

KT LCD3 TSDZ2 V20.1C.4-2 OSF

CAUTION:

- The following only applies to firmware version 20.X! It is recommended to look through all settings before using the bike. Especially the Basic Setup.
- Always use the same firmware version for both the motor controller and LCD unless otherwise specified!
- Before using the mid drive with new firmware, you must correctly configure the options on the display. For instance, you should configure your battery 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.

Main Screen

Assist Level Field

The assist level field displays the active assist level. This sets the motor power as a factor of the power that rider is generating on the pedals. For instance, if current assist level is 3 and if this level is configured as a factor of 2.0, when rider is doing on the pedals a power of 100 watts, the motor power supplied will be 200 watts. The assist level is changed by pressing either UP or DOWN button.

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

P - **POWER ASSIST** assistance proportional to the power on the pedals.

T - **TORQUE ASSIST** assistance proportional to the torque on the pedals.

C - **CADENCE ASSIST** assistance subordinated to the movement of the pedals.

E - **EMTB ASSIST** assistance with progressive percentage of the torque on the pedals.

H - **HYBRID ASSIST** combined torque + power assistance .

Setting the assist mode

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

NOTES:

- It is possible to configure the number of assist levels (1 to 9) in the configuration menu.
 - In "Power assist" mode, the assistance values of the previous version must be multiplied by 50. "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.
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Wheel Speed Field

This sub field displays information about speed. The values are displayed in either metric or imperial units and the user can switch between a couple of different speed measurements. The default one is current wheel speed. Other ones are average speed since power on and peak speed since power on.

- **Wheel speed:** Displays current wheel speed.
 - **Average wheel speed:** Displays average wheel speed since power on.
 - **Top wheel speed:** Displays peak wheel speed since power on.
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Motor Power Field

The motor power field displays instantaneous motor power in watts.

It is possible to access a quick-power-set menu by pressing and holding the ON/OFF and UP buttons. When entered in the menu, press or hold UP and DOWN buttons to increase or decrease the power limit. This can be useful for various reasons, for instance controlling the battery range on long trips. Exit the menu by holding the ON/OFF button.

Note that the menu cannot be accessed when Street Mode is enabled. Disable Street Mode first or change the motor power limit in the configuration menu.

How it works: the motor controller will automatically limit current and therefore limit maximum motor power. As the battery discharges and the voltage decreases the motor controller will adjust the current to maintain the set power limit.

NOTES:

- Enter the quick-power-set menu by pressing and holding the ONOFF and UP buttons. Exit by holding the ONOFF button.
- The motor power will not exceed the maximum battery current set by user.

Odometer Field

The odometer field located at the bottom of the display can show a few variables that are logically grouped in sub fields. You can change between fields by pressing the ON/OFF button. To change between different data in a sub field quickly press UP button followed by a long hold on UP button. The current field and sub field number will temporarily blink in the wheel speed field.

Summary:

Group	Option .1	Option .2	Option .3
1 - Distance	Trip	Since Power On	Odometer
2 - Battery Charge	Percentage	Consumed Wh	-
3 - Battery State	Voltage (V)	Current (A)	-
4 - Pedal Data	Power	Cadence	Weight
5 - Energy	Average Wh/distance	Est range	-
6 - Time	Since Power On	Total	-
7 - Wheel Speed	Current	Average	Peak
8 - Motor Temperature	Current	-	-
9 - Cruise	Target Speed	-	-

If there are any system errors the error code will be force-displayed in the odometer field. To look up what the error code means please take a look at the table under Error Codes.

NOTES:

- Sub fields are only displayed if the function in question is enabled and not set to hidden in the Configuration Menu, Main Screen Setup.

- 1. Distance

- 1.0 Trip distance: You can manually reset the trip distance by pressing DOWN button quickly followed by a long press on the DOWN button until value resets. It will start to blink when it is about to reset.
- 1.1 Distance since power on: this value will automatically reset during power on/off.
- 1.2 Odometer: can be set to a specific value in the configurations menu or reset as described above.

- 2. Battery State of Charge

- 2.0 State of charge in percentage
- 2.1 Consumed watt-hours

- 3. Battery State

- 3.0 Voltage: voltage of battery.
- 3.1 Current: instantaneous current drawn from battery.

- 4. Pedal data

- 4.0 Rider pedal power: in watts.
- 4.1 Pedal cadence: in revolutions per minute.
- 4.2 Pedal weight: in kilograms.

- 5. Energy data

- 5.0 Average consumed power since power on: displayed in watt-hours per kilometer or watt-hours per mile.

- 5.1 Estimated range since power on: displayed in kilometers or miles and is based on the watt-hour consumption since power on and remaining watt-hours in the battery. This sub field will not be displayed if the Battery State of Charge function has not been enabled.

