

INSTRUCTION MANUAL



Vosponder Voice Radio Interface
for Use with Campbell Scientific
Dataloggers

3/05

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Vosponder Overview

The Vosponder converts raw digital data input from a datalogger to natural human speech. The model VSP3 is designed to connect via an industry standard SDI-12 serial digital interface to data acquisition systems such as the Campbell Scientific, Inc. CR510, CR10X, and CR23X series dataloggers. The Vosponder also interfaces to a two-way radio system to broadcast the information to the user over the radio link.

The voice message broadcast sequence starts when the selected data values are sent from the datalogger and stored temporarily in the Vosponder's memory. The Vosponder uses what is called a "voice image" to determine what text string to associate with each data value, how to speak the decimal point, and how many numbers after the decimal point to speak. The combined text and data values are then broadcast over the radio link.

A voice message can be initiated in several ways.

- Based on a DTMF tone sequence from a radio handset - Anyone with a two-way radio which has DTMF features, can request the current data from a datalogger. This is done by entering a pre-set key press sequence on the radio handset's keypad. The Vosponder is also addressable, so a user may request data from multiple stations simply by entering the different numeric key press sequences (DTMF codes) that are assigned to various Vosponders.
- Based on a user set interval - This option allows for transmission of the stored data at predefined intervals (i.e., you can have your data broadcast every 15 minutes).
- Based on events or conditions - Standard voice messages as well as voice alarm messages can be broadcast based on events (i.e., if the battery voltage gets low, the station can report a low battery alarm).

Programming the datalogger and configuring the Vosponder requires four steps. One of the steps is covered in each of the first four sections of this manual.

- 1. Hardware connections to the datalogger and radio (Section 1)**
- 2. Programming the datalogger to output the data values to the Vosponder (Section 2)**
- 3. Developing a voice image file for the Vosponder (Section 3)**
- 4. Setup and testing of the Vosponder (Section 4)**

Two modes of operation are supported. These modes relate to the SDI-12 specification and are referred to as 'slave' and 'master' mode.

The Vosponder defaults to the SDI-12 slave mode. In this mode the Vosponder responds to commands issued by the datalogger over the SDI-12 bus. This is the method best used with Campbell Scientific dataloggers.

Several special “extended SDI-12 commands” are used to deliver data from the datalogger to the Vosponder for verbalization through the radio telemetry link.

The SDI-12 master mode can be used to interface the Vosponder directly to any SDI-12-compatible sensor or other SDI-12 compatible devices. Some information about this mode is covered in Appendix A. However, detailed use and configuration instructions are not included in this manual. If you want to use the master mode, please contact DACOM Technologies at (435) 755-0300 or request this information by e-mail via support@dacomtechnologies.com.

Section 1. Hardware

- ▶ **1. Hardware connections to the datalogger and radio (Section 1)**
- 2. Programming the datalogger to output the data values to the Vosponder (Section 2)**
- 3. Developing a voice image file for the Vosponder (Section 3)**
- 4. Setup and testing of the Vosponder (Section 4)**

Understanding how to connect the various hardware components is the first step in the setup process. The Vosponder has three input connectors. These include an SDI-12 bus interface, a radio interface, and an RS-232C terminal serial interface. Before the Vosponder can be used it must be connected to a datalogger, a power supply, and a radio. The RS-232C serial interface is only used when the Vosponder is connected directly to a computer for configuration. Following is a description of each connection and its purpose.

1.1 SDI-12 Bus and Power Input

This connection provides an interface to the datalogger and power to the Vosponder. The Vosponder is designed to operate from the nominal +12 Volt DC provided via the SDI-12 interface cable. J1 is a four place, right angle, 5 mm screw terminal that facilitates the mechanical connections as shown in Figure 1-1. A schematic of the connector can be found in Appendix B, Figure B-2.



FIGURE 1-1. J1, SDI-12 Bus Interface Connector

The SDI-12 interface cable is wired between Vosponder and a CSI datalogger as follows:

<u>Vosponder</u>	<u>Color</u>	<u>Purpose</u>	<u>CSI Datalogger</u>
Terminal 1	Black	Ground	G
Terminal 2	Red	+12 VDC	12V
Terminal 3	White	Data	Control Port
Terminal 4	No Connection		

1.2 Two-Way Radio Interface

This connection provides an interface from the Vosponder to a two-way radio. The Vosponder interfaces to most any two-way radio system through J6 which is an 8 x 8 (8 pin, 8 pin used) RJ45 modular connector, shown in Figure 1-2.

Each cable must be designed for a specific radio, and is therefore provided as a separate item. Several standard cables are available for Maxon, ICOM, and Bendix King radios. A custom cable can be ordered for any radio by contacting a technical support representative at (435) 755-0300, or by e-mailing your request to support@dacomtechnologies.com.

Users can also build their own radio interface cable. A schematic of this connection can be found in Appendix B, Figure B-4.



FIGURE 1-2. J6, Radio Interface Port

1.3 RS-232C Terminal Interface

This connection provides an interface from the Vosponder to a computer. The connection is made using a 9-pin female to 9-pin female null modem cable, as shown in Figure 1-3.

This allows a user to configure various operational parameters, upload the voice image file, view existing settings, and view incoming DTMF tones and SDI-12 commands. The terminal interface is time-out protected, which means that it will return the Vosponder to its runtime mode after 60 seconds of inactivity on the terminal keyboard. This is done to prevent inadvertent system lock-ups. A schematic of the connector can be found in Appendix B, Figure B-3.



FIGURE 1-3. J5, RS-232C Terminal Interface

Section 2. Programming the Datalogger

1. **Hardware connections to the datalogger and radio (Section 1)**
- ▶ **2. Programming the datalogger to output the data values to the Vosponder (Section 2)**
3. **Developing a voice image file for the Vosponder (Section 3)**
4. **Setup and testing of the Vosponder (Section 4)**

The datalogger should now be connected to the Vosponder via the SDI-12 interface cable and the Vosponder should be connected to the radio via the radio interface cable.

The second step is to develop or modify an existing datalogger program so that it includes the instructions that will output the desired data values to the Vosponder. There are three commands that will be described in this section, each has a different purpose and all can be used in a datalogger program to maximize the benefits of the Vosponder. These three commands are:

- **Send Data Command (XD)**; transfers the current data values to the Vosponder so that they can be associated with specified text strings and then broadcast.
- **Speak Text Command (XT)**; sends text strings to the Vosponder to be broadcast. This command is useful for creating customized alarm messages.
- **Speak Now Command (XS)**; causes the most recent data values and their associated text strings that are stored on the Vosponder to be broadcast immediately. This command is useful for causing voice alarms to be issued based on events or conditions.

This manual assumes that the user is familiar with writing programs for Campbell Scientific dataloggers. This manual in no way covers all of the possible programming instructions and program configurations that could be used to initiate a voice message broadcast from a datalogger.

Several examples are provided to give the user the basic programming concepts and program structure necessary to send data, text, or commands from the datalogger through the Vosponder and over the radio link. If you just want to get a quick idea of how the Vosponder works, then create a program in EDLOG that is exactly like the one shown in Example 2-1 and then move on to Section 3. Otherwise, develop your own datalogger program using any or all of the instructions demonstrated in this section and then move on to Section 3.

IMPORTANT: The data values that you want the Vosponder to verbalize <u>must be located in consecutive input locations</u> in the datalogger program.

2.1 Send Data Command

The following example depicts an EDLOG program for a CSI datalogger that sends the battery voltage, internal datalogger temperature, and the time to the Vosponder. The Vosponder is assumed to have been set up with an SDI-12 address of 1 and the SDI-12 data line (white wire) to be wired into the dataloggers control port 1 (C1).

Example 2-1. Program to send three data values to the Vosponder

*Table 1 Program		
01:	10	Execution Interval(seconds)
1: Batt Voltage (P10)		
1:	1	Loc [BatVolts]
2: Internal Temperature (P17)		
1:	2	Loc [IntTemp]
3: Time (P18)		
1:	1	Minutes into current day (maximum 1440)
2:	0	Mod/By
3:	3	Loc [Time]
4: SDI-12 Recorder (P105)		
1:	1	SDI-12 Address; Vosponder SDI-12 Address
2:	0	Start Measurement (aM0!)
3:	1	Port ;Control Port C1
4:	1	Loc [BatVolts] ;Location of the first data point to be sent
5:	1.0	Mult
6:	0.0	Offset
5: Extended Parameters 4 Digit (P68)		
1:	88	Option ;Send "X" to indicate an extended command
2:	68	Option ;Send "D" to indicate that data is to follow
3:	128	Option ;Send the first data value (BatVolts)
4:	128	Option ;Send the second data value (IntTemp)
5:	128	Option ;Send the third data value (Time)
6:	0000	Option ;End of command marker
7:	0000	Option
8:	0000	Option

The above program will issue the SDI-12 command "1XD" then transfer three data values to the Vosponder. This will take place every execution interval (i.e., ten seconds in our example).

IMPORTANT:

- It is critical that all of the data values you will be sending to the Vosponder are in consecutive input locations.
- The position that follows the last 128 must have "0000" (zeros) in it. If the eighth position in the P68 is filled with a 128, then you will need to issue another P68 with just "0000" (zeros) in it.

Additional data values (input locations) can be sent to the Vosponder by adding P68 commands consecutively, as shown in Example 2-3. The number of data value characters is limited to no more than 102. For example, you could transmit as many as 17 data values that each had 6 characters. When calculating the total number of characters, the positive and negative sign (+/-) and the decimal point are included.

Example 2-2. Character Count

Input Locations:	Possible Value	Characters
1. BatVolts	+10.51	6
2. IntTemp	-15.6126	8
3. Time	+1012	5

Total Characters		19

Example 2-3 shows only the program section that would send the data values from the datalogger to the Vosponder. The measurement instructions for all of the data values would need to be added prior to this section. The code shown will issue the SDI-12 command "IXD" then transfer nine data values to the Vosponder.

