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Canada

PRELIMINARY EVALUATION OF THE VALERIOTE INDIVIDUAL ANIMAL FEEDING GATE SYSTEM

(Temperature Testing - Electronics Portion Only)

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1.0 INTRODUCTION

The measurement of individual animal food intake for group-housed animals is of importance in many experimental designs. Obtaining such measurements necessitates the use of some means of feeding each animal from an individual, controlled-access feed box. The most effective solution to this problem to date has been the electronically-controlled, individual feeding gates described originally by Simpson (1968) and Broadbent (1970) for use with cattle. These gates are currently manufactured by Calan Electronics Ltd., East Lothian, Scotland (Fig. 1). Canadian experience with the Calan-Broadbent gates has indicated unreliable operation, primarily due to temperature extremes which caused freezing of the electromechanical door latch mechanism and also failure of operation of the sensing and animal "key" electronics at low temperatures. Another company, Valeriote Electronics Ltd., Guelph, Ontario, has designed a similar electronic feeding gate system. This report describes only the temperature characteristics of the Valeriote system's sensing and animal "key" electronics, since the electromechanical latch portion of the system is not yet available. For proper system evaluation, the effects of other factors such as humidity, corrosive gases, ruggedness, supply voltage variation, and "key" selectivity would have to be determined for the complete system.

2.0 THE VALERIOTE SYSTEM

Each animal gate subsystem consists of a sensing electronic doorlock unit (DLU) and a tuned "key" unit carried by the animal (Fig. 2). Each subsystem operates as a frequency selective proximity switch. Each "key" is matched to a particular door (DLU) and should only operate that door. The planned total system capacity is 30 units with operating frequencies from 7 to approximately 30 Mhz, spaced at 5% intervals. The Valeriote DLU has an effective sensing area of about 19 by 19 cm square in relation to the position of the "key" unit. The DLU operates when the "key" unit is within 8 cm from the center of the sensing area or within 2 cm from the edges of the sensing area, provided the plane of the "key" unit is within 45 degrees to parallel with the plane of the sensing area. For comparison, the Calan-Broadbent gate DLU has an effective sensing area of about 3 by 12 cm and operates with the key within 1 to 2 cm from the sensing region. Also, the Calan-Broadbent key is designed for mounting on a collar around the animal's neck, whereas the Valeriote "key" can be mounted either on the animal's face or suspended from the animal's neck.

3.0 METHOD OF TESTING

The variation of the frequency of the DLU oscillator and the DLU output control voltage (TP2 on the Valeriote circuit diagram) with temperature was measured over a temperature range from -40 to 110°F, the anticipated operating temperature range requirement. The DLU control voltage would operate the electromechanical door bolt and driver circuits in the complete subsystem. One run measured these parameters with the "key" unit out of the electromagnetic circuit, while a second run measured these parameters with the "key" unit mounted (on a styrofoam cup) 10.5 cm above the center of the DLU sensing area. The DLU was operated at 13.5 volts DC from a HP 6220B power supply. Frequency was measured with an ERC Model 2705 frequency counter, accurate to .001%, Voltage was measured with a Darcy Model 440 digital multimeter, and temperature was measured with an Ircon digital thermocouple thermometer.

The variation of the DIU oscillator frequency and output control voltage with supply voltage was also measured.

4.0 RESULTS

Fig. 3 indicates the variation of the DIU oscillator frequency and output control voltage with temperature with the "key" unit out of the circuit. Frequency variation from -40 to 110°F ambient was about 0.44% of the nominal operating frequency. The output control voltage varied about 2.25% over the same temperature range.

Fig. 4 indicates the variation of the DIU oscillator frequency and output control voltage with temperature with the "key" unit mounted 10.5 cm above the center of the DIU sensing area. Frequency variation from -40 to 110°F ambient was about 0.66% of the nominal operating frequency. The output control voltage varied from about 9.2 volts at the higher temperatures to about 3.2 volts at the lower temperatures, indicating increased key distance sensitivity at the lower temperatures. There appeared to be an anomaly in the temperature versus frequency and voltage characteristics below -20°F. This may have been due to lack of proper temperature stabilization at these temperatures in this particular run.

