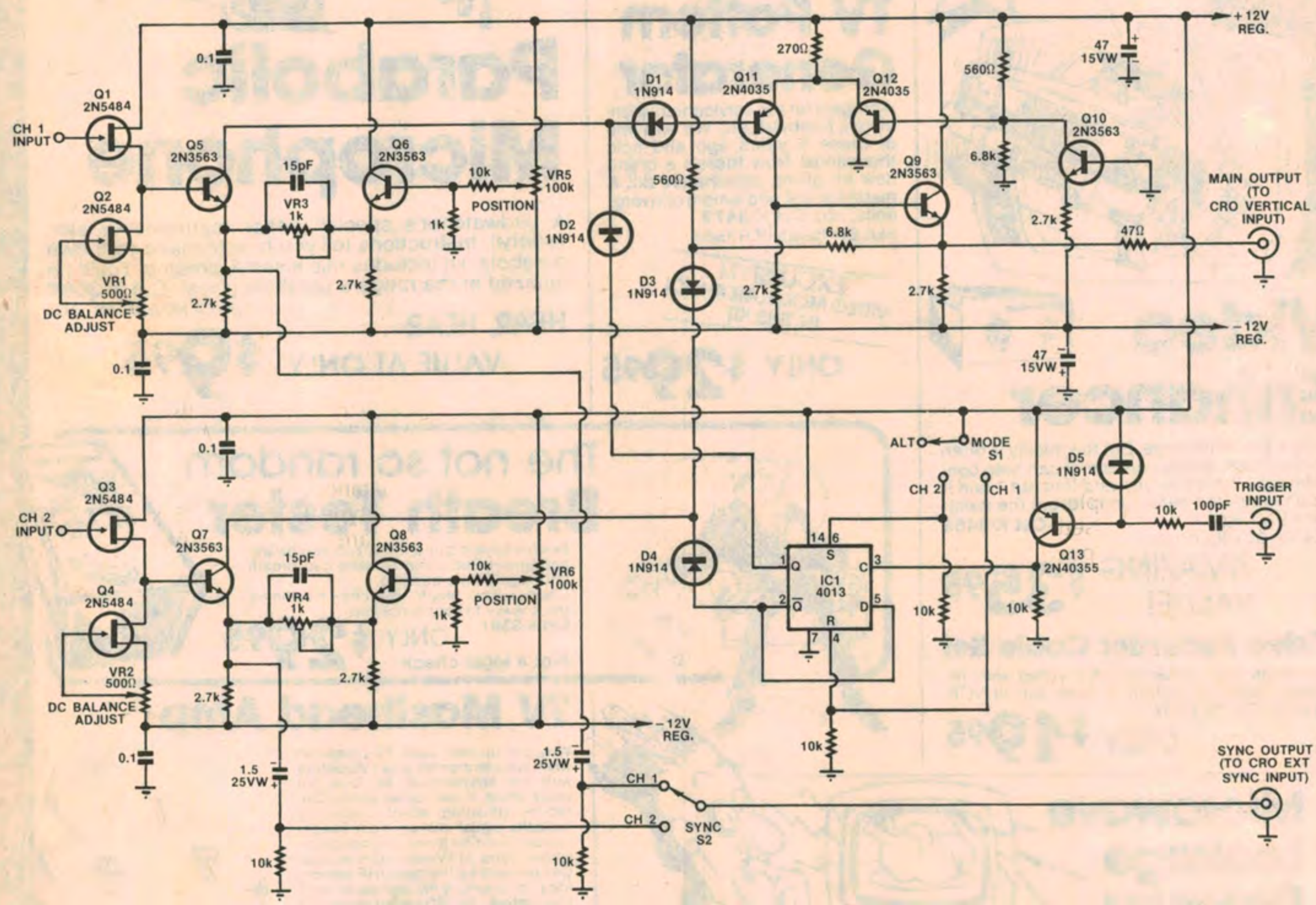
Circuit & Design Ideas

Interesting circuit ideas from readers and technical literature. While this material has been checked as far as possible for feasibility, the circuits have not been built and tested by us. As a consequence, we cannot accept responsibility, enter into correspondence or provide constructional details.



