Advanced Weather Computer Technical Manual

Model IDA-5001-4

595-4245

HEATH COMPANY
BENTON HARBOR, MICHIGAN 49022

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INTRODUCTION

The Heathkit Model ID-5001 Advanced Weather Computer is a microprocessor-based meteorological unit that measures and displays all of those weather variables that are so useful to boaters, pilots, farmers, amateur radio operators, meteorologists, and general consumers.

All of the display functions are programmable from the front panel keypad. A 6-digit clock displays the time in either a 12- or 24-hour format. Day and date are shown in a separate, 4-digit format. Automatic leap-year correction is provided, and auto daylight savings time adjustment is also selectable.

Two digits display the wind speed, while one or two of 16 indicators shows the wind direction by compass point. The keypad allows selecting the wind speed to be displayed in miles-per-hour, knots, or kilometers-per-hour. Other keypad-selectable displays include instantaneous and average wind speed. The Weather Computer can also record and show high and low wind speeds and their time and date of occurrence.

The ID-5001 continuously displays the indoor and outdoor temperatures and barometric pressure. Through the keypad, you can select the temperature display to be in either Celsius or Fahrenheit and show the high and low temperatures with time and date. Wind chill temperature display is another keypad selection. Barometric pressure is continuously displayed in four digits. Keypad selections include displaying the date and time of minimum or maximum pressure in either inches of mercury or millibars. A Clear key on the keypad permits resetting either individual minimum and maximum values or all at once.

A Rate key causes the display to show hourly rates of change for wind, rain, pressure, humidity, and temperature. The display continuously shows the rate for temperature, barometer, and humidity using rate arrows consisting of an arrowhead to show an increase or decrease, and three tails to indicate the rate of change.

The Z80 computer in the ID-5001 continuously processes the data it receives to enable it to generate an alert if it detects bad weather. It will do so if the rate of change for wind speed, barometric pressure, or temperature exceeds programmed values (selected through the keypad). If the IDA-5001-1 Humidity Sensors are installed, the Weather Computer can generate a fog alert if the humidity, temperature, and wind speed meet certain criteria.

A fluorescent lamp provides a backlight for the display. The ID-5001 controls display brightness by sensing the ambient light, thus providing a brighter display in sunlit areas for easier reading. The keypad allows setting the range of the intensity and also the viewing angle of the LCD.

An optional 9-volt battery (NEDA #1604 or equivalent) provides backup power during an AC power-line failure for up to 18 hours. It can be installed either inside or outside the cabinet. Other options include the IDA-5001-1* Indoor/Outdoor Humidity Sensor Accessory, the IDA-5001-2 Rain Gauge Accessory, and the IDA-5001-3* RS-232C Accessory. The IDA-5001-3 permits connecting a computer to the Weather Computer for either remote control or automated monitoring.

In addition to the above operating features and accessories, the ID-5001 has several features that make it easy to service. You can access the main circuit board and power supply by removing seven screws and lifting off the top cover. The display assembly can be accessed by removing it and connecting it to the unit through extension cables. Most of the digital circuits are based on a standard Z80 design consisting of a processor, RAM, ROM, and I/O ports. The analog circuits consist of op amp and transistor designs similar to those used in other Heath weather equipment. To troubleshoot these circuits, you will only need standard test equipment such as an oscilloscope, voltmeter, and signal generator. You will find complete service information in the "Disassembly," "Troubleshooting," and "Alignment" sections of this Book.

Besides providing disassembly, troubleshooting, and alignment information, this Book contains circuit board layout and a circuit description. A "Visual Checks" section helps you quickly locate and verify the correct installation of components. The "Operation" section provides enough information for you to effectively bench test the unit. The "Specifications" and "Normal Operating Characteristics" sections describe what to expect from the ID-5001 and point out some of its idiosyncrasies. The schematic diagrams has detailed voltages, pulses measurements, and other useful information.

*Standard on wired units.

While this Book provides sufficient information to successfully troubleshoot the ID-5001, you may want to study the ID-5001 Operation Manual, part number 595-3736. This manual provides a complete description of all the commands, detailed operating procedures, boom installation, and other information that doesn't normally apply to bench testing the unit.

NOTE: The binder parts you received with this Technical Manual are listed below.

PART NO	QTY	DESCRIPTION
597-5175	1	1" binder cover
701-234	1	3-ring assembly
485-70	2	Binder fastener

WIND DIRECTION*

Display	32 points of resolution. One or two of 16 indicators arranged in a circular compass configuration. Identified by compass points and radial degrees.
Gust Mode	1 second averaging.
Average Mode	60 second averaging.
"Wind" Mode	60 second averaging of displays to nearest 10°.
Memory	Average direction when minimum or maximum gust or average wind speed occurred.

THERMOMETER

Displays	Indicates indoor and outdoor temperature 2-1/2-digit readout with "– " sign outdoor indicator, Fahrenheit-Celsius indicators, and rising/falling indicators. Rate of change per hour.
Temperature	– 40°C to + 70°C (– 40°F to + 158°F).
Accuracy	± 1°C from – 40°C to + 70°C. ± 2°F from – 40°F to + 158°F.
Memory	Date, time, and magnitude of maximum and minimum temperatures since cleared; change in the last 24 hours.

* In conformance with the National Weather Service Federal Meteorological Handbook #9, Aviation Weather Observation, Chapter A8, Sections 3 & 3.5, Specifications for Supplementary Aviation Weather Reporting Stations.

SPECIFICATIONS

DIGITAL CLOCK/4-YEAR CALENDAR

Displays	6-digit, 12 or 24-hour format time readout; 6-digit date readout. AM-PM indicator in 12-hour format.
Time Accuracy	Determined by the accuracy of the AC line frequency. No accumulative error; .003% error with battery-backed clock during power failure.

WIND SPEED*

Displays	Two significant digits. Separate indicators show if the display is in miles-per-hour, knots, or kilometers-per-hour.
Gust Mode	Instantaneous peak wind speed; memory stores the date, time, and magnitude of minimum and maximum gusts.
Average Mode	One minute wind speed average; memory stores the date, time, and magnitude of minimum or maximum average wind speed.
Memory	Date, time, and magnitude of minimum or maximum gust or average wind speed. Changes in last hour or last 24 hours.
Accuracy	± 5% or better.

* In conformance with the National Weather Service Federal Meteorological Handbook #9, Aviation Weather Observation, Chapter A8, Sections 3 & 3.5, Specifications for Supplementary Aviation Weather Reporting Stations.

BAROMETER

Displays	4-digit readout. Separate indicators show if pressure is rising or falling and if display is in inches of mercury or millibars. Rate of change per hour.
Pressure Range	28.00 to 32.00 in.Hg (inches of mercury), 948 to 1083 millibars.
Accuracy of Reading	29.00 to 31.00 in.Hg (inches of mercury) ± .25% plus ± .033%/°C (± .075 in.Hg plus ± .01 in.Hg/°C).
Memory	Date, time and magnitude of maximum and minimum pressure since memory was cleared; change in the last 24 hours.

GENERAL

Power Requirements	120/240 VAC, 50/60 HZ; 19 watts (30 watts with all options installed). Provision for connection to an external 6- to 9-volt battery which can supply about 30mA (60mA with all options) to retain memory contents and maintain clock and rain gauge operation during power interruptions. (This feature suspends all other functions during the interruption and draws current from the battery only during the interruption.)
Operating Temperature	15°C to 35°C (59°F to 95°F).
Dimensions (overall)	39.4 cm wide × 22.2 cm deep × 14.6 cm high. (15-1/2" × 8-3/4" × 5-3/4").
Weight	4.5 kg (9.8 lbs.).

RELATIVE HUMIDITY ACCESSORY* (MODEL IDA-5001-1)

Displays	Indicates indoor and outdoor relative humidity. 2-digit readout and rising and falling indicators. Rate of change per hour.
Measurement Range	10% to 90% relative humidity.
Accuracy at 25°C (77°F)	± 10 counts.
Response Time to 90% value at 25°C (77°F)	From 10% to 43% relative humidity in less than 3 minutes. From 43% to 90% relative humidity in less than 5 minutes.
Memory	Date, time, and magnitude of maximum and minimum humidity since memory was cleared; change in the last 24 hours.
Operating Temperature Range	0°C to 50°C (32°F to 122°F).

RAIN GAUGE ACCESSORY (MODEL IDA-5001-2)

Displays	4 digit.
Units	0 to 99.9 inches; 0 to 250 centimeters; automatic decimal point adjust.
Repeatability	± 1 count in 10 for a 1-inch-per-hour (2.5 cm/hr) rain fall.
Memory	Change in last hour or 24 hours.

*Standard on wired units.

Rain Unit

Operating Temperature...... 0°C to 50°C (32°F to 122°F).

Dimensions............... 22.9 cm diameter × 24.4 cm high (9.0" × 9.6").

Weight .... 0.7 kg (1.6 lbs.).

The Heath Company reserves the right to discontinue products and to change specifications at any time without incurring any obligation to incorporate new features in products previously sold.

OPERATION

This section, which tells you how to set up and operate your ID-5001 Weather Station, includes descriptions of the front panel indicators and the rear panel connections. Following that is a summary of the ID-5001 operating modes, plus the essentials on interfacing a computer to the optional RS-232C serial port and definitions of the serial port commands. Due to space limitations, this Book only covers the basic modes and commands. However, this is enough information for you to operate the unit while bench-testing it. For detailed infomation, see the ID-5001 Advanced Weather Computer Operation Manual, part number 595-3736.

The ID-5001 Weather Computer has two basic modes of operation: a setup mode that lets you program the various operating parameters into the Weather Computer; and a normal mode, where you read the weather information from the displays. The following "Front and Rear Panels" section defines each display for both the normal mode and the setup mode. The keypad is used for the setup mode and is described in "Powerup Operation," and in more detail in "Keypad Operation."

FRONT AND REAR PANELS

(Controls, Indicators, & Connections)

Refer to Pictorial 3-1, "Front Panel Controls and Indicators," in the Illustration Booklet as you read the following paragraphs. The numbers at the beginning of the paragraphs are keyed to the numbers in the pictorial.

1. F/C — Indicates whether the displayed temperature is in degrees Fahrenheit (F) or degrees Celsius (C).

2. INDOOR TEMPERATURE — Indicates the indoor temperature.

3. OUTDOOR TEMPERATURE — Indicates the outdoor temperature.

4. HOURS — Indicates the hours (0-12 format, or 0-23 for 24-hour format).

5. MINUTES — Indicates the minutes (0-59). Indicates upper 2 digits of baud rate when the BAUD key is pressed.

6. SECONDS — Indicates the seconds (0-59). In the set-up mode, it indicates the display intensity (0-32). Indicates lower 2 digits of baud rate when the BAUD key is pressed.

7. AM/PM — Indicates Am or PM when 12-hour time is displayed, but are absent when 24-hour time is displayed.

8. D/S — Indicates D for daylight saving time or S for standard time. Appears only when setting the time/date section of the display.

9. MONTH-DATE — Indicates the month (1-12) on the left-hand side and the date (1-31) on the right-hand side. In the set-up mode, it also indicates the year on the right-hand side.

10. RATE OF CHANGE — Indicates if the rate of change is rising or falling. NOTE: This rate of change arrow is for the outdoor temperature. Identical indicators are used for the indoor temperature, barometric pressure, indoor humidity, and outdoor humidity.

11. WIND DIRECTION — Indicates the direction that the wind is coming from when one or two bars are lit.

12. SPEED/DIRECTION — Indicates the speed (0-99) of the wind with the "SPEED" indicator lit. With the "SPEED" indicator off, indicates the wind direction in degrees after multiplying the displayed number by 10.

13. GUST/AVG — Indicates the wind gust or wind average mode.

14. KNOTS-MI/H-KM/H — Indicates the selected wind speed unit-of-measure.

15. IN/MB — Indicates whether the barometric pressure is being displayed in inches (IN) or millibars (MB).

16. LED — Indicates when AC power is being applied to the Weather Computer.

17. BAROMETRIC PRESSURE — Indicates the barometric pressure.

18. INDOOR HUMIDITY* — Indicates the indoor relative humidity in percent (%).

19. OUTDOOR HUMIDITY* — Indicates the outdoor relative humidity in percent (%).

20. IN/CM — Indicate whether the amount of rain displayed is being measured in inches (IN) or centimeters (CM).

21. RAIN** — Indicates the amount of rain collected since the memory was cleared. Also, indicates the rate at which the rain is falling when you press the RATE and RAIN keys. Also, indicates the amount of rain collected in the last hour when you press RATE and the last 24 hours when you press the 24HR key.

22. WEATHER ALERT/WARN — Indicates that the rate change for wind speed, barometric pressure, or temperature meet the criteria to turn one or both on. Also, the top bar only lights when "ALERT" turns on, while both bars light when "ALERT WARN" turns on.

23. FOG — Indicates that the posibility of fog exists. Turns on when relative humidity is 90% or higher, average wind speed is less than 5 MPH, and outdoor temperature is steady or falling.

24. PHOTO RESISTOR — Detects the ambient light level and, in turn, controls the display's light intensity.

25. KEYPAD — (see the text.)

NOTE: Refer to Pictorial 3-2, "Rear Panel Connections," in the Illustration Booklet for rear panel details.

* Optional accessory for kits. Standard for wired units.

** Optional accessory for both kits and wired units.

POWERUP OPERATION

A special form of the setup mode is used when the Weather Computer is powered-up without battery backup. The unit will enter the setup mode for one minute to allow you time to enter the time and date. If the information isn't entered during that time, the unit will switch to the normal mode. (This is true of the setup mode in general. Once you enter the mode, you have one minute to make your entries.)

NOTE: If a battery isn't connected to the ID-5001, do not connect one until you've applied AC power. Otherwise, the unit may not initialize properly and will appear dead at powerup.

At initial powerup, the time display will be 12:00:00AM standard time and the date will be 1-1-87. The hours digits will flash and the clock won't be running. The flashing digits indicate the numbers you can modify when you press a number key on the keypad.

Note that during this procedure, the Weather Computer won't let you make an erroneous time or date entry (33:00 PM, February 31, etc.).

- Enter the hours in 12-hour format and press **ENTER**.

  The hours will stop flashing and the minutes will start.

- In a similar manner, enter the minutes and seconds.

  As soon as you enter the seconds, the clock will begin running and the AM indicator will begin flashing. Perform one of the following:

  - Press **UNITS** to toggle between AM and PM.

  - Press **24 HR** to toggle between 12-hour and 24-hour formats. (Disables the AM/PM display.)

  - Press **ENTER** to store the selection.

The display will start flashing an "S" to indicate standard time.

- Press **UNITS** to toggle between standard time (S) and daylight savings time (D).

- Press **ENTER** to store the selection.

  The D (or S) will turn off and remain off until the next time you enter this mode. The month digit will begin flashing.

- Enter the month (**1-12**) and press **ENTER.**

  The day digit will begin flashing.

- Enter the day-of-month and press **ENTER.**

  The last two digits of the year will replace the number at the day-of-month and begin flashing.

- Enter the the last two digits of the year and press **ENTER.**

  The year will disappear, the day-of-month will reappear, and the ID-5001 will exit the setup mode.

To re-enter the setup mode, refer to "Keypad Operation."

KEYPAD OPERATION

Because many of the keys on the keypad perform multiple functions, this text describes keypad operation by function rather than defining each key. Thus, some of the keys will be described more than once.

TIME

Zero the Seconds

Press TIME SET and ENTER keys; then press ENTER again. Rounds off seconds to nearest minute.

Set Entire Clock

Press TIME SET and ENTER keys; then press TIME SET keys again. Enter hours, minutes, etc. with numeral and ENTER keys. Select AM or PM, and S (standard time) or D (daylight saving time), by pressing UNITS key while that display is flashing.

WIND

Wind Direction

Press WIND key. Multiply displayed number by 10 to obtain wind direction in degrees.

Average or Gust

Press WIND and RATE keys to toggle between Average and Gust mode. Read direction and speed from wind display.

Wind Speed

Press WIND and HIGH keys to view time, date, speed, and direction of highest wind speed (average or gust).

Press WIND and LOW keys to view time, date, speed, and direction of lowest wind speed (average or gust).

Wind Chill

Wind-chill (average or gust) - Press TEMP and WIND keys.

RAIN

Rain Rate

Press RAIN and RATE keys to find the instantaneous rain rate. Based on the time between two previous pulses of the rain gauge.

Reset Rain Rate

Press RAIN and CLEAR keys.

RATE

General

When you press the RATE key, the rate value displayed for wind speed or rain reflects the change that has occurred since the value recorded exactly one hour earlier. The wind speed rate is based upon the average wind speed value. The rate values for barometric pressure, humidity, and temperature are based on the time between successive changes; however, the values are calculated and displayed based on the corresponding hourly rate. If the ID-5001 hasn't been on long enough to compute a rate of change, the associated display will light only the "g" segment ("–").

Press WIND and RATE to change between wind speed gust and average modes.

Press RATE and RAIN to display the hourly rate of change for rain.

Default Values

Each segment on the display rate arrows represent a rate of change in the last hour. The default values are:

Humidity:	3%, 6%, 9%, 12%
Barometer:	1, 3, 6, 8 (.01, .03, .06, .08 inches of mercury)
Outdoor Temp:	3°, 6°, 9°, 12° Fahrenheit
Indoor Temp:	1°, 3°, 5°, 7° Fahrenheit

To Change Default Values: Press the following keys, a 2-digit number and ENTER. Press the ENTER key to step through default sections and exit.

Outdoor Humidity: Press HUMID and RATE.
Indoor Humidity: Press HUMID and RATE, and INDOOR.
Barometer: Press PRESSURE and RATE.
Outdoor Temp: Press TEMP and RATE.
Indoor Temp: Press TEMP and RATE, and INDOOR.

24 HOUR

Puts the clock into the 24-hour mode. When you are setting the clock, press 24HR after entering the seconds. At other times, if you press the 24HR key, the rate value shown reflects the change that has occurred since the value recorded exactly 24 hours earlier for the various displays. The appropriate up and down arrows will light to indicate increases or decreases. If the ID-5001 hasn't been on long enough to compute a rate of change, the display will light only the "g" segments ("–").

AUDIO WARNING

Press the ENTER and AL/WARN keys to turn on key click and audio alarm.

Press the CLEAR and AL/WARN keys to turn audio off.

ALERT WARNING

Press the AL/WARN and either TEMP, PRESSURE, or WIND key. Enter 2-digit Alert value, followed by 2-digit Alert Warn value. The default values are:

Indoor Temp:	99° Alert 99° Alert/Warning
Outdoor Temp:	14° Alert 16° Alert/Warning
Barometer:	6 (.06 in/Hg) Alert 9 (.09 in/Hg) Alert/Warning
Wind	40 mph Alert 40 mph Alert/Warning

UNIT SELECTION

Use this key to select the unit of measurement for a particular function.

Press WIND and UNITS to switch between knots, mi/hr, or km/hr.

Press TEMP and UNITS to toggle between oF and oC.

Press PRESSURE and UNITS to toggle between IN and MB.

Press RAIN and UNITS to toggle between IN and CM.

MIN/MAX FUNCTIONS

Displays the minimum and maximum values recorded by the Weather Station.

To recall the maximum value, press HIGH and one of the following keys: TEMPERATURE, PRESSURE, HUMIDITY, or WIND.

To recall the minimum value, press LOW and one of the following keys: TEMPERATURE, PRESSURE, HUMIDITY, or WIND.

In either mode, you can recall TEMP, PRESSURE, HUMID, or WIND simply by pressing the appropriate key. Recall indoor temperature or humidity by pressing INDOOR key when in temperature or humidity min/max mode. To remove one of these values, press CLEAR.

Press ENTER to exit.

To clear all minimum and maximum values, press ENTER and CLEAR keys while in the normal mode.

BAUD

Selects the baud rate for the optional ID-5001-3 RS-232C interface. The hours and minutes of the time display will show the rate.

Press BAUD key to choose baud rate. The default is 9600 baud. Continue to press BAUD to step through 110, 150, 300, 600, 1200, 2400, and 4800. Press ENTER to enter the rate and exit.

DISPLAY INTENSITY

Sets the upper and lower range of ambient light the lamp intensity control circuits will respond to. To properly set these levels, the ambient light must be at the high or low level limits that you expect to have when you are setting the corresponding high or low backlit intensity.

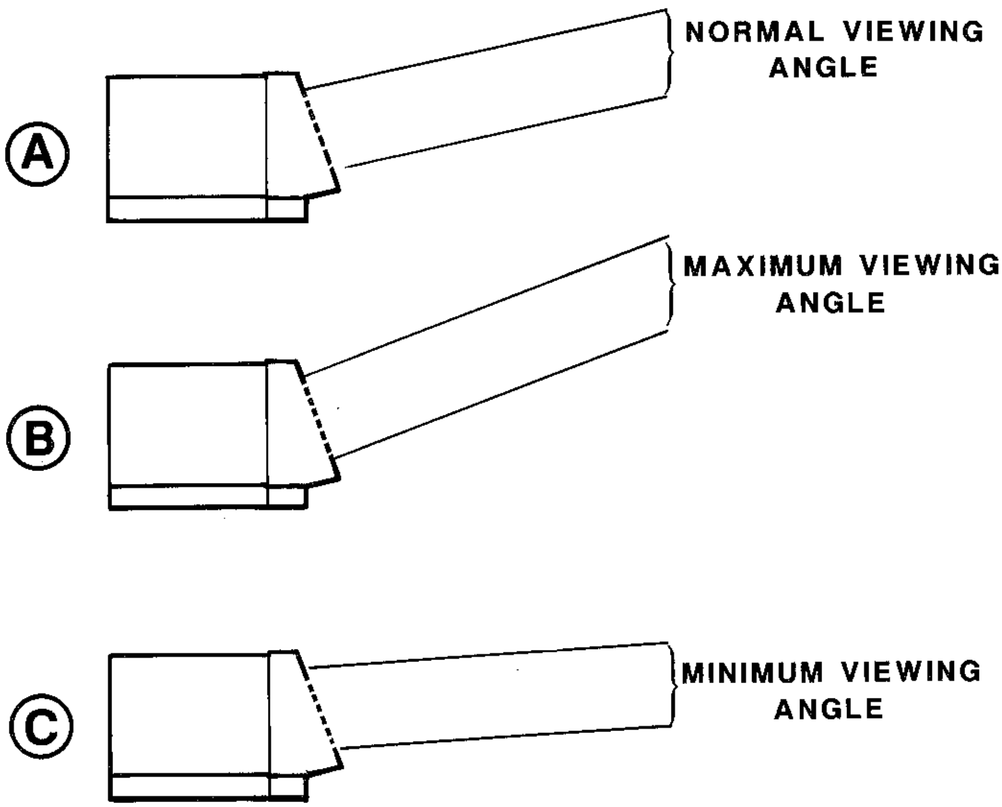
Press and release ENTER and HIGH to set the upper intensity range. The seconds display will show an intensity level between 1 and 32 (default is 32). Press LOW to decrement this value, HIGH to increment. The lamp will darken or brighten accordingly. Press ENTER to store the desired level.

Press and release ENTER and LOW to set the lower intensity range. The seconds display will show an intensity level between 1 and 32 (default is 1). Press HIGH to increment this value, LOW to decrement. The lamp will brighten or darken accordingly. Press ENTER to store the desired level.

Note that you can't adjust the LOW level above the HIGH level and vice-versa.

DISPLAY ANGLE

Adjusts the viewing angle of the display. There are five different levels from maximum (default) to minimum. Refer to the following pictorial.



Press the UNITS and INDOOR keys. Press the keys repeatedly to select the setting you desire.

DISPLAY TEST

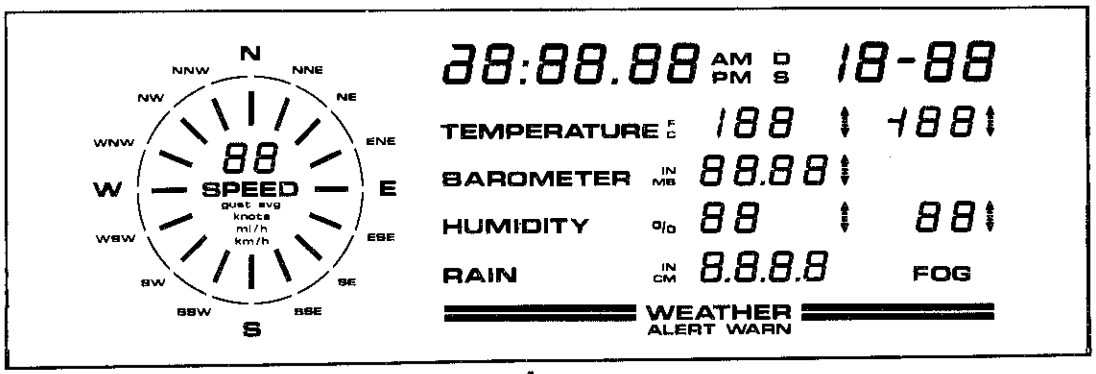
To verify all of the segments on the display, refer to the following steps and the display test patterns.

1. Press the PRESSURE and HUMID keys, you should get the display shown at **A**.

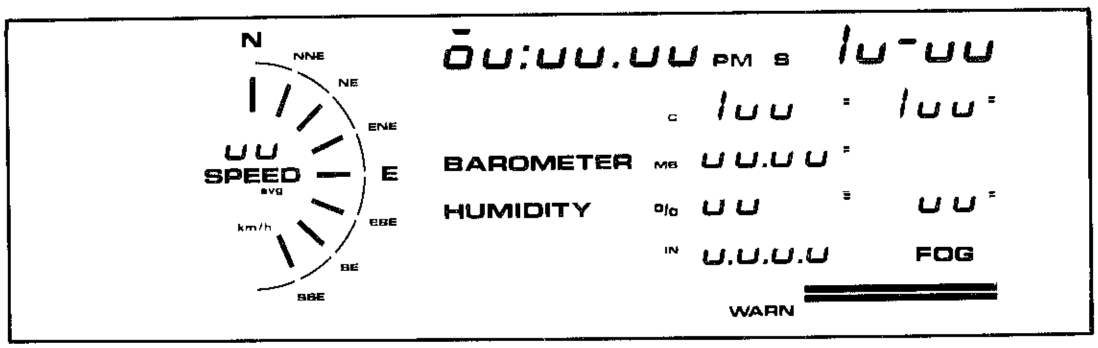
2. Press these two keys a second and third time and you should get the patterns at **B** and **C**.

3. Press the PRESSURE and HUMID keys a fourth time, the display will go blank.

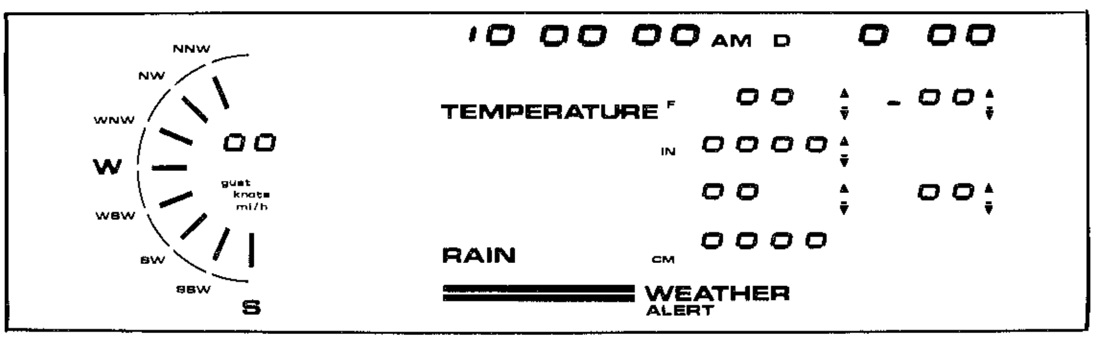
4. To exit, press ENTER or wait one minute.



A



B



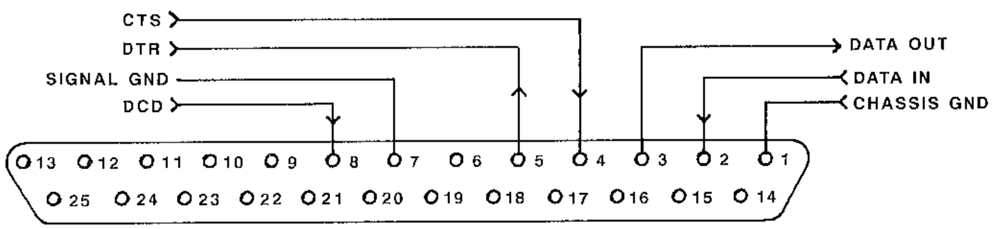
C

RS-232C INTERFACE ACCESSORY

(Model IDA-5001-3)

COMPUTER INTERFACING

The RS-232C plug on the back of the ID-5001 is a 25-pin Data Communication Equipment (DCE) female connector. The following illustration shows its pin-out as viewed from the back of the chassis.



(NOTE: ARROWS LEAVING CONNECTOR ARE OUTPUTS FROM ID-5001)

To interface the Weather Station to computers with 9-pin serial connectors, such as the Z-241, Z-248, and Z-386, use cable HCA-200-PC. For computers with 25-pin connectors, such as the Z-100 or Z-148 through Z-150 series, use HCA-11. To transfer data, use a communications program such as HUGMCP (#885-3033-37), which will work with the Z-100, Z-150 series, or any other standard MS-DOS system.

RS-232C OPERATION EXAMPLE

Refer to the documentation of the communications program and set it up for 9600 baud. Alternately, adjust the baud rate of the Weather Computer as described in "Keyboard Operation." Next, perform the following steps.

NOTE: When you type the following characters, make sure that they are all in the designated UPPERCASE.

- Type **ATES** and then press the **RETURN** key. You may see a 0 (no error) on the screen or an 8 (syntax error) if you made a typing error in the entry.
- Type **ATLS** and press the **RETURN** key. You will see ATLS on the screen.
- Type **ATRD** and press the **RETURN** key. You will now see the year, month, and date displayed on the screen (e.g. 870805). **NOTE:** The correct date will not be displayed unless you set it correctly on the Weather Computer at an earlier time.
- Type **ATRT** and press the **RETURN** key. You should see the time in hours, minutes, and seconds displayed on the screen (e.g. 104617). **NOTE:** The time display will be random unless you set it to the correct time on the Weather Computer at an earlier time.

End of example. Refer to "Serial Interface Commands" for a description of the commands available.

SERIAL INTERFACE COMMANDS

In the following table, the Command column shows the information the computer sends to the Weather Station. All characters must be in the case designated. Though not shown, all commands begin with AT (ATtention) followed immediately by the sequence of letters representing the command. All commands must end with a carriage return. The second column shows the Weather Station's response. Lower case letters indicate some form of numeric response. If there is no response listed, the response will be "0," which means the weather computer received the information and no errors occurred.

Characters in parenthesis indicate optional entries or responses. Multiple characters separated by commas [example:(**a,b,c**)] indicate that only one of the characters may be entered. The () themselves are never entered in these commands. A "greaterthan" symbol (>) indicates that the returned number is the minimum recorded rate. A "lesserthan" symbol (<) indicates a peak rate.

Command	Response	Action
AC		Alarm clear. Shuts off the alarm.
ASHHMM(SS)(A,P)		Set the alarm to HHMM or HHMMSS. If SS is not entered, 0 is entered for seconds. If A or P are not entered, the time is entered in 24-hour format. When the alarm sounds, an "A" will be sent from the RS-232 serial interface port.
CBH		Clear Barometer High
CBL		Clear Barometer Low.
CHIH		Clear Humidity Indoor High.
CHIL		Clear Humidity Indoor Low.
CHOH		Clear Humidity Outdoor High.
CHOL		Clear Humidity Outdoor Low.
CR		Clear Rain.
CTIH		Clear Temperature Indoor High.
CTIL		Clear Temperature Indoor Low.
CTOH		Clear Temperature Outdoor High.

Command	Response	Action
CTOL		Clear Temperature Outdoor Low.
CWAH		Clear Wind Average High.
CWAL		Clear Wind Average Low.
CWGH		Clear Wind Gust High.
CWGL		Clear Wind Gust Low.
EC		Echo Clear. Turns off the echoing of the received characters. **NOTE:** This is the default setting.
ES		Echo Set. Turns on the Echoing.
LC		Line feed Clear. Sends only a CR after returning the results of a command. **NOTE:** This is the default setting.
LS		Line feed Set. Sends CR-LF after returning the results of a command.
RA	(W)(a)(F)	Read Alert-Warning and Fog conditions.
RB	Bnnnn(M)	Read Barometer. "M" is present if the units are set to millibars.
RBH	<Bnnnn(M) mm(/)dd hh(:)mm(:)ss	Read Barometer High. **NOTE:** The (:) and (/) symbols represent the optional time and date separator characters, respectively.
RBL	>Bnnnn(M) mm(/)dd hh(:)mm(:)ss	Read Barometer Low. The (:) and (/) symbols represent the optional time and date separator characters, respectively.
RBR	BRnnnnn(M)	Read Barometer Rate (24 hour rate). nnnnn=32768 indicates no rate available. This holds true for all rate commands.
RBr	Br nnnn(M)	Current Barometer Rate.
RD	yy(/)mm(/)dd	Read Date.
RHI	hnn	Read Humidity Indoor.
RHIH	<hnn mm...	Read Humidity Indoor High. **NOTE:** mm... = mm(/)dd hh(:)mm(:)ss.
RHIL	>hnn mm...	Read Humidity Indoor Low.
RHIR	hRnn	Read Humidity Indoor Rate (24 hour).
RHIr	hrnn	Read Humidity Indoor rate (current).

Command	Response	Action
RHO	Hnn	Read Humidity Outdoor.
RHOH	<Hnn mm...	Read Humidity Outdoor High.
RHOL	>Hnn mm...	Read Humidity Outdoor Low.
RHOR	HRnn	Read Humidity Outdoor Rate (24 hour).
RHOr	Hmn	Read Humidity Outdoor rate (current).
RR	Rnnnnn((n)C)	Read Rain in Inches or Centimeters (cm). Decimal point 2 places from right implied (rain in .10 inches or .01 cm).
RRR	RRnnnnn((n)C)	Read Rain Rate.
RRI	RInnnnn(C)	Read Rain Instantaneous rate.
RT	hh(:)mm(:)ss (A,P)	Read Time.
RTI	tnnn(C)	Read Temperature Indoor in degrees Fahrenheit (°F) or Celsius (°C).
RTIH	<tnnn(C)mm...	Read Temperature Indoor High.
RTIL	>tnnn(C)mm...	Read Temperature Indoor Low.
RTIR	tRnnn(C)	Read Temperature Indoor Rate (24 hour).
RTIr	trnnn(C)	Read Temperature Indoor Rate (current).
RTO	Tnnn(C)	Read Temperature Outdoor.
RTOH	<Tnnn(C)mm...	Read Temperature Outdoor High.
RTOL	>Tnnn(C)mm...	Read Temperature Outdoor Low.
RTOR	TRnnn(C)	Read Temperature Outdoor Rate (24 hour).
RTOr	trnnn(C)	Read Temperature Outdoor Rate (current).
RW	Dn	Read Weekday (0 through 6, Monday-Sunday).
RWA	wnnn(K,L,M) nnnD	Read Wind Average. (K:Knots, L:Kilometers, M:Miles) (nnn=wind in degrees).
RWAH	<wnnn(K,L,M) nnnD mm...	Read Wind Average High.
RWAL	>wnnn(K,L,M) nnnD mm...	Read Wind Average Low.
RWCA	cTnnn(C)	Read Wind Chill Average.

Command	Response	Action
RWCG	CTnnn(C)	Read Wind Chill Gust.
RWG	Wnnn(K,L,M) nnnD	Read Wind Gust.
RWGH	<Wnnn(K,L,M) nnnD mm...	Read Wind Gust High.
RWGL	>Wnnn(K,L,M) nnnD mm...	Read Wind Gust Low.
SD	yymmdd	Set Date.
ST	hhmmss(A,P)	Set Time. Sets the 24-hour format unless A or P is entered. This only affects the way the serial interface returns the results. It has no effect on the Weather Computer's display.
VDc		Set the Date separator character, where "c" is the character to be placed between the date items as: yycmmcdd
VD		Clear Date separator character.
VTc		Set Time separator character as: hhcmmcss
VT		Clear time separator character.
XC(B)(H)(h)(T) (t)(R)(W)(w)		auto Xmit Clear stops auto transmission of selected items: B: Barometer H: Outdoor Humidity h: Indoor Humidity T: Outdoor Temperature t : Indoor Temperature R: Rain W: Wind Gust w: Wind Average
XCA		Auto Xmit Clear. Stops auto transmission of all all items.
XSA		Auto Xmit Set of all items. Automatically transmits new information to the serial port. It only transmits when a reading changes on the Weather Computer. For example, if the outdoor temperature changes, the outdoor reading is transmitted. If the wind speed changes, the wind speed is transmitted.
XS(B)(H)(h)(T) (t)(R)(W)(w)		Auto Xmit Set. Starts auto transmission the same as XSA except that this command only auto transmits selected items. For example, if you enter "A T X SB," the barometer reading will be transmitted any time the reading changes.

NORMAL OPERATING CHARACTERISTICS

The following characteristics of the ID-5001 Advanced Weather Computer are considered normal. Become familiar with these characteristics before you service the unit. By doing so, you'll save troubleshooting time.

- During the 10-second backlight warmup time after turn-on, the ends of the fluorescent lamp will glow slightly.
- During battery backup operation, a NEDA 1604 9-volt battery will typically last about 18 hours. DC current drain will vary from about 17mA to 30mA.
- If you install a new battery while the power is off, the Weather Computer may not operate when you plug it back into an AC outlet.
- If an ID-5001 with battery backup loses AC power, the LCD will still be active. This is usually only noticable if the light shield has been removed and a bright light is shining behind the LCD. The reason is that the battery-backed supply, VCCB, provides power to the LCD drivers.
- In the first production run, the peak wind gust reading would randomly change when a battery-backed ID-5001 would momentarily lose AC power. This was especially noticable if the peak reading was a low value before power loss. In later production runs, this problem was fixed by changing the EPROM at U418 to part number 444-475-3.

- Though the system monitor is less than 16 kilobytes, Engineering selected a 32K EPROM at U418. The upper 16K is disabled by grounding the A14 line.

- If the temperature sensors are disconnected from the back of the Weather Computer, the temperature, humidity, and barometer may give false readings. Also, the display brightness may behave erratically due to false readings from the light sensor. This is because the temperature sensor interface circuits are overdriving the electronic switch at U405 and are causing crosstalk.

CIRCUIT DESCRIPTION

NOTE: Refer to the various Weather Computer Schematics in the separate folder as you read the following pages. For some of the smaller circuits, small schematics are reproduced on the following pages and in the Illustration Booklet for your convenience.

120VAC rms couples through the three-wire plug, the 1/4-ampere fuse at F1 (1/8A for 240VAC), and a noise filter consisting of C1-C3 and LX1 to the power transformer at T1. The 2.2megohm resistor at R1 prevents a static charge from building up on the chassis by referencing the AC common line to the chassis and earth grounds. The large resistance reduces the possibility of a shock hazard in case the AC hot and AC common leads are accidentally reversed. (Such as by using a cheater plug or two-wire extension cord.)

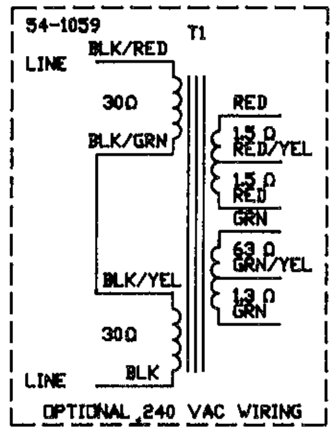
The two parallel-connected primaries of T1 (series connected for 240VAC) steps down the line voltage into two center-tapped secondary voltages. Secondary #1 provides a 10VAC source (to the center tap) and secondary #2 generates 20VAC to the center tap. These voltages are coupled through S304 to the power supply board.

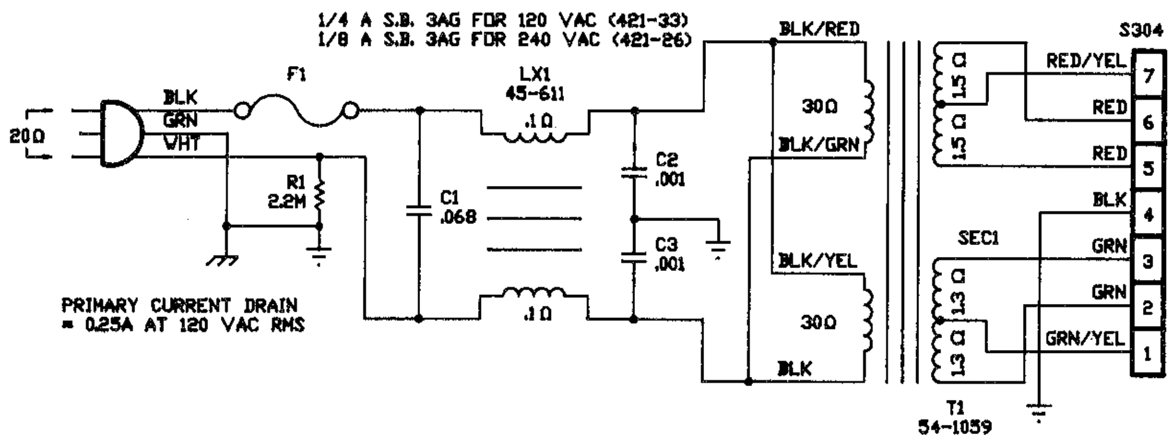
± 15 VOLT SUPPLIES

On the power supply board, D315/D317 and D316/D318 form two full-wave rectifiers that convert the secondary #2 AC voltages to – 27VDC and + 25VDC, respectively. C318 filters the negative DC supply and U305 regulates it to – 15 volts. C319 and C320 filter the output before it's coupled to the main board through S303-8. On the main board, it provides power to the analog interface circuits and the optional RS-232C circuits.

C317 filters the + 25VDC supply before it is connected to the lamp power supply (see "Backlight Circuits") and to the + 15VDC regulator, U302. This IC provides + 15 volts to the same main board circuits as U305, plus the wind sensor LEDs through R477 (upper right on the Main Board schematic). U302 also provides power through D322 to the battery backup circuit, which is discussed in "AC Power Detector."

AC POWER





5-VOLT SUPPLIES

The full-wave rectifier consisting of D319 and D321 generates + 13VDC to drive the two five-volt regulators, U303 and U304. U304 develops the VCCA supply, which is present only when AC power is present. This supply provides power to the fluorescent lamp circuits (see "Backlight Circuits") and couples through S303-7 to the main board. On the main board, VCCA powers U406, which is a hex inverter used in the keyboard and wind speed interface circuits. VCCA leaves the main board through P409-3 (Main Board schematic, upper right) to the wind direction circuits and through P402-10 (Main Board schematic, center) to power the light sensor and pilot lamp on the display board.

U303 regulates the battery-backed VCCB supply. D313 sets the output to 5.6 volts while C315 references the regulator common lead to AC ground. AC-derived DC couples through D311, while the positive side of the 9-volt battery connects to the anode of D312. These diodes act as switches to isolate the two sources. When AC power is present, the 13VDC across C316 causes D311 to conduct and turns off D312. When the AC power is lost, the voltage across C316 will drop to a point where D312 conducts and D311 cuts off. Thus VCCB remains at + 5.6VDC and the battery is isolated from U304. D311 also isolates the battery from D310 in the AC power detector circuits to ensure that they will detect the power failure.

The output of U303 provides power for the reset interface at Q319 and connects to S303-6 to the main board to power all the logic circuits except U406. On the main board, it couples through S402-8 (center of Main Board schematic) to provide power to the logic circuits on the display driver board.

AC POWER DETECTOR, 60 Hz SWITCH, AND RESET SWITCH

The AC power detector monitors the AC line voltage and battery voltage to control the 60Hz switch and the reset switch. The specific action it takes depends on whether or not the 9-volt battery is installed. If it is, the AC power detector will cause the 60Hz switch to short the output of the 60Hz detector to ground upon AC power failure. This ensures that noise on the 60Hz line will not cause false triggering on the main board.

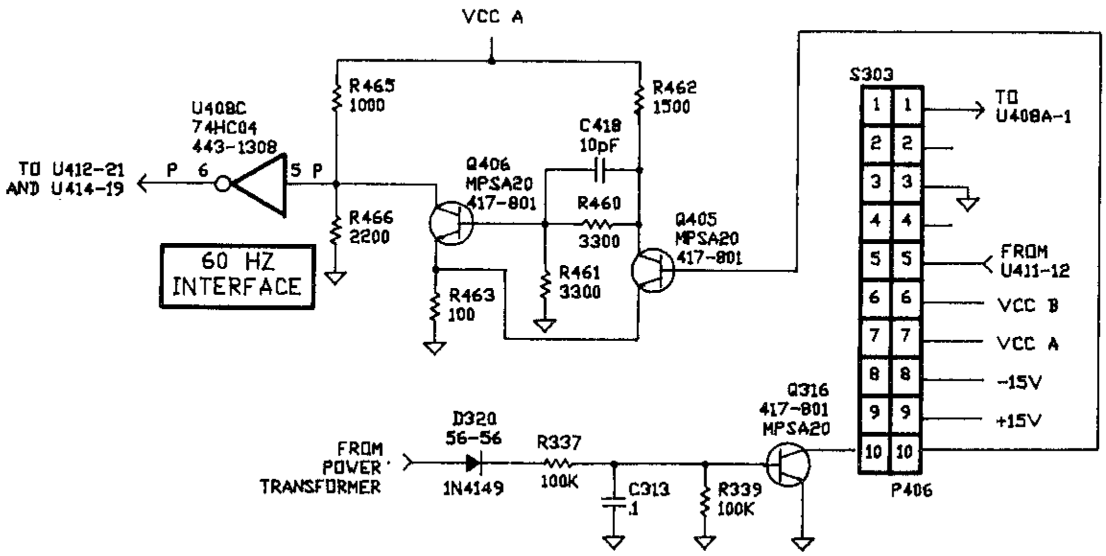
The AC power detector controls the reset switch by causing it to generate a system reset if the battery isn't connected and a momentary power failure occurs.

To power these circuits during AC operation, D322 drops the + 15VDC from U302 to about ten volts and couples it through D307. At this time, D309 is cut off to isolate the battery. D310 drops the 13VDC from D319/D321 to 4.8VDC and couples it through R326 to the base of Q314, which forms a Schmitt trigger with Q315. At normal AC voltages, Q314 conducts and Q315 is cut off. If the voltage drops below about 92VAC, the two transistors will change state and not switch back until the line voltage rises above about 100VAC. The result of this hysteresis effect is that the circuit is relatively immune to noise during a brownout.

When 120VAC is connected to the ID-5001, the resulting high from the Schmitt trigger couples through D308 and R332 to turn off the 60Hz switch at Q317/Q316 to allow the 60Hz signal from D320 to couple to the main board. In the reset switch circuits, the +9VDC from R332 is more positive than the +5.6 volts at the emitter of Q319, so D314 is reverse-biased. The result is that Q319 and Q318 will be turned off and the reset line will be in its inactive state, or high. Incidentally, the polarity of D314 gives Q319 a very high input impedance. Even measuring the base of this transistor with an 11-megohm VTVM will cause a reset due to the current through the probe to the base-emitter junction of Q319.

During a power failure, D322 and D307 will cut off and D309 will turn on to connect the battery to these circuits. Q315 will turn on to drop the base voltage of Q317 low enough to turn it on. This causes Q316 to conduct and short the 60Hz line to ground. Circuits on the main board will detect the lack of the 60Hz signal and switch to the battery-backup program to reduce power consumption. (See "60Hz Circuits" for more information.) At the same time, the reset circuits will remain deactivated because the cathode of D314 is still more positive than the emitter of Q319 (see "Reset Circuits").

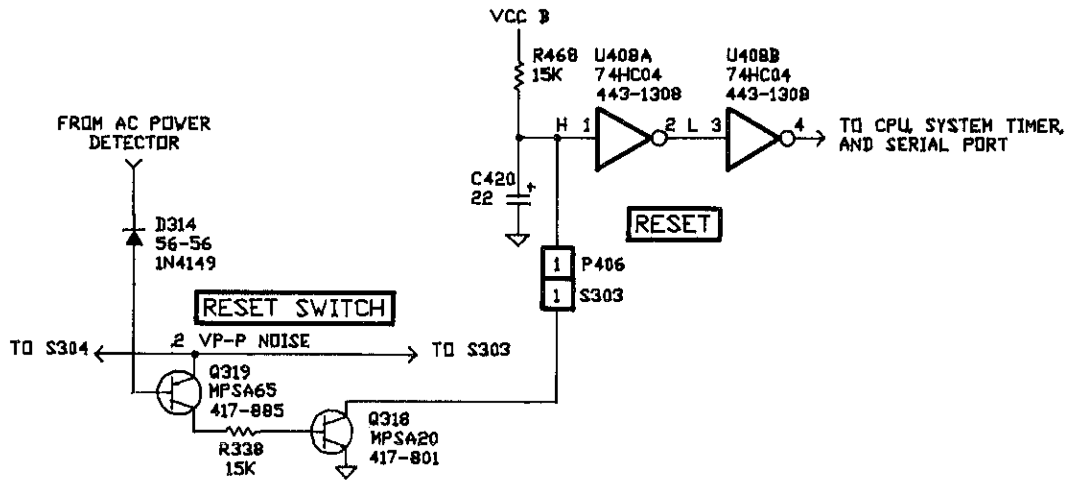
60-HZ CIRCUITS



The 60Hz circuits consist of the 60Hz detector on the power supply board and the 60-Hz interface on the main board. The 60-Hz detector is a half-wave rectifier at D320 that taps one side of secondary #1. R337 provides current limiting to the base of Q316 on the main board, while R339 references the signal to ground. C313 filters any switching noise that may be present. Because of the relatively low input impedance of Q405, the junction of R337 and R339 is only about 0.8VDC instead of the expected 2.5VDC.