Variation of DIU oscillator frequency and output control voltage with supply voltage was also measured at a constant temperature of 75°F. The frequency varied about 0.3% and the control voltage dropped from 9.6 to 6.4 volts for a supply voltage change from 14 volts to 10.5 volts.

Considering the above, the over-all DIU frequency variation over the anticipated operating temperature range and supply voltage range would be about 1%. Also, assuming the "key" unit is remote from the DIU, the output control voltage would remain above 6.4 volts.

5.0 CONCLUSIONS

With individual DLU frequencies spaced 5% from each other, the frequency variation of 1% measured over a temperature range from -40 to 110°F and a voltage supply range from 14 to 10.5 volts would provide satisfactory performance. Since the operating lower limit of the DLU output control voltage is about 3.5 volts, the minimum of 6.4 volts measured over the same temperature and supply voltage ranges with the "key" unit out of the circuit would also be satisfactory. The observed increased sensitivity "key", at lower temperature, which caused the control voltage to drop to 3.2 volts with the "key" unit in the circuit, should not affect reliable operation. Although the portion of the subsystem covered in this report appeared to operate satisfactorily over the anticipated temperature and supply voltage variations, the complete system would have tested over the same operating conditions to determine system reliability. In addition, the effects of other factors such as humidity, corrosive gases, ruggedness, and "key" unit selectivity would have to be determined for proper evaluation of the complete system.

6.0 REFERENCES

Broadbent, P.J., J.A.R. McIntosh and A. Spence. 1970. The evaluation of a device for feeding group-housed animals individually. Anim. Prod. 12: 245 - 252.

Simpson, D.J. 1968. An automatic gate selector device for cattle feeding. Phys. Med. Biol. 13: 459 - 460.

