

MeloYelo E-Bikes NZ

Torque Sensor Replacement, Hub motor bikes

Why this operation would be needed:

The torque sensor is built into the bottom bracket / pedal bearing assembly within the frame.

It has a central shaft that carries the pedal crank arms at either end, bearings to allow that shaft to spin, and a mechanism that senses pedal rotation and downforce on the pedals and translates those mechanical motions / forces into electrical signals that are fed to the bike's controller through an electrical cable.

These electrical signals trigger the controller to provide power (pedal assistance) and regulate how much assistance is given.

If the torque sensor fails, the electrical signals will be absent or incorrect, and the controller will not provide the correct (or any) assistance power due to pedalling. The throttle should still work if the controller and throttle are ok.

The unit may also need replacing or removing if the shaft is damaged or the bearings become worn or corroded.

Tools needed: As well as a normal set of tools, the following specific tools are needed:

8mm Allen key;

Pedal crank removal tool;

External spline bottom bracket tool;

Internal spline bottom bracket tool.



Background information:

Diagrams:

Assembly diagram of torque sensor when installed, and illustrations of the parts disassembled

Description of operation:

The pedal shaft acts as an input for the rider's pedalling speed and torque (pedal force).

This "mechanical" input is measured in the torque sensor then transferred to the chainring through the internally / externally splined hub.

The outer body of the torque sensor carries the electronic components that carry out the measurement of the mechanical input, and has an electrical cable attached to transmit this information to the controller. This cable passes through the narrow space between the outside of the torque sensor and the inside of the bottom bracket tube of the frame, and passes out through a small diameter hole in the tube.

Warning:

The space between the torque sensor and bottom bracket tube is narrow and the hole that the cable passes through is small.

If the outer body of the torque sensor is rotated while the sensor is installed, that will result in the electrical cable being torn out of the torque sensor, which will ruin it. This is not easily repaired, and a new sensor will be needed. Torque sensors are not cheap!!

When installed, the component that anchors the outer body of the sensor is the inner left-hand housing (on the opposite side to the chain). That housing must be installed and tightened before fitting the sensor, and once the sensor is fitted, that housing **MUST NOT BE ROTATED**. Note that the left-hand housing is the one opposite the chainring.. on the left-hand side of the bike while it is upright. If the bike is upside down while changing the sensor, this may be less obvious, so it might be a good idea to mark this housing, perhaps with a wrap of red insulation tape, to remind you not to rotate it.

On earlier bikes the left-hand housing was a wide, one-piece unit, and the left-hand bearing assembly screwed into it with only thread-locking compound to retain it.

On later bikes the left-hand housing is slightly narrower, and the left-hand bearing assembly has a locking ring, the same diameter as the housing, that locks it once adjusted.

Method:

- 1) Remove both pedal crank arms. (Remember that these should be refitted on the correct side, so mark them if it is not obvious.);
- 2) Remove the chromed ring that retains the chainring hub (Note: the chromed ring has a left-hand (reverse) thread) and remove the chainring;
- 3) Remove the right-hand bearing housing (chain side) (Note: The right-hand housing has a left-hand (reverse) thread);
- 4) Remove whatever parts are necessary to get to the controller (varies from one model to another). Find the cable coming from the torque sensor (small round black plug) and unplug it;
- 5) Withdraw the torque sensor unit from the right-hand side of the bike while assisting the cable to slide through the hole in the frame;

6) Wind out the left-hand bearing assembly a few turns or remove it completely (Note: it has a right-hand (normal) thread);

7) Look at the cable hole in the frame. If it has sharp edges that could damage the cable, try to remove these as much as possible using files, chisel, Dremel... whatever you have available.

If the cable can slide through the hole smoothly during assembly, the job will be easier and the risk of damaging the cable is reduced.

8) If the Left-hand housing has been removed, refit it now (Note: the left-hand housing has a right-hand (normal) thread). Check that the housing is tightened firmly against the frame. Remember NOT to turn this housing from now on! Mark it if needed to remind you. If the left-hand bearing assembly has been removed, refit it now, but only screw it in a couple of turns.

9) Put a smear of antiseize compound or grease on the pedal shaft of the new sensor where the left-hand bearing will sit, and where the splined hub will sit at the right-hand end. Slide the splined hub onto the sensor and fully engage it onto the spline of the sensor.

Note: This spline will only engage in one exact position... the external spline has one wide ridge, and there is a matching wide groove in the internal spline in the hub. These must line up or you will not be able to engage the splines. Even when correctly aligned, this spline is a bit stiff / notchy to assemble, so it is much easier to do it now when you can see both parts easily;

10) Slide the cable plug of the new sensor through the hole in the bottom bracket tube of the frame, then slide the new sensor into the frame while pulling gently on the cable from inside so it doesn't kink.

Enter the pedal shaft into the left-hand bearing, and push the sensor body into the left-hand housing. A few raised plastic keys on the outside of the sensor slide into matching slots on the inside of the housing, so you might have to rotate the sensor body slightly to align them. Do not force the sensor if it doesn't slide in fully at first. The point where the cable exits the torque sensor body does not need to be exactly aligned with the hole in the frame, but should be fairly close.

11) Wipe a smear of antiseize or grease onto the splined hub where the right-hand bearing will sit, then fit the right-hand bearing housing and tighten it fully against the frame (remember the left-hand thread).

Note: If the left-hand bearing assembly is adjusted too far in while fitting the right-hand housing, there will not be enough room for the torque sensor between the bearings, and the right-hand housing will become tight before touching the frame. If this happens, unscrew the left-hand bearing assembly until there is room to screw in the opposite housing fully.

12) Push the torque sensor hard to the right and screw in the left-hand bearing assembly unit until the bearing just touches the step in the shaft. There should be no side-play in the sensor shaft, but the bearings must not have any side force applied or they will be damaged.

If it is a later bike with locking ring: tighten the locking ring to secure the bearing assembly.

13) Measure how much length of pedal shaft projects at each end. There should be approximately 19mm of shaft projecting on the right. If this measurement is incorrect, the unit may not be correctly assembled. If there is only approx 15mm projecting on the right, the splined hub is probably not engaged properly onto the output spline of the torque sensor;

13) Refit the chainring and chromed retaining ring. Note that the spline in the chainring hub also has one wider "King spline" that must be aligned to allow it to be fitted, and remember the left-hand thread in the chromed ring.

14) Refit the pedal cranks, checking that they are on the correct side. Check that there is clearance (airgap) between the inside of the right-hand crank and the chromed retaining ring. If the crank touches the ring it will put a side-load onto the right-hand bearing and damage it, as well as making the torque sensor less sensitive.

If there is less than 1.5mm clearance, the crank will have to be replaced or modified so there is good clearance.

Photos:

1) Components at right hand end (Chain side)



Chromed ring, Chainring hub, bearing housing, splined hub, torque sensor.

2) Components at Left hand side



Torque sensor, housing, bearing assembly.

3) Inside LH housing (slots), outside of Torque Sensor (raised keys)



4) Splined hub and torque sensor spline (Note the wide spline in both components)



5) Correctly assembled splined hub: 19mm shaft extension on Right-hand side

