear ratio and slope to be overcome), then it stabilizes at the set speed. The adjustment is made on the motor revolutions, therefore it remains constant even when setting undetectable speed values. If necessary, it is possible to repeat the self-calibration, release the button and press again. The set speed may not be achieved due to the power limitation. With speed sensor problems, walk assist does not work properly. By enabling on the display in the "Varius" menu, "Assist with error", walk assist will work like the previous versions, without speed control.

Startup BOOST / Start Power

Name	Recommended value	Description
Feature	Enable	"Startup boost" must be enabled. The feature only works in POWER mode. Uses torque and cadence to give additional power at startup.
Boost Torque Factor	300	It is used to increase the starting assistance and at a low cadence. Available only in "Power assist" mode. It works both with a standing start and with resuming the pedaling in motion. The value of this parameter is the percentage increase in torque applied to the pedals with cadence = 0. This value gradually decreases as the cadence increases, depending on the next parameter. Set carefully, aware that setting too high a value can cause greater stress to the transmission. Value in %, recommended 250, maximum 500.
Startup boost cadence step	20	It is used to calculate the decrease in the boost torque factor as the cadence increases until extinction. Recommended value 25. Limits from 10 to 50, higher value = shorter effect.
Startup	cadence	Startup Boost Mode:

boost at zero		- Cadence It intervenes both starting from a standstill and resuming pedaling with the bike in motion. - Speed It only intervenes starting from a standstill, recommended for motors with coaster brake.
Startup assist	enabled	Enabled / Disabled. It is used to start from a stationary on difficult climbs. If enabled, it is activated by pressing the "Up" button and holding it down, start pedaling. After starting, release the button. Function that can be activated up to 6 km/h. With the button pressed, the operation is similar to the accelerator but to start you need to pedal, the power delivered depends on the level of assistance and the thrust on the pedals.

Motor temperature

Here you can enable or disable the throttle or the motor temperature protection that will let you push the motor limits. Note that you must first install the [motor temperature sensor](#).

NOTES:

- The throttle and the motor temperature protection cannot be active simultaneously. This is because they use the same hardware ports to operate.
- If the motor temperature sensor is installed it is not possible to use the throttle. Do NOT enable throttle if that is the case.

Name	Recommended value	Description
Feature	Throttle	NOTE: THIS SETTING ENABLES THROTTLE. You must also enable throttle in STREET MODE to fully activate. "disabled" means that neither motor temperature limit function nor throttle is enabled. Set to "temperature" to enable the automatic motor temperature control limit or set to "throttle" to enable the throttle. NOTE: Do NOT enable the throttle if you have installed the motor temperature sensor. If you have the temp sensor installed you need to either have the motor temperature limit function enabled or everything disabled.
Min limit	149F or 75°C	Set the minimum motor temperature at which the power will start to be limited.
Max limit	185F or 85°C	Set the maximum motor temperature at which the power will be completely blocked, i.e. no motor assistance. Max

		recommended value is 85 degrees Celsius.
Units	Auto	Choice of temperature measurement units: - Auto, Celsius with SI, Fahrenheit with Imperial. - Celsius - Fahrenheit
Sensor type	LM35	Choice of temperature sensor type: - LM35 - TMP36
Brake	brake	If the throttle input is not available, a thermostat can be installed, using the brake input. Brake input choice: - brake, if brake sensor is installed. - temperature, if an on/off thermostat is installed (NO max 85°C). Attention, the choice affects only the display message, "BRAKE" or "Temp Shutdown" . In theory, both can be installed (contacts in parallel), but the message is only one.

Street mode

This feature enables users to limit speed and power when using the bike on public roads (useful in the case the local laws impose such limitations - YOU MUST CHECK YOUR OWN LOCAL LAWS AND COMPLY WITH THEM). It is also possible to disable the throttle function when in Street Mode.

On the 860C display, you will see the ASSIST label with orange color when the street mode is disabled.

