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ABSTRACT

Predicting weather conditions is a topic of interest for students who want to make plans for outside activities. This paper discusses the development of an inexpensive computer-interfaced classroom weather station using an Apple IIe computer that provides the viewer with up to the minute digital readings of inside and outside temperature, barometric pressure, humidity, precipitation, and daily high and low temperatures. Instructions describe methods for creating a working weather disk that contains the main computer program, calibration files, and several programs used to create and read data files for the weather factors being studied. Diagrams illustrate the configurations for the weather station, the wind vane, the shutter station, and the electrical circuitry of the computerized weather system. A supply list for the commercially made components and the BASIC programs of the system are provided. (MDH)

A Computerized Weather Station For The Apple IIe

by

Mark V. Lorson

A COMPUTERIZED WEATHER STATION FOR THE APPLE IIe

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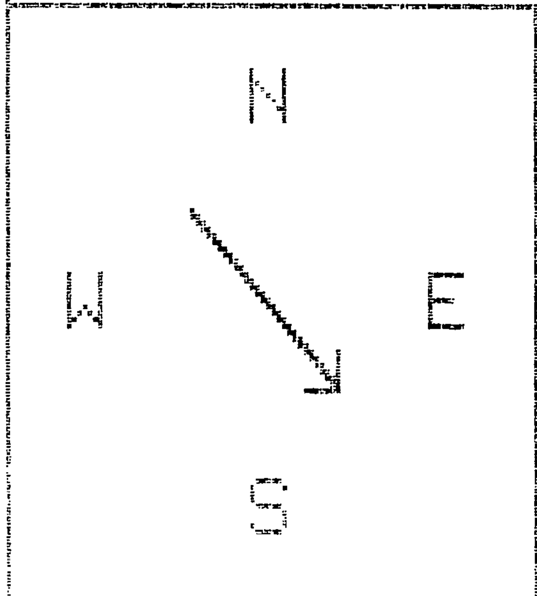
INSIDE 68F	OUTSIDE 42F
HUMIDITY 79%	HIGH TEMP 47F 12:05AM
PRECIPITATION 0.0"DAY 1.7"MON.	LOW TEMP 42F 6:27AM
WIND SPEED 8 MPH	BAROMETER 29.89"



SCREEN VIEW (FULL SIZE

Weather has always been a fascination for both young and old alike. There is an inherent interest in using the current weather conditions to predict the upcoming weather. Studying local weather conditions is of great interest to students because it affects their outside activities. Strong storms and fair weather can often be "seen" coming and the effects can be followed if one has access to weather data.

It is usually not difficult to have student volunteers manually record the weather conditions during the school day. Unfortunately, when using this method data is not collected during non-school hours. The automated collection system presented here collects and presents weather data continuously and saves the current weather conditions hourly. With little effort students are able to follow weather patterns for weeks at a time.

This article discusses the development of an inexpensive computer-interfaced classroom weather station using an Apple IIe computer which provides the viewer with up to the minute digital readings of inside and outside temperature, barometric pressure, humidity, precipitation, and daily high and low temperatures. (See Figure 1). An animated wind vane and digital wind speed reading are updated approximately 12 times a minute. The barometric pressure is graphed for the past 24 hours and is updated every 20 minutes. Weather conditions are saved to disk every hour for future study.

The hardware needed includes several sensor kits, a no-slot clock chip, a disk drive, an Apple IIe, and a few miscellaneous electronic and hardware components. The total cost of the system was under $400 including the cost of the clock chip. Software for the system includes a BASIC program written in Applesoft BASIC DOS 3.3 format from the author and machine language programs which come with the instruction books for the sensor kits. A parts list is included in Table 1.

The system uses the 9-pin gameport on the back of the Apple IIe computer for input from the interface devices. This port has four paddle inputs which can measure resistance, three switch inputs which sense voltage changes, a +5 volt source, and ground. Discussions of this port are numerous in the literature.

The seven sensors used measure temperature (2 needed), humidity, barometric pressure, wind speed, wind direction, and precipitation. The barometric pressure sensor and anemometer (wind speed) produce a voltage signal which is difficult to be measured cheaply. By using an inexpensive voltage to frequency converter to indirectly monitor the voltage output of these two devices the computer can produce usable results.

A guide to building the IC temperature probe circuits, humidity meter, and two voltage monitors needed are available from Vernier Software and described in How to Build a Better MOUSETRAP and 13 Other Science Projects Using the Apple II by David Vernier. A guide to building the barometer is in CHAOS in the Laboratory and 13 Other Science Projects Using the Apple II edited by David Vernier. These books also include disks with the software necessary to test, calibrate, and operate the sensors in conjunction with the author's main program. Remember to work from backups of the disks, not the originals!

CREATING A WORKING WEATHER DISK

The WEATHER disk (from the author) contains the main program, calibration files, and several programs that are used to create and read data files. Machine language programs, however, are also needed from the MOUSETRAP and CHAOS disks, and the clock chip disk. Some of these files need to be moved in memory locations and rewritten by running the file called CREATER on the WEATHER disk which will load programs from the MOUSETRAP and CHAOS disks and save them to the WEATHER disk. Begin by using appropriate software to copy the VIU.READ file from the CHAOS disk onto the working MOUSETRAP disk. (This requires software that can copy from PRODOS to DOS 3.3 such as COPYIIPC or PRODOSMASTER).

Insert the WEATHER disk and run the CREATER program from the WEATHER disk and follow its instructions by inserting the WEATHER disk and typing:

RUN CREATER <<RETURN>>

The data files for the weather data need to be created in the following manner. The WEATHER disk is inserted and the program CREATE MONTHLYDATA is run by typing:

RUN CREATE MONTHLYDATA <<RETURN>>

The program will count to approximately 1100. This program creates the file that contains the hourly data readings for the month. This file is long enough to last 44 days.

Next, run the program CREATE HIGHLOW.DAILY by typing:

RUN CREATE HIGHLOW.DAILY <<RETURN>>

This program will count to 44. This program creates a file that will contain the daily high and low temperature readings and is long enough to last 44 days.

NOTE!! Each month the MONTHLYDATA and HIGHLOW.DAILY files need to be recreated. First, however, you either need to copy the data files to a different disk or make a copy of the disk and then recreate each data file. In this way you can have continuing records of the weather. If you wish to view the weather data records run the READ MONTHLYDATA and READ HIGHLOW.DAILY files.

The clock chip is inserted in the computer following its instructions and the time of day set using its software. The machine language program for reading the clock chip needs to be copied onto the WEATHER disk. Again, using appropriate software copy the READ.TIME file from the clock chip disk onto the working <u>WEATHER</u> disk. (If a chip other than the SMT clock chip were used, make sure the chip's machine language program is loaded at A$260, the call statement is at A$300, and the name of the file is READ.TIME to allow for proper operation).

If you CATALOG the <u>WEATHER</u> disk by typing:

CATALOG <<RETURN>>

you should see the following programs listed on your disk (although maybe in different order).

```
A 002 HELLO
B 010 SYMBOLS
A 002 READ HIGHLOW.DAILY
A 003 CREATE MONTHLYDATA
A 003 CREATE HIGHLOW.DAILY
T 002 TEMP.CAL.2
B 003 READ.TIME
B 002 VIU8000.READ
B 005 FREQ.PB1
B 002 PDL8060.CHECK
A 003 READ MONTHDATA
T 010 HIGHLOW.DAILY
A 003 CREATER
T 209 MONTHLYDATA
A 049 WEATHER
```

With this part of the preparation out of the way, it is now time to build and test the individual components.

ASSEMBLING AND TESTING THE SENSORS

Calibration of the individual components can be easily done as each sensor is built. This can be aided by making test wires by taking pieces of 22 gauge wire and stripping the ends about 3/8". On one end of each wire melt some solder to stiffen the stripped end. Place an alligator clip on the other end of each wire. These wires will be easier to use if they are of different colors. The soldered end of the wires can now be gently inserted into the socket of the gameport on the back of the computer. Calibrations need to be done on the same computer which will be running the WEATHER STATION!

TEMPERATURE PROBES

The easiest solution to building these sensors is to buy two premade probes (#TPP) from Vernier Software and build the interface circuit as described on page 6-9 in <u>MOUSETRAP</u>. The premade probes (#TPP) can plug directly into a jack (RS#274-279) added to the temperature sensor interface circuit. On the #TPP probe the tip of the plug is positive while the center of the plug is negative.

Be sure to include the 220 ohm resistors as described in the project extension on page 6-9. It is important to use high quality capacitors to insure accuracy in measurements over the outside temperature range. The inside probe will use the PDLO line while the outside probe will use the PDL1 line.

When calibrating the temperature probes you can use the four cables with alligator clips. By studying the figure on page A-2 in <u>MOUSETRAP</u> you can determine which holes in the gameport socket to use. The two probes use PDLO, PDL1, +5V, and ground. Remember that the outside temperature probe will be placed about 20 feet outside so add enough cable between PDL1, +5V, and ground to simulate this distance. This will allow for a more accurate calibration of this probe.

A good range for the calibration temperatures will be on each end of your area's temperature ranges i.e. 0C to 40C for the outside temperature probe and 15C to 30C for the inside temperature probe. The WEATHER program reports in Fahrenheit but the calibration is done with Celsius. Load the calibration program TEMP.SENSOR.2 on the <u>MOUSETRAP</u> disk by typing:

LOAD TEMP.SENSOR.2 <<RETURN>>

Insert the WEATHER disk to modify and set the calibration values in the file TEMP.CAL.2 by typing:

RUN <<RETURN>>

and following the instructions. Later, the outside temperature sensor circuit will be located in Junction Box A in the shutter station while the inside temperature sensor circuit will be located in Junction Box B.

HUMIDISTAT

The humidity meter kit (#BHM-16) is constructed as described in <u>MOUSETRAP</u>. The humidistat operates on the PB1 switch input line. The humidistat is mounted outside in Junction Box A located in the shutter station.

**NOTE--A problem arises with the use of the PB1 input on the Apple IIe. If the input is above +2V on the PB1 line when the Apple IIe is turned on, the computer goes into and stays in a self-diagnostic mode. This problem can be circumvented by using a 45 second on-delay relay on the PB1 line. The on-delay relay controls a 120v relay which connects the PB1 input to the computer 45 seconds after startup avoiding the self-diagnostic mode (see Figure 2). The on-delay relay comes with a resistor (already soldered in place) that provides for a 180 second delay. This resistor is replaced with a 1 Megohm resistor giving a 45 second delay. The delay relay and the 120v relay are mounted inside the building in Junction Box B while the humidistat meter will be mounted outside in Junction Box A.

**NOTE--If power outages are rare in your area, the on-delay relay and 120v relay are probably not necessary. Remember, however, that the computer will probably not restart after any power outage (including turning off and on the computer) and the ensuing weather data will be lost until you restart your computer with the <u>interface cable removed</u> from the gameport.

Load the the file HUMIDITY on the <u>MOUSETRAP</u> disk to calibrate the humidity meter. Remove the <u>MOUSETRAP</u> disk and replace it with the WEATHER disk. Normally, the HUMIDITY program uses the PB2 line so a program line must be changed in the HUMIDITY program to allow the computer to read the PB1 line. This is accomplished by inserting the <u>MOUSETRAP</u> disk and typing:

LOAD HUMIDITY <<RETURN>>

150 PRINT D$ "BLOAD FREQ.PB1,A$8300" <<RETURN>

List 150 to make sure the above was entered.

LIST 150 <<RETURN>>

Then type:

RUN <<RETURN>>

Since the humidity meter is to be placed outside, calibration can be accomplished by using the same length of cable used for the outside temperature probe. If possible, place the humidistat circuit outside and let it equilibrate for 5 to 10 minutes. Run the HUMIDITY program and check the humidity reading. If an airport, TV or radio station, or government weather station is nearby call for an accurate relative humidity reading. (If not, use or build a wet-bulb/dry-bulb hygrometer as described on page 4-7 in <u>MOUSETRAP</u>). If the humidity reading is not accurate enough, the value for C12 in line 260 of the HUMIDITY program needs to be changed. If you need lower humidity readings, increase the value of C12. The simplest way to reach the correct value is to use the "hit and miss" method until the proper humidity reading is reached. If line 260 needs to be changed first type:

LIST 260 <<RETURN>>

Increase or decrease the value of C12 by re-entering the line and then RUN the program. This process is repeated until an adequate reading for the humidity is reached. When the proper value for C12 is found, <u>record it</u> because this value needs to be entered into the WEATHER program to give accurate humidity readings. Insert the WEATHER disk and load the WEATHER program by typing:

LOAD WEATHER <<RETURN>>

LIST 730 <<RETURN>>

Note that the variable is no longer called C12 in the WEATHER main program but is now called CQ. You will now enter your recorded value into the WEATHER program. Type:

730 CQ= xxx <<RETURN>>

Your value should have been substituted for xxx. Now type:

LIST 730 <<RETURN>>

and make sure the line has your value entered equal to CQ. Now the value is saved into the WEATHER program by typing:

SAVE WEATHER <<RETURN>>

BAROMETER

The barometer kit (#BAR-DIN) is built as described in CHAOS. A voltage monitor (#BVM-16) is required to interface the barometer with the computer. Instructions for building the voltage monitor are described in MOUSETRAP. The voltage monitor must be calibrated before attaching it to the barometer sensor. The barometer sensor and its voltage monitor use the PB2 line. The barometer and its voltage monitor are mounted outside in Junction Box A located in the shutter station.

