Light Movement, an art installation by Alan Smith

(http://www.alansmithartist.com/lightmovement.html)

www.alansmithartist.com

Effect delivered by the "Kinelume" designed by

J.H. Paterson. Circa 1975

Renovation by Gary Morgan 2016

Owning a company that specialises in lighting control, I was put in touch with Alan, an artist seeking the repair of a lighting controller he had for an art installation. Alan had been on a quest to get someone to take on the work but given that the unit was custom built in a university, it was not going to be easy.

Alan was looking to revisit his artworks and this one last saw service in America some 30 years or more prior, although it had been exhibited in UK & Europe previously. I fancied a challenge so I arranged to meet up with Alan and was shown the unit, beaten and battered sitting on a desktop still with a US plug top.

The controller uses ultrasonic's to detect the motion of a person and flash the light accordingly so the participant becomes the creator of the work.

Upon receipt of the unit, called a "Kinelume", there were some obvious issues that needed dealing with. Not least of which was to fire it up on 110V to get some idea of the power supply requirements. From there it could be converted back to UK operation and see how alive it was after the initial works.

Immediately the mains wiring gave cause for concern and when powered up, occasionally the office RCB tripped indicating earth leakage issues. This was hardly surprising given that that mains suppression inductors were burnt out.

So these issues were addressed. There was a compromise of trying to keep the unit faithful to its original build or make it safe. The latter won over, with a new mains filter being installed together with a proper plug and switch arrangement for the power cables.

This was a project that reminded me very much of the types of circuits I would have played around with as a hobbyist in my school days.

The biggest issue was to know what to expect from the unit. Alan had not seen it working for a number of years and I had not seen it working at all. We knew the name of the original designer but could not get in touch with him. Of course there was not video to refer to either being built before the Internet & YouTube.

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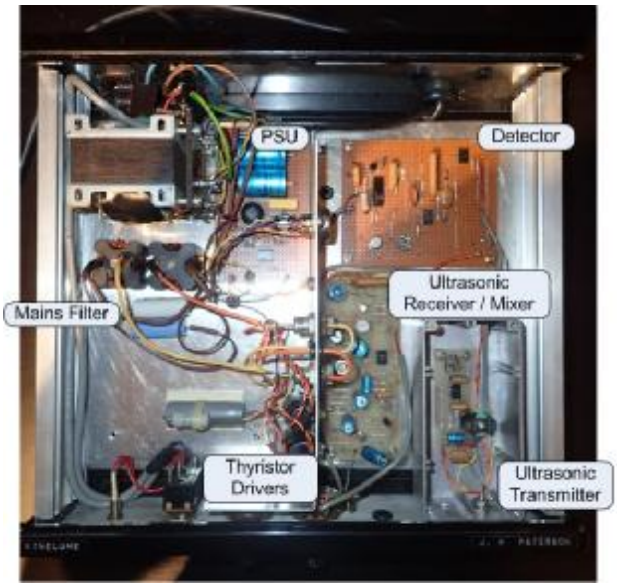
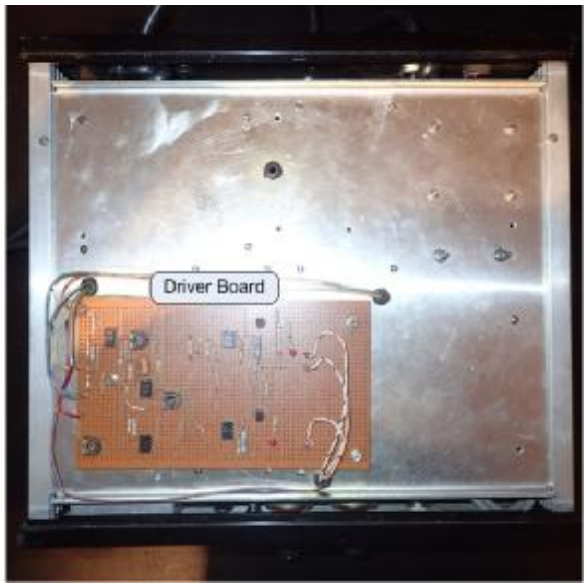
Internally the unit was broken down in to several subsections (circuit boards). Once the functions of these were understood it was easier to understand what was going on.





A little bit of coaxing on the bench and it did start to produce light linked to motion, but not very bright and often of its own accord.

Looking at the brightness issue I found that only one of the output thyristors was firing so the lamp was only ever getting a half wave output. Digging around I found dry joints to a DC blocking tantalum capacitor on driver board, correcting this gave a brighter light.

