

## Vantage Pro and Vantage Pro2 Serial Support 2.2 - 01-25-2005

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## Important Note:

Please note, this information is provided as is, and we do not provide application engineering or comprehensive technical support. Also, we do not guarantee our station will meet the needs of your specific application. If you have questions, they should be submitted through email and they will be answered when resources are available. Also, although we would not do so without good reason, we reserve the right to modify our weather station design without warning at any time.

## I. Introduction

Thank you for choosing Davis Instruments for your weather application. This document explains the serial data protocol between the Vantage Pro or Vantage Pro2 consoles (or Envoys) and a PC. This requires a WeatherLink for Vantage Pro data logger and connector. It is not possible to communicate with the console without it.

Note, the serial communication between Vantage Pro and Vantage Pro2 are very similar except in a few places noted in this document. Important differences are described in section III.

Serial communication parameters are:

8 data bits, 1 start bit, 1 stop bit, and no parity.

Default baud rate is 19200. User selectable between 1200, 2400, 4800, 9600, 14400, and 19200 baud.

The console with a WeatherLink data logger has 3 types of memory:

- 132 KB archive memory, which stores up to 2560 archive records
- 4 KB EEPROM memory, which is used for calibration numbers, station latitude/longitude/elevation/timezone values, transmitter configuration, and Console graph points
- 4 KB of processor memory, which is used to store the current sensor data, today's high/low values, and other real-time values. **This memory is not directly available to the PC!** Commands such as LOOP, provide access to the most useful and important of these data values.

Commands are primarily ASCII strings. Letters should be in ALL CAPS. Please note that in some strings numeric values are in decimal, while in others are in hexadecimal.

Multi-byte binary values are generally stored and sent least significant byte first. Negative numbers use 2's complement notation. CRC values are sent and received most significant byte first.

## II. Differences from WeatherLink for Monitor II

1. An expanded LOOP packet is the only way to receive the current weather data. There is no command to get a single parameter (such as outside temperature).
2. Similarly there is a HILOWS command to receive all of the current daily, monthly, and yearly high/low values with corresponding dates and times.
3. A special DMPAFT command allows you to specify the last record you have previously downloaded so that only the records after that one are downloaded. There is no need to

clear the archive memory to keep download times short. The downloaded records are pre-sorted, so you do not have to determine where the first record is.

4. You can not reset individual high or low values. Instead there are commands to clear all the high values or all the low values.
5. You must make sure that the console is awake before sending commands to it.

### III. Differences from Vantage Pro to Vantage Pro 2

**The Vantage Pro2 serial support is almost the same as the Vantage Pro, but there are some important differences listed below.**

1. Serial commands for Vantage Pro2 must be terminated by a single line feed or a single carriage return character, but not both. Older code that terminates commands with both a line feed and a carriage return will not work or will work intermittently. *Beware that some communication programs translate a line feed to both a line feed and a carriage return.*
2. The locations of the graph data has changed in Vantage Pro2.
3. The transmission packet interval of the Vantage Pro2 ISS is 1/16 of a second longer for every station ID number. For example, ID 1 transmits at an interval of every 2.5625 seconds rather than 2.5 seconds.
4. "GAIN" command is supported in Vantage Pro but not in Vantage Pro2.
5. "STRMON" command returns data packet in different format for Vantage Pro2.
6. Vantage Pro2 does not support different transmitting period. It only supports the normal ISS transmit period.
7. Vantage Pro2 does not support SensorLink station type.

### IV. Waking up the Console

In order to conserve battery power, the console spends as much time "asleep" as possible, waking up only when required. Receiving a character on the serial port will cause the console to wake up, but it might not wake up fast enough to read the first character correctly. Because of this, you should always perform a wakeup procedure before sending commands to the console:

Console Wakeup procedure:

1. Send a Line Feed character, '\n' (decimal 10, hex 0x0A).
2. Listen for a returned response of Line Feed and Carriage Return characters, ('\n\r').
3. If there is no response within a reasonable interval (say 1.2 seconds), then try steps 1 and 2 again up to a total of 3 attempts.
4. If the console has not woken up after 3 attempts, then signal a connection error

After the console has woken up, it will remain awake for 2 minutes. Every time the Vantage receives another character, the 2 minute timer will be reset.

Please note that this is **NOT TRUE** for the LOOP command. In the LOOP mode, we expect that the LOOP packets will be sent over time, so the Vantage will go to sleep immediately between each packet.

## V. Blackout Periods

The console will not process commands when it is in any of the Setup screens (except the first: "Receiving From..."). It will also not process commands when the console is in a number entry mode (e.g. setting an alarm value).

Similarly, when a Download is in progress, the console will not respond to key presses and will not receive data packets from remote sensors.

## VI. Command Formats

The command strings given in the following sections must be followed by a Line Feed characters ('n' or 0x0A or decimal 10) before the console will execute the command.

Command parameters are shown with "<parameter name-decimal>", "<parameter name-hex>", or "<parameter name-binary>". For the -decimal and -hex parameters, substitute an ASCII string. For the -binary parameters, send the character value.

Please note that using the correct number of spaces is very important. For example the command "LOOP <number of LOOP packets to send-decimal>" should be realized with the string "LOOP 4".

There are several different types of command responses. These responses come before any other returned data values.

1. ACK response: when this command is recognized, the console responds with an ASCII ACK (0x06) character. If the command parameters are invalid, a Not Acknowledge response of (0x21) is used. If a block of data is sent with a CRC code, the response CANCEL (0x18) means that the data did not pass the CRC check.
2. "OK" response: when this command is recognized, the console responds with the character string "\n\rOK\n\r".
3. "DONE" response: Some commands take some time to complete their operation. For example the command "CLRGRA" will clear all the console graph points. The Vantage will respond with an "OK" when it receives the command, and "DONE" when it is finished. Do not attempt to send any commands to the console until the "DONE\n\r" response has been received.

## VII. Command Summary

### 1. Testing commands

"TEST"

Sends the string "TEST\n" back.

"WRD" <0x12><0x4d>, ACK

Responds with a weather station type that is backward compatible with earlier Davis weather products.

"RXCHECK"

Sends the Console Diagnostics report.

"STRMON"

Echos all of the data packets sent by sensor transmitters.

"STRMOFF"

Stops sending sensor packets.

"VER"

Sends the firmware date code as a text string.

"RECEIVERS"

Sends the bit map of station IDs that the console can hear, This is not the byte for indicating what the console selects to listen from.

## 2. Current Data commands

"LOOP <number of LOOP packets to send-decimal>"

Sends the specified number of LOOP packets, 1 every 2 seconds. Console sleeps between packets.

"HILOWS"

Sends all the current high/low data in a single 436 byte data block, plus 2 CRC bytes.

"PUTRAIN <Yearly Rain in rain clicks-decimal>"

Set the Yearly rainfall amount on the Vantage Console.

"PUTET <Yearly ET in 100th inch-decimal>"

Set the Yearly ET amount on the Vantage Console.

## 3. Download Commands

"DMP"

Downloads the entire archive memory. See the sections IX.5 and IX.3 for more details.

"DMPAFT"

Downloads the records after a specified date and time. See the sections IX.5 and IX.3 for more details.

## 4. EEPROM Commands

"GETEE"

Reads the full 4K EEPROM in one data block.

"EEWR <EE address-hex> <EE data-hex>"

Writes one byte of data to the specified address in the EEPROM.

"EERD <EE address-hex> <number of bytes to read-hex>"

Reads the specified number of bytes starting at the specified address. Results are given as hex strings, one byte per line.

"EEBWR <EE address-hex> <number of bytes to write-hex>"

Writes data to the EEPROM. The data and CRC are given in binary format following an ACK response.

"EEBRD <EE address-hex> <number of bytes to read-hex>"

Reads data from the EEPROM. The data and CRC are given in binary format following an ACK response.

## 5. Calibration Commands

"CALED"

Sends a block of data with the current temperature and humidity values for setting calibration values.

"CALFIX"

Updates the display when calibration numbers have been changed.

"BAR=<bar value to display (in Hg \* 1000)-decimal> <elevation (ft)-decimal>"

Sets the elevation and barometer offset values when setting the barometer for a new location.

"BARDATA"

Displays of the current barometer calibration parameters in text.

## 6. Clearing Commands

- "CLRLOG"  
Clears the archive data.
- "CLRALM"  
Clears all the alarm thresholds.
- "CLRCAL"  
Clears all the Temperature and Humidity calibration offsets.
- "CLRGRA"  
Clears all of the graph points on the Vantage console.
- "CLRVAR <Data variable-decimal>"  
Clears a rain or ET data value.
- "CLRHIGHS <0, 1, or 2>"  
Clears all of the daily (0), monthly (1), or yearly (2) high values.
- "CLRLOWS <0, 1, or 2>"  
Clears all of the daily (0), monthly (1), or yearly (2) low values.
- "CLRBITS"  
Clears the active alarm bits. Alarms will be reactivated if the alarm condition is still present.
- "CLRDATA"  
Clears all current data values to dashes.

## 7. Configuration Commands

- "BAUD <New baud rate-decimal>"  
Sets the console to a new baud rate. Valid values are 1200, 2400, 4800, 9600, 14400, and 19200.
- "SETTIME"  
Sets the time and date on the Vantage console. Data in a binary format is sent after ACK.
- "GAIN <Gain State: '0' (off) or '1' (on)>"  
Sets the gain of the radio receiver. This command is currently not supported in Vantage Pro2.
- "GETTIME"  
Retrieves the current time and date on the Vantage console. Data is sent in a binary format.
- "SETPER <Archive interval in minutes-decimal>"  
Sets the Vantage archive interval. Valid values are (1, 5, 10, 15, 30, 60, and 120).
- "STOP"  
Disables the creation of archive records.
- "START"  
Enables the creation of archive records, if they have been halted with the STOP command.
- "NEWSETUP"  
Re-initialize the Vantage console after making certain configuration changes.
- "LAMPS <Lamp state: '0' (off) or '1' (on)>"  
Turns the lamps on the Vantage console on or off.

## VIII. Command Details

All commands must be terminated by a single line feed character ('`\n`') or a single carriage return character ('`\r`'). These are not shown in the command syntax, but are shown in the examples. Beware that some systems may translate a new line character into both a new line and a carriage return which will cause intermittent operation when using a Vantage Pro2 console.

In the following command examples, lines starting with “>” are set to the console, and lines starting with “<” are received from the console.

### Character symbols

| Symbol   | Value | Name                             |
|----------|-------|----------------------------------|
| <CR>     | 0x0D  | Carriage return, “\r”            |
| <LF>     | 0x0A  | Line Feed, “\n”                  |
| <ACK>    | 0x06  | Acknowledge                      |
| <NAK>    | 0x21  | Not Acknowledge                  |
| <CANCEL> | 0x18  | Bad CRC code                     |
| <0xdd>   | 0xdd  | Character code specified in hex. |

### 1. Testing commands

#### "TEST"

It sends the string “TEST\n” back. Mostly useful when using HyperTerminal for testing a connection to the console.

Example:

```
>"TEST"<LF>
<"TEST"<LF><CR>
```

#### "WRD"<0x12><0x4d>

It is the same command sequence used by earlier Davis weather stations to read the Station Type value. The station will respond with an <ACK> and then a one byte identifier, which can be one of these values:

| Value | Station    | Value | Station                    |
|-------|------------|-------|----------------------------|
| 0     | Wizard III | 4     | GroWeather                 |
| 1     | Wizard II  | 5     | Energy Enviromontor        |
| 2     | Monitor    | 6     | Health Enviromonitor       |
| 3     | Perception | 16    | Vantage Pro, Vantage Pro 2 |

Example:

```
>"WRD"<0x12><0x4D><LF>
<<ACK><16>
```

#### "RXCHECK"

It sends the Console Diagnostics report. The following values are sent on one line as a text string: total packets received, total packets missed, number of resynchronizations, the largest number of packets received in a row., and the number of CRC errors detected.

All values are recorded since midnight, or since the diagnostics are cleared manually.

Example:

```
>"RXCHECK"<LF>
```

```
<<LF><CR>"OK"<LF><CR>" 21629 15 0 3204 128"<LF><CR>
```

It shows we received 21,629 packets, missed 15 packets, there were no resynchronizations, the maximum number of packets received in a row without an error was 3204, and there were 128 CRC errors detected.

#### **"STRMON"**

It echos all of the data packets sent by sensor transmitters. The station will respond with an "OK" message and Davis Talk data packets when received by the console until the STRMOFF command is given.

For Vantage Pro, each packet contains six bytes and each byte is shown as a two-digit hex string per line, with a blank line between packets.

For VantagePro 2, each packet contains eight bytes instead of six and it returns the byte number along with the content for better clarity.

Example (VantagePro):

```
>"STRMON"<LF>
<<LF><CR>"OK"<LF><CR>
<"F7"<LF><CR>
<"07"<LF><CR>
<"E0"<LF><CR>
<"82"<LF><CR>
<"08"<LF><CR>
<"C4"<LF><CR> . . .
```

Example (VantagePro2):

```
>"STRMON"<LF>
<<LF><CR>"OK"<LF><CR>
<"0 = 81"<LF><CR>
<"1 = 0"<LF><CR>
<"2 = 0"<LF><CR>
<"3 = ff"<LF><CR>
<"4 = c5"<LF><CR>
<"5 = 0"<LF><CR>
<"6 = b7"<LF><CR>
<"7 = 42"<LF><CR><LF><CR> . . .
```

#### **"STRMOFF"**

It halts the flow of Davis Talk data packets started by the STRMON command. Note that this command is the only way to stop receiving Davis Talk data packets.

Example:

```
>"STRMOFF"<LF>
```



<<LF><CR> "OK " <LF><CR>

#### **"VER"**

It sends the firmware date code as a text string. Some functions on the console are implemented differently in different firmware versions. See the separate file "Vantage Console Firmware Release History.doc" or "Envoy Firmware Release History.doc" to determine which functions are available with each firmware version.

The date code is sent in the following format:

"Mmm dd yyyy"

Mmm is the three-letter English month abbreviation

dd is the day of the month

yyyy is the year.

Example:

>"VER"<LF>

<<LF><CR> "OK " <LF><CR> "Apr 24 2002 " <LF><CR>

#### **"RECEIVERS"**

It sends a byte that contains the stations received in the "Receiving From ..." setup screen. The station responds with "OK" followed by the bit map. For each bit position, a value of 1 indicates that that transmitter was received. Bit position 0 (least significant bit) corresponds with Tx ID 1 in the Davis Talk protocol.

Example:

>"RECEIVERS"<LF>

<<LF><CR> "OK " <LF><CR> <0x01>

## 2. Current Data commands

#### **"LOOP <number of LOOP packets to send-decimal>"**

It sends the specified number of LOOP packets, 1 every 2 seconds. Console sleeps between each packet sent. The station responds with an <ACK> then with binary data packet every 2 seconds.

To halt the sending of LOOP packets before receiving all of the requested packets, send a <CR> by itself. Note that this is the same as the Wakeup sequence.

Each data packet is 99 bytes long and contains most of the current data values shown on the vantage console. In addition, the state of alarms, the battery status of the console and the transmitters, the weather forecast icon, and the sunrise and sunset times are included. Rev B and Vantage Pro2 firmware also have the 3 hour barometer trend value. A CRC value is calculated and transmitted so that the PC can validate the transmission accuracy of the data. The data format is described in detail in section IX.1

Example (request 4 LOOP packets):

```
>"LOOP 4"<LF>  
<<ACK>  
<<99 byte loop packet> . . .
```

#### **"HILOWS"**

It sends all the current high/low data in a single data block. The station responds with an <ACK> then a 436 byte data block that includes all the daily, monthly, and yearly high and low values on the Vantage console, and then a 2 byte CRC value. This is so that the PC can validate the transmission accuracy of the data. The data format is described in detail in section IX.2 .

Example:

```
>"HILOWS"<LF>  
<<ACK>  
<<436 byte hi/low packet><2-Byte CRC>
```

#### **"PUTRAIN <Yearly Rain in rain clicks-decimal>"**

It sets the Yearly rainfall amount on the console.

Example (set the Yearly rain to 24.83 inches):

```
>"PUTRAIN 2483"<LF>  
<<ACK>
```

The console shows yearly rain of 24.83 inches (assuming that the rain collector is configured for a 0.01" collector).

