Display's additional manual

TSDZ2 open source firmware mb.20 beta1.B
modified version of 20 beta 1 (C)
adapted to the original VLCD5 - VLCD6 - XH18 displays

Before using the software, consult the configuration guide for parameters mb.20beta1.B
If necessary, modify them according to your needs, in the config.h file or using the configurator.
Check carefully the correctness of the type of motor, battery and display.

See the display operating manual for version mb.20beta1.A
This manual is only an integration.

List of changes:
 1 - added cadence sensor calibration in advanced mode.
 2 - added calibration of maximum torque value (torque sensor range).
 3 - added ADC conversion factor calibration of the torque sensor (with weight).
 4 - added ADC offset adjustment of the torque sensor.
 5 - added choice to display, standard or advanced mode for cadence and torque sensors.
 6 - added data display in automatic sequence when the lights are turned on.
 7 - added other data that can be shown on the display.
 8 - access to parameters and data also with error code present.
 9 - separate definitions for TARGET_MAX_BATTERY_POWER and TARGET_MAX_BATTERY_CAPACITY.
10 - with WALK_ASSIST_DEBO UNCE_TIME, the brake sensors in addition to the motor now also stop time.
11 - CRUISE mode now also operable with walk assist command.
12 - at level 0 = OFF the accelerator is disabled.
13 - moved the parameters for error E04 "motor blocked" to the config.h file.
14 - modified " fix overrun " for a quick stop of the motor when you stop pedaling.
15 - modified the manual reset of the residual battery percentage.
16 - fixed data saving problem in eeprom.
17 - fixed display battery residual percentage problem at startup.
18 - fixed problem displaying error E06 "over temperature".

Cadence sensor calibration

With the cadence sensor in advanced mode double the pulses, you get better resolution and better responsiveness.
Change mode at level 3-SPORT, E04 (light button 2 + 2 + 2 times).
How to recognize the chosen mode: if the calibration value is displayed, it is advanced, if the value is zero and / or flashes E04 is standard.
Press the lights button twice to change from one mode to another.

To use the advanced mode, a calibration is required.
See also the instructions specific (wiki) 20 beta 1.
https://github.com/OpenSource-EBike-firmware/TSDZ2_wiki/wiki/How-to-Calibrate-the-Cadence-Sensor

Put a zip tie to lock the pedal and crown together.
Turn on the display. Warning, SET PARAMETER is by default.
Go to level 3-SPORT, E04 (light button 2 + 2 + 2 times), 500 is displayed.
If the value is not displayed, you are in standard mode, press the lights button 2 more times to change to advanced, until 500 is displayed.

The value may be slightly different due to the low resolution, take note of the difference.

The time available to start the calibration is 10 seconds.

At this point, with 500 on the display, activate the walk assist by lifting the rear wheel. Attention, in addition to the wheel, the pedals also turn.

The number changes until it stabilizes on a new value, it only takes a few seconds.

Release the walk assist button.

Take note of this value, it will be needed later.

With the number displayed, wait 10 seconds or change the level to end the procedure, the display goes to zero. Calibration has ended.

Now you need to store the value in eeprom.

Without turning off the display, first take a ride with the bike to test correct operation.

If it is all right, go to level 0-OFF, E04 (light button 2 + 2 + 2 times), the calibration value is memorized and the advanced mode is default.

Attention not only these two parameters are saved but the current configuration.

When saving in eeprom, the calibration value is maintained when the display is switched on again.

If instead the program is reloaded, this value is lost.

In order not to repeat the calibration every time the program is loaded, assign this value to the CADENCE_SENSOR_PULSE_HIGH_PERCENTAGE_X10 parameter in the config.h file.

Example:

Value displayed before calibration 490 (should be 500), the difference is 10 (if greater than 500 the difference is negative). Value after calibration 425.

The value to insert in the config.h file is 435 (425 + 10).

If you want to have the default advanced mode, in the config.h file set the parameter CADENCE_SENSOR_MODE_ON_STARTUP to 1 (ENABLED).

In this menu position, level 3 -SPORT, E04 (light button 2 + 2 + 2 times), in addition to calibration, you can change the mode of the cadence sensor, standard or advanced.

Each time you press the light button, you change from one mode to another.

How to recognize the chosen mode : if the calibration value is displayed, it is advanced, if the value is zero and / or flashes E04 is standard. To finish, wait 10 seconds or change level.

Torque sensor calibration

There are also two modes of use for the torque sensor, standard and advanced.

In advanced mode a calibration is required.

There are two possible calibrations:

1 - ADC conversion factor calibration, is carried out in standard mode but is used in both modes.

