DOCUMENTATION FOR PROCESSING STEVENS ANALOG HYDRA PROBE OUTPUT DATA.

INTRODUCTION

The Stevens Hydra Probe works with a capacitance-based technology rather than with a time-domain-reflectivity (TDR)-based technology like Campbell's sensor. Therefore its output is a series of four voltages which the CSI data loggers read in millivolts.

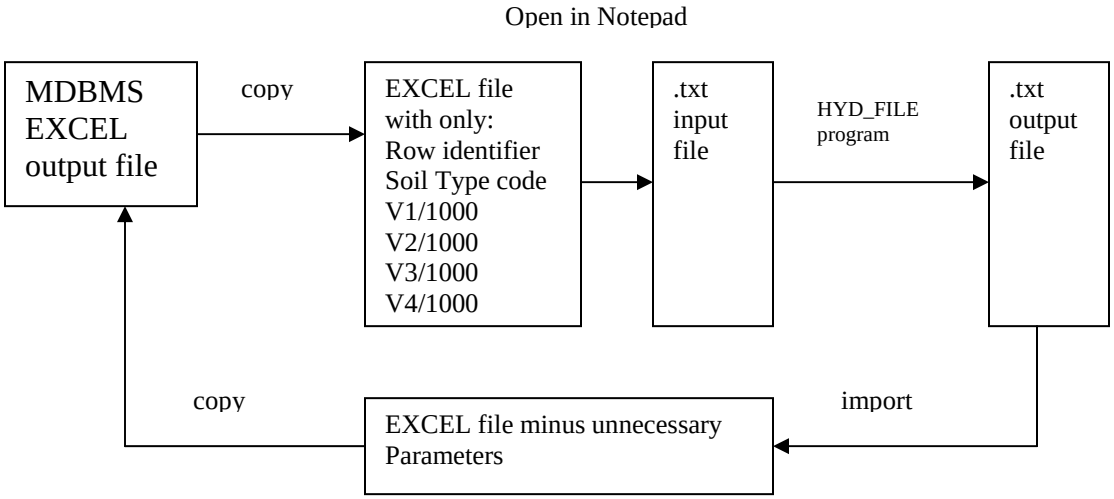
These four voltage outputs must be converted into useful measurement units by the Stevens proprietary program HYD_FILE found at http://www.stevenswater.com/catalog/stevensProduct.aspx?SKU=%2770030%27 at the Hydra Probe page. This documentation covers a procedure to take the CSI LoggerNet data from the DCP with these sensors and manipulate them into useful data.

This documentation concludes with an appendix of further documentation of another Stevens proprietary program (HYDRA.exe) that converts data one record at a time. HYDRA.exe is useful for quick spot checks of a single set of voltages but not for entire data sets. A second appendix provides contact persons with the company.

THE PROCESSING PATHWAY

Data are extracted from LoggerNet data that has been put into the AMNET MDBMS database via an EXCEL spreadsheet. The first step: out of all such data you extract the four voltages from each Hydra-Probe onto a new spreadsheet, manipulate and add some more data manually, and then use Notepad to create a .txt file. The second step: you process the .txt file with the Stevens-Vitel program HYD_FILE to obtain a second .txt as output. The third step: you import this .txt file into a new EXCEL spreadsheet, delete superfluous data not needed by your customer, and copy into the original EXCEL spreadsheet that you began with.

Here is a flow chart of the process you need to follow in processing Hydra-Probe voltage data into useful units of measurement.



You have to repeat this processing pathway for each probe used on the DCP since the Stevens-Vitel program can only process one probe at a time.

STEP ONE: PREPARATION OF THE HYD_FILE INPUT FILE

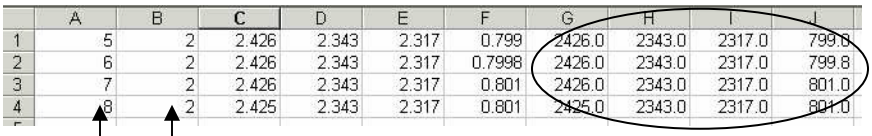
"out of all such data you extract the four voltages from each Hydra-Probe onto a new spreadsheet, manipulate and add some more data manually, and then use Notepad to create a .txt file."