#### **"PUTET <Yearly ET in 100th inch-decimal>"**

It sets the Yearly ET amount on the console

Example (set the Yearly ET to 24.83 inchex):

```
>"PUTET 2483"<LF>  
<<ACK>
```

The console display shows yearly ET 24.83 inches.

### 3. Download Commands

#### **"DMP"**

It downloads the entire archive memory. See the sections IX.5 and IX.3 for more details on downloading data.

#### **"DMPAFT"**

It downloads the records after a specified date and time. See the sections IX.5 and IX.3 for more details on downloading data.

#### 4. EEPROM Commands

##### **"GETEE"**

It reads the full 4K EEPROM in one data block. There is also a 2 byte CRC.

Example:

```
>"GETEE"<LF>
<<ACK>
<<4096 byte block of EEPROM data>
<<2-Byte CRC>
```

##### **"EERD <EE address-hex> <number of bytes to read-hex>"**

It reads the specified number of bytes starting at the specified address. Results are given as hex strings, one byte per line. See section XII for more details on accessing EEPROM data.

Example (Read the station Longitude [-122.1]):

```
>"EERD 0D 02"<LF>
<"OK"<LF><CR>
<" 3B"<LF><CR>
<" FB"<LF><CR>
-- 0xFB3B = -1221
```

##### **"EEWR <EE address-hex> <EE data-hex>"**

It writes one byte of data to the specified address in the EEPROM. See section XII for more details on accessing EEPROM data.

Example (It writes 0x87 to EEPROM address 0x58.):

```
>"EEWR 58 87"<LF>
<<LF><CR> "OK" <LF><CR>
```

##### **"EEBRD <EE address-hex> < number of bytes to read-hex>"**

Reads data in binary format from the EEPROM. The data and CRC is given in binary format following an ACK response. See section XII for more details on accessing EEPROM data.

Example (It reads three bytes from the EEPROM at location 0x32.)

```
>"EEBRD 32 03"<LF>
<<ACK>
<<0x05><0xFA><0x0E><2-Byte CRC>
```

##### **"EEBWR <EE address-hex> <number of bytes to write-hex>"**

It writes data to the EEPROM. The data and CRC is given in binary format following an ACK response. See section XII for more details on accessing EEPROM data.

Example (Set the time alarm to 7:15 am, the TIME\_COMP field must also be set):

```
>"EEBWR 54 04"<LF>  
<<ACK>  
><0xCB><0x02><0x34><0xFD><2-Byte CRC>
```

## 5. Calibration Commands

### "CALED"

It sends a block of data with the current temperature and humidity values for setting calibration values. These values are the current CALIBRATED sensor values. The data format is the same that is used in the "CALFIX" command.

Example:

```
>"CALED"<LF>  
<<ACK>  
<<43 bytes of data block with current data values><2-Byte CRC>
```

### "CALFIX"

It updates the display when temperature and humidity calibration numbers have been changed. The values sent should be UN-CALIBRATED sensor values.

Example:

```
>"CALFIX"<LF>  
<<ACK>  
><43 bytes of data block with raw sensor values><2-Byte CRC>  
<<ACK>
```

### "BAR=<bar value to display (in Hg \* 1000)-decimal> <elevation (ft)-decimal>"

It sets the elevation and barometer offset values when setting the barometer for a new location.

**<bar value to display (in Hg \* 1000)-decimal>**

If you have a current barometer reading from a very reliable nearby reference, you can use this parameter to force the display to an exact setting. The console uses this value to fine-tune its own adjusted barometric pressure calculations. Do not use this setting alone to correct your barometer to sea-level.

Use a value of zero when you do not have an exact barometer value that you want the Vantage console to display. This also clears out any existing offset value previously set.

This value should either be zero or between 20.000" Hg and 32500" Hg.

**<elevation (ft)-decimal>**

This is the primary means to correct the barometer measurement. Negative values for elevation can be used.

This value should be between -2000 ft and 15000 ft.

Example (No local Barometer value, elevation 132 ft):

```
>"BAR=0 132"<LF>
<<ACK>
```

Example (Barometer value = 29.491 in Hg, elevation 0 ft):

```
>"BAR=29491 0"<LF>
<<ACK>
```

Example (Barometer value = 29.991 in Hg, elevation -75 ft):

```
>"BAR=29991 -75"<LF>
<<ACK>
```

### "BARDATA"

It retrieves the current barometer calibration parameters in text. These tell you what the current elevation setting and barometer offset values are, plus some details on the barometer correction factor being used.

Example:

```
>"BARDATA"<LF>
<<LF><CR>"OK"<LF><CR>
<"BAR 29775"<LF><CR>
<"ELEVATION 27"<LF><CR>
<"DEW POINT 56"<LF><CR>
<"VIRTUAL TEMP 63"<LF><CR>
<"C 29"<LF><CR>
<"R 1001"<LF><CR>
<"BARCAL 0"<LF><CR>
<"GAIN 1533"<LF><CR>
<"OFFSET 18110"<LF><CR>
```

| Name         | Value in example | Explanation   |
|--------------|------------------|---|
| BAR          | 29.775 in Hg     | The most recent barometer measurement.  |
| ELEVATION    | 27 ft            | Elevation in feet   |
| DEW POINT    | 56 °F            | Dew point when the barometer measurement was taken  |
| VIRTUAL TEMP | 63 °F            | Temperature used in correction formula (12 hour average)                                  |
| C            | 29               | Humidity correction factor used in the formula  |
| R            | 1.001            | Correction ratio. Multiply the raw sensor value by this to get the corrected measurement. |
| BARCAL       | 0.000 in Hg      | Constant offset correction factor. See " <b>BAR=</b> " command.                           |
| GAIN         |                  | These are the factory set values to calibrate the barometer sensor on this console.       |
| OFFSET       |                  |   |

## 6. Clearing Commands

### "CLRLOG"

It clears the archived data.

Example:

```
>"CLRLOG"<LF>  
<<ACK>
```

### "CLRALM"

It clears all the alarm thresholds. Use "CLRBITS" to clear any active alarms.

This command takes time to perform, so you must wait for the console to send "DONE" before sending any further commands

Example:

```
>"CLRALM"<LF>  
<<LF><CR> "OK " <LF><CR>  
-- After some time passes --  
<"DONE " <LF><CR>
```

### "CLRCAL"

Clears all the Temperature and Humidity calibration offsets to zero.

Note that the values displayed on the console do not use the new calibration values until a new data packet arrives for that sensor. You must use the procedure from section XIII.1 to force the current display to use the new cal numbers

Example:

```
>"CLRCAL"<LF>  
<"OK " <LF><CR>  
-- After some time passes --  
<"DONE " <LF><CR>
```

### "CLRGRA"

It clears all of the graph points on the Vantage console.

Example:

```
>"CLRGRA"<LF>  
<"OK " <LF><CR>  
-- After some time passes --  
<"DONE " <LF><CR>
```

**"CLRVAR <Data variable-decimal>"**

It clears a rain or ET data value from the following table:

| Rain Variable Name | Number | ET Variable Name | Number |
|--------------------|--------|------------------|--------|
| Daily Rain         | 13     | Day ET           | 26     |
| Storm Rain         | 14     | Month ET         | 25     |
| Month Rain         | 16     | Year ET          | 27     |
| Year Rain          | 17     |                  |        |

Results are undefined if you use a number not on this list

Example (Clear Month Rain value):

```
>"CLRVAR 16"<LF>  
<<ACK>
```

**"CLRHIGH <0, 1, or 2>"**

It clears all of the daily (0), monthly (1), or yearly (2) high values

Example (Clear Monthly High values):

```
>"CLRHIGH 1"<LF>  
<<ACK>
```

**"CLRLOW <0, 1, or 2>"**

It clears all of the daily (0), monthly (1), or yearly (2) low values

Example (Clear Yearly Low values):

```
>"CLRLOW 2"<LF>  
<<ACK>
```

**"CLRBITS"**

It clears the active alarm bits. They will reactivate if the alarm condition is still present.

Example:

```
>"CLRBITS"<LF>  
<<ACK>
```

**"CLRDATA"**

It clears all current data values to dashes.

Example:

```
>"CLRDATA"<LF>  
<<ACK>
```

## 7. Configuration Commands

### "BAUD <New baud rate-decimal>"

It sets the console to a new baud rate. Valid values are 1200, 2400, 4800, 9600, 14400, and 19200. If the new baud rate is accepted, an "OK" will be returned at the new baud rate. If it is not, a "NO" will be returned and the baud rate will not be changed.

Example (to set 9600 baud):

```
>"BAUD 9600"<LF>
<<LF><CR>"OK"<LF><CR>
```

### "SETTIME"

It sets the time and date on the console. Data in a binary format is sent after ACK.

The data is 6 bytes plus a 2 bytes of CRC. The each field is one byte. The fields, in order, are: seconds, minutes, hour (24 hour format), day, month, year – 1900. See section XI for more information on calculating CRC values.

Example (to set 3:27:00 pm, June 4, 2003):

```
>"SETTIME"<LF>
<<ACK>
><0><27><15><4><6><103><2 Bytes of CRC>
<<ACK>
```

### "GETTIME"

It retrieves the current time and date on the console. Data is sent in a binary format. The format is the same as the SETTIME command.

Example (Vantage responds with 5:17:42 am, January 28, 1998):

```
>"GETTIME"<LF>
<<ACK>
><42><17><5><28><1><98><2 Bytes of CRC>
```

### "GAIN <Gain State: '0' (off) or '1' (on)>"

**This command only works with the VantagePro station and is not currently implemented on the VantagePro 2 station.**

It sets the gain of the radio receiver, same as pressing the HI/LOW key on the console diagnostics screen. "GAIN 1" turns the gain on. "GAIN <Anything else>" turns the gain off:

Example (Turn on the Radio Gain):

```
>"GAIN 1"<LF>
<<LF><CR>"OK"<LF><CR>
```

Example (Turn off the Radio Gain):

```
>"GAIN 0"<LF>
<<LF><CR>"OK"<LF><CR>
```



**"SETPER <Archive interval in minutes-decimal>"**

It sets the console archive interval. This is the interval that archive data records are recorded into the archive memory. The smaller this value is, the faster the archive memory will fill up.

Valid values are (1, 5, 10, 15, 30, 60, and 120). Results are undefined if you try to select an archive period not on the list.

This command automatically clears the archive memory. Use the "CLRLOG" command to clear the archive memory. WeatherLink clears the archive memory so that all archived records in the archive memory use the same archive interval.

Example (set a 10 minute archive interval):

```
>"SETPER 10"<LF>  
<<ACK>
```

**"STOP"**

It disables the creation of archive records.

**"START"**

It enables the creation of archive records, if they have been halted with the STOP command.

These two commands are not needed for normal operation.

**"NEWSETUP"**

It re-initializes the console after making certain configuration changes.

**Make sure to issue this command after you set the Latitude or Longitude, and after you change any of the Setup bits in the EEPROM (address 43 = 0x2B) especially the Rain collector type,**

Example (set a 10 minute archive interval):

```
>"NEWSETUP"<LF>  
<<ACK>
```

**"LAMPS <Lamp state: '0' (off) or '1' (on)>"**

It turns the lamps on the Vantage console on or off.

Example (turn the lamps off):

```
>"LAMPS 0"<LF>  
<<LF><CR>"OK "<LF><CR>
```

## IX. Data Formats

### 1. LOOP data format

There are two different loop data formats. Rev "A" firmware, dated before April 24, 2002 uses the old format. Rev "B" firmware, dated on or after April 24, 2002 uses the new format. The only difference between these formats is the inclusion of the current 3 hour barometer trend in place of the fixed value "P" in the fourth byte of the data packet.

Only values read directly from sensors are included in the LOOP packet. Desired values (i.e., Dew Point or Wind Chill) must be calculated on the PC. The LOOP packet also contains information on the current status of all Vantage Alarm conditions, battery status, weather forecasts, and sunrise and sunset times.

#### Contents of the LOOP packet.

| Field                            | Offset | Size | Explanation   |
|----------------------------------|--------|------|---|
| "L"                              | 0      | 1    | Spells out "LOO" for Rev B packets and "LOOP" for Rev A packets. Identifies a LOOP packet   |
| "O"                              | 1      | 1    |   |
| "O"                              | 2      | 1    |   |
| "P" (Rev A)<br>Bar Trend (Rev B) | 3      | 1    | Signed byte that indicates the current 3-hour barometer trend. It is one of these values:<br>-60 = Falling Rapidly = 196 (as an unsigned byte)<br>-20 = Falling Slowly = 236 (as an unsigned byte)<br>0 = Steady<br>20 = Rising Slowly<br>60 = Rising Rapidly<br>80 = ASCII "P" = Rev A firmware, no trend info is available<br>Any other value means that the Vantage does not have the 3 hours of bar data needed to determine the bar trend. |
| Packet Type                      | 4      | 1    | Has the value zero. In the future we may define new LOOP packet formats and assign a different value to this field.   |
| Next Record                      | 5      | 2    | Location in the archive memory where the next data packet will be written. This can be monitored to detect when a new record is created.  |
| Barometer                        | 7      | 2    | Current Barometer. Units are (in Hg / 1000). The barometric value should be between 20 inches and 32.5 inches in Vantage Pro and between 20 inches and 32.5 inches in both Vantatge Pro Vantage Pro2. Values outside these ranges will not be logged.   |
| Inside Temperature               | 9      | 2    | The value is sent as 10 <sup>th</sup> of a degree in F. For example, 795 is returned for 79.5°F.  |
| Inside Humidity                  | 11     | 1    | This is the relative humidity in %, such as 50 is returned for 50%.   |
| Outside Temperature              | 12     | 2    | The value is sent as 10 <sup>th</sup> of a degree in F. For example, 795 is returned for 79.5°F.  |
| Wind Speed                       | 14     | 1    | It is a byte unsigned value in mph. If the wind speed is dashed because it lost synchronization with the radio or due to some other reason, the wind speed is forced to be 0.   |
| 10 Min Avg Wind Speed            | 15     | 1    | It is a byte unsigned value in mph.   |
| Wind Direction                   | 16     | 2    | It is a two byte unsigned value from 0 to 360 degrees. (0° is North, 90° is East, 180° is South and 270° is West.)  |
| Extra Temperatures               | 18     | 7    | This field supports seven extra temperature stations. Each byte is one extra temperature value in whole degrees F with an offset of 90 degrees. For example, a value of 0 = -90°F ; a value of 100 = 10°F ; and a value of 169 = 79°F.  |

| Field                       | Offset | Size | Explanation   |
|-----------------------------|--------|------|---|
| Soil Temperatures           | 25     | 4    | This field supports four soil temperature sensors, in the same format as the Extra Temperature field above          |
| Leaf Temperatures           | 29     | 4    | This field supports four leaf temperature sensors, in the same format as the Extra Temperature field above          |
| Outside Humidity            | 33     | 1    | This is the relative humidity in %.   |
| Extra Humidities            | 34     | 7    | Relative humidity in % for extra seven humidity stations.   |
| Rain Rate                   | 41     | 2    | This value is sent as 100 <sup>th</sup> of a inch per hour. For example, 256 represent 2.56 inches/hour.            |
| UV                          | 43     | 1    | The unit is in UV index.  |
| Solar Radiation             | 44     | 2    | The unit is in watt/meter <sup>2</sup> .  |
| Storm Rain                  | 46     | 2    | The storm is stored as 100 <sup>th</sup> of an inch.  |
| Start Date of current Storm | 48     | 2    | Bit 15 to bit 12 is the month, bit 11 to bit 7 is the day and bit 6 to bit 0 is the year offsetted by 2000.         |
| Day Rain                    | 50     | 2    | This value is sent as the 100 <sup>th</sup> of an inch.   |
| Month Rain                  | 52     | 2    | This value is sent as the 100 <sup>th</sup> of an inch.   |
| Year Rain                   | 54     | 2    | This value is sent as the 100 <sup>th</sup> of an inch.   |
| Day ET                      | 56     | 2    | This value is sent as the 100 <sup>th</sup> of an inch.   |
| Month ET                    | 58     | 2    | This value is sent as the 100 <sup>th</sup> of an inch.   |
| Year ET                     | 60     | 2    | This value is setnt as the 100 <sup>th</sup> of an inch.  |
| Soil Moistures              | 62     | 4    | The unit is in centibar. It supports four soil sensors.   |
| Leaf Wetnesses              | 66     | 4    | This is a scale number from 0 to 15 with 0 meaning very dry and 15 meaning very wet. It supports four leaf sensors. |
| Inside Alarms               | 70     | 1    | Currently active inside alarms. See the table below   |
| Rain Alarms                 | 71     | 1    | Currently active rain alarms. See the table below   |
| Outside Alarms              | 72     | 2    | Currently active outside alarms. See the table below  |
| Extra Temp/Hum Alarms       | 74     | 8    | Currently active extra temp/hum alarms. See the table below   |
| Soil & Leaf Alarms          | 82     | 4    | Currently active soil/leaf alarms. See the table below  |
| Transmitter Battery Status  | 86     | 1    |   |
| Console Battery Voltage     | 87     | 2    | Voltage = ((Data * 300)/512)/100.0  |
| Forecast Icons              | 89     | 1    |   |
| Forecast Rule number        | 90     | 1    |   |
| Time of Sunrise             | 91     | 2    | The time is stored as hour * 100 + min.   |
| Time of Sunset              | 93     | 2    | The time is stored as hour * 100 + min.   |
| "\n" <LF> = 0x0A            | 95     | 1    |   |
| "\r" <CR> = 0x0D            | 96     | 1    |   |
| CRC                         | 97     | 2    |   |
| Total Length                | 99     |      |   |

