

## The Temperature-Humidity Index

For the derivation of the temperature – humidity index, see the following article:

Steadman, R. G. 1979. The Assessment of Sultriness. Part I: A Temperature-Humidity Index Based on Human Physiology and Clothing Science. *Journal of Applied Meteorology*, July 1979.

In the article, Steadman assesses and compares the relative “sultriness” or combined effects of high temperature and humidity on physiology in warm-humid climates and hot-arid climates. Steadman then prepares a table of apparent temperature corresponding to summer temperatures and humidities.

To obtain a copy of the article, you can (1) check your local library and interlibrary loan, (2) contact the American Meteorological Society at

45 Beacon Street  
Boston, MA 02108-3693  
Telephone: 617-227-2425  
Fax: 617-742-8718  
Web: <http://www.ametsoc.org/>

Or (3) contact Davis Instruments.

## for Vantage Pro2™ systems

### INTRODUCTION

This document outlines the process to determine what repeaters may be needed and how they should be placed and configured to bring weather data from one location to another. With the superior wireless transmission scheme of the Vantage Pro2, it is possible to send data much greater distances. This, in turn, provides greater flexibility, but also greater complexity in the possibilities of various station layouts. This document will attempt to simplify this decision process.

### REPEATER NEEDS

Determine whether you actually need a repeater. If you have a major obstruction(s) or already know that you need to employ multiple chains in your network, then you will need a solution to extend your data transmission range. The following table lists the conditions where standard equipment should be sufficient (ISS™ + console or Envoy™ receiver).

Distance to Transmit	Environmental Conditions
<300' (90 m)	Any (excepting Major Obstructions)
<400' (120 m)	Indoors or High RF interference Outdoors
<800' (240 m)	Minor Obstructions or Low RF interference Outdoors
<1000' (300 m)	Line of Sight (Outdoors)

If your distance requirements exceed those in the table above, then you will need a solution to extend the range of data transmission:

- If cost is a concern for your setup, then determine whether you have AC power and a land-based phone line near (within 1000' of the weather station) where you want to place your weather station. If they are both available, then purchasing WeatherLink™ software and external telephone modem is your most cost effective solution (see Application Note 27).
- If cost isn't an issue and cellular service is available where the weather station is located, then you may want to consider purchasing WeatherLink software along with a cellular telephone modem.
- If neither type of telephone service is viable, you will need to employ repeaters in your layout. However, the longest transmission distance from weather station to receiver cannot exceed 14.4 miles (23.3 km).

It is impossible to cover all the possible scenarios that might be encountered in real-world situations. This document will attempt to give the most common examples and provide the tools needed to help you to determine what you will need for your specific application. For specific information on how to mount and configure your repeater, consult the Wireless Repeater for Vantage Pro2 instruction manual. Bear in mind that due to unanticipated levels of RF interference, you may need more repeaters in your network than your careful planning may indicate. You may not come to this realization until you begin to test and install the elements of your network.

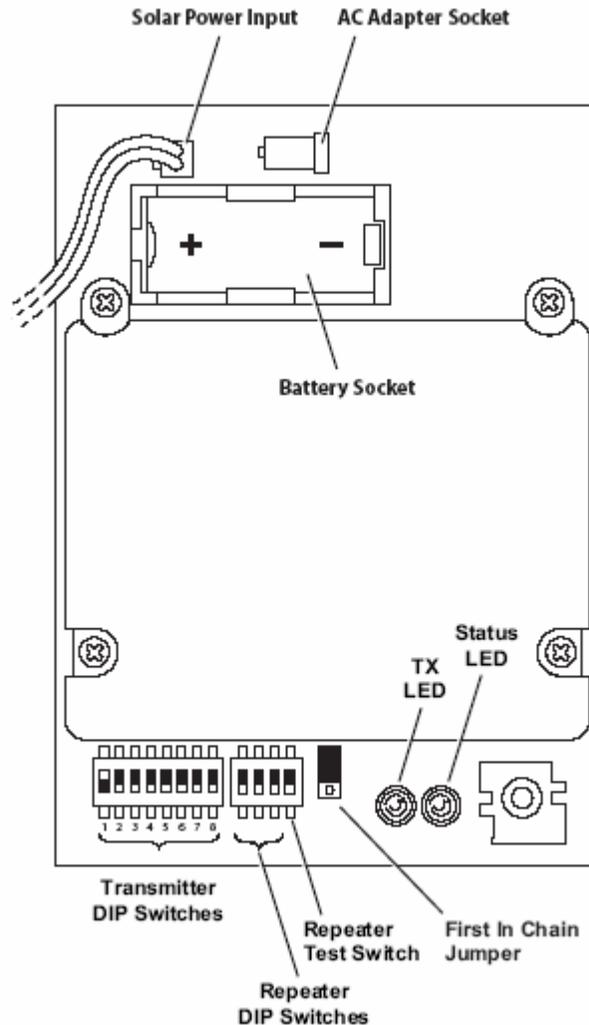
## WIRELESS THEORY OF OPERATION

In any weather station setup, there are two types of wireless equipment: transmitters and receivers. A transmitter is an outside Station, like the ISS (Integrated Sensor Suite), a Leaf/Soil Station, or a Temperature/Humidity Station. A receiver is either a Console or an Envoy. A repeater falls into both categories: It both *receives* data and *retransmits* data. A display console or Envoy can also function as a repeater and retransmit data in addition to its basic function as a receiver. The basic function of a repeater is to extend the range of a transmitter by receiving data and re-transmitting it.

For example, if your transmitter is over 1000' (300 m) away from your receiver, and/or your receiver is indoors, you may need to place a repeater close enough to the transmitter (say, 1000' (300 m) away) so that it can reliably receive the transmitter, yet close enough to the receiver that it can reliably hear the repeater.

## USING ONE REPEATER WITH ONE TRANSMITTER

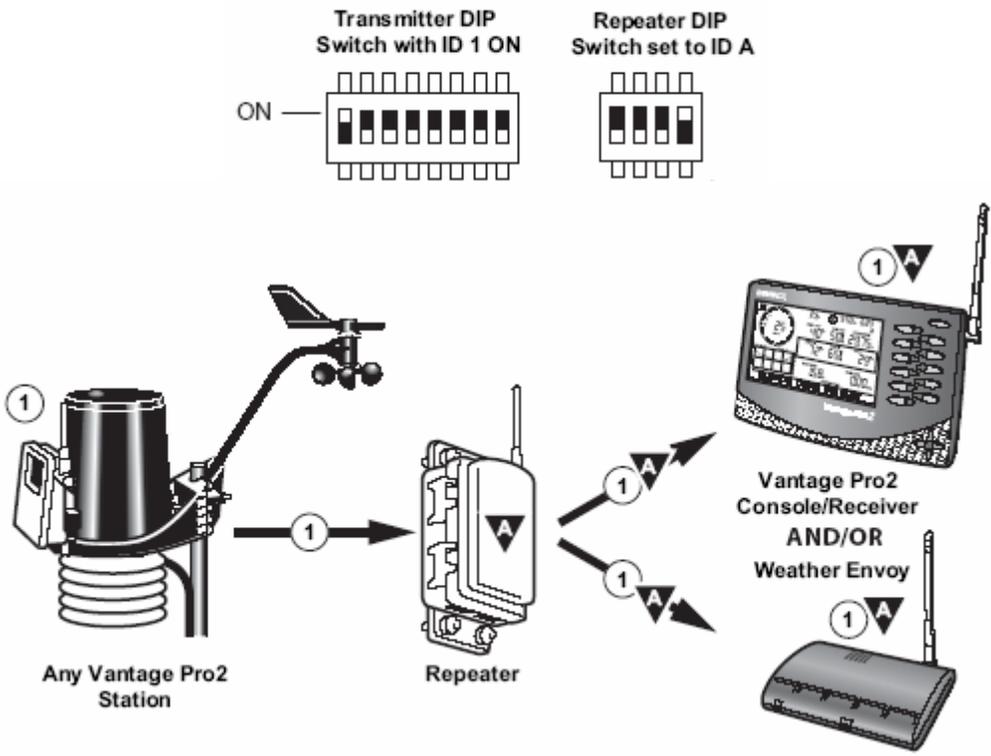
All repeaters have an ID that is indicated by a letter (A through H) and the ability to indicate which transmitters to receive and repeat.



All repeaters come from the factory configured for Repeater ID A. This is the setting for a simple, “one” repeater setup and applies to the most common repeater applications. Repeater A, the first repeater in a “chain” by design, will not listen to other repeaters. It will only listen to all transmitter ID’s selected by the DIP switches (ID #1 selected is the factory default), and re-transmit them.

REPEATER ID CODE	SWITCH 1	SWITCH 2	SWITCH 3
A (default)	off	off	off
B	off	off	ON
C	off	ON	off
D	off	ON	ON
E	ON	off	off
F	ON	off	ON
G	ON	ON	off
H	ON	ON	ON

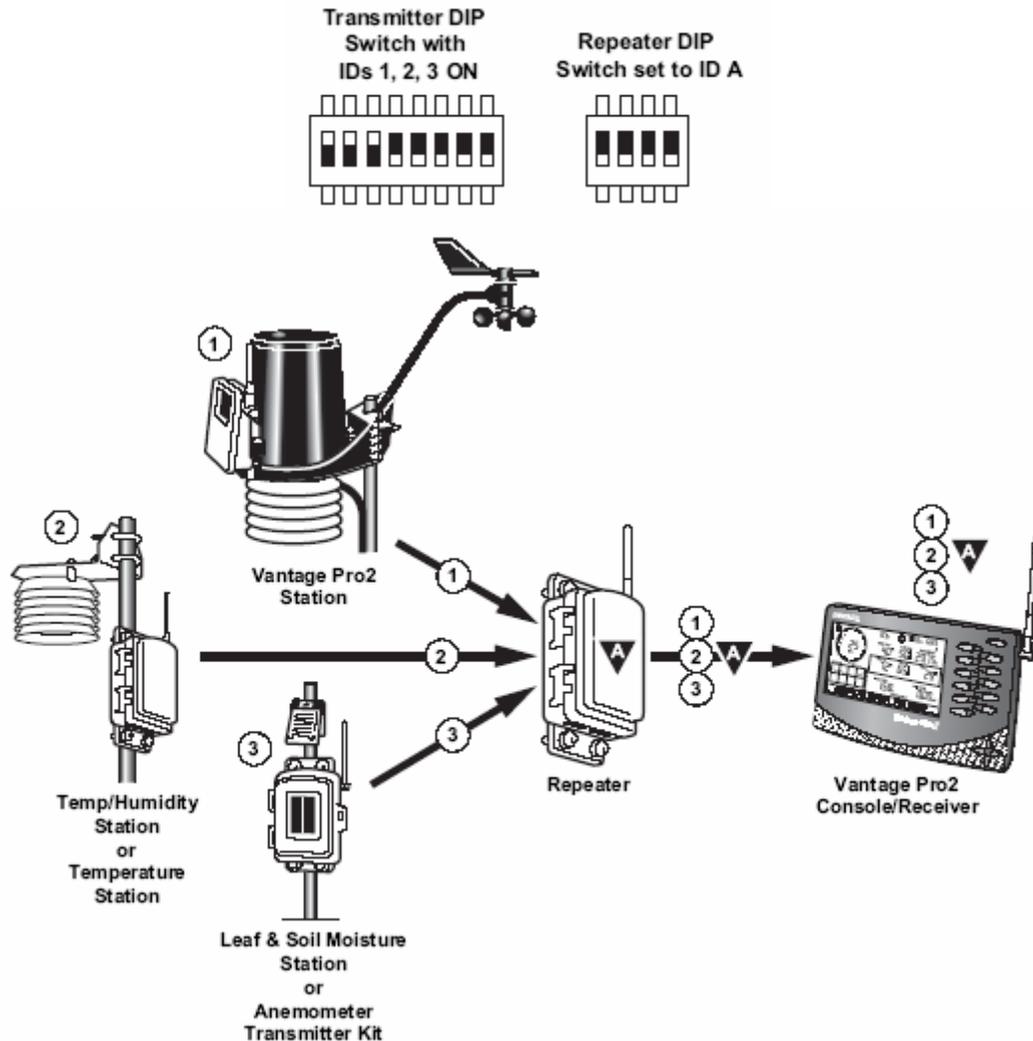
*Repeater ID DIP Switch Positions*



Information is added to the packets that a repeater transmits, (i.e., that this packet came from Repeater A), so that receivers can distinguish between repeated data packets and data packets from the original transmitter, as well as other Repeater ID's. Other additional information includes a transmitter list (of what this repeater is re-transmitting), as well as battery status information. The Vantage Pro2 Console/Receiver and Weather Envoy also need to be specifically configured to receive the correct repeater.

## USING ONE REPEATER WITH MULTIPLE TRANSMITTERS

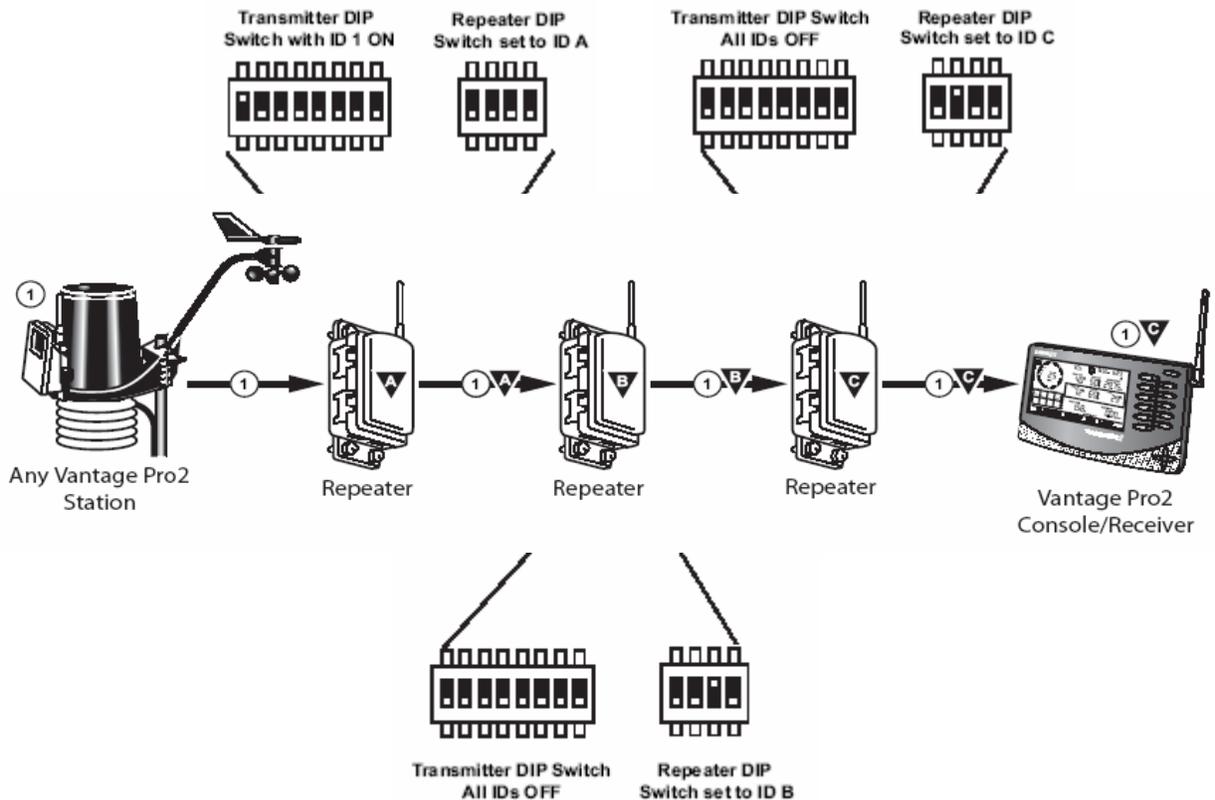
More than one transmitter can be repeated. Select additional transmitter ID's with the DIP switches and the repeater will receive all these ID's and re-transmit them.



## USING MULTIPLE REPEATERS

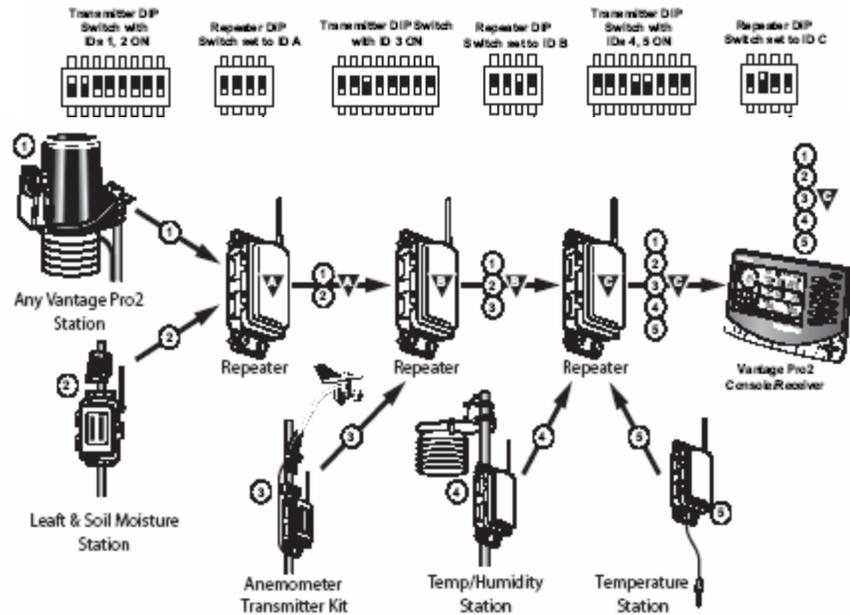
If you need even greater distance between the transmitter and the receiver, up to eight Repeaters can be strung together in a “chain”.

The second repeater in a chain is normally Repeater B. Repeater B will always look for Repeater A. Once it acquires any Transmitter ID being re-transmitted by Repeater A, it will get the list of all Transmitter ID's being re-transmitted by Repeater A. It will then continue acquisition until it has successfully found all re-transmitted ID's on the list. You do not need to tell Repeater B which ID's to get from Repeater A, it will automatically get the list from Repeater A. In the factory default case (Transmitter ID 1 on Repeater A only), Repeater B is done as soon as it acquires ID 1 from Repeater A, as it is the only ID on the list.



Additionally, Repeater B will only acquire data packets being re-transmitted by Repeater A (transmitters selected by the transmitter ID DIP switches). Repeater B will ignore packets from other repeaters, as well as original transmitter packets (unless specifically selected). If you setup both Repeater A and B to retransmit the same transmitter ID, Repeater B will flag a configuration error using the repeater's diagnostic LED's (if in TEST mode). Consult the Repeater Troubleshooting Error Codes in the Wireless Repeater for Vantage Pro2 manual.

Repeaters C-H behave similarly, with each Repeater only acquiring the previous Repeater ID (Repeater C acquires Repeater B, etc.), plus any ID's selected by the Transmitter ID switches.



## REPEATER TYPE AND ACCESSORY NEEDS

This section will help you determine what types and quantity of repeaters, if any, you will need to achieve your data transmission goals.

### DETERMINING STATION/REPEATER LAYOUT

First, determine your weather station(s) layout.

Do you have?

- One weather station in your proposed layout? or
- Multiple weather stations located in one general area?

And,

- Are you transmitting data back to one central location? or
- Are multiple receivers located in one general area?

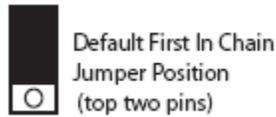
If the answer to either of the first questions is yes, and the answer to either of the second questions is yes, then you can apply a single chain configuration. Whether you need one or more repeaters is a question of distance and whether there are any obstructions in your proposed transmission path.

If the answer to both questions above in either section is no, you probably need to employ multiple chains to your repeater layout. In this case, you will need to determine your repeater needs for each branching chain of your system layout, and add the results together to determine the total number and type of repeaters you will need.

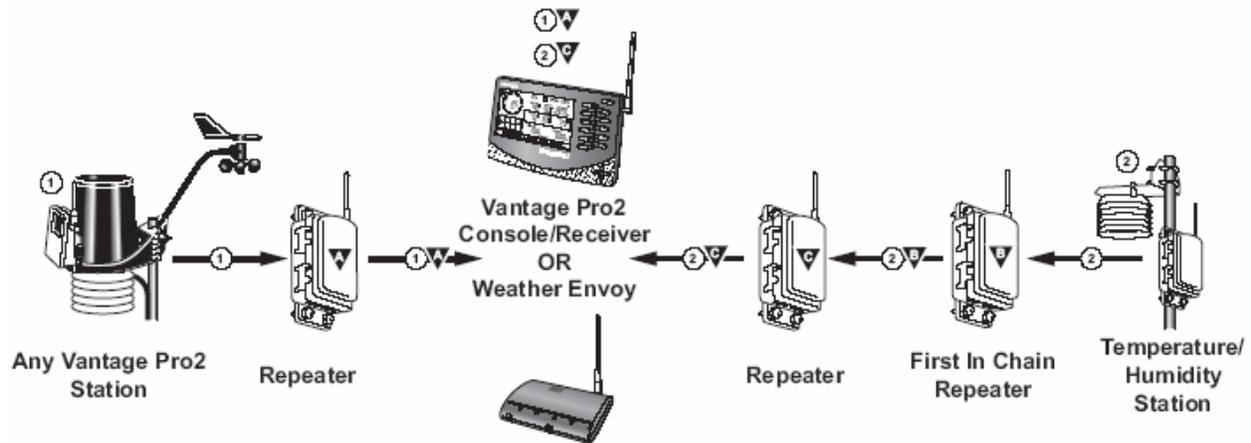
Note: You cannot exceed a total of eight repeaters in one chain regardless of repeater type.

There are other situations where weather stations are located in opposite directions from where the data is to be received. Less common, you may transmit data from one weather station to

multiple receiving locations. If you need multiple chains in your repeater network and want to use less than 8 repeaters, you can configure a repeater that is not A to behave like Repeater A—that is, it will not try to acquire a previous repeater ID in the chain. For example, if Repeater C has the First in Chain jumper set, then it will not try to acquire Repeater B, only the transmitter ID DIP switches that are set.



An example with two chains (two weather stations and one receiver) is shown below.



It is best to utilize no more than 8 repeaters in a network, however, if the chains are spaced apart enough, you can utilize up to 8 repeaters on any chain. This can also be aided by having major obstructions between repeaters where you don't want one to hear the other. You can only have up to 8 chains because you can only have 8 weather stations in a network. The maximum theoretical number of repeaters you can have is 64 (8 repeater IDs x 8 chains).

## DETERMINING YOUR ENVIRONMENT

First, you must assess how far you want to transmit your data. As we all know, the shortest distance between two points is a straight line. If the shortest distance between your transmit and receive locations does not contain any solid obstructions such as hills, large buildings or large thickets of vegetation, you can use this distance to determine your needs. If not, then you will need to attempt to go over or around these obstructions. This scenario is covered in the section "Overcoming Major Obstructions". Note that any case involving obstructions will require the use of at least one repeater. A map or measuring device (tape measures, string, range finders, handheld GPS receiver, etc.) will help you determine distances. Use a topographic map to help you determine whether or not you have any significant obstructions or elevation changes. Free topographic maps can be found at the following site: <http://www.topozone.com>.

## Overcoming Major Obstructions

Whether you go over or around an obstruction, you should choose whichever is the shortest distance. To determine the distance when going around, if possible, select a location to place a repeater where you can visually see repeaters on either side of the obstruction. If you cannot, you will need to place one or more repeaters around the obstruction until you achieve this criterion. When going over an obstruction, if possible, place a repeater at the top of the obstruction where the repeaters on either side can be seen. For long range repeaters with Yagi antennas, the angle between the ground and the straight line up to the repeater on the obstruction cannot exceed 25°, for standard repeaters, this angle is 30°.

## DETERMINING DISTANCE

Next, determine what type of repeater(s) you need.

### Standard Repeaters

Most antennas sacrifice performance in certain directions in order to gain performance in other directions. This makes the relative orientation of two antennas important. Most antennas do not perform equally well in all directions.

All Davis transmitters, receivers and Standard Repeaters come with a Dipole antenna, which is omni-directional. This means that (with the antenna pointing straight up), the antenna performs best and equally well in all directions around the side of the antenna (perpendicular to the antenna). It does not do as well above or below the antenna. For a vertically oriented dipole antenna, another antenna can be 30° above or below its horizontal plane before the performance starts to seriously degrade. If two dipole antennas need to communicate, but have more than this 30° angle between them (say due to an elevation change), the antennas can be rotated so that this perpendicular direction of best performance can be pointing at each other.



With sufficient height, optimal antenna orientation, and no obstacles or interference, a Davis Vantage Pro2 transmitter/receiver pair with dipole antennas can achieve a range of 1000 feet (300 m). Obstacles or interference will reduce this range.

The following table covers the shorter ranges where a standard repeater should be sufficient.

### Standard Minimum Repeater Requirement Table

(Use Yagi antennas on all Long Range Repeaters)

Total Transmission Distance	Line of Sight with Little or No Interference (Outdoors)	Minor RF Interference or Minor Obstructions	Into a Building or All Outdoors <i>with</i> High RF Interference	Into a Building <i>with</i> Minor RF Interference
<300' (90 m)	None Needed	None Needed	None Needed	None Needed
300' to 400' (90 m to 120 m)	None Needed	None Needed	None Needed	1 Standard
400' to 600' (120 m to 180 m)	None Needed	None Needed	1 Standard	1 Standard
600' to 800' (180 m - 240 m)	None Needed	None Needed	1 Standard	2 Standard
800' to 900' (240 m to 270 m)	None Needed	1 Standard	2 Standard	2 Standard

Note:

- Any solid obstructions have to be overcome by going over or around them. In this case, you will need to include that in your transmission distance figures.
- If either your multiple weather stations or multiple receivers are spread far enough apart to require the use of multiple chains:
  - You will need to apply the distance figures in the above table for each chain, and then add the requirements for each chain together to get the total number of repeaters required.
  - If the total distance to be covered exceeds 3000' (920 m), it may be less expensive to use Long Range Repeaters. Use the appropriate table to determine the optimum layout.

If your distance needs are greater than those covered in the table above, you may need a Long Range repeater.

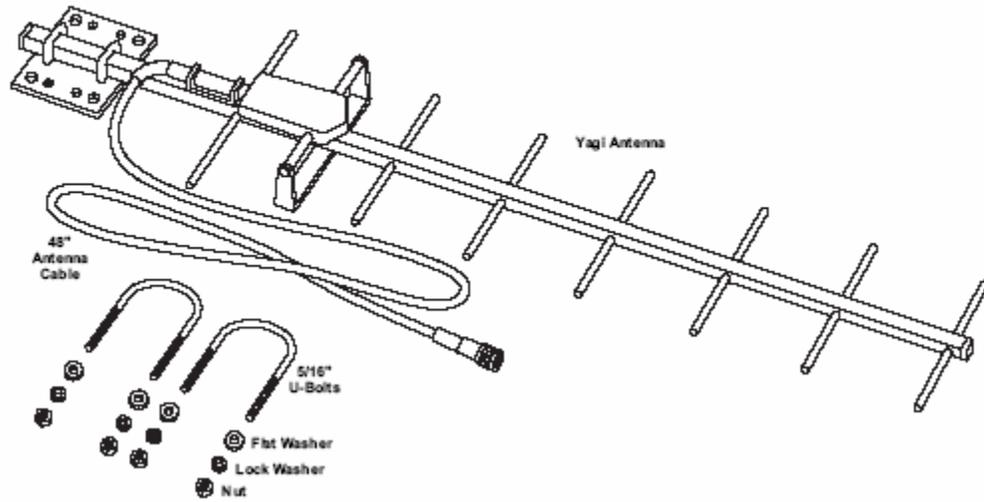
#### Long Range Repeaters

The Long Range Repeater is very similar to the Standard Repeater. The only difference is that instead of a single dipole antenna, there are two antenna connectors (one for transmit, one for receive). This allows the connection of higher performance (gain) antennas.