ANEMOMETER

The anemometer provides a linear voltage output according to the manufacturer. This voltage is measured by a second voltage monitor (#BVM-16). The anemometer uses the PB0 input. As mentioned in MOUSETRAP, the PB0 line is slightly different from the PB1 and PB2 lines and the incoming signal needs to be amplified for proper sensitivity. This amplifier circuit can be simply added onto the voltage monitor circuit board and is described in Appendix J in MOUSETRAP. Calibration of the voltage monitor should take place after the amplifier circuit is in place. Because the voltage monitor is located on the PB0 line, the VOLTAGE MONITOR calibration program needs to be changed to read this line as noted on page G-5 of MOUSETRAP. The voltage monitor is mounted outside in Junction Box C, close to the anemometer if possible. Using a voltmeter, determine which line of the anemometer is positive and negative by gently spinning the anemometer. Mark them for proper attachment to the voltage monitor.

WIND DIRECTION

The wind direction is monitored by attaching a wind vane onto a conti ous turn 100K ohm rheostat mounted inside 1.5" PVC pipe. This rheostat is connected in series with a 30K ohm resistor and fed into the PDL2 line which can read the resistance. In order to save the life of the rheostat, a strain relief was made from a bicycle hub and mounted onto PVC pipe (see Figure 3). The 30K ohm resistor is mounted in Junction Box C.

One end of the bicycle hub where the spokes are attached is ground down until the spoke holes are no longer visible. This is most easily accomplished by using a grinding wheel after first removing the axle and bearings. Be sure to wear safety goggles and hold the hub with a locking pliers while grinding it down!!! Although simple, grinders can be very dangerous.

A hole is cut into a 1.5" PVC endcap (cutting through the side wall) using a scroll saw. The hole should be large enough so the end of the hub with spoke holes can rest flatly on the endcap but not fall through. In order to get the endcap flexible enough to slip the hub through, the PVC endcap was submerged in a cup of water and microwaved on high for approximately 2 minutes (time may vary). After the hub is through the endcap, small holes were drilled through eight of the spoke holes and the hub was secured to the endcap using loops of nichrome wire and twisting it until tight. The bearings were lightly greased, and the axle was reassembled so that a maximum of axle protrudes outside the top of the endcap while still allowing free movement.

The rheostat case was wrapped with tape until it had a snug fit when inserted inside a six inch length of 1.5" PVC. With the rheostat again removed wire leads are connected onto the outer pins of the rheostat. (The leads will need to reach the location of Junction Box C). A short piece of flexible rubber tubing is pushed onto the rheostat shaft with the other end placed onto the axle at the bottom of the hub. The rheostat and endcap are inserted into the 6" length of pipe and glued with PVC cement. Be sure to dry fit the endcap first to assure sufficient free movement of the axle. A can lid of sufficient size is drilled and mounted onto the top of the hub to serve as a weather protector for the hub bearings.

The wind vane was made from a 24 inch length of 3/4" PVC conduit, a piece of 1/8" plexiglas, and a 6" long 1/2" stove bolt (see Figure 4). The stove bolt is used as a counterweight for the front end of the wind vane. A 10" long slot is made into the 3/4" conduit to receive the plexiglas vane. Three holes are drilled through the conduit and plexiglas and it is secured with small nuts and bolts. A hole is also drilled just in front of the plexiglas and secured with a nut and bolt to help keep the conduit from splitting from the stress.

After heating the front end of the 3/4" conduit gently in a burner flame the stove bolt is inserted threads first with slight pressure until a tight fit is obtained. After the center of gravity is found, a hole is drilled to fit the wind vane onto the bicycle hub. If the 3/4" PVC conduit is too large to fit the axle, it can be ground down slightly using the grinder. Using a 1.5" PVC coupling, the 6" PVC pipe (bicycle hub, rheostat, and vane) is mounted onto a much longer piece of PVC conduit which will serve as a mast for the wind vane. The 30K ohm resistor is attached in series on the PDL2 line in Junction Box C.

The calibration of the wind vane can be completed prior to its mounting on the roof or wall or afterwards. Since the rheostat is a continuous turn model from OK to 100K there is a small area where the resistance is not measured before it returns to OK. This area is located by attaching an ohmmeter and spinning the wind vane until the area is found which fluctuates between zero and 100+K. The direction the front tip of the wind vane is pointing should be marked on the 1.5" PVC at this location of 0 ohms. If the wind vane is to be mounted before calibration, make sure this mark is aimed due <u>northeast</u> (per later instructions).

The computer determines wind direction by reading the value of the rheostat. Since eight wind directions are available, eight ranges of resistance need to be measured. These ranges can be measured by making an enlargement of Figure 5 out of cardboard. The hole in the center is so the 1.5" PVC pipe can slide inside. The lines are spaced 22.5 degrees apart around the circle. For calibration purposes, you are interested in the heavy black lines numbered 1-8.

Because of a lack of sensitivity, the fluctuation point between 0-100K is pointed towards the blackened circle on the cardboard calibration aid (northeast). This area was chosen because in the author's area the wind least often blows from the northeast.

At this point the 30K ohm resistor needs to be added in series with the rheostat in the wind vane circuit if it is not already in Junction Box C. This means the wind vane resistance should actually vary from 30K to 130K. This is done because the Apple IIe gives more accurate readings above 30K for the range we are interested in. In order to determine the computer interpreted resistance readings for the PDL2 port, type in the following program after loading BASIC:

```
NEW       <<RETURN>>
5   HOME   <<RETURN>>
10  X=PDL(2)  <<RETURN>>
20  VTAB 2:PRINT "        "        <<RETURN>>
30  VTAB 2:PRINT X        <<RETURN>>
40  GOTO 10      <<RETURN>>
RUN    <<RETURN>>
```

With the mark on the mast pointing towards the darkened circle on the cardboard calibration aid (northeast) turn the head of the weather vane arrow towards #1 on the aid and record the value written on the screen. Do the same for the remaining points #2-8.

These values will be substituted into the WEATHER program in program line #48. Each value for #1-8 will correspond to the I- value used in the program i.e. 1 is I1, 2 is I2, etc. Place the WEATHER disk in the computer and load the WEATHER program by typing:

LOAD WEATHER <<RETURN>>

LIST 48 <<RETURN>>

You need to retype program line number 48, setting your own values equal to the I- values. List the line to make sure you entered it correctly:

LIST 48 <<RETURN>>

Then:

SAVE WEATHER <<RETURN>>

If the calibration of the wind vane was done after it was mounted on the roof or wall you are finished with the wind vane. If it was calibrated unmounted it is very important that when it is mounted that the mark on the mast be pointing directly northeast. Otherwise, your previous calibration efforts will be lost.

PRECIPITATION

Precipitation is measured by using a 0.1" tipping bucket raingauge by RAINWISE. This gauge signals a 555-based timing circuit which turns on an infrared-LED for approximately 10 seconds (for schematic of this circuit see Figure 6). The infrared-LED signal is read by a phototransistor into the PDL3 line. The infrared-LED signal is activated for a time period of 10 seconds in order to assure that the WEATHER program has adequate time to respond to the momentary signal of the raingauge. The 555-circuit is mounted inside the building in Junction Box B.

PUTTING IT ALL TOGETHER

After all of the components are tested they are ready to be mounted in a weather shelter. An adequate weather collection shelter can be made from four shutters (see Figure 7) mounted in a grassy, unshaded area at least 20 feet from a building on a five foot pole. The barometer and its voltage monitor, humidistat and its voltage monitor, and the outside temperature probe are mounted inside the weather shelter in Junction Box A (see Figure 8). The barometer, temperature probe and its circuit, and humidistat can be mounted in Junction Box A in the middle of the shutters. Many small holes are drilled in the Junction Box around the humidistat to allow for air movement. The barometer should also be open to the air. Likewise, the tip of the temperature probe needs to be out in the air. Cables are rur into the building from the weather shelter to Junction Box B. It is possible to use 6-conductor cable and only run one line.

The wind direction vane, rain gauge, and anemometer are mounted on the roof or side of the building extending above the roof line. It is important to get the anemometer and wind vane high enough to avoid roof effects on the true wind speed and direction. The lines of these devices are run into Junction Box C (see Figure 9) where the voltage monitor and 30K resistor are located. Six-conductor cable is again run to Junction Box B.

The cables from Junction Boxes A and C are run to Junction Box B (located inside) which contains the circuitry for the inside temperature probe and the circuitry for the rain gauge. In Junction Box B, all connections are also made to the 9-pin interface cable (see Figure 10) using a (RS#276-148) circuit board. The cable is then inserted into the gameport on the rear of the computer.

The weather station is now ready to operate as an entire unit. Insert the <u>WEATHER</u> disk, turn on the computer, and begin enjoying the weather!!

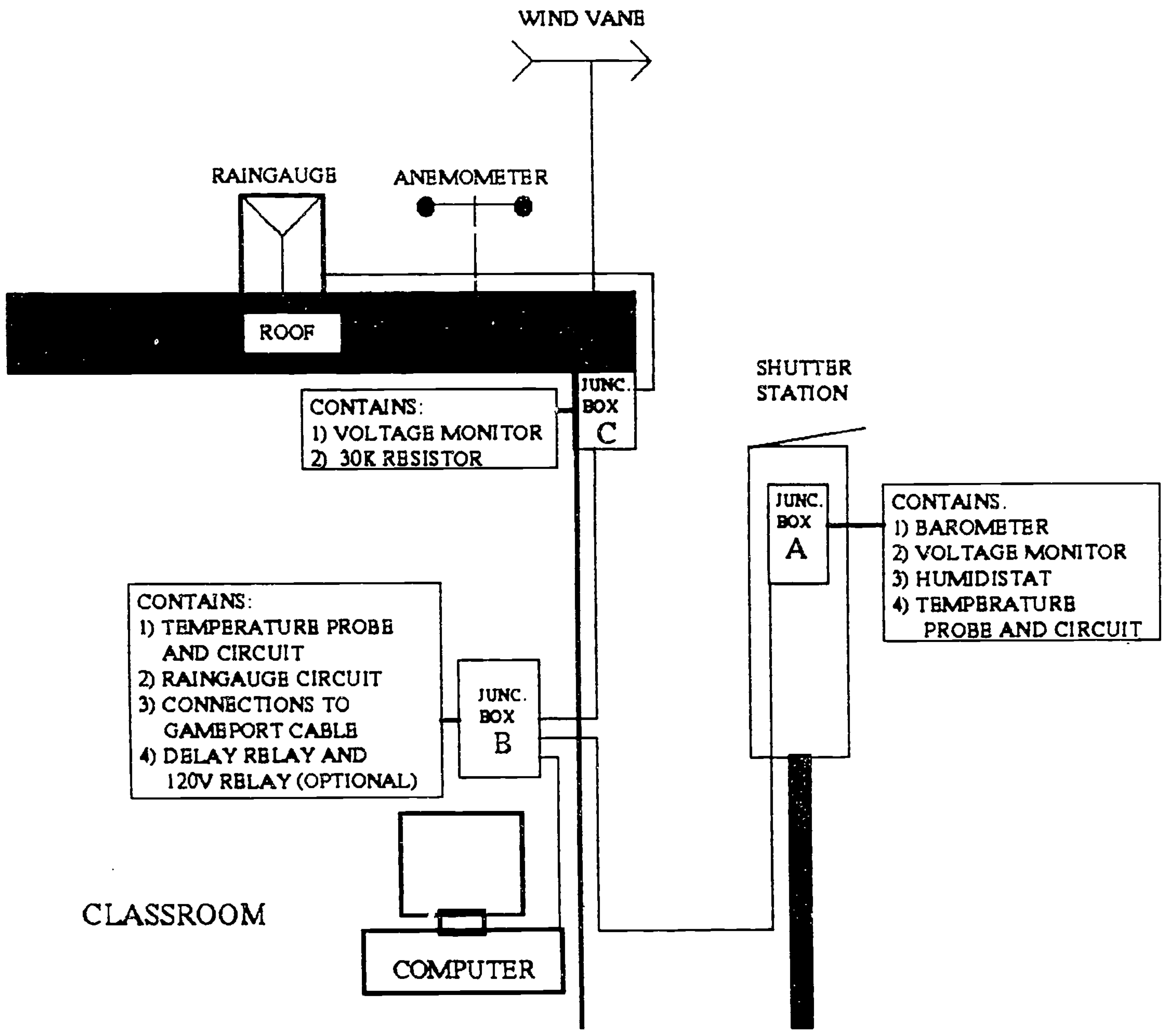
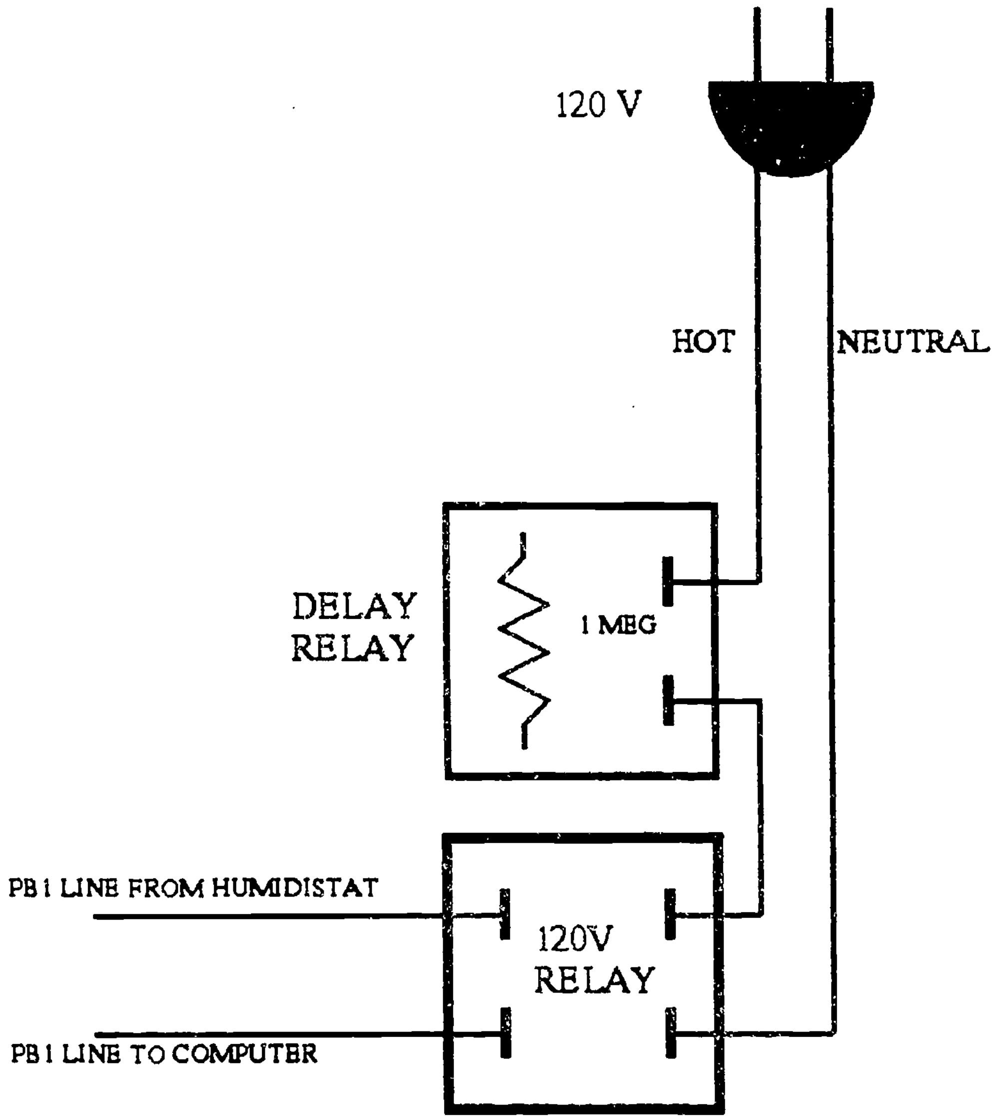


