

White Paper: The KCC Scientific Model 1900W Clock Winder For Standard Electric Clocks

Ken Reindel, KCC Scientific Updated 6-12-09

The purpose of this White Paper is to help provide some background on Standard Electric Time master clock minute winding, what a Model 1900W Clock Winder does, and how it works.



Historical Perspective. From the 1880s and beyond, inventors became interested in applying the principles of telegraphy to horology. The idea of a battery-wound master clock which would drive multiple slave clocks, effectively communicating the time signal to them, began to take shape. Additionally, it became fascinating to inventors that the “slave” clocks could be very simple, with no escapements or springs and requiring little if any maintenance. Charles Warner, who founded the Standard Electric Time Company in 1884,¹ was one such inventor.

Very early on, Standard Electric borrowed heavily from the Self Winding Clock Company for the design of its master clock movements. Master clocks would have the characteristics described above and relied on special contacts to drive the slaves. Later on, this same concept would be extended to driving program wheels and punched tape ribbons within the clocks themselves, to provide bell timing and other electrical sequences to businesses, schools, etc. For example, many such clocks have been found in schoolhouses and were at one time responsible for ringing bells at the proper times throughout different parts of the building to send students to the next class, as well as driving classroom slave clocks.

Standard Electric’s master clock movements eventually took a shape similar to that of the slave clocks: simple, elegant minute impulse ratchet designs for winding the 60, 72, or 80 beat pendulum movements. Originally, banks of large, central remote batteries provided power. Many systems were designed to operate from 24 volts. These clocks are found today, often powered by makeshift—and sometimes unsafe—20 to 24 volt power supplies.

A large number of these early Standard Electric clocks wind by way of a pair of electromagnetic coils located at the bottom of the clock movement. The system is very simple. Each revolution of the escape wheel results in electrical contact between a set of points which energize the winding coil once per minute, with pulse duration from 0.5 seconds to sometimes up to 2 seconds per minute. This was efficient at the time because of its mechanical simplicity. Energizing the electromagnets pulls a ratchet pawl against a ratchet wheel which increments a helical mainspring enough to power the clock’s train.

Today we are often asked if it is possible to “untether” the clock from a power cord, since quite often the owner wants to locate the clock somewhere that is not close to an electrical outlet. Bottom line, it is very inefficient to run these clocks directly from batteries. Simply connecting a series of batteries to replace the line operated 24 volt power supply would result in poor battery life. Customers often try connecting four 6 volt lantern batteries in series to replace the 24 volt power supply that came with the clock.

What would be battery life be in this case? Think back at the minute wind cycle that lasts over 1 second for each impulse (“contact dwell”). This means that the battery is connected to the coil for over 1.7 percent of the time (1 out of every 60 seconds, which is 1/30th of the time or 1.7%). A typical 24 volt winding coil might draw up to 80mA from the battery. For purposes of winding these clocks, typical lantern battery has a useful capacity of about 10 amp-hours. Battery life can therefore be calculated:

$$\text{Life, in Hours} = 10 \text{ amp-hours} / 1.7\% \text{ of } .08 \text{ amps} = < 7300 \text{ hours}$$

There are 8760 hours in a year, so the FOUR batteries would have to be changed at least every 10 months or so. With an average cost of \$10 per lantern battery, this would equate to about \$50 per year! Certainly there has to be a better solution to this “contact dwell” problem. In addition, where would you mount four lantern batteries in a typical Standard Electric clock?

The Model 1900W. The Model 1900W kit is an innovative new way to wind your minute impulse Standard Electric master clock, available as either a module or No. 6 kit. On the outside, the kit looks like an ordinary pair of No. 6 vintage batteries. On the inside, the kit contains four alkaline D cells (two in each No. 6 unit) and a highly efficient 24 volt converter and regulator that is pulsed on exactly once per minute. The two No. 6 units are connected together with the supplied wire. The output of the Winder is connected directly to the Standard Electric clock coil. The movements are similar to the one shown below.

