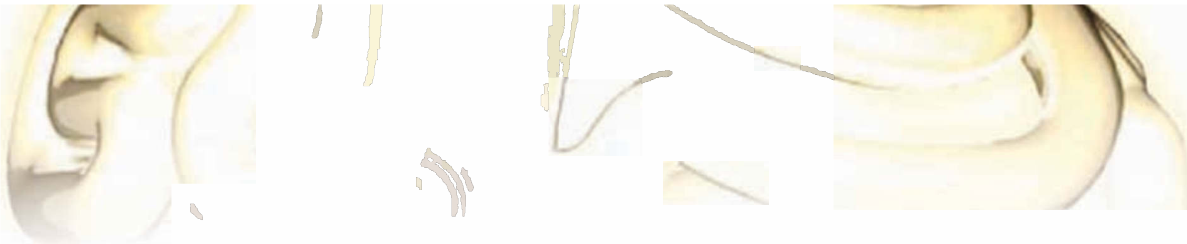
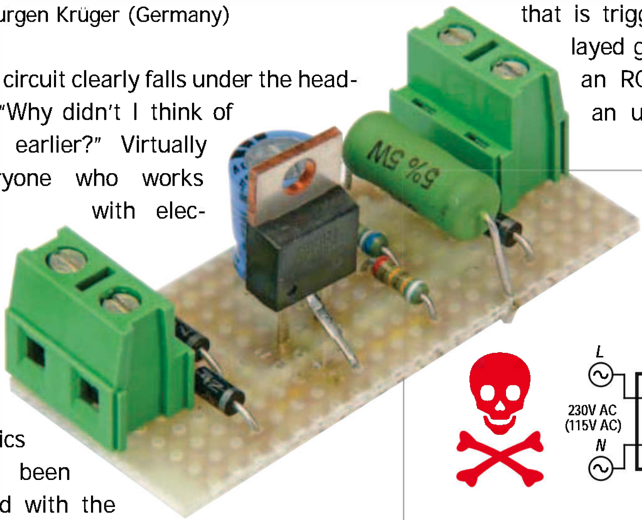
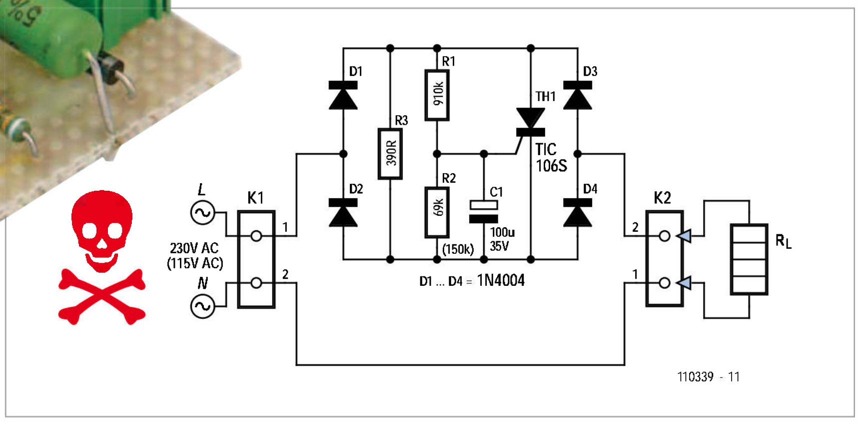


Soft AC Line Start

Small Circuit, Big Effect

By Jurgen Krüger (Germany)



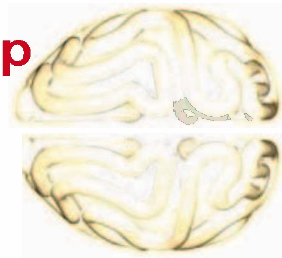


This circuit clearly falls under the heading "Why didn't I think of that earlier?" Virtually everyone who works with electronics has been faced with the need or desire to limit the inrush current of a large load. In the distant past this was achieved by placing a hefty resistor in series with the supply line and using a contactor (or a relay with a bit of additional electronics) to short out the resistor shortly after the load is switched on. Although this does the job, it's an electromechanical solution and therefore subject to wear, bulky and not especially elegant. Now you have the option of putting together a microcontroller circuit that uses an analogue input to detect the presence of AC line voltage and an internal timer to generate a delayed trigger for a triac that shorts out the series resistor. This also does the job, but it's actually a bit of overkill.

Mr Krüger adopted a logical approach and came up with a minimalistic circuit that not only does the job, but does it with remarkable simplicity. Although the simplest solution would be a triac that is triggered by a delayed gate signal from an RC network with an upstream series diode, it suffers from the fact that triacs with unipolar triggering have different trigger sensitivities for positive and negative half-waves. This means that when the load is switched on, it is possible for one or more negative half-waves to get lost. This is not so nice with inductive loads such as transformers, since they may become saturated and as a result cause exactly what you are trying to avoid: a blown fuse or tripped circuit breaker.

For this reason, the author chose to implement a slightly more complicated version. The basic principle is the same as with the series triac, but with an SCR incorporated in the DC arm of a bridge rectifier instead. That's all there is to it. An SCR also has the advantage that the necessary trigger current can be significantly lower than with a triac. The proposed type (TIC106) typically triggers at a gate current of 60 µA. This allows resistors R1 and R1 to have relatively high values. These resistors in combination with C1 determine the trigger delay, which is dependent on the component tolerances and can be as much as several hundred milliseconds. A 5 W type should definitely be used for R3, since it has to dissipate a considerable amount of power during this brief interval.

The author has used series circuits of this type fairly often as soft-start circuits for incandescent lamps, which as is well known have low cold resistance. Particularly when you use an inverter to convert 12 V DC to 230 C AC for camping, high inrush currents with a 100-watt incandescent lamp can be enough to cause start-up problems with the inverter, even with a 300 watt rating, or fry the lamp. Relatively large transformers can also generate high peak currents during switch-on if they happen to be switched on exactly at



the zero crossing point and become saturated due to inadequate core magnetisation.

With the specified components and component values, the circuit can be used for loads up to 230 VA. Higher currents require heavier-duty diodes and an SCR with a higher current rating, as well as a heat sink for the SCR.

With such modifications you should bear in mind that high-current SCRs require higher trigger currents, so the values of R1 and R2 should be reduced and the value of C1 should be increased. Another option would be to use separate drive logic, but that would detract from the elegant simplicity of the circuit. The value or R3 should be adapted to the intended use or desired inrush current level.

(110339-I)

Knitting Counter

By Marian van Hal (Netherlands)

Knitting always involves a lot of counting as you have to keep track how many rows you've knitted and how many should follow. This can of course be done with pen and paper, but it's more fun with an electronic variant using a microcontroller.

This counter has the following functions:

- Switch S1 increases the counter by one.
- Switch S2 saves the current count in the EPROM memory of the microcontroller.
- Switch S3 resets both the counter and internal memory to zero.
-

Switch S4 turns the device on and off. When it is turned on the display will show the value stored in the internal memory.