1. For the date/time period of interest, copy from the MDBMS EXCEL output file of the DCP with the Stevens Hydra-Probe(s), the four columns of voltages for the first probe. Note the row numbers on this original MDBMS output spreadsheet for your date/time period of interest. Copy the four columns to a new spreadsheet and put into columns G, H, I, and J. For example:

	A	B	C	D	E	F	G	H	I
1									
2					Soil Moisture Voltages				
3									
4	Date	Time (EST	Avg_PnlTemp		V1_1	V1_2	V1_3	V1_4	Min_BattV
5	8/15/2002	14:45	25.1		2426.0	2343.0	2317.0	799.0	13.22
6	8/15/2002	15:00	25.1		2426.0	2343.0	2317.0	799.0	13.23
7	8/15/2002	15:15	25.0		2426.0	2343.0	2317.0	801.0	13.23
8	8/15/2002	15:30	25.0		2425.0	2343.0	2317.0	801.0	13.23

2. Create four more columns in this new spreadsheet of the voltages divided by 1000 so that the numbers are in units of volts instead of millivolts which MDBMS gives. Map column G to column C, column H to column D, column I to column E, and column J to column F using the cell formula "C row x = G row x / 1000" for the first mapping, and so

on. Put into column A numbers that match the row numbers containing the set of four voltages on the original MDBMS spreadsheet.



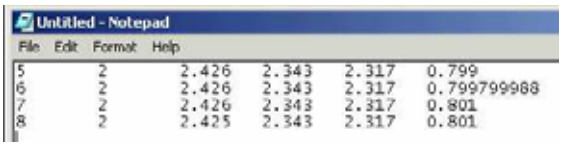
	A	B	C	D	E	F	G	H	I	J
1	5	2	2.426	2.343	2.317	0.799	2426.0	2343.0	2317.0	799.0
2	6	2	2.426	2.343	2.317	0.7998	2426.0	2343.0	2317.0	799.8
3	7	2	2.426	2.343	2.317	0.801	2426.0	2343.0	2317.0	801.0
4	8	2	2.425	2.343	2.317	0.801	2425.0	2343.0	2317.0	801.0

Numbers in Column A correspond to row numbers in original file

Column B is soil type: 1 = sand; 2 = silt; 3 = clay

Columns C through F show numbers from columns G through J
Divided by 1000

3. Step one is finished when you copy the cells you have developed in columns A to F (omit columns G to J) out of this new spreadsheet into MS Notepad. You now have:



Untitled - Notepad

File Edit Format Help

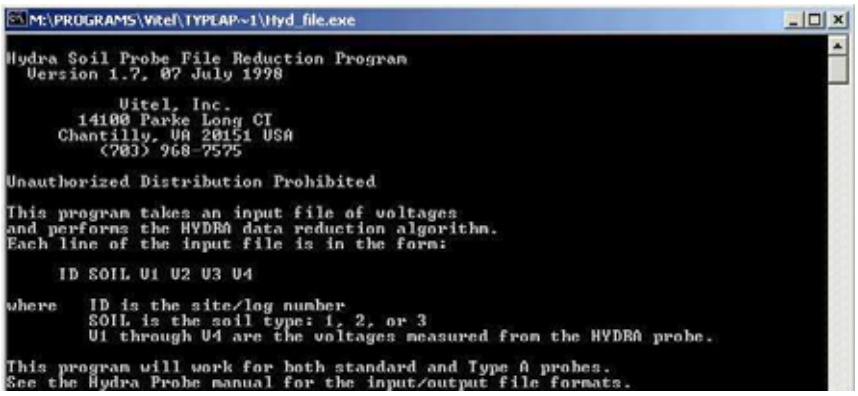
```
5       2       2.426   2.343   2.317   0.799
6       2       2.426   2.343   2.317   0.799799988
7       2       2.426   2.343   2.317   0.801
8       2       2.425   2.343   2.317   0.801
```

So that the HYD_FILE program can access this file, save it to whatever directory and folder where you have HYD_FILE. (Note. You must have the HYD_File and the input notepad sheet in the same file.) You have now created the input file for the Stevens conversion program.