Example 2-3. Program to send seven data values to the Vosponder

```

4: SDI-12 Recorder (P105)
1: 1      SDI-12 Address
2: 0      Start Measurement (aM0!)
3: 1      Port ;C1
4: 1      Loc [ BatVolts ] ;Location of the first data point to be sent
5: 1.0    Mult
6: 0.0    Offset

5: Extended Parameters 4 Digit (P68)
1: 88     Option ;Send "X" to indicate an extended command
2: 68     Option ;Send "D" to indicate that data is to follow
3: 128    Option ;Send the first data value (BatVolts)
4: 128    Option ;Send the second data value (IntTemp)
5: 128    Option ;Send the third data value (Time)
6: 128    Option ;Send the fourth data value (AirTemp_C)
7: 128    Option ;Send the fifth data value (Rel_Humid)
8: 128    Option ;Send the sixth data value (Wind_Spd)

6: Extended Parameters 4 Digit (P68)
1: 128    Option ;Send the seventh data value (Wind Dir)
2: 128    Option ;Send the eighth data value (Solar_Rad)
3: 128    Option ;Send the ninth data value (Baro_Pres)
4: 0000   Option ;End of command marker
5: 0000   Option
6: 0000   Option
7: 0000   Option
8: 0000   Option
    
```

IMPORTANT: The position that follows the last 128 must have "0000" (zeros) in it. If the eighth position in the P68 is filled with a 128, then you will need to issue another P68 with just "0000" (zeros) in it.

2.2 Speak Text Command

The speak text command can be used for alarming conditions. Example 2-4 is a program that shows how the speak text command could be formatted.

Example 2-4. Program to send text string to the Vosponder

```

*Table 1 Program
01: 10      Execution Interval(seconds)

1: Batt Voltage (P10)
1: 1      Loc [ BatVolts ]

;IF BATTERY VOLTAGE IS LESS THAN 10.5 VOLTS...
1: If (X<=>F) (P89)
1: 1      X Loc [BatVolts ]
2: 4      <
3: 10.5   F
4: 30     Then Do

;EVERY FIVE MINUTES
2: If time is (P92)
1: 0      Minutes (Seconds --) into a
2: 5      Interval (same units as above)
3: 30     Then Do

;INITIATE AN ALARM MESSAGE OVER THE RADIO LINK
11: SDI-12 Recorder (P105)
1: 1      SDI-12 Address
2: 0      Start Measurement (aM0!)
3: 1      Port                      ;Control Port C1
4: 1      Loc [ BatVolts ]          ;Starting location, but ignored
5: 1.0    Mult                      ;in "Speak Text" mode
6: 0.0    Offset

12: Extended Parameters 4 Digit (P68)
1: 88     Option                    ;Send "X" to indicate an extended command
2: 84     Option                    ;Send "T", Speak Text Command
3: 32     Option                    ;Send a Space Character
4: 83     Option                    ;Send "S"
5: 73     Option                    ;Send "I"
6: 84     Option                    ;Send "T"
7: 69     Option                    ;Send "E"
8: 32     Option                    ;Send a Space Character

13: Extended Parameters 4 Digit (P68)
1: 51     Option                    ;Send "3"
2: 49     Option                    ;Send "1"
3: 32     Option                    ;Send a Space Character
4: 76     Option                    ;Send "L"
5: 79     Option                    ;Send "o"
6: 87     Option                    ;Send "w"
7: 32     Option                    ;Send a Space Character
8: 66     Option                    ;Send "B"

```


14: Extended Parameters 4 Digit (P68)		
1: 65	Option	;Send "A"
2: 84	Option	;Send "T"
3: 84	Option	;Send "T"
4: 69	Option	;Send "E"
5: 82	Option	;Send "R"
6: 32	Option	;Send a Space Charter
7: 69	Option	;Send "E"
8: 0000	Option	;End of command marker
6: End (P95)		
7: End (P95)		

The program in Example 2-4 will issue the SDI-12 command "1XT" which causes the Vosponder to say "Site 31 Low Battery" every five minutes, when the battery voltage measurement is less than 10.5 volts. This message will continue to be sent through the Vosponder every time the instruction executes as long as the condition remains true.

The speak text command can be useful for creating custom alarm conditions and specific text beyond the standard data strings. The speak text instructions should typically be put after a conditional "IF" statement (i.e., P89 IF X=F) or be based on the condition of a flag or port. This allows the user to maintain control of how often the message is broadcast. Putting the voice text section of the code inside a P92 (IF Time) instruction or a counter loop, can also be used to limit the number of times a message is broadcast. This keeps the system from continuously broadcasting and tying up the radio link and draining the power supply.

2.2.1 ASCII Table

This table is used to determine the ASCII value for the characters that will be spoken. The corresponding numbers are entered into the P68 instruction as shown in Examples 2-1 and 2-3. USE ONLY UPPER CASE CHARACTERS; lower case characters WILL NOT BE RECOGNIZED BY THE VOSPONDER.

ASCII value & character	ASCII value & character	ASCII value & character	ASCII value & character	ASCII value & character	ASCII value & character	ASCII value & character	ASCII value & character
32 (space)	44 ,	56 8	68 D	79 O	92 [104 g	116 s
33 !	45 -	57 9	69 E	80 P	93 \	105 h	117 t
34 "	46 .	58 :	70 F	81 Q	94]	106 i	118 u
35 #	47 /	59 ;	71 G	82 R	95 ^	107 j	119 v
36 \$	48 0	60 <	72 H	83 S	96 _	108 k	120 w
37 %	49 1	61 =	73 I	84 T	97 `	109 l	121 x
38 &	50 2	62 >	74 J	85 U	98 a	110 m	122 y
39 '	51 3	63 ?	75 K	86 V	99 b	111 n	123 z
40 (52 4	64 @	76 L	87 W	100 c	112 o	124 {
41)	53 5	65 A	77 M	88 X	101 d	113 p	125
42 *	54 6	66 B	78 N	90 Y	102 e	114 q	126 }
43 +	55 7	67 C	79 O	91 Z	103 f	115 r	127 ~

2.3 Speak Now Command

The speak now command can be used for outputting a voice data string upon conditions determined by the datalogger. This command will do nothing unless a speak data or speak text command has been implemented in the program. Example 2-5 is a program that shows how the speak now command could be formatted. The conditions for using the speak now command might be a timed interval (i.e., P92 IF Time), a conditional “IF” statement (i.e., P89 IF X=F), or a flag or port condition. This allows the user to maintain control of how often the message is broadcast. This keeps the system from continuously broadcasting and tying up the radio link and draining the power supply.

If you were to create a datalogger program using the instructions shown in Example 2-1 followed by the instructions shown in Example 2-5, the Vosponder would speak the three data values (battery voltage, datalogger temperature, and time) every 60 minutes.

Example 2-5. Program to initiate immediate broadcast of the most recent data values

```

;AT THE START OF EVERY HOUR
2: If time is (P92)
  1: 0      Minutes (Seconds --) into a
  2: 60      Interval (same units as above)
  3: 30      Then Do

;SEND DATA VALUES OVER VOICE RADIO LINK
3: SDI-12 Recorder (P105)
  1: 1      SDI-12 Address
  2: 0      Start Measurement (aM0!)
  3: 1      Port ; Control Port 1
  4: 1      Loc [ BatVolts ] ; Starting location, but ignored
  5: 1.0    Mult ; in "Speak Now" mode
  6: 0.0    Offset

4: Extended Parameters 4 Digit (P68)
  1: 88      Option ; Send "X" to indicate an extended command
  2: 83      Option ; Send "S", Speak Now Command
  3: 0000    Option ; End of command marker
  4: 0000    Option
  5: 0000    Option
  6: 0000    Option
  7: 0000    Option
  8: 0000    Option

7: End (P95)

```

The program in Example 2-5 will issue the SDI-12 command “1XS” and will cause the Vosponder to speak its programmed voice data string every 60 minutes. Anyone with a radio set to the same frequency as the remote site would be able to hear the broadcast message.

Appendix F is an example of a program that uses all three SDI-12 commands.

Section 3. Developing the Voice Image File

1. Hardware connections to the datalogger and radio (Section 1)
2. Programming the datalogger to output the data values to the Vosponder (Section 2)
- ▶ **3. Developing a voice image file for the Vosponder (Section 3)**
4. Setup and testing of the Vosponder (Section 4)

After completing Section 2, you should now have the datalogger programmed to send data values to the Vosponder. Step 3 is used to create a voice image file to upload to the Vosponder.

3.1 Purpose of the Voice Image

The Vosponder uses an image string to associate the appropriate text with the data values that it receives from a datalogger. The voice image file contains the following information:

- How many data values will be sent from the datalogger.
- The text to be spoken prior to each data value.
- How to speak the numerals.
- Whether to speak the decimal point or not.
- How many digits to the right of the decimal point to speak.
- The text to be spoken following each data value.

An example of a single data value that contains the numeral +76.457 could sound like this:

“The current temperature is seventy six point four degrees.”

Or:

“Tank number three is +76.46 percent full.”

3.2 Creating a Voice Image File

There are two ways to create a voice image file.

1. Use the Voice Image Development Software that is included with the Vosponder.

2. Manually create the text strings and associate the data values. This can be done using any text editor. A user must be very careful to make sure that the format of the voice image text string is correct. If it isn't, then the Vosponder may react adversely when the file is uploaded to it and may require a complete reset. Appendix E offers information on the anatomy of a voice image file so that users can manually create or modify the voice image file should they choose to do so. We only recommend that this be done if the software is not available.

The following section of the manual only covers the methods used to create a voice image file using the development software. The best way to start this process is to identify the data values (input locations) you would like to include in your voice data string, and what the message will say. Using Example 2-1 from Section 2, the input locations that we have programmed the datalogger to send to the Vosponder are as follows:

Data value 1 = Battery Voltage	(BatVolts)
Data value 2 = Logger Temperature	(IntTemp)
Data value 3 = Minutes into the Day	(Time)

IMPORTANT: The data values that you want to verbalize must be located in consecutive input locations. If they are not, then the data value (input location) will not be associated with the correct text string.

Once the data value list is assembled, you should then write out your ideal sentence structure (preferably on paper). An example might look like this:

For Beaver Creek Station 31.
The current battery voltage is "Value1" volts.
The dataloggers internal temperature is "Value2" degrees C.
The time is "Value3" minutes into the day.

The Vosponder has the ability to verbalize a wide range of text, which allows the voice message to be completely customized to a user's requirements. When developing voice text strings there are several things the user should be aware of, these are:

- Numbers can be entered as either 123, which will be spoken as one hundred twenty-three or can be entered with spaces between each number, such as 1 2 3, which will be spoken as one, two, three.
- Common abbreviations such as St., Mt., Rd., Ave. can be used. However, the abbreviation must be followed with a period. Not all abbreviations are supported, so you may have to spell out the word completely if the abbreviation is not spoken correctly.
- Individual letters that are consecutive will be spoken as letters as long as no vowels are included in the string. However, if a vowel is included in the string, the Vosponder will attempt to speak the text string as a word. For example: "DO" would be pronounced as "do" instead of "D" "O". To use this abbreviation for dissolved oxygen you would put a space or a period between the D and the O so that the Vosponder will understand that the letters are to be spoken separately. "pH" on the other hand would be spoken as "P" "H" because there is no vowel in the text string. It is still often a good practice to put a space or period between the characters, as

this causes a small pause between the letters and makes the verbalization clearer.