The 7660 Yagi antenna has much greater performance in one direction, at the sacrifice of all other directions. Its transmission distance is 3.16 times greater than a dipole antenna. When you pair a Yagi antenna with a dipole antenna, you can achieve a maximum transmission distance of 3160' (950 m), and 5000' (1500 m) with a high-gain Omni. When paired with another Yagi, the distance increases to a maximum 10,000' (3000 m). This antenna is best used when a repeater is receiving from one transmitter, transmitting to one receiver, or receiving or transmitting multiple transmitters or receivers that are all in a straight line.

### Yagi (Directional) Antenna (#7660)

The Yagi antenna includes the directional antenna and mounting hardware:



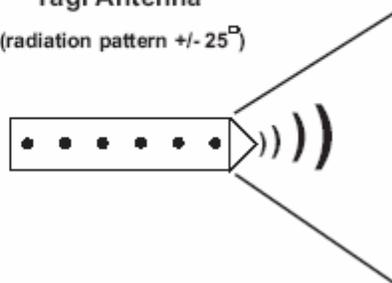
When paired with another antenna, it is best to be in the 'beam' of the Yagi antenna (Yagi antenna pointed straight at the other antenna), but can be up to 25° above, below, left or right of the center of the beam as shown below before performance seriously degrades.

### External Antenna Radiation Patterns (Top View)

Omni-Direction Antenna  
(radiation pattern 360°)



Yagi Antenna  
(radiation pattern +/- 25°)



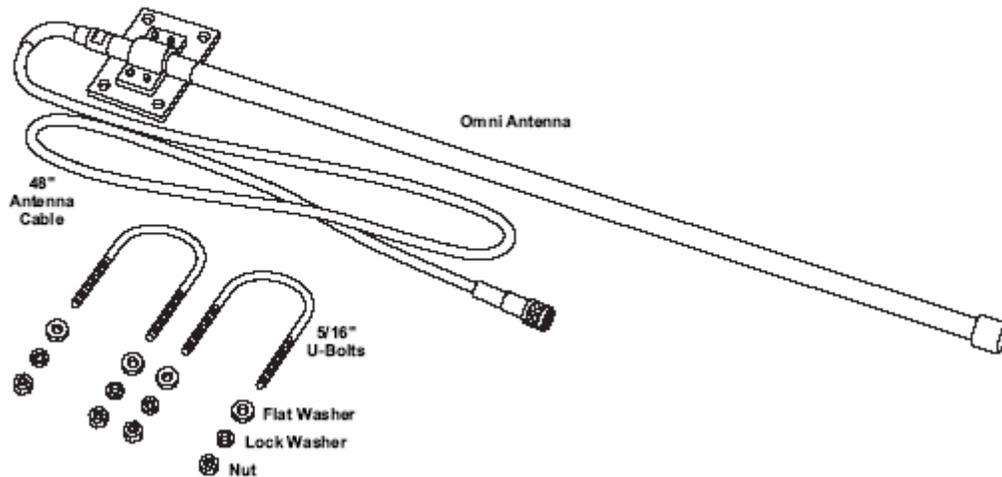
Determine whether you can use all Yagi antennas in your network. If any of the situations below apply, you may use table on page 16 to determine your minimum repeater requirements.

- If you have one weather station and one receiver.
- If you have more than one weather station or more than one receiver, and they all fall within 25° either side of your proposed transmission path centerline.
- If either your multiple weather stations or multiple receivers are spread far enough apart to require the use of multiple chains
  - And they all fall within 25° either side of the transmission path centerline.
  - If any of them do, you can use all Yagis in those particular chains. Add the repeater requirement results from each chain together to get the total number of repeaters required for those types of chains. Any that don't are covered in the next section below.

The 7656 high-gain Omni antenna is similar to the dipole since it performs best and equally well in all directions around the antenna. However, it has higher performance compared to the dipole. Its transmission distance is 1.58 times better than the dipole. The main disadvantages of the high-gain Omni over the dipole is that it cannot be rotated to an angle and it performs even worse above and below the transmission plane than the dipole does. Another antenna can only be about 20° above or below this horizontal plane before the performance begins to seriously degrade. When you pair a high-gain Omni antenna with a dipole antenna, you can achieve a maximum transmission range of 1580' (475 m). When paired with another high-gain Omni, the distance increases to 2500' (750 m). This antenna is best used when a repeater is receiving multiple transmitters that are in very different directions relative to the antenna, or transmitting to multiple receivers that are in very different directions relative to the antenna.

#### Omni-direction Antenna (#7655)

The omni-direction antenna includes the omni-directional antenna and mounting hardware:



You may need to use high-gain Omni antennas at one end of your transmission chain(s):

- If your weather stations are spread far enough apart to fall outside 25° either side of the transmission path centerline or
- If your receivers are spread far enough apart to fall outside 25° either side of the transmission path centerline

You may need to employ high-gain Omni antennas in the middle of the chain:

- A station branching off of a main chain may require the use of a high-gain Omni antenna if it branches off at greater angle than the transmission cone of a Yagi antenna AND the station is not near the Yagi antenna. Yagi antennas can receive transmissions behind or to their side when close to the antennas (<200' (60 m) line of sight)
- Two stations branching off a main chain will always require the use of a high-gain Omni at that point.

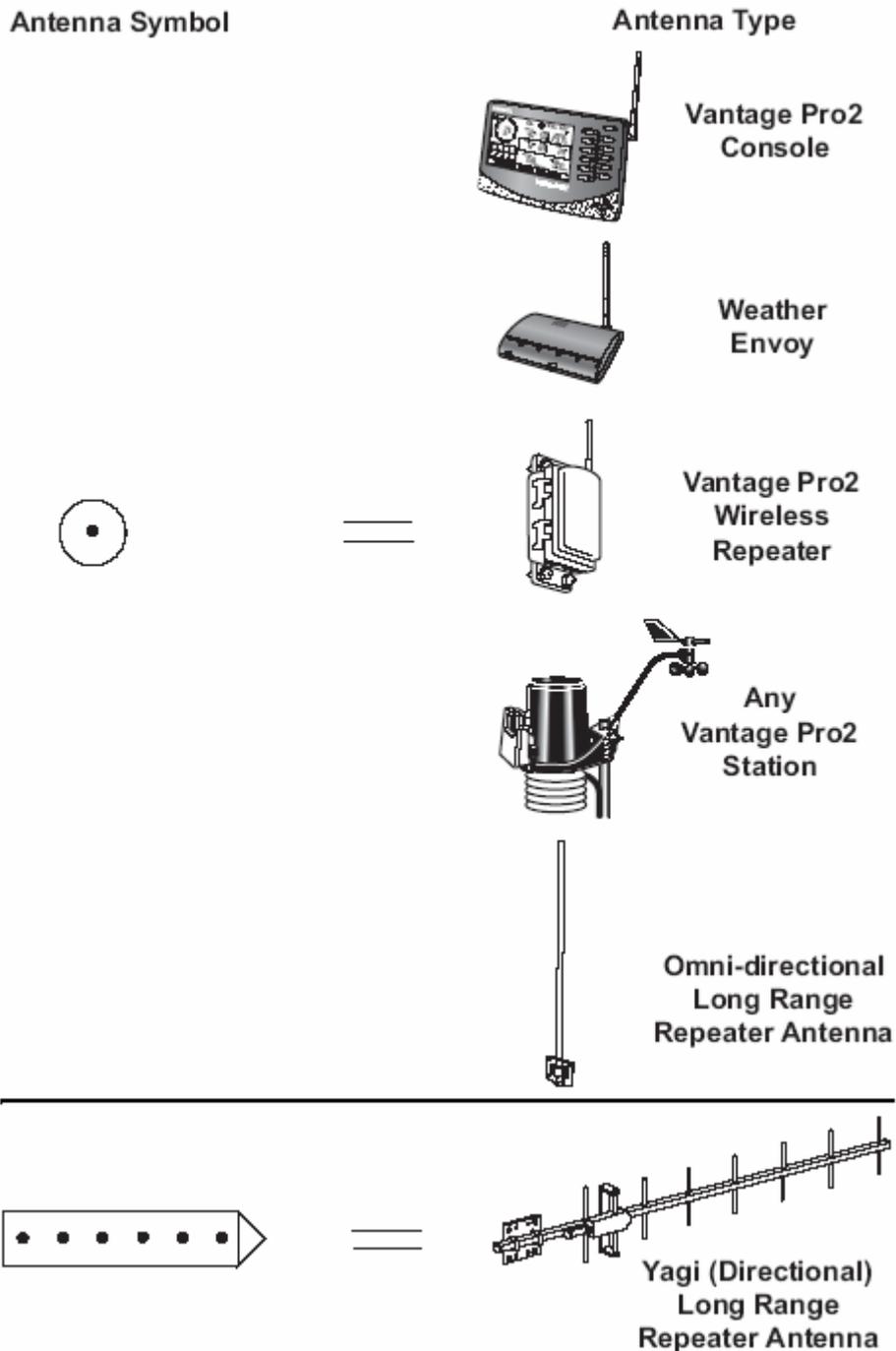
Since placing high-gain Omni antennas in the middle of chains complicates your network distance capabilities, it is best to use the distance table in the “Planning Where to Place Repeaters” section. You may still use one of the “Omni” Tables to determine the requirements for the branching chain since the high-gain Omni will reside at the end of the branching chain.

General Notes on the use of Long Range Repeaters:

- Remember that Standard Repeaters use dipole antennas which are omni-directional, so they will transmit and receive in all directions just like the high-gain Omni antennas.
- You cannot exceed a total of eight repeaters in a chain regardless of repeater type.
- If RF interference levels are higher than anticipated, you may need to use more repeaters than indicated.

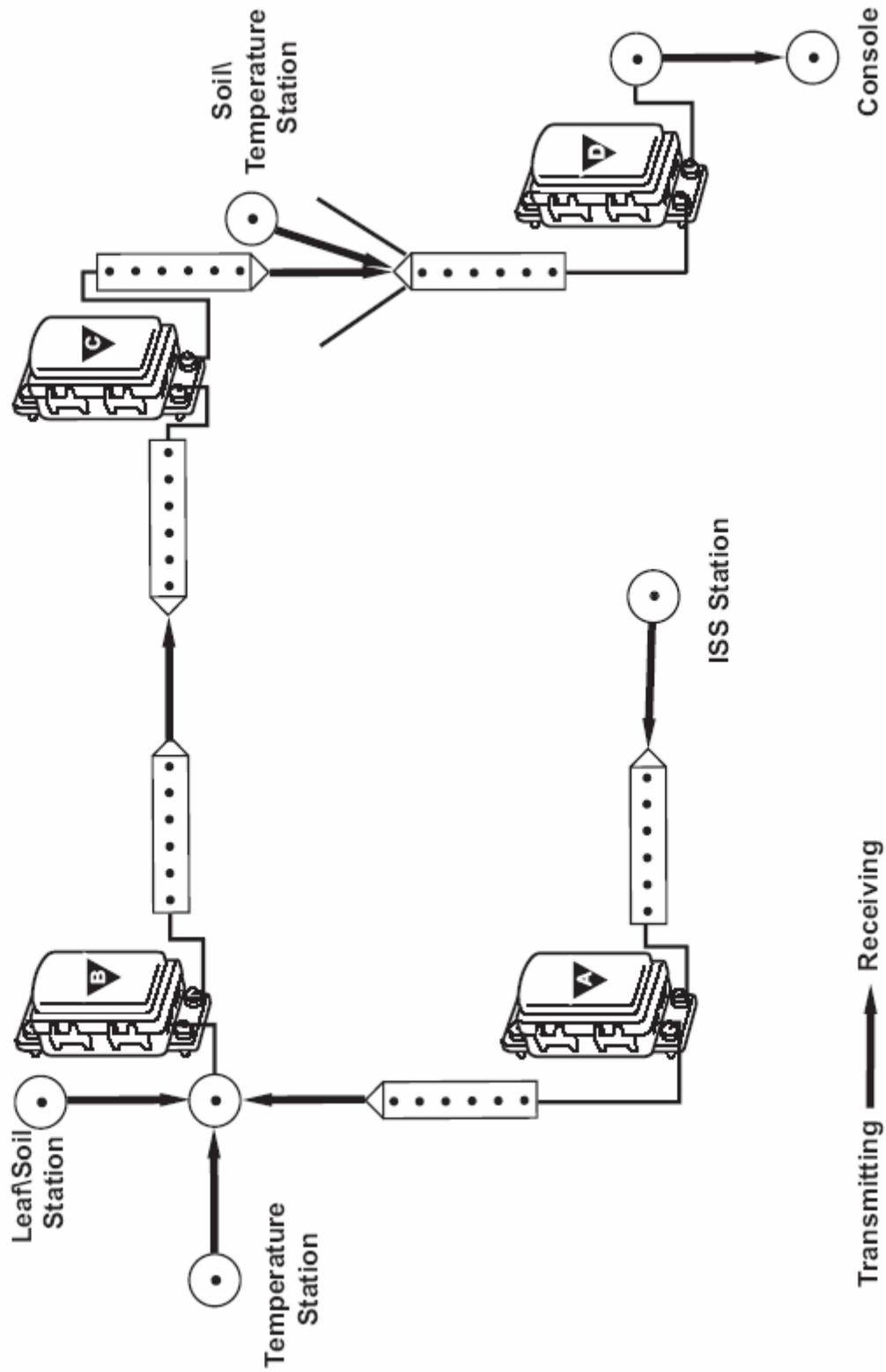
The legend below describes the antenna types and how they are represented in the sample antenna configuration:

### Antenna Topology Legend



The first symbol represents any station/receiver/repeater with a normal dipole or long range omni antenna. The second symbol represents the long range Yagi antenna. The diagram on the next page contains all the long range external antenna configurations available for a network. In this example, there are four repeaters, each with a unique station-to-repeater or repeater-to-repeater antenna relationship.

# Representative Antenna Configurations



## PLANNING WHERE TO PLACE REPEATERS

You should position your repeaters within a chain at equal distances apart unless you have obstructions to overcome (see “Overcoming Obstructions” section). Avoid placing repeaters at the edge of the maximum transmission range. This may lead to inconsistent reception due to varying RF environmental factors. It is better to add one more repeater to a chain if you are on the edge of the transmission range.

Consider the installation environment. Determine, if possible, whether or not your situation has any significant RF interference or any minor obstructions. Use the following table to determine the maximum distances you can place your repeaters apart from each other. Remember that a weather station, console/receiver, Weather Envoy, and standard repeater all have dipole antennas. You should use one of the Dipole antenna combinations to determine the maximum distance between these devices and a long range repeater.

Transmit Antenna to Receive Antenna	Multiplier	Maximum Transmission Distance			
		Line of Sight with Little or No Interference (Outdoors)	Minor RF Interference or Minor Obstructions	Into a Building or All Outdoors with High RF Interference	Into a Building with Minor RF Interference
Dipole to Dipole	1.00	1000' (300 m)	500 - 800' (150 - 250 m)	200 - 400' (60 m - 120 m)	100 - 320' (30 - 100 m)
Dipole to Omni	1.58	1580' (475 m)	790 - 1260' (240 - 380 m)	320 - 630' (100 m - 380 m)	160 - 510' (50 - 150 m)
Dipole to Yagi	3.16	3160' (950 m)	1580 - 2530' (475 - 760 m)	630 - 1260' (190 m - 380 m)	320 - 1010' (95 - 210 m)
Omni to Omni	2.50	2500' (750 m)	1250 - 2000' (375 - 600 m)	500 - 1000' (150 - 300 m)	250 - 800' (40 - 240 m)
Omni to Yagi	5.00	5000' (1500 m)	2500 - 4000' (750 - 1200 m)	1000 - 2000' (300 - 600 m)	500 - 1600' (75 - 480 m)
Yagi to Yagi	10.00	10,000' (3000 m)	5000 - 8000' (1500 - 2400 m)	2000 - 4000' (600 - 1200 m)	1000 - 3200' (150 - 960 m)

If you are unaware of whether you have RF interference, use the Line of Sight or the Minor Obstructions column as appropriate to determine the maximum transmission distance between repeaters. If you have higher levels of RF interference than you are aware of, you will need to install each repeater closer together.

If there are hazards (bodies of water, unstable ground, livestock range) along your transmission path where you cannot place repeaters, then it is best to place one on each side of the hazard. If the hazard is more than 10,000' (3000 m) across, then try going around the hazard. In the case where the weather station is located at the edge of the hazard and the distance across the hazard is more than 1000' (300 m), you will need a Long Range Repeater with a high-gain Omni antenna for receiving, and a Yagi antenna for transmitting adjacent to the weather station. This configuration will allow you to transmit up to 10,000' (3000 m) across the hazard if you use a long range repeater with a Yagi antenna at the other side of the hazard. One example of this would be where a weather station is installed on a small island in the middle of the lake, which must then transmit to the lake shore and this distance exceeds 1000' (300 m) line of sight.

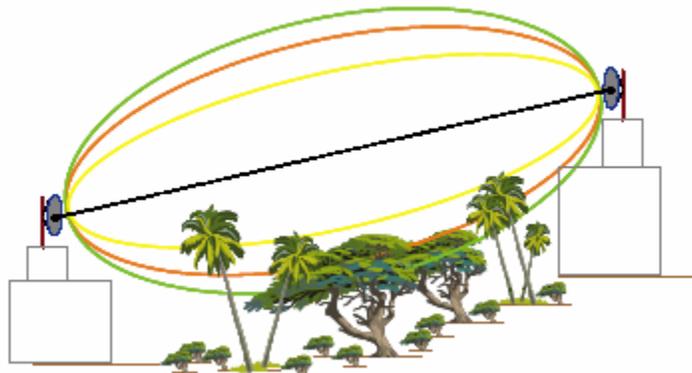
## MOUNTING HEIGHT AND LINE OF SIGHT

Antennas transmit in both the horizontal *and* vertical direction. For this reason the antennas effectiveness may be altered by objects that are not directly in the straight line of sight transmission path or even the ground itself. For this reason, best results are obtained the higher you mount antennas above the ground. The transmission distance specifications attempt

to take the ground into account, and to a lesser extent, minor obstructions in the transmission path. Assuming there are no objects in the transmission cone, mounting the long-range repeater antennas up to the maximum effective height (see table below) above the ground should improve your reception. Mounting heights above this value have little additional benefit. However, Davis Instruments cannot guarantee better results than those specified in the distance tables.

Transmit Antenna to Receive Antenna	Maximum Effective Antenna Mounting Height
Dipole to Dipole	8' (2.4 m)
Dipole to Omni	9' (2.8 m)
Dipole to Yagi	12' (3.8 m)
Omni to Omni	11' (3.4 m)
Omni to Yagi	17' (5.1 m)
Yagi to Yagi	22' (6.6 m)

The transmission cone of each transmit/receive antenna pair merge to form a football shaped zone between them. Thus, objects near either antenna that are below them have little affect, whereas, objects on the ground halfway between the two antennas can have a significant impact on the transmission distance. In this case, the antennas should be mounted even higher: above the height of any objects within the transmission zone. The closer you mount the antennas, the less effect these objects will have.



## REPEATER NETWORK FINALIZATION HINTS

### TESTING AND INSTALLATION GUIDELINES

The following instructions will have you install each “link” of the network, one by one, verifying that each link in the network is working properly, first with the weather station, then with the first repeater in the chain, and then each repeater in the chain, working your way back to the receiver location. This will make it easier to check and verify that each repeater in each chain is working. For networks with multiple chains, test and install each chain one at a time.

It is highly recommended that you familiarize yourself with the diagnostic parameters (Received Signal Strength Indicator (RSSI), synchronization, background noise, reception %, and signal to noise ratio (S/N)), where they are found and how to set transmitter IDs. This information can be found in the console and repeater manuals.

First, power up and test just the weather station(s) and receiver(s) in your living room, garage or office before placing the weather station(s) in their proposed outdoor location(s). This will verify that the main components of your weather station network are functioning normally. If you have both a console and Envoy, use the console for testing because it is easier to carry around and has the ability to provide more data on reception diagnostics than the Envoy does. Consult the Vantage Pro2 console manual for details on how to enter and use the diagnostic screen. If you only have an Envoy, you will need to carry a laptop with you to read the data from the Envoy. Select Console Diagnostics on the Reports menu to access this information. If you are receiving 95% or more of the data packets after a few minutes of operation and your RSSI is 50 or greater while the weather station(s) and receiver(s) are adjacent, you have successfully determined that they are working and can safely proceed to the next step in installation. Consult the troubleshooting section of the appropriate manual if you fail to achieve these results. Failure to receive any of the weather stations may indicate a problem with the receiver, but you should go through the troubleshooting sections of both instruction manuals to be sure.

Next, take your weather station and receiver out to the weather station installation site and install the weather station. Power up both units and verify that the receiver is successfully receiving the weather station (using the same criteria as above). Force a resynch by going in and out of the setup screen, then go into and clear the diagnostic screen on the receiver. Check the background noise (measured only during signal acquisition). If the number is 10 or greater, then you may have high RF interference issues outdoors. If you fail to achieve the same success here in the outdoors that you obtained in your workspace environment or you fail to receive any signal at all, your RF environment may be so poor that wireless technology may not be feasible in your area. Should you encounter such trouble, leave the receiver in the area for a few hours to gather enough diagnostic information to be sure.

If successful, near the weather station, power up the first repeater in the chain, configure it to listen to the weather station's ID number, and place it in Test mode. You will need to reconfigure your receiver to listen to repeater A (or whichever is first in the chain) and place it near that repeater. Remember, unless you set the "first-in-chain" jumper, the first repeater in the chain must be A. Clear the diagnostic screen on the receiver. When the receiver acquires the signal from the repeater, check both the reception % and RSSI. An RSSI of less than 50 or reception % of less than 95% while the weather station(s) and receiver(s) are adjacent indicates the receiver is having trouble listening to the repeater. If the receiver tested well before, then the problem may lie with the repeater. Go to the Current screen and select wind direction. The number that appears there will be that repeater's RSSI from the weather station while the repeater is in Test mode. If the reception % is below 95% and/or the RSSI is below 50, this indicates that the repeater is having trouble listening to the weather station. Should a problem be indicated, consult the wireless repeater manual troubleshooting section to determine the problem and course of action.

If you are able to receive the weather station through the first repeater in the chain as you just tested, relocate the repeater to its proposed installation location. Again, on the receiver, force a resynch and clear the diagnostic screen on the receiver. Check the background noise. (What is shown is the receiver value, but it will be the same for the repeater if you are using a standard repeater because they both have dipole antennas.) As before, a background noise of 10 or more indicates high RF interference. When you acquire the repeater signal, take the RSSI reading. Subtract the background noise value from it to get your signal to noise ratio value. If the number is 10 or less and the reception % is 75% or greater after waiting a few minutes, then you may confidently install the first repeater in the chain at this location.

However, if your background noise value is 10 or higher, force a resynch on the console and move the repeater gradually closer to the weather station. When the background noise level on the console diagnostics drops below 10, clear the diagnostic screen and leave the receiver at this location for several minutes. Afterwards, read your RSSI, calculate your signal to noise ratio and check your reception % again. If the numbers are acceptable here ( $S/N \geq 10$ ,  $\% \geq 75\%$ ), then you will need to install the repeater here (closer to the weather station) rather than where originally planned due to higher levels of RF interference than anticipated. You may need to repeat this process several times to determine the correct installation location of this repeater because RF interference can vary widely at any given location and over short distances. If the background noise level is less than 30 and your reception % does not improve before you reach the weather station, make sure you followed the guidelines for your layout outlined earlier in this document. If you have, then you may have a problem with your repeater. Consult the wireless repeater manual troubleshooting section to determine the problem and course of action.

If you have only one repeater in the chain you are testing, then verify your receiver's reception diagnostics at the location where the receiver is to be located. If they are acceptable, then you are done testing for that chain and you should turn OFF TEST mode on the repeater. If the numbers are not acceptable, you may need to add a repeater to your chain.

If you have more repeaters, replicate the instructions above for the second repeater excepting that you will set the next repeater to listen to the previous repeater.

## TROUBLESHOOTING & MAINTENANCE HINTS

If you leave either a weather station or a repeater in Test mode, it will drain the battery rapidly. So, when you are finished testing your network, be sure and turn off Test mode. Also, if you leave Test mode on one or more repeaters, the RSSI number you see will be for the last repeater in that chain that is in Test Mode.

If you believe your transmission success is less than optimal, check for any Low Battery messages on any of the weather stations or repeaters. You may simply need to change the batteries in one or more parts of your network. If no battery message is present, check your reception diagnostics. If you are receiving less than 75% of the data packets after a few minutes and your RSSI is 30 or less, then you may have a problem with one or more repeaters, the weather station(s), or receiver. Repeat the steps in the "Testing Hints" section to determine where in the network the problem lies. If each part of the network appears to be functioning normally, but you still have poor reception, you may simply need more repeaters than originally anticipated. This may be the result of increased RF interference or an increase in the number and size of obstructions (construction and/or foliage growth) since the original installation.

If you ever receive a Low Battery message for any of the repeaters, you should change the battery as soon as possible. The receiver can only process 4 Low Battery messages at a time, so there may be more low batteries in your repeater network than it appears. If you find that you have to change batteries often, make sure no repeaters are in Test mode. For solar powered repeaters, be sure they are mounted in a location that receives direct sunlight most of the day (avoid shaded locations) and face the solar panel south in the Northern Hemisphere (north in the Southern Hemisphere). If these suggestions don't remedy the situation, make sure that the repeater with the low battery is able to receive all the stations and repeaters it is intended to receive. This will be confirmed by seeing two flashing green lights while in Test mode. Any other colors displayed indicate a problem with either reception or the repeater itself.

Consult the wireless repeater manual troubleshooting section to determine the problem and course of action.

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## with WeatherLink™

### INTRODUCTION

This document provides a step-by-step process on how to set up your own personal weather website including choosing an Internet Service Provider. WeatherLink™ is compatible with many of the ISPs out there and provides a great deal of flexibility in how you want to present your weather information: You can either use pre-made templates from Davis Instruments or create your own web pages.

### INTERNET CONNECTION

First of all, you will need access to the Internet. If you already have access to the Internet, you may skip to the next paragraph. If you don't have access, you will need to get an Internet Service Provider (ISP). There are many out there to choose from. Some of the most well-known and well-liked ISPs are AOL, EarthLink, AT&T Yahoo, NetZero and Juno. Some offer only dialup service (low speed), while others offer only high speed service, and some offer both types of service. Dialup service is available to anyone with a phone line, but long-distance charges or other charges may apply in rural areas. High speed service, which may be supplied by either a phone company (e.g., AT&T, Qwest) or a cable company (e.g., Comcast, Cox) is typically only available in urban or suburban areas. High speed service is also available via satellite to anyone with a clear view of the southern sky (in the contiguous United States through HughesNet). High speed service generally costs more even though there are companies offering cheaper introductory rates or lower rates for somewhat lower speed service. High speed is generally a better value for speed. Also note that WeatherLink does not support secure FTP, so ask the ISP whether they require you to use secure FTP to upload information to your website.

You will need some personal web space on the ISPs server (or your own server) for your website. The cheaper services may not include this space for free. Others may not offer it at all. You should weigh the cost of the cheaper services + web space cost versus the cost of a more expensive service with web space included. To activate your personal web space on AOL, users must use the (keyword FTP) AOL FTP client to go to the Favorite Site "members.aol.com", where a "/screenname" directory is created. AOL includes 2 MB of web space with its service free. If you use the Davis Instruments web templates only (~80 KB), then the web space that is typically provided should be sufficient. Otherwise, you may want to consider the size and content of your website, usually quoted in MB (1000s of KB).