Name	Recommended value	Description
Enable Mode	No	When this feature is disabled, you cannot activate it from the main screen.
Enable at startup	No	Determines whether Street mode should be active on system startup.
Speed limit	25 km/h 35 mph	Set the speed limit for when Street Mode is active. The motor will fade out power from -0.5 km/h to +2,0 km/h to prevent overspeeding.
Motor power limit	250 W	The power limit in watts when Street Mode is active. Maximum value that can be set = Max motor power (Motor menu).
Throttle	No	Enable / disable throttle in STREET mode, choice:

		- disabled, throttle disabled.
		- pedaling, the operation of the throttle depends on the movement of the pedals. When you stop pedaling, the motor stops.
		- 6 km/h only, the throttle is only enabled up to 6 km/h, even without pedaling.
		- 6 km/h & pedaling, the throttle is enabled up to 6 km/h without pedaling, beyond 6 km/h pedaling is required.
		- unconditional, the throttle is always enabled, without conditions.
		Regarding the use, find out about the legislative restrictions of your country. The installation of brake sensors is recommended. At 0-OFF level the throttle is disabled. The choice also applies to the virtual throttle . Limit setting = Throttle mode (Bike menu)
Cruise	No	Enable / disable cruise function in STREET mode, Walk assist must also be enabled, choice:
		- disabled, cruise function disabled.
		- pedaling, the operation of the cruise depends on the movement of the pedals. When you stop pedaling, the motor stops.
		- unconditional, the cruise function is always enabled, without conditions.
		Regarding the use, find out about the legislative restrictions of your country. The installation of brake sensors is recommended. At 0-OFF level the cruise mode is disabled. Use: by pressing and holding the DOWN button at speeds above 9 km/h and with the function enabled, the current speed is memorized and maintained for as long as the button is pressed. Speed may not be achieved due to limited engine power. The speed limit takes priority. Limit setting = Cruise mode (Bike menu)
Hotkey enable	No	No / Yes, enable activation via a combination of buttons, the functions: Street mode: on / off Motor max power: set value

		Virtual throttle: set and use

Variables

This configuration lets you configure some options of the possible variables shown on the numeric field and on graphs.

Name	Recommended value	Description
Graph auto max min	x	Should the graph use automatic values for max and min or use the following manual values.
Graph max	x	Set the graph max value. Will be set up to when a new value on the graph is lower than this value.
Graph min	x	Set the graph min value. Will be set up to when a new value on the graph is higher than this value.
Thresholds	x	Thresholds will make the graph or numeric field values fade to yellow or red color, depending on the variable value. For instance, as soon as motor speed starts to approach near its max value, the color will fade first to yellow and then to red. You can disable, set to manual or automatic the thresholds.
Max threshold	x	Set the value for manual max threshold, for red color.
Max threshold	x	Set the value for manual max threshold, for yellow color.

Various

Name	Recommended value	Description
Lights configuration	x	Choose your preferred mode from the 9 available. With light control ON: 0 – on 1 – flashing 2 - on and fast flashing when braking 3 - flashing and on when braking 4 - flashing and fast flashing when braking 5 - on and on during braking also with light control OFF

		6 - on and fast flashing when braking even with the light control OFF 7 - flashing and switched on when braking even with the light control OFF 8 - flashing and fast flashing when braking even with the light control OFF The braking modes are only available with the brake sensors installed.
Virtual throttle step	5	Amount steps for each increase and decrease of Virtual throttle.
Odometer	0	This field shows the current odometer value. You can also edit the value, like set to 0 to reset the odometer.
Service A		Enabled / Disabled Enable maintenance warning when the set distance is reached.
Service A distance		Distance for maintenance warning, in km or miles.
Service B		Enabled / Disabled Enables maintenance warning when the set travel time is reached.
Service B hours		Travel time for maintenance warning in hours.