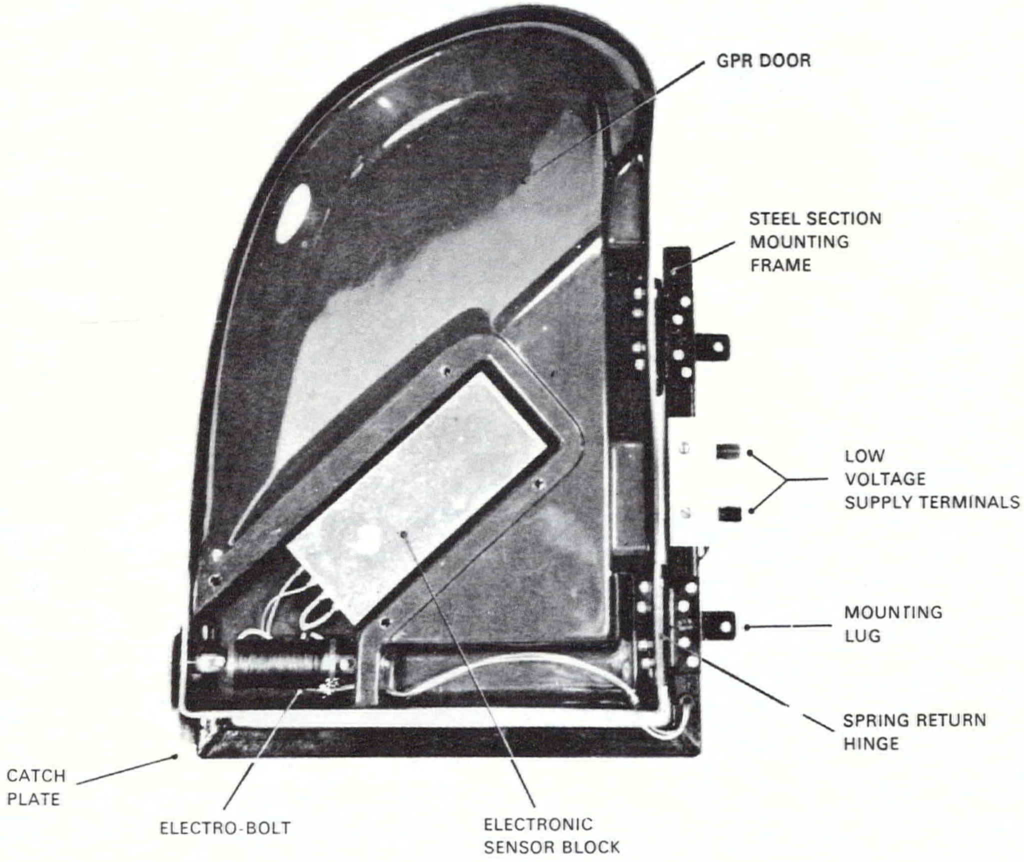

Figure 1. Calan-Broadbent individual animal feeder gate.

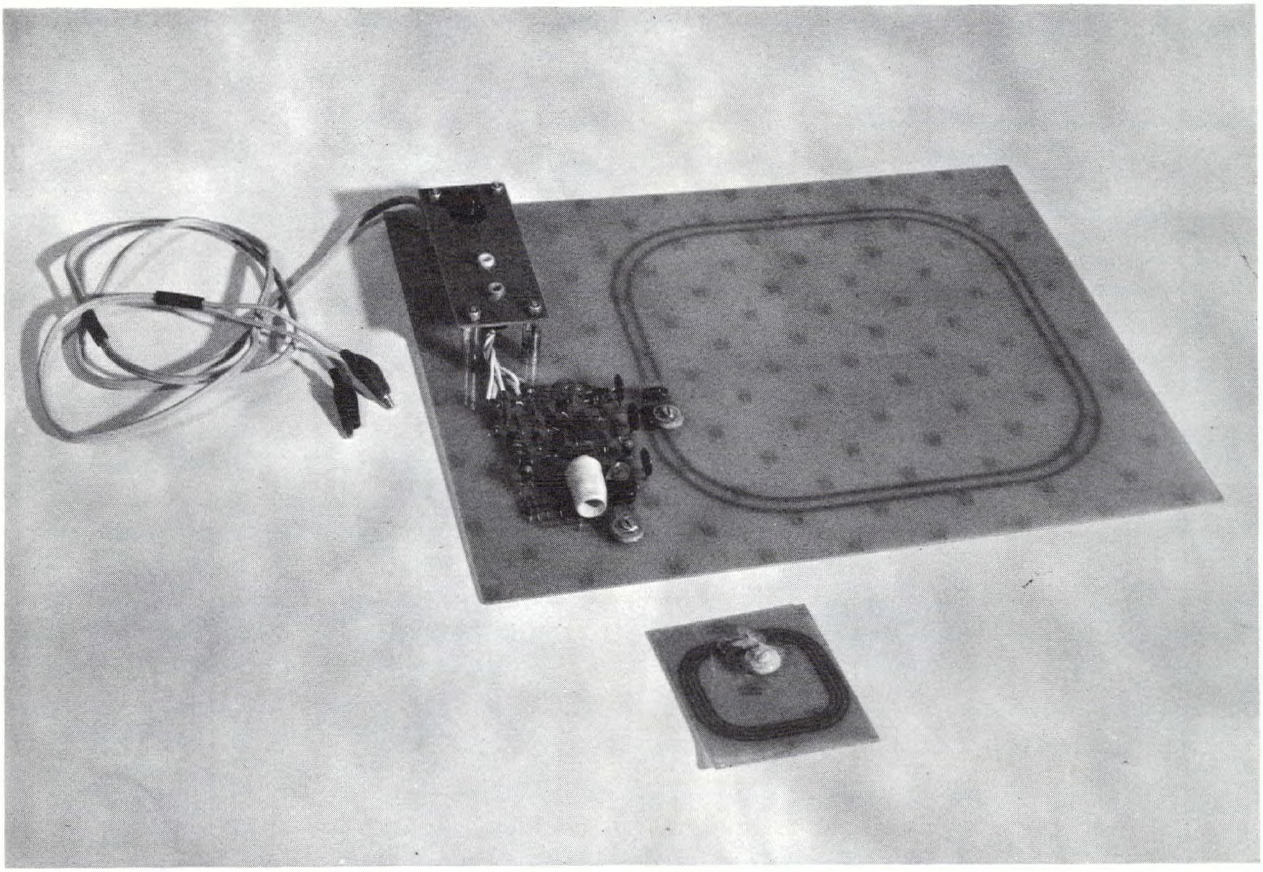

Figure 2. Valeriote individual animal feeder gate, electronics only.