Figure 1. Weather Station.



Located in Junction Box B

Figure 2. Delay and 120 volt relay.

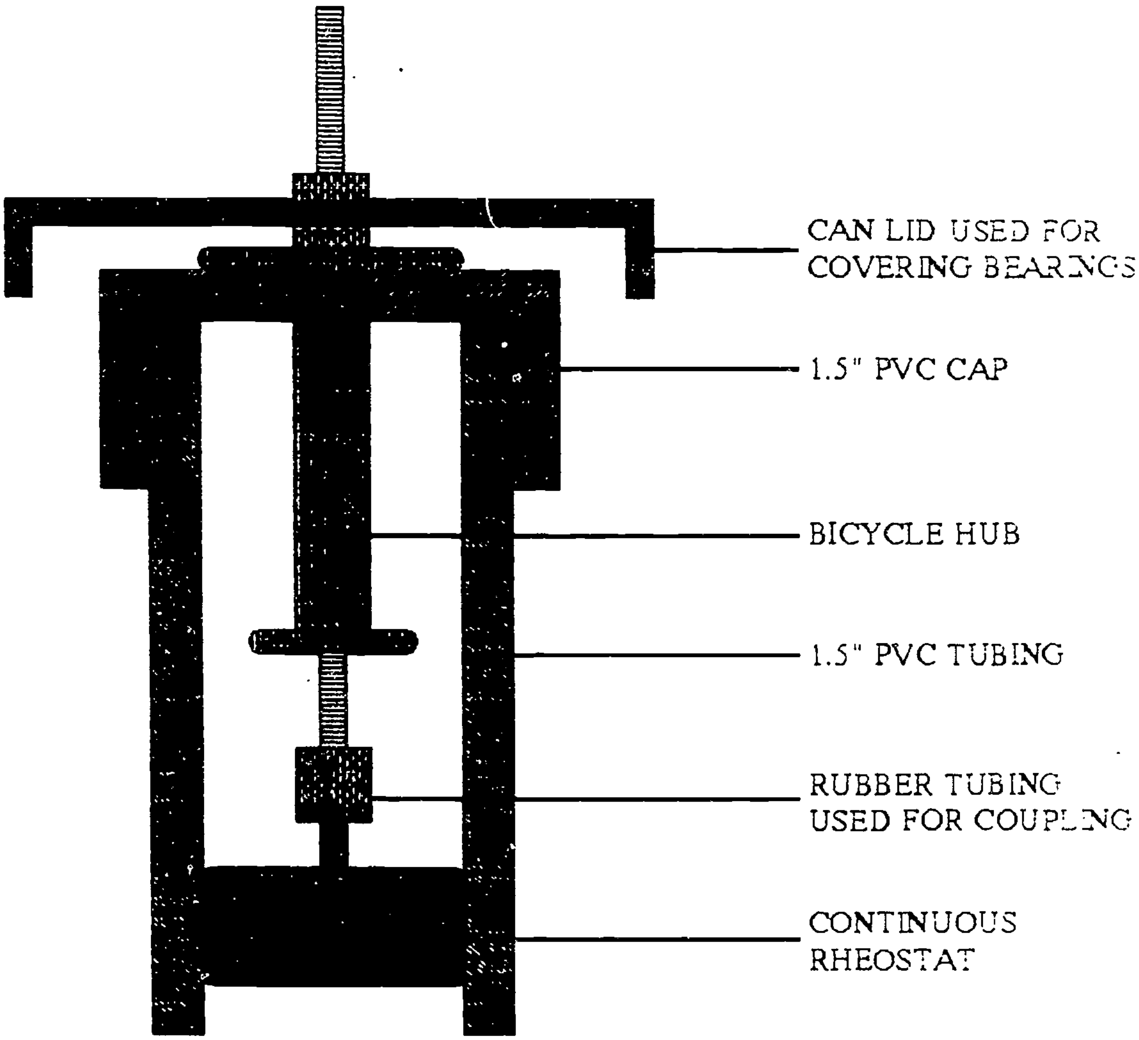


Figure 3. Wind vane strain relief.

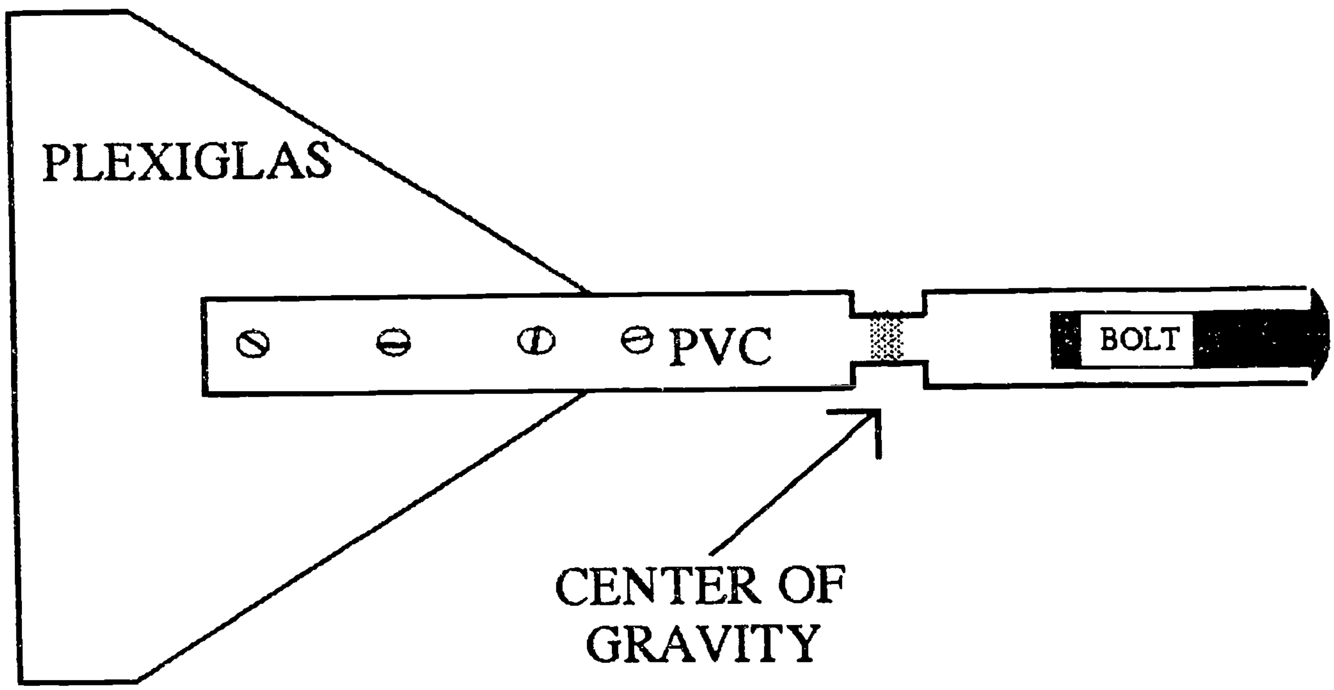


Figure 4. Wind vane.

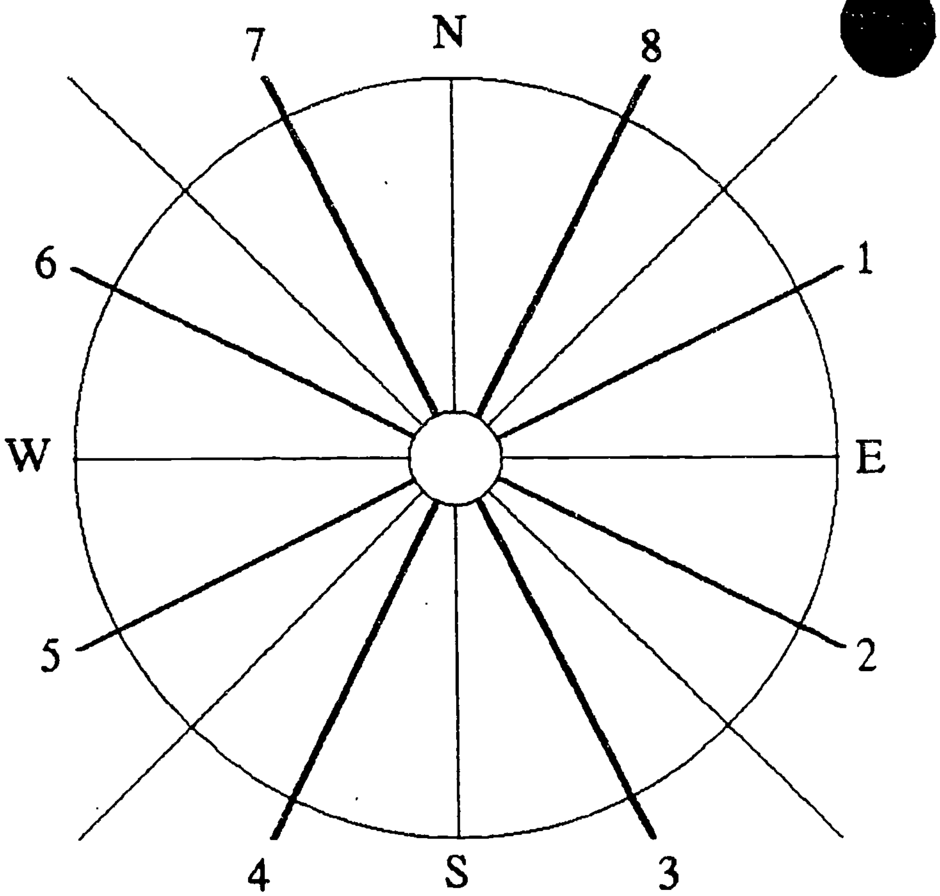


Figure 5. Wind vane calibration aid.