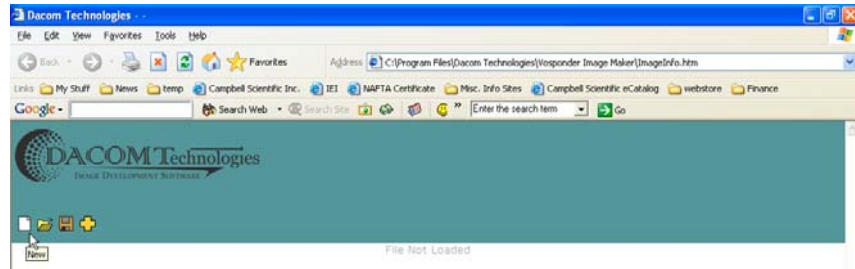
- Punctuation and other characters are verbalized as follows:
 - Period, question mark, exclamation mark, and a comma can be used to create pauses between sentences, words, or letters. Adding any of these characters consecutively will create a longer pause. Each of these characters adds a little less than a one-half-second delay (i.e., 12 periods will cause a 5-second delay)
 - # is spoken as “number” (i.e., Station # 5 would be spoken as “Station number five”)
 - \$ is spoken as “dollar”
 - * is spoken as “star”
 - & is spoken as “and”
 - % is spoken as “percent”
 - = is spoken as “equals”
 - + is spoken as “plus”
 - > is spoken as “greater than”
 - < is spoken as “less than”
- The Vosponder can reproduce most words. However, if you find a word that is not spoken correctly, then spell the word phonetically. The Vosponder will then verbalize it correctly. For example, if the name of the site location were “Duchesne River” (pronounced Do Shane River), the Vosponder would not pronounce it correctly using that spelling. However, by spelling the site name as “Dewshane River” or “Do Shane River” the Vosponder would now pronounce the site name correctly.
- Foreign languages are not supported at this time. However, many words may be spoken by using a phonetic spelling. For example, “the water level” in Spanish would be spelled “el nivel del agua”. The Vosponder could speak this phrase by entering text as “el neevel del augwah”. However, the data value will still be spoken only in English. Exception and foreign language dictionaries for the Vosponder may be available. Contact a technical support representative at (435) 755-0300 or e-mail your inquiry to support@dacomtechnologies.com.

3.3 Using the Voice Image Development Software

Install the Image Development Software program on your computer. You should see the image maker shortcut icon appear on your desktop after the program has been installed. Double-click on the image maker icon to open the program.

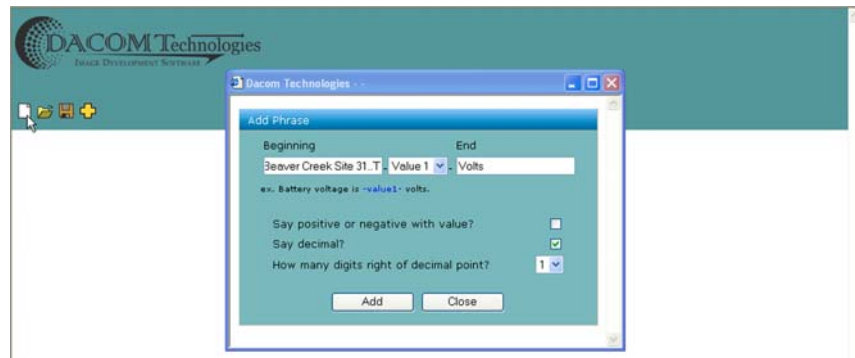
The Image Development program is a basic Java Script that will open in any browser such as Internet Explorer. The program has four basic options; these are denoted by an icon in the upper left section of the screen.

<u>Icon</u>	<u>Text</u>	<u>Purpose</u>
Sheet of Paper	New	Creates a new voice image file
Folder	Open	Opens an existing voice image file for editing
Diskette	Save	Saves the current voice image file as a .txt file
Plus Sign	Add Phrase	Add a sentence to the open voice image file



3.3.1 Building the Voice Image File

Begin by selecting the “New” icon (picture of a sheet of paper). This will open a new file and the “Add Phrase” window will appear. In this window you enter the text you want spoken before and after the data values. You can also select settings for how the data will be spoken. This is done by selecting the box to the right of the option. If you choose to have the decimal spoken, then you can also set how many decimal points you want spoken. When you are done select “Add”. This will save the first text string, clear the text boxes, and increment to the second data value.

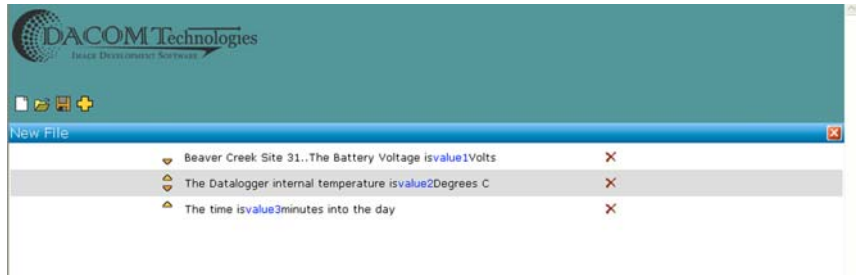


NOTE

The value corresponds to the order of the input locations that will be sent from the datalogger to the Vosponder. In our previous programming Example 2-1 the input locations that we programmed the datalogger to send to the Vosponder were in the order of battery voltage, datalogger temperature, and time. The battery voltage would be Value1, datalogger temperature would be Value2, and time would be Value3.

Using our example data values we would enter the following text. In the Beginning field type in “Beaver Creek Site 31..Battery voltage is” then move to the End field and type “Volts..”.

We would then enter the two other text strings in a similar manner. Note that we have added two periods after the end of each sentence. This helps to clearly separate each sentence from each other. After you have added your final text string, select “Close” from the “Add Phrase” window. You see the main screen with a line of text for each data value you want to have spoken.



When you have finished creating the voice image file, it can be saved by selecting the “Save” icon located on the upper left side of the screen (picture of a disk). You should give each image a unique name and save it to floppy disk or to your computer’s hard drive. The voice image file will need to be uploaded to the Vosponder, so saving it someplace that is easy to find is a good idea.

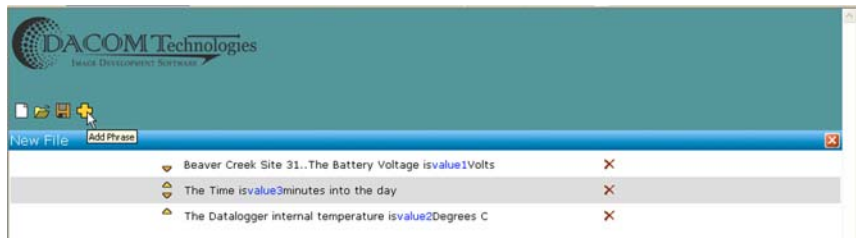
Close out of the Voice Image Development Software simply by closing your browser.

3.3.2 Editing the Voice Image File

If you need to make changes to an existing voice image file, you can do so by first selecting the “Open” icon from the main screen (picture of a folder). You can now add, delete, edit, or move a phrase.

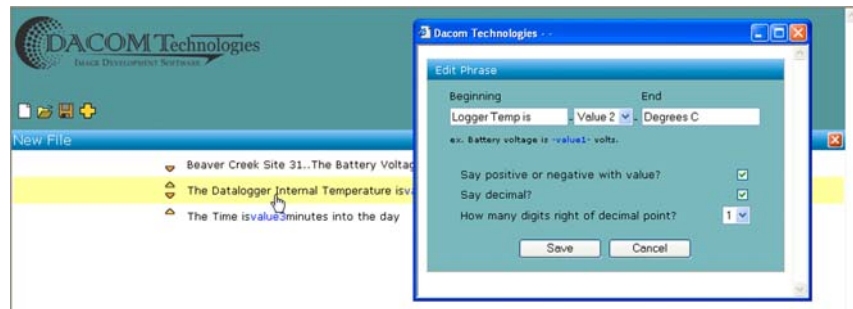
Add a Phrase

To add phrases select the “Add Phrase” icon from the upper left side of the screen (picture of a plus sign). The “Add Phrase” screen will appear and you can make modifications as desired. Once all the modifications are completed select “Close”.



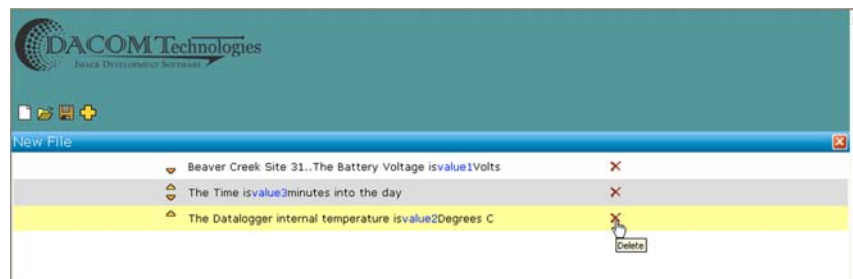
Edit a Phrase

To edit a phrase select it by double-clicking on the phrase to be edited. The “Add a Phrase” screen will appear with the text and setting for the current phrase. Make any modifications and then select “Close”.



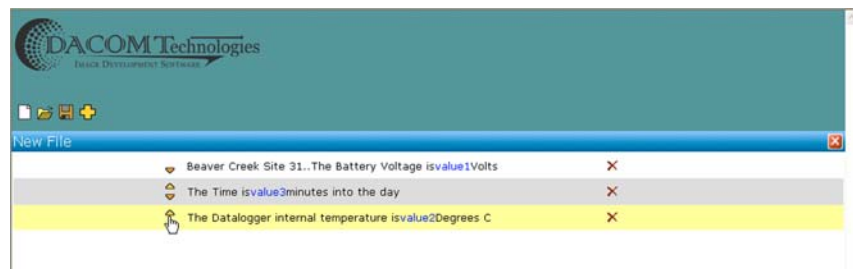
Delete a Phrase

To delete a phrase select the “x” to the right of the phrase you want to delete. You will be asked to confirm the deletion process. If you answer “OK”, the phrase will be deleted.



