How to Repair and Calibrate a Stuck Speedometer

Warning: I do not recommend doing this unless you have a steady hand. It is easy to fudge and damage a delicate spring that will put and end to the repair.

The steps to remove the speedometer for the Reflex are outlined in the factory service manual.

In brief, the following items are removed,

- First the windshield garnish comes off
- Next the windshield
- Next the front meter visor
- and, finally the front cover

Once the above items are removed, these items are removed from the combination meter

- the speedometer cable
- two connectors from the main electrical harness

The combination meter is held by four self tapping screws to the inner cover. Once these are removed the combination meter can be removed. The rear meter visor shown below the combination meter in figure 1 is detached by removing four chrome color self tapping screws in the location of the red lines.

Figure 1

The meter lens is detached next by removing the seven brass color self taping screws shown circled in figure 2.

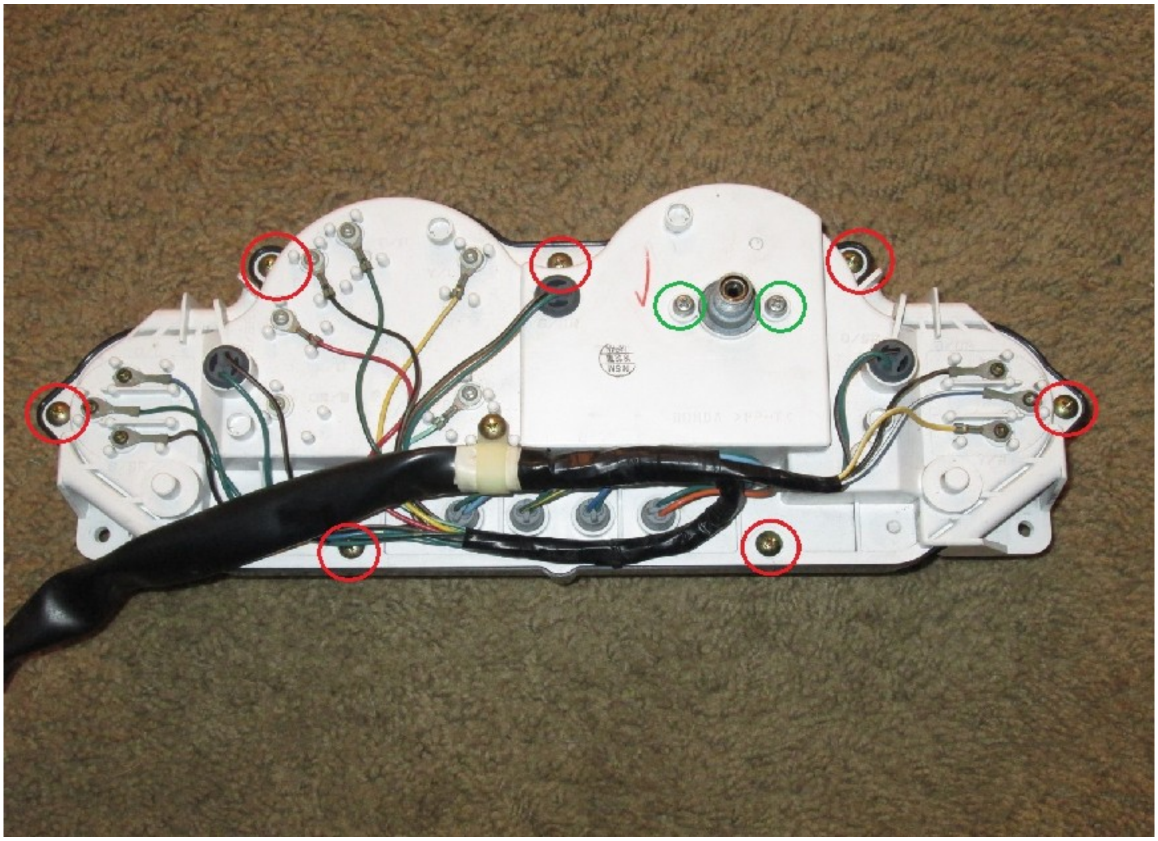

Figure 2

It is not necessary to remove the wire harness in figure 2. Once the meter lens is removed the speedometer can be detached from the combination meter assembly by removing the two screws circled in green. The speedometer will come straight out the front.

