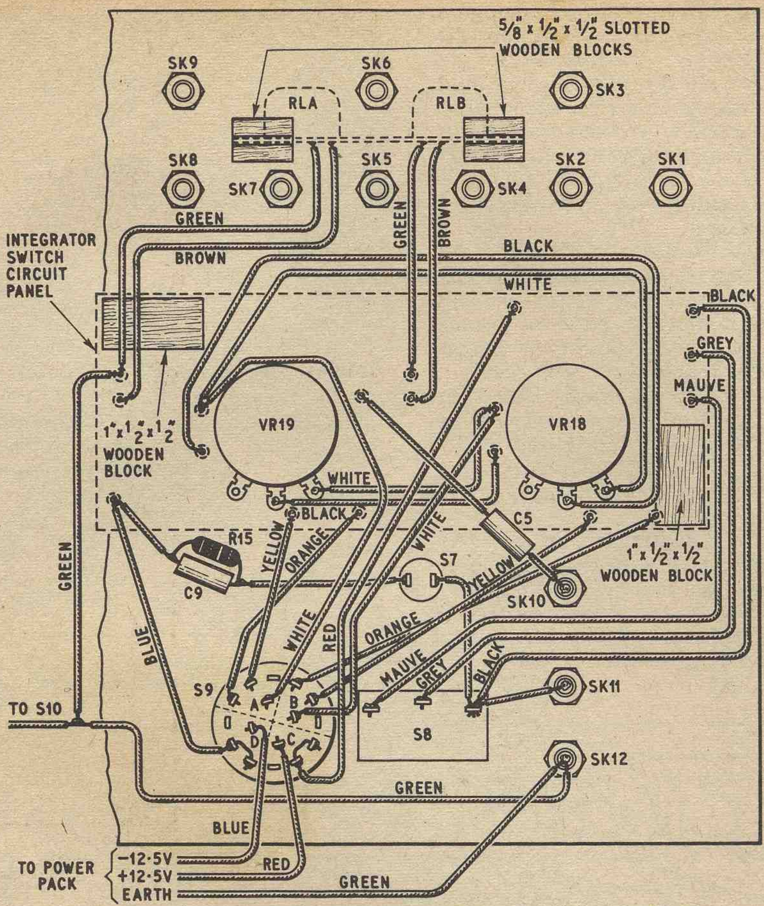

Fig. 7.3. Rear view of UNIT "B" front panel showing integrator switch wiring

CALIBRATING THE SECOND RANGE

To calibrate the 10–100ms S9 range, repeat the above procedures in just the same way, but this time use a 0·1μF capacitor for C_t in sockets OA3/SK11 and SK12, and adjust the value of timing capacitor C7 for correct compute intervals.

1st monostable timing capacitors C3 and C4 need not be precise, as VR18 has no effect on the accuracy of computations, and is mainly used to control the switch cycle frequency when integrator output waveforms are displayed by oscilloscope. Therefore, and merely for the sake of conformity, build up C3 and C4 capacitor values until the coverage of VR18 is approximately as indicated by the reset interval dial calibration.

CIRCUIT ADJUSTMENTS

The Fig 6.10 circuit should operate reliably at all switch and dial settings, with no noticeable relay bounce or overlap between the closure of reset and compute switches. However, it may be found that the integrator switch will stop running during repetitive operation, when reset and compute intervals approach 10ms, despite the fact that VR1 has already been trimmed for optimum performance. If so, try reducing the value of R8.

At the opposite extreme, if the integrator switch suddenly goes into repetitive operation when S8 is at "Hold", and VR18 and VR19 settings are near 1s, increase R8, and also try the effect of doubling the value of C1 to improve decoupling.

PROBLEM EXAMPLE 4

STRAIGHT PATH MOTION OF AN OBJECT

Problem Example 4 is primarily intended as a comprehensive introduction to the use of integrator mode switching, but the programme is sufficiently flexible to allow many experiments in dynamics to be performed.

Several factors can combine to influence the overall motion of an object, and some are shown in the ball problem of Fig. 7.4. A ball thrown vertically into the air will be subject to an initial upward velocity iv, retardation or negative acceleration due to gravity $-a$, and air resistance. The situation is further complicated if the ball is projected upwards from an initial height is, and is arrested at some height other than zero.

Ignoring for the moment air resistance, the equations which govern the motion of the ball are,

$$v = \int_0^t a\,dt + iv \qquad \text{(Eq. 7.1)}$$

and

$$s = \int_0^t v\,dt + is \qquad \text{(Eq. 7.2)}$$

Clearly, integration of a yields v, and a further integration of v will give s.

The formulae used to calculate velocity or distance when acceleration is constant are,

$$v = iv + at \qquad \text{(Eq. 7.3)}$$

and

$$s = ivt + \tfrac{1}{2}at^2 + is \qquad \text{(Eq. 7.4)}$$

Eq. 7.3 and 7.4 will not apply if, for example, acceleration is proportional to time. A discussion of the implications of variable acceleration lies outside the