Ask a friend to print out the following websites for you. They contain information on choosing an ISP:

<http://www.consumersearch.com/www/internet/isp/comparisonchart.html>

<http://pcworld.about.com/magazine/1811p148id18624.htm>

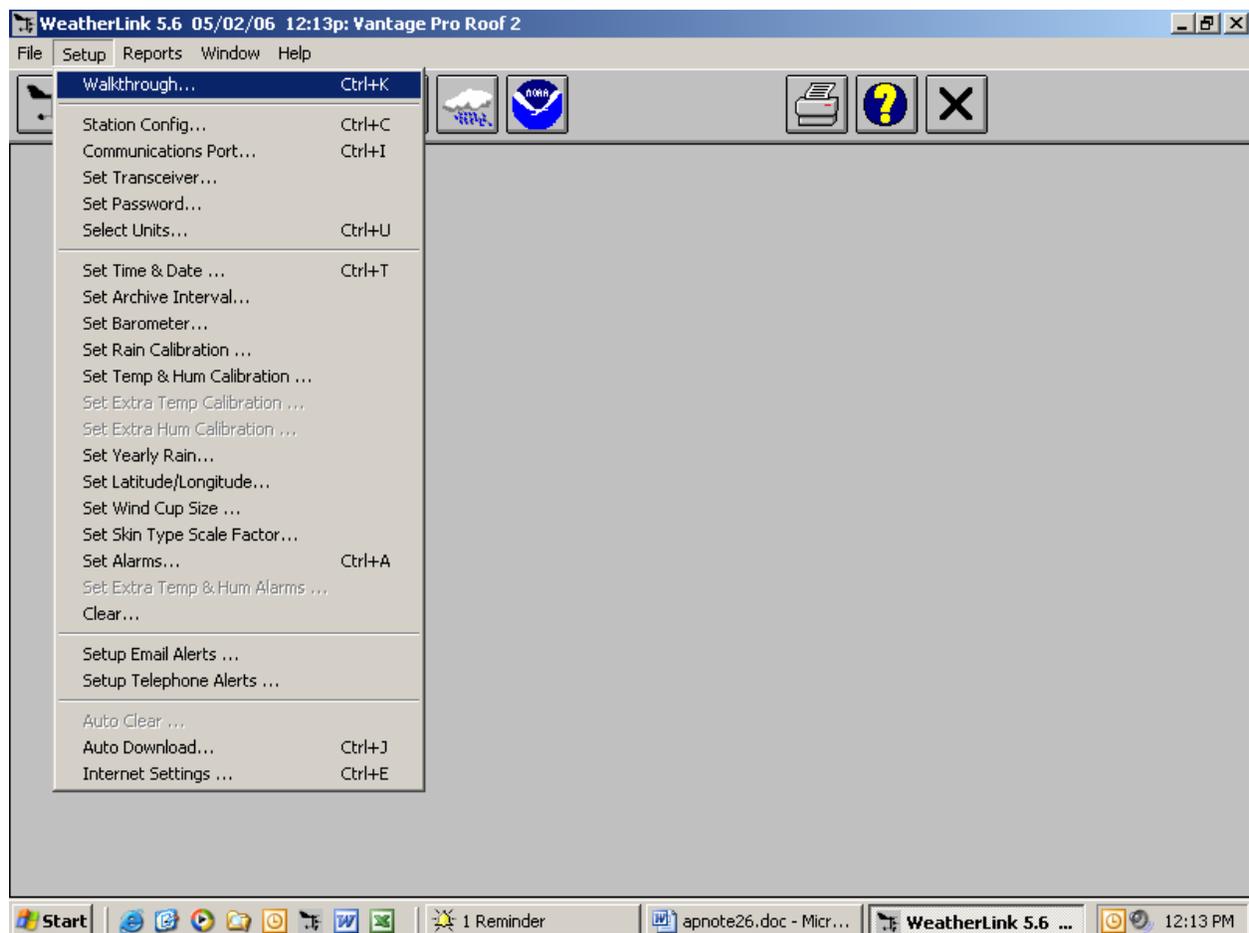
<http://www.theispguide.com/>

Often times, the ISP will provide software that will automatically configure your computer's settings. If not, for a dial up connection, more recent versions of Windows will have a Wizard that will walk you through the setup. For a high speed connection, consult your ISP. Typically, for high speed service, you will need to have a "specialized" modem installed.

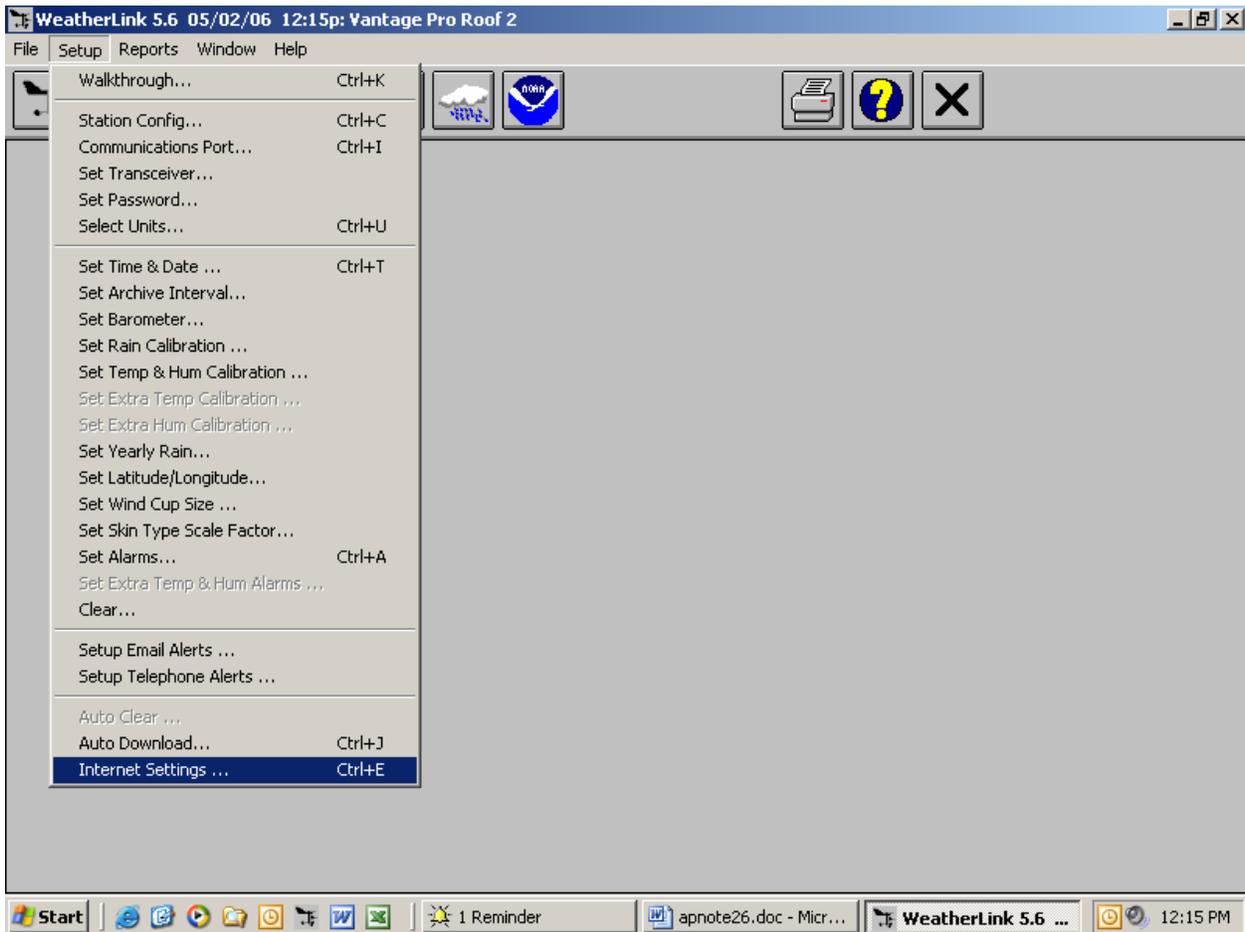
## SETTING UP WEATHERLINK

To avoid interruptions in your day to day computing, it is best to have a dedicated stand-alone system and a router (which allows multiple computers to access the Internet). The router will allow multiple computers to access the Internet as needed. WeatherLink will work just fine on any compatible system, but will periodically interrupt your activities to inform you of its Internet upload activities. You will need a version of WeatherLink for Windows 5.1 or later and a Windows 95 PC or later or WeatherLink for Mac OSX and a Vantage Pro2, Vantage Pro, Weather Monitor II, Weather Wizard III, or Perception station. Consult your particular WeatherLink product for any other specific computer requirements.

Follow the installation instructions to install WeatherLink on your computer (if it isn't already installed). Use the Walkthrough feature on the Setup menu to setup your weather station on your computer. After those steps are completed, you are ready to start setting up the software to send updated weather information to your personal weather website.



Select Internet Settings on the Setup menu (at the bottom of the menu),



and then push the Internet Connection Settings button.

**Internet Settings**

Internet Connection Summary

Internet Transfer Enabled:  Internet logon:  FTP host:

Local Transfer Enabled:  Connection Type:  FTP logon:

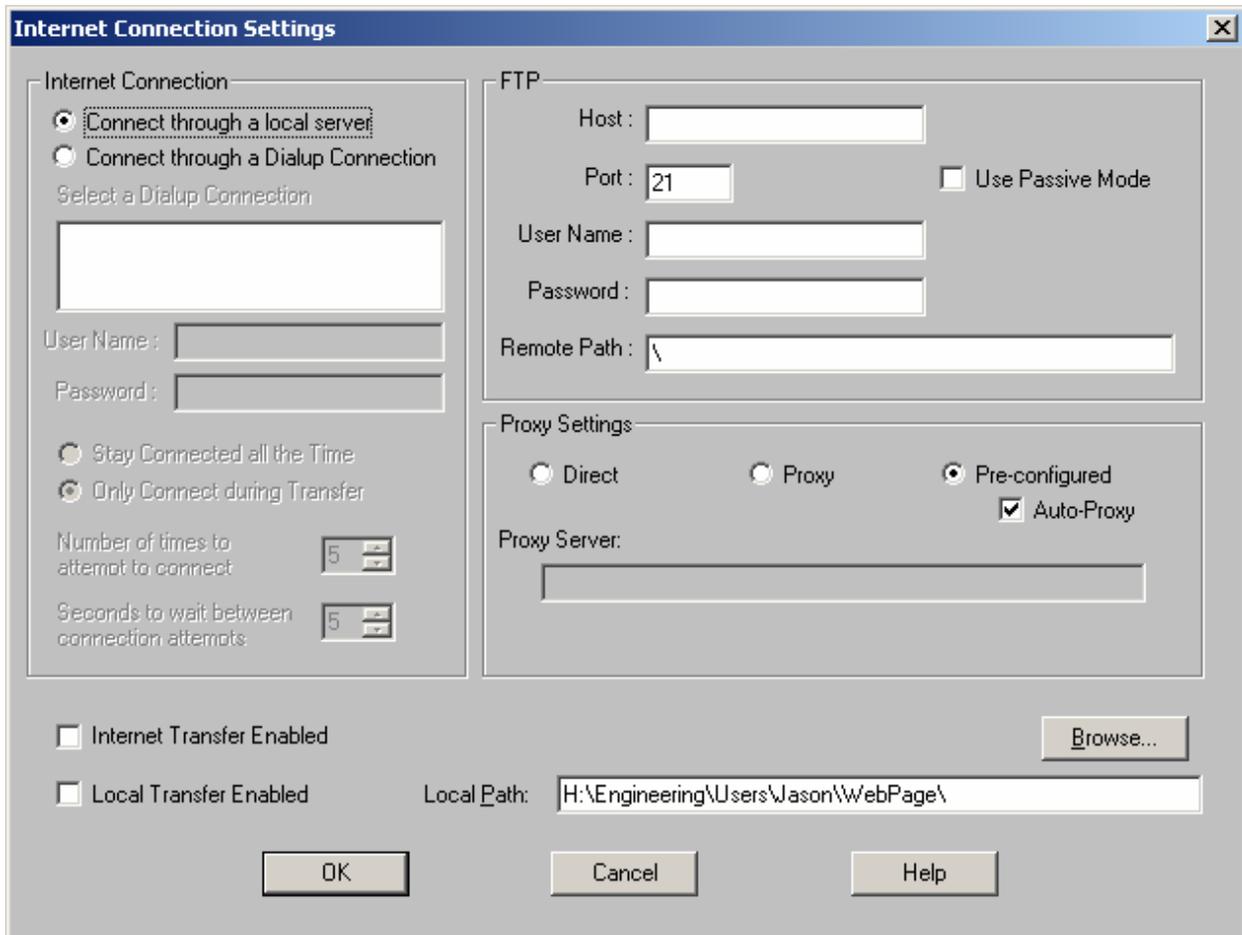
FTP Path:  Proxy Server:

Local Path:

Data Upload Summary

	Profile 1	Profile 2	Profile 3	Profile 4	Profile 5	Profile 6	Profile 7	Profile 8
Offset Time:	<input type="text" value="..."/>	<input type="text" value="..."/>	<input type="text" value="..."/>	<input type="text" value="..."/>	<input type="text" value="..."/>	<input type="text" value="..."/>	<input type="text" value="..."/>	<input type="text" value="..."/>
Upload Frequency	<input type="text" value="1 min."/>	<input type="text" value="..."/>						
Automatically download before Internet upload	<input type="text" value="Yes"/>	<input type="text" value="..."/>						
Number of Template Files to transfer	<input type="text" value="3"/>	<input type="text" value="0"/>						
Number of Reports to transfer	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0"/>
Number of Current Data Images to transfer	<input type="text" value="26"/>	<input type="text" value="0"/>						
Number of Historical Data Images to transfer	<input type="text" value="31"/>	<input type="text" value="0"/>						

First indicate whether you connect to the Internet using a dialup connection or not. Select the “Connect through a Dialup Connection” for dialup, otherwise select the “Connect through a local server”. If you have a Dialup connection, your connection should be listed in the box below. If not, you may need to setup one. You will still need to enter your username and password for your Internet connection. AOL users must use the “local server” selection and manually connect or sign-on to AOL before attempting a web page upload. The reason for this is “The Internet-connected machines at AOL do not have access back to the systems where the membership data is kept, so there is currently no way to verify login/password information on external connects.”



If you have dialup service, choose whether you want to “Stay Connected all the Time” to the Internet or whether you want WeatherLink to “Only Connect during Transfer”. If you do not have a second phone line, you should select “Only Connect During Transfer”. You will need the phone line open for phone calls when not in use. You can alter the settings for connection attempts if you wish. Unless you experience issues with your connection, these settings should be fine.

Next, enter your FTP information unless you are transferring data to local hard drive. A local hard drive is a letter drive accessible from your computer. You will need to get FTP information from your ISP. The host is a domain name such as [www.davisnet.com](http://www.davisnet.com) or a series of numbers with dots in-between (Internet Protocol address). The host is sometimes different from your ISP domain address. For AOL users, the FTP host is “members.aol.com”. The FTP port number is usually 21 and is the default setting. Enter a user name and password, if required, to FTP. These may be different than those used to connect to your ISP. AOL users will need use the user name ANONYMOUS and the password is your AOL e-mail address: [“screen-name”@aol.com](mailto:screen-name@aol.com) for the FTP settings. Enter a remote path or subdirectory where you want the data files to be transferred if desired. If you plan to only have one web page on your website, you don’t need a remote path or subdirectory.

Proxy settings of “Pre-Configured” and “Auto-Proxy” are generally the correct choice for most ISPs. Use these settings unless the pre-configured setting is not working for you. The “Proxy” should be used if you will be using a different proxy server for uploading data than you use for

browsing the Internet or checking e-mail. (This is not common). "Direct" is when you know that you do not need to use a proxy server (when you are connected directly to the server through a LAN or WeatherLink is running on the server).

If you have Local Transfer (to a local hard drive) enabled, you will need to enter a file path name or use the Browse button to select a location. It is recommend to test uploading to a local hard drive first before attempting to upload to your website. This way, you may determine whether any problems you encounter are due to the upload information or the Internet Connection setup.

## **CHOOSING YOUR PREFERRED TYPE OF WEB PAGE**

WeatherLink provides sample template files that you can use without having to design your own web pages. We provide you samples that will match your station type. WeatherLink provides detailed instructions on how to select and setup any of the sample templates for your web page. Under the Help file Index, type or search for "Sample Templates" or look under "Sample HTML Templates". The sample templates come in three basic flavors:

- "Weather Summary" (Current conditions text only)
- "Current". Current conditions with text , graphics, and historical information in a Java applet "ticker"
- "History". Historical data with text. graphics, and current conditions in a Java applet "ticker"

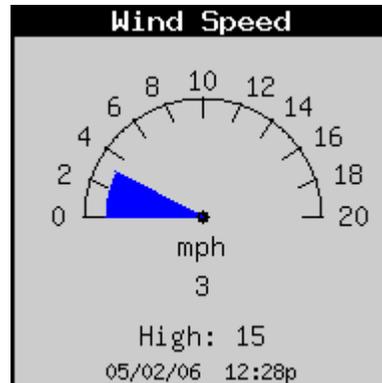
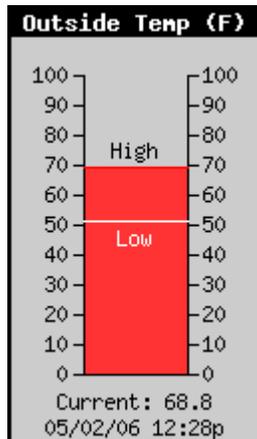
If one of these pages is all the content you want on your website, you can name the template file "index.htx" and your website address will take visitors directly to that page. Otherwise, use this as your main page. You may name it index.htm if it does not contain weather data tags.

However, you may design your own web pages as well. WeatherLink provides several style elements that can be utilized in the design of your web page:

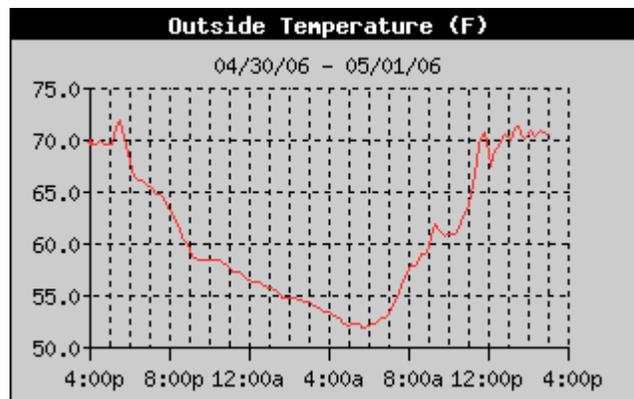
- Current and Historical text
- Current data graphics
- Historical data graphics
- Reports
- Java applet "ticker"

WeatherLink uses what are called "weather tags" or place holders for weather data. These are called "comment tags" in HTML syntax: <!--outsideTemp-->. The software parses through a template file with the default extension \*.htx and replaces these tags with actual weather data before uploading the web page to its destination site. From that, WeatherLink creates an \*.htm page with actual weather data values on it. These can either be current conditions or highs and lows (daily in the Vantage Pro, high/low from the console display for the Monitor, Wizard, or Perception)

WeatherLink uses a \*.gif file format to generate graphics representing current data conditions. WeatherLink generates a bar graph with current data value and the current time as of upload and the option to show a low and/or high. The wind graphics use a dial format.



WeatherLink also uses \*.gif to generate history graphics. These are graphs of history weather data. You pick the plot span of choice in the Profile options.



These images are created by the WeatherLink software at the time of upload and placed at your destination web page location. Thus, these images exist only at the destination location.

Reports: WeatherLink also allows you to upload text reports. The choices of upload to your website are NOAA summaries, or text listing of weather records for the past 2 days or the past week. Additionally, you may provide your weather data to the Citizen Weather Observer Program (CWOP) or Weather Underground. Please note that none of the Reports are part of the Sample Templates. You will need to configure them manually if you want to use them.

Depending upon your version of WeatherLink, to upload to Weather Underground, you may need to get a software plug-in from Weather Underground and it may appear as a separate feature item on the Setup menu. To utilize this as a separate feature item, you will need to consult their documentation or website for details: <http://www.wunderground.com>. Otherwise, the feature is documented in the WeatherLink Help file.

The CWOP captures the data that is sent by the APRS feature for use in improving NOAA's forecast models. You will need to sign up before sending your data. This process gives you a

“call sign” which is a unique identifier for your weather station. Details on this are provided in the WeatherLink software Help file and at the following website: <http://www.wxqa.com>

Java Applet “Ticker”: We include a Java applet called “davisticker.class” that will show you a text string in a “ticker” format. The Sample History template is designed so that the applet gets its data from a separate data file. You may configure your own custom web page to do the same or you may embed the text weather data within the java code itself. The following website includes instructions on how to specialize the ticker to your own preferences: <http://www.davisnet.com/support/weather/davisticker.asp>

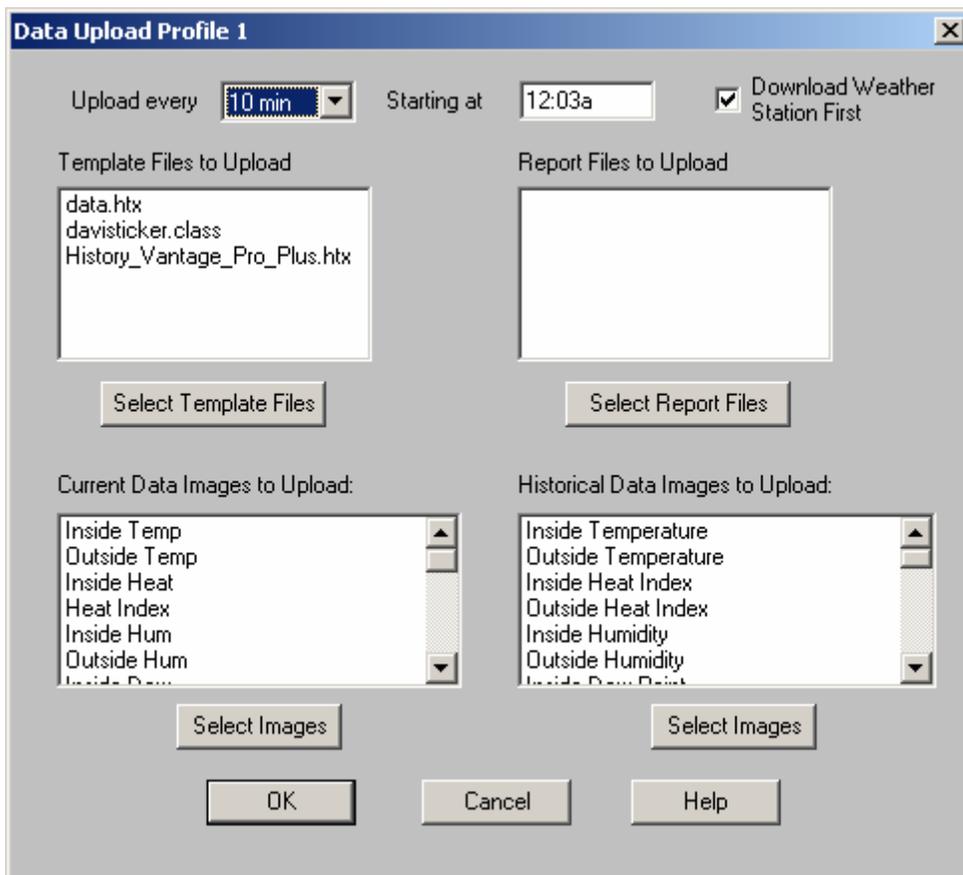
## SETTING UP YOUR CUSTOM WEB PAGE

WeatherLink provides a number of Profiles to give you flexibility in the timing of updating data. Depending upon the data presented on your website, you may want to update some data less often than other data. For example, you may want to update your current data every 10 minutes, but update your reports twice a day. The APRS report may be an exception to this. NOAA retrieves the data every 15 minutes. Sending APRS data any more often than this will not benefit NOAA.

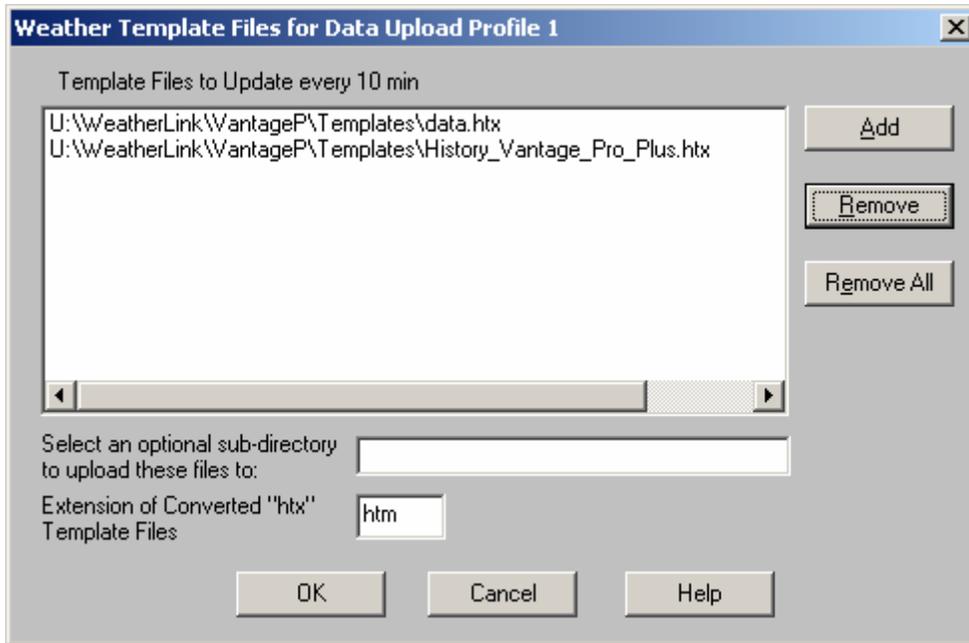
To configure a particular profile, select one of the Configure buttons on the main Internet Settings dialog box at the bottom.