The speedometer assembly is shown in figure 3 below. The view is from the front left side of the speedometer..There are only two bearing surfaces to oil. One at the front and one at the rear of the assembly.

In a mechanical, eddy current speedometer, there is no physical contact between the drive shaft from the front wheel and the speedometer pointer needle. The drive shaft has one bearing and the pointer needle shaft has one bearing.

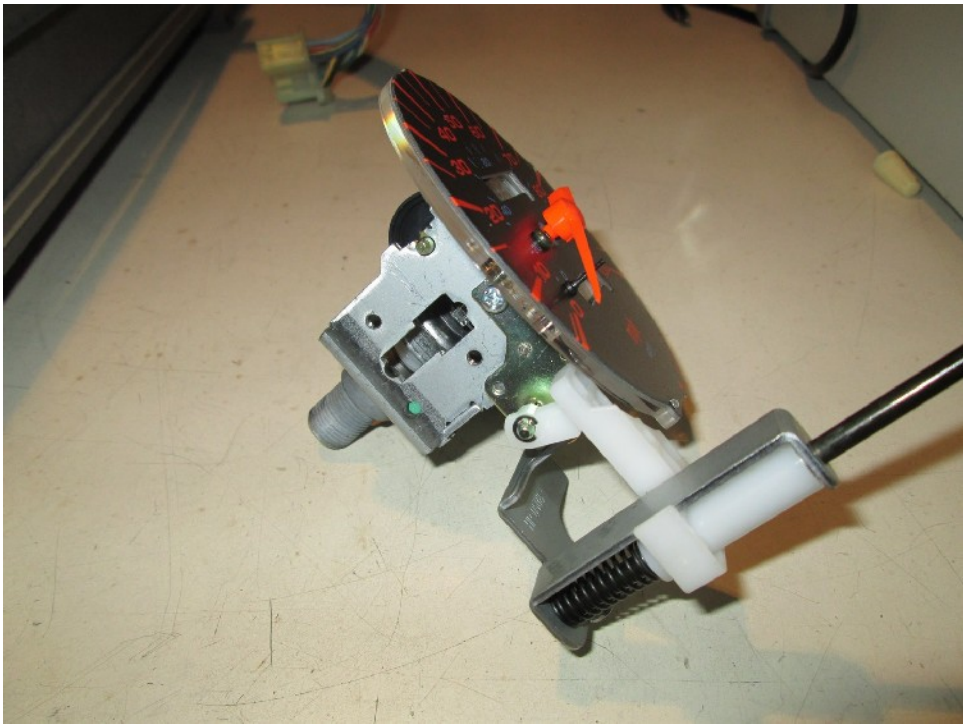

Figure 3

The trip meter assembly does not need to be removed to service the speedometer but the two screws to remove it are shown circled in figures 5 and 6 below. Removing the trip meter assembly in this article is done only so that the issues that cause speedometer needle sticking can be illustrated more readily.