Q405 and Q406 form a Schmitt trigger to square-up the signal, reduce the effects of noise through its built-in hysteresis action, and amplify the signal enough so that it will drive U408C. U408C is one section of a 74HC04 CMOS hex inverter. It converts the 60Hz signal to a TTL level square wave and sends it to the system timer at U412 and the optional serial port at U414. If U414 is present, it processes the 60Hz signal, otherwise U412 does. (See "Timer Port," "Optional IDA-5001-3 RS-232C Serial Port," and "Interrupt Operation" for more information.)

RESET CIRCUITS



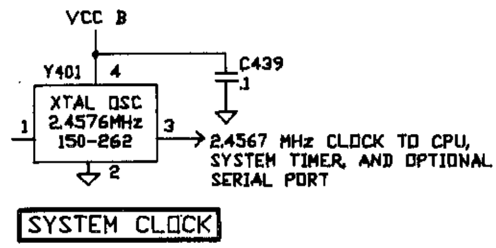
The reset circuits are active only when the optional backup battery is not connected. They may also activate if the battery is too weak to maintain a reverse bias on D314. Otherwise, if the battery is good, the unit will not be reset during a power failure (see "AC Power Detector, 60Hz Switch, and Reset Switch").

If the battery is disconnected and power is just applied to the Weather Computer, C420 on the main board will begin to charge through R468. The time constant is such that U408B-4 will remain low for about 1/4 second, thus holding the system reset. This delay gives the systems crystal-controlled clock time to stabilize at its operating frequency. As explained in the Z80C IC data sheets, the CPU needs to be held reset for at least three system clock pulses while it performs some internal initialization.

Once C420 becomes charged, U408B goes high, the Z80C fetches the first instruction from location 0000H of the EPROM, and the Weather Computer begins its powerup initialization procedure.

The reset switch at Q319 and Q318 on the power supply board ensures that C420 is fully discharged during a momentary power failure. The AC power detector would quickly drive the cathode of D314 low while there was still + 5 volts on VCCB. Q319 would conduct and drive Q318 into saturation, discharging C420. If this circuit wasn't present, the time constant of C420 and R468 may not allow the reset circuits time to respond to a momentary power failure. It would be possible for the DC power supply to be lost while the charge on C420 remains. This could result in unpredictable operation or, since U408B-4 would go high the instant power was restored, the Z80C would not be held reset for the minimum three clock pulses and would appear to lock up.

SYSTEM CLOCK



The system clock at Y401-3 is a 2.4576MHz TTL-level square wave with a 50% duty cycle. It provides synchronous timing to the CPU, system timer, and the optional serial port. Its frequency was selected so the system timer at U412 could evenly divide it for the most common frequencies it must generate. For example, the 120 Hz interrupt (divide by 20480) and the 153.6 kHz baud rate generator for the optional serial port (divide by 16).

THE Z84C00 (Z80C) CENTRAL PROCESSING UNIT

Refer to Pictorial 5-1 in the Illustration Booklet as you read the following paragraphs.

The CPU at U420 is a 2.5MHz Z84C00 CMOS IC that is compatible with the standard Zilog Z80 microprocessor; including pin-out, timing relationships, and instruction set. Thus, it will be referred to as the Z80C in this Manual. The advantage of the Z80C over the Z80 is that it draws about six times less current (25mA worst-case versus 150mA). In addition, it can be put in a standby mode to reduce the current drain to less than 10µA. To enter the standby mode, simply program the Z80C to process a HALT instruction, then stop the system clock at logic zero during T4 of the following machine cycle (see the timing diagrams in the #443-1392 IC data sheets).

The Z80C executes the programs stored in memory to control all the functions in the ID-5001. This IC was selected for its versatile instruction set (158 different types) and large number of internal registers. The registers include two 8-bit accumulators and associated flag registers, twelve 8-bit general-purpose registers, two 8-bit special-purpose registers, and four 16-bit special-purpose registers.

The Z80C transfers data between the registers and other circuits in the ID-5001 through the bidirectional data bus at D0-D7 and the address bus at A0-A15. The CPU also has several lines for controlling and monitoring the status of the circuits it's communicating with. Basically, these lines function as follows.

Pins 1-5 and 30-40, A0-A15 — Address bus. The Z80C uses these output lines to select a specific I/O port or memory location. A0-A7 are used to select I/O, thus allowing up to 256 I/O ports. In certain types of I/O instructions, the contents of the B register is placed on the upper eight address bits, A8-A15. All sixteen lines are used to address a byte in memory. This permits the Z80C to directly address up to 65536 bytes of RAM or ROM. The address lines are active high. That is, at address zero all lines are low, while at address FFFFH all lines are high.

The address bus also provides a refresh function for systems using dynamic RAMs. It does this at the end of each instruction fetch cycle by placing the contents of the refresh register onto A0-A7. It then increments the refresh register so a different refresh address will be placed on the bus during the next instruction fetch. During refresh, only A0-A6 are incremented, A7 is held at logic zero, and the contents of the interrupt page address register are placed on A8-A15.

Pin 6, CLK — Clock. The signal on this input line provides all the internal timing to the Z80C. In the ID-5001, this signal is a 2.4576MHz TTL square wave with a 50% duty cycle. Unlike a standard Z80, which has a minimum specified clock frequency of 500kHz, the Z80C clock can be reduced to DC without losing data. As described earlier, this allows placing the CPU in the standby mode.

Pins 7-10 and 12-15, D0-D7 — Data bus. These eight bidirectional bus lines permit the Z80C to communicate with memory and I/O. During a read operation, these are input lines, so data travels from the addressed device to the CPU. During a write, they're output lines, so the CPU can transfer data to the addressed device.

Pin 16, $\overline{\text{INT}}$ — Interrupt request. When an I/O device requires CPU time, it places a logic zero on this input control line. The Z80C will complete its current instruction and then process the interrupt request. At this time, the CPU simultaneously asserts $\overline{\text{IORQ}}$ at pin 20 and $\overline{\text{M1}}$ at pin 27. This does not occur in any other CPU activity, so the interrupting device decodes it as an interrupt-acknowledge signal.

How the Z80C responds to a pulse on pin 16 depends on whether the CPU was programmed for interrupt Mode 0, 1, or 2. In the ID-5001, the CPU is programmed for Mode 2 interrupts, so the interrupting device is required to send an 8-bit vector address to the Z80C when it detects the interrupt-acknowledge signal. In turn, the CPU combines this byte with the contents of its interrupt page register, thus forming a 16-bit vector address. This address holds the location of the appropriate interrupt-handling program which the Z80C calls in the same way it would a subroutine. Once the Z80C has processed the interrupt, it returns to the previous program and continues with it.

Note that the interrupt request line at pin 16 can be disabled (masked) through software control. When masked, a logic zero at $\overline{\text{INT}}$ won't affect Z80C operation.

Pin 17, NMI — Nonmaskable Interrupt. This input control line is similar to the INT line at pin 16 except that it can't be disabled through software control. Also, it's triggered on the negative-going edge of the input rather than on a logic zero. When an NMI occurs, the Z80C performs a restart to address 0066H, which contains a jump instruction to the NMI handler. The NMI function isn't used in the ID-5001, so it's tied high through R482.

Pin 18, HALT — Halt. This output line goes low to indicate that the Z80C has executed a HALT instruction. While halted, the Z80C will execute NOPs to maintain memory refresh activity. The only way to restart the processor is to generate an interrupt or a hard reset. In a battery-backed ID-5001, the Z80C enters the halt state when AC power is lost. This helps conserve power by reducing bus activity. During this time, the system timer generates an interrupt request at an 8.3mS rate, which brings the Z80C out of the halt state.

The CPU responds by checking if AC power has been restored, then updating the system clock in RAM, and checking the rain interface and updating the rain rate information in RAM. If the Z80C had found that AC power was still lost, it would not check the remaining interface circuits since they have lost one or more DC power supplies. Instead, the Z80C will execute another HALT instruction and "sleep" until the next interrupt.

Pin 19, MREQ — Memory Request. The CPU pulls this output control line low when it needs to read or write memory. The low indicates that the address bus holds a valid address.

Pin 20, IORQ — Input/Output Request. The CPU pulls this output control line low when it needs to read or write a port. The low indicates that the lower 8 bits of the address bus hold a valid I/O port address.

Pin 21, RD — Read. When low, this output control line indicates that the Z80C is ready to read data from the addressed memory or I/O device. The addressed device uses this signal to gate the data onto the data bus.

Pin 22, WR — Write. When low, this output control line indicates that the Z80C data bus holds valid data to be stored in the addressed memory or output port.

Pin 23, BUSACK — Bus Acknowledge. When low, this output control line indicates to the requesting device that the CPU has given up control of the system address, data, and control busses. (See **Pin 25, BUSREQ** for more details.) This circuit isn't used in the ID-5001, so it's not connected.

Pin 24, $\overline{\text{WAIT}}$ — Wait. When low, this input control line puts the Z80C into a wait state. Data, address, and control lines will remain in their current logic state until pin 24 goes high. Typically, this line is used to synchronize the CPU to slow memory and I/O circuits. It's not used in the ID-5001, so it's tied high.

Pin 25, $\overline{\text{BUSREQ}}$ — Bus Request. This input is a control line that's used by DMA circuits to gain access to the system bus. When low, the Z80C halts operation and its address, data, and output control lines enter a high-impedance state. DMA isn't used in the ID-5001, so this line is tied high to ensure reliable operation.

Pin 26, $\overline{\text{RESET}}$ — Reset. When brought low, this input control line halts all CPU operation. It disables interrupts and sets the interrupt mode to zero. The program counter, interrupt vector register, and refresh registers are cleared. During reset time, the address and data bus go to a high-impedance state, and all control output signals go high. No memory refresh occurs. Note that the reset line must be held low for at least three clock cycles to allow the Z80C to properly initialize its internal registers. In the ID-5001, pin 26 is held low for about 250mS at powerup to give the clock oscillator time to start up. If the reset line was allowed to go high before the clock pulses started, the Z80C would lock up.

Pin 27, $\overline{\text{M1}}$ — Machine cycle one. This output line pulses low when the Z80C is fetching an instruction from memory. The pulse occurs during the first half of the M1 cycle when the instruction is fetched. During the second half of the M1 cycle, the Z80C is internally processing the instruction and doesn't need to access the bus. It's during this time that a memory refresh takes place.

Pin 28, $\overline{\text{RFSH}}$ — Refresh. This output control line goes low during the second half of an M1 cycle to inform external circuits that a dynamic RAM refresh is taking place. During this time, the rest of the Z80C is internally processing an instruction and does not need to access the busses. Instead, the Z80C places the contents of the refresh register on A0-A6 and pulses $\overline{\text{MREQ}}$. External circuits decode these lines to perform a memory read to refresh the RAM. (Note that there's no data transfer, however.) This results in a transparent refresh and eliminates the need of arbitration logic, which would otherwise slow down system operation. Since the ID-5001 uses static RAM, this line isn't connected.

MEMORY CIRCUITS

Refer to Pictorial 5-2 as you read the following paragraphs.

HARDWARE

The memory circuits consist of a decoder at U419A, the system ROM at U418, and system RAM at U416. U419A is a 74HC139 CMOS 1-of-4 decoder that monitors the A14 address line at pin 2 to chip-enable either U416 or U418. When A14 is low, U419A-6 (pin 6) goes low to enable the ROM. When A14 goes high, U419A-6 returns high and U419A-7 goes low to enable the RAM. As shown in the ID-5001 Memory Map illustration, this is a partial decoding scheme that leaves images of the RAM and ROM throughout the 64K address space. However, since the system is a dedicated processor, nothing more elaborate is needed.

The memory request line, $\overline{\text{MREQ}}$ at U419A-1, ensures that the memory chips won't be activated during an I/O operation.

The Z80C halt line, $\overline{\text{HALT}}$ at U419A-3, goes low during an AC power failure to prevent glitches on the bus from destroying data in the battery-backed RAM. U419A, which is also battery-backed, will decode the lows on A14 and $\overline{\text{HALT}}$ as address zero and assert U419A-4 low. The $\overline{\text{CE}}$ lines at pins 6 and 7 will remain high and thus keep the memory chips disabled. Every 8.3mS, the system timer at U412 will send an interrupt signal to the Z80C, which in turn will place a high on the halt line so that it can access RAM and ROM. This allows the CPU to see if power has been restored and to update the clock and calendar data in RAM. Once finished, the Z80C re-enters the halt state (due to an instruction from the ROM) and again lowers U419A-3.

The ROM at U418 is a 32K × 8 27C256 CMOS EPROM wired for only 16K. Its A14 line is jumpered to ground through W401 to disable the upper 16K. Engineering chose this technique simply because it was cheaper to use a 27C256 rather than a 16K 27C128.

The Z80C reads an instruction from U418 by placing a 14-bit address on A0-A13. About 200nS later, it places a logic zero on the read line, $\overline{RD}$ at U418-22, and the $\overline{CE}$ line at U418-20. This causes the ROM to select the byte at the specified address and place it on the data bus, D0-D7. The Z80C waits about 600nS for the signals on the bus lines to stabilize, then reads the byte. At the same time, it brings $\overline{RD}$ high to disable the EPROM output while the Z80C internally processes the instruction. Depending on what the instruction is, the CPU will then either read more bytes from U418, or access the RAM to read or write data.

The RAM at U416 is a TC5565PL-15 8K × 8 CMOS IC that is compatible with a standard 6264 15nS CMOS RAM. The Z80C uses it to store weather data, data going to or coming from the serial port, and configuration information. Battery backup to U416 ensures that this information won't be lost during an AC power failure.

The Z80C reads data from U416 in the same manner as it does the ROM; it places an address on A0-A12, pulses $\overline{RD}$ at U416-22 and $\overline{CS}$ at U416-20, and reads the data the RAM places on D0-D7. Writing data is also similar. The CPU first places an address on A0-A12. About 200nS later, it places the data on D0-D7 and puts a logic zero on U416-20. The Z80C then waits about 600nS and then pulses $\overline{WR}$ to latch the data into the addressed memory location.

The remaining chip-select line, U416-26, isn't used, so it's tied to the battery-backed supply to keep it permanently activated.

FIRMWARE

U418 contains the program that controls all the actions of the Z80C. This includes powerup initialization, processing data from the sensors, and acting on the results of the processed data (such as indicating a fog or weather alert). From a troubleshooting standpoint, the important part of the ROM is the powerup procedure. This procedure takes place whenever AC power is first applied to the ID-5001 and the battery backup isn't connected. Once the battery backup is installed, the Z80C will skip the powerup procedure the next time the Weather Station temporarily loses AC power.

At powerup, the Z80C fetches the first three bytes from U418 starting at address 0000H. These bytes form a jump instruction to the initialization routine elsewhere in the ROM. Basically, the routine causes the Z80C to perform the following steps.

- Clear all RAM locations in U416 to zero.

- Set the Z80C stack pointer to the last RAM address (5FFFFH).

- Initialize specific RAM locations so that the Weather Computer will be in the default powerup operating mode.

  This includes such things as the default time and date, units in non-metric numbers, default weather rates that would cause an ALERT/WARNING display.

- Initialize specific RAM locations as interrupt vectors.

  The RAM interrupt vectors point back to interrupt-handling routines in the EPROM. By storing the vector addresses in RAM, the CPU has the ability to dynamically change to other interrupt-handlers in the EPROM as external conditions change. For example, the 8.3mS timer interrupt changes its address every interrupt in order to generate the 60Hz signal used by the fluorescent lamp (see "Interrupt Operation").

- Set the Z80C interrupt type to Mode 2 (see "The Z84C00 (Z80) Central Processing Unit").

- Initialize the system timer, U412.

  This includes setting the interrupt vector low byte, putting timers 0, 2, and 3 into the counter mode, and programming timer 1 to generate the 8.3mS interrupt. It also initially programs timer 2 to generate the 50/60 Hz interrupt. (See "Interrupt Operation" and "The Z84C30 Counter/Timer" for more information.)

- Enable Z80C interrupts.

  This is necessary because the Z80C maskable interrupts are disabled at powerup or reset.

- Initialize a memory location to a count of 120 which is used as a counter by the 50/60Hz timer in the system timer at U412.

  Each time U412 counts a transition from the AC line, it generates an interrupt that causes the CPU to decrement this memory location. Note that the transition can be either positive- or negative-going. Thus, a 50Hz signal will generate 100 interrupts per second, while a 60Hz signal 120 interrupts per second. In a later step during the initialization procedure, the Z80C will use this information to determine the line frequency.

- Initialize the display drivers, U201-U203 on the display driver board.

  The Z80C sends synchronizing and programming information to U201-U203 and then waits in a loop until it gets a certain response from these ICs. As described in "Troubleshooting," if one of the ICs doesn't respond, the CPU will loop forever, making the ID-5001 appear dead.

- Determine the AC line frequency.

  Basically, the Z80C pauses for 200mS by entering a tight loop. The 8.3mS timer in U412 sets the delay by generating an interrupt and updating a counter. At the same time, the AC line counter in U412 is also generating interrupts at twice the line frequency and is decrementing the memory counter mentioned two steps ago.

  When the 8.3mS timer indicates the end of 200mS, the Z80C exits the loop and checks the AC line counter value in memory. If the value is 96, then the line frequency is 60Hz. If the value is 100, then the frequency is 50Hz. That is, with an initial count of 120, a 60Hz signal generates 120 interrupts per second which will decrement the AC line counter to 96 in 200mS. Similarly, a 50Hz signal generates 20 interrupts in 200mS and will decrement the count to 100.

  If the frequency is either 50Hz or 60Hz, the Z80C stores the appropriate information in memory and, on the next AC line interrupt, reprograms the 8.3mS timer. For 60Hz, the timer continues to generate interrupts every 8.3mS, otherwise, the Z80C will program it to generate interrupts every 10mS to allow it to generate a 50Hz signal.

  If the Z80C doesn't get a count of 96 or 100, it loops back and repeats the last two major steps until it does. This includes re-initializing the display drivers. One possible cause of an incorrect count would be a failure in the 60Hz circuits driving the trigger-2 input at U412-21. The AC counter in memory wouldn't get incremented and, as described in "Troubleshooting," the Weather Computer would appear dead.

- Once again initializes the display drivers to ensure that they're in sync.

This is the last time the Z80C performs the above steps once the backup battery is installed. When a power failure occurs, the Z80C program counter will be in another memory location and the hardware will not generate a reset pulse (which would restart the CPU at the beginning).

- Check for the presence of the serial port.

  If the RS-232C port is installed, the Z80C will program it for 9600 baud, 8 data bits, no parity, and one stop bit.

- Enter the setup polling loop.

  At this time, the Z80C is time-sharing several tasks:

  A. It applies a DC voltage to the filaments of the fluorescent lamp for 10 seconds prior to lighting them. It does this by checking a counter during the 8.3mS interrupt.

  B. It monitors the keypad (also during the 8.3mS interrupt) for a keypress and processes it if there is one. (If you wished, you could start entering time and date information, even though the display is blank.)

  C. It monitors and processes data from the sensors.

- Light the fluorescent lamp, flash the time and date displays, and wait for a keypad entry.

  If the time and date is not entered in about 60 seconds, the Weather Computer enters the normal mode and performs tasks similar to the ones in the previous step. The only difference is that it modulates the fluorescent lamp with a 60Hz (or 50Hz) signal generated by the 8.3mS timer circuits.

INTERRUPT OPERATION

Refer to Pictorial 5-3 as you read the following paragraphs.

INTERRUPT REQUEST/ACKNOWLEDGE SEQUENCE

Many of the sensors in the ID-5001 generate an interrupt request to notify the Z80C that they have data for it. These include the analog circuits connected to the V.F. converter, the 60Hz square wave from the AC power line, the windspeed circuits, an internal line time counter in the system counter, and the optional RS-232C interface. All of the circuits but the RS-232C interface generate an interrupt request through the $\overline{\text{INT}}$ line from the system timer, U414-12. The RS-232C interface is connected in parallel to $\overline{\text{INT}}$ at U414-5. Both lines are open-collector and are pulled high by R483 (near U420-16) when inactive.

To begin an interrupt procedure, either U412 or U414 will pull $\overline{\text{INT}}$ low and then wait for the Z80C to respond. The CPU acknowledges the request by asserting $\overline{\text{M1}}$ and $\overline{\text{IORQ}}$ at the same time. (See "The Z84C00 (Z80C) Central Processing Unit.") These two lines connect to U412 at pins 14 and 10, and to U414 at pins 8 and 36. The IC generating the request responds to these lows by placing an 8-bit vector address on the data bus that tells the CPU where the interrupt-handling routine is located.

To allow for several circuits generating simultaneous interrupt requests, and to ensure that the right address is put on the bus, the ID-5001 uses a daisy chain architecture and ICs with built-in priorities.

DAISY CHAIN ARCHITECTURE

The architecture of the interrupt system is a daisy chain configuration consisting of the system timer at U412, the CPU at U420, and the optional RS-232C port at U414. These components are covered in more detail elsewhere, this section only covers how they respond to an interrupt.

The daisy chain configuration is determined by two control lines on U412 and U414, Interrupt Enable Input (IEI) and Interrupt Enable Output (IEO). If the IEI line on a particular chip is low, that particular IC will be unable to generate an interrupt request. Thus, U412 will always be able to generate an interrupt request because its IEI line at pin 13 is connected to VCCB. The other line, IEO, is normally high and goes low only if the chip's IEI line is high and the IC is generating an interrupt request. Since the IEO line at U412-11 connects to the IEI line at U414-6, the system timer will always have priority over the serial port.

INTERRUPT PRIORITIES

Interrupt priorities for the circuits inside these ICs partly depend on the chip characteristics and partly on the system ROM. For example, assume that the RS-232C chip isn't installed. U412 contains four counter/timers numbered 0 through 3, with counter zero having the highest priority. Refer to the following table.

Priority	Counter /Timer	Function
Highest	CTC-0	V.F. Converter Counter
	CTC-1	8.3 mS Timer
	CTC-2	60 Hz Line Counter
Lowest	CTC-3	Wind Speed Counter

If the RS-232C port is installed, the CPU will sense it at powerup and program the 60Hz line counter to be a baud rate timer for U414. The resulting output will be a rectangular wave with a frequency that is 16 times the serial port baud rate, or 153.6kHz for the default speed of 9600 baud. This signal connects to the transmit and receive clock inputs at pins 27 and 28 of U414.

U414 consists of two serial ports, lettered "A" and "B," in one chip. Port B is the serial interface to the outside world, while port A is now the 60Hz line interface. This signal connects to U414-19, the Data Carrier Detect port A ($\overline{\text{DCDA}}$) handshake line. Other handshake lines are disabled by connecting them to VCCB through R474 or by internal programming. While the 60Hz signal is still present at the trigger 2 input at U412-21, the IC ignores it.

U414 internally sets its own priorities. Port A is higher than B and, within each port, the receiver is higher than the transmitter. The handshake lines and internal status registers share the lowest position. This results in the revised priority table.

Priority	Port	Function
Highest	CTC-0	V.F. Converter Counter
	CTC-1	8.3 mS Timer
	CTC-2	Baud Rate Generator*
	CTC-3	Wind Speed Counter
	$\overline{DCDA}$	60 Hz Line Counter
	RxDB	Receive Data port B
	TxDB	Transmit Data port B
Lowest	----	Status Registers/Handshake Lines

*The CTC-2 input no longer generates an interrupt request.

The following paragraphs briefly describe what takes place during the interrupts.

V.F. CONVERTER INTERRUPT

The V.F. converter is hard wired through U408D to the counter zero input because it's generating the highest-frequency pulses (4000Hz/V). This requires that the CPU respond to it the fastest so that data won't be lost. Thus, the program that handles this interrupt just takes enough time to increment a location in RAM that indicates the interrupt occurred. It's up to other programs in ROM to process the data. Some of these are in the 8.3mS timer interrupt handler.

8.3 mS TIMER INTERRUPT

The 8.3mS timer is the only circuit in U412 that isn't externally connected. Both the input at pin 22 and the output at pin 8 are open. In addition, it is the only one that is programmed as a timer. The others are event counters and don't increment their internal registers until a negative-going pulse occurs on their trigger inputs. At powerup, however, the CPU monitors the AC line frequency present at U412-21 and then programs the 8.3mS timer to automatically generate an interrupt request at twice the line frequency. (For 50Hz systems, this would of course be called a 10mS timer.)

The program that handles the 8.3mS timer interrupt does most of the work in the circuit. It checks to make sure that AC power is present. If not, it takes over control of keeping the clock/calendar timers updated (formerly done by the 60Hz timer interrupt) and reads the status of the rain gauge circuits. (See "Pin 18, HALT" in "The Z84C00 (Z80C) Central Processor Unit" for more information.)

If AC power is okay, the program switches the control line to the fluorescent lamp circuits either off or on, depending on what it was during the previous 8.3mS interrupt and the current ambient light level. This results in a 60Hz signal with a controllable duty cycle that can set the lamp intensity.

The 8.3mS timer interrupt then checks the status of the active V.F. converter channel and switches it to the next channel if necessary. Next, it processes wind speed and direction data gathered by other subroutines. This mainly consists of finding the maximum and average values, then placing them back into RAM for later processing. Following that, the timer interrupt program reads the keypad to see if a key is pressed. If so, it debounces and decodes the key (or keys) and once again places the result into RAM for processing by other subroutines. Finally, the timer interrupt checks the rain gauge for activity. It does this by reading bit D5 of the wind/rain port, U421-13. If the line has gone low since the last time it was checked, the interrupt program updates the appropriate locations in RAM. Other subroutines will read this data and update the rain display.

60 Hz LINE INTERRUPT

As mentioned in "Interrupt Priorities," the 60Hz line interrupt will have the third highest priority if the optional RS-232C port isn't installed. It will generate an interrupt request through the system timer at U412-21. If the port is installed, the CPU reprograms it to generate interrupt requests through serial port A at U414-19. Its interrupt priority will then be fifth highest. In this case, the priority difference is not critical and the interrupt handler program processes both in the same way.

The handler program first modifies a RAM location to indicate that a 60Hz line interrupt did occur. When the next 8.3mS timer interrupt occurs, it will check this location and, if different than what was expected, will know that there'd been an AC power failure and will modify its actions as described previously.

After modifying the memory location, the program updates the clock/calendar RAM locations. This results in the front panel display clock being synchronized to the power line frequency, which has a better long-term accuracy than the built-in crystal oscillator. If power had been lost, the 8mS timer interrupt program would take over clock maintenance and use the 2.4576MHz system clock as a time base. This, however, is accurate enough for the few hours that AC power is down.

After updating the clock, the program exits the routine.

WIND SPEED INTERRUPT

Sinusoidal pulses from U406F-12 in the wind speed circuits connect to counter #3 in the CTC through U412-20. This counter doesn't have a direct output, but can pulse the interrupt line.

When the CPU processes the wind speed interrupt, it increments the contents of a memory location in U416 then exits the routine. The next time the Z80 processes an 8.3mS timer interrupt, it compares the current count with a previous count to determine wind speed.

RS-232C RECEIVE INTERRUPT

When the optional IDA-5001-3 RS-232C Accessory* receives a serial byte from the external terminal, the accessory converts the byte to parallel, pulses the interrupt line, then waits for the CPU to respond. When the Z80C processes the serial port receive interrupt, it reads the byte from U414 and stores it in a buffer in RAM for further processing later. The CPU then checks the buffer to see if it's about to overflow. If so, the CPU immediately sends a control-S to the terminal to stop the flow of data until the Z80 gets time to process what's already been received.

* Standard with wired units.

RS-232C TRANSMIT INTERRUPT

When the ID-5001 has data to send to the terminal, the Z80C places the information into a buffer in RAM, initializes the transmitter in U414, and continues processing other data. When U414 is ready to send a byte, it interrupts the CPU which responds by sending it a byte from the buffer. While U414 is converting the byte from parallel to serial and transmitting it to the terminal, the CPU exits the interrupt routine and continues performing its previous task. Once the byte is sent, U414 will again interrupt the Z80C and the cycle will repeat until the buffer is empty.

By using a buffered interrupt technique, the Z80C doesn't need to wait in a loop while the relatively slow serial port sends data.

RS-232C STATUS/HANDSHAKE INTERRUPT

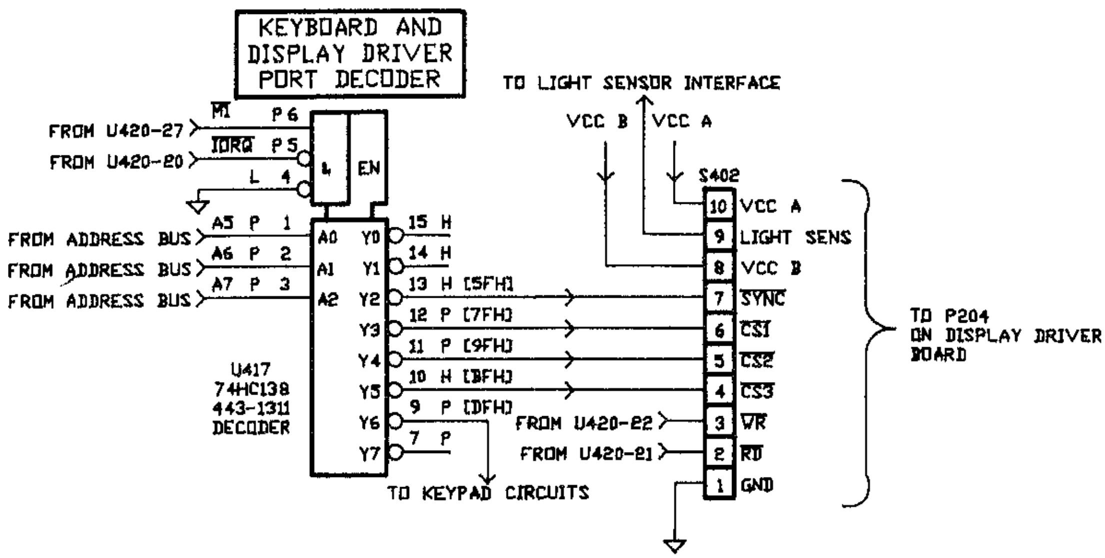
The serial port sends a handshake interrupt when an internal status register changes states or when a terminal asserts the $\overline{\text{CTSB}}$ line at U414-23. Internal status register changes can occur for such things as a framing error (received stop bit not detected) or overrun error (received data coming in too fast for the CPU to read from U414). Such errors usually won't occur unless the external terminal is sending a large amount of data at a high baud rate. In such a case, the CPU will respond by sending a control-S and placing a high on the $\overline{\text{DTRB}}$ at U414-25 in an attempt to tell the external device to stop sending data.

If the opposite happens, that is, the ID-5001 sends data to the terminal at a speed too fast for it to process, the terminal may place a logic one on the $\overline{\text{CTSB}}$ handshake line at U414-23. U414-5 goes low to send an interrupt request to the Z80C which responds by halting data transmission. When the terminal is ready to receive data, it places a low on the $\overline{\text{CTSB}}$ line. This again generates an interrupt and causes the ID-5001 to restart transmission.

Though wired to the rear panel, the $\overline{\text{DCDB}}$ handshake line currently isn't used.

I/O PORT DECODERS

There are two I/O port decoders in the Advanced Weather Computer, one enables the weather sensor interface circuits, while the other chip-selects the keypad and display circuits.

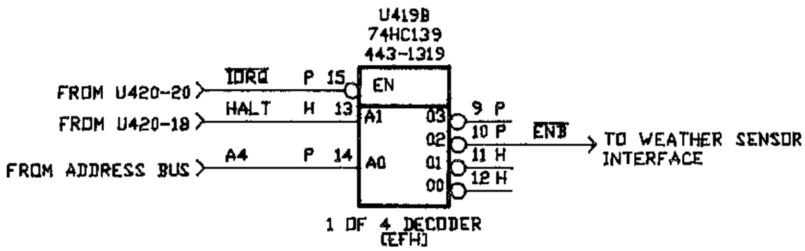


U417 is the keypad and display driver port decoder. Pins 1-3 monitor A5-A7 to drive low the appropriate chip-select line at pins 9 through 13. Refer to the following table.

Address	Pin	Function
05FH	13	Synchronizes U201-U203 on display driver.
07FH	12	Chip-selects U203 on display driver.
09FH	11	Chip-selects U201 on display driver.
0BFH	10	Chip-selects U202 on display driver.
0DFH	9	Chip-selects U409 & U411 in keypad circuits.

The active-low IORQ line at U417-5 ensures that U417 won't activate during a memory access. The M1 goes low to disable U417 during an interrupt-acknowledge sequence. As described in "The Z84C00 (Z80C) Central Processing Unit," the Z80C asserts both IORQ and M1 at the same time to indicate an interrupt-acknowledge. This extra decoding is necessary because the SYNC line at U417-13 may otherwise pulse and send an erroneous synchronization pulse to the display drivers.

WEATHER SENSOR
PORT DECODER



The other port decoder, U419B, chip-enables U421 to read the wind speed and rain data, and selects U410 to write scanning data to the V.F. converter circuits. U419B decodes the A4 address line at U419B-14 and the HALT line at U419B-13 to assert U419B-10 whenever the CPU accesses port EFH (A4 low, HALT high). During battery-backup operation, HALT goes low to force U419B-10 high and thus prevent an accidental write to U410; which may cause the V.F. converter to generate an erroneous interrupt request. Only the 8.3mS timer in U412 will generate interrupt requests during this time. The CPU will respond by bringing HALT high and using U419B to read the rain rate through U421.

The active-low IORQ line at U419B-15 ensures that U419B won't activate during a memory access. However, unlike U417, U419B doesn't need the M1 line to prevent it from activating on an interrupt-acknowledge cycle. This is because the CPU holds the RD line at U421-1 high when IORQ and M1 are simultaneously low, thus preventing U421 from placing data on the bus at the same time the interrupting device does.

WIND DIRECTION AND RAIN SENSORS PORT

Refer to Pictorial 5-4 and to the interconnect schematic as you read the following paragraphs. Note that Q411-Q414, U408, and U421 interface the wind direction and rain gauge circuits to the ID-5001.

The wind direction circuits consist of the wind direction sensor on the boom assembly and Q411-Q414 on the main board. The sensor consists of four infrared LEDs at D602-D605 and four IR-sensitive phototransistors at Q602-Q605. On the main board, R477 couples + 15VDC through P409-2 and the white lead in the boom cable assembly to the anode of D602 in the wind vane top. These four LEDs, plus the IR LED at D601 in the wind speed sensor, divide the voltage equally to about three volts each. The cathode of D601 connects to chassis ground through points F, K, W, G, and F on three of the sensor boards.

The collectors of Q602, Q603, Q604, and Q605 connect to the +5VDC VCCA supply through the blue wire at H. The four emitters connect to their respective input resistors connected to the bases of Q411, Q412, Q413, and Q414.

Located between the LEDs and phototransistors is a plastic disk that contains alternating opaque and transparent sections. There is a diode above each transistor that will cause the transistor to conduct when a transparent section of the disk is between them. The conducting transistor couples the high to its associated transistor on the main board, which inverts it and connects the low to U421.

The disk is designed so that the four-bit parallel output from the wind direction sensor will generate a Gray code when the wind direction changes and rotates the disk. Gray codes have the characteristic that only one bit changes state from one numeral to the next. It's used in this position encoder design because the maximum reading error during the transition from one incremental position to the next is the adjacent numeral. If a standard 8421 binary code had been used, all bits to be changed would have to change at exactly the same position to avoid large error outputs. (For example, from 3 (0011B) to 4 (0100B) and 7 (0111B) to 8 (1000B)). Such precision would require unreasonable mechanical tolerances.

In the Weather Computer, the emitters of Q602-Q605 generate the following Gray code for each point of the compass.

Point	Q605	Q604	Q603	Q602
N	H	H	H	H
NNW	L	H	H	H
NW	L	L	H	H
WNW	H	L	H	H
W	H	L	L	H
WSW	L	L	L	H
SW	L	H	L	H
SSW	H	H	L	H
S	H	H	L	L
SSE	L	H	L	L
SE	L	L	L	L
ESE	H	L	L	L
E	H	L	H	L
ENE	L	L	H	L
NE	L	H	H	L
NNE	H	H	H	L

The optional IDA-5001-2 Rain Gauge Accessory works in a simpler manner. When the sensor dipper fills with water during a rain storm, a magnet will close the reed switch at A3. This connects R2 on the chassis to P409-1 on the main board and, due to the large resistance ratio of R476 to R484 and R2, pulls U408F-13 low. U408E inverts the resulting high at U408F-12 and couples a low to U421-14. D404 and D405 provides static discharge protection for the CMOS inverter. C427, along with C447-C450, filter RFI.

U421 is a 74HC365 3-state bus driver that couples the direction and rain data to the CPU. During the 8.3mS interrupt, the CPU will activate this chip by pulling low U421-1 and U421-15. It will then wait about 500nS for the data to stabilize, then load it into its accumulator. From there, the Z80C converts the direction information to the pattern necessary to light the correct segments on the display. It also checks the Rain Gauge status and, if it's gone from a high to a low since the last measurement, it increments the rain display by 0.01.

ANALOG SELECT PORT AND V.F. CONVERTER

Refer to Pictorial 5-5 as you read the following paragraphs.

Most of the weather conditions the ID-5001 measures are slowly-varying analog values. This includes temperature, humidity, barometric pressure, and ambient light level. The V.F. converter changes these analog values into a digital pulse whose repetition rate is proportional to the event being measured. A counter circuit then counts the number of pulses within a specified interval and the CPU retrieves this count to convert it into data for display. Because the analog values change relatively slowly, one V.F. converter can easily handle all six of the values to be measured. Thus, the analog select port electronically switches each value to the V.F. converter for sequential processing.

The analog select port consists of an octal D latch at U410 and two electronic switches at U405 and U407. The logic levels on the Q-outputs of U410 control the status of the switches. A high will close the switch, allowing the signal on the input to couple to the output. The input voltages come from the various interface circuits, including indoor and outdoor temperature, indoor and outdoor humidity, barometer, and light sensor. Normally, these voltages will vary from zero to about +3VDC, depending on the circuit and the weather condition. The exception is the humidity circuits, which will be some small negative value (−40mV typical) when the optional IDA-5001-1 Humidity Accessory isn't installed. The Z80C will correctly interpreted this voltage and blank the display.

The outputs of the six switches connect in parallel to the input of the V.F. converter through R420. The Z80C periodically writes a bit pattern to U410 to make it act as a ring counter and enable only one switch at a time. Starting with the barometer, the following table shows the sequence the switches that are enabled and how long they're on.

Switch	Time On	Function
U405A	500 mS	Barometer
U405B	25 mS	Indoor temperature
U405C	25 mS	Outdoor temperature
U407A	25 mS	Indoor humidity
U407B	25 mS	Outdoor humidity
U407C	25 mS	Light sensor

The barometer has a longer sampling period because its four-digit display is used when calibrating the V.F. converter, thus ensuring better accuracy than the two-digit displays of the other analog interfaces.

The V.F. converter consists of a voltage-to-current generator at U403A and an astable multivibrator at U401. At the beginning of a cycle, U410 turns on U407D and Q407 for about 5mS to discharge C401 and set U401-3 high. When U407D turns off Q407, C401 begins charging at a rate determined by the voltage from the electronic switches. R409 provides positive feedback to U403A-3 and causes the output to draw proportionately more current through C401. Since the current increase is constant through C401, the voltage across it increases at a constant rate, which results in a linear ramp and a consistent frequency for a specific voltage.

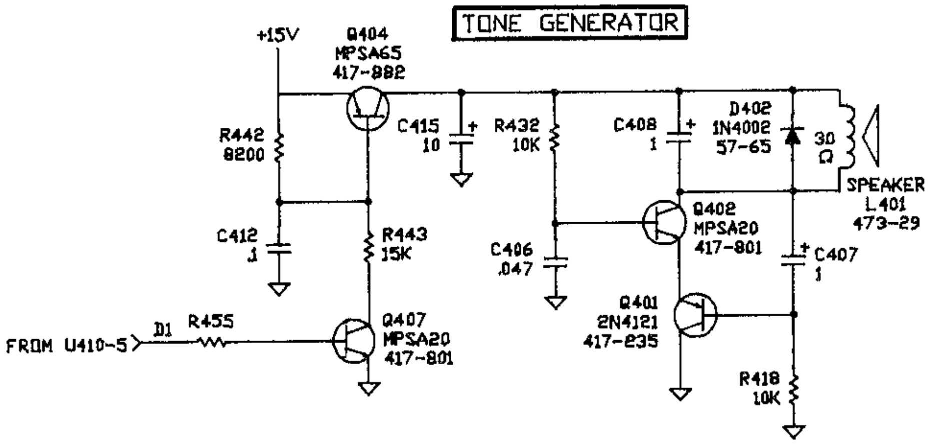
When the ramp charges to the threshold voltage at U401-6 (about + 10VDC), the DISCH line at U401-7 conducts to rapidly discharge the capacitor and drive U401-3 low. When the capacitor voltage drops below the trigger level at U401-7 (about + 5VDC), the DISCH line goes high, C401 begins charging again, and the output at pin 3 returns high.

The ratio of R411 to R410 set the overall stage gain to unity. VCCB connects to U405D-12 to keep the switch on all the time. Its purpose is to help balance the inverting side with the resistance of the active switch connected to R420. (Depending on the manufacturer, these switches may have an "on" resistance of several hundred ohms.) Similarly, the thermistor and resistors at R412A-R412C compensate for thermal drift in the op amp.

R407 and R408 set the basic charge rate and thus the multivibrator frequency. This rate is based on a change of 4000Hz per volt from the barometer circuits and results in display showing the actual frequency. Thus, calibrating the V.F. converter to the 3.1-volt reference (see "Alignment") results in a display of 62.00, or 6200Hz.

R402 and R401 attenuate the 15-volt pulse from U401-3 to TTL levels and couple it to U408D. U408D-8 inverts the signal and couples it to the TRG0 input of the counter/timer chip, U412-23. U412 generates an interrupt and the Z80C responds by updating a count in memory. The next time U412 generates an 8.3mS interrupt (timer 1), the CPU checks to see if the time is up for the current channel being measured (1/40 second or 1/2 second). If so, it converts the count in memory to the appropriate display value, clears out the counter in memory, resets counter 0 in U412, discharges C401, and activates the next switch with U410.

AUDIO TONE GENERATOR



Besides controlling the electronic switches, U410 turns the tone generator off and on. This is a simple audio oscillator that the ID-5001 sounds during weather alerts or to create key clicks. It can be disabled through software control. It consists of Q401 through Q404 and their associated circuits.

At powerup, the Z80C disables this circuit by writing a logic zero to U410-5. This cuts off Q403 and Q404 and so removes power from the oscillator. Deliberately shutting down the circuit at powerup is necessary because U410 tends to turn on with its outputs at logic one. Q403 and Q404 conduct and the speaker will continuously beep.

Q401 and Q402 form a relaxation oscillator operating at about 2kHz. When Q404 turns on, C406 charges through R432 until it is positive enough to turn on Q402 (about +5.8VDC). The collector of Q402 sends a negative-going pulse through C407 which saturates Q401 and discharges C406 through the base-emitter junction of Q402. Q402 reverse-biases and shuts off Q401. C406 again begins charging through R432 and the cycle repeats. The time constant of C406 and R432 set the frequency to 470uS, or about 2kHz. Depending on component tolerances, this may vary by several hundred hertz. D402 protects the transistors from inductive kickback from the speaker, while C408 smoothes the negative-going spike caused by Q402 turning on.

BAROMETER

Refer to Pictorial 5-6 as you read the following paragraphs.

The barometric pressure sensor consists of a voltage reference at D401, a pressure sensor at A401, and an instrumentation amplifier designed around U402.

D401 performs two functions: (1) It's used to calibrate the V.F. converter and barometer circuits, and (2) it provides a stable reference for the pressure sensor. When calibrating the V.F. converter, jumpers across pins 2 and 3 of P404 and 1 and 2 of P403 connect the junction of R421 and R422 to the V.F. converter. These precision resistors divide the voltage from D401 to about 3.2VDC, which the V.F. converter displays as 62.00 when it's properly calibrated.

Once the V.F. converter is calibrated, it's used as a reference to calibrate the barometer. The jumper on P404 is moved from pins 2 and 3 to pins 1 and 2 and R425 is adjusted for 1/2 the voltage across D401, or 62.00 on the display. This is used as the reference value for A401 once the barometer is operational. A401 is a piezoresistive bridge whose output at A401-2 varies proportionally with the atmospheric pressure with respect to A401-4 (3.2744mV/in.Hg). A401-2 connects to the noninverting input of U402B-5 and A401-4 to the noninverting input of U402C-10. To balance the amplifier, these two inputs are shorted together during calibration by moving the jumper at P404 to pins 1 and 2 of P401 (shorting A401), moving the jumper at pins 1 and 2 of P403 to pins 2 and 3 of P403, and adjusting the display for zero (corresponding to 0V at U402C-8).

Next, the short across A401 is removed and a near-vacuum corresponding to 2in.Hg is applied to the transducer using the calibration hose. R414 is then adjusted until the two-inch vacuum produces a 2in.Hg change in the displayed pressure. Parallel resistors at R405 can be added or removed to compensate for voltage and gain characteristics of A401 and U402. Reducing the resistance increases the reading.

Note though the amplifier has been balanced, the transducer output will have a small offset voltage (instead of the ideal 0 volt) when the 2in.Hg is applied to it. This voltage at zero pressure is about 1/4 the output when the applied pressure is 30in.Hg. Thus, the negative voltage at U402C-8 equals the transducer offset voltage plus the pressure-induced voltage times the gain of the amplifier. R413 and the unity-gain follower at U402A compensates for this offset by coupling a positive voltage to U402D-13 that is equal to the offset. These two offsets cancel and only the voltage representing the barometric pressure is left.

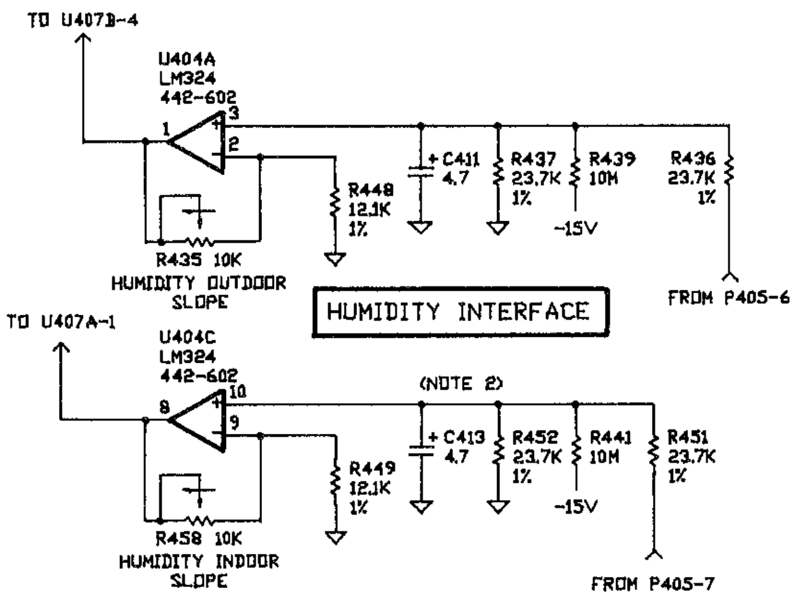
Once the amplifier is calibrated properly, the voltage at U402D-14 is 1.5 volts for a pressure of 30in.Hg and will vary 0.05V/in.Hg. At the end of calibration, a jumper is placed across pins 1 and 2 of P402 and all others are removed.

HUMIDITY SENSOR ACCESSORY*

(Model IDA-5001-1)

Since the indoor and outdoor humidity sensor circuits operate the same way, only the indoor sensor circuit will be described.

The humidity sensor generates a voltage proportional to the humidity by comparing a reference oscillator against an oscillator that changes frequency with humidity. This voltage is coupled to an op amp on the main board which converts it to the levels required by the V.F. converter for a proper display.



U701A and U701B form the reference oscillator. R702, R705, and C701 set the frequency to about 10kHz. The output at U701A-3 couples to one input of the variable oscillator, U701D and U701C, at U701C-9. R701, R703, R704, R710, and A701 set the frequency. A701 directly varies its capacitance to the humidity. As the humidity increases, the capacitance increases, and the frequency attempts to decrease. However, the gate signal at U701C-9 locks U709C and U709D to its frequency, so, instead, the duty cycle increases.

* Standard with wired units.

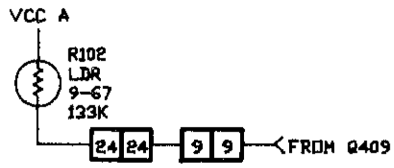
The output of each multivibrator couples to a set of inputs of the parallel-connected quad NOR gate at U702. The input signals are 180° out of phase and, at 0%RH, the duty cycles are equal and result in zero volts at the output of U702. As the relative humidity increases, the duty cycle varies and pulses appear at the output of U702. D701 rectifies the pulses while R706, C702, and R708 filter and couple the signal through the cable and rear panel to P405-7 on the main board.

From P405-7, the voltage couples through R451 to U404C-10. C413 provides additional filtering while R441 and R452 biases the input. The – 15VDC supply at R441 ensures that the output at U404C-8 will be zero (or slightly negative) when the external sensors aren't present. When the Z80C gets this information from the V.F. converter, it shuts off the display.