2 - calibration of the ADC working range, only for advanced mode.

Mode change at level 1-ECO, E04 (light button 2 + 2 + 2 times).

How to recognize the chosen mode: if the value of the ADC conversion factor (67) is displayed, it is standard, if the displayed value is zero, the mode is advanced.

Press the lights button twice to change from one mode to another.

- ADC conversion factor calibration

In standard mode it is possible to calibrate the ADC conversion factor with a weight.

The purpose of this calibration is to obtain a correct calculation of human power (up to 40 kg).

Prepare a weight between 20 and 25 kg max, which can be hung on the pedal in a horizontal position.

Go to level 1-ECO, E04 (light button 2 + 2 + 2 times), the current value is displayed, by default 67.

At this point within 10 seconds, hang the weight on the pedal and with the value on the display, activate walk assist.

The display shows another number that gradually increases, release walk assist when the value displayed corresponds to the weight on the pedal.

After the release of walk assist, the display shows the new calculated ADC conversion factor.

Make a note of this value to update the parameters in the config.h file.

Wait 10 seconds or change level to finish the procedure. Calibration has ended.

It is possible to store the value in eeprom, as already described for the calibration of the cadence sensor.

The parameter to update in the config.h file is PEDAL_TORQUE_PER_10_BIT_ADC_STEP_X100.

This parameter is used only in POWER ASSIST mode.

Attention, the calculated value can be very different from the default one, so much so as to require a modification of the assistance values POWER_ASSIST_LEVEL_X in the config.h file.

This calibration is not essential, it is recommended only if you want a precise calculation of human power and possibly show it on the display.

If you decide to do it, it must be done after the calibration of the ADC working range.

Hardware calibration is required to improve the accuracy and resolution of the torque sensor.

- ADC working range calibration

In advanced mode it is possible to calibrate the maximum relative torque applied to the pedal.

It is the difference between the ADC value with maximum torque applied (weight of the cyclist on the pedal) and the ADC value without thrust on the pedals.

The torque sensors have different sensitivity and working range, this causes different responses in the assistance of the engine.

The purpose of this calibration is to measure and memorize the value of the maximum relative torque, to then amplify the working range if less than a minimum value (160).

Go to level 1-ECO, E04 (light button 2 + 2 + 2 times), choose the advanced mode, the displayed value is zero.

At this point, within 10 seconds, stand on one pedal, it must be in a horizontal position.

The display shows the value of the maximum relative torque (working range), take note of it to update the config.h file.

Wait 10 seconds or change level to finish the procedure. Calibration has ended.

It is possible to store the value in eeprom, as already described for the calibration of the cadence sensor.

The parameter to update in the config.h file is PEDAL_TORQUE_10_BIT_ADC_RANGE.

By setting a value lower than the calibration one, a higher amplification is obtained, on the contrary with a higher value the amplification will be more attenuated.

Attention, the working range of the torque sensor is amplified by the software only if the value is lower than 160, higher values are not amplified.

This calibration is recommended for torque sensors with low sensitivity and limited working range.

Hardware calibration is required to improve the accuracy and resolution of the torque sensor.

In this menu position, level 1-ECO, E04 (light button 2 + 2 + 2 times), in addition to the ADC calibrations, you can change the torque sensor mode, standard or advanced.

Each time you press the light button, you change from one mode to another.

How to recognize the chosen mode: if the value of the conversion factor ADC (67) is displayed, it is standard, if the displayed value is zero, the mode is advanced. To finish, wait 10 seconds or change level.

If you want to have the default advanced mode, in the config.h file set the TORQUE_SENSOR_MODE_ON_STARTUP parameter to 1 (ENABLED).

Data visualizations

The previous data display, still active, required double pressing the light button for each data to be displayed, and if the default display mode was SET PARAMETER, it was necessary before set the data display to level 0-OFF – E02.

A simplified display procedure has been added with a single press of the lights button.
Enable the parameter ENABLE_AUTO_DATA_DISPLAY (default enabled) in the config.h file.
When the lights come on, after 5 seconds with code E02, the data are automatically displayed in sequence, for the set time of each individual data, then the lights can be turned off or left on.
It is possible to interrupt the data sequence by turning off the lights, or by changing the level.
If the lights are already on, to repeat display, just turn them off and on again.
It works with all gear levels (from 1 to 4, ECO - TOUR - SPORT - TURBO), even in the modes of the SET PARAMETER display which is now the default one.
The number of data that can be displayed automatically can be set with the AUTO_DATA_NUMBER_DISPLAY parameter in the config.h file, from 1 to 3, or from 1 to 6 if ENABLE_DISPLAY_DOUBLE_DATA is enabled.