The trick to delivering long battery life is the length of the pulse, which is internally controlled to exactly 0.3 seconds—much shorter than the mechanical pulse which will be more than 1 second long, but yet more than adequate to assure positive winding of the clock. In addition, since the internal electronics is regulated, the stored battery energy is more efficiently utilized. The result is over 1 year of battery life with four alkaline D cells, which can be replaced for under \$4 per year—a \$46 savings in cost per year vs. the lantern solution, a more convenient battery changing schedule, and fewer cells to hook up.

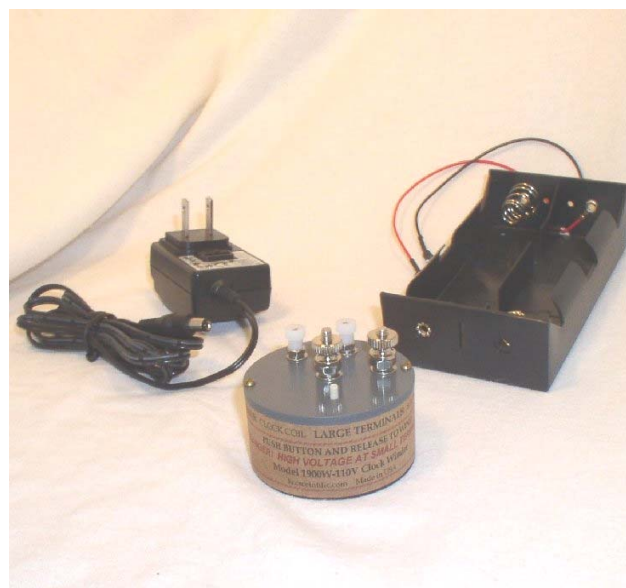


One important benefit is that the 1900W is connected directly to the clock coil, bypassing contacts. The result is elimination of a common source of failure—burned, pitted or misadjusted contacts! Of course, if you still prefer to use the clock’s contacts, you can refer to Q&A #14 below.

NOTE: The Model 1900W is intended for impulse wind Standard Electric clocks with electromagnetic coils located at the bottom of the movement as shown to the left. It is not intended for clocks with large motors which power gearboxes to pull chains, cords, and weights to run the clock. These are sometimes called “Automatic Reset” clocks and must be line powered.

¹More pictures and historical information on Standard Electric clocks can be found at: http://clockhistory.com/setclocks/master_clocks/index.html.

Many thanks to Jeffrey Wood for his fabulous, timeless collection of pictures and detailed descriptions of these clocks, some of which we reference here.



Model 1900W Module (Wall power adapter optional)



Model 1900W-UNV Kit (includes internal batteries)

Questions and Answers about the Model 1900W Clock Winder

1. I have a minute impulse wind Standard Electric Clock with a transformer and power plug. Do I have to remove these items from the clock in order to use the Model 1900W? Do I need to remove the contacts?

No changes need to be made to the clock. The output of the 1900W simply needs to be connected directly to the clock coil in place of the wires already there. The 1900W takes care of the rest. NOTE: Do not plug the clock's old power supply into the wall with the 1900W connected. Simply leave the power cord disconnected. If you wish, you can remove the old power supply from the clock but this is not necessary. We recommend you leave the contacts and other devices in place, in the event that someone down the road prefers to operate the clock from line power again.

If you wish, you can adjust the contacts so they do not commutate with the escape wheel, but this is not necessary.

2. Why don't I connect the 1900W in place of the clock's internal wall-powered circuit?

Because the 1900W contains the timing elements to excite the winding coil exactly every minute, there is no need to use the contacts on the clock. In fact, using the contacts will not work since the 1900W—not the contacts—governs when and how long the coils are excited.

