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AN ELECTRONIC FISH SCALE PROPORTIONING SYSTEM

The back calculation of growth using the annular rings on scales is a routine standard procedure in fisheries research. To increase the speed and accuracy of this operation an electrical proportioning system was devised (Figure 1).

If a set voltage is applied to the extremities of a potentiometer wire, the voltage between the slider contact and one end is directly proportional to the distance between the slider and that end. If the potentiometer wire is superimposed on a projected, and magnified, image of a fish scale in such a way that the scale radius corresponds to the potentiometer wire length, and if the slider is positioned against one of the growth rings, the voltage at the slider, relative to the applied voltage, will have the same proportions as those of the growth ring to the full fish scale radius.

This voltage can be unambiguously read on a digital voltmeter, and by applying a suitable voltage across the measuring potentiometer (RV1) the units displayed can correspond to length measurements.

In the equipment developed we have used a multi-turn potentiometer as our measuring potentiometer, this being driven by a rack and pinion system mounted on the fish-scale image projector.

A zener stabilized voltage is applied across RV1, and the fish length scaling factor is obtained by shunting some of the slider current through R5, R6, RV2, this being found to give better stability than changing the voltage across RV1. R3 and RV3 set the system slightly positive of Ov to allow some adjustment for zero drift (Figure 2).

The accuracy of the system depends on the linearity of the measuring potentiometer, the accuracy of the digital voltmeter, and the stability of the other components. Checking the system against a centimetre rule, the following figures were obtained.

	12 cm traverse, set f.s.d. at 240											
	1	2	3	4	5	6	7	8	9	10	11	12
reading.....	19	39	59	80	100	120	140	160	181	201	221	240 rising
reading.....	19	39	59·5	80	100	119	140	160	181	200	221	240 falling
reading.....	20	40	60	80	100	120	140	160	180	200	220	240 theoretical

resolution is 0·5 mm per digit
drift over the period of one measurement is negligible
drift over five hours is ± 1 digit from the set point.
hysteresis (see table) is negligible.

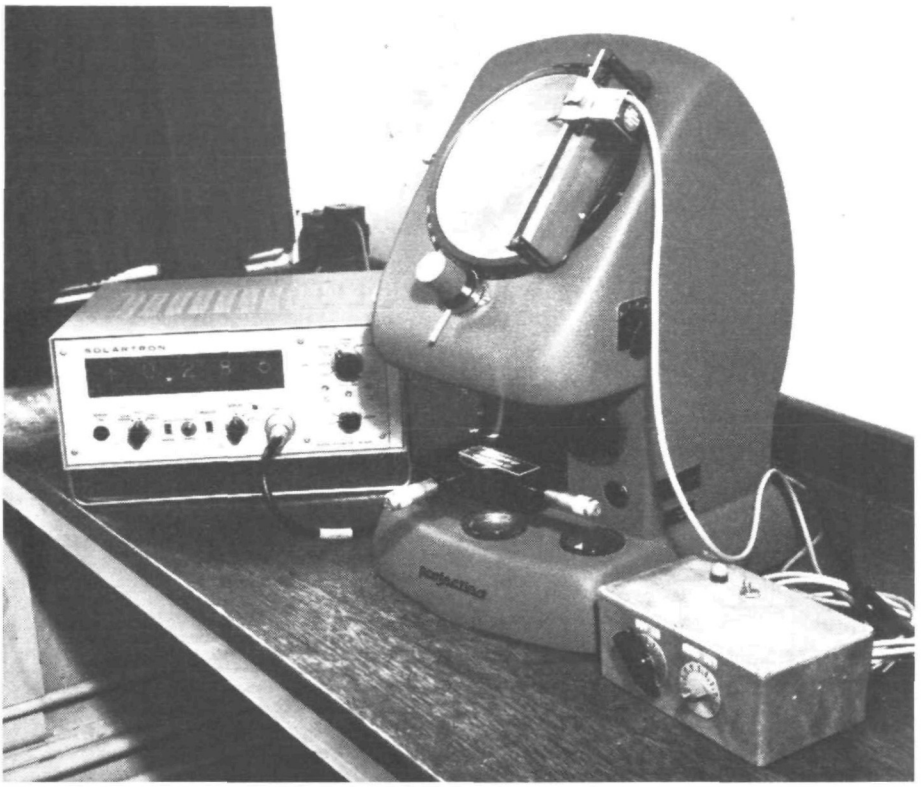

Figure 1. Fish scale proportioning apparatus showing (from left to right) digital voltmeter, projector with measuring potentiometer attachment, and control system box.

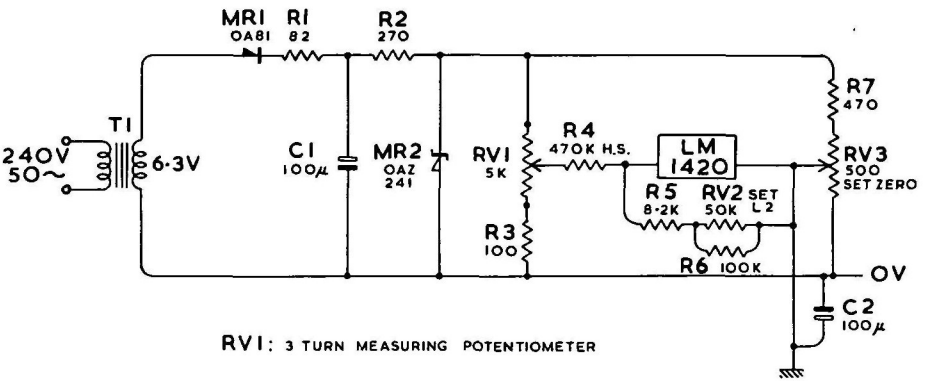

Figure 2. Circuit diagram of fish scale proportioning system.

The system accuracy is well within the human error likely to occur in aligning the pointer with the relevant rings on the fish scale.

In operation the slider is set to the full radius of the fish scale and RV2 (set L2) is adjusted until the fish length is displayed on the digital voltmeter. The slider is then moved to the first growth ring and the reading noted. This is repeated for each ring on the fish scale.

PARTS USED

Digital voltmeter (4 digits, > 50 MΩZ in, 2v f.s.d.).
Rack, 7 inches long with teeth at linear pitch of 0·0327 inches (Reliance Gear Company Limited, type AG-38-P1.)
Pinion, anti-backlash type, 60 teeth (Reliance Gear Company Limited, type P50-7-60.) $\frac{1}{8}$ inch bore, screw fixing.
L.T. transformer (giving 13v).
5000 Ω 3-turn potentiometer, linearity 0·3%.
Two potentiometers (set f.s.d., set zero) 3 watt, general purpose.
Resistors, 5%, $\frac{1}{2}$ watt, high stability.

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