R458 sets the stage gain, and thus, the range of the humidity circuits. During calibration, A701 on the sensor board is replaced with a 118pF capacitor and R704 is adjusted for a minimum value. Next, a 42pF capacitor is placed in parallel with the 118pF to give an effective relative humidity increase of 93%. R458 is then adjusted to reflect this change on the display. Once the range has been set, the capacitors are removed, A701 reinstalled, and R704 adjusted against a local standard to display the actual relative humidity.

Properly adjusted, the voltage at U404C-8 varies from 0 to 1VDC for a 0%RH to 100%RH change, or 10mV/%RH. This signal connects to the V.F. converter circuits at U407A-1 for A/D conversion and further processing by the logic circuits.

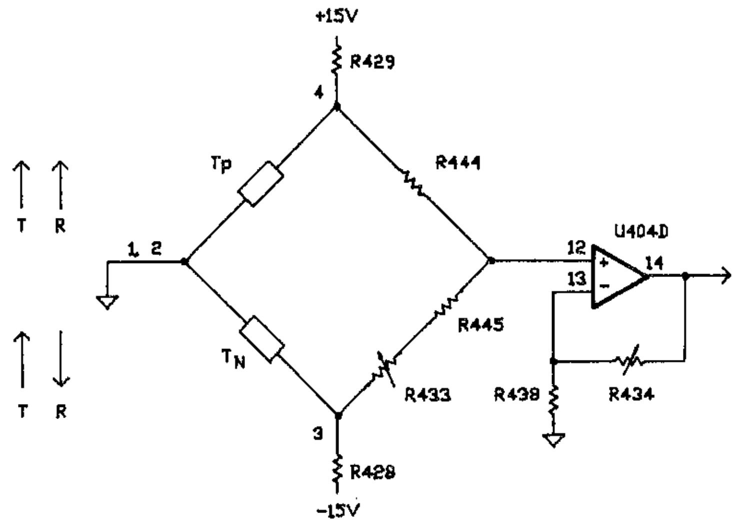
LIGHT SENSOR



The light sensor consists of a photoresistor at R102 on the display board and an emitter follower at Q409 on the main board. There are no specified sensitivities or calibration procedures for the sensor. Basically, R102 will be at maximum resistance in a dark room and thus the output to Q409 will be zero volts. In an average-lit room, R102 will conduct enough to send about 2 volts to Q409, while a bright light (such as a 60-watt bulb) shining directly into R102 will produce about 4 volts. The voltage divider on the emitter of Q409 shifts this range to 0-4 volts before sending it to the V.F. converter circuits at U407C-8.

During the 8.3mS interrupt, the Z80C checks this value and adjusts the fluorescent light level accordingly. (See "Fluorescent Light Circuits" for more details.)

TEMPERATURE SENSORS



EQUIVALENT CIRCUIT

The indoor/outdoor temperature sensors both function in the same manner, so only the outdoor sensor will be discussed. Refer to the equivalent circuit above, the main board schematic, and the interconnect diagram as you read the following.

Electrically, the temperature sensor is made up of two temperature-sensitive devices, T_P and T_N, having opposite temperature coefficients. That is, the resistance of the element at pin 4 to ground has a positive coefficient and will increase with an increase in temperature, while the other element will decrease. The change is linear for both units, so the voltage across pins 3 and 4 will remain constant--in this case, the component will appear to act as a 6.8-volt zener diode.

When it is connected to the back of the ID-5001, the sensor forms a bridge circuit with R444, R445, and R433 on the main board. R428 and R429 bias the bridge, R433 sets the bridge output voltage at 32°F, and R434 sets the op amp gain at 120°F. The bridge is balanced at – 40°F, so the output at U404D-14 is zero volts. As the temperature increases, the resistance of T_P increases and T_N decreases; thus shifting the voltage at U404D-12 in a positive direction. At 158°F, the voltage at U404D-14 rises to + 1.98VDC, resulting in a 10mV change per °F.

U404D-14 couples the voltage to the V.F. converter, which changes it to a digital signal for further processing by the Z80C.

THE SYSTEM TIMER

Refer to U412 on the main circuit board schematic diagram.

The system timer is designed around a Z84C30 Counter/Timer Circuit (CTC). This CMOS LSI chip contains four independently programmable counter/timer channels, each with a downcounter and a software-selectable 256 or 16 prescaler. The downcounters are reloaded automatically when they reach zero.

The CTC directly interfaces with the Z80C. The CPU can program it and read and write it's internal registers through D0-D7. It can read the status of the counters without disturbing the count. The CPU accesses this chip by placing the proper address on A0-A2 and asserting $\overline{\text{IORQ}}$ at U412-10. The state on $\overline{\text{RD}}$ at pin 6 determines if the Z80C is reading data (low) or writing (high). The relationship between A0-A2 and the addressed counter is as follows.

A2	A1	A0	Counter
0	0	0	0 - V.F. Converter
0	0	1	1 - 8.3 mS Timer
0	1	0	2 - 60 Hz Counter
0	1	1	3 - Wind Speed Counter

Note that the CPU can not access the CTC if A2 is high.

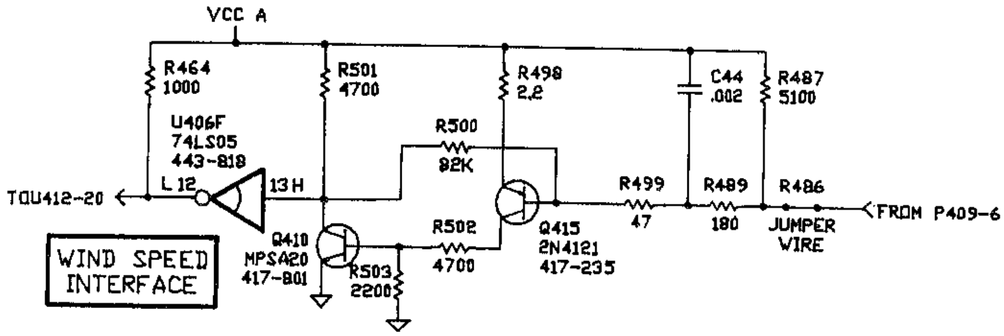
The CPU asserts $\overline{\text{M1}}$ at U412-14 and $\overline{\text{IORQ}}$ when it acknowledges an interrupt request. For more information on these, the interrupt-related lines at pins 11-13, see "Interrupt Operation."

The clock input at U412-16 comes from Y401-3 and provides the basic timing for the CTC. The $\overline{\text{RESET}}$ input at U412-17 goes low at initial powerup to initially clear the internal registers and counters. Note that this doesn't happen if AC power is momentarily lost and the backup battery is installed.

Of the four channels in U412, the CPU programs channel one as a timer and the others counters. The counters decrement each time they receive a trigger signal at pins 23, 21, and 20. Of these, channel zero generates an interrupt for every 256 pulses from the V.F. converter, while channels two and three generates interrupts on every trigger signal. The 8.3mS timer doesn't use it's trigger input but generates an interrupt request at a 100Hz or 120Hz rate, depending on the line frequency.

For specific information on how the CTC affects the ID-5001, refer to "Interrupt Operation" and associated circuit descriptions.

WIND SPEED SENSOR



The wind speed circuits consist of the anemometer on the boom assembly and Q415, Q410, and U406F on the main board. The sensor consists of an infrared LED at D601 placed directly above an IR-sensitive phototransistor at Q601. In between them is a plastic disk with alternating clear and opaque squares that will cause Q601 to generate 32 pulses per revolution of the wind cups.

The anode of D601 gets +3V from the +15VDC supply dropped by D602-D605. It's cathode, plus the emitter of Q601, connect to chassis ground through the black wire at point F in the wind direction sensor. The collector of Q601 couples through point W of the bottom wind vane board to P409-5 on the main circuit board. This couples through the jumper at R486 and through R489 and R499 to the base of Q415. R487 provides collector bias for Q601. When an opaque section of the anemometer disk is between the phototransistor and the LED, Q601 turns off to place +5VDC on the junction of R487/R489. If a clear section passes over Q601, the phototransistor will conduct enough to drop the voltage to about three volts. The result is that the wind speed signal on the rear panel connector will be a crude sine wave that is about 2VP-P riding on +5VDC.

The Schmitt trigger at Q415 and Q410 amplifies and squares up the signal enough to drive U406F. R500 provides hysteresis to reduce external noise interference. The open-collector inverter at U406F and R464 ensures that the signal is at TTL levels. This signal couples to the CTC at U412-20, which generates an interrupt request and causes the CPU to respond by updating a counter in memory. On the next 8.3mS interrupt (from channel 1 in the CTC), the CPU will check the wind speed memory location, calculate the rate the pulses have been occurring from the current data and previous readings, and update the wind speed display accordingly.

RS-232C INTERFACE ACCESSORY*

(Model IDA-5001-3)

THE 84C42 SERIAL I/O PORT

The optional IDA-5001-3 RS-232C Serial Port Interface consists of an 84C42 dual serial port at U414 on the main board schematic. This IC contains two independent full-duplex channels with separate control and status lines for modems or other devices. The Z80C can program each channel for data rate, number of data bits per character, type of parity bit, number of stop bits, and handshaking characteristics. In the ID-5001, these values are set by default to 9600 baud, 8 data bits, no parity, and one stop bit. In the ID-5001, one channel (port A) is the 60Hz AC line interface and the other (port B) the RS-232C serial port. (See "Interrupt Operation" for a description of the 60Hz line interface.)

Data communication with the external terminal takes place in port B. Serial data enters at U414-29, gets converted to a parallel byte, and is sent to the CPU through the data bus at D0-D7. When the Z80C transmits data, it sends the parallel byte through D0-D7 to U414, which converts it to serial, and transmits it through U414-26. U413 and U415 translate the ±10V RS-232C signals to and from the TTL-level voltages (see "Serial I/O Drivers").

To prevent loss of data, the ID-5001 uses both software and hardware handshaking. Software handshaking consists of processing and responding to control-S (^S) and control-Q (^Q) ASCII signals. If the Weather Station is receiving serial data so fast that it's internal buffer is about to overflow, it sends a ^S to the external terminal to halt transmission. When the Weather Station has processed the data and there's room in its buffer, it sends ^Q to tell the terminal to resume transmission. In a similar fashion, the terminal can send ^S and ^Q to regulate the data flow from the Weather Station.

The Weather Computer also uses hardware handshake lines in case the external terminal won't respond to ^S and ^Q. These lines are $\overline{\text{DTR}}$ (Data Terminal Ready) at U414-25 and $\overline{\text{CTS}}$ (Clear To Send) at U414-23. If data is coming in too fast, U414-25 goes high to inform the external terminal to stop transmitting. In a similar manner, the external terminal can halt transmission from the Weather Station by placing a logic one on U414-23.

* Standard with wired units.

U414 directly interfaces with the Z80C. The CPU can program it and read and write it's data and control registers through D0-D7. The CPU accesses this chip by placing the proper address on A0, A1, and A3 and then asserting $\overline{IORQ}$ at U414-36. The state on $\overline{RD}$ at pin 32 determines if the Z80C is reading data (low) or writing (high). The relationship between the addressed internal registers and A0, A1, and A3 is as follows.

A3	A1	A0	Register
0	0	0	Channel A Data
0	0	1	Channel A Control
0	1	0	Channel B Data
0	1	1	Channel B Control

Note that the CPU can't access U414 if A3 is high.

The CPU asserts $\overline{M1}$ at U414-8 and $\overline{IORQ}$ when it acknowledges an interrupt request. For more information on these, and the interrupt-related lines at pins 5-7, see "Interrupt Operation."

The clock input at U414-20 comes from Y401-3 and provides the basic timing for the CPU-side of the internal logic. Baud-rate timing for the serial data comes from U412-9 and enters at U414-27 for the transmitter and U414-28 for the receiver. The frequency is 16 times the baud rate, or 153.6kHz for the default speed of 9600 baud. Note that if U414 isn't installed, the signal from U412-9 will be either 50Hz or 60Hz (see "Interrupt Operation").

The $\overline{RESET}$ input at U414-21 goes low at initial powerup to initially clear the internal data and control registers. Note that this doesn't happen if AC power is momentarily lost and the backup battery is installed.

SERIAL I/O DRIVERS

A standard EIA (Electronics Industries Association) RS-232C device communicates by means of a serial stream of voltage levels that correspond to logic ones and zeros. Note, however, that negative logic is used. That is, a logic one, or mark, is defined as a negative voltage between – 3V and – 25V. Logic zero, or space, is between + 3V and + 25V. In the ID-5001, the voltage swing is from about – 10V to about + 10V. The EIA doesn't define how the circuit will respond to the transitional region, – 3V to + 3V.

U415, a standard MC1488/75188 EIA line driver, converts the TTL inputs to the ± 10V levels required by the RS-232C standard. The output impedance is 300 ohms and the signal is current-limited to ± 10mA. U413 is a standard MC1489/75189 EIA line receiver that converts the RS-232C signals to TTL levels. It has built-in hysteresis to improve noise rejection and has a 3- to 7-kilohm input resistance. These ICs connect through P408 to a DCE female DB-25 connector on the chassis. C429-C433 limit the signal slew rate to 30 volts per microsecond as specified by the RS-232C standard. L402-L406 block high-frequency signals to maintain FCC RFI regulations.

KEYPAD CIRCUITS

Refer to Pictorial 5-7 as you read the following paragraphs.

The keypad circuits consist of Q0 through Q3 of U411, U406A through U406D, the keypad assembly, and U409. RP402 is a pullup network for the open-collector inverters at U406 and the inputs of U409, while RP401 protects the CMOS inverter at U409 from static discharge. Firmware in the ROM takes care of keypad debouncing.

U417 is the port decoder that brings the enable line, U417-7, low whenever the CPU reads or writes address 0DFH. This couples to U411-1 and to U409-1. If writing to the latch at U411, the CPU next places the data on D0-D7 and brings low $\overline{WR}$ at U411-11. To read the inverters at U409, it asserts the enable line, then brings low $\overline{RD}$ on U409-15.

The keypad has 16 normally-open keys electrically arranged as four columns and four rows with each key in a column connected to a different row. The outputs of U406 connect to the columns while the rows connect to U409. The "Keypad Connection Table" shows the signal paths.

Keypad Connection Table

	U411/U406			
U409	D3	D2	D1	D0
D0	0 / TIME SET	4 / PRESSURE	8 / RAIN	ENTER
D1	1 / WIND	5 / LOW	9 / CLEAR	UNITS
D2	2 / HIGH	6 / HUMID	BAUD	AL/WARN
D3	3 / TEMP	7 / RATE	24	INDOOR

The CPU scans the keypad during the 8.33mS interrupt. It begins by reading a location in RAM that contains a copy of the logic states on pins 12, 15, 16, and 19 of U411. It places these bits on D4-D7 of the data bus, along with all highs on D0-D3, then latches them into U411. This ensures that the viewing angle and light-control bits aren't changed while it latches Q0-Q3 of U411 high.

If none of the keys are pressed, RP402 will hold all inputs to U409 high so, when the Z80 reads the keypad port, U409 will place all zeros on the bus. The CPU will respond by leaving the keypad scan routine and continue processing other parts of the timer interrupt routine.

If a key is pressed, it will couple one or more logic zeros to the inputs of U409, which places a high on the appropriate data bus line when the Z80 reads the port. The CPU responds by sending a bit pattern to the keypad port to scan for the row and column of the keypress. It does this by sequentially writing a logic one to each column beginning with D3 and ending with D0. Within each column, it will scan each row from D0 to D3.

For example, when the Baud key is pressed, the Z80 begins the scan by latching XXXX1000B into U411, activating the D3 column as shown in the "Keypad Connection Table." Next, the CPU reads U409, which places lows on D0-D3 since none of the keys in the D3 column are closed. The Z80C responds by shifting the high to D2 (XXXX0100) and again performing a keypad write/read test. Once again the Z80 reads back all lows, so it shifts the scan bit to D1. This time it gets a nonzero result, so it scans each bit (starting with D0) until it locates a logic one. In this case, it will be the Baud key on the D2 row. The Z80C will store the bit and row position information and then continue scanning the remaining rows and columns. This is necessary because several functions available to the ID-5001 require pressing two keys at the same time.

Once the CPU gets the keypad data, it stores the information in RAM for further processing by another part of the program.

DISPLAY CIRCUITS

The display circuits are designed around three HD61604 surface-mount LCD driver ICs and a custom liquid crystal display. Refer to the display driver schematic and display schematic board as you read the following.

LCD101 on the display board was designed by Heath Company but is custom manufactured for Heath by Toshiba. It's a back-lit display with front and rear polarizer films that keep it opaque until a potential difference is applied across one of the two backplanes and the appropriate segments to be lit. As with most LCDs, the backplane voltage and segment voltage are pulsing between zero and +5 volts and are 180° out of phase. This effectively places an AC signal across the electrodes and thus prevents damage to the DC-sensitive liquid crystal.

Because there are so many segment on the display, the Weather Computer uses HD61604 display drivers to multiplex the segment data being sent to the display. These ICs are located at U201-U203 on the driver board and do most of the work interfacing the Z80C to the LCD. The pins on the computer-side of these chips consist of an input-only data bus, D0-D7 at pins 1-10 and 12-15, a READY handshake line at pin 2, chip-select and write/read lines at pins 3-5, and some special control lines at pins 16-22, 78, and 80. LCD control lines consist of two backplane-select lines at pins 23 and 24, and 51 segment drivers at pins 27-77.

The ground return is at pin 11 and VCCB supplies +5 volts at pin 1. Since the battery-backed supply is used, the chips remain active during an AC power failure. (You can verify this by removing the light shield on a battery-backed unit and shining a strong light behind the LCD. You'll be able to see segments for the functions that hadn't been shut down — the time for example — still working.) Since these chips typically draw less than 100µA, it's easier to let them keep running rather than add the cost of standby circuits or extra code to reprogram them after each power failure (which would be necessary if they were connected to VCCA).

The oscillator at U204A and U204D generates the internal timing for the driver ICs. C207, R203 and R204 set the frequency to about 125kHz. The output at U204D-11 connects in parallel to pin 80 of U201-U203 to clock the three chips. To make sure the chips operate in phase, the CPU pulses the SYNC line at U204B-4 (from U417-13 on the main board) several times at powerup. The high on this line connects in parallel to pin 78 of each driver and resets the internal registers so that they start at the same count. From then on, the drivers do not require resynchronization, so the CPU won't pulse U204B-4 again unless AC power is momentarily lost and the backup battery isn't installed.

V1, V2, and V3 at pins 21, 21, and 22 set the voltage levels that the driver will send to the LCD. VREF1 and VREF2 at pins 16 and 17 internally set maximum levels for these. As will be explained in more detail later, the LCD requires a stepped voltage to light a segment. VREF2 sets the high voltage, V1 the intermediate voltage, and V2/V3 the lowest voltage. R205, R206, and R207 provide the initial voltage levels. These resistors are only needed on U203 since it's the only one that supplies the stepped voltages (pins 23 and 24). C209 and C210 provide filtering. With the exception of the resistors, the VREF and V1-V3 lines are wired the same on all three chips.

The viewing angle control voltage, from P205-1, connects in parallel to V2 and V3 of each driver. This is a stepped voltage from U411 and a simple D/C converter at Q408 on the main board. It controls the minimum voltage to the LCD and thus the total angle the LCD nematic crystals will move when switched between on to off. The result is that the display can be programmed to appear brighter when viewed from one angle than from another. (Also, if you adjust the viewing angle without changing your position, it's analogous to adjusting the contrast control on a CRT-based display.)

The READY line at pin 2 is a handshake line that synchronizes the Z80C to the driver IC it is addressing. This includes programming the driver and sending display data to it. All three READY lines are tied in parallel to the D0 data line and are open collector, so R202 is present to act as a pull-up resistor. Before the CPU writes to one of the drivers, it first reads the IC by bringing low the $\overline{\text{RE}}$ line at pin 5 and the appropriate $\overline{\text{CS}}$ line at pin 3. If the driver IC is busy with internal processing, it will respond by placing a logic zero on the READY line and continue with its own work. The Z80C reads the low on D0 (and ignore D1-D7) and will loop back and try again. Once the driver chip is ready to accept data, it will go to its high-impedance state. The Z80C interprets this as a logic one due to R202 and prepares to write the data. It does this by placing the data on the bus and asserting the $\overline{\text{WR}}$ line at pin 4 and $\overline{\text{CS}}$ at pin 3. When the CPU returns these two lines high, the data latches into the addressed driver.

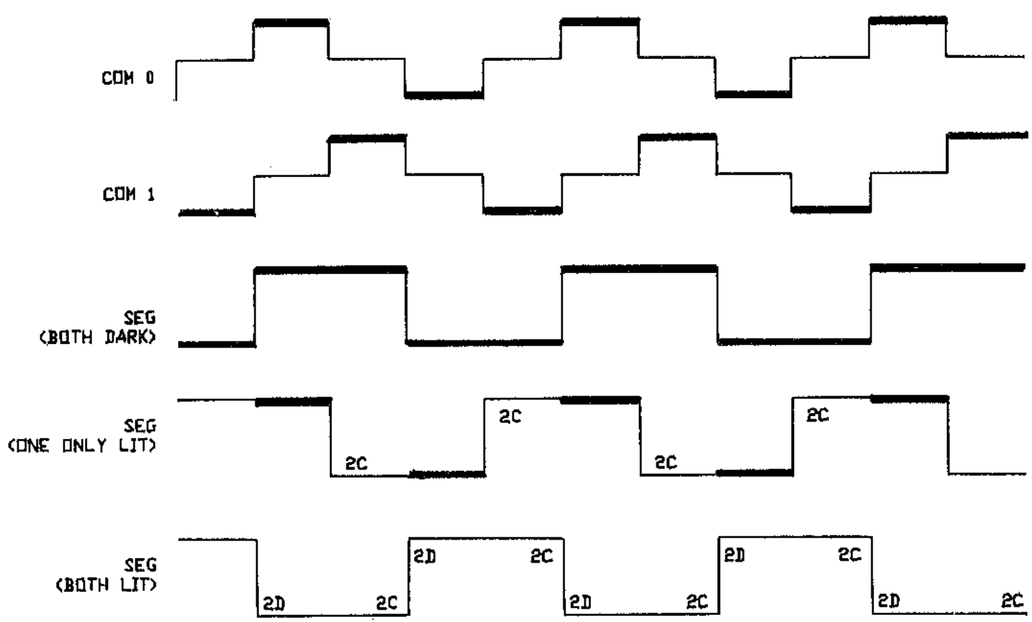
Note that D0-D7 are input-only lines to the drivers, the CPU can only write to them to program the ICs or to output display information. At powerup, the Z80C programs each driver for 1/2-duty cycle operation and then loads the initial display data. One-half duty cycle operation sets up the LCD backplane lines for three-level operation, activates only two of the four available lines (COM0 and COM1), programs the driver to treat any incoming data as a seven-segment display pattern.

When the CPU writes a seven-segment display pattern to one of the display drivers, it first sends a byte representing the segment address. This is a number that selects one of twelve possible segment groups. A segment group consists of four SEG lines at the outputs. For example, group zero is SEG00-SEG03 at pins 77-44, while group one is SEG04-SEG07 at pins 73-70

After addressing the appropriate segment group, the Z80C sends the data byte. The driver IC will store in in the segment group location using the following format.

	COM0	COM1
SEGn	Bit 7	Bit 6
SEGn+1	Bit 5	Bit 4
SEGn+2	Bit 3	Bit 2
SEGn+3	Bit 1	Bit 0

When it is time to display this information, the display driver will alternately activate the COM0 and COM1 lines to multiplex the 8-bit pattern into four segment lines. COM0 and COM1 at pins 23 and 24 of U203 control the two LCD backplanes. (The COM lines from U201 and U202 aren't needed since these ICs are SYNCed to U203.) To light a segment, the logic states on the SEGn+x outputs must 180° out of phase with the associated COM line. To see how this is done, refer to the "Segment Driver Timing Diagram."



SEGMENT DRIVER TIMING DIAGRAM

As discussed earlier, the COM0 and COM1 lines are a stepped voltage. They vary from zero volts (set by V2/V3), to about + 2.5 volts (set by V1), to about + 5 volts (set by VCCB). COM0 leads COM1 by 1/4 cycle, or 90° to ensure that the maximum and minimum levels don't overlap, which may cause ghosting. Assume that the three waveforms following COM0 and COM1 represent different conditions of segments DG2b and DG2c in the tens-of-hours display. The specific driver line is U203-55. COM0 controls DG2c and COM1 controls DG2b (see "Troubleshooting").

To make an LCD segment become transparent (light up), the segment driver line must be opposite the logic state of the COM line. The heavy dark lines in the timing diagram show when they are the same state and the segment is dark.

When both segments are dark, the SEG(BOTHDARK) waveform shows that it's in phase with the extremes of both COM lines. In this case, no voltage difference exists, so the segments do not become transparent. Note that while there is some potential difference between the segment driver line and the time the COM line is at its step voltage, it isn't enough to trigger the transparent mode. If the step voltage wasn't present, then ghosting could occur due to the overlap of the phase-shifted COM waveforms.

If U203 had to light the DG2c segment, but not DG2b, it would shift the segment driver signal forward 90° so that it is 180° out of phase with COM1 (marked "2C" in the diagram), but in phase with COM0. To light both segments, U203-55 shifts the signal so that it's 180° out of phase with both extremes of the COM lines. This will cause the DG2d and DG2c segments to light at the times indicated on the timing diagram.

FLUORESCENT LIGHT CIRCUITS

Refer to Pictorial 5-8 as you read the following paragraphs.

The CPU controls the display lighting by supplying a 60Hz square wave through U411-12 on the main board to the bases of Q301, Q312, and Q313 on the power supply board. Refer to the power supply schematic as you read the following.

At powerup, the CPU drives the light control line at S303-5 (from U411-12) low for about ten seconds. Q301 turns off and causes Q302 and Q304 to saturate. In turn, these transistors ground the bases of Q305 and Q306 through D301 and D303, which kills the 30kHz oscillator.

At the same time, the low on the light control line turns off Q312 and Q313 to turn on Q308-Q311. This causes current flow through Q311, filament 1 of the fluorescent lamp, T302, T301, and to the lamp supply regulator, U301/Q307. The circuitry for the filament 2 side of the lamp works in the same manner. This ten-second warmup heats the filaments and makes it easier for the lamp to light.

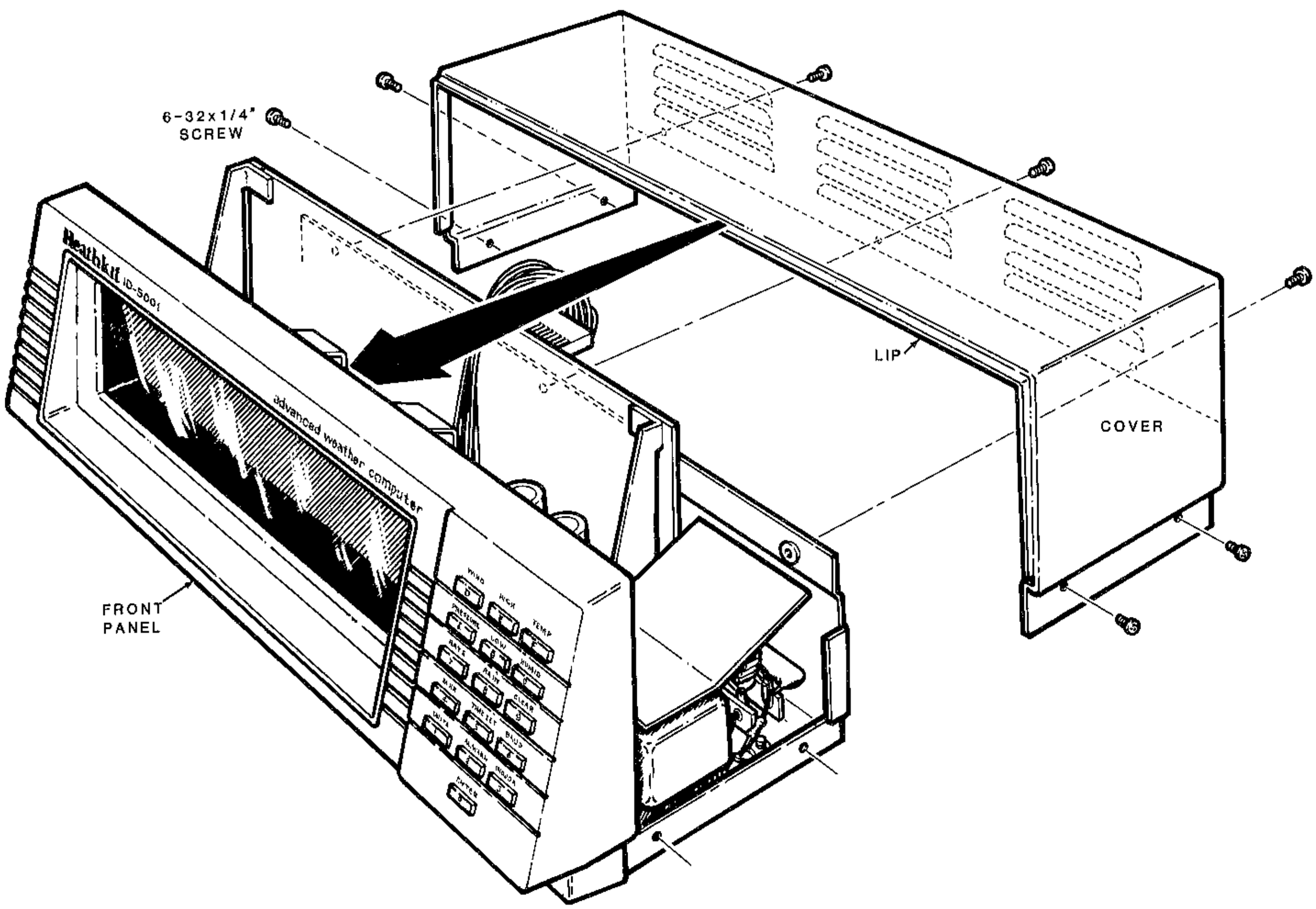
At the end of ten seconds, the Z80C starts toggling the light control line to its opposite state during every other 8.3mS interrupt, resulting in a 60Hz signal. Each time S303-5 goes high, Q302 and Q304 turns off and allows Q305 and Q306 to oscillate. This results in a 120VP-P, 30kHz signal (with a 27 μs spike of about 500V) at pins 1 and 5 of S303 which lights the lamp.

At the same time, the Z80C monitors the output of the light sensor on the front panel and controls the duty cycle of the light control line according to the ambient light level. If in a normally-lit room, the duty cycle is roughly 50%. If in a bright sunlit area, it will increase the duty cycle to brighten the lamp and make the display easier to read. At night, it reduces the duty cycle to reduce the on-time and thus dim the lamp so it won't disturb sleepers. The duty cycle range is roughly 30% to 60%.

The lamp circuits use their own regulated supply to isolate its high-energy switching noise from the rest of the Weather Station. The +22VDC supply connects to U301-3, which controls Q303 and the pass transistor at Q307. R304 and R309 returns a portion of portion of the output voltage to U301-6 to set the regulator output to about +17.5VDC. The tap at R303 and R307 lets U301-1 monitor the voltage across R301 and R302. If the current through R301 and R302 exceeds a predetermined value, the regulator circuit will quickly reduce the output current to less than 200mA. This foldback action protects Q305 and Q306 against excessive currents that may develop if the lamp does not light.

DISASSEMBLY

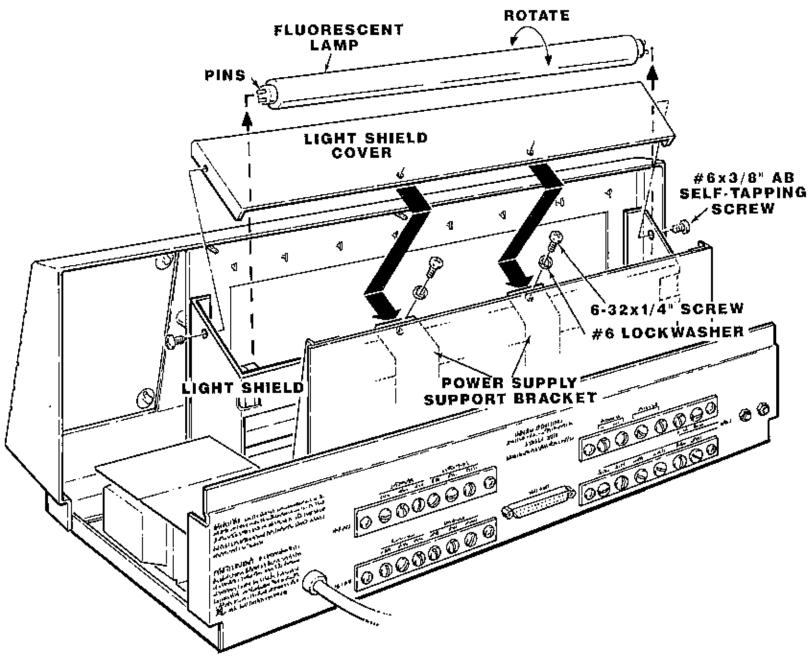
COVER REMOVAL



PICTORIAL 6-1

- Remove the seven 6-32 × 1/4" screws at the indicated locations.
- Pull the cover away and place it someplace where it will not get scratched.

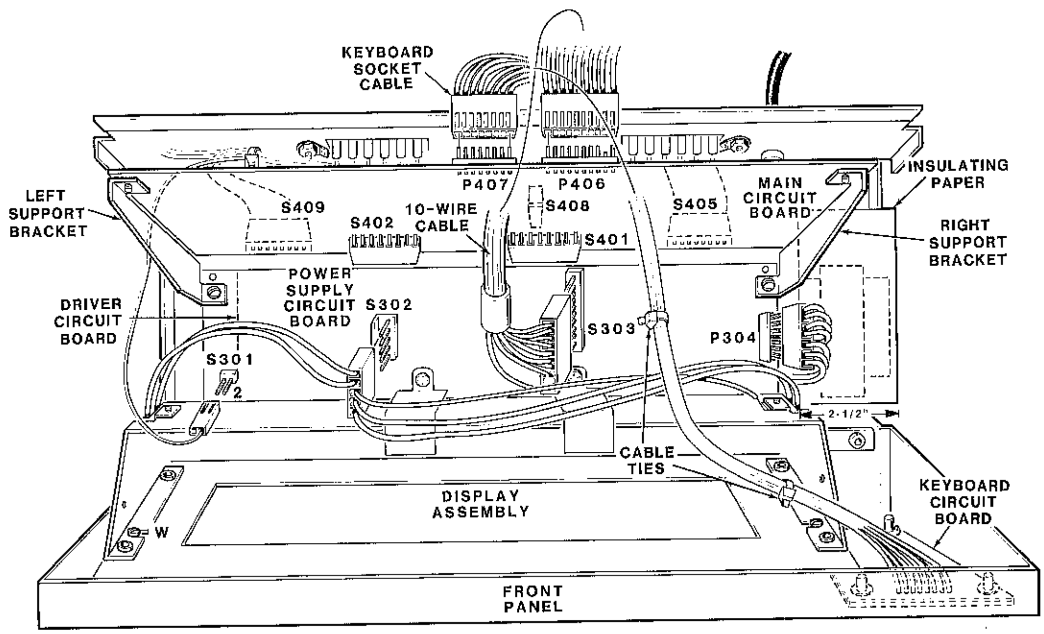
FLUORESCENT LAMP ACCESS



PICTORIAL 6-2

- Remove the two 6 × 3/8"AB self-tapping screws from the sides of the light shield cover.
- Remove the two 6-32 × 1/4" screws and #6 lockwashers from the power supply support brackets.
- Lift off the light shield cover.
- Grasp the lamp near both ends and carefully rotate it for about 1/4 turn in the direction of least resistance. (It may be either direction.)
- Lift out the lamp.

MAIN CIRCUIT BOARD REMOVAL



PICTORIAL 6-3

- Unplug S409 and S405 from the bottom of the main circuit board.
- Unplug S408 from the bottom of the main board if the RS-232C interface is present.
- Unplug the connectors from P406 and P407 at the top of the main circuit board.
- Remove the two sets of 4-40 × 1/4" hardware from the top of the left and right support brackets.
- Carefully lift the main circuit board until the sockets at S402 and S401 clear their mating connectors on the driver board (beneath the power supply board).

When you are reinstalling the main circuit board, make sure S401 and S402 are not offset by one pin when they are plugged into the display driver board.

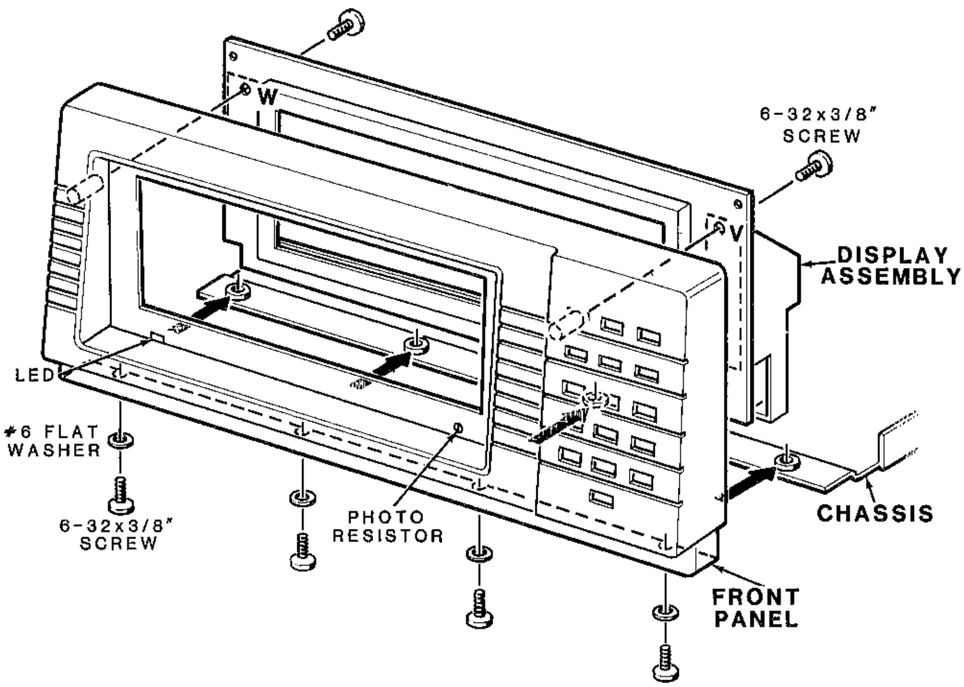
POWER SUPPLY BOARD REMOVAL

Refer to Pictorial 6-3.

- Remove the main circuit board. (See "Main Circuit Board Removal.")
- Unplug S301, S302, S303, and P304.
- Remove the two sets of 6-32 × 1/4" hardware that hold power supply support brackets to the light shield. (See Pictorial 6-2.)
- Remove the left and right support brackets from the back of the power supply board. **NOTE:** Be sure to replace the #6 fiber shoulder washers at these locations when reassembling.
- Remove the two 6-32 × 1/4" screws from the front of the power supply board.
- Lift out the power supply board.

When you are reinstalling the power supply and main circuit boards, do not tighten all the hardware until all of it is installed.

DISPLAY AND DISPLAY DRIVER REMOVAL

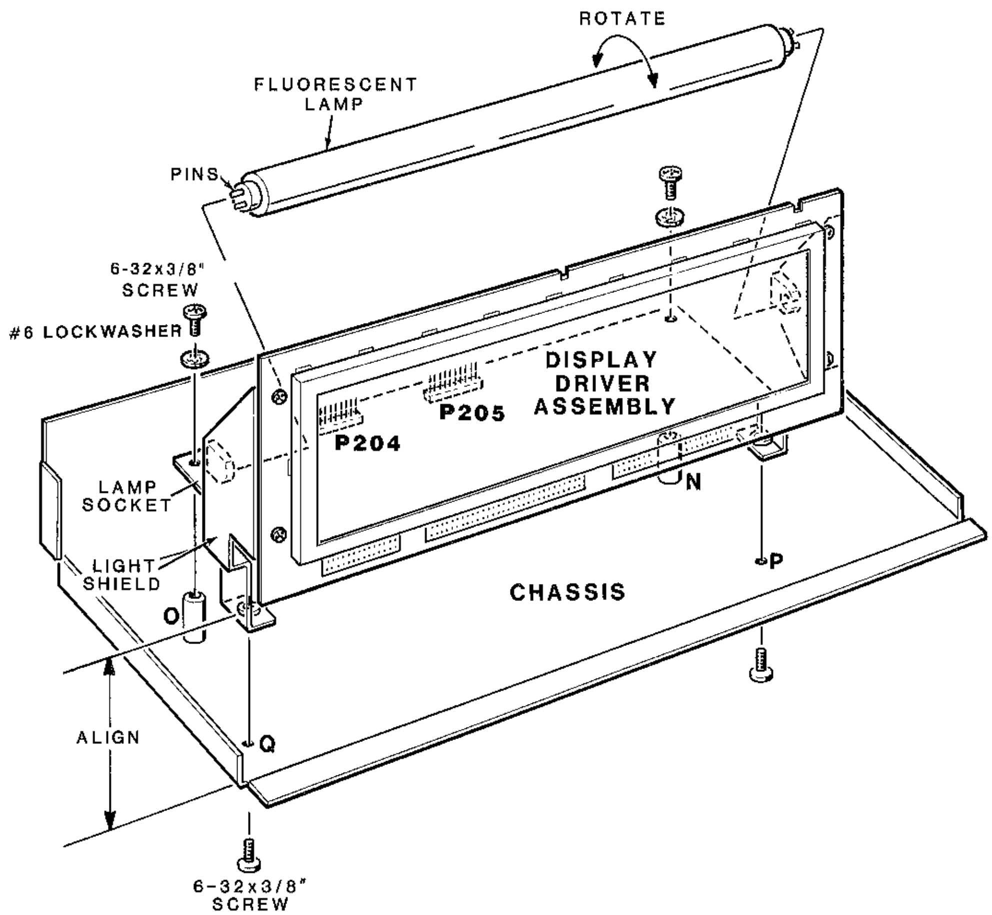


PICTORIAL 6-4

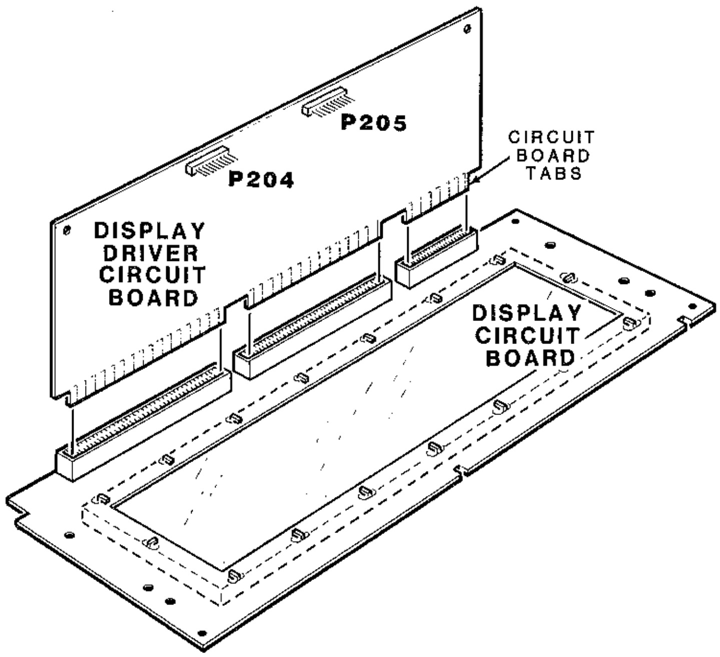
- Remove the main circuit board. (See "Main Circuit Board Removal.")
- Remove the light shield cover. (See "Fluorescent Lamp Access.")
- Loosen the four 6-32 × 3/8" screws that hold the front panel to the bottom of the chassis. (It is not necessary to remove them.)
- Remove the two 6-32 × 3/8" screws shown above at locations W and V.
- Lift off the front panel.

When you are re-installing the front panel, make sure the keypad keys, photo resistor, and LED are properly mounted before you tighten the hardware.

- Remove the two sets of 6-32 × 3/8" hardware from the rear corners of the display driver board (at O and N on Pictorial 6-5).
- Unplug the lamp power cable from S302 (See Pictorial 6-3) on the power supply circuit board.
- Remove the screws from the bottom of the chassis at P and Q.
- Remove the display driver board and circuit board assembly from the chassis.



PICTORIAL 6-5



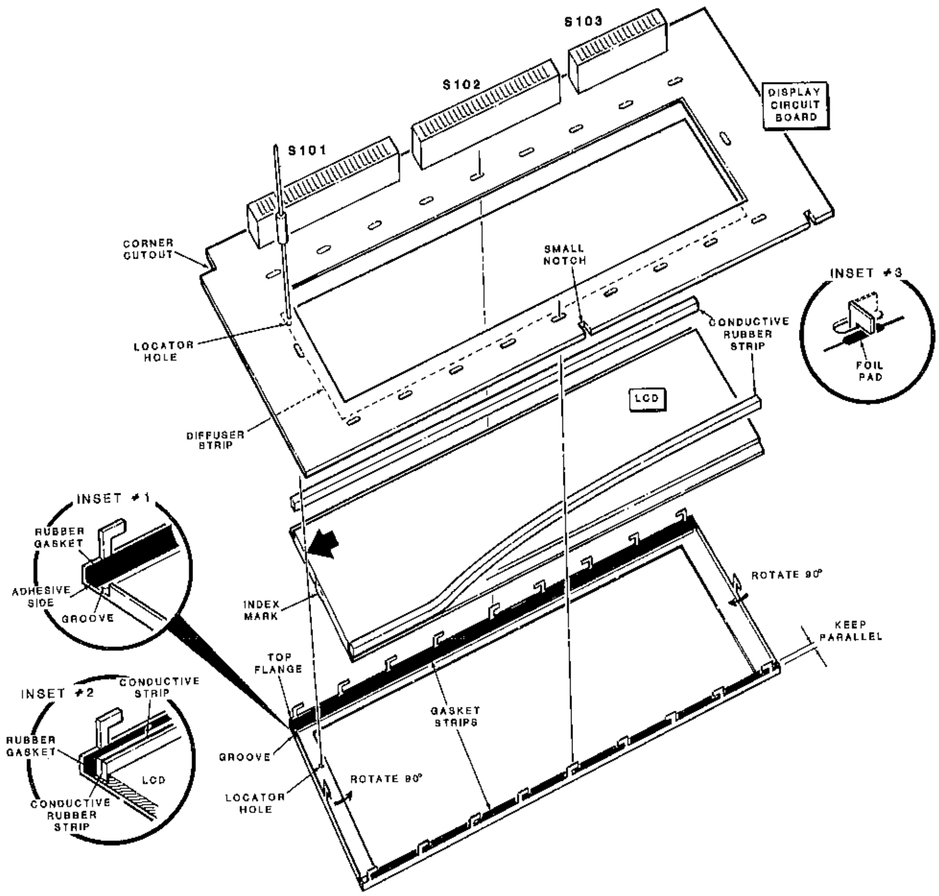
PICTORIAL 6-6

- Carefully unplug the display driver circuit board from the display circuit board.

DISPLAY CIRCUIT BOARD

DISASSEMBLY

CAUTION: The LCD is a very fragile electronic component. Be careful when you handle it that you do not bump or drop it. Also be careful not to touch the conductive surfaces along the edges of the display.



PICTORIAL 6-7
LCD exploded view.

- Refer to Pictorial 6-5 and remove the four screws that secure the light shield to the display driver assembly.

- Remove the light shield and set it aside.

- Lay a soft cloth on your work surface.
- Place the display circuit board assembly face down on the cloth.
- Refer to inset drawing #3 on Pictorial 6-7 and rotate the tabs on the LCD frame until they are parallel with the slots on the display circuit board (dashed lines).
- Carefully lift the display circuit board away from the LCD.

To reassemble, refer to the next section.

REASSEMBLY

Though reassembling the display board is a simple procedure, you must do some of the steps carefully. For example, if you do not handle or install the elastomeric strip properly, you could end up with missing segments or crosstalk between segments. Perform each step in the following procedure.

- Lay a soft cloth on your work surface.
- Position the LCD frame on the cloth with the locator hole to the left and the tabs facing up.
- Replace the 1/8" × 10" gaskets (#73-250) if they are loose or not installed as shown in inset drawing #1 of the "LCD Exploded View."
- If you are replacing the LCD, unpack the new one and remove the protective covering from both sides of the display.
- Position the LCD with the index mark (small glass bulge) to the left with the flat side of the glass against the cloth (notched edges up).
- Carefully place the top edge of the LCD firmly against the top gasket strip. Then lower the bottom edge of the LCD so that it fits inside (not over) the lower gasket strip. The LCD should fit between the gasket strips, which help center it in the frame. Use a small knife blade to position the gasket as necessary.
- Slide the LCD over so the left edge is aligned with the edge of the locator hole, but not covering it.