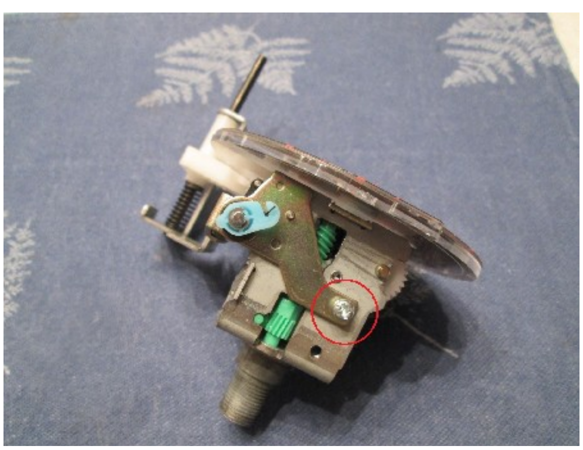

Figure 5

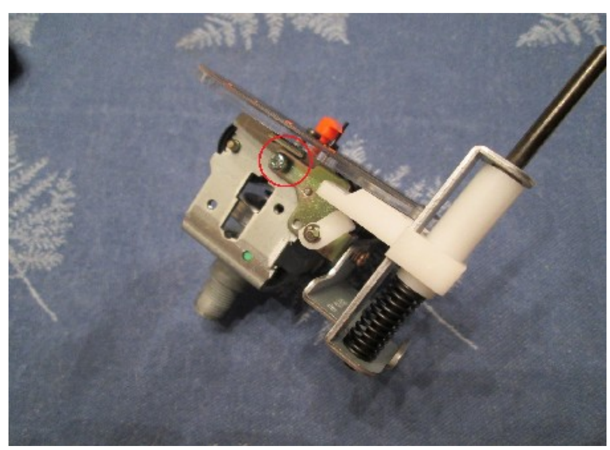

Figure 6

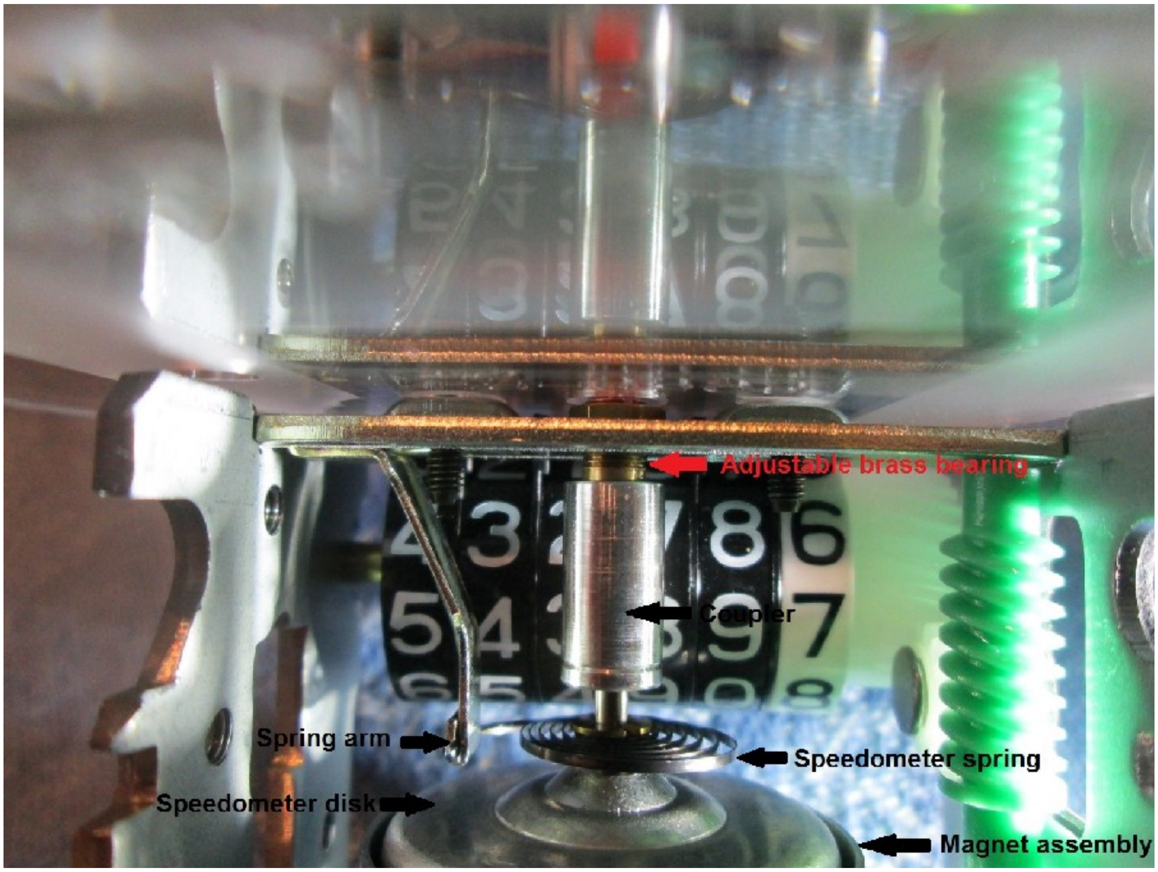

Figure 7

The principle components of the speedometer are identified in the above photo with the trip odometer removed. The speedometer cable drives the magnet assembly. If the odometer works then the magnet assembly and the worm gear to the right of it are working. An important item to remember is that although it may look like the rotating magnet assembly and the speedometer disk in figure 7 are connected they are not in physical contact at all. Rotate the magnet assembly slowly by hand and the speedometer disk should not move.

The actual speedometer parts are the pointer needle, its shaft, an adjustable brass bearing though which the shaft fits, a speedometer spring which holds the needle at zero mph and the metal speedometer disk labeled in figure 7.

When the magnet assembly spins, eddy currents are created in the metal speedometer disk which causes it to rotate against the spring.

The next step is to get access to the adjustable brass bearing. To do this the speedometer needle needs to be removed and the faceplate. The needle is simply pressed on over a metal shaft but it is not easy to pull off by hand. Also the needle has a some tension applied to it at zero mph. This is the reason there is a plastic post in the faceplate. In the photo below, the needle has been lifted over the zero mph stop to show the pre-load tension. A nail is shown resting against the plastic zero mph stop. A piece of masking tape is applied to the faceplate and marked where the needle comes to rest due to the spring. To restore the original calibration of the speedometer this position must be marked so the needle can be replaced at the same position.