#### Forecast Icons in LOOP packet

| Field          | Byte | Bit # |  |
|----------------|------|-------|--|
| Forecast Icons | 89   |       | Bit maps for forecast icons on the console screen. |
| Rain           |      | 0     |  |
| Cloud          |      | 1     |  |
| Partly Cloudy  |      | 2     |  |
| Sun            |      | 3     |  |
| Snow           |      | 4     |  |

#### Forecast Icon Values

| Value Decimal | Value Hex | Segments Shown                    | Forecast                                       |
|---------------|-----------|-----------------------------------|--|
| 8             | 0x08      | Sun                               | Mostly Clear                                   |
| 6             | 0x06      | Partial Sun + Cloud               | Partially Cloudy                               |
| 2             | 0x02      | Cloud                             | Mostly Cloudy                                  |
| 3             | 0x03      | Cloud + Rain                      | Mostly Cloudy, Rain within 12 hours            |
| 18            | 0x12      | Cloud + Snow                      | Mostly Cloudy, Snow within 12 hours            |
| 19            | 0x13      | Cloud + Rain + Snow               | Mostly Cloudy, Rain or Snow within 12 hours    |
| 7             | 0x07      | Partial Sun + Cloud + Rain        | Partially Cloudy, Rain within 12 hours         |
| 22            | 0x16      | Partial Sun + Cloud + Snow        | Partially Cloudy, Snow within 12 hours         |
| 23            | 0x17      | Partial Sun + Cloud + Rain + Snow | Partially Cloudy, Rain or Snow within 12 hours |

### Currently active alarms in the LOOP packet

This table shows which alarms correspond to each bit in the LOOP alarm fields. Not all bits in each field are used. The Outside Alarms field has been split into 2 1-byte sections.

| Field                         | Byte      | Bit # |                                  |
|-------------------------------|-----------|-------|----------------------------------|
| <b>Inside Alarms</b>          | <b>70</b> |       | Currently active inside alarms.  |
| Falling bar trend alarm       |           | 0     |                                  |
| Rising bar trend alarm        |           | 1     |                                  |
| Low inside temp alarm         |           | 2     |                                  |
| High inside temp alarm        |           | 3     |                                  |
| Low inside hum alarm          |           | 4     |                                  |
| High inside hum alarm         |           | 5     |                                  |
| Time alarm                    |           | 6     |                                  |
| <b>Rain Alarms</b>            | <b>71</b> |       | Currently active rain alarms.    |
| High rain rate alarm          |           | 0     |                                  |
| 15 min rain alarm             |           | 1     | Flash Flood alarm                |
| 24 hour rain alarm            |           | 2     |                                  |
| Storm total rain alarm        |           | 3     |                                  |
| Daily ET alarm                |           | 4     |                                  |
| <b>Outside Alarms</b>         | <b>72</b> |       | Currently active outside alarms. |
| Low outside temp alarm        |           | 0     |                                  |
| High outside temp alarm       |           | 1     |                                  |
| Wind speed alarm              |           | 2     |                                  |
| 10 min avg speed alarm        |           | 3     |                                  |
| Low dewpoint alarm            |           | 4     |                                  |
| High dewpoint alarm           |           | 5     |                                  |
| High heat alarm               |           | 6     |                                  |
| Low wind chill alarm          |           | 7     |                                  |
| <b>Outside Alarms, byte 2</b> | <b>73</b> |       |                                  |
| High THSW alarm               |           | 0     |                                  |
| High solar rad alarm          |           | 1     |                                  |
| High UV alarm                 |           | 2     |                                  |
| UV Dose alarm                 |           | 3     |                                  |

| Field                      | Byte    | Bit # |   |
|----------------------------|---------|-------|---|
| Outside Humidity Alarms    | 74      | 1     | Currently active outside humidity alarms.   |
| Low Humidity alarm         |         | 2     |   |
| High Humidity alarm        |         | 3     |   |
| Extra Temp/Hum Alarms      | 75 - 81 | 7     | Each byte contains four alarm bits (0 – 3) for a single extra Temp/Hum station. Bits (4 – 7) are not used and reserved for future use.<br>Use the temperature and humidity sensor numbers, as described in Section XIII.4 to locate which byte contains the appropriate alarm bits. In particular, the humidity and temperature alarms for a single station will be found in different bytes. |
| Low temp X alarm           |         | 0     |   |
| High temp X alarm          |         | 1     |   |
| Low hum X alarm            |         | 2     |   |
| High hum X alarm           |         | 3     |   |
| Soil & Leaf Alarms         | 82 - 85 | 4     | Currently active soil/leaf alarms.  |
| Low leaf wetness X alarm   |         | 0     |   |
| High leaf wetness X alarm  |         | 1     |   |
| Low soil moisture X alarm  |         | 2     |   |
| High soil moisture X alarm |         | 3     |   |
| Low leaf temp X alarm      |         | 4     |   |
| High leaf temp X alarm     |         | 5     |   |
| Low soil temp X alarm      |         | 6     |   |
| High soil temp X alarm     |         | 7     |   |

## 2. HILOW data format

The "HILOWS" command sends a 436 byte data packet and a 2 byte CRC value. The data packet is broken up into sections of related data values.

Contents of the HILOW packet.

| Field                | Offset | Size | Explanation |
|----------------------|--------|------|-------------|
| Barometer Section    | 0      | 16   |             |
| Daily Low Barometer  | 0      | 2    |             |
| Daily High Barometer | 2      | 2    |             |
| Month Low Bar        | 4      | 2    |             |
| Month High Bar       | 6      | 2    |             |
| Year Low Barometer   | 8      | 2    |             |
| Year High Barometer  | 10     | 2    |             |
| Time of Day Low Bar  | 12     | 2    |             |
| Time of Day High Bar | 14     | 2    |             |
|                      |        |      |             |
| Wind Speed Section   | 16     | 5    |             |
| Daily Hi Wind Speed  | 16     | 1    |             |
| Time of Hi Speed     | 17     | 2    |             |
| Month Hi Wind Speed  | 19     | 1    |             |
| Year Hi Wind Speed   | 20     | 1    |             |
|                      |        |      |             |
| Inside Temp Section  | 21     | 16   |             |

| Field                          | Offset    | Size      | Explanation |
|--------------------------------|-----------|-----------|-------------|
| Day Hi Inside Temp             | 21        | 2         |             |
| Day Low Inside Temp            | 23        | 2         |             |
| Time Day Hi In Temp            | 25        | 2         |             |
| Time Day Low In Temp           | 27        | 2         |             |
| Month Low In Temp              | 29        | 2         |             |
| Month Hi In Temp               | 31        | 2         |             |
| Year Low In Temp               | 33        | 2         |             |
| Year Hi In Temp                | 35        | 2         |             |
|                                |           |           |             |
| <b>Inside Humidity Section</b> | <b>37</b> | <b>10</b> |             |
| Day Hi In Hum                  | 37        | 1         |             |
| Day Low In Hum                 | 38        | 1         |             |
| Time Day Hi In Hum             | 39        | 2         |             |
| Time Day Low In Hum            | 41        | 2         |             |
| Month Hi In Hum                | 43        | 1         |             |
| Month Low In Hum               | 44        | 1         |             |
| Year Hi In Hum                 | 45        | 1         |             |
| Year Low In Hum                | 46        | 1         |             |
|                                |           |           |             |
| <b>Outside Temp Section</b>    | <b>47</b> | <b>16</b> |             |
| Day Low Out Temp               | 47        | 2         |             |
| Day Hi Out Temp                | 49        | 2         |             |
| Time Day Low Out Temp          | 51        | 2         |             |
| Time Day Hi Out Temp           | 53        | 2         |             |
| Month Hi Out Temp              | 55        | 2         |             |
| Month Low Out Temp             | 57        | 2         |             |
| Year Hi Out Temp               | 59        | 2         |             |
| Year Low Out Temp              | 61        | 2         |             |
|                                |           |           |             |
| <b>Dew Point Section</b>       | <b>63</b> | <b>16</b> |             |
| Day Low Dew Point              | 63        | 2         |             |
| Day Hi Dew Point               | 65        | 2         |             |
| Time Day Low Dew Point         | 67        | 2         |             |
| Time Day Hi Dew Point          | 69        | 2         |             |
| Month Hi Dew Point             | 71        | 2         |             |
| Month Low Dew Point            | 73        | 2         |             |
| Year Hi Dew Point              | 75        | 2         |             |
| Year Low Dew Point             | 77        | 2         |             |
|                                |           |           |             |
| <b>Wind Chill Section</b>      | <b>79</b> | <b>8</b>  |             |
| Day Low Wind Chill             | 79        | 2         |             |
| Time Day Low Chill             | 81        | 2         |             |
| Month Low Wind Chill           | 83        | 2         |             |
| Year Low Wind Chill            | 85        | 2         |             |
|                                |           |           |             |
| <b>Heat Index Section</b>      | <b>87</b> | <b>8</b>  |             |
| Day High Heat                  | 87        | 2         |             |
| Time of Day High Heat          | 89        | 2         |             |
| Month High Heat                | 91        | 2         |             |
| Year High Heat                 | 93        | 2         |             |
|                                |           |           |             |

| Field                          | Offset     | Size       | Explanation   |
|--------------------------------|------------|------------|---|
| <b>THSW Index Section</b>      | <b>95</b>  | <b>8</b>   |   |
| Day High THSW                  | 95         | 2          |   |
| Time of Day High THSW          | 97         | 2          |   |
| Month High THSW                | 99         | 2          |   |
| Year High THSW                 | 101        | 2          |   |
|                                |            |            |   |
| <b>Solar Radiation Section</b> | <b>103</b> | <b>8</b>   |   |
| Day High Solar Rad             | 103        | 2          |   |
| Time of Day High Solar         | 105        | 2          |   |
| Month High Solar Rad           | 107        | 2          |   |
| Year High Solar Rad            | 109        | 2          |   |
|                                |            |            |   |
| <b>UV Section</b>              | <b>111</b> | <b>5</b>   |   |
| Day High UV                    | 111        | 1          |   |
| Time of Day High UV            | 112        | 2          |   |
| Month High UV                  | 114        | 1          |   |
| Year High UV                   | 115        | 1          |   |
|                                |            |            |   |
| <b>Rain Rate Section</b>       | <b>116</b> | <b>10</b>  |   |
| Day High Rain Rate             | 116        | 2          |   |
| Time of Day High Rain Rate     | 118        | 2          |   |
| Hour High Rain Rate            | 120        | 2          |   |
| Month High Rain Rate           | 122        | 2          |   |
| Year High Rain Rate            | 124        | 2          |   |
|                                |            |            |   |
| <b>Extra/Leaf/Soil Temps</b>   | <b>126</b> | <b>150</b> | Each field has 15 entries.<br>Indexes 0 – 6 = Extra Temperatures 2 – 8<br>Indexes 7 – 10 = Leaf Temperatures 1 – 4<br>Indexes 11 – 14 = Soil Temperatures 1 – 4 |
| Day Low Temperature            | 126        | 15         | (15 * 1)  |
| Day Hi Temperature             | 141        | 15         | (15 * 1)  |
| Time Day Low Temperature       | 156        | 30         | (15 * 2)  |
| Time Day Hi Temperature        | 186        | 30         | (15 * 2)  |
| Month Hi Temperature           | 216        | 15         | (15 * 1)  |
| Month Low Temperature          | 221        | 15         | (15 * 1)  |
| Year Hi Temperature            | 236        | 15         | (15 * 1)  |
| Year Low Temperature           | 251        | 15         | (15 * 1)  |
|                                |            |            |   |
| <b>Outside/Extra Hums</b>      | <b>276</b> | <b>80</b>  | Each field has 8 entries<br>Index 0 = Outside Humidity<br>Index 1 – 7 = Extra Humidities 2 – 8  |
| Day Low Humidity               | 259        | 8          | (8 * 1)   |
| Day Hi Humidity                | 267        | 8          | (8 * 1)   |
| Time Day Low Humidity          |            | 16         | (8 * 2)   |
| Time Day Hi Humidity           |            | 16         | (8 * 2)   |
| Month Hi Humidity              |            | 8          | (8 * 1)   |
| Month Low Humidity             |            | 8          | (8 * 1)   |
| Year Hi Humidity               |            | 8          | (8 * 1)   |
| Year Low Humidity              |            | 8          | (8 * 1)   |
|                                |            |            |   |
| <b>Soil Moisture Section</b>   | <b>356</b> | <b>40</b>  | Each field has 4 entries.<br>Indexes 0 – 3 = Soil Moistures 1 – 4   |

| Field                      | Offset | Size | Explanation   |
|----------------------------|--------|------|---|
| Day Hi Soil Moisture       |        | 4    | (4 * 1)   |
| Time Day Hi Soil Moisture  |        | 8    | (4 * 2)   |
| Day Low Soil Moisture      |        | 4    | (4 * 1)   |
| Time Day Low Soil Moisture |        | 8    | (4 * 2)   |
| Month Low Soil Moisture    |        | 4    | (4 * 1)   |
| Month Hi Soil Moisture     |        | 4    | (4 * 1)   |
| Year Low Soil Moisture     |        | 4    | (4 * 1)   |
| Year Hi Soil Moisture      |        | 4    | (4 * 1)   |
|                            |        |      |   |
| Leaf Wetness Section       | 496    | 40   | Each field has 4 entries.<br>Indexes 0 – 3 = Leaf Wetness 1 – 4 |
| Day Hi Leaf Wetness        |        | 4    | (4 * 1)   |
| Time Day Hi Leaf Wetness   |        | 8    | (4 * 2)   |
| Day Low Leaf Wetness       |        | 4    | (4 * 1)   |
| Time Day Low Leaf Wetness  |        | 8    | (4 * 2)   |
| Month Low Leaf Wetness     |        | 4    | (4 * 1)   |
| Month Hi Leaf Wetness      |        | 4    | (4 * 1)   |
| Year Low Leaf Wetness      |        | 4    | (4 * 1)   |
| Year Hi Leaf Wetness       |        | 4    | (4 * 1)   |
|                            |        |      |   |
| CRC                        | 436    | 2    |   |

### 3. DMP and DMPAFT data format

There are two different archived data formats. Rev "A" firmware, dated before April 24, 2002 uses the old format. Rev "B" firmware dated on or after April 24, 2002 uses the new format. The fields up to ET are identical for both formats. The only differences are in the Soil, Leaf, Extra Temperature, Extra Humidity, High Solar, High UV, and forecast fields (reedOpen and reedClosed fields are removed).

You can use the VER command and parse the date returned to determine the archive data format, or you can examine byte 42 in the archive record. In a Rev B record, it will have the value 0x00. In a Rev A record, this byte is used for "Leaf Wetness 4" which is never assigned a real data value, so it will always contain 0xFF. Future record formats may assign different values for this field.

Each archive record is 52 bytes. Records are sent to the PC in 264 byte pages. Each page contains 5 archive records and 4 unused bytes. See section 5 for more details on performing download operations.

The value in the "Dash Value" column is what you will see if that field is not updated at all during the archive interval. A dash value can appear for several reasons, and different weather variables are treated differently. For example, if you see 32767 for Outside Temperature that could be because of a communication problem, the sensor was unplugged, or the sensor has failed. Note, a dashed value is not always the sign of a problem. For example, the rainfall reading could be 0 if no rain fell in that interval. To determine if a problem exists, often times you will need to look at more than one weather variable.



