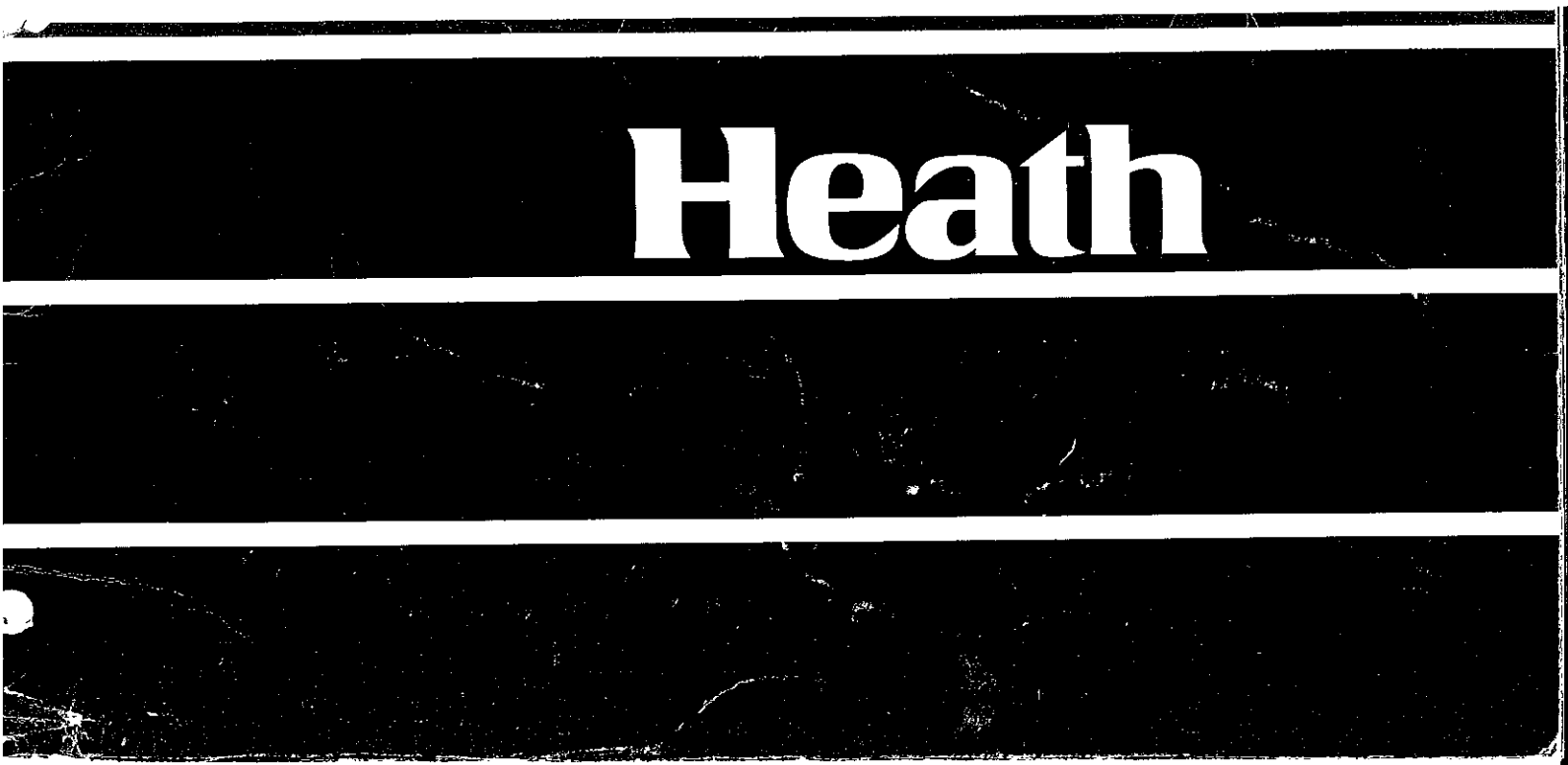
# ADVANCED
# WEATHER COMPUTER
## Model IDW-5001-C

OPERATION 595-4927



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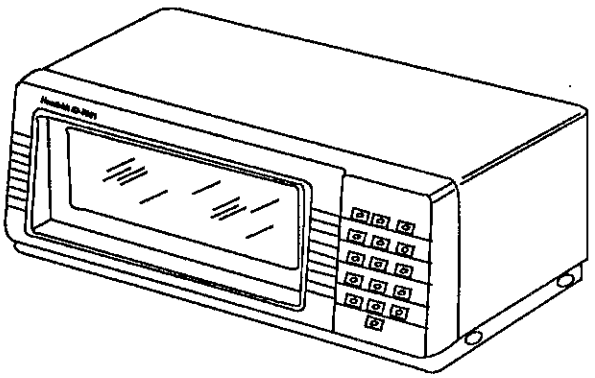


**HEATH COMPANY**
**BENTON HARBOR, MICHIGAN 49022**

# FCC Regulatory Information

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation.

This equipment generates, uses, and can radiate radio frequency energy. If not installed and used according to this manual, this equipment may cause harmful interference with radio and television communications. However, there is no guarantee that interference will not occur in a particular installation.

To meet Class B emission limits, the user must observe the following requirements:

1. Use only shielded I/O cables to connect this digital device.
2. The user is cautioned that changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

If this equipment does cause interference with radio or television reception, which you can determine by turning the equipment off and on, try to correct the interference by using one or more of the following measures:

- Move the digital device away from the affected receiver.
- Reposition the device with respect to the affected receiver.
- Reorient the affected receiver's antenna.
- Plug the digital device into a different AC outlet so the digital device and the receiver are on different branch circuits.
- Disconnect and remove any I/O cables that the digital device does not use. (Unterminated I/O cables are a potential source of high RF emission levels.)

If you need additional help, consult your dealer, manufacturer, or an experienced radio or television technician.

This device complies with Part 15 of FCC Rules. Operation is subject to the following two conditions:

- This device must not cause harmful interference.
- This device must accept any interference that may cause undesired operation.

**Canadian Regulatory Information** — This equipment complies with the Class B limits for radio noise emissions from digital apparatus as described in the Radio Interference Regulations of the Canadian Department of Communications.

**WARNING:** This device is not designed for outdoor use. To prevent fire or shock hazard, do not expose this device to rain or moisture.

# Table of Contents

# INTRODUCTION

Your Heath/Zenith Model IDW-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, climatologists, and general consumers.

You can set all of the display functions from the front panel keyboard. 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 saving time adjustment is also selectable.

Two digits display the wind speed, while one or two of 16 indicators show the wind direction by compass point. The keyboard allows you to select wind speed in miles-per-hour, knots, or kilometers-per-hour, which is then shown in the display. Instantaneous or average wind speed is keyboard selectable and displayed. The high or low wind speed that occurred since the memory was cleared can be recalled and is displayed with time and date of occurrence.

Indoor and outdoor temperatures are displayed continuously. You can select a temperature unit display in either Celsius or Fahrenheit and the readout will show the high and low temperatures with time and date. Wind chill temperature display is another keyboard selection.

Barometric pressure is displayed in four digits. You can also have the display show the date and time of minimum or maximum pressure in either inches of mercury or millibars.

Indoor and outdoor humidity are each displayed continuously in 2 digits. You can also have the display show the date and time of minimum or maximum humidity, as well as the rate of change during the last 24 hours.

You can clear specific minimum or maximum values by pressing the CLEAR key while the high or low value to be cleared is displayed. You can clear both minimum and maximum indoor and outdoor values by pressing the appropriate key along with the CLEAR key.

Rate arrows, consisting of an arrow head to show increase or decrease, and three tails to indicate greater rates, are located to the right of the displayed values.

The word ALERT with one bar or ALERT-WARN with two bars is displayed if the rate exceeds a predetermined level.

ALERT-WARN and arrow segment rates are individually keyboard selectable.

You can adjust the display brightness at the highest and lowest expected level. The brightness will then automatically change for ambient light levels in between.

A battery connector and clip are provided so you can install a 9-volt battery to keep the memory intact during power interruptions.

An RS-232C connector is provided, to send weather data, as established by the Weather Computer, to a computer using a standard RS-232C serial format.

A rain gauge is available as an optional accessory. The rain legend is not displayed if it is not installed.

Your Advanced Weather Computer will provide a vast amount of valuable weather information, and its handsome styling will be attractive in any decor.

## BATTERY INFORMATION

We recommend that you obtain a 9-volt rectangular battery to use as a backup for your Weather Computer's memory in case of a power interruption. This battery will provide the necessary backup power for approximately 18 hours.

Although you may use any battery that supplies from 6 to 9 volts at 30 milliamperes, we recommend a 9-volt alkaline battery. (Useful battery life ends when the battery voltage drops to 4.2 volts.) Representative manufacturers and their type numbers are listed below.

| | |
|---|---|
| NEDA | #1604A |
| Duracell | #MN1604 |
| Eveready | #522 |
| Mallory | #MN1604 |
| Ray-O-Vac | #A-1604 |

# 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; memorizes the date, time, and magnitude of minimum and maximum gusts. |
| Average Mode | One minute wind speed average; memorizes 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. |

## 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. |

*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.

## THERMOMETER

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

## 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. |

## RAIN GAUGE

| | |
|---|---|
| Displays | 4 digit. |
| Units | Inches to 99.9, centimeters to 250, with automatic decimal point adjust. |
| Repeatability | ±1 count in 10 for a 1-inch-per-hour rain fall. |
| Memory | Change in last hour or 24 hours. |
| Operating Temperature | Rain unit 0°C to 50°C (32°F to 122°F). |
| Dimensions | Rain unit 9.0" diameter x 9.6" high . |
| Weight | Rain unit 1.6 lbs. (.7 kg). |

## RELATIVE HUMIDITY

| | |
|---|---|
| Displays | Indicates indoor and outdoor relative humidity on a 2-digit readout and rising and falling indicators. Rate of change per hour. |
| Measurement Range | 10% - 90% relative humidity. |
| Accuracy | 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 | High and low since cleared, change in last 24 hours. |
| Operating Temperature Range | 0°C to 50°C (32°F to 122°F). |

## GENERAL

| | |
|---|---|
| Power Requirements | 120/240 VAC, 50/60 Hz; approximately 19 watts. Provision for connection to an external 6- to 9-volt battery which can supply approximately 30 mA 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) | 15-1/2" wide x 8-3/4" deep x 5-3/4" high. (39.4 x 22.2 x 14.6 cm). |
| Weight | 9.8 lbs. (4.5 kg). |

# BOOM ASSEMBLY

( ) Carefully unpack your Weather Computer. This will consist of the Computer, boom, wind vane, wind cup, and some bagged parts. The bagged parts are identified as follows. NOTE: The numbers in parentheses correspond to the numbers on the drawings at the bottom of this page.

| | | |
|---|---|---|
| (A1) | 1 | 6-32 cap nut |
| (A2) | 24 | Spade lug |
| (A3) | 1 | U-bolt |
| (A4) | 2 | U-bolt nut |
| (A5) | 1 | U-bolt housing |
| (A6) | 1 | U-bolt grip plate |
| (A7) | 2 | End cap |
| (A8) | 1 | Alignment tool |
| (A9) | 1 | Rubber flat washer |

Refer to Pictorial 1-1 (Illustration Booklet, Page 1) while you perform the following steps.

( ) Position the boom so the cable that is closer to one end of the boom is toward the left as shown.

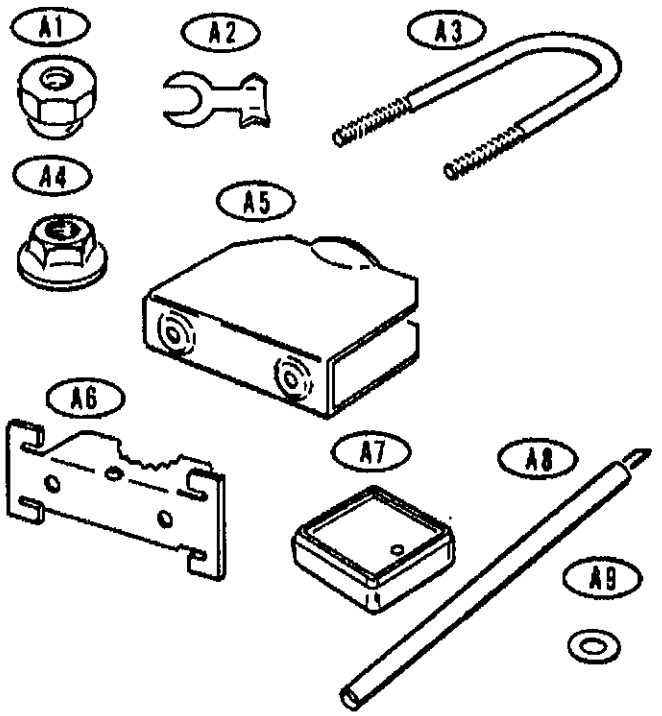
( ) Position each end cap so the small hole is downward as shown. Then push the end caps into the ends of the boom.

Refer to Pictorial 1-2 while you perform the following steps.

NOTE: Your wind vane was balanced at the factory. You should, however, use the following procedure to recheck the balancing.

( ) Position the boom vertically so the end of the boom (not the cups) is resting on the edge of your work surface.

( ) Turn the fin so it is perpendicular to the boom. The fin and counterweight should remain in this position (balanced). If you have to make an adjustment, loosen the cap screw just enough so you can rebalance the fin and counterweight. Then retighten the screw.



(J) Position the wind cup as shown. Then line up the flat in the cup with the flat on the shaft and install the cup. Fasten it with a rubber flat washer and a 6-32 cap nut.

NOTE: Before you attach the U-bolt assembly to the boom in the next step, determine which side is more practical when you mount the boom to your TV tower or other location later.

(K) Mount the U-bolt, U-bolt grip plate, and U-bolt housing to the boom with two U-bolt nuts. Do not tighten the nuts all the way. NOTE: When you insert the U-bolt through he boom, be careful that none of the wires get in the way.

(L) Position the wind vane as shown. Then line up the setscrew with the flat on the housing shaft and tighten the setscrew.

This completes the assembly and checkout of the boom.

NOTE: Your Weather Computer has been carefully calibrated at the factory. Due to geographical differences between your location and the factory, however, you will need to touch-up the barometric pressure adjustment. In addition, if you change the lengths of the temperature and humidity sensor cables, you will have to recalibrate the temperature and humidity circuits. These adjustments begin on Page 10. Do not attempt to recalibrate the barometer or humidity sensors unless both temperature probes are connected to the Weather Computer.

# RECALIBRATION

Most of the calibration has already been done for you by the factory. You still need to make some minimal adjustments, however, due to the difference between your location and the factory.

We recommend that you use the temperature and humidity sensor cables at their present lengths. If, however, you want to lengthen or shorten one or more of these cables (due to the locations you will select for the Weather Computer and the sensors), do it now before you perform the "recalibration". Refer to the "Installation" section beginning on Page 19 to determine where to mount them. Then return to this page and continue.

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

NOTE: Disregard any arrows or Alert/Warning indicators that may appear while you perform the following adjustments. Pictorial 2-1 shows you the locations of the various display indicators. Depending upon which options you have in your Weather Computer, you may or may not see all of the indicators.

## BAROMETRIC PRESSURE ADJUSTMENTS

In the following steps, you will calibrate the barometric pressure circuit of your Weather Computer. You will do this by adjusting it to the same reading as a reference barometer at a local weather observing station (radio or TV station, Coast Guard station, airport, etc.).

The pressure transducer is a very responsive and accurate device and is the heart of this pressure circuit. Since it will reflect extremely minute variations in your environment, however, several factors will affect the overall accuracy of your barometric display, including:

- The accuracy of the reference barometer (mercury column, aneroid, etc.) from which your Weather Computer is calibrated.
- The accuracy with which the person takes the reading from the reference barometer, and how recently he took the reading.
- The accuracy of the observing station's conversion of atmospheric pressure to the barometric pressure corrected at sea level.
- The difference in the weather pressure gradients between your location and the reference barometer.
- The stability of the environment that your 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 equals +.01 inches of mercury), and atmospheric pressure gradients within your environment.
- The accuracy of the calibration itself. The best time to do the calibration is during a period when the barometric pressure is fairly stable. Do not attempt to perform these adjustments, therefore, during a period when the barometric pressure is changing rapidly, such as when a thunderstorm is approaching.

( ) Connect the Weather Station's line cord to the proper AC outlet. After 10 seconds, the display should light.

NOTE: Wait at least 30 minutes to allow the Computer's inside temperature to stabilize before you proceed to the next step. Make sure the cover is on the Weather Computer during this warm-up period.

( ) Call an airport, radio station, or TV station, etc. and ask for the barometric pressure. Usually, an airport flight station (FSS) is best for this purpose.

( ) Refer to Pictorial 2-2 and remove the screws and lockwashers that secure the cover to the chassis. Then remove the cover, refer to Pictorial 2-3, and adjust control R413 (**be careful not to adjust the wrong control**) until the display indicates the correct pressure.

( ) Reinstall the cover on the Weather Computer.

## Barometer Recalibration

NOTE: The following adjustments should be necessary only if components in the pressure sensor circuitry have been replaced. This procedure requires additional parts, available from the Heath Company and not supplied with your Weather Computer.

( ) Obtain the following parts from the Heath Company:

| PART NUMBER | QTY. | DESCRIPTION |
|---|---|---|
| 250-1411 | 3 | 4-40 x 1/4" screw |
| 252-2 | 3 | 4-40 nut |
| 260-92 | 3 | Clip |
| 73-92 | 1 | 3/4" x 1" double-stick tape |
| 205-1828 | 1 | 29" x 1" metal strip |
| 346-2 | 5" | Small clear tubing |
| 346-90 | 10' | Medium clear tubing |
| 597-5205 | 1 | Instruction Sheet (Order this only if you replaced the pres sure sensor.) |

Refer to Pictorial 2-4 while you perform the following steps.