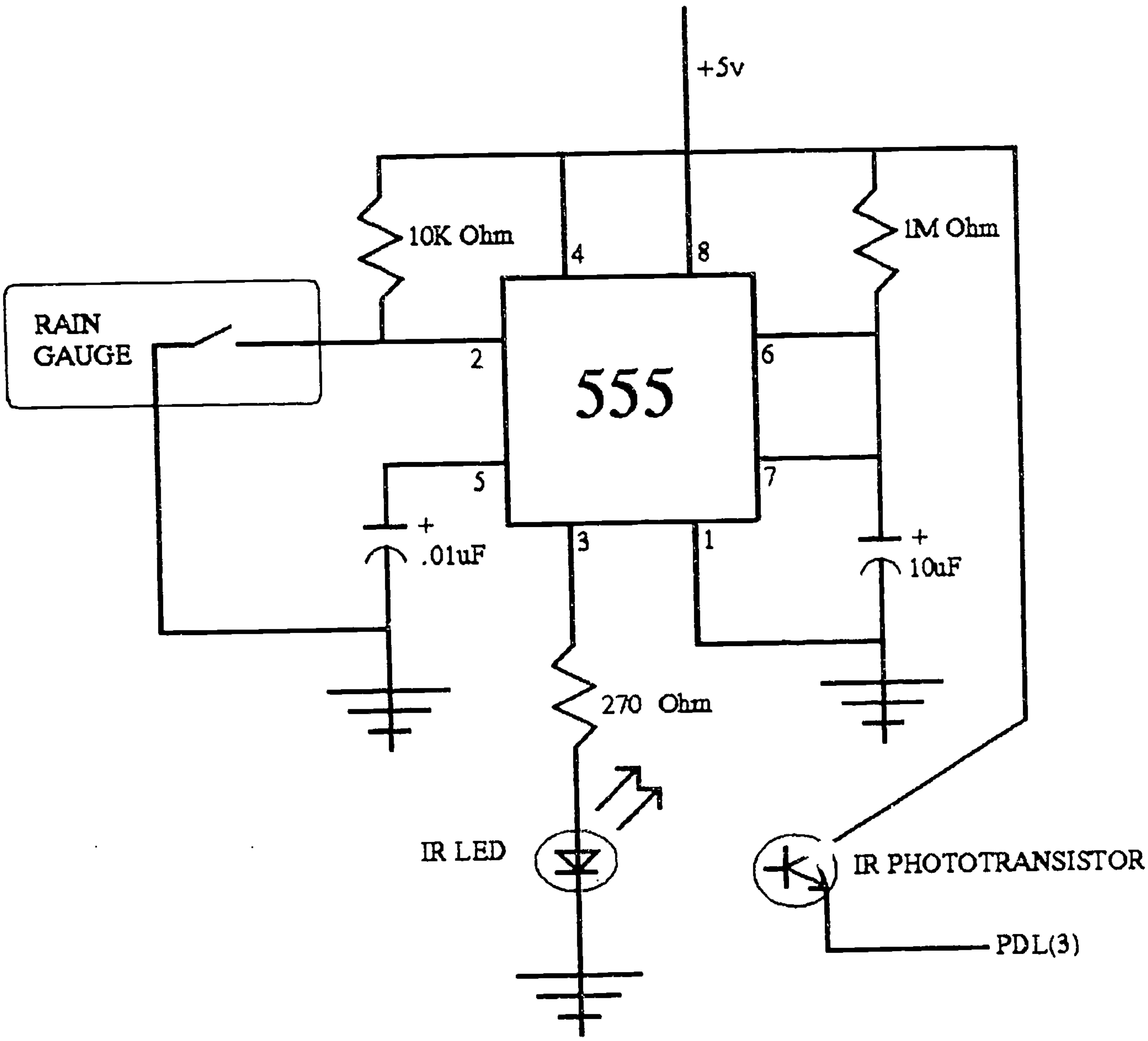


Figure 6. 555-Timing Circuit.

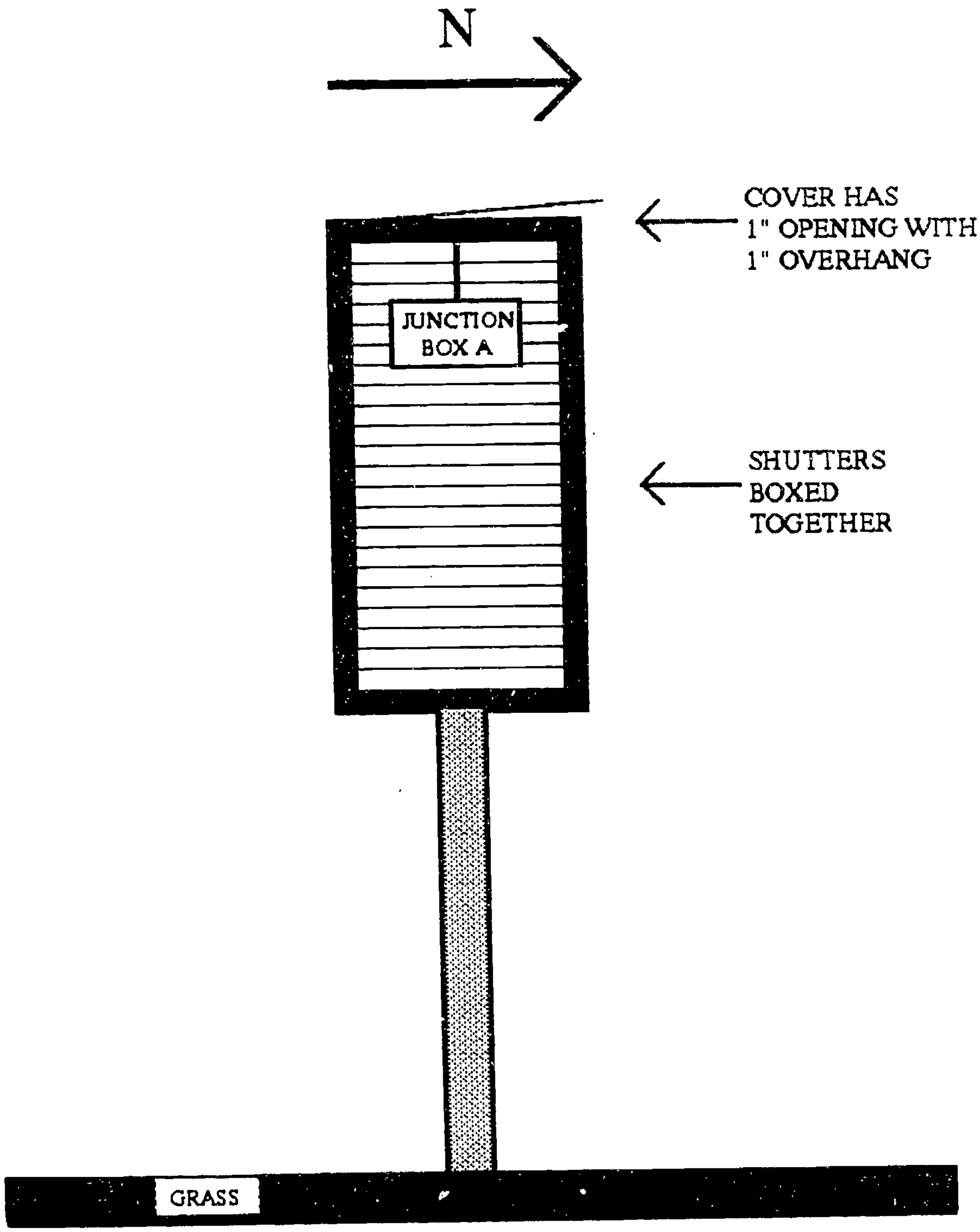


Figure 7. Shutter station.

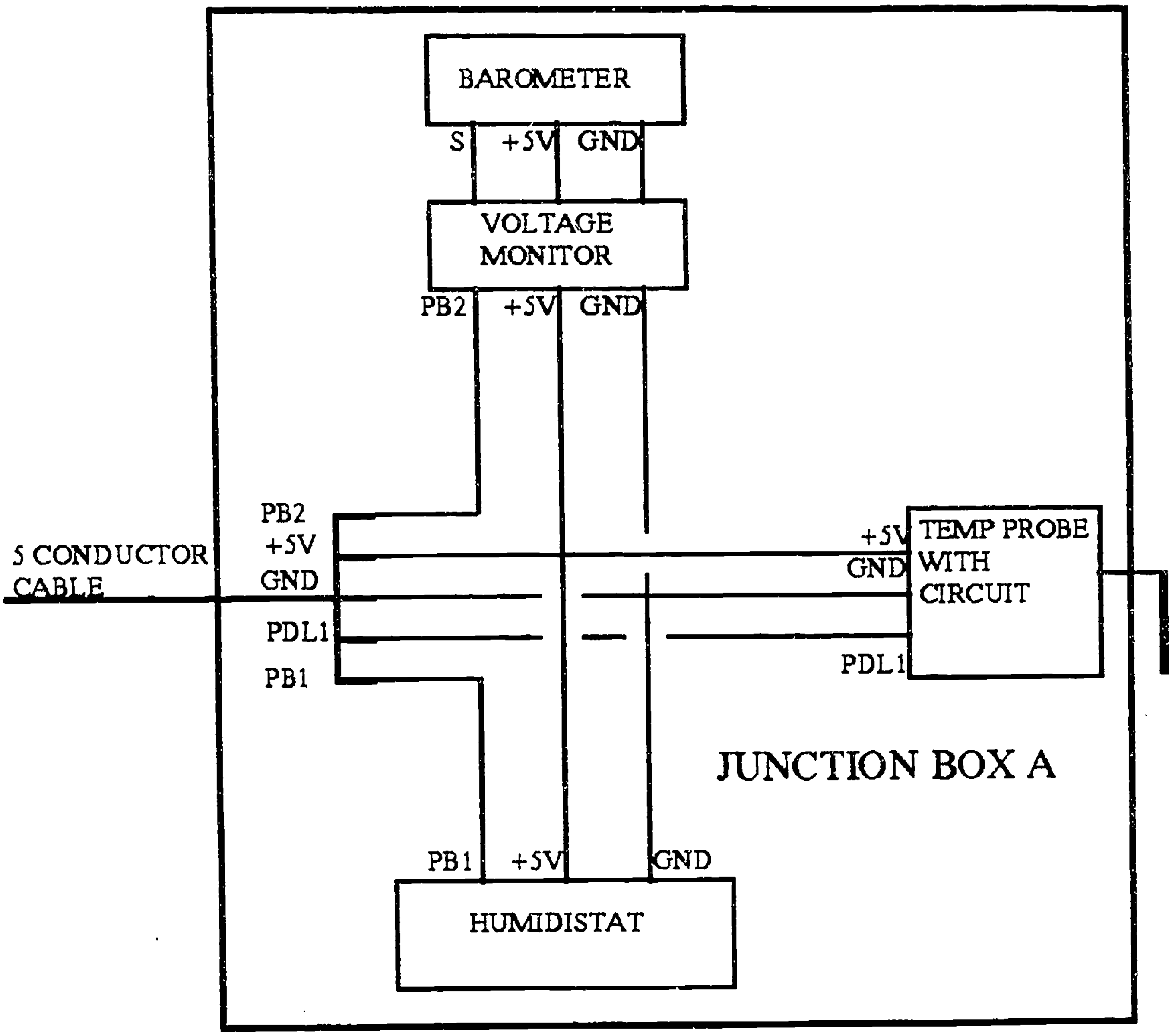


Figure 8. Junction Box A.

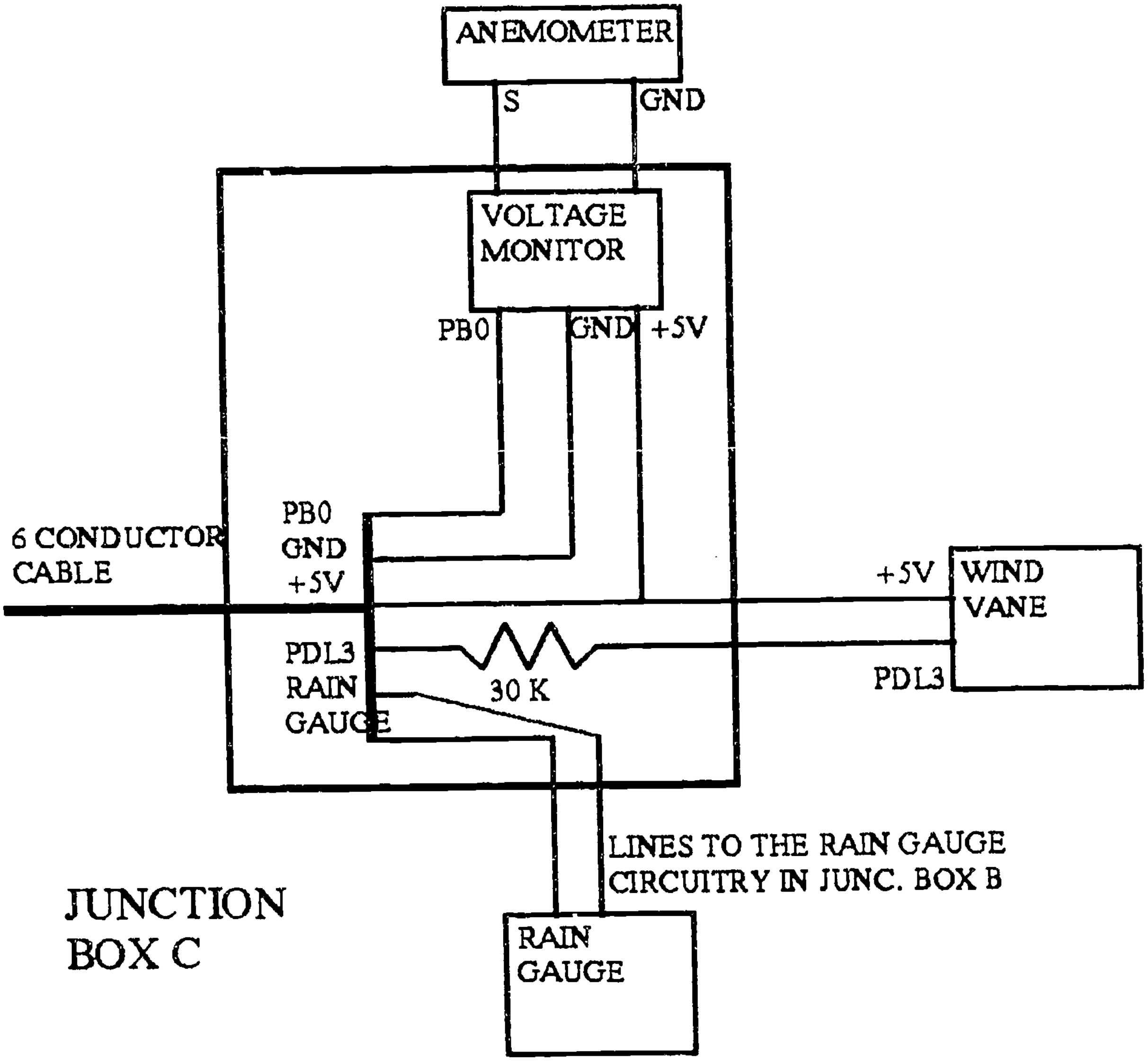


Figure 9. Junction Box C.