Move a Phrase

To move a phrase so that it is spoken sooner when the message is broadcast, select the UP arrow symbol located to the left of the phrase. To move a phrase so that it is spoken later, select the DOWN arrow symbol located to the left of the phrase. When the arrow is selected, the phrase will move up or down one location in the direction of the selected arrow. Note, this has no effect on the order that the data values are sent from the datalogger to the Vosponder. It only affects the order in which the Vosponder broadcasts the text phrases associated with each data value.



After making any changes to the current voice image file, select the “Save” icon (picture of a diskette).

Section 4. Vosponder Configuration and Programming

1. Hardware connections to the datalogger and radio (Section 1)
2. Programming the datalogger to output the data values to the Vosponder (Section 2)
3. Developing a voice image file for the Vosponder (Section 3)
- ▶ 4. Setup and testing of the Vosponder (Section 4)

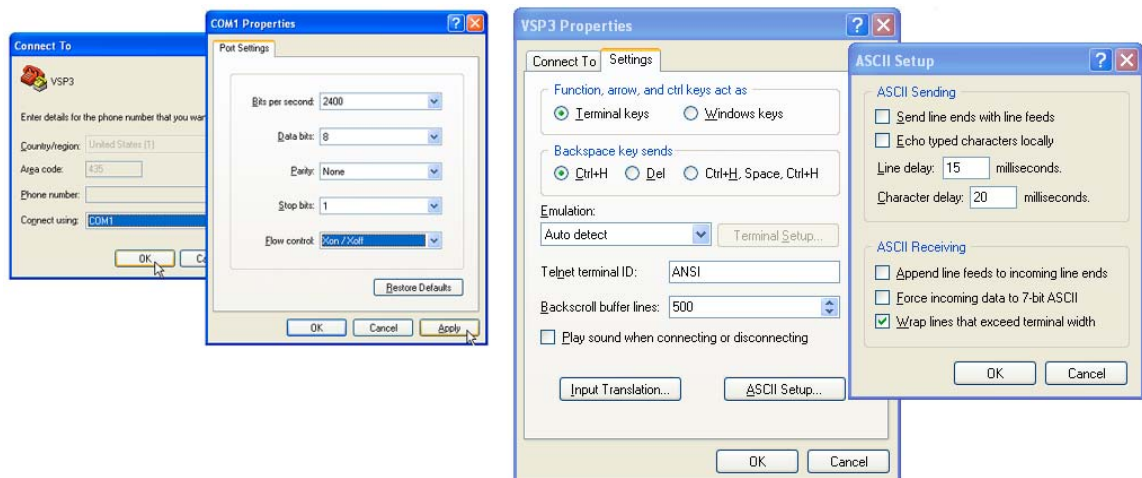
4.1 Communicating with the Vosponder

The final step is to configure the Vosponder and upload the voice image file that you created in Section 3. Connect the Vosponder to a computer using a null modem cable. (See Section 1, Figure 1-3.) The computer will need to be running a terminal program such as HyperTerminal® or Procom®. The Vosponder will also need to be powered. If you have the Vosponder connected to the datalogger with the SDI-12 cable and the datalogger's power supply is on, then the Vosponder will have power. Otherwise, you will need to run a 12 VDC power connection to +12 V and GND inputs on the Vosponder's SDI-12 terminal.

Open HyperTerminal or your terminal program and set up a new file. The terminal communications settings **must** to be set as follows:

Baud Rate	2400
Data Bits	8
Parity	None
Stop Bit	1
Flow Control	Xon / Xoff

ASCII Line Delay	15 milliseconds or greater
ASCII Character Delay	20 milliseconds or greater



The screen replicas depicted in this section will be those displayed when using Microsoft® HyperTerminal® Version 5.1 running under Windows® XP. Other terminal emulation programs may have some slight differences, but should function in a similar manner.

Once the terminal program is running and the configuration settings have been saved, you should see a blank terminal screen. Press any key to bring up the Vosponder main menu prompt. At this point the Vosponder switches from runtime mode to terminal command mode.

```
DACOM Technologies, Inc. 435-755-0300
www.dacomtechnologies.com
13DACOMTEC VSP3_010*034C*EU2025

(R)eset
(V)iew
(E)dit
(S)peak
(A)larm
(T)alk
(U)pload
(X)parent
(ESC)

M:>
```

FIGURE 4-1. Terminal Command Mode - Main Menu Prompt

4.2 Entering Commands

Upon displaying the main menu prompt (M:>), the Vosponder is ready to accept commands. Note that, due to the precedence of the internal processes the terminal may require several keystrokes before it responds with the initial main menu prompt. The terminal cannot respond while transmitting text or receiving SDI-12 data and does not store keystrokes while busy.

All command entries must be in UPPER CASE letters. You may want to turn the keyboard “Caps Lock” on while working with the Vosponder in terminal command mode. Lower case letters are ignored, and thus you may try to enter commands using lower case letters and think the Vosponder is not working properly.

Menu prompts that are displayed will indicate the current menu level and command. If a colon (“:”) is present, it indicates that you are at the top level of the current menu.

M:> denotes that you are in the Main menu at the top level

When the colon (“:”) is not present then it indicates that you are in the lowest possible level of a menu. For example:

Vi> denotes that you are in the View | Image menu, and that there are no other menus below this level. You still have options to choose from but you are at the end of the menu tree.

See Appendix D for a complete diagram of the Vosponder menu tree.

At any prompt, entry of an <ESC> will abort the command and/or move back one menu level. If at the main menu, <ESC> will return the Vosponder to its runtime mode.

At each prompt a 10-second timeout feature is provided that will abort the command and/or move back one menu level if no activity on the keyboard happens in this time period. Ultimately the unit will return to the runtime mode from any menu level or command prompt if there is 60 seconds of inactivity on the keyboard.

From this point in the manual you can continue on through Section 4.2 and familiarize yourself with each of the menus and commands. Or you can skip to Section 4.3 and start setting up the Vosponder while using this section as a reference as you work your way through the setup process shown in Section 4.3.

4.2.1 Main Menu Commands

A description of each main menu command follows. Letters that are bolded on the screen shots are examples of what the user would enter to progress through the Vosponder's menu tree.

R - Reset System. This command executes a cold reset. It restores all parameters to the factory defaults including the SDI-12 mode, voice image file, and test data values. A confirmation of "Y" is required to complete the reset command. You must enter a "Y" and then press <ENTER> in order for this command to take affect. When the "Reset" is complete the Vosponder will return to the main menu M:>.

```
DACOM Technologies, Inc. 435-755-0300
www.dacomtechnologies.com
13DACOMTEC VSP3_010*034C*EU2025

M:>R

M:>!! *CONFIRM RESET* !! (Y)
```

V- View. Allows the user to see the following parameters (for more details see Section 4.2.1):

- DTMF digits received
- Voice image ID
- Two-way radio transmit hang time, delay, and channel busy sense settings
- Data last transferred to the Vosponder from the datalogger
- SDI-12 address and DTMF code assignments

```
M:>V
(D)TMF
(I)mage
(T)X
(A)ddr
Data (V)alues
(ESC)
V:>
```

E - Edit. Allows user to edit the following parameters (for more details see Section 4.2.2):

- DTMF Code
- SDI-12 Address
- SDI-12 Mode
- Transmit Settings

```
M:>E
(D)TMF Code
(S)DI-12 Adr
SDI-12 (M)ode
(T)x
(ESC)
E:>
```

S - Speak Now. Speaks the most recent data values using the current voice image file. If a radio is attached to the Vosponder and a handset is turned on and listening on the same frequency as remote sites radio, the user will hear the voice message.

```
M:>S
S:>
```

A - Speak Alarm. Speaks the currently loaded alarm text. (Not used in this version.)

T - Talk Keyed Entry. This allows the user to enter a “pass-through” mode that sends text entered from the keyboard directly to the Vosponder’s speech module. In the example screen below, the user typed in “THIS IS A TEST” then pressed <ENTER>. The Vosponder would immediately broadcast this message over the radio link.

If you have any question about how the Vosponder will speak a word or a symbol, this feature will allow you to test those text strings before you program them into a voice image file.

```
M:>T
T:>THIS IS A TEST
```

U - Upload. Transfers a prepared voice image file to the Vosponder from a computer. The image must be properly formatted for the intended function. (See Section 3 for details on creating the voice image file and Section 4.3 for details about uploading a voice image file to the Vosponder.)

```
M:>U
U:>***
```

X – Transparent. Enters SDI-12 transparent mode. (Used only in master mode.)

ESC. Entering <ESC> exits the system command mode and puts the Vosponder back into the runtime mode with all changes saved.

4.2.2 View Menu Commands

The view menu as shown in Figure 4-3 allows the user to see the DTMF digits received, the voice image ID, the two-way radio transmit hang time, delay and channel busy sense settings, the data last transferred to the Vosponder from the datalogger, and the assigned SDI-12 address and DTMF code.

```
V:>
(D)TMF
(I)mage
(T)x
(A)ddr
Data (V)alues
(ESC)
V:>
```

FIGURE 4-3. Terminal Command Mode – View Menu Prompt (With Help)

D - DTMF. This command allows the user to view received DTMF digits on the computer terminal. DTMF digits are generated by pressing the numeric keypad on a radio handset. Each numeric character on the keypad creates a specific tone.

After entering “V” then “D” the Vosponder will reply with Bye! It is now in a listening mode and will echo back to the PC terminal any DTMF keys that it receives from a radio handset. Press the radio handset’s “Push-to-talk” key and enter any pattern of numbers from the keypad. You will see each number that you press appear on the computer terminal screen. In the example screen below the user has pressed each of the numeric keys 9-1 on the handset. To exit from this mode, press any key on the computer keyboard.