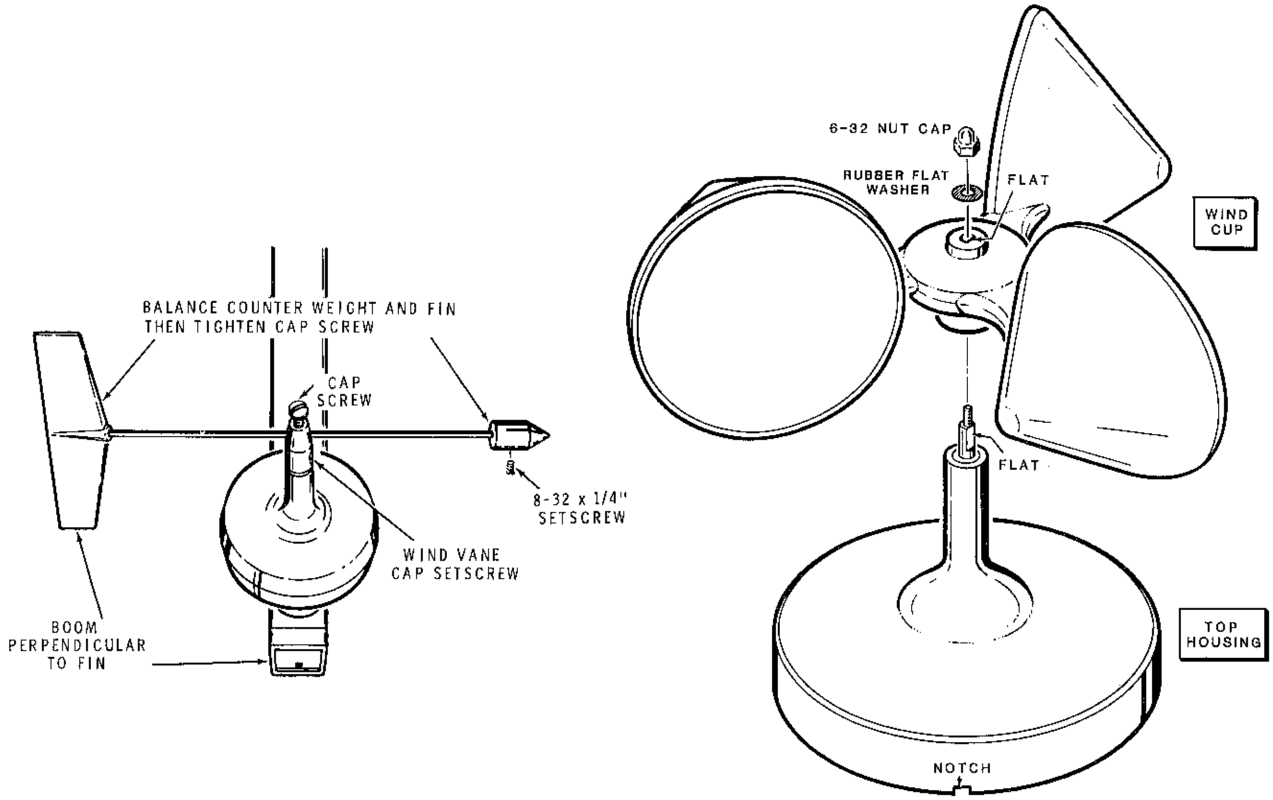
NOTE: Do not touch the edges of the black conductive rubber when you handle the elastomeric strips in the following steps.

- Position an elastomeric strip (#432-1607) so that it's black conductive portion is perpendicular to your work surface.
- Tuck the strip between the top of the LCD frame gasket and the lip of the LCD as shown in inset drawing #2. Keep the gasket parallel with the edge of the flange as shown in the inset.
- Similarly install the remaining strip along the bottom of the LCD.
- Place the white diffuser over the LCD surface so the edges align.
- Position the display circuit board over the LCD assembly with the corner cutout and the small notch positioned as shown in Pictorial 6-7.
- Lower the board over the frame so the frame tabs fit into the circuit board holes. Make sure the diffuser and conductive strips remain positioned properly as you mount the circuit board.
- Insert a resistor lead through both the LCD frame and circuit board locator holes.
- Slide the LCD and diffuser against the resistor lead. Make sure that both the LCD and diffuser contact the lead.
- Remove the resistor.
- Press firmly against the center of the circuit board and twist the top center LCD frame tab 90° so it faces the display and over the indicated foil pad as shown in inset drawing #3 on Pictorial 6-7.
- Similarly twist the bottom center tab 90° so it faces the LCD.
- Starting at the top and bottom center tabs and working outward in both directions, alternately twist the remaining top, bottom, and end tabs 90° toward the display. Press down firmly on the board as you go.
- Reinstall the light shield and secure it with the four screws you removed earlier.

This completes the reassembly.

BOOM DISASSEMBLY

Perform the steps in "Wind Vane" disassembly or "Wind Speed Disassembly" as appropriate.



PICTORIAL 6-8

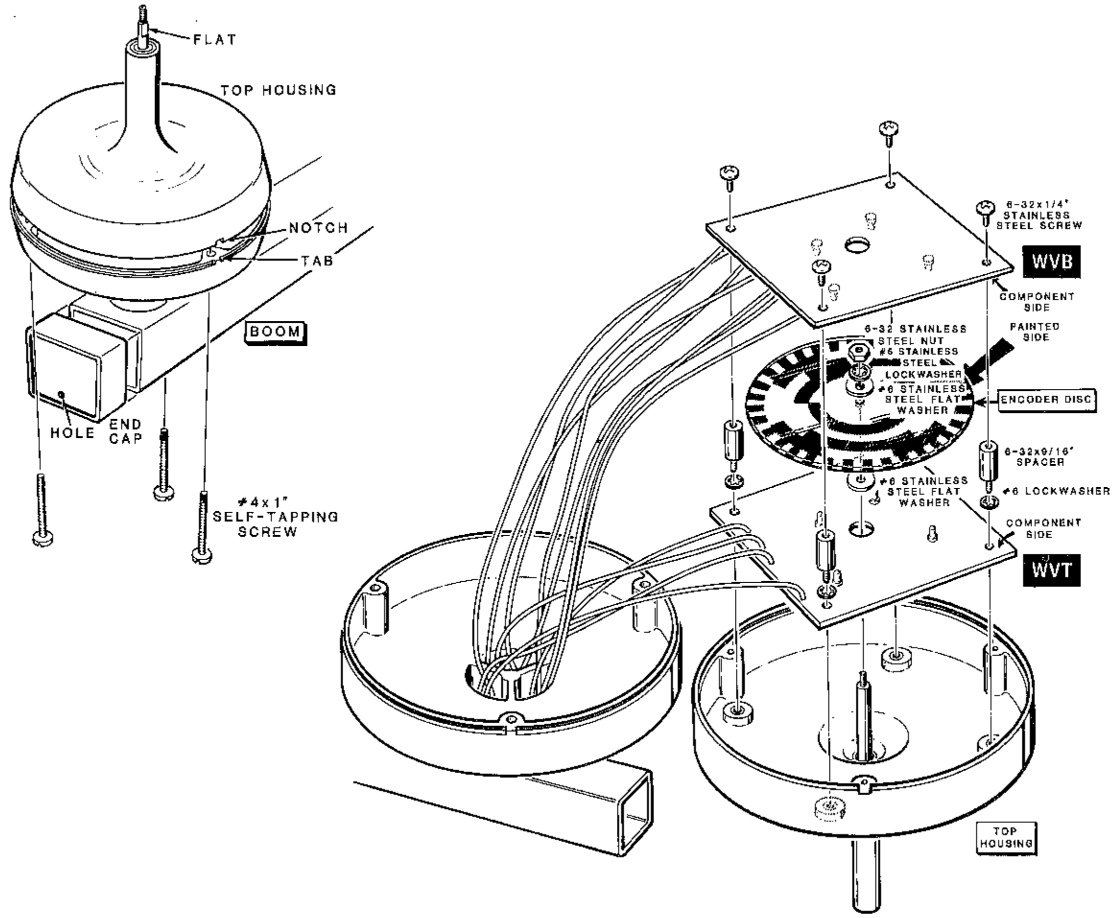
WIND VANE

If you just need to replace or adjust the wind vane, perform only the next two steps. Otherwise, skip to the third step.

- Loosen the cap screw and the 8-32 × 1/4" setscrew in the counterweight.
- Remove the counterweight and slide the wind vane out of the wind vane cap.
- Loosen the wind vane cap setscrew and lift off the wind vane assembly.
- Proceed to "Housing Disassembly."

WIND SPEED

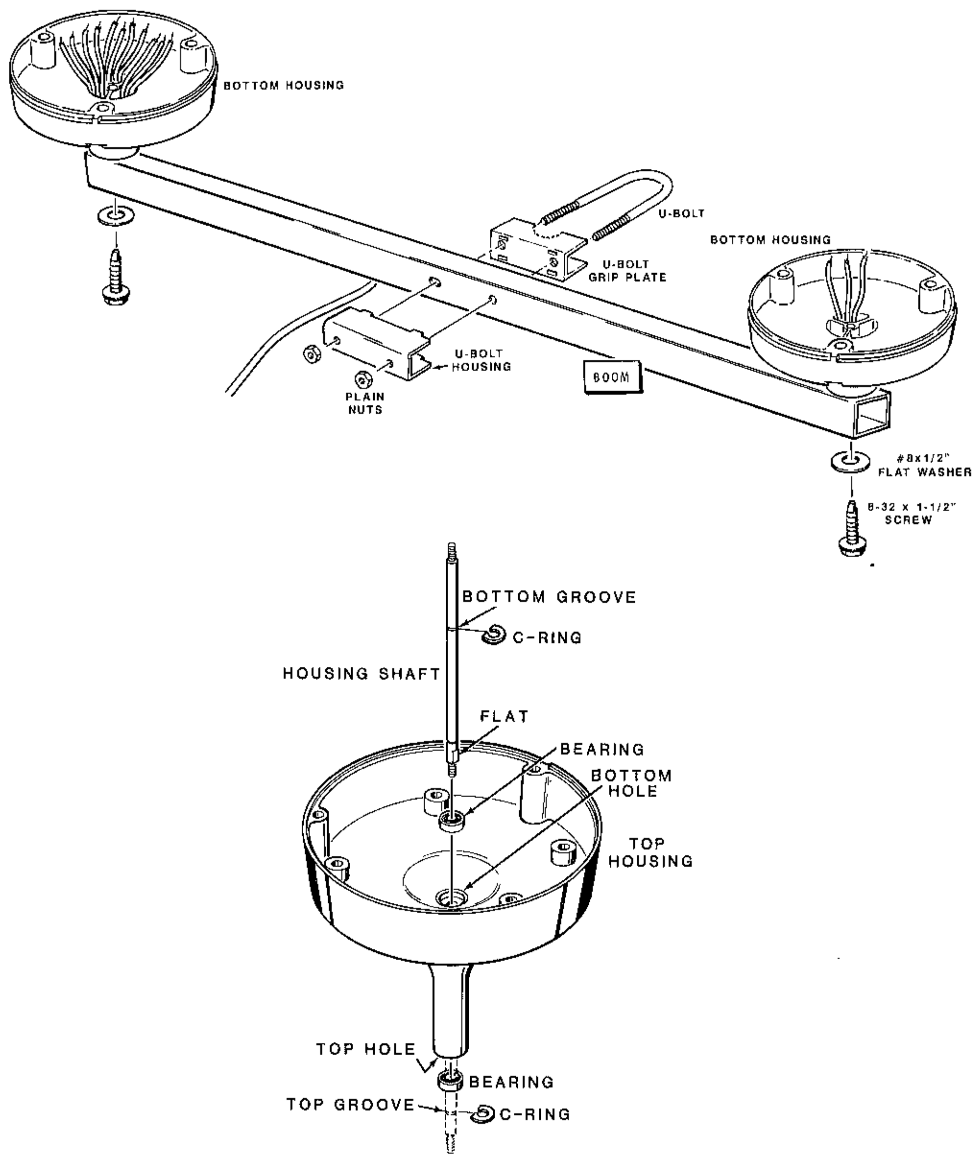
- Remove the 6-32 nut cap and rubber flat washer.
- Lift off the wind cup assembly.
- Proceed to "Housing Disassembly."



PICTORIAL 6-9

HOUSING

- Remove the three #4 × 1" self-tapping screws that hold the two sensor halves together.
- Lift off the top housing.
- Remove the four 6-32 × 1/4" stainless steel screws which hold the bottom circuit board to the spacers and remove this board.
- Remove the 6-32 stainless steel nut, lockwasher, and flat washer which hold the encoder disk to the housing shaft.
- Remove the four 6-32 × 9/16" spacers and #6 lockwashers which hold the top circuit board to the housing top.
- Refer to the "Boom Assembly Exploded View" on Page 6-14 to remove the bottom housing or the housing shaft from the top housing.



PICTORIAL 6-10

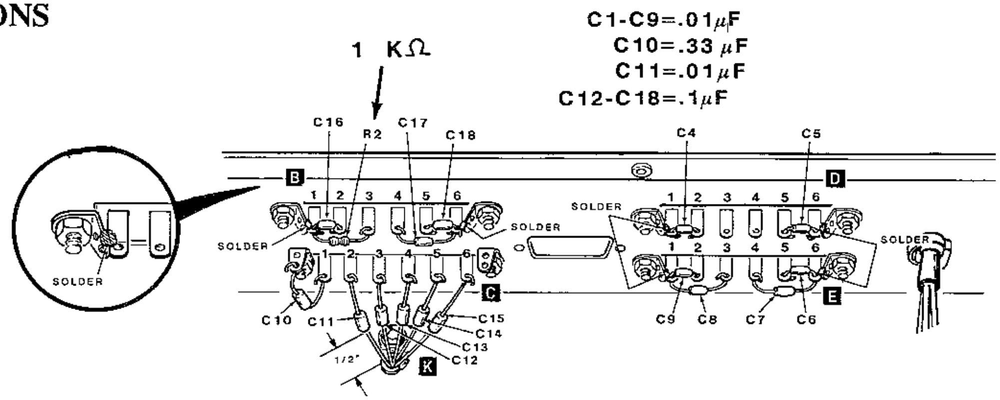
Boom assembly exploded view.

VISUAL CHECKS

NOTE: The illustrations in this section have been turned 90 degrees (printed sideways) on the pages so they will be larger and easier for you to read. Refer to the "Parts Lists" and "Circuit Board X-Ray Views" sections for information about parts and circuit board details.

CHASSIS

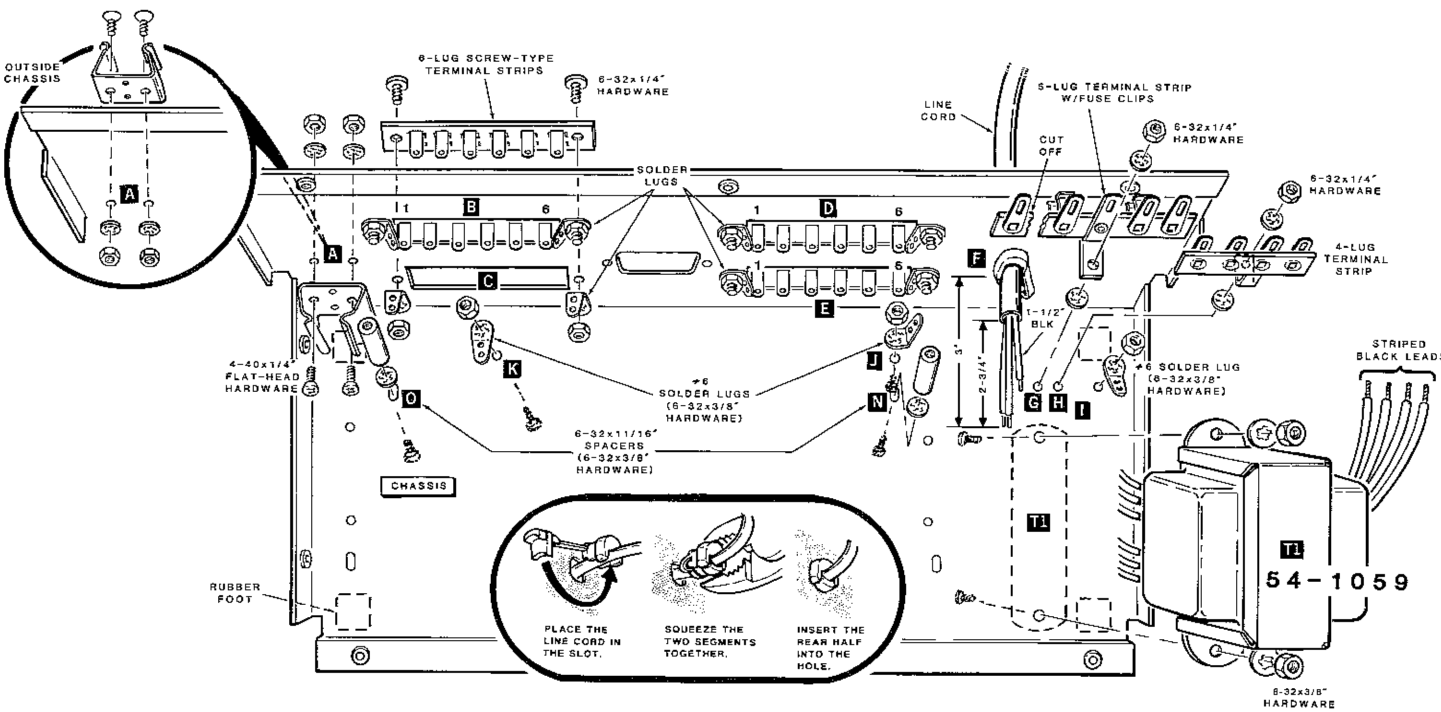
REAR PANEL HARDWARE LOCATIONS



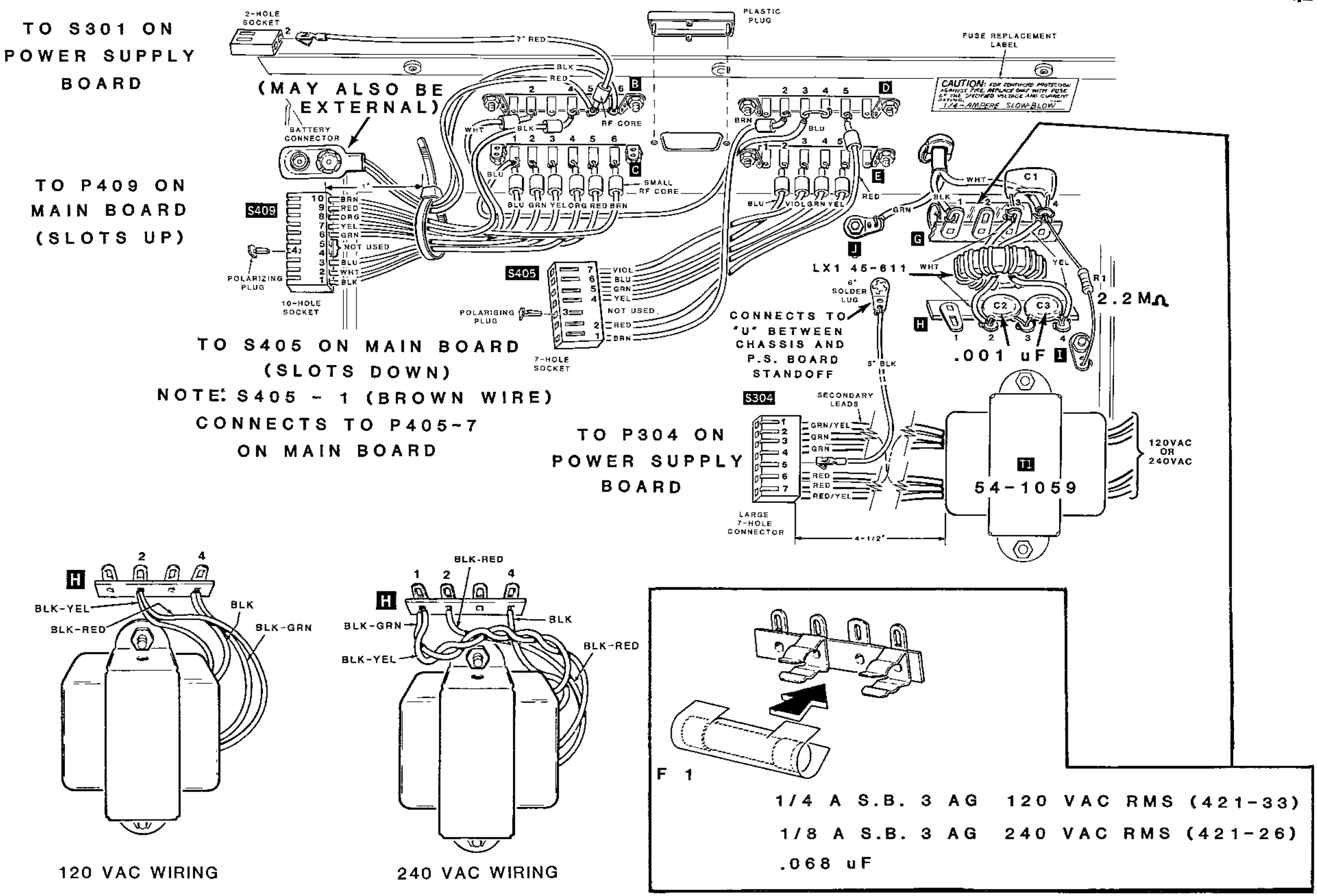
OPTION 1

BATTERY BACKUP

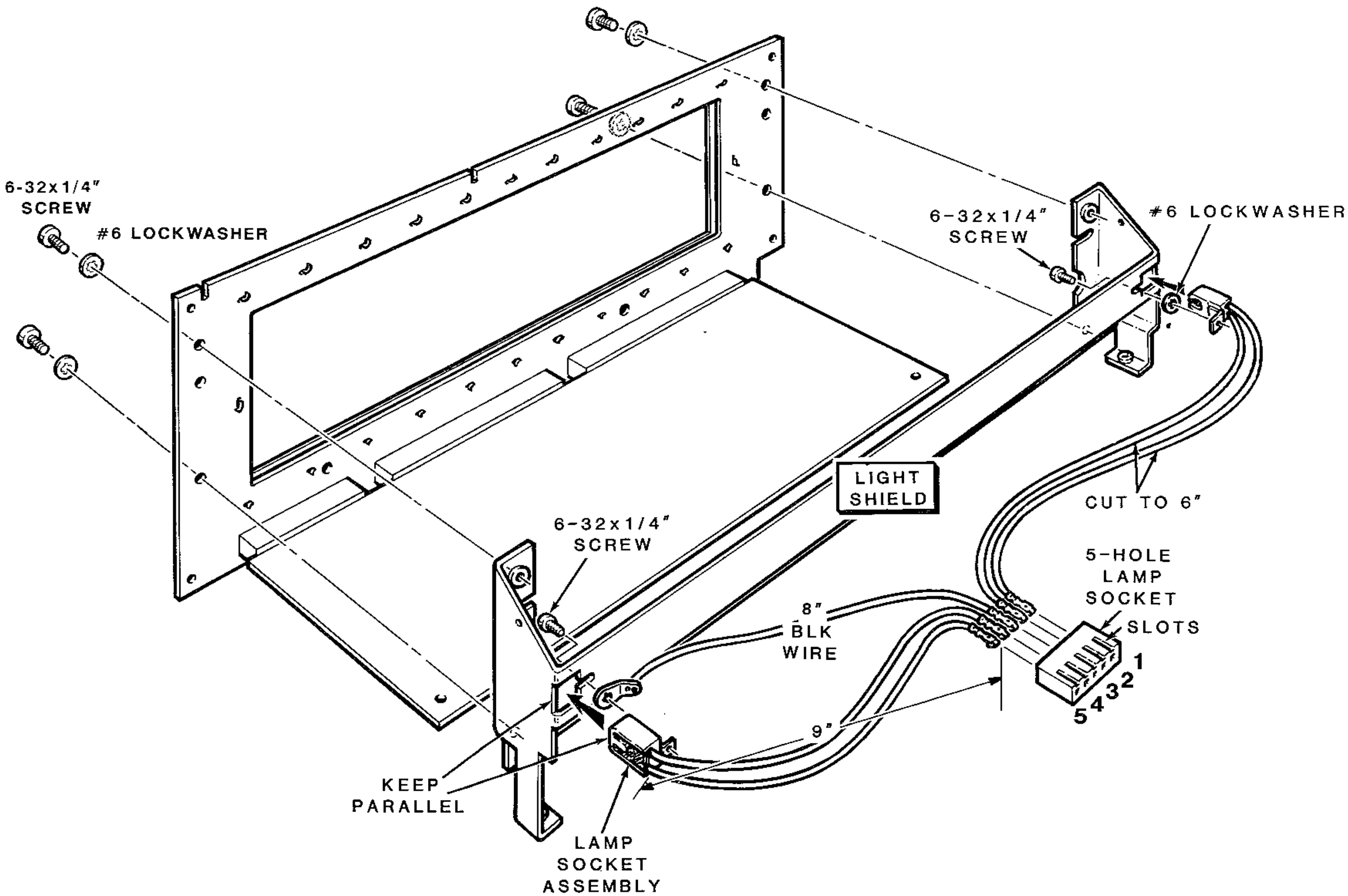
HOLDER LOCATION



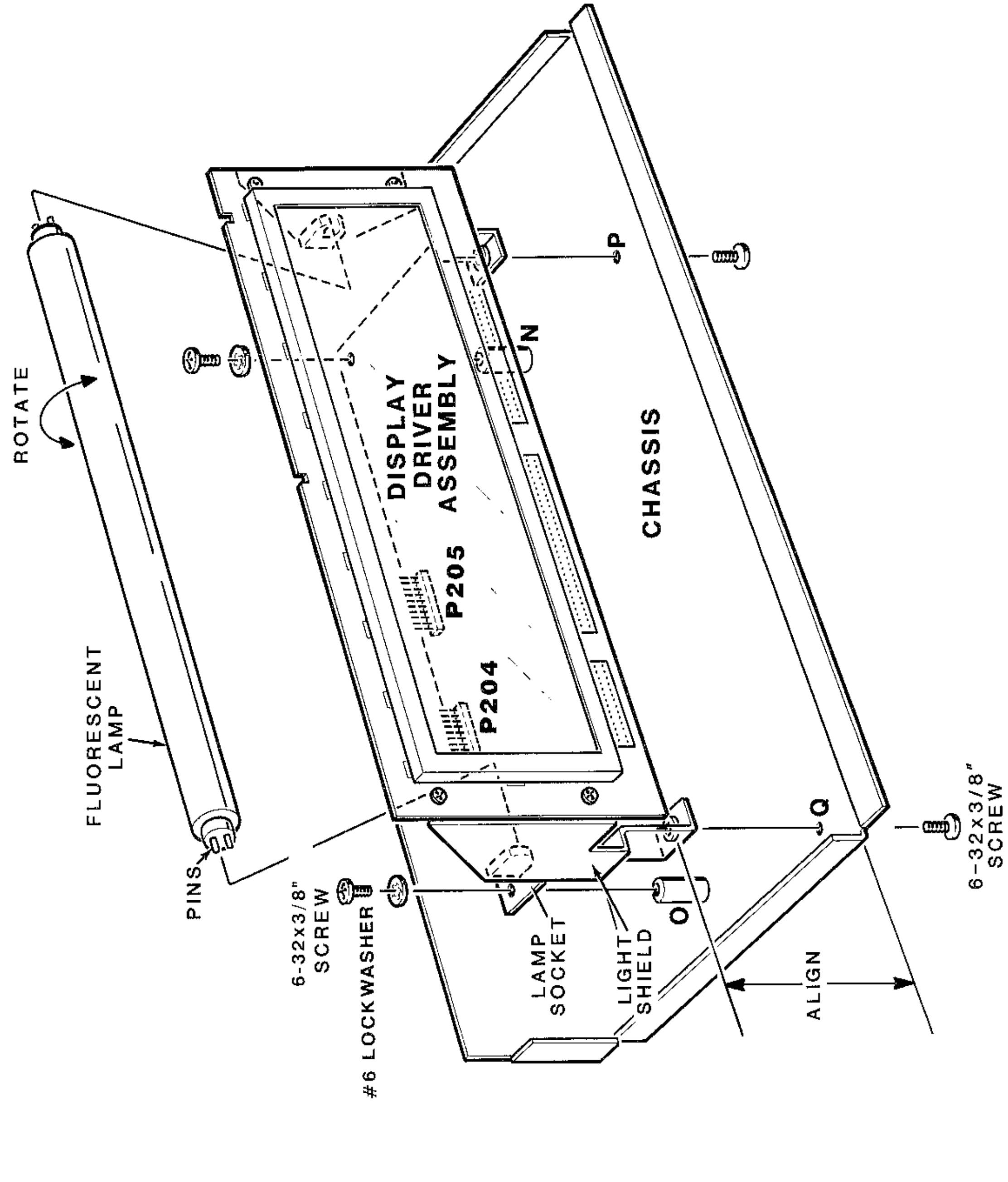
REAR PANEL WIRING



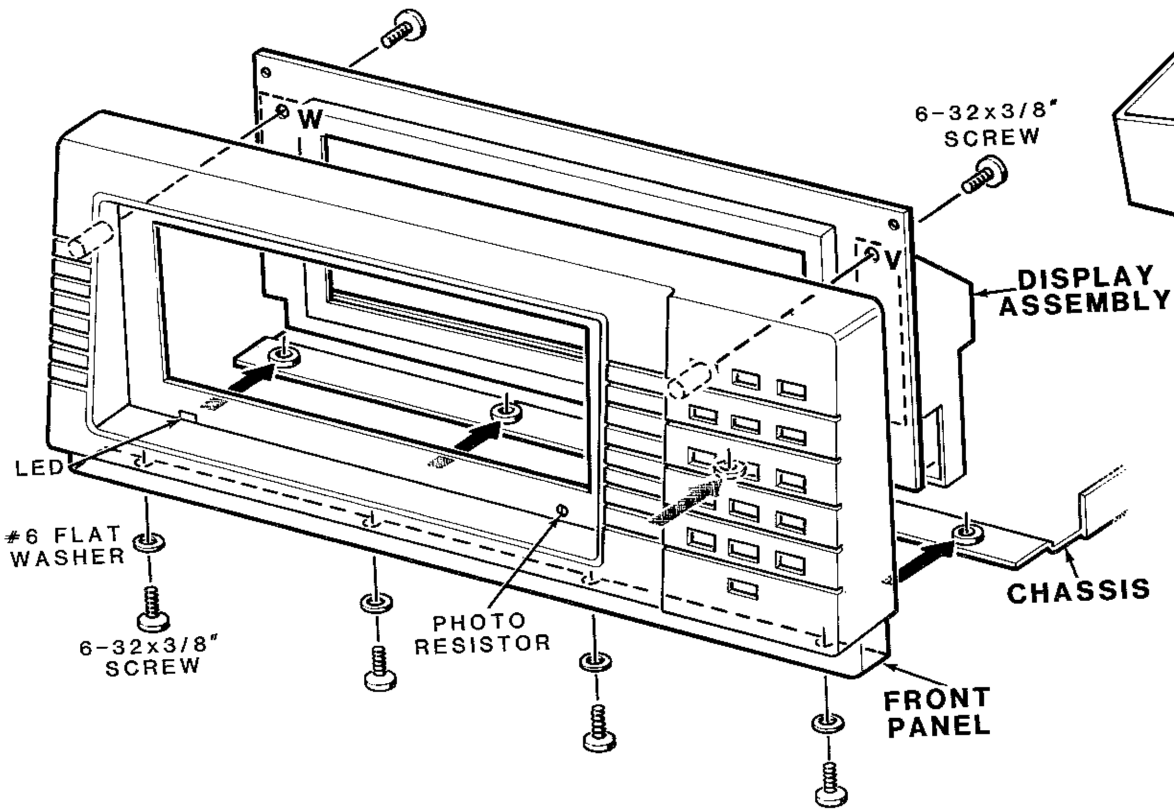
DISPLAY ASSEMBLY WIRING AND HARDWARE LOCATIONS

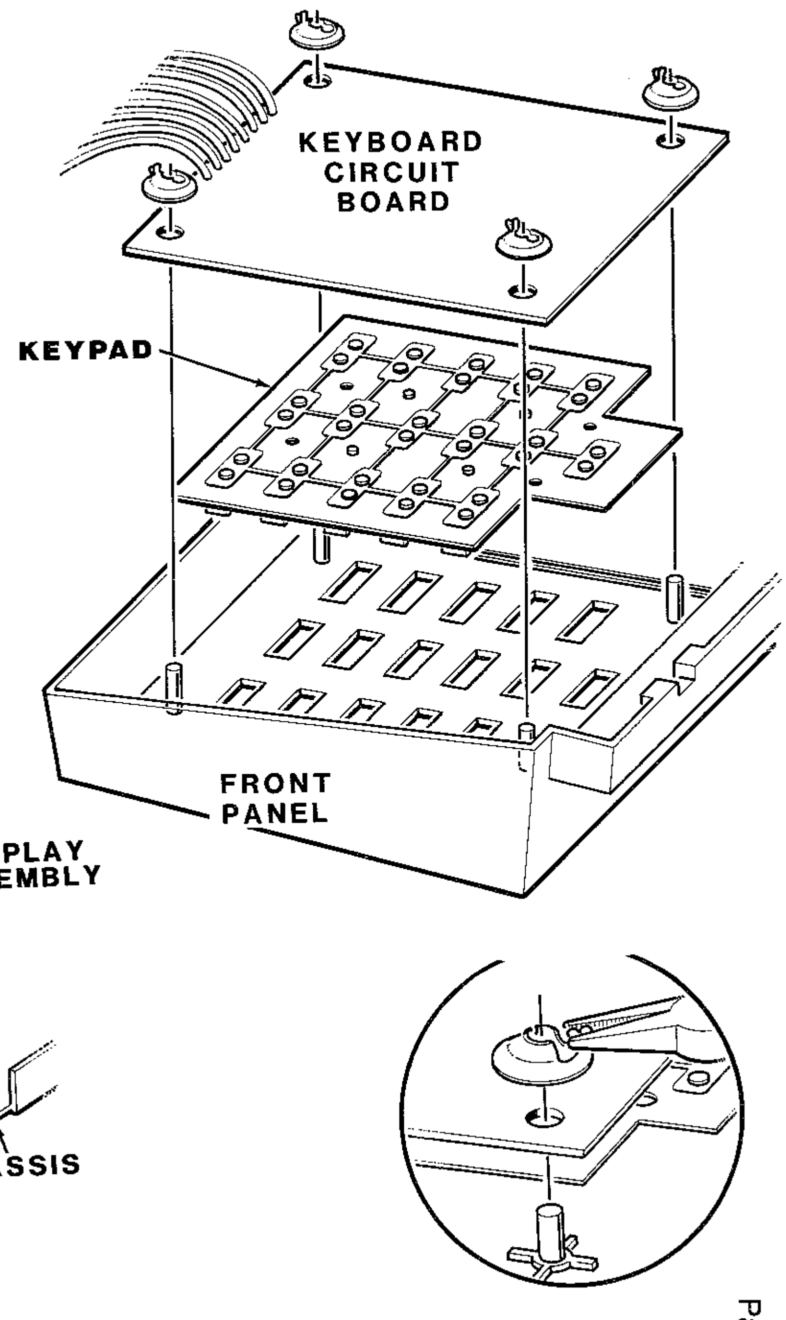


DISPLAY ASSEMBLY CHASSIS MOUNTING

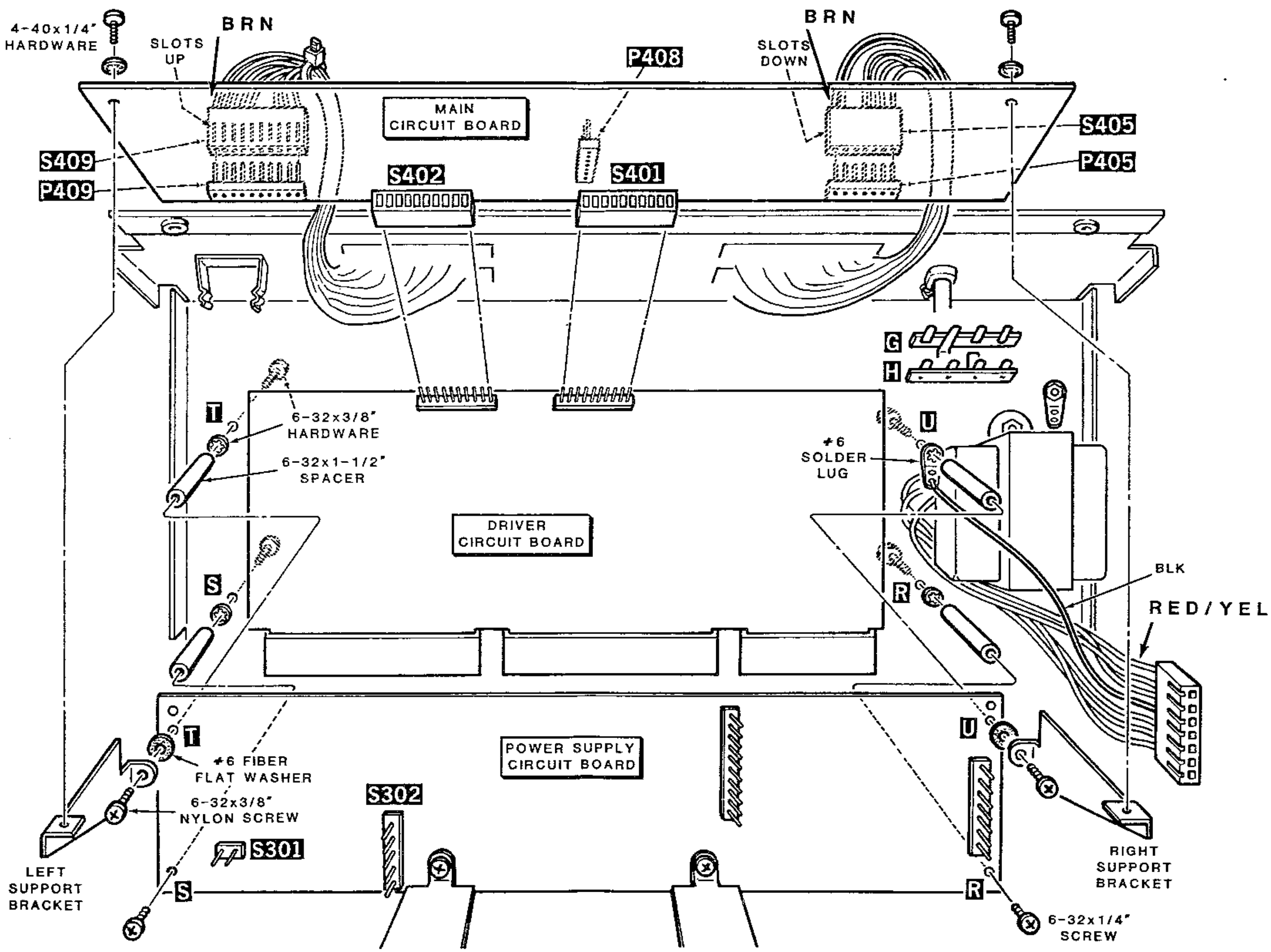


DISPLAY ASSEMBLY FRONT PANEL AND KEYPAD INSTALLATION

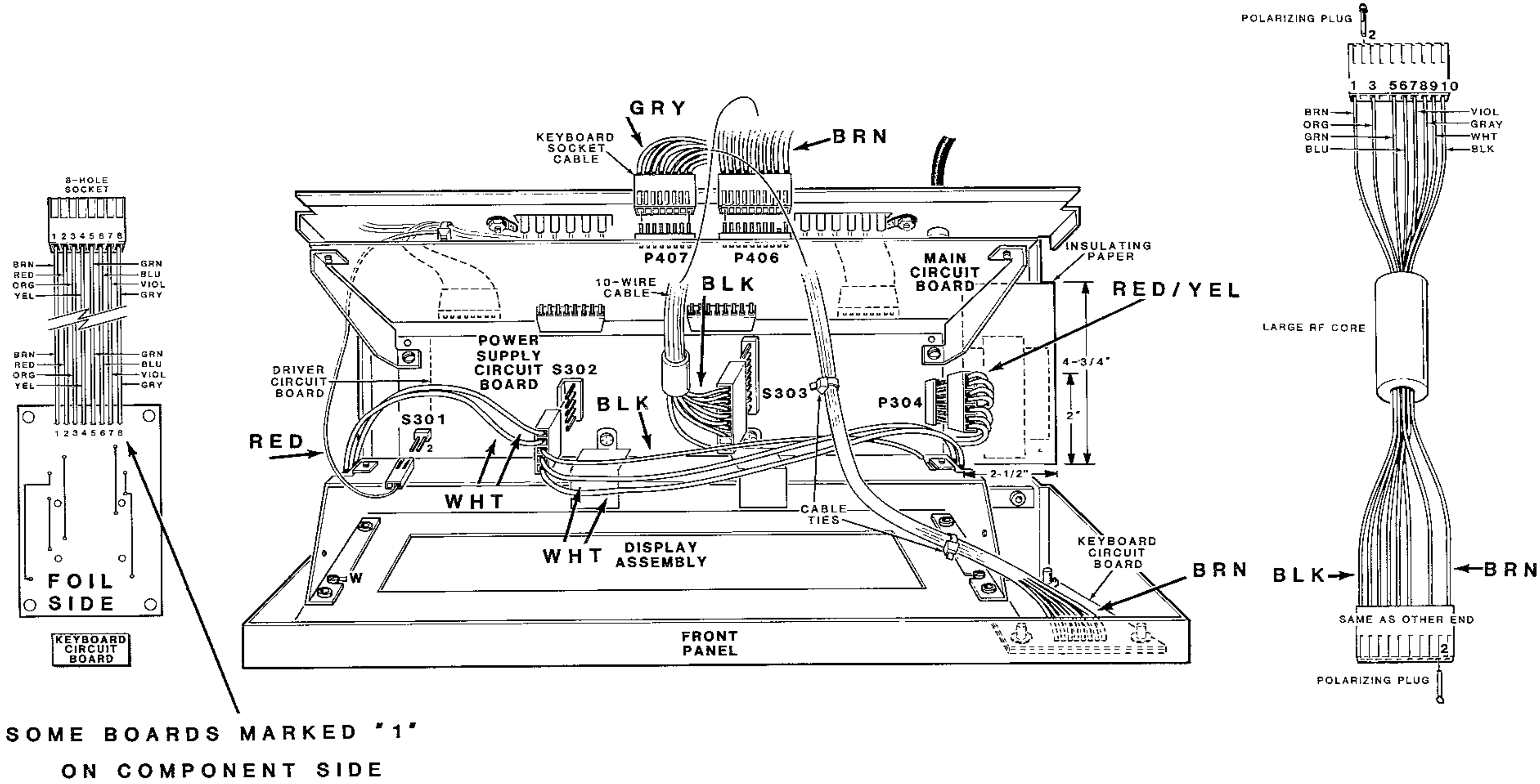




CIRCUIT BOARD INSTALLATION

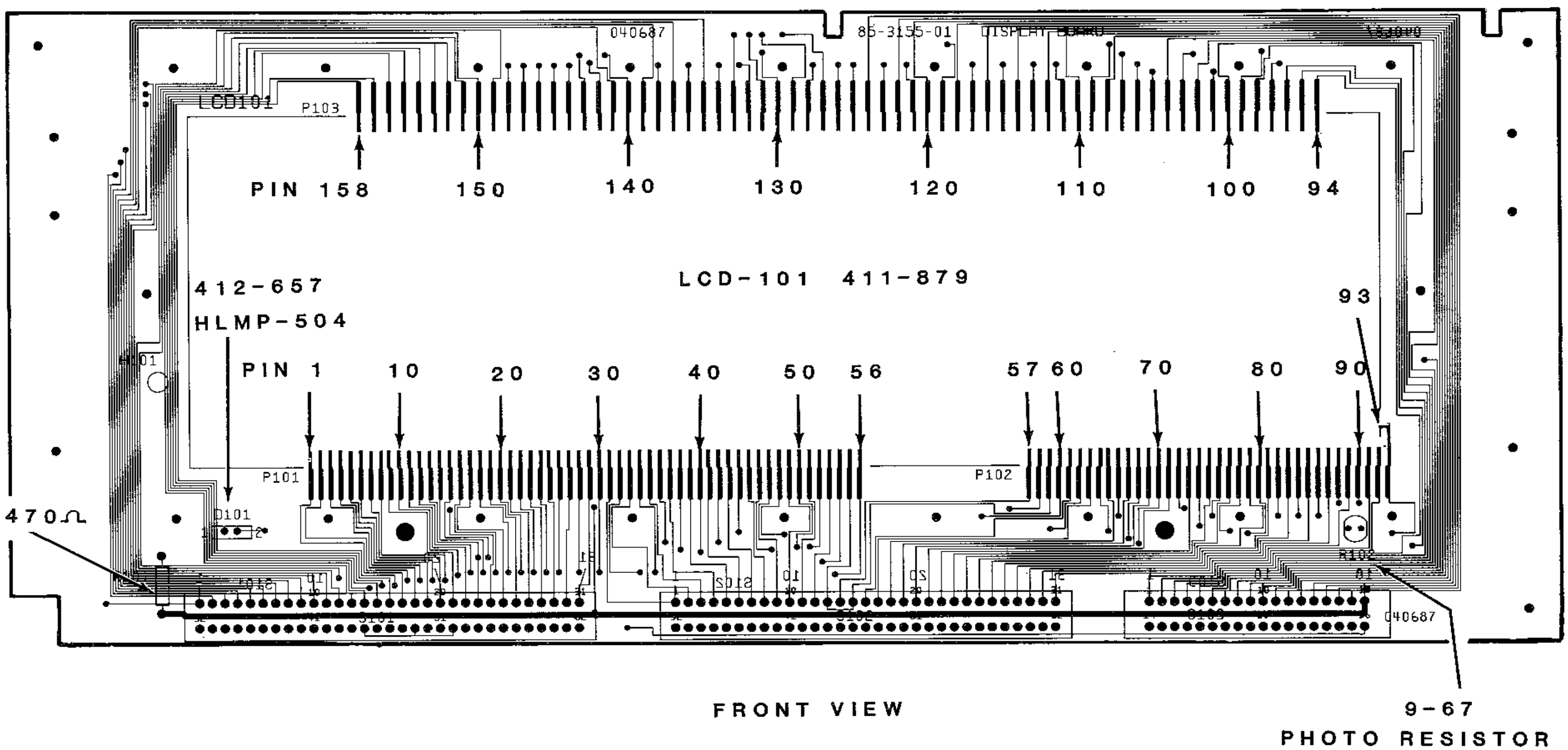


CIRCUIT BOARD INTERCONNECT WIRING



DISPLAY CIRCUIT BOARD

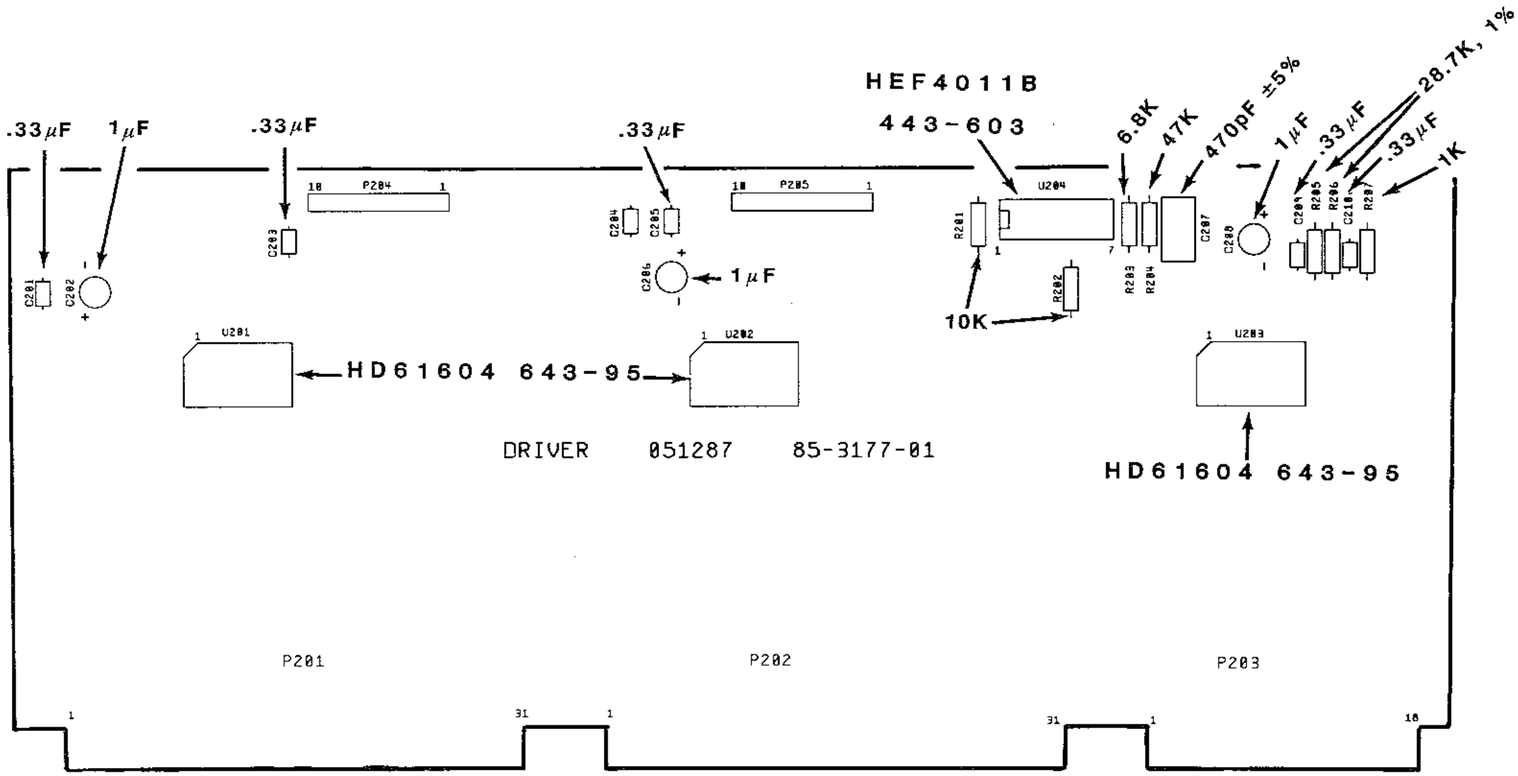
COMPONENT LOCATIONS



FRONT VIEW

DISPLAY DRIVER CIRCUIT BOARD

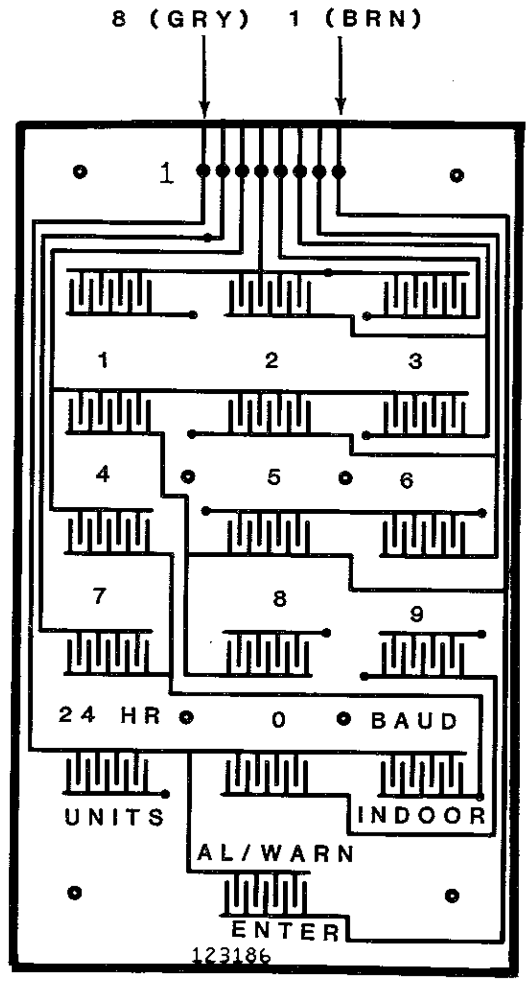
COMPONENT LOCATIONS



NOTE: U201, U202, and U203 are surface-mounted to the foil side (bottom) of the board.