STEP TWO: CONVERTING THE DATA

"you process the .txt file with the Stevens program HYD_FILE to obtain a second .txt as output"

1. Double click on the Stevens program HYD_FILE.exe to get into this DOS-based program. You will see this screen:

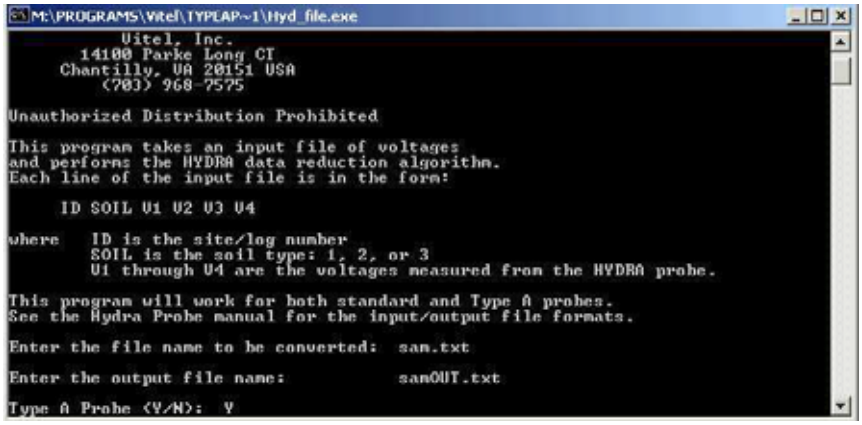


2. Scroll down to the <u>first</u> query that asks for the file name of the input file you have just created.

CAUTION: the filename must observe DOS limitations (filename 8 characters or less) and must include the filename extension ".txt".

After typing it in and entering, you get a <u>second</u> query for the output file name. SUGGESTION TO AVOID CONFUSION: repeat the filename of the input file and add the 3 letters "OUT" to it (making sure that the total number of characters is 8 or less). That way you can remember which input file goes with which output file.

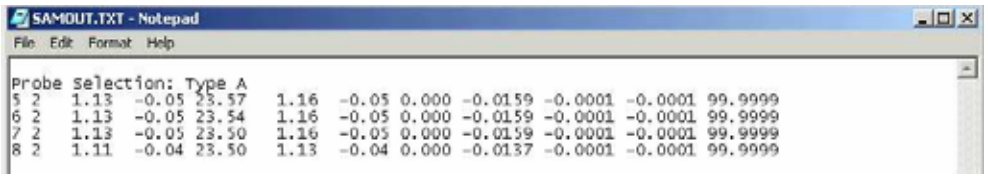
After responding to the first two queries, you will see the following in the screen the input filename "sam.txt" and the output filename "samOUT.txt":



You need to respond to a <u>third</u> query asking whether or not you have data from a Type A Hydra-Probe. The Meteorology Team has both the old "Standard" probes and the new "Type A" probes. Be careful which one the DCP had on it. Generally, we now use all Type A probes because they can be used with the CR10T data logger that only can read voltages up to 2.5 VDC. The old Standard Hydra-Probes output as much as 5 VDC and required a "voltage divider" to be added to the terminal strip of the CR10T data logger.

3. After you hit <Enter> in the third query, HYD_FILE ingests the input text file and outputs a text file with the name you called for in the second query. In the example,

HYD_FILE created the output file “samOUT.txt” which, when opened within MS Notepad, looked like this:



You now have the actual measurements in proper units and have completed the second step in the Stevens data processing.