	Profile 1	Profile 2	Profile 3	Profile 4	Profile 5	Profile 6	Profile 7	Profile 8
Offset Time:	...	...	...	...	...	...	...	...
Upload Frequency	1 min.	...	...	...	...	...	...	...
Automatically download before Internet upload	Yes	...	...	...	...	...	...	...
Number of Template Files to transfer	3	0	0	0	0	0	0	0
Number of Reports to transfer	0	0	0	0	0	0	0	0
Number of Current Data Images to transfer	26	0	0	0	0	0	0	0
Number of Historical Data Images to transfer	31	0	0	0	0	0	0	0

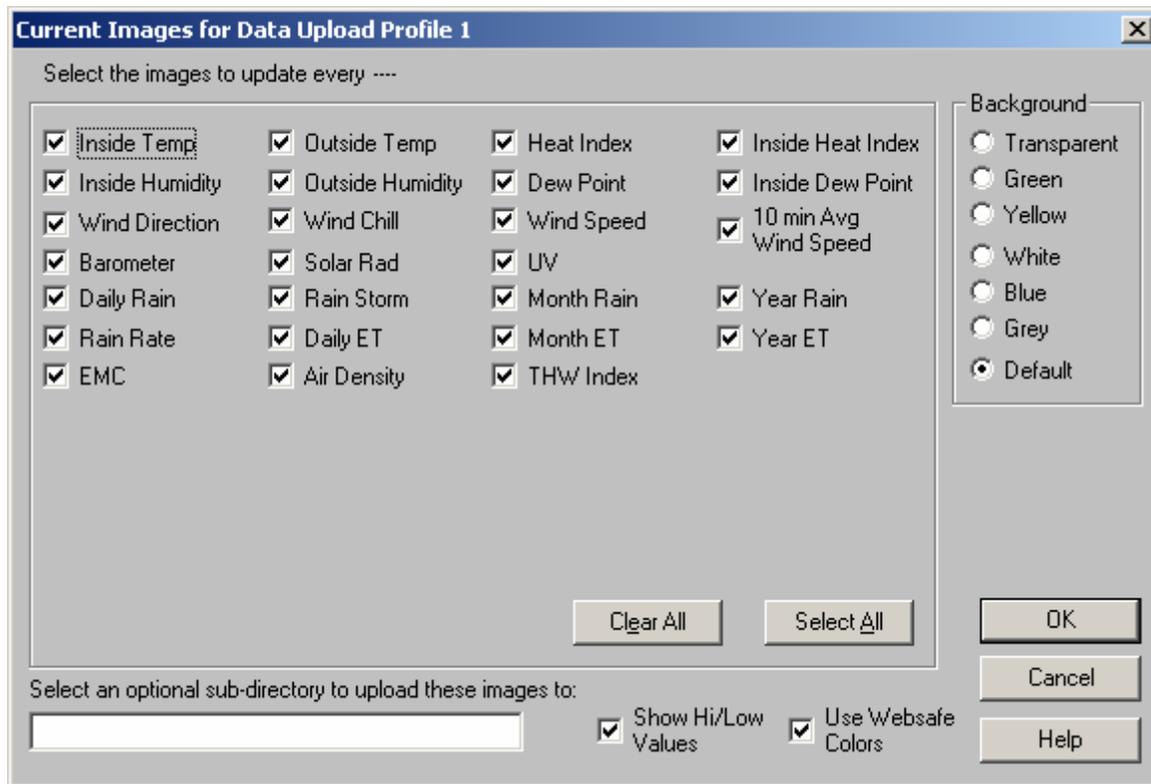
Each dialog box lets you select what you want to update. Choose the Upload Interval to indicate how often you want to update your web page data. Select “Download Weather Station First” if you are uploading Historical data or a report to ensure the most up to date data is uploaded. For web pages that contain current data, choose an Upload Interval that balances the need to have updated data with the need to conserve bandwidth or computer resources. 10 minutes is generally a good interval for most people, particularly if you have a high speed connection. You may want a slower interval, like 1 hour, if you have dialup, particularly if you don’t have a second dedicated phone line for Internet access. For updating reports, twice a day is a good upload interval. An interval of 1 minute should *only* be used if you are transferring data directly to a server (“direct” FTP) or a local hard drive. For testing purposes, temporarily set the “Starting at” time to 2 minutes later than the current time to force an upload. You may leave the Upload Interval set to the value you normally have set. Note that due to finite bandwidth, ISPs have limits on how much data you can transfer at any given time.



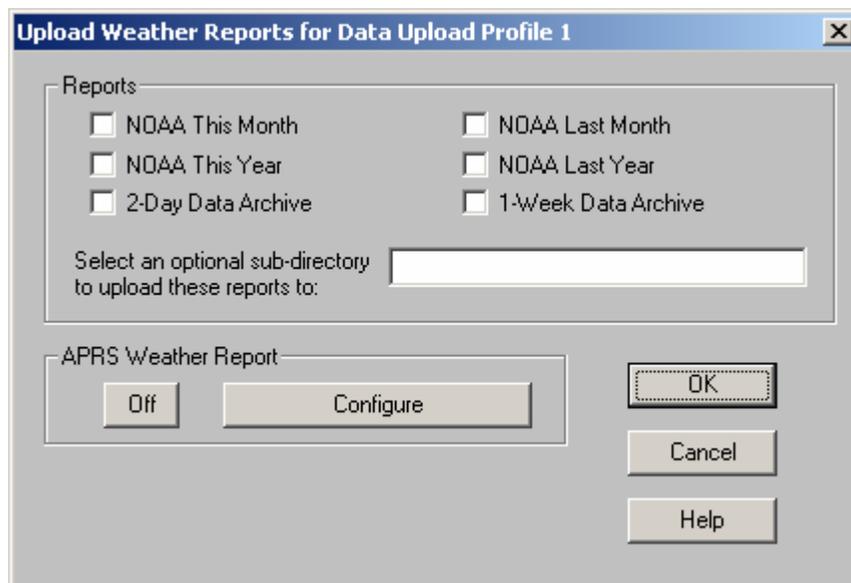
If your web pages contain weather data “tags”, select the “Select Templates Files” button to tell WeatherLink where you’re template files are located. You will need to do this whenever you have text weather data on your web page that needs to be updated regularly. It is recommended that you store these files in the Templates folder of your station folder.



If the pages contain Current or History Data image \*.gifs, be sure to indicate which \*.gifs your web page will need.



If you plan to update reports as often as you update your web pages, then select the reports you want to update. Otherwise, select another Profile, and choose the Reports feature to active one or more of the reports. Use the Upload Interval to determine how often to update the reports. As stated earlier, you may want to select another Profile to activate your APRS weather report to specifically update every 15 minutes.



## **TESTING YOUR WEB PAGE**

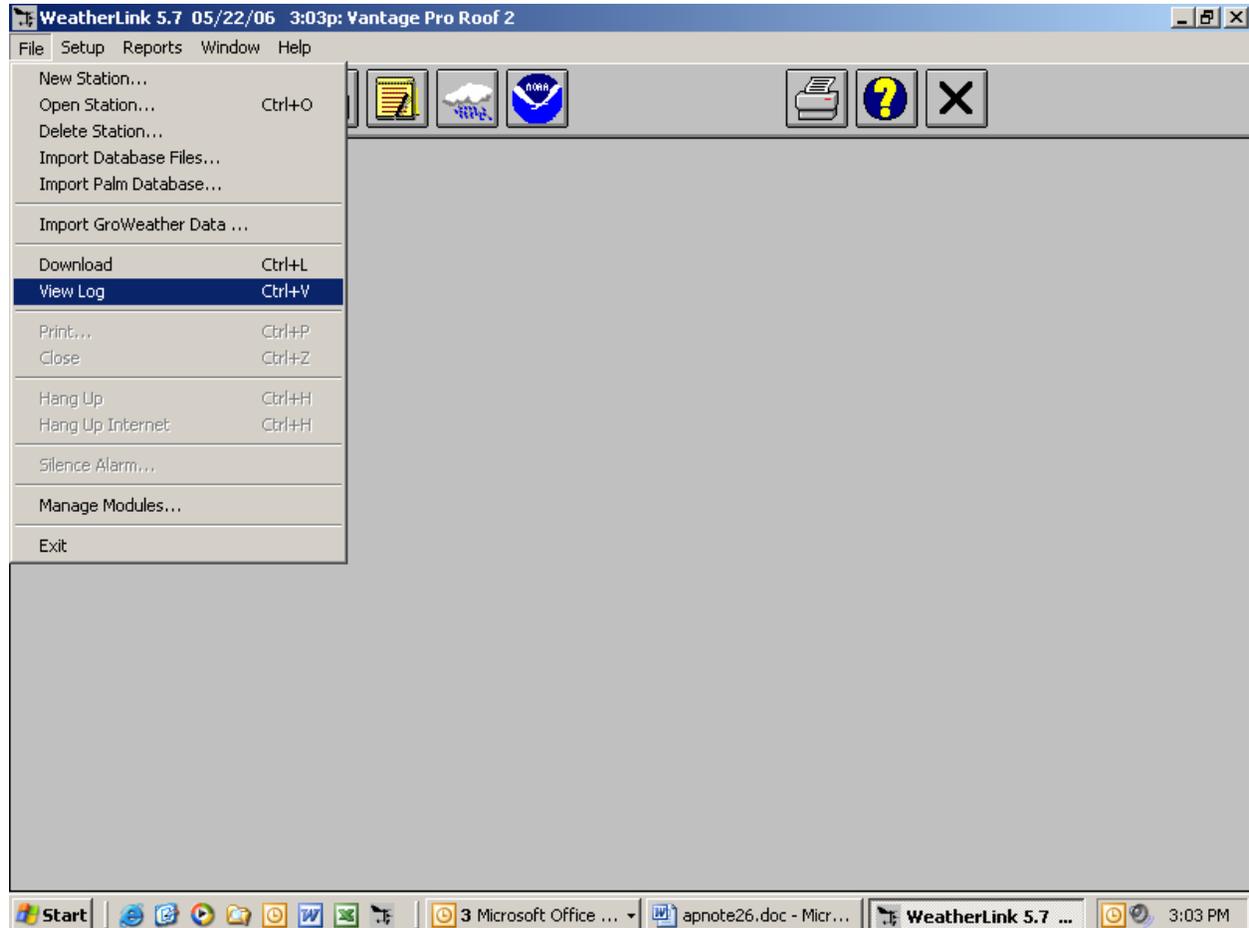
First, configure your web page to transfer to a location on a local hard drive (any file location you can access using a letter drive) to ensure that the web page is being properly created. Be sure to enable your "Local Transfer" by selecting the button on the main Internet Settings or checking the check box on the Internet Connection Settings dialog box.

Note that only Current and History images files and web template files need to be uploaded each time. Other files such as the Davis logo or the davisticker need only be uploaded to your FTP site once. Once these are confirmed to have successfully transferred to your website, you remove these files from the upload list. If you are only transferring files to a local drive, you can simply copy these other files to the destination location without using the automated WeatherLink mechanism. AOL does not support file names that have spaces in them, so you will need to rename the "Davis Logo.gif" file either "Davis\_Logo.gif" or DavisLogo.gif.

If the local drive transfer is successful, next try to transfer to your FTP site (if you have one). Be sure to enable your "Internet Transfer" by selecting the button on the main Internet Settings or checking the check box on the Internet Connection Settings dialog box. AOL users will need to be signed-on to AOL to FTP files to their AOL web page.

## TROUBLESHOOTING

WeatherLink keeps track of the success of each Internet upload in its “Log” file. Generally, this can be used as a helpful tool to diagnose any upload problems you may have. Select “View Log” from the File menu to see the log file.



If you can successfully create and transfer web pages to a local drive, but you cannot successfully FTP to your website, then your FTP settings may not be configured correctly, or there may be technical problems at your FTP site.

If you have problems creating a web page on your local drive, then check your Profile settings to ensure that you are uploading enough information (files) to properly generate a web page:

If you have missing weather data text in your web page, check to make sure that the web page is selected as a template for upload. Dashes indicate proper data encoding, but missing data being reported by your weather station. Check your weather station documentation for troubleshooting this problem.

If you are missing a Current or History image, then check to make sure that these images are selected under the “Select Images” dialog box. These images must be checked here for them to be generated. It may be simpler to use the “Select All” option when troubleshooting the upload of an image. In normal practice, only the images used on the web page should be

selected to reduce upload time and minimize bandwidth issues, particularly with a dialup connection. These images are created by the WeatherLink program and transferred to your FTP or local transfer site. These images will not appear in your station's Templates folder. Be sure you are looking at the web page at the final destination before deciding if your images uploaded correctly.

If you are using a History image, select "Download Weather Station First" to make sure the history graph is filled out with the latest data. Also, if you have no data at all, the images will not be created.

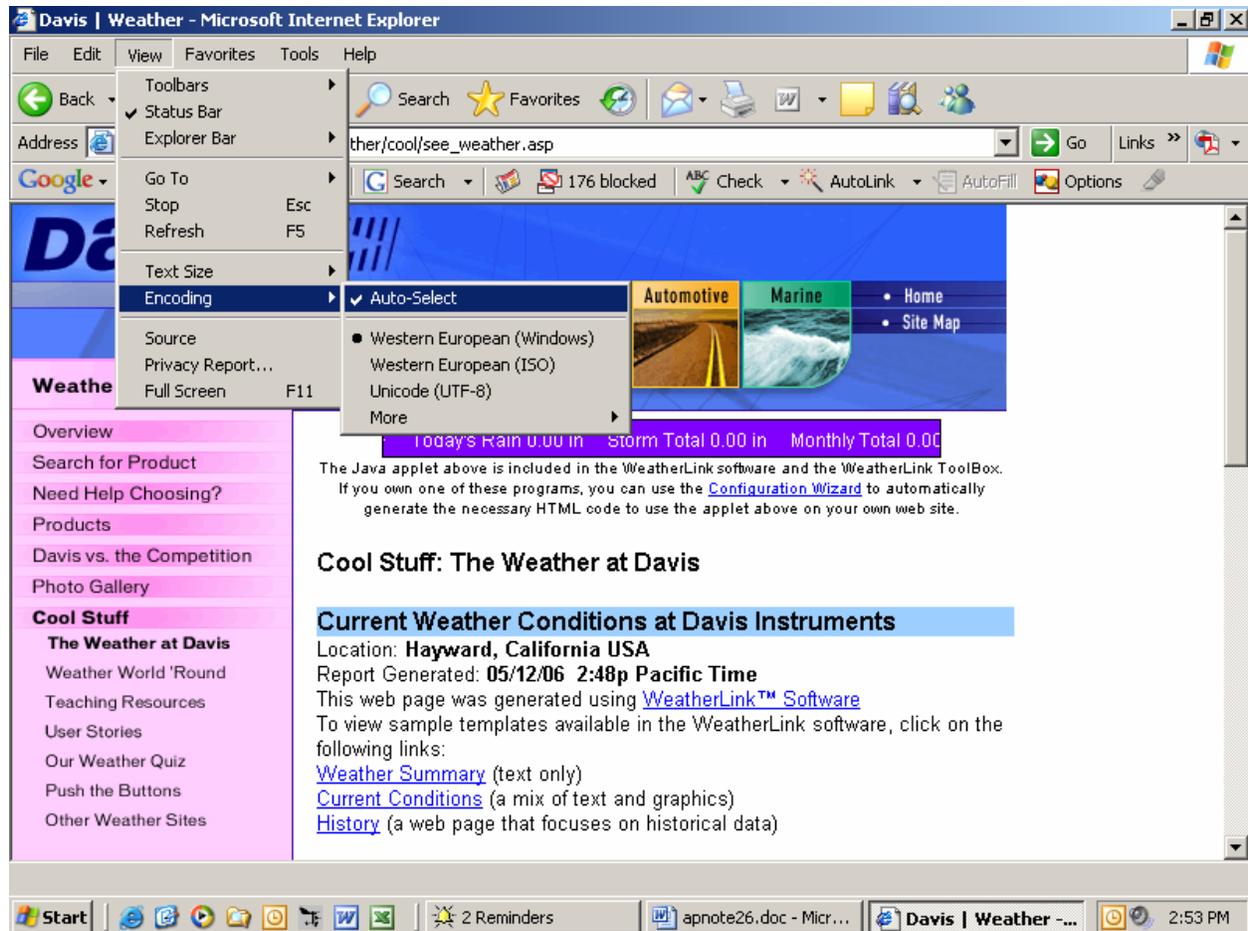
If you are missing a Report, check to make sure that it is selected in the Select Reports dialog box. You may want to test these separately from your other web page elements when initially testing.

If you are using a java applet such as the "davisticker.class" file, be sure this file resides at the destination location. If your applet does not appear on your web page, this may explain why. If the applet appears, but is missing data, check to make sure that this data file is selected for upload as a template file. Also note that there is a 200 character buffer limit for the Java ticker applet. If the 200 character limit falls within a tag then the software will not recognize it as a tag and just display it as text. To fix this do a <cr> right before the Tag.

If you are attempting to use one of the Sample Templates, you will find the various selections under the Sample Templates folder in the WeatherLink folder. The selection you choose should be copied from this folder to the Templates folder under your particular station folder.

If you are attempting to upload your own custom web page, and the data does not appear correctly, try uploading a sample template. If the sample template uploads correctly, you may want to check your HTML code for errors. Remember, WeatherLink uses the comment tag syntax as place holders for inserting current weather data.

WeatherLink uses a degree symbol for temperature units and a superscript 2 for the solar radiation units. These may not appear properly depending upon your web browser text encoding settings. You should use an Auto-Select setting, if available. In Windows' Internet Explorer, this setting is accessible under Encoding under the View menu.



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## with WeatherLink® for Windows® Serial Version Only

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### INTRODUCTION

This document provides guidelines on how to set up a remote modem connection. This type of connection allows you to setup your weather station in a remote location and receive data at a more convenient location. AC power and a phone line are required at the weather station site. If you have a Vantage Pro2™, you may want to consider using a repeater (see Application Note 25 for Vantage Pro2 repeaters) if you lack either AC power or a phone line and the distance you want to send data is under 14.4 miles (23.3 km).

This application details the use of a “landline” modem (a modem attached to a telephone line). Setting up a link using a cellular modem is similar. However, you will have to read the manual for your cell modem carefully, and adjust the set up commands in this application note to those required for your modem. You must also have “circuit switched service” activated on your cellular account to make the modem connection work. Unfortunately, some US cellular providers no longer provide this service.

The information in this application note is a supplement to the instructions in the WeatherLink Getting Started Guide. Please consult it (especially the "Remote Connections" sections) for additional information about setting up and using your weather station.

### EQUIPMENT NEEDED

There is a lot to consider when connecting one of our weather stations to a remote modem. You should be aware that there are compatibility issues between different modems. This is not a turnkey system and some degree of effort is required. In recent years, modem manufacturers have put many commands in software “drivers” that automatically configure the modem. These are usually optimized for Internet dialup applications. Some of these settings will hinder the ability to communicate with a Davis weather station. A suggested example is provided in the “Turnkey Remote Modem Solution” of using a 56k US Robotics modem.

A remote modem connection requires two modems. One modem will be used as the remote modem connected to the station and must be an external modem. The other modem will be connected to the computer often referred to as the originating modem. Do not use a USB modem at the remote end because it will not work with our WeatherLink USB product. This is due to USB protocol design constraints.

For the originating modem, most computers today come with an internal modem already installed. If for some reason your computer does not already have a modem installed, you will likely need to purchase a second modem to connect to your computer (which may be external or internal to the computer). Internal modems plug directly into a slot inside your computer. External modems may require you to buy a separate cable connection to your computer (not sold by Davis Instruments). Should you choose to buy an internal modem, check with your computer manufacturer to determine which internal modems are compatible with your computer.

For the remote modem, you will need a serial modem and a Davis modem adapter. For a Vantage Pro® or Vantage Pro2 station you would need part number 6533...

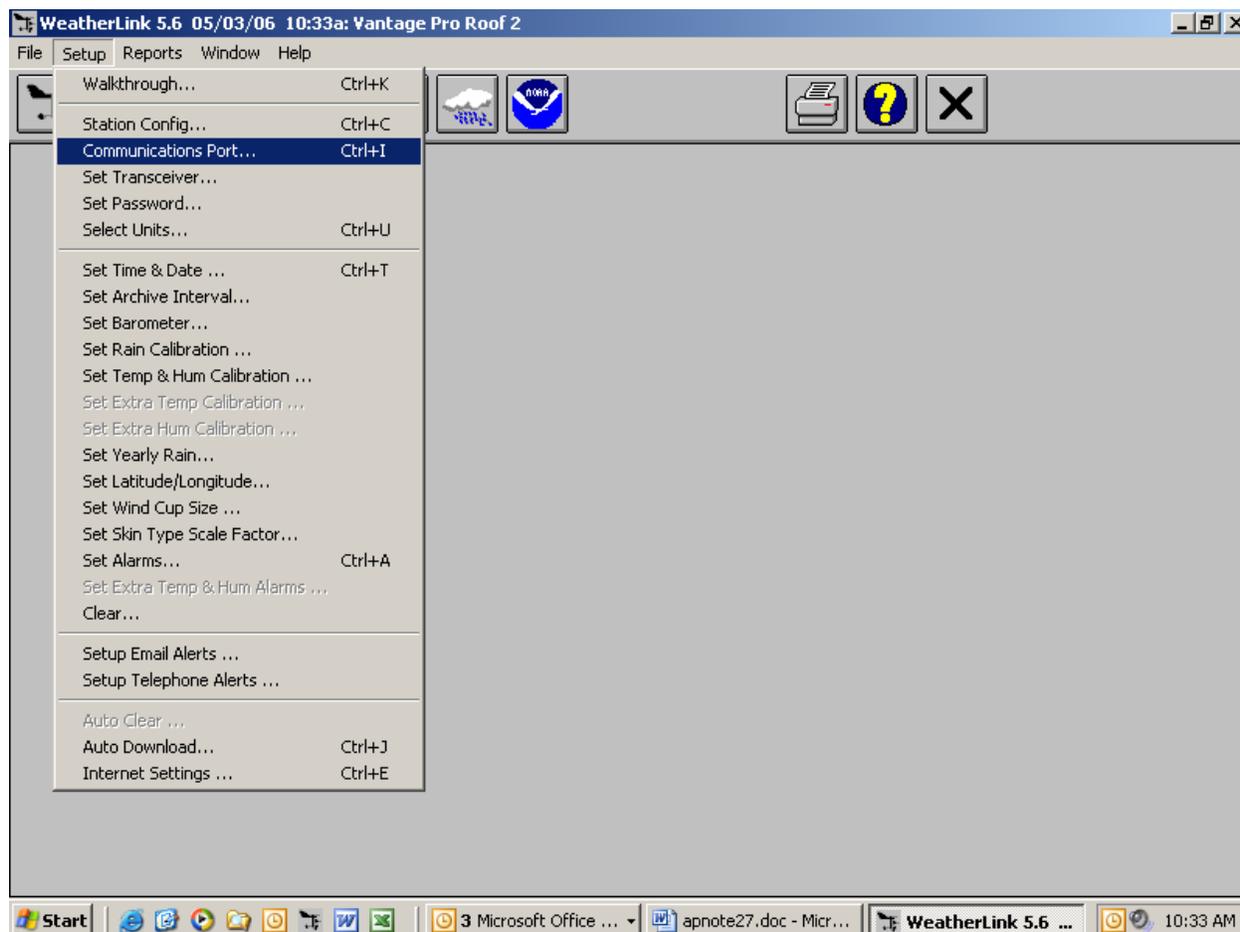
[http://www.davisnet.com/weather/products/weather\\_product.asp?pnum=6533](http://www.davisnet.com/weather/products/weather_product.asp?pnum=6533)

For our older stations you would need part number 7870...

[http://www.davisnet.com/weather/products/weather\\_product.asp?pnum=7870](http://www.davisnet.com/weather/products/weather_product.asp?pnum=7870)

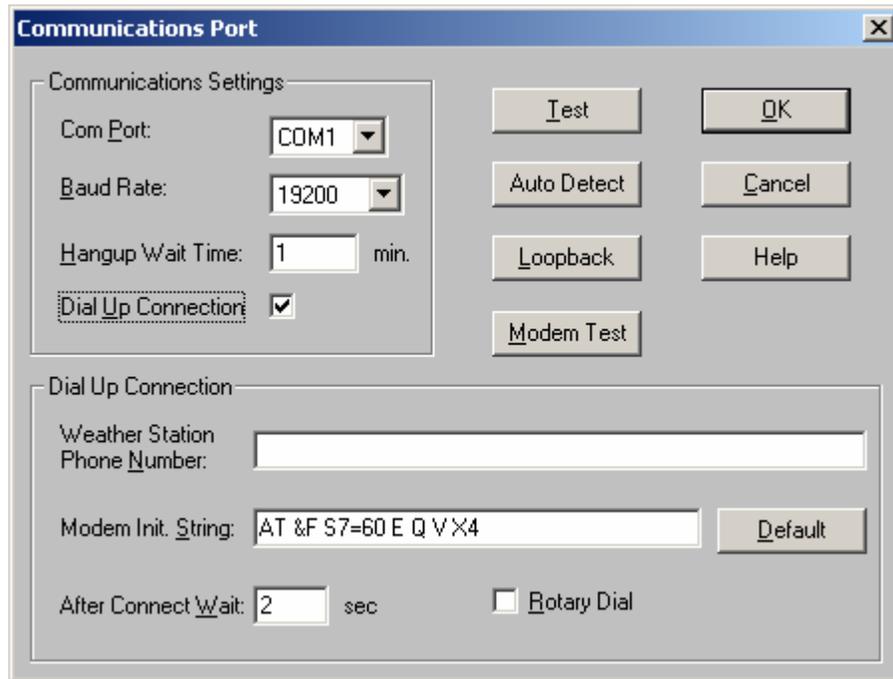
## SETTING UP WEATHERLINK AND THE ORIGINATING MODEM

Start by connecting the weather station directly to the PC as described in the WeatherLink Getting Started Guide. Under the Setup Menu is the Communications Port feature that allows you to test the connection to the weather station (whether direct or via remote modem). Run WeatherLink and verify that the weather station is working.



If a direct connection is successful, setup the connection for communication via the modem. If possible, test the connection to your weather station at a more convenient location before attempting to test and configure the modem at the remote location. You will need to check "Dial Up Connection" for the modem connection. Be sure and select the correct COM port that the modem on your computer is connected to (whether physical or virtual, in the case of a USB modem) and enter the phone number of the phone line the remote modem is connected to at the weather station end. You should use the Modem Test button to test the functioning of your modem. If the Modem Test is successful, use the Test button to test the connection to your

remote weather station once you have the remote modem properly configured. More detailed information can be found in the WeatherLink Help files.



## SETTING UP THE REMOTE MODEM

If you have access to a second phone line at the PC location, you can test the remote modem and weather station before permanently installing the weather station and modem in the remote location. Otherwise, you will need to bring a laptop to the remote site. Connect the remote modem to the other phone line (whether local or remote), connect the station to the modem, and power on the modem. Follow the instructions below to configure the modems using the instructions in the appropriate Getting Started Guide for your weather station model. For Vantage Pro and Vantage Pro2 system consoles, be sure to follow the step of checking the Baud Rate Settings. For Weather Monitor II, Weather Wizard III, and Perception II stations, be sure to repower the unit. This sends an initialization string that configures the modem to work with the weather station: "ATS0=4 E0 Q1 &W". The console's "AT" initialization string sets 3 values: "S0=4" - answer after 4 rings, "E0" - do not echo modem commands back to the PC, and "Q1" - quiet (no result codes) mode enabled. All other settings will remain unchanged and all settings are saved with the "&W" command. The last three settings are most critical. You will need to manually enter configuration settings when the default values on the modem for any other parameter besides S0, E, or Q need to be changed in order to work with the weather station. This setting can be useful in determining whether the modem received the commands you set it. Both WeatherLink and the weather stations want NO echo and NO result codes in normal operation. If you have an Envoy, you will need to follow the advanced settings procedure below.

## TURNKEY REMOTE MODEM SOLUTION

### EQUIPMENT NEEDED

One possible solution for implementing a remote modem connection would be to use two external US Robotics *serial* modems. One modem would connect to the station while the other modem would connect externally to your computer. The idea of using an external modem as the originating modem eliminates the guesswork with configuring your existing internal modem.

US Robotics *serial* modems can be purchased at the following website:  
<http://www.usr.com/products/home/home-product.asp?sku=USR5686E>

You will need a serial port to connect this modem to your computer. If your computer only has a USB port, you can add a serial port using a USB to serial adapter. USB to serial adapters are sold by many electronic outlets. Davis Instruments sells a USB to serial adapter (part number 8434). [http://davisnet/drive/products/drive\\_product.asp?pnum=08434](http://davisnet/drive/products/drive_product.asp?pnum=08434) . You would also need to purchase a serial cable to allow connection between the modem and the computer's serial port (not sold by Davis Instruments).

### SETUP

The configuration switches for for the originating modem (the modem connected to your computer) can remain in the out of the box, default position (switches 3, 5 and 8 down). Note some external modems use physical hardware switches.

The remote or answering modem (the one that will connect directly to the weather station) will require configuring the modem before connecting it to the station. To do this, you first need to configure the switches on the modem. Make sure the modem is set for SMART MODE and NO ECHO. On a US Robotics modem this would mean that switches 4 and 8 are set in the down position and all other switches set in the up position. The complete settings should be...

