

THE THORN 9000 CHASSIS

Syclops and all that

Barry F. PAMPLIN

THE new Thorn 9000 colour chassis, built around the PIL c.r.t., introduces to the UK domestic electronics market circuitry which is both novel and ingenious – in particular the Syclops line output/regulated power supply arrangement. The purpose of this article is to explain the operation of this circuit and to discuss some servicing aspects: we shall also take a look at the rather unusual field output stage.

Syclops, derived from SYNchronous Converter and Line Output Stage, has the somewhat abstract connection with its mythological namesake that whereas the latter saw all with one eye the former does all (or nearly so) with one transistor. By using a single transistor as both a power supply chopper and the line output device, economies have been achieved: the cash saved has been used to provide a really effective automatic overload trip circuit.

Evolution of Syclops

The way in which Syclops was evolved is illustrated in Fig. 1. Consider first the basic shunt chopper arrangement shown in Fig. 1(a). The mains input is rectified by D1, C1 and applied to a transformer (T1) whose primary winding is returned to chassis via the chopper transistor Tr1. A squarewave input applied to the base of this transistor switches it between cut off and saturation, the resulting build up and decay of flux in the transformer inducing a voltage in the secondary winding. The value of this voltage varies according to the mark-space ratio of the transistor's base drive waveform: it feeds a second rectifier D2 which provides d.c. for the various circuits in the receiver. The circuit shown in Fig. 1(b) is a conventional transistor line output stage with shunt efficiency diode: for this circuit to function the base of the transistor must be fed with a squarewave drive synchronised to the line frequency.

The combination of these two circuits to give the Syclops arrangement is shown in Fig. 1(c): the circuit requires a transistor base drive waveform consisting of line frequency pulses with a variable mark-space ratio, while the primary of the line output transformer T2 must be fed from an h.t. rail derived from the secondary winding of the chopper power supply transformer T1. This, in bare essentials, is the Syclops circuit.

Putting Syclops into Practice

Converting this essentially simple concept into a practical circuit is of course a long-term design job. How it has been put into practice in the Thorn 9000 chassis will now be explained.

The complete line timebase/power supply circuit is shown in simplified form in Fig. 2. To start at the beginning, let's first consider what happens at switch on. The 230V a.c. mains supply is applied to W701, which conducts on alternate half cycles charging C702 to 325V d.c. This voltage is applied via T701 and W702 to the collector of the Syclops transistor VT701, which is cut off since it is without base bias. The 325V supply is also applied to the collector and base of the driver transistor VT412, via R422 and R419 respectively. In consequence this transistor turns on and its emitter current, flowing via the regulator circuit, generates a nominal 12V supply for the line oscillator and the Syclops control circuit.

Two things then start to happen: the line oscillator starts up and provides approximately squarewave pulses to VT602 base, and the charging (ramp) capacitor C604 commences to charge towards 12V at a rate determined by RB and the transistor in parallel with it (VT601). When the voltage across C604 reaches 4.9V it operates a switch circuit which biases VT605 into conduction (the switch consists of a couple of transistors, VT603 and VT604, connected in a regenerative circuit — see Fig. 3). Consequently VT605's emitter voltage falls towards chassis potential, removing the forward bias to VT412 via R419. The driver transistor cuts off, and the resulting pulse at its collector is coupled by T401 to the base of the Syclops transistor VT701. This now conducts and after a few cycles the h.t. supplies appear.

One of these supplies is the 90V rail used to feed the line

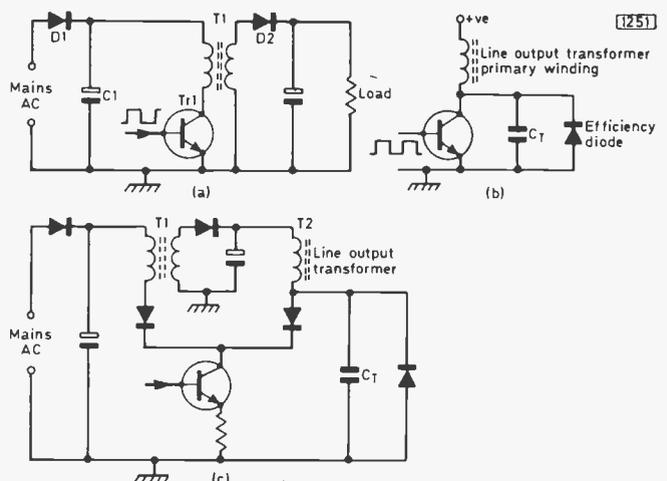


Fig. 1: Evolution of Syclops. (a) Shunt chopper (Tr1) switch-mode power supply circuit. (b) Basic transistor line output stage with shunt efficiency diode. (c) How (a) and (b) combine to give Syclops—synchronous converter and line output stage.