STEP THREE: MERGING THE DATA INTO YOUR FINAL SPREADSHEET

“you import this .txt file into a new EXCEL spreadsheet, delete superfluous data not needed by your customer, and copy into the original EXCEL spreadsheet that you began with”

1. Open a new EXCEL worksheet and import the HYD_FILE output text file. In the EXCEL Import Wizard Step 1, click on “Delimited” not “Fixed Width” since the text file records have varying widths. In Step 2, click on “Space delimiter” and click on “Treat consecutive delimiters as one”. Finish with Step 3 as usual and obtain:

	A	B	C	D	E	F	G	H	I	J	K	L
1												
2	Probe	Selection:	Type	A								
3	5	2	1.13	-0.05	23.57	1.16	-0.05	0	-0.0159	-0.0001	-0.0001	99.9999
4	6	2	1.13	-0.05	23.54	1.16	-0.05	0	-0.0159	-0.0001	-0.0001	99.9999
5	7	2	1.13	-0.05	23.5	1.16	-0.05	0	-0.0159	-0.0001	-0.0001	99.9999
6	8	2	1.11	-0.04	23.5	1.13	-0.04	0	-0.0137	-0.0001	-0.0001	99.9999

2. You must now decide how many of the resulting columns of data you want to delete. It depends upon your customer. Here is the key to the columns (descriptions follow the Stevens Instruction Manual in the Tech Library):

Column	Parameter	Units	Description
A	Number of row in original spreadsheet that this row should be merged with	EXCEL Row Integer	Can be deleted after you use this information to “line up” these data with that in the original MDBMS EXCEL spreadsheet
B	Soil Type	Stevens-Vitel code	Should be left in the final data spreadsheet
C	Real part of the dielectric soil constant	Dimensionless	Only needed by research folks and the curious
D	Imaginary part of the dielectric soil constant	Dimensionless	Only needed by research folks and the curious
E	Soil Temperature	Deg Celsius	Probably always kept

F	Column C data corrected to 25'C environment	Dimensionless	Only needed by research folks and the curious
G	Coumn D data corrected to 25'C environment	Dimensionless	Only needed by research folks and the curious
H	Soil Moisture	Fraction of water to soil volumn	The whole point of doing this!!
I	Salinity in terms of NaCl	Grams per Liter	For Soil water slurries only. Most applicable for the Hand Held Units
J	Soil Electrical conductivity	Siemens per meter (Siemen is reciprocal of Ohm = Amps/Volt)	May be of use for detection instrumentation
K	Column J data corrected to 25'C.	Siemens per meter (Siemen is reciprocal of Ohm = Amps/Volt)	May be of use for detection instrumentation

For most customers, you can delete columns C, D, F, G, I, J and may even delete columns K and L for some customers. Be sure to keep column A for now. With columns C,D,F,G,I,J deleted, leaving only A,B,E,H,K,L, you have:

	A	B	C	D	E	F
1	5	2	23.57	0	-0.0001	99.9999
2	6	2	23.54	0	-0.0001	99.9999
3	7	2	23.5	0	-0.0001	99.9999
4	8	2	23.5	0	-0.0001	99.9999

3. Next you merge this new spreadsheet data into the original spreadsheet taken from MDBMS. Here's where the Row A numbers come in handy. These numbers clue you where to copy these new spreadsheet data into the original. Merely line up the numbers with the rows of the original. After copying onto the original, you can then delete the column of these numbers.

