Advanced Matrix Display Overview

The Advanced Matrix Display acts as the dashboard for your e-bike. It has the ability to show the basic status of the electronics system such as speed, distance traveled and battery level.

It also has an “Advanced Mode” that can give additional information which can be useful for understanding how your electric vehicle is working. The display also has the ability to adjust a limited set of parameters to better customize the performance of your e-bike.

Button Overview

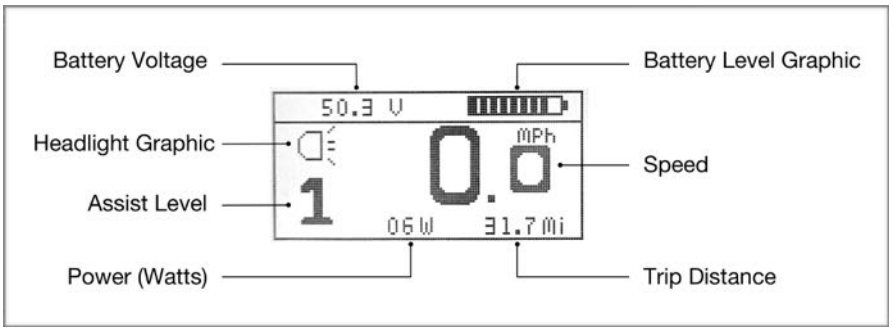
There are 3 buttons used to control the functions of the display.

Power Button: Located on the back side of the display

Assist Up Button: Located on the front face of the display

Assist Down Button: Located on the front face of the display

Main Display Screen Overview



The Main display shows several important metrics:

Battery Voltage (Volts)
This is the voltage level of the battery. It is measured in Volts (V).

Headlight Graphic
The Headlight Graphic will appear when the LED headlight is turned on. Turning on the headlight will also turn on the display's backlight so the screen is visible in the dark

Assist Level
The Assist Level indicator displays which assist mode the bike is in.
The Assist Levels progress in the following order:

ECO → 1 → 2 → 3 → SPORT

Power (Watts)
The Power indicator shows how many watts the system is using in real time. When the e-bike is turned on, the bike uses about 4-6 Watts even when not moving. This number will never be zero as the system requires some small amount of power to operate.

Battery Level Graphic
The Battery Level graphic is a graphical representation of how much charge remains in the battery. More bars will appear in the graphic when the battery is charged. Less bars will appear when the battery is depleted.

Speed (mph or km/h)
The Speed Indicator shows the current speed that the e-bike is traveling. The speed can be shown in mph or km/h depending on which unit setting is used. The speed sensor picks up information from the rear wheel.

Trip Distance (mi or km)
The trip distance keeps track of how far the bike has traveled until it is reset by the user.

Turning the E-Bike ON and OFF

How to turn the e-bike ON:

➡ Push and hold the Power Button for 3 seconds when the bike is off. The LED will come on and the bike will power up.

How to turn the e-bike OFF:

➡ Push and hold the power button for 3 seconds when the bike is on. The LCD display will power down and the bike will shut off.

Automatic Shutoff
The electronic system will also automatically shutdown after a preset period of time. This duration can be adjusted in the setup menu.

Adjusting the Assist Levels

How to increase the assist levels:

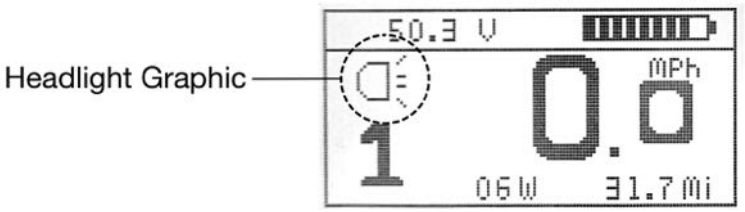
➡ When the bike is on, push and release the Assist Up Button. The assist will advance by one level until SPORT is reached.

How to decrease the assist levels:

➡ To decrease the assist level, push and release the Assist Down Button. The assist will decrease by one level until ECO level is reach.

The default assist setting is Assist Level 1 this will appear each time the e-bike is turned off and back on.