( ) Position the 29" x 1" metal strip as shown. Then mount a clip at each of the three indicated locations with 4-40 x 1/4" hardware. Position the clips as shown before you tighten the hardware.

( ) Remove the paper backing from one side of the 5" x 1/2" double-stick tape and press the tape onto the indicated side of the metal strip at its center.

Refer back to Pictorial 2-3 while you perform the following steps.

NOTE: When you remove or install jumper sockets on the main circuit board, in the following steps, 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 on plug P403 pins 1 and 2.

( ) Install a jumper socket on plug P404 pins 2 and 3.

( ) Connect the line cord plug to a proper AC outlet, if this has not already been done.

( ) Observe the barometer indication on the display. It should indicate 62.00 ±.20. If the indication is not in this range, adjust A/D CURRENT control R407 until you obtain the correct indication. NOTE: Make this adjustment only if absolutely necessary; it will affect all other adjustments (including temperature and humidity).

( ) Remove the jumper socket from plug P404 pins 2 and 3. Then install it on P404 pins 1 and 2.

( ) Adjust TRANSDUCER BIAS control R425 until you obtain a barometer indication of 62.00 ±.20.

( ) Remove the jumper socket from plug P403 pins 1 and 2. Then install it on plug P403 pins 2 and 3.

( ) Remove the jumper socket from plug P404 and install it on plug P401 pins 1 and 2.

( ) If the barometer indication is .00, adjust BALANCE control R424 clockwise to obtain an indication that is slightly higher than .00. Then adjust control R424 counterclockwise until the barometer indication just becomes .00.

( ) Remove the jumper socket from plug P401. Then install it on plug P401 pin 2 (with pin 1 open) for storage.

( ) Remove the jumper socket from plug P403. Then install it on plug P402 pins 1 and 2.

Refer to Pictorial 2-5 while you perform the following steps.

( ) Remove the paper backing from the double-stick tape on the back of the barometer calibration fixture (assembled earlier). Mount the fixture in a convenient place, using the double-stick tape to fasten it to a stationary object. Be sure to select a location where there is no risk of pulling paint off when you later remove the foam tape.

NOTES:

1. In the following steps, it is very important that you do not get any water inside the pressure transducer. Be sure, therefore, to position your Weather Computer so it is 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 pressure that is equivalent to a two-inch drop in a mercury column. Filling the hose with hot water will remove any kinks in it and make it easier to work with.

( ) 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 as necessary to hold the hose in place.

NOTE: The pressure transducer that you received will either have one or two ports (only one port is open in the two-port type). Complete the following step if you have a one-port transducer. Otherwise, skip this step.

( ) Refer to the Detail 2-5A and slide 1/2" of the medium clear tubing over one end of the 5" length of small clear tubing.

NOTES:

- If you received a one-port transducer, complete step 1 below. If you received a two-port transducer, complete step 2.

- When you install the 5" tubing in one of the following two steps, 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.

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

( ) 2. Refer to Detail 2-5B 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.

( ) 1. Adjust control R413 for an indication 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 Pictorial 2-6, Part A).

( ) 3. Write down the indication on the display. NOTE: If the indication is less than 27.00 or greater than 33.00, adjust control R413 until the display indicates approximately 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 Pictorial 2-6, Part B).

( ) 6. Write down the new indication on the display.

( ) 7. Subtract the indication you obtained in step 6 from the indication in step 3.

NOTE: In the next step, each complete turn of control R414 will produce a change of approximately 1 inch on the display. This change will, in turn, produce a change of about .08 inches in the result in step 7.

( ) 8. If the result in step 7 is less than 2.00, turn control R414 clockwise (to increase the gain). This will cause the display indication to increase.

If the result in step 7 is greater that 2.00, turn control R414 counterclockwise (to reduce the gain). This will cause the display indication to decrease.

( ) 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 (1.99 to 2.01 is okay).

( ) 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. Refer back to Pictorial 2-2 and temporarily install the cover on the Weather Computer. Leave the cover on for at least 30 minutes to allow the temperature inside the Computer to stabilize.

( ) 12. Call an airport, radio station, or TV station, etc. and ask for the barometric pressure. Usually, an airport flight service station (FSS) is best for this purpose.

( ) 13. Remove the cover; then adjust control R413 for the correct pressure.

This completes the "Entire Recalibration" of your Weather Computer's pressure sensor circuitry. If you do not intend to perform any other recalibration, reinstall the cover on the Weather Computer.

## WIND SENSOR ADJUSTMENTS

NOTE: There are no electrical wind sensor adjustments, but you need to perform the following steps to determine which way north is on your wind vane.

Refer to Pictorial 2-7 and temporarily connect the wires at the free end of the 8-wire cable, coming from the boom assembly to the connector strip labeled **WIND** on the back of your Weather Computer as follows:

( ) Blue wire to BLU.

( ) Green wire to GRN.

( ) Yellow wire to YEL.

( ) Orange wire to ORG.

( ) Red wire to RED.

( ) Brown wire to BRN.

( ) Black wire to BLK.

( ) White wire to WHT.

Refer to Pictorial 2-8 while you perform the following steps.

( ) Turn the wind vane slowly clockwise and notice how the display indicators light sequentially.

( ) Turn the wind vane until the N wind direction indicator lights.

( ) Slowly turn the wind vane counterclockwise until the NNW indicator just lights. Make a pencil mark on the wind vane cap and top housings as shown in Part A of the Pictorial.

( ) Slowly turn the wind vane clockwise until the NNE indicator just lights. This time, make a pencil mark on only the top housing, but directly beneath the pencil mark on the wind vane cap as shown in Part B of the Pictorial.

( ) Turn the wind vane counterclockwise and position the upper pencil mark midway between the two lower pencil marks. Make a longer pencil mark as shown in Part C of the Pictorial. You will use this long mark as a **north** indicator when you permanently install the sensors outside.

This completes the "Wind Sensor Adjustments."

## TEMPERATURE ADJUSTMENTS

NOTE: The Temperature circuits of your Weather Computer were properly calibrated before it left the factory. The following adjustments should be necessary only if components in the temperature sensor circuitry have been replaced, or you have appreciably changed the length of the sensor cables. This procedure requires additional parts, available from the Heath Company and not supplied with your Weather Computer.

( ) Obtain the following part from the Heath Company:

| PART NUMBER | QTY. | DESCRIPTION |
|---|---|---|
| 406-650 | 1 | Thermometer |

NOTE: The above thermometer is accurate only at 120°F. Do not use it to measure ice water or air temperatures, as the readings will not be accurate.

( ) Refer to Pictorial 2-7 and temporarily connect the wires at the ends of the temperature sensors to the connector strip labeled TEMPERATURE on the back of your Weather Computer as shown.

Refer back to Pictorial 2-3 while you perform the following steps.

( ) Connect the Weather Computer's line cord plug to as appropriate AC outlet, if this has not already been done, and allow it to warm up for at least 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. Position 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 5 minutes, stirring the contents occasionally to insure a constant, uniform temperature.

NOTE: You will use the Fahrenheit scale when you perform the following temperature calibration. Therefore, complete the next step only if TEMPERATURE c appears in your display. Otherwise skip the next step.

( ) Press the TEMP and UNITS buttons on the keyboard. An "F" should now appear after TEMPERATURE in the display.

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

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

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

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

( ) Fill a second insulated container with hot water. NOTE: The thermometer that you obtained from the Heath Company is calibrated to 120°F ±.5°F. Most water heaters provide water that is close to this temperature.

( ) Position 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 next step. Do not, however, leave the thermometer in water that is hotter than 125°, or it will be damaged.

( ) Adjust TEMP OUTDOOR SLOPE control R434 to produce an indication that is close to 120°F and agrees with the temperature indication.

( ) Adjust TEMP INDOOR SLOPE control R457 to produce an indication that is close to 120° and agrees with the temperature indication.

( ) 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 the hot water without error at either temperature end.

This completes the adjustments of your Weather Computer's temperature sensor circuitry. If you do not intend to perform any other recalibration, reinstall the cover on the Weather Computer.

## HUMIDITY SENSOR ADJUSTMENTS

NOTE: The following adjustments should be necessary only if components in the humidity sensor circuitry have been replaced, or you have appreciably changed the length of the humidity sensor cables. This procedure requires additional parts, available from the Heath Company and not supplied with your Weather Computer or the Humidity Sensor Accessory.

( ) Obtain the following parts from the Heath Company:

| PART NUMBER | QTY. | DESCRIPTION |
|---|---|---|
| 20-736 | 1 | 118 pF (118) mica capacitor |
| 20-174 | 1 | 42 pF (420) mica capacitor |
| 349-12 | 6" | Wicking |
| 406-680 | 2 | Thermometer |

( ) Unplug the line cord and remove the cover from the Weather Computer, if this has not already been done.

( ) Refer to Pictorial 2-9 and temporarily connect the cables coming from the humidity sensors to the connector strip labeled HUMIDITY on the back of your Weather Computer as shown.

### Slope Adjustments

Refer to Pictorials 2-10 and 2-11 while you perform the following steps.

( ) Preset main circuit board controls R458 (HUMIDITY INDOOR SLOPE) and R435 (HUMIDITY OUTDOOR SLOPE) to their centers of rotation.

( ) Preset controls R704 on the indoor and outdoor sensor circuit boards to their fully counterclockwise positions.

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

NOTES:

1. In the following steps, there are two rows of check-off spaces. One row is for the indoor sensor, and the other is for the outdoor sensor. Calibrate the indoor sensor first.

2. Make sure you do not touch any of the circuit board components inside the Weather Computer unless a step directs you to do so.

( )( ) Apply a small amount of solder to "tack solder" the leads of the 118 pF mica capacitor into holes E and F.

NOTES:

1. With indoor (outdoor) sensor circuit board control R704 turned fully counterclockwise, the digital display may indicate a value up to 99.

2. If both the indoor and outdoor humidity readings are zero (0) in the following step, the humidity display will disappear. When you continue to turn control R704 clockwise, the display will reappear.

( )( ) Plug in the Weather Computer.

( )( ) Turn indoor (outdoor) sensor circuit board control R704 slowly clockwise until the digital display drops to its lowest value; then continue to turn the control clockwise until the display increases by 1 count. If the indoor reading is greater than 6, adjust R458 until the reading is 5. If the outdoor reading is greater than 6, adjust R435 for a reading of 5. Note this reading.

( )( ) Unplug the Weather Computer.

( )( ) Tack solder the leads of the 42 pF mica capacitor into holes G and H.

( )( ) Plug in the Weather Computer.

( )( ) Turn main circuit board control R458 (indoor) or R435 (outdoor) until the digital display indicates 93 ±1 counts higher than the indication you obtained with the only the 118 pF capacitor installed in the holes.

( )( ) Unplug the Weather Computer.

( )( ) Unsolder the 42 pF and 118 pF mica capacitors from the holes. Then solder the free end of the yellow wire at hole D into hole F.

Return to the beginning of "Slope Adjustments" and repeat the second row of check-off spaces for the outdoor sensor calibration. After you complete the steps for the second time, reinstall the cover on the Weather Computer. Then proceed to "Relative Humidity Adjustments."

## Relative Humidity Adjustments

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 approximately 50% at a room temperature of 70°F.

There are two ways to calibrate the relative humidity readings. If you use "Method #1", you will need to have another accurate humidity indicator that you can use as a reference standard. If you use "Method #2", you will use two thermometers as a reference standard in a "wet and dry bulb" calibration procedure. Decide now which method you will use; then proceed with the following steps.

( ) Position the indoor and outdoor humidity sensors close to your reference standard (the other accurate humidity indicator or the two thermometers) and allow them to stabilize.

( ) Position your Weather Computer's indoor and outdoor temperature sensors at this same location and then proceed to "Method #1" or "Method #2". If you cannot position them at the same location, you will have to calculate a "compensation number" and add it to your relative humidity indication as described in the numbered steps below:

1. Mark down the temperature indication where the humidity sensor is located:

_____ (indoor) _____ (outdoor)

2. Mark down the temperature indication at the temperature sensor:

   _____ _____
   (indoor) (outdoor)

3. Subtract the indication in step 2 from the indication in step 1. This may be either a positive or negative number:

   _____ _____
   (indoor) (outdoor)

4. Multiply the number you obtained in step 3 by .22. This will give you the compensation number:

   _____ _____
   (indoor) (outdoor)

5. You will add the compensation number you obtain in step 4 to the humidity indication you obtain from your reference standard (in the Method #1 or Method #2 steps). This will give you a corrected humidity indication.

EXAMPLE #1: The humidity at the reference standard is 50%.

1. The temperature at the outdoor humidity sensor (measured by the indoor temperature sensor): 70°F.
2. The temperature at the outdoor temperature sensor: 40°F.
3. 70°F — 40°F = 30°F.
4. 30°F x .22%/°F = 6.6%.
5. 50% + 6.6% = 56.6%.

In this case, you would set the outdoor humidity sensor to 57%.

EXAMPLE #2: The humidity at the reference standard is 50%.

1. The temperature at the outdoor humidity sensor (measured by the indoor temperature sensor): 70°F.
2. The temperature at the outdoor temperature sensor: 90°F.
3. 70°F — 90°F = -20°F.
4. -20°F x .22%/°F = -4.4%.
5. 50% + (-4.4%) = 45.6%.

In this case, you would set the outdoor humidity sensor to 46%.

Now proceed to the steps under "Method #1" or "Method #2".

Method #1

( ) Adjust control R704 on the indoor sensor circuit board until the digital display indicates the same reading as the humidity indicator that you are using as a reference — plus the "compensation number" if you had to calculate one (to compensate for the temperature difference between corresponding humidity and temperature sensors).

( ) Adjust control R704 on the outdoor sensor circuit board until the digital display indicates the same reading as your reference humidity indicator — plus the "compensation number" if you had to calculate one (to compensate for the temperature difference between the corresponding humidity and temperature sensors).

( ) Temporarily install the sensor cabinet tops for two hours to allow the temperature inside them to stabilize; then repeat the two previous steps.

Method #2

Refer to Pictorial 2-12 while you perform the following steps.

You will have to perform this calibration twice, once with the sensor cabinet tops off, and again two hours later after the sensors have stabilized with their cabinet tops installed. Two sets of check-off spaces have been provided for this purpose.

( ) Tape both thermometers to a wall or other solid object approximately 4 to 5 inches above your work area and about 8" apart.

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

( )( ) After the thermometer indications have stabilized, make a note of these first readings in degrees Fahrenheit (°F).

( )( ) Wet the entire wicking. Then position one end of it over the bottom of one of the thermometers and let the other end hang in the cup of water.

( )( ) Position a portable fan in a location where a fair amount of air movement can be directed onto both thermometers and both sensors for about eight minutes.

( )( ) Read both thermometers again, and then write down this second set of wet bulb and dry bulb readings.

( )( ) Turn off the fan.

( )( ) 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 chart in Figure 1 (Illustration Booklet, Page 16) to determine the relative humidity as follows:

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 control R704 on the indoor sensor circuit board until the digital display matches the relative humidity number that you just located on the chart — plus the "compensation number" if you had to calculate one (to compensate for the temperature difference between corresponding humidity and temperature sensors).

( ) Position the sensor cabinet top over each if the sensor bases but do not fasten them at this time. See Pictorial 2-13.

( ) Remove the wicking from the wet bulb thermometer.

Allow the two sensors to stabilize for two hours; then return to the beginning of "Method #2 and repeat the steps with the double check-off spaces once more. Leave the sensor cabinet tops loosely installed and remove them only to adjust the controls. After you complete these steps for the second time, remount the cabinet tops on the sensor bases.

## RAIN SENSOR ACCESSORY (optional)

Refer to Pictorial 2-14 while you perform the following steps.

WARNING: The collector ring is made of thin metal and can have very sharp edges. Handle the sensor carefully to avoid cuts. Wear leather gloves if they are available.

( ) Carefully remove the sensor (#150-211) from its shipping carton.

( ) Separate the sensor wires for 3/4" and remove 1/4" of insulation from each end.

( ) Refer to the inset drawing on the Pictorial and grasp the sensor at its narrowest point; then carefully pry the base off with your fingertips.

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

( ) Remove any packing materials that prevent the dipper from moving.

Temporarily connect the sensor wires to lugs 3 and 4 of the connector strip labeled **RAIN** on the back of your Weather Computer as follows. These wires can be connected either way.

( ) Carefully rock the sensor dipper from one side to the other. You should hear a click from the sensor each time the sensor moves to the opposite stop, and the display should increment by .01 for inches or .0254 for centimeters.

If the sensor increments properly, proceed to "Installation". If the sensor does not increment properly, 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 1/16" 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:

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

2. 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.

( ) Remove the backing paper from the blue and white label supplied with the Rain Sensor. Then press the label onto the bottom of the Weather Computer. Do not cover any other labels that may already be present.

NOTE: The sensor has been accurately calibrated, and does not require additional calibration.

This completes the "Recalibration" of your Weather Computer".

# INSTALLATION

This section of the Manual gives you general information for mounting and connecting the temperature sensors and the wind sensor assembly. Your installation will vary to suit your particular requirements. You should have already cut the various cables to the proper length.

NOTE: The wind sensor assembly comes with 100' of cable. If your installation requires more cable to reach the Weather Computer, you can purchase it from the Heath Company. The splicing techniques of the additonal cable are left up to you. Use the extra spade lugs, already supplied, for the ends of the cable wires.

## TEMPERATURE SENSORS

NOTE: If the temperature sensor cables are too long, you may shorten them. If you do, however, you must purchase additional parts and perform the "Recalibration" steps for the cable (or cables) that you shortened. If possible, roll the extra cable up and store it in an out-of-the-way place instead of shortening it.