This mode is useful for testing the communication link between the handset and the Vosponder, and to make sure that DTMF entries on the handset are correctly received by the remote site.

```
V:>D
VD>Bye!
9 8 7 6 5 4 3 2 1
```

I - Image. This command allows the user to view the current voice image file that is loaded on the Vosponder. Entering a “V” will display the voice image text string. (M)aster is only used with the master mode option and does not apply to CSI datalogger users with the Vosponder in slave mode. For more information on the anatomy of a voice image file, see Appendix E.

```
V:>I
VI>
(V)oice/(M)aster
VI>V0301The Battery is|NY2volts.|02The temperature
is|NY1Degrees C.|03 and it's|NN0minutes into the
day.|{^9*^1*^1*. Alarm!}
```

T – X (Transmit). This command allows the user to view the current two-way radio transmit hang time and delay and channel busy sense settings. The example screen shows the Vosponder’s default settings for these parameters. Only in special cases should a user ever need to modify these settings. Changes should never be made to these settings without first consulting a technical support representative. The only exception to this is if the user fully understands the ramifications of making changes to these settings.

```
V:>T
VT>TX Int:0 TX Dly:500 TX Hang:750 RCOS TX:N
```

A - Address. This command allows the user to view the current SDI-12 Mode, the assigned SDI-12 address, and the assigned DTMF code. In the example screen below the Vosponder has been set to the SDI-12 “S” (slave) mode, has been assigned the number “1” as the SDI-12 address, and has a DTMF code of “123”.

```
V:>A
VA>SDIMode:S SDIADR:1 DTMF:123
```

V - Data Values. This command allows the user to view the most recent string of data values received by the Vosponder from the datalogger. The data values shown in the example screen below are test values that come preloaded on the Vosponder. If the Vosponder has never received data from a datalogger, or has been reset, these are the data values that will be used when the (S)peak command is issued from the main menu. Once the Vosponder has received a data string from the datalogger, the numbers on this screen would reflect the values that the Vosponder is receiving.

This feature is useful for checking the communication link between the datalogger and the Vosponder. It allows the user to make sure that the Vosponder is getting data values in the expected order from the datalogger. If

not, then the user will need to modify either the datalogger program or the Vosponder voice image file.

```
V:>
VV>
VV>+12.491+20.762+748.00
```

4.2.3 Edit Menu Commands

The edit menu as shown in Figure 4-4 allows the user to edit the DTMF code, SDI-12 address, SDI-12 mode, and transmit settings.

```
M:>E
(D)TMF Code
(S)DI-12 Adr
SDI-12 (M)ode
(T)x
(ESC)
E:>
```

FIGURE 4-4. Terminal Command Mode – Edit Menu Prompt (With Help)

D – DTMF. This is the DTMF code that the Vosponder responds to. The DTMF code can be from 1 to 5 digits and can be any combination of valid DTMF digits 0 – 9, * and #. Characters are not echoed on the PC terminal until an <ENTER> key is pressed. It is recommended that DTMF codes be kept to 2 or 3 digits. Longer DTMF codes can be more susceptible to a user inadvertently hitting an invalid key and thus having to re-key the DTMF code over and over until it is exactly correct.

In the example screen below the user has entered the DTMF code 123 and the pressed <ENTER>. The user can now cause the Vosponder to send a voice message by pressing the numbers 1 2 3 on the radio hand sets keypad.

```
E:>D
ED>
Enter DTMF Code
ED>123
```

S – SDI-12 Address. This is the SDI-12 bus device address. This can be any valid SDI-12 address 0 – 9. The Vosponder comes with a default SDI-12 address of “0”. See Appendix A for more information about the SDI-12 protocol.

```
E:>S
ES>
Enter SDI-12 Slave Ad
ES>1
```

M – SDI-12 Mode. The SDI-12 mode can be set to master or slave . The unit defaults to “Slave” mode. In the slave mode the unit emulates a sensor. In the master mode the unit emulates a datalogger. For CSI datalogger users, it is recommended that the Vosponder be in the “Slave” mode. See Appendix A for more information on why and how to use the “Master” mode.

```
E:>M
EM>

(M)aster
(S)lave
(ESC)
EM>S
```

T – x (Transmit). *The transmit settings below should not require modification under normal conditions.* This command allows the user to modify radio transmit interval, delay, hang time and channel busy sense settings.

```
E:>T
E:>
ET>
ET>TX Int:0 TX Dly:500 TX Hang:700 RCOS TX:N

TX Int:0
ET>TX Dly:500
ET>TX Hang:700

TX on COS Y/I/N/D:N
ET>
```

- The Transmit Interval is set in seconds from 0 to 65535 seconds. {default = 0}
 - This value is used to determine the time between transmission of the last data stored in the unit from the datalogger in the slave mode or the interval between issuing a sensor query and transmitting the data retrieved from the sensor(s).
 - The interval timer (not the time value) is reset upon DTMF or RCOS query.
 - The keyboard characters entered here are not echoed to the PC terminal until an <ENTER> key has been pressed.
- The Transmit Delay is set in milliseconds from 0 to 65535. {default = 500}
 - This parameter determines the delay time before the Vosponder starts speaking after it keys the transmitter push-to-talk.
 - The keyboard characters entered here are not echoed to the PC terminal until an <ENTER> key has been pressed.

- The Transmit Hang Time is set in milliseconds from 0 to 65535. { default = 539}
 - Hang time determines the duration that the Vosponder leaves the transmitter keyed after speaking.
 - The keyboard characters entered here are not echoed to the PC terminal until an <ENTER> key has been pressed.

- The Busy Sense or COS sets how the Vosponder responds to a channel busy signal on pin 8 of the radio connector (J6 in Figure 1-1). { default = N}
 - No; any input on this pin is ignored.
 - Yes; the Vosponder will speak the voice image when there is a voltage (3 – 13 Volts) applied to the pin.
 - Inverted; the Vosponder responds to the pin if a voltage is *absent*.

- This means that if power to the radio is lost or the radio is disconnected, the Vosponder will be stuck in the speak mode. **Caution: This option should not be used under most conditions, because it will tie up the radio frequency and drain the power supply very quickly.**
 - If Set to Data, the Vosponder will suspend speech output and transmitter keying when there is a voltage (3 – 13 Volts) applied to the pin. This provides a “polite” mode of operation to prevent the unit from transmitting while the radio channel is busy. This setting can be used when a single radio or radio frequency is used for both data and voice transmissions.
 - The keyboard characters entered here are not echoed to the PC terminal until an <ENTER> key has been pressed.

4.2.4 Uploaded Menu (Transfer the Voice Image File)

```
M:>U
U:>***
```

From the main menu (M:>) prompt enter a “U” to go to the upload menu then follow these steps:

1. From the HyperTerminal Transfer drop-down menu select the “Send Text File” option.
2. Locate and select the voice image file that you have created and want to transfer onto the Vosponder. Either double-click on the file or select “Open”.
3. Select “Send” to complete the file transfer to the Vosponder. As the upload proceeds you will see some characters (!!*<*<) echoed by the Vosponder for each 64 byte block successfully transferred. If the voice image file is small, you will only see a few characters. A larger voice image file will create multiple instances of the characters as it loads. If you do not get these characters, then you may need to make some changes to your terminal software settings, see Section 5 - Troubleshooting.

4.3 Configuring the Vosponder Settings

Information that you will want to have before you start setting up the Vosponder includes:

1. What SDI-12 address do you want to assign to the Vosponder? The default is 0. The SDI-12 address should relate to the control port on the datalogger that you have chosen to wire the SDI-12 interface cable into.
2. What DTMF code (numeric key sequence) do you want to assign to the Vosponder? The default is 123. Up to five numbers can be used. The longer the number sequence the more careful you will need to be when keying in the numbers from the radio handset. Numeric codes of two or three numbers are recommended.
3. Will you be using the Vosponder in SDI-12 slave or master mode? The default is slave mode. If you are using the Vosponder with a CSI datalogger, you will want to be in slave mode.

4.3.1 Steps for Configuration and Testing the Vosponder

1. First view the current settings on the Vosponder by going to the M:> prompt and entering the letters “V” and then “A”. This will take you to the Vosponder View | Address screen. From here you can see what the current settings are for SDI-12 mode, SDI-12 address, and DTMF code. If the settings do not match what you want, then you will need to go to Step 2, otherwise you can jump to Step 3.
2. To change settings in the Vosponder from the M:> prompt enter “E” this will take you to the Edit menu. From here make changes to the various parameters by doing one or all of the following:
 - a. Change SDI-12 Address - From the E:> enter “S” to and then from the ES> type in the new SDI-12 address (number from 0-9).
 - b. Change the DTMF Code – From the E:> enter “D” and then from the ED> prompt type in the new DTMF code (one to five numbers) and press <ENTER>
 - c. Change SDI-12 Mode - From the E:> enter “M” and then from the EM> type in either “S” (Slave) or “M” (Master) to select the new mode
3. Upload the voice image file to the Vosponder (see Section 4.2.3).
4. Check the voice image file to make sure that it transferred correctly. After the voice image file has been transferred, from the M;> prompt enter a “V”, from the V:> prompt enter an “I”, and then from the “VI” prompt enter another “V” to view the voice image. Check the text string to make sure that the text transferred to the Vosponder completely and in the correct order. For more information about the anatomy of the voice image file see Appendix E.

The Voice Image Development program adds some additional characters and numbers that make the image look a little different when it is viewed

in HyperTerminal. Do not be alarmed by seeing some additional characters. The image might look something like that shown in Figure 4-3.

```
V:>I
VI>V0301Beaver Creek Site 31..The battery voltage
is|NY1volts..|02The dataloggers internal temperature
is|YY1degrees C..|03The time is|NN0minutes into the
day|{^9*^1*^1*. Alarm!}
V:>
```

FIGURE 4-5. Terminal Command Mode – View | Image | Voice Screen

5. Turn on your radio handset and make sure your remote site radio is powered. Perform a test on the radio link – from the M:> prompt enter “S”. The Vosponder should now speak the text with data it has received from the datalogger. If this works, your program and the voice image are correct and you have successfully completed the programming process.
6. Initiate a voice message from the datalogger through the Vosponder.
 - a. Enter <ESC> until you see the word Bye! on the screen.
 - b. Disconnect the serial cable from the Vosponder COM port.
 - c. Press the push-to-talk button on your radio handset and while holding it down, key in the DTMF code and then let off the push-to-talk button. If this works, you are ready to deploy the remote site.

If you have reached this point in the manual, then congratulations are in order. You have successfully programmed and configured a Vosponder and understand the basics of how to get voice data messages. You should now be able to deploy your datalogger with the Vosponder to a remote site.

After deploying the system it is a good idea to initiate another voice message test by keying in the DTMF code from your radio handset. Sometimes what works in the office may have some issues in the field. A clear line of site is critical for any RF telemetry application. If your remote site does not have this either directly to your handset or through a repeater network, then you will likely have difficulty getting voice messages from the remote site.

Section 5. Testing and Troubleshooting

5.1 ERROR Codes

When in the terminal mode, error codes may be directed to the screen to aid in troubleshooting. The following table provides context for the error codes.