Activating the LED Headlight and Display Backlight



To turn on the LED light:

➡ Push and hold the assist Up button for 2 seconds. The front LED headlight will be illuminated and the display's backlight will also illuminate. There will also be a headlight status icon displayed on the screen.

To turn off the LED light:

➡ Push and hold the Assist Up Button for 2 seconds and the LED Headlight will turn off.

Activating the Walk Mode

When pushing the bike up hill the Walk Mode can be used. This mode will turn the motor at walking speed to assist you in moving the bike.

To activate the Walk Mode:

➡ To activate the Walk Mode, push and hold the Assist Down Button. After 2 seconds the motor will began to turn at walking speed.

To stop using the Walk Mode:

➡ To stop using the walk mode. Release the Assist Down Button. The motor will stop turning and resume normal operation. Using either brake lever will also stop the walk mode.

Activating the Cruise Control Function

The cruise control feature can be used to maintain a desired speed without using the Throttle or Pedal Assist.

To activate the Cruise Control function:

➡ Use the throttle or pedal assist to reach your desired speed. Push and hold the Assist Down Button for 2 seconds, when the “C” graphic appears, release the Assist Down Button and the current speed will be maintained without the need to pedal our use the throttle. In cruise mode, the throttle is automatically modulated so that the desired speed is maintained.

To discontinue the use of the cruise control function you can do the following actions:

1. Use the brakes by squeezing the brake lever
2. Use the throttle
3. Push the Assist Up or Assist Down button

Important notes about the Cruise Control Function

- The cruise is considered a type of throttle and the maximum cruise controllable speed is 20 mph in accordance with regulations.
- If the cruise control speed is set above 20 mph, the cruise control speed will default to 20 mph. The speed will be allowed to decrease until 20 mph is reached.
- The pedal assist is still available when the cruise control is active. It may be possible to pedal the e-bike faster than the pre-set cruise speed. However the cruise will automatically resume if the speed is allowed to decrease to the pre-set cruise controlled speed.
- If more power is needed to achieve a pre-set speed, for example when encountering resistance such as a hill or headwind, more power will be automatically given the the motor to attempt to maintain the preset speed.
- If the resistance is too much for the system to retain the pre-set speed, the resulting speed will be limited by the capability of the motor.

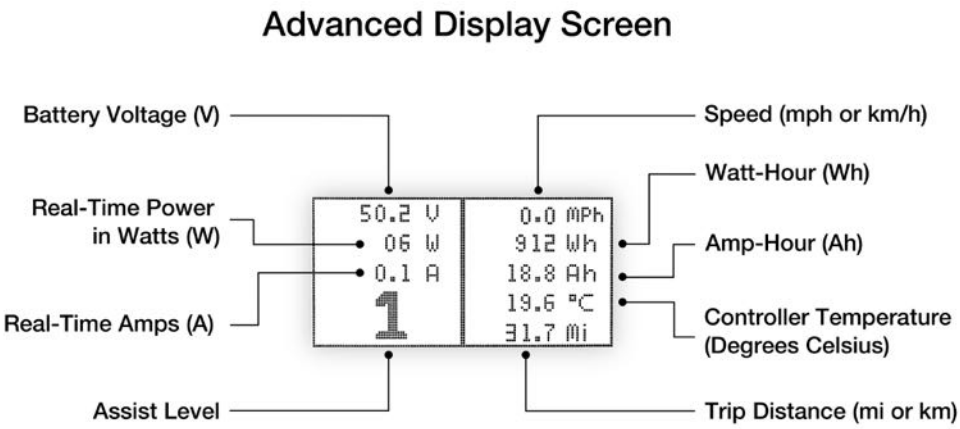
Resetting the Trip Counter

The LCD display has a trip counter function. This is useful to keep track of the distance of your ride over time. The Amp-hours (Ah) and Watt-hour (Wh) drawn from the battery pack is also linked to the trip counter data. The trip data can be reset to zero at any time.

To reset the Trip, Ah, and Wh counter to zero:

➡ Push and hold both the power button and Assist Down button for 3 seconds then release both buttons. The trip and Ah counter will be rest to zero

Activating the Advance Display Screen



In some instances it is useful to see additional ride statistics. The display can be switched into the advanced display mode. This function will allow you to see expanded real-time data on one screen.