KEYPAD CIRCUIT BOARD

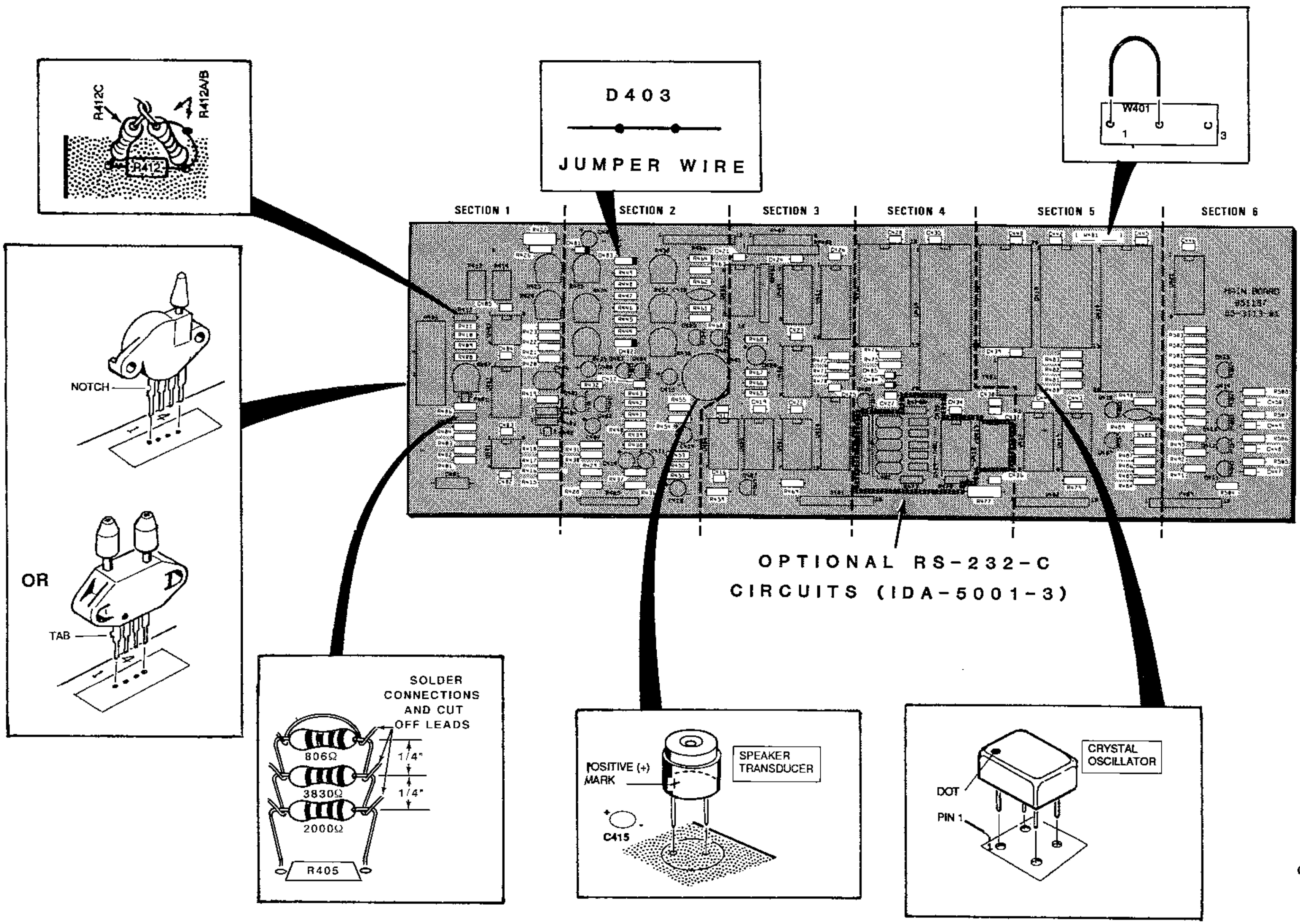
KEY LOCATIONS



FRONT VIEW

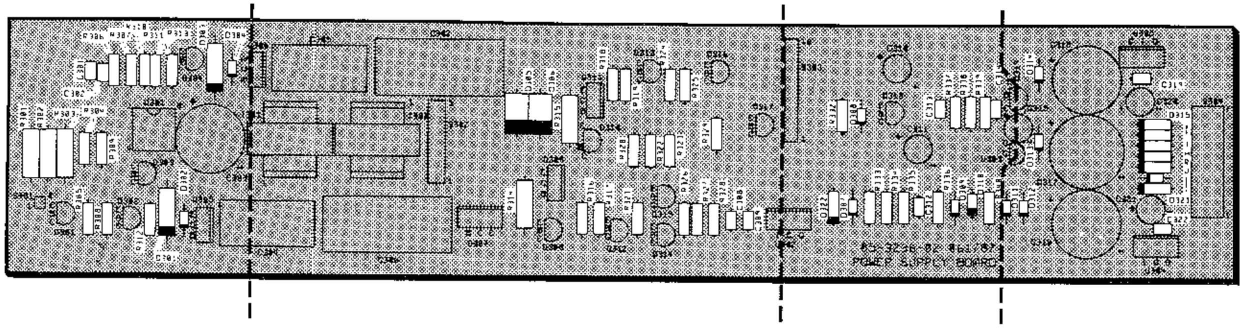
MAIN CIRCUIT BOARD

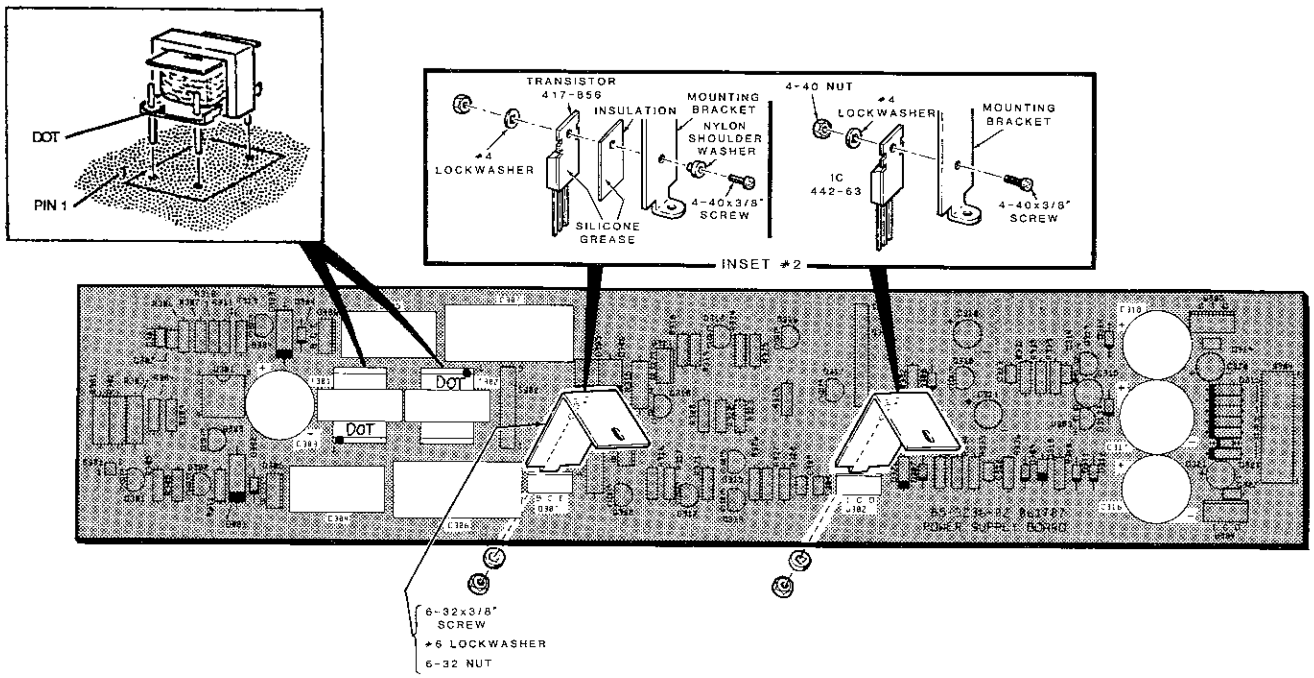
COMPONENT LOCATIONS



POWER SUPPLY CIRCUIT BOARD

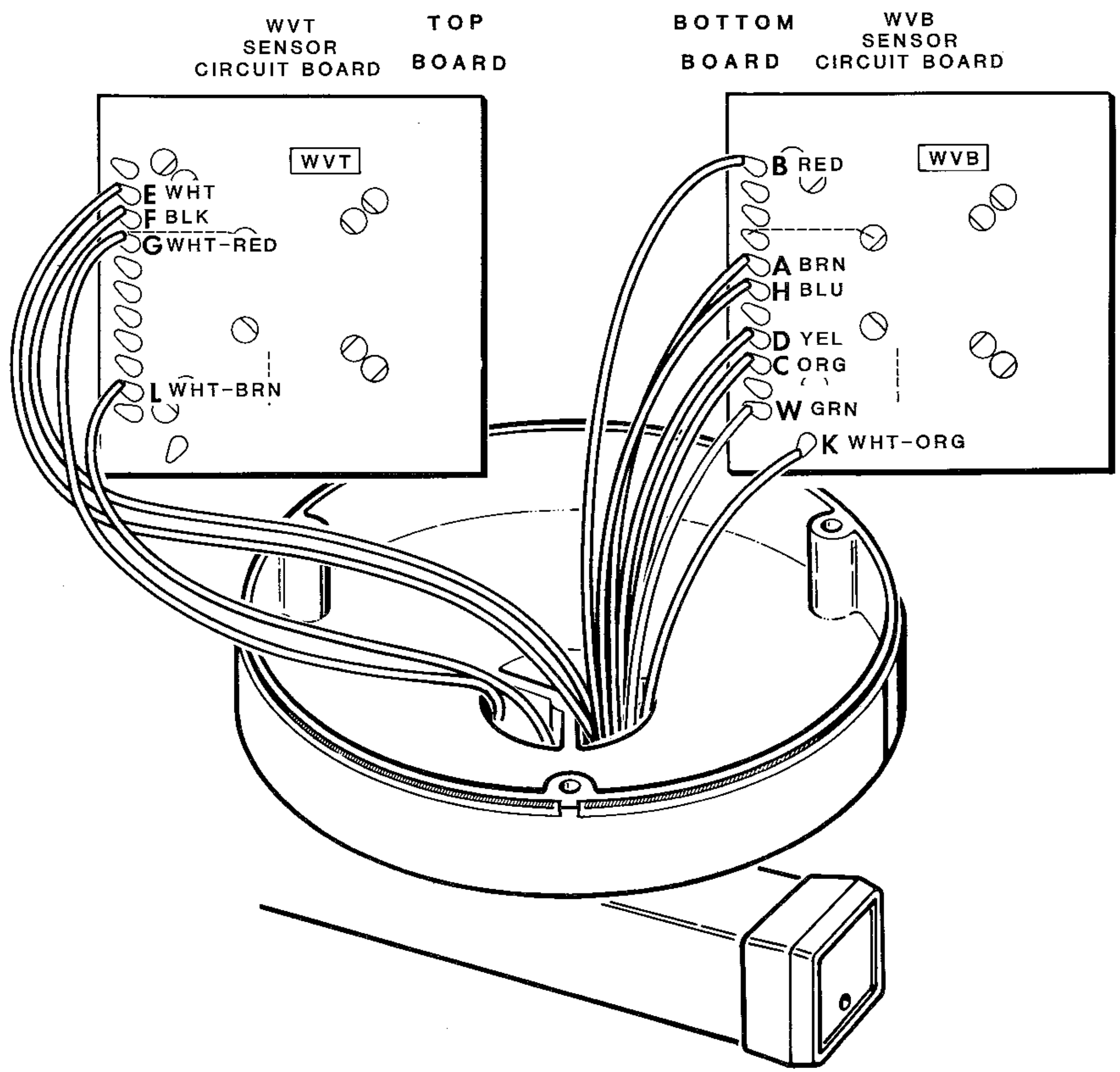
COMPONENT LOCATIONS



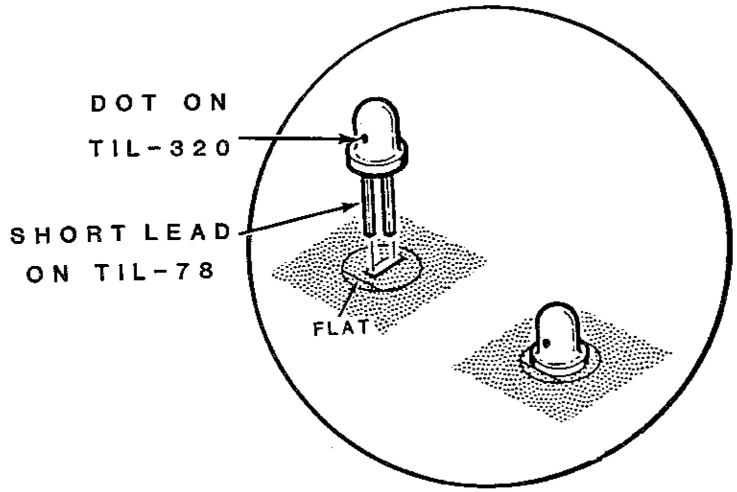


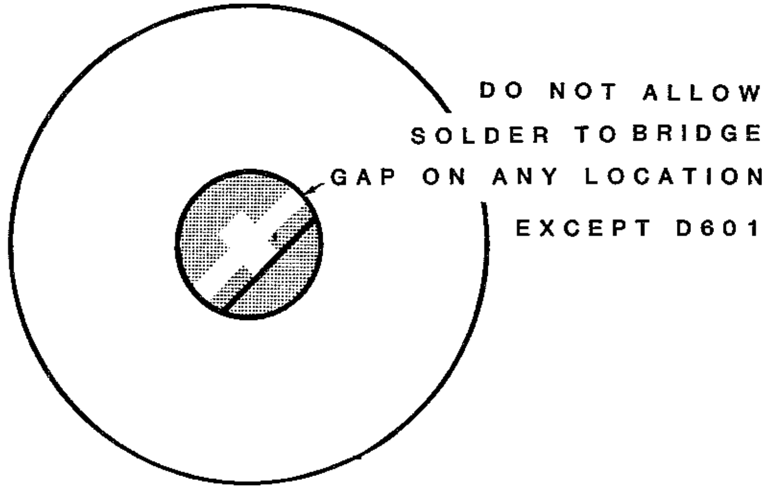
BOOM ASSEMBLY

WIND DIRECTION SENSOR INTERCONNECT WIRING

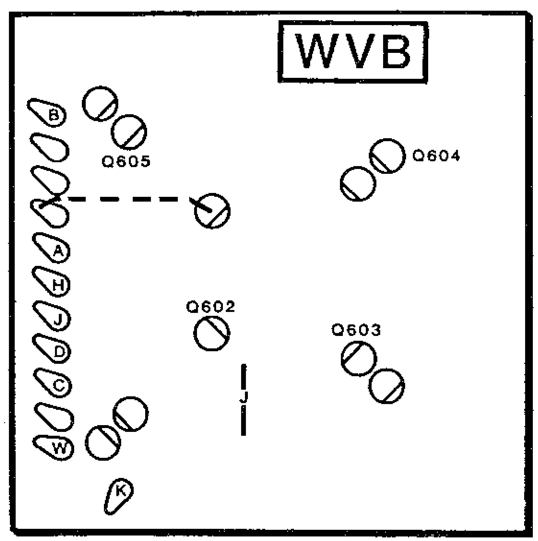


WIND DIRECTION SENSOR
COMPONENT LOCATIONS

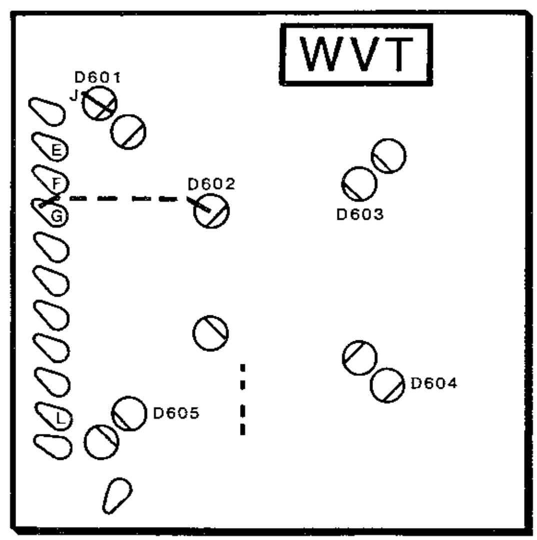




BARE WIRE ON FOIL SIDE

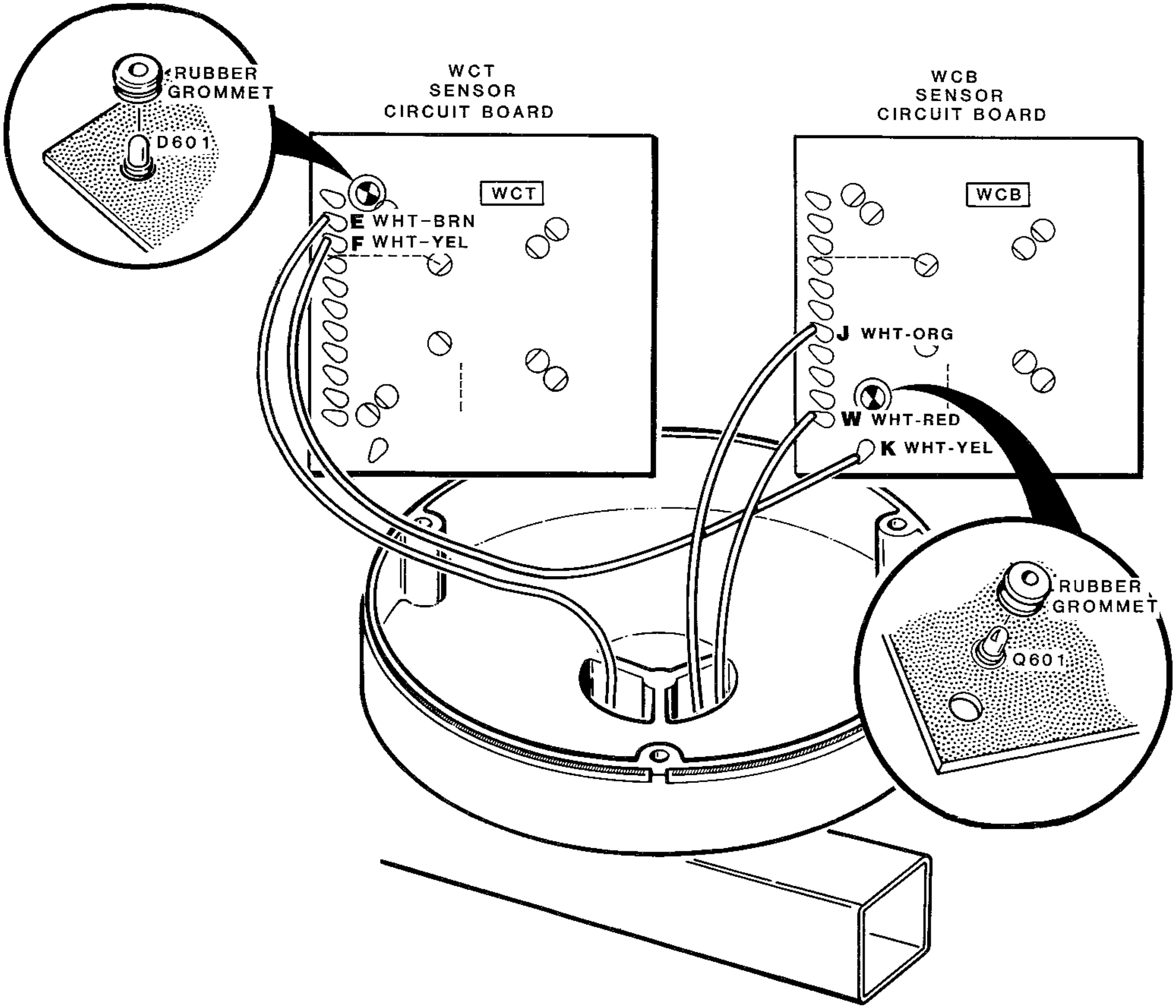


BOTTOM BOARD

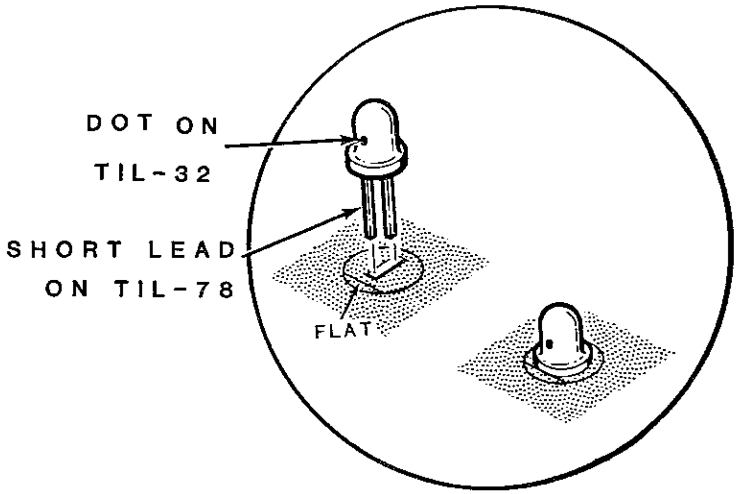


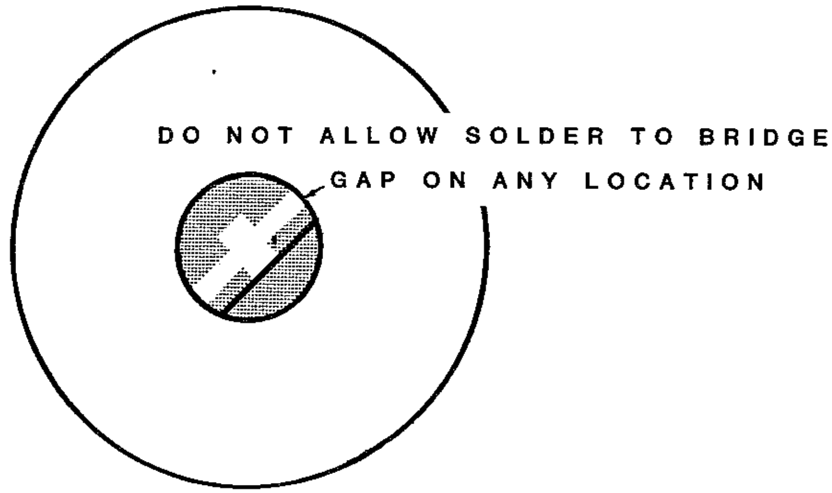
TOP BOARD

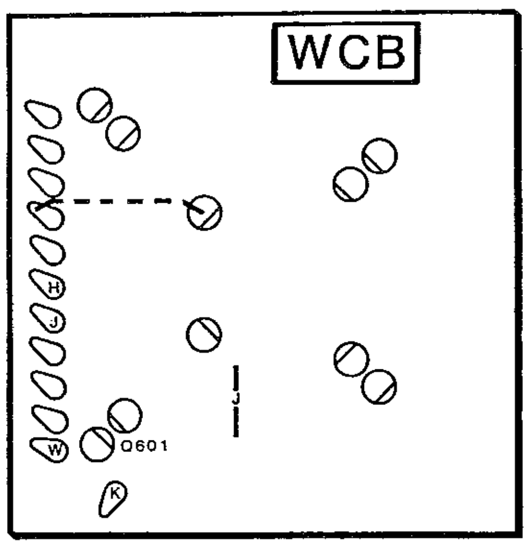
WIND SPEED SENSOR INTERCONNECT WIRING



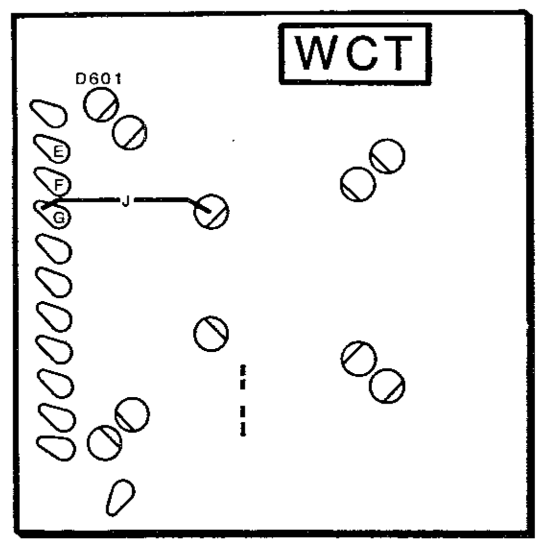
WIND SPEED SENSOR COMPONENT LOCATIONS







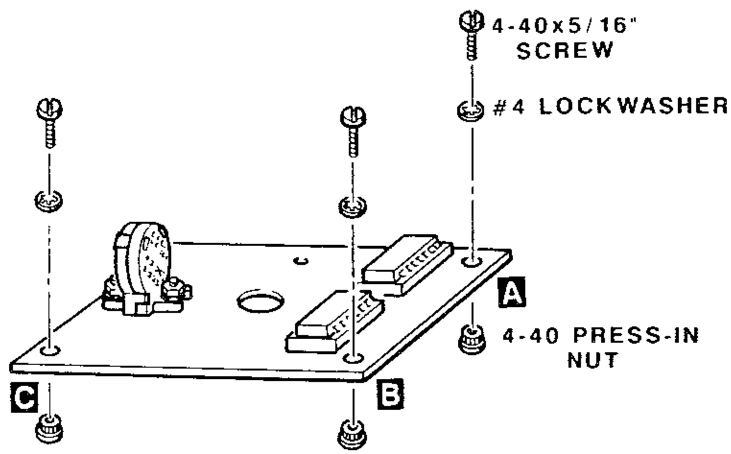
BOTTOM BOARD

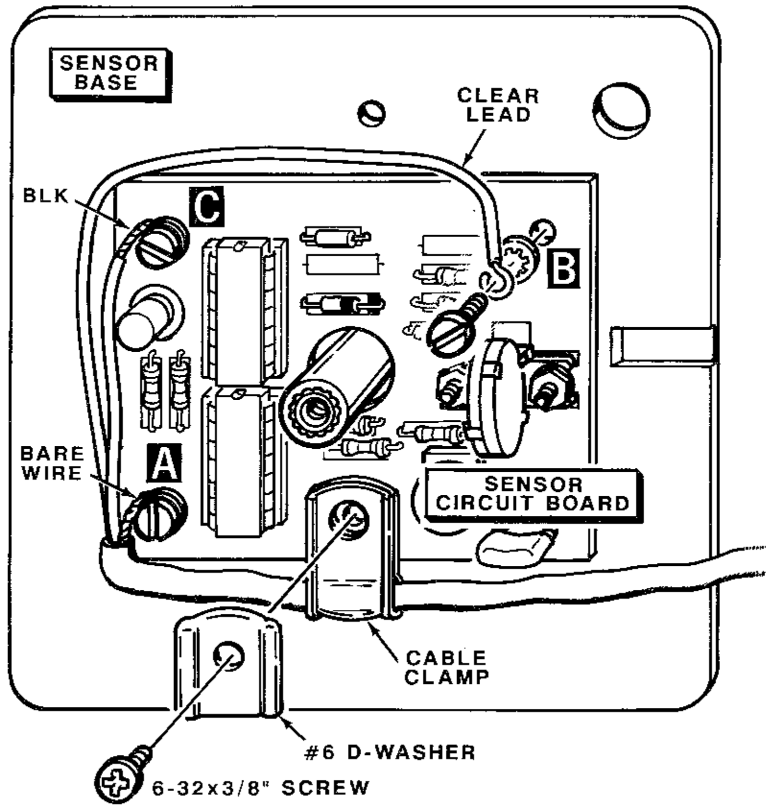


TOP BOARD

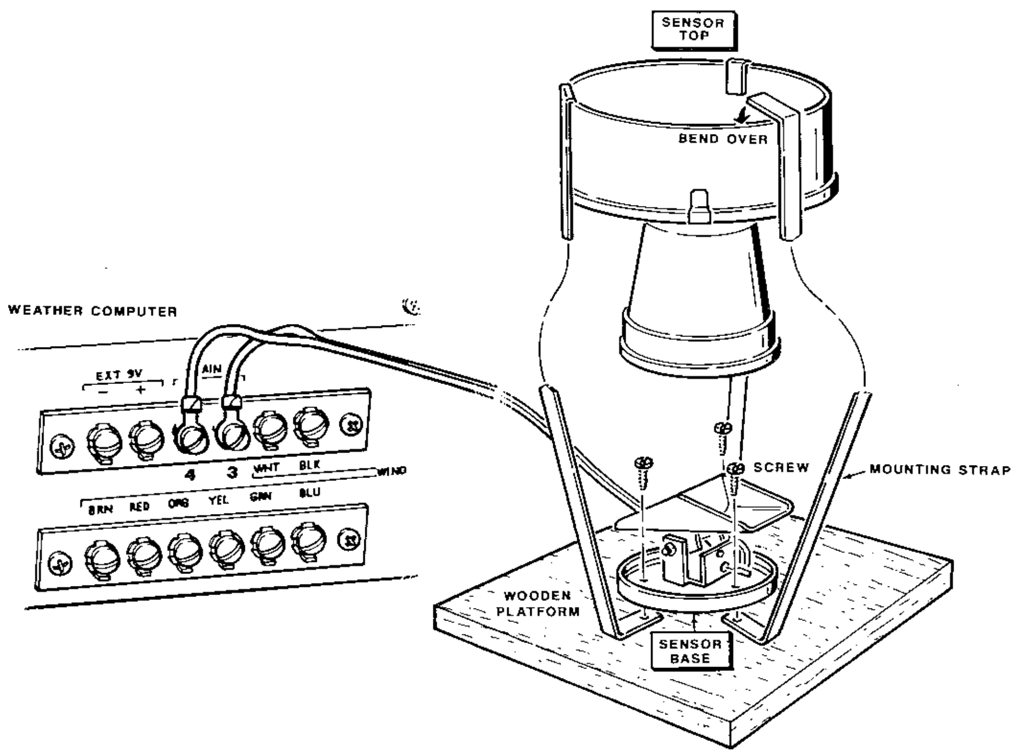
HUMIDITY SENSOR ACCESSORY (IDA-5001-1)

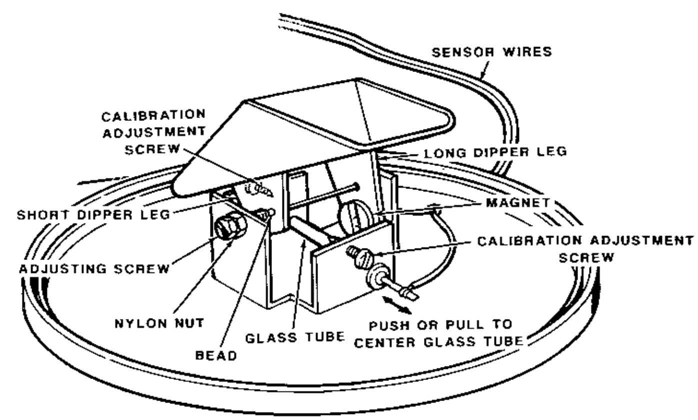
CIRCUIT BOARD INSTALLATION





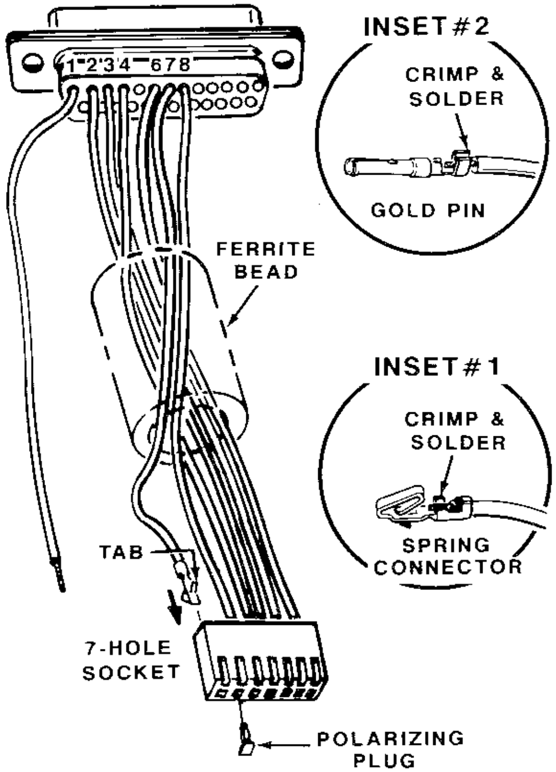
RAIN GAUGE ACCESSORY (IDA-5001-2)

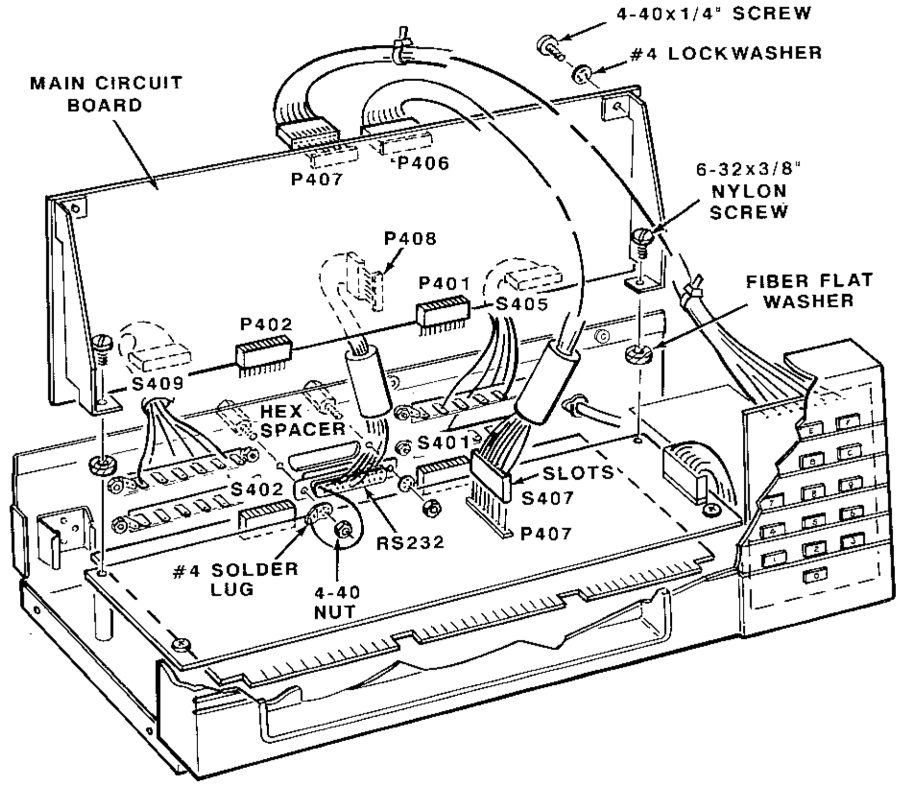




RS-232C ACCESSORY (IDA-5001-3)

CONNECTOR WIRING AND INSTALLATION





ALIGNMENT

EQUIPMENT NEEDED

To align the ID-5001 Weather Computer and the Model IDA-5001-1 Humidity Sensors, you will need the following equipment. The suggested model numbers at the end of each item will fulfill these requirements.

ID-5001 WEATHER COMPUTER

Thermometer: Accurate to ± 0.5°F at 120°F. Heath #406-650.

Barometer Calibration Fixture: Consists of the following Heath parts:

Part No.	Qty	Description
73-92	1	Tape, double-stick, 5" × 3/4"
205-1823	1	Metal strip, 29" × 1"
250-1411	3	Screw, 4-40 × 1/4"
252-2	3	Nut, 4-40
254-9	3	Lockwasher, #4
260-92	3	Clip
346-2	5"	Tubing, small clear
346-7	10'	Tubing, medium clear
346-60	1	Tubing, large clear (cut to 1.5")

Barometer: Heath ID-1990 or equivalent.

IDA-5001-1 HUMIDITY SENSORS

Calibration Capacitors: 42 pF mica, Heath #20-174. 118 pF mica, Heath #20-736.

Humidity Sensor: A calibrated relative humidity indicator for use as a reference. This provides the fastest method of calibration. Heath ID-2295 or equivalent.

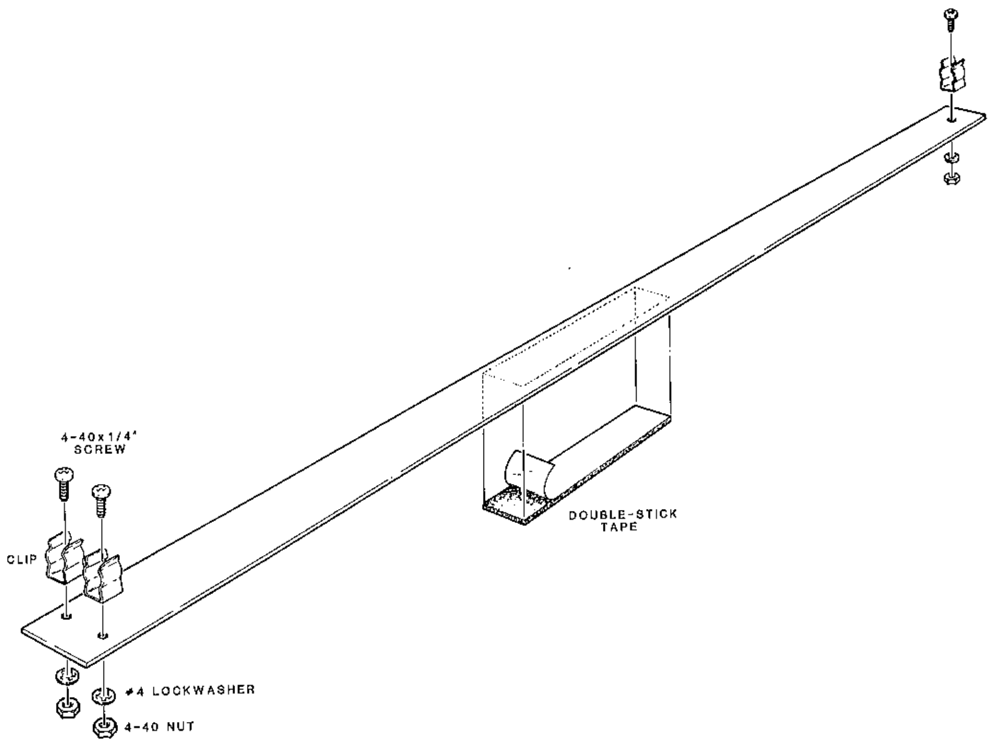
If a calibrated humidity sensor is not available, you will need the following equipment.

Thermometer: You will need two calibration thermometers for wet/dry bulb calibration. Heath #406-680.

Wicking: You will need 6" of wicking for the wet/dry bulb calibration. Heath #349-12.

Electric Fan: Tatung LE-6 GEP or equivalent. Heath #230-6809 fan.

BAROMETER CALIBRATION FIXTURE CONSTRUCTION



PICTORIAL 8-1

- Locate the 29" × 1" metal strip and position it as shown.

- Mount a clip at the three indicated locations with 4-40 hardware. Position the clips as shown.

- Remove the paper backing from one side of the 5" × 3/4" double-stick tape and press the tape onto the indicated side of the metal strip at its center.

- Remove the paper backing from the other side of the foam tape.

In the following step, select a fixture location that is lower than the Weather Computer being aligned.

- Place the fixture in a convenient place and use the foam tape to fasten the fixture to a stationary object.

See "Barometric Pressure" to complete the construction.

WEATHER COMPUTER ALIGNMENT

IMPORTANT: Both temperature sensor cables must be connected to the back of the Weather Computer before it will operate properly.

NOTES:

- Disregard any arrows or Alert/Warning indicators that may appear in the display during the calibration.
- Before you start to calibrate the Weather Computer, be sure it has been powered up until the pressure reading stabilizes and does not change for a 5-minute period (or for about one hour with the cover off).

BAROMETRIC PRESSURE

Overview

In the following steps, you will temperature compensate and calibrate the barometric pressure circuits using a reference barometer. This can be another ID-5001 Weather Computer or a similar Heath weather instrument. If a reference barometer is not available, check with a local weather observing station such as a radio or TV station, Coast Guard station, or airport.

The pressure transducer in the Weather Computer is a very responsive and accurate device, and will reflect extremely small variations in the environment. Thus, several factors will affect the overall accuracy of the barometric pressure display, including:

- The accuracy of the reference barometer.
- The accuracy of the person reporting the reading from the reference barometer, and how recently the reading was taken.
- The accuracy of the observing station's conversion of atmospheric pressure to the barometric pressure corrected at sea level.

- The difference in the barometric pressure gradients between where the reference barometer is and where the unit under test is.

- The stability of the environment that the Weather Computer is monitoring. The environment could easily be changed by such factors as window fans, a room's sound pressure level, an air conditioner, the opening and closing of doors and windows, placement of the Weather Computer after calibration (10′ in height corresponds to +0.01in./Hg), and atmospheric pressure gradients within the shop area.

- The accuracy of the calibration itself. The best time to do the calibration is during a period where the barometric pressure is fairly stable. Therefore, do not attempt to calibrate in a period during which the barometric pressure is changing rapidly, such as when a thunderstorm is approaching.

Refer to Pictorial 8-2, "ID-5001 Control and Jumper Locations," in the Illustration Booklet as you perform the following steps.

Coarse Adjustments

If this is the first time the barometer circuit has been adjusted, complete the following steps. However, if it has been previously adjusted, you may proceed to "Fine Adjustments."

NOTE: When you remove or install jumper sockets on the main circuit board, you may see a noticeable change in the display brightness. The display may darken completely.

- Remove any jumper sockets that may be installed on plugs P401, P402, P403, and P404.

- Install a jumper socket at P403, pins 1 and 2.

- Install a jumper socket at P404, pins 2 and 3.

- Connect the line cord plug to the AC outlet and allow the Weather Computer to warm up until the pressure reading stabilizes for five minutes, or for about one hour with the cover off.

- Adjust R407 (A/DCURRENT) for a barometer reading of 62.00 ± 0.20 on the display.
- Remove the jumper socket from pins 2 and 3 of P404 and install it on pins 1 and 2 of P404.
- Adjust R425 (BAR TRANSDUCER BIAS) to get a barometer reading of 62.00 ± 0.20.
- Remove the jumper from pins 1 and 2 of P403 and install it on pins 2 and 3 of P403.
- Remove the jumper from P404 and install it on pins 1 and 2 of P401.
- Note the barometer reading and perform one of the following two steps.

  A. If the barometer reading is .00, adjust R424 (BAR BALANCE) clockwise to get a reading that is slightly higher than .00. Then adjust R424 counterclockwise until the barometer reading just becomes .00.

  B. If the barometer reading is not .00, adjust R424 (BAR BALANCE) counterclockwise until the barometer reading just becomes .00.

- Remove the jumper socket from P401 and install it on pin 2 of P401. Leave pin 1 open, this configuration is the jumper socket's storage location.
- Remove the jumper socket from P403 and install it on pins 1 and 2 of P402.

Refer to Pictorial 8-3, "Calibration Tube Setup," in the Illustration Booklet for the following procedure.

- Turn R413 (BAR INTERCEPT) 25 turns clockwise or until you hear a faint click from the control.
- Adjust R414 (BAR SLOPE) 25 turns counterclockwise or until you hear a faint click from the control.

NOTE: In the following **numbered** steps, be sure to complete only the step(s) that cause(s) the display reading to drop below 39.00. Do **NOT** cut the leads of R405C.

1. If the display reading is greater than 39.00, refer to inset drawing #1 in the pictorial and cut one end of the bare lead shorting the parallel resistor network.

2. If the display is still greater than 39.00, cut one lead of R405A. Cut the lead at its center so you can resolder it together again, if necessary.

3. If the display is still greater than 39.00, cut one lead of R405B.

- Adjust R414 for a display of 39.00.

- Adjust R413 for a display of 30.00 (not critical).

Proceed to "Fine Adjustments."

Fine Adjustments

- Write down the exact reading of the barometer display.

- Temporarily install the cover on the Weather Computer.

- Leave the cover on for at least one hour to allow the internal temperature to stabilize.

- Observe the new reading of the display and compare it to the reading that you previously wrote down. Write down the difference between the two readings. (Ideally, this should be as close as possible to zero.)

- Remove the cover from the Weather Computer.

- Perform one of the following two steps depending on the type of difference you noted between the two readings.

  A. If the reading increased by 0.10 or less, turn R425 (BAR TRANSDUCER BIAS) clockwise to increase the displayed value by 1.00 inch for every 0.01 of difference between the two readings.

  For example, if the initial reading was 30.00 and the reading increased to 30.04, turn the control clockwise to increase the reading to about 34.04. If the difference is greater than 0.10, turn R425 clockwise to increase the displayed value by 10.00 inches.

  B. If the reading decreased by 0.10 or less, turn R425 (BAR TRANSDUCER BIAS) counterclockwise to decrease the displayed value by 1.00 inch for every 0.01 of difference between the two readings.

  For example, if the initial reading was 30.00 and the reading dropped to 29.96, adjust R425 counterclockwise for a reading of about 25.96. If the difference is greater than 0.10, turn R425 counterclockwise to decrease the displayed value by 10.00 inches.

- Adjust R414 for a display of 30.00 (not critical).

  - If you can not get down to 30, disconnect the next resistor at R405.

    However, if R405C is the only resistor left, you will need to troubleshoot the unit.

  - If you can not get a high-enough reading, reconnect the last resistor (or jumper wire) at R405 that you disconnected earlier.

- If the difference value that you noted at the beginning of "Fine Adjustments" was greater than 0.10, repeat the above steps beginning at "Fine Adjustments."

  If the difference value was less than 0.10, it is not necessary to repeat the procedure. If you do, however, you can approach the ideal difference value.

Refer to Pictorial 8-3, "Calibration Tube Setup," as you perform the following.

NOTES:

1. In the following steps, it is important that you do not get any water inside the pressure transducer. Therefore, be sure to place the Weather Computer higher than the top of the water level.

2. The purpose of the calibration hose (medium clear tubing), which you will use in the following steps, is to cause a change in the pressure that is equivalent to a two-inch drop in a mercury column.

- Fill the calibration hose with 44 to 60 inches of water until you have a loop of water 22 to 30 inches high, as shown. Tap the sides of the hose to remove any air bubbles. Then clamp the hose in the top calibration clips, as shown. Pinch the clips together to hold the hose in place, if necessary. Filling the hose with hot water will remove any kinks in it and make it easier to work with.

NOTE: When you install the 5" tubing in the following step, be sure to push it firmly onto the transducer port. Otherwise, air leaks will make it impossible for you to calibrate the Weather Computer. Also, water will run out of the calibration hose when you later reposition it on the fixture.

- If the Weather Computer has a single-port transducer similar to the one in Detail A of the "Calibration Tube Setup" illustration, perform step 1 below. Otherwise, perform step 2.

1. Refer to inset #2 in the illustration and slide 1/2" of one end of the medium clear tubing over one end of the 5" length of small clear tubing. Then cut off the medium tubing so that it is even with the end of the small tubing as shown.

   Refer to detail A and slide the 1/2" end of the 5" length of small clear tubing onto the transducer port.

2. Refer to detail B and slide either end of the 5" length of small clear tubing onto the indicated port P1 of the two-port transducer.

- Push the long end of the calibration tubing into the 5" length of tubing that is already installed on the transducer.

Final Adjustments

If this is the first time you have calibrated the Weather Computer, read the remaining steps to become familiar with the procedure before you continue calibrating the barometer.

Refer to Pictorial 8-4, "Final Adjustments Setup," for the following steps.