Error Code	Cause	Corrective Action
2	Attempt to use transparent command in slave mode	Change to master mode
3	SDI-12 transparent mode timed out	Re-enter transparent mode
4	Logger data overrun	Reduce the number of data values or the number of characters in the data values to 102 or less.
6	N-V memory ID error	Use correct SDI-12 address
7	N-V memory load error	Retry image upload

5.2 Frequently Asked Questions

Problem: *I should be hearing voice messages on my radio handset, but I'm not.*

Solution: Check the following:

1. Check the radio handset
 - a. Wait a minute and try again. Sometimes the Vosponder can be busy and doesn't pick up the code on the first try. It also takes about two program execution intervals before the datalogger fully runs the program.
 - b. If you have a second handset, can you talk to the other handset? If not, you may need to change the handset's batteries or recharge them. If this doesn't correct the problem, then you may need to have the handset repaired or replaced.
 - c. Make sure that the handset is set to the same frequency and channel as the radio that is located at the remote site.
 - d. Make sure the volume on the handset is not turned down so low that you can't hear any voice transmission.
 - e. Make sure the squelch on the handset is not turned up so high that you can't hear transmissions.

2. Check the Vosponder

- a. Leave the radio system in place. Connect the Vosponder to the computer using a null modem cable and initiate communication using a terminal program such as HyperTerminal. (Refer to Section 4.) At the main menu prompt (M:>), issue a (S)peak command by pressing "S". You should then hear the default text message coming over your radio.

If this works, then the problem is most likely due to one of the following:

1. The output from the datalogger program does not match with the voice image file that is loaded on the Vosponder. Refer to Sections 2 and 3 to make sure that the program is written correctly and that the voice image file matches with the output being sent from the datalogger.
2. Make sure that the SDI-12 address in the datalogger program matches the SDI-12 address of the Vosponder. Refer to Section 3 for details on how to view the Vosponder's assigned SDI-12 address.

If this doesn't work, then the problem is likely with the radio or radio handset, or a connection problem between the radio the Vosponder. Check each component if possible to make sure they are all working properly.

3. Check the datalogger program

- a. Make sure that the part of your program where SDI-12 command (i.e., "XD", "XS", or "XT") is issued follows the correct format. See Section 2. It is critical that there is a "0" (zero) following the last numeric value in the last P68 instruction that follows the P105 instruction.
- b. You can also connect to the datalogger via a computer and in LoggerNet and view the Ports/Flags. If your program is sending more than two values to the Vosponder, you should see the port that you have called in your P105 instruction go high (green dot). If it doesn't, then you probably need to modify your program.

If the datalogger control port goes high, if the Vosponder responds to the Speak command when directly connected to a computer, and if the radio link is functional, you should be able to hear message broadcasts.

Problem: *My data values are being spoken in the wrong order.*

Solution: Open your voice image file in the Vosponder Image Development Software, and using the UP and DOWN arrow keys to the left of the phrases, move the phrases into the order that you want them spoken. Refer to the Section 3.2.

Problem: *My data values are being spoken with the wrong text phrases.*

Solution: This is caused by the order of the data being sent from the datalogger to the Vosponder not matching with the order that the Vosponder voice image file is expecting.

1. Check your datalogger program to make sure that the values are located in consecutive input locations. Write this order down or print a copy of the program to have available when you check the voice image file later. Refer to Section 2.
2. Check the section of your program where the data values are being transferred to the Vosponder to make sure that you are sending the same number of data values as you have set the voice image file up to expect. Refer to Section 2.
3. Open the voice image file using the Vosponder Image Development Software and check to see that the text strings are associated with the data values in the order that they are being sent from the datalogger. If they are not, then make the necessary modifications to the voice image file. Save and test. Refer to Section 3.

Problem: *The message is coming out but with the default data values (i.e., 12.777, +27.777,+ 7777) instead of my data values, and the message gets all messed up after these three values are spoken.*

Solution: This is caused by the Vosponder not getting new data values from the datalogger.

1. You will need to connect to the Vosponder through HyperTerminal and at the M:> issue a “V” and then another “V”. This will show you the most recent data that the Vosponder has received from the datalogger. If the values are still the default values of 12.77, +77.77, 7777 then this means the datalogger is never passing new data values to the Vosponder and there is a problem with the datalogger’s program or the datalogger may not be functioning correctly.
2. Connect to the datalogger using LoggerNet and view the numeric fields to make sure that new data values are being displayed there.
3. Check the datalogger program to make sure that the control port used for the P105 instruction is the same one that you wired the SDI-12 interface cable from the Vosponder into on the datalogger.

4. Open the Ports/Flags window and watch to see if the control port that you have wired the Vosponder's SDI-12 interface cable into ever goes high (green dot). The port must go high in order for data to be transferred to the Vosponder. If it doesn't, then you will need to check your program and/or the datalogger's control port to see why the control port is not working.

Problem: *The Vosponder transmits fine on interval transmissions, or when I issue a "Speak Now" command, but it doesn't respond when I key in the DTMF code from a handset.*

Solution: There are two possible reasons for this problem.

1. You are not keying in the DTMF code that the Vosponder is expecting.
2. Each radio has small variances that can, in some cases, make a difference. You will need to test your DTMF decoding.

Both of these solutions can be checked fairly quickly by doing the following:

1. Connect the Vosponder to a computer using a null modem cable.
2. Make sure the radio is plugged in to the Vosponder
3. Make sure the Vosponder has at least 10 VDC of power applied to the +12 VDC SDI-12 terminal.
4. Initiate communication using a terminal program such as HyperTerminal. (Refer to Section 4.) At the main menu prompt (M:>), issue a (V)iew command by pressing "V", and then enter a "A" to see the current DTMF code. If this is the same code you have been keying in, then go to the next steps.
5. At the V:> prompt, enter a "D". The screen will do a hard return and the word Bye! will be displayed. The Vosponder is now in a listening mode where the corresponding number associated with any DTMF tones from the radio handset should be displayed on the PC screen.
6. Hold down the push-to-talk button on the handset and press various numeric keys on your keypad. You should see the corresponding number displayed on the PC. If the numbers are not decoding correctly, or if multiple instances of the same number are appearing, minor adjustments to the Vosponder will need to be made. Refer to Appendix C for a detailed explanation of how to make adjustments to the Vosponder in order to fix this problem.

Problem: *The radio doesn't hang up after a voice message transmission.*

Solution: Check the radio interface cable. Make sure that the connection to the radio and the Vosponder are solid. If the problem still exists, then try replacing the cable with another one if you have a spare or can swap one out from another Vosponder that is working. You may need to repair or replace the cable.

Problem: *The Vosponder transmits voice messages great when I set it up in the office, but when I deploy it to my remote site it doesn't transmit when I key in the DTMF code from a handset, unless I am close to the site.*

Solution: The problem likely has something to do with loss of radio signal due to the physical or environmental conditions. RF signals require a clear line of site from the remote to the handset or through a repeater and then to the handset. If trees, buildings, mountains, etc. are blocking the path, then the signal may be reduced or completely lost. Environmental conditions such as fog and snow can also reduce the range of the RF signal.

A visual check for line of sight may reveal problems that may be corrected by relocating a remote station or adding a repeater. If the network appears to have good line of site, then a radio path study may be in order. This would reveal any weak links in your radio network. Things like loose cable connections, damaged cables, radios, or antennas could be the source of the problem. Contact a radio specialist who has the right equipment to perform a radio path study if you don't have the equipment yourself.

Problem: *When the voice message is transmitted, it speaks a bunch of random letters and will not stop transmitting.*

Solution: This is typically caused by an error that has occurred while uploading the voice image file to the Vosponder.

1. First check your terminal communication settings in HyperTerminal or whatever terminal program you are using. See Section 4.1.
2. Reset the Vosponder by entering an "R" from the M:> prompt. Then upload the voice image file again. Make sure to check the voice image file by viewing after you have uploaded it to the Vosponder. (Refer to Section 4.2.4.)

Important Note: After resetting the Vosponder you will also need to reset any settings that you had previously changed from the default settings, like the SDI-12 address or DTMF code.

Problem: *The Vosponder prompt does not appear when HyperTerminal is opened and a key is pressed on the keyboard.*

Solution: This is typically caused by the setting in the terminal program not being quite right. Check the following:

1. Be sure to use a null modem cable.
2. Verify that Vosponder has +12 VDC on Pin 2 of connector J1 and that Pin 1 is grounded to the power supply or datalogger.
3. Go to HyperTerminal and select File | Properties | Connect To. Make sure that the COM port is the one that you are connected to on your PC. Now select "Configure" and make the settings are as follows:

Bits per second: 2400
Data Bits: 8
Parity: None
Stop Bits: 1
Flow Control: Xon / Xoff
ASCII Line Delay = 15 milliseconds
ASCII Character Delay = 20 milliseconds

Problem: *The voice image file does not transfer to the Vosponder correctly.*

Solution: The terminal program is possibly sending the file across faster than the Vosponder can receive it and store it. You need to slow the transfer process down. In HyperTerminal this is done by going into the File | Properties | Settings Tab | ASCII Settings. Then make the following changes:

Line Delay = 15 milliseconds
Character Delay = 20 milliseconds

Appendix A. SDI-12 Interface

If you are not familiar with the SDI-12 protocol, you can visit the following web page and learn more about it:

http://www.sdi-12.org/sdi-12/table_of_contents.htm

A.1 SDI-12 Modes

The Vosponder is capable of emulating either an SDI-12 master unit or an SDI-12 slave unit. The master mode is best used when the Vosponder is being used with any SDI-12 compatible sensor or any SDI-12 device that cannot issue SDI-12 extended commands. The slave mode allows the Vosponder to be controlled by a datalogger, receiving data from the datalogger and then verbalizing it upon command.

A.2 SDI-12 Slave Mode Commands

The Vosponder responds to a subset of the commands specified in the SDI-12 protocol. They are:

Command Name	ASCII Codes	Response	Vosponder Action
Address Query	?!	Address	None
Acknowledge Active	a!	Address	None
Send Identification	aI!	Address, ID String	None
Change Address	aAb!	New Address	None
Start Measurement	aM!	Address, 0011	None, SDI Compliance Only
Retrieve Data	aDx!	Address, First Data Location of Last Received Burst	None, SDI Compliance Only
Verify	aV!	Address, 0011	None, SDI Compliance Only
Send Data	aXDnnnnnnn~!	Address	Stores New Data
Speak Data Now	aXS!	Address	Speaks Image w/Last Data
Speak Alarm	aXA!	Address	Speaks Alarm String
Speak Text	aXTxxxxxxx!	Address	Speaks Included Text String

FIGURE A-1. SDI-12 Slave Mode Commands

Where a = the Vosponder SDI-12 Address, b = the New address, nnnnnn = the input locations reporting, and xxxxxx = a text string.