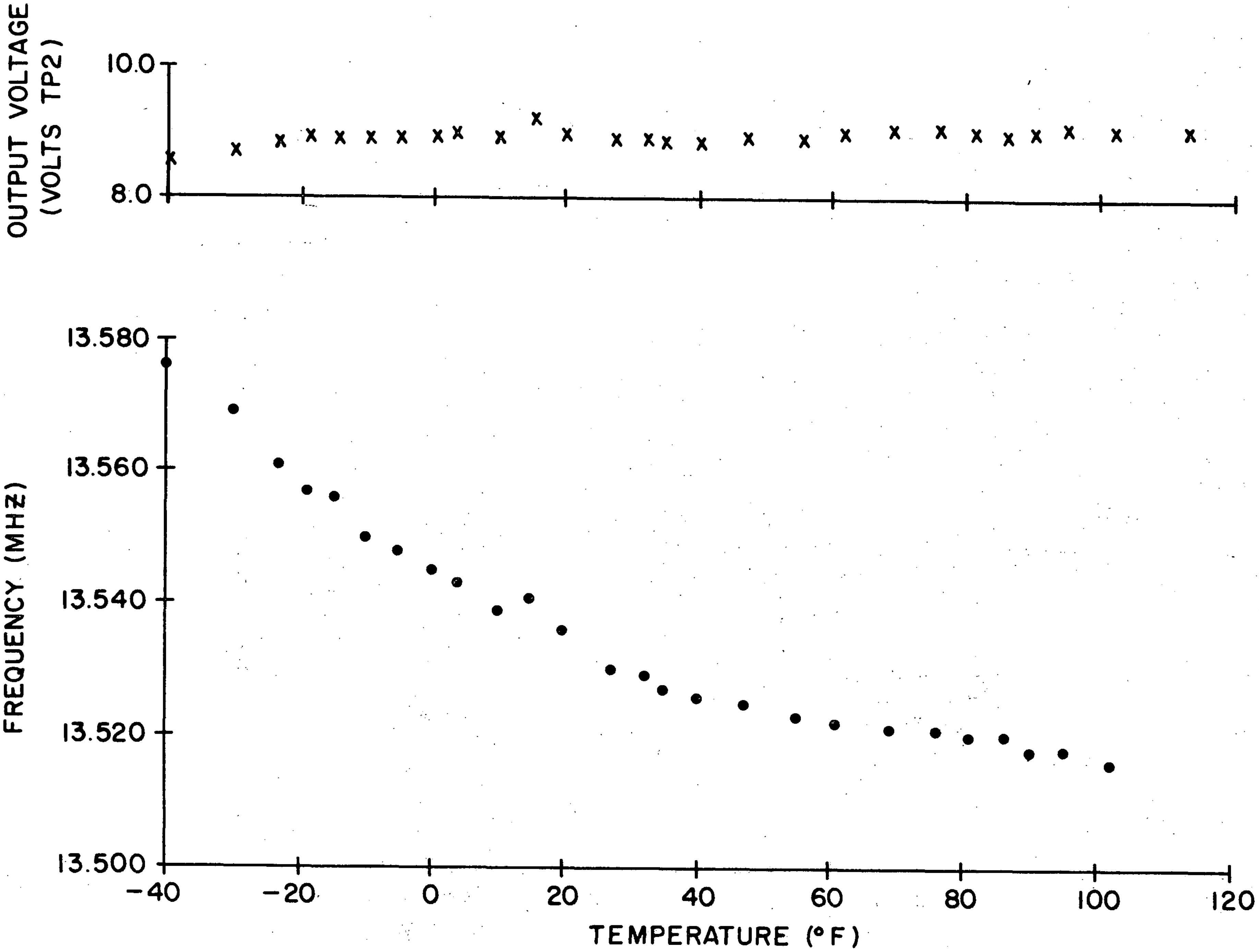

Figure 3. Frequency and output voltage variation with temperature with "key" unit out of the circuit.