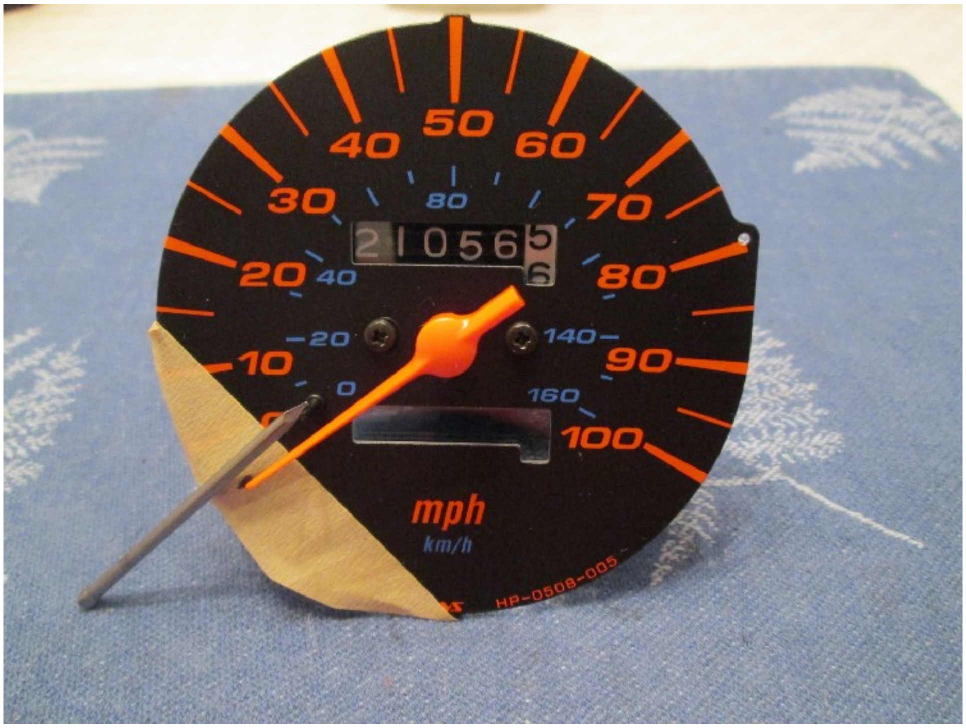

Figure 8

Figure 9 shows an additional piece of masking tape placed on the faceplate to prevent marring the surface as the for fork is used to release the speedometer needle.

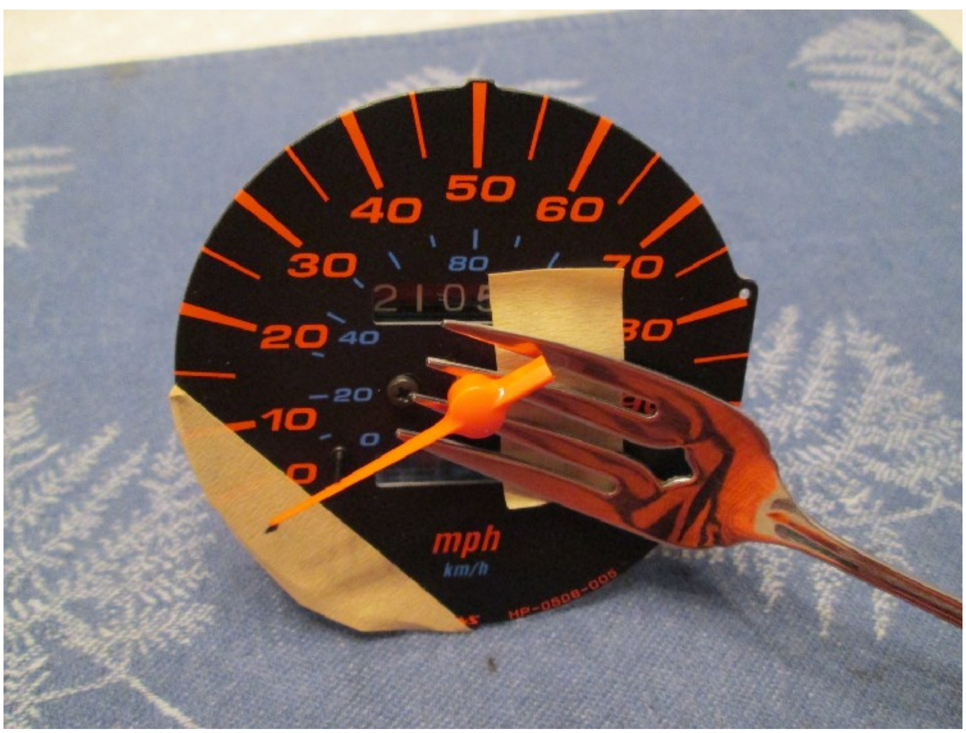

Figure 9

Figure 10 shows the faceplate and needle removed. In the center is a brass nut that holds the speedometer bearing in position.

