

Troubleshooting Guide

Electrical System

This guide is intended to give you a procedure to diagnose and repair problems in the electrical systems of our e-bikes.

It cannot cover every possible scenario, but will assist in most situations.

There are several possible scenarios that you may have to deal with, based on whether the problem is evident when the bike is turned on, or whether it appears later, so this guide will be separated into sections:

- 1) The display does not turn on at all;
- 2) The display turns on but shows an Error Code;
- 3) The display turns on and looks normal but power is not delivered normally when the bike is ridden; or
- 4) The display turns on normally, the bike rides normally at first, then a problem shows up while riding.

General comments that relate to all electrical issues:

Cables:

It is easy to think about issues in major components, such as the controller, battery, motor or display, but remember that these components are connected together by cables, using plugs and sockets.

Cables can be damaged by impact or sharp objects, especially where they pass through cutouts in the frame, pass under the frame or exit the axle of a hub motor etc, so check the cables as part of your diagnosis.

The plugs and sockets of our bikes are quite waterproof, but may have been separated in the past and got wet or dirty. It is rare but possible for plugs to be corroded or to have the pins bent or broken, so do separate the plug / socket pairs and inspect them if you can't find an issue elsewhere.

Displays:

Displays are pretty reliable.. if they appear to be working, they usually are ok.

Even though it is rare, it is possible that a display may show an error code relating to another component when the error is within the display itself. So before starting any major disassembly during the diagnostic process, if another display is available (maybe the display of another bike) try connecting the other display to the "bad" bike. If the same error code or failure to work shows up on the second display, that will confirm that the problem is in the bike, not the display.

However if things change when the second display is connected, the problem might be in the display.

Connect the display from the "bad" bike to a known good bike and see if it works. If it works ok on the "good" bike, that confirms it is ok.

1) The display will not turn on:

Either the display or power button is broken or there is no power reaching the display.

Components that may be involved:

- Battery (including battery terminals);
- Battery terminal on the bike;
- Wires from the bike battery terminal to the controller (including connectors at the controller);
- Controller; or
- Main cable (4-into-1 or 3-into-1 cable) from the controller to the handlebars, including plug or socket at either end.

Diagnosis:

A) Battery:

-Check battery voltage. It should be between 32 and 42 Volts DC (except the Teebike, which should be between 42 and 54V). If low or no voltage, you have found the problem: Charge the battery if voltage is low, checking that the voltage rises over time.

If it will not take the charge, or if voltage is zero, battery needs repair or replacement;

-If a similar battery is available, try fitting a different battery to the bike. Does the problem remain or disappear?;

-Inspect the battery terminals.. are they clean? If dirty or discoloured, see if you can clean them. If they are “sprung” terminals that “squeeze” onto the sides of the bike terminals, do they look as if they would grip the terminals tightly.. sometimes they loosen off.. see if you can bend them so they still fit over the bike terminals but grip tighter. (Early Townee and Town’n’Trail occasionally had trouble with these sprung battery terminals)

B) Bike Battery Terminals:

Power is transferred to the bike through these terminals. Check that they are clean and undamaged.

Our bikes with “Dorado” batteries (Roam, Hub drive Ascent, Hub drive Traverse, Hub drive Transit, Cruz) occasionally had issues with the bike terminals overheating.

Wires have been known to break off the back of the bike battery terminals due to vibration.

C) Battery wires to the controller:

Check that battery voltage is reaching the controller. Remove covers etc to reach the controller. Battery voltage is fed into the controllers through single red (positive) and black (negative) wires using “bullet” connectors. Reconnect the battery and test for

voltage at the bullet connectors. Check that the connectors are clean and tight when the “bullet” is pushed into the sleeve.

D) Controller:

Visually check the wires entering the controller body and check that all connections / plugs are fully inserted and tight.

There is no easy way to check that the controller is supplying power to the main cable.

E) Main cable to handlebars (4 into 1 or 3 into 1 cable):

These are usually ok, but occasionally they cause problems with a bad connection or broken internal wire.

Check the plugs at both ends are tight, check the cable for damage where you can see it, especially where it exits the frame and if it has tight bends near the controller.

Repair action:

If a problem has been identified during this process, repair or replace the item involved.

If the battery seems ok, the display has been tested ok on another bike and battery power is reaching the controller then the only components that could be causing the issue are the controller and the main cable. --The controller is more likely to have failed so replace the controller first.

-If that doesn't fix it, replace the main cable. You may be able to run a new main cable outside the frame and connect it to all components to see if that resolves the problem, before removing the old cable and fitting the new one properly.

2) The display starts up but displays an Error Code:

Error 4: “Throttle not returning to zero state”.