Ideally, the outdoor temperature sensor should be housed in white-colored louvered shelters (see Pictorial 3-1). If possible, install such shelters at least 100 feet from any concrete or other hard-surface area, and not closer to any object than four times the height of the object above the floor of the shelter. Install the shelter approximately four feet above the ground with the door opening facing north. Avoid rooftop installations, if possible. If you have to place the shelter on a roof, make sure that it is at least 30 feet from any exhaust fans, or large vertical reflecting surfaces.

You may place these sensors wherever you want to monitor the temperature; but do not place the indoor sensor near any heat source, such as a heat register or TV set. If you do, false readings will be displayed.

Mount the outdoor temperature sensor in a location that is shielded from direct or reflected sunlight, such as under an eave (see Pictorial 3-2). Also, select a location where ice and snow will not accumulate, as this would influence the reading.

## WIND SENSOR ASSEMBLY

Ideally, the wind sensor assembly should be installed so that the distance to any obstruction is at least 10 times the height of the obstructions above the elevation of the ground on which the wind sensor assembly is located.

This assembly should be as far away as possible from objects that will shield the wind sensors, cause air turbulence or vibration (such as an attic power ventilator), or divert the wind against them from other than the true wind direction. An existing facility, such as a television tower or mast, may be used (see Pictorial 3-3). The boom mounting clamp furnished will accept a tubular object up to 1-1/2" diameter. We recommend that you do not mount the wind sensor assembly on a chimney mast due to corrosive fumes from the chimney. Several types of TV masts for roof mounting are available from TV installers. Some of these are suitable for mounting the assembly above the roof. Be sure to properly ground any of these mounting masts, as outlined at the end of this section.

Be sure you line up the pencil line (from the "Recalibration") on the side of the wind vane with due north.

## HUMIDITY SENSORS

NOTE: If the humidity sensor cables are too long, you may shorten them. If you do, however, you must purchase additional parts and perform the "Recalibration" steps for the cable (or cables) that you shortened. If possible, roll the extra cable up and store it in an out-of-the-way place instead of shortening it.

### Indoor Sensor

Position the indoor sensor wherever you want to monitor relative humidity, provided it is not above a source of dry or moist air. Placing the sensor over such a source would provide false indications. Do not put the sensor in the kitchen or in a room that is closed for long periods of time. The ideal location for the sensor is in a hallway off of the living room.

### Outdoor Sensor

Refer to Pictorial 3-4 while you perform the following steps.

NOTES:

1. You will need to remove the sensor cabinet top to mount the base to the overhang. Be sure to use the correct screws and replace the cover after you complete the mounting.

2. If the sensor becomes moist, the unit will indicate erratically until the sensor element dries.

( ) Mount the outdoor sensor in a louvered shelter or on the overhang, about 3" away from the edge of the house, as shown in the Pictorial. This will protect the sensor from direct sunlight and rain. Use the two #6 x 1" screws supplied.

## RAIN SENSORS

NOTE: The rain sensor is part of the Model IDA-5001-2 Rain Gauge Accessory.

The Rain Gauge Accessory is supplied with 60 feet of 2-wire cable to reach between the sensor unit and the Weather Computer. Be sure to consider this when you choose the location for the rain sensor. NOTE: You can splice an additional length of cable to the sensor unit, up to a maximum length of 150 feet. Be sure the splice connection is properly sealed to prevent moisture from reaching the wires.

You can mount the sensor unit on any level outdoor surface, such as a 6" x 6" (minimum) platform on a fence post or wooden pole, or on a wooden platform extended out from a tower (see Pictorial 3-5). Avoid placing the sensor on a metal surface, however, as this could interfere with the operation of the magnet. The top of the sensor should be close to the ground (where the wind speed is the lowest) and yet high enough to be above any expected snowfall accumulation. Be sure you choose a location that will not be affected by other structures or trees, which might prevent the full rain fall from reaching the sensor or cause an extra amount of rain to fall into it. The sensor must also be able to drain accumulated rain from its base.

Refer to Pictorial 3-6 while you perform the following steps.

( ) Mount a suitable wooden platform or board at the selected location. The platform must be level for accurate measurements.

NOTE: Use the screws supplied with the Rain Gauge Accessory to mount the sensor base to the platform. Be careful not to pinch the wires when you install the screws.

( ) Position the sensor base onto the platform. Then slide a mounting strap under the base, and start a screw though the holes in the base and strap into the platform.

( ) Similarly, start screws through the remaining two base holes and mounting straps. Then tighten all of the screws enough to hold the base firmly in place.

WARNING: The collector ring is made of thin metal and can have very sharp edges. Handle the sensor carefully to avoid cuts. Wear leather gloves if they are available

( ) Push the sensor top onto the base; then bend each mounting strap up and over the edge of the collector ring to hold the sensor in place.

## CABLE ROUTING

How you route the sensor cables depends upon your particular installation. We recommend that you use plastic tape (not supplied) to secure the cables to a tower or mast. You can use staples or TV lead-in standoffs to secure the cables to wood.

You may be able to bring the cable into the building in the same manner as your TV lead-in (see Pictorial 3-3). To keep out moisture, you should plug the entry hole with a good grade of caulking compound that will remain pliable and will not harden.

## CABLE CONNECTIONS

Refer to Pictorial 3-7 while you perform the following steps.

NOTES:

1. Some of the sensor cables have a silver (bare) wire. Use a 1/2" length of sleeving on these wires when you connect them, in the following steps, so that they cannot short out to other nearby connections.

2. If you do not have a soldering iron when you install the spade lugs, be sure to crimp the lugs to the wires as securely as possible so they cannot easily come loose.

### Wind Sensor Assembly

( ) After you have properly routed the 8-wire cable from the wind sensor assembly, refer to the inset drawing on the Pictorial and install spade lugs on the end of this cable.

Position the Weather Computer as shown. Then connect the wires at the end of the 8-wire cable to the connector strip labeled **WIND** on the back of your Weather Computer as follows:

( ) Blue wire to BLU.

( ) Green wire to GRN.

( ) Yellow wire to YEL.

( ) Orange wire to ORG.

( ) Red wire to RED.

( ) Brown wire to BRN.

( ) Black wire to BLK.

( ) White wire to WHT.

### Temperature Sensors

( ) Refer to the inset drawing on the Pictorial and install spade lugs on the free ends of the indoor and outdoor temperature sensor cables.

Connect the wires at the free end of the outdoor temperature sensor cable to the connector strip labeled OUTDOOR TEMPERATURE as follows:

( ) Silver wire to GND.

( ) White wire to WHT.

( ) Black wire to BLK.

Connect the wires at the free end of the indoor temperature sensor cable to the connector strip labeled INDOOR TEMPERATURE as follows:

( ) Silver wire with sleeving to GND.

( ) White wire to WHT.

( ) Black wire to BLK.

### Humidity Sensors

( ) Refer to the inset drawing on the Pictorial and install spade lugs on the free ends of the indoor and outdoor humidity sensor cables.

Connect the wires at the free end of the outdoor humidity sensor to the connector strip labeled OUDOOR HUMIDITY as follows:

( ) Silver wire to GND.

( ) White wire to WHT.

( ) Black wire to BLK.

Connect the wires at the free end of the indoor humidity sensor to the connector strip labeled INDOOR HUMIDITY as follows:

( ) Silver wire to GND.

( ) White wire to WHT.

( ) Black wire to BLK.

### Rain Sensor

Perform the next two steps only if you have the Rain Sensor Accessory.

( ) Refer to the inset drawing the Pictorial and install spade lugs on the free ends of the rain sensor cable.

( ) Connect the wires at the free end of the rain sensor cable to the connector strip labeled RAIN. These wires can be connected either way.

## CONNECTION TO A COMPUTER OR TERMINAL

An RS-232 cable is not supplied with your Weather Computer, nor is the software you will need to operate your Weather Computer with your computer or terminal. You will need to determine the appropriate interface cable and software to use. You may use a terminal emulation program or write your own program.

The RS-232C connector on the Weather Computer is wired as Data Communication Equipment (DCE), and its pinouts are as follows (also see Pictorial 3-8):

| P1 | RS-232C connector |
|---|---|
| Pin 1 | Chassis Ground |
| Pin 2 | Receive Data (RXD) |
| Pin 3 | Transmit Data (TXD) |
| Pin 4 | Clear-To-Send (CTS) |
| Pin 6 | Data Set Ready (DSR) |
| Pin 7 | Signal Ground |
| Pin 8 | Data Carrier Detect (DCD) |

You can make your own cable, or you can purchase cable **HCA-200-PC** from the Heath Company, which will work for any of the following computer models, regardless of their prefix letters (H, Z, HS, etc.):

| Computer Model | Cable Pin Out | |
|---|---|---|
| | 9-pin Connector (Computer) | 25-Pin Connector (Weather Computer) |
| 159 | 1 | 8 |
| 183 | 2 | 3 |
| 184 | 3 | 2 |
| 241 | 4 | 20 |
| 248 | 5 | 1,7 |
| 386 | 6 | 6 |
| EZ PC AT | 7 | 4 |
| IBM PC AT | 8 | 5 |
| | 9 | 22 |

You can make your own cable or purchase cable **HCA-51** from the Heath Company if you have one of the following computers:

| Computer Model | Cable Pin Out | |
|---|---|---|
| | 9-Pin Connector (Computer) | 25-Pin connector (Weather Computer) |
| 100 | 1 | 1 |
| 148 | 2 | 2 |
| 150 | 3 | 3 |
| 158 | 4 | 4 |
| 160 | 5 | 5 |
| 171 | 6 | 6 |
| 181 | 7 | 7 |
| IBM PC XT | 8 | 8 |
| | 20 | 20 |

If you use a terminal instead of a computer, use a straight-through male-to-female **shielded** cable, such as the Heath Company **HCA-51**.

( ) Using the appropriate interconnect cable, connect your Weather Computer to your computer or terminal.

## LIGHTNING PROTECTION

The greatest danger to your Weather Computer comes from lightning. The following paragraphs outline what you can do to protect your electronic equipment, as well as your family and home, from this danger.

It is impossible to absolutely eliminate the possibility of a lightning strike. But you can reduce the probability of a strike by intelligent operating procedures and proper grounding systems and techniques. Lightning is simply a massive current flow between points of potential difference. Reduce the places where potential differences exist and you will reduce the possibility of a strike.

It is better and safer, for example, to mount the Weather Computer's sensors on a mast or tower rather than close to the rooftop of a house. A properly grounded mast (or tower) provides a "cone of protection" for a house, as shown in Pictorial 3-9, by presenting a path that will continuously bleed off static electricity. This will prevent a potential difference, which could attract a lightning strike.

To protect your electronic equipment from a lightning-induced static discharge, you must first bond all metal objects to an effective ground system. This system must provide a low-resistance, high-capacity reservoir for soaking up the static charges. Pay particular attention to your mast or tower since it will act as a giant lightning rod. Clean and lubricate all joints with a conductive grease; then tie the mast or tower to your ground system (a ground rod, for example) with heavy copper or aluminum wire (see Pictorial 3-10). Simply having the tower's base in the earth does not guarantee that it will shunt a lightning strike to ground.

### Grounding

An effective ground system is a must for every home. The purpose of the ground system is twofold. First, it reduces the possibility of electrical shock if something inside a piece of equipment should fail and the chassis or cabinet becomes "hot." If connected properly, three-wire electrical systems ground the chassis; however, the majority of electrical equipment still uses the ungrounded two-wire system. A ground system that prevents shock hazards is generally referred to as "DC ground." Second, it will serve as a path to bleed off static electricity.

For your electronic equipment, you can use your house's cold water pipe network as the primary ground source, assuming sweat-jointed copper tubing is used. Never use hot-water lines or iron pipe systems. Even with copper pipe, a good ground may be impossible to reach, unless your Weather Computer is in the kitchen, bathroom, or laundry room. The use of a water pipe instead of a good earth ground rod is justified only if you live on the first floor of an apartment building, for example.

If you do not have copper plumbing, use an 8-foot (or longer) heavily copper-plated 5/8" diameter steel ground rod with a #8 wire connection to the main power line ground lug at your electric service entrance box (see Pictorial 3-11). Keep in mind that you are trying 1) to dissipate existing static potential over as broad an area as possible and 2) to dissipate a lightning strike if one should come.

The construction of a good earth ground, while not difficult, requires more than driving a metal rod into the lawn. The soil into which you drive the ground rod should present minimum resistance to the electric currents. When completely dry, most soils are non-conductors. Pure water is a very poor conductor. The basic electrical conductivity of a soil is the result of electron transfer through electrolytes dissolved in the water that is present in that soil. This basic conductivity is greatly affected by moisture and salt concentration in the soil. A direct correlation exists between increased soil moisture and lowered resistance. The same effect is noted with respect to dissolved salts in the soil. Salts disassociate into the ions that are involved when electric current passes through a medium; water provides the medium to fascilitate easy flow of these ions through the soil.

### Chemical Treatment

CAUTION: Be extremely careful when you apply chemicals that may pollute ground water, wells, or soil.

Chemical treatment of the soil around a ground rod will increase the effectiveness of your ground system. Rock salt, copper sulphate, or magnesium sulphate will inject large quantities of ions into the soil, resulting in an increase of the soil's conductivity. However, these salts will be gradually washed away by rain and groundwater. You should replace them every one to three years depending on climate and soil type.

## Ground Rods

Copper pipe makes the best ground rod; however, it's expensive and too soft to be driven into the ground. The best practical rods are made of steel which is plated with copper to decrease resistance. Keep in mind that the length of a ground rod is more important than its diameter. Doubling its length will reduce resistance by 40%, while doubling the diameter will result only in a 10% reduction.

Spaced rods further reduce the resistance of your earth ground system. Ground rods should be separated from each other by a distance equal to their length. The reduction of resistance is not proportional to the number of rods in the system. Three rods spaced 15 to 25 feet apart will provide an optimal ground system for all home installations.

A typical ground setup is shown in Pictorial 3-12. This is most effective since the chemical salts are distributed through a large volume of soil. Unfortunately, these salts are toxic to vegetation and can leave a ring of bare soil around each rod.

If you have a small area available for ground rods, you may use the alternate installation method shown in Pictorial 3-13. While not quite as effective as the method shown in Pictorial 3-12, it allows much greater latitude in the placement of your ground rods.

## Radial Wires

If you live in an area that has been plagued with lightning strikes and resulting damage, you may consider using the ground system shown in Pictorial 3-14. Depending on the conductivity of your soil, use four 20-foot (or longer) lengths of solid, bare #8 copper wire. Each wire is connected to a common ground rod and buried at least 6" below the ground surface.

## AC Power Surge Protection

In addition to grounding protection, it is a good idea to invest in surge suppressors for your Weather Computer and other electronic equipment. Since electrical storms frequently cause power outages, surge suppressors also protect the equipment when power returns. However, when power fails, it is best to turn off all equipment. Leave a low-wattage lamp on to signal return of power.

## BATTERY INSTALLATION

Your Weather Computer has provision for a memory back-up battery (not supplied). This battery will retain all parameters that are stored in memory, and will keep the clock running (although not displayed) for up to 18 hours during a power interruption.

The battery can either be installed outside the Weather Computer or inside, with a simple modification. Perform the steps under "External Battery" to install the battery outside the Weather Computer or under "Internal Battery" to install the battery inside the Weather Computer. Your Weather Computer is factory assembled for external battery installation.

### External Battery

Refer to Pictorial 3-15 and perform the following steps to install the battery outside the Weather Computer.

( ) Remove any sleeve that may be on the battery connector. Then plug the battery connector onto the battery (not supplied).

( ) Push the battery into its rear panel holder.

### Internal Battery

Refer to Pictorial 3-16 and perform the following steps to install the battery inside the Weather Computer.

( ) Unplug the Weather Computer's line cord from the AC outlet.

( ) Remove the seven screws (three on the back and two on each side) that secure the cabinet top on the Weather Computer. Then carefully remove the cabinet top and set it aside temporarily.

( ) Remove the hardware that secures the battery holder to the rear panel. Then use this same hardware to mount the holder onto the inside of the rear panel.

( ) Loosen the terminal screws where the leads of the battery are connected so you can disconnect the spade lugs.

( ) Cut the spade lugs off the ends of the battery connector leads. Then remove 1/4" of insulation from the end of each lead.

( ) Solder the end of the black battery connector lead to terminal strip B lug 6.

( ) Solder the end of the red battery connector lead to terminal strip B lug 5.

( ) Remove any sleeve that may be on the battery connector. Then plug the battery connector onto the battery (not supplied).

( ) Push the battery into its rear panel holder.

( ) Reinstall the cabinet top onto the Weather Computer.

This completes the "Installation." Proceed to "Operation."

# OPERATION

Your Weather Computer has two basic modes of operation:

- The "set-up" mode, which you use to set up its various operating parameters, such as the time, date, and display intensity; and

- The normal mode, where you are reading out and using information from its displays.

The Weather Computer will automatically proceed from one parameter to the next one when you are setting up the time and date information. As soon as you enter the current time in hours (by pressing the correct digit keys and ENTER), for example, it will be ready to accept the current time in minutes. And as soon as you enter either the 12-hour (AM or PM) or 24-hour format, it will be ready to accept the correct designation for "standard" or "daylight saving" time.

Each time you place the Weather Computer in the set-up mode, you will have a time period of exactly one minute in which to enter your new information. If you have not entered it by the end of this one-minute period (by pressing the necessary keys), the Weather Computer will automatically go back to its normal display mode.

In the set-up mode, two steps are necessary to enter information into your Weather Computer. First, you have to press the keys that will supply the information you need (digit keys, AM or PM, etc.). Your second step is to press the ENTER key. Nothing will be actually entered into the Computer until you press ENTER. If you make a mistake, press the necessary keys again and then press ENTER once more.

