

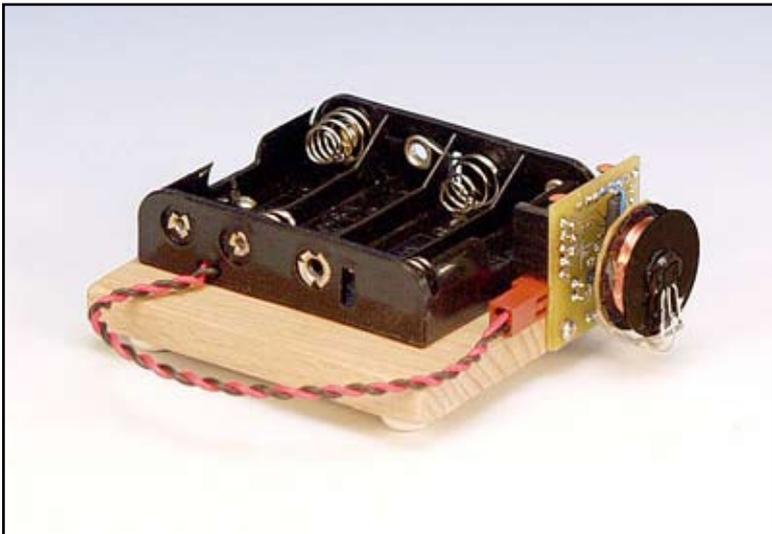
The Mumford Pendulum Governor

A rate corrector to make pendulum clocks keep quartz accurate time

The Pendulum Governor will correct the rate of any one second pendulum, making it keep quartz accurate time. It does this by counting swings of the pendulum and comparing this to the quartz time base in the circuit. When the Governor detects a discrepancy, it couples to the pendulum magnetically and brings the pendulum rate into conformity with the quartz time base.

The Pendulum Governor is a new invention. We're still developing methods of installing it in different clocks. Please read these instructions through before you start to install it. You can return the Governor for a complete refund at any time (up to 30 days after receipt) if you decide you don't want to keep it.

The first step in installing the Pendulum Governor is to fasten a small permanent magnet to the tip of the pendulum rod. This is done by clamping a small brass rod to the pendulum adjusting screw. The magnet is stuck to the end of this rod, facing the left side of the clock. The magnet bar should be adjusted so the height of the magnet will place it in the center of the circuit's coil when the coil is sitting on the bottom of the clock case. The magnet should face the left side of the clock. It may be necessary to place something under the Governor to adjust the height of the coil. For now, just get the heights right. Don't worry about the horizontal location.



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After you've attached the magnet to the pendulum tip and the height aligns it near the center of the Governor's coil, move the Governor to the far left side of the clock case so it's out of the way. Start the pendulum swinging and leave it alone long enough for it to reach a stable amplitude of swing. This could take as long as an hour if it is a heavy pendulum bob.

The rate of the clock needs to be within a "capture range" of the Governor circuit. It should be adjusted to run slow by three to five minutes per day. If you don't have a clock timer to measure this quickly, you ought to let the clock run overnight to confirm it is slow by about this much. If the clock runs fast, the Governor cannot control it. If the clock runs too slow, the Governor may not be able to bring it up to speed.

Once you have the pendulum rate adjusted in the right range and the amplitude of swing has settled, you must move the Governor towards the swinging pendulum until the face of the coil is 1/8" away from the left-most reach of the magnet. Then you will connect the batteries to start the circuit. There are two ways to connect the batteries. You can plug in the battery connector, or you can leave the connector in place and put the last battery into the holder. You will need to do this without moving the Governor after you get it in place, and without bumping the pendulum. You may wish to decide which operation will be easier for you to manage. Then disconnect the batteries and do as was described above --- move the Governor circuit slowly towards the swinging pendulum. Watch closely, and move the Governor until the face of the coil is about 1/8" from the swinging magnet. The magnet should be in the center of the coil in both front to back and top to bottom directions.

When you have the Governor in place, you must connect the batteries when the pendulum is at the right side of swing --- away from the Governor. And you must do this without moving the Governor or bumping the pendulum. If the Governor moves when you connect the batteries, just disconnect them and try again. If you accidentally bump the pendulum, you should wait for it to reach a stable amplitude before continuing.

This is a little delicate, but once done, you are finished. As you watch the Governor, you should see the following:

- The LED will come on the first time the pendulum swings to the left.
- The LED will come on again the second time the pendulum swings to the left. (The Governor is measuring the clock.)
- For the next half hour or so, the LED will blink very briefly every time the pendulum swings to the left.

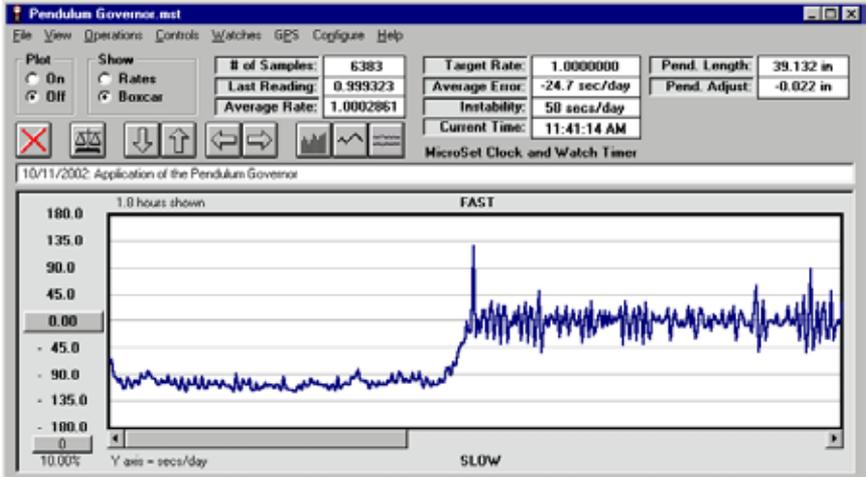
- After a few minutes, the Governor should try to correct the slow rate of the pendulum. On each swing when a correction is made, the LED will blink twice.
- After a few minutes of this, the LED will stop blinking every time, and only come on when a correction is necessary.
- After an hour or two, you should see the LED blink infrequently. If things are working correctly, the pendulum will swing for several times until it gets a little slow. The Governor should then apply a correction for a swing or two (blinking the LED), and then wait several swings before applying another correction. You should let the clock run overnight and see if it keeps perfect time. It should be good to the second.

If the LED is still blinking twice on every swing after two hours, it suggests the clock was adjusted too slow and the Governor is not able to correct it. You should raise the pendulum bob 1/2 turn and start over.

If the LED NEVER blinks after two hours, it suggests the clock was adjusted too fast. You could lower the pendulum bob 1/2 turn and start over. Or, just let the clock run overnight to be sure. If things are adjusted very closely, the Governor may need very few corrections to keep the clock running perfectly.

Feel free to call or email with questions. As stated earlier, this is a new invention. If you have trouble or decide you don't want to tinker with it, send it back for a refund. We have tested it on several clocks with different movements and pendulums and have confidence it will make any one second pendulum clock keep quartz accurate time. We would very much like to hear from you after installation so we can learn how easy or difficult it was for you and how well it works.

The Governor in Action



This MicroSet graph shows the Pendulum Governor taking control of a clock. In the left half, the rate of the clock is slow by about 90 seconds per day. In the middle of the graph, the Governor has synchronized the pendulum. Though the rate speeds up and slows down, it is maintained at the correct rate to within two seconds per week.

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