This data includes:

Voltage, Power, Amps, Assist Level, Speed, Watt-hours, Amp-hours, Controller Temperature, Trip Distance

To toggle between the main screen and the advanced display screen:

➡ Push the Power Button and the Assist Up Button at the same time for 1 second. The display screen will change to the Advanced mode.

Note: The default display is the standard screen. This is the first display that will appear when the e-bike is turned on.

Understanding the Advanced Display Mode

Voltage
The voltage displayed is the voltage of the pack. When the battery is charged, the voltage will be higher, around 54V. When the pack is depleted, the voltage will be lower around 43V. Voltage fluctuates when the battery is under load.

Note: the voltage display is only accurate to about +/- 0.3 Volts, and should not be used for any scientific measurements.

Amps
The amperage is the current flow through the wires. In this case we measure the current flow through the controller. The average will not be non-zero as the system needs some small amount of current to operate. When the motor is under load, the Amp value will increase. The maximum value should be 20-22A on the 9 transistor controller.

Note: The Amperage display is only accurate to about +/- 1 A, and should not be used for any scientific measurements.

Power
Power is the Voltage x Amperage and displayed in Watts. This is the power output at any moment of your e-bike. The more power used to propel the e-bike, the higher this value will be.

Note: The Power display should not be used for any scientific measurements.

Amp-hours
The amp hour figure measures the amount of current flowing out of the battery for a given hour. The amp-hour and watt-hour value can be reset by resetting the trip counter.

Watt-hours
The watt-hour is the measurement of how many watts are sustained for a given hour**.** The watt-hour is the energy consumed by the system. You can get a good indication of how much energy remains inside the battery by subtracting the total Watt-Hours consumed by the total Wh available in the battery.

Note: Because there is a small error rate in the Amp and Voltage measurements. The Watt-hour value will also have some degree of error. The measurement should be used for informational purposes and not used for scientific measurements.

Assist Level
The assist level indicator shows the assist level you are in at any given moment. It is visible in both the advanced and the standard display modes.

Speed
The speed indicator measures the speed of the bike. This value is measured from the motor's internal speed sensor. If you have changed to a new tire with a larger or smaller diameter than the included tire, You may need to manually adjust the wheel speed setting.

Controller Temp
The controller temperature is measured by a temperature sensor mounted inside of the controller near the transistors. The temperature is displayed displayed on the screen in Celsius. When the e-bike is under load, the controller's temperature will increase. The bike's performance will began to decrease when the temperature exceeds 80 degrees Celsius.

Trip Distance
The trip distance counts up from zero. The distance is calculated by each rotation of the rear wheel. The trip distance can be reset from the instructions provided above.

Adjusting Parameters in the Setup Menu

There are a few parameters that you are allowed to adjust to control the behavior of your e-bike.

To enter the settings menu:

➡ Hold the assist Up and Assist down buttons for about 3 seconds then release. You will now enter the Setup Menu. Here you can adjust a few settings to control the behavior of the e-bike.

Available menu options are:

Unit	**Power Off Delay**
Speed Limit	**NDW**
Back Light	**Torque**
Wheel Size	**Low Volts**

Navigating and entering a menu setting:

➡ Use the Assist Up Button and Assist Down Button to navigate through the menu. When you have selected a parameter which you wish to adjust, push the power button once and you will enter that setting.

You will then have the ability to adjust this setting's value with the Assist UP and Assist down buttons. When you have adjusted the setting to your preference, push the power button to exit that setting. Continue pressing and releasing the Power Button. Until you have exited out of the setup menu and return to the main screen.

The parameters you have adjusted will not be programmed into the system. You can check to see if the settings are to your preference with a short test ride. If the settings need to be further adjusted, follow the setup instructions again.

Unit
The unit setting allows you to select between mph and kmh.

- mph: miles per hour
- kmh: kilometers per hour

Speed Limit
The speed limit setting allows you to set the speed limit of the bike.
The bike will be allowed to accelerate up to the maximum speed specified in this setting.