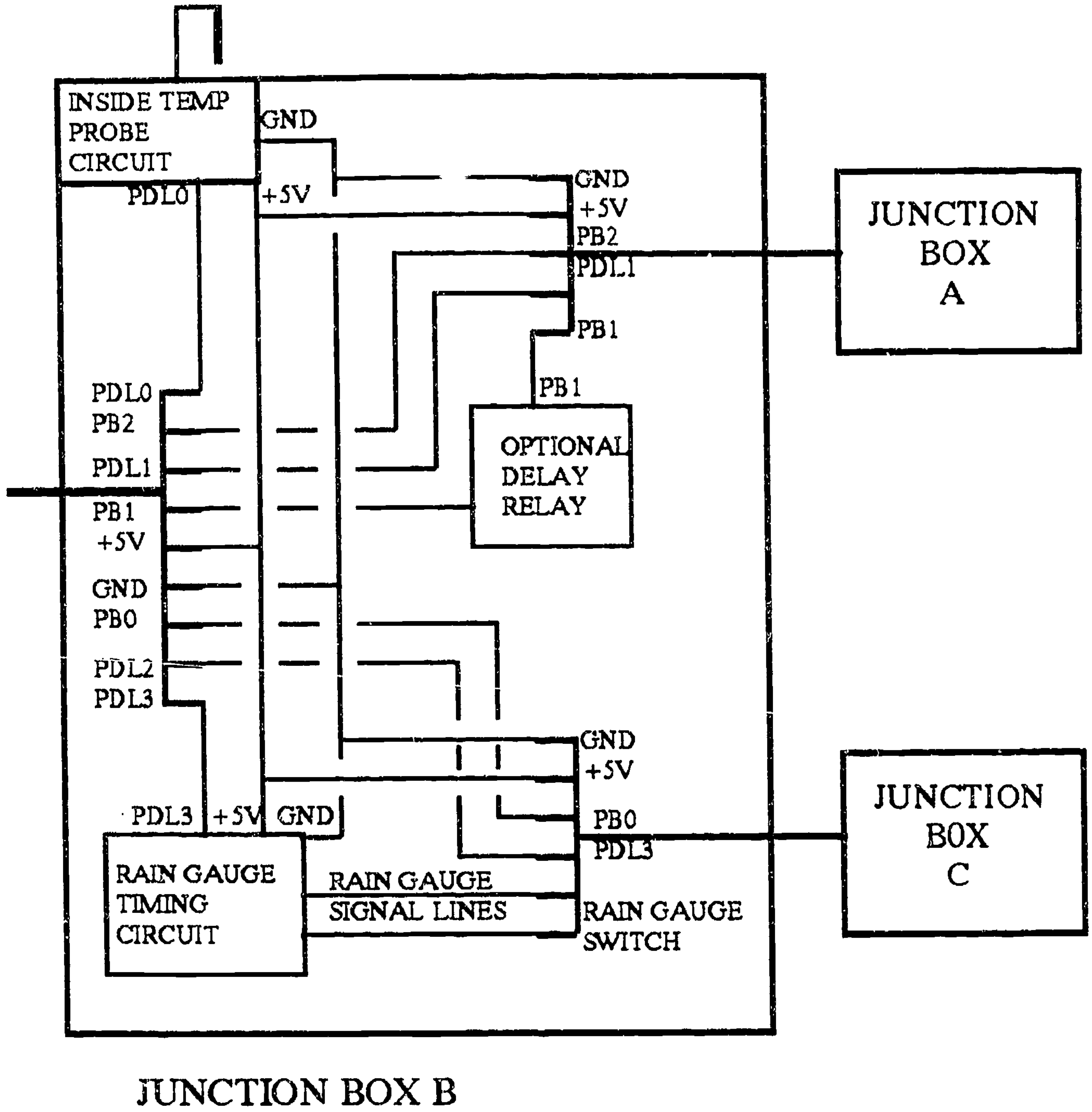


Figure 10. Junction Box B.

TABLE 1. COMMERCIAL SUPPLY LIST AND SOURCES

	AMOUNT	COST	TOTAL	SOURCE
INSTRUCTION BOOKS				
CHAOS IN THE LABORATORY	1	$25.95	$25.95	4
HOW TO BUILD A BETTER MOUSETRAP	1	$24.95	$24.95	4
TEMPERATURE SENSORS				
TEMPERATURE PROBES (TPP)	2	$10.00	$20.00	4
RESISTORS 220 OHM	2	$.39	$.78	5
CAPACITOR 4.7uF	2	$.89	$1.78	5
JACKS-OPEN CIRCUIT (RS#274-249) (PAIR)	1	$1.59	$1.59	5
WIND VANE SENSOR				
BOURNE RHEOSTAT (#6657S-1-104)	1	$25.00	$25.00	2
RESISTOR 33K OHM	1	$.39	$.39	5
WIND SPEED SENSOR				
ANEMOMETER	1	$40.00	$40.00	1
VOLTAGE MONITOR (BVM-16)	1	$24.00	$24.00	4
BAROMETER SENSOR				
BAROMETER (CBR-DIN)	1	$42.00	$42.00	4
VOLTAGE MONITOR (BVM-16)	1	$24.00	$24.00	4
TRANSISTOR (MSP2907 PNP)	1	$1.50	$1.50	5
RESISTOR 10K OHM	1	$.39	$.39	5
HUMIDISTAT SENSOR				
HUMIDITY METER (BHM-16)	1	$23.00	$23.00	4
DELAY RELAY (OMNETICS MMS115A1x180)	1	$3.50	$3.50	3
RELAY 120V DPDT (RS#275-217)	1	$5.95	$5.95	5
RESISTOR 1MEG OHM	1	$.39	$.39	5
RAIN GAUGE SENSOR				
RAINWISE 0.1" RAIN GAUGE	1	$42.00	$42.00	6
555 IC TIMER CHIP	1	$1.19	$1.19	5
RESISTOR 3.9K OHM	1	$.29	$.29	5
RESISTOR 150 OHM	1	$.39	$.39	5
RESISTOR 1 MEG OHM	1	$.39	$.39	5
RESISTOR 10K OHM	1	$.39	$.39	5
CAPACITOR 10 uF (TANTALUM)	1	$.79	$.79	5
CAPACITOR 0.01 uF (DISK CERAMIC)	1	$.49	$.49	5
IR LED (RS#276-143)	1	$1.69	$1.69	5
IR PHOTOTRANSISTOR (RS#276-145)	1	$.99	$.99	5
CIRCUIT BOARD (RS#276-159)	1	$1.49	$1.49	5
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SOURCES:

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5 RADIO SHACK STORES

6 RAINWISE
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25 FEDERAL ST.
BAR HARBOR, MAINE 04609

```
LIST

10  REM     WEATHER STATION
15  REM    BY MARK V. LORSON, PH.D.
20  REM        2-19-93
23  REM  ---------------------------------
25  REM  SET STANDARDS
30  NORMAL
35  HIMEM: 32512
40  LOMEM: 27000
45 MA = 1:MB = 1:MC = 1:NA = 1:NB = 1:NC = 1:PA = 1:PB = 1:PC = 1:PD = 1
   :GG = 1:HA = 1:HB = 1:WA = 1:WB = 1:KA = 1:KB = 1:KC = 1:LA = 1:LB =
   1:LC = 1:T6 =  - 1:G7 =  - 100:G8 = 200:VA = 1:VB = 1:VC = 1:JA = 1:
   JB = 1
48 I1 = 7:I2 = 34:I3 = 60:I4 = 88:I5 = 116:I6 = 142.5:I7 = 167.5:I8 = 19
   4
50  DIM P(80)
55  DIM MT$(27): DIM MT(27)
60  POKE 216,0
65  TEXT : HOME
70 D$ =  CHR$ (4)
75 OP$ = D$ + "OPEN":CL$ = D$ + "CLOSE":RD$ = D$ + "READ":WR$ = D$ + "WR
   ITE"
80 Z$ = "MONTHLYDATA"
85 RTIO = 1.00
90  REM  ---------------------------------
100  REM  LOAD MACHINE PROGRAMS
105  PRINT D$;"BLOAD READ.TIME,A$260"
110  PRINT D$;"BLOAD SYMBOLS,A$6000"
115  PRINT D$;"BLOAD VIU8000.READ,A$8000": REM    LOAD THE MACHINE LANGU
   AGE FREQUENCY MONITORING ROUTINE
120  PRINT D$;"BLOAD FREQ.PB1,A$8300": REM  READ HUMIDISTAT
125  POKE 252,2: POKE 253,0: POKE 206,151: POKE 238,1: POKE 235,0
130  PRINT D$;"BLOAD PDL8060.CHECK,A$8060": PRINT D$;"OPEN TEMP.CAL.2": PRINT
    D$;"READ TEMP.CAL.2": INPUT C1: INPUT T1: INPUT C2: INPUT T2: INPUT
    C3: INPUT T3: INPUT C4: INPUT T4: PRINT D$;"CLOSE TEMP.CAL.2"
135 S0 = (T2 - T1) / (1 / C2 - 1 / C1):S1 = (T4 - T3) / (1 / C4 - 1 / C3
    )
140  REM  ------------------------------------------------
200  REM  SCREEN SETUP
205  POKE 49168,0: SCALE= 1: ROT= 0: HCOLOR= 3: POKE 232,0: POKE 233,96:
    PRINT : PRINT
210 AA = 120
215  POKE 49168,0: PRINT D$: HOME : HGR2 : FOR B = 1 TO AA: READ S,X,Y: DRAW
    S AT X,Y: NEXT B
220  POKE  - 16302,0
225  HPLOT 100,96 TO 100,190: HPLOT 139,0 TO 139,96: HPLOT 0,24 TO 278,2
    4: HPLOT 0,48 TO 278,48: HPLOT 0,72 TO 278,72: HPLOT 0,96 TO 278,96
226  HPLOT 0,0 TO 0,190 TO 278,190 TO 278,0 TO 0,0
230  HPLOT 122,104 TO 122,184: HPLOT 120,104 TO 122,104: HPLOT 120,184 TO
    122,184: HPLOT 120,124 TO 122,124: HPLOT 120,144 TO 122,144: HPLOT 1
    20,164 TO 122,164
233  REM  ---------------------------------
235  REM  TIME CALL
240  CALL 768,TM$:TM$ =  LEFT$ (TM$,11) + ";" +  MID$ (TM$,13,2) + ";" +
    RIGHT$ (TM$,2):CD$ =  LEFT$ (TM$,2):CD =  VAL (CD$): IF CD < 10 THEN
    TM$ = "*" +  RIGHT$ (TM$,16)
245 T5$ =  MID$ (TM$,10,2):T6 =  VAL (T5$):KZ$ =  MID$ (TM$,4,2):KY =  VAL
    (KZ$)
250  GOSUB 20005: GOSUB 21000
```

```
255  CALL 768,TM$:TM$ =  LEFT$ (TM$,11) + ";" +  MID$ (TM$,13,2) + ";" +
     RIGHT$ (TM$,2):CD$ =  LEFT$ (TM$,2):CD =  VAL (CD$): IF CD < 10 THEN
    TM$ = "*" +  RIGHT$ (TM$,16)
260 T5$ =  MID$ (TM$,10,2):T5 =  VAL (T5$):T7$ =  MID$ (TM$,2,1):T7 =  VAL
    (T7$):KZ$ =  MID$ (TM$,4,2):KZ =  VAL (KZ$)
270  IF T5 <  > T6 THEN  GOSUB 18000:T6 = T5
271  IF QR = 1 THEN MV = 0: IF KZ <  > KY THEN G7 =  - 100:T1$ = TM$:G8 =
    200:T2$ = TM$:R = 0:KY = KZ: GOSUB 300: GOSUB 900: GOSUB 5000
272  IF T7 <  > T8 THEN MO = 0:T8 = T7
275  GOSUB 300: GOSUB 5000: GOSUB 700: GOSUB 5000: GOSUB 900: GOSUB 5000
    : GOSUB 600: GOSUB 3000: FOR PL = 1 TO 10: GOSUB 500: GOSUB 800: GOSUB
    5000: NEXT PL
280  GOTO 255
285  REM  ---------------------------------------------------
300  REM  DETERMINE TEMPERATURE
305 V = 0: FOR CC = 1 TO 5: CALL 32864:CT =  PEEK (32974) + ( PEEK (3297
    5) - 96) * 256:V = V + CT: NEXT CC:CT = V / 5
310  POKE 49168,0:V = 0: FOR CC = 1 TO 5: CALL 32890:CZ =  PEEK (32974) +
    ( PEEK (32975) - 96) * 256:V = V + CZ: NEXT CC:CZ = V / 5
315 PR = SO * (1 / CT - 1 / C1) + T1:PR =  INT (PR * 10) / 10:PS = S1 *
    (1 / CZ - 1 / C3) + T3:PS =  INT (PS * 10) / 10
320 FO = (1.8 * PR) + 32:F1 = (1.8 * PS) + 32:PR = FO:PS = F1
325  IF PR < 0 THEN R$ = "N"
330  IF PR > 0 THEN R$ = "Y"
335 M = PR + .5:M =  ABS ( INT (M)):M1 =  INT (M / 100):M2 =  INT ((M -
    M1 * 100) / 10):M3 =  INT (M - (M1 * 100 + M2 * 10)):M4 = M1 + 1:M5 =
    M2 + 1:M6 = M3 + 1
340  IF M4 < 1 OR M4 > 10 THEN M4 = 1
345  IF M5 < 1 OR M5 > 10 THEN M5 = 1
350  IF M6 < 1 OR M6 > 10 THEN M6 = 1
355  HCOLOR= 0: IF S$ = "N" THEN XY = 0: DRAW 37 AT 28,14
360  IF MA = 1 THEN 370
365  DRAW MA AT 40,14
370  DRAW MB AT 52,14: DRAW MC AT 64,14:S$ = R$:MA = M4:MB = M5:MC = M6
375  HCOLOR= 3: IF R$ = "N" THEN XY = 0: DRAW 37 AT 28,14
380  IF MA = 1 THEN 390
385  DRAW MA AT 40,14
390  DRAW MB AT 52,14: DRAW MC AT 64,14
395  IF PS < 0 THEN U$ = "N"
400  IF PS > 0 THEN U$ = "Y"
405 N = PS + .5:N =  ABS ( INT (N)):N1 =  INT (N / 100):N2 =  INT ((N -
    N1 * 100) / 10):N3 =  INT (N - (N1 * 100 + N2 * 10)):N4 = N1 + 1:N5 =
    N2 + 1:N6 = N3 + 1
410  IF N4 < 1 OR N4 > 10 THEN N4 = 1
415  IF N5 < 1 OR N5 > 10 THEN N5 = 1
420  IF N6 < 1 OR N6 > 10 THEN N6 = 1
425  HCOLOR= 0: IF V$ = "N" THEN XY = 0: DRAW 37 AT 170,14
430  IF NA = 1 THEN 440
435  DRAW NA AT 182,14
440  DRAW NB AT 194,14: DRAW NC AT 206,14:V$ = U$:NA = N4:NB = N5:NC = N
    6
445  HCOLOR= 3: IF U$ = "N" THEN XY = 0: DRAW 37 AT 170,14
450  IF NA = 1 THEN 460
455  DRAW NA AT 182,14
460  DRAW NB AT 194,14: DRAW NC AT 206,14
465  RETURN
470  REM  ---------------------------------------------------
500  REM  WIND DIRECTION
505 CB =  PDL (2)
510  IF CB <  = I1 THEN BB = 32:HH = 44: GOTO 550
```

```
513  IF CB > I1 AND CB <  = I2 THEN BB = 32:HH = 43: GOTO 550
515  IF CB > I2 AND CB <  = I3 THEN BB = 0:HH = 45: GOTO 550
520  IF CB > I3 AND CB <  = I4 THEN BB = 48:HH = 43: GOTO 550
525  IF CB > I4 AND CB <  = I5 THEN BB = 0:HH = 44: GOTO 550
530  IF CB > I5 AND CB <  = I6 THEN BB = 0:HH = 43: GOTO 550
535  IF CB > I6 AND CB <  = I7 THEN BB = 32:HH = 45: GOTO 550
540  IF CB > I7 AND CB <  = I8 THEN BB = 16:HH = 43: GOTO 550
545  IF CB > I8 THEN BB = 32:HH = 44: GOTO 550
550  IF GG = 0 THEN 560
555  ROT= HI: HCOLOR= 0: DRAW GG AT 50,142
560  ROT= BB: HCOLOR= 3: DRAW HH AT 50,142:GG = HH:HI = BB: ROT= 0
565  RETURN
570  REM  ---------------------------------
600  REM   DETERMINE PRESSURE
604  POKE 32771,2: REM     READS PB2
608  GOSUB 16000
612 V = F / 1000: REM        VOLTAGE = FREQUENCY/1000
616 T = T + .60
620 IN = 25 + V / .524: REM    INCH OF HG.
624 IN = IN * RTIO: REM    CORRECTION FACTOR
628 P = IN * 100:P1 =  INT (P / 1000):P2 =  INT ((P - P1 * 1000) / 100):
    P3 =  INT ((P - (P1 * 1000 + P2 * 100)) / 10):P4 =  INT (P - (P1 * 1
    000 + P2 * 100 + P3 * 10))
632 P5 = P1 + 1:P6 = P2 + 1:P7 = P3 + 1:P8 = P4 + 1
636  IF P5 < 1 OR P5 > 10 THEN P5 = 1
640  IF P6 < 1 OR P6 > 10 THEN P6 = 1
644  IF P7 < 1 OR P7 > 10 THEN P7 = 1
648  IF P8 < 1 OR P8 > 10 THEN P8 = 1
652  HCOLOR= 0: DRAW PA AT 176,86: DRAW PB AT 188,86: DRAW PC AT 212,86:
     DRAW PD AT 224,86:PA = P5:PB = P6:PC = P7:PD = P8
656  HCOLOR= 3: DRAW PA AT 176,86: DRAW PB AT 188,86: DRAW PC AT 212,86:
     DRAW PD AT 224,86
660 H7$ =  MID$ (TM$,13,2):H7 =  VAL (H7$)
664  IF R7 = H7 THEN 676
668  IF H7 = 20 OR H7 = 40 OR H7 = 0 THEN R7 = H7: GOSUB 5000: GOSUB 170
    05
672 QR = 1: REM  SEE LINE 905
676  RETURN
680  REM  ---------------------------------
700  REM  HUMIDITY
705  CALL 33536: REM  READS PB1
710 C =  PEEK (250) + 256 *  PEEK (251)
715 F =  INT (C / .501563 + .5)
720  IF F = 0 THEN 750
725 CA = 1.443 / (2.1E6 * F) * 1E12
730 CQ = 125
735  IF CA / CQ < .986 THEN  PRINT "OUT OF RANGE": GOTO 740
740  REM  CONTINUE FROM ERROR
745 H = 2.7183 ^ (( LOG (CA / CQ - .985) + 1.079) / 1.4) * 100:H =  INT
    (H)
750 H1 =  INT (H / 10):H2 =  INT (H - H1 * 10):H3 = H1 + 1:H4 = H2 + 1
755  IF H3 > 10 OR H3 < 1 THEN H3 = 1
760  IF H4 > 10 OR H4 < 1 THEN H4 = 1
765  IF H > 99 THEN  HCOLOR= 3: DRAW 2 AT 40,38
770  IF H < 100 THEN  HCOLOR= 0: DRAW 2 AT 40,38
775  HCOLOR= 0: DRAW HA AT 52,38: DRAW HB AT 64,38:HA = H3:HB = H4: HCOLOR=
    3: DRAW HA AT 52,38: DRAW HB AT 64,38
780  RETURN
785  REM  ------------------------------------------------
800  REM  WIND SPEED
```

```
805  POKE 32771,0: REM   READS PBO
810 VW = 0
815  FOR WW = 1 TO 5: GOSUB 16000:VW = VW + V: NEXT WW:V = VW / 5
820 WS = (320 * V) + 1.01
825  IF WS < 1.793 THEN WS = 0
830 WS =  INT (WS + .5)
835 W1 =  INT (WS / 10):W2 =  INT (WS - W1 * 10):W3 = W1 + 1:W4 = W2 + 1

840  IF W3 > 10 OR W3 < 1 THEN W3 = 1
845  IF W4 > 10 OR W4 < 1 THEN W4 = 1
850  HCOLOR= 0: DRAW WA AT 38,86: DRAW WB AT 50,86:WA = W3:WB = W4
852  HCOLOR= 3: DRAW WB AT 50,86: IF WA > 1 THEN  DRAW WA AT 38,86
855  RETURN
860  REM  ---------------------------------------
900  REM  HIGH AND LOW TEMP
905  IF QR = 0 THEN  RETURN : REM  ALLOWS FOR SETTLING OF OUTSIDE TEMP P
    ROBE
910  IF PS > G7 THEN G7 = PS:T1$ = TM$
915  IF PS < G8 THEN G8 = PS:T2$ = TM$
920  IF G7 < 0 THEN UU$ = "N"