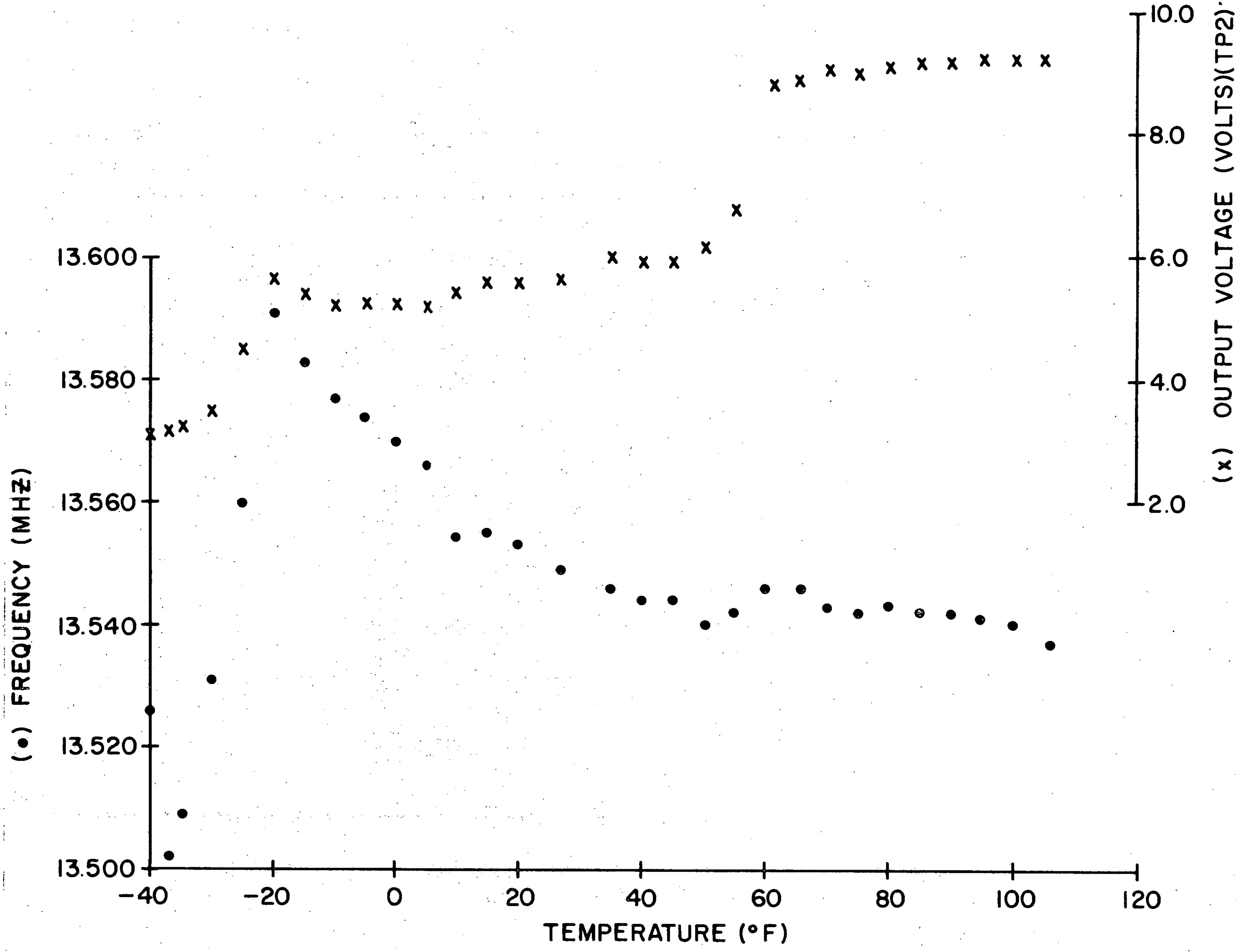

Figure 4. Frequency and output voltage variation with temperature with "key" unit mounted 10.5 cm above DLU.