- 6. Time Measurement

- 6.0 Time Measurement: time measured since display is powered on. You can reset by pressing DOWN button quickly followed by a long press on the DOWN button until value resets. It will start to blink when it is about to reset.

- 6.1 Total Time Measurement: total time measured since last reset. Can be reset as described above.

- 7. Wheel Speed

- 7.0 Current wheel speed: Current wheel speed.

- 7.1 Average wheel speed: The average speed since power on.

- 7.2 Peak wheel speed: The measured peak value of wheel speed since power on.

- 8. Motor Temperature

- 8.0 Motor temperature: temperature of motor.

- 9. Cruise Function

- 9.0 See target speed for Cruise:

Motor Temperature Field

This field can either show the motor temperature, when the function is enabled and the temperature sensor is installed, or some other data depending on user preference. It is also possible to set so that the field displays nothing.

The temperature value on the display will blink if the motor current is being limited. As the function limits the current more it will blink faster corresponding to higher limitations on current. Finally, if the current is completely limited, the blink rate will be very fast.

NOTES:

- Set your desired configuration under the Main Screen Setup in the Configuration Menu.
- The chosen field to be displayed will be temporarily hidden and the motor temperature will be displayed if it is at temperature limits.

- **Motor temperature:** Motor temperature in degrees Celsius. When the power power is being limited due to over temperature, this field will blink. It is possible to configure the temperature limits in the Configurations Menu.

- **Battery state of charge in percent:** This percentage value is based on measured watt hours consumed from the battery. Set different modes and read more about this function in the configurations menu.

- **Battery voltage:** When you prefer to always have the battery voltage displayed it is possible to set this in the motor temperature field.

- **Battery current:** Monitor the instantaneous current drawn from the battery.

- **Pedal cadence:** Set to pedal cadence if you wish to see the instantaneous cadence of pedal rotation.

- **Average wheel speed:** Set to average wheel speed if you wish to see the average wheel speed since power on.

Time Measurement Field

The time measurement field displays elapsed time since power on or since last reset. It displays either the TM symbol, stands for Time Measurement, or TTM symbol, stands for Total Time Measurement. This corresponds to the mentioned "time since power on" and "time since last reset".

- **TM:** Elapsed time since power on.

- **TTM:** Elapsed time since last reset.

Battery State of Charge field

The battery state of charge bar in the top left corner of the display is based on battery voltage. There are 6 different levels. When battery is near empty the bar will start blinking and the motor power will be reduced accordingly.

The system considers the internal resistance of the battery pack to display appropriate battery state of charge. This filters out voltage drops when drawing higher amounts of current from the battery. Set the internal resistance of your particular battery in the configurations menu.

Powering up the system

Powering up the system will initiate a calibration period for the torque sensor. It is important to not rest on the pedals or to apply any force as this will offset the calibration. The riding experience will suffer with a less sensitive torque sensor.

This is only applicable for torque based riding modes.

Motor Temperature Control Function

This motor temperature protection eliminates overheating. Without this function the motor might overheat during heavy loads, resulting in permanent damage/loss of torque.

See: **TSDZ2 motor demagnetized due to overheating**. You can only use and enable this feature if you have installed the motor temperature sensor.

If you have installed the motor temperature sensor and you enable the function, you will be able to see the motor temperature in the temperature field of the display. When the set minimum motor temperature threshold is reached, the motor current will start to be limited. If the temperature keeps rising this will result in even more current, and therefore overall power, limitations. If the maximum motor temperature is reached the current will be completely limited.

Tip for setting up the temperature control function: It is usually better to set the minimum temperature a considerable amount lower and have some margin to the maximum temperature limit. It will operate much better and cope better with the thermal delay in the system. It is required to allow for some margin to have it manage the temperature as intended and this is very important!

In short, the margin between the minimum and maximum limit should be as large as possible. So set the maximum limit to a value that is considered almost at the edge of safe operation. And then have the minimum temperature limit as low as possible. The thermal management will be much smoother and it will reduce complete shutdown of assistance. It will instead stabilize to a balanced temperature and the user can keep on riding the bike.

If the margin is lower it is possible to reach the maximum temperature limit and the assistance will be disabled until the motor temperature lowers for a cool down period. That should never happen as there is a power level the TSDZ2 can maintain without overheating at each and every ambient temperature, altitude, humidity, etc. So if it does overheat the settings are not optimally configured as the thermal management should find and settle at the perfect power level that does not increase the temperature any more for the given riding conditions.

Buttons

There are three buttons connected to the KT-LCD3. Used for controlling functions, navigating the menus and actually turning the system on and off.

The uppermost button is referenced as the UP button in this manual. The middle button is called the POWER button whilst the last button is the DOWN button.

Lights

Switch between day time and night time mode by pressing the UP button.