With this procedure the individual codes are not displayed but only the data values, for this reason it is recommended to limit the number.

In addition to the data from the previous version, human power can also be viewed.
See the configuration guide of the config.h file

In the previous version, the display of an error code had priority, this prevented the use of the display.
Now even with a mistake you can access the data display or to set parameters. After the operation, the error code returns if still present.

Fixed some display issues:
- saving data in eeprom, not all were saved.
- display of battery residual percentage at start-up.
- display of error E06 "over temperature".

Parameters and functions

- added ADC offset adjustment of the torque sensor.
  A parameter has been added for adjusting the ADC offset of the torque sensor.
  The value is subtracted from the one calculated at power-on, it is used to give greater sensitivity to the push on the pedals. In the config.h file ADC_TORQUE_OFFSET_ADJUSTMENT, value from 0 to 20 max.
  Attention. Too high values can cause an unwanted start and / or a delayed motor stop.

 - separate definitions for TARGET_MAX_BATTERY_POWER and TARGET_MAX_BATTERY_CAPACITY.
   In the previous version, although they are different functions, to simplify they were a single parameter.
   They are now separate, in this way the functions is explicit and different values can be set.
   TARGET_MAX_B ATTERY_POWER is the maximum power that can be supplied by the battery in watts.
   It is also the motor power limit in OFFROAD mode.
   TARGET_MAX_BATTERY_CAPACITY is the capacity of battery in Watt hours.
   The values can be modified in the config.h file, see the parameter configuration guide.

 - with WALK_ASSIST_DEBOUNCE_TIME, the brake sensors, in addition to the motor, now also stop time.
   In the previous version, during the debounce time the intervention of the brake sensors stopped the motor, when the brakes were released, if the debounce time was not finished the motor would start working again, now for greater safety the intervention of the sensors also interrupts the time.

 - CRUISE mode now also operable with walk assist command.
   The default CRUISE mode is available only in OFFROAD mode, to use it also in STREET mode enable the parameter STREET_MODE_CRUISE_ENABLED in the config.h file.
   The cruise activation mode is subject to the movement of the pedals.
   Above 10 km / h, the speed is maintained only with a minimum movement of the pedals.

By stopping pedaling the motor stops. It is is the default mode.
With CRUISE_MODE_WALK_ENABLED enabled, it is now possible to maintain cruising speed only by pressing the walk assist button. Available only with brake sensors installed and enabled.
There are limitations due to the displays, with XH18 and VLCD5, activating the walk assist button also decreases the level, it is a defect of the displays you have to take this into account, the speed of the set level is not activated but the lower one. Not only that, but activating the walk assist button at level 1-ECO, it switches to level 0-OFF and the motor stops. It is a limitation of the displays.
In CRUISE mode, walk assist is disabled.
See also the parameter configuration guide.

- at level 0 = OFF throttle disabled.
For safety reasons and to maintain the principle that there must be no assistance at level 0-OFF, the throttle has been disabled at this level.

- moved to config.h the parameters for error E04 "motor blocked".
The ERROR_MOTOR_BLOCKED parameters for blocked motor or wheel control have been moved to config.h to be able to easily modify them according to your needs.
Set to minimum values, an error immediate action helps to preserve the blue gear.
For details, see the parameter configuration guide.

- modified " fix overrun " for a quick stop of the motor when you stop pedaling.
The " fix overrun " modification already anticipated for the previous version has been added.
There were reports of too rapid shutdown and a case of lack of startup assistance.
For this was added the PWM_DUTY_CYCLE_RAMP_DOWN_MIN_ADDITIONAL parameter editable in the config.h file. Increases the value of the motor deceleration ramp.
This parameter also has a second function, increasing the value, it also increases the control time of the stationary pedals, it is a remedy for a possible lack assist at startup caused by "fix overrun".
Attention, increasing the value increases the stopping time of the motor, with brakes sensors installed, change only if necessary and a few units.

- modified the manual reset of the residual battery percentage.
As in the previous version, manual reset of the residual battery percentage is possible.
Select the 4-TURBO level and press the light button 2 times within 5 seconds of power on.
Now the fixed value of 99.9% is no longer set, but at a percentage value proportional to the bars (4 or 6).
Useful when putting a battery that is not fully charged or the first time it is turned on after flashing.
Keep in mind that now, at the first start after having flashing the program, the percentage is always set at 99.9%, regardless of the battery charge, therefore manual reset is recommended.