Contents of the Rev "A" archive record.

| Field                      | Offset | Size | Dash Value     | Explanation   |
|----------------------------|--------|------|----------------|---|
| Date Stamp                 | 0      | 2    | Not applicable | These 16 bits hold the date that the archive was written in the following format:<br>Year (7 bits)   Month (4 bits)   Day (5 bits) or:<br>day + month*32 + (year-2000)*512)   |
| Time Stamp                 | 2      | 2    | Not applicable | Time on the Vantage that the archive record was written:<br>(Hour * 100) + minute.  |
| Outside Temperature        | 4      | 2    | 32767          | Either the Average Outside Temperature, or the Final Outside Temperature over the archive period. Units are (°F / 10)   |
| High Out Temperature       | 6      | 2    | -32768         | Highest Outside Temp over the archive period.   |
| Low Out Temperature        | 8      | 2    | 32767          | Lowest Outside Temp over the archive period.  |
| Rainfall                   | 10     | 2    | 0              | Number of rain clicks over the archive period   |
| High Rain Rate             | 12     | 2    | 0              | Highest rain rate over the archive period, or the rate shown on the console at the end of the period if there was no rain. Units are (rain clicks / hour)   |
| Barometer                  | 14     | 2    | 0              | Barometer reading at the end of the archive period. Units are (in Hg / 1000)  |
| Solar Radiation            | 16     | 2    | 32767          | Average Solar Rad over the archive period. Units are (Watts / m <sup>2</sup> )  |
| Number of Wind Samples     | 18     | 2    | 0              | Number of packets containing wind speed data received from the ISS or wireless anemometer.  |
| Inside Temperature         | 20     | 2    | 32767          | Either the Average Inside Temperature, or the Final Inside Temperature over the archive period. Units are (°F / 10)   |
| Inside Humidity            | 22     | 1    | 255            | Inside Humidity at the end of the archive period  |
| Outside Humidity           | 23     | 1    | 255            | Outside Humidity at the end of the archive period   |
| Average Wind Speed         | 24     | 1    | 255            | Average Wind Speed over the archive interval. Units are (MPH)   |
| High Wind Speed            | 25     | 1    | 0              | Highest Wind Speed over the archive interval. Units are (MPH)   |
| Direction of Hi Wind Speed | 26     | 1    | 32767          | Direction code of the High Wind speed. 0 = N, 1 = NNE, 2 = NE, ... 14 = NW, 15 = NNW, 255 = Dashed  |
| Prevailing Wind Direction  | 27     | 1    | 32767          | Prevailing or Dominant Wind Direction code. 0 = N, 1 = NNE, 2 = NE, ... 14 = NW, 15 = NNW, 255 = Dashed<br>Firmware before July 8, 2001 does not report direction codes of 255. Software should substitute the dash value whenever the High Wind Speed is zero. |
| Average UV                 | 28     | 1    | 255            | Average UV Index. Units are (UV Index / 10)   |
| ET                         | 29     | 1    | 0              | ET accumulated over the last hour. Only records "on the hour" will have a non-zero value. Units are (in / 1000)   |
| Invalid data               | 30     | 1    |                | This byte is contains invalid data in Rev A data records  |
| Soil Moistures             | 31     | 4    | 255            | 4 Soil Moisture values. Units are (cb)  |
| Soil Temperatures          | 35     | 4    | 255            | 4 Soil Temperatures. Units are (°F + 90)  |

| Field              | Offset | Size | Dash Value | Explanation   |
|--------------------|--------|------|------------|---|
| Leaf Wetnesses     | 39     | 4    | 255        | 4 Leaf Wetness values. Range is 0 – 15                            |
| Extra Temperatures | 43     | 2    | 32767      | 2 Extra Temperature values. Units are (°F + 90)                   |
| Extra Humidities   | 45     | 2    | 255        | 2 Extra Humidity values   |
| Reed Closed        | 47     | 2    | 0          | Count of the number of time the anemometer reed switch was closed |
| Reed Opened        | 49     | 2    | 0          | Count of the number of time the anemometer reed switch was opened |
| Unused Byte        | 51     | 1    |            |   |

Contents of the Rev "B" archive record.

| Field                      | Offset | Size | Dash Value     | Explanation  |
|----------------------------|--------|------|----------------|--|
| Date Stamp                 | 0      | 2    | Not applicable | These 16 bits hold the date that the archive was written in the following format:<br>Year (7 bits)   Month (4 bits)   Day (5 bits) or:<br>day + month*32 + (year-2000)*512)    |
| Time Stamp                 | 2      | 2    | Not applicable | Time on the Vantage that the archive record was written:<br>(Hour * 100) + minute.   |
| Outside Temperature        | 4      | 2    | 32767          | Either the Average Outside Temperature, or the Final Outside Temperature over the archive period. Units are (°F / 10)  |
| High Out Temperature       | 6      | 2    | -32768         | Highest Outside Temp over the archive period.  |
| Low Out Temperature        | 8      | 2    | 32767          | Lowest Outside Temp over the archive period.   |
| Rainfall                   | 10     | 2    | 0              | Number of rain clicks over the archive period  |
| High Rain Rate             | 12     | 2    | 0              | Highest rain rate over the archive period, or the rate shown on the console at the end of the period if there was no rain. Units are (rain clicks / hour)                      |
| Barometer                  | 14     | 2    | 0              | Barometer reading at the end of the archive period. Units are (in Hg / 1000).  |
| Solar Radiation            | 16     | 2    | 32767          | Average Solar Rad over the archive period. Units are (Watts / m <sup>2</sup> )   |
| Number of Wind Samples     | 18     | 2    | 0              | Number of packets containing wind speed data received from the ISS or wireless anemometer.   |
| Inside Temperature         | 20     | 2    | 32767          | Either the Average Inside Temperature, or the Final Inside Temperature over the archive period. Units are (°F / 10)  |
| Inside Humidity            | 22     | 1    | 255            | Inside Humidity at the end of the archive period   |
| Outside Humidity           | 23     | 1    | 255            | Outside Humidity at the end of the archive period  |
| Average Wind Speed         | 24     | 1    | 255            | Average Wind Speed over the archive interval. Units are (MPH)  |
| High Wind Speed            | 25     | 1    | 0              | Highest Wind Speed over the archive interval. Units are (MPH)  |
| Direction of Hi Wind Speed | 26     | 1    | 32767          | Direction code of the High Wind speed. 0 = N, 1 = NNE, 2 = NE, ... 14 = NW, 15 = NNW, 255 = Dashed   |
| Prevailing Wind Direction  | 27     | 1    | 32767          | Prevailing or Dominant Wind Direction code. 0 = N, 1 = NNE, 2 = NE, ... 14 = NW, 15 = NNW, 255 = Dashed<br>Firmware before July 8, 2001 does not report direction codes of 255 |
| Average UV Index           | 28     | 1    | 255            | Average UV Index. Units are (UV Index / 10)  |

| Field                | Offset | Size | Dash Value | Explanation   |
|----------------------|--------|------|------------|---|
| ET                   | 29     | 1    | 0          | ET accumulated over the last hour. Only records "on the hour" will have a non-zero value. Units are (in / 1000) |
| High Solar Radiation | 30     | 2    | 0          | Highest Solar Rad value over the archive period. Units are (Watts / m <sup>2</sup> )                            |
| High UV Index        | 32     | 1    | 0          | Highest UV Index value over the archive period. Units are (Watts / m <sup>2</sup> )                             |
| Forecast Rule        | 33     | 1    | 193        | Weather forecast rule at the end of the archive period.   |
| Leaf Temperature     | 34     | 2    | 255        | 2 Leaf Temperature values. Units are (°F + 90)  |
| Leaf Wetnesses       | 36     | 2    | 255        | 2 Leaf Wetness values. Range is 0 – 15  |
| Soil Temperatures    | 38     | 4    | 255        | 4 Soil Temperatures. Units are (°F + 90)  |
| Download Record Type | 42     | 1    |            | 0xFF = Rev A, 0x00 = Rev B archive record   |
| Extra Humidities     | 43     | 2    | 255        | 2 Extra Humidity values   |
| Extra Temperatures   | 45     | 3    | 32767      | 3 Extra Temperature values. Units are (°F + 90)   |
| Soil Moistures       | 48     | 4    | 255        | 4 Soil Moisture values. Units are (cb)  |

#### 4. Alarm thresholds data format

The alarm thresholds data does not have a dedicated command to set or retrieve the values. Instead see section XII for more information on reading and writing EEPROM data.

| Field               | Offset  | Size | Explanation  |
|---------------------|---------|------|--|
| ALARM_START         | 82=0x52 | 94   | Starting location for the Alarm threshold data. See section 0 for more details on setting alarm thresholds |
| BAR_RISE_ALARM      | 0       | 1    | 3 hour rising bar trend alarm. Units are in Hg * 1000  |
| BAR_FALL_ALARM      | 1       | 1    | 3 hour falling bar trend alarm. Units are in Hg * 1000   |
| TIME_ALARM          | 2       | 2    | Time alarm. Hours * 100 + minutes  |
| TIME_COMP_ALARM     | 4       | 2    | 1's compliment of TIME_ALARM to validate alarm entries   |
| LOW_TEMP_IN_ALARM   | 6       | 1    | Threshold is (data value – 90) °F  |
| HIGH_TEMP_IN_ALARM  | 7       | 1    | Threshold is (data value – 90) °F  |
| LOW_TEMP_OUT_ALARM  | 8       | 1    | Threshold is (data value – 90) °F  |
| HIGH_TEMP_OUT_ALARM | 9       | 1    | Threshold is (data value – 90) °F  |
| LOW_TEMP_ALARM      | 10      | 15   | 7 extra temps, 4 soil temps, 4 leaf temps  |
| HIGH_TEMP_ALARM     | 25      | 15   | 7 extra temps, 4 soil temps, 4 leaf temps  |
| LOW_HUM_IN_ALARM    | 40      | 1    | Inside humidity is one byte unsigned number in decimal, such as 100 represent 100%.                        |
| HIGH_HUM_IN_ALARM   | 41      | 1    | Inside humidity is one byte unsigned number in decimal, such as 100 represent 100%.                        |
| LOW_HUM_ALARM       | 42      | 8    | First entry is the current Outside Humidity setting  |
| HIGH_HUM_ALARM      | 50      | 8    | First entry is the current Outside Humidity setting  |
| LOW_DEW_ALARM       | 58      | 1    | Threshold is (data value – 120) °F   |
| HIGH_DEW_ALARM      | 59      | 1    | Threshold is (data value – 120) °F   |
| CHILL_ALARM         | 60      | 1    | Threshold is (data value – 120) °F   |
| HEAT_ALARM          | 61      | 1    | Threshold is (data value – 90) °F  |
| THSW_ALARM          | 62      | 1    | Threshold is (data value – 90) °F  |
| SPEED_ALARM         | 63      | 1    | Current Wind Speed alarm. Units are MPH  |
| SPEED_10MIN_ALARM   | 64      | 1    | 10 minute average Wind Speed alarm. Units are MPH  |
| UV_ALARM            | 65      | 1    | Current UV index alarm. Units are (UV Index * 10)  |
| UV_DOSE_ALARM       | 66      | 1    | Daily UV Dose alarm. Units are MEDS * 10   |

| Field            | Offset | Size | Explanation   |
|------------------|--------|------|---|
| LOW_SOIL_ALARM   | 67     | 4    | Low soil moisture alarm with unit in centibar.                                |
| HIGH_SOIL_ALARM  | 71     | 4    | High soil moisture alarm with unit in centibar.                               |
| LOW_LEAF_ALARM   | 75     | 4    | Low leaf wetness alarm with index 0 to 15. 0 is very dry and 15 is very wet.  |
| HIGH_LEAF_ALARM  | 79     | 4    | High leaf wetness alarm with index 0 to 15. 0 is very dry and 15 is very wet. |
| SOLAR_ALARM      | 83     | 2    | Solar energy alarm with unit in watt/meter <sup>2</sup> .                     |
| RAIN_RATE_ALARM  | 85     | 2    | Rain rate alarm is set with 0.01 inch per hour.                               |
| RAIN_15MIN_ALARM | 87     | 2    | 15-minute rain alarm is set with 0.01 inch resolution.                        |
| RAIN_24HR_ALARM  | 89     | 2    | 24-hour rain alarm is set with 0.01 inch resolution.                          |
| RAIN_STORM_ALARM | 91     | 2    | Rain storm alarm is set with 0.01 inch resolution.                            |
| ET_DAY_ALARM     | 93     | 1    | Units are (0.001 inches)  |

## 5. CALED and CALFIX data format

The "CALED" and "CALFIX" commands send and receive a block of temperature and humidity data used to update the current display whenever the calibration offsets are changed. The format of this data block is:

| Field               | Offset | Size | Explanation |
|---------------------|--------|------|-------------|
| Inside Temperature  | 0      | 2    |             |
| Outside Temperature | 2      | 2    |             |
| Extra Temperature   | 4      | 14   | (7 * 2)     |
| Soil Temperatures   | 18     | 8    | (4 * 2)     |
| Leaf Temperatures   | 26     | 8    | (4 * 2)     |
| Inside Humidity     | 34     | 1    |             |
| Outside Humidity    | 35     | 1    |             |
| Extra Humidities    | 36     | 7    |             |

## X. Download Protocol

There are two commands you can use to get archived data records from the console. "DMP" download all data records, while "DMPAFT" only downloads the records archived "after" a selected time and date. The other advantage of the "DMPAFT" command is that the data blocks are sorted so that the oldest data downloaded is in the first page sent. The "DMP" command on the other hand always starts with "page zero" which may not be the oldest data if the archive memory has filled up.

This section will concentrate on the operation of the "DMPAFT" command. The "DMP" command is identical in operation except that you do not send or receive any additional data between sending the command and receiving archive records.

In order to use the "DMPAFT" command you need to determine the time and date-stamp of the last record that you already have, AND this record should match one of the records already archived in the WeatherLink data logger. (if the data is not found, then the entire contents of the data archive will be downloaded.)

To calculate the time and date-stamps, use these formulas: (hour is in 24 hour format, both of these values are 2-byte values)

$\text{vantageDateStamp} = \text{day} + \text{month} * 32 + (\text{year} - 1900) * 512;$

$\text{vantageTimeStamp} = (100 * \text{hour} + \text{minute});$

Use zero for both of these values (and the CRC) to force a full download.

Send the command "**DMPAFT**" to the Vantage Pro

When you get an <ACK> back, send the 2 byte vantageDateStamp, the 2 byte vantageTimeStamp, and a 2 byte CRC value calculated from them. See section XI for more information on calculating CRC values. Send the MSB of the CRC first, then the LSB.

If the CRC is correct, the will send back another <ACK> the number of "pages" that will be send (2 bytes), the location within the first page of the first record, and 2 Byte CRC.

If the CRC is not correct, the vantage will respond with 0x18. If you do not sent 6 bytes, it will respond with 0x21.

Note that while the console tells you which record in the first page it sends contains the first new data record, it does not tell you which record in the last page it sends is the last new data record. Records after the most recent will either contain all 0xFF bytes (if the archive has never been completely filled), or will contain old data records.

At this point you can either send an <ESC> = 0x1B to cancel the download, or an <ACK> to start the download.

After receiving each page of data, calculate the CRC value. If the CRC was incorrect, send 0x21 (really "!" but used as <NAK>) to have the Vantage send the page again.

Otherwise, send <ACK> to receive the next page (if there is one), or <ESC> to cancel the download early.

Each "Page" is 267 bytes and contains 5 records of data. There are a total of 512 pages of archive memory for a total of 2560 records. If a "**DMPAFT**" command results in downloading the entire archive, 513 pages will be downloaded. The first and last pages in this case are identical.

The format of each page is:

1 Byte sequence number (starts at 0 and wraps from 255 back to 0)

52 Byte Data record

52 Byte Data record

52 Byte Data record

52 Byte Data record

52 Byte Data record

4 Byte unused bytes

2 Byte CRC

See section IX.3 for details on the format of the archive data record.

