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Model HTA4200™
DIGITAL HYGRO-THERMOMETER ANEMOMETER DATALOGGER

User Manual

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INTRODUCTION

Pacer's model HTA4200 digital hygro-thermometer-anemometer is a versatile instrument for measuring and logging air velocity, relative humidity and temperature of airflow from HVAC ducts or process air flow. Included are an RS232C output port with 9-pin serial cable and an analog output with cable. Temperature is selectable from either the air velocity probe or the RH probe.

The heavy, all metal air velocity probe can be used for airstreams which have a wide range of humidity, temperature and contaminants without compromising accuracy. Temperature sensors are platinum resistance elements (RTD) and the humidity sensor is a fast, accurate, capacitive thin-film ceramic model.

Features of the air velocity probe include choice of diameters, custom cable lengths, tolerance of temperatures up to 210ºF (98.9ºC), and durability. A sintered metallic filter is available for the RH probe to protect it from dust.

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Notes:

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CALIBRATION

To maintain your instrument in top working order, we recommend that you send it back to us for calibration each year, beginning one year after purchase.

Our calibration services include ensuring the instrument performs within its accuracy tolerance, making any necessary adjustments, and inspecting all aspects of the instrument's functionality so that you'll have another year of dependable service.

NIST-Traceable multi-point calibration is also available from the factory. We can offer precise calibration tailored to your specific measurement needs using our state-of-the-art facilities and calibration equipment.

Please contact us or visit our website for the latest information on calibrating your instrument.

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Warranty

This product is fully warranted against defective materials and/or workmanship for a period of one year after purchase, provided it was not improperly used. For your protection, please use this product as soon as possible. If returned, it must be securely wrapped, sent prepaid and insured to:

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Keene, New Hampshire 03431
USA

Please include a note with name, address, telephone number and description of the problem. Although we provide assistance on Pacer products both personally and through our literature, it is still the total responsibility of the customer to determine the suitability of the product for use in their application.

This manual is provided by Pacer Instruments without any kind of warranty. Precautions have been taken in accurately preparing this manual; however, we neither assume responsibility for any omissions or errors that may appear nor assume liability for any damages that result from the use of the products in accordance with the information contained in the manual.

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SECTION 1 - SPECIFICATIONS

Ranges:

Air Probe APT275: 40 to 7800 ft/min (feet per minute)
0.2 to 40.00 m/sec (meters per second)

Air Probe APT100: 60 to 6800 ft/min
0.3 to 35.00 m/sec

Relative Humidity (%RH): 5.0 to 95.0 %RH

Temperature (using combination HTP201 probe): -4° to 176°F
(-20° to 80°C)

Temperature (using Air Probes): -22° to 212°F
(-30° to 100°C)

Accuracy:

Air Velocity with APT275: ± 1.0% of reading ±1 digit
Air Velocity with APT100: ± 1.0% of reading ±1 digit
Relative Humidity: ± 2.0 %RH
Temperature: ± (0.3°C + 0.2% of reading in °C)
Temperature accuracy examples: ± 0.3°C at 20°C
± 0.5°F at 68°F

Resolution:

Air Velocity: 1 ft/min or 0.01 m/sec
Relative Humidity: 0.1 %RH
Temperature: 0.1˚F or 0.1˚C (1˚F below -99.0˚F)

Operating Temperature:

Instrument: 32˚ to 125˚F (0˚ to 50˚C)
Air Probes: -22˚ to 212˚F (-30˚ to 100˚C)
HTP202 Probe: -4˚ to 176˚F (-20˚ to 80˚C)

Power Supply: 9V Alkaline Battery (Optional 9V Wall Transformer Power)

Battery Life: Approx. 30 hours

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APPENDIX H – LOOK-UP TABLES FOR PROBES