Dual trace CRO adapter

This dual trace CRO adapter circuit comprises two independent input amplifier stages alternately switchable to a common output stage. With the output connected to a CRO input, a dual trace display of two input signals can be obtained. The circuit incorporates a three position "mode" switch which can be selected so that either one channel (CH1 or CH2) is displayed at a time or both are displayed in an "alternate" mode.

The circuit can also be easily adapted to include a "chop" mode as will be explained later.

To achieve a wide frequency response, discrete transistors were used rather than ICs in the critical signal handling portions of the circuit. Switching between channels is accomplished by means of high speed silicon diodes (D1-D4) controlled by one half of a 4013 CMOS dual flipflop IC. Diode switches were chosen in preference to CMOS IC switches because of their lower capacitances, hence less likelihood of channel crosstalk and of switching transients appearing at the output.

The small signal (1V p-p output) frequency response of the prototype was better than 10MHz per channel, while channel crosstalk and switching transients at the output, although not measured, were quite low. This circuit is capable of a large output voltage swing (approx 15V p-p) and high slew rate (about 80V/μs negative-going and 200V/μs positive-going) measured with a 100pF capacitive load.

To achieve the "alternate" mode of operation, it is necessary to derive a suitable signal from the internal sweep circuit of the CRO, Most CROs include an external sweep (or trigger) output. If not, you will have to delve into the "works" to derive a suitable negative-going pulse.

Transistor Q13 is used to invert these pulses to the correct (positive) polarity required to operate the clock input of the flipflop. In the "ALT" mode, the flipflop changes its output state each time a pulse appears at the "C" input.

If the sweep circuit of a CRO is not readily accessible, the adapter circuit can be easily modified to operate in a "chop" mode. All that is required is to feed a pulse or square wave signal of appropriate amplitude and desired frequency directly to the "C" input of the flipflop. The astable oscillator configuration used in the circuit described in EA February, 1981 (pp 40-47) would probably be quite suitable. However, it should be noted that the supply terminals of the CMOS IC should now be connected to +12V and ground, not to ±6.8V as in the EA circuit.

Sync signals for the CRO are taken off

low impedance points in the CH1 and CH2 input amplifiers. Ideally, a wide-band IC amplifier (not shown) with a voltage gain of 10 or more could be used between the sync select switch (S2) and the sync output to raise the sync signal level to something comparable to that appearing at the main output terminal.

A few hints on construction may be helpful. Because of relatively wide parameter spreads in FETs it is desirable that Q1, Q2 and Q3, Q4 be selected to be as closely matched as possible. A simple way of doing this is to temporarily short the gate to source of each in turn and measure the drain current (Idss) with a voltage of 10 to 15V applied between drain and source. Then, when installing the FETs select Q2 with a slightly higher Idss reading than Q1 and Q4 with a slightly higher Idss reading than Q3.

This will ensure that the DC balance for each channel can be properly adjusted within the ranges of VR1 and VR2.

The balance adjustment is made (after wiring has been completed and the power switched on) by setting VR5 and VR6 each to its centre position, setting the mode switch (S1) to CH1 or CH2 position and adjusting VR1 or VR2 as appropriate to obtain zero output voltage with the input at zero volts. This is repeated for the other channel.

Next, the voltage gain for each channel can be adjusted by means of VR3 or VR4. For this an input signal, preferably square wave, of known amplitude is needed. In the prototype each channel was adjusted for a voltage gain of 10.

The final adjustment is for optimum square wave response at high frequencies. For this a square wave signal of about 1MHz with short rise and fall times and minimum overshoot is ideal. If the signal is known to be "clean" but ringing shows up on the display then the value of the 47Ω resistor in series with the main output will have to be adjusted, or it may be necessary to insert a resistor in series with the input (say, 100Ω or so). Now, adjust C1 and C2 by trial and error or use trimmer capacitors to obtain optimum square wave form.

Constructors should also take the usual precautions to minimise stray signal coupling between input and output paths and signal paths should be kept as short as possible (or shielded). Finally, tie all unused CMOS inputs to either +Vcc or ground.