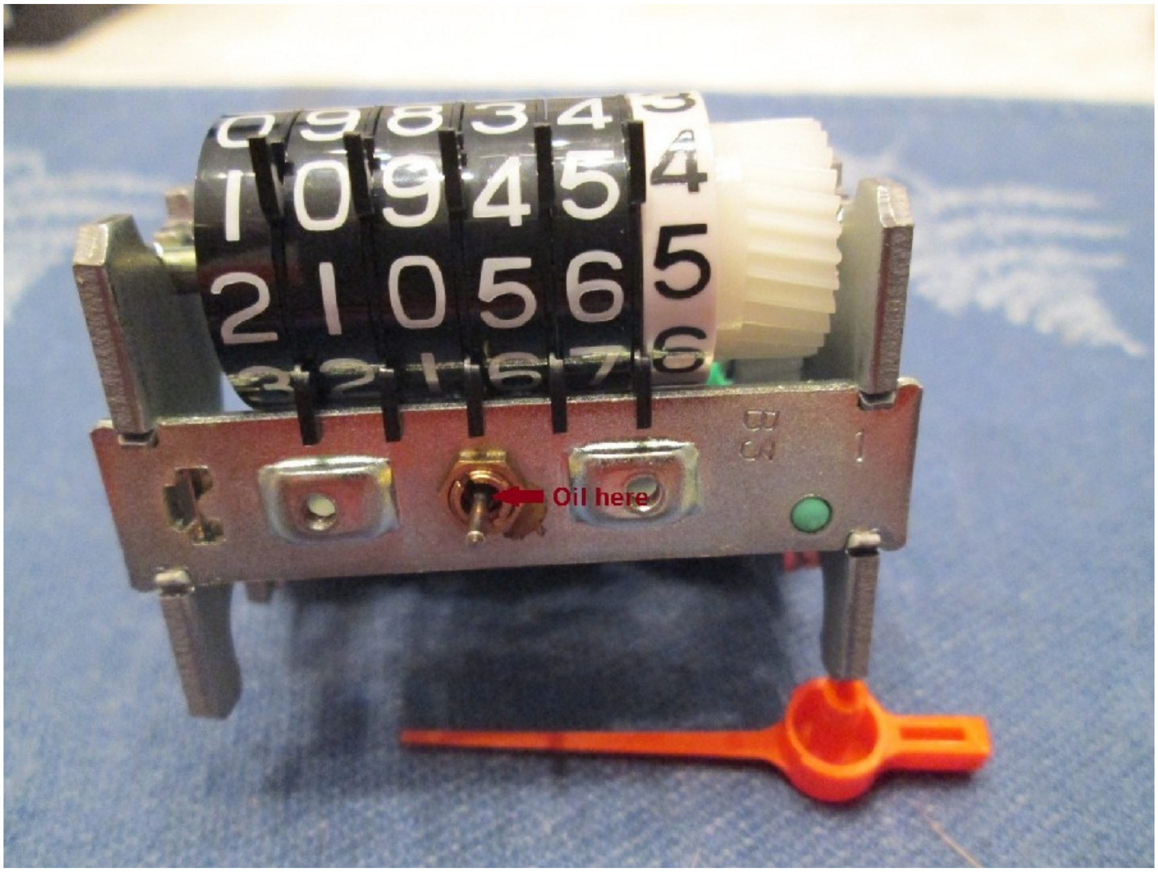

Figure 10

The speedometer needle can stick for two reasons.

- Lack of lubrication
- and, binding between the magnet assembly and the speedometer disk

There are oils made for watch repair that work well but sewing machine oil was used for this repair. If the problem is lubrication, just add a drop of oil at the position where the speedometer shaft comes out of the brass bearing indicated in figure 10.

The second problem comes about due to wear in the odometer part of the unit. This is shown in figure 11 where the speedometer assembly is attached to the speedometer cable. A screwdriver used to push the speedometer cable core into the cable sheath. Notice that the speedometer cable core is able to force the magnet assembly so that it comes into contact with the speedometer disk binding the speedometer needle at 40 mph.

Figure 11

The solution to this problem is to loosen the brass nut holding the brass bearing in place. A razor blade or X-Acto knife can be used to score and remove the paint holding the nut in place. The brass bearing has two slots cut into it so they can be used to rotate the bearing clockwise or counter-clockwise. Rotating counter-clockwise allows the speedometer disk to move more toward the front of the speedometer so that the magnet assembly cannot bind it. I adjusted the the bearing until there was no binding anywhere in the range of the needle by rotating the needle by hand then adding a half turn more to accommodate dimension changes due to temperature.

Figure 12 below shows the bearing surface for the magnet assembly which is rotated by the speedometer drive shaft.