Probe Output Hz	Airspeed AP100 Probe FPM	Airspeed MPS	Airspeed AP275 Probe FPM	Airspeed MPS
5	68.6	0.34	52.2	0.26
10	84.1	0.42	68.0	0.34
20	115.2	0.58	99.6	0.50
30	146.2	0.74	131.2	0.66
40	177.3	0.90	162.8	0.82
50	208.3	1.05	194.3	0.98
60	239.3	1.21	225.9	1.14
70	270.4	1.37	257.5	1.30
80	301.4	1.53	289.1	1.46
90	332.4	1.68	320.7	1.62
100	363.5	1.84	352.3	1.78
200	673.9	3.42	668.3	3.39
300	984.2	4.99	984.2	4.99
400	1294.6	6.57	300.2	6.60
500	1605.0	8.15	1616.2	8.20
600	1915.4	9.72	1932.1	9.81
700	2225.8	11.30	2248.1	11.41
800	2536.2	12.88	2564.0	13.02
900	2846.5	14.45	2880.0	14.62
1000	3156.9	16.03	3195.9	16.23
1100	3467.3	17.61	3511.9	17.83
1200	3777.7	19.18	3827.8	19.44
1300	4088.1	20.76	4143.8	21.04
1400	4398.4	22.34	4459.8	22.65
1500	4708.8	23.91	4775.7	24.25
1600	5019.2	25.49	5091.7	25.86
1700	5329.6	27.07	5407.6	27.46
1800	5640.0	28.64	5723.6	29.07
1900	5950.3	30.22	6039.5	30.67
2000	6260.7	31.80	6355.5	32.28
2100			6671.5	33.88
2200			6987.4	35.49
2300			7303.4	37.09
2350			7461.3	37.90

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APPENDIX G – ANALOG OUTPUTS

TEMPERATURE:

Range: -148º to 572ºF (-100º to 300ºC)
Scale: 360ºF/V (200ºC/V)
Offset: -0.4111V for ºF; -0.5V for ºC

Example: For Vout = 1V:

ºF temp is: (1-0.4111)V x 360ºF/V = 212ºF
ºC temp is: (1-0.5)V x 200ºC/V =100ºC

RELATIVE HUMIDITY:

Range: 0% to 100%RH
Scale: 50%RH/V

Example: For Vout = 1V:

%RH is: 1V x 50%RH/V =50%RH

AIR VELOCITY:

Range: 0 to 7935 FPM (0 to 40.31 MPS)
Scale: 3967.5FPM/V (20.155 MPS/V)

Example: For Vout = 1V:

Velocity in FPM: 1V x 3967.5FPM/V =3967.5FPM
Velocity in MPS: 1V x 20.155MPS/V =20.155MPS

NOTES:

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Battery check: Automatic low battery display

Display: 0.5” LCD, 4 digits

Data acquisition: Storage capacity up to 999 triple measurements of humidity, temperature and air velocity with manual “SAVE”.

Data link: Standard RS-232C at 1200 baud, including handshake signals CTS and RTS.

Weight: 24.4 ounces with probe

Dimensions:

Instrument:	7.5” x 3.2” x 1.2”
APT275 probe:	2 ¾” diameter
APT100 probe:	1” diameter
HTP201 RH probe:	7” length x 1” diameter

Options Available:

Additional velocity probe:	APT100 (1”) or APT275 (2 ¾”)
Extension cables:	PN 3831 air velocity probes
(Specify length)	PN 3833 HTP201 probe
Extra extension rod:	PN 5001 rigid, PN 5002 flexible
Sinter filter for RH probe:	PN 3901 for harsh environments

Included:

1: Air Velocity Probe:	Choice, #APT100 or #APT275
1: %RH Probe:	PN #HTP201
3 pieces:	PN #5001 Rigid Extension Rod
1 piece:	PN #5002 Flexible Extension Rod
1 piece:	PN #3830 5’ Air Velocity Cable
1 piece:	PN #3843 5’ RS-232C Cable
1 piece:	PN #3839 5’ Analog Output Cable
1 piece:	9V Alkaline Battery
1 piece:	PN #3894 Hard-shell Harrying Hase
1 set:	PN #3895 Foam Case Insert
1 piece:	Operation Manual