The term "default" refers to a decision that the Computer is programmed to make for you under certain conditions. For example, if you do not enter the time during the one-minute set-up period, the Computer will automatically reset the time to its "default" (preprogrammed starting) value of 12:00:00 AM.

Refer to Pictorial 4-1, which shows the LCD display and the keyboard keys, as you read the following information. NOTE: A "Quick Reference Guide," which provides a quick reminder on how to operate each key, is included with your Advanced Weather Computer.

## SETTING THE TIME AND DATE

When you first apply power to the Weather Computer, it comes up in the time/date set-up mode. The time will be at 12:00:00 AM standard time, and the date (month, day of the month, and year) will be 1-1-87, with the hours digits flashing and the clock not running.

If the clock is already running, enter the time/date set-up mode by pressing and holding the TIME SET key while pressing ENTER; then release both keys and press only the TIME SET key once again.

To set the time/date display, use the following keys:

**0 1 2 3 4 5 6 7 8 9 ENTER UNITS**

You may modify any of the digits in that part of the display where the digits are flashing by first pressing keys 0 through 9 to enter the correct hours in the flashing hours display. After you enter the correct hours, press ENTER to actually load the hours into the clock. Then use the same procedure to enter the desired minutes and seconds. As soon as you enter the seconds, the clock will begin running.

After you enter the seconds, the AM indicator will flash; you can then set the time display for either AM, PM, or 24-hour format. (The 24-hour format modes do not display AM or PM.) Press the UNITS key to go between AM and PM; press the 24HR key to go between the 12-hour and 24-hour formats. After you set the desired mode, press ENTER to enter this mode into the Weather Computer.

As soon as you enter the AM-PM information, the Weather Computer will go into the standard or daylight saving time set-up mode. Initially, it should be in standard time as indicated by a flashing S. Press the UNITS key to go between standard and daylight saving time, where daylight saving time is indicated by a flashing D. After you set the desired mode, press ENTER to enter it into the Weather Computer's clock. NOTE: The D or S is never displayed, except when you are in the D-S set-up mode.

The date functions are called up next (this occurred when you pressed ENTER to set D or S). The order of setup is: month, day of month, and year. The year is not normally displayed; however, it is written over the day

of month when you set the year. Enter this information, followed by ENTER, as you did when you used the digit keys to set the desired time. After you enter the year, the Weather Computer exits the clock set-up mode.

You can manually enter the time/day set-up mode anytime by first pressing the TIME SET and ENTER keys; then releasing these keys and pressing the TIME SET key again. If you just press the TIME SET and ENTER keys once, you enter a simple minute-update mode, where the seconds go to 00 when you press the ENTER key. If the displayed seconds are 30 or less when you press ENTER, the minutes remain unchanged. If the displayed seconds are greater than 30 when you press the ENTER key, "1" is added to the minutes. Then the clock will exit the set-up mode and start keeping time again.

## RATE FUNCTIONS

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 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 rate displays will be held as long as you keep the key depressed, and will revert back to the normal display as soon as you release the RATE or 24 HR key. If the Weather Computer does not have enough data to base a rate upon, such as on initial powerup, two dashes (--) and two "arrow heads" (▲ for an increase, or ▼ for a decrease) will be displayed to indicate that no rate is yet available. The two dashes will be displayed for up to three hours after power is turned on. After this time, the current rate of change will appear in the display. However, rain will continue to display the current rain value for the rate, if it has been raining, and the optional Rain Gauge Accessory is installed.

### Rain Rate

With the optional Rain Gauge Accessory, Model IDA-5001-2, an "instantaneous" rain rate is available in which the hourly rain rate is calculated based upon the time between the two previous pulses from the rain gauge. You can obtain this rate by pressing and holding the RAIN and RATE keys. If the time that has elapsed since the last two rain gauge pulses is greater than the time between the previous two pulses, the displayed rain rate value will gradually decrease in anticipation of the next pulse from the rain gauge, indicating a lower rain rate value.

### Rate Arrows

NOTES:

1. After you enter the set-up mode, you have 60 seconds to make your desired changes before the Weather Computer automatically reverts to the normal mode. Therefore, be sure you are familiar with the information under the "Rate Arrows" heading before you actually enter the set-up mode.

2. If one or more of the rate arrows is not displayed, your Weather Computer has not yet registered a change that is large enough to light the arrow(s).

Rate arrows that appear after the temperature, barometer, and humidity show you the "hourly rate of change". Each rate arrow has four "levels" and is made up of an arrow head and a "tail" consisting of one, two, or three bars. The default rates are shown below.

| | |
|---|---|
| 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. |

NOTE: In the following steps, if you make an incorrect entry or "get lost" and the numbers start flashing in the display, simply wait for 60 seconds and the Weather Computer will return to the normal mode. Also, you may exit the mode you are in by pressing the number key(s) corresponding to the flashing number(s) followed by ENTER. Keep doing this until the display stops flashing. Then you can re-enter the mode.

If you wish to display the preprogrammed default values for the outdoor temperature, first press the TEMP and then the RATE key to enter the temperature rate arrow set-up mode. "3" and an arrow head will then appear in the display. Press the ENTER key; "6" and the arrow

head with one bar will appear. Again press ENTER; "9" and the arrow head with two bars will be displayed. Again press ENTER; "12" and the arrow head with three bars will appear. Press ENTER one last time; you will exit the temperature rate arrow set-up mode and return to the normal display mode.

To display the preprogrammed default values for the indoor temperature, first press the TEMP and RATE keys to enter the temperature rate arrow set-up mode. "3" and an arrow will then appear in the outdoor temperature display. Press the INDOOR key; "1" and one arrow head will appear in the indoor temperature display. Then press ENTER to cycle through the various default values until the display reverts back to the normal display mode.

You can change these default values by entering the rate arrow set-up modes. Enter these modes by pressing and holding the TEMP, PRESSURE, or HUMID key as you press the RATE key. When you first enter one of these modes, only the arrow head is displayed, along with the rate value required to light just this portion of the rate arrow. You can then modify this value by entering the appropriate digits (05, for example), followed by ENTER to actually enter the value into the Weather Computer.

The next level of the arrow will then be displayed, along with the rate value required to light up this segment of the arrow display. You can then enter the digits to modify this value and so on until all four sections of the arrow are set up and the display reverts back to the normal mode. Each entered rate value must be equal to or greater than the previously entered value; otherwise, the previous value will be displayed flashing to give an indication of the minimum rate value that you must enter to proceed.

If you attempt to change the default value that was initially assigned to the third section of the rate arrow's tail for the outdoor temperature from a 9 to a 5 (by entering 05), for example, a 6 will flash in the display after you press ENTER. This indicates that, for the **third** section of the rate arrow's tail, the Weather Computer will not accept a default value that is lower than 6. Therefore, you must select a value that is equal to or higher than 6; otherwise, your input will be ignored and, after 60 seconds, the rate arrow set-up mode will time out, and the Weather Computer will revert back to the normal mode.

You can enter the indoor rate arrow set-up modes by simply pressing the INDOOR key anytime the keyboard is in the corresponding outdoor rate arrow set-up mode for the particular display desired (Temperature or Humidity).

## Alert/Warning Display

The Alert/Warning display is just an extension of the rate arrow concept. It provides you with first an alert and then a warning display (also alert and warning sounds, if you like) for rates of change that you feel are significant or critical for the temperature, pressure, and wind speed (but not the humidity). The Speed Alert/Warning display is based on wind gust speed and not on the average wind value. The display's Weather Alert or Warn indicators will stay turned on as long as the rate change or wind speed meets the criteria to turn them on. The default values for these displays are shown below.

| | | |
|---|---|---|
| **Indoor Temperature** | **99°** | **Alert** |
| | **99°** | **Alert/Warning** |
| **Outdoor Temperature** | **14°** | **Alert** |
| | **16°** | **Alert/Warning** |
| **Barometer** | **6*** | **Alert** |
| | **9*** | **Alert/Warning** |
| **Wind** | **40 mph** | **Alert** |
| | **40 mph** | **Alert/Warning** |

You can also change the default values for these displays by means that are similar to those for the rate arrows. You can enter the Alert/Warning mode by pressing and holding the AL/WARN key and either the TEMP, PRESSURE, or WIND key. Then enter the two-digit Alert value, followed by the two-digit value for Alert/Warning.

Press AL/WARN and ENTER to activate the audio circuitry. Ten short beeping sounds will occur whenever a measurement advances to an alert condition, and a steady tone will sound for about five seconds whenever a measurement advances to the warning condition. Press AL/WARN and CLEAR to disable the audio circuitry.

* .06 and .09 inches of mercury.

NOTE: If the sound circuitry is turned on, a clicking sound is activated whenever you press a key, or whenever the rain gauge trips when it is counting the amount of rain that it is collecting.

## MIN/MAX FUNCTIONS

You can recall the minimum and maximum values for Temperature, Pressure, Humidity, and (wind) Speed by pressing one of these keys at the same time that you press either the HIGH or LOW key. The time and date that these maximum and minimum values occurred will also be shown.

As soon as you press one of these key combinations, you are in the MIN/MAX mode. You will remain in this mode as long as you hold the keys down, and for four seconds after you release them. The display will then return to normal.

When you are in this mode, you can easily recall other values simply by pressing the HIGH, LOW, TEMP, PRESSURE, HUMID, or WIND key. You can recall the indoor temperature or humidity simply by pressing the INDOOR key when in the temperature or humidity min/max mode. The min/max values for the wind speed will be for either "wind gust" or "wind average," depending on which one is being displayed when the min/max value for the speed was entered.

You may clear a specific minimum or maximum value for temperature, pressure, humidity, or speed to the current value simply by pressing CLEAR when in the min/max mode. You can clear both the minimum and maximum values at any time in the normal mode by pressing the appropriate key with CLEAR. Both outdoor and indoor min/max will be cleared for temperature and humidity. Exit the min/max mode immediately by pressing ENTER.

To clear the accumulated RAIN display in the normal mode, press and hold the RAIN and CLEAR keys.

You can clear all minimum and maximum values in the normal mode by pressing and holding the ENTER and CLEAR keys.

## UNITS SETUP

You can step through the units for the (wind) Speed, Temperature, Pressure, and Rain displays by pressing any one of those keys with the UNITS key.

## WIND SPEED

The display will indicate the wind speed in either the GUST or AVG (average) mode. To change from one mode to the other, press and hold the WIND key while you press the RATE key.

## WIND DIRECTION

In the normal display mode, one or two of 16 indicators shows the wind direction by compass point (S for south, for example). If you press the WIND key only, the wind speed display will indicate the average wind direction in degrees. Multiply the displayed number by 10 to obtain the actual reading. For example, 18 corresponds to 180 degrees, or due south. NOTE: The "SPEED" indicator will not be displayed if you press the WIND key only.

## WINDCHILL

Press and hold the TEMP and WIND keys to obtain the windchill value in the outdoor temperature display. Either wind average or the current wind gust value will be used for the windchill calculation, depending upon which mode the WIND display is in (GUST or AVG).

## FOG INDICATOR

The display's "FOG" indicator turns on when the relative humidity is 90% or higher, wind speed average is less than 5 mph, and the outdoor temperature is steady or falling.

## DISPLAY INTENSITY SETUP

The backlit display intensity is controlled by the ambient light level, which is detected by the photo resistor in the lower right-hand corner of the front panel opening. You can set the desired intensity level at a particular high and low ambient light level; the display intensity will then vary as the ambient light level changes between these set points. 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.

NOTE: Operating the fluorescent lamp inside your Weather Computer at less than full brightness greatly reduces its life. The default setting is full brightness. If you must run the lamp at less than full brightness, follow the instructions outlined in the next two paragraphs.

Enter the intensity set-up mode by pressing the ENTER key while you press and hold the HIGH (or LOW) key, depending upon whether you desire the high or low intensity setup. When you set the low intensity level, by pressing the ENTER and LOW keys, the ambient light level must be somewhat less than when you set the high intensity level; otherwise, the Weather Computer will not enter the low intensity set-up mode. When you set the high intensity level, the ambient light level must be higher than when you set the low intensity level. NOTE: To obtain the longest life from the fluorescent lamp inside your Weather Computer, set the brightness for the highest possible level.

When you enter the intensity set-up mode, the seconds display will indicate the current backlit intensity level on a scale from 1 through 32. You may then use the HIGH or LOW keys to step the intensity up or down throughout this range of intensity levels, until the desired level is reached. Then press ENTER to actually set the intensity for the current ambient light level. NOTE: You cannot advance the LOW setting to equal the value currently used for the HIGH setting and vice versa.

Operating the fluorescent lamp inside your Weather Computer at less than full brightness greatly reduces its life. In addition, you may hear a buzz coming from inside the unit at low brightness settings. To obtain much longer life from the lamp, use the following procedure to set the brightness to level 32:

1. Hold your finger over the light sensor (located just below the lower right corner of the display). Keep this sensor covered while you perform the next three steps.

2. Press and hold the ENTER key while you press the HIGH (2) key. Then release both keys.

3. Press and hold the HIGH (2) key until the seconds digits of the display indicate 32.

4. Press the ENTER key to return to normal operation.

## DISPLAY VIEWING ANGLE

You can also adjust the vertical viewing angle of the display by pressing and holding the UNITS and INDOOR keys. You may select five different settings by simply pressing these keys repeatedly to step through the available angles. Refer to Detail 4-1A.

## DISPLAY TEST

When you repeatedly press and hold the PRESSURE and HUMID keys, the display segments will turn on as follows: 1) all segments on; 2) one half of the segments on; 3) the other half of the segments on; 4) all segments off. If you press ENTER, the display will revert back to normal, or it will time out and default to a normal display after one minute.

## ERRONEOUS DISPLAY READINGS

If the temperature sensors are disconnected from the back of the Weather Computer or if they are damaged (by lightning, for example), it can cause the input voltage to the analog switches on the main circuit board to exceed the supply voltages of the switches. This causes "crosstalk" which, in turn, causes false outputs that can affect the display brightness. This can also cause erroneous readings on two or more of the display indicators, such as the ones for temperature and barometer. The temperature probes are most likely to cause this situation; however, the humidity and pressure sensors can also cause the inputs of the analog switches to be overdriven.

## ADDITIONAL INFORMATION ABOUT THE RAIN ACCESSORY

If all AC (line) or DC (battery) power to the Weather Computer is removed and then restored, the rain display will not light until the rain sensor detects a rainfall. To clear the digits in the rain display, just press and hold the RAIN and CLEAR keys.

You may clear the data, except the rain data, that is stored in the Weather Computer's memory by pressing and holding the CLEAR and ENTER keys. This allows the Computer to continue accumulating a total rain value (for the entire month). If you wish to obtain the rainfall for the last day, press the 24HR key.

## DEW POINT

Press and hold the TEMP and HUMID keys to obtain the dew point in the outdoor temperature display.

## USING THE COMPUTER INTERFACE

Load a terminal emulator program into the computer's memory. Then make sure it is configured for the following parameters:

| | |
|---|---|
| Data bits: | 8 |
| Stop bits: | 1 |
| Parity: | None |
| Matching baud rates | |

### Baud Rate Setup

You can set up the baud rate for the serial interface by pressing the BAUD key. This will display the current baud rate in the time display. The BAUD rate can then be used to step through all possible baud rates. When the desired baud rate is displayed, press the ENTER key to set the baud rate to the displayed value.

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

1. 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 make a typing error in the entry. (ATES = turns on echo.)

2. Type **ATLS** and press the RETURN key. You will see ATLS on the screen. (ATLS = enables line feeds.)

3. Type **ATRD** and press the RETURN key. You will now see the year, month, and date displayed on the screen (e.g. 882903). NOTE: The correct date will not be displayed unless you set it correctly on the Weather Computer at an earlier time.

4. 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 incorrect unless you set it to the correct time on the Weather Computer at an earlier time. The time will be returned in the 24-hour format even if the Weather Computer is set for a 12-hour format.

NOTE: If you wish, you can experiment with some of the other codes by referring to the "Appendix" on Page 51 in the back of this Manual.

This completes the "Operation" of your Weather Computer.

# IN CASE OF DIFFICULTY

This section of the Manual is divided into three parts. The first part, titled "Troubleshooting and Repair Precautions," points out the care that you should use when you service the unit to prevent damaging components.

The second part, titled "Troubleshooting Chart," shows some difficulties and likely causes.

If the "Troubleshooting Chart" does not help you locate a problem, read the "Circuit Description" and refer to the Schematic Diagram (fold-in) to help you determine where the trouble is.

The third part, titled "Replacing the Fluorescent Lamp" provides you with detailed directions for changing the fluorescent lamp inside the Weather Computer.

Refer to the "Circuit Board X-Ray Views" (Illustration Booklet, Pages 17 - 20) for the physical locations of parts on the circuit boards.

NOTE: In an extreme case where you are unable to resolve a difficulty, refer to "Customer Service" inside the rear cover of this Manual. Your Warranty is located inside the front cover.

## Troubleshooting And Repair Precautions

WARNING: When the line cord is connected to an AC outlet, hazardous voltages are present inside your Weather Computer. See Pictorial 5-1 (Illustration Booklet, Page 15).

Be sure you disconnect the line cord before you remove the cabinet top from your Weather Computer.

1. Make sure you do not short any adjacent terminals or foils when you make tests or voltage measurements. If a probe or test lead slips, for example, and shorts together two adjacent connections, it is very likely to damage one or more of the transistors, diodes, or integrated circuits (ICs).

2. Be especially careful when you test any circuit that contains an IC or a transistor. Although these components have an almost unlimited life when they are used properly, they are much more vulnerable to damage from excess voltage and current than many other parts.

3. Do not remove any components while the unit is turned on.

4. Use a voltmeter with a high input impedance when you measure voltages.

5. Never apply +5 volts or ground potentials to the output of any IC.

6. When you make repairs, make sure you eliminate the cause as well as the effect of the trouble. If, for example, you find a damaged resistor, be sure you find what damaged the resistor. If you do not eliminate the cause, the replacement resistor may also become damaged when you put the unit back into operation.

