Universal Impulse Driver for Slave Clocks

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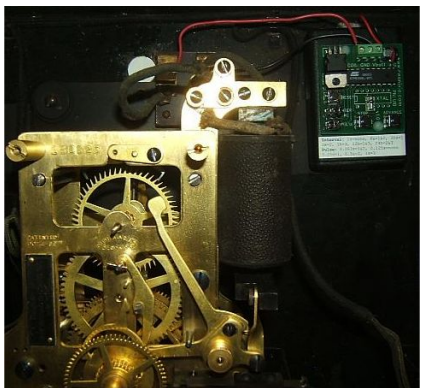
[Model # UID]

Bring those old slave clocks back to life!

The Neonixie Universal Impulse Driver is a replacement for the master clocks that were once was used to run slave clocks, or dials. Slave clocks were once common in schools, big offices, and public buildings, anywhere accurate time was needed on a large scale. This master/slave arrangement made it very easy to maintain accurate time. Only the master clock was set, after which the time was 'distributed' to all the other clocks.

These original master/slave systems were a combination of both electrical and mechanical systems. Commonly a mechanical, highly accurate clock was used as the master. The master was electrically wired to send a pulse every so often to run the slave clocks. The slave clocks were very simple, usually consisting of only a few gears and an electrical solenoid. The slave clocks would advance when a pulse was received from the master.



There are variations to this theme, one good example is the popular Self Winding Clock Company Clocks (SWCC), or commonly known as Western Union Clocks. Although not a pure slave dial, it contained a mechanism that would reset the hands of the clock to the top of the hour. Users would subscribe to a service that would send a periodic pulse at exactly the top of the hour, which would synchronize the clock to near perfect time.

Western Union discontinued its time synchronization service many decades ago. The original arrangement of electrical/mechanical distributed time has also fallen out of favor, replaced by all electrical systems usually running large LED displays. Many of these old slave dials can now be found, from the most basic office clocks to ornate double-faced examples that used to hang in train stations. Using our impulse driver you can bring them back to life, or in the case of the Western Union clocks, synchronize them to quartz crystal accuracy!

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Precautions

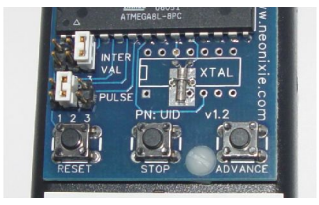
- **Read through all the instructions before using the impulse driver.**
- **Handle the impulse driver with care.** It is a bare board and is sensitive to static electricity (the zap you sometimes get from touching a doorknob). This can damage the unit. When setting the jumpers, you should neutralize the static electricity in your body by touching a grounded metal object; one good example is a computer case. Note that even a small static discharge, one that you cannot feel, can damage the unit. Try not to handle the board otherwise, instead holding it from the plastic battery case. The switches are fairly safe to touch, but in extreme static environments, such as a very dry room during winter (where you've just walked across your wool rug!), it is recommended that you push the switches with a plastic pen, a wooden toothpick or any other insulating device.
- **Do not drop the unit**; it contains a delicate quarts crystal, which can be damaged.
- **Know what you are running!** You should make certain that in case of a failure of the device or a short, that the clock you are running would not be hazardous. Although most slave dials can withstand being left on continuously, since their coils are relatively large compared to the amount of power dissipated, shorted windings in the coil can cause them to draw large amounts of current. Version 1.2 of the impulse driver (characterized by its blue circuit board) has a build in self-resetting fuse. This will limit the continuous current to about 0.3 to 0.6 amps. If this limit is not sufficient, or you are running an earlier version of the impulse driver, you should install an external fuse on your coil. Also be aware that the self-resetting fuse does not protect the coil when an external power supply is used. It is your responsibility to assure that your clock will run safely, if in doubt, get help from an experienced electronics and/or clock technician.
- **Never exceed a current draw of 2 amps, and never switch more then 60 volts with the impulse driver!** If you require more current to be switched an appropriate relay should be used.
- Do not use the device if you notice any damage to wiring or any other component. Return the device to us for repair.

Using the Impulse Driver

Batteries

First you will need to install a fresh set of 3 AA alkaline batteries. We do not recommend rechargeable batteries due to their high self-discharge rates. Depress the bottom of the battery cover (where the pulse and interval settings label is located) and slide it upwards to access the battery compartment. Be careful not to pull the power wires apart, as they are attached to both the battery compartment and the cover. Make sure to correctly orient the polarity of the batteries as indicated.

Pulse and Interval Jumpers



The Pulse and Interval jumpers should now be set. The Interval jumpers control the interval between each pulse. The pulse jumpers control the pulse length. There are 6 jumper positions, 3 for the Pulse Length and 3 for the Interval. Jumpers are numbered from 1 to 3 (left to right) and are "ON" when the corresponding jumper is installed horizontally, shorting the top and bottom pins of the associated number. The example in the picture sets Interval jumper 3 and Pulse jumper 2, which correspond to a 0.5 second pulse every 1-hour. Unused jumpers can be stored on a single pin.
NOTE that after setting the jumpers the reset button will need to be pressed for the new settings to take effect.