The controller expects to receive a voltage signal from the throttle of less than 1 Volt when it starts up. If it receives a higher voltage it will display Error 4.

Possible components involved: Throttle, 4 – 1 cable, controller.

-Check that the throttle lever is returning to the “off” position. They can be dirty or damaged or the return spring can break. Free it up if you can, push it to the “off” position and restart the bike.

-If the error recurs, check the throttle for dirt or moisture;

-Check for a damaged cable;

-Disconnect the throttle from the 4 into 1 cable and restart the bike. The error should disappear if the problem is in the throttle. If it stays, the problem is in the 4 into 1 cable or the controller.

If the problem is in the throttle, clean and dry it or replace it. If it cannot be replaced immediately the bike can still be ridden on pedal assist with the throttle unplugged.

Error 5: “Throttle Abnormality”.

Rare code. Proceed as for Error 4.

Error 6: “Low Voltage Protection”.

The controller will not provide power to the motor because it reads the battery as below the safe minimum voltage.

Possible components involved: Battery, Battery terminals, Battery wiring to controller; Controller; Charger.

-Check battery voltage with your multimeter. If below 32V (41.6V for Teebike’s “48V” battery) the error code is correct.

Charge the battery.

- Try a different battery if available.

-If the battery voltage is over 32V, check battery terminals, battery wires to controller and the “bullet” terminals at the controller.

-If no faults are found, the most likely problem is a faulty controller.

Error Code 7: “Battery Overvoltage Protection”.

The controller reads the battery voltage as too high (over 42V or 54.6V for Teebike).

Possible components involved: Charger; Battery; Controller.

-Measure battery voltage. If it is over 42V / 54.6V then the charger is faulty, (and probably so is the BMS in the battery) as the charger and BMS should both prevent overcharging.

-Fit a different battery if available to see if the fault disappears.

-If battery voltage is not too high, replace the controller as it must be faulty.

Error 8: “Motor Hall Sensor abnormality”.

When the motor turns, hall sensors in the motor send signals back to the controller to let it know what position the motor rotor is in. Even with the motor stationary at least one of these sensors should be sending a signal to the controller.

If the controller receives no signal on startup, or incorrect signals while running, it will signal this error code.

Possible Components involved: Hall Sensor in motor; Motor cable (including plugs / sockets); Controller.

-On Hub motor bikes, the most common cause is the motor cable being unplugged from the controller. Check plug / socket under frame on right hand side. If fully inserted, check for cable damage, especially where the cable exits the axle of the motor.

-If the cable looks ok, replace the controller;

-If the fault persists, replace the motor core.

Error 9: “Motor Phase Wire Failure”.

The controller is connected to the phase windings in the motor stator, and expects to see that the windings are connected at all times. If not, it will raise this error code.

Rare. Most likely there is a fault in the cable between the controller and the motor. Proceed as for Error 8.

If no wiring faults are found, the motor will have to be stripped and checked.

Error 10: “Controller High Temperature Protection”.

Heat is generated in the controller especially when riding in high assist levels or high throttle. There are temperature probes inside some controllers, and if the temperature rises above a safe limit the controller will shut down. This error code may be displayed (we have had cases of overheating controllers where the error code was not displayed).

Components that may be involved: Controller.

-This error should not appear on startup unless the bike has only just been shut down after hard riding. If it does, replace the controller.

-If it occurs after prolonged hard riding, it should be self-resolving as the controller cools down (a restart may be required). If it does not resolve, or occurs frequently, replace the controller.

Error 11: “Controller Temperature Sensor abnormality”.

There is a problem with the temperature sensor in the controller. Replace the controller.

Error 12: “Current Sensor Fault”.

There is a sensor in the controller that measures the current flow. If this sensor is faulty the controller cannot work properly and other components might be damaged.

-Replace controller.

Error 13: “Battery Overtemperature”.

As of 2022, none of our bikes have been fitted with temperature sensors in the batteries, or communication between the battery and the controller, so this error should never be displayed. It is possible that future bikes may have this feature.

-If this error code occurs and the bike will not run, try replacing the controller.

Error 14: “Motor Temperature Sensor failure”.

As of 2022, none of our bikes have temperature sensors in the motors, so this error code should not occur.

-If this code appears and the bike will not run, try changing the controller.

Error 21: “Speed sensor error”.

The controller expects to receive a signal indicating road speed while the bike is moving. This will be one electrical pulse per wheel revolution (but see note below about early hub motors).

The signal is generated by the magnet on the spokes activating a reed switch on the frame (Mid-drive bikes) or a magnet in the hub motor passing a hall sensor on the motor stator (hub motor bikes).