Example (download records after June 6, 2003 9:30am [270 pages, the first valid record is 2]):

```
>"DMPAFT"<LF>
<<ACK>
-- Send the Date and Time stamp --
><0xC6><0xCE><0xA2><0x03>
-- Send the calculated CRC 0xE2B4 --
><0xE2><0xB4>
<<ACK>
-- Vantage responds with the number of pages it will send --
<<0x0E><0x01><0x02><0x00><2 Bytes of CRC Data>
-- Begin the download – Use <ESC> instead to cancel it
><ACK>
-- Block sequence number
<<0x00>
<<52 byte data record 0>
<<52 byte data record 1>
-- The next record is the first record with new data
<<52 byte data record 2>
<<52 byte data record 3>
<<52 byte data record 4>
<<4 unused bytes>
<<2 byte CRC>
-- At this point verify the CRC and send either <ACK>, <0x21>, or <ESC>
```

## **XI. CRC calculation**

The console uses the same CRC calculation that was used by earlier Davis Instruments weather stations.

The CRC checking used by the WeatherLink is based on the CRC-CCITT standard. The heart of the method involves a CRC-accumulator that uses the following formula on each successive data byte. After all the data bytes have been "accumulated", there will be a two byte CRC checksum that will get processed in the same manner as the data bytes. If there has been no transmission error, then the final CRC-accumulator value will be 0 (assuming it was set to zero before accumulating data).

In the following code, "crc" is the crc accumulator (16 bits or 2 bytes), "data" is the data or CRC checksum byte to be accumulated, and "crc\_table" is the table of CRC values found in the CCITT.h header file. The operator "^" is an exclusive-or (XOR), ">> 8" shifts the data right by one byte (divides by 256), and "<< 8" shifts the data left by one byte (multiplies by 256).

```
crc = crc_table [(crc >> 8) ^ data] ^ (crc << 8);
```

When sending a CRC to the console, always send the most significant byte first. This is the opposite of how regular data values are sent where the least significant byte is sent first.

Example, calculating the CRC in the DMPAFT example above:

| Old CRC | Data byte | Table index                 | Table Value | New CRC                                    |
|---------|-----------|-----------------------------|-------------|--|
| 0x0000  | 0xC6      | $(0x00 \wedge 0xC6) = 0xC6$ | 0xB98A      | $(0x0000 \wedge 0xB98A) = 0xB98A$          |
| 0xB98A  | 0xCE      | $(0xB9 \wedge 0xCE) = 0x77$ | 0x0E70      | $(0x8A00 \wedge 0x0E70) = 0x8470$          |
| 0x8470  | 0xA2      | $(0x84 \wedge 0xA2) = 0x26$ | 0x44A4      | $(0x7000 \wedge 0x44A4) = 0x34A4$          |
| 0x34A4  | 0x03      | $(0x34 \wedge 0x03) = 0x37$ | 0x46B4      | $(0xA400 \wedge 0x46B4) = \mathbf{0xE2B4}$ |

If you continue processing the received CRC value of 0xE2B4 it will look like this:

| Old CRC | Data byte | Table index                 | Table Value | New CRC                                    |
|---------|-----------|-----------------------------|-------------|--|
| 0xE2B4  | 0xE2      | $(0xE2 \wedge 0xE2) = 0x00$ | 0x0000      | $(0xB400 \wedge 0x0000) = 0xB400$          |
| 0xB400  | 0xB4      | $(0xB4 \wedge 0xB4) = 0x00$ | 0x0000      | $(0x0000 \wedge 0x0000) = \mathbf{0x0000}$ |

The final CRC of zero indicates that the "packet" passed its CRC check.

## XII. EEPROM configuration settings

There are two different ways to access data from the EEPROM. The commands "**EERD**" and "**EEWR**" provide a text based interface that you can use with a terminal emulation program, such as HyperTerminal. All numerical data is sent and received as ASCII strings that represent hexadecimal numbers. You can read as many values as you want with one "**EERD**" command, but you can only write one byte of data for each "**EEWR**" command.

The commands "**EEBRD**" and "**EEBWR**" use similar hex strings to specify what data you want to read or write, but the actual EEPROM data is sent and received as binary bytes. You can read and write as many bytes as you would like to in a single command.

Both read and written data includes a CRC code. A CRC is required for data written with the "**EEBWR**" command.

There are several EEPROM data locations that should not be written with the "**EEWR**" or "**EEBWR**" commands. These are either factory calibration values that should not be changed, or else they are values that can be set from a different command. For example, use the "**SETPER**" command to set the ARCHIVE\_PERIOD value, and the "**BAR=**" command to set the BAR\_CAL and ELEVATION values. It is safe to read these EEPROM values.

The table below gives the addresses and sizes of the most useful EEPROM data values. The address of each field is given both in decimal and in hex. Use the hex value in all "**EE...**" commands. There is a supplemental list of the locations where the Vantage graph data is stored in section XIV.

## EEPROM address table

| Name             | Hex | Dec | Size | Description  |
|------------------|-----|-----|------|--|
| BAR_GAIN         | 1   | 1   | 2    | These are the factory barometer calibration values.  |
| BAR_OFFSET       | 3   | 3   | 2    | <b>Do not modify them!</b>   |
| BAR_CAL          | 5   | 5   | 2    | Barometer Offset calibration.<br><b>Use the "BAR=" command to set this value!</b>  |
| HUM33            | 7   | 7   | 2    | These are the factory inside humidity calibration values.  |
| HUM80            | 9   | 9   | 2    | <b>Do not modify them!</b>   |
| LATITUDE         | 0B  | 11  | 2    | Station Latitude in tenths of a degree. Negative values = southern hemisphere  |
| LONGITUDE        | 0D  | 13  | 2    | Station Longitude in tenths of a degree. Negative values = western hemisphere  |
| ELEVATION        | 0F  | 15  | 2    | Station elevation in feet.<br><b>Use the "BAR=" command to set this value!</b>   |
| TIME_ZONE        | 11  | 17  | 1    | String number of the time zone selected on the setup screen.   |
| MANUAL_OR_AUTO   | 12  | 18  | 1    | 1 = manual daylight savings, 0 = automatic daylight savings  |
| DAYLIGHT_SAVINGS | 13  | 19  | 1    | This is the configuration bit for the day light savings mode when it is set in manual mode. 1 = daylight savings is now on, 0 = daylight savings is now off. When automatic daylight savings mode is selected, this bit is ignored and it does not indicate whether the daylight savings is on or not. |
| GMT_OFFSET       | 14  | 20  | 2    | The time difference between GMT and local time (a 2-byte signed number in hundredths of hours. For example, a value of 850 would be +8.50 hours. Negative values in 2's complements, represent western hemisphere.   |
| GMT_OR_ZONE      | 16  | 22  | 1    | 1 = use the GMT_OFFSET value, 0 = use the TIME_ZONE value  |
| USETX            | 17  | 23  | 1    | Bitmapped field that indicates which DavisTalk transmitters to listen to. Bit 0 = ID 1.  |
| RE_TRANSMIT_TX   | 18  | 24  | 1    | ID number to use for retransmit. 0 = don't retransmit, 1 = use ID 1.   |
| STATION_LIST     | 19  | 25  | 16   | 2 bytes per transmitter ID. First byte is station type, second byte is <temp sensor #   hum sensor #>. See section XIII.4 for more details.  |



| Name  | Hex | Dec | Size | Description  |
|---|-----|-----|------|--|
| UNIT_BITS   | 29  | 41  | 1    | Barometer unit (bit 1:0):<br>0: 0.01 INCHES<br>1: 0.1 MM<br>2: 0.1 HPA<br>3: 0.1 MB<br>Temperature unit (Bit 3:2):<br>0: °F (Whole degrees)<br>1: °F (Tenths of a degree)<br>2: °C (Whole degrees)<br>3: °C (Tenths of a degree)<br>Elevation unit (Bit 4):<br>0: FEET<br>1: METERS<br>RAIN unit (Bit 5):<br>0: INCHES<br>1: MM<br>Wind unit (Bit 7:6):<br>0: MPH<br>1: M/S<br>2: Km/H<br>3: KNOTS         |
| UNIT_BITS_COMP  | 2A  | 42  | 1    | This should be the 1's complement of UNIT_BITS for validation.   |
| SETUP_BITS  | 2B  | 43  | 1    | AM/PM Time Mode (Bit 0):<br>0: AM<br>1: PM<br>Is AM on (Bit 1):<br>0: AM OFF<br>1: AM ON<br>Month/Day Format (Bit 2):<br>0: Shown as Month/Day<br>1: Shown as Day/Month<br>Wind Cup Size (Bit 3):<br>0: Small Size<br>1: Large Size<br>Rain Collector Size (Bit 5:4):<br>0: 0.01 INCHES<br>1: 0.2 MM<br>2: 0.1 MM<br>Latitude (Bit 6):<br>0: South<br>1: North<br>Longitude (Bit 7):<br>0: West<br>1: East |
| RAIN_SEASON_START   | 2C  | 44  | 1    | Month that the Yearly rain total is cleared. 1 = January, etc  |
| ARCHIVE_PERIOD  | 2D  | 45  | 1    | Number of minutes in the archive period.<br><b>Use "SETPER" to set this value.</b>   |
| Calibration values are 1 byte signed numbers that are offsets applied to the corresponding raw sensor value in the native sensor units (either 0.1 °F or 1 %) |     |     |      |  |
| TEMP_IN_CAL   | 32  | 50  | 1    | The setting range is from (-12.8 °F to 12.7 °F) with the most significant byte as the sign bit.  |
| TEMP_IN_COMP  | 33  | 51  | 1    | 1's compliment of TEMP_IN_CAL to validate calibration data   |

| Name                | Hex | Dec | Size | Description  |
|---------------------|-----|-----|------|--|
| TEMP_OUT_CAL        | 34  | 52  | 1    | The setting range is from (-12.8 °F to 12.7 °F) with the most significant byte as the sign bit.                        |
| TEMP_CAL            | 35  | 53  | 15   | 7 "extra" temperatures, 4 soil temperatures, and 4 leaf temperatures   |
| HUM_IN_CAL          | 44  | 68  | 1    | The inside humidity calibration value is ranged from 0 to 100%.  |
| HUM_CAL             | 45  | 69  | 8    | The first entry is the currently selected outside humidity sensor.   |
| DIR_CAL             | 4D  | 77  | 2    | 2 byte wind direction calibration allows full 360° calibration in both directions.                                     |
| DEFAULT_BAR_GRAPH   | 4F  | 79  | 1    | These values control which time span to use on the console graph display when Rain, Barometer, or Wind Speed is shown. |
| DEFAULT_RAIN_GRAPH  | 50  | 80  | 1    |  |
| DEFAULT_SPEED_GRAPH | 51  | 81  | 1    |  |
| ALARM_START         | 52  | 82  | 94   | Starting location for the Alarm threshold data. See section XIII.5 for more details on setting alarm thresholds        |
| BAR_RISE_ALARM      | 52  | 82  | 1    | 3 hour rising bar trend alarm. Units are in Hg * 1000  |
| BAR_FALL_ALARM      | 53  | 83  | 1    | 3 hour falling bar trend alarm. Units are in Hg * 1000   |
| TIME_ALARM          | 54  | 84  | 2    | Time alarm. Hours * 100 + minutes  |
| TIME_COMP_ALARM     | 56  | 86  | 2    | 1's compliment of TIME_ALARM to validate alarm entries   |
| LOW_TEMP_IN_ALARM   | 58  | 88  | 1    | Threshold is (data value – 90) °F  |
| HIGH_TEMP_IN_ALARM  | 59  | 89  | 1    | Threshold is (data value – 90) °F  |
| LOW_TEMP_OUT_ALARM  | 5A  | 90  | 1    | Threshold is (data value – 90) °F  |
| HIGH_TEMP_OUT_ALARM | 5B  | 91  | 1    | Threshold is (data value – 90) °F  |
| LOW_TEMP_ALARM      | 5C  | 92  | 15   | 7 extra temps, 4 soil temps, 4 leaf temps  |
| HIGH_TEMP_ALARM     | 6B  | 107 | 15   | 7 extra temps, 4 soil temps, 4 leaf temps  |
| LOW_HUM_IN_ALARM    | 7A  | 122 | 1    | Low relative humidity alarm in %.  |
| HIGH_HUM_IN_ALARM   | 7B  | 123 | 1    | High relative humidity alarm in %.   |
| LOW_HUM_ALARM       | 7C  | 124 | 8    | First entry is the current Outside Humidity setting  |
| HIGH_HUM_ALARM      | 84  | 132 | 8    | First entry is the current Outside Humidity setting  |
| LOW_DEW_ALARM       | 8C  | 140 | 1    | Threshold is (data value – 120) °F   |
| HIGH_DEW_ALARM      | 8D  | 141 | 1    | Threshold is (data value – 120) °F   |
| CHILL_ALARM         | 8E  | 142 | 1    | Threshold is (data value – 120) °F   |
| HEAT_ALARM          | 8F  | 143 | 1    | Threshold is (data value – 90) °F  |
| THSW_ALARM          | 90  | 144 | 1    | Threshold is (data value – 90) °F  |
| SPEED_ALARM         | 91  | 145 | 1    | Current Wind Speed alarm. Units are MPH  |
| SPEED_10MIN_ALARM   | 92  | 146 | 1    | 10 minute average Wind Speed alarm. Units are MPH  |
| UV_ALARM            | 93  | 147 | 1    | Current UV index alarm. Units are (UV Index * 10)  |
| LOW_SOIL_ALARM      | 95  | 149 | 4    | Low soil moisture alarm in centibar. It supports four soil moisture sensors.   |
| HIGH_SOIL_ALARM     | 99  | 153 | 4    | High soil moisture alarm in centibar. It supports four soil moisture sensors.  |
| LOW_LEAF_ALARM      | 9D  | 157 | 4    | Low leaf wetness alarm with index 0 to 15. 0 is very dry and 15 is very wet.   |
| HIGH_LEAF_ALARM     | A1  | 161 | 4    | High leaf wetness alarm with index 0 to 15. 0 is very dry and 15 is very wet.  |
| SOLAR_ALARM         | A5  | 165 | 2    | Solar energy alarm is set with watts/meter <sup>2</sup> .  |
| RAIN_RATE_ALARM     | A7  | 167 | 2    | Rate rain alarm is set with inches/hour  |
| RAIN_15MIN_ALARM    | A9  | 169 | 2    | 15-minute alarm is set with 100 <sup>th</sup> of an inch.  |
| RAIN_24HR_ALARM     | AB  | 171 | 2    | 24-hour alarm is set with 100 <sup>th</sup> of an inch.  |
| RAIN_STORM_ALARM    | AD  | 173 | 2    | Rain storm alarm is set with 100 <sup>th</sup> of an inch.   |
| ET_DAY_ALARM        | AF  | 175 | 1    | Evapotranspiration alarm is set with 1000 <sup>th</sup> of an inch.  |

| Name                    | Hex | Dec  | Size | Description  |
|-------------------------|-----|------|------|--|
| Graph Pointers          |     | 177  | 8    | See section XIV  |
| Graph data              |     | 185  | 3898 | See section XIV  |
| Log Average Temperature | FFC | 4092 | 1    | Set this value to zero to enable logging of average temperature values. A non-zero value causes the temperature at the end of the archive period to be logged.   |
| Password CRC            | FFE | 4094 | 2    | WeatherLink uses these two bytes to hold the CRC of a password in order to provide some protection from unauthorized access. This is only enforced by software implementation. The value 0xFFFF indicates that no password is set. |

### XIII. Common Tasks

This section describes how to perform several common tasks, especially ones that need to be done in a particular way.

#### 1. Setting Temperature and Humidity Calibration Values

The 28 EEPROM bytes starting at address 50 (0x32) contain the calibration offsets for temperature and humidity values. Unfortunately, if you modify these values in the EEPROM, the new calibration value will not take effect until the next time the Vantage receives a data packet containing that temperature or humidity value. In order to update the Vantage display with the new calibration values, you have to follow this procedure.

Create a data structure to hold all of the calibration values, and one to hold the results of the "CALED" command.

1. Use "EEBRD 32 2B" to read in the current calibration offset values.
2. Use "CALED" to read in the current calibrated sensor values.
3. Determine what the un-calibrated sensor values are by subtracting the calibration offset from the data value. Make sure that you only do this if the sensor has valid data (i.e. not 0x7FFF, or 0xFF).
4. Determine and write the new calibration values into the EEPROM using "EEBWR 32 2B".
5. Use "CALFIX" to send the un-calibrated sensor values to the Vantage to have the display update using the new calibration values.