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Using the Impulse Driver (continued)

Wiring Your Clock

There are 3 connections on the green colored terminal block at the top of the impulse driver: COIL, GND and Vbatt. They work as follows:

- COIL: This will always be connected to one side of your clocks coil. It acts as a switch that grounds your coil when it needs to be activated.
- GND: This is the ground or negative side of the impulse driver.
- Vbatt: This is the battery power of 4.5 volts.

There are basically two ways to wire your clock, depending on how you will power your clocks coil: using the internal batteries of the impulse driver or an external power supply/batteries.

If your clock requires 4.5 volts or less, you can wire one side of your coil to the "COIL" terminal and the other side to the "Vbatt" terminal. NOTE that if your clock requires less then 4.5 volts, you should also use an appropriately sized resistor in series with your coil to reduce the voltage to the proper level. The "GND" terminal is not connected in this arrangement.

If your clock requires greater then 4.5 volts, you will need to use an external power supply. You can use a variety of power sources, from batteries to common wall adapters. Wire one side of your coil to the "COIL" terminal on the impulse driver. Wire the positive power lead from your supply to the other side of your clocks coil. Wire the ground or negative lead of your power supply to the "GND" terminal on the impulse driver. The "Vbatt" terminal is not connected in this arrangement.

Mounting

Mount the impulse driver to your clock. You can use the supplied Velcro if desired. Make sure to keep metal parts of your clock away from the impulse driver, as it can cause a short. Version 1.2 of the impulse driver contains a self-resetting fuse, which will get hot if triggered, make sure heat sensitive or flammable items are not touching or near the impulse driver.

Setting The Time

Hit the reset button to make sure the jumper settings are read and your driver is active. Once the reset button is released you should get the first pulse from the impulse driver. If the clock does not send the first impulse, disconnect your coil and refer to the troubleshooting section. To set the time you can use the advance button to advance your clock, holding the button down will advance your clock rapidly. If your clock is too far off, you can also use the stop button to prevent any pulses from being sent to your clock, you can then come back at a later time and use the advance button to set it.

For Self Winding Clock Company Clocks (SWCC, aka Western Union Clocks) wait until the top of the hour and hit the reset button. The impulse driver will send an initial pulse right after the reset button is released and subsequent pulses will follow exactly 1 hour later (or 12, or 24, depending on your desired synchronizing interval).

Troubleshooting

If your impulse driver is not operating properly, here are testing procedures you can use to locate the fault.

- **Do not leave your coil/clock connected to the impulse driver in a fault condition!**
- Disconnect the impulse driver from your clock. Using a voltmeter, measure the voltage between the "GND" and "Vbatt" terminals; you should be reading a voltage of about 4.5 volts. If your voltage is lower then 3.5 volts, your batteries have been exhausted and should be replaced.
- Always remember to reset your impulse driver after replacing batteries or changing jumper settings.
- Remove all jumpers and reset your impulse driver, measure the voltage between "COIL" and "Vbatt". You should see your meter pulsing every second. This confirms proper operation of the time circuit and the transistor. NOTE: Your meter might not show the full voltage (4.5v). This is because the pulse duration might be too short for most meters to display the actual peak voltage.
- If all the above tests pass, the problem might be your clocks coil and/or wiring. Test the coil with an ohmmeter. The resistance of coils vary, but there are two conditions which are obvious faults; one is a shorted coil or wiring, which will show up as 0 ohms (or close to 0 ohms) on your meter; the second fault condition is an open coil or wiring, which will show up as infinite ohms on your meter. If you experience any of these conditions, have a clock repair tech examine your clock.

Technical Details

Switching Transistor
The impulse driver contains a transistor (actually a FET, Field Effect Transistor) that acts as the switch used to pulse your clocks coil at the appropriate time. It works by grounding one side of your coil and allowing current to flow through it. Most clocks require 1.5 to 24 volts and less then 0.5 amps. **You should never exceed the voltage rating of 60 for the transistor, or exceed 2 amps of current draw!**

Self Resetting Fuse
Version 1.2 of the Impulse Driver contains a self-resetting fuse. This fuse has a hold rating of 0.3 amps, meaning that it will not trip at this current. The minimum current at which the device will trip is 0.6 amps. Under high current conditions the self-resetting fuse is designed to trip in a maximum time of 3 seconds at 1.5 amps. **If these ratings are not sufficient, or you have an earlier version without the fuse, you should consider installing a fuse for circuit protection.** Note that these ratings will vary slightly with temperature. You should also be aware that this fuse will not protect your coil if you will be using an external power supply; if required it will need to be fused separately.

The self-resetting fuse will get hot under fault conditions. The fuse is disk shaped, tan in color and is located at the upper right hand corner of the impulse driver where the power wires attach to the board. If you notice it getting hot, you have a fault condition that needs to be corrected. You might also notice erratic behavior, as it re-applies power when it cools. **Disconnect your clock/coil, do not operate your clock in a fault condition!**

If you are drawing approximately 1.5 amps or more from the Impulse Drivers battery supply (the Vbatt terminal), the self-resetting fuse might trip without an actual fault condition. The fuse tripping and resetting continuously will also cause erratic behavior. It is recommended that if you will be exceeding 1.5 amps of current draw that you use an external battery or power source. This will also prolong the life of the Impulse Drivers batteries, since their life will be shortened by very high current draws.

It should also be noted that the self resetting fuse has a resistance of about 1ohm in its non-tripped state, this will slightly reduce the amount of voltage available from the "Vbatt" terminal under high current draw.

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