925  IF G7 > 0 THEN UU$ = "Y"
930 K = G7 + .5:K =  ABS ( INT (K)):K1 =  INT (K / 100):K2 =  INT ((K -
    K1 * 100) / 10):K3 =  INT (K - (K1 * 100 + K2 * 10)):K4 = K1 + 1:K5 =
    K2 + 1:K6 = K3 + 1
935  IF K4 < 1 OR K4 > 10 THEN K4 = 1
940  IF K5 < 1 OR K5 > 10 THEN K5 = 1
945  IF K6 < 1 OR K6 > 10 THEN K6 = 1
950  HCOLOR= 0: IF VV$ = "N" THEN XY = 0: DRAW 37 AT 150,38
955  IF KA = 1 THEN 965
960  DRAW KA AT 150,38
965  DRAW KB AT 160,38: DRAW KC AT 170,38:VV$ = UU$:KA = K4:KB = K5:KC =
    K6
970  HCOLOR= 3: IF UU$ = "N" THEN XY = 0: DRAW 37 AT 150,38
975  IF KA = 1 THEN 985
980  DRAW KA AT 150,38
985  DRAW KB AT 160,38: DRAW KC AT 170,38
990  IF G8 < 0 THEN SS$ = "N"
995  IF G8 > 0 THEN SS$ = "Y"
1000 L = G8 + .5:L =  ABS ( INT (L)):L1 =  INT (L / 100):L2 =  INT ((L -
    L1 * 100) / 10):L3 =  INT (L - (L1 * 100 + L2 * 10)):L4 = L1 + 1:L5 =
    L2 + 1:L6 = L3 + 1
1005  IF L4 < 1 OR L4 > 10 THEN L4 = 1
1010  IF L5 < 1 OR L5 > 10 THEN L5 = 1
1015  IF L6 < 1 OR L6 > 10 THEN L6 = 1
1020  HCOLOR= 0: IF TT$ = "N" THEN XY = 0: DRAW 37 AT 150,62
1025  IF LA = 1 THEN 1035
1030  DRAW LA AT 150,62
1035  DRAW LB AT 160,62: DRAW LC AT 170,62:TT$ = SS$:LA = L4:LB = L5:LC =
    L6
1040  HCOLOR= 3: IF UU$ = "N" THEN XY = 0: DRAW 37 AT 160,62
1045  IF LA = 1 THEN 1055
1050  DRAW LA AT 150,62
1055  DRAW LB AT 160,62: DRAW LC AT 170,62
1060 D3$ =  MID$ (T1$,13,1):D4$ =  MID$ (T1$,14,1):D1$ =  MID$ (T1$,10,1
    ):D2$ =  MID$ (T1$,11,1):D5$ = D1$ + D2$ + D3$ + D4$:D5 =  VAL (D5$)
    : IF D5 > 1170 THEN D9 = 26:D5 = D5 - 1200: GOTO 1075
1070 D9 = 11
1075  IF D5 < 100 THEN D5 = D5 + 1200
1080 D1 =  INT (D5 / 1000):D2 =  INT ((D5 - D1 * 1000) / 100):D3 =  INT
    ((D5 - (D1 * 1000 + D2 * 100)) / 10):D4 =  INT (D5 - (D1 * 1000 + D2
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```
   * 100 + D3 * 10))
1085 D1 = D1 + 1:D2 = D2 + 1:D3 = D3 + 1:D4 = D4 + 1: IF BQ = 0 THEN  GOTO
    1093
1090  HCOLOR= 0: DRAW 2 AT 208,38: DRAW A2 AT 218,38: DRAW A3 AT 234,38:
     DRAW A4 AT 244,38: DRAW A9 AT 254,38
1093 A1 = D1:A2 = D2:A3 = D3:A4 = D4:A9 = D9:BQ = 1
1095  IF A1 > 1 THEN  HCOLOR= 3: DRAW A1 AT 208,38
1100  HCOLOR= 3: DRAW A2 AT 218,38: DRAW A3 AT 234,38: DRAW A4 AT 244,38
    : DRAW A9 AT 254,38
2060 E3$ =  MID$ (T2$,13,1):E4$ =  MID$ (T2$,14,1):E1$ =  MID$ (T2$,10,1
    ):E2$ =  MID$ (T2$,11,1):E5$ = E1$ + E2$ + E3$ + E4$:E5 =  VAL (E5$)
    : IF E5 > 1170 THEN E9 = 26:E5 = E5 - 1200: GOTO 2075
2070 E9 = 11
2075  IF E5 < 100 THEN E5 = E5 + 1200
2080 E1 =  INT (E5 / 1000):E2 =  INT ((E5 - E1 * 1000) / 100):E3 =  INT
    ((E5 - (E1 * 1000 + E2 * 100)) / 10):E4 =  INT (E5 - (E1 * 1000 + E2
     * 100 + E3 * 10))
2085 E1 = E1 + 1:E2 = E2 + 1:E3 = E3 + 1:E4 = E4 + 1: IF BR = 0 THEN  GOTO
    2093
2090  HCOLOR= 0: DRAW 2 AT 208,62: DRAW B2 AT 218,62: DRAW B3 AT 234,62:
     DRAW B4 AT 244,62: DRAW B9 AT 254,62
2093 B1 = E1:B2 = E2:B3 = E3:B4 = E4:B9 = E9:BR = 1
2095  IF B1 > 1 THEN  HCOLOR= 3: DRAW B1 AT 208,62
2100  HCOLOR= 3: DRAW B2 AT 218,62: DRAW B3 AT 234,62: DRAW B4 AT 244,62
    : DRAW B9 AT 254,62
2300  RETURN
3000  REM  RAINFALL
3005 J9 = R * 10:J1 =  INT (J9 / 10):J2 =  INT (J9 - J1 * 10):J3 = J1 +
    1:J4 = J2 + 1
3010  IF J3 > 10 OR J3 < 1 THEN J3 = 1
3020  IF J4 > 10 OR J4 < 1 THEN J4 = 1
3030  HCOLOR= 0: DRAW JA AT 4,62: DRAW JB AT 16,62:JA = J3:JB = J4: HCOLOR=
    3: DRAW JA AT 4,62: DRAW JB AT 16,62
3100 V9 = MO * 10:V1 =  INT (V9 / 100):V2 =  INT ((V9 - V1 * 100) / 10):
    V3 =  INT (V9 - V1 * 100 - V2 * 10):V4 = V1 + 1:V5 = V2 + 1:V6 = V3 +
    1
3110  IF V4 > 10 OR V4 < 1 THEN V4 = 1
3120  IF V5 > 10 OR V5 < 1 THEN V5 = 1
3130  IF V6 > 10 OR V6 < 1 THEN V6 = 1
3140  HCOLOR= 0: DRAW VA AT 74,62: DRAW VB AT 82,62: DRAW VC AT 94,62:VA
     = V4:VB = V5:VC = V6
3150  IF VA < 2 THEN  GOTO 3160: HCOLOR= 3: DRAW VA AT 74,62
3160  HCOLOR= 3: DRAW VB AT 82,62: DRAW VC AT 94,62
3170  RETURN
4999  REM   CHECK RAINFALL
5000 OL =  PDL (3): IF OL > 127 THEN JM = 0: RETURN
5020  IF OL < 128 AND JM = 1 THEN  RETURN
5030  IF OL < 128 THEN R = R + .1:MO = MO + .1:JM = 1: RETURN
5040  RETURN
16000  REM  READ THE SENSOR
16005  CALL 32768: REM   READ COUNTS
16010 C =  PEEK (6) + 256 *  PEEK (7)
16015 F = C / .409148: REM       FREQUENCY = COUNTS PER TIME INTERVAL (T
    HE COUNT TIME IS .499542 SECONDS)
16020 V = F / 1000: REM        VOLTAGE = FREQUENCY/1000
16025  RETURN
16030  REM  ------------------------------
17000  REM  DRAW THE PRESSURE GRAPH
17005 Q4 = Q4 + 1: IF Q4 > 72 THEN Q4 = 72:SS = 1
17010  HCOLOR= 0: FOR Z = 1 TO Q4:U1 = 122 + 2 * Z: IF P(Z) = 0 THEN 170
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17015  HPLOT U1,P(Z)
17020  NEXT Z
17025  HCOLOR= 3:Y1 = IN
17030  IF Y1 > 32 THEN Y1 = 32
17035  IF Y1 < 28 THEN Y1 = 28
17040  IF SS = 1 THEN P(73) = ((32 - Y1) / .05) + 104: FOR X = 2 TO 73:P
    (X - 1) = P(X): NEXT X: GOTO 17050
17045 P(Q4) = ((32 - Y1) / .05) + 104
17050  FOR Z = 1 TO Q4:U = 122 + 2 * Z: HPLOT U,P(Z): NEXT Z
17055  RETURN
17060  REM  --------------------------------
18000  REM  DATAFILE
18005  PRINT OP$;Z$;",L48"
18010  PRINT RD$;Z$;",R";1
18015  INPUT OT$,IT$,BP$,HM$,WS$,DT$,RA$,RM$
18020 TT =  VAL (OT$): IF TT = 0 THEN TT = 2
18025 G1 =  INT (PS + .5):G2 =  INT (PR + .5):G4 =  INT (H + .5):G5 =  INT
    (WS + .5)
18030 OT$ =  STR$ (G1):IT$ =  STR$ (G2):BP = IN * 100:BP =  INT (BP):BP$
     =  STR$ (BP):HM$ =  STR$ (G4):WS$ =  STR$ (G5):DT$ = TM$:RA$ =  STR$
    (R):RM$ =  STR$ (MO)
18035  PRINT WR$;Z$;",R";TT
18040  PRINT OT$: PRINT IT$: PRINT BP$: PRINT HM$: PRINT WS$: PRINT DT$:
     PRINT RA$: PRINT RM$: PRINT D$
18045 TT = TT + 1:OT$ =  STR$ (TT)
18050  PRINT WR$;Z$;",R";1
18055  PRINT OT$: PRINT IT$: PRINT BP$: PRINT HM$: PRINT WS$: PRINT DT$:
     PRINT RA$: PRINT RM$: PRINT D$
18060  PRINT CL$;Z$
18063  GOSUB 5000
18065  REM  --------------------------------
18070  REM   HIGHLOW.DAILY
18075  PRINT OP$;"HIGHLOW.DAILY,L45"
18080  PRINT RD$;"HIGHLOW.DAILY,R";45
18085  INPUT HT$: INPUT TH$: INPUT LT$: INPUT TL$
18090 QB =  VAL (TH$): IF QB = 0 THEN QB = 1
18095  PRINT RD$;"HIGHLOW.DAILY,R";QB
18100  INPUT HT$: INPUT TH$: INPUT LT$: INPUT TL$
18110 AC$ =  MID$ (TH$,4,2):AC =  VAL (AC$)
18115  IF AC <  > KY THEN QB = QB + 1
18120 TH$ =  STR$ (QB)
18125  PRINT WR$;"HIGHLOW.DAILY,R";45
18130  PRINT HT$: PRINT TH$: PRINT LT$: PRINT TL$: PRINT D$
18135  PRINT RD$;"HIGHLOW.DAILY,R";QB
18140  INPUT HT$: INPUT TH$: INPUT LT$: INPUT TL$
18145 HT =  VAL (HT$):LT =  VAL (LT$)
18150 E7 =  INT (G7 + .5)
18155 E8 =  INT (G8 + .5)
18160  IF E7 > HT THEN HT$ =  STR$ (E7):TH$ = T1$
18165  IF E8 < LT THEN LT$ =  STR$ (E8):TL$ = T2$
18170  PRINT WR$;"HIGHLOW.DAILY,R";QB
18175  PRINT HT$: PRINT TH$: PRINT LT$: PRINT TL$: PRINT D$
18180  PRINT CL$;"HIGHLOW.DAILY"
18183  GOSUB 5000
18185  RETURN
18190  REM  ----------------------------------
20000  REM   CHECK FOR PREVIOUS PRESSURE AND RAINFALL DUE TO POWER LOSS

20005  REM
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```
20010  PRINT OP$;Z$;",L48"
20015  PRINT RD$;Z$;",R";1
20020  INPUT OT$,IT$,BP$,HM$,WS$,DT$,RA,RM$
20025 TS =  VAL (OT$) - 1: IF TS < 24 THEN  RETURN
20030  FOR IJ = 0 TO 23
20035  PRINT RD$;Z$;",R";TS - IJ
20040  INPUT OT$,IT$,BP$,HM$,WS$,DT$,RA$,RM$
20045 X = 24 - IJ:MT$(X) = BP$: NEXT IJ
20050  PRINT CL$;Z$
20055  FOR X = 1 TO 24:MT(X) =  VAL (MT$(X)):MT(X) = MT(X) / 100: NEXT X

20060  FOR X = 1 TO 24:P(3 * X - 2) = MT(X):P(3 * X - 1) = MT(X):P(3 * X
    ) = MT(X): NEXT X
20065 Q4 = 72: FOR X = 1 TO 72:P(X) = ((32 - P(X)) / .05) + 104: NEXT X
20066  FOR Z = 1 TO Q4:U = 122 + 2 * Z: HPLOT U,P(Z): NEXT Z
20067  PRINT OP$;Z$;",L48"
20068  PRINT RD$;Z$;",R";1
20069  INPUT OT$,IT$,BP$,HM$,WS$,DT$,RA$,RM$
20070 TT =  VAL (OT$): IF TT = 0 THEN TT = 3
20071  PRINT RD$;Z$;",R";TT - 1
20072  INPUT OT$,IT$,BP$,HM$,WS$,DT$,RA$,RM$
20074 Q1$ =  MID$ (DT$,4,2):KY =  VAL (Q1$):Q2$ =  MID$ (TM$,4,2): IF Q1
    $ <  > Q2$ THEN  GOTO 20076
20075 R =  VAL (RA$)
20076 Q1$ =  MID$ (DT$,2,1):Q2$ =  MID$ (TM$,2,1):TB =  VAL (Q2$): IF Q1
    $ <  > Q2$ THEN  GOTO 20078
20077 MO =  VAL (RM$)
20078  PRINT CL$;Z$
20079  RETURN
20080  REM  ------------------------------
21000  REM  CHECK FOR PREVIOUS HIGHLOW IF POWER FAILURE
21005  PRINT OP$;"HIGHLOW.DAILY,L45"
21010  PRINT RD$;"HIGHLOW.DAILY,R";45
21015  INPUT HT$: INPUT TH$: INPUT LT$: INPUT TL$
21020 QB =  VAL (TH$): IF QB = 0 THEN QB = 1
21025  PRINT RD$;"HIGHLOW.DAILY,R";QB
21030  INPUT HT$: INPUT TH$: INPUT LT$: INPUT TL$
21035  PRINT CL$;"HIGHLOW.DAILY"
21040 AB$ =  MID$ (TM$,4,2):AB =  VAL (AB$)
21045 AC$ =  MID$ (TH$,4,2):AC =  VAL (AC$)
21050  IF AC <  > AB THEN  RETURN
21055 G7 =  VAL (HT$):T1$ = TH$
21060 G8 =  VAL (LT$):T2$ = TL$
21065  RETURN
50000  REM  ------------------------------------------------
50010  REM  VALUES FOR SHAPE TABLES
