# NTSC VECTOR SWITCH UNIT UN9/546

## Introduction

The UN9/546 accepts one or two composite NTSC colour signals, a feed of negative-going mixed-sync pulses[1] and a positive-going line-frequency back-porch pulse signal. It provides: (a) a time-shared output which is switched between two signals at 3·9 kHz[2,3] (b) a line-duration pulse which recurs on every fourth line.

From the A-channel colour-input signal the unit regenerates a reference sub-carrier signal. The unit also generates a 3·583-MHz sine-wave signal (used to provide a test-circle facility). This forms part of the time-shared output when the output selection switch is set to $A + O$.

An externally generated feed of sub-carrier can be used, if required, instead of the internally generated signal.

The following controls are mounted on the front panel of the unit:

*Sinewave Int/ Sinewave Ext* (sub-carrier)
*A+O/A/A+B* (output selection switch)
*A Gain*
*B Gain*

The unit is mounted on a CH1/12A chassis with index-peg positions 14 and 34. Power supplies at +6 volts and −6 volts are required[1].

## General Specification

| | |
|---|---|
| *Input Levels* | |
| A and B inputs | 1 volt p-p (composite) |
| Subcarrier | 1 volt p-p |
| Mixed syncs | 2 volts p-p |
| Burst Gate-pulse | +5 volts |
| *Output Levels* | |
| Coded output (at 100% saturation) | 1·4 volts p-p (nominal) |
| Subcarrier | 1 volt p-p |
| *Line-duration Pulse* | 2·5 volts max. |
| *Subcarrier Frequency* | 3·579545 MHz |
| *Test-circle Frequency* | 3·583 MHz |
| *A and B Bandwidth* | −3 dB at 800 kHz |
| *A and B Time Input-to-output* | identical |
| *Current Consumption* | 100 mA |
| *Operating Temperature* | 0−50°C |
| *Weight* | 1 lb. |

## Circuit Description

A block diagram which shows the interconnections between the various stages of the unit is given in Fig. 1 and the circuit diagram in Fig. 2 on page 5.

### Chrominance and Burst-gate Amplifiers

The A-input signal is applied to transistor TR4 and to field-effect transistor TR5 (described later). The base-bias resistors of TR4 together with the input coupling capacitor form a high-pass network which removes the low-frequency components from the input signal and passes only chrominance information.

Transistors TR4 and TR21 form a complementary feedback amplifier and the chrominance signal developed at the output is mixed at the base of TR3 with positive-going back-porch pulses derived from an associated UN1/540 Sync Separator Unit. About 25 volts of colour burst is developed at the collector of TR3 and this is applied, via auto-transformer L2, to the phase detector.

*Phase Detector*

The subcarrier signal present at the collector of TR2 is applied to the detector diodes, together with the colour-burst signal developed across the auto-transformer L2. The output of the detector is developed at the junction of R8 and R9 and consists of a d.c. signal which is proportional to the phase error.

*D.C. Amplifier*

The phase-error signal developed at the junction of R8 and R9 is integrated by R34 and C23 and is then applied to the common-emitter amplifier TR8. Temperature-compensation is provided for the stage by thermistor TH1, which forms part of the collector load. The signal developed at the collector of TR8 is applied to the variable-capacitance diode in the sub-carrier generator stage.

*Sub-carrier Generator*

Transistor TR7 is a crystal-controlled common-base oscillator in which the feedback path is con-

