
Notes and Observations

On-Line Multiple Temperature Recording for the Autogen 2000b and Apple II

James W. Hoare and Evelyn I. Bird¹

University of Guelph

Vietta E. Wilson

York University

Multiple site temperature readings are often desired in biofeedback and self-regulation research and therapy. While the Autogen 2000b temperature biofeedback unit has multiple inputs, they are electrically averaged and only a single output is available. The absolute temperature signal on the rear of the unit can be amplified by a DC amplifier (custom-built) and monitored by a computer via an analogue to digital (A/D) converter (Mountain Hardware A/D + D/A), but only one temperature site can be measured at a time.

Therefore, to measure more than one temperature site the probes are individually selected and the outputs read by the computer. The probes are computer- rather than manually selected by using several digital-to-analogue (D/A) outputs connected to the electric relays. Semiconductor analogue switches were not suitable because the "on" resistance of the switch would influence the accuracy of the temperature reading since the thermistor's resistance is proportional to the temperature.

Figure 1 shows the circuit to select 1 of n temperature thermistors to be used as the input to the ASI temperature unit. In our implementation we used the analogue outputs of a Mountain Hardware A/D + D/A board to energize each of the electrical relays that selected the desired thermistor. A 2-second delay between selecting a probe and reading the temperature was necessary to allow the reading to stabilize. Table I is a listing of a demo program used to select and read the temperatures from four probes, but an n

¹Address all correspondence to Dr. Evelyn I. Bird, School of Human Biology, University of Guelph, Guelph, Ontario, Canada N1G 2W1.

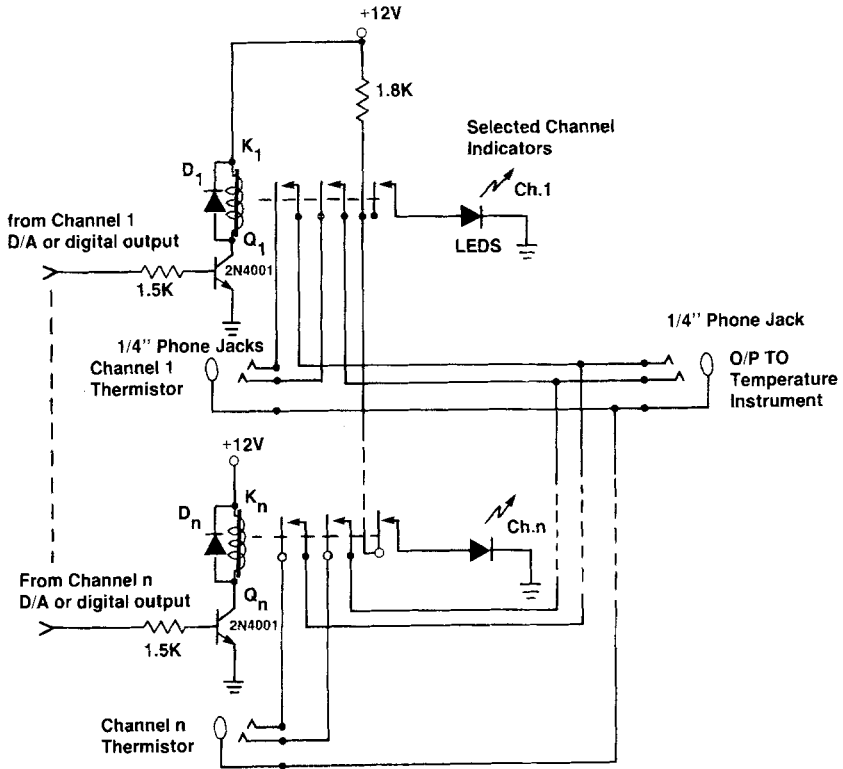


Fig. 1. Circuit diagram of n channel input selectors.

Table I. Program Listing for the On-Line Multiple Temperature Collection Routine

```

10 REM MULTITEMP
20 REM
30 AD = 49345:DA40 = 49344: REM MOUNTAIN A/D+D/A IN SLOT 4
40 POKE DA,128: POKE DA + 1,255: REM TURN ON CHAN 1
50 FOR I = 2 TO 15: POKE DA + 1,128: NEXT I: REM TURN OFF OTHERS
60 HOME
70 INVERSE : PRINT "    MULTI TEMPERATURE DEMO PROGRAM    "
80 NORMAL
90 INPUT "NUMBER OF CHANNELS (1-4) ?";N
100 IF N < 1 OR N > 4 THEN 60
110 INPUT "ENTER DELAY : ";D
120 PRINT "PRESS SPACE TO START...";
130 GET A$: POKE 36,0: INVERSE
140 FOR I = 1 TO N: PRINT TAB( I * 6 - 3);I;: NEXT
150 PRINT TAB( 40);"": NORMAL
160 POKE 34,4: REM SET WINDOW
170 FOR I = 1 TO N
180 A = PEEK (AD):A = PEEK (AD): REM TAKE DUMMY READING FIRST
190 POKE DA + I,128: REM TURN OFF CHAN
200 IF I = N THEN POKE DA + 1,255: GOTO 220
210 POKE DA + I + 1,255: REM TURN ON NEXT CHAN
220 T = INT (A * 1.37) / 10 + 65: REM A/D UNITS TO DEG F
230 PRINT TAB( I * 6 - 5);T;
240 FOR Z = 1 TO D:Z = Z: NEXT I: REM DELAY BETWEEN CHANNELS
250 NEXT I
260 PRINT
270 FOR Z = 1 TO 500:Z = Z: NEXT I: REM DELAY BETWEEN SAMPLES
280 GOTO 170

```

number of thermistors could be programmed. This software was written for a Mountain Hardware D/A output but could also be done for a digital output or a combination of both.

Revision received September 12, 1986)