Data terminal ready normal  
Verbal result codes  
Suppress result codes  
No echo offline commands  
Auto answer on first ring or higher if specified in NVRAM  
Carrier detect normal  
Load NVRAM defaults  
Smart Mode

Open Hyperterminal or any other terminal communication software. Details on the location and use of Hyperterminal follow this section. You also will need to write to one of the S registers (internal registers of the modem used to configure the modem) to complete the configuration. Send the following AT string to the modem (AT &F0 S41=255 &W0). The &F0 resets to factory defaults (US Robotics switches may override this command). The S41=255 is necessary to enable remote access. The &W0 saves configuration settings in memory. After this command is sent you can verify the settings by using the command AT I5. The resulting display should look similar to the one shown below: However, displays may vary.

```
AT I5
U.S. Robotics 56K FAX EXT NVRAM Settings...
```

```
Template Y0
```

```
DIAL=TONE B0 F1 M1 X1
BAUD=19200 PARITY=N WORDLEN=8
```

```
&A1 &B0 &G0 &H0 &I0 &K1 &M4 &N0
&P0 &R1 &S0 &T5 &U0 &Y1
```

```
S00=001 S02=043 S03=013 S04=010 S05=008 S06=004 S07=060
S08=002 S09=006 S10=014 S11=070 S12=050 S13=000 S15=000
S19=000 S21=010 S22=017 S23=019 S25=005 S27=000 S28=008
S29=020 S30=000 S31=128 S32=002 S33=000 S34=000 S35=000
S36=014 S38=000 S39=000 S40=001 S41=255 S42=000
```

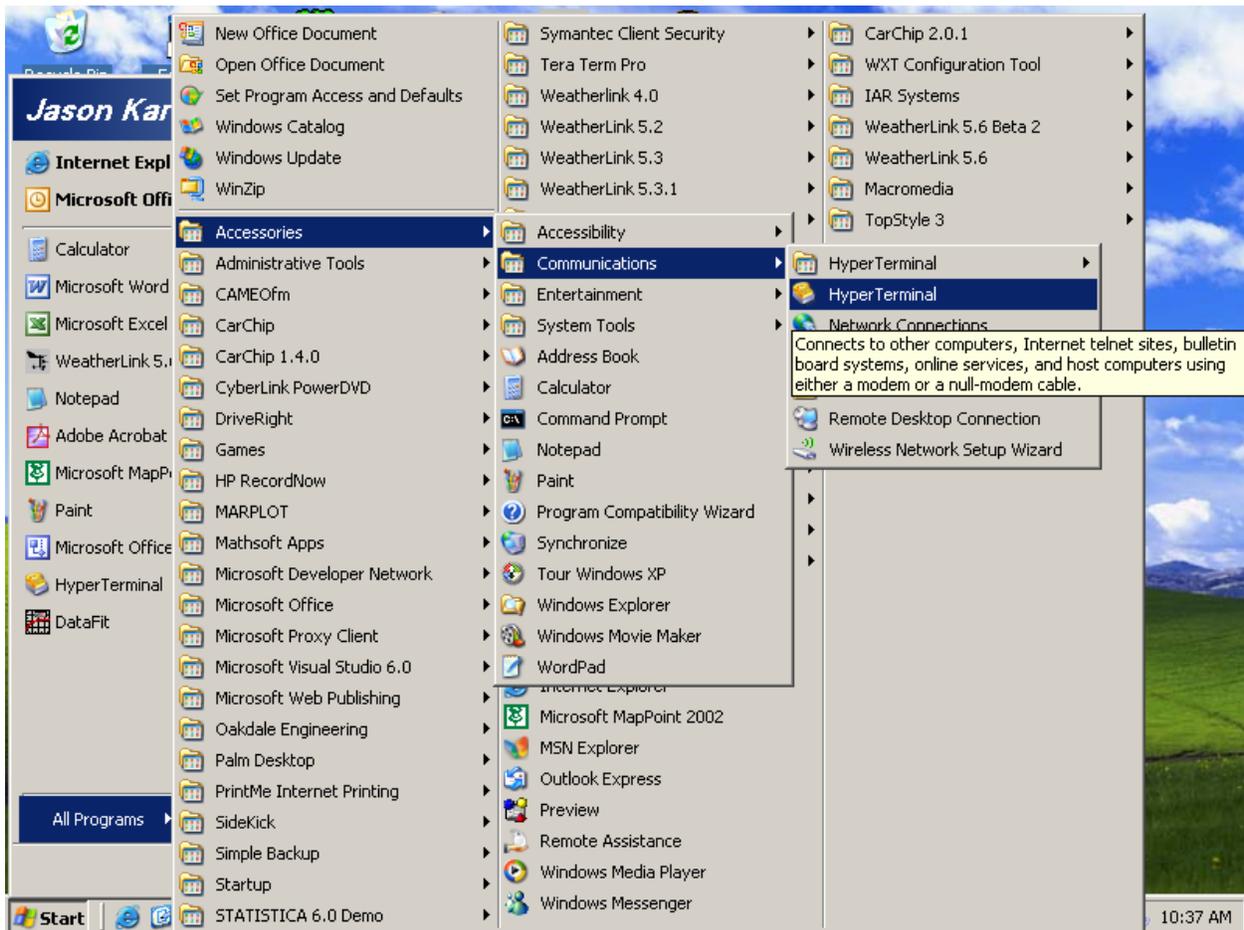
Note: In the command AT I5 that the character before the 5 is the letter I and (not the number 1).

## **USING HYPERTERMINAL**

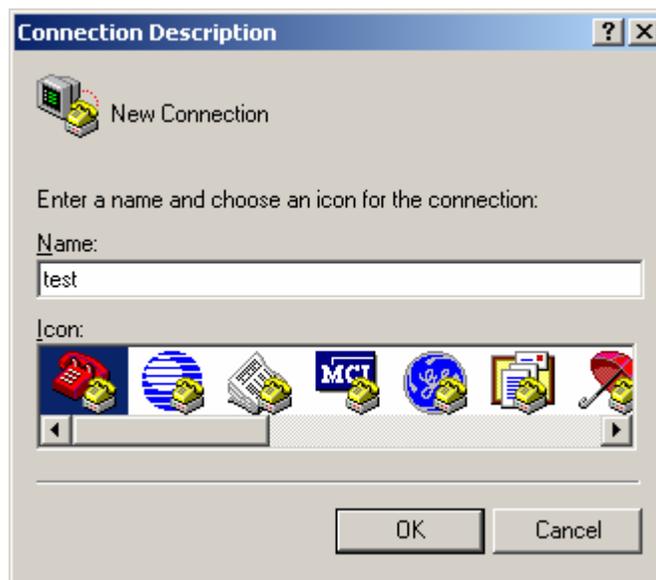
If you are unfamiliar with using HyperTerminal (which comes as part of the Windows Operating System), here are some notes on how to use Hyperterminal...

- 1) Connect the external modem to a com port of your computer using a serial cable.

2) Open HyperTerminal (Usually under Accessories in the Program Menus of the Start Menu).



3) In the CONNECTION DESCRIPTION dialog box enter a name for your connection then click OK. For example, enter the name "test".

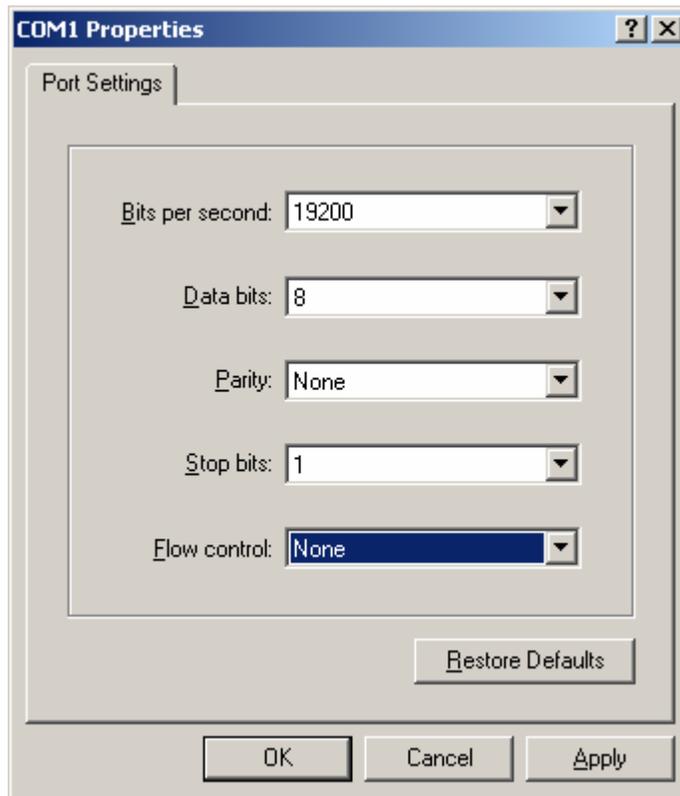


- 4) In the CONNECT TO dialog box select the com port you will be using by selecting from the options in the CONNECT USING dropdown menu. Click OK.

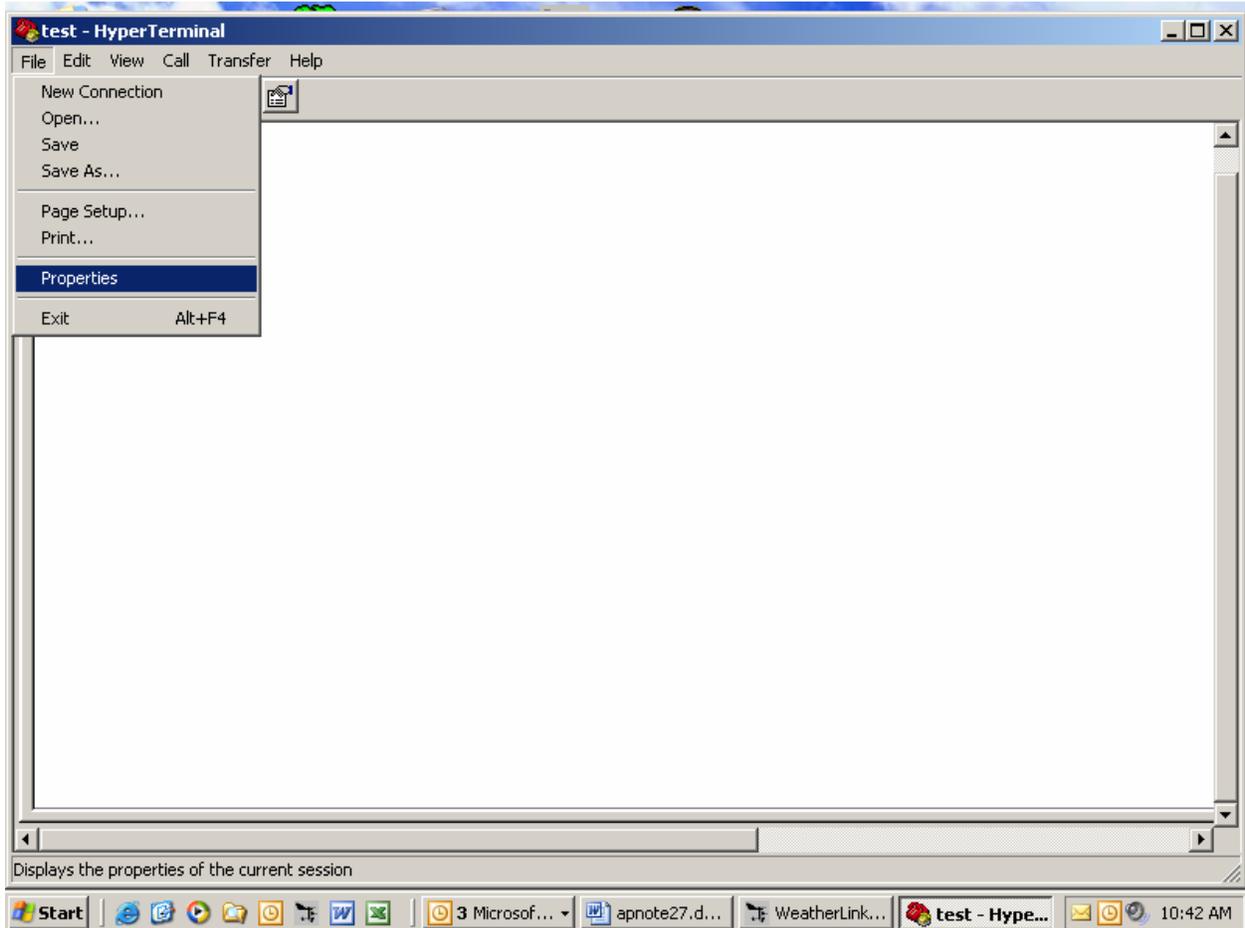


5) Under the properties dialog box select...

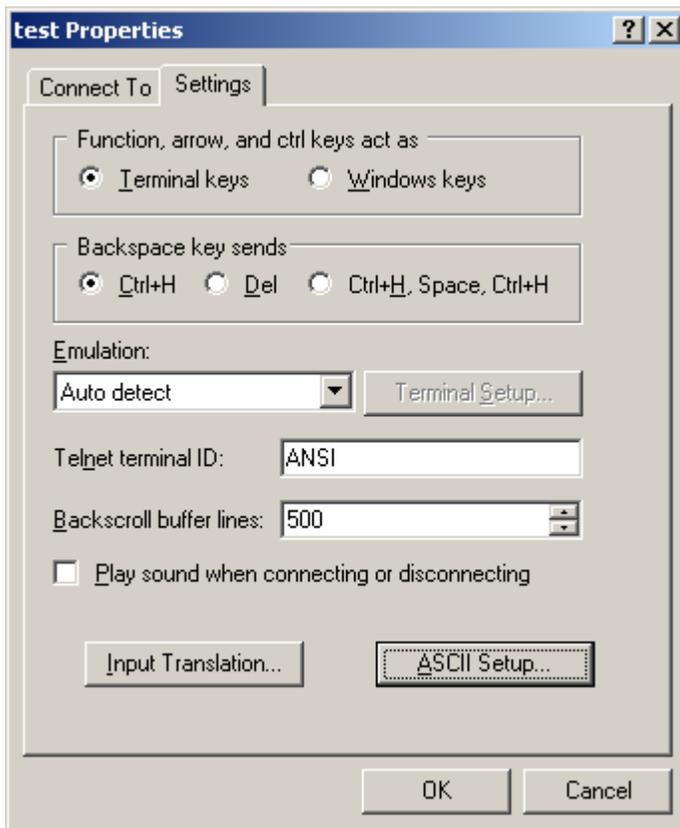
bits per second        19200 (can be any baud rate, but be sure to select the one the weather station will be set to. Weather Monitor II, Wizard III and Perception II stations have a max baud rate of 2400)  
data bits                8  
parity                    none  
stop bits                1  
flow control            none  
and then Click OK



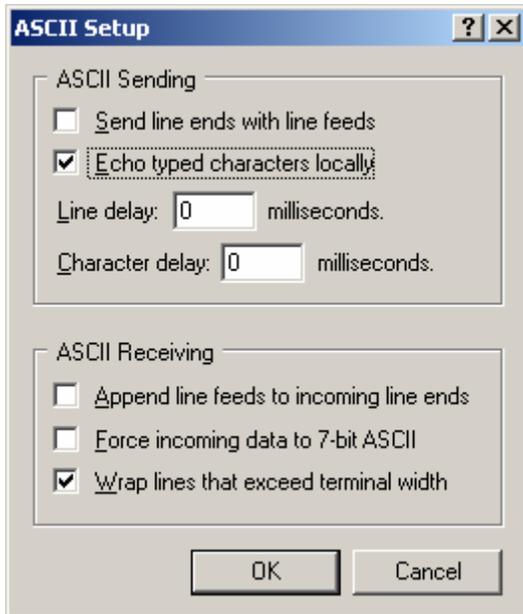
6) From the main FILE menu select PROPERTIES.



7) Click the Settings tab and then click the ASCII SETUP button. Note that if you have the modem command “E” enabled, you want to skip these last two steps.



- 8) Check "Echo typed characters locally". If you have the "E" command enabled and this HyperTerminal setting checked, you will see each character displayed twice in the window. If you need to check that the modem is receiving commands, you may want to leave this setting unchecked.



After all this you can enter AT commands in the large white area of Hyperterminal. You should see a cursor. When you press the ENTER key, the command will be sent to the modem. If you make a mistake, press ENTER and retype the command. Be sure to turn result codes and echo modem commands OFF ("Q1" command, quiet mode enabled and "E" command) before exiting HyperTerminal.

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**and other weather observation groups****INTRODUCTION**

This document provides guidelines for the setup and installation of your weather station so as to provide the highest quality observations for use by NOAA (National Oceanic and Atmospheric Administration) and other weather groups. Through the Citizen Weather Observer Program (CWOP), NOAA ingests weather data into its weather forecast models at the Forecast Systems Laboratory in Boulder, Colorado. As a Cooperative Observer (COOP), it is possible to supplement the sensor data from the NOAA equipment with data from your weather station. However, it should be noted that no consumer system has been officially approved for COOP use other than the equipment provided by the NWS. Other private media groups also have interest in “backyard” weather station data.

Since the number of “official” real-time observations is limited to the Automated Surface Observing System (ASOS) which has sites primarily at airports and military installations, using private weather stations provides a means to capture more observations without expending substantial resources to acquire, install, and maintain these high-end systems. More observations means better forecast prediction and forecast verification (checking to see if the forecast was correct). However, the quality of observations is also just as important. Since Davis Instruments weather station specifications closely mirror those used by the meteorological community, you can report professional quality observations for just a fraction of the price. Proper siting and installation of the weather station is the primary key here.

As the owner of a Davis Instruments weather station, you can help NOAA improve their forecasts by providing more ground-truth observations. The guidelines here follow recommendations provided by CWOP, NOAA and the National Weather Service (NWS). Data provided to other private weather groups also helps them in a similar manner since they also do their own in-house weather forecasting and forecast verification.

**EQUIPMENT NEEDED**

You can use any Davis Instruments weather station, but you will also need a PC with Windows 95 or Mac OSX or later, WeatherLink™ software and an Internet Connection to report your data to CWOP. If you have a Weather Wizard III® or Weather Monitor II®, it is highly recommended that you obtain a Radiation Shield (P/N 7714), the reasons for which will be discussed later. Refer to the weather station instruction manual for a list of tools and weather station mounting options. The WeatherLink Help files cover how to set up the software to report your data to CWOP. Additionally, Application Note 26 provides guidelines on choosing an Internet Service Provider (ISP) and setting up your Internet data transfer. This document will cover more information on becoming a member of CWOP or COOP later.

Optionally, you may choose to have your unit NIST certified. In the U.S., the National Institute of Standards and Technology (NIST) develops and maintains the standards of measurement to which all others are ultimately compared and certified. NIST certification is typically required by public agencies that monitor weather conditions, but it is not a requirement for CWOP at this time. If you are a member or want to be a member of COOP, contact your local NWS office to see if NIST traceability is a requirement for your Davis Instruments weather station. For more

information about NIST, check out their website at <http://www.NIST.gov> . If resources allow, you may choose to have your weather station NIST certified. If so, then you have documentation that proves that your system has been compared to a higher-order standard. This may alleviate some concerns about data quality that may arise in the future. To be continually certified, you will need to be certified once every year. Contact Davis Instruments Customer Service for more details about having your station NIST certified.

## **ASSESSING YOUR ENVIRONMENT**

Whether the weather station is installed at a business or at home, the type of building and surrounding environment has a dramatic effect on the values of the weather parameters throughout this location. It is generally best to have plenty of naturally (best) or artificially landscaped ground space that is flat or on a gentle slope away from the building. Also, the location should not be heavily shaded by trees. If you lack sufficient or acceptable ground space on the property, the next best, but not ideal location, is a rooftop location. Cases where rooftop installations are the only option are generally urban areas including multi-story office buildings, apartments, condominiums, or office space where the ground space is almost entirely paved. Never install a weather station over or near any sort of paved surface regardless of whether it is asphalt or concrete. Try to be at least 100 feet away from any driveway or roadway. If you lack a suitable location, see if your neighbors have an acceptable location and would be willing to allow you to put a weather station on their property. Be sure and tell them it is possible to locate it in an inconspicuous location. If you fail to find an “ideal” location, don’t be discouraged. Data can still be of value. In most cases, any data is better than no data.

## **FINDING AN INSTALLATION LOCATION**

If you manage to find an available location on your property or nearby, next determine your exact station location and configuration. Generally and ideally, you should locate the temperature/humidity and rain sensors in the open ground space area and the wind sensor (anemometer) on the building rooftop. If possible, also try to choose a location not visible from the street. Some homeowner’s association covenants and city ordinances require that systems such as these not be visible to the general public. Generally, this means siting the weather station in a backyard or lot and a rooftop location toward the back of the building away from the street. Finally, make sure the location is easily and safely accessible. One important part of quality data is maintenance, so you should be able to return to the installation location to check, clean, and, if necessary, replace sensors. If you have the resources, professional contractors will, for a fee, install items for you.

First, assess your ground location. If possible, select a location that has a natural ground cover surface. This way, your readings will be “representative” of the natural, local environment. Natural surfaces will have vegetation that grows naturally in the climate in which you live. In semi-arid or arid areas, such surfaces are referred to as “xeriscapes” or dry landscaping that may consist of cactus, scrub brush and be interspersed with sandy areas. You can check with a local landscaping company or supplier for what types of vegetation grows naturally in your area. Otherwise, regularly mowed turf-grass will suffice. Note that all agricultural applications where the calculation of evapotranspiration (ET) is involved, the temperature and humidity sensors need to be installed over well-irrigated, regularly mowed grass. If possible, install all the sensors between two orchards, two vineyards or two row crops. If this is not possible, install the sensors near the edge of the primary crop of interest. Be sure and locate the weather station where a sprinkler system will not directly spray the weather station. This can adversely affect the readings. Choose an area with the gentlest slope possible. Never install on a steep hillside

if at all possible unless the entire neighborhood is located on a hillside. The rain collector will need to be installed level regardless of the slope of the landscape. Never install near a body of water such as a pond, lake or swimming pool. Avoid low lying areas that don't drain well, that is, areas that experience a lot of standing water.

It is highly recommended that Weather Wizard III or Monitor II users obtain the Davis Radiation Shield, P/N 7714. If this is prohibitive, the temperature sensor will need to be installed in a shady location. Unfortunately, this is often times on the north side of a building. If you must install your temperature sensor up against a building, avoid locations near heating or air conditioning units, exhaust vents, or other sources of heat. Choose a location that remains in the shade all day long, and if possible, is over a landscaped or dirt surface. Stay away from areas with asphalt, concrete, or brick pavement.

Siting your rain collector in a manner that limits the effect of "rain shadow" or blockage from nearby objects needs to be assessed. Rain shadow occurs when rain, that otherwise might fall into the gauge, is captured or deflected by obstructions upstream. As a rule of thumb, the top edge of the rain collector should be no less than twice the height away from any obstruction such as a fence, tree, or building. Never install a rain collector near a building. For heavily forested areas, site your rain collector in a clearing or meadow. Because temperature/humidity sensors should be installed about 5 feet (1.5 m) above the ground, on a Vantage Pro or Vantage Pro2 Integrated Sensor Suite (ISS, where the rain collector is above the temperature/humidity radiation shield), the rain collector will be about 6 feet (2 m) off the ground. In this case, the distance between a 10 foot (3 m) wall and the ISS can be 8 feet (0.5 m) because the difference in height between the 10 foot wall and the Vantage Pro rain collector is only 4 feet (1 m). If necessary, you can site your rain collector away from your ISS. See Application Note 32 for details.

Next, assess the location for your anemometer. As stated before, the easiest way to get your anemometer up into the wind is to install it on the roof of the building or on a tall antenna tower. If at all possible, install it on a rooftop location. If you cannot, then you should install it as high as possible in the surrounding landscape.

Finally, your barometric pressure readings will also be sent to NOAA if you join the CWOP. The barometric sensor is located inside your display console or Weather Envoy. If at all possible, the console should be located indoors in a dry, indoor location away from outside doors, heating and cooling registers, and direct sunlight. Barometric sensors can be affected by rapid changes in temperature from these sources. Avoid pressurized rooms.

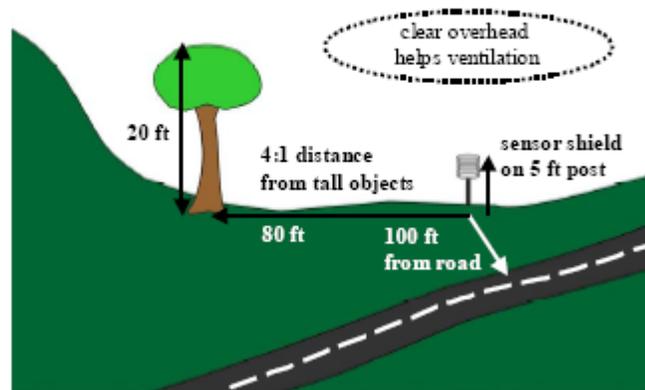
If your weather station location is remote, obtain the Complete System Shelter P/N 7724 to house the console or Envoy. Do not completely seal off the shelter because your system will need exposure to outside air to obtain the true air pressure and to ventilate excessive hot air on hot days. You will also need to connect to the weather station from a phone line and transfer the data to your computer and then to CWOP. Application Note 27 provides guidelines on setting up a remote modem.

## **INSTALLATION GUIDELINES**

### **TEMPERATURE AND HUMIDITY**

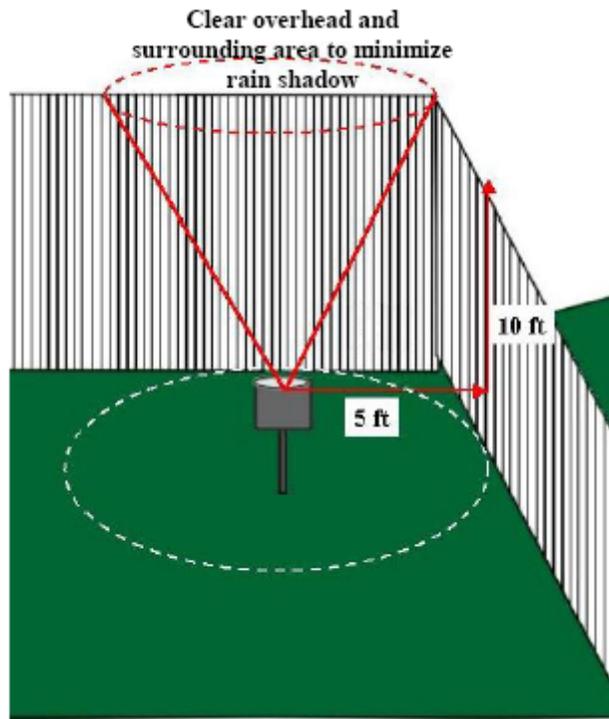
As stated before, the best location for the temperature/humidity sensors is inside a radiation shield located over the ground. Second best is a rooftop location. Either way, the shield

should be mounted so that the sensors are about 5 feet (1.5 m) +/- 1 foot (0.3 m) above the ground or rooftop (or, for ground installations or flat roof installations, 2 feet (0.6 meters) above the average maximum snow depth, whichever is higher).