Classification	Set Power Limit	Set Pedal Assist	Throttle Operation
USA Class 1 / 750W	Set NDW to 4	20 mph	Not allowed
USA Class 2 / 750W*	Set NDW to 4	20 mph (32 km/h)	20 mph (32 km/h)
USA Class 3 / 750W	Set NDW to 4	28 mph (45 km/h)	20 mph (32 km/h)
Europe 250W / 25 km/h	Set NDW to 1	15.5 mph (25 km/h)	Not Allowed
Europe S-Pedelec / 45 km/h	Set NDW to 4	28 mph (45 km/h)	Not Allowed
Off-road mode	Set NDW to 4	> 28 mph	20 mph (32 km/h)

*default configuration

Note: in all instances the throttle is limited to 20mph

Back Light
The brightness of the backlight can be set to the desired level.

Wheel Size
The circumference of the tire can be set according to the specific wheel specification.
The wheel circumference is set in mm (millimeters)

Power Off Delay
The power off delay timer lets you set the duration that bike will remain inactive before the electronics system will automatically shut down to conserve power.

NDW
The NDW is the pedal assist level limiter. In the default configuration there are 5 modes of pedals assist.

ECO, 1, 2, 3, and Sport

The maximum pedal assist level that can be selected can be adjusted by adjusting the value of the ndw setting.

NDW setting:

- The maximum assist level that can be selected is ECO
- The maximum assist level that can be selected is assist level 1
- The maximum assist level that can be selected is assist level 2
- The maximum assist level that can be selected is assist level 3
- The maximum assist level that can be selected is assist level SPORT

Torque
The Pedal Assist System is designed to provide you with motor assistance when you pedal. The torque sensor setting allows you to choose if you want to use the torque sensor measurement for the pedal assist. The torque sensor is on by default. In normal operation, both the torque sensor and cadence sensor measurements will be used to determine the pedal assist support level.

On: The torque sensor will be activated and the pedal assist will factor in torque and cadence measurements to determine the pedal assist support level.

OFF: The torque sensor will be turned off and only the cadence sensor measurement will be used to determine the pedal assist support level.

Low Volts
The low voltage setting controls how deeply the battery is allowed to discharge. The lower this setting, the lower the battery is allowed to discharge.

Studies have shown that avoiding a deep discharge state can significantly increase battery life. The low volts setting will set a limit to the lowest voltage that the System will allow the pack to discharge.

When the motor draws power from the battery pack, the voltage of the battery will decrease. When the voltage further decreases and reaches the preset limits, the control system will automatically limit power so the voltage never decreases below this pre-set limit.

When the nominal voltage of the pack is nearing the low voltage limits which have been set, very little power will be available to propel the e-bike. The battery needs to be recharged to regain full power.

Error Codes:

The electronics system has some ability to self-diagnose and report a limited set of faults. The faults will be reported as error codes displayed on the screen. Below is a chart explaining the meaning of each error code.

Advanced Matrix Display - Error Code Chart		
Error Code	**Error**	**Notes**
4	Open Throttle Fault	Throttle has not returned to the start position on start up. Check to see if the throttle can return to the start position or if there is something blocking the throttle unit.
5	Throttle Fault	Throttle may be damaged. Check the throttle or throttle cable for damage
6	Low Voltage Protection	The battery voltage is too low to operate. Incorrect battery was used on the bike. The battery is in sleep mode or not functioning correctly.
7	Over Voltage Protection	The battery voltage is too high to operate. Incorrect battery was used on the bike. Check to be sure that the correct battery is being used on the bike.
8	Motor Hall Signal Fault	At least one of the motor's hall sensor wires have been disconnected or damaged Disconnect and reconnect the motor cable
9	Motor Phase Line Fault	At least one of the motor's phase wire has been disconnected or damaged
10	High Temperature Fault	The controller has reached the highest allowable temperature, Allow the controller to cool down before using the e-bike again.
11	Temperature Sensor Fault	The controller's temperature sensor has become disconnected or damaged. Contact tech support.
12	Current Sensor Fault	The controler's current sensor has become disconnected or damaged. Contact Tech Support.
21	Speed Sensor Fault	The speed sensor has become disconnected or damaged. Contact Tech Support.
30	Communication Fault	Poor connection between the controller and the display. Check all cable connections. Check for Corrosion damage.