You can use the "EERD 32 2B" command if you want to, but it is harder to process.

You do not have to set all of the calibration values, but you do have to send all of the sensor data values in the "CALFIX" command.

## 2. Setting the Time, Time Zone, and Daylight savings

The "GETTIME" and "SETTIME" commands will get and set the time and date on the Vantage console, but you will need to use additional commands to set the time zone and daylight savings settings.

### Daylight Savings

To set up the automatic daylight savings mode (works for US, Europe, and Australia), use the command "EEWR 12 00" (or its "EEBWR" equivalent). To use manual daylight savings mode (or if daylight savings is not used at all) use the command "EEWR 12 01".

If you have selected manual daylight savings mode, use the command "EEWR 13 00" to set standard time and "EEWR 13 01" to set daylight savings time.

### Time Zone

You can either choose a time zone from the list of timezones shown on the console time zone setup screen, or you can set the GMT offset directly.

To use a preset time zone, write the zone index number from the table below into the TIME\_ZONE EEPROM field (i.e. "EEWR 11 xx"), and also write a zero into the GMT\_OR\_ZONE field (i.e. "EEWR 16 00").

To use a custom time zone, write the GMT offset – in (hours \* 100 + minutes), to a 15 minute resolution, with negative values for time zones west of GMT – to the 2 byte GMT\_OFFSET field. Also write a one to the GMT\_OR\_ZONE field (i.e. "EEWR 16 01").

Table of preset time zones on the Vantage and WeatherLink software.

| Index | GMT Offset | Name   |
|-------|------------|--|
| 0     | -1200      | (GMT-12:00) Eniwetok, Kwajalein                              |
| 1     | -1100      | (GMT-11:00) Midway Island, Samoa                             |
| 2     | -1000      | (GMT-10:00) Hawaii   |
| 3     | -900       | (GMT-09:00) Alaska   |
| 4     | -800       | (GMT-08:00) Pacific Time, Tijuana                            |
| 5     | -700       | (GMT-07:00) Mountain Time                                    |
| 6     | -600       | (GMT-06:00) Central Time                                     |
| 7     | -600       | (GMT-06:00) Mexico City                                      |
| 8     | -600       | (GMT-06:00) Central America                                  |
| 9     | -500       | (GMT-05:00) Bogota, Lima, Quito                              |
| 10    | -500       | (GMT-05:00) Eastern Time                                     |
| 11    | -400       | (GMT-04:00) Atlantic Time                                    |
| 12    | -400       | (GMT-04:00) Caracas, La Paz, Santiago                        |
| 13    | -330       | (GMT-03.30) Newfoundland                                     |
| 14    | -300       | (GMT-03:00) Brasilia   |
| 15    | -300       | (GMT-03:00) Buenos Aires, Georgetown, Greenland              |
| 16    | -200       | (GMT-02:00) Mid-Atlantic                                     |
| 17    | -100       | (GMT-01:00) Azores, Cape Verde Is.                           |
| 18    | 0          | (GMT) Greenwich Mean Time, Dublin, Edinburgh, Lisbon, London |
| 19    | 0          | (GMT) Monrovia, Casablanca                                   |

|    |      |   |
|----|------|---|
| 20 | 100  | (GMT+01.00) Berlin, Rome, Amsterdam, Bern, Stockholm, Vienna      |
| 21 | 100  | (GMT+01.00) Paris, Madrid, Brussels, Copenhagen, W Central Africa |
| 22 | 100  | (GMT+01.00) Prague, Belgrade, Bratislava, Budapest, Ljubljana     |
| 23 | 200  | (GMT+02.00) Athens, Helsinki, Istanbul, Minsk, Riga, Tallinn      |
| 24 | 200  | (GMT+02:00) Cairo   |
| 25 | 200  | (GMT+02.00) Eastern Europe, Bucharest                             |
| 26 | 200  | (GMT+02:00) Harare, Pretoria                                      |
| 27 | 200  | (GMT+02.00) Israel, Jerusalem                                     |
| 28 | 300  | (GMT+03:00) Baghdad, Kuwait, Nairobi, Riyadh                      |
| 29 | 300  | (GMT+03.00) Moscow, St. Petersburg, Volgograd                     |
| 30 | 330  | (GMT+03:30) Tehran  |
| 31 | 400  | (GMT+04:00) Abu Dhabi, Muscat, Baku, Tblisi, Yerevan, Kazan       |
| 32 | 430  | (GMT+04:30) Kabul   |
| 33 | 500  | (GMT+05:00) Islamabad, Karachi, Ekaterinburg, Tashkent            |
| 34 | 530  | (GMT+05:30) Bombay, Calcutta, Madras, New Delhi, Chennai          |
| 35 | 600  | (GMT+06:00) Almaty, Dhaka, Colombo, Novosibirsk, Astana           |
| 36 | 700  | (GMT+07:00) Bangkok, Jakarta, Hanoi, Krasnoyarsk                  |
| 37 | 800  | (GMT+08:00) Beijing, Chongqing, Urumqi, Irkutsk, Ulaan Bataar     |
| 38 | 800  | (GMT+08:00) Hong Kong, Perth, Singapore, Taipei, Kuala Lumpur     |
| 39 | 900  | (GMT+09:00) Tokyo, Osaka, Sapporo, Seoul, Yakutsk                 |
| 40 | 930  | (GMT+09:30) Adelaide  |
| 41 | 930  | (GMT+09:30) Darwin  |
| 42 | 1000 | (GMT+10:00) Brisbane, Melbourne, Sydney, Canberra                 |
| 43 | 1000 | (GMT+10.00) Hobart, Guam, Port Moresby, Vladivostok               |
| 44 | 1100 | (GMT+11:00) Magadan, Solomon Is, New Caledonia                    |
| 45 | 1200 | (GMT+12:00) Fiji, Kamchatka, Marshall Is.                         |
| 46 | 1200 | (GMT+12:00) Wellington, Auckland                                  |

### 3. Setting the Rain Collector type

The rain collector type is stored in the SETUP\_BITS EEPROM data byte.

To read what the current rain collector type is:

1. Use "**EEBRD 2B 01**" to read the current setup bits into the variable `setup_bits`.
2. Calculate: `rain_type = setup_bits & 0x30`
3. `rain_type` will have one of the following values: `0x00 = 0.01 in`, `0x10 = 0.2 mm`, or `0x20 = 0.1 mm`

To set a new rain collector type:

1. Use "**EEBRD 2B 01**" to read the current setup bits into the variable `setup_bits`.
2. Mask the rain collector bits to zero with `setup_bits = setup_bits & 0xCF`
3. Set `rain_type` to one of the rain collector values given above.
4. Calculate the new `setup_bits = setup_bits | rain_type`
5. Use "**EEBWR 2B 01**" to set the new rain collector type
6. Use "**NEWSETUP**" to have the Vantage use the new setting.

#### 4. Setting up transmitter station ID's and retransmit function.

The 16 bytes of EEPROM data at STATION\_LIST, plus the USETX field, control what transmitters the Vantage will listen to. These can be set for both wireless and cabled consoles, but the cabled ISS will always transmit on ID 1.

**IMPORTANT!!** You must use the "NEWSETUP" command after changing the transmitter ID or retransmit settings. This allows the console to use the new settings.

Use "EEBRD 19 10" to read in the 16 bytes of station data. The format will look like this:

| Index | Contents          |                       |
|-------|-------------------|-----------------------|
|       | Upper nibble      | Lower nibble          |
| 0     | Tx period         | ID 1 Transmitter type |
| 1     | Humidity Sensor # | Temperature Sensor #  |
| 2     | Tx period         | ID 2 Transmitter type |
| 3     | Humidity #        | Temperature #         |
| 4     | Tx period         | ID 3 Transmitter type |
| 5     | Humidity #        | Temperature #         |
| 6     | Tx period         | ID 4 Transmitter type |
| 7     | Humidity #        | Temperature #         |
| 8     | Tx period         | ID 5 Transmitter type |
| 9     | Humidity #        | Temperature #         |
| 10    | Tx period         | ID 6 Transmitter type |
| 11    | Humidity #        | Temperature #         |
| 12    | Tx period         | ID 7 Transmitter type |
| 13    | Humidity #        | Temperature #         |
| 14    | Tx period         | ID 8 Transmitter type |
| 15    | Humidity #        | Temperature #         |

The Transmitter type field is taken from either the Rev A or Rev B station type tables below, depending on the firmware version date (April 24, 2002 and later use Rev B format).

The Tx period field will have one of these values: 0 = station turned off, 1 = ISS normal or Temp/Hum 4x, 4 = ISS 0.25x or Temp/Hum normal. Note that Vantage Pro2 does not support different transmit period. It only supports normal ISS period.

For example, a normal ISS would have the value  $(0x10 + 0x00) = 0x10$ . An ISS station being used as an extra Temp Hum station would have the value  $(0x10 + 0x03) = 0x13$ , and a standard Temp Hum station would have the value  $(0x40 + 0x03) = 0x43$ .

The humidity sensor number and temperature sensor number fields are only used if the transmitter type is a Temperature-Humidity station or a Temperature only station. These fields determine how the extra temperature and humidity data values are logged. These fields are ignored for other station types.

Starting with ID 1, the first transmitter with an extra Humidity sensor should be assigned the value 1, the second should have the value 2, etc.

In the same maner, the first extra temperature sensor should be assigned the value **ZERO**, the second should have the value 1, etc.

The USETX field holds bitmapped information on the transmitters that the Vantage will actively listen to. Bit 0 corresponds with ID 1, Bit 1 with ID 2, etc. Set this value after you have made any modifications to the STATION\_LIST field.

**IMPORTANT!!** You must use the "NEWSETUP" command after changing the transmitter ID or retransmit settings. This allows the console to use the new settings.

Set Transmitters example (Rev B and VantagePro 2):

| Index | Contents |   |      | Description               |
|-------|----------|---|------|---------------------------|
| 0     | 1        | 0 | 0x10 | ID 1 = ISS                |
| 1     | F        | F | 0xFF |                           |
| 2     | 4        | 3 | 0x43 | ID 2 = Temp/Hum           |
| 3     | 1        | 0 | 0x10 |                           |
| 4     | 1        | 3 | 0x13 | ID 3 = Temp/Hum 4x        |
| 5     | 2        | 1 | 0x21 |                           |
| 6     | 1        | 8 | 0x18 | ID 4 = Leaf/Soil          |
| 7     | F        | F | 0xFF |                           |
| 8     | 1        | 4 | 0x14 | ID 5 = Wireles anemometer |
| 9     | F        | F | 0xFF |                           |
| 10    | 0        | A | 0x0A | ID 6 = Not used           |
| 11    | F        | F | 0xFF |                           |
| 12    | 0        | A | 0x0A | ID 6 = Not used           |
| 13    | F        | F | 0xFF |                           |
| 14    | 0        | A | 0x0A | ID 6 = Not used           |
| 15    | F        | F | 0xFF |                           |
| USETX |          |   | 0x1F |                           |

List of Station Types (Rev A):

| Station Name                 | Station Type (hex) | "standard" period |
|------------------------------|--------------------|-------------------|
| ISS                          | 0                  | 1                 |
| Temperature Only Station     | 1                  | 4                 |
| Humidity Only Station        | 2                  | 4                 |
| Temperature/Humidity Station | 3                  | 4                 |
| Wireless Anemometer Station  | 4                  | 1                 |
| Rain Station                 | 5                  | 1                 |
| Leaf Station                 | 6                  | 1                 |
| Soil Station                 | 7                  | 1                 |
| SensorLink Station           | 8                  | 1                 |
| No station – OFF             | 9                  | 0                 |

List of Station Types (Rev B and VantagePro 2):

| Station Name                 | Station Type (hex) | "standard" period |
|------------------------------|--------------------|-------------------|
| ISS                          | 0                  | 1                 |
| Temperature Only Station     | 1                  | 4                 |
| Humidity Only Station        | 2                  | 4                 |
| Temperature/Humidity Station | 3                  | 4                 |
| Wireless Anemometer Station  | 4                  | 1                 |
| Rain Station                 | 5                  | 1                 |
| Leaf Station                 | 6                  | 1                 |
| Soil Station                 | 7                  | 1                 |
| Soil/Leaf Station            | 8                  | 1                 |
| SensorLink Station *         | 9                  | 1                 |
| No station – OFF             | A                  | 0                 |

\* Vantage Pro2 does not support SensorLink station type.

Retransmit feature

To activate the retransmit feature of the console, write the ID number (1-8) that you would like the Vantage to transmit on into the RE\_TRANSMIT\_TX field. This ID can not also be used to receive data from a remote sensor. Use the value 0 to turn retransmit off.

**IMPORTANT!!** You must use the "NEWSETUP" command after changing the transmitter ID or retransmit settings. This allows the console to use the new settings.

5. Setting Alarm Thresholds

The alarm values are stored in the EEPROM. Each alarm is described below along with its EEPROM address.

| Field              | Offset  | Size | Explanation   |
|--------------------|---------|------|---|
| ALARM_START        | 82=0x52 | 94   | Starting location for the Alarm threshold data.   |
| BAR_RISE_ALARM     | 0       | 1    | The BAR_RISE alarms is 1 byte unsigned number. A zero value indicates the alarm is not set. A non-zero value of 1 to 255 represents .001 in to .255 in.   |
| BAR_FALL_ALARM     | 1       | 1    | The BAR_FALL alarms is 1 byte unsigned number. A zero value indicates the alarm is not set. A non-zero value of 1 to 255 represents .001 in to .255 in.   |
| TIME_ALARM         | 2       | 2    | The TIME_A alarm is a 2 byte number in the format HOURS * 100 + MINUTES.  |
| TIME_COMP_ALARM    | 4       | 2    | A value of 0xffff indicates an alarm is not set.  |
| LOW_TEMP_IN_ALARM  | 6       | 1    | The temperature alarm is in 1 unsigned byte in 1 °F resolution. It has an offset of +90°F so every number is positive. For example -32 °F would be stored as 58°F. If the alarm is not set, a 255 is stored.  |
| HIGH_TEMP_IN_ALARM | 7       | 1    | The temperature alarm is in 1 unsigned byte in 1 °F resolution. It has an offset of +90°F so every number is positive. For example -32 °F would be stored as 58 °F. If the alarm is not set, a 255 is stored. |



| Field               | Offset | Size | Explanation  |
|---------------------|--------|------|--|
| LOW_TEMP_OUT_ALARM  | 8      | 1    | The temperature alarm is in 1 unsigned byte in 1 °F resolution. It has an offset of +90°F so every number is positive. For example -32°F would be stored as 58°F (-32 + 90). If the alarm is not set, a 255 is stored.   |
| HIGH_TEMP_OUT_ALARM | 9      | 1    | The temperature alarm is in 1 unsigned byte in 1 °F resolution. It has an offset of +90°F so every number is positive. For example -32°F would be stored as 58°F (-32 + 90). If the alarm is not set, a 255 is stored.   |
| LOW_TEMP_ALARM      | 10     | 15   | The temperature alarm is in 1 unsigned byte in 1 °F resolution. It has an offset of +90°F so every number is positive. For example -32°F would be stored as 58°F (-32 + 90). If the alarm is not set, a 255 is stored. There are 15 bytes for the temperature alarm. Bytes 0 to 6 are for the extra temperature stations, bytes 7 to 10 are for the soil station temperature, and bytes 11 to 14 are for the leaf station temperature. |
| HIGH_TEMP_ALARM     | 25     | 15   | The temperature alarm is in 1 unsigned byte in 1 °F resolution. It has an offset of +90°F so every number is positive. For example -32°F would be stored as 58°F (-32 + 90). If the alarm is not set, a 255 is stored. Bytes 0 to 6 are for the extra temperature stations, bytes 7 to 10 are for the soil station temperature, and bytes 11 to 14 are for the leaf station temperature.   |
| LOW_HUM_IN_ALARM    | 40     | 1    | The humidity alarm is stored in 1 unsigned byte in 1% resolution. A value of 255 indicates the alarm is not set.   |
| HIGH_HUM_IN_ALARM   | 41     | 1    | The humidity alarm is stored in 1 unsigned byte in 1% resolution. A value of 255 indicates the alarm is not set.   |
| LOW_HUM_ALARM       | 42     | 8    | The humidity alarm is stored in 1 unsigned byte in 1% resolution. A value of 255 indicates the alarm is not set. Note that the first byte is for the ISS outside humidity.   |
| HIGH_HUM_ALARM      | 50     | 8    | The humidity alarm is stored in 1 unsigned byte in 1% resolution. A value of 255 indicates the alarm is not set. . Note that the first byte is for the ISS outside humidity.   |
| LOW_DEW_ALARM       | 58     | 1    | The dew alarm is in 1 unsigned byte in 1 °F resolution. It has an offset of +90°F so every number is positive. For example -32 °F would be stored as 58 °F. If the alarm is not set, a 255 is stored.  |
| HIGH_DEW_ALARM      | 59     | 1    | The dew alarm is in 1 unsigned byte in 1 °F resolution. It has an offset of +90°F so every number is positive. For example -32 °F would be stored as 58 °F. If the alarm is not set, a 255 is stored.  |
| CHILL_ALARM         | 60     | 1    | The chill alarm is in 1 unsigned byte in 1 °F resolution. It has an offset of +90°F so every number is positive. For example -32 °F would be stored as 58 °F. If the alarm is not set, a 255 is stored.  |
| HEAT_ALARM          | 61     | 1    | The heat alarm is in 1 unsigned byte in 1 °F resolution. It has an offset of +90°F so every number is positive. For example  |
| THSW_ALARM          | 62     | 1    | The temperature alarm is in 1 unsigned byte in 1°F resolution. It has an offset of +90°F so every number is positive. For example, -32°F would be stored as -32 plus 90, which is 58°F.  |
| SPEED_ALARM         | 63     | 1    | Wind speed alarm is stored in 1 unsigned byte in 1 mph resolution. A value of 255 indicates the alarm is not set.  |
| SPEED_10MIN_ALARM   | 64     | 1    | 10 minute average Wind Speed alarm is stored in 1 unsigned byte in 1 mph resolution. A value of 255 indicates the alarm is not set.  |