It is possible to install front and rear lights that can be powered from the motor controller and toggled from the display. Enabling the lights will also increase the brightness for the LCD backlight. The LCD backlight brightness can be configured in the Configuration Menu,

Basic Setup. To further make it apparent that the lights are enabled a symbol will light up on the display. Other Light flashing modes as well as brake activated lights can be configured under the Advanced menu section.

To toggle the lights and the LCD backlight, press and hold the UP button until the lights are enabled.

Brakes

TSDZ2 supports most brake sensors. Lever, magnetic or even "hidden wire" types. It is usually recommended to install brake sensors as it is for safety and that automatically qualifies to recommend such an installation.

You can buy brake sensors at online shops like BMSBattery or PSWPower.

NOTE: it is really important to make sure the brake sensor installation is complete and fully working before powering on the system. Otherwise it will not properly initialize and as a result the display will show the entire range of digits and symbols.

When brakes are installed the brake symbol will lighten up highlighting that the brakes are engaged. This is also useful for checking that the E-Brakes are operating properly and at all times.

Here is a link with more information regarding brake sensors and how to install them: [How to install brake sensors](#)

Throttle function

On 8 pin cable versions of the TSDZ2 motor a throttle controller can be added by connecting to the 5V(White), Gnd(Black) and throttle(Orange) wires. The throttle will output a voltage between 0v and 5V on the throttle pin to represent the throttle input level. Settings to enable throttle control and monitor throttle input are available under the advanced menu. Please note:- Throttle control shares the same control pin as the temperature sensor, so cannot be used together.

Error codes

If there is an error in the system it will be force-displayed in the odometer field. There will be a number associated with the error and this is the actual error code. Below are explanations and suggestions for the different error states.

E01 - ERROR_OVERVOLTAGE

Battery voltage higher than the maximum expected value. Probable error in setting the battery parameters.

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.

E08 - ERROR_SPEED_SENSOR

Faulty speed sensor or magnet too far away.

E09 - ERROR_WRITE_EEPROM

Error writing to eeprom. Switch off and on again to try again. The writing in eeprom occurs at the first start-up after loading the program and every time the display is turned off.

Configuration Menu

How to Navigate the Configuration Menu:

- To enter the configuration setup menu: long-press the UP and DOWN buttons
- To navigate between menus: press either the UP or DOWN button
- To enter a menu: press the POWER button
- To navigate between submenus: press either the UP or DOWN button
- To select a submenu to change: press the POWER button
- To change a value: press either the UP or DOWN button (press and hold the UP or DOWN button to rapidly increase or decrease the value)
- To exit a submenu, menu, or configuration setup: long-press the POWER button

Note: If starting from an unknown state do a factory reset (see 0:9).

0: Basic Setup

The parameters in the Basic Setup should always be configured before using the bike.

Submenu number	Configuration name	Description
0	Unit	(Metric) (Imperial) Press the UP or DOWN button to switch between metric (km/h, kilometers, Celsius) or imperial units (mph, miles and Fahrenheit).
1	Maximum wheel speed	Enter speed limit from where the motor will fade out power from. The power fade starts from -0.5 km/h to +2,0 km/h. If you enter 0 as a speed limit there will be no speed limiting.
2	Wheel circumference	Enter your wheel circumference in millimeters so that speed and distance are correctly calculated. Tip: Search on Google how to measure the wheel

		<p>circumference. Below are approximate values for a quick setup. Remember to calibrate with GPS for finer adjustments.</p> <p>26 inch wheel = 2050 mm 27 inch wheel = 2150 mm 27.5 inch wheel = 2215 mm 28 inch wheel = 2250 mm 29 inch wheel = 2300 mm</p>
3	Motor voltage type	<p>(0) 48 V motor. (1) 36 V motor.</p> <p>Choice of 48V or 36V motor type, read motor plate data. Caution. It is not the battery voltage. High-cadence experimental modes are no longer available.</p> <ul style="list-style-type: none"> The TSDZ2 52 V version has a 48 V motor.
4	Motor power limit	Set value after user preference. Install the motor temperature sensor if a lot of power is frequently needed so as not to overheat the motor.
5	Set odometer	Set the odometer to preferred value.
6	Light mode configuration	<p>(0) Day time mode enabled on system startup (1) Night time mode enabled on system startup (2) Remember light mode through power cycles</p> <p>Day time mode is when the external lights are off and the screen brightness percentage is set slightly lower. During night time mode the external lights are enabled and the screen brightness increases to better see the display when dark. Switch between light modes by pressing and holding the UP button on the main screen.</p>
7	Screen brightness, day time mode	Preferred screen brightness percentage during day time mode.
8	Screen brightness, night time mode	Preferred screen brightness percentage during night time mode.
9	Screen auto power off	Automatic power off after amount of minutes.
10	Reset to defaults	Reset to default values. Enter the sub menu so that the number 42 starts blinking. Hold the POWER button a short amount of time and the system will reset to default values.
11	Number of assist levels	Choice of the number of levels to use, from 1 to 9. It has the same function as the deleted items in the assist mode menus.