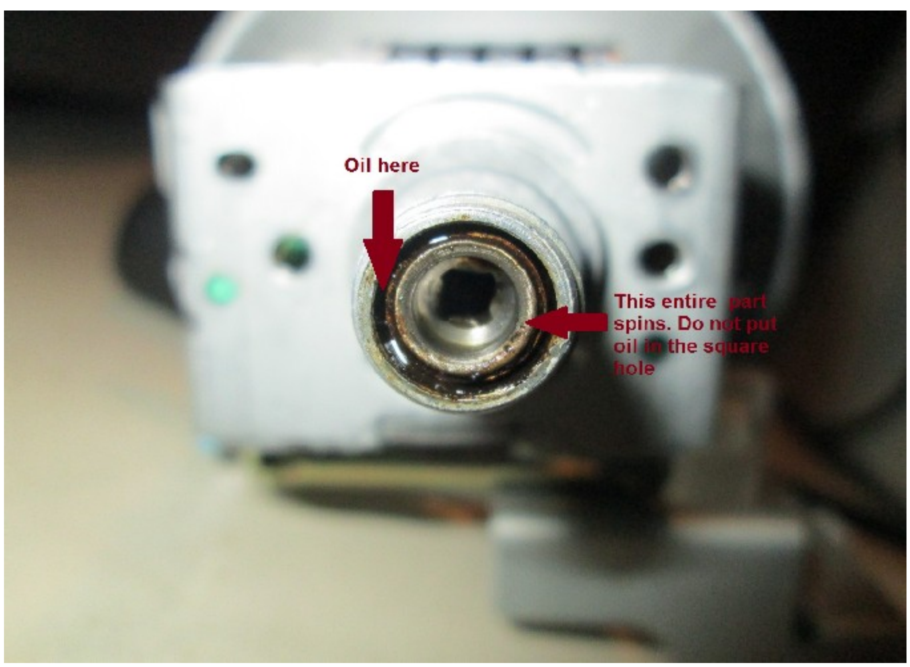

Figure 12

A drop of oil in the area shown lubricates the rear bearing. Do not put oil into the rectangular drive hole.

After this is done, I filed a nail into a rectangular shape at one end and inserted it into an electric drill to spin the magnet assembly as the speedometer drive shaft would to check speedometer function.

Calibration

Can the speedometer be easily calibrated? Only partially without much difficulty. Here is why. The speedometer needle moves because a magnet is spun by the speedometer cable. This magnet induces eddy currents (but does not touch) a metal disk to which the speedometer needle is attached. The result is that the needle is dragged by the torque created by the spinning magnet clockwise. If there were no spring, the needle would just go completely around clockwise until it hit the zero mph peg on the faceplate. A weak spring will allow too high a reading and too strong a spring will result in too low a reading with respect to actual speed. Unfortunately, increasing the strength of the spring is not easy or reducing the strength of the magnet. The only readily available adjustment is the pre-load torque.

In figure 8 above, the original pre-load tension of the speedometer needle was noted so the original calibration could be restored. Figure 13 below shows the results of adjusting the pre-load tension.