My probing also found that the supply was very noisy so I set about replacing old electrolytic capacitors and adding decoupling capacitors. This made the supply very much more stable.

As the “Kinelume” is analogue there were a lot of preset potentiometer’s, the setting and effects of which were not known. Their intial positions were noted. Then out with the oscilloscope to investigate and calibrate. A lot of time was spent playing and adjusting while watching what was going on. This resulted in much better performance of the unit and I was able to document the setup of the unit.

That said the behaviour of the unit was still erratic often giving a burst of light for no reason and was not easy to setup as it seemed different every time. Maybe it was supposed to be like that, maybe that was its charm and character, I did not know. However, it did not seem right. I traced the fault to the driver board and there were two parts to it. One was to generate a zero crossing signal from the mains signal so that the thyristors could be triggered correctly. This seemed to be influenced a lot by what was happening on the output. I found that the circuit to one of the thyristors put a lot of load on this signal but the other side did not. Tracing the circuit, I found that one side had a resistor in its path the other not. Placing one on the other side made it much more stable. Maybe this was part of the original design or maybe it was a mistake in construction. I don’t know.

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The other thing with the driver board was its stability and random triggering. Investigation found a capacitor in a pulse shaping circuit to be faulty, replacing this gave a unit that could be set to reliably trigger on motion. But the big question is, does it work like it used to? Time to hand it back to the artist and let him see it for himself.

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Initial Works

- Securely fixed base plate to chassis to prevent broken connections
- Securely fixed transmitter housing to baseplate
- Lubricated Sensitivity Potentiometer
- Glued broken front bezel
- Remade 12Vac connection from transformer to power supply PCB
- Remade RX connection from front panel to preamp PCB
- Photographed unit
- Sourced alternative ultrasonic transducers to the original EFR-OAB40K4 & EFR-RAB40K4 units that were damaged or lost. Replaced with Pro-Wave 400ST160 & 400SR160.
- Powered up on 110V transformer and took initial PSU readings with outputs disconnected. ±10V
- Rewired transformer for 240V operation

Safety Concerns

- Poor Earthing
- Earth leakage
- Mains Input & Output Connections
- Strain relief to Mains Cables
- Inductors burnt out

Observations & Modifications

- Rewired power supply lines to PCBs to minimise noise & earth loops etc.
- Rewired mains wiring
- Added smoothing and decoupling capacitors to all circuit boards to reduce noise and ripple
- Installed IEC plug & socket to front panel to provide better safety and cable management.
- Replaced snubber circuit
- Replaced mains input chokes to provide better RFI protection
- Installed a single point earth.
- Replaced key capacitors to PSU and ultrasonic pre-amp
- Replaced ultrasonic transducers and re housed
- Removed unnecessary component's from external panels
- Replaced capacitor on driver board providing much better performance
- Recalibrated unit & documented

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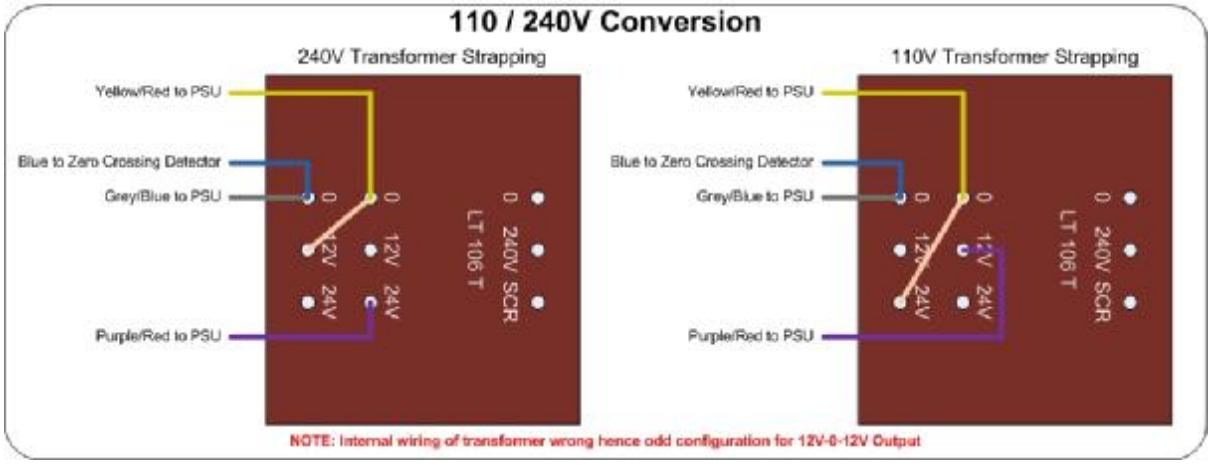
- Transformer outputs transposed and do not provide the voltages indicated.
- Input fuse rated at 5A
- No load transformer outputs: 2 x 0V, 13.6V & 27.3VAC 0.5A,

  Note: A couple of the output pins have been miss-wired internally and so do not deliver the voltages marked up.