7. In several areas of the circuit boards, the foil patterns are quite narrow. When you unsolder a part to check or replace it, avoid excessive heat while you remove the part. A suction-type desoldering tool makes part removal easier.

### COMPONENTS

To remove faulty resistors or capacitors, first clip them from their leads; then heat the solder on the foil and allow each lead to fall out of its hole. Preshape the leads of the replacement part and insert them into the circuit board holes. Solder the leads to the foil and cut off the excess lead lengths.

You can remove transistors in the same manner as resistors and capacitors. Make sure you install the replacement transistor with its leads in the proper holes. Then solder the leads quickly to avoid heat damage. Cut off the excess lead lengths.

### FOIL REPAIR

To repair a break in a circuit board foil, bridge solder across the break. Bridge large gaps in the foil with bare wire. Lay the wire across the gap and solder each end to the foil. Carefully trim off any excess bare wire.

## Troubleshooting Chart

The following chart lists the "Condition" of several specific malfunctions and some "Possible Causes." If a particular part or area is mentioned (U301, D304, etc.) as a possible cause, check the parts associated with that circuit. It is also possible, or rare occasions, for a part to be faulty and require replacement.

| CONDITION | POSSIBLE CAUSE |
|---|---|
| Fluorescent lamp filament does not light. | 1. Open light control line.<br>2. Q314, Q315, or D322.<br>3. Q316, Q317, or D324.<br>4. U305, Q307, Q308, Q309 – Q313.<br>5. Lamp.<br>6. D317 – D320. |
| Fluorescent lamp filaments light but lamp does not turn on. | 1. Q309 through Q313.<br>2. D317 through D320.<br>3. T301 or T302.<br>NOTE: Check ID dot position. |
| A single keyboard key does not function. | 1. Keyboard wiring for non-functioning key. |
| Several keyboard keys do not function. | 1. Plug P407.<br>2. U406, U411, or U409. |
| None of the keys function. | 1. U417, U406, U411, or U409. |
| The fuse blows. | 1. Short circuit on the +5, +15, or -15 volt supply line. |
| Cannot calibrate the pressure sensor, or it does not function properly. | 1. A401 or its circuitry.<br>2. U402.<br>3. U405, U407, or U410.<br>4. U401, U403, or surrounding circuitry |
| Cannot calibrate a temperature sensor, or it does not function properly. | 1. Cable connections on the back of the main unit.<br>2. The sensor (A1 or A2) or its circuitry.<br>3. U404.<br>4. U405, U407, or U410.<br>5. U401, U403, or surrounding circuitry. |
| Time counts too fast or too slow. | 1. 50/60 Hz wave-shaping circuitry.<br>2. Q405 or Q406.<br>3. U408C. |
| The Wind speed indicator does not function properly. | 1. U421 interface circuitry.<br>2. U421 or U419. |
| The Weather Computer does not keep proper time during a power failure. | 1. D315.<br>2. Socket S301.<br>3. Battery. |

### Troubleshooting Chart (Cont'd)

| PROBLEM | POSSIBLE CAUSE |
|---|---|
| Shorting the terminal screws labeled "RAIN" does not produce the proper display reading. | 1. Rear panel connections to the main board at plug P409-1.<br>2. R476 or R484.<br>3. D404 or D405.<br>4. C427.<br>5. U408 or U421. |
| Noticeable buzz coming from inside the Weather Computer at low brightness level settings. | 1. This is normal. To reduce the buzz, set the brightness level higher. |

## Replacing the Fluorescent Lamp

Use the following procedure whenever the fluorescent lamp needs to be replaced.

NOTES:

1. Your Weather Computer uses a type F8T5/ Coolwhite bulb, which is available from almost any store that sells bulbs.

2. A small percentage of fluorescent lamps display a "swirling" action when you first turn the power on. If this happens, unplug the unit for several minutes, and then plug it back in. This should eliminate the swirling, which is a result of contamination within the lamp that takes place during manufacturing.

( ) Unplug the Weather Computer's line cord from the AC outlet.

( ) Remove the seven screws (three on the back and two on each side) that secure the cabinet top to the Weather Computer. Then carefully remove the cabinet top and set it aside temporarily.

Refer to Pictorial 5-2 (Illustration Booklet, Page 15) while you perform the following steps.

( ) Remove the two #6 x 3/8" AB self-tapping screws that secure the ends of the light shield cover to the light shield.

( ) Remove the two 6-32 x 1/4" screws and #6 lockwashers that secure the rear edge of the light shield cover to the power supply support brackets.

( ) Carefully work the light shield cover out of the Weather Computer and set it aside temporarily.

Refer to Pictorial 5-3 while you perform the following steps.

( ) Hold the fluorescent lamp near the ends. Then rotate the lamp in either direction while you gently pull on it until it releases from its sockets. Dispose of the old lamp properly.

( ) Hold the new lamp near the ends and insert the pins into the lamp socket slots. Then rotate the lamp in either direction until it locks into place.

( ) Use the #6 x 3/8" AB self-tapping screws, 6-32 x 1/4" screw, and #6 lockwashers removed earlier to reinstall the light shield cover on the light shield. Refer back to Pictorial 5-2 if necessary.

( ) Carefully reinstall the cabinet top on the Weather Computer. Use the seven screws removed earlier to secure the cabinet top.

# CIRCUIT DESCRIPTION

Refer to the Interconnect Diagrams and the Schematic Diagrams (fold-in) while you read the following general description. The part numbers are arranged in the following groups to help you locate specific parts on the Schematics, circuit boards, and chassis:

| | |
|---|---|
| 1 - 99 | Chassis |
| 101-199 | Display circuit board |
| 201-299 | Display driver circuit board |
| 301-399 | Power supply circuit board |
| 401-499 | Main circuit board |
| 701-799 | Humidity sensor circuit boards (optional). |

The heart of the Advanced Weather Computer is U420, a Z80C microprocessor CPU (central processing unit). This IC (integrated circuit) accepts input signals from the temperature, pressure, humidity, and wind transducers and processes these signals for use by the display and memory circuits. Proper conversion gating times are precisely derived from the 2.4576 MHz crystal clock oscillator (Y401), while a 50/60 Hz synchronous signal from the AC line allows the IC to keep proper time.

When you first power up the Weather Computer, the microprocessor determines whether the AC line frequency is 50 or 60 Hz and properly scales this frequency for accurate timekeeping.

Each of the sensors (A701 for humidity, and A1 and A2 for temperature) provide a voltage that is proportional to the relative humidity (in percent) or temperature, respectively. When the slope and intercept controls on the humidity amplifiers are properly adjusted, the output voltage at U404A and U404C is proportional to the sensor output voltage. This voltage varies from 0 V to 1 V for a 0 % to 100 % relative humidity change, where DV/D% RH (the change in voltage per change in percent relative humidity) equals 10 mV/% RH.

For temperature, this voltage varies from 0 V to 1.98 V for a -40° F to +158° F temperature range, where DV/D°F (the change in voltage per change in degrees Fahrenheit) equals 10 mV/° F.

These voltages are applied sequentially to the frequency converter formed by U403A and U401 and provide a signal with a frequency that is proportional to the input voltage (Df/DV = 4000 Hz/V). The output of the A/D (analog-to-digital) converter is counted by CTC (counter/timer circuit) U412. The period over which this frequency is to be counted is selected by the microprocessor to be 1/40th second for all voltages, except the barometer voltage. The actual number of cycles counted is displayed for humidity (i.e. if the voltage is .5V, the resulting frequency at the A/D converter output equals 2000 Hz); the display is (2000 Hz) x 1/40 s = 50 counts or 50 % RH.

For temperature readings, the display for .5V would be (2000 Hz) x 1/40 s = 50 counts - 40 counts = 10 counts (required to make 0 Hz correspond to -40° F) or 10° F.

The barometric pressure is monitored by A401, which provides a voltage that is proportional to the pressure (DV/DP = 3.2744 mV/in. Hg*). This voltage is applied to a slope intercept correction instrumentation amplifier (made up of U402A, U402B, U402C, and U402D). The resulting voltage is proportional to the pressure (DV/DP = .05 V/in. Hg) and is referenced to a vacuum at 0 V. This voltage is applied sequentially to the voltage-to-frequency converter (U403A and U401) in the same manner as the other voltages.

The count period for the CTC is selected as .5 second when the barometer voltage is applied to the A/D converter and yields 50% of the A/D converter frequency per volt. A 1.496 V output voltage from the barometer will produce 1.496 (4000/2) = 2992 cycles. This 4-digit number is displayed with a fixed decimal point between the second and third digits (i.e. 29.92).

Humidity, temperature, pressure, and ambient light level are all "read" by the CPU using programmed transfer.

The wind vector (speed and direction) uses an infrared optical technique. The wind speed sensor presents 32 pulses per revolution of the anemometer cups to the CTC (U412). The CTC then determines the frequency of the pulses and transfers them on the data lines, in BCD (binary-coded decimal) form, to the CPU when requested. Wind direction is a 4-bit parallel "gray code," which is derived by the angular position of the wind vane. The CPU reads this code on data lines D0 through D3 via bus driver U421 and converts it to indicate one of 16 compass points.

Each time the Rain Gauge fills up and dumps its contents, a logic 0 is applied on data line D5 from U408E and F through U421.

The CPU processes the temperature in degrees Fahrenheit (°F), barometric pressure in inches of mercury (in. Hg), and wind speed in miles per hour (mi/h). All other possible units of display (temperature in °C, pressure in millibars, and wind speed in knots or kilometers per hour) are converted by the microprocessor.

The CPU scans the keyboard by latching information on data lines D0 through D3 in U411, applying this information through U406 to the keyboard, and then "looking for" a return on the same lines via U409 if a key is pressed.

The CPU also sends information to the display drivers U201, U202, and U203) via the eight data lines. Decoder U417 employs address lines A5, A6, and A7 to determine which IC the information is destined for. Along with the IORQ line, U417 also controls the enable lines to U409 and U411.

Decoder U419A employs lines A14 and MREQ to determine if the CPU wants to communicate with ROM read only memory) U418 or RAM (random access memory) U416.

U419B decodes the information on lines A4 and IORQ to enable analog switch controller U410 and wind input buffer U421.

The CPU stores memory data into RAM U416 and also reads data from U416 and ROM U417 via the 8-bit bidirectional data lines. This data, which is an 8-bit word, is located in memory with a 16-bit address that is also supplied by the microprocessor. A battery back-up circuit supplies power for all digital devices, except U406, in the event of a brownout or AC power interruption. This keeps the contents of the RAM intact and the clock running.

Power for the Weather Computer is provided by a +5 volt, a +15 volt, and a -15 volt supply, and a +5.5 volt battery-backed +5 volt supply.

NOTE: The following sections provide you with a more detailed description of each individual circuit.

## HUMIDITY SENSORS

NOTE: The indoor and outdoor humidity sensor circuits operate in an identical manner. Therefore, only the indoor sensor circuit will be described below.

A multivibrator circuit, consisting of ICs U701A and U701B, generates a signal with a stable, fixed frequency of approximately 10 kHz. This frequency is determined by an R/C network, which is made up of resistors R702 and R705 and capacitor C701. A second gated multivibrator (U701D and U701C) with resistors R701, R703, R704, and R710 and sensor A701 generates a signal that is controlled by the capacitance of the sensor and the gate signal to U701C-9 (pin 9). As the humidity increases at the sensor, its capacitance increases and the frequency attempts to decrease. However, the probe is held constant by the gate signal, which causes a variation in the duty cycle.

NOR gate U702 receives both multivibrator signals — the fixed-frequency signal at pins 2, 6, 9 and 13, and the variable-duty-cycle signal at pins 1, 5, 8, and 12. These signals are 180° out of phase and cancel when the duty cycles are equal. This results in an indication of 0 % relative humidity. As the relative humidity increases, the duty cycle of the signal on pins 1, 5, 8, and 12 varies. This causes a positive pulse to appear at the outputs of U702 (the outputs are in parallel with pins 3, 4, 10, and 11). Diode D701 rectifies this pulsed signal and applies a DC voltage through resistor R706 to capacitor C702 and through resistor R708 to plug P405, pin 7.

The combination of resistors R706, R708, R451, and R452, along with capacitors C702 and C413, provide a linear voltage at the input (pin 10) of operational amplifier U404C. Resistor R441, which is connected from U404C-10 to the -15 volt supply, insures that the voltage at the input of U404C will be 0 volt when the humidity sensors are not installed.

The sensor is replaced with a fixed capacitor, while intercept control R704 on the sensor board is adjusted to provide a minimum humidity reading. A second fixed capacitor, which will provide a 93% higher humidity measurement, is added and slope control R458 is adjusted to provide the proper slope. The calibration capacitors are then removed and, with the sensor reattached, the intercept control is adjusted to provide the correct humidity reading.

The output of U404C is connected to MOSFET bilateral switch U407A which, when the microprocessor selects the information from this port, couples the indoor humidity analog voltage to the input of voltage-to-frequency converter U403A and U401.

## TEMPERATURE SENSORS

The outdoor and indoor temperature sensor circuits operate in an identical manner. Therefore, only the outdoor sensor circuit will be described below.

Outdoor temperature transducer A2 is a 3-terminal device, since pins 1 and 2 are connected inside the sensor housing. This common junction is then connected via the 3-wire cable to chassis ground. Externally, pins 3 and 4 look like a 6.8-volt zener diode. In fact, however, the voltage between pins 3 and 4 varies linearly with the temperature.

A2 is connected via the cable to the outdoor temperature terminals on the back of the Weather Computer. Resistors R428 and R429 on the main circuit board supply the proper DC bias for this transducer via plug P405, pins 3 and 4. This resistor network and the internal 6.8-volt zener diode in the transducer, which is connected between the +15 and -15 volt DC supplies, establishes the required bias current. A voltage, which is proportional to the temperature, appears at both the top and bottom of the resistor network made up of R444, R445, and R433. Since the voltage change with respect to temperature is identical at the top and bottom of this resistor network, the network provides an offset adjustment which is independent of the slope (amplifier gain).

The intercept is set with control R433, while the sensor is kept in an ice bath at 32°F. The slope or gain is set with control R434, while the sensor is kept in warm water of a known temperature. The thermometer that is supplied with your Weather Computer to determine the warm water temperature is calibrated and has a maximum error of ±.5°F at 120°F. The two adjustments are somewhat interactive and should be repeated to get the best accuracy.

The output of U404D is connected to MOSFET bilateral switch U405C which, when the microprocessor selects the information from this port, couples the outdoor temperature analog voltage to the input of voltage-to-frequency converter U403A and U401.

## PRESSURE SENSOR

Pressure transducer A401 is a piezoresistive bridge that is biased through the temperature-compensating network of resistor R426 and bias control R425. R425 is adjusted to provide a bias voltage that is equal to one half (1/2) of the voltage across zener diode D401. The positive voltage at A401-2 with respect to A401-4 is proportional to the atmospheric pressure, and is applied to pin 5 of inverting instrumentation amplifier U402B. To balance the amplifier, the two inputs are shorted together by installing a jumper socket on plug P401; R424 is then adjusted to set the output at pin 8 of U402C to 0 volt. NOTE: A small offset voltage, instead of the ideal 0 volt, will be present at the output of the transducer with zero pressure applied to it. The output voltage at zero pressure is about one fourth (1/4) of the output when the applied pressure is 30 inches of mercury.

Using the calibration hose, a vacuum corresponding to two inches of mercury is applied to transducer A401. Slope control R414 is then adjusted until the two-inch vacuum produces a two-inch change in the pressure displayed. The negative voltage at the output (pin 8) of U402C equals the transducer offset voltage plus the pressure-induced voltage times the gain of the amplifier. A positive voltage is supplied at the output (pin 1) of U402A. The two voltages are applied to the input (pin 13) of inverting/summing amplifier U402D. When the output of U402A is made equal to the applied offset voltage, by adjusting intercept control R413, the output of U402D is 1.5 volts at 30 inches of mercury, and varies .05 volt per inch. This voltage is supplied to the A/D converter via U405A-1.

## WIND SENSORS

An infrared transmissive/interruptive sensor, which is formed by LED (light-emitting diode) D601 and light-sensing transistor Q601 (both inside the anemometer cup housing), determines the wind speed component. The optically-encoded disc, which is also inside the cup housing, provides 32 interruptions per revolution of the cups. These interruptions produce pulses that feed a two-transistor hysteresis switch (Q415 and Q410) via the green cable wire and plug P409-6. The hysteresis switch forces the logic level to be either high or low rather than somewhere in between. The output pulses from Q410 drive inverter U406F-13. The output of U406F-12 drives the TRG3 input (pin 20) of counter-timer U412, which counts the pulses from the wind speed sensor under control of the CPU and then transfers the count to the CPU, in BCD form, via the data bus when instructed by the CPU.

LEDs D602, D603, D604 and D605 and light-sensing transistors Q602, Q603, Q604, and Q605 determine the angular (position) component of the wind vector. This circuit also uses an infrared sensing circuit, which is inside the wind vane assembly, and uses the gray code. This 4-bit code is connected to the main circuit board via four wires (brown, red, orange, and yellow) of the 8-wire cable, through the back panel connector strip (labeled WIND), and plug P409, pins 10, 9, 8 and 7. Buffer transistors Q411, Q412, Q413, Q414 invert the code and apply it to the inputs of bus driver U421. The CPU then obtains the code on data lines D0, 1, 2, and 3 by reading from the buffer.

## VOLTAGE-TO-FREQUENCY CONVERTER

The voltage-to-frequency converter, which is formed by voltage-to-current converter U403A and timer U401, sequentially presents temperature, pressure, humidity, and ambient light information from the common bus that connects the outputs of the bilateral switches together. The analog voltage is applied to the non-inverting input of voltage-to-current converter U403A which, in turn, furnishes a constant current output that is proportional to the input voltage. The current charges capacitor C401 to the timer threshold voltage.