1: Battery Setup

In the Battery Setup menu it is possible to configure all battery parameters.

Subme nu number	Configuration name	Defaul t value	Description
0	Maximum battery current	16 A	Set maximum allowable current to be pulled from the battery. The controller is software limited internally to the safe value of 18 A.
1	Battery low- cut-off voltage	39 volt	<p>The controller will reduce power to not get below the minimum voltage limit. Calculate the limit by multiplying amount of cells in series with the safe cut-off-voltage per cell, which is usually between 2.8 - 3.0 volts. Example: 13 cells in series * 3.0 volts safe minimum = 39.0 volts for the entire battery pack.</p> <p>Tip: The standard Samsung cells allow down to 2.75 V but you need some safety margin because not all cells have exactly the same capacity. But setting a too large value you loose range and power.</p>
2	Number of cells in series	13	<p>Set this value so the battery state indicator works properly. This value can be any integer from 7 to 14</p> <p>Example values: 7 for 24 V battery; 10 for 36 V battery; 13 for 48 V battery; 14 for 52 V battery.</p>
3	Battery internal resistance	130 millioh ms	<p>Set this value so the battery state indicator does not display a lower state of charge when pulling a lot of power from battery and the voltage sags.</p> <p>Explanation: If you set the value to 0, you will see the battery state indicator fluctuating whenever the motor draws current from the battery. This is due to the internal resistance in the battery. The fluctuation will disappear and be filtered out with a correct value.</p> <p>How to calculate the battery pack resistance:</p> <ol style="list-style-type: none">1. Limit the battery current to a known value, e.g. 10 amps2. Read the voltage drop when motor is pulling the 10 amps3. Calculate the resistance value <p>Example for 10 amps current, $R = U / I$, $R = 1.2 \text{ volts drop} / 10 \text{ amps}$, $R = 0.120 = 120 \text{ milliohms}$.</p>

4	Battery voltage (SOC)	-	<p>This is the battery voltage adjusted with the configured internal resistance of the battery.</p> <p>Tip: It is possible to evaluate and test how the configured internal resistance affects the voltage reading by looking at this value when riding the bike. It should not change much regardless of power used.</p>
5	Enable and set State of Charge function	0	<p>(0) Function disabled (1) Function enabled (100 % to 0 %) (2) Function enabled (0 % to 100 %) If the function is enabled it is possible to have it display state of charge percentage remaining (100 % to 0 %) or percentage consumed (0 % to 100 %). Choose whatever is preferable.</p>
6	Threshold voltage to reset watt-hour meter	54.2 volt	<p>The system will compare this value to the battery voltage. If it is lower, the battery is expected to be fully charged and the watt-hour meter is reset.</p> <p>Tip: To find a suitable value, fully charge the battery and measure the voltage on the KT-LCD3, use a slightly lower value for the threshold voltage.</p> <p>Example: A 48 V battery charges up to 54.6 volts, so set the threshold voltage to 54.2 volts.</p>
7	Total watt-hours of battery	0	<p>Set the total battery capacity in watt-hours.</p> <p>Tip: fully charge the battery and then discharge it completely and use the real measured value to input here. Use here the value read the next field (Consumed watt-hours)</p> <p>Tip: roughly calculate the capacity by multiplying the nominal voltage with the nominal ampere hours. Example: a 48 volt, 14.5 Ah battery has a nominal watt-hour capacity of 696 Wh.</p>
8	Consumed watt-hours	-	<p>This value represents consumed watt-hours since last reset. It is reset automatically when you power on the LCD and the battery voltage is above the set threshold voltage, i.e. fully charged.</p>

2: Power Assist

Here you can configure if you wish to enable the Power Assist riding mode. And also what multipliers to use for the different assist levels.

The assist level multipliers sets the motor power as a factor of the power the rider is generating at the crankshaft. For instance, if the rider is generating 100 watts of power and the multiplier is 1.0, there will be another 100 watts of assistance from the motor.

This riding mode is based on the generated power from the rider. The power you generate on the crank the more assistance you will receive. This relationship is proportional to the power assist level multipliers.

Submenu number	Configuration name	Description
0	Startup Boost	<p>(0) Disable, (1) At zero cadence, (2) At zero speed .</p> <p>The BOOST function increases assistance when starting and at low cadence in "Power assist" mode.</p> <ul style="list-style-type: none"> - At zero cadence, it intervenes both starting from a standstill and resuming pedaling with the bike in motion. - At zero speed, it only intervenes starting from a standstill, recommended for motors with coaster brake. <p>Attention, by enabling BOOST and "Start-up assistance without pedaling" at the same time, the effect increases! This can cause greater transmission stress.</p>
1	Power Assist level 1	This is the value with which the human pedaling power is multiplied with. Assistance values from 1 to 254.
X	Power Assist level X	This is the value with which the human pedaling power is multiplied with. Assistance values from 1 to 254.