3. What is the Model 1900W-UNV?

The Model 1900W-UNV is our NEW Universal Winder. It was designed to automatically detect the voltage required by the clock and apply the correct drive to the coil. It is revolutionary because you don't have to worry about the required voltage. It will drive any master or slave clock from 1.5 volts to 25 volts—automatically, correctly, and very efficiently. This eliminates a lot of confusion in getting the right power source for the clock. Given the broad number of clock voltages in existence, this is quite important.

The Model 1900W-UNV also has a mode to drive 30 second impulse clocks. The Model 1900W-UNV replaces all previous 1900W-xV units.

4. What kind of wire do I use to connect the 1900W products?

We provide wire sufficient to connect the clock, if the 1900W is placed on top of the clock. If you want to place the 1900W kit on the bottom of the clock and therefore need longer wire, let us know and we can provide additional wire. Our wire is vintage-looking cloth covered wire so that the system blends in with the look of the clock.

5. How do I manually wind the clock, say, if it had been previously unwound?

There is a button on top of the 1900W Clock Winder which, when depressed, will automatically wind the clock. This button can be pressed multiple times until the clock is wound sufficiently to run.

Typically, you would want to wind the clock with 60 impulses to fully wind, but fewer are fine, too. We suggest at least 40 impulses to get things started.

6. Is it possible for the clock to unwind itself despite being run by the 1900W?

For clocks with a 59 tooth ratchet wheel (many of the clocks out there), there is no realistic way it will ever unwind itself with a 1900W. For clocks with a 60 tooth ratchet wheel, if the clock is poorly adjusted and runs, say, 10 minutes per month fast, the clock may unwind before the batteries need to be replaced. But what use is a clock if it is left to run at such a rate? Most enthusiasts will regulate the clock quite closely.

Should the clock unwind, it will obviously stop, and the winder will bring it back to fully wound in a matter of less than one hour if left undisturbed. Should this happen, restart the clock.

7. Can the 1900W be used to regulate the clock?

It is interesting to note that the extreme high accuracy of the 1900W can be used to “pace” the clock to timing perfection. The second hand is observed at each audible winding. The pendulum can be adjusted so that over the course of time, the second hand is pointing to the exact same place on the seconds dial every time the clock winds. When this is achieved, the clock will be timed in at a rate of better than 2 seconds per week! Granted, this will take substantial trial and error with most pendulum clocks.

8. What about minute impulse Stromberg clocks, or ITR models? These are difficult to wind. Can I use the 1900W-UNV to wind them?

Many Stromberg of Chicago movements, such as the Model 45, are also minute wound designs much like the Standard Electric models. The most popular we’ve seen has 10 volt coils but we have also seen 15 volt, 20 volt masters—all of which can be wound with the Model 1900W-UNV without worrying about which voltage clock you have.

Periodically we run across 110 volt DC movements. We also offer the Model 1900W-110V for these movements. The 1900W-110V is very exciting because it eliminates a potentially very dangerous wiring condition often found in these 110 volt clocks.

9. I have a weight driven Standard Electric master clock that is wound by a 120 volt AC motor. Can I battery operate this model?

Not with our products. Models with 120 volt, 240 volt, or 24 volt AC or DC electric motors cannot be powered by any KCC products. These must continue to be operated from line power. The Model 1900W is intended only for minute impulse wind clocks with two coils located at the bottom of the movement.

10. Will the escape wheel experience abnormal wear as a result of using the 1900W?

No! Let’s compare the two scenarios. Consider first the clock run from the 24 volt supply, and the coil energized with mechanical actuation. With Standard Electric masters, the contacts are set to energize at or during escapement impulse. At some point, the movement becomes fully wound. Because there is no clutch arrangement on the movement, eventually there is forward impulse between the winding mechanism and the train when the clock winds, resulting in strain to the escape wheel teeth. This is especially true since the escape wheel could be forced forward during drop depending on the contact setting in a particular clock. With mechanical actuation through a contact set to energize at escapement impulse, the same tooth will experience wear, every time for all time.