When the threshold is reached, C401 is discharged by the timer. A pulse is sent from U401-3; the charging of C401 then resumes to produce a series of pulses that are proportional to the input voltage at the output of U401. R401 and R402 form a voltage divider that reduces the output of the 15-volt supply to 5 volts. The pulses are applied through inverter U408D to the TRG0 input (pin 23) of counter/timer U412 to be counted under control of the CPU. Analog switch section U405D is always on and balances the inverting input with the non-inverting input. U407D is turned on between each of the other inputs, turning Q407 on to ensure that C401 is at the same level before each updated voltage is supplied from the switches. A/D current control R407 provides a small adjustment range of the constant current output; R407 is adjusted by applying one half (1/2) of the voltage across zener diode D401 to the input (pin 3) of voltage-to-frequency converter U403A through barometer input switch U405A.

## MICROPROCESSOR (CPU)

CPU U420, along with ROM U418 and RAM U416, form the heart of the Weather Computer. The ROM contains the preprogrammed instructions for the tasks that the CPU must perform. To access the instructions, the CPU sends an address on lines A0 through A13. HALT, MREQ, and A14 are applied to decoder U419A and, if HALT is high and MREQ and A14 are low, the ROM chip enable line (pin 20) will be low. When the RD line goes low, the ROM will place an 8-bit word from the ROM location on the data lines to be read by the CPU. A read from or write to RAM is essentially the same, except A14 is high to cause decoder U419A to enable the RAM. A read is performed if RD is low, or a write is performed if WR is low.

To determine which sensor signal is to be applied to the A/D converter, the CPU takes A4 and IORQ low. When decoder U419B sends an enable signal (low) to U410, the data on all of the output lines (except the selected line) from the CPU is low. When WR goes low and then high, the data is latched at the output of U410 in order to turn on one of the linear switches (U405 or U407A, B, or C).

The various data enters the microprocessor in units of degrees Fahrenheit (°F), miles-per-hour (mi/h), and inches of mercury (in. Hg). U420 converts this data into degrees Celsius (°C), knots or kilometers-per-hour (km/h), and millibars (MB). The same enable line is connected to U421. If RD goes low when this enable signal is low, the 4-bit wind direction code and the rain input are placed on the CPU data bus.

The keyboard has 16 keys electrically arranged as four columns and four rows with each key in a column connected to a different row. Data line D0 is connected through U411-3,-2, U406A-1,-2, and P407-8 to pin 8 of the keyboard. On the keyboard, pin 8 or D0 is connected to one side of SW516 (ENTER), SW513 (UNITS), SW514 (AL/WARN) and SW515 (INDOOR). The other side of each of these key switches is connected to keyboard pins 1, 2, 3, and 4 to P407-1, -2, -3, and -4. This side of the key switches is further connected to U409-2, -4, -6, and -10 through resistor pack RP401 and then through U409 to D0, D1, D2, and D3, respectively. With none of the keys closed, all inputs and outputs to U409 are high due to the pull-up resistors connected to them through RP402.

Resistor pack RP401, in series with the input lines to U409, provides protection against static discharges through the keyboard into these high-impedance inputs.

To scan the keyboard, the CPU sends an address with A5 low and all other address lines high. With M1 high and IORQ and WR low, the address is decoded by U417. The output of U417 (pin 9) goes low, causing the enable lines to the keyboard output latch and input driver to be low. The CPU places a 4-bit word on data lines D0 through D4 such that one line is high and the rest low. When WR goes high, the data is latched in the output of U411. The data is inverted by open-collector buffers U406A through D and applied to the keyboard columns via P407-8, -7, -6, and -5. The data line that was high and the column it is connected to will remain low until the CPU changes data and again writes to U411.

If a key connected to this row is pressed, an input line (pin 2, 4, 6 or 10) of U409 will go low until the key is released. The CPU again places A5 and IORQ low to enable both U411 and U409. This time, RD is low and the keyboard information at the input to U409 is passed to the CPU via data lines D0 through D3. The CPU knows which row is low and determines the pressed key by ascertaining the row returned low. If more than one row is returned low when a given column is low or a row is returned low by more than one column, multiple keys are closed.

Crystal oscillator Y401 generates a 2.4576 MHz square wave that is supplied to the clock input of CPU U420, CTC U412 and SIO (serial input/output) U414. The clock signal synchronizes these three devices to each other and provides for easier interchange of information.

The CPU communicates with the CTC by placing an address for one of the four counter/timers in the CTC using address line A0 and A1. Data is placed on the data line to indicate what is to be done. A2 is low to enable the CTC, and IORQ goes low to transfer the data. The CTC RD line is used as either read or write. If the CPU is writing to the CTC, RD is high and, if the CPU want information from the CTC, RD is placed low.

Once the CTC is told what to do, it can carry out the instructions on its own and the CPU is free to do other tasks.

As with the CTC and counting or timing, the SIO is capable of handling all the serial input-output functions on its own. If either IC has completed a task or has information for the CPU, it lets the CPU know by setting the INT line low.

Communication between the CPU and SIO U414 uses the same format except address line A3 is used to enable the SIO.

The CPU, CTC, and SIO use a daisy chain interrupt system. In this case, the higher priority is assigned to the CTC. The IEI (interrupt enable input) line, pin 13 of the CTC, is connected to VCCB and its IEO line (pin 11) is connected to the IEI line, pin 6 of the SIO. A device in a daisy chain system can only generate an interrupt if its IEI is high and, when it does set INT low, it also sets its IEO low. In this circuit, the CTC has priority over the SIO. When the CPU is interrupted by a peripheral, the CPU responds by placing M1 and IORQ low. This "tells" the interrupter that the CPU is ready for it. The interrupter responds by placing eight bits of an address on the data lines. The CPU adds these eight bits to eight bits previously reserved to form a sixteen bit address which points to the location of the start of the program to handle the interrupt.

## SERIAL INTERFACE

The CTC divides the clock signal, as instructed by the CPU, to furnish the correct clock frequency at the TO2 output (pin 9) of U412 to the transmit and receive clock inputs (pins 27 and 28) of U414 for the eight available baud rates.

Serial data is sent from U414 pin 26 to the input (pin 12) of line driver U415; data is then passed from the output (pin 11) of U415 to P408-2 and P1-3.

Serial data is received at P1pin 2 and P408 pin 3 and then passed on via line receiver U413 pin 13 and U413 pin 11 to U414 pin 29.

A clear-to-send signal is received at P1 pin 4 and P408 pin 4; this signal is then passed via U413 pin 4 and U413 pin 6 to U414 pin 23.

A data-terminal-ready signal is sent via U414 pin 25 to U415 pin 5; this signal is then passed via U415 pin 6 to P408 pin 1 and P1 pin 6.

The various coils and capacitors used between P408 and the input or output ICs, respectively, make up RFI filters.

The wire between P408 pin 7 and P1 pin 7 serves as signal ground, while P1 pin 1 provides a separate chassis ground.

When the line cord plug is connected to the AC line, a sample of the line frequency is furnished via S303 pin 10 to P406 pin 10, and shaped into a square wave by Q405 and Q406; it is then applied through inverter U408C to input TRG 2 (pin 20) of CTC U412.

The instruction at the first interrupt is: "wait until the next interrupt to this address and see how long it takes." When the second interrupt occurs, the CPU determines from the time whether the line frequency is 50 or 60 Hz and sets up the real-time clock for accurate time keeping. An interrupt occurs at each half succeeding cycle. If the interrupts stop, the CPU will switch timekeeping to battery operation and uses its crystal oscillator for that purpose. The CPU also suspends any operations that are not battery backed.

## DISPLAY

The display is a half duty, back lit, transparent liquid crystal display. With no segments lit, the panel is translucent blue. The segments would be clear when enabled, except for the white diffuser covering the back of the panel. 154 segment driver lines are used, each capable of driving two segments. The two backplane drive signals are applied to four connections, two on each end of the display. Display drivers U202 and U203 supply the segment drive while only U201 supplies the backplanes. Signals are always present on all drive lines. An off segment has the backplane and segment drive out of phase. On segments have in-phase signals.

U204, C207, R203, and R204 form a 125 kHz oscillator. The output of the oscillator is supplied to the clock input on all three display drivers. The drivers divide the clock frequency to produce segment and backplane signals that are continuously supplied to the display once the CPU informs the drivers which segments are to be on or off.

To communicate with the display drivers, the CPU uses address lines A5, A6, A7, and IORQ. The CPU first places A5 and A7 low and A6 high; then it places IORQ low. This causes U417-13 and the sync input line (pin 78) on all drivers to be low. This, in turn, ensures that the counting in all the drivers is synchronized.

The CPU then addresses the individual drivers through U417. It puts the address for the individual drivers on address lines A5, A6, and A7 with IORQ low. The address is decoded by U417 to enable the desired driver. The CPU first places RD low and reads the data bus. If the addressed driver is read for update, it places D0 low. When the CPU sees this, it repeats the above with data supplied on the eight data lines and WR low to write to the driver.

## POWER SUPPLY

Power transformer T1 steps down the 120/240-volt AC line voltage into two center-tapped secondary voltages. One of these windings provides power for the +5 volt circuits, while the other winding provides power for the +15 volt, -15 volt, and +17.5 volt circuits.

Diodes D306 and D307 and capacitor C311 supply +12 volts DC, which is regulated by U304 to provide a +5 volts DC source (VCCA). The output voltage is further filtered by C315 and C316 and powers all circuits that require a +5 volt DC source and are not battery backed.

The +12 volt DC source is also applied through diode D314 to regulator U303. U303's GND pin is connected to ground through diode D316, which establishes a +5.6 volt DC level for the output of the regulator. Capacitor C312 bypasses D316 to prevent variations in the output current from changing the voltage across it. This voltage is further filtered by C313 and C314. Referred to as VCCB, this voltage is supplied to all battery-backed circuits.

Diodes D301 and D302 and capacitor C301 supply -27 volts DC, which is regulated by U301 to provide -15 volts DC. This voltage is further filtered by C302 and C303, and supplied to the RS-232C output IC and analog circuits where required.

Diodes D303 and D304 and capacitors C304 and C305 supply +22 volts DC, which is regulated by U302 to provide +15 volts DC. This voltage is further filtered by C306 and C307 and supplied to the RS-232C output IC and the analog circuits. The +22 volts DC is also supplied to regulator U305, which controls the output of pass transistor Q307 via Q308. Resistor divider R319 and R320 returns a portion of the output voltage to pin 6 of the regulator to determine the output voltage, which is approximately +17.5 volts DC.

The voltage drop across R316, R317, and R318 is reflected at pin 1. If the current through R316, R317, and R318 exceeds a predetermined value, the regulator circuit will quickly reduce the output current capability of the regulator to less than 200 mA. This is a foldback regulator and is employed in this circuit to protect transistors Q312 and Q313 against excessive currents that can develop if the lamp does not light.

## LIGHT CIRCUIT

The CPU controls the display lighting by supplying on/off drive signals through U411 and the light control line (P406 pin 5 and S303 pin 5). When the unit is first turned on, the control line is low. Transistors Q309, Q314, and Q316 are off, while Q310, Q311, Q315, and Q317 are on. With Q310 and Q311 on, the bases of Q312 and Q313 are held low to keep them turned off. Because Q315 and Q317 are on, current passes through transformers T301 and T302, the lamp filaments, D322 and D324, transistors Q315 and Q317, and resistors R330, R331, R334, and R335. This preheats the lamps for approximately 10 seconds. When the light control goes high, the reverse occurs. T301, T302, Q312, Q313, C320, C322, C321, C323, D319, and D320 form an oscillator that drives the fluorescent lamp with a 25 kHz signal. To control the lamp brightness, the duty cycle of the oscillator drive versus filament on-time is altered at a 60 Hz rate.

# REPLACEMENT PARTS LIST

## DISPLAY CIRCUIT BOARD

| CIRCUIT Comp. No. | HEATH Part No. | DESCRIPTION |
|---|---|---|
| R101 | 6-471-12 | 470 , 5%, 1/4-watt resistor |
| R102 | 9-67 | Photo resistor |
| | 432-1607 | Conductive rubber strip |

NOTE: Refer to "Semiconductor Identification" for the LED and LCD (liquid-crystal display).

## POWER SUPPLY CIRCUIT BOARD

### Resistors

NOTE: All resistors are rated at 1/4-watt and have a 5% tolerance unless otherwise noted.

| | | |
|---|---|---|
| R301 | 6-102-12 | 1.0 k |
| R302 | 6-104-12 | 100 k |
| R303 | 6-753-12 | 75 k |
| R304 | 6-103-12 | 10 k |
| R305 | 6-224-12 | 220 k |
| R306 | 6-683-12 | 68 k |
| R307 | 6-473-12 | 47 k |
| R308 | 6-103-12 | 10 k |
| R309 | 6-153-12 | 15 k |
| R310 | 6-472-12 | 4.7 k |
| R311 | 6-334-12 | 330 k |
| R312 | 6-104-12 | 100 k |
| R313 | 6-104-12 | 100 k |
| R314 | 6-153-12 | 15 k |
| R315 | 6-680-12 | 68 |
| R316 | 6-109-12 | 1.0 |
| R317 | 6-109-12 | 1.0 |
| R318 | 6-109-12 | 1.0 |
| R319 | 6-2261-12 | 2.26 k , 1% |
| R320 | 6-2052-12 | 20.5 k , 1% |
| R321 | 6-152-12 | 1.5 k |
| R322 | 6-682-12 | 6.8 k |
| R323 | 6-470-12 | 470 |
| R324 | 6-470-12 | 470 |
| R325 | 6-470-12 | 470 |
| R326 | 6-682-1 | 6.8 k , 1 W |
| R327 | 6-682-1 | 6.8 k , 1 W |
| R328 | 6-272-12 | 2.7 k |
| R329 | 6-121-12 | 120 |
| R330 | 6-1829-12 | 18.2 , 1% |
| R331 | 6-1829-12 | 18.2 , 1% |
| R332 | 6-272-12 | 2.7 k |
| R333 | 6-121-12 | 120 |
| R334 | 6-1829-12 | 18.2 , 1% |
| R335 | 6-1829-12 | 18.2 , 1% |

| CIRCUIT Comp. No. | HEATH Part No. | DESCRIPTION |
|---|---|---|

### Capacitors

| | | |
|---|---|---|
| C301 | 25-893 | 1000 µF, 35 V electrolytic |
| C302 | 21-786 | 0.1 µF axial-lead ceramic |
| C303 | 25-917 | 10 µF electrolytic |
| C304 | 25-963 | 2200 µF electrolytic |
| C305 | 25-963 | 2200 µF electrolytic |
| C306 | 21-786 | 0.1 µF axial-lead ceramic |
| C307 | 25-917 | 10 µF electrolytic |
| C308 | 21-786 | 0.1 µF axial-lead ceramic |
| C309 | 21-786 | 0.1 µF axial-lead ceramic |
| C310 | 21-786 | 0.1 µF axial-lead ceramic |
| C311 | 25-963 | 2200 µF electrolytic |
| C312 | 25-928-1 | 33 µF electrolytic |
| C313 | 25-917 | 10 µF electrolytic |
| C314 | 21-786 | 0.1 µF axial-lead ceramic |
| C315 | 25-917 | 10 µF electrolytic |
| C316 | 21-786 | 0.1 µF axial-lead ceramic |
| C317 | 21-786 | 0.1 µF axial-lead ceramic |
| C318 | 21-773 | 470 pF (471) ceramic |
| C319 | 25-951 | 1000 µF, 25 V electrolytic |
| C320 | 27-106 | 0.01 µF (103) Mylar® |
| C321 | 27-249 | 0.022 µF (223) Mylar® |
| C322 | 27-106 | 0.01 µF (103) Mylar® |
| C323 | 27-249 | 0.022 µF (223) Mylar® |

### Transformers

| | | |
|---|---|---|
| T301 | 51-212 | Input |
| T302 | 51-211 | Resonator |

### Diodes — Transistors — Integrated Circuits

Refer to "Semiconductor Identification."