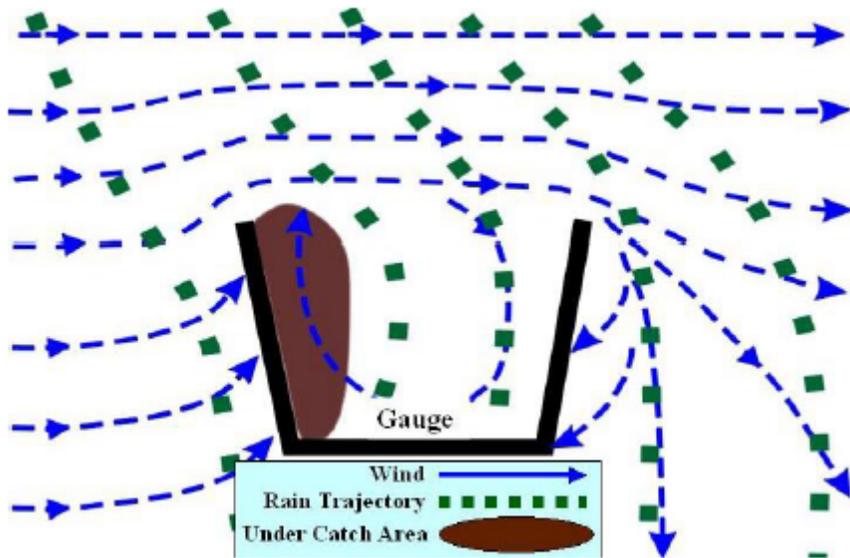


## RAIN COLLECTOR

If you have a Vantage Pro or Vantage Pro2 system, your rain collector will be mounted above your temperature/humidity radiation shield since both are included as part of the ISS. If you have a Weather Wizard III or Weather Monitor II, you will need to find a separate location for your rain collector. Generally, the best location will be similar to that of the temperature-humidity sensors. A 2 foot (0.6 m) mounting height for stand-alone gauges is usually best. The area above the gauge should be free of obstructions. Avoid areas where a sprinkler system will produce false rain readings. Make sure the rain collector is as level as possible. Since Davis rain collectors use tipping bucket technology, accuracy degrades significantly if the unit is not level. A T-shaped trough in the base of the rain collector provides a simple way to determine how level the rain collector is. Consult the appropriate instruction manual for more details. The Rain Collector Shelf (Part #: 7704) and Sensor Mounting Arm (Part #: 7702) back plate can be used together to mount a rain collector to a pole.



If you live in an area that receives significant snowfall throughout the year, you should mount the rain collector 2 feet (0.6 meters) above the average maximum snow depth. You will need to obtain a Rain Collector Heater (Part #: 7720) to measure the liquid equivalent of falling snow. Additionally, you may want to consider installing a small fence (the top of which is at the same height as the top edge of the rain collector), particularly if you experience frequent wind driven snow. This will ensure blowing snow falls into the rain collector and doesn't blow around and by it.



The following figure provides an example of a wind shield that professionals use. Some shields use aluminum and others use wood. Either way, it may be possible to build an inexpensive version of your own.



#### ANEMOMETER (WIND SENSOR)

As stated before, it is easiest to mount your anemometer on your roof to achieve height. The standard mounting height is 33 feet (10 m) for most applications. For agricultural applications when calculating ET, 6 feet (2 m) is the standard mounting height. For two or more story buildings, this can be achieved by installing the anemometer at least 10 feet (3 m) above the highest point on the roof (regardless of height above the ground) to minimize the affects of the roof on the wind. For most single story buildings, you will need to use an already existing, secured TV or radio antenna tower to achieve this height. Seek profession help to install a TV or radio tower. Generally, if you are uncertain about the safety of your proposed task, seek professional help.

If there are obstructions such as trees within 66 feet (20 m) of the anemometer, you should mount your anemometer at least 7 feet (2 m) above these tree tops. Due to stability issues, CWOP does not encourage members to install masts longer than 16 feet (5 m), if tripod mounted, or 33 feet (10 m), if ground based mast connected to a building or supported using guy wires. For masts higher than 33 feet (10 m), seek professional installation.

If you decide you cannot mount your anemometer from your rooftop, you should make every attempt to satisfy the siting guidelines. Never install an anemometer near the side of a building. Get as far away from the building as possible. Install the anemometer as high off the ground as possible. If there are no other obstructions such as trees on your property, and you have at least 0.25 acre of property and a one story building, you may be able to use a Mounting Tripod if you place it at least 50 feet (15 m) away from the building. For two or more story buildings, you will probably need to use a tower mount for any ground based installation unless you have approximately 2.5 acres or more. Any property with a lot of large trees will probably require a tower mount. As with a rooftop mounting, if you have trees on your property, you may want to consider installing the anemometer at least 7 feet (2 m) above the height of the tree tops.

Note that the Vantage Pro anemometers are designed to be mounted with the mounting arm facing “true” north. If you live in an area where all the streets run north-south or east-west in a

square-grid pattern, it will be relatively easy to determine which direction is true north. Otherwise, you can use a local map of your area and align the map so that the street or highway near your building on the map and the actual street are parallel to each other. You can also use a magnetic compass, but keep in mind that the compass will have to be corrected to read the true direction. The National Geophysical Data Center (NGDC) has a page that will calculate this correction or “declination” for you: <http://www.ngdc.noaa.gov/seg/geomag/jsp/Declination.jsp> . Here’s a link to a declination map for the CONUS (lower 48 states of the U.S.): [http://www.spacecom.com/customer\\_tools/html/body\\_mag\\_dec\\_map.htm](http://www.spacecom.com/customer_tools/html/body_mag_dec_map.htm) . A GPS receiver can also be used, but they tend to be very inaccurate in determining direction when used in a stationary position. If you decide that you must face the anemometer a different direction, instructions are provided in the manual on how to recalibrate your direction readings. (For the most precise calibration, remove the wind vane, using the numeral direction display turn the wind pot until the unit displays as close to 180° (true south) as possible, and then reinstall the vane with the nose pointing to the south.) Consult the instruction manual for more details.

## MOUNTING OPTIONS

Davis Instruments weather equipment is designed so that it can be mounted to either a pole or a post or flat surface. Davis also provides a Mounting Tripod (Part #: 7716) and Mounting Pole Kit (Part #: 7717) to assist in mounting. The provided poles have nearly the same diameter as poles for mounting TV antennas, thus you may also obtain additional accessories for attaching poles to buildings. Application Note 18 provides guidelines on how to use these mounting accessories whenever a user wants to avoid installing lag screws or bolts into a flat roof or mounting surface (e.g., school or office building installations). Roof mounts are used frequently for small satellite dishes, wireless cable dishes and antennas. Many are stocked or can be ordered through local wireless communications equipment suppliers or ham radio stores.

If you find you need to mount all your sensors in the same general location, use a radiation shield for the temperature/humidity sensor (if the installation site is in direct sunlight) if you have a Monitor or Wizard. Follow the guidelines for each parameter to optimize the final location.

## SHARING YOUR WEATHER OBSERVATIONS

There are many entities out there who would like you to share your weather data with them. The ones mentioned primarily in this document are under the jurisdiction of the NOAA. NOAA has the highest standards for quality, so the guidelines in this document are more critical than they are for other groups such as WeatherUnderground and WeatherBug. Additionally, local newspapers, radio and TV stations also like to receive observations from local observers due to the lack of a substantial number of official NOAA sites available. However, the better quality of data you provide, the more useful it is to the meteorological community at large. So, regardless of who you share your observations with, it is highly recommended that you site your weather station in the best location(s) possible to achieve the highest quality and most representative data for your neighborhood.

After you setup your weather station, the next step is to become a part of the volunteer weather observer community. The following paragraphs give general instructions on how to join each network. In many cases, and Internet connection is essential, but not always.

## THE COOPERATIVE OBSERVER NETWORK (COOP) (United States Residents Only)

The following website provides guidelines on how to join:

<http://www.weather.gov/om/coop/become.htm>. In summary, contact your local NWS office and they will determine whether there is a need for a COOP site in your location. If you are selected for COOP, your local NWS office will provide the “official” equipment for monitoring. Unofficially, many COOP observers supplement their “official” readings with readings from their Davis Instruments weather stations.

## THE CITIZEN WEATHER OBSERVER PROGRAM (CWOP)

It is possible there may not be a need for a COOP station in your location. It is possible to provide data to NOAA through the CWOP program. The program is open to anyone who has the equipment listed at the beginning of this document. The following website provides details on how to join: <http://www.wxqa.com/SIGN-UP.html>. Most of the information in this document is based on the guidelines CWOP has provided.

## GLOBE

If you are an educator or member of an educational institution, then you may participate in the GLOBE program. Global Learning and Observations to Benefit the Environment is a worldwide hands-on, primary and secondary school-based education and science program. Teachers and other educators who wish to lead students in GLOBE need to attend special workshops in order to fully participate in the program. Visit the following website for more details:

<http://www.globe.gov/fsl/html/aboutglobe.cgi?intro&lang=en&nav=1>

## WEATHER UNDERGROUND

As with CWOP, you only need Internet access to send data to Weather Underground. Contact Weather Underground for the software that will interface with WeatherLink. This software is not compatible with WeatherBug (below). The following website allows you to sign up:

<http://www.wunderground.com/signup/signup.asp?mode=pws>

## WEATHERBUG

WeatherBug offers a co-branded version of Davis Instruments weather stations. These operate just like our weather stations except they have a different name on the box and display console. They also include WeatherBug software that automatically uploads data to their network. This software does not include the Weather Underground feature and may not include the CWOP upload feature. Visit the following website for details: <http://www.weatherbug.com/backyard/>

## LOCAL MEDIA (Newspapers, Radio & TV Stations)

Contact your local media weather departments and ask them if they would be interested in your weather data. Note that one outlet in each TV market will probably have exclusive agreements with other weather station vendors that will not allow you to use a Davis Instruments weather station to send them data. Other than those, they should be happy to receive your data.

## MAINTENANCE AND QUALITY CONTROL

In general, the maintenance required for all the sensors will be infrequent and relatively simple. Periodically inspect your sensors to ensure that they are relatively free of dust, leaves, twigs, spider webs, and insect and bird nests. DO NOT remove nesting insects or animals by spraying insecticide because this may damage the plastic and sensors. Generally, if sited properly and well maintained, your Davis Instruments weather station should give you years of quality data and trouble-free performance. However, be sure and keep a periodic eye on your data readings. If they appear suspect, the following section will provide specific guidelines to determine whether you have incorrect readings and if so, how to address them. Although not covered below, missing data (dashes) in readings may indicate a severed cable, loose connection, or poor wireless reception. Consult your instruction manual for troubleshooting suggestions for these types of problems. Also, for CWOP use, be sure you have the latest version of WeatherLink™ software. It will probably have the latest fixes and corrections to the CWOP upload feature. CWOP uses the Automated Position Reporting System (APRS) data protocol text format to transfer data.

### TEMPERATURE AND HUMIDITY

NOAA will perform quality control checks on the temperature and humidity data that your weather station reports. However, you should also verify yourself that the data your weather station reports are correct. In addition to following the siting and installation guidelines above, you can use an inexpensive sensor to compare your readings. Make sure the other sensor is properly shaded and located in the same well-ventilated location. If you are a member of COOP, the temperature readings of the MMTS shield and your Davis weather station should agree to within a few degrees if properly sited. You can also check the readings at a nearby airport. When making these comparisons, keep these issues in mind. Differences in elevation will affect temperature (on average 5.5°F (3.0°C) cooling per 1000 feet (300 m) rise in elevation), and subsequently, relative humidity. Differences in your micro-climate will make significant differences in temperature readings, whether you are located in urban area or the countryside or whether you live in a valley or on top of a ridge. Large differences of 5°F (3°C) in temperature or 10% relative humidity or more between your inexpensive device or MMTS shield and the Davis weather station or differences of 10°F (5°C) or more or 20% relative humidity between your weather station and the nearest airport (if within the 100' elevation difference or less) may indicate either improper siting or sensor malfunction. If it is determined there are no siting issues, following the guidelines below for cleaning and maintenance. If these efforts don't solve the problem, contact Davis Instruments Technical Support.

To remove dust build-up from the temperature/humidity sensor, using a clean, dry toothbrush, gently brush the gold-colored mesh cloth. (If you have a Monitor II system, you will need to remove the lower portion of the temperature/humidity sensor cover by loosening the two screws.) Clean the white plastic cover with water and a mild liquid detergent, and rinse thoroughly before replacing. Depending upon the vintage of your humidity sensor, it may need to be recalibrated once every five years. Contact Technical Support with your manufacturing code and station model type to determine whether your humidity sensor supports calibration. Also, both the temperature and humidity readings can be manually adjusted through settings on the display console or in the WeatherLink software.

The outer portion of the plates of the radiation shield should be cleaned when there is excessive dirt and build up on them. Use a damp cloth to clean the outer edge of each ring. The effectiveness of the radiation shield will be reduced if the surfaces of the shield become dusty or

dirty. A buildup of material inside the shield reduces its effectiveness and may lead to inaccurate temperature and humidity readings. Keep areas between radiation shield plates free of debris that may obstruct air flow. This type of maintenance will probably need to be done on an annual basis, or more often during drier times of the year when regular rains do not wash dust off the radiation shield. Consult the appropriate instruction manual for details on how to disassemble and reassemble the radiation shield.

## RAIN COLLECTOR

Determining if your rainfall measurements are correct is more difficult. Precipitation can be highly variable over very short time and distance. For this reason, NOAA does not yet have quality control algorithms to verify the accuracy of rainfall readings. So, maintaining rainfall accuracy is up to you. In addition to following the siting guidelines earlier in this document, use the maintenance guidelines below to ensure the most accurate readings.

For greatest accuracy, clean several times a year. Dust and debris can accumulate on the tipping bucket, affecting its operation. Spiders and insects can make their homes in the base, and birds have been known to nest in the funnel. To clean the rain collector, remove the funnel from the base. Gently clean the tipping bucket and the funnel with water and a mild liquid detergent. Rinse thoroughly.

If you use the Rain Collector Heater, only use the device during periods when freezing weather is expected. The heat generated by the heater is enough to cause evaporation of rain water when used during liquid precipitation events. As a general guideline, leave it turned off during the summer months.

To check the accuracy of the rain collector, compare the Davis Rain Collector with a tube type "manual" rain gauge. Use a rain gauge with an opening diameter of at least 4 inches. If you are a COOP member, you can safely use this type of gauge for comparison provided it is located near your weather station. Rain gauges with openings smaller than 4 inches (1.5 cm) will not be sufficiently accurate or precise. Make sure there are no cracks in the rain gauge. In areas that experience freezing weather, plastic gauges can crack and develop leaks. Place the tube type rain gauge directly next to the Davis rain collector. If using the device to measure frozen precipitation, remove the funnel and center tube and melt the catch. Use the center tube for measurement. Compare the totals on three storms. Based on this, develop an average for how far off the readings are. There are adjustment screws under the rain collector bucket that are designed to fine tune readings. Use at least three rain storms to determine the appropriate adjustment. DO NOT compare rainfall readings to reading obtained from television, radio, newspapers, or the neighbors. Due the wide variation in rainfall over small distances, such readings are not an accurate measurement of the weather readings taking place at your site. The rain collector is carefully tested and calibrated at the Davis Instruments factory to conform to its stated specifications.

Additionally, the NWS WSR-88D Doppler radar measures storm precipitation amounts (to the nearest 0.25 inch). Check the storm total precipitation amount over your location from the WSR-88D total precipitation product for a gross check (generally good in non-winter precipitation events). Doppler radar precipitation reports are available on your local NWS Weather Forecast Office web page, which can be found by going to the NWS national page and clicking on your location on the map: <http://www.weather.gov/> .

## ANEMOMETER (WIND SENSOR)

Generally, if you mounted your anemometer at an ideal height and either pointed it in the correct direction or calibrated it to report correctly, your wind speed readings should be correct. You can validate your wind direction by monitoring your winds against area airport winds to see if your wind direction is consistent with their data. Complete your wind direction validation on an afternoon that is the day before or the day after a cold frontal passage. Use the readings on your display console, don't look at the unit on the roof. The roof device will always point into the wind regardless of the calibration setting. Ideally you want moderate, but not overly gusty, winds where flow is relatively uniform in speed and direction throughout your region. If wind direction is consistently off by more than 30 degrees from your reference station, apply a correction to your direction so it is consistent with area wind direction. This can be done on a Vantage Pro system using your weather station display console. A Monitor II or Wizard III unit will have to be manually calibrated on the roof.

Generally, if you mounted your anemometer at an ideal height, your wind speed readings should be correct. Wind speed will be difficult to validate using local airport data due to the large fluctuations in wind speed over time. Obstructions surrounding your anemometer may also decrease your wind speed significantly relative to your local airport's wind speed. Use the Beaufort Scale below for wind speed (land version) to determine whether your wind speed readings are in the "ballpark". Observe the motion of tree leaves, twigs, and chimney smoke plumes to estimate wind speed at the elevation of the anemometer.

Beaufort Code	Speed (mph)	Speed (km/hr)	Wind Category Description	Effects on the Environment
0	< 1	< 1	calm	smoke rises vertically
1	2 - 3	1 - 5	light air	smoke drifts slowly
2	4 - 7	6 - 11	light breeze	leaves rustle, wind can be felt, wind vanes move
3	8 - 12	12 - 19	gentle breeze	leaves and twigs on trees move
4	13 - 18	20 - 29	moderate breeze	small tree branches move, dust is picked up from the ground surface
5	19 - 24	30 - 38	fresh breeze	small trees move
6	25 - 31	39 - 51	strong breeze	large branches move, telephone and power overhead wires whistle
7	32 - 38	51 - 61	near gale	trees move, difficult to walk in the wind
8	39 - 46	62 - 74	gale	twigs break off from trees
9	47 - 54	75 - 86	strong gale	branches break off from trees, shingles blown off roofs
10	55 - 63	87 - 101	whole gale	trees become uprooted, structural damage on buildings
11	64 - 74	102 - 120	storm	widespread damage to buildings and trees
12	> 75	> 120	hurricane	severe damage to buildings and trees

Another method for checking anemometer performance is to use a less-expensive, separate hand-held anemometer such as the Davis Wind Scribe (Part # 276), Wind Wizard (Part #281), or Turbo Meter (Part # 271). Taking a series of comparisons between the hand-held anemometer and your weather station anemometer readings will help validate your anemometer's readings. Bear in mind that you will need to take these measurements at or near the same location as the anemometer itself. DO NOT attempt this method if the anemometer is in a difficult to reach location and/or if winds are currently in excess of 25 mph or if you are uncertain about the safety of going on your roof.

Your anemometer should provide years of trouble-free service. However, spiders and insects can affect its operation. If wind speed seems low, use an Allen wrench to loosen the set-screw on the side of the wind cups. Remove the wind cups, and clean the exposed portion of the shaft with a damp cloth or cotton swab. Clean the wind cups with water and a mild liquid detergent. Rinse thoroughly before replacing. *Do not use or add grease, oil, or a spray lubricant of any kind.* After replacing the wind cups and tightening the setscrew, check to make sure that the wind cups spin freely. If they do not, the bearings may be worn and need factory-replacement. To ensure accurate wind direction readings, check the orientation of the wind vane annually. Consult the instruction manual for details.

#### BAROMETER (ALTIMETER SETTING)

CWOP prefers to receive barometer data in the form of altimeter. Altimeter is the CWOP pressure standard because it is the simplest pressure reduction format that most CWOP members can reliably deliver. The National Meteorological Services use this information to determine the uncorrected pressure value at your location, called station pressure. Altimeter uses only elevation to determine a sea-level pressure value. Sea-level pressure is determined from temperature and humidity also, making it more difficult to determine station pressure. Davis Instruments weather stations normally report sea-level pressure.

WeatherLink versions 5.7 and later automatically convert Vantage Pro and Vantage Pro2 barometer data to altimeter. Monitor II data is reported as is. Vantage Pro barometers only need the elevation to be set once to report properly. Monitor II barometers require a user offset calibration to be entered whenever powered up. The following procedure is the CWOP guidelines for checking barometric pressure tailored specifically for Davis weather stations. To ensure you are reporting the correct value, the following procedure is highly recommended. For Vantage Pro systems, you should get your CWOP/APRS upload working before beginning this procedure.

1. Select a nearby (within 20 miles or 28 km) airport weather station to provide your reference or calibrated pressure. Data online is available through the following website if you know your airports 4-letter identifier (in the US, it is the 3-digit code with a K at the beginning: e.g., Chicago O'Hare's identifier is KORD): <http://weather.noaa.gov/weather/metar.shtml> . Otherwise, you can go to your local National Weather Service website <http://www.weather.gov/> , click on the map for your location, and scroll down to Current Conditions. The link to "Other Local Obs" will provide a list of other nearby weather reports. Be sure to select an airport and not a CWOP station (indicated by call letters, rather than a name).
2. Vantage Pro users should set their correct elevation in the setup procedure and configure their WeatherLink APRS upload feature for frequent uploads. If not feasible at this time, set the elevation to zero and use the on-screen displayed value.

3. If making an adjustment or correction, wait for optimal weather conditions to conduct a series of comparisons; these conditions are:
  - High pressure is nearly overhead
  - Wind is less than 5 mph (3 m/s), preferably calm
  - Outside air temperature should be relatively stable or slowly changing
  - The best time to conduct pressure comparisons is in the early afternoon; if the winds are light, then you are reasonably certain high pressure is in the areaIf starting up the weather station new or new to CWOP, simply use the readings you have regardless of the weather conditions.
4. For Vantage Pro users, take a series of four pressure measurements using the altimeter setting from the airport and your APRS altimeter value in the View Log file (or on-screen value if unavailable); each comparison should be at least 15 minutes apart (see procedure below for obtaining airport observations).  
For Monitor II users, take a series of four pressure measurements using the altimeter setting from the airport and your on-screen displayed barometer reading; each comparison should be at least 15 minutes apart (see procedure below for obtaining airport observations). If the unit is newly in use, use the first reading to adjust your Monitor II to match, for an initial working value. Consult the instruction manual on details on how to set the barometer.

Notes:

- Some airports only report every hour on the hour, so you will have to take 4 hourly comparisons in this case.
  - Check that the time of your weather station reading and the airport reading are within 5 minutes of each other.
5. After completing the four comparisons noting your altimeter and the reference airport pressure simultaneously; sum the differences between the comparisons and divide by 4 (the number of comparisons) to get a mean difference.
  6. If the mean difference between your station and the reference station is more than  $\pm 0.03$  inches ( $\pm 1.0$  mb) add (or subtract) the difference from the on-screen barometer reading and use that value to correct the appropriate reading. Let the pressure settle for at least 15 minutes and try another series of comparisons to see if you get within  $\pm 0.03$  inches ( $\pm 1.0$  mb). Repeat the procedure until you achieve the goal a pressure difference of less than  $\pm 0.03$  inches ( $\pm 1.0$  mb).
  7. Stop the comparison series when the mean difference is less than or equal to  $\pm 0.03$  inches ( $\pm 1.0$  mb).
  8. Barometers occasionally will “drift” requiring re-calibration. Therefore, do barometer comparisons at least once every 3 months.
  9. Keep a record of your comparisons to monitor performance over time.

It is also possible to check the readings you send to CWOP online. This is recommended because the data you see on your display console may not match the data that gets sent to CWOP. If it doesn't match, make sure the elevation you report to CWOP is correct and matches what you entered into your Vantage Pro system, if applicable. You can get direct access to station data by simply entering your call sign in the search bar:

<http://www.wxqa.com/search.htm>.

Finally, if your unit is NIST certified, it does not guarantee that the unit could be damaged or fail within the year long certification period. NIST is mainly an indication that if your unit appears to be reporting information that is within “ball-park” expectations, it probably is reporting the correct value. If your readings are in question, but your system appears to be functioning normally, double-check to make sure the sensors have not been unintentionally moved. You may also

want to reconsider your sensor siting especially if your original installation was less than ideally located. NIST certification on the temperature and humidity sensors certifies that the sensors will read within specifications within the environment they are exposed to, but does not guarantee the radiation shield's effectiveness in blocking various forms of radiation. It is up to you to install the sensors within the radiation shield correctly according to the directions in the instruction manual. As with all sensors, it is your responsibility to locate them according to the guidelines in this document since NIST only certifies that the sensors will properly report the readings of the environment to which they are exposed.

Davis Instruments weather stations are designed to meet specifications. If you believe your unit to need repair or replacement, we have a fully staffed Support and Repairs team available to help you address your problem. (For residents outside the U.S. and Canada, most countries have a local Davis service center available to help. Contact our Customer Service department for the service center in your country.) Call our Tech Support department and our fully knowledgeable, friendly and helpful staff will listen to your problem and offer suggestions to rectify your problem. If they recommend a repair, they will provide you with the necessary information to get your unit fixed and returned in a timely fashion. If your readings are critical, you can shorten the total time the unit is out of service by shipping it to us via next day delivery and requesting that we return the unit to you the same way. Depending on where you are located, this can shorten the time the unit spends in transit by two weeks or more. We must, of course, charge you for the cost of returning the unit to you by next day delivery, whether it is under warranty or not. We will also send you a replacement part with the repair charge in exchange for returning the original part. This way, you do not have to wait for the unit to be repaired. Failure due to a power surge or lightning damage is not covered by our one year warranty and may not be repairable. In such cases, you may have to pay the full price to replace your unit. Repairs or replacement items have a 90 day warranty period.

## REFERENCE

*CWOP Weather Station Siting, Performance, and Data Quality Guide*, March 2005

*Federal Standards for Siting Meteorological Sensors at Airports*, August 1994, Julian M. Wright, Jr., Federal Coordinator

*Weather Station Siting and Installation Tools*, 1997, Campbell Scientific, Inc.

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### in Vantage Pro2™ and Vantage Pro® systems

#### INTRODUCTION

In addition to logging weather data, the Vantage Pro consoles and Weather Envoys™ continuously monitor the station's radio reception. You may find this information very helpful, especially when you are choosing where to locate your display console, Envoy and ISS.

#### DIAGNOSTIC SCREEN(S) ON THE DISPLAY CONSOLE

The method you use to access the diagnostic screen varies depending upon which system you have:

**For Vantage Pro2 consoles:**

From the Current Data screen, press and hold TEMP, then press the HUM key to access this screen. The right arrow is used to select various station transmitter IDs when the console is configured to receive multiple stations.

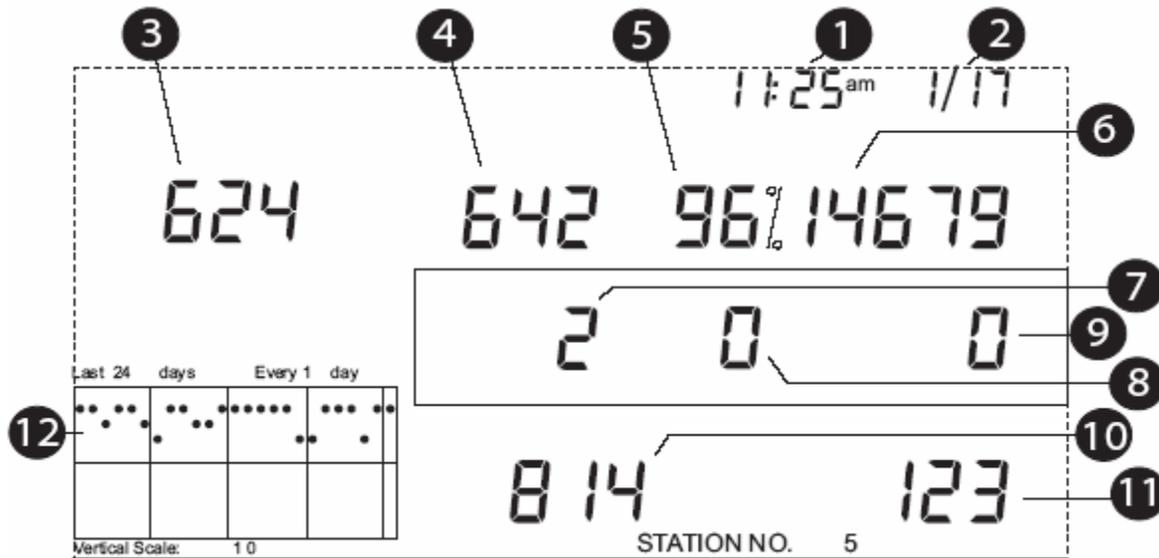
**For Vantage Pro consoles:**

From the Current Data screen, press and hold TEMP, then press the TIME key to access this screen. The STATION key is used to select various station transmitter IDs when the console is configured to receive multiple stations.

**For both systems**, press the DONE key to exit a diagnostic screen. This information is cleared at midnight automatically, so all data values represent those calculated since midnight. The data can be manually reset at any time using the Clear button while in the Reception Diagnostics screen on the LCD.