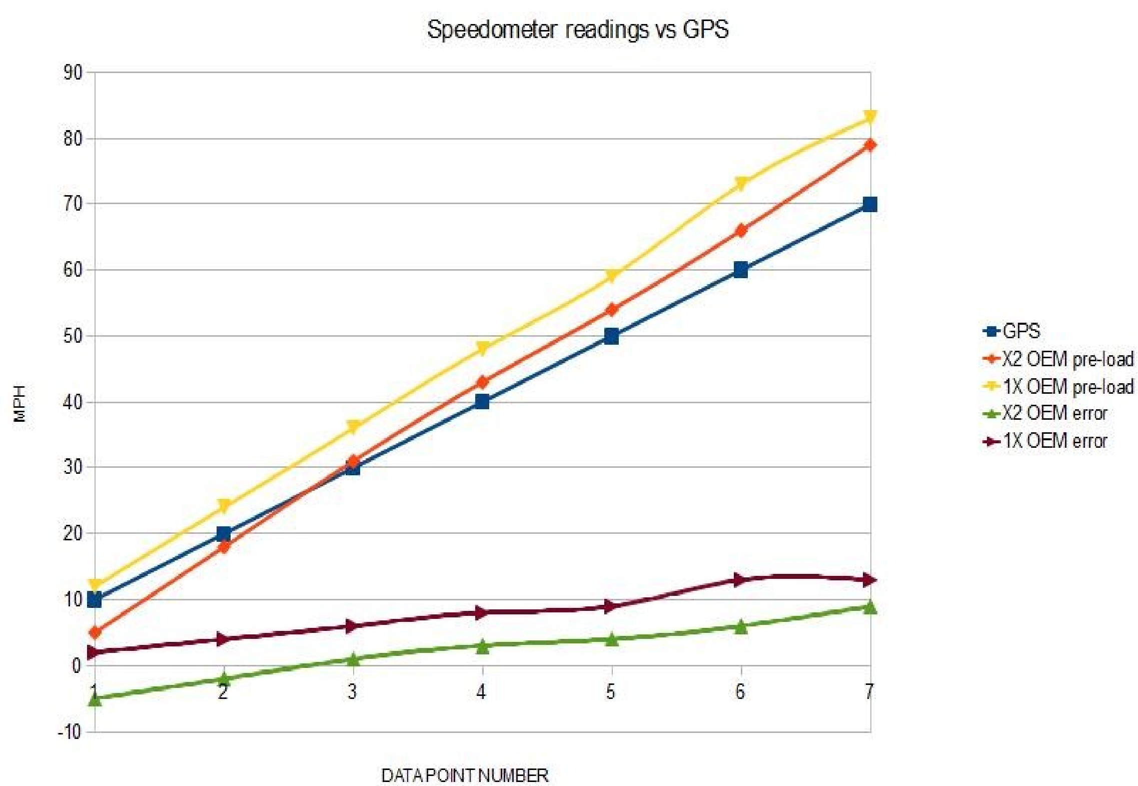

Figure 13

Data was taken at GPS speeds from 10 mph to 70 mph every 10 mph. The speedometer reading was recorded with the OEM pre-load and twice that. Doubling the pre-load effectively shifts the entire curve down about 5-6 mph. Notice that if the yellow plot line is extrapolated to the left, it will pass through zero mph.

The lower burgundy and green lines represent the error of the speedometer readings vs the GPS. For example, if the speedometer reads 12 mph and the GPS reads 10 mph, the difference equals 2 mph which is plotted with these lines. Note that the error with the OEM pre-load is always a positive number indicating a higher than actual speed reading which is likely Honda's objective.

What is not easily altered is that the yellow and orange plot lines are too steep compared to the GPS plot line in blue indicating that a stronger spring or weaker magnet is needed to cause these curves to be parallel to the GPS line. The pre-load can then be used to move the parallel line up or down to sit on the blue GPS line.

Since I only have access to one speedometer its hard to know how other speedometers compare. This one with the OEM pre-load is about 20% off at all speeds due to the weakness of the spring. The pre-load can be used to adjust the percent error at low speeds down to zero but it does not help much at higher speeds since the effect of pre-load adjustments is a fixed mph correction that is independent of speed. For example, the pre-load could be used to reduce the 2 mph error at 10 mph to zero percent but a 2 mph correction at 70 mph reducing the error from 13 mph to 11 mph is about an improvement of 18% down to 16%.

Figure 14 shows how the tests were done with the meter lens assembly removed so the speedometer needle could be removed and re-attached at different pre-loads. Tests were run with pre-loads from 1X to 4X.

The GIVI windshield with bulges at the bottom made it easy to strap a cord over the GPS unit with two large rubber bands around the cord and GPS as third backup.

Figure 14