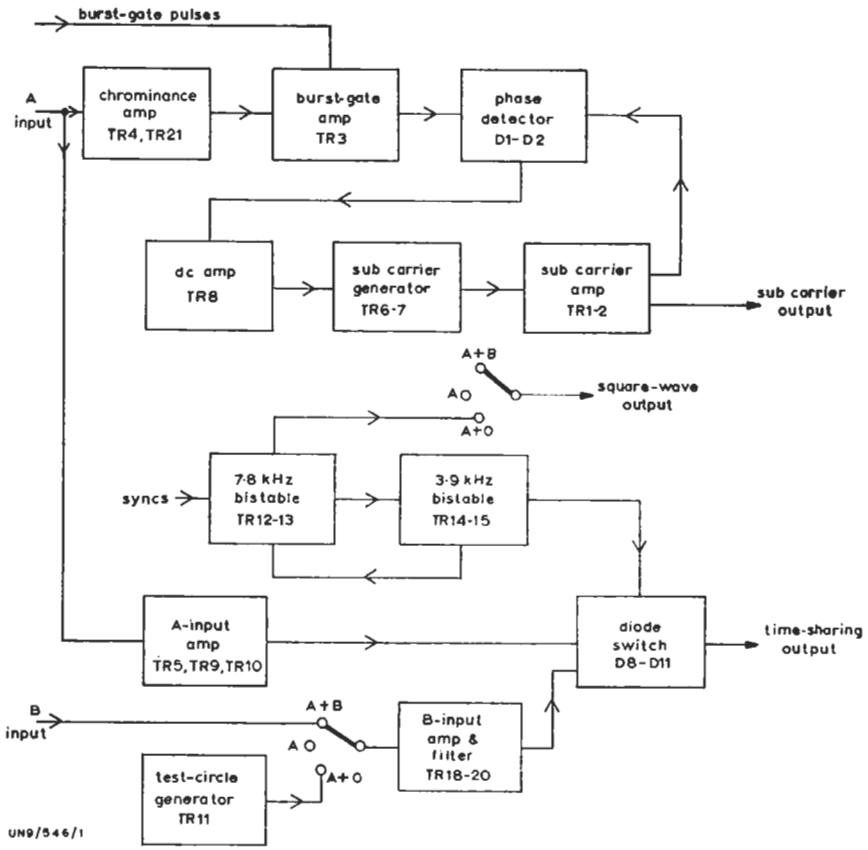


*Fig. 1 Block Diagram of the UN9/546*

trolled by the variable-capacitance diode D3. The capacitance of D3 is determined by the collector potential of TR8 and so provides a very fine control of the frequency of oscillation. The oscillatory signal developed at the emitter of TR7 is fed to the base of emitter-follower TR6. The reference potential applied to the emitter of TR6 by the potential divider R22-R23 is such that the transistor behaves as a common-emitter amplifier at d.c. and applies a feedback signal to the base of TR7; this feedback holds the operating point of the oscillator constant.

The output of TR6 is applied to the common-emitter amplifier TR1. Two outputs are taken from the collector load of this transistor; one provides a 1-volt p-p sub-carrier output signal (this replaces the external feed of sub-carrier when switch S3 is in the *Int* position) and the other is fed via common-emitter stage TR2 to the phase detector, described previously, where it is used as the reference sub-carrier signal.

The sub-carrier signal applied to the phase detector completes an automatic phase-control loop[4] comprising the sub-carrier generator, the sub-carrier amplifier, the phase detector and the d.c. amplifier.

*Rectangular Waveform Generator*

A feed of mixed-sync pulses from the associated UN1/540 Sync Separator Unit is applied, via a differentiating circuit, to a bistable multivibrator (see Television Engineering, Volume 3) consisting of transistors TR12 and TR13. This stage generates a 7·8-kHz square wave from the leading edges of the applied sync pulses and square waves of opposite polarity appear at the collectors of TR12 and TR13. The output of TR13 is applied to another bistable multivibrator consisting of transistors TR14 and TR15. The output of this stage is a 3·9-kHz square wave; this is applied via emitter-follower TR17 to the centre-tap of the output transformer L5.

At the centre-tap of L5 the 3·9-kHz waveform switches diodes D8, D10 and D9, D11 alternately into conduction and so routes first the A-signal and then the B-signal to the output of the unit.

Each time transistor TR17 is cut off diode D14 conducts and applies the negative-going portion of the 3·9-kHz waveform to the junction of R46 and R47 where it gates out alternate positive-going half cycles of the 7·8-kHz waveform. The resultant signal consists of a positive-going rectangular waveform, of line-duration, which recurs on every fourth line. This signal is coupled to the square-wave output of the unit when switch S1 is in the $A+O$ position.

*Input A and Input B Amplifiers*

The A-input to the unit is applied to the field-effect transistor TR5 which operates as a common-source amplifier. The gain of the stage can be varied by means of the *A-Gain* control. The drain load of TR5 is a resonant circuit tuned to sub-carrier frequency; the signal developed at this point is fed to emitter-follower TR10. From emitter-follower TR10 the signal is applied via emitter-follower TR9 to the primary winding of transformer L6.

The input-B amplifier is similar to the input-A amplifier, but has an extra emitter-follower stage connected to its input when switch S1 is in the $A+B$ position. The output of the amplifier is applied to the primary winding of transformer L7.

The signals developed across transformers L6 and L7 are coupled to the primary winding of the output transformer L5 by diodes D8 to D11, as previously mentioned.

*Test Circle Generator*

Transistor TR11 is a crystal-controlled sine-wave oscillator which produces an output at 3·583 MHz; the output amplitude is determined by the setting of R42. When switch S1 is in the $A+O$ position the oscillator output is applied, via the input-B amplifier, to the output of the unit. For all other positions of S1 the oscillator is muted.