## MAIN CIRCUIT BOARD

| CIRCUIT Comp. No. | HEATH Part No. | DESCRIPTION |
|---|---|---|

### Resistors — Controls — Resistor Packs — Thermistor

NOTE: All resistors are rated at 1/4-watt and have a 5% tolerance unless listed otherwise.

| | | |
|---|---|---|
| R401 | 6-331-12 | 330 |
| R402 | 6-102-12 | 1000 |
| R403 | 6-1542-12 | 15.4 k, 1% |
| R404 | 6-1542-12 | 15.4 k, 1% |
| R405A | 6-8060-12 | 806, 1% |
| R405B | 6-3831-12 | 3830, 1% |
| R405C | 6-2001-12 | 2000, 1% |
| R406 | 6-1502-12 | 15 k, 1% |
| R407 | 10-1141 | 1000, 3/4-watt control |
| R408 | 6-2551-12 | 2550, 1% |
| R409 | 2-767-12 | 250 k, 1/4% |
| R410 | 2-767-12 | 250 k, 1/4% |
| R411 | 2-767-12 | 250 k, 1/4% |
| R412A | 6-4990-12 | 499, 1% |
| R412B | 9-165 | Thermistor |
| R412C | 6-3011-12 | 3010, 1% |
| R413 | 10-1200 | 50 k control |
| R414 | 10-1153 | 1000, 1/2-watt control |
| R415 | 6-1542-12 | 15.4 k, 1% |
| R416 | 6-1542-12 | 15.4 k, 1% |
| R417 | 6-1542-12 | 15.4 k, 1% |
| R418 | 6-1542-12 | 15.4 k, 1% |
| R419 | 6-103-12 | 10 k |
| R420 | 2-767-12 | 250 k, 1/4% |
| R421 | 6-8060-12 | 806, 1% |
| R422 | 6-8060-12 | 806, 1% |
| R423 | 6-3832-12 | 38.3 k, 1% |
| R424 | 10-1141 | 1000, 3/4-watt control |
| R425 | 10-1141 | 1000, 3/4-watt control |
| R426 | 6-1500-12 | 150, 1% |
| R427 | 6-271 | 270, 1/2-watt |
| R428 | 6-622-12 | 6200 |
| R429 | 6-912-12 | 9100 |
| R430 | 6-622-12 | 6200 |
| R431 | 6-912-12 | 9100 |
| R432 | 6-103-12 | 10 k |
| R433 | 10-1138 | 10 k control |
| R434 | 10-1138 | 10 k control |
| R435 | 10-1138 | 10 k control |
| R436 | 6-2372-12 | 23.7 k, 1% |
| R437 | 6-2372-12 | 23.7 k, 1% |
| R438 | 6-2002-12 | 20 k, 1% |
| R439 | 6-106-12 | 10 M |
| R440 | 6-1212-12 | 12.1 k, 1% |
| R441 | 6-106-12 | 10 M |
| R442 | 6-822-12 | 8200 |
| R443 | 6-153-12 | 15 k |
| R444 | 6-2102-12 | 21 k, 1% |

| CIRCUIT Comp. No. | HEATH Part No. | DESCRIPTION |
|---|---|---|

### Resistors — Controls — Resistor Packs — Thermistor (cont'd)

| | | |
|---|---|---|
| R445 | 6-3832-12 | 38.3 k, 1% |
| R446 | 6-2102-12 | 21 k, 1% |
| R447 | 6-3832-12 | 38.3 k, 1% |
| R448 | 6-1212-12 | 12.1 k, 1% |
| R449 | 6-1212-12 | 12.1 k, 1% |
| R450 | Not used | |
| R451 | 6-2372-12 | 23.7 k, 1% |
| R452 | 6-2372-12 | 23.7 k, 1% |
| R453 | 6-2002-12 | 20 k, 1% |
| R454 | 6-1212-12 | 12.1 k, 1% |
| R455 | 6-204-12 | 200 k |
| R456 | 10-1138 | 10 k control |
| R457 | 10-1138 | 10 k control |
| R458 | 10-1138 | 10 k control |
| R459 | 6-102-12 | 1000 |
| R460 | 6-332-12 | 3300 |
| R461 | 6-332-12 | 3300 |
| R462 | 6-152-12 | 1500 |
| R463 | 6-101-12 | 100 |
| R464 | 6-102-12 | 1000 |
| R465 | 6-102-12 | 1000 |
| R466 | 6-222-12 | 2200 |
| R467 | 6-103-12 | 10 k |
| R468 | 6-153-12 | 15 k |
| R469 | 6-242-12 | 2400 |
| R470 | 6-5622-12 | 56.2 k, 1% |
| R471 | 6-3162-12 | 31.6 k, 1% |
| R472 | 6-2372-12 | 23.7 k, 1% |
| R473 | 6-223-12 | 22 k |
| R474 | 6-103-12 | 10 k |
| R475 | 6-9091-12 | 9090, 1% |
| R476 | 6-204-12 | 200 k |
| R477 | 6-391-12 | 390, 1/2-watt |
| R478 | 6-333-12 | 33 k |
| R479 | 6-204-12 | 200 k |
| R480 | 6-103-12 | 10 k |
| R481 | 6-103-12 | 10 k |
| R482 | 6-103-12 | 10 k |
| R483 | 6-103-12 | 10 k |
| R484 | 6-102-12 | 1000 |
| R485 | 6-104-12 | 100 k |
| R486 | Not used | |
| R487 | 6-512-12 | 5100 |
| R488 | 6-225-12 | 2.2 M |
| R489 | 6-181-12 | 180 |
| R490 | 6-104-12 | 100 k |
| R491 | 6-472-12 | 4700 |
| R492 | 6-103-12 | 10 k |
| R493 | 6-472-12 | 4700 |
| R494 | 6-103-12 | 10 k |
| R495 | 6-472-12 | 4700 |
| R496 | 6-103-12 | 10 k |
| R497 | 6-472-12 | 4700 |
| R498 | 6-229-12 | 2.2 |
| R499 | 6-470-12 | 47 |

| CIRCUIT Comp. No. | HEATH Part No. | DESCRIPTION |
|---|---|---|
| R500 | 6-823-12 | 82 k |
| R501 | 6-472-12 | 4700 |
| R502 | 6-472-12 | 4700 |
| R503 | 6-222-12 | 2200 |
| R504 | 6-103-12 | 10 k |
| R505 | 6-103-12 | 10 k |
| R506 | 6-103-12 | 10 k |
| R507 | 6-103-12 | 10 k |
| R508 | 6-103-12 | 10 k |
| RP401 | 9-185 | 150 k resistor pack |
| RP402 | 9-128 | 10 k resistor pack |

## Capacitors

| | | |
|---|---|---|
| C401 | 29-67 | .01 µF polystyrene |
| C402 | 21-786 | .1µF axial-lead ceramic |
| C403 | 21-786 | .1 µF axial-lead ceramic |
| C404 | 21-786 | .1 µF axial-lead ceramic |
| C405 | 21-786 | .1 µF axial-lead ceramic |
| C406 | 27-129 | .047 µF Mylar |
| C407 | 25-900 | 1 µF electrolyitc |
| C408 | 25-900 | 1 µF electrolytic |
| C409 | 25-900 | 1 µF electrolytic |
| C410 | 25-900 | 1 µF electrolytic |
| C411 | 25-900 | 1 µF electrolytic |
| C412 | Not used | |
| C413 | 25-900 | 1 µF electrolyic |
| C414 | 25-900 | 1 µF electrolytic |
| C415 | 25-917 | 10 µF electrolytic |
| C416 | 21-786 | .1 µF axial-lead ceramic |
| C417 | 21-786 | .1 µF axial-lead ceramic |
| C418 | 21-3 | 10 pF disc ceramic |
| C419 | 21-786 | .1 µF axial-lead ceramic |
| C420 | 25-927 | 22 µF electrolytic |
| C421 | 21-786 | .1 µF axial-lead ceramic |
| C422 | 21-786 | .1 µF axial-lead ceramic |
| C423 | 21-786 | .1 µF axial-lead ceramic |
| C424 | Not used | |
| C425 | 21-786 | .1 µF axial-lead ceramic |
| C426 | 21-786 | .1 µF axial-lead ceramic |
| C427 | 21-786 | .1 µF axial-lead ceramic |
| C428 | 21-786 | .1 µF axial-lead ceramic |
| C429 | 21-769 | .01 µF axial-lead ceramic |
| C430 | 21-769 | .01 µF axial-lead ceramic |
| C431 | 21-769 | .01 µF axial-lead ceramic |
| C432 | 21-769 | .01 µF axial-lead ceramic |
| C433 | 21-769 | .01 µF axial-lead ceramic |
| C434 | Not used | |
| C435 | 21-786 | .1 µF axial-lead ceramic |
| C436 | Not used | |
| C437 | Not used | |
| C438 | 21-786 | .1 µF axial-lead ceramic |
| C439 | 21-786 | .1 µF axial-lead ceramic |
| C440 | 21-786 | .1 µF axial-lead ceramic |
| C441 | 21-786 | .1 µF axial-lead ceramic |
| C442 | 21-786 | .1 µF axial-lead ceramic |

| CIRCUIT Comp. No. | HEATH Part No. | DESCRIPTION |
|---|---|---|

## Capacitors (cont'd)

| | | |
|---|---|---|
| C443 | 21-786 | .1 µF axial-lead ceramic |
| C444 | 21-36 | .002 µF disc ceramic |
| C445 | 21-786 | .1 µF axial-lead ceramic |
| C446 | 21-786 | .1 µF axial-lead ceramic |
| C447 | 21-773 | 470 pF axial-lead ceramic |
| C448 | 21-773 | 470 pF axial-lead ceramic |
| C449 | 21-773 | 470 pF axial-lead ceramic |
| C450 | 21-773 | 470 pF axial-lead ceramic |

## Diodes — Transistors — Integrated Circuits

Refer to "Semiconductor Identification."

## Miscellaneous

| | | |
|---|---|---|
| A401 | 442-786 | Pressure transducer |
| L401 | 473-29 | Speaker |
| L402 | 235-229 | 35 µH choke |
| L403 | 235-229 | 35 µH choke |
| L406 | 235-229 | 35 µH choke |
| Y401 | 150-262 | 2.4576 MHz crystal oscillator |

# CHASSIS

## Resistors — Capacitors

| | | |
|---|---|---|
| C1 | 27-236 | .068 µF Mylar capacitor |
| C2 | 21-71 | .001 µF, 1.4kV ceramic capacitor |
| C3 | 21-71 | .001 µF, 1.4kV ceramic capacitor |
| C4 | 21-786 | .1 µF axial-lead ceramic capacitor |
| C5 | 21-786 | .1 µF axial-lead ceramic capacitor |
| C6 | 21-786 | .1 µF axial-lead ceramic capacitor |
| C7 | 21-786 | .1 µF axial-lead ceramic capacitor |
| C8 | 21-786 | .1 µF axial-lead ceramic capacitor |
| C9 | 21-786 | .1 µF axial-lead ceramic capacitor |
| C10 | 21-811 | .33 µF axial lead ceramic capacitor |
| C11 | 21-769 | .01 axial-lead ceramic capacitor |
| C12 | 21-786 | .1 µF axial-lead ceramic capacitor |
| C13 | 21-786 | .1 µF axial-lead ceramic capacitor |
| C14 | 21-786 | .1 µF axial-lead ceramic capacitor |
| C15 | 21-786 | .1 µF axial-lead ceramic capacitor |
| C16 | 21-811 | .33 µF axial-lead ceramic capacitor |
| C17 | 21-786 | .1 µF axial-lead ceramic capacitor |
| C18 | 21-786 | .1 µF axial-lead ceramic capacitor |
| R1 | 6-225 | 2.2 M , 1/2-watt, 5% resistor |
| R2 | 6-102-12 | 1000 , 1/4-watt, 5% resistor |

| CIRCUIT Comp. No. | HEATH Part No. | DESCRIPTION |
|---|---|---|

### Light-Emiting Diodes — Transistors

Refer to "Semiconductor Identification."

### Miscellaneous

| | | |
|---|---|---|
| A1 | 100-1728 | 10' indoor temperature probe assembly |
| A2 | 100-1727 | 70' outdoor temperature probe assembly |
| F1 | 421-33 | 1/4-ampere slow-blow fuse |
| LP1 | 412-670 | Fluorescent lamp |
| LX1 | 45-611 | RF choke |
| T1 | 54-1059 | Power transformer |
| | 150-324 | Display driver circuit board |

## HUMIDITY SENSOR CIRCUIT BOARDS

### Resistors — Controls

NOTE: All resistors are rated at 1/4-watt and have a 1% tolerance unless listed otherwise.

| CIRCUIT Comp. No. | HEATH Part No. | DESCRIPTION |
|---|---|---|

### Resistors — Controls (cont'd)

| | | |
|---|---|---|
| R701 | 6-3013-12 | 301 k |
| R702 | 6-3013-12 | 301 k |
| R703 | 6-2373-12 | 237 k |
| R704 | 10-1259 | 200 k control |
| R705 | 6-3013-12 | 301 k |
| R706 | 6-7501-12 | 7500 |
| R707 | Not used | |
| R708 | 6-7501-12 | 7500 |
| R709 | Not used | |
| R710 | 6-3013-12 | 301 k |

### Capacitors

| | | |
|---|---|---|
| C701 | 20-124 | 115 pF mica |
| C702 | 21-811 | .33 µF axial-lead ceramic |
| C703 | 21-786 | .1 µF axial-lead ceramic |
| C704 | 20-880 | 10 µF electrolytic |

### Miscellaneous

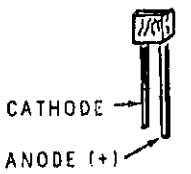
| | | |
|---|---|---|
| A701 | 473-32 | Sensor |

# SEMICONDUCTOR IDENTIFICATION

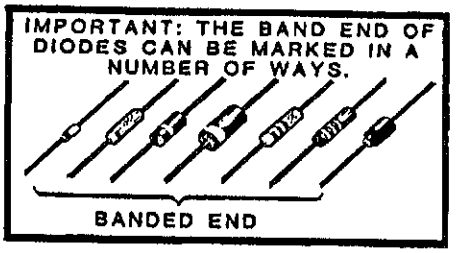
| COMPONENT NUMBER | HEATH PART NUMBER | MAY BE REPLACED WITH | KEY NUMBER |
|---|---|---|---|
| **DIODES** | | | |
| D101 | 412-657 | HLMP0504 | A1 |
| D301 | 57-65 | 1N4002 | A2 |
| D302 | 57-65 | 1N4002 | A2 |
| D303 | 57-65 | 1N4002 | A2 |
| D304 | 57-65 | 1N4002 | A2 |
| D305 | 56-56 | 1N4149 | A2 |
| D306 | 57-65 | 1N4002 | A2 |
| D307 | 57-65 | 1N4002 | A2 |
| D308 | 56-659 | 1N5998B (selected 8.2-volt zener) | A2 |
| D309 | 56-56 | 1N4149 | A2 |
| D310 | 56-56 | 1N4149 | A2 |
| D311 | 56-56 | 1N4149 | A2 |
| D312 | 56-613 | 1N5231B (selected 4.7-volt zener) | A2 |
| D313 | 56-56 | 1N4149 | A2 |
| D314 | 56-56 | 1N4149 | A2 |
| D315 | 56-56 | 1N4149 | A2 |
| D316 | 56-56 | 1N4149 | A2 |
| D317 | 57-65 | 1N4002 | A2 |
| D318 | 57-65 | 1N4002 | A2 |
| D319 | 57-65 | 1N4002 | A2 |
| D320 | 57-65 | 1N4002 | A2 |
| D321 | 56-695 | LM385Z-2.5 | A3 |
| D322 | 57-27 | 1N5397 | A2 |
| D323 | 56-695 | LM385Z-2.5 | A3 |
| D324 | 57-27 | 1N5397 | A2 |
| D401 | 56-91 | 1N823A | A2 |
| D402 | 57-65 | 1N4002 | A2 |
| D403 | (Not used) | | |
| D404 | 56-56 | 1N4149 | A2 |
| D405 | 56-56 | 1N4149 | A2 |
| D601 | 412-635 | TIL-32 | A4 |
| D602 | 412-635 | TIL-32 | A4 |
| D603 | 412-635 | TIL-32 | A4 |
| D604 | 412-635 | TIL-32 | A4 |
| D605 | 412-635 | TIL-32 | A4 |
| **DISPLAY** | | | |
| LCD101 | 411-879 | * | B1 |

*Part available only from Heath Company.

A1

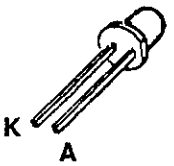



A2

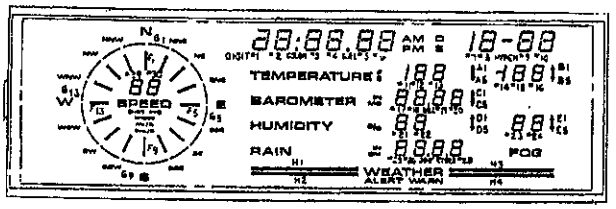



A3


A4



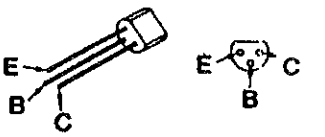

B1



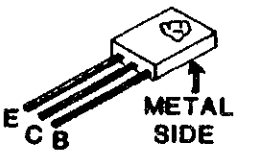
| COMPONENT NUMBER | HEATH PART NUMBER | MAY BE REPLACED WITH | KEY NUMBER |
|---|---|---|---|
| **TRANSISTORS** | | | |
| Q301 | 417-801 | MPSA20 | C1 |
| Q302 | 417-801 | MPSA20 | C1 |
| Q303 | 417-235 | 2N4121 | C1 |
| Q304 | 417-801 | MPSA20 | C1 |
| Q305 | 417-885 | MPSA65 | C1 |
| Q306 | 417-801 | MPSA20 | C1 |
| Q307 | 417-856 | MJE5979 | C3 |
| Q308 | 417-235 | 2N4121 | C1 |
| Q309 | 417-801 | MPSA20 | C1 |
| Q310 | 417-864 | MPSA05 | C1 |
| Q311 | 417-864 | MPSA05 | C1 |
| Q312 | 117-17 * | D44H10 | C3 |
| Q313 | 117-17 * | D44H10 | C3 |
| Q314 | 417-801 | MPSA20 | C1 |
| Q315 | 417-195 | MJE340 | C2 |
| Q316 | 417-801 | MPSA20 | C1 |
| Q317 | 417-195 | MJE340 | C2 |
| Q401 | 417-235 | 2N4121 | C1 |
| Q402 | 417-801 | MPSA20 | C1 |
| Q403 | 417-801 | MPSA20 | C1 |
| Q404 | 417-885 | MPSA65 | C1 |
| Q405 | 417-801 | MPSA20 | C1 |
| Q406 | 417-801 | MPSA20 | C1 |
| Q407 | 417-801 | MPSA20 | C1 |
| Q408 | 417-801 | MPSA20 | C1 |
| Q409 | 417-801 | MPSA20 | C1 |
| Q410 | 417-801 | MPSA20 | C1 |
| Q411 | 417-801 | MPSA20 | C1 |
| Q412 | 417-801 | MPSA20 | C1 |
| Q413 | 417-801 | MPSA20 | C1 |
| Q414 | 417-801 | MPSA20 | C1 |
| Q415 | 417-235 | 2N4121 | C1 |
| Q601 | 417-919 | TIL-78 | C4 |
| Q602 | 417-919 | TIL-78 | C4 |
| Q603 | 417-919 | TIL-78 | C4 |
| Q604 | 417-919 | TIL-78 | C4 |
| Q605 | 417-919 | TIL-78 | C4 |