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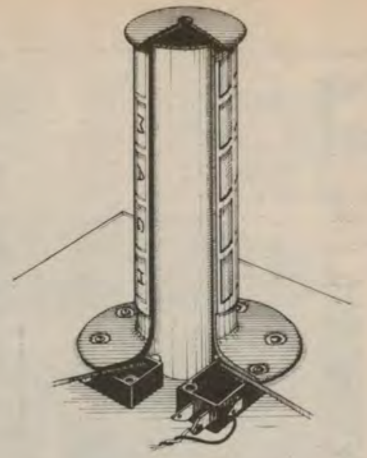
Editorial note: The above circuit will require a frequency-compensated attenuator circuit if the claimed frequency response is to be obtained.

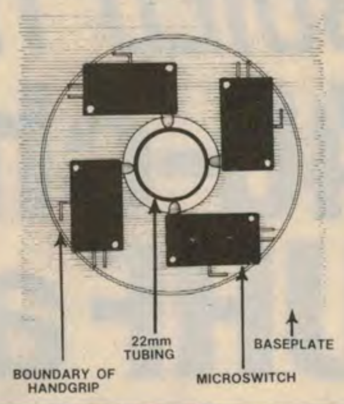
Effective joystick

If you are seeking the ultimate joystick, this easy-to-build unit should fit the bill. It is built around a rubber motorbike handgrip, the base of which, when bolted to a strong baseplate, provides a self-centring, multidirectional hinge. The handgrip is linked to microswitches, wired to the unit to be controlled.

The main component is the handgrip, and this should have a large springy base about 65mm diameter and about 4mm thick, with a simple, comfortable grip design. The prototype had "OGK MODEL 68-15R" printed on the bottom, and "MACH" within the grip lattice. This grip has proved itself over two years of fanatical usage.

A section of 22mm tubing is fitted snugly into the handgrip so that about 15 to 20mm protrudes beyond the base. A metal baseplate is prepared with an oversize hole in the centre through which the tubing will pass when the base





of the grip is mounted on it. This baseplate requires either side sections or rubber feet so that those parts underneath it will clear the surface on which the joystick is used.

Four microswitches are mounted underneath the baseplate in such a way that the activating pins just touch and are barely depressed by the metal tubing. This allows diagonal movement ie, up and left, to activate two switches simultaneously. The switches used in the prototype measured 25 x 15 x 10mm, and are rated at 250V, 15A. Smaller switches could be used.

Mounting holes (3mm) are drilled through the handgrip base and the baseplate, and fitted with 3mm x 20mm machine screws with washers to prevent the heads of the screws from pulling through the rubber. A firing button can be added by simply screwing it in the top or, for those who prefer a trigger action, through the side.

Ian Fieggen,
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Improving the solenoid

A problem with the solenoid described in the "Build Your Own Solenoid" article in EA for March 1983 was the energy lost in the spring loaded version, due to the high reluctance of the air gap caused by the compression spring.

This can be overcome by mounting the spring externally, thus reducing the reluctance, since the air is displaced by the plunger. The plunger is now allowed to contact the end cheek at the bottom, locking it into position by the added magnetism of the cheek. To separate the plunger from the end cheek now requires a greater pulling force.

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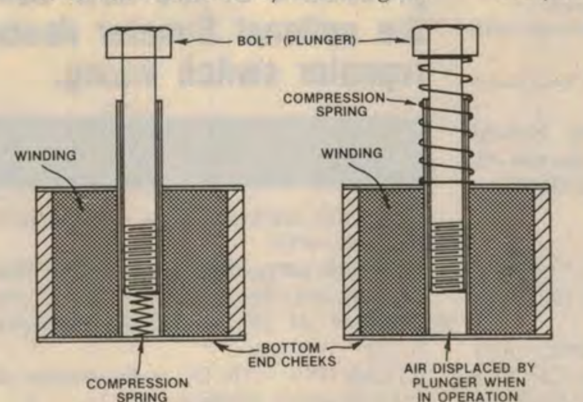

WANTED

PSST! Got any neat circuit ideas? We pay between $5 and $40 per item, depending on how much work we have to do to publish it. Send your idea to "Electronics Australia," PO Box 163, Chippendale 2008.