3: Torque Assist

Here you can configure if you wish to enable the Torque Assist riding mode. And also set the multipliers for the different assist levels.

The assist level multipliers sets the motor power as a factor of applied torque on the pedals. The values are relative and are somewhat dependent on the configuration and bike setup. Please configure levels comfortable for your riding style.

This riding mode is only using the torque sensor to determine how much assistance to give. More torque applied on the pedals will result in more assistance. This relationship is proportional to the torque assist multiplier.

Submenu number	Configuration name	Description
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0	Torque sensor calibration	<p>(0) Disable, (1) Calibrated, (2) Estimated.</p> <p>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: display in the "Technical Data" menu, the item (11.2) - "Torque sensor ADC value", enter the ADC value of the torque sensor without any push on the pedals in "Pedal torque ADC offset" (10.9). 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" (10.10). Torque sensor calibration is required if the working range is limited, “Pedal torque ADC max” - “Pedal torque ADC offset” < 140. Caution. The ADC values of the torque sensor over time may change, check periodically.</p> <p>Estimated (2) With this function it is possible to calculate an estimated value of 10.2 "Torque ADC step" for a weight of 24Kg. The value is less accurate than that obtained with calibration, but it is adequate for the purpose.</p> <p>Available only after entering the actual values of 10.10 “Torque ADC offset” and 10.11 “Torque ADC max”.</p> <p>Attention, by modifying the 10.2 “Torque ADC step” value, it will also be necessary to modify the % values of the assistance levels in "Power assist" mode. Used only with calibration disabled.</p>
1	Torque Assist level 1	Assistance values from 1 to 254.
X	Torque Assist level X	Assistance values from 1 to 254.

4: Cadence Assist

Here you can configure if you wish to enable the Cadence Assist riding mode. And also set the assistance level for each and every assist level.

Submenu number	Configuration name	Description
0	Assist with error	<p>(0) Disable (1) Enable</p> <p>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</p>

		involve the use of the faulty sensor. Use only in case of need, with this function enabled there are limitations in assistance. The error codes have changed, see the new codes below.
1	Cadence Assist level 1	Assistance values from 1 to 254.
X	Cadence Assist level X	Assistance values from 1 to 254.

5: eMTB Assist

Here it is possible to configure the eMTB Assist riding mode. This riding mode automatically adjusts motor torque depending on the torque applied on the pedals. More pedal torque equals a greater percentage of motor torque. Meaning that you can get everything from normal assistance all the way to absolute maximum power without changing assist levels.

Submenu number	Configuration name	Description
0	eMTB Assist Enable	(0) Disable eMTB Assist (1) Enable eMTB Assist
1	eMTB Assist level 1	Also for eMTB assist, the same number of levels of assistance is provided as for the other modes. The values are those of the available eMTB sensitivities, from 1 to 20.
X	eMTB Assist level X	EMTB sensitivity up to level 9. There is an additional level 10 (0 on the display), it is used in the other modes after the last level of assistance when "E" is displayed, only if "Enable eMTB assist" is enabled. Attention, if you have chosen 5 levels of assistance, the value used after the last level will not be 10, but 6.

6: Walk Assist

Enable or disable walk assist with a long hold of DOWN button at speeds below 8 km/h (approximately 5 mph). The motor will start to give assistance configured by user and maintain that as long as the DOWN button is being pressed. At the same time the walk assist symbol will light up. To set different power levels simply select appropriate assist level.

Below you can enable or disable the walk assist function and also configure the motor duty cycle in each and every enabled assist level.

The walk assist PWM value sets the motor duty cycle. It is an open loop controller. A PWM value of 30 will set the target duty cycle to 30. Maximum settable PWM in the walk assist function is limited to a value of 100.

Please use low gears when using Walk Assist. This causes the motor to rotate faster and consequently the blue gear. This will put less of a strain on the drive train.

NOTES:

- Use as low gear as possible. Having high gears can cause a lot of strain on the blue gear.
- There are only as many walk assist levels as there are assist levels.
- Carefully test and set appropriate values.
- The function can only be activated at speeds below 8 km/h or around 5 mph.
- Number of walk assist levels correspond to number of configured assist levels.