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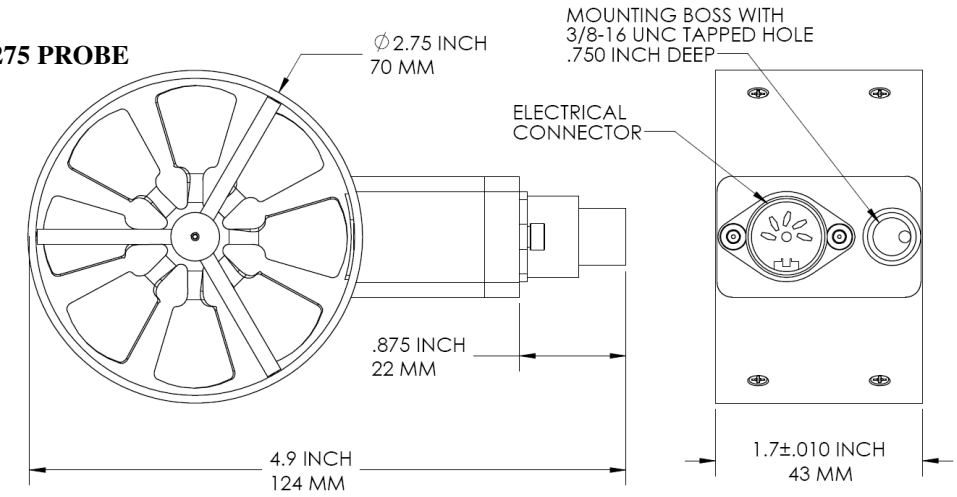
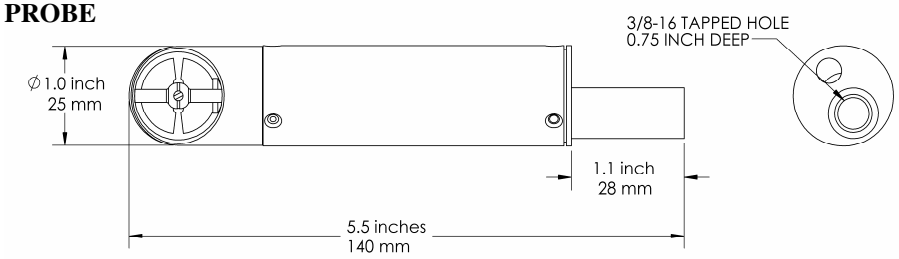
Dimensions

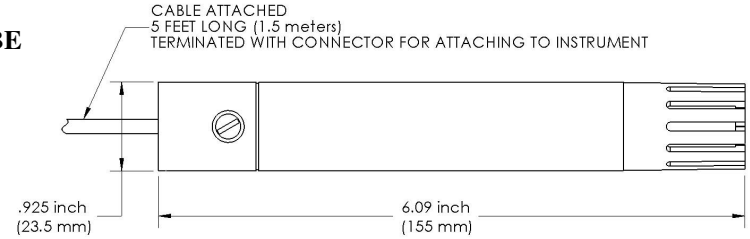
APT275 PROBE



APT100 PROBE



HTP201 PROBE



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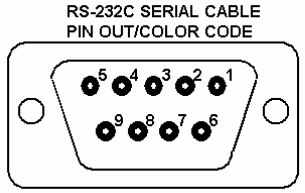
APPENDIX E – RS-232C CABLE PINOUTS



9-PIN SUB D	PIN no. 4-POLE FEM	SIGNAL	COLOR
5	1	GND	GRN
2	2	TXD	BRN
7	3	CTS	GRA
8	4	RTS	WHT

APPENDIX F – DATA COMMUNICATIONS

The instrument provides an RS-232 data output. The voltage levels are plus and minus 9V. A voltage of +9V represents a space (logical "0"). A voltage of -9V represents a mark (logical "1").

The protocol is: 1 start bit, 7 data bits, 1 odd parity bit, 1 stop bit, ASCII data format, 1200 baud.

Sample data items:
001 34.7 %RH 76.9 dgF 2385 FPM
002 34.7 %RH 24.9 dgC 12.12 MPS

RS-232 Data Pin-out Connections:

Signal	4P-Female	9-pin	Printer
Gnd	1	5	7
Transmit - TXD	2	2	2
Clear/send-CTS	3	7	5
Ready/send-RTS	4	8	4

After pressing the "DUMP" key an RTS (1) appears on the RS-232 cable. The PC or printer must respond with a CTS (0) within 1 second; if not, an "E-04" shows and DUMP mode ends. If hand-shaking occurs, ASCII data transfers at 1200 baud. Each data line (record) is terminated with a CR (carriage return) and LF (line feed). At the end of transmission the instrument generates an EOF (end of file) character. The PC can then return to the OS.

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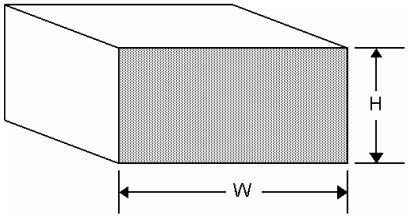
APPENDIX D – AIRFLOW VOLUME CALCULATIONS

To calculate cubic feet per minute (CFM) from a measured air velocity (FPM), you need the calculated cross-sectional area of the air flow stream:

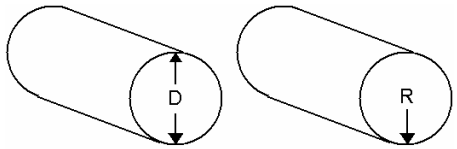
Volume Flow (CFM) = Velocity (FPM) X Area (sq ft).