Display

Name	Recommended value	Description
Clock field	clock	- disable - clock - batt soc % - batt volts
Clock hours	0	See current hour value or set a different value.
Clock minutes	0	See current minutes value or set a different value.
Brightness on	50%	Set display backlight brightness when lights are on.
Brightness off	100%	Set display backlight brightness when lights are

		off.
Button invert	default	- default - invert
Config Shortcut Key for 860C	Yes	By enabling this function (yes), with an assistance level greater than zero, it is possible to directly access the configuration menu with a long press of the M button. Only with level = 0, long pressing of the M button activates the customization of the numerical fields and graphs in the 3 main screens. It is always possible to access the configuration menu with the UP + DOWN + POWER buttons.
Auto power off	30m	Set the number of minutes for the display automatic power off. The auto power-off timer counter is reset when wheel speed or battery current is higher than 0, or if brakes or buttons are active.
Units	Imp	Set units to SI or Imperial.
LCD type	unknown	This is read-only and is the LCD type on the display and is relevant for developers. Actual options are ILI9481, ST7796 and unknown.
Reset to defaults	no	Set yes to reset all the configurations to default values. Confirmation required.
Confirm reset	no	Confirm the default reset.

Technical

Here you can see the values of some variables of the system. This can help debug issues on TSDZ2 or help you understand how the system works.

Name	Recommended value	Description
ADC Battery Current	x	How much current is being drawn from the battery?
ADC throttle sensor	x	The current value of the input signal from the throttle, from 0 to 255.

Throttle sensor	x	The current value of the input signal from the throttle, without offset, from 0 to 255.
ADC torque sensor	x	Torque sensor ADC values, to be used for calibration. - Value of "Torque adc offset" without any push on the pedals. - Value of "Torque adc max" with the maximum thrust applied to the pedal (standing cyclist, on the right pedal in a horizontal position). - Value of "Torque adc on weight" with a weight from 20 to 25Kg applied to the pedal. Take note of the values obtained and enter them in the items of the "Torque sensor" menu.
ADC torque delta	x	ADC value of the torque sensor without offset. It is possible to observe and analyze the variations resulting from the calibration.
ADC torque boost	x	ADC value of the torque sensor without offset and with the increase of the "Startup boost" function if enabled. Only in "Power assist" mode.
Pedal cadence	x	The instantaneous value of the pedal cadence.
PWM duty-cycle	x	These values can fluctuate between 0 and 100 max. Where 0 means 0 battery voltage applied to motor coils while 100 means max battery voltage applied. When this value hits the max of 100, means that the max motor power possible is being applied.
Motor speed	x	In ERPS (electric rotation per second) units. The motor has 8 pairs of magnets inside, meaning each 1 ERPs equal to one RPS (rotation per second).
Motor FOC	x	Angle calculated by FOC algorithm, between 0 and 30. Higher motor phase current and/or higher motor speed makes this value increase.
Hall sensors	x	The current value of the motor hall sensor. You can rotate very slowly the bicycle wheel back backward to see this value changing and it must always follow the next same sequence and values must be only the next ones: 4, 6, 2, 3, 1, 5.

Error codes

Error codes and description:

E01 – MOTOR_NOT_INIT

Communication problem, the display receives data from the motor controller, but the controller does not receive it from the display. Check the wiring.

E02 - ERROR_TORQUE_SENSOR
A mechanical problem may have occurred with the torque sensor or the calibration at startup has not been performed correctly. A torque was probably applied to the pedals during power on. Switch off and on again so that the system can recalibrate, without forcing the pedals. If the "Torque sensor calibration" function is enabled, check on the display if the value of "Pedal torque ADC offset" with free pedals and "Pedal torque ADC max" with maximum effort, correspond to those entered.

E03 - ERROR_CADENCE_SENSOR
While pedaling, no pulses are generated by the cadence sensor, possibly faulty.

E04 - ERROR_MOTOR_BLOCKED
Motor or wheel blocked, excessive current absorption without motor rotation.
Check the cause. After 6 seconds the error disappears and the bike can be reused.

E05 THROTTLR FAULT
Throttle input check on power up, failed.

E06 - ERROR_COMMS
Communication problem between motor controller and display, check wiring.

E07 - OVERCURRENT
Excessive current draw. Turn the display off and on again.

E08 - ERROR_SPEED_SENSOR
Faulty speed sensor or magnet too far away.