## SCREEN 1: STATISTICAL DIAGNOSTIC SCREEN FEATURES

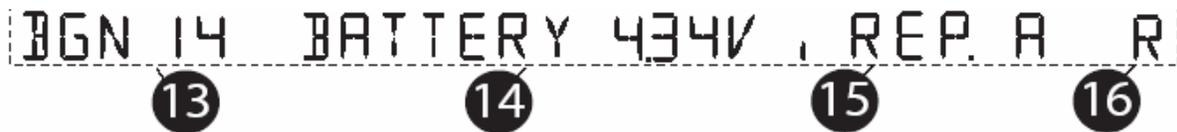
The following diagram illustrates the features that both Vantage Pro and Vantage Pro2 consoles have in common.



1. Time of day or the number of times the anemometer reed switch was seen closed\*. The reed switch opens and closes once each revolution of the anemometer. Press the WIND key to toggle between these two values.
2. Date or the number of times the anemometer reed switch was seen open\* is displayed. Press the WIND key to toggle between these two values.
3. Number of packets containing CRC errors that were received. The system runs a CRC check on data packets. Any data packets that don't pass this CRC check are considered to contain errors and the packet is discarded. These are considered "bad" packets.
4. Number of missed data packets. These are times when a data packet is expected, but is not recognized as a data packet by the wireless receiver. These are also considered "bad" packets.
5. Percentage of good data packets received.
6. Total number of good data packets received.
7. Number of times the console resynchronized with the transmitter. The console will attempt to resynchronize after 20 consecutive bad packets.
8. Maximum number of bad data packets in a row without resynchronization.
9. Current number of consecutive bad packets. The counter increments when the console is synchronized but a packet is bad. This value is reset to zero when a good packet is received.
10. Longest streak of consecutive good packets received.
11. Current streak of consecutive good packets received. This value is reset to zero when a bad packet is received.
12. Graph of the daily percentage of good data packets received over the last 24 days.

\*Davis Instruments use only

The information displayed in the ticker or banner at the bottom of the display differs between the two systems. Below is how it looks on a Vantage Pro2 with recent firmware dated May 2005 or later.



13. Background noise level. This refers to the undesirable signal level the console hears while it is in the process of acquiring a signal from a station. The range displayed is from 5 to 60. When the noise level is high, you may need to move the console closer to the station to get a stronger signal. Small background noise level does not always guarantee good reception. The signal strength from a transmitter needs to be stronger than the background noise level in order for the console to receive clearly. If there are reception problems while a small background noise level is still being displayed, make sure the console is within reasonable range of the transmitter. If the console has currently acquired all the station signals it is set to receive, the background noise level displayed is the last noise level measurement taken before acquisition finished.
14. Current console battery voltage. If no batteries are installed, this number is meaningless.
15. Repeater ID currently communicating with console. If a repeater or group of repeaters is used to relay station information to the console, the Repeater ID is the repeater that the console is set to receive. If the console is not listening to repeaters, the section remains blank. Application Note 25 provides detailed information on using Vantage Pro2 repeaters.
16. The console's reception status: Blinking "X" = Receiving Packets, toggles on and off for each good packet received; "R" = Resynch, when the console is trying to reestablish reception, the console will try for about 10 minutes until going to the "L" mode: "L" = Loss of Signal; the console will stay in that mode for 15 minutes until returning to the "R" mode. You can manually force the console into "R" mode earlier by going into and back out of the Setup screen.

Here is how the ticker looks on a Vantage Pro2 with firmware dated before May 2005 and on ALL Vantage Pro consoles. This Receiver Gain Status indicator appears instead of the background noise level in the ticker.

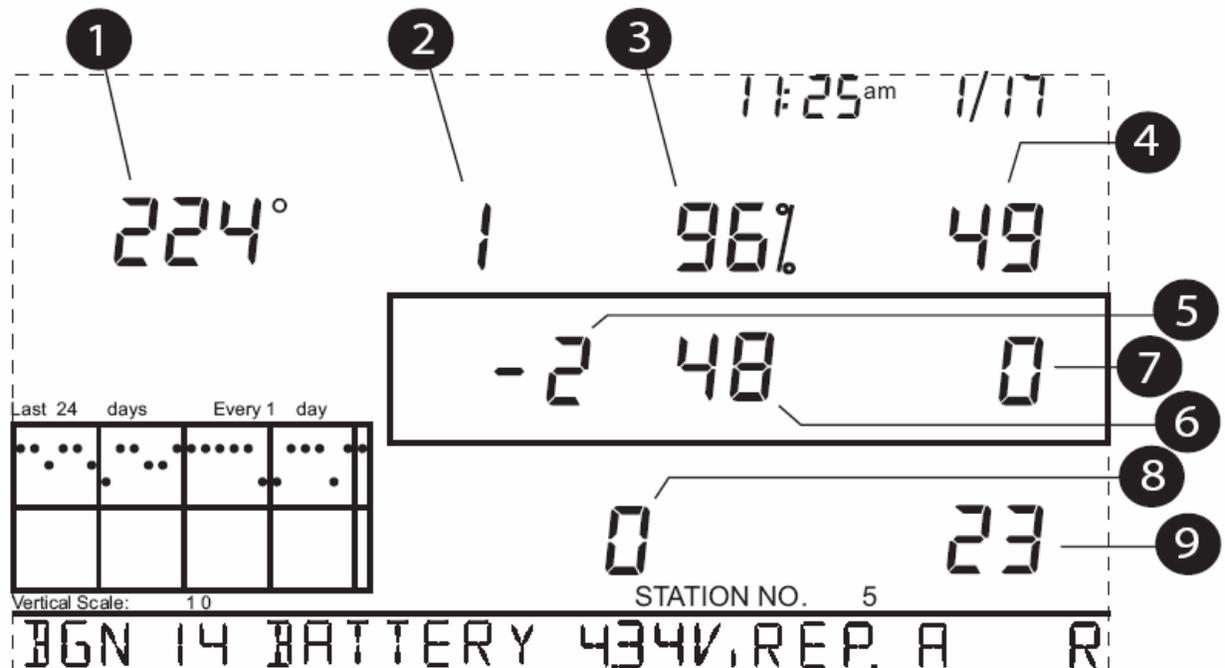


13. The Receiver Gain setting provides control over the receiver sensitivity. Press HI/LOW to toggle Gain on and off. If you're having trouble with reception, try changing the Gain. Note that Gain can adversely affect performance depending upon conditions. If you are having reception problems, you should try both settings. Gain should generally not be turned on when signal strength is above 30. See #4 below. Gain setting is automatic for later firmware versions.
14. Current console battery voltage. If no batteries are installed, this number is meaningless.
16. The console's reception status: Blinking "X" = Receiving Packets, "R" = Resynch, "L" = Loss of Signal. These have the same functions for all versions of Vantage Pro2 and Vantage Pro console firmware.

Note: The Repeater ID does not appear in the ticker in Vantage Pro2 firmware versions prior to May 2005 when the repeater was not supported. If you want to use repeaters with your Vantage Pro2, upgrade to a a firmware version of May 2005 or later.

Additionally, the Vantage Pro2 console includes a Reception Diagnostic screen that specifically addresses the statistics related to the quality of wireless reception. To view this screen, press 2<sup>ND</sup> and then press CHILL from the Diagnostic screen.

## SCREEN 2: RECEPTION DIAGNOSTIC SCREEN FEATURES



1. 8-bit timer value of next reception.\* The degree sign displaying in the upper right hand corner next to this value verifies that the Reception Diagnostic screen is currently displayed.
2. Radio frequency error of the last packet received successfully. In normal operation, this value is +1, -1 or 0. This changes the value in # 5 below.
3. Percentage of good packets received.\*\*
4. Signal strength of the last packet received. The values displayed in this field should generally be between 20 and 60. If a packet is not received successfully, the signal strength field is dashed out (--). See #13 on Screen 1 for details on receiver gain.
5. Current frequency correction factor. Shows Automatic Frequency Control setting.
6. Frequency index of the next packet to be received.\*
7. Current number of consecutive bad packets.\*\*
8. The number of times that the Phase Lock Loop did not lock.\*
9. Current streak of consecutive good packets received.\*\*

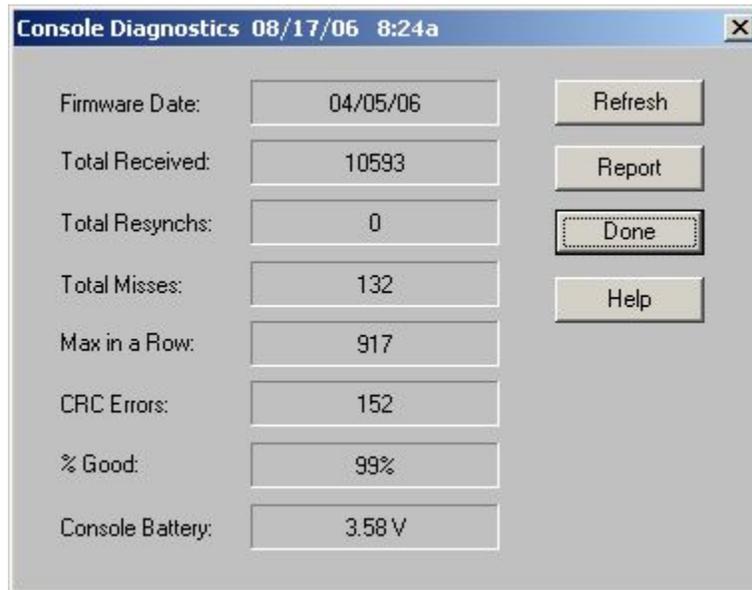
\*Davis Instruments Engineering department development use only

\*\*fields common to both diagnostic screens

## DIAGNOSTICS ON THE WEATHER ENVOY™

With the Weather Envoy, you do not have access to the diagnostic screens that are normally viewed on the Vantage Pro console. What you do have access to is the Console Diagnostics dialog box under the Reports menu and the “ISS Recept” column in the WeatherLink® browser. This feature is available for both the Vantage Pro2 and Vantage Pro consoles.

The WeatherLink Console Diagnostics dialog box is found under the Reports menu. This menu contains data calculated in the display console or Envoy and normally displayed on the wireless diagnostic screen of the Vantage Pro console. This dialog box is a snapshot. You must hit the Refresh button to get newer numbers. The Report button will generate a text file with the same information. The data here is based on the reception of the actual transmitter data packets as defined in WeatherLink’s Set Transceiver dialog box. On an Envoy the way to manually clear the data is to go into the Set Transceiver dialog box and press the OK button. This causes the unit to perform a “resynch”. Repowering the Envoy will also reset these values. Like with the console diagnostic screen, this information is automatically cleared at midnight. The % Good is calculated from the total received good packets and the total number of bad packets since the data was last reset. Reception diagnostics are not available.



The "ISS Recept" column in the WeatherLink browser is an RF reception percentage statistic only for that archive interval. The ISS Reception numbers are intended to show the overall quality level of the radio reception between the Vantage Pro consoles and the ISS transmitter. The reception value is a percentage calculated from the number of wind speed samples received (reported in the "Wind Samp" column of the data browser) divided by the expected number of packets. The possible number of wind samples is based upon the transmitter ID and the archive interval period. Since wind speed data is in every data packet, it is possible to determine how many packets should have been received during the archive interval. The actual number of wind packets received is listed in the "Wind Samp" column. Since this figure is based on wind speed packets, if you are using an Anemometer Transmitter Kit, the column actually represents the reception statistics for your anemometer transmitter only.

<b>ET</b>	<b>Wind Samp</b>	<b>Wind Tx</b>	<b>ISS Recept</b>	<b>Arc. Int.</b>
0.017	104	5	100.0	5
0.000	104	5	100.0	5
0.000	102	5	98.1	5
0.000	105	5	100.0	5
0.000	104	5	100.0	5
0.000	105	5	100.0	5
0.000	103	5	99.0	5
0.000	103	5	99.0	5
0.000	103	5	99.0	5
0.000	106	5	100.0	5

If you have an anemometer transmitter in your network, but you want to log the ISS reception in the software, you can temporarily disable the wind transmitter, and then the data you view in the ISS Reception column will represent the ISS. If you are worried about missing wind data, it may be possible to temporarily string the anemometer cable over to your ISS since it is 40' (12 m) in length. If needed, additional extension cables and couplers are available from Davis Instruments.

The number of packets with wind speed data received by a VantagePro2 system is approximately 3% more than the number received by a VantagePro system. The software, however, uses the same "expected number of packets" for both systems which will result in a small overestimation of the ISS reception value for VantagePro2 systems.

Below are tables that list the expected number of wind speed packets for each transmitter ID and archive interval. WeatherLink uses the VantagePro table. The VantagePro2 table is listed for reference purposes only.

Expected number of Wind Speed packets  
VantagePro

Tx ID	Archive Interval (min)						
	1	5	10	15	30	60	120
1	23	114	228	342	684	1368	2736
2	22	111	222	333	667	1335	2670
3	22	108	218	326	652	1302	2606
4	21	106	212	318	637	1273	2545
5	21	104	207	311	622	1244	2487
6	20	102	202	304	608	1216	2432
7	20	99	199	297	595	1189	2379
8	19	97	194	291	582	1165	2328

VantagePro2

Tx ID	Archive Interval (min)						
	1	5	10	15	30	60	120
1	23	117	234	351	702	1405	2810
2	23	114	229	343	686	1371	2743
3	22	112	223	335	670	1340	2679
4	22	109	218	327	655	1309	2618
5	21	107	213	320	640	1280	2560
6	21	104	209	313	626	1252	2504
7	20	102	204	306	613	1226	2451
8	20	100	200	300	600	1200	2400



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## With WeatherLink<sup>®</sup> and a Device Server

### INTRODUCTION

It is possible to substitute an Ethernet connection for the direct USB or serial connection that WeatherLink normally uses to communicate with a weather station. An Ethernet connection refers to a connection using the TCP/IP protocol for communication over the Internet or on a Local Area Network [LAN]. A LAN is normally within the confines of a building or group of buildings, while communication over the Internet is across a router which separates the LAN from the Internet. The concept is similar to using a remote telephone modem except that a device server takes the place of the remote telephone modem. The device server converts the serial or USB data signals to TCP/IP to allow transmission over the Internet or a LAN.

This document will provide general guidelines for setting up this kind of connection on a LAN and enabling access over the Internet. Please note that due to the variety of device servers and routers on the market, it is nearly impossible to document all the possible issues that you may encounter. Additionally, more detailed instructions on how to setup a Lantronix device server and a LinkSys router will be provided.

### GENERAL INSTRUCTIONS

To set up this kind of connection, you will need a device server (not a print server, as these are specially designed for printers only!) that is either USB or Serial, WeatherLink software, a CAT-5 network cable, and a functional Ethernet network with a switch or a router. For access over the Internet, you will also need a high-speed (broadband) Internet connection. Be sure to get the same kind of device server as the type of WeatherLink you have or plan to buy. Generally, devices of this type will be around \$100 and are rarely available at most consumer electronics stores. You will probably need to purchase the item online or go to a store that specializes in products for Information Technology or Networking. Many device servers come with multiple serial or USB ports. You only need one port per weather station.

For a USB device server, the WeatherLink USB connector plugs into the USB connector on the device server. Depending upon the design of the device server, the WeatherLink serial adapter may or may not be an appropriate connector. If the connection is male (like on a PC serial port), then the WeatherLink adapter should work. If the connection is female, you will need to get a Telephone Modem Adapter (#6533 for Vantage Pro2 and Vantage Pro; #7870 for Wizard III<sup>®</sup>, Monitor II<sup>®</sup> and Perception II<sup>®</sup>) to make the serial connection. This is the case for the Lantronix device server (to be discussed later). The other connector accepts the CAT-5 network cable that connects the device server to the router.

The device server includes driver software to install on your computer that converts the Internet connection to your weather station to one that emulates a USB or serial connection. From a computer on the local LAN, you will need to use the software provided with the device server to set the communications settings including the Baud Rate to match the settings on the weather station. The software from the device server manufacturer will generally install a virtual serial port (such as COM10) or virtual USB connection on your PC. If you are using a USB WeatherLink, you would then install the USB driver at this time. Finally, you need to configure the WeatherLink software to use the virtual serial port to connect to your console.

If you wish to access the device server and your console from the internet (on the network beyond the local router), you will need to configure your router. You will need to know the IP address assigned to

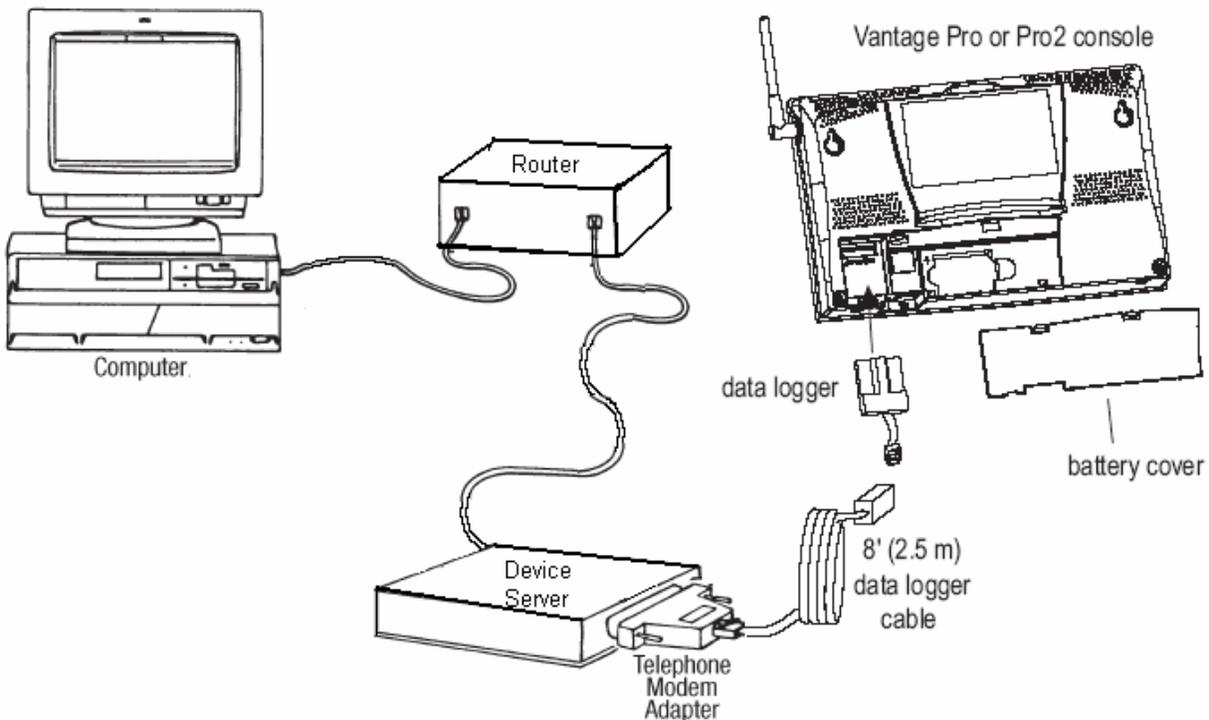
the device server by the router, and you will need to know the external IP address assigned to your router by your ISP. Because the internal IP address assigned by the router is not available from over the Internet, you will need to configure your router to forward traffic that comes in for the device server to the correct internal address.

Your router settings will have information on your current external IP address and the address assigned to the device server. Instructions are provided at the end of this document on how to view these settings on a LinkSys router.

This external IP address will allow a remote computer on the internet to connect to the device server and subsequently to your weather station. If you have a static IP address, this address will be fixed and always accessible, however most ISPs provide dynamic addresses that can change every few days. One solution to this problem is to register with a free domain name mapping service such as [www.dyndns.org](http://www.dyndns.org) that will assign a fixed domain name that will always point to your changing IP address. To use such a service, you must also have a device server that allows entry of a domain name (such as "yourstation.dyndns.org.") instead of an IP address. The Lantronix device server is a product that allows entry of a domain name.

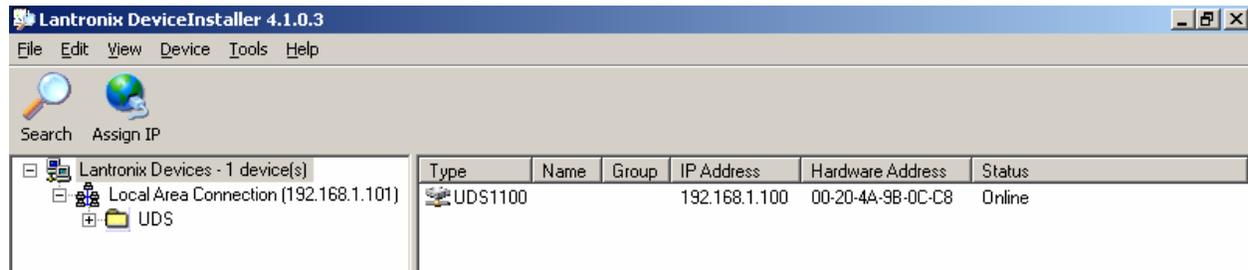
### LANTRONIX UNIVERSAL DEVICE SERVER (UDS) 1100 SETUP GUIDELINES

As stated before, you will need to obtain a Telephone Modem adapter to allow you to connect your weather station to the Lantronix UDS 1100. For configuration, install the device server as shown. Follow the instructions provided in the Quick Start Guide to connect and power the UDS. Install both the Device software and the Redirector software on a computer on your LAN. The following diagram shows the basic connection setup:

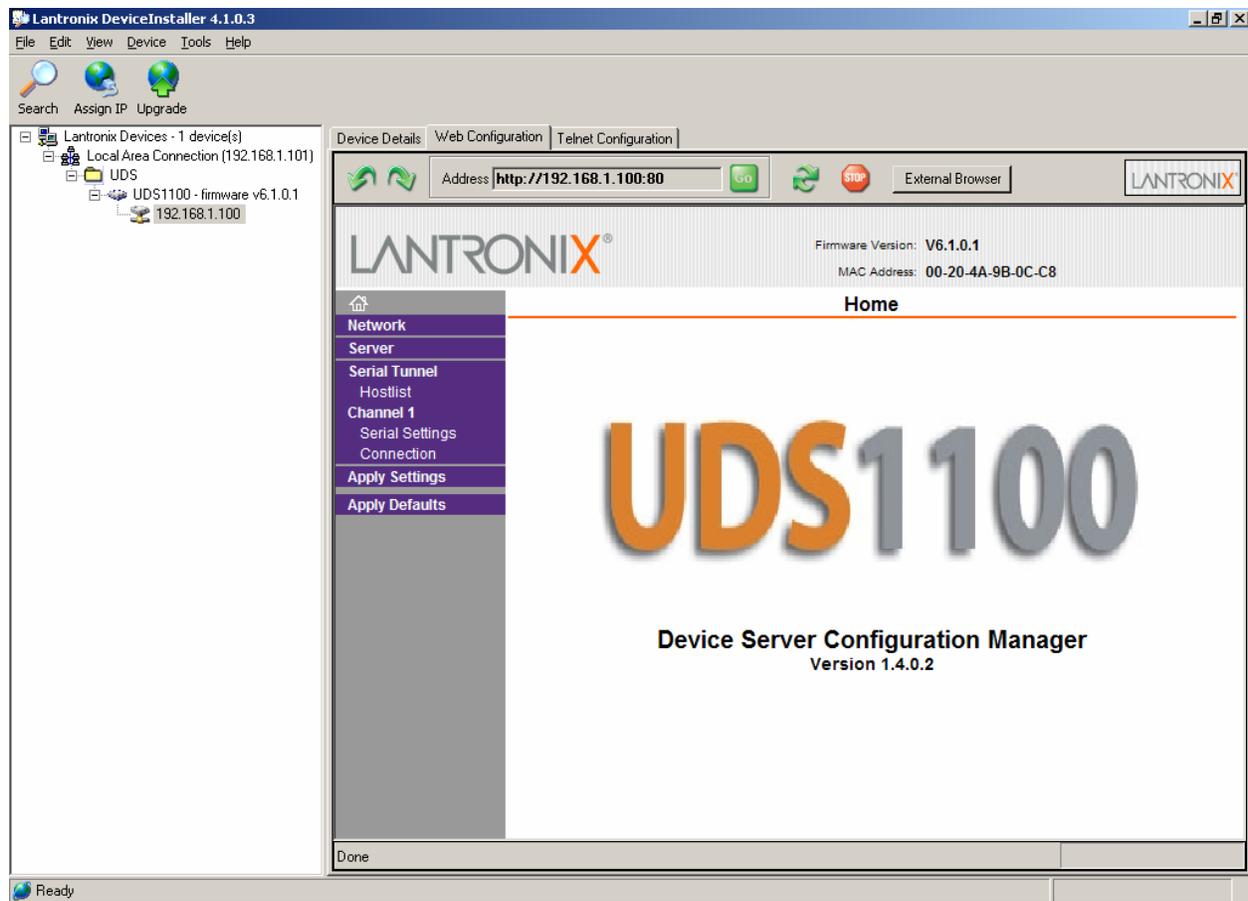


In most cases, the device server will be automatically assigned an IP address by the router. If power is lost to the device server, when power resumes, the router may assign it a different IP address and you may need to repeat the setup below.

Run the DeviceInstaller application on the Lantronix installation CD. The IP address of the device (if it was automatically assigned by the router) will be indicated. This address will appear on the right. Don't confuse this with the address on the left. The address on the left is the IP address of your PC. The hardware address of the device will also appear on the right. Double-clicking on the device listed on the right will bring up more information on the settings and allow to configure your device.



Click the Web Configuration Tab and then the Go button. A web page that allows you to configure the communication settings of the device server should appear. A dialog box asking you to enter a username and password will appear. Just press OK without entering anything. (You can also use an Internet browser and type in the IP address the device server was assigned in the URL window.) A page will appear as shown below:

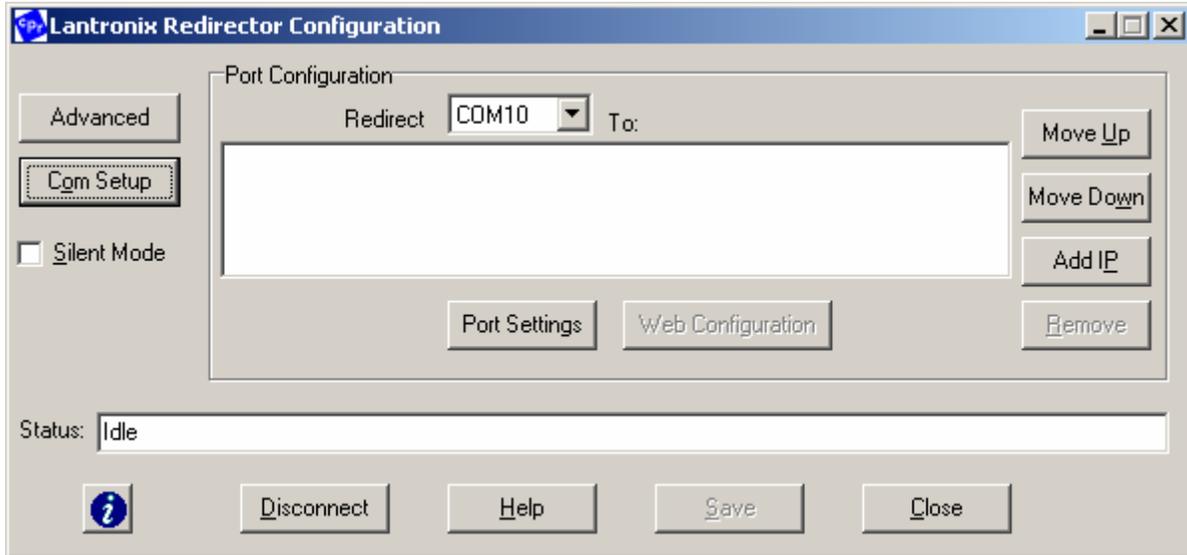


Click on Serial Settings on the left and enter the baud rate setting on your weather station. The communications settings should be 8 data bits, 1 stop bit, and no parity. Normally, the baud rate is 2400 for Monitor/Wizard/Perception stations, and 19200 for Vantage Pro2 and Vantage Pro stations. Press OK to enter these settings at the bottom of the page. The message “Done!” will appear to the right of the OK button. Then, click Apply Settings on the left to save these settings. A message will appear indicating that the device will reboot and apply these settings. This will take a few seconds. Wait until the main web page appears again to verify the changes were successful before exiting your browser.