In a rectangular duct this cross sectional area equals the Width times the Height.



W x H=A (cross-sectional area)

In a circular duct this cross section area equals the radius squared times π (3.14).



R x R x 3.14=A (cross-sectional area)

To convert an area calculated in square inches to an area calculated in square feet (which is required for the Volume Flow equation above) divide by 144: (area in sq in.)/144 = (area in sq ft.).

Example: The air duct is rectangular, the width is 24 in. and the height is 12 in. The air velocity reading through the duct is 450 FPM. Calculate the Volume Flow.

Step 1: Cross-sectional area = 24 in. x 12 in. = 288 sq in.
Step 2: 288 sq in /144 = 2 sq ft.
Step 3: Volume flow = Air Velocity x Area, therefore,
Volume flow rate = 450 FPM x 2 sq ft. = 900 CFM.

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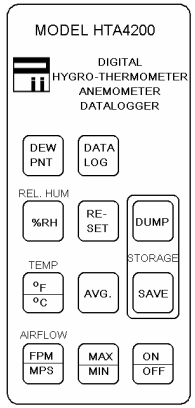
SECTION 2 – SWITCH FUNCTIONS



ON/OFF Pressing "ON/OFF" key switches unit ON. Pressing the key a second time turns it OFF.

FPM/MPS Pressing "FPM/MPS" key toggles unit from FPM (1 FPM resolution) to MPS (0.01 MPS resolution); both with average of 2 second measurement period.

ºF/ºC Pressing the "ºF/ºC" key displays temperature in degrees Fahrenheit (ºF); pressing key a second time changes display to Celsius (ºC). Readings are updated 2.5 times/second.
NOTE: The small slide switch at top chooses probe from which temperature is read.

%RH Pressing "%RH" key displays relative humidity with 0.1%RH resolution updated 2.5 times/second.

DEW/PNT Pressing "DEW PNT" key displays calculated dew point in ˚F with 0.1 ˚F resolution. Pressing the key a second time displays dew point in ˚C with 0.1 ˚C resolution.
NOTE: To shift directly to temperature from dew point, press "RESET" before pressing "ºF/ºC".

AVG Applies only to air velocity: Pressing "AVG" key sets measurement period to sixteen seconds. The display will show

"16 S" for 16 sec., then a measurement value. It will update every two seconds with average of the preceding sixteen seconds. Press "RESET" to return to normal 2 second averaging period.

RESET Pressing "RESET" key will switch the unit back to normal measurements after using the Max/Min, Datalog, Average or Dew Point modes.

SAVE Pressing "SAVE" during a measurement mode will store a data triple consisting of the %RH, temperature and air velocity values being measured at that instant, for a maximum of 999 data triples.

MAX/MIN Pressing "MAX/MIN" key displays the highest reading since turn-on for the parameter being measured, independent of any SAVED values. Pressing key again will display lowest reading since turn-on. See APPENDIX C for description of algorithm that determines MAX and MIN.
NOTE: Press "RESET" to return to measuring.

DATALOG Pressing the "DATALOG" key while still in "MAX/MIN" mode (see above) will display the maximum or minimum of the SAVED data points, if any. EXAMPLE: After pressing key, view "H" followed by value "1056" followed by sample number "P038" which contains that value.
NOTE: You will see only the value referring to the parameter you are currently measuring – air velocity in above example. If you want the SAVED max/min for, say, temperature, you need to press "RESET", "ºF/ºC", "MAX/MIN" and "DATALOG" to read the sample number and value of the highest (or lowest) stored temperature.

DUMP Pressing the "DUMP" key will transfer the SAVED measurements to a connected printer or PC. Measurements will be retained for at least 1 year or until memory is cleared by holding the "DUMP" key when turning unit on.

ANALOG OUTPUT Analog outputs for temperature, %RH and airspeed provide 0-2V FS. See APPENDIX G for details.