Submenu number	Configuration name	Description
0	Enable/disable walk assist function	(0) Walk Assist disabled (1) Walk Assist enabled
1	Walk Assist button bounce time	(0) milliseconds by default This parameter defines how many milliseconds before Walk Assist is turned off after the DOWN button is released. Useful when the bike bounces around in rough terrain or when in any other challenging situation that can cause accidental button releases. Configure the time in milliseconds. It is set to 0 by default and this immediately turns off Walk Assist as soon as the DOWN button is released. The system will immediately turn off Walk Assist if the button is not pressed long enough. This provides an extra layer of safety with minimized risk of runaway events.
2	Enable/disable	Enabled / Disabled.

	startup assist function	<p>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 to start pedaling. After starting, release the button. Usage time is limited to 10 seconds.</p> <p>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.</p>
3	Walk assist speed 1	<p>For each level, you set the speed to reach and maintain, in km / h x10 or in mph x10.</p> <p>Maximum value 60 (6.0 km / h) or 37 (3.7 mph). Try low values and gradually increase.</p> <p>Recommended values from 25 to 45 (2.5 to 4.5 km / h) or 15 to 28 (1.5 to 2.8 mph).</p> <p>Starting "Walk assist" there will be an overrun of the set speed, this is an auto calibration.</p> <p>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.</p> <p>The adjustment is made on the motor revolutions, therefore it remains constant even when setting undetectable speed values.</p> <p>In this case, a change in grade can cause a change in speed. If necessary, it is possible to repeat the self-calibration, release the button and press again.</p> <p>The set speed may not be achieved due to the power limitation.</p> <p>With speed sensor problems, walk assist does not work properly.</p> <p>By enabling “Assist with error” on the display in menu 4.0, walk assist will work like previous versions, without speed control.</p>
11	Walk assist speed 9	

7: Cruise

Enable or disable the cruise function with a long hold of DOWN button at speeds above 8 km/h or slightly above 5 mph. If the function is enabled it will by default save the current wheel speed and maintain it for as long as the DOWN button is pressed. It is also possible to enable a feature where you enter the desired wheel speed and the cruise function will automatically accelerate or decelerate to that speed and maintain it. Both modes of operation are activated the same way as described above.

The cruise symbol will light up to let the user know that the function is active.

If it is preferred to set a target speed and let the cruise function maintain that speed there are two ways in which the user can set the speed. The first way is through the configuration menu. The second way is by enabling the cruise display in the odometer field in the Main Screen Setup. This will display an extra sub field where the target speed is displayed in the odometer field. Pressing the UP or DOWN buttons will not change the assist level in this sub field, instead, it will change the target speed.

NOTES:

- It is recommended to install and use the E-brakes when using Cruise.
- The cruise function only works at speeds above 9 km/h or slightly over 5 mph.
- The motor power will not exceed set power limits.

Submenu number	Configuration name	Description
0	Enable/disable cruise function	(0) Cruise disabled (default) (1) Cruise enabled
1	Set speed to maintain	(0) Disabled (default) (1) Enabled Set speed to maintain feature. This will enable the user to set desired speed and the cruise function will maintain that speed.
2	Set target speed	Here it is possible to set the target speed for the cruise function to maintain. This is when the "set speed to maintain" feature is enabled.
3	Display set target speed for cruise	(0) Disabled (default) (1) Enabled Display of user set target speed in which the cruise function will try to maintain. In this menu the UP and DOWN buttons will increment or decrement target speed. The target speed is displayed in the odometer field if enabled.

8: Main Screen Setup

In the Main Screen Setup it is possible to configure and customize the main screen.

NOTES:

- Some variables can only be reset in the odometer field so it is required to enable those variables to be able to reset.

Submenu number	Configuration name	Default value	Description
0	Distance data	1	Display of distance data, i.e. trip distance, distance since power on and odometer, in the odometer field is enabled (1) by default. Set (0) to disable.
1	Battery SOC	1	Display of battery state of charge, i.e. watt-hours consumed or percentage of state of charge, in the odometer field is enabled (1) by default. Set (0) to disable.
2	Battery state	1	Display of battery state, i.e. voltage and current, in the odometer field is enabled (1) by default. Set (0) to disable.
3	Pedal data	1	Display of pedal data, i.e. rider pedal power, pedal cadence or pedal torque, in the odometer field is enabled (1) by default. Set (0) to disable.
4	Energy data	1	Display of energy data, i.e. average consumed power since power on, in the odometer field is enabled (1) by default. Set (0) to disable.
5	Time measurement	1	Display of time measurement, i.e. TM or TTM, in the odometer field is enabled (1) by default. Set (0) to disable.
6	Wheel speed	1	Display of wheel speed, i.e. current wheel speed, average wheel speed or peak wheel speed, in the odometer field is enabled (1) by default. Set (0) to disable.
7	Motor temperature	1	Display of motor temperature in the odometer field is enabled (1) by default. Set (0) to disable. This will only be shown if the motor temperature sensor is installed and the function is enabled. Read more about this mod here. How-to-install-motor-temperature-sensor
8	Display target speed for cruise	0	Display of user set target speed in which the cruise function will try to maintain. This menu will only be shown if the function is enabled. Press UP or DOWN buttons to increment or decrement target speed. The target