A.3 Master Mode for SDI-12 Sensors

This appendix does not cover the operation of the Vosponder in master mode. The master mode is best used when attaching the Vosponder directly to stand alone SDI-12 sensors such as a water quality multi-probe, pressure transducer, shaft encoder, or any sensor or SDI-12 device that does not have the ability to issue SDI-12 commands.

A.4 SDI-12 Master Mode

The Vosponder must be converted over to master mode by using terminal programming. At the main menu prompt “M:>” you must enter the edit sub menu by pressing “E”. It will look like this:

```
13DACOMTECH VSP3_010_034A*EU1002 * ? for Help
M:>E
E:>?
(D)TMF Code
(S)DI-12 Adr
SDI-12 (M)ode
(T)x
(ESC)
E:>M
EM>?
(M)aster
(S)lave
(ESC)
EM>M
```

Then press “M” to edit the mode. You will see a prompt that now shows EM>.

Here you can enter either an “S” for slave or “M” for master. This will change the modes accordingly. Remember you can back up to the main menu and enter the (V)iew modes to verify that your Vosponder is in it’s correct mode.

NOTE

RESETTING THE VOSPONDER WILL RETURN IT TO SLAVE MODE!

If a user is going to interface the Vosponder directly to an SDI-12 sensor, a secondary image known as the master image file will need to be created in addition to the voice image file. The master image file will tell the Vosponder how many data points to expect and the SDI-12 address of the slave device (sensor). Detailed documentation of how to set up the master mode option is not covered in this manual. This information will gladly be provided by contacting Intermountain Environmental, Inc. at 435-755-0774 or by e-mailing your request to info@inmtn.com

Appendix B. Cabling and Connections

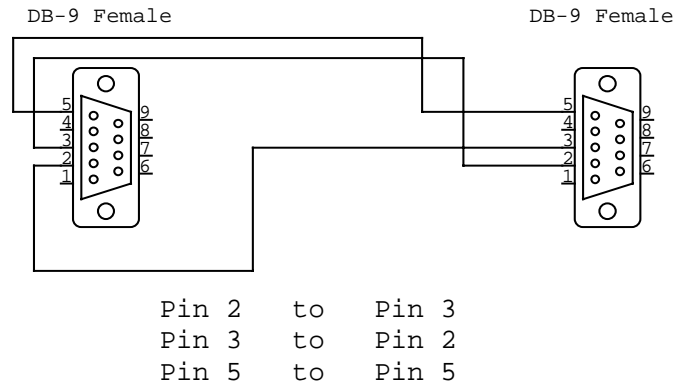


FIGURE B-1. Terminal Interface Cable (Null Modem)

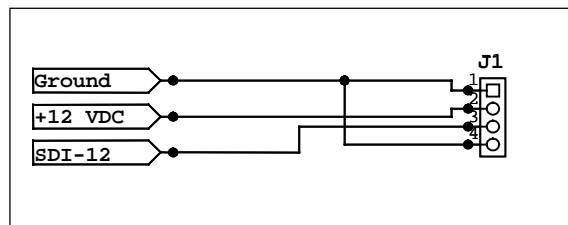


FIGURE B-2. SDI-12 Data and Power Interface Connector

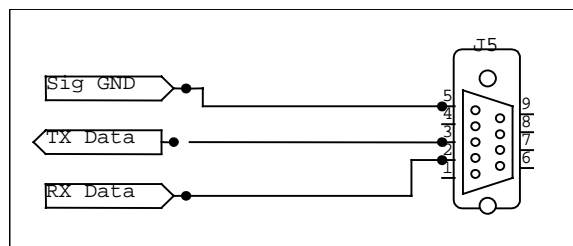


FIGURE B-3. RS-232C Terminal Interface Connector

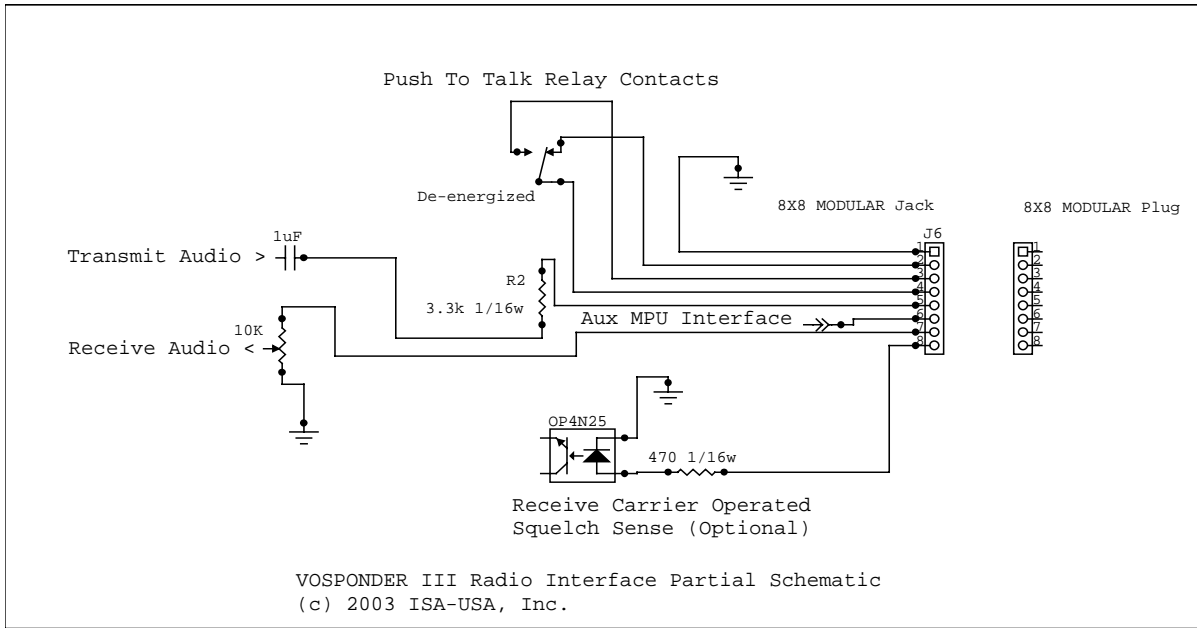


FIGURE B-4. Radio Interface Connector (Partial Schematic)

Appendix C. Audio Level Controls

Four audio level controls are provided on the Vosponder. The information provided here is only for a reference should a technical support representative ask you to make adjustments to the factory settings.

Opening the case and adjusting these settings without first consulting with a technical support representative will VOID the warranty. Under normal circumstances no adjustment from the factory settings will ever be required.

However, some special applications may require small variations in the settings. Contact a technical support representative at (435) 755-0300 or submit a request via e-mail at support@dacomtechnologies.com prior to making any modifications to the default settings.

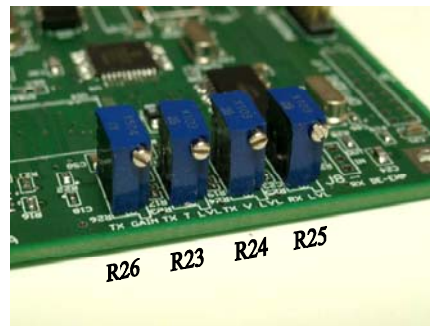


FIGURE C-1. Audio Level Controls

The audio level controls are designated as follows, left to right, as in Figure C-1:

1. R26 – Transmit Gain – Sets the overall gain level for audio originating within the Vosponder.
2. R23 – Tone Level – Not implemented in this version of the Vosponder firmware.
3. R24 – Voice Level – Sets the voice module level into the transmit amplifier.
4. R25 – Receive Level – Controls the level presented to the tone decoder system.

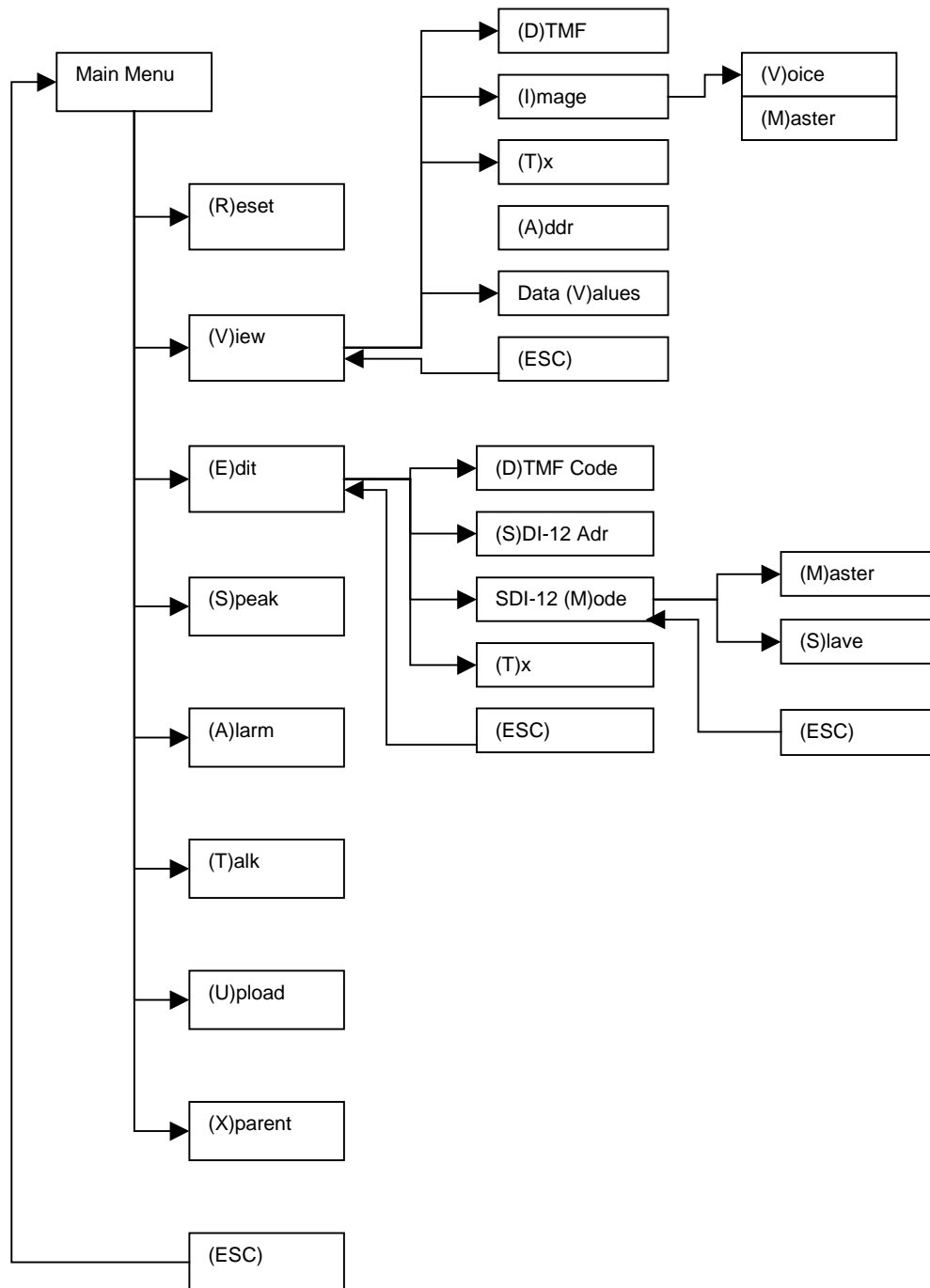
R26 Transmit Gain – should be set to accommodate the level required by the two-way radio microphone or audio input. This is best done using a calibrated communications service monitor.