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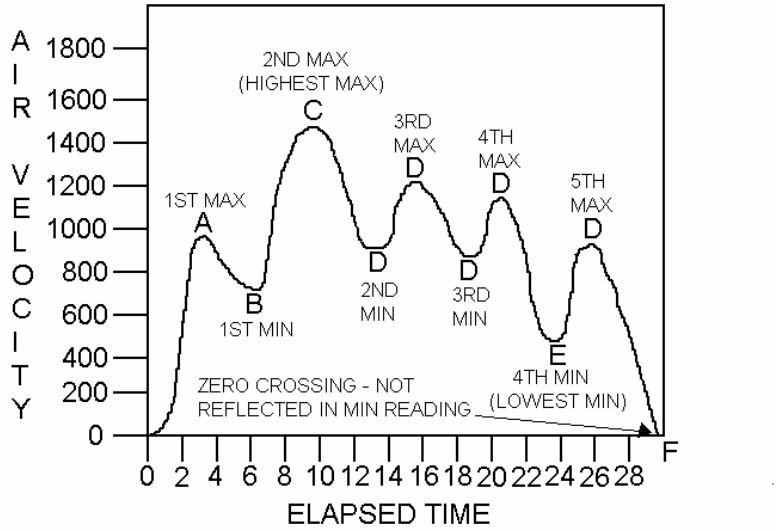
APPENDIX C – MIN/MAX CALCULATIONS



A) 1st MAX reading; also first minimum reading, to be replaced at B.

B) 1st MIN at B is the lowest yet and will be registered as velocity increases.

C) This 2nd, higher MAX at C will register as the velocity decreases, replacing 1st MAX.

D) This 2nd MIN at D is higher than the MIN already registered and will be ignored.

E) This 4th MIN at E is lower than the 1st MIN, registered at B, and will replace it.

The zero crossing at F does not form a MIN and will be ignored. This protects against false MIN readings when the probe is withdrawn from the air stream.

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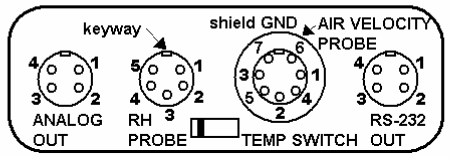
APPENDIX A – CONNECTOR OUTPUTS

Connector Pinouts/Wire Code
(top view)



ANALOG OUT CABLE		RH PROBE		AIR VELOCITY CABLE		RS-232 CABLE	
PIN 1 GND	BLK	PIN 1 RTD1a	GRN	PIN 1 S/L PRB	GRA	PIN 1 GND	GRN
PIN 2 TEMP OUT	GRN	PIN 2 GND	BRN	PIN 2 PULSE OUT	WHT	PIN 2 TXD	BRN
PIN 3 %RH OUT	GRA	PIN 3 %RH IN	GRA	PIN 3 V+	RED	PIN 3 CTS	GRA
PIN 4 VELOCITY OUT	WHT	PIN 4 V+	WHT	PIN 4 DIG GND	BLK	PIN 4 RTS	WHT
		PIN 5 RTD2a	YEL	PIN 5 RTD1a	BRN		
				PIN 6 RTD2a	YEL		
				PIN 7 RTD2b	BLU		

NOTE: Slide TEMP SWITCH toward the RH PROBE or AIR VELOCITY PROBE connector to display temperature from that probe respectively.

APPENDIX B – ERROR CODES

"E-02" Data logger is filled to maximum capacity of 999 SAVED measurements.

"E-03" Storage is empty. No measurements have been SAVED since last time memory was cleared.

"E-04" No communication is occurring through the RS232 data link with the printer or PC.

"E-06" Relative humidity is below range (<3.0%RH).

"E-07" Relative humidity is above range (>97.0%RH).

"E-08" Temperature is below range (<-99.9 ºC or ºF).

"E-09" Temperature is above range (>300.0ºC or >575ºF).

"E-10" Relative humidity is not within the range of 3.0% to 97.0%RH necessary for calculating dew point.

"E-11" Temperature is not within the range of -5º to 175ºF or -20º to 80ºC necessary for calculating dew point.

"E-XX" Error codes of 50 or higher are internal errors. In this case, contact the manufacturer.

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SECTION 3 – OPERATIONAL NOTES

NOTE: Unit should be "OFF" before changing batteries or attaching cables.

1) Remove battery compartment lid and insert battery; replace lid.

2) Attach the probe cable(s) by aligning the keyway(s), inserting connector(s) and turning collar(s) to tighten. You may use either probe by itself or both simultaneously. If no RH probe is attached, unit will display error codes for temperature or %RH when pressing those keys. (See APPENDIX A for unit's connector wiring diagram).