			speed is displayed in the odometer field and is enabled (1) by default. Set (0) to disable.
9	Enable main screen power menu	1	When this feature is enabled (1) a power menu can be displayed from the main screen so the user can quickly set the motor power limit. Instead of going to the Configuration Menu. This menu can be accessed from the main screen by long pressing the ON/OFF and UP buttons. Press or hold the UP or DOWN button to increase or decrease the power limit. Exit the menu by holding the ON/OFF button. The main screen power menu can not be accessed when Street Mode is enabled. Set (0) to disable this menu altogether.
10	Temperature field setup	0	<p>In this sub menu it is possible to set the temperature field to display different data depending on user preference. Such as:</p> <p>(0) = Display nothing (1) = Motor temperature (2) = Battery state of charge in percent (3) = Instantaneous voltage on battery (4) = Instantaneous current drawn from battery (5) = Pedal cadence (6) = Average wheel speed since power on</p> <p>NOTE: If the motor temperature is hitting the temperature limits the field will temporarily flash the motor temperature and override any other data.</p>

9: Street Mode

Street Mode is a function that can be configured as a street legal riding mode. It is possible to limit speed and power in Street Mode and it can be configured so that the throttle and/or Cruise are either enabled or disabled in Street Mode.

If the Street Mode function is enabled and activated the "ASSIST" symbol will be solid. Switch to Offroad mode by pressing and holding the POWER and DOWN buttons until the "ASSIST" symbol starts to blink. This indicates that Street Mode is disabled. To enable Street Mode simply press and hold the POWER and DOWN buttons once again until the "ASSIST" symbol is solid.

Submenu number	Configuration name	Description
0	Enable Street Mode	(0) Street Mode disabled (1) Street Mode enabled

		(2) Street Mode enabled on system startup
1	Street Mode Speed limit	Speed limit when Street Mode is enabled. The motor will fade out power to prevent overspeeding.
2	Limit power in Street Mode	(0) Disables power limit in Street Mode (1) Enables power limit in Street Mode
3	Street Mode Power limit	Power limit in watts when Street Mode is enabled
4	Throttle Enabled	(0) Throttle disabled in Street Mode (1) Throttle enabled in Street Mode
5	Cruise Enabled	(0) Cruise disabled in Street Mode (1) Cruise enabled in Street Mode

10: Advanced Setup

In the Advanced Setup it is possible to setup parameters and functions for slightly more experienced users.

NOTES:

- The throttle and the motor temperature protection can not 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.

Sub menu number	Configuration name	Default value	Description
0	Motor acceleration adjustment	0 %	<p>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.</p> <p>Default value = 0 % 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 %</p>

			<p>48 volt motor, 48 volt battery = 35 % 48 volt motor, 52 volt battery = 30 %</p> <p>(VALUES NEED VALIDATION FROM USER FEEDBACK, work in progress)</p>
1	Startup assist without pedal rotation	0	<p>(0) Disabled (X) Enabled with torque sensitivity X %</p> <p>If you wish to enable startup assist without pedal rotation it is done by appropriately configuring this variable. If set to (0), startup assist without pedal rotation will be disabled. But any value above (0) will enable assist without pedal rotation. Enabled e sensitivity of the torque to be applied for the start. 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. Attention, by enabling the BOOST function at the same time, the effect increases! This can cause greater transmission stress.</p> <p>When configuring it is good to incrementally increase the sensitivity until you are satisfied. Do not start with too high values. The sensitivity is different for each and every bike and should be configured after personal preference with the main riding mode you intend to use.</p> <p>Recommended values range between 10-15 %.</p>
2	Pedal torque conversion factor	67	<p>Torque conversion factor applied to the pedal with calibration disabled.</p> <p>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 with weight can be entered.</p> <p>Warning: weight calibration must be performed with calibration disabled.</p> <p>The "Torque adc step" value is inversely proportional to the ADC range of the torque sensor.</p> <p>If the human power display is of no interest, this parameter can be used to change the ratio when calculating the assistance% values at all levels (only in "Power assist").</p> <p>Set the pedal torque conversion so that the displayed weight is correct in the sub menu number 3. This is so that the human power calculation is correct and so that Power Assist operates optimally. It does not affect the resolution nor range of the torque sensor. To change the accuracy and range of the torque sensor you instead need</p>