| Field            | Offset | Size | Explanation  |
|------------------|--------|------|--|
| UV_ALARM         | 65     | 1    | The UV alarm is stored in 1 unsigned byte in the units of .1 index. A value of 255 indicates no alarm is set.  |
| UV_DOSE_ALARM    | 66     | 1    | The UV exposure alarm threshold is stored in the UV_DOSE_A_X location. However, this is an internal alarm that must be set through the console.  |
| LOW_SOIL_ALARM   | 67     | 4    | The soil moisture alarm is stored in 1 byte unsigned values with resolution of 1 cb. A value of 255 indicates the alarm is not set. There are four bytes for the soil alarm, one for each of the four sensors.         |
| HIGH_SOIL_ALARM  | 71     | 4    | The soil moisture alarm is stored in 1 byte unsigned values with resolution of 1 cb. A value of 255 indicates the alarm is not set. There are four bytes for the soil alarm, one for each of the four sensors.         |
| LOW_LEAF_ALARM   | 75     | 4    | The leaf wetness alarm is stored in 1 byte unsigned value. Leaf wetness ranges from 0 to 15. A value of 255 indicates the alarm is not set. There are four bytes for the leaf alarm, one for each of the four sensors. |
| HIGH_LEAF_ALARM  | 79     | 4    | The leaf wetness alarm is stored in 1 byte unsigned value. Leaf wetness ranges from 0 to 15. A value of 255 indicates the alarm is not set. There are four bytes for the leaf alarm, one for each of the four sensors. |
| SOLAR_ALARM      | 83     | 2    | The solar radiation alarm is a 2 byte value stored in 1 W/m <sup>2</sup> resolution. Valid range is from 0 to 1800. A value of 0xffff (65535) indicates the alarm is not set.  |
| RAIN_RATE_ALARM  | 85     | 2    | The rain rate alarm is a 2 byte value stored in units of .01 inch. A value of 0xffff (65535) indicates the alarm is not set.   |
| RAIN_15MIN_ALARM | 87     | 2    | The rain total alarm is stored in 2 bytes in the resolution of .01 inches. A value of 0xffff (65535) means no alarm is set.  |
| RAIN_24HR_ALARM  | 89     | 2    | The rain total alarm is stored in 2 bytes in the resolution of .01 inches. A value of 0xffff (65535) means no alarm is set.  |
| RAIN_STORM_ALARM | 91     | 2    | The rain total alarm is stored in 2 bytes in the resolution of .01 inches. A value of 0xffff (65535) means no alarm is set.  |
| ET_DAY_ALARM     | 93     | 1    | The ET day alarm is stored in 1 unsigned byte in the resolution of .01 inches. A value of 255 means no alarm is set.   |

## 6. Calculating ISS reception

The "Number of Wind Samples" field in the archive record can tell you the quality of radio communication between the ISS (or wireless anemometer) and the console because wind speed data is sent in almost all data packets. In order to use this, you need to know how many packets you could have gotten if you had 100 % reception. This is a function of both the archive interval and the transmitter ID that is sending wind speed. The formula for Vantage Pro2 console is different from the one for Vantage Pro console.

The formulas for determining the expected maximum number of packets containing wind speed are:

$$\frac{\text{archive\_interval\_min} * 60}{2.5 + \frac{ID - 1}{16.0}} - \frac{\text{archive\_interval\_min} * 60}{50.0 + (ID - 1) * 1.25} \quad \text{(for Vantage Pro)}$$

or

$$\frac{\frac{archive\_interval\_min * 60}{41 + ID - 1}}{16}$$

(for Vantage Pro2)

Here *archive\_interval\_min* is the archive interval in minutes and *ID* is the transmitter ID number between 1 and 8.

It is possible for the number of wind samples to be larger than the "expected" maximum value. This is because the maximum value is a long term average, rounded to an integer. The WeatherLink program displays 100% in these cases (i.e. not the 105% that the math would suggest).

## XIV. EEPROM Graph data locations for Vantage Pro

|                         |                     |        |        |
|-------------------------|---------------------|--------|--------|
| GRAPH_START             | 176                 |        |        |
| NEXT_10MIN_PTR          | GRAPH_START+1       |        |        |
| NEXT_15MIN_PTR          | GRAPH_START+2       |        |        |
| NEXT_HOUR_PTR           | GRAPH_START+3       |        |        |
| NEXT_DAY_PTR            | GRAPH_START+4       |        |        |
| NEXT_MONTH_PTR          | GRAPH_START+5       |        |        |
| NEXT_YEAR_PTR           | GRAPH_START+6       |        |        |
| NEXT_RAIN_STORM_PTR     | GRAPH_START+7       |        |        |
| NEXT_RAIN_YEAR_PTR      | GRAPH_START+8       |        |        |
| START                   | GRAPH_START+9 = 185 |        |        |
| //                      |                     |        |        |
| //                      |                     |        |        |
| //                      |                     |        |        |
| //                      |                     |        |        |
|                         |                     | NUMBER | NUMBER |
|                         |                     | OF     | OF     |
|                         |                     | ENTRYS | BYTES  |
|                         |                     | -----  | -----  |
| TEMP_IN_HOUR            | START + 0           | // 24  | 1      |
| TEMP_IN_DAY_HIGHS       | START + 24          | // 24  | 1      |
| TEMP_IN_DAY_HIGH_TIMES  | START + 48          | // 24  | 2      |
| TEMP_IN_DAY_LOWS        | START + 96          | // 24  | 1      |
| TEMP_IN_DAY_LOW_TIMES   | START + 120         | // 24  | 2      |
| TEMP_IN_MONTH_HIGHS     | START + 168         | // 25  | 1      |
| TEMP_IN_MONTH_LOWS      | START + 193         | // 25  | 1      |
| TEMP_IN_YEAR_HIGHS      | START + 218         | // 1   | 1      |
| TEMP_IN_YEAR_LOWS       | START + 219         | // 1   | 1      |
| TEMP_OUT_HOUR           | START + 220         | // 24  | 1      |
| TEMP_OUT_DAY_HIGHS      | START + 244         | // 24  | 1      |
| TEMP_OUT_DAY_HIGH_TIMES | START + 268         | // 24  | 2      |
| TEMP_OUT_DAY_LOWS       | START + 316         | // 24  | 1      |
| TEMP_OUT_DAY_LOW_TIMES  | START + 340         | // 24  | 2      |
| TEMP_OUT_MONTH_HIGHS    | START + 388         | // 25  | 1      |
| TEMP_OUT_MONTH_LOWS     | START + 413         | // 25  | 1      |
| TEMP_OUT_YEAR_HIGHS     | START + 438         | // 25  | 1      |
| TEMP_OUT_YEAR_LOWS      | START + 463         | // 25  | 1      |
| DEW_HOUR                | START + 488         | // 24  | 1      |
| DEW_DAY_HIGHS           | START + 512         | // 24  | 1      |
| DEW_DAY_HIGH_TIMES      | START + 536         | // 24  | 2      |
| DEW_DAY_LOWS            | START + 584         | // 24  | 1      |
| DEW_DAY_LOW_TIMES       | START + 608         | // 24  | 2      |
| DEW_MONTH_HIGHS         | START + 656         | // 25  | 1      |
| DEW_MONTH_LOWS          | START + 681         | // 25  | 1      |
| DEW_YEAR_HIGHS          | START + 706         | // 1   | 1      |
| DEW_YEAR_LOWS           | START + 707         | // 1   | 1      |
| CHILL_HOUR              | START + 708         | // 24  | 1      |
| CHILL_DAY_LOWS          | START + 732         | // 24  | 1      |
| CHILL_DAY_LOW_TIMES     | START + 756         | // 24  | 2      |
| CHILL_MONTH_LOWS        | START + 804         | // 25  | 1      |
| CHILL_YEAR_LOWS         | START + 829         | // 1   | 1      |
| THSW_HOUR               | START + 830         | // 24  | 1      |
| THSW_DAY_HIGHS          | START + 854         | // 24  | 1      |
| THSW_DAY_HIGH_TIMES     | START + 878         | // 24  | 2      |
| THSW_MONTH_HIGHS        | START + 926         | // 25  | 1      |
| THSW_YEAR_HIGHS         | START + 951         | // 1   | 1      |
| HEAT_HOUR               | START + 952         | // 24  | 1      |
| HEAT_DAY_HIGHS          | START + 976         | // 24  | 1      |
| HEAT_DAY_HIGH_TIMES     | START + 1000        | // 24  | 2      |
| HEAT_MONTH_HIGHS        | START + 1048        | // 25  | 1      |
| HEAT_YEAR_HIGHS         | START + 1073        | // 1   | 1      |
| HUM_IN_HOUR             | START + 1074        | // 24  | 1      |
| HUM_IN_DAY_HIGHS        | START + 1098        | // 24  | 1      |
| HUM_IN_DAY_HIGH_TIMES   | START + 1122        | // 24  | 2      |
| HUM_IN_DAY_LOWS         | START + 1170        | // 24  | 1      |
| HUM_IN_DAY_LOW_TIMES    | START + 1194        | // 24  | 2      |

|                           |              |       |   |
|---------------------------|--------------|-------|---|
| HUM_IN_MONTH_HIGHS        | START + 1242 | // 25 | 1 |
| HUM_IN_MONTH_LOWS         | START + 1267 | // 25 | 1 |
| HUM_IN_YEAR_HIGHS         | START + 1292 | // 1  | 1 |
| HUM_IN_YEAR_LOWS          | START + 1293 | // 1  | 1 |
|                           |              |       |   |
| HUM_OUT_HOUR              | START + 1294 | // 24 | 1 |
| HUM_OUT_DAY_HIGHS         | START + 1318 | // 24 | 1 |
| HUM_OUT_DAY_HIGH_TIMES    | START + 1342 | // 24 | 2 |
| HUM_OUT_DAY_LOWS          | START + 1390 | // 24 | 1 |
| HUM_OUT_DAY_LOW_TIMES     | START + 1414 | // 24 | 2 |
| HUM_OUT_MONTH_HIGHS       | START + 1462 | // 25 | 1 |
| HUM_OUT_MONTH_LOWS        | START + 1487 | // 25 | 1 |
| HUM_OUT_YEAR_HIGHS        | START + 1512 | // 1  | 1 |
| HUM_OUT_YEAR_LOWS         | START + 1513 | // 1  | 1 |
|                           |              |       |   |
| BAR_15_MIN                | START + 1514 | // 24 | 2 |
| BAR_HOUR                  | START + 1562 | // 24 | 2 |
| BAR_DAY_HIGHS             | START + 1610 | // 24 | 2 |
| BAR_DAY_HIGH_TIMES        | START + 1658 | // 24 | 2 |
| BAR_DAY_LOWS              | START + 1706 | // 24 | 2 |
| BAR_DAY_LOW_TIMES         | START + 1754 | // 24 | 2 |
| BAR_MONTH_HIGHS           | START + 1802 | // 25 | 2 |
| BAR_MONTH_LOWS            | START + 1852 | // 25 | 2 |
| BAR_YEAR_HIGHS            | START + 1902 | // 1  | 2 |
| BAR_YEAR_LOWS             | START + 1904 | // 1  | 2 |
|                           |              |       |   |
| WIND_SPEED_10_MIN_AVG     | START + 1906 | // 24 | 1 |
| WIND_SPEED_HOUR_AVG       | START + 1930 | // 24 | 1 |
| WIND_SPEED_DAY_HIGHS      | START + 1954 | // 24 | 1 |
| WIND_SPEED_DAY_HIGH_TIMES | START + 1978 | // 24 | 2 |
| WIND_SPEED_DAY_HIGH_DIR   | START + 2026 | // 24 | 1 |
| WIND_SPEED_MONTH_HIGHS    | START + 2050 | // 25 | 1 |
| WIND_SPEED_MONTH_HIGH_DIR | START + 2075 | // 25 | 1 |
| WIND_SPEED_YEAR_HIGHS     | START + 2100 | // 25 | 1 |
| WIND_SPEED_YEAR_HIGH_DIR  | START + 2125 | // 25 | 1 |
|                           |              |       |   |
| WIND_DIR_HOUR             | START + 2150 | // 24 | 1 |
| WIND_DIR_DAY              | START + 2174 | // 24 | 1 |
| WIND_DIR_MONTH            | START + 2198 | // 24 | 1 |
| WIND_DIR_DAY_BINS         | START + 2222 | // 8  | 2 |
| WIND_DIR_MONTH_BINS       | START + 2238 | // 8  | 2 |
|                           |              |       |   |
| RAIN_RATE_1_MIN           | START + 2254 | // 24 | 2 |
| RAIN_RATE_HOUR            | START + 2302 | // 24 | 2 |
| RAIN_RATE_DAY_HIGHS       | START + 2350 | // 24 | 2 |
| RAIN_RATE_DAY_HIGH_TIMES  | START + 2398 | // 24 | 2 |
| RAIN_RATE_MONTH_HIGHS     | START + 2446 | // 25 | 2 |
| RAIN_RATE_YEAR_HIGHS      | START + 2496 | // 25 | 2 |
|                           |              |       |   |
| RAIN_15_MIN               | START + 2546 | // 24 | 1 |
| RAIN_HOUR                 | START + 2570 | // 24 | 2 |
| RAIN_STORM                | START + 2618 | // 25 | 2 |
| RAIN_STORM_START          | START + 2668 | // 25 | 2 |
| RAIN_STORM_END            | START + 2718 | // 25 | 2 |
| RAIN_DAY_TOTAL            | START + 2768 | // 25 | 2 |
| RAIN_MONTH_TOTAL          | START + 2818 | // 25 | 2 |
| RAIN_YEAR_TOTAL           | START + 2868 | // 25 | 2 |
|                           |              |       |   |
| ET_HOUR                   | START + 2918 | // 24 | 1 |
| ET_DAY_TOTAL              | START + 2942 | // 25 | 1 |
| ET_MONTH_TOTAL            | START + 2967 | // 25 | 2 |
| ET_YEAR_TOTAL             | START + 3017 | // 25 | 2 |
|                           |              |       |   |
| SOLAR_HOUR_AVG            | START + 3067 | // 24 | 2 |
| SOLAR_DAY_HIGHS           | START + 3115 | // 24 | 2 |
| SOLAR_DAY_HIGH_TIMES      | START + 3163 | // 24 | 2 |
| SOLAR_MONTH_HIGHS         | START + 3211 | // 25 | 2 |
| SOLAR_YEAR_HIGHS          | START + 3261 | // 1  | 2 |
|                           |              |       |   |
| UV_HOUR_AVG               | START + 3263 | // 24 | 1 |
| UV_MEDS_HOUR              | START + 3287 | // 24 | 1 |