With the 1900W, it is virtually impossible for the clock coils to be energized with the same escape wheel tooth in the same position, every time, for all time. It would be unimaginable that the movement would run at the exact same rate as the 1900W, no matter how well the movement were adjusted or timed in. Natural drift in the movement timekeeping due to temperature, humidity, etc. will mean that the winding impulse most likely occurs across multiple escape wheel teeth over the course of time, which will tend to lessen the wear or distribute it more evenly, not increase it. Further, statistically it will occur during escapement lock for some portion of the wind cycles when using the 1900W (which it cannot in the previous case), again reducing potential for wear, and does not depend on how the switch is adjusted.

Further, because the actual impulse lasts about 4 times shorter than with mechanical actuation, the time during which this force is applied is lessened very significantly. This statistically results in less wear to the escape wheel than with the mechanical arrangement.

11. Can the 1900W be used to impulse ribbon and wheel program mechanisms and circuits?

The Model 1900W was designed for customers wishing to run their clocks from battery power, using them as timekeeping devices. We can also provide other battery products for enthusiasts wishing to reproduce complete signaling systems, master/slave arrangements, etc. But that is not the intention of this product.

In theory, it is possible for an enthusiast to impulse ribbon and wheel program mechanisms with the 1900W. However, this must be done with great care, and it is advisable to contact Ken’s Clock Clinic for

consultation. You can also use the 1900W to drive a distribution relay that in turn can then drive program units and other things, but an auxiliary power supply would likely be needed to handle the additional load.

12. Can the 1900W be used to drive slave clocks?

Yes, the Model 1900W-UNV can be used to drive slave clocks. The minute impulses are very accurate short term and cumulatively. Our typical timekeeping performance when driving slave clocks is on the order of 1 second per week. Our Model 1900W-UNV will drive any slave clock from 1.5 volts to 24 volts. No special setup or wiring is necessary. It automatically detects the required voltage.

13. Can I power the 1900W with a lantern battery?

We produce a modular version of the 1900W which is very versatile. It can be used with lantern batteries such as Energizer 528 or 529, four alkaline D batteries (using the supplied battery holder), or can be run from our optional ES-9 EnergyStar wall power adapter.

The 1900W No. 6 Kit runs on four internal D batteries installed internally, which can be replaced when needed. Battery life is about the same whether you use the 1900W module with an external batteries or the No. 6 Kit version with four internal alkaline D batteries.

15. What if I decide I don't want the 1900W to impulse the clock?

Many, although not all, Standard Electric master units have a contact system connected directly between the verge and the escape wheel. These clocks have the advantage of a relatively short mechanical impulse time, which conserves battery power reasonably well if adjusted correctly. **We manufacture a product called the Model 1900-24V Kit** which looks just like the **1900W-UNV Kit** but outputs a continuous 24 volt DC level. Battery life will be reduced substantially due to contact dwell as described previously, but it will operate in this mode for an estimated run time of 4-5 months between battery changes. We would be happy to exchange your Model 1900W-UNV Clock Winder with the 1900-24V Kit if you prefer. But, we doubt you will ever want to give up your Model 1900W-UNV Clock Winder.

16. Does the 1900W save energy?

Absolutely! Most transformer powered clocks use older iron core transformers that are extremely inefficient. They will waste up to 10 watts, possibly more, plugged in all the time. This amounts to around 90KW-Hrs of energy usage per year! At \$.12 per kilowatt-hour, it costs almost \$11 to keep the clock plugged in per year, which is twice as expensive as changing batteries.

Keep in mind that power supplies found with the early Standard Electric and Stromberg clocks were later add-ons by enthusiasts. These were not part of the clocks originally. We find many of them in unsafe condition today, creating risk of fire or shock. BE CAREFUL with these old power supplies.

As always, Ken's Clock Clinic and KCC Scientific encourage you to dispose of spent batteries responsibly. Collection areas are available in most communities for this purpose. **And, of course, NEVER dispose of alkaline batteries in a fire.**