			<p>to calibrate the hardware.</p> <p>Do not use weights over 25 kg when calibrating if you want maximum accuracy for the human power calculation! The torque sensor has an operating range of around 0 -> 40 kg. So the calibration should be performed with a calibration weight somewhere in between. But if the human power accuracy is not a priority it is possible to use a slightly heavier calibration weight. The result would be a feeling of a slightly wider operating range on the torque sensor and therefore a more responsive feeling.</p>
3	Weight on pedals	-	<p>Here you can see the weight on the pedals. If it is not correct try adjusting the Pedal torque conversion factor in sub menu number 2. The weight will be displayed in either metric or imperial units depending on system configuration (IMPERIAL MEASUREMENTS NOT YET IMPLEMENTED).</p>
4	Coaster brake torque threshold	25	<p>(0) Disabled (X) Enabled and sensitivity of the torque to be applied for braking.</p> <p>(*) Value from 15 to 40. Disable if you do not have a coaster brake motor.</p>
5	External lights configuration	0	<p>(0) lights ON when enabled</p> <p>(1) lights FLASHING when enabled</p> <p>(2) lights ON when enabled and BRAKE-FLASHING when braking</p> <p>(3) lights FLASHING when enabled and ON when braking</p> <p>(4) lights FLASHING when enabled and BRAKE-FLASHING when braking</p> <p>(5) lights ON when enabled, but ON when braking regardless if lights are enabled</p> <p>(6) lights ON when enabled, but BRAKE-FLASHING when braking regardless if lights are enabled</p> <p>(7) lights FLASHING when enabled, but ON when braking regardless if lights are enabled</p> <p>(8) lights FLASHING when enabled, but BRAKE-FLASHING when braking regardless if lights are</p>

			enabled
6	Optional ADC channel	0	<p>(0) Not in use (1) Motor temperature control (2) Throttle</p> <p>NOTE: Do NOT enable the throttle if you have installed the motor temperature sensor. If you have the sensor installed you need to either have the motor temperature limit function enabled or everything disabled, i.e. set to either (1) or (0).</p> <p>Please read more about the temperature control or throttle function in the appropriate parts in the beginning of this manual.</p>
7	Minimum temperature in Celsius	-	Set the motor temperature from where the motor temperature protection will start to limit the power.
8	Maximum temperature in Celsius	-	Set the maximum motor temperature. At this temperature the motor will be turned off.
9	Min current ADC step	0	Minimum current value (ADC step) maintained during pedal movement, even without any force detected by the torque sensor. Useful for immediate resumption of assistance after a break. Value 0=disabled, 1=0.16, 2=0.32, 3=0.48 Amp.
10	Pedal torque ADC offset (no weight)	-	<p>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.</p> <p>Do not use to change the sensitivity of the torque sensor at start-up, for this use "Torque offset adj".</p>
11	Pedal torque ADC max (max weight)	-	<p>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.</p> <p>Do not use to change the amplification of the torque sensor range, for this purpose use "Torque range adj".</p>
12	Startup boost torque factor (%)	250	It is used to increase the starting assistance and at low cadence. "Startup boost" must be enabled. Available only in "Power assist" mode. It works both with standing start and with resuming 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. Recommended value 250, maximum 500.

13	Startup boost cadence step	25	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.
14	Field weakening Enable/Disable	1	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%.
15	Torque offset adjustment	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 unwanted 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".
16	Torque range adjustment	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 gamma value is fixed at 160 (133 with 0, 186 with 40).
17	Torque angle adjustment	20	Parameter for adjusting the initial angle of the torque sensor curve. Value from 0 to 40, default value 20 (neutral). Try it with a value of 20, then adjust to "feel". With a value below 20, more gradual response and less consumption. With a value greater than 20, more responsiveness but with greater 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 recommended to disable "Startup boost".
18	Pedal torque conversion	34	Torque conversion factor applied to the pedal with calibration enabled.

	factor advanced	<p>It has the same function as parameter 10.2 Torque adc step, but only with calibration enabled.</p> <p>In the calculation of human power, "Torque offset adj" and "Torque range adj" are also evaluated. Do not use this parameter to change the amplification of the assistance levels, for this purpose use "Torque range adj".</p> <p>An optional calibration with weight is also possible for this parameter.</p> <p>Warning: weight calibration must be performed with calibration enabled.</p> <p>The value of "Torque adc step adv" is constant, independent of the ADC range of the torque sensor.</p>
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11: Advanced Technical Data

Submenu number	Configuration name	Description
0	Optional ADC value	The optional ADC is used for either throttle or motor temperature control. Here it is possible to see the instantaneous value.
1	Throttle or temperature limiting value mapped from 0 to 255	See the instantaneous value.
2	Torque sensor ADC value	See the current value.
3	Pedal cadence	The instantaneous value of the pedal cadence. This value is not filtered.
4	PWM duty cycle	This is the instantaneous duty cycle of the motor. It ranges from a value of 0 to 254.
5	Motor speed in ERPS	This value is the instantaneous rotational speed of the motor. The ERPS value can be divided by eight (8) to get the motor shaft revolutions per second. Or it can be multiplied with 7.5 to get the motor shaft revolutions per minute, RPM.
6	FOC angle	See the current value. This value must be multiplied by 1.4 to get angle value in degrees.
7	Pedal torque delta	Display only. ADC value of the torque sensor without offset. It is possible to observe and analyze the variations resulting from the torque calibration and BOOST.