* Matched pair

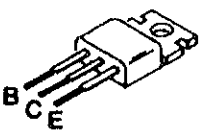
C1



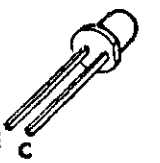

C2




C3

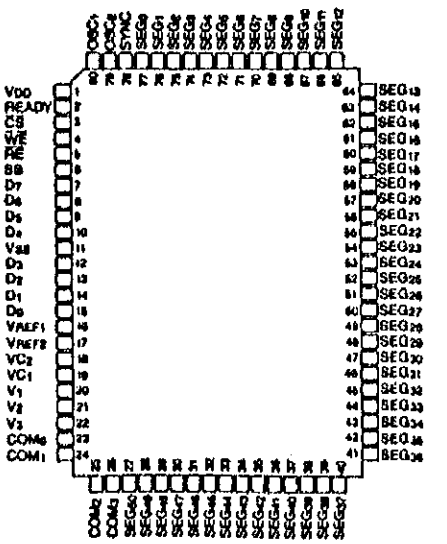



C4




| COMPONENT NUMBER | HEATH PART NUMBER | MAY BE REPLACED WITH | KEY NUMBER |
|---|---|---|---|
| **INTEGRATED CIRCUITS (ICs)** | | | |
| U201 | — | HD61604 | D1 |
| U202 | — | HD61604 | D1 |
| U203 | — | HD61604 | D1 |

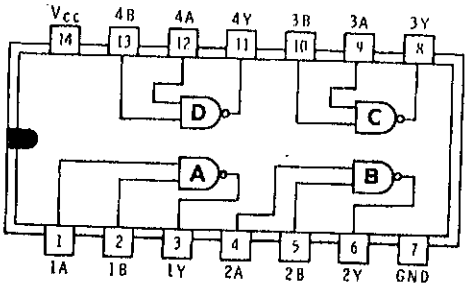
D1



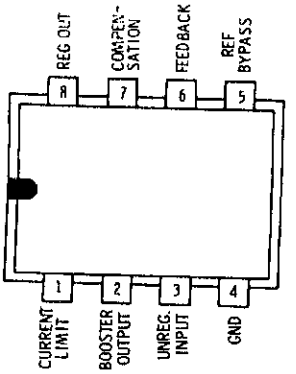
## INTEGRATED CIRCUITS (Cont'd)

| COMPONENT NUMBER | HEATH PART NUMBER | MAY BE REPLACED WITH | KEY NUMBER |
|---|---|---|---|
| U204 | 443-603 | CD4001 | D2 |
| U301 | 442-613 | MC7915 | D6 |
| U302 | 442-63 | UA7815 | D4 |
| U303 | 442-787 | LP2950C | D5 |
| U304 | 442-54 | UA7805 | D4 |
| U305 | 442-24 | LM376N | D3 |
| U401 | 442-801 | TLC555 | D7 |
| U402 | 442-602 | LM324 | D8 |
| U403 | 442-707 | LF353 | D9 |

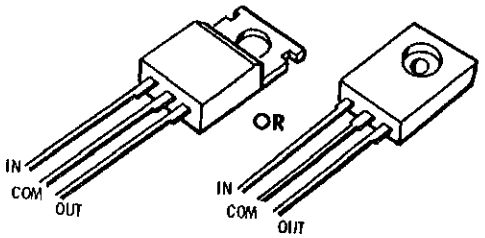
D2



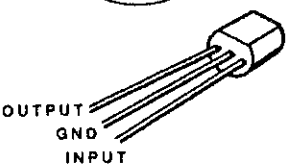

D3



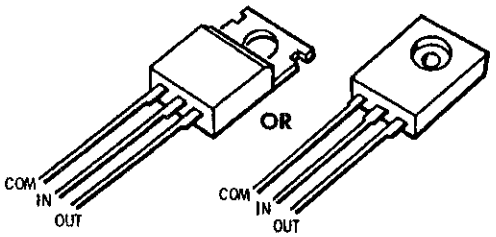

D4



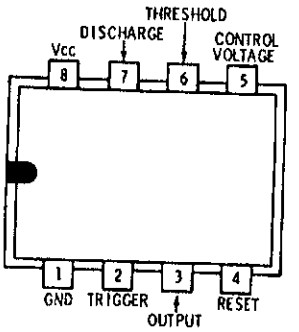

D5



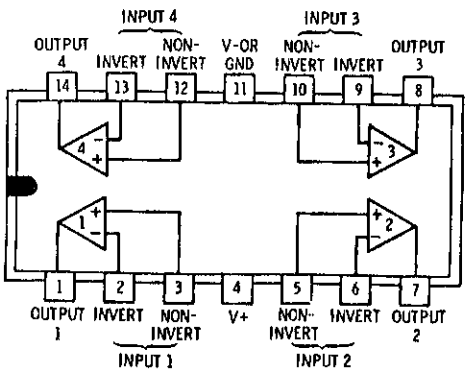

D6



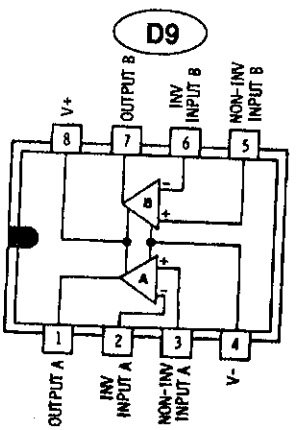

D7




D8

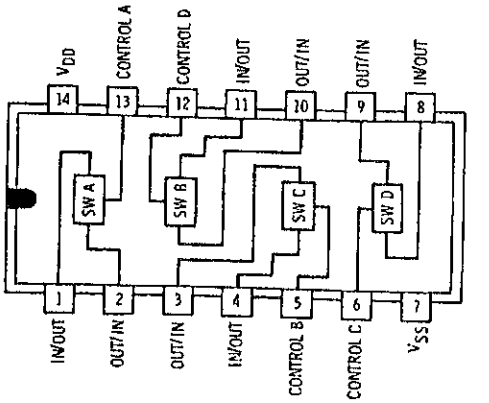



D9

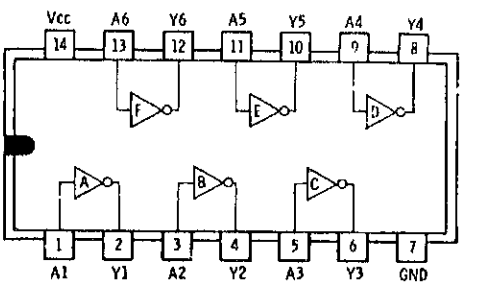


| COMPONENT NUMBER | HEATH PART NUMBER | MAY BE REPLACED WITH | KEY NUMBER |
|---|---|---|---|
| **INTEGRATED CIRCUITS (Cont'd)** | | | |
| U404 | 442-602 | LM324 | D8 |
| U405 | 442-744 | CD4066 | D10 |
| U406 | 443-818 | 74LS05 | D11 |
| U407 | 442-744 | CD4066 | D10 |
| U408 | 443-1308 | 74HC04 | D11 |
| U409 | 443-1391 | 74HC366 | D12 |
| U410 | 443-1362 | 74HC377 | D13 |
| U411 | 443-1362 | 74HC377 | D13 |
| U412 | 443-1393 | 84C30 | D14 |
| U413 | 443-795 | 1489 | D15 |
| U414 | 443-1394 | 84C42 | D16 |

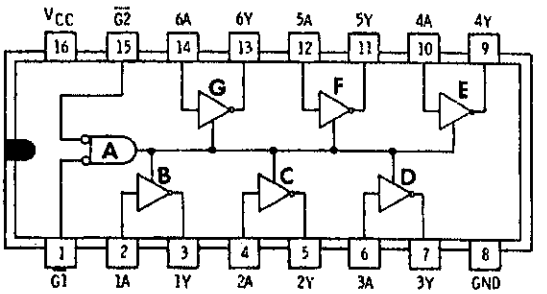
**D10**



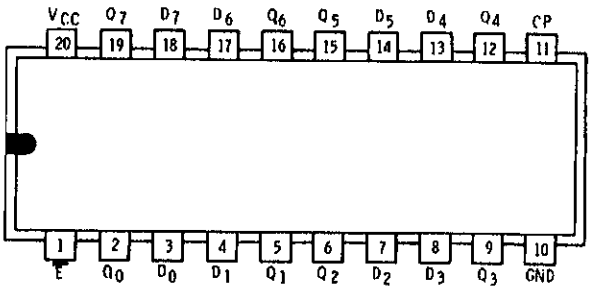

**D11**



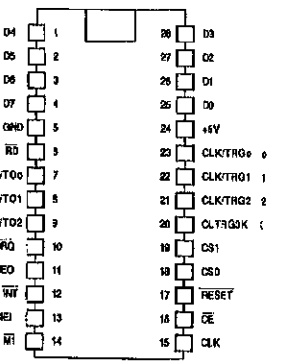

**D12**



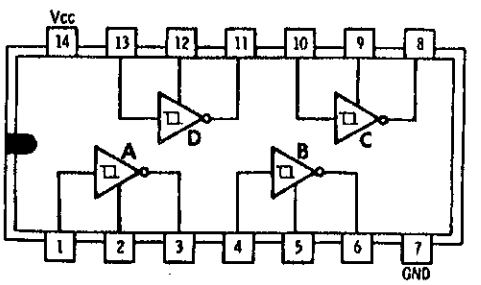

**D13**



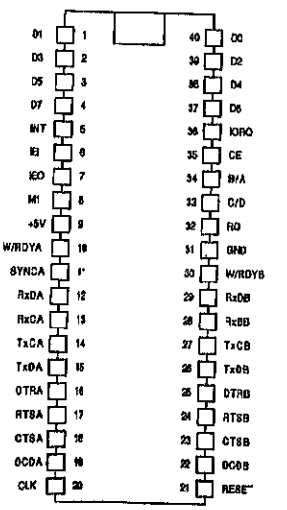

**D14**



**D15**



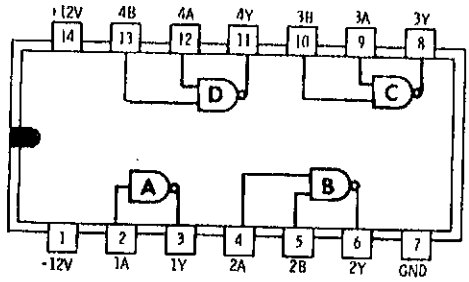

**D16**



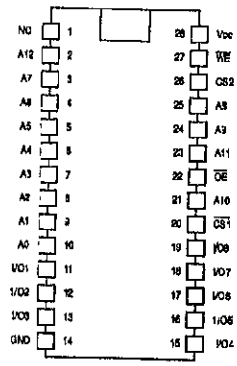
| COMPONENT NUMBER | HEATH PART NUMBER | MAY BE REPLACED WITH | KEY NUMBER |
|---|---|---|---|
| **INTEGRATED CIRCUITS (Cont'd)** | | | |
| U415 | 443-794 | 1488 | D17 |
| U416 | 443-1422 | 6264 | D18 |
| U417 | 443-1311 | 74HC138 | D19 |
| U418 | 444-475* | 27C256 | D20 |
| U419 | 443-1319 | 74HC139 | D21 |
| U420 | 443-1392 | 84C00 | D22 |
| U421 | 443-1390 | 74HC365 | D23 |

* Available only from Heath Company.

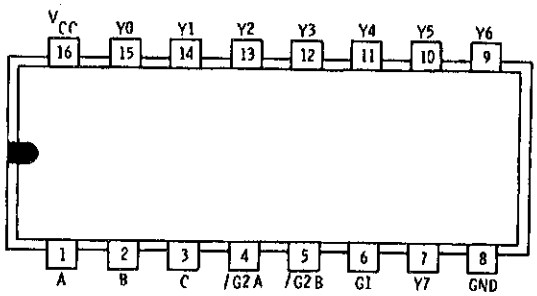
D17



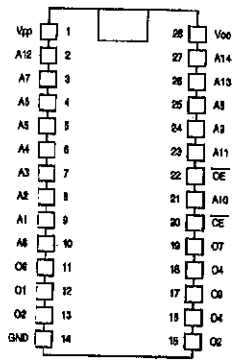

D18



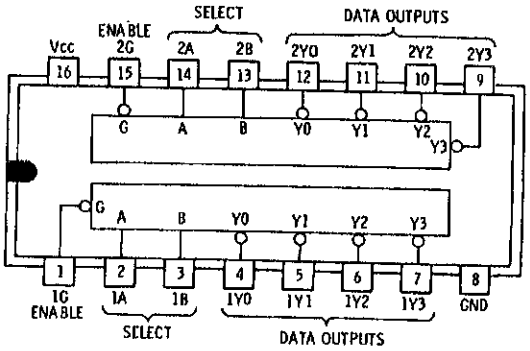

D19



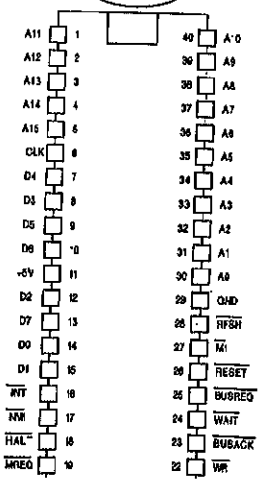

D20



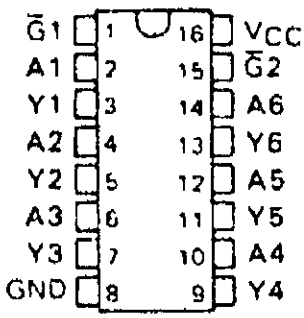

D21




D22




D23



# APPENDIX

## SERIAL INTERFACE COMMANDS

All commands end with a carriage return. **All characters must be in the case designated.** All commands begin with "AT" (not shown). Parentheses [( )] indicate optional entries with (a,b,c) indicating that only one of the characters (a, b, or c) may be entered. Do not enter the parentheses themselves in these commands. If there is no response listed, the response will be "0" which means the Weather Computer received the information and no errors occurred. If you obtain an "8" indication, it means that the information was typed in wrong and you should enter it again.

| Command | Response | Action |
|---|---|---|
| AC | | Alarm clear. Shuts off the alarm. |
| ASHHMM(SS)(A,P) | | Sets the time when an "A" for Alarm will be sent from the RS-232 serial interface port. 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 the 24-hour format. |
| 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. |
| 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. |

| Command | Response | Action |
|---|---|---|
| ES | | Echo Set. Turns on the echoing. |
| LC | | Line feed Clear. Sends only a CR after returning the results of a command. |
| LS | | Line feed Set. Sends CR-LF after returning the results of a command. |
| RA | (W)(a)(F) | Read Alert-Warning and Fog conditions. Nothing will be displayed if the Warn, Alert, or Fog is not indicated on the Weather Computer. |
| RB | Bnnnn(M) | Read Barometer. "M" is present if the units are set to millibars. |
| RBH | <Bnnnn(M)<br>mm(/)dd<br>hh(:)mm(:)ss | Read Barometer High. NOTE: The (:) and (/) symbols represent the optional time and date separator characters, respectively. |
| RBL | >Bnnnn(M)<br>mm(/)dd<br>hh(:)mm(:)ss | Read Barometer Low. NOTE: The (:) and (/) symbols represent the optional time and date separator characters, respectively. |
| RBR | BRnnnn(M) | Read Barometer Rate (24 hour rate). nnnn=-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 | hmn | Read Humidity Indoor Rate (current). |
| 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 on all rain readings (rain in .01 inches or .01 cm). |
| RRR | RRnnnnn((n)C) | Read Rain Rate. |
| RRI | RInnnnn(C) | Read Rain Instantaneous rate. |
| RT | hh(:)mm(:)ss<br>(A,P) | Read Time. |

| Command | Response | Action |
|---|---|---|
| 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 | tmnn(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 | tmnn(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) (Wnnn = Wind Speed nnnD = Wind Direction 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. |
| RWCG | CTnnn(C) | Read Wind Chill Gust. |
| RWG | Wnnn(K,L,M) nnnD | Read Wind Gust. |
| RWGH | <Wnnn(K,L,M) nnnDmm... | Read Wind Gust High. |
| RWGL | >Wnnn(K,L,M) nnnD mm... | Read Wind Gust Low. |
| SDyymmdd | | Set Date. |
| SThhmmss(A,P) | | Sets the time on the Weather Computer but does not change the format (12- or 24-hour). It does, however, determine the time format that the serial interface returns. If you do not select A or P, the time returned will be in the 24-hour format. NOTE: When you set the time in the 12-hour format, (using A or P), the hours cannot exceed 12 (i.e. 130000P is invalid). |
| VDc | | Set the Date separator character, where "c" is the character to be placed between the date items as:<br><br>**yycmmcdd** |

| Command | Response | Action |
|---|---|---|
| VD | | Clear Date separator character. |
| VTc | | Set Time separator character as:<br>**hhcmmcss** |
| VT | | Clear time separator character. |
| XC(B)(H)(h)(T)<br>(t)(R)(W)(w) | | Auto Xmit Clear. Stops auto transmission of selected items:<br><br>B: Barometer<br>H: Outdoor Humidity<br>h: Indoor Humidity<br>R: Rain<br>T: Outdoor Temperature<br>t: Indoor Temperature<br>W: Wind Gust<br>w: Wind Average |
| XCA | | Auto Xmit Clear. Stops auto transmission of 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)<br>(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 "AT X SB," the barometer reading will be transmitted any time the reading changes. |

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