|                       |                         |       |  |   |
|-----------------------|-------------------------|-------|--|---|
| UV_MEDS_DAY           | START + 3311            | // 24 |  | 1 |
| UV_DAY_HIGHS          | START + 3335            | // 24 |  | 1 |
| UV_DAY_HIGH_TIMES     | START + 3359            | // 24 |  | 2 |
| UV_MONTH_HIGHS        | START + 3407            | // 25 |  | 1 |
| UV_YEAR_HIGHS         | START + 3432            | // 1  |  | 1 |
| LEAF_HOUR             | START + 3433            | // 24 |  | 1 |
| LEAF_DAY_LOWS         | START + 3457            | // 24 |  | 1 |
| LEAF_DAY_LOW_TIMES    | START + 3481            | // 24 |  | 2 |
| LEAF_DAY_HIGHS        | START + 3529            | // 24 |  | 1 |
| LEAF_DAY_HIGH_TIMES   | START + 3553            | // 24 |  | 2 |
| WIND_SPEED_HOUR_HIGHS | START + 3601            | // 24 |  | 1 |
| LEAF_MONTH_LOWS       | START + 3625            | // 1  |  | 1 |
| LEAF_MONTH_HIGHS      | START + 3626            | // 25 |  | 1 |
| LEAF_YEAR_LOWS        | START + 3651            | // 1  |  | 1 |
| LEAF_YEAR_HIGHS       | START + 3652            | // 1  |  | 1 |
| SOIL_HOUR             | START + 3653            | // 24 |  | 1 |
| SOIL_DAY_LOWS         | START + 3677            | // 24 |  | 1 |
| SOIL_DAY_LOW_TIMES    | START + 3701            | // 24 |  | 2 |
| SOIL_DAY_HIGHS        | START + 3749            | // 24 |  | 1 |
| SOIL_DAY_HIGH_TIMES   | START + 3773            | // 24 |  | 2 |
| SOIL_MONTH_LOWS       | START + 3821            | // 25 |  | 1 |
| SOIL_MONTH_HIGHS      | START + 3846            | // 25 |  | 1 |
| SOIL_YEAR_LOWS        | START + 3871            | // 1  |  | 1 |
| SOIL_YEAR_HIGHS       | START + 3872            | // 1  |  | 1 |
| SOIL_YEAR_HIGHS_COMP  | START + 3873            | // 1  |  | 1 |
| RX_PERCENTAGE         | START + 3874            | // 24 |  | 1 |
| SAVE_MIN              | RX_PERCENTAGE+25 = 4084 |       |  |   |
| SAVE_HOUR             | SAVE_MIN+1              |       |  |   |
| SAVE_DAY              | SAVE_HOUR+1             |       |  |   |
| SAVE_MONTH            | SAVE_HOUR+2             |       |  |   |
| SAVE_YEAR             | SAVE_HOUR+3             |       |  |   |
| SAVE_YEAR_COMP        | SAVE_HOUR+4             |       |  |   |
| BAUD_RATE             | SAVE_HOUR+5             |       |  |   |
| DEFAULT_RATE_GRAPH    | SAVE_HOUR+6             |       |  |   |

## XV. EEPROM Graph data locations for VP2

```

#define GRAPH_START          176

NEXT_10MIN_PTR              GRAPH_START+1
NEXT_15MIN_PTR              GRAPH_START+2
NEXT_HOUR_PTR               GRAPH_START+3
NEXT_DAY_PTR                GRAPH_START+4
NEXT_MONTH_PTR              GRAPH_START+5
NEXT_YEAR_PTR               GRAPH_START+6
NEXT_RAIN_STORM_PTR         GRAPH_START+7
NEXT_RAIN_YEAR_PTR          GRAPH_START+8

#define START                325

//
//
//
//
//
TEMP_IN_HOUR                START + 0          // 24 || 1
TEMP_IN_DAY_HIGHS           START + 24         // 24 || 1
TEMP_IN_DAY_HIGH_TIMES      START + 48         // 24 || 2
TEMP_IN_DAY_LOWS            START + 96         // 24 || 1
TEMP_IN_DAY_LOW_TIMES       START + 120        // 24 || 2
TEMP_IN_MONTH_HIGHS         START + 168        // 25 || 1
TEMP_IN_MONTH_LOWS          START + 193        // 25 || 1
TEMP_IN_YEAR_HIGHS          START + 218        // 1  || 1
TEMP_IN_YEAR_LOWS           START + 219        // 1  || 1

TEMP_OUT_HOUR               START + 220        // 24 || 1
TEMP_OUT_DAY_HIGHS          START + 244        // 24 || 1
TEMP_OUT_DAY_HIGH_TIMES     START + 268        // 24 || 2
TEMP_OUT_DAY_LOWS           START + 316        // 24 || 1
TEMP_OUT_DAY_LOW_TIMES      START + 340        // 24 || 2
TEMP_OUT_MONTH_HIGHS        START + 388        // 25 || 1
TEMP_OUT_MONTH_LOWS         START + 413        // 25 || 1
TEMP_OUT_YEAR_HIGHS         START + 438        // 25 || 1
TEMP_OUT_YEAR_LOWS          START + 463        // 25 || 1

DEW_HOUR                    START + 488        // 24 || 1
DEW_DAY_HIGHS               START + 512        // 24 || 1
DEW_DAY_HIGH_TIMES          START + 536        // 24 || 2
DEW_DAY_LOWS                START + 584        // 24 || 1
DEW_DAY_LOW_TIMES           START + 608        // 24 || 2
DEW_MONTH_HIGHS             START + 656        // 25 || 1
DEW_MONTH_LOWS              START + 681        // 25 || 1
DEW_YEAR_HIGHS              START + 706        // 1  || 1
DEW_YEAR_LOWS               START + 707        // 1  || 1

CHILL_HOUR                  START + 708        // 24 || 1
CHILL_DAY_LOWS              START + 732        // 24 || 1
CHILL_DAY_LOW_TIMES         START + 756        // 24 || 2
CHILL_MONTH_LOWS            START + 804        // 25 || 1
CHILL_YEAR_LOWS             START + 829        // 1  || 1

THSW_HOUR                   START + 830        // 24 || 1
THSW_DAY_HIGHS              START + 854        // 24 || 1
THSW_DAY_HIGH_TIMES         START + 878        // 24 || 2
THSW_MONTH_HIGHS            START + 926        // 25 || 1
THSW_YEAR_HIGHS             START + 951        // 1  || 1

HEAT_HOUR                   START + 952        // 24 || 1
HEAT_DAY_HIGHS              START + 976        // 24 || 1
HEAT_DAY_HIGH_TIMES         START + 1000       // 24 || 2
HEAT_MONTH_HIGHS            START + 1048       // 25 || 1
HEAT_YEAR_HIGHS             START + 1073       // 1  || 1

HUM_IN_HOUR                 START + 1074       // 24 || 1
HUM_IN_DAY_HIGHS            START + 1098       // 24 || 1
HUM_IN_DAY_HIGH_TIMES       START + 1122       // 24 || 2

```

|                           |              |       |   |
|---------------------------|--------------|-------|---|
| HUM_IN_DAY_LOWS           | START + 1170 | // 24 | 1 |
| HUM_IN_DAY_LOW_TIMES      | START + 1194 | // 24 | 2 |
| HUM_IN_MONTH_HIGHS        | START + 1242 | // 25 | 1 |
| HUM_IN_MONTH_LOWS         | START + 1267 | // 25 | 1 |
| HUM_IN_YEAR_HIGHS         | START + 1292 | // 1  | 1 |
| HUM_IN_YEAR_LOWS          | START + 1293 | // 1  | 1 |
|                           |              |       |   |
| HUM_OUT_HOUR              | START + 1294 | // 24 | 1 |
| HUM_OUT_DAY_HIGHS         | START + 1318 | // 24 | 1 |
| HUM_OUT_DAY_HIGH_TIMES    | START + 1342 | // 24 | 2 |
| HUM_OUT_DAY_LOWS          | START + 1390 | // 24 | 1 |
| HUM_OUT_DAY_LOW_TIMES     | START + 1414 | // 24 | 2 |
| HUM_OUT_MONTH_HIGHS       | START + 1462 | // 25 | 1 |
| HUM_OUT_MONTH_LOWS        | START + 1487 | // 25 | 1 |
| HUM_OUT_YEAR_HIGHS        | START + 1512 | // 1  | 1 |
| HUM_OUT_YEAR_LOWS         | START + 1513 | // 1  | 1 |
|                           |              |       |   |
| BAR_15_MIN                | START + 1514 | // 24 | 2 |
| BAR_HOUR                  | START + 1562 | // 24 | 2 |
| BAR_DAY_HIGHS             | START + 1610 | // 24 | 2 |
| BAR_DAY_HIGH_TIMES        | START + 1658 | // 24 | 2 |
| BAR_DAY_LOWS              | START + 1706 | // 24 | 2 |
| BAR_DAY_LOW_TIMES         | START + 1754 | // 24 | 2 |
| BAR_MONTH_HIGHS           | START + 1802 | // 25 | 2 |
| BAR_MONTH_LOWS            | START + 1852 | // 25 | 2 |
| BAR_YEAR_HIGHS            | START + 1902 | // 1  | 2 |
| BAR_YEAR_LOWS             | START + 1904 | // 1  | 2 |
|                           |              |       |   |
| WIND_SPEED_10_MIN_AVG     | START + 1906 | // 24 | 1 |
| WIND_SPEED_HOUR_AVG       | START + 1930 | // 24 | 1 |
| WIND_SPEED_HOUR_HIGHS     | START + 1954 | // 24 | 1 |
| WIND_SPEED_DAY_HIGHS      | START + 1978 | // 24 | 1 |
| WIND_SPEED_DAY_HIGH_TIMES | START + 2002 | // 24 | 2 |
| WIND_SPEED_DAY_HIGH_DIR   | START + 2050 | // 24 | 1 |
| WIND_SPEED_MONTH_HIGHS    | START + 2074 | // 25 | 1 |
| WIND_SPEED_MONTH_HIGH_DIR | START + 2099 | // 25 | 1 |
| WIND_SPEED_YEAR_HIGHS     | START + 2124 | // 25 | 1 |
| WIND_SPEED_YEAR_HIGH_DIR  | START + 2149 | // 25 | 1 |
|                           |              |       |   |
| WIND_DIR_HOUR             | START + 2174 | // 24 | 1 |
| WIND_DIR_DAY              | START + 2198 | // 24 | 1 |
| WIND_DIR_MONTH            | START + 2222 | // 24 | 1 |
| WIND_DIR_DAY_BINS         | START + 2246 | // 8  | 2 |
| WIND_DIR_MONTH_BINS       | START + 2262 | // 8  | 2 |
|                           |              |       |   |
| RAIN_RATE_1_MIN           | START + 2278 | // 24 | 2 |
| RAIN_RATE_HOUR            | START + 2326 | // 24 | 2 |
| RAIN_RATE_DAY_HIGHS       | START + 2374 | // 24 | 2 |
| RAIN_RATE_DAY_HIGH_TIMES  | START + 2422 | // 24 | 2 |
| RAIN_RATE_MONTH_HIGHS     | START + 2470 | // 25 | 2 |
| RAIN_RATE_YEAR_HIGHS      | START + 2520 | // 25 | 2 |
|                           |              |       |   |
| RAIN_15_MIN               | START + 2570 | // 24 | 1 |
| RAIN_HOUR                 | START + 2594 | // 24 | 2 |
| RAIN_STORM                | START + 2642 | // 25 | 2 |
| RAIN_STORM_START          | START + 2692 | // 25 | 2 |
| RAIN_STORM_END            | START + 2742 | // 25 | 2 |
| RAIN_DAY_TOTAL            | START + 2792 | // 25 | 2 |
| RAIN_MONTH_TOTAL          | START + 2842 | // 25 | 2 |
| RAIN_YEAR_TOTAL           | START + 2892 | // 25 | 2 |
|                           |              |       |   |
| ET_HOUR                   | START + 2942 | // 24 | 1 |
| ET_DAY_TOTAL              | START + 2966 | // 25 | 1 |
| ET_MONTH_TOTAL            | START + 2991 | // 25 | 2 |
| ET_YEAR_TOTAL             | START + 3041 | // 25 | 2 |
|                           |              |       |   |
| SOLAR_HOUR_AVG            | START + 3091 | // 24 | 2 |
| SOLAR_DAY_HIGHS           | START + 3139 | // 24 | 2 |
| SOLAR_DAY_HIGH_TIMES      | START + 3187 | // 24 | 2 |
| SOLAR_MONTH_HIGHS         | START + 3235 | // 1  | 2 |
| SOLAR_YEAR_HIGHS          | START + 3237 | // 1  | 2 |



|                      |                  |                    |  |   |
|----------------------|------------------|--------------------|--|---|
| UV_HOUR_AVG          | START + 3239     | // 24              |  | 1 |
| UV_MEDS_HOUR         | START + 3263     | // 24              |  | 1 |
| UV_MEDS_DAY          | START + 3287     | // 24              |  | 1 |
| UV_DAY_HIGHS         | START + 3311     | // 24              |  | 1 |
| UV_DAY_HIGH_TIMES    | START + 3335     | // 24              |  | 2 |
| UV_MONTH_HIGHS       | START + 3383     | // 1               |  | 1 |
| UV_YEAR_HIGHS        | START + 3384     | // 1               |  | 1 |
|                      |                  |                    |  |   |
| LEAF_HOUR            | START + 3385     | // 24              |  | 1 |
| LEAF_DAY_LOWS        | START + 3409     | // 24              |  | 1 |
| LEAF_DAY_LOW_TIMES   | START + 3433     | // 24              |  | 2 |
| LEAF_DAY_HIGHS       | START + 3481     | // 24              |  | 1 |
| LEAF_DAY_HIGH_TIMES  | START + 3505     | // 24              |  | 2 |
| LEAF_MONTH_LOWS      | START + 3553     | // 1               |  | 1 |
| LEAF_MONTH_HIGHS     | START + 3554     | // 1               |  | 1 |
| LEAF_YEAR_LOWS       | START + 3555     | // 1               |  | 1 |
| LEAF_YEAR_HIGHS      | START + 3556     | // 1               |  | 1 |
|                      |                  |                    |  |   |
| SOIL_HOUR            | START + 3557     | // 24              |  | 1 |
| SOIL_DAY_LOWS        | START + 3581     | // 24              |  | 1 |
| SOIL_DAY_LOW_TIMES   | START + 3605     | // 24              |  | 2 |
| SOIL_DAY_HIGHS       | START + 3653     | // 24              |  | 1 |
| SOIL_DAY_HIGH_TIMES  | START + 3677     | // 24              |  | 2 |
| SOIL_MONTH_LOWS      | START + 3725     | // 1               |  | 1 |
| SOIL_MONTH_HIGHS     | START + 3726     | // 1               |  | 1 |
| SOIL_YEAR_LOWS       | START + 3727     | // 1               |  | 1 |
| SOIL_YEAR_HIGHS      | START + 3728     | // 1               |  | 1 |
| SOIL_YEAR_HIGHS_COMP | START + 3729     | // 1               |  | 1 |
|                      |                  |                    |  |   |
| RX_PERCENTAGE        | START + 3730     | // 24              |  | 1 |
|                      |                  |                    |  |   |
| SAVE_MIN             | RX_PERCENTAGE+25 |                    |  |   |
| SAVE_HOUR            | SAVE_MIN+1       |                    |  |   |
| SAVE_DAY             | SAVE_HOUR+1      |                    |  |   |
| SAVE_MONTH           | SAVE_HOUR+2      |                    |  |   |
| SAVE_YEAR            | SAVE_HOUR+3      |                    |  |   |
| SAVE_YEAR_COMP       | SAVE_HOUR+4      |                    |  |   |
| BAUD_RATE            | SAVE_HOUR+5      |                    |  |   |
| DEFAULT_RATE_GRAPH   | SAVE_HOUR+6      |                    |  |   |
| LCD_MODEL            | SAVE_HOUR+8      |                    |  |   |
| LCD_MODEL_COMP       | SAVE_HOUR+9      |                    |  |   |
| LOG_AVERAGE_TEMPS    | SAVE_HOUR+11     | // MUST BE AT 4092 |  |   |
| →                    |                  |                    |  |   |