3) Press the "ON/OFF" key to turn unit ON. The display will show all elements followed by the remaining battery capacity ("8.2" means the battery is at 8.2V), followed by "P" and a 3 digits (i.e. "P025 which means 24 data points are stored). If the "DUMP" key in held when pressing "ON/OFF" key at turn-on, the data point memory will be cleared.
NOTE: If the battery drops below 6V during use, an "L" will be displayed in the leftmost digit.

4) To view airspeed, press "FPM/MPS" key to display desired units. Place probe in the air stream with the axis or direction arrow (if present) in the direction of airflow. To calculate volume flow rate see APPENDIX D.

5) To correctly measure the air velocity from a large duct, set unit to "AVG" mode and move probe about the area of the opening. After 16 seconds, the unit will display the velocity for the preceding 16 seconds, updating after that every 2 seconds by adding the latest 2 second measurement and dropping the oldest 2 second measurement.

6) To view temperature or %RH, press "ºF/ºC" or "%RH" keys respectively, and place probe in area to be measured. See APPENDIX B if "E-xx" (error xx) is displayed.

7) To get maximum readings since turn-on, press "MAX/MIN" key; to get minimum readings, press "MAX/MIN" key a second time. For explanation of the displayed views, see "MAX/MIN" paragraph in SECTION 2. For explanation of algorithm which calculates MAX and MIN see APPENDIX C.

8) To SAVE the displayed reading (see SAVE in SECTION 2), press the "SAVE" key.

To dump data to a PC, see SECTION 4.

SECTION 4 – INSTRUCTIONS FOR DUMPING MEMORY

For use with Win 95, 98, NT4, 2000 and Win XP computers using resident HyperTerminal (See APPENDIX F for data explanation).

A. Open HT (If a configured HT file already exists, open it and go to "**E**")
- **1)** Click "Start" button on task bar.
- **2)** Open "Programs" window
- **3)** Open "Accessories" window
- **4)** Open "Communications" window ("HyperTerminal" folder (Win 95))
- **5)** Start "HyperTerminal" program

B. The "Connection Description" window comes up
- **1)** Under "Name" type: "Pacer Terminal"
- **2)** Choose an icon or accept default
- **3)** Click "OK"

C. The "Connect To" or "Phone Number" (Win 95) window comes up
- **1)** In "Connect using:" box select the Com port you will use (probably "Com1" if not otherwise in use)
- **2)** Click "OK"

D. The "Com() Properties" window comes up
- **1)** Set "Bit per second:" to "1200"
- **2)** Set "Data bits:" to "7"
- **3)** Set "Parity:" to "odd"
- **4)** Set "Stop bits:" to "1"
- **5)** Set "Flow control:" to "Hardware", click "Apply" and "OK"
- **6)** Under "File" menu click "Properties"
- **7)** In "Pacer Terminal Properties" window click "Settings" tab
- **8)** Click "ASCII Setup…" box at bottom right

PACER INSTRUMENTS
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- **9)** Check "Force incoming data to 7-bit ASCII" under "ASCII Receiving"
- **10)** Click "OK" in "Properties" windows, then click "Save" under "File" menu

E. Under the "Transfer" menu select "Capture Text…"
- **1)** The "Capture Text" window appears
- **2)** Type in a name for the data file you're creating
- **3)** Click "Start"

F. Connect the cable from the HTA4200
- **1)** Connect the RS232 cable to the serial port.
- **2)** Turn on the HTA4200

G. Transfer the data
- **1)** Press the "ºF/ºC" and "Dump" keys
- **2)** The flowing data will now appear in the "Pacer Terminal" window
- **3)** Wait until the data has finished transferring
- **4)** Highlight "Capture Text" under the "Transfer" menu
- **5)** Select "Stop"
- **6)** The data is now in the file named in step E2

H. Select "Exit" under the "File" menu
- **1)** Note message "You are currently connected. Are you sure you want to disconnect now?"
- **2)** Click "Yes"
- **3)** If the message "Do you want to Save Session ()?" appears, click "Yes"
- **4)** Your data is now downloaded and saved

I. Instructions for moving transferred data into an Excel spread sheet
- **1)** Find and open the data file created in **G** above
- **2)** The "Open With" window should appear
- **3)** Select "Notepad" and open the file
- **4)** Select any amount of data and execute "Copy"
- **5)** Open a new Excel spreadsheet, execute "Paste"
- **6)** The A column now contains the data.

J. Split data into temperature, humidity and air velocity
- **1)** Under "Data" menu select "Text to columns…" and click "Next" in the open window
- **2)** Use the directions to place column breaks

After the column breaks are in place, click "Finish"