1. Adjust R413 for a display of 30.00 (not critical at this time).

2. Adjust the longer hose (right clip) so the water level in the hose is exactly even (see Part A).

3. Write down the reading of the display.

   NOTE: If the reading is less than 27.00 or greater than 33.00, adjust R413 until the display reads about 30.00 (not critical).

4. Remove the hose from the left clip on the calibration fixture. Then clamp it in the bottom clip on the fixture.

5. Adjust the hose in both clips so the water levels are even with the top of their corresponding clips (see Part B).

6. Write down the new reading of the display.

7. Subtract the reading taken in step 6 from the reading taken in step 3.

NOTE: In the next step, each complete turn of R414 will produce a change of 0.02 to 0.08 in the result obtained in step 7. The variation per turn depends upon the value of R405A, B, and C; the greatest being when the resistors are shorted.

8. Observe the result in step 7 and perform either A or B below.

   A: If the result in step 7 is less than 2.00, turn R414 clockwise to increase the display reading.

      NOTE: If you run out of adjustment range by turning R414 fully clockwise reconnect the last resistor (or jumper) that you disconnected from the network at R405.

B: If the result in step 7 is greater than 2.00, turn R414 counterclockwise to decrease the display reading.

NOTE: If you run out of adjustment range by turning R414 fully counterclockwise, disconnect the component that is still connected to the top of the network at R405. If you still do not have enough range, disconnect the next component and so on until you do. However, do **NOT** disconnect R405C.

9. Return the shorter hose to the top left clip of the calibration fixture. Then repeat steps 2 through 8 until the result in step 7 is 2.00 ± 0.01.

10. Make sure the shorter end of the hose is clamped to the top left clip of the calibration fixture. Then remove the hose from the transducer.

11. Adjust R413 to match the Weather Computer barometric pressure display to your reference barometer.

This completes the barometric pressure calibration.

TEMPERATURE CALIBRATION

Initial Setup

NOTE: The calibration thermometer (#406-650) is only accurate at 120°F. Therefore, do not use it to measure ice water or air temperatures, as the readings will not be accurate.

Refer to Pictorial 8-2, "ID-5001 Control and Jumper Locations," for the following steps.

- Connect the Weather Computer's line cord plug to an appropriate AC outlet and allow it to warm up for 30 minutes.

NOTE: While it is warming up; perform the next three steps.

1. Fill an insulated container (glass-lined Thermos bottle or other brand vacuum bottle) half full of crushed ice.

2. Place both temperature sensors into the insulated container and finish filling the container with crushed ice.

3. Fill the container with cold water and allow it to set for five minutes, stirring the contents occasionally to ensure a constant, uniform temperature.

- If the Weather Computer is in the Celsius mode, press **TEMP** and **UNITS** on the keypad to put it in the Fahrenheit mode..

- Record both temperature readings in the display.

- Set R434 (TEMP OUTDOOR SLOPE) and R457 (TEMP INDOOR SLOPE) until the display indicates a reading that is 5°F higher than the one you noted in the previous step.

Calibration Procedure

- In very small steps, adjust R433 (TEMP OUTDOOR INTERCEPT) until the display just indicates 33°F; then stop.

- In very small steps, adjust R433 back down until the display just goes to + 32. The correct display is + 32, but the control should be set as close to a + 33 display as possible.

- In very small steps, adjust R456 (TEMP INDOOR INTERCEPT) until the display just indicates 33°F; then stop.

- In very small steps, adjust R456 back down until the display just goes to + 32. The correct display is + 32, but the control should be set as close to a + 33 display as possible.

- Fill a second container with hot water.

  NOTE: The thermometer that was supplied with your Weather Computer is calibrated to 120°F ± .5°F. Most hot water heaters provide water that is close to this temperature.

  CAUTION: Do not leave the thermometer in water that is so hot that the liquid inside the thermometer touches the top of the tube.

- Place the thermometer and both temperature sensors into the hot water for at least five minutes.

- Stir the water.

  NOTE: If the thermometer indicates over 120°F, wait until the temperature is at or slightly below 120°F before you complete the following step.

- Adjust R434 (TEMP OUTDOOR SLOPE) to produce a reading that is close to 120°F and agrees with the thermometer reading.

- Adjust R457 (TEMP INDOOR SLOPE) to produce a reading that is close to 120°F and agrees with the temperature reading.

- Repeat the adjustments for controls R433 and R456 (for the low temperature) and controls R434 and R457 (for the high temperature) until you can go back and forth between the cold water and hot water without error at either temperature end.

This completes the temperature calibration.

IDA-5001-1 HUMIDITY SENSOR CALIBRATION

SLOPE ADJUSTMENTS

Refer to Pictorial 8-5, "ID-5001 Humidity Sensor Control Locations," for the following steps.

- On the main circuit board, preset R458 (HUMIDITY INDOOR SLOPE) and R435 (HUMIDITY OUTDOOR SLOPE) to their center positions.

- On the two sensor boards, preset R704 fully counterclockwise.

- Locate the 42 pF (#20-174) and 118 pF (#20-736) mica capacitors and cut their leads to 1/2". You will use these capacitors in the following steps.

Perform the following steps twice. First for the indoor sensor, then for the outdoor.

- Install the 118 pF mica capacitor into the wire sockets at E and F.

- With R704 turned fully counterclockwise, the digital display may indicate a value that is higher than 100. (Since numbers over 99 cannot be displayed, numbers such as 101 will be displayed as: 01.)

- Turn R704 slowly clockwise until the digital display drops to its lowest value; then continue to turn the control until the display increases by 1. Note this reading.

- Install the 42 pF mica capacitor into the wire sockets at G and H.

- Turn the main circuit board control (R458 indoor, and R435 outdoor) until the digital display indicates a reading that is 93 ± 1 counts higher than the reading with the 118 pF capacitor only.

- Remove the 42 pF and 118 pF mica capacitors and install the free end of the yellow wire into wire socket F.

Repeat the previous six steps for the outdoor sensor. After you complete the steps for the second time, proceed to "Relative Humidity Adjustments."

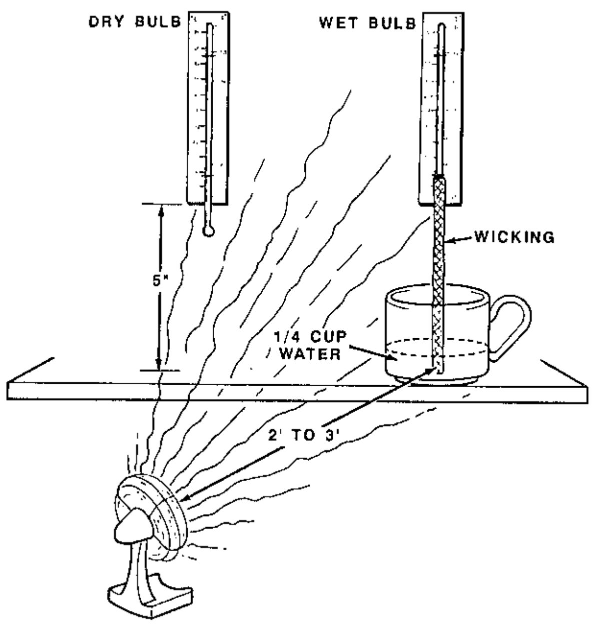
RELATIVE HUMIDITY ADJUSTMENTS

There are two ways to calibrate the relative humidity readings. The first method uses another reliable humidity indicator as a standard, while the second — a "wet and dry bulb" calibration procedure — uses two calibrated thermometers (#406-680). If you plan to use another humidity indicator, proceed to "Method #1." If you plan to use the wet and dry bulb calibration, proceed to "Method #2."

Method #1

Refer to Pictorial 2-2 for the following steps.

- Place the indoor and outdoor temperature sensors near the corresponding humidity sensors.
- Adjust R704 on the indoor sensor circuit board until the digital display indicates the same reading as your reference humidity indicator.
- Adjust R704 on the outdoor sensor circuit board until the digital display indicates the same reading as your reference humidity indicator.



PICTORIAL 8-6

Wet bulb/dry bulb calibration.

- Place the sensor covers over each of the sensor bases but do not fasten them. Allow the two sensors to stabilize for two hours.

- Remove the sensor covers and adjust R704 on the two sensor circuit boards until the display matches the reference value.

- Replace the sensor covers and tighten the mounting screws.

This completes the humidity adjustment.

Method #2

Refer to the "Wet Bulb/Dry Bulb" illustration for the following steps.

NOTE: The room that you use when you calibrate the sensor units should have a fairly constant humidity level. You can obtain the best result when you adjust the units at a relative humidity of about 50% at a room temperature of 70°F.

You will have to perform this calibration twice, once with the sensor covers off, and again two hours later after the sensors have stabilized with their cabinet tops installed.

- Mount both thermometers in an area of a wall about 4 to 5 inches above your work area and about 8" apart.

- Fill a cup 1/4 full of water and place the cup under one of the thermometers. This thermometer will be called the "wet bulb." The other thermometer will be called the "dry bulb."

- Place the indoor and outdoor temperature sensors near the corresponding humidity sensors.

- After the thermometer readings have stabilized, make a note of these first readings.

- Wet the entire wicking. Then place one end of it over the bottom of the wet bulb and let the other end hang in the cup of water.

- Place an electric fan two to three feet away from the thermometers and direct the air onto both bulbs for about eight minutes.

- Read both thermometers and write down this second set of wet bulb and dry bulb readings.

- Subtract the second wet bulb reading from the first wet bulb reading. This difference number is called the "evaporation effect."

- Compare the two dry bulb readings.

  If the second reading is higher than the first, add the difference between the two to the evaporation effect.

  If the second reading is lower than the first, subtract the difference from the evaporation effect reading.

  If there is no temperature difference, do not change the evaporation effect reading.

  Round all readings off to the nearest degree.

- Use the "Evaporation Effect Chart" (Illustration Booklet, Page 10) to determine the relative humidity in the following manner:

  1. Find your second dry bulb temperature in the left column and draw a straight line below that row of numbers to the right.

  2. Find your evaporation effect number by reading across the top of the chart. Then follow that column down until it intersects the first line you drew. The number at this intersection is the relative humidity.

- Adjust R704 on the indoor sensor circuit board until the digital display matches the relative humidity number you just located on the chart.

- Adjust R704 on the outdoor sensor circuit board until the digital display matches the relative humidity number you just located on the chart.

- Place the sensor cabinet top over each of the sensor bases but do not fasten them at this time.

Allow the two sensors time to stabilize for two hours; then return to the beginning of "Method #2" and repeat the calibration procedure. Leave the sensor covers loosely installed and remove them only to adjust the controls.

This completes the humidity adjustment.

IDA-5001-2 RAIN GAUGE ACCESSORY CALIBRATION

CAUTION: The Sensor's movable dipper is coated with a white film that prevents water from collecting on its surface. Do not touch or remove this film from the dipper, as it will cause a calibration error.

- Connect the Rain Gauge Accessory to the Weather Computer as shown.

- Connect the Weather Computer to an AC outlet.

- Carefully rock the sensor dipper from one side to the other.

  You should hear a click each time the Sensor moves to the opposite stop. At the same time, the display should increment by 0.01 for inch calibration or 0.02 for centimeter calibration. If so, the unit is adjusted properly. Otherwise, perform the following steps.

- Examine the dipper assembly.

  The short dipper leg should be against the small bead on the dipper shaft, and the long leg (with the magnet attached) should be against the adjustment screw at the opposite end of the shaft. The magnet should be about 1/8" away from the glass tube containing the contacts.

- Rock the dipper from stop to stop.

  If you hear no click, or a click only when the dipper moves in one direction, carefully reposition the glass tube to center the contacts in the magnet's path. Then recheck the dipper operation.

If the contacts still do not close properly:

- Loosen the nylon nut on the bead side of the shaft and turn the adjusting screw 1/4-turn counterclockwise. Then retighten the nut.

- Loosen the nut on the opposite end of the shaft, turn the adjusting screw 1/4-turn clockwise, and retighten the nut.

You should now hear a click when the dipper moves in either direction, and the readout should increment properly. If it does not, repeat the above two steps, repositioning the magnet closer to the contacts. The magnet should not end up closer than 1/16" to the glass tube.

TROUBLESHOOTING

The following service procedures provide guidelines on what areas to check when you are troubleshooting a particular problem. To service to the component level, you must be familiar with the complete system operation. Study the "Circuit Description," "Operation," and "Specifications." Review the "Normal Operating Characteristics." Once you understand how the ID-5001 Advanced Weather Computer works, you will be able to quickly repair the unit.

EQUIPMENT NEEDED

To troubleshoot the ID-5001 Advanced Weather Computer, you will need the following test equipment. The test equipment specifications should meet or exceed those listed below. The suggested model numbers at the end of each item will fulfill these requirements.

Oscilloscope: DC to 25 MHz, dual trace, triggered sweep, Heath IO-4225 or equivalent.

Low-Capacitance Oscilloscope Probe: Input capacitance adjustable between 15-50pF, 4 nS rise time. Heath PKW-105 or equivalent.

Logic Probe: DC to 20 MHz, capable of detecting 10 nS single pulses. Indicates logic one, logic zero, and high-impedance states. Heath IT-7410, or Hewlett-Packard HP-545A, or equivalent.

Digital Multimeter: High-impedance input. Measures ohms, AC/DC voltage, and AC/DC current. Heath SM-77 or equivalent.

Frequency Counter: Able to measure from 5 Hz to 512 MHz with a resolution from 0.1 Hz to 1000 Hz. Heath IM-2420 or equivalent.

Audio Signal Generator: Able to generate sine waves from 1 Hz to 100 kHz. Amplitude adjustable from 1 mV to 10 V rms. Heath IG-18 or equivalent.

AC Power Supply: Voltage adjustable to 120 VAC rms. Able to display primary current. Heath IP-5220 or equivalent.

DC Power Supply: Voltage adjustable from 1 to 15 VDC. Current adjustable from 0 to 500 mA. Heath IP-2728 or equivalent.

Resistance Substitution Box: Switch-selectable standard resistance values from 150 kilohms to 1.5 megohms. Heath IN-3137 or equivalent.

Computer Terminal: RS-232C and ASCII compatible. Data rate adjustable to 9600 baud. Heath H-19 or equivalent. Alternately, you can use a computer and modem communication software, such as the Heath HS-158 and HUGMCP (885-3033-37 from Heath Users' Group).

DISPLAY ASSEMBLY TEST FIXTURE

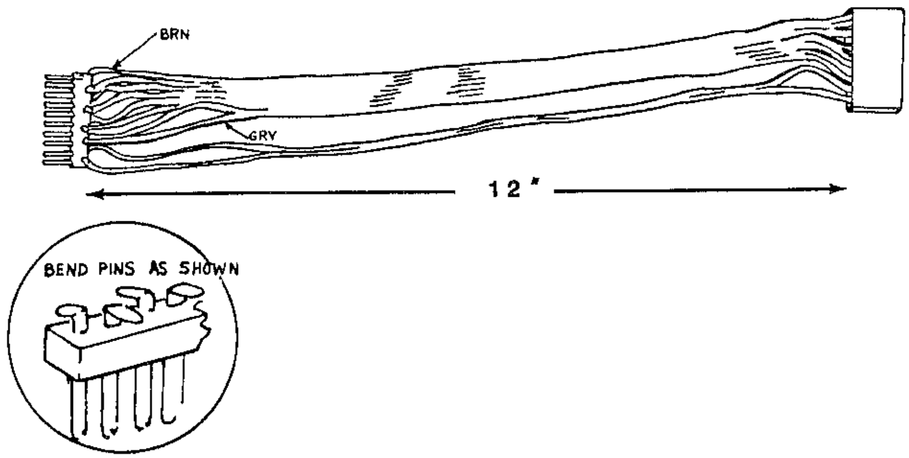
To service the display driver board, you need to build the following extender cables. These will allow you to access the components on both sides of this board while the unit is operating.

PARTS NEEDED

To build the extender cables, you will need the following parts.

Qty.	Description	Part No.
5 ft	Wire, green stranded	344-155
1 ft	Tubing, heat shrink	346-66
3 ft	Cable, flat, 8 conductor	347-55
5	Connector, large spring	432-753
20	Connector, small spring	432-866
2	Plug, 10 pin	432-903
2	Connector shell, 10 hole	432-958
1	Plug, 5 pin	432-1182
1	Connector shell, 5 hole	432-1183

CONSTRUCTION



PICTORIAL 9-1

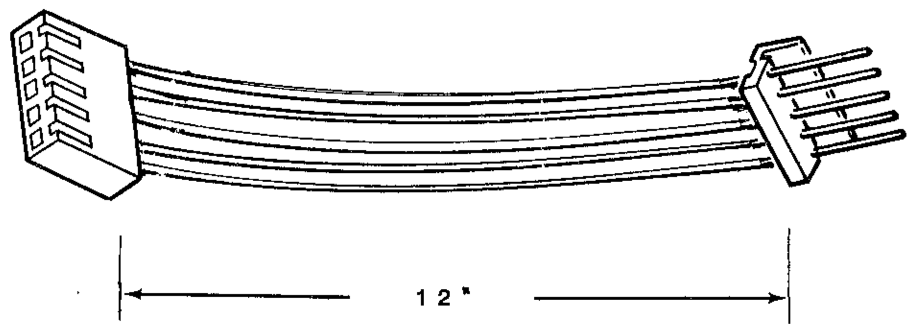
Display driver extension cable.

Refer to Pictorial 9-1 as you perform the following steps.

- On each 10-pin connector, bend every other pin (the short ends) so that you can solder the ribbon cable to them without adjacent wires touching.
- Cut the 8-wire ribbon cable into three 12-inch lengths.
- Split one of the 12" cables into two 2-pair cables. Discard the remaining four pairs.
- Solder the brown wire of an 8-wire cable to one end of a 10-pin plug.
- Solder the remaining seven wires to the next seven pins. Make sure that none of the wires are crossed. The gray wire should be last.
- Solder one of the 2-wire cables to the remaining two pins on the 10-pin plug.

- Solder small spring connectors to the free ends of the cable and install them into a 10-hole socket shell. Install the wires in the same order that you did on the 10-pin plug. Make sure that none of the wires are crossed.

- In the same manner, build one more display driver extension cable.



PICTORIAL 9-2

Lamp extension cable.

Refer to Pictorial 9-2 as you perform the following steps.

- Cut the green stranded wire into five 12-inch lengths.

- Solder each wire to the short end of each pin on the 5-pin plug.

- Cut off five 1/2-inch lengths of shrink tubing and slide them over the soldered pins. Then heat them.

- Install a large spring connector on the remaining end of each wire.

- Insert each wire into its corresponding slot on the 5-pin socket. Make sure none of the wires are crossed.

This completes the extension cable construction.

SETUP

Perform the following setup procedure if you are servicing a problem in the display circuits. Refer to "Disassembly" and to Pictorial 9-3, the "Display Driver Assembly Setup" illustration, as you perform these steps.

- Remove the two sets of hardware holding the main circuit board to the brackets.
- Lift the main circuit board until S401 and S402 unplug from P205 and P204 on the display driver board.
- Unplug S302 on the power supply circuit board.
- Temporarily remove the front panel.
- Remove the display driver assembly and set it down in front of the chassis.
- Loosely reinstall the front panel onto the chassis so you can use the keypad.
- Plug the display driver extension cables into S401 and S402.
- Route the cables under the power supply circuit board and through the front panel display opening.
- Connect the free ends of the display driver extension cables to P205 and P204 as shown. Make sure that the plugs are not offset by one pin.
- Connect the fluorescent lamp to S302 through the lamp power extension cable. Route the cable over the top of the front panel and away from the display driver extension cables to reduce the effects of noise.

The Weather Computer is ready for servicing. You can now easily reach both sides of the display driver circuit board with a test probe.

DEAD UNIT OR LOCKED UP

POWER SUPPLY

NOTE: If you install the backup battery before applying AC power, the Weather Computer will not initialize properly and will appear dead when plugged in. To correct this, disconnect the battery, plug in the unit, and reconnect the battery.

- Check the power supply voltages. Make sure the fuse is okay and the power transformer is wired properly.

- Check the hum and noise on the power supply lines against those on the schematic.

  Excessive voltage spikes can cause the logic circuits to behave unpredictably.

  NOTE: When you check the power supply, be sure to ground your probe on the supply circuit board. Otherwise, noise generated by the fluorescent lamp circuits will cause erroneous results.

- Check the power-handling components for excessive heat.

  The following components were checked with an Electrotherm M-99 digital thermometer. All other components should be near room temperature (27°C [81°F] at time of measurement).

Component	Temperature
Q302	37.8°C (100°F)
Q305	41.1°C (106°F)
Q306	43.2°C (110°F)
Q307	37.8°C (100°F)
Q309	65.6°C (150°F)
Q311	65.6°C (150°F)
T301	32.2°C (90°F)
T302	32.2°C (90°F)
U304	43.3°C (110°F)

LOGIC CIRCUITS

NOTE: If the system's speaker sounds continuously, it usually indicates that the problem is in the logic circuits. For some reason, the Z80 wasn't able to shut off the latch at U410 to disable the speaker oscillator. To prevent distraction, you can disable the oscillator by grounding the base of Q403. Then, if you get the proper signals in the following checks, proceed to "CPU Test Waveforms."

- Check for a high at U420-26. If it is low, trace back to the reset circuits.
- Check for pulses at U420-6. If they are missing, check Y401.
- Check for pulses at U408C-6. If they are missing, trace back to the 60-Hz circuits on the power supply. Otherwise, substitute a known-good U412 and U414 (if present).
- Substitute a known-good RAM chip at U416 and ROM at U418.
- Make sure U418-27 is grounded through U401.
- Check U417 on the main circuit board and U204 on the display driver circuit board.

The display driver chips at U201-U203 will also lock up the system, but—unless you have the equipment necessary to replace surface-mount ICs—it is quicker to substitute a known-good board.

You can solve most problems using the following checks. While they will not help you spot a defective driver IC, they will help you determine if the driver board or the main board is the cause of the problem.

When you are making these checks, bear in mind that a defective display driver causes the Z80 to enter an endless loop at powerup (see "Circuit Description"). Thus, you can ignore the segment lines at pins 27-77, the COM lines at pins 23-24, and the viewing-angle lines at pins 17-22.

- Closely inspect the board for solder bridges and cracked foil runs.
- Check for +5VDC at pin 1 of each driver IC and ground at pin 11.

- Check for pulses at pin 80 of each driver IC. If they are missing, check U204A, U204D, and their associated RC network.
- Check for pulses on the chip-select, write, and read lines at pins 3-5 of each driver IC.

  Trace defective chip-select lines to U417 and the other lines to the Z80.
- Make continuity checks on the SYNC line between pin 78 of each driver IC to U204B-4. From the input of U204B, trace back to U417.

  Note that you normally will not see pulses on this line except for a short time at powerup. (See "Display Circuits Waveforms" for more information.)
- Check the continuity of the data bus to each driver IC. Note that the READY line at pin 2 of each chip should be connected to pin 15 (D0).
- Check for an open resistor at R202.

BAROMETER CIRCUITS TESTING

- Make sure there is a jumper across pins 1 and 2 of P402, and that P401, P403, and P404 are open.
- Check for +15VDC at U402-4 and −15VDC at U402-11. If either are incorrect, trace back to the power supply.
- Swap U402 with U404. If the problem moves to the temperature or humidity circuits, replace the IC now at U404 and recalibrate.
- Swap U405 with U407. If the problem moves to the indoor humidity display, replace the IC now at U407.
- Remove the jumper from P402.
- Install a jumper socket at P403, pins 1 and 2.
- Install a jumper socket at P404, pins 2 and 3.

- If the barometer display is in the "millibars" mode, press PRESSURE and UNITS to put it in the "in.Hg" mode.

- Adjust R407 for a barometer reading of 62.00 ± 0.20 on the display.

  If you can not get the reading, check the junction of R421 and R422 for about + 3.1 VDC. If it is incorrect, check the resistor values, D401, C409, and R427.

  If the divider voltage is okay, check the V.F. converter circuits (see "V.F. Converter Circuits Waveforms"). Make sure there is – 15 VDC at U403-4, + 15 VDC at U403-8, and + 5V DC at U405-14. If not, trace back to the appropriate power supply.

  If the V.F. converter is okay, check the RAM chip at U416. The Z80 temporarily stores the barometric pressure here before processing it and sending it to the display. A stuck bit at the right address could cause an incorrect pressure reading yet allow the other sensors to function properly.

- Remove the jumper socket from pins 2 and 3 of P404 and install it in pins 1 and 2 of P404.

- Adjust R425 to get a barometer reading of 62.00 ± 0.20.

  If you can not get the correct display, check R426, R425, R423, and R413. If these are okay, temporarily unplug the jumper at P404 and the op amp at U402. Turn off the unit and measure the resistance of A401. On a good sensor, pin 3 will typically measure 400 to 500 ohms to ground and across pins 2 and 4 will measure 1500 to 1600 ohms (polarity isn't critical). If you get different values, make sure the erroneous readings are not caused by shorted foils.

- Remove the jumper from pins 1 and 2 of P403 and install it on pins 2 and 3 of P403.

- Remove the jumper from P404 and install it on pins 1 and 2 of P401.

- Note the barometer reading and perform one of the following two steps.

  A. If the barometer reading is .00, adjust R424 CW to get a reading that is slightly higher than .00. Then adjust R424 CCW until the barometer reading just becomes .00.

  B. If the barometer reading is not .00, adjust R424 CCW until the barometer reading just becomes .00.

  If R424 will not adjust properly, check U402, R424, and the resistor network between U402B and U402C. Note that the voltage on U402B-7 and U402C-8 should increase as you adjust R424 CW, while U402B-6 should track U402B-5 and U402C-9 should track U402C-10.

- Remove the jumper socket from P403 and install it on pins 1 and 2 of P402.

- Remove the jumper socket from P401 and install it on P401-2. Leave pin 1 open, this configuration is the jumper socket's storage location.

- Turn R413 25 turns clockwise or until you hear a faint click from the control.

  The barometer display should increase as you adjust the control. If not, check R423, U402A, U402D, and their respective bias resistors. The voltage on U402A-1 should track U402A-3. U402D-14 should be the inverted sum of U402C-8 and U402A-1. As you adjust R413 clockwise, U402A-1 should become less positive and U402D-14 more positive.

- Adjust R414 25 turns counterclockwise or until you hear a faint click from the control.

  The barometer display should decrease as you adjust the control. If not, check R414, U402C, and the resistor network biasing these components. U402C-8 should become less negative and U402D-14 less positive.

- The barometer display should be less than 39.00 in.Hg.

  If it does not, check the jumper wire and parallel resistor combination at R405 (see the main board schematic). If the jumper, R405A, or R405B are present, start with the jumper and clip one end of each component until the display drops below 39.00. If only R405C is left, then check for an out-of-tolerance bias resistor in the U402 area.

HUMIDITY INTERFACE CIRCUIT TESTING

Perform the following steps to test the humidity circuits in the Weather Computer. To check the sensors, refer to "IDA-5001-1 Humidity Sensor Waveforms."

- Check for +15VDC at U404-4 and −15VDC at U404-11. If either is incorrect, trace back to the power supply.
- Swap U404 with U402. If the problem moves to the barometer, replace the defective op amp now at U402.
- Swap the electronic switches at U405 and U407. If the problem moves to the indoor temperature or the barometer, replace the defective IC now at U405.
- Check for proper installation of the bias and feedback resistors at U404A and U404C.

To check the circuit linearity, disconnect the humidity sensors from the back panel and connect a resistance substitution box between the WHT (input) and BLK (+5 volts) humidity lugs. For the following resistance settings, you should get voltages similar to those in the table.

Resistance	WHT Lug	U404A-3 U404C-10	U404A-1 U404C-8	Relative Humidity
150 kilohms	1.20 VDC	0.59 VDC	0.87 VDC	76%
220 kilohms	0.83 VDC	0.40 VDC	0.58 VDC	47%
330 kilohms	0.56 VDC	0.26 VDC	0.39 VDC	28%
470 kilohms	0.43 VDC	0.20 VDC	0.29 VDC	19%
680 kilohms	0.29 VDC	0.13 VDC	0.19 VDC	8%
1.0 megohm	0.20 VDC	0.09 VDC	0.13 VDC	2%
1.5 megohms	0.13 VDC	0.05 VDC	0.07 VDC	0%
Disconnected	−0.02 VDC	−0.02 VDC	−0.04 VDC	Blank

Note that you may get readings slightly different from those in the table. The voltages depend on the characteristics of the humidity sensor used during calibration, while the humidity display (while using a resistance substitution box) depends on the characteristics of the V.F. converter. One thing that will remain fairly constant, however, is that the relative humidity will change by 1% for a 10mV change at U404A-1 and U404C-8. Thus, if U408A-1 is increased from 0.58VDC to 0.87VDC, the Z80 interprets the 0.29VDC changes as 29% and adds it to the current display of 47% to get 76%. The accuracy will drop off at the lower humidity ranges, but bear in mind that the specifications call for an accuracy of ± 10 counts at 25°C over a range of 10% to 90%.

- If the voltages do not track, substitute a known-good op amp at U404.
- Make sure the slope controls at R435 and R458 are properly set.
- Make sure the input filters at C411 and C413 are properly installed and are not leaky.

RAIN SENSOR CIRCUITS TESTING

- Check for TTL-level pulses at U421-14 as you momentarily short together the two RAIN inputs on the back panel.

  If they are missing, trace back through U408E, U408F, and R484 to the RAIN input lugs. Make sure R2 is properly installed on the chassis.
- If U421-14 pulses, but the Rain Display doesn't increment 0.01 inch for each momentary short, check U421.
- Substitute a known-good RAM at U416.
- Check the display circuits (see "Display Circuits Waveforms").

RS-232C CIRCUITS TESTING

In the following steps, use all capital letters when you enter a command on the keyboard.

- Check the RS-232C handshake and signal voltages at U413 and R415 against those on the schematic. Note that the low voltage on U413-4 is due to the ratio of the IC's input impedance (3 to 7 kilohms) to R473.
- Connect the terminal (or computer) to the Weather Computer's serial port, and set the baud rate of both units to the value you are using.

- At the terminal keyboard, repeatedly press the **RETURN** key and check for pulses at U414-29. If it is missing, trace back through U413 to your computer.

  CAUTION: Depending on the terminal, the voltages at U413-13 may vary as much as ± 10 volts. Though most logic probes are protected from such voltages, some may be damaged. Also, the RS-232C standard requires at least a ± 3-volt swing, which can't be spotted with a logic probe. Use an oscilloscope.

- At the terminal keyboard, type **ATES** and press the **RETURN** key.

  You should see a "0" or "8" on the screen. The 0 indicates that you've sucessfully entered the Echo Set command and that further keystrokes will echo to the CRT. An 8 means you made a typing error; try again. In any case, the serial port hardware is functioning properly. If the unit is loosing data or improperly interpreting commands, it is probably due to the RAM (U416) or ROM (U418).

- Enter "ATLS" and repeatedly press the **RETURN** key.

  You should see pulses at U415-6 (use an oscilloscope). If not, check U415 and U414. Make sure that + 15VDC is present at U415-14 and – 15VDC at U415-1. Check the continuity on the interrupt line from U414-5 to U420-16.

- Check the wiring between the main board and the back panel.

Note that some terminals and computers require special handshaking signals. Thus, the constant high on the DTR line at U415-6 may cause some computers to lock up. This is not a problem with most Heath computers, since they can be customized to operate with a variety of handshaking protocols.

TEMPERATURE CIRCUITS TESTING

SENSOR CHECKS

- If you are not using known-good temperature sensors, swap them and see if the symptoms move to the other temperature display. If they move, replace the defective sensor and recalibrate. Otherwise, go to "Internal Checks."

If you suspect that both sensors may be bad (due to lightning for example) but you don't have good ones in stock to compare them against, make the following checks.

- Check for 6.8VDC across the BLK and WHT temperature terminals on the back of the unit (BLK is positive).

  If it is present, the temperature sensor is okay. Otherwise, disconnect the sensor and verify it with an ohmmeter. With the negative lead connected to the ground lead, you should get one of the following typical readings.

	IM-28 (RX1K)	IM-2202 (1K)	SM-77 (Auto)
BLK	7.1 K	1.6 K	5.1 M
WHT	6.5 K	0.7 K	3.5 M

INTERNAL CHECKS

NOTE: This procedure is described in a general manner since it applies to both the indoor and outdoor circuits.

- Connect known-good temperature sensors to the temperature inputs on the rear panel.

- Check U404-4 for + 15 VDC and U404-11 for – 15 VDC. If these voltages are missing, trace back to the appropriate power supply.

- Swap U404 in the temperature circuits with U402 in the barometer. If the problem moves to the barometer, replace the IC now at U402 and recalibrate.

- Swap U405 with U407 in the V.F. converter circuits. If the problem moves to the humidity or light sensors, replace the IC now at U407.

- Momentarily ground the + input to the suspect op amp (U404B-5 or U404D-12).

  The respective output at U404B-7 and U404D-12 should drop to about 1mV and the appropriate indoor or outdoor display show – 40. (The indoor will show only the "40," since the LCD doesn't have a minus sign at this location.)

  If you do not get this response, the V.F. converter at U403A may be defective or misaligned. Also check the input voltages of U405 and U407. If one of the other circuits are defective, it could be interfering with the temperature circuits through crosstalk.

- Check the RAM at U416.

  The Z80 stores intermediate temperature values here. If the appropriate memory cell is defective, the Weather Computer will give erroneous temperature displays but everything else will work properly.

LINEARITY CHECKS

To check the circuit linearity, obtain two insulated cups and fill one with ice water and the other with hot tap water. Check the faulty circuit at cold, hot, and room temperatures. Using the indoor op amp, U404B, as an example, you should get DC voltages similar to the following.

Temp.	BLK	WHT	U404-5	U404-7
36°F	2.8V	– 4.0V	0.44V	0.77V
81°F	3.0V	– 3.8V	0.70V	1.22V
130°F	3.3V	– 3.5V	0.98V	1.71V

Note that the three input voltages may be slightly different due to component tolerances. However, the voltage difference between the BLK and WHT inputs should be nominally 6.8 volts and not vary more than about 10mV from one temperature extreme to the other. Also, the output voltage should be within a few millivolts of those shown for U404-7. That's because the Z80 interprets zero volts as – 40°F and a 10mV change as a 1°F change. Thus, since there is a 77-degree difference between 36°F and – 40°F (including 0°F), the output of the op amp will be 0.77mV.

You should get similar results from the outdoor circuits.

- If the voltages are not tracking properly, substitute a known-good IC at U404.
- Check the input resistors and op amp feedback resistors for the proper values.
- Check C410 and C414 for proper installation. The one in the faulty circuit may also be leaky.

WIND DIRECTION TESTING

INTERNAL CHECKS

Perform these checks to isolate the problem to the ID-5001 or the wind vane.

To quickly check the wind direction circuits, connect a jumper wire to the BLU terminal (+5VDC) on the rear panel and sequentially touch the other end to the BRN, RED, ORG, and YEL terminals. The display should show the following direction readings.

Terminal	Direction	Conducting Transistor
Disconnected	SE	All Off
BRN	ESE	Q411
RED	SSE	Q414
ORG	ENE	Q413
BLU	WSW	Q412

As you switch the +5VDC jumper from one terminal to the next, the system firmware will cause the display to behave as if the wind direction sensor was connected. For example, if the terminals were disconnected, and you jumpered the ORG input to +5VDC, the ESE and E indicators would sequentially light until the ENE light was reached.

- If you get the above results, proceed to "Boom Assembly Checks."
- If the indicators between the old and new directions will not light, suspect a problem in the display circuits, a defective RAM at U416, or a defective ROM at U418.
- If any directions in the above table fails to light, suspect the associated inverter transistor (Q411-Q414), the hex bus driver at U421, the display circuits, U416, and U418, in that order.

BOOM ASSEMBLY CHECKS

- Connect the color-coded wires from the boom assembly to their appropriate terminal lugs on the back of the Weather Computer.

- Spin the wind speed sensor.

  You should see a 2VP-P distorted sine wave riding on + 5VDC. At the same time, the wind speed display should indicate some value (100Hz=10MPH).

  If you get the sine wave, but no wind speed display, proceed to "Wind Speed Circuits Waveforms" and perform the checks described there.

  If the sine wave is missing, check D601 and Q601 in the wind cup. Check the continuity of the cable.

- Rotate the wind direction sensor 360°.

  You should get the following TTL logic levels on the indicated rear panel inputs. At the same time, the display should light the indicated direction under the "point" column.

Point	BRN	RED	ORG	YEL
N	H	H	H	H
NNW	L	H	H	H
NW	L	L	H	H
WNW	H	L	H	H
W	H	L	L	H
WSW	L	L	L	H
SW	L	H	L	H
SSW	H	H	L	H
S	H	H	L	L
SSE	L	H	L	L
SE	L	L	L	L
ESE	H	L	L	L
E	H	L	H	L
ENE	L	L	H	L
NE	L	H	H	L
NNE	H	H	H	L

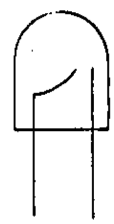
If the logic levels are present but the display is incorrect, check the display circuits.

If the logic levels are incorrect, check D602-D605 and Q602-Q605 in the wind direction sensor. Check the continuity off all the wires and make sure the sensor is constructed properly.

WIND SENSOR SERVICE HINTS

417-919 Transistor Case Color The TIL-78 phototransistor in the wind speed and direction sensors can have either a red case or a clear case. Both are transparent to infrared.

Identifying the LED A quick way to tell the #412-635 infrared LED from the #417-919 phototransistor (clear case) is to look at the device from the side. The LED has internal leads that are visible (see sketch), while the transistor doesn't.



Erratic or Improper Wind Speed Display This is caused by an oversensitive phototransistor in the wind speed sensor. Make sure the #73-53 rubber grommets are properly installed on D601 and Q601 (see "Visual Checks").

WAVEFORMS

OVERVIEW

Unless noted otherwise, the following waveforms were measured with an ID-4850 Computer Oscilloscope under the following conditions.

- The battery backup is disconnected.
- The unit is powered up and is in the normal mode (initial setup mode timed out).
- No entries have been made on the keypad.
- Indoor/outdoor temperature sensors are connected.

Due to the random nature of some of the pulses and the sampling characteristics of the ID-4850, some of the waveforms will look different on a cathode ray tube oscilloscope. However, such things as general timing and rise/fall times are the same.

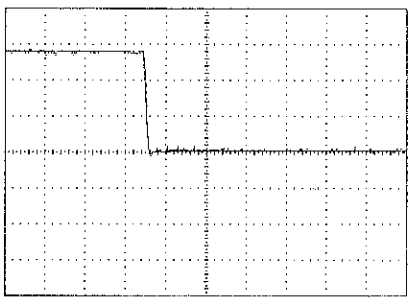
Unless noted otherwise, the waveforms are usually shown with the synchronizing signal on top. They are grouped alpha-numerically by the non-synchronized signals (shown in bold face). To find a waveform, look up the bold face letter, then sync your scope to the test point listed above it (if it's a dual-trace illustration).

When you are making a measurement, ground your probe on the circuit board under test. This is especially important on the power supply board, which generates a lot of noise due to the fluorescent lamp circuits. When measuring logic circuits, adjust the oscilloscope vertical input for DC. Be sure to use a ×10 probe, such as the PKW-105, to ensure accurate rise-time measurements.

ID-5001 ADVANCED WEATHER COMPUTER

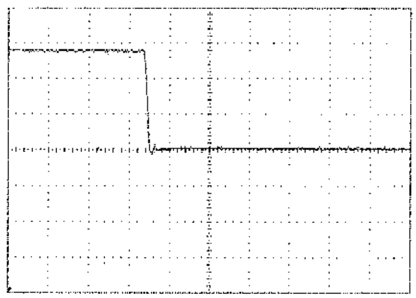
System Timing Waveforms

Note that the signal from U412-9 depends on whether or not the IDA-5001-3 RS-232C accessory is installed. If it is, the signal is a 153.6kHz, 600nS-wide pulse which clocks the baud rate generator in U414. If the serial port accessory isn't installed, U412-9 is a 60Hz, 600nS-wide pulse used for power-fail detection (see "Circuit Description"). Because of its extremely short duty cycle, you may not be able to see it with a standard oscilloscope.

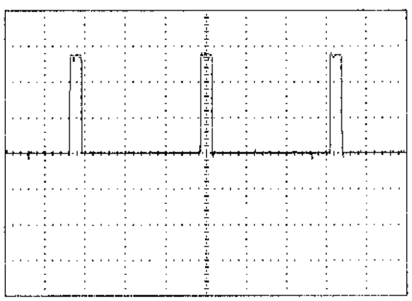


U412-8
(Synchronizing Signal)
V = 2.0 V/div
H = 100 nS/div

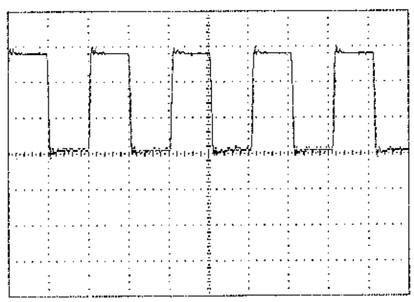
Baseline at division 4



U412-9 (w/o RS-232C)
(Synchronizing Signal)
V = 2.0 V/div
H = 100 nS/div
(Duty Cycle = 0.0037%)
Baseline at division 4



U412-9 (with RS-232C)
(Synchronizing Signal)
V = 2.0 V/div
H = 2 uS/div
(Duty Cycle = 9.2%)
Baseline at division 4



Y401-3
(Synchronizing Signal)
V = 2.0 V/div
H = 200 nS/div

Baseline at division 4

CPU Test Waveforms

Because several circuits are time-sharing the same bus lines, it's difficult to view a single pulse with an oscilloscope. With experience, however, you can usually tell if there is a problem on a particular line. Normally, the signals will have steep rise and fall times, about 15 to 20nS. The exception is the D0 line, which has a rise time of about 2uS due to the loading caused by R202 on the display driver board. If these conditions are not present, suspect a leaky component on the bus.

Also, the signals should switch from less than + 0.8 volts (logic zero) to greater than + 2.4 volts (logic one). If the pulse on one or more lines doesn't reach either of these limits, or appears to "step" when switching, suspect a short circuit to an adjacent bus line. (An exception to this is some outputs from U201-U203 on the display driver board. These lines will step due to the characteristics of the HD61604 ICs. See "Display Circuits Waveforms.")

Despite the "randomness" of the bus signals, you can take advantage of a characteristic of the Z80 to check if the CPU is working and if there are any shorts on the address bus. The characteristic is that if the data bus lines are at logic zero, the Z80 will interpret it as a NOP instruction (No Operation) and attempt to read the next memory address. The result is that the Z80 will sequentially step through all memory locations from zero to 65535 and generate square waves on A0 through A15. A0 will be the highest frequency and each succeeding line will divide the frequency by two.

Note that the signals at the lower frequencies will appear to be modulated by a 1.6uS signal. This is unavoidable because the Z80 is also placing a memory refresh address on the bus during the M1 cycle (see "Circuit Description"). However, you will be able to sync a scope to these signals and be able to spot such things as shorted bus lines or leaky components.

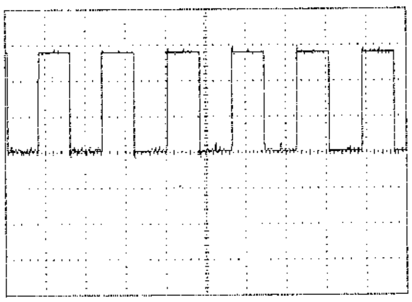
To generate these signals, perform the following steps.

- Remove the RAM and ROM at U416 and U418.
- Ground the D0 line to defeat R202 on the display driver board.

  If you do not have any clips small enough to safely connect to D0 on one of the IC pins, tack-solder a wire to U420-14 on the foil side of the main board.
- Ground the base of Q403 to disable the speaker while you are troubleshooting.

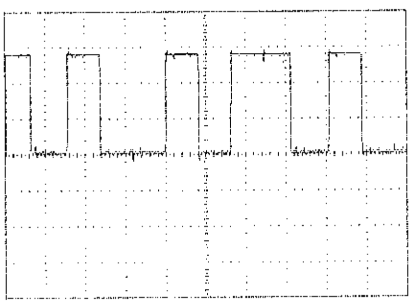
Refer to the following waveforms. They are listed by mnemonic rather than test point to make them easier to locate. A sugggested test point is shown beside each one. Note that the 1.6 µS modulating signal appears to be a lower frequency on lines A9-A15. This is due to aliasing in the ID-4850.

When finished, reinstall the ICs and remove the jumpers.



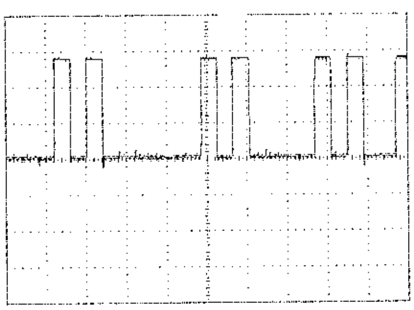
A0 (U420-30)
(Synchronizing Signal)
V = 2.0 V/div
H = 2 uS/div

Baseline at division 4



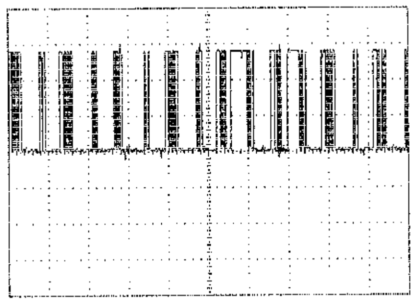
A1 (U420-31)
(Synchronizing Signal)
V = 2.0 V/div
H = 1 uS/div

Baseline at division 4



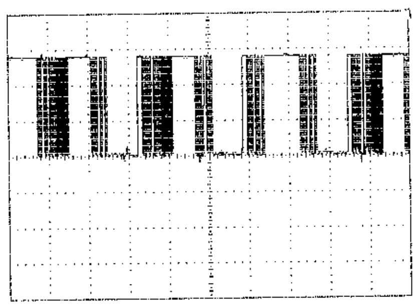
A2 (U420-32)
(Synchronizing Signal)
V = 2.0 V/div
H = 2 uS/div

Baseline at division 4



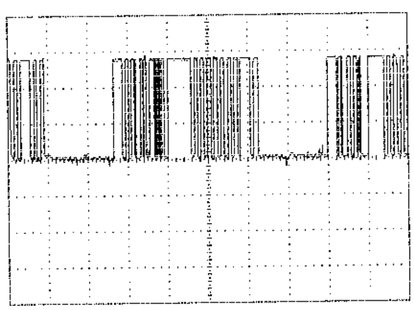
A3 (U420-33)
(Synchronizing Signal)
V = 2.0 V/div
H = 20 uS/div

Baseline at division 4



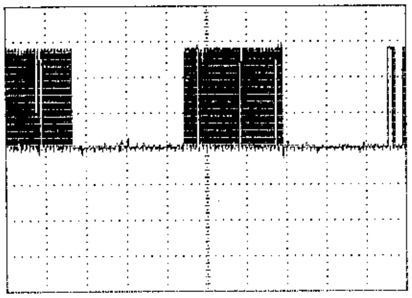
A4 (U420-34)
(Synchronizing Signal)
V = 2.0 V/div
H = 20 uS/div

Baseline at division 4



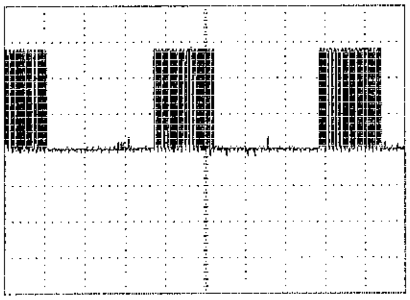
A5 (U420-35)
(Synchronizing Signal)
V = 2.0 V/div
H = 10 uS/div

Baseline at division 4



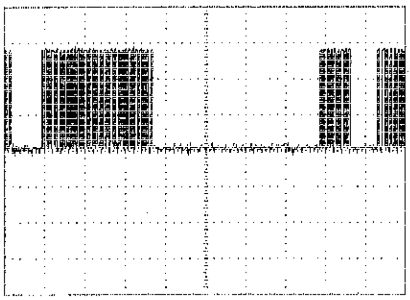
A6 (U420-36)
(Synchronizing Signal)
V = 2.0 V/div
H = 20 uS/div

Baseline at division 4



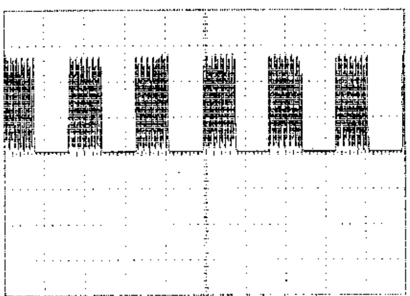
A7 (U420-37)
(Synchronizing Signal)
V = 2.0 V/div
H = 100 uS/div

Baseline at division 4



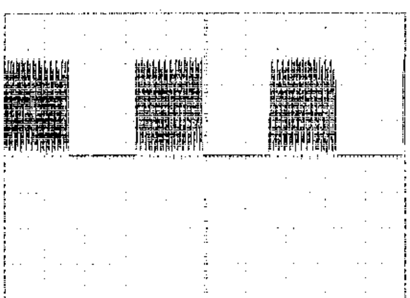
A8 (U420-38)
(Synchronizing Signal)
V = 2.0 V/div
H = 100 uS/div

Baseline at division 4



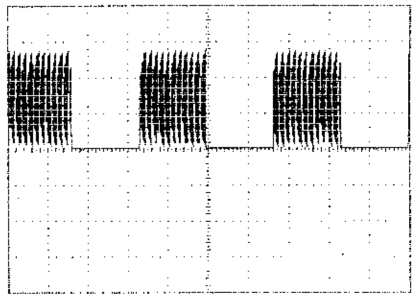
A9 (U420-39)
(Synchronizing Signal)
V = 2.0 V/div
H = 1 mS/div

Baseline at division 4



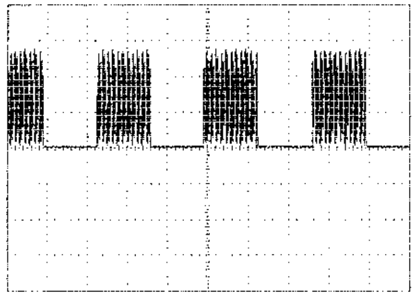
A10 (U420-40)
(Synchronizing Signal)
V = 2.0 V/div
H = 1 mS/div

Baseline at division 4



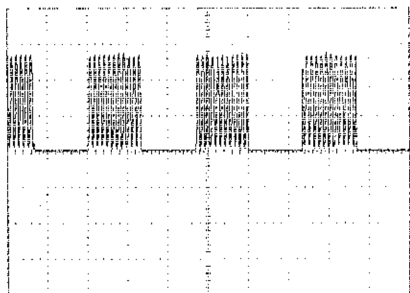
A11 (U420-1)
(Synchronizing Signal)
V = 2.0 V/div
H = 2 mS/div

Baseline at division 4



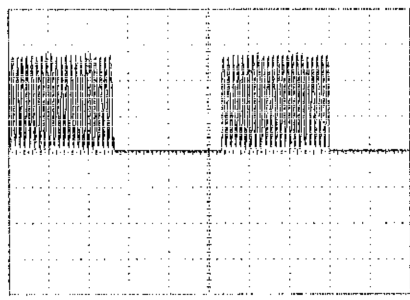
A12 (U420-2)
(Synchronizing Signal)
V = 2.0 V/div
H = 5 mS/div

Baseline at division 4



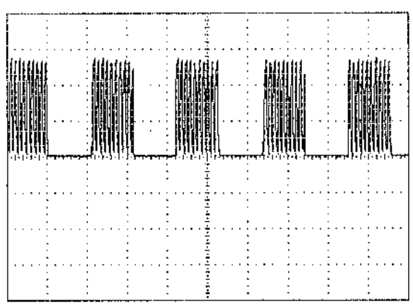
A13 (U420-3)
(Synchronizing Signal)
V = 2.0 V/div
H = 10 mS/div

Baseline at division 4



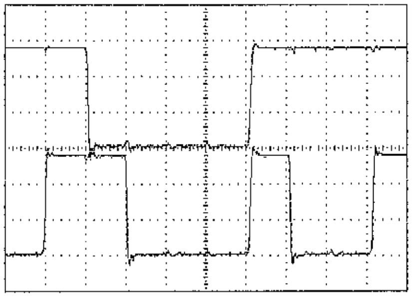
A14 (U420-4)
(Synchronizing Signal)
V = 2.0 V/div
H = 10 mS/div

Baseline at division 4



A15 (U420-5)
(Synchronizing Signal)
V = 2.0 V/div
H = 50 mS/div

Baseline at division 4



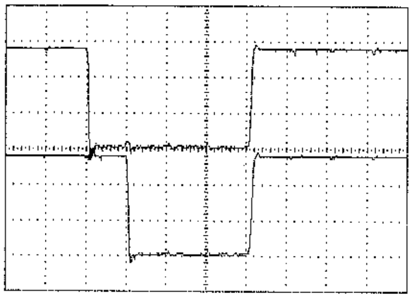
M1 (U420-27)
(Synchronizing Signal)
V = 2.0 V/div
H = 200 nS/div

Baseline at division 4

MREQ (U420-19)

V = 2.0 V/div
H = 200 nS/div

Baseline at division 1



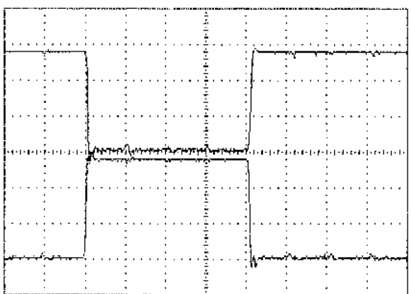
M1 (U420-27)
(Synchronizing Signal)
V = 2.0 V/div
H = 200 nS/div

Baseline at division 4

RD (U420-21)

V = 2.0 V/div
H = 200 nS/div

Baseline at division 1



M1 (U420-27)
(Synchronizing Signal)
V = 2.0 V/div
H = 200 nS/div

Baseline at division 4

RFSH (U420-28)

V = 2.0 V/div
H = 200 nS/div

Baseline at division 1

Display Circuits Waveforms

The duty cycles of the three chip-select signals, $\overline{CS1}$-$\overline{CS3}$, are so low that you may not be able to clearly see them with a cathode ray tube oscilloscope. Use either a digital storage scope or a logic probe. $\overline{CS1}$ will pulse several times per second as U203 updates the wind direction and time displays. $\overline{CS2}$ pulses at 1-second intervals when U201 updates the date, temperature, and barometer displays. $\overline{CS3}$ usually will not pulse unless U202 needs to update the wind speed, humidity, or rain displays. An easy way to force a pulse on this line is to press the WIND key on the keypad.