PCBs

PSU (±10Vdc)

VR1 = Output voltage

Consumption +10Vdc @ ~ 92mA -10Vdc @ ~ 40mA

Ultrasonic Transmitter (40KHz)

VR1 = Output frequency

Ultrasonic Receiver & Mixer

VR1 = Input sensitivity

Detector

VR1 = Trigger voltage

Driver Stage (Located on the underside)

- VR1= Zero Crossing Null (Just centre as it has no affect)
- VR2 = 50Hz Zero crossing saw tooth (set for minimum offset)
- VR3 = Drive signal

Drive Circuit

2 off 10RIA40 SCR Thyristor 10A 400V TO48 in an anti-parallel configuration

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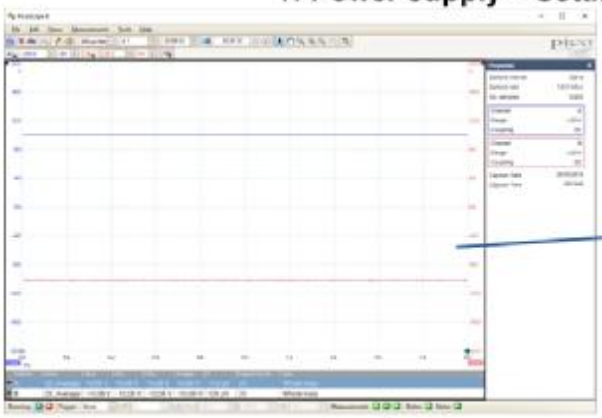
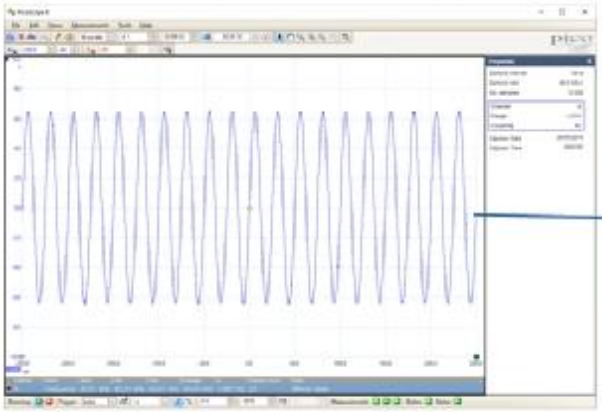
Unit Calibration

1: Power supply – Setting the output voltage



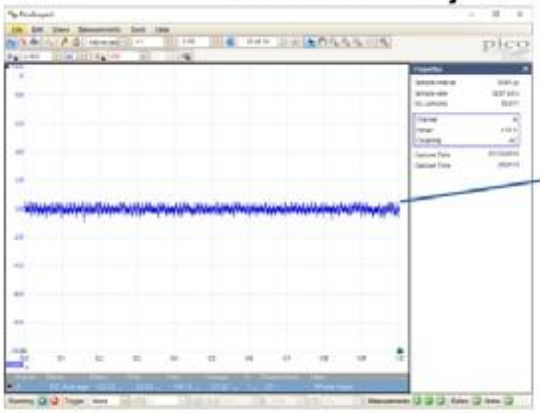
Allow a 15min warm-up period. adjust VR1 for an output voltage of ± 10Vdc

2: Ultrasonic Transmitter – Setting the transmit frequency



Connect ultrasonic transmitter to Kinelume and allow a warm up of 15mins to allow for stabilisation. Adjust the pot for an output frequency of 40kHz

3: Calibration - Adjustment of Ultrasonic Receiver/Mixer



Allow a warm up of 15mins to allow for stabilisation. Turn the pot fully clockwise. With the ultrasonic receiver disconnected turn the pot anticlockwise until the voltage suddenly drops