Components that may be involved: Speed sensor, Speed sensor cable, Controller.

-This error should not be displayed on startup as the controller would not expect to see a signal when not riding. If it occurs on startup, probably the controller is faulty. If it prevents the bike from being ridden, replace controller.

-If it occurs while riding, check speedometer.. you would expect to see it reading 0kph. You may find that the bike will not ride normally, e.g you might not be able to change assist level.

-On mid drive bikes: Check that the spoke magnet is pointing towards the sensor, check that the sensor has not moved (the magnet should pass within a few mm of the sensor), check condition of the cable and connectors.

-On hub motor bikes: Check for damage of the motor cable, especially where it exits the motor axle; check that the plug / socket in the motor cable is fully inserted. If there are no obvious faults, replace the controller. If that doesn't work, the motor will have to be stripped to check the magnet and sensor.

*Early Hub motor bikes: these used the same hub motor as the more recent bikes, but some had 6 magnets in the motor so generated 6 pulses per wheel revolution. The controllers can be programmed to allow for this and display the speed correctly. If you replace a motor or controller on an older bike and the speedo reads incorrectly, the controller will have to be reprogrammed or 5 of the 6 magnets in the motor will have to be removed so only 1 pulse is generated per revolution.

Error 23: “Light Circuit Fault”

Error 24: “Light Sensor Fault”

As of 2022, I do not think our controllers monitor the lighting circuit, so this fault should not occur.

Components that may be involved: Lights, Wiring to lights, Controller.

Error 25 and 26: “Torque Sensor signal failure”.

The Torque sensor (if fitted) sends signals to the controller when the bike is ridden. If these signals do not arrive or are incorrect, this error signal may be generated.

NOTE: it is possible for a Torque Sensor to be faulty without raising this error.

Components that may be involved: Torque sensor, Torque Sensor cable, Controller.

-Check that the torque sensor is plugged into the controller and that the cable is undamaged. If no obvious problems are found, probably one of the components has failed.

-The most likely cause is a failed torque sensor. These can be tested by the Service Manager, but replacement of the torque sensor is very likely to resolve the problem.

-If not, replace the controller.

Error 30: “Communication error between Controller and Display”.

Components that may be involved: Display, 4 -1 cable, controller.

-Check that the display is fully plugged in to the 4 -1 cable;

-Check that the cable is fully plugged in to the controller and is not damaged.

-Replace display, cable, controller one at a time until fault clears.

4) The display turns on, no error codes are displayed, but no power is produced on throttle and / or pedalling.

4.1) If throttle does not work but power is delivered while pedalling:

-If mid drive, remember that speed must be above 6kph for the throttle to work;

-Check the cable from the throttle is undamaged and is plugged in to the main 4-1 cable;

-try a different throttle on the bike, try the suspect throttle on a different bike, to see if the problem is in the bike or the throttle;

-If replacing the throttle does not work, the problem must be in the main cable or controller.

4.2) If the throttle works, but no power is produced when pedalling:

-Cadence sensing hub motor bike:

-Check magnet ring is straight and close to the sensor;

-Check sensor cable is undamaged and is plugged in to controller;

-Try a new cadence sensor;

-Try a new controller.

-Torque sensing hub motor bike:

-Check torque sensor cable is undamaged and is plugged into the controller

-Replace torque sensor;

-Replace controller.

- Torque sensing mid drive:
 - Faulty torque sensor or controller.
 - Controller is MUCH easier to replace (on the M400) than the torque sensor, so replace that first;
 - Replace torque sensor.
- Cadence sensing mid drive:
 - Replace controller or cadence sensor, whichever is easier;
 - Replace the other one..

4.3) If display is live but no power on throttle or pedalling:

- Check if the tail light is on (indicating that one of the brake switches is faulty);
- Unplug brake switches from main cable. If power returns, adjust or replace brake switch.
- Check all cables and plugs for damage;
- Replace controller.

5) Display normal, no error codes but motor vibrates / is noisy instead of running smoothly.

This is probably caused by power only being fed to two of the three motor phases. Components that may be involved: Controller, motor cable, motor.

-Check the cable between the controller and the motor for damage or loose / damaged / dirty plug and socket. Repair or replace as appropriate.

-Try to run a different motor from the bike. If the different motor is also noisy, the problem is in the bike, but if the second motor runs smoothly, the problem is in the bike's motor.

Replace controller or motor core as appropriate.

If replacing the motor core works, the most likely problem with the old motor core is that one or more of the Hall Sensors is blown. These sensors can be replaced, but it is quite a lot of work, so the customer would probably be paying just as much or more as they would for replacing the motor core. If no motor core is available, Dave can usually replace hall sensors.