DIM AND DISTANT PAST...

...THE STORY OF DIMMER TECHNOLOGY

Since the Ancients scheduled their productions at Dawn or Sunset to maximise visual impact, control of the intensity of light has been one of the most important factors in lighting design — if not **the** most important factor.

THE HISTORY

Earliest dimmers took the form of shades or dousers used to cover a light source whose intensity could not be varied. Gas lighting introduced the ability to control the intensity of the light source itself and brought with it the concepts of remote control and energy saving we now take for granted.

Theatre technicians are expert at stealing concepts and ideas from science and industry and adapting them to enhance their work. Electric lighting was avidly purloined, combined with a variable resistor (comprising two electrodes in an earthenware bucket, filled with an undefined saline solution) and stage lighting had its first electric dimmer.

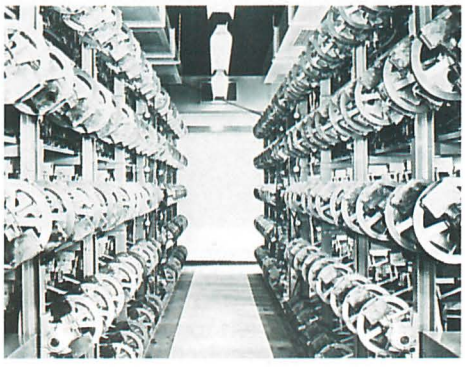
As the world's electrical industry developed, saline dimmers gave way to wire-wound resistors, but the principle remained the same: limiting the current flowing through the lamp by increasing the value of a resistor connected in series with it.

There were several problems with this technology: Heat dissipated in the resistors caused ageing, and remote control required complex mechanics and a plethora of moving parts. However the major constraint was that resistance dimmers had to be matched to the power of the lamp being dimmed.

TRANSFORMERS

Transformers offered the possibility of supplying the lamp with a lower voltage to dim it. A transformer with many tappings on its secondary winding allowed the voltage applied to the lamp to be varied.

Heat losses in the transformer dimmer were much lower than the resistance dimmer and the need to match dimmers to lamp power was greatly reduced. The first tranformer dimmers in the UK were installed at Glyndebourne in 1934. However prohibitive costs prevented transformer dimmers becoming commonplace until the 1950's.



The electro-mechanical dimmer banks installed at Wembley during the 1950's.

THYRISTORS ARRIVE

The era of voltage control was short lived following the demonstration of the Thyratron Dimmer by George Izenour, in the USA, during the late 1940's. The thyratron was a glass thermionic valve which, once triggered, allowed current to flow (in one direction) until the voltage across the device fell to zero. Even when the voltage was restored the thyratron would not conduct until the triggering signal was applied again.

Clearly by synchronising the triggering signal with the mains supply a thyratron could be triggered part way through the mains cycle and would continue to pass current for the remainder of that half cycle. By varying the time delay from the start of the mains cycle to the triggering signal the energy supplied to the lamp could be controlled.

As the thyratron conducts only in one direction two devices were connected in parallel 'facing' in opposite directions to give control during both halves of the mains cycle. This is the principle of phase control used in all dimmers today by the thyratron's silicon successor, the thyristor.

Thyristor dimmers are more efficient than their predecessors, typically dissipating less than two percent of the total power of the circuit at full load. Their output is independent of the size of the connected load; their control interface is amenable to remote siting of a lighting desk and they are reliable. Above all else they are inexpensive, allowing hundreds of dimmers to be installed in a theatre or TV studio.

'It is a sobering thought that if the cost of dimmers had risen in line with inflation one 10 Amp dimmer would now cost over £2000, whilst a 96 channel control desk would cost about £100,000.'

It is easy to see why phase control dimmers eclipsed their predecessors during the 1960's and 1970's, however even these dimmers present technical challenges to their designers. The fast switch-on speeds of thyristors responsible for the dimmer's high efficiency, also give rise to electromagnetic interference which, if unchecked, would be picked-up by other equipment.

Most thyristor dimmers in use today have an analogue control circuit. Such analogue circuits are subject to component tolerance variations which may be compensated for by adjustment potentiometers. Even so there will be slight variances between individual dimmers and possible fluctuations with temperature change or as components age.

TODAY

In the same way that compact discs have eliminated the analogue vagaries associated with magnetic tapes or vinyl records, so digital control circuits can overcome the shortfalls of the analogue dimmer.

In future, control consoles will issue instructions to digital dimmers which will hold outputs steady despite component or environmental variances. These things are made possible by the tumbling price of microprocessor technology.

Strand's Triac ACT 3 dimmer pack developed in the 1980's.

Good dimmer performance, however, is not the only benefit to spring from microprocessors. Since 1987 Strand's PIP dimmers combined with a Galaxy control console have had the optional ability to monitor and report the status of each dimmer and its load.