

## LCD3 additional manual

TSDZ2 open source firmware v20.1C.4 for KT- LCD3 display  
modified version of 20 beta 1 (C)

Before using the software, please read the following instructions and the display wiki carefully:

[0.20.0 \(DEVELOPMENT\) | KT LCD3 | TSDZ2 | Manual · OpenSourceEBike/TSDZ2\\_wiki Wiki · GitHub](#)

This manual is a supplement only.

### Menu items changed or added:

0.3 removed "Experimental high cadence mode", choice of motor only 0=48V or 1=36V

0.11 added "Number of assist levels"

2.0 removed "Enable Power Assist", replaced with -> "Startup Boost" 0=dis 1=zero cadence 2=zero speed

2.1 removed "Number of assist levels", moved in 0.11

3.0 removed "Enable Torque Assist", replaced with -> "Torque calibration" 0=dis 1=calibrated 2=estimated

3.1 removed "Number of assist levels", moved in 0.11

4.0 removed "Enable Cadence Assist", replaced with -> "Assist with error enabled"

4.1 removed "Number of assist levels", moved in 0.11

5.1 removed "Sensitivity" eMTB", replaced with -> "eMTB assist level 1"

5.x added "eMTB assist level x" until 9 + 1

6.2 added "Startup assist" disabled/enabled

6.3 speed setting "Walk assist speed 1" until 9.

6.x "Walk assist speed x" until 6.11 (level 9).

10.4 removed "Cadence sensor mode", replaced with -> "Coaster brake torque threshold"

10.9 added "Motor deceleration"

10.10 added "Pedal torque ADC offset"

10.11 added "Pedal torque ADC max"

10.12 added "Startup Boost torque factor"

10.13 added "Startup Boost cadence step"

10.14 added "Field Weakening" disabled/enabled

10.15 added "Torque offset adj"

10.16 added "Torque range adj"

10.17 added "Torque angle adj"

10.18 added "Torque adc step adv"

11.7 removed "Cadence sensor magnet pulse percentage", replaced with -> "Pedal torque delta"

The choice of assistance mode is in the main screen.

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.

### Description of the modified or added parameters:

#### 0.3 - Motor voltage type

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.

## 0.11 - 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.

## 2.0 - Startup Boost

0 = Disabled / 1 = at zero cadence / 2 = at zero speed.

The BOOST function increases assistance when starting and at low cadence in "Power assist" mode.

- 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.

Attention, by enabling BOOST and "Start-up assistance without pedaling" at the same time, the effect increases! This can cause greater transmission stress.

## 3.0 - Torque sensor calibration

0 = Disabled / 1 = Enabled / 2 = Estimated.

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" (10.10). 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" (10.11).

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.

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.

Available only after entering the actual values of "Torque ADC offset" and "Torque ADC max".

Attention, by modifying the "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.

## 4.0 - Assist with error enabled

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.

The error codes have changed, see the new codes below.

## 5.1 - 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.

## 5.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.

## 6.2 – Startup assist

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 to start pedaling. After starting, release the button. Usage time is limited to 10 seconds.

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.

### 6.3 to 6.11 – Walk assist speed 1 to 9

For each level, you set the speed to reach and maintain, in km / h or in mph.

Maximum value 6.0 km / h or 3.7 mph. Try low values and gradually increase.

Recommended values from 2.5 to 4.5 km / h or from 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 calculate the maximum power required in those conditions of use (transmission ratio and slope to be overcome), then it stabilizes at the set speed.

Adjustment occurs only with set values higher than the minimum detectable speed, which is approximately 3.6 km / h (2.2 mph). With lower values there is no adjustment, only the power needed to maintain the assumed speed in those conditions is calculated.

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.

The set speed may not be achieved due to the power limitation.

With speed sensor problems, walk assist does not work properly.

By enabling "Assist with error" on the display in menu 4.0, walk assist will work like previous versions, without speed control.

## 10.0 - Motor acceleration

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

### 10.1 - Startup assist without pedal rotation

0 = Disabled, X = 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.

### 10.2 - Torque adc step

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 with weight can be entered.

Warning: weight calibration must be performed with calibration disabled.

The "Torque adc step" value is inversely proportional to the ADC range of the torque sensor.

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").

#### 10.4 - Coaster brake torque threshold

0 = Disabled, X = Enabled and sensitivity of the torque to be applied for braking. Value from 15 to 40.  
Disable if you do not have a coaster brake motor.

#### 10.9 – Motor deceleration

Motor deceleration. Set to zero, the default deceleration ramp is active, the minimum deceleration ramp set to 100% (faster stop).

#### 10.10 - Pedal torque ADC offset (no weight)

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 change the sensitivity of the torque sensor at start-up, for this use "Torque offset adj".

#### 10.11 - Pedal torque ADC max (max weight)

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".

#### 10.12 - Startup boost torque factor (%)

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.

#### 10.13 - Startup boost cadence step

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.

#### 10.14 – Field weakening

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%.

#### 10.15 – Torque offset adj

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".

#### 10.16 – Torque range adj

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).

### 10.17 – Torque angle adj

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".

### 10.18 - Torque adc step adv

Torque conversion factor applied to the pedal with calibration enabled.

It has the same function as parameter 10.2 Torque adc step, but only with calibration enabled.

In the calculation of human power, "Torque offset adj" and "Torque range 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".

An optional calibration with weight is also possible for this parameter.

Warning: weight calibration must be performed with calibration enabled.

The value of "Torque adc step adv" is constant, independent of the ADC range of the torque sensor.

### 11.7 – 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.

### - Set assist mode

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

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.

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.

### - Error codes

The errors and related codes listed in the previous version manual are no longer valid.

Error codes and description:

#### 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.