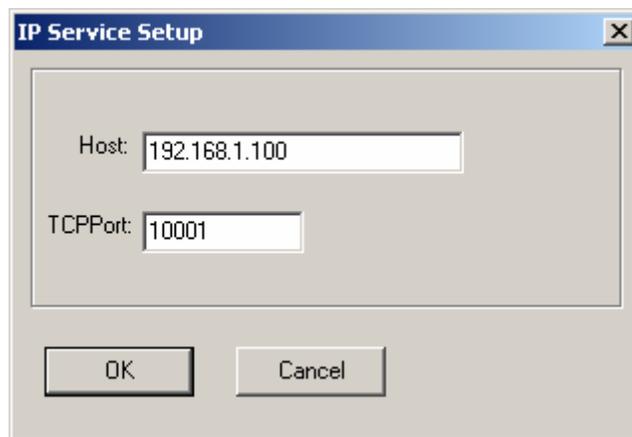
The default factory settings will have the username and password functions disabled. You can click Connection to enter a required username and password if you want to limit access to the configuration settings of this device. All settings will be saved even if the device loses power.

If you want to configure these settings over the Internet, you will need to set your router IP address settings to automatically route traffic on Port 80 (Web Port) to the device server. Specific instructions for a LinkSys router are provided later in this document. It is highly recommended that you create a password for your device server if you allow access to it from over the internet.

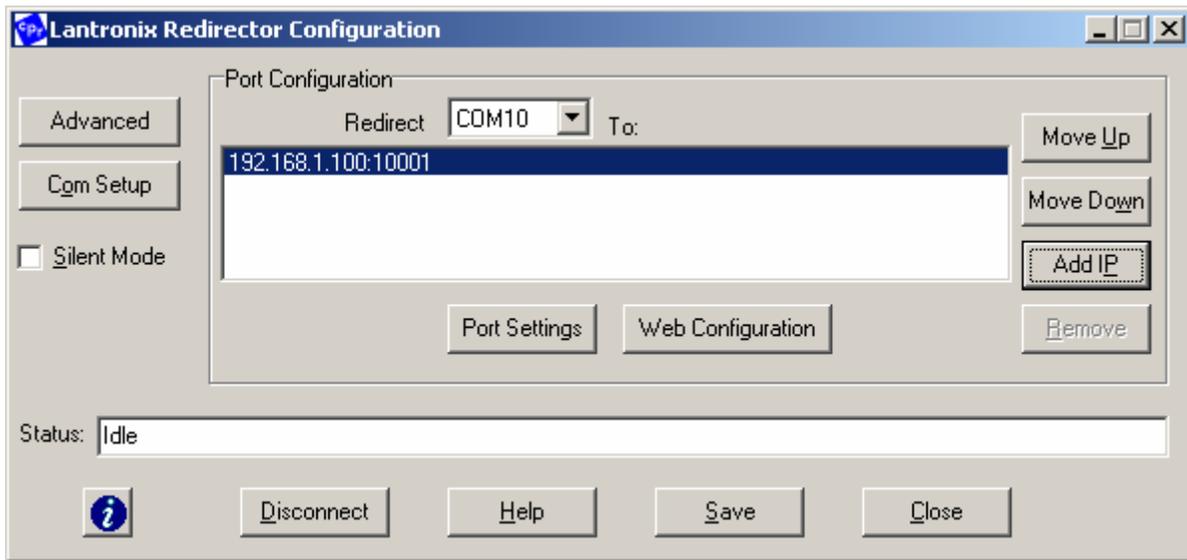
Next, run the Lantronix Redirector software. An unused COM port on your PC will be indicated (This is automatically assigned). Make sure the COM port number is between 1 and 18. WeatherLink only works with COM ports 1 through 18. You can click the Com Setup button to change the COM port that the device server uses. COM ports already assigned to other devices (both physical and virtual) will be grayed out.



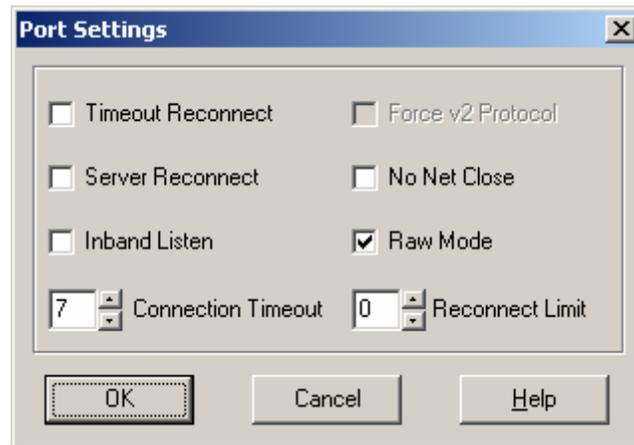
You will need to click the Add IP button to enter the IP address and port assignment of the device server (usually automatically assigned by the router as described previously). If you are connecting within a LAN, you can enter the IP address of the device. If you are connecting from another computer over the Internet, you will need to enter the external IP address of your router or a domain name that is mapped to this address (through a service such as from dyndns.org). Enter this IP address in the host section and, as suggested by Lantronix, enter 10001 for the TCP Port value and press OK.



The IP address will then appear in the Redirector software's main dialog box.

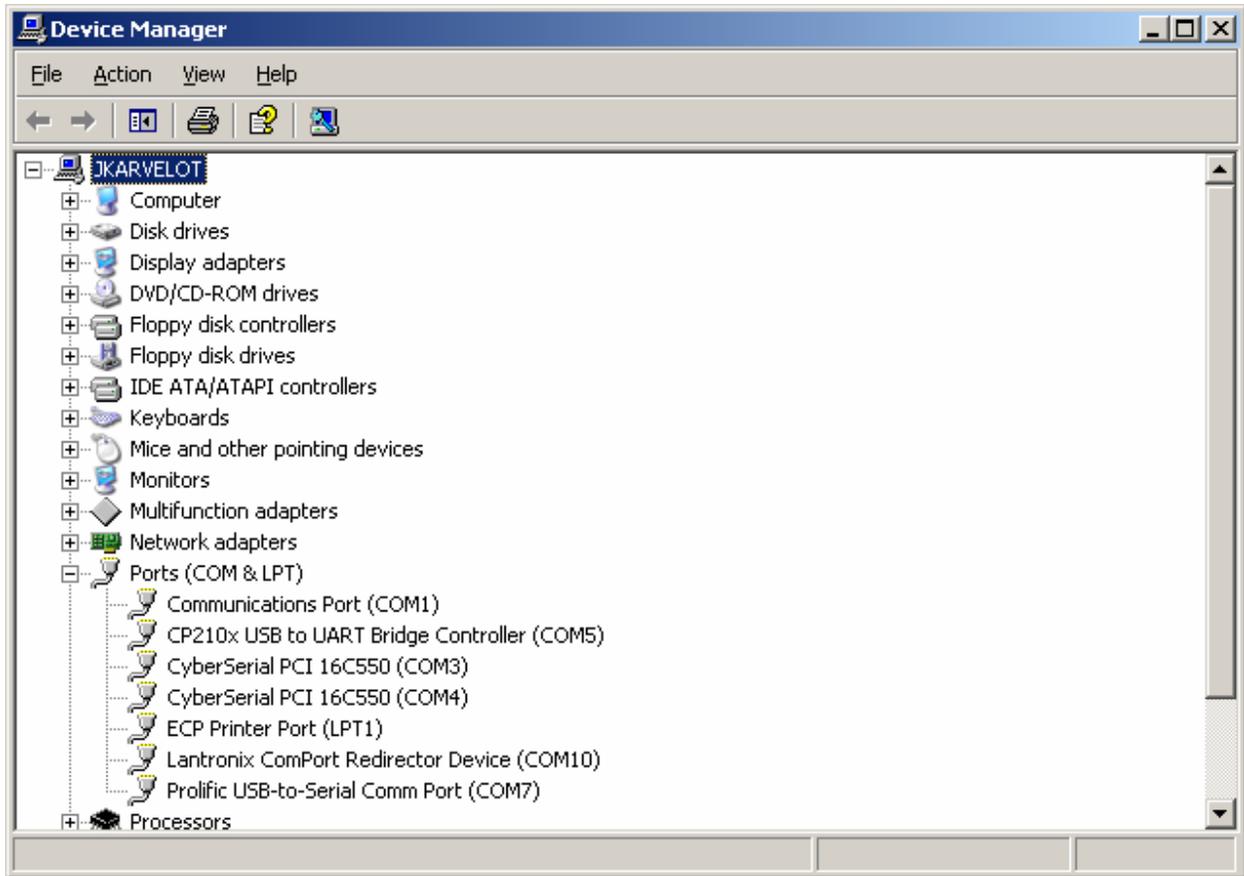


Press the Port Settings button and check Raw Mode. This is required for this particular model (UDS) of Lantronix device server as per their documentation. Press the OK button to save this setting and exit the dialog box.



Press the Save button in the Redirector software's main dialog box to preserve the settings you just entered. A message indicating that the connection will work when the COM port is reopened next will appear.

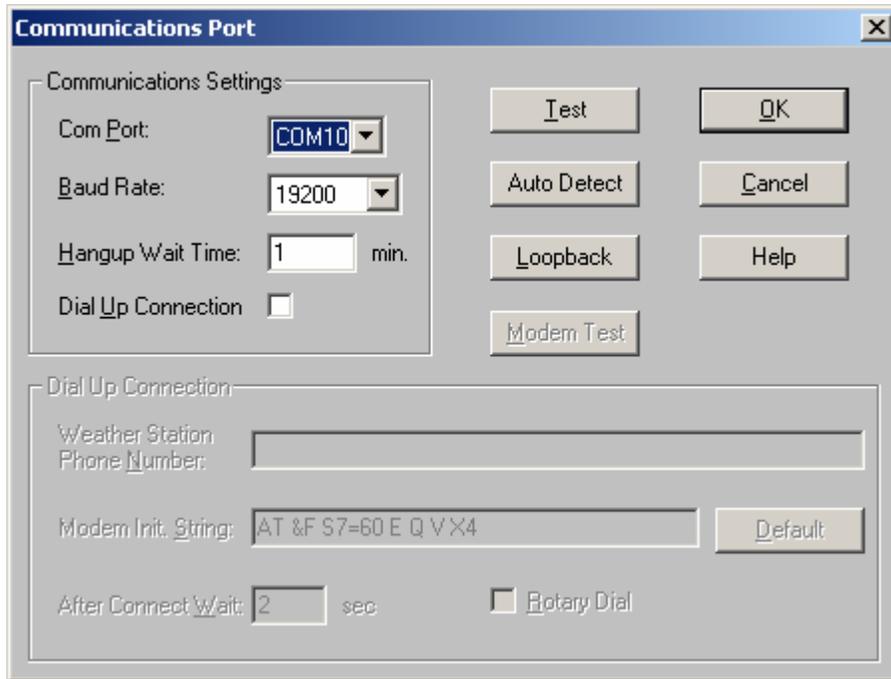
If properly connected and your driver software properly configured, your device server will show up as COM port (for serial devices) or as a USB connection (for USB devices) in your Device Manager. Right click on My Computer, then select the Hardware tab, and click the Device Manager button to view this dialog box in Windows XP. An example is shown below (Lantronix ComPort Redirector Device):



Device Manager screen showing correct installation of the ComPort Redirector

Make sure the device server is properly connected and appears in the Device Manager before attempting to “Test” communications in WeatherLink. Select the COM port assigned to the Lantronix ComPort Redirector and press test - you should get a message that connection was successful. Additional dialog boxes from the Lantronix software will also appear indicating the status of the connection to the device server.

If properly connected, but the connection fails, make sure the COM port assignments in WeatherLink and your Redirector software match and that you are using the correct IP address. Re-run the Lantronix DeviceInstaller application if necessary to verify the settings and the device's IP address.



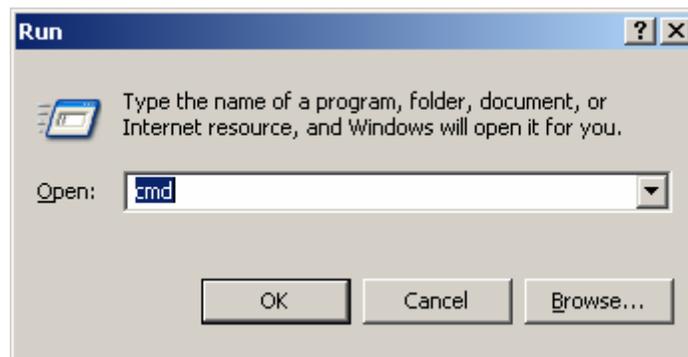
WeatherLink Communications screen for testing the connection

## LINKSYS ROUTER SETUP GUIDELINES

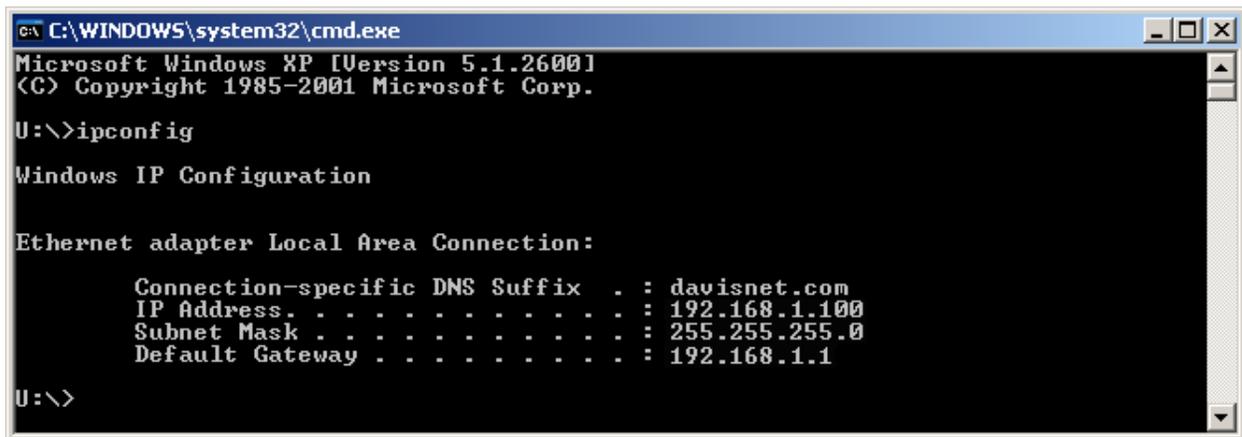
The following guidelines can be used to configure a Linksys router to properly direct Internet traffic to your device server. Like your device server, there will be an IP address you can enter into your Internet browser's URL window to configure your router. To determine that IP address, press the Start Menu button in the lower left hand corner, and then select Run.



Type "cmd" in the window.



A DOS window will appear. At the prompt, type “ipconfig”. A window similar to the one below will appear:



```
C:\WINDOWS\system32\cmd.exe
Microsoft Windows XP [Version 5.1.2600]
(C) Copyright 1985-2001 Microsoft Corp.

U:\>ipconfig

Windows IP Configuration

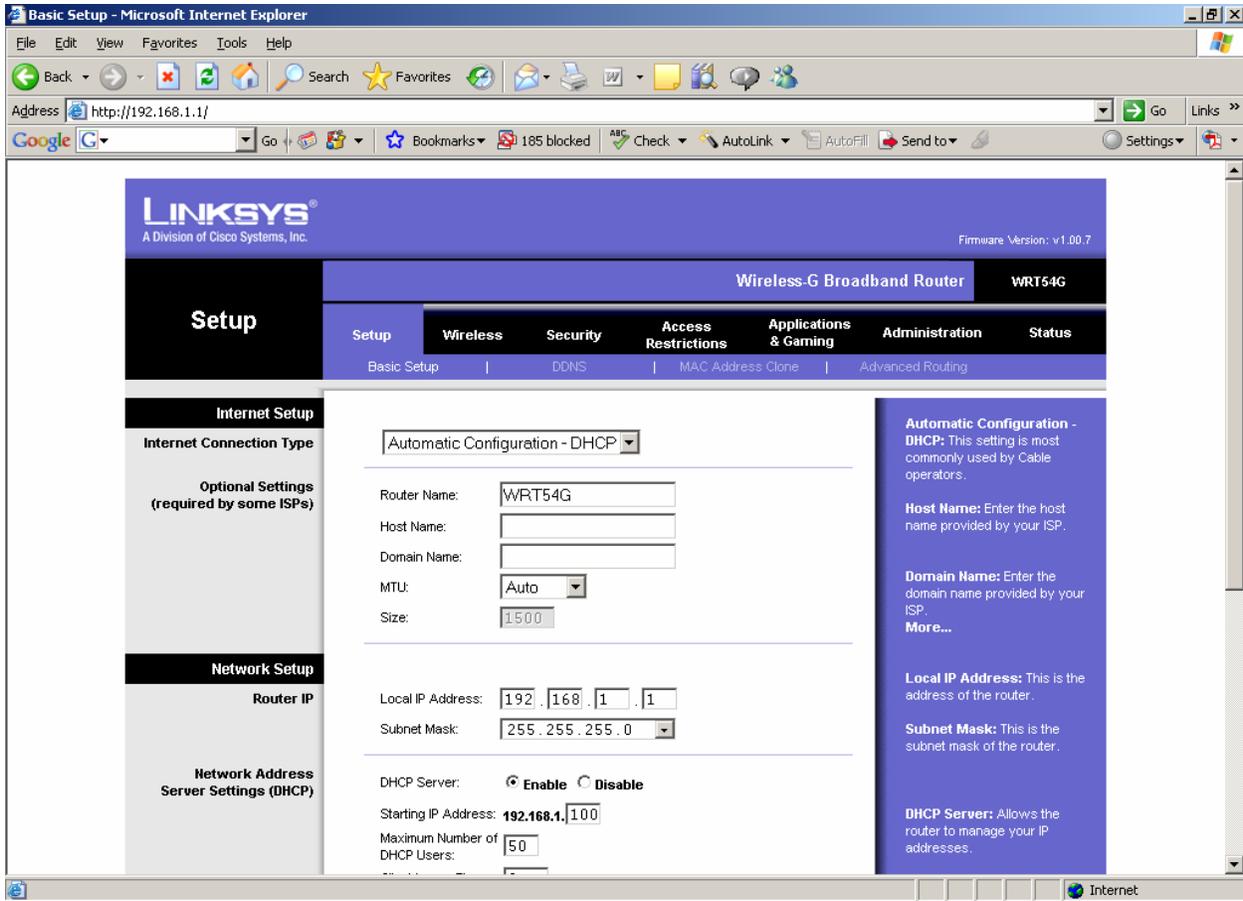
Ethernet adapter Local Area Connection:

    Connection-specific DNS Suffix . : davisnet.com
    IP Address . . . . . : 192.168.1.100
    Subnet Mask . . . . . : 255.255.255.0
    Default Gateway . . . . . : 192.168.1.1

U:\>
```

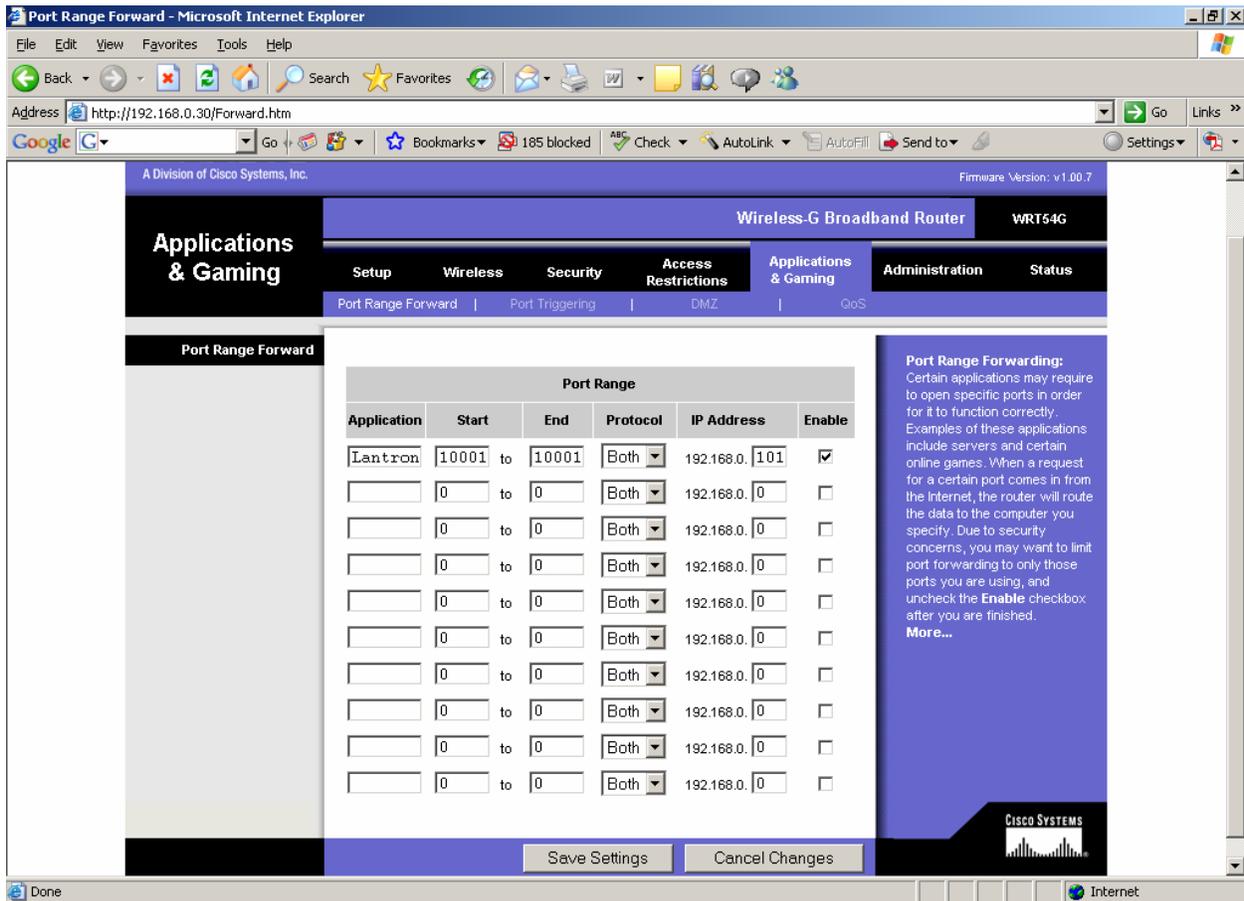
Make note of the “Default Gateway” address. This is the address you will use to access your router. The addresses that will most commonly appear are “192.168.0.1” or “192.168.1.1”.

Enter the Default Gateway address in your Internet browser. A password prompt will appear. If the Linksys router settings are factory default, there is no username and the password is “admin”. The following web page should appear. If not, check the address again and make sure your computer is connected directly to your router.

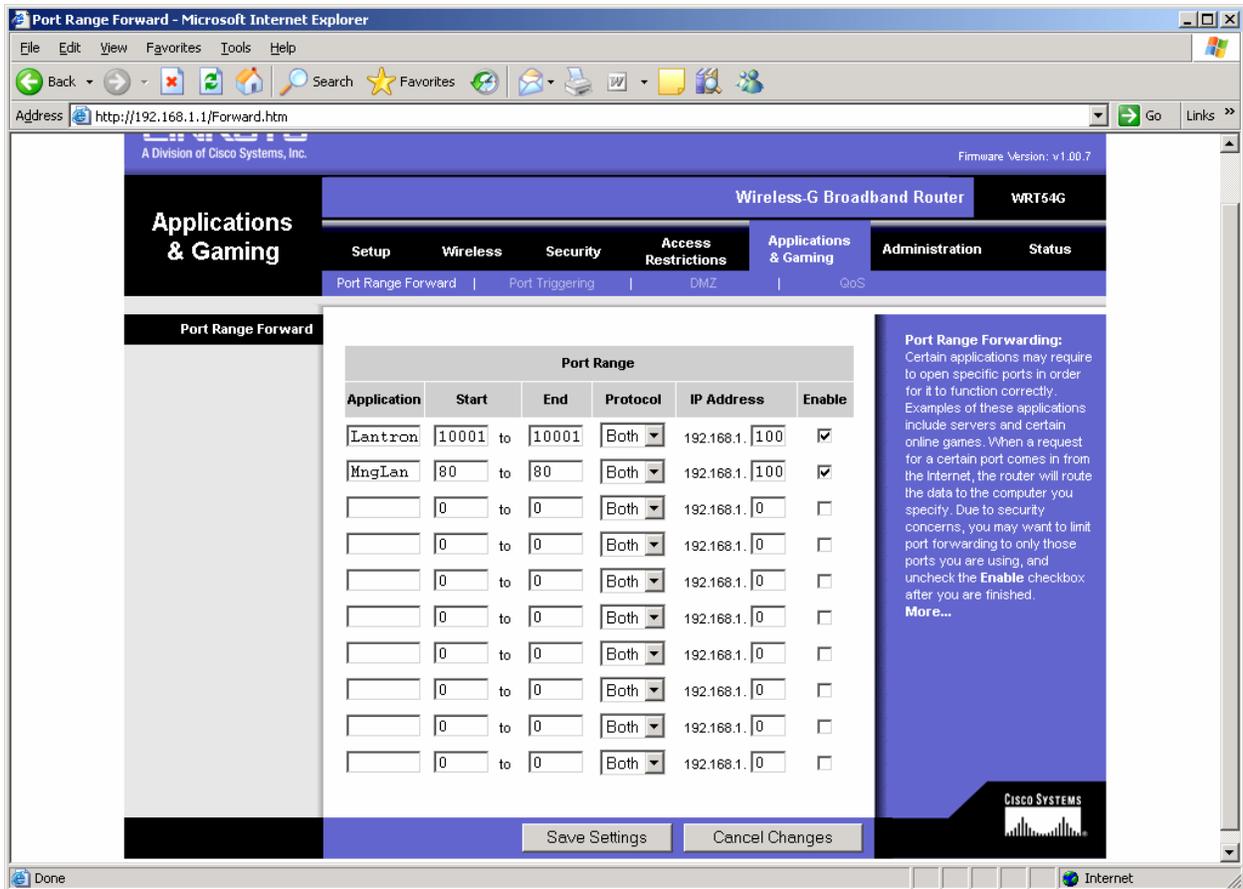


Click on Applications & Gaming. On the page that appears, you will need to tell the router where to forward traffic for the device server. A "port" is used to indicate traffic type, and 10001 is the default and recommended value for the Lantronix UDS 1100. In this case traffic for the Lantronix server is being forwarded on port 10001 to 192.168.1.100, the IP address of the device server which we got from the Device Installer application. If power is lost, your router may assign a different address to the Lantronix and you may need to go back, check and re-enter the new settings.

Since your device server uses only one port, both the Start and End port settings values should be the same. For Internet security purposes, it is highly recommended that you only allow port forwarding to specific known devices. Click Enable to the right and then the Save Settings button at the bottom of the page to enable these settings. You can put any text in the "Application" field to help you remember the purpose of this forward.



If you want to configure your device server remotely, you will need to add another setting to forward the configuration (not communication) traffic properly. The following screen shows this additional setting (the second line item). A web browser is used to configure the device server and web traffic, by convention is usually on Port 80. Here it is being forwarded to same the IP address of the Lantronix UDS:



If you need to view the External IP address for Internet connections (connections from outside your LAN), you can click on Status to view it under “IP Address” – this is the external address of your router. This is the address you would enter into a remote installation of the ComPort redirector to access your station from over the internet.