(When the oscillator output is applied to a DM1/503 demodulator unit a difference-frequency sine wave of about 3·5 kHz is produced. This provides the test-circle facility for the alignment of an associated vectorscope.)

**References**

1. Sync Separator UN1/540.
2. NTSC Vector Demodulator DM1/503.
3. Vector Detector Unit UN20L/508A.
4. Designs Department Technical Memorandum 8.163(64): Design of Automatic Phase Control in NTSC-type decoders.

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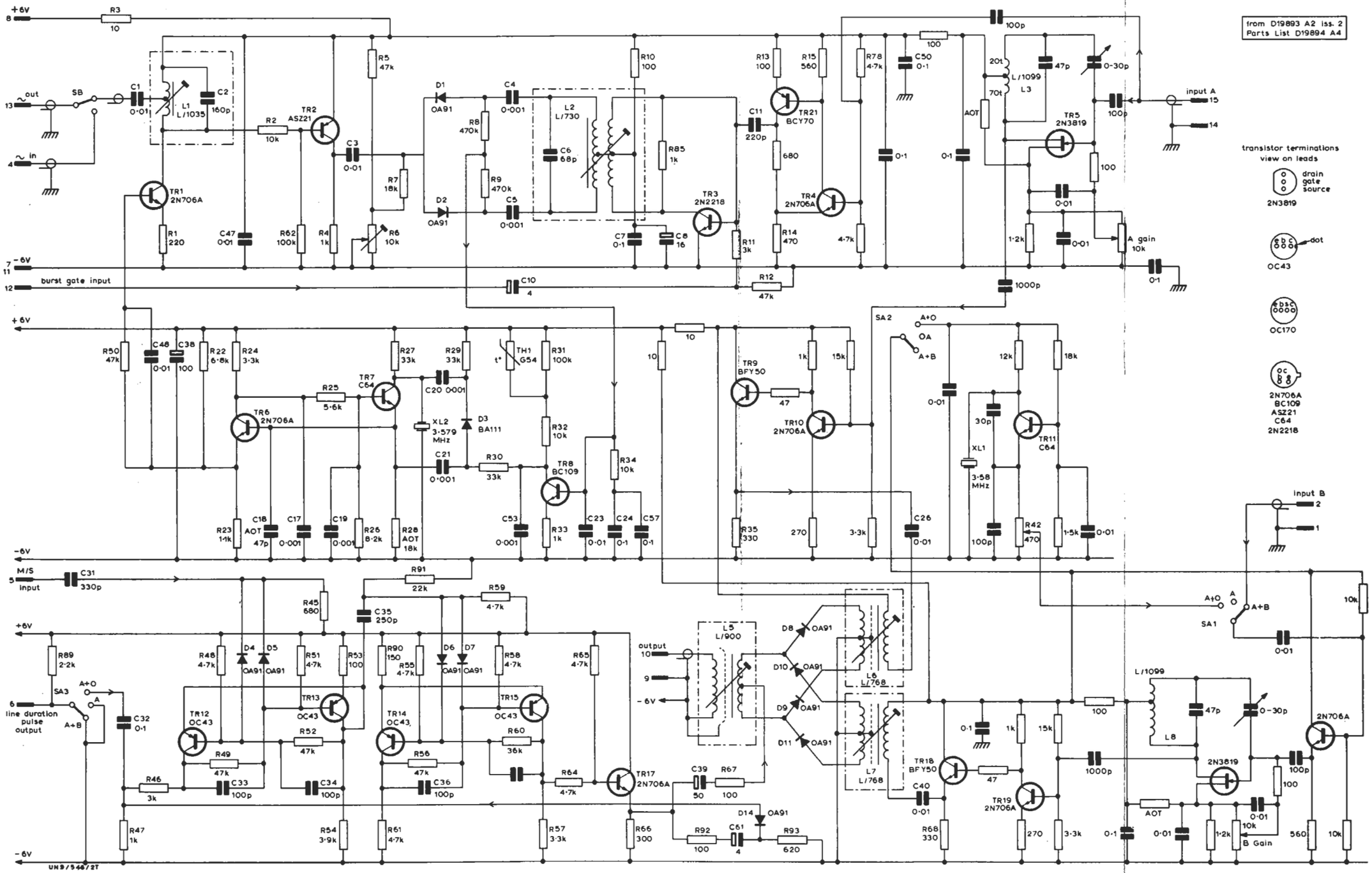




*Fig. 2 Circuit of the UN9/546*