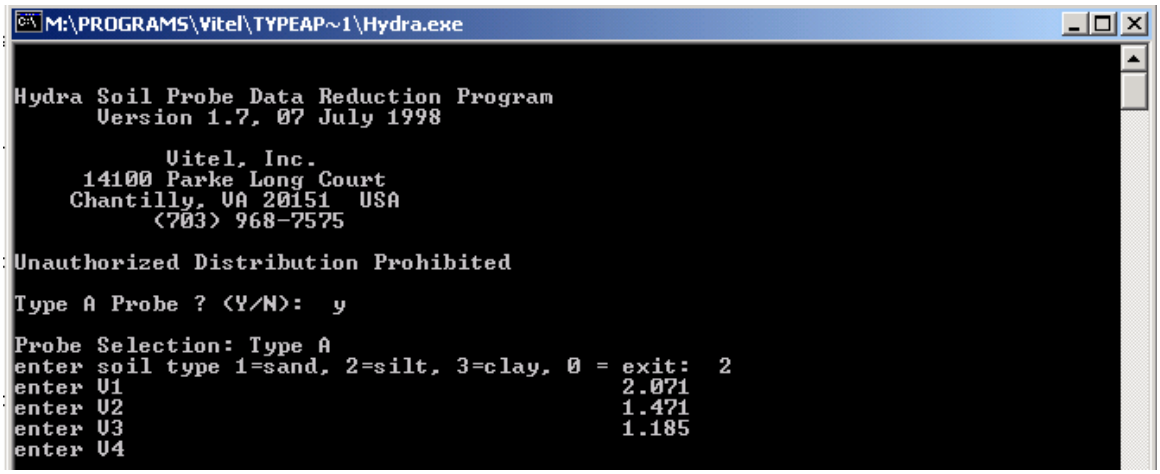
You finish the job by correctly labeling the column headers for the customer and by adding any other synchronous data that is required from a nearby Basic DCP.

APPENDIX A:

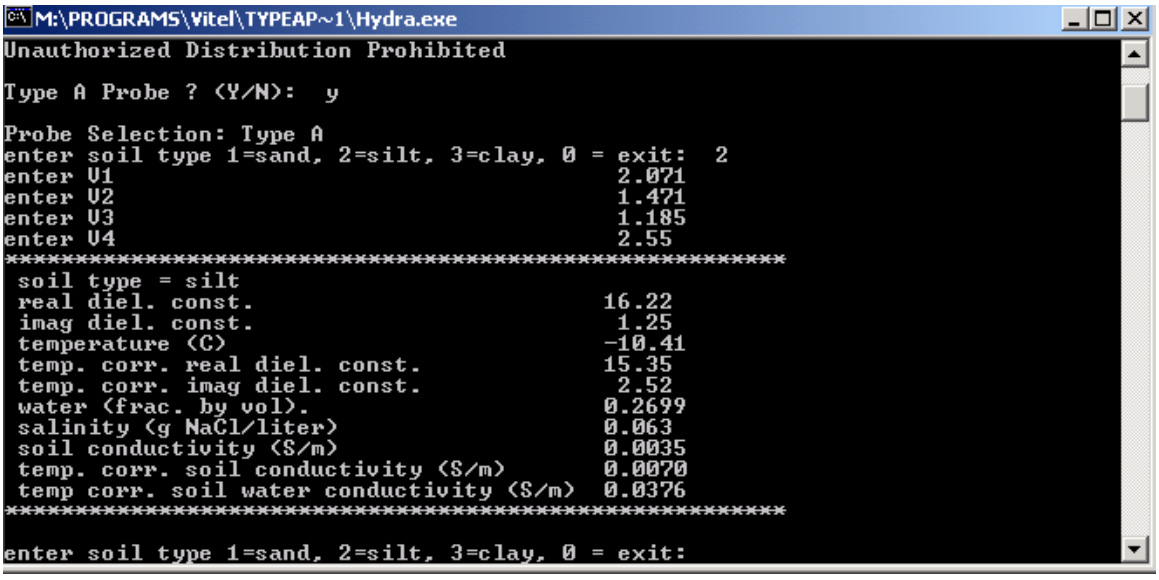
USING THE MANUAL "CALCULATOR" VERSION (HYDRA.exe)

For doing a quick calculation of only a few sets of probe voltages, Stevens provides a simple "calculator" version of their program called HYDRA.exe. It may be found at http://www.stevenswater.com/index.aspx under Hydra Probe.

1. Double click on HYDRA.exe and get the input screen:



2. Enter the requested data as shown and you get the results instantly:



APPENDIX B:

Sources of information from Stevens and Tech Support Contacts.

Stevens Water Monitoring Systems Inc. Beaverton, OR:

Keith Bellingham (800-452-5272) Soil Scientist/Geochemist.

Chuck Pergiel (800-452-5272) Electrical Engineer.