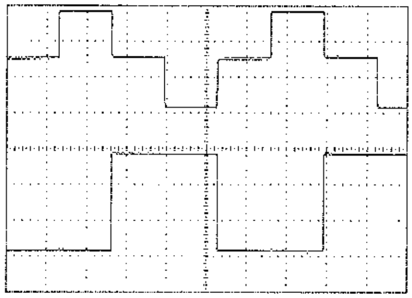
The SYNC line pulses only three or four times during initial powerup (without battery backup). This is too short an interval to be seen on a standard CRT oscilloscope and doesn't provide enough samples for the ID-4850 (512 are required in the equivalent-time mode). To check this line, use a logic probe with a pulse stretching circuit. Momentarily ground the reset line at U408-1. The probe will indicate a logic one. About 1/4 second after you remove the ground, the logic probe light will blink a couple of times, then indicate a constant high.

Note that a segment is blank when the signal on the segment line is in phase with the corresponding backplane line. For example, the P203-2/P203-1 dual-trace waveform under "Typical Signals" will not light the DG15a segment because there's no potential difference between it and the corresponding BP1 signal. (There's about 3 volts difference at the BP1 step voltage, but not enough to light the LCD.)

The dual-trace waveform P203-19/P203-2 shows the two backplane signals. The following two traces, P203-10(A) and P203-10(B) show the 90° phase shift that takes place to selectively light either or both of the multiplexed segments. (See "Circuit Description" for more details.) P203-10(A) is out of phase with both BP1 and BP2, so both DG6b and DG6c will light. P203-10(B) shows the waveform shifted forward 90° so that it is still out of phase with BP1, but in phase with BP2. Segment DG6c remains lit, while DG6b turns off.

Refer to the LCD Connection Table following the waveforms when tracing a backplane segment problem.

Typical Signals



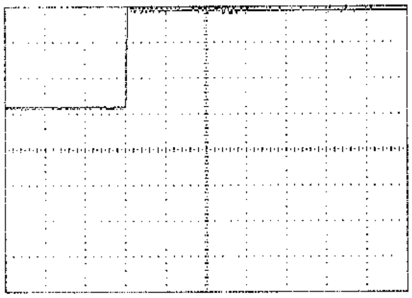
P203-19
(Synchronizing Signal)
V = 2.0 V/div
H = 5 mS/div

Baseline at division 5

P203-10 (B)

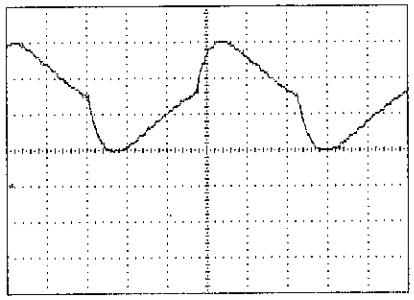
V = 2.0 V/div
H = 5 mS/div

Baseline at division 1



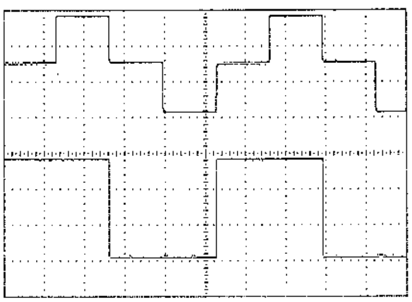
$\overline{CSI}$ (P204-6)
(Synchronizing Signal)
V = 2.0 V/div
H = 200 nS/div

Baseline at division 5



U204-1
(Synchronizing Signal)
V = 2.0 V/div
H = 2 uS/div

Baseline at division 4



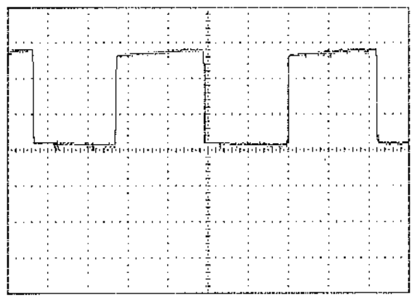
P203-2
(Synchronizing Signal)
V = 2.0 V/div
H = 5 mS/div

Baseline at division 5

P203-1

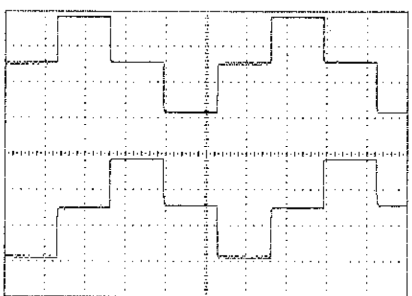
V = 2.0 V/div
H = 5 mS/div

Baseline at division 1



U204-3
(Synchronizing Signal)
V = 2.0 V/div
H = 2 uS/div

Baseline at division 4



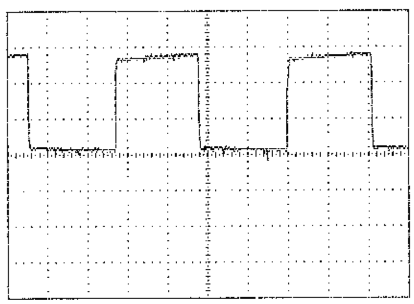
P203-19
(Synchronizing Signal)
V = 2.0 V/div
H = 5 mS/div

Baseline at division 5

P203-2

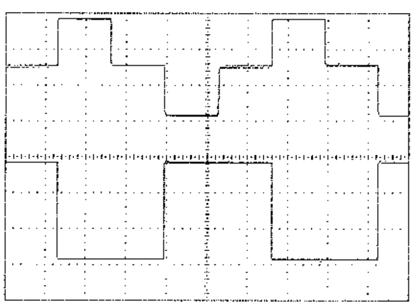
V = 2.0 V/div
H = 5 mS/div

Baseline at division 1



U204-11
(Synchronizing Signal)
V = 2.0 V/div
H = 2 uS/div

Baseline at division 4



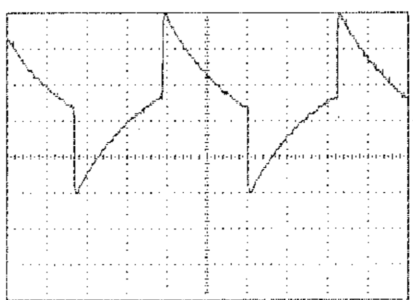
P203-19
(Synchronizing Signal)
V = 2.0 V/div
H = 5 mS/div

Baseline at division 5

P203-10 (A)

V = 2.0 V/div
H = 5 mS/div

Baseline at division 1



R204/R203 Junction
(Synchronizing Signal)
V = 2.0 V/div
H = 2 uS/div

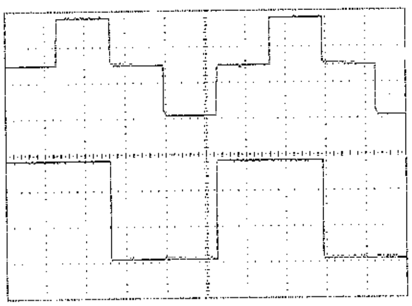
Baseline at division 4

Viewing Angle Signal Levels

At initial powerup, the Z80 sets the viewing angle to maximum. By repeatedly pressing the UNITS and INDOOR keys, you can set the angle to one of four other levels (see "Operation"). The following table shows the DC voltages that you should get. If you do not get them, trace back to Q408 and U411.

Viewing Angle		P205-1 (R207)	U203-20 (R205-R206 Junction
Maximum	[1]	0.11 V	2.92 V
	[2]	0.53 V	3.13 V
	[3]	1.00 V	3.36 V
	[4]	1.36 V	3.54 V
Minimum	[5]	1.84 V	3.71 V

If the voltages are okay but one or more segments are brighter (or dimmer) than the others, refer to the LCD Connection Table to trace back to the faulty IC. The following waveforms are what you should see on a good backplane or segment line. The numbers in brackets match those in the table. Use these as a reference when you are tracing the suspected line.



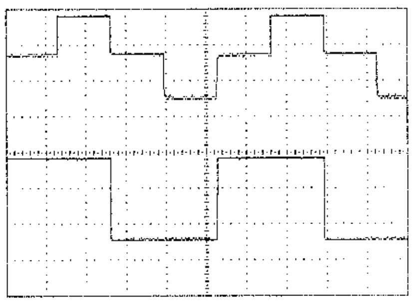
P203-19 (Maximum Angle [1])
(Synchronizing Signal)
V = 2.0 V/div
H = 5 mS/div

Baseline at division 5

P203-1

V = 2.0 V/div
H = 5 mS/div

Baseline at division 1



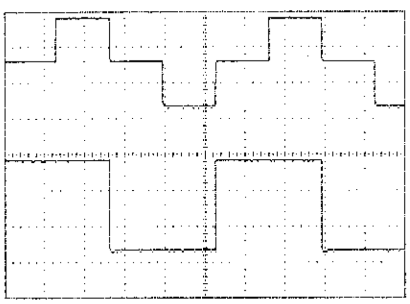
P203-19 (Normal Angle [3])
(Synchronizing Signal)
V = 2.0 V/div
H = 5 mS/div

Baseline at division 5

P203-1

V = 2.0 V/div
H = 5 mS/div

Baseline at division 1



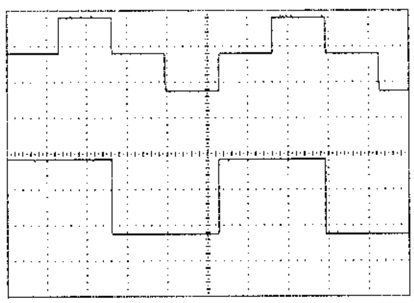
P203-19 ([2])
(Synchronizing Signal)
V = 2.0 V/div
H = 5 mS/div

Baseline at division 5

P203-1

V = 2.0 V/div
H = 5 mS/div

Baseline at division 1



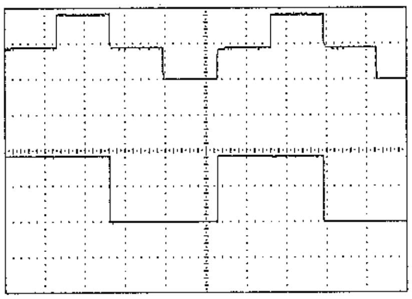
P203-19 ([4])
(Synchronizing Signal)
V = 2.0 V/div
H = 5 mS/div

Baseline at division 5

P203-1

V = 2.0 V/div
H = 5 mS/div

Baseline at division 1



P203-19 (Minimum Angle [5])
(Synchronizing Signal)
V = 2.0 V/div
H = 5 mS/div

Baseline at division 5

P203-1

V = 2.0 V/div
H = 5 mS/div

Baseline at division 1

LCD Connection Table

The following table shows which backplane each segment is associated with. Use this and the schematic diagrams to trace back to the associated ICs.

Pin No.	Backplane 1	Backplane 2
1	-	Backplane 2
2	-	NNW NW WNW W WSW G12-G16
3	29e	29f
4	29d	29g
5	29c	29b
6	AVG	KNOTS
7	KM/H	MI/H
8	-	SW SSW S G9-G11
9	F8	F9
10	F7	F10
11	F6	F11
12	F5	F12
13	SSE SE ESE E G4-G8	-
14	C	F
15	BAROMETER	TEMPERATURE
16	MB	IN
17	DG17e	DG17f
18	DG17d	DG17g
19	DG17c	DG17b
20	DG18e	DG18f
21	DG18d	DG18g
22	DG18c	DG18b
23	DG19e	DG19f
24	DG19d	DG19g
25	DG19c	DG19b
26	DG20e	DG20f
27	DG20d	DG20g
28	DG20c	DG20b
29	-	DG22a
30	-	DG21a
31	DG21e	DG21f
32	DG21d	DG21g
33	DG21c	DG21b
34	DG22e	DG22f
35	DG22d	DG22g
36	DG22c	DG22b
37	HUMIDITY %	RAIN

LCD Connection Table (continued)

Pin No.	Backplane 1	Backplane 2
38	IN	CM
39	-	DG28a
40	DP5	DG27a
41	DP4	DG26a
42	DP3	DG25a
43	DG25e	DG25f
44	DG25d	DG25g
45	DG25c	DG25b
46	DG26e	DG26f
47	DG26d	DG26g
48	DG26c	DG26b
49	DG27e	DG27f
50	DG27d	DG27g
51	DG27c	DG27b
52	DG28e	DG28f
53	DG28d	DG28g
54	DG28c	DG28b
55	-	WEATHER
56	WARN	ALERT
57	H4	H2
58	H3	H1
59	FOG	-
60	-	D5
61	D3	D4
62	D2	D1
63	DG23e	DG23f
64	DG23d	DG23g
65	DG23c	DG23b
66	DG24e	DG24f
67	DG24d	DG24g
68	DG24c	DG24b
69	-	E5
70	E3	E4
71	E2	E1
72	-	DG24a
73	-	DG23a
74	-	C5
75	C3	C4
76	C2	C1
77	-	A5

LCD Connection Table (continued)

Pin No.	Backplane 1	Backplane 2
78	A3	A4
79	A2	A1
80	-	DG14g
81	DG14b,c	-
82	DG15e	DG15f
83	DG15d	DG15g
84	DG15c	DG15b
85	DG16e	DG16f
86	DG16d	DG16g
87	DG16c	DG16b
88	-	B5
89	B3	B4
90	B2	B1
91	-	DG16a
92	-	DG15a
93	BACKPLANE 1	-
94	-	BACKPLANE 2
95	DG8d	DG8g
96	DG9d	DG9g
97	DG10d	DG10g
98	DG10c	DG10b
99	-	DG10a
100	DG10e	DG10f
101	DG9c	DG9b
102	-	DG9a
103	DG9e	DG9f
104	DG8c	DG8b
105	-	DG8a
106	DG8e	DG8f
107	DG7b,c	-
108	S	D
109	PM	AM
110	DG6c	DG6b
111	-	DG6a
112	DG6e	DG6f
113	DG5c	DG5b
114	-	DG5a
115	DG5e	DG5f
116	DG5d	DG5g
117	DG6d	DG6g

LCD Connection Table (continued)

Pin No.	Backplane 1	Backplane 2
118	DG4c	DG4b
119	-	DG4a
120	DG4e	DG4f
121	DG3c	DG3b
122	-	DG3a
123	DG3e	DG3f
124	DG3d	DG3g
125	DG4d	DG4g
126	COLON DP1 HYPHEN	-
127	DG2c	DG2b
128	-	DG2a
129	DG2e	DG2f
130	DG1c	DG1b
131	DG1a,d,e,g	-
132	DG2d	DG2g
133	-	DG13a
134	-	DG12a
135	DG11b,c	-
136	DG12e	DG12f
137	DG12d	DG12g
138	DG12c	DG12b
139	DG13e	DG13f
140	DG13d	DG13g
141	DG13c	DG13b
142	-	DG20a
143	-	DG19a
144	DP2	DG18a
145	-	DG17a
146	SPEED	GUST
147	DG30e	DG30f
148	DG30d	DG30g
149	DG30c	DG30b
150	-	DG30a
151	-	DG29a
152	N NNE NE ENE	-
153	G1,G2,G3	-
154	F4	F13
155	F3	F14
156	F2	F15
157	F1	F16
158	BACKPLANE 1	-

Fluorescent Lamp Circuits Waveforms

At powerup, S303-5 on the power supply board will go high for about ten seconds to heat the filaments in the lamp. It will then start generating a 60Hz or 50Hz squarewave (depending on the AC line frequency) to modulate the light intensity. The duty cycle depends on the ambient light and ranges from about 30% for a dim area to about 60% for a brightly lit area.

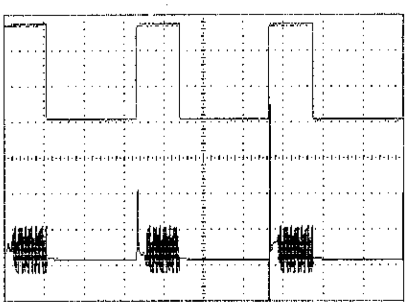
- If you do not get a 50/60Hz signal, check U411, U412, and U417 on the main circuit board. Also check the 60Hz interface: D320 and Q316 on the power supply circuit board and Q405, Q406, and U408C on the main circuit board.

- If the signal is present but the duty cycle won't vary with light level, check R102 on the display circuit board and Q409 on the main circuit board.

  Make sure the temperature probes are connected and functioning properly. If any of the voltages are too large at the inputs of U405 and U407 on the main circuit board, they will generate crosstalk and the Z80 will misinterpret the output of Q409.

  Check U401, U403, U405, U407, U408, and U410 for proper operation (see "V.F. Converter Circuits Waveforms").

- If the signal is okay at S303-5, refer to the following waveforms and check the fluorescent lamp circuits on the power supply circuit board.



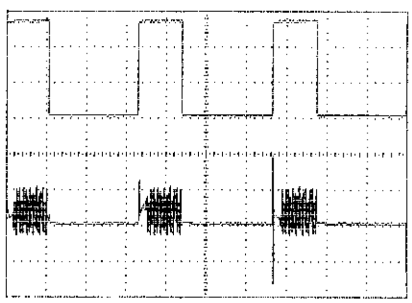
S303-5
(Synchronizing Signal)
V = 2.0 V/div
H = 5 mS/div

Baseline at division 5

D305 Anode

V = 50 V/div
H = 5 mS/div

Baseline at division 1



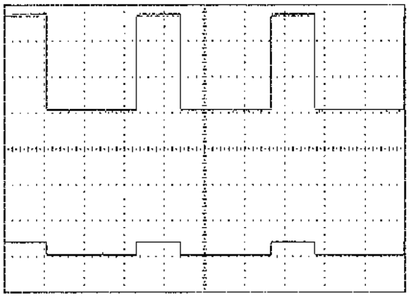
S303-5
(Synchronizing Signal)
V = 2.0 V/div
H = 5 mS/div

Baseline at division 5

D306 Anode

V = 50 V/div
H = 5 mS/div

Baseline at division 2



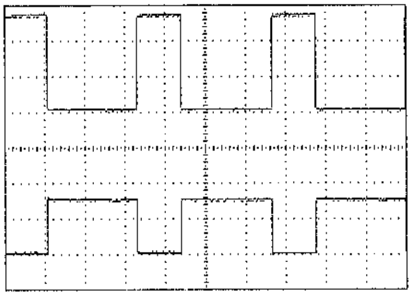
S303-5
(Synchronizing Signal)
V = 2.0 V/div
H = 5 mS/div

Baseline at division 5

Q301 Base

V = 2.0 V/div
H = 5 mS/div

Baseline at division 1



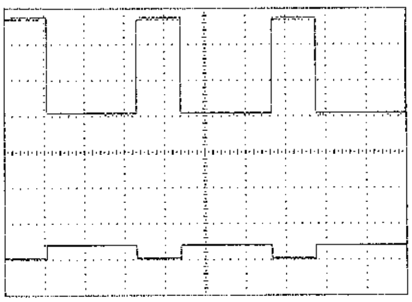
S303-5
(Synchronizing Signal)
V = 2.0 V/div
H = 5 mS/div

Baseline at division 5

Q301 Collector

V = 2.0 V/div
H = 5 mS/div

Baseline at division 1



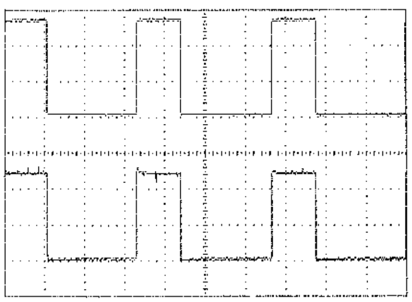
S303-5
(Synchronizing Signal)
V = 2.0 V/div
H = 5 mS/div

Baseline at division 5

Q302 Base

V = 2.0 V/div
H = 5 mS/div

Baseline at division 1



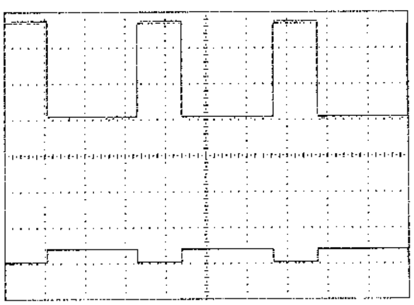
S303-5
(Synchronizing Signal)
V = 2.0 V/div
H = 5 mS/div

Baseline at division 5

Q302 Collector

V = 2.0 V/div
H = 5 mS/div

Baseline at division 1



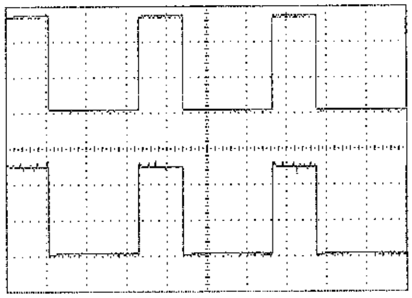
S303-5
(Synchronizing Signal)
V = 2.0 V/div
H = 5 mS/div

Baseline at division 5

Q304 Base

V = 2.0 V/div
H = 5 mS/div

Baseline at division 1



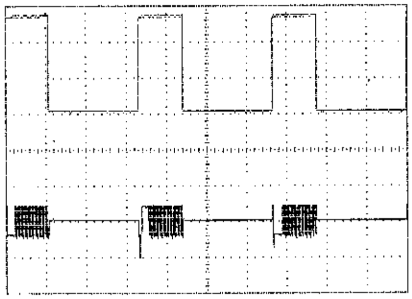
S303-5
(Synchronizing Signal)
V = 2.0 V/div
H = 5 mS/div

Baseline at division 5

Q304 Collector

V = 2.0 V/div
H = 5 mS/div

Baseline at division 1



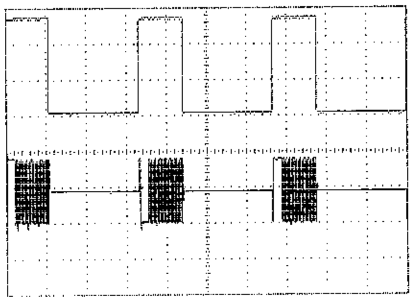
S303-5
(Synchronizing Signal)
V = 2.0 V/div
H = 5 mS/div

Baseline at division 5

Q305 Base

V = 2.0 V/div
H = 5 mS/div

Baseline at division 2



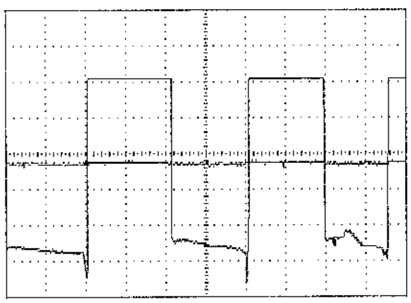
S303-5
(Synchronizing Signal)
V = 2.0 V/div
H = 5 mS/div

Baseline at division 5

Q305 Collector

V = 20 V/div
H = 5 mS/div

Baseline at division 2



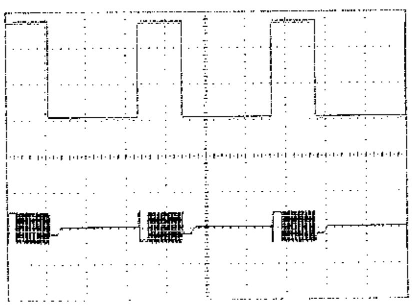
S303-5
(Synchronizing Signal)
V = 2.0 V/div
H = 10 uS/div

Baseline at division 1

Q305 Collector

V = 2.0 V/div
H = 10 uS/div

Baseline at division 1



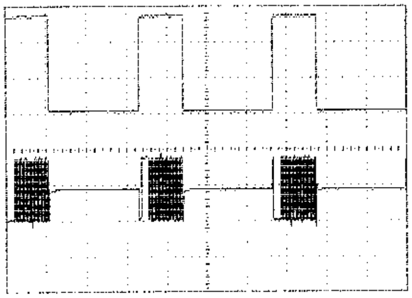
S303-5
(Synchronizing Signal)
V = 2.0 V/div
H = 5 mS/div

Baseline at division 5

Q306 Base

V = 2.0 V/div
H = 5 mS/div

Baseline at division 2



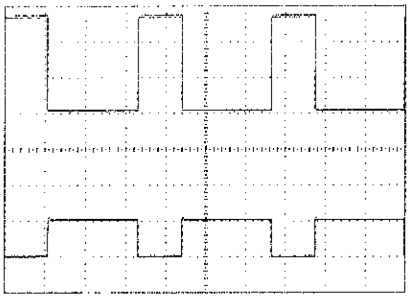
S303-5
(Synchronizing Signal)
V = 2.0 V/div
H = 5 mS/div

Baseline at division 5

Q306 Collector

V = 20 V/div
H = 5 mS/div

Baseline at division 2



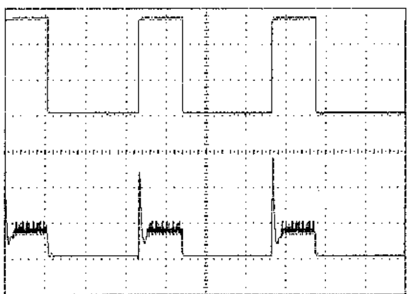
S303-5
(Synchronizing Signal)
V = 2.0 V/div
H = 5 mS/div

Baseline at division 5

Q308 Emitter

V = 2.0 V/div
H = 5 mS/div

Baseline at division 1



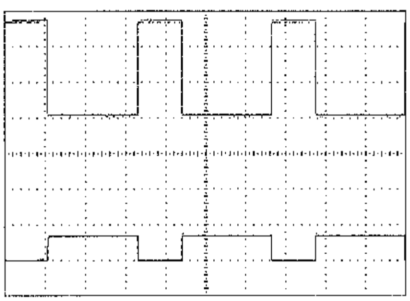
S303-5
(Synchronizing Signal)
V = 2.0 V/div
H = 5 mS/div

Baseline at division 5

Q309 Collector

V = 50 V/div
H = 5 mS/div

Baseline at division 1



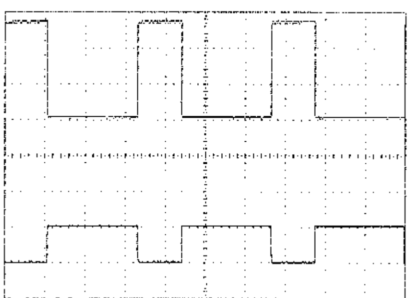
S303-5
(Synchronizing Signal)
V = 2.0 V/div
H = 5 mS/div

Baseline at division 5

Q309 Emitter

V = 2.0 V/div
H = 5 mS/div

Baseline at division 1



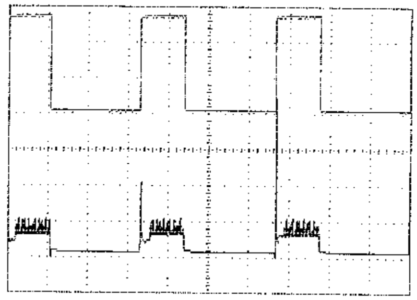
S303-5
(Synchronizing Signal)
V = 2.0 V/div
H = 5 mS/div

Baseline at division 5

Q310 Emitter

V = 2.0 V/div
H = 5 mS/div

Baseline at division 1



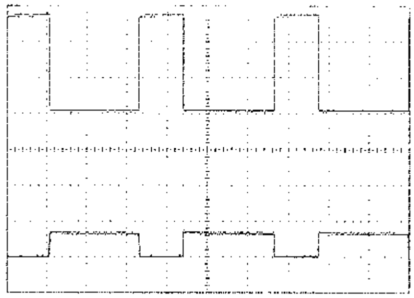
S303-5
(Synchronizing Signal)
V = 2.0 V/div
H = 5 mS/div

Baseline at division 5

Q311 Collector

V = 50 V/div
H = 5 mS/div

Baseline at division 1



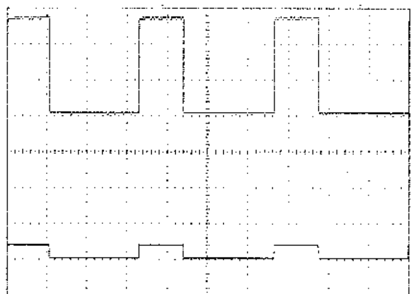
S303-5
(Synchronizing Signal)
V = 2.0 V/div
H = 5 mS/div

Baseline at division 5

Q311 Emitter

V = 2.0 V/div
H = 5 mS/div

Baseline at division 1



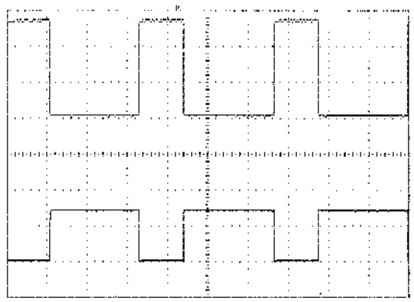
S303-5
(Synchronizing Signal)
V = 2.0 V/div
H = 5 mS/div

Baseline at division 5

Q312 Base

V = 2.0 V/div
H = 5 mS/div

Baseline at division 1



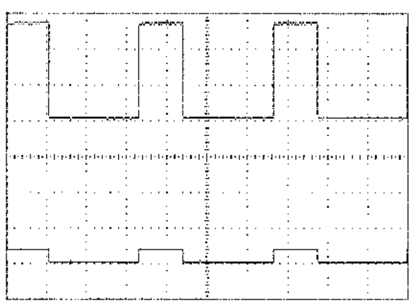
S303-5
(Synchronizing Signal)
V = 2.0 V/div
H = 5 mS/div

Baseline at division 5

Q312 Collector

V = 2.0 V/div
H = 5 mS/div

Baseline at division 1



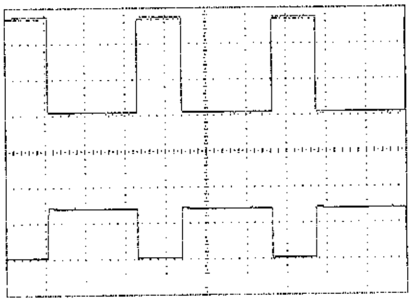
S303-5
(Synchronizing Signal)
V = 2.0 V/div
H = 5 mS/div

Baseline at division 5

Q313 Base

V = 2.0 V/div
H = 5 mS/div

Baseline at division 1



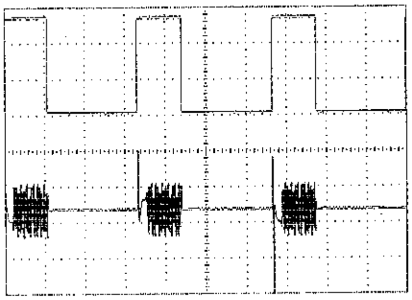
S303-5
(Synchronizing Signal)
V = 2.0 V/div
H = 5 mS/div

Baseline at division 5

Q313 Collector

V = 2.0 V/div
H = 5 mS/div

Baseline at division 1



S303-5
(Synchronizing Signal)
V = 2.0 V/div
H = 5 mS/div

Baseline at division 5

T302-3

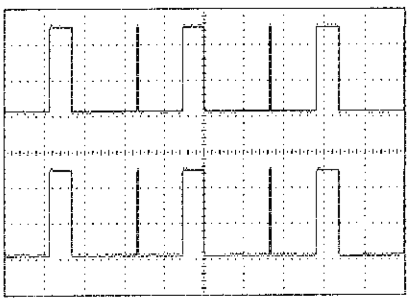
V = 50 V/div
H = 5 mS/div

Baseline at division 2

Keypad Circuits Waveforms

Without pressing a key, you should see the following waveforms on the outputs of U406 on the main circuit board. If not, check U406, U411, and U417. Also make sure that VCCA is present at RP402. Note that the duty cycle of the waveforms depends on the ambient light levels. This is because the keypad circuits are at the same port address as the lamp control circuits.

If you press a key, the waveform will widen by about 100uS as the Z80 senses the keypress and sends a scanning signal through U406. If not, check the keypad, RP401, and U409.



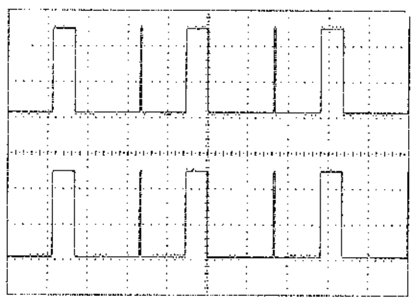
U406-2
(Synchronizing Signal)
V = 2.0 V/div
H = 5 mS/div

Baseline at division 5

U406-4

V = 2.0 V/div
H = 5 mS/div

Baseline at division 1



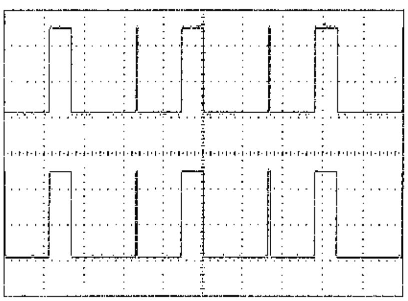
U406-2
(Synchronizing Signal)
V = 2.0 V/div
H = 5 mS/div

Baseline at division 5

U406-8

V = 2.0 V/div
H = 5 mS/div

Baseline at division 1



U406-2
(Synchronizing Signal)
V = 2.0 V/div
H = 5 mS/div

Baseline at division 5

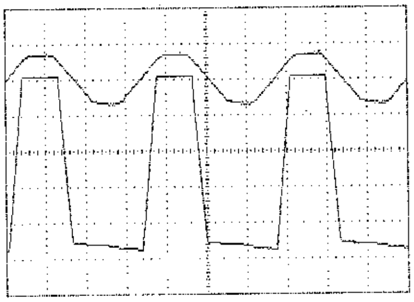
U406-6

V = 2.0 V/div
H = 5 mS/div

Baseline at division 1

60-Hz Circuits Waveforms

NOTE: These signals are only present when the Weather Computer is plugged into an AC outlet.



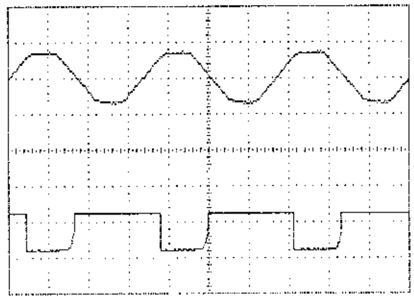
D320 Anode
(Synchronizing Signal)
V = 20 V/div
H = 5 mS/div

Baseline at division 6

D320 Cathode

V = 2.0 V/div
H = 5 mS/div

Baseline at division 1



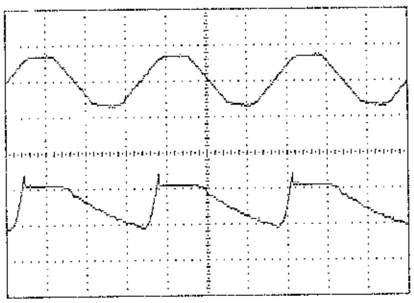
D320 Anode
(Synchronizing Signal)
V = 20 V/div
H = 5 mS/div

Baseline at division 6

Q406 Base

V = 1.0 V/div
H = 5 mS/div

Baseline at division 1



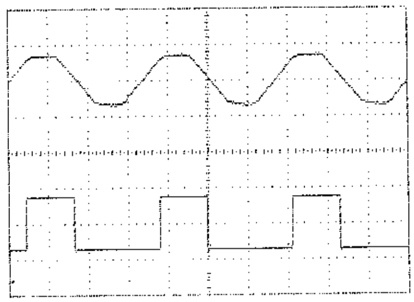
D320 Anode
(Synchronizing Signal)
V = 20 V/div
H = 5 mS/div

Baseline at division 6

Q316 Collector

V = 500 mV/div
H = 5 mS/div

Baseline at division 1



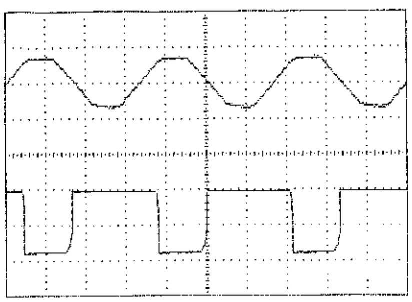
D320 Anode
(Synchronizing Signal)
V = 20 V/div
H = 5 mS/div

Baseline at division 6

Q406 Collector

V = 2.0 V/div
H = 5 mS/div

Baseline at division 1



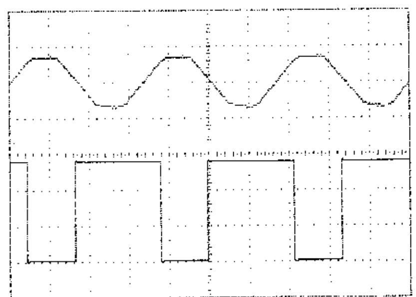
D320 Anode
(Synchronizing Signal)
V = 20 V/div
H = 5 mS/div

Baseline at division 6

Q405 Collector

V = 2.0 V/div
H = 5 mS/div

Baseline at division 1



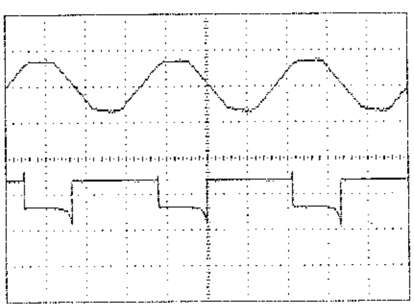
D320 Anode
(Synchronizing Signal)
V = 20 V/div
H = 5 mS/div

Baseline at division 6

U408-6

V = 2.0 V/div
H = 5 mS/div

Baseline at division 1



D320 Anode
(Synchronizing Signal)
V = 20 V/div
H = 5 mS/div

Baseline at division 6

Q405 Emitter

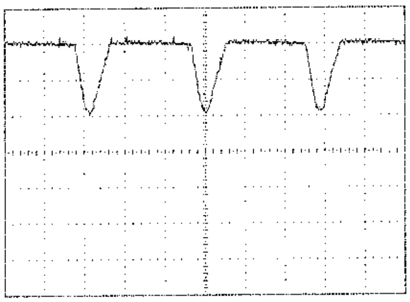
V = 200 mV/div
H = 5 mS/div

Baseline at division 1

Speaker Circuits Waveforms

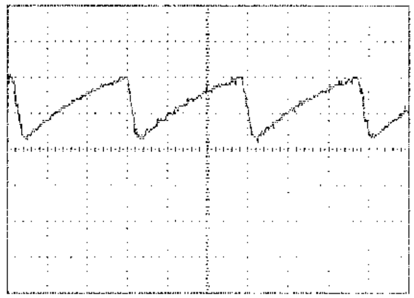
- Press AL/WARN and ENTER.

You should hear the speaker click each time you press a key. If not, temporarily ground the collector of Q403 on the main circuit board. You should hear a 1.5kHz to 2kHz tone. If so, check Q403 and U410. Otherwise, refer to the following waveforms and check Q401, Q402, and Q403.



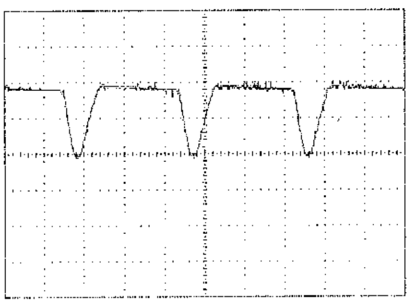
D402 Anode
(Synchronizing Signal)
V = 5 V/div
H = 200 uS/div

Baseline at division 4



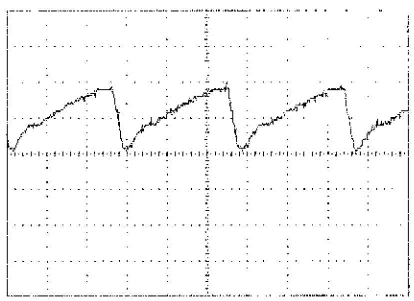
Q402 Base
(Synchronizing Signal)
V = 5 V/div
H = 200 uS/div

Baseline at division 4



Q401 Base
(Synchronizing Signal)
V = 5 V/div
H = 200 uS/div

Baseline at division 4



Q401 Emitter
(Synchronizing Signal)
V = 5 V/div
H = 200 uS/div

Baseline at division 4

V.F. Converter Circuits Waveforms

Check these circuits if there is a problem with the light-level control, or the temperature, barometer, and humidity displays.

When you are testing the V.F. converter circuits, first check the voltages at the inputs of the electronic switches, U405 and U407 on the main board. These ICs will generate crosstalk if the input voltages exceed the 4066 power supply voltage. This can easily happen because U405 and U407 are powered from the +5VDC VCCA supply, while the barometer, temperature, and humidity op amps get their power from the ± 15volt supplies. Be sure these circuits are adjusted properly and that the temperature probes are connected.

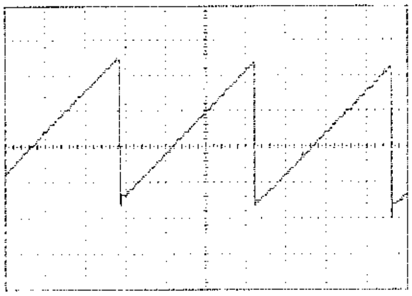
If the inputs to U405 and U407 are okay, refer to the following waveforms and check the V.F. converter circuits. Note that with the slow sweep speeds required (100mS/div), you will not see much more than a moving dot with a CRT oscilloscope. However, if the outputs of U410 are changing between TTL low and high, and make a rapid transition when it does, the IC is probably okay.

You can check the ramp generator by adjusting the oscilloscope sweep to 50uS and monitoring U401-1. You will see a waveform similar to the following. The center horizontal line represents +5VDC and the frequency will vary slightly according to the barometric pressure. The image will jitter roughly every 0.7 seconds as the other sensors get sampled.

- If the ramp is not linear, check U403A, C401, and U401. Check for leakage in Q407.

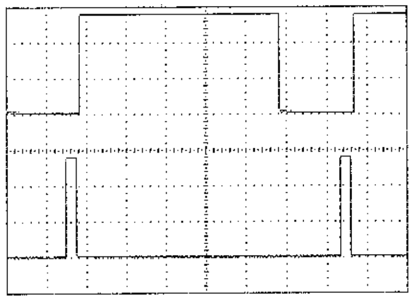
- If the ramp is okay, check for pulses at U401-3 and U408D-8. If it is missing, replace the appropriate component. Otherwise, replace U412.

  Usually, if U401 or U408D is bad, the lamp will be very dim, the temperature display show 40°F indoor and −40°F outdoor, the barometer will be 0, and the humidity display will be off.