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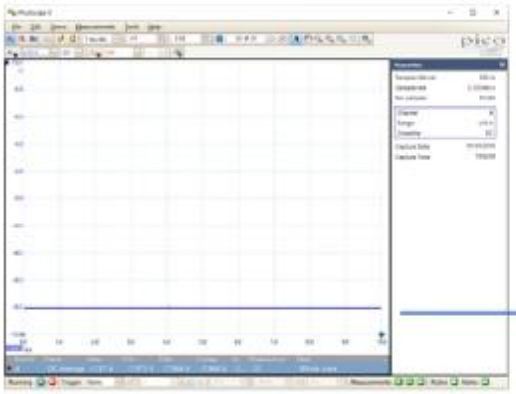
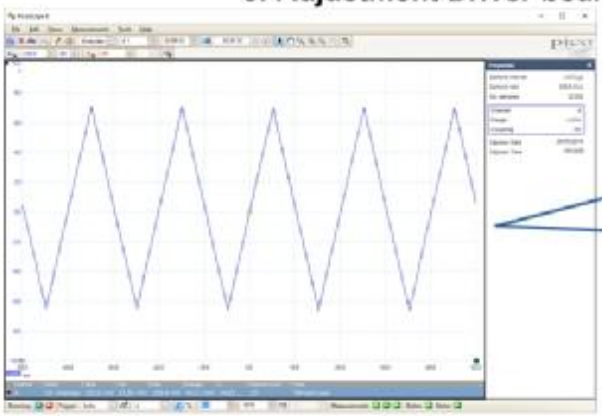
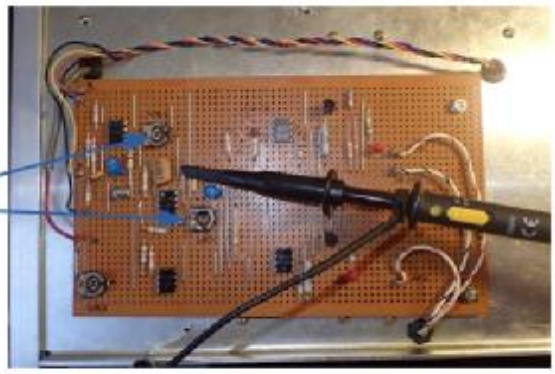
4: Calibration - Adjustment of Detector



Allow a warm up of 15mins to allow for stabilisation. With the front panel sensitivity set at minimum, turn the pot anticlockwise until the voltage drops to -8V.

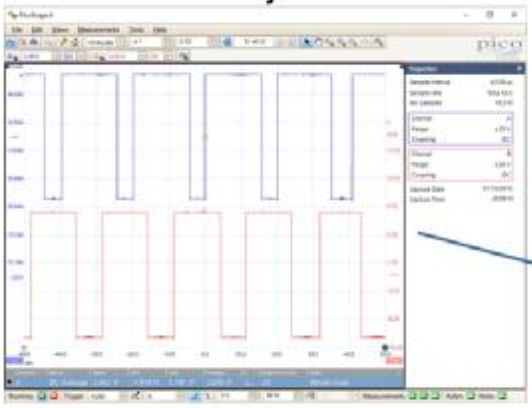
5: Adjustment Driver board - Zero crossing offset

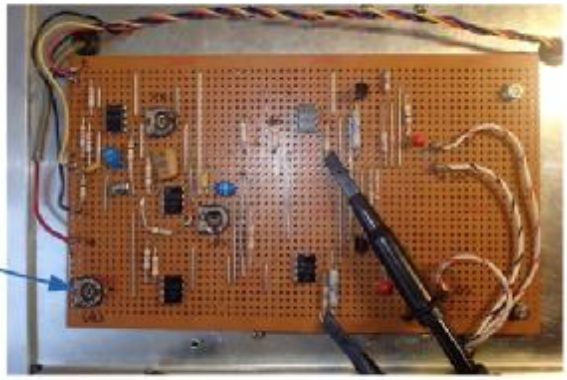




Allow a warm up of 15mins to allow for stabilisation. Set the front panel sensitivity to maximum. Centre VR1. Adjust VR2 for an DC average of 0V (until the saw tooth is centred on the 0V axis).

6: Adjustment Driver board – Thyristor output balancing





Allow a warm up of 15mins to allow for stabilisation. Set the front panel sensitivity to maximum. Adjust VR3 until the light is as bright as it will go. Then with the sensitivity set minimum rotate the pot anticlockwise until the lamp is fully off

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