50011  REM  INSIDE
50015  DATA   19,34,2,24,46,2,29,58,2,19,70,2,14,82,2,15,94,2,16,76,14
50020  REM   OUTSIDE
50025  DATA   25,170,2,31,182,2,30,194,2,29,206,2,19,218,2,14,230,2,15,2
    42,2,16,218,14
50030  REM  HUMIDITY
50035  DATA   18,22,26,31,34,26,23,46,26,19,58,26,14,70,26,19,82,26,30,9
    4,26,35,106,26,41,76,38
50040  REM   BAROMETER
50045  DATA   12,158,74,11,170,74,28,182,74,25,194,74,23,206,74,15,218,
    74,30,230,74,15,242,74,28,254,74,46,200,86,40,236,86
50050  REM  PRECIPITATION
50055  DATA  26,6,50,28,16,50,15,26,50,13,36,50,19,46,50,26,56,50,19,66,
    50,30,76,50,11,86,50,30,96,50,19,106,50,25,116,50,24,126,50
```

```
50056  DATA  46,10,62,40,24,62,14,34,62,11,42,62,35,50,62
50057  DATA  46,134,62,24,128,62,25,120,62,23,112,62,40,102,62,46,88,62
50059  REM  HIGH TEMP
50060  DATA   18,166,26,19,176,26,17,186,26,18,196,26,30,:16,26,15,226,2
    6,23,236,26,26,246,26
50061  DATA      16,180,38,23,264,38,46,226,38,46,226,32
50062  REM  LOW TEMP
50063  DATA  22,172,50,25,182,50,33,192,50,30,212,50,15,222,50,23,232,50
    ,26,242,50
50064  DATA      16,180,62,23,264,62,46,226,62,46,226,56
50065  REM  WIND SPEED
50070  DATA     33,14,74,19,26,74,24,38,74,14,50,74,29,74,74,26,86,74,15,
    98,74,15,110,74,14,122,74,23,74,86,26,86,86,18,98,86
50075  REM  N,S,E,W
50080  DATA   24,47,106,29,47,170,15,80,138,33,12,138
50085  REM  PRESSURE GRAPH
50090  DATA     4,102,100,3,102,180,3,110,100,9,110,180,4,102,140,1,110,1
    40
50095  DATA     12,134,98,11,142,98,28,150,98,25,158,98,23,166,98,15,174,
    98,30,182,98,15,190,78,28,198,98,38,214,98,3,222,98,5,230,98,18,246,
    98,28,254,98,29,262,98,39,270,98

]
```

```
LIST

10  REM  CREATER
15  REM  MARK V. LORSON
20  REM     3/4/93
50  HOME : PRINT "PLEASE INSERT THE ";: INVERSE : PRINT "MOUSETRAP";: NORMAL
     : PRINT " DISK."
52  PRINT : PRINT "HIT ANY KEY WHEN READY.
55  GET A$
100 D$ =  CHR$ (4)
150  PRINT "WORKING"
200  PRINT D$;"BLOAD FREQ,A$8300"
220  PRINT D$;"BLOAD VIU.READ,A$8000"
240  PRINT D$;"BLOAD PDL.CHECK,A$8060"
250  HOME : PRINT "PLEASE INSERT THE ";: INVERSE : PRINT "WEATHER";: NORMAL
     : PRINT " DISK."
260  PRINT : PRINT "HIT ANY KEY WHEN READY."
270  GET A$
280  PRINT "WORKING"
300  POKE 33565,98
400  POKE 33575,98
500  POKE 33632,98
600  POKE 33649,98
700  POKE 33757,98
800  POKE 33770,98
900  PRINT D$;"BSAVE FREQ.PB1,A$8300,L$300"
1200  POKE 32770,128
1300  POKE 32774,128
1400  POKE 32780,128
1500  POKE 32783,128
1600  POKE 32786,128
1700  POKE 32800,128
1800  POKE 32825,128
1900  POKE 32828,128
2000  POKE 32844,128
2100  POKE 32850,128
2200  POKE 32856,128
2300  POKE 32860,128
2400  PRINT D$;"BSAVE VIU8000.READ,A$8000,L95"
2700  POKE 32883,148
2800  POKE 32884,128
2900  POKE 32888,103
3000  POKE 32889,128
3100  POKE 32909,148
3200  POKE 32910,128
3300  POKE 32914,129
3400  POKE 32915,128
3500  POKE 32918,128
3600  POKE 32921,128
3700  POKE 32923,180
3800  POKE 32924,128
3900  POKE 32927,128
4000  POKE 32930,128
4100  POKE 32941,180
4200  POKE 32942,128
4300  POKE 32946,163
4400  POKE 32947,128
4500  PRINT D$;"BSAVE PDL8060.CHECK,A$8060,L95

]
```

```
LIST

10  REM  CREATE MONTHLYDATA
15  REM  MARK V. LORSON
18  REM     3/4/93
20  PRINT "NOMONI,O,C": HOME
40  TEXT :D$ =  CHR$ (4)
60 OP$ = D$ + "OPEN"
70 CL$ = D$ + "CLOSE"
80 RD$ = D$ + "READ"
90 WR$ = D$ + "WRITE"
95 Z$ = "MONTHLYDATA"
98  PRINT Z$
100  PRINT OP$;Z$;",L48"
105  FOR I = 1 TO 1100
110  PRINT I
115 OT$ = " ":IT$ = " ":BP$ = " ":HM$ = " ":WS$ = " ":DT$ = " ":RA$ = "
   ":RM$ = " "
120  PRINT WR$;Z$;",R";I
125  PRINT OT$: PRINT IT$: PRINT BP$: PRINT HM$: PRINT WI$: PRINT DT$: PRINT
   RA$: PRINT RM$: PRINT D$
140  NEXT I
145  PRINT CL$;Z$

]
```

```
LIST

10  REM   CREATE HIGHLOW.DAILY
12  REM   MARK V. LORSON
14  REM          3/4/93
20  PRINT "NOMONI,O,C": HOME
40  TEXT :D$ =  CHR$ (4)
60 OP$ = D$ + "OPEN"
70 CL$ = D$ + "CLOSE"
80 RD$ = D$ + "READ"
90 WR$ = D$ + "WRITE"
95 Z$ = "HIGHLOW.DAILY"
98  PRINT Z$
100  PRINT OP$;Z$;",L45"
105  FOR I = 1 TO 44
110  PRINT I
115 HT$ = "-100":TH$ = "  ":LT$ = "100":TL$ = " "
120  PRINT WR$;Z$;",R";I
125  PRINT HT$: PRINT TH$: PRINT LT$: PRINT TL$: PRINT D$
129  NEXT I
130  PRINT WR$;Z$;",R";45
131 HT$ = "0":TH$ = "0":LT$ = "0":TL$ = "0"
135  PRINT HT$: PRINT TH$: PRINT LT$: PRINT TL$: PRINT D$
145  PRINT CL$;Z$

]
```

```
]LIST

10  REM  READ MONTHLYDATA
12  REM  MARK V. LORSON
14  REM      3/4/93
20  PRINT "NOMONI,O,C": HOME
40  TEXT :D$ =  CHR$ (4)
60 OP$ = D$ + "OPEN"
70 CL$ = D$ + "CLOSE"
80 RD$ = D$ + "READ"
90 WR$ = D$ + "WRITE"
95 Z$ = "MONTHLYDATA"
98  PRINT Z$
100  PRINT OP$;Z$;",L48"
105  FOR I = 1 TO 1100
108  PRINT RD$;Z$;",R";I
110  INPUT OT$,IT$,BP$,HM$,WS$,DT$,RA$,RM$
130  PRINT I,OT$,IT$,BP$,HM$,WS$,DT$,RA$,RM$
140  NEXT I
145  PRINT CL$;Z$

]
```

```
]LIST

 5  REM  READ HIGHLOW.DAILY
 6  REM  MARK V. LORSON
 7  REM      3/4/93
 10 D$ =  CHR$ (4)
 20  PRINT D$;"OPEN HIGHLOW.DAILY,L45"
 25  FOR X = 1 TO 45
 30  PRINT D$;"READ HIGHLOW.DAILY,R";X
 40  INPUT HT$: INPUT TH$: INPUT LT$: INPUT TL$
 50  PRINT X,HT$,TH$,LT$,TL$
 60  NEXT X
 70  PRINT D$;"CLOSE HIGHLOW.DAILY"

]
```

```
]LIST

2  ONERR  GOTO 2700
5  DIM Z$(15)
8 Q = 1
1000  REM    READER
1100  REM  MARK V. LORSON
1200  REM      5/30/93
1300  PRINT "NOMONI,O,C": HOME
1400  TEXT :D$ =  CHR$ (4)
1500 OP$ = D$ + "OPEN"
1600 CL$ = D$ + "CLOSE"
1700 RD$ = D$ + "READ"
1800 WR$ = D$ + "WRITE"
1820 C$(1) = "OUT TEMP"
1821 C$(2) = "IN TEMP "
1822 C$(3) = "PRESSURE"
1823 C$(4) = "HUMIDITY"
1824 C$(5) = "WIND SPD"
1825 C$(6) = "DAILY RN"
1826 C$(7) = "MONTH RN"
1827 C$(8) = "        "
1890 Z$ = "/WD/MONTHLYDATA/MONTHLYDATA
1891 H1 = 45:H2 = 45:H3 = 45:H4 = 45
1896 Z$(1) = Z$ + ".JAN":Z$(2) = Z$ + ".FEB":Z$(3) = Z$ + ".MAR":Z$(4) =
    Z$ + ".APR":Z$(5) = Z$ + ".MAY":Z$(6) = Z$ + ".JUN"
1897 Z$(7) = Z$ + ".JUL":Z$(8) = Z$ + ".AUG":Z$(9) = Z$ + ".SEP":Z$(10) =
    Z$ + ".OCT":Z$(11) = Z$ + ".NOV":Z$(12) = Z$ + ".DEC"
1901  HOME : PRINT "WHICH MONTH DO WANT DATA FOR?": PRINT : PRINT "1-JAN
      2-FEB  3-MAR  4-APR
1902  PRINT : PRINT "5-MAY  6-JUN  7-JUL  8-AUG
1903  PRINT : PRINT "9-SEP 10-OCT 11-NOV 12-DEC
1904  VTAB (10): INPUT N
1905  IF N < 1 OR N > 12 THEN  VTAB (10): PRINT "    ": GOTO 1904
1909 Z$ = Z$(N)
1920  HOME : PRINT "WHICH DATA DO YOU WISH TO SEE?": PRINT : PRINT "YOU
    MAY CHOOSE TWO WHEN PROMPTED."
1921  PRINT : PRINT : PRINT : PRINT "1-OUTSIDE TEMP         2-INSIDE TEM
    P
1922  PRINT : PRINT "3-BAROMETRIC PRESSURE  4-HUMIDITY
1923  PRINT : PRINT "5-WIND SPEED           6-DAILY RAINFALL
1924  PRINT : PRINT "7-MONTHLY RAINFALL     8-NO CHOICE
1930  VTAB (17): INPUT "1ST DATA ";V1: PRINT : INPUT "2ND DATA ";V2
1931  IF V1 < 1 OR V1 > 7 THEN  VTAB (17): PRINT "      ": GOTO 1920
1932  IF V2 < 1 OR V2 > 8 THEN  VTAB (19): PRINT "      ": GOTO 1920
1940  HOME : PRINT "HOW OFTEN DO YOU WANT READINGS?": PRINT : PRINT : PRINT
    "1--EVERY 24 HOURS   2--EVERY 12 HOURS": PRINT : PRINT "3--EVERY 6 H
    OURS    4--EVERY HOUR": PRINT : PRINT : PRINT
1941  INPUT J: IF J < 1 OR J > 4 THEN 1941
1942  IF J = 4 THEN  HOME : GOTO 1980
1945  PRINT : PRINT : PRINT "WHAT HOUR OF THE DAY WOULD YOU": PRINT "LIK
    E TO BEGIN? (0-23)  ": PRINT : INPUT H: IF H < 0 OR H > 23 THEN 1942
```

```
1960  IF J = 1 THEN H1 = H: GOTO 1980
1965  IF J = 2 THEN H1 = H:H2 = H + 12: IF H2 > 23 THEN H2 = H2 - 24: GOTO
    1980
1966  IF J = 3 THEN H1 = H:H2 = H + 6: IF H2 > 23 THEN H2 = H2 - 24
1967  IF J = 3 THEN H3 = H + 12: IF H3 > 23 THEN H3 = H3 - 24
1968  IF J = 3 THEN H4 = H + 18: IF H4 > 24 THEN H4 = H4 - 24: GOTO 1980

1980  HOME
1981  INPUT "DO YOU WANT A PRINTOUT (Y/N)? ";K3$
1982  IF K3$ = "Y" OR K3$ = "y" THEN  PRINT D$;"PR#1"
1983  HOME
2000  PRINT Z$
2050  PRINT "  DATE   TIME",C$(V1);"        ";C$(V2)
2100  PRINT OP$;Z$;",L48"
2200  FOR I = 1 TO 1100
2300  PRINT RD$;Z$;",R";I
2350 Q = 0
2400  INPUT OT$,IT$,BP$,HM$,WS$,DT$,RA$,RM$
2401 BP =  VAL (BP$):BP = BP / 100:BP$ =  STR$ (BP)
2402 DT$ =  LEFT$ (DT$,14)
2403  IF J = 4 THEN  GOTO 2425
2410 K =  VAL ( MID$ (DT$,10,2)): IF K = H1 OR K = H2 OR K = H3 OR K = H
    4 THEN 2425
2411  GOTO 2600
2425 B$(1) = OT$ + "F":B$(2) = IT$ + "F":B$(3) = BP$ + "''":B$(4) = HM$ +
    "%":B$(5) = WS$ + "MPH":B$(6) = RA$ + "''":B$(7) = RM$ + "''"
2426 B$(8) = "  "
2500  PRINT DT$,B$(V1),B$(V2)
2600  NEXT I
2650  PRINT CL$;Z$
2655  PRINT D$;"PR#0"
2660  END
2700  PRINT CL$;Z$
2701  PRINT D$;"PR#0"
2703  PRINT : PRINT : PRINT : PRINT
2704  IF Q = 0 THEN  GOTO 2800
2705  PRINT "THAT MONTH IS NOT AVAILABLE."
2755  PRINT D$;"PR#0"
2800  END
```

The author can be contacted and a disk of all the author written programs can be obtained by sending a blank disk and prepaid disk mailing envelope to:

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