U401-1
(Synchronizing Signal)
V = 2.0 V/div
H = 50 uS/div

Baseline at division 4



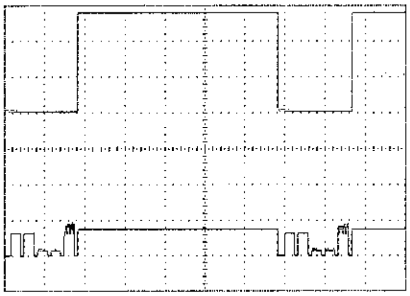
U410-19
(Synchronizing Signal)
V = 2.0 V/div
H = 100 mS/div

Baseline at division 5

U410-6

V = 2.0 V/div
H = 100 mS/div

Baseline at division 1



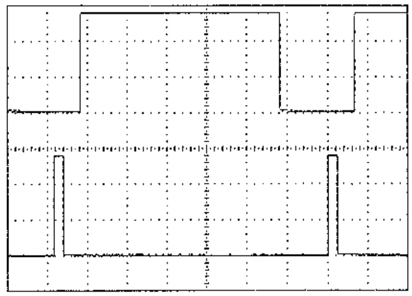
U410-19
(Synchronizing Signal)
V = 2.0 V/div
H = 100 mS/div

Baseline at division 5

U405-2

V = 2.0 V/div
H = 100 mS/div

Baseline at division 1



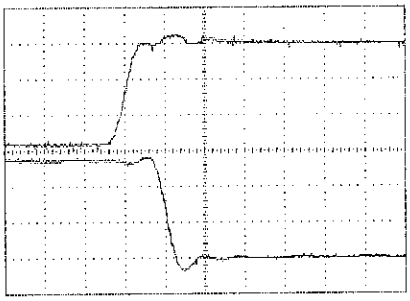
U410-19
(Synchronizing Signal)
V = 2.0 V/div
H = 100 mS/div

Baseline at division 5

U410-9

V = 2.0 V/div
H = 100 mS/div

Baseline at division 1



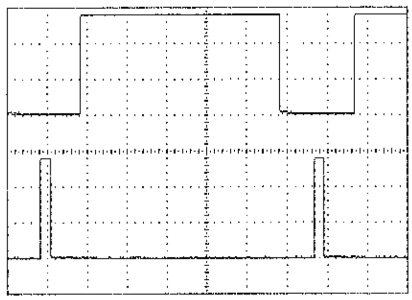
U401-3
(Synchronizing Signal)
V = 5 V/div
H = 20 nS/div

Baseline at division 4

U408-8

V = 2.0 V/div
H = 20 nS/div

Baseline at division 1



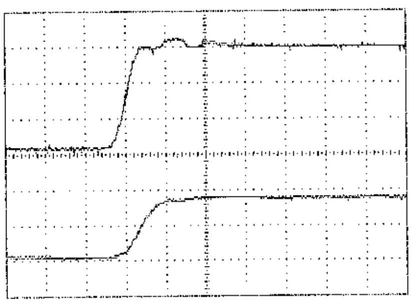
U410-19
(Synchronizing Signal)
V = 2.0 V/div
H = 100 mS/div

Baseline at division 5

U410-12

V = 2.0 V/div
H = 100 mS/div

Baseline at division 1



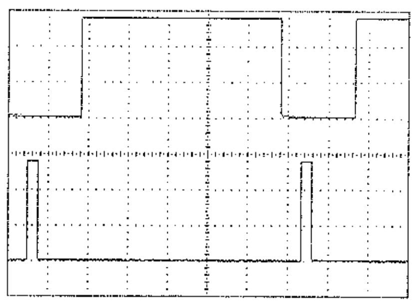
U401-3
(Synchronizing Signal)
V = 5 V/div
H = 20 nS/div

Baseline at division 4

U408-9

V = 2.0 V/div
H = 20 nS/div

Baseline at division 1



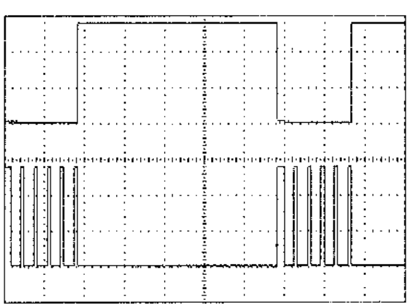
U410-19
(Synchronizing Signal)
V = 2.0 V/div
H = 100 mS/div

Baseline at division 5

U410-15

V = 2.0 V/div
H = 100 mS/div

Baseline at division 1



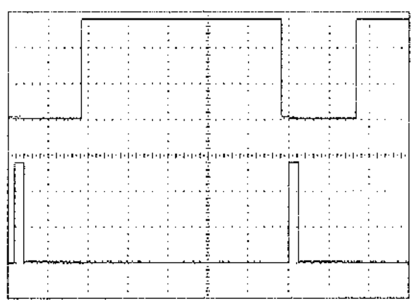
U410-19
(Synchronizing Signal)
V = 2.0 V/div
H = 100 mS/div

Baseline at division 5

U410-2

V = 2.0 V/div
H = 100 mS/div

Baseline at division 1



U410-19
(Synchronizing Signal)
V = 2.0 V/div
H = 100 mS/div

Baseline at division 5

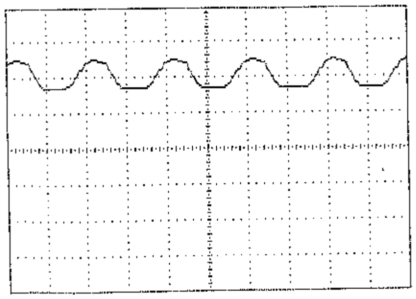
U410-16

V = 2.0 V/div
H = 100 mS/div

Baseline at division 1

Wind Speed Circuits Waveforms

The first waveform, Wind Cup Output, shows the typical output of the wind speed sensor when subjected to a breeze of roughly 10MPH. Use this as a reference when you are troubleshooting the boom assembly. The other waveforms were obtained with an audio generator to permit troubleshooting the Weather Computer without a boom assembly and to ensure consistent results.



Wind Cup Output
(Synchronizing Signal)
V = 2.0 V/div
H = 5 mS/div

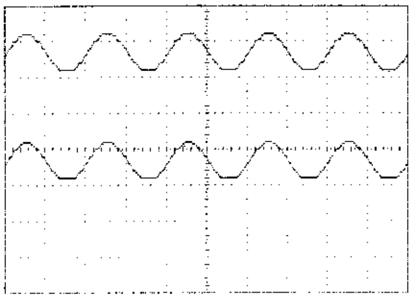
Baseline at division 3

To set up the unit for testing the wind speed circuits, perform the following steps.

- Connect the generator ground to the Weather Computer chassis ground.
- Connect the hot lead of the generator to the negative lead of a 33 µF, 25V electrolytic capacitor (#25-973). This capacitor value is not critical as long as it's greater than 10 volts and is large enough to pass a 100-Hz sine wave without excessive attenuation.
- Adjust the generator output for a 100-Hz, 2 V P-P sine wave.

The wind speed display should show 10MPH. It will increase or decrease by 1MPH for every 10Hz that you increase or decrease the generator frequency. You should get a weather alert at 40MHP. If so, the wind speed circuits are working properly.

- If you are not getting the weather alert, check the RAM at U416 and the ROM at U418.
- If the wind speed is inaccurate, check the CTC at U412 and the system clock at Y401.
- If you are not getting any readings at all, refer to the following waveforms and signal-trace through Q415, Q410, and U406F.



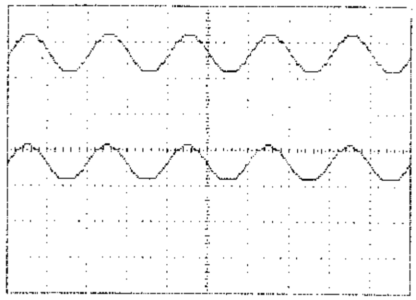
Wind Speed Connector (GRN)
(Synchronizing Signal)
V = 2.0 V/div
H = 5 mS/div

Baseline at division 4

C444/R489 Junction

V = 2.0 V/div
H = 5 mS/div

Baseline at division 1



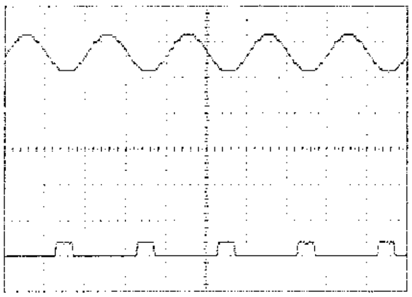
Wind Speed Connector (GRN)
(Synchronizing Signal)
V = 2.0 V/div
H = 5 mS/div

Baseline at division 4

Q415 Base

V = 2.0 V/div
H = 5 mS/div

Baseline at division 1



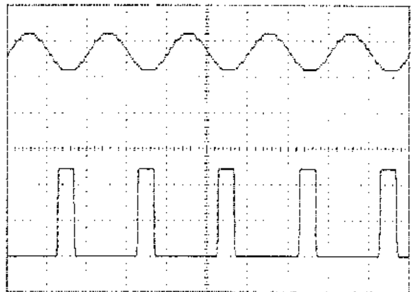
Wind Speed Connector (GRN)
(Synchronizing Signal)
V = 2.0 V/div
H = 5 mS/div

Baseline at division 4

Q410 Base

V = 2.0 V/div
H = 5 mS/div

Baseline at division 1



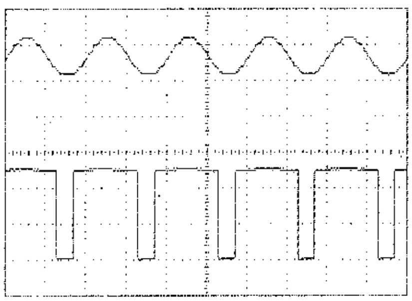
Wind Speed Connector (GRN)
(Synchronizing Signal)
V = 2.0 V/div
H = 5 mS/div

Baseline at division 4

Q415 Collector

V = 2.0 V/div
H = 5 mS/div

Baseline at division 1



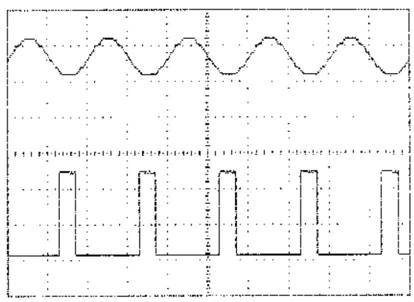
Wind Speed Connector (GRN)
(Synchronizing Signal)
V = 2.0 V/div
H = 5 mS/div

Baseline at division 4

Q410 Collector

V = 2.0 V/div
H = 5 mS/div

Baseline at division 1



Wind Speed Connector (GRN)
(Synchronizing Signal)
V = 2.0 V/div
H = 5 mS/div

Baseline at division 4

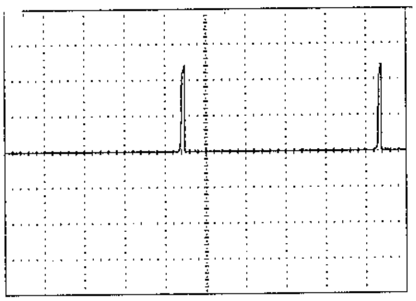
U406-12

V = 2.0 V/div
H = 10 nS/div

Baseline at division 1

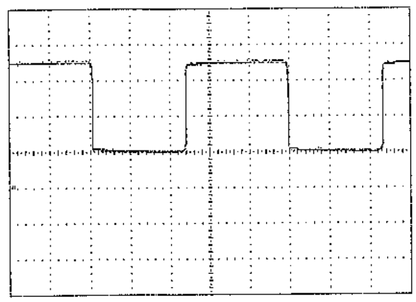
IDA-5001-1
HUMIDITY SENSOR ACCESSORY WAVEFORMS

When you are measuring these test points, connect your probe common lead to the shield ground a point A on the humidity board.



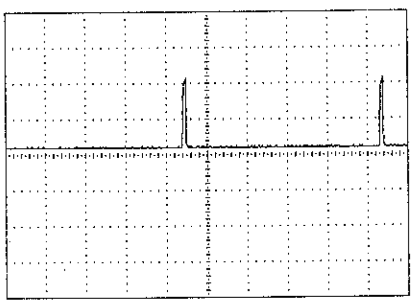
D701 Anode
(Synchronizing Signal)
V = 2.0 V/div
H = 20 uS/div

Baseline at division 4



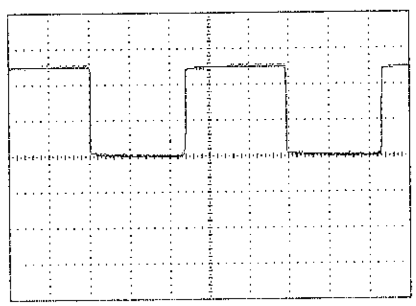
U701-4
(Synchronizing Signal)
V = 2.0 V/div
H = 20 uS/div

Baseline at division 4



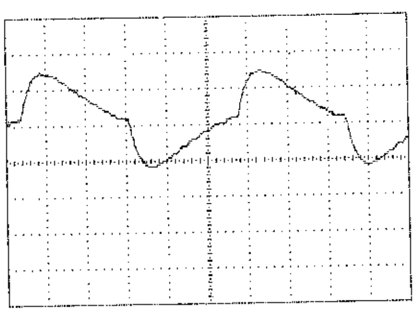
D701 Cathode
(Synchronizing Signal)
V = 2.0 V/div
H = 20 uS/div

Baseline at division 4



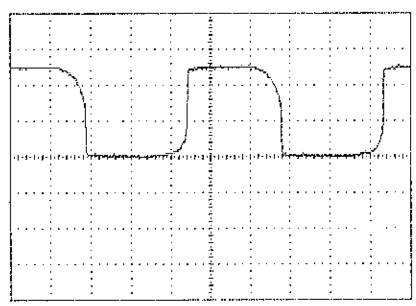
U701-10
(Synchronizing Signal)
V = 2.0 V/div
H = 20 uS/div

Baseline at division 4



U701-1
(Synchronizing Signal)
V = 2.0 V/div
H = 20 uS/div

Baseline at division 4

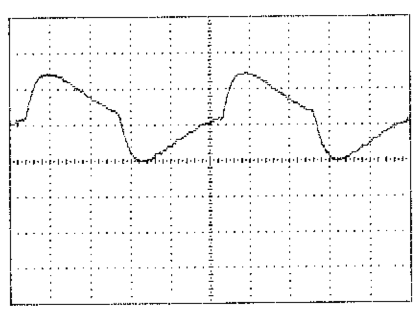


U701-11
(Synchronizing Signal)
V = 2.0 V/div
H = 20 uS/div

Baseline at division 4

U701-3
(Synchronizing Signal)
V = 2.0 V/div
H = 20 uS/div

Baseline at division 4



U701-13
(Synchronizing Signal)
V = 2.0 V/div
H = 20 uS/div

Baseline at division 4

FINAL CHECKS

Be sure your ID-5001 Advanced Weather Computer is working properly by performing the following final checks.

- Be sure all of the internal hardware is installed and tightened.

- Be sure the circuit boards are securely installed.

  NOTE: Make sure the main board is properly plugged into the display driver board. The sockets aren't keyed and the main board mounting brackets are flexible enough to allow offsetting the plugs by one pin.

- Be sure the unit is properly configured and aligned.

- At powerup, the front panel LED should glow, and the display should be dark for 10 seconds; then the fluorescent lamp should light. The time and date displays should flash until you enter a date and time or for 60 seconds, whichever comes first.

- Be sure all keypad keys function properly.

- Be sure all LCD segments function properly.

  To confirm, perform the steps under "Display Test" in "Operation."

- The wind speed indicator should display properly when you spin the anemometer. A 2VP-P, 100Hz signal at the input will result in a 10mph display.

- The wind direction indicator should function properly when you rotate the wind vane or place a logic one on the appropriate inputs. (See the truth table in "Boom Assembly Checks.")

- The temperature and barometer displays should indicate correctly.

- The indoor/outdoor humidity displays should be blank unless you have installed the optional IDA-5001-1 Humidity Sensors.*

  If the sensors are not installed, check the circuitry by connecting a 220 kilohm resistor between the BLK and WHT wires on the rear panel humidity inputs. The displays should light with a random number.

* Standard with wired units.

- The rain indicator should be blank. To check this, momentarily short together the two rain inputs on the rear panel. The display should light and increment by .01 each time you short the inputs. The optional IDA-5001-2 Rain Gauge Accessory should function in the same manner when you tip the sensor dipper.

- The display viewing angle should change for five levels as you repeatedly press the UNITS and INDOOR keys.

- If you cover the front panel light sensor with an opaque object, the fluorescent lamp should go dim.

- Pressing the ENTER and AL/WARN keys should enable the key click. Pressing CLEAR and AL/WARN should disable the click.

- The clock should maintain the proper time after you install the 9-volt battery backup, remove AC power for a moment, and then reapply power.

- The optional IDA-5001-3 RS-232C Accessory* should communicate properly (if it is installed) with a terminal or computer.

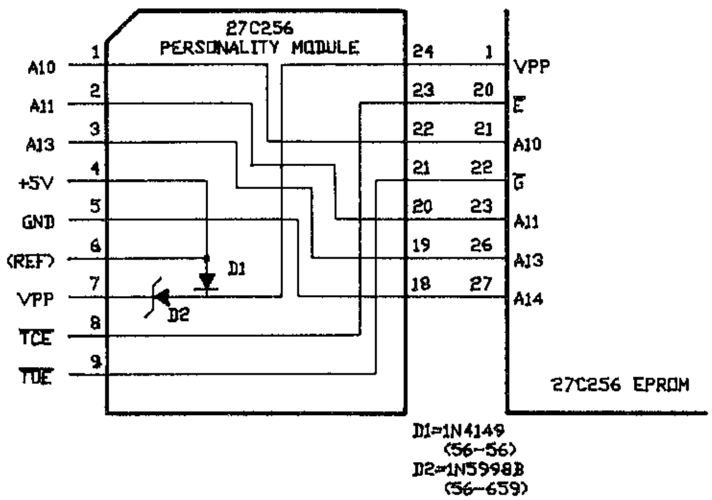
- All other functions, such as MIN/MAX, unit conversions, AL/WARN and CLEAR should function properly.

To thoroughly check all available functions would require going through each possible option discussed in "Powerup Operation" and "Keypad Operation." However, at this point in "Final Checks," you have verified that most of the hardware is operating properly. Any operational failures would more likely be due to a faulty monitor ROM at U418. If you have an ID-4801 EPROM Programmer, you can use it as a piece of test equipment to check U418 and thus verify that the other functions operate properly.

* Standard with wired units.

To use the Programmer, refer to the following parts list and schematic to build the 27C256 personality module.

Qty	Description	Part No.
1	Diode, 1N4149	56-56
1	Diode, 1N5998B	56-659
1	Wire, yellow stranded	344-244
1	Cement	350-12
1	Plug	432-1423
1	Plug cover	432-1424



After building the personality module, plug it and the EPROM to be tested into their appropriate sockets in the Programmer and press the following keys in the sequence shown.

FUNCTION SELECT
1
LOAD
FUNCTION SELECT
9
3FFF

The programmer will pause a second, and then display the checksum on the Address LEDs and the letters "CS" on the Data LEDs. For the first and second production runs of the Weather Computer, you should get the following checksums.

Part No.	Checksum	Comments
444-475	AF8F hex	First run.
444-475-1	----	Never released.
444-475-2	362E hex	Second run.
444-475-3	2F7A hex	

PARTS LISTS

ADVANCED WEATHER COMPUTER

Chassis

CIRCUIT Comp. No.	DESCRIPTION	HEATH Part No.
CAPACITORS		
C1	.068 uF Mylar(r)	27-236
C2	.001 uF, 1.4 kV ceramic	21-71
C3	.001 uF, 1.4 kV ceramic	21-71
C4	.1 uF axial-lead ceramic	21-786
C5	.1 uF axial-lead ceramic	21-786
C6	.1 uF axial-lead ceramic	21-786
C7	.1 uF axial-lead ceramic	21-786
C8	.1 uF axial-lead ceramic	21-786
C9	.1 uF axial-lead ceramic	21-786
C10	.33 uF axial-lead ceramic	21-811
C11	.01 uF axial-lead ceramic	21-769
C12	.1 uF axial-lead ceramic	21-786
C13	.1 uF axial-lead ceramic	21-786
C14	.1 uF axial-lead ceramic	21-786
C15	.1 uF axial-lead ceramic	21-786
C16	.33 uF axial-lead ceramic	21-811
C17	.1 uF axial-lead ceramic	21-786
C18	.1 uF axial-lead ceramic	21-786
CHOKE		
LX1	RF choke	45-611
RESISTORS		
R1	2.2 megohms, 5%, 1/2 W	6-225
R2	1.0 kilohm, 5%, 1/4 W	6-102-12

CIRCUIT Comp. No.	DESCRIPTION	HEATH Part No.
TEST	220 kilohms, 5%, 1/4 W	6-224-12
TRANSFORMER		
T1	Transformer, power	54-1059
CONNECTORS — TERMINAL STRIPS — SOCKETS		
	Connector shell, 10-hole	432-958
	Connector shell, 2-hole	432-1030
	Connector shell, 5-hole	432-1183
	Connector shell, 7-hole lg	432-1304
	Connector shell, 7-hole sm	432-822
	Connector shell, 8-hole	432-1150
	Connector, battery	432-798
	Socket assembly, lamp	434-328
	Socket, jumper, 2F Berg	432-1041
	Spring connector, large	432-753
	Spring connector, small	432-1142
	Terminal strip, 4-lug	431-44
	Terminal strip, 5-lug (with fuse clips)	431-609
	Terminal strip, 6-lug screw	431-7

CIRCUIT Comp. No.	DESCRIPTION	HEATH Part No.
HARDWARE		
#4 Hardware		
	Lockwasher, #4	254-9
	Nut, 4-40	252-2
	Screw, 4-40 × 1/4"	250-1411
	Screw, 4-40 × 1/4" FH	250-1489
#6 Hardware		
	Lockwasher, #6	254-1
	Lug, #6 solder	259-1
	Nut, 6-32	252-3
	Screw, #6-AB × 3/8" ST	250-1432
	Screw, 6-32 × 1/4"	250-1325
	Screw, 6-32 × 3/8"	250-1280
	Spacer, 6-32 × 1-1/2"	255-129
	Spacer, 6-32 × 11/16"	255-83
	Washer, #6 fiber shoulder	253-2
	Washer, #6 flat	253-127
#8 Hardware		
	Lockwasher, #8	254-2
	Nut, 8-32	252-4
	Screw, 8-32 × 3/8"	250-1436
Other Hardware		
	Lug, spade	259-1
	Nut, push-on	252-146
MANUALS AND BINDER PARTS		
	3-ring assembly	701-233
	Binder cover	597-4460
	Manual, Assembly	595-3735
	Manual, Operation	595-3736
	Nut	252-3

CIRCUIT Comp. No.	DESCRIPTION	HEATH Part No.
	Screw, 3/8" nylon	250-357
	Washer, flat	253-14
SHEET METAL PARTS		
	Bracket, left support	204-3192
	Bracket, right support	204-3193
	Cabinet top	90-1385-1
	Chassis	200-1570-1
	Light shield	206-1537-1
	Light shield cover	206-1538-1
TUBING		
	Large clear	346-60
	Medium clear	346-7
	Small clear	346-2
WIRE		
	Bare, #22 solid	340-8
	Black, #24 stranded	344-90
	Blue, #24 stranded	344-96
	Brown, #24 stranded	344-91
	Gray, #24 stranded	344-98
	Green, #24 stranded	344-95
	Orange, #24 stranded	344-93
	Red, #24 stranded	344-92
	Violet, #24 stranded	344-97
	White-brown, #24 stranded	344-114
	White-orange, #24 stranded	344-116
	White-red, #24 stranded	344-115
	White-yellow, #24 stranded	344-158
	White, #24 stranded	344-99
	Yellow, #24 stranded	344-94
MISCELLANEOUS		
A1	Probe Assb, 10'indoor temp	100-1728
A2	Probe Assb, 70' outdr temp	100-1727

CIRCUIT Comp. No.	DESCRIPTION	HEATH Part No.
F1	Fuse, 1/4-ampere slow-blow	421-33
LP1	Lamp, fluorescent	412-670
	Braid, desoldering	490-185
	Cable tie	354-5
	Core, Large RF	475-35
	Core, Small RF	475-15
	Display driver assembly	150-324
	Foot	261-49
	Holder, battery	208-48
	Insulating paper	75-824
	Keyboard circuit board	85-3235
	Keypad	64-954
	Label, fuse	390-2941
	Line cord	89-54
	Nut starter	490-5
	Panel, front	203-2385
	Plug, polarizing	438-55
	Plug, rectangular plastic	485-42
	Strain relief	75-736
	Thermometer	406-650
	Wrench, Allen	490-6

Display Circuit Board

LED

D101	HLMP-504	412-657

LCD

LCD101	LS222-JA	411-879

RESISTORS

R101	470 ohms, 5%, 1/4 W	6-471-12
R102	Photo resistor	9-67

CIRCUIT Comp. No.	DESCRIPTION	HEATH Part No.
CONNECTORS		
	36-pin	432-1606
	62-pin	432-1351
MISCELLANEOUS		
	Bracket, LCD mounting	204-2993
	Circuit board, display	85-3155-1
	Diffuser, white	446-763
	Sleeving, black fiber	346-1
	Strip, 1/8" × 10" gasket	73-250
	Strip, conductive rubber	432-1607

Display Driver Circuit Board

The display driver is an assembled unit and contains surface-mount components that require special tools to replace.

RESISTORS

R201	10 kilohms
R202	10 kilohms
R203	6.8 kilohms
R204	47 kilohms
R205	28.7 kilohms, 1%
R206	28.7 kilohms, 1%
R207	1 kilohms

CAPACITORS

C201	.33 µF
C202	1 µF
C203	.33 µF
C204	.33 µF
C205	.33 µF
C206	1 µF
C207	470 pF, ±5%
C208	1 µF
C209	.33 µF
C210	.33 µF

CIRCUIT Comp. No.	DESCRIPTION	HEATH Part No.

INTEGRATED CIRCUITS

U201	HD61604	643-95
U202	HD61604	643-95
U203	HD61604	643-95
U204	HEF4011B	443-603

MISCELLANEOUS

	Circuit board, display driver	85-3177-1
	Display driver assembly	150-324

Power Supply Circuit Board

CAPACITORS

C301	.1 uF axial-lead ceramic	21-786
C302	470 pF (471) ceramic	21-773
C303	1000 uF, 25V electrolytic	25-951
C304	.01 uF Mylar(r)	27-106
C305	.01 uF Mylar(r)	27-106
C306	.047 uF Mylar(r)	27-110
C307	.047 uF Mylar(r)	27-110
C308	.1 uF axial-lead ceramic	21-786
C309	.1 uF axial-lead ceramic	21-786
C310	10 uF electrolytic	25-917
C311	10 uF electrolytic	25-917
C312	.1 uF axial-lead ceramic	21-786
C313	.1 uF axial-lead ceramic	21-786
C314	.1 uF axial-lead ceramic	21-786
C315	33 uF electrolytic	25-928
C316	2200 uF electrolytic	25-963
C317	2200 uF electrolytic	25-963
C318	1000 uF, 35V electrolytic	25-893
C319	.1 uF axial-lead ceramic	21-786
C320	10 uF electrolytic	25-917
C321	10 uF electrolytic	25-917
C322	.1 uF axial-lead ceramic	21-786

DIODES

D301	1N5817	57-607
D302	1N4149	56-56
D303	1N5817	57-607
D304	1N4149	56-56
D305	1N5397	57-27
D306	1N5397	57-27
D307	1N4149	56-56

CIRCUIT Comp. No.	DESCRIPTION	HEATH Part No.
D308	1N4149	56-56
D309	1N4149	56-56
D310	Selected 8.2 V zener	56-659
D311	1N4149	56-56
D312	1N4149	56-56
D313	1N4149	56-56
D314	1N4149	56-56
D315	1N4002	57-65
D316	1N4002	57-65
D317	1N4002	57-65
D318	1N4002	57-65
D319	1N4002	57-65
D320	1N4149	56-56
D321	1N4002	57-65
D322	1N5231B 4.7 volt zener	56-613

TRANSISTORS

Q301	MPSA20	417-801
Q302	MPSA20	417-801
Q303	2N4121	417-235
Q304	MPSA20	417-801
Q305	MJE181	417-818
Q306	MJE181	417-818
Q307	MJE5979	417-856
Q308	MPSA20	417-801
Q309	MJE340	417-195
Q310	MPSA20	417-801
Q311	MJE340	417-195
Q312	MPSA20	417-801
Q313	MPSA20	417-801
Q314	MPSA20	417-801
Q315	MPSA20	417-801
Q316	MPSA20	417-801
Q317	2N4121	417-235
Q318	MPSA20	417-801
Q319	MPSA65	417-885

RESISTORS

R301	1.5 ohms, 5%, 1/2 W	6-159
R302	1.5 ohms, 5%, 1/2 W	6-159
R303	750 ohms, 5%, 1/2 W	6-751
R304	20.5 kilohms, 1%, 1/4 W	6-2052-12
R305	6.8 kilohms, 5%, 1/4 W	6-682-12
R306	68 ohms, 5%, 1/4 W	6-680-12
R307	91 ohms, 5%, 1/4 W	6-910-12
R308	4.7 kilohms, 5%, 1/4 W	6-472-12
R309	2.26 kilohms, 1%, 1/4 W	6-2261-12
R310	2.2 kilohms, 5%, 1/4 W	6-222-12
R311	4.7 kilohms, 5%, 1/4 W	6-472-12

CIRCUIT Comp. No.	DESCRIPTION	HEATH Part No.
R312	1.0 kilohm, 5%, 1/4 W	6-102-12
R313	1.0 kilohm, 5%, 1/4 W	6-102-12
R314	6.8 ohms, 5%, 1/2 W	6-689
R315	6.8 ohms, 5%, 1/2 W	6-689
R316	1.0 kilohm, 5%, 1/4 W	6-102-12
R317	1.5 kilohms, 5%, 1/4 W	6-152-12
R318	1.0 kilohm, 5%, 1/4 W	6-102-12
R319	1500 ohms, 1%, 1/4 W	6-1501-12
R320	2.7 kilohms, 5%, 1/4 W	6-272-12
R321	2.7 kilohms, 5%, 1/4 W	6-272-12
R322	1500 ohms, 1%, 1/4 W	6-1501-12
R323	909 ohms, 1%, 1/4 W	6-9090-12
R324	909 ohms, 1%, 1/4 W	6-9090-12
R325	10 kilohms, 5%, 1/4 W	6-103-12
R326	100 kilohms, 5%, 1/4 W	6-104-12
R327	220 kilohms, 5%, 1/4 W	6-224-12
R328	68 kilohms, 5%, 1/4 W	6-683-12
R329	330 kilohms, 5%, 1/4 W	6-334-12
R330	Not used	
R331	Not used	
R332	15 kilohms, 5%, 1/4 W	6-153-12
R333	10 kilohms, 5%, 1/4 W	6-103-12
R334	4.7 kilohms, 5%, 1/4 W	6-472-12
R335	1.0 kilohm, 5%, 1/4 W	6-102-12
R336	47 kilohms, 5%, 1/4 W	6-473-12
R337	100 kilohms, 5%, 1/4 W	6-104-12
R338	15 kilohms, 5%, 1/4 W	6-153-12
R339	100 kilohms, 5%, 1/4 W	6-104-12
R340	75 kilohms, 5%, 1/4 W	6-753-12

TRANSFORMERS

T301	Input	51-212
T302	Resonator	51-211

INTEGRATED CIRCUITS

U301	LM376N	442-24
U302	UA7815	442-63
U303	LP2950C	442-787
U304	UA7805	442-54
U305	MC7915	442-613

HARDWARE

CIRCUIT Comp. No.	DESCRIPTION	HEATH Part No.
	Lockwasher, #4	254-9
	Lockwasher, #6	254-1
	Nut, 4-40	252-2
	Nut, 6-32	252-3
	Screw, 4-40 × 3/8"	250-1412
	Screw, 6-32 × 3/8"	250-1280
	Washer, nylon shoulder	253-198

PLUGS — SOCKET

	Plug, 10-pin	432-1073
	Plug, 2-pin	432-1171
	Plug, 5-pin	432-1182
	Plug, 7-pin	432-828
	Socket, 8-pin IC	434-230

MISCELLANEOUS

	Bracket, mounting	204-3101
	Circuit board, power supply	85-3236-2
	Grease, silicone	352-13
	Insulator, transistor	75-204

Main Circuit Board

CAPACITORS

C401	.01 uF (103) polystyrene	29-67
C402	.1 uF axial-lead ceramic	21-786
C403	.1 uF axial-lead ceramic	21-786
C404	.1 uF axial-lead ceramic	21-786
C405	.1 uF axial-lead ceramic	21-786
C406	.047 uF Mylar(r)	27-129
C407	1 uF electrolytic	25-900
C408	1 uF electrolytic	25-900
C409	4.7 uF electrolytic	25-879
C410	4.7 uF electrolytic	25-879
C411	4.7 uF electrolytic	25-879
C413	4.7 uF electrolytic	25-879
C414	4.7 uF electrolytic	25-879
C415	10 uF electrolytic	25-917
C416	.1 uF axial-lead ceramic	21-786
C417	.1 uF axial-lead ceramic	21-786
C418	10 pF (10K) ceramic	21-3
C419	.1 uF axial-lead ceramic	21-786
C420	22 uF electrolytic	25-927
C421	.1 uF axial-lead ceramic	21-786
C422	.1 uF axial-lead ceramic	21-786
C423	.1 uF axial-lead ceramic	21-786
C425	.1 uF axial-lead ceramic	21-786

CIRCUIT Comp. No.	DESCRIPTION	HEATH Part No.
C426	.1 uF axial-lead ceramic	21-786
C427	.1 uF axial-lead ceramic	21-786
C428	.1 uF axial-lead ceramic	21-786
C429*	.01 uF axial-lead ceramic	21-769
C430*	.01 uF axial-lead ceramic	21-769
C431*	.01 uF axial-lead ceramic	21-769
C432*	.01 uF axial-lead ceramic	21-769
C433*	.01 uF axial-lead ceramic	21-769
C434	.1 uF axial-lead ceramic	21-786
C435	.1 uF axial-lead ceramic	21-786
C437	.1 uF axial-lead ceramic	21-786
C438	.1 uF axial-lead ceramic	21-786
C439	.1 uF axial-lead ceramic	21-786
C440	.1 uF axial-lead ceramic	21-786
C441	.1 uF axial-lead ceramic	21-786
C442	.1 uF axial-lead ceramic	21-786
C443	.1 uF axial-lead ceramic	21-786
C444	.002 uF ceramic	21-36
C445	.1 uF axial-lead ceramic	21-786
C446	.1 uF axial-lead ceramic	21-786
C447	470 pF axial-lead ceramic	21-773
C448	470 pF axial-lead ceramic	21-773
C449	470 pF axial-lead ceramic	21-773
C450	470 pF axial-lead ceramic	21-773

DIODES

D401	1N823A	56-91
D402	1N4002	57-65
D403	Not used	
D404	1N4149	56-56
D405	1N4149	56-56

CHOKES

L402*	35 uH	235-229
L403*	35 uH	235-229
L404*	35 uH	235-229
L405*	35 uH	235-229
L406*	35 uH	235-229

TRANSISTORS

Q401	2N4121	417-235
Q402	MPSA20	417-801
Q403	MPSA20	417-801
Q404	MPSA65	417-885
Q405	MPSA20	417-801
Q406	MPSA20	417-801
Q407	MPSA20	417-801
Q408	MPSA20	417-801
Q409	MPSA20	417-801

CIRCUIT Comp. No.	DESCRIPTION	HEATH Part No.
Q410	MPSA20	417-801
Q411	MPSA20	417-801
Q412	MPSA20	417-801
Q413	MPSA20	417-801
Q414	MPSA20	417-801
Q415	2N4121	417-235

RESISTORS

R401	330 ohms, 5%, 1/4 W	6-331-12
R402	1.0 kilohm, 5%, 1/4 W	6-102-12
R403	15.4 kilohms, 1%, 1/4 W	6-1542-12
R404	15.4 kilohms, 1%, 1/4 W	6-1542-12
R405A	806 ohms, 1%, 1/4 W	6-8060-12
R405B	3830 ohms, 1%, 1/4 W	6-3831-12
R405C	2000 ohms, 1%, 1/4 W	6-2001-12
R406	15.0 kilohms, 1%, 1/4 W	6-1502-12
R407	1000 ohm, 3/4-watt control	10-1141
R408	2.55 kilohms, 1%, 1/4 W	6-2551-12
R409	250 kilohms, 1/4%, 1/4 W	2-767-12
R410	250 kilohms, 1/4%, 1/4 W	2-767-12
R411	250 kilohms, 1/4%, 1/4 W	2-767-12
R412A	499 ohms, 1%, 1/4 W	6-4990-12
R412B	Thermistor	9-165
R412C	3.01 kilohms, 1%, 1/4 W	6-3011-12
R413	50 kilohm control	10-1200
R414	1000 ohm, 1/2-watt control	10-1153
R414A	3830 ohms, 1%, 1/4W	6-3831-12
R415	15.4 kilohms, 1%, 1/4 W	6-1542-12
R416	15.4 kilohms, 1%, 1/4 W	6-1542-12
R417	15.4 kilohms, 1%, 1/4 W	6-1542-12
R418	15.4 kilohms, 1%, 1/4 W	6-1542-12
R419	10 kilohms, 5%, 1/4 W	6-103-12
R420	250 kilohms, 1/4%, 1/4 W	2-767-12
R421	806 ohms, 1%, 1/4 W	6-8060-12
R422	806 ohms, 1%, 1/4 W	6-8060-12
R423	38.3 kilohms, 1%, 1/4 W	6-3832-12
R424	1000 ohm, 3/4-watt control	10-1141
R425	1000 ohm, 3/4-watt control	10-1141
R426	150 ohms, 1%, 1/4 W	6-1500-12
R427	270 ohms, 5%, 1/2 W	6-271
R428	6.2 kilohms, 5%, 1/4 W	6-622-12
R429	9.1 kilohms, 5%, 1/4 W	6-912-12
R430	6.2 kilohms, 5%, 1/4 W	6-622-12
R431	9.1 kilohms, 5%, 1/4 W	6-912-12
R432	10 kilohms, 5%, 1/4 W	6-103-12
R433	10 kilohm control	10-1138
R434	10 kilohm control	10-1138
R435	10 kilohm control	10-1138
R436	23.7 kilohms, 1%, 1/4 W	6-2372-12

* Installed only if IDA-5001-3 RS-232C Interface Accessory installed.

CIRCUIT Comp. No.	DESCRIPTION	HEATH Part No.
R437	23.7 kilohms, 1%, 1/4 W	6-2372-12
R438	20.0 kilohms, 1%, 1/4 W	6-2002-12
R439	10 megohms, 5%, 1/4 W	6-106-12
R440	12.1 kilohms, 1%, 1/4 W	6-1212-12
R441	10 megohms, 5%, 1/4 W	6-106-12
R442	8.2 kilohms, 5%, 1/4 W	6-822-12
R443	15 kilohms, 5%, 1/4 W	6-153-12
R444	21.0 kilohms, 1%, 1/4 W	6-2102-12
R445	38.3 kilohms, 1%, 1/4 W	6-3832-12
R446	21.0 kilohms, 1%, 1/4 W	6-2102-12
R447	38.3 kilohms, 1%, 1/4 W	6-3832-12
R448	12.1 kilohms, 1%, 1/4 W	6-1212-12
R449	12.1 kilohms, 1%, 1/4 W	6-1212-12
R450	Not used	
R451	23.7 kilohms, 1%, 1/4 W	6-2372-12
R452	23.7 kilohms, 1%, 1/4 W	6-2372-12
R453	20.0 kilohms, 1%, 1/4 W	6-2002-12
R454	12.1 kilohms, 1%, 1/4 W	6-1212-12
R455	200 kilohms, 5%, 1/4 W	6-204-12
R456	10 kilohm control	10-1138
R457	10 kilohm control	10-1138
R458	10 kilohm control	10-1138
R459	1.0 kilohm, 5%, 1/4 W	6-102-12
R460	3.3 kilohms, 5%, 1/4 W	6-332-12
R461	3.3 kilohms, 5%, 1/4 W	6-332-12
R462	1.5 kilohms, 5%, 1/4 W	6-152-12
R463	100 ohms, 5%, 1/4 W	6-101-12
R464	1.0 kilohm, 5%, 1/4 W	6-102-12
R465	1.0 kilohm, 5%, 1/4 W	6-102-12
R466	2.2 kilohms, 5%, 1/4 W	6-222-12
R467	10 kilohms, 5%, 1/4 W	6-103-12
R468	15 kilohms, 5%, 1/4 W	6-153-12
R469	2.4 kilohms, 5%, 1/4 W	6-242-12
R470	56.2 kilohms, 1%, 1/4 W	6-5622-12
R471	31.6 kilohms, 1%, 1/4 W	6-3162-12
R472	23.7 kilohms, 1%, 1/4 W	6-2372-12
R473*	22 kilohms, 5%, 1/4 W	6-223-12
R474*	10 kilohms, 5%, 1/4 W	6-103-12
R475	9.09 kilohms, 1%, 1/4 W	6-9091-12
R476	200 kilohms, 5%, 1/4 W	6-204-12
R477	390 ohms, 5%, 1/2 W	6-391
R478*	33 kilohms, 5%, 1/4 W	6-333-12
R479	200 kilohms, 5%, 1/4 W	6-204-12
R480	10 kilohms, 5%, 1/4 W	6-103-12
R481	10 kilohms, 5%, 1/4 W	6-103-12
R482	10 kilohms, 5%, 1/4 W	6-103-12
R483	10 kilohms, 5%, 1/4 W	6-103-12
R484	1.0 kilohm, 5%, 1/4 W	6-102-12
R485	100 kilohms, 5%, 1/4 W	6-104-12
R486	Not used (jumper wire here)	
R487	5.1 kilohms, 5%, 1/4 W	6-512-12
R488	2.2 megohms, 5%, 1/4 W	6-225-12
R489	180 ohms, 5%, 1/4 W	6-181-12
R490	100 kilohms, 5%, 1/4 W	6-104-12
R491	4.7 kilohms, 5%, 1/4 W	6-472-12
R492	10 kilohms, 5%, 1/4 W	6-103-12
R493	4.7 kilohms, 5%, 1/4 W	6-472-12
R494	10 kilohms, 5%, 1/4 W	6-103-12
R495	4.7 kilohms, 5%, 1/4 W	6-472-12
R496	10 kilohms, 5%, 1/4 W	6-103-12
R497	4.7 kilohms, 5%, 1/4 W	6-472-12
R498	2.2 ohms, 5%, 1/4 W	6-229-12
R499	47 ohms, 5%, 1/4 W	6-470-12
R500	82 kilohms, 5%, 1/4 W	6-823-12
R501	4.7 kilohms, 5%, 1/4 W	6-472-12
R502	4.7 kilohms, 5%, 1/4 W	6-472-12
R503	2.2 kilohms, 5%, 1/4 W	6-222-12
R504	10 kilohms, 5%, 1/4 W	6-103-12
R505	10 kilohms, 5%, 1/4 W	6-103-12
R506	10 kilohms, 5%, 1/4 W	6-103-12
R507	10 kilohms, 5%, 1/4 W	6-103-12
R508	10 kilohms, 5%, 1/4 W	6-103-12

RESISTOR PACKS

CIRCUIT Comp. No.	DESCRIPTION	HEATH Part No.
RP401	150 kilohm	9-185
RP402	10 kilohm	9-128

INTEGRATED CIRCUITS

CIRCUIT Comp. No.	DESCRIPTION	HEATH Part No.
U401	TLC555	442-801
U402	LM324N	442-602
U403	LF353N	442-707
U404	LM324N	442-602
U405	CD4066	442-744
U406	74LS05	443-818
U407	CD4066	442-744
U408	74HC04	443-1308
U409	74HC366	443-1391
U410	74HC377	443-1362
U411	74HC377	443-1362
U412	84C30	443-1393
U413*	MC75189 or MC1489	443-795
U414*	84C42	443-1394
U415*	MC75188 or MC1488	443-794
U416	5565PL-15	443-1422
U417	74HC138	443-1311
U418	27C256 EPROM	444-475-2
U419	74HC139	443-1319
U420	84C00	443-1392
U421	74HC365	443-1390

* Installed only if IDA-5001-3 RS-232C Interface Accessory installed.

CIRCUIT Comp. No.	DESCRIPTION	HEATH Part No.

PLUGS - SOCKETS

	Connector, 10-hole rt-angle	432-1074
	Plug, 10-pin	432-1073
	Plug, 2-pin	432-1171
	Plug, 3-pin	432-1102
	Plug, 7-pin	432-1281
	Plug, 8-pin	432-1268
	Socket, 14-pin IC	434-298
	Socket, 16-pin IC	434-299
	Socket, 20-pin IC	434-311
	Socket, 28-pin IC	434-312
	Socket, 40-pin IC	434-253
	Socket, 8-pin IC	434-230

MISCELLANEOUS

A401	Pressure transducer	442-786
L401	Speaker	473-29
Y401	2.4576 MHz xtal oscillator	150-262
	Circuit board, main	85-3113-1

Boom Assembly

LEDS

D601	TIL-32 Infrared LED	412-635
D602	TIL-32 Infrared LED	412-635
D603	TIL-32 Infrared LED	412-635
D604	TIL-32 Infrared LED	412-635
D605	TIL-32 Infrared LED	412-635

TRANSISTORS

Q601	TIL-78 photo transistor	417-919
Q602	TIL-78 photo transistor	417-919
Q603	TIL-78 photo transistor	417-919
Q604	TIL-78 photo transistor	417-919
Q605	TIL-78 photo transistor	417-919

CIRCUIT Comp. No.	DESCRIPTION	HEATH Part No.

HARDWARE

#4 Hardware

	Lockwasher, #4	254-9
	Nut, 4-40	252-2
	Screw, #4 x 1" SSTL ST	250-1168
	Screw, 4-40 x 1/4"	250-1411

#6 Hardware

	Lockwasher, #6 SSTL	254-25
	Nut, 6-32 SSTL cap	252-80
	Nut, 6-32 SSTL	252-77
	Screw, 6-32 x 1/4" SSTL	250-1428
	Spacer, 6-32 x 9/16"	255-735
	Washer, #6 SSTL flat	253-96

#8 Hardware

	Screw, 8-18 x 1-1/2"	250-1405
	Screw, 8-32 x 3/8" SSTL	250-328
	Setscrew, 8-32 x 1/4"	250-1485
	Washer, #8 x 1/2" flat	253-42
	Washer, #8 flat	253-14

Other Hardware

	Bearing	455-643
	Boom	142-737
	C-ring	253-712
	Counterweight	266-943
	Shaft, 1/8" x 3" housing	453-282

CIRCUIT Comp. No.	DESCRIPTION	HEATH Part No.
	U-bracket assembly package	305-128
	U-bolt	969-770
	U-bolt nuts	969-771
	U-bolt housing	969-772
	U-bolt grip plate	969-773
	End caps	969-774

WIRE

CIRCUIT Comp. No.	DESCRIPTION	HEATH Part No.
	Bare	340-8
	White-yellow	344-158

MISCELLANEOUS

CIRCUIT Comp. No.	DESCRIPTION	HEATH Part No.
	Circuit board, Wind sensor	85-1982-1
	Encoder disc	266-1263-1
	Foam tape, 3/4" × 5"	73-92
	Fuse clip	260-92
	Grommet, plastic	73-43
	Grommet, rubber	73-53
	Housing, bottom	214-209-1
	Housing, top	214-208-1
	Metal strip, 29" × 1"	205-1823
	Washer, Neoprene rubber	253-713
	Wind cup	266-939
	Wind vane	266-930
	Wind vane cap	266-1200

HUMIDITY SENSOR ACCESSORY (IDA-5001-1)

CIRCUIT Comp. No.	DESCRIPTION	HEATH Part No.
CAPACITORS		
C701	115 pF mica	20-124
C702	.33 uF axial-lead ceramic	21-811
C703	.1 uF axial-lead ceramic	21-786
C704	10 uF electrolytic	25-880
CAL	118 pF mica	20-736
CAL	42 pF mica	20-174
DIODE		
D701	1N4149	56-56
RESISTORS		
R701	301 kilohms, 1%, 1/4 W	6-3013-12
R702	301 kilohms, 1%, 1/4 W	6-3013-12
R703	237 kilohms, 1%, 1/4 W	6-2373-12
R704	200 kilohm control	10-1185
R705	301 kilohms, 1%, 1/4 W	6-3013-12
R706	7.50 kilohms, 1%, 1/4 W	6-7501-12
R707	Not used	
R708	7.50 kilohms, 1%, 1/4 W	6-7501-12
R709	Not used	
R710	301 kilohms, 1%, 1/4 W	6-3013-12
INTEGRATED CIRCUITS		
U701	CD4001	443-695
U702	CD4001	443-695
HARDWARE		
#4 Hardware		
	Lockwasher, #4	254-9
	Nut, 4-40 hex	252-2
	Nut, 4-40 press-in	252-746
	Screw, 4-40 × 5/16"	250-213
#6 Hardware		
	Lug, #6 spade	259-11
	Nut, 6-32 press-in	252-725
	Screw, #6 × 1"	250-347
	Screw, 6-32 × 3/8	250-1280
	Washer, #6 D	253-89
MANUAL — BINDER PARTS		
	3-ring assembly	701-235
	Cover, binder	597-4462
	Manual, Assembly	595-3737
	Nut, 6-32	252-3
	Screw,6-32 × 3/8" nylon	250-357
	Washer, flat	253-14
MISCELLANEOUS		
A701	Sensor	473-32
	Base	92-771
	Cabinet, sensor	305-111
	Cable, shielded	347-35
	Circuit board, sensor	85-3244-1
	Clamp, cable	207-03
	IC socket, 14-pin	434-298
	Sleeving	346-1
	Socket, wire	432-134
	Thermometer	406-680
	Top	92-770
	Wicking	349-12
	Wire, yellow	344-54

RAIN GAUGE ACCESSORY (IDA-5001-2)

CIRCUIT Comp. No.	DESCRIPTION	HEATH Part No.

NOTE: Individual parts are not available from Heath Company for this buy-sell item.

	Assembly, rain sensor	150-211
	Manual, instruction	597-4398

RS-232C ACCESSORY (IDA-5001-3)

CIRCUIT Comp. No.	DESCRIPTION	HEATH Part No.

NOTE: The RS-232C Accessory parts are installed on the main board.

CAPACITORS

C429	.01uF axial-lead ceramic	21-769
C430	.01uF axial-lead ceramic	21-769
C431	.01uF axial-lead ceramic	21-769
C432	.01uF axial-lead ceramic	21-769
C433	.01uF axial-lead ceramic	21-769

CHOKE

L402	35 uH	235-229
L403	35 uH	235-229
L404	35 uH	235-229
L405	35 uH	235-229
L406	35 uH	235-229

RESISTORS

R473	22 kilohms, 5%, 1/4 W	6-223-12
R474	10 kilohms, 5%, 1/4 W	6-103-12
R478	33 kilohms, 5%, 1/4 W	6-333-12

INTEGRATED CIRCUITS

U413	MC75189 or MC1489	443-795
U414	84C42	443-1394
U415	MC75188 or MC1488	443-794

CONNECTORS — SOCKETS

	Connector, RS-232C	432-1028
	Connector, spring	432-1142

CIRCUIT Comp. No.	DESCRIPTION	HEATH Part No.
	Socket, 40-pin IC	434-253
	Socket, 14-pin IC	434-298
	Socket, 7-hole	432-1304

HARDWARE

	Nut, 4-40	252-2
	Lockwasher, #4	254-9
	Solder lug, #4	259-9
	Spacer, hex	255-757

MANUAL — BINDER PARTS

	3-ring assembly	701-235
	Binder cover	597-4462
	Manual	595-4002
	Nut, 6-32	252-3
	Screw, nylon	250-357
	Washer, fiber flat	253-14

PINS — PLUGS

	Pin, gold	432-1031
	Plug, 7-pin	432-1281
	Plug, polarizing	438-55

MISCELLANEOUS

	Bead, ferrite	475-35
	Wire, blue	344-96