R24 Voice Level – should not require field adjustment. It may, however, be set using a quality oscilloscope. To make adjustments, cause the voice module to produce a pure tone then, while observing the output

at pin 6 of J6, increase the output level until peak clipping occurs then back off on R24 approximately 20% (2-3 turns). This will provide for optimum voice clarity.

R25 Receive Level – has a very broad acceptance range and is set for the optimum level at the factory. Should adjustment of this control be desired in the field a PC running a terminal program such as HyperTerminal® is required.

Appendix D. Terminal Commands Menu Tree



Appendix E. The Anatomy of the Voice Image File

The voice image file can be created using any basic word processor or text editor that is capable of saving simple .txt files. The editor must not insert any embedded control characters, visible or invisible. .RTF, .DOC, .HTM or any other format is unacceptable. Most offer this as an option under the “save as” file selection.

The constructed voice image file will appear similar to Example E-1.

Example E-1

```
000301The battery is|NY2volts.|02The temperature
is|NY1Degrees C.|03and it's|NN0 Minutes it's|minutes
into the day.|~
```

Here is a breakdown of the voice image file shown in Example E-1.

- 00 The first two characters are the “Image ID”. This field is always the first in the image and instructs the Vosponder to load the image in a particular location in the non-volatile memory.
- 03 The second two characters form the “Number of Records” field. This field tells the Vosponder how many data points to expect to be reported from the data acquisition system each time it sends a block of input locations.
- 01 The third set of two characters form the “Record Identifier” field. This field starts with 01 for the first record and increments by one for each successive field.

The next field is the “Preamble Text” to be spoken in front of the data point. Remember the characters, ~ | { } are not allowed in any text string.

- | The character following the “Text Block” is the “End of Text Marker”. This marker tells the Vosponder to speak the numeric data contained in the appropriate Data Point.
- N The next field is the “Speak Sign” character. This field tells the Vosponder how to deal with the sign, +/-, that precedes the data point. A “Y” will say the sign as received, “N” will ignore the sign.
- Y Next is the “Speak Decimal Point” character. A “Y” speaks the decimal point, an “N” ignores the decimal point. An “A” will say “and” in place of the decimal point.
- 2 The “Number Right Digits to Speak” character is next. This field allows excess digits right of the decimal point to be truncated. “0” (zero) speaks none and any number equal to or greater than the quantity received will speak all digits. Any number “0-7” may be entered here.

The “Postscript” field follows. This is what is to be spoken after the data point is verbalized. Remember the characters, ~ | { } are not allowed in any text string.

- | Another “End of Text” marker is required next. When the Vosponder encounters this marker, it checks to see if any further data points must be reported. If there are, it continues to retrieve information from the voice image and verbalize it. If not, it wraps up the verbalization and shuts down the radio transmitter.

In the example two additional data points are verbalized, one for temperature and one for minutes into the day. Their record identifier’s are 02 and 03 respectively.

- ~ “End of Image” string marker. This is used to tell the Vosponder that the voice image is complete.

The voice image should be saved as a text (.txt) file.

Appendix F. Datalogger Program Example

This program will send three new data values to the Vosponder every ten seconds. Every five minutes the most recent data values will be broadcast over the radio link. The data values can also be broadcast at anytime by using a radio handset and keying in the DTMF code that has been set in the Vosponder. If the batter voltage ever drops below 10.5 volts, the message "Site 31, alarm low battery" will be broadcast over the radio link every ten minutes as long as the battery voltage remains low.

```
*Table 1 Program
01: 10      Execution Interval (seconds)

;MEASURE BATTER VOLTAGE
1: Batt Voltage (P10)
   1: 1      Loc [ BatVolts ]

;MEASURE THE DATALOGGERS INTERNAL TEMPERATURE
2: Internal Temperature (P17)
   1: 2      Loc [ IntTemp ]

;CALCULATE THE TIME
3: Time (P18)
   1: 1      Minutes into current day (maximum 1440)
   2: 0      Mod/By
   3: 3      Loc [ Time ]

;TRANSFER THREE DATA VALUES TO THE VOSPONDER
4: SDI-12 Recorder (P105)
   1: 1      SDI-12 Address
   2: 0      Start Measurement (aM0!)
   3: 1      Port
   4: 1      Loc [ BatVolts ]
   5: 1.0    Mult
   6: 0.0    Offset

5: Extended Parameters 4 Digit (P68)
   1: 88     Option           ;X
   2: 68     Option           ;D
   3: 128    Option           ;Data Value 1 = BatVolts
   4: 128    Option           ;Data Value 2 = IntTemp
   5: 128    Option           ;Data Value 3 = Time
   6: 0000   Option           ;End of command marker
   7: 0000   Option
   8: 0000   Option

;BROADCAST THE MOST RECENT DATA VALUES EVERY FIVE MINUTES
6: If time is (P92)
   1: 0      Minutes (Seconds --) into a
   2: 5      Interval (same units as above)
   3: 30     Then Do
```

```

7: SDI-12 Recorder (P105)
  1: 1      SDI-12 Address
  2: 0      Start Measurement (aM0!)
  3: 1      Port
  4: 1      Loc [ BatVolts ]
  5: 1.0    Mult
  6: 0.0    Offset

8: Extended Parameters 4 Digit (P68)
  1: 88     Option                ;X
  2: 83     Option                ;S
  3: 0000   Option                ;End of command marker
  4: 0000   Option
  5: 0000   Option
  6: 0000   Option
  7: 0000   Option
  8: 0000   Option

9: End (P95)

;IF THE BATTERY VOLTAGE DROPS BELOW 10.5 VDC THEN...
10: If (X<=>F) (P89)
  1: 1      X Loc [ BatVolts ]
  2: 4      <
  3: 10.5   F
  4: 30     Then Do

;EVERY 10 MINUTES...
11: If time is (P92)
  1: 0      Minutes (Seconds --) into a
  2: 10     Interval (same units as above)
  3: 30     Then Do

;IMMEDIATELY BROADCAST "SITE 31, ALARM LOW BATTERY"
12: SDI-12 Recorder (P105)
  1: 1      SDI-12 Address
  2: 0      Start Measurement (aM0!)
  3: 1      Port
  4: 1      Loc [ BatVolts ]
  5: 1.0    Mult
  6: 0.0    Offset

13: Extended Parameters 4 Digit (P68)
  1: 88     Option                ;X
  2: 84     Option                ;T
  3: 32     Option                ;space
  4: 83     Option                ;S
  5: 73     Option                ;I
  6: 84     Option                ;T
  7: 69     Option                ;E
  8: 32     Option                ;space

```

14: Extended Parameters 4 Digit (P68)		
1:	51	Option ;3
2:	49	Option ;1
3:	46	Option ;period, creates a 0.4 sec. pause
4:	46	Option ;period, creates a 0.4 sec. pause
5:	65	Option ;A
6:	76	Option ;L
7:	65	Option ;A
8:	82	Option ;R
15: Extended Parameters 4 Digit (P68)		
1:	77	Option ;M
2:	46	Option ;period, creates a 0.4 sec. pause
3:	46	Option ;period, creates a 0.4 sec. pause
4:	76	Option ;L
5:	79	Option ;O
6:	87	Option ;W
7:	32	Option ;space
8:	66	Option ;B
16: Extended Parameters 4 Digit (P68)		
1:	65	Option ;A
2:	84	Option ;T
3:	84	Option ;T
4:	69	Option ;E
5:	82	Option ;R
6:	32	Option ;space
7:	69	Option ;E
8:	0000	Option ;End of command marker
17: End (P95)		
18: End (P95)		

Campbell Scientific Companies

Campbell Scientific, Inc. (CSI)

815 West 1800 North
Logan, Utah 84321
UNITED STATES
www.campbellsci.com
info@campbellsci.com

Campbell Scientific Africa Pty. Ltd. (CSAf)

PO Box 2450
Somerset West 7129
SOUTH AFRICA
www.csafrica.co.za
sales@csafrica.co.za

Campbell Scientific Australia Pty. Ltd. (CSA)

PO Box 444
Thuringowa Central
QLD 4812 AUSTRALIA
www.campbellsci.com.au
info@campbellsci.com.au

Campbell Scientific do Brazil Ltda. (CSB)

Rua Luisa Crapsi Orsi, 15 Butantã
CEP: 005543-000 São Paulo SP BRAZIL
www.campbellsci.com.br
suporte@campbellsci.com.br

Campbell Scientific Canada Corp. (CSC)

11564 - 149th Street NW
Edmonton, Alberta T5M 1W7
CANADA
www.campbellsci.ca
dataloggers@campbellsci.ca

Campbell Scientific Ltd. (CSL)

Campbell Park
80 Hathern Road
Shepshed, Loughborough LE12 9GX
UNITED KINGDOM
www.campbellsci.co.uk
sales@campbellsci.co.uk

Campbell Scientific Ltd. (France)

Miniparc du Verger - Bat. H
1, rue de Terre Neuve - Les Ulis
91967 COURTABOEUF CEDEX
FRANCE
www.campbellsci.fr
campbell.scientific@wanadoo.fr

Campbell Scientific Spain, S. L.

Psg. Font 14, local 8
08013 Barcelona
SPAIN
www.campbellsci.es
info@campbellsci.es