RS-232 Software Rev 4.3XX
For The DSTS-4A/3 with EAB-3 Electronic Attenuator Board Option

OVERVIEW

The EAB-3 is an electronic attenuator with 255 steps of 0.3 decibel per step. The maximum attenuation referenced to 50 mV is -76.5 dB, or 0.0075 mV. Table 1 gives the attenuation in dB and the output voltage in mV. Note that the level is correct only when the panel controls are set for a 50 mV reply. The attenuator defaults to 0 dB when power is applied so the DSTS-4A to be used without a terminal.

TESTING THE BI-DIRECTIONAL RS-232 INTERFACE

To use the RS-232 software, you must have a terminal configured at 9600 baud, 8 data, no parity, and 1 stop bit. Any terminal program, such as the Windows Terminal program, will work with the DSTS-4A.

CONNECTING THE DSTS-4A TO A TERMINAL

Connect the DSTS-4A to the serial port of the terminal device. The cable wiring and part numbers are specified in the operators manual. If you already have the RS-232 option, use the cable supplied with the DSTS-4A.

DSTS-4A CONTROL SETUP

Always set the REPLY LEVEL switch to the 50 mV position, and the AMPL VERNIER control to the CAL position. Select the appropriate load with the LOAD SELECTION SWITCH.

INITIAL TEST

Connect a depth sounder to the DSTS-4A. Apply power to the DSTS-4A and the Depth sounder. Type a lowercase x. The terminal will display “ack”, and the DSTS will display "Rem" just over the mode switch to indicate it is in the remote mode.

Press the lowercase ‘l’. The terminal will display the incoming pulse frequency, width, period, and voltage, followed by "ack". To exit the remote mode and return control to the DSTS-4A panel, press the uppercase X. The terminal will display "local" followed by "ack", and "Menu" is displayed over the mode switch to indicate the DSTS is back in the normal (local) mode of operation. This completes the initial test of the RS-232 option.

ATTENUATOR TEST

The attenuator defaults to the maximum output level, 255. Type “l000" (lower case “l” followed by three zeros) to set the output to the minimum level of .0075 mV. The depth sounder may not show an echo at this low level. Refer to the table for the relationship to the level value (0- 255) and the output amplitude. The attenuator changes by 0,3 dB each step.

TESTING WITHOUT A DEPTH SOUNDER CONNECTED

The DSTS-4A will also respond to commands when no depth sounder is connected to the input. The depths and widths for bottom and fish echos can be preset, but will have no effect until a pulse is received from the DUT.

This completes the initial test of the RS-232 interface.

COMMAND STRUCTURE

The commands are one or two characters. Both lower and uppercase are used. There are two types of commands. One type consists of a command that requires no additional data or cr-lf. A cr-lf is a carriage return/linefeed sequence generated by pressing the ***enter*** key on the terminal. The other type requires the input of a single letter followed by some additional numeric data and a cr-lf. A cr-lf is the sequence sent when the '***enter***' key on a PC is pressed. The simple commands are listed under the heading "COMMAND LIST". The commands requiring extra data input are listed under the heading "DATA COMMAND LIST"

COMMAND LIST

LETTER	FUNCTION
a	Sets width Auto Track mode on. Turns off when a width is sent to the DSTS.
A	Sets frequency Auto Track mode on. Turns off when a frequency sent to the DSTS.
b	Sets normal (pulsed output) mode of operation.
B	Sets output signal to continuous wave (CW mode).
C	Checks 50 kHz clock frequency.
Cf	Sets the calibration to feet.
cF	Sets the calibration to Fathoms.
cm	Sets the calibration to meters.
cR	Extend Depth range to 9999 FT/FM/MT.
cr	Reduce Depth range to 999.9 FT/FM/MT.
dxxxx	Sets the bottom depth in tenth's of the selected units.
Dxxxx	Sets the fish depth in tenth's of the selected units.
e	Turns off the fish echo mode. Returns one bottom echo.
E	Turns on the fish echo mode. Returns two echoes.
fxxxx	Sets the reply frequency in 100 Hz units.
i	Returns DSTS data on input pulse parameters in this order: Frequency, width, period, P-P voltage. A typical string is 503,192,107,540. Leading 0's are not sent.
l	Sets the reply level in .3 dB steps, 0 to 255 max.
m	Returns DSTS modes in this order: Calibration — 0=ft, 1=fm, 2=mt Number of processed pulses received since reset — 0-255 Bottom echo or fish with bottom echo — bot or fsh Auto width Track or manual — awt or mwt Auto frequency Track or manual — aft or mft CW or pulsed output — cwo or pul Filter settled or not settled. — set or nst A typical string is 0,bot,73,awt,aft,pul,set
o	Returns DSTS data on output pulse parameters in this order: Frequency, width, depth, reply level.
P	Prints "Rem" in the DSTS-4A text window.
Pxxxxx	Accepts five characters for display in a text window.
r	Resets tracking gate and adaptive filters for frequency acquisition.
R	Resets the DSTS to power up default mode without exiting RS-232.
s	Reads the mode switch and replies with "mode_dn" or "mode_up".
v	Reports the software version.
wxxxxx	Sets the bottom echo width in microseconds.
Wxxxxx	Sets the fish echo width in microseconds.
x	Enters the remote mode of control.
X	Exits the remote mode and return DSTS to normal operation.
?	Sends a simple menu of all commands to the terminal.

USING COMMANDS

The commands discussed here are the single key commands listed under "COMMAND LIST".

These commands are entered as one or two keystrokes without pressing the ***enter*** key. They are not echoed to the terminal. An "ack" is returned to the terminal if the command is successful; if not, "nak" is returned. For example, if the DSTS-4A is in the local mode, and "x" is sent, the terminal will display "ack". If another lower-case "x" is sent, the reply will be "nak", indicating the command was not successful as the DSTS-4A is already in the remote mode. Pressing "E" will turn on the fish echo and return "ack". The character string "ack" or "nak" is always returned after any command. The exceptions are the “x”, “X”, and “s” commands. When “x” is issued, “remote” is sent, followed by “ack”. Exiting the remote mode sends “local” followed by “ack”. The “s” command sends “wait_sw” only.

SENDING STRING DATA TO THE TEXT WINDOW.

String data may be sent to a 5-character text window located just above the mode switch. For example, type "P.02mV " followed by ***enter***, and the text “.02mV” appears in the user window. To erase the message, send five blank spaces ("P "). a quick way to restore the text window is to type a lowercase "p". This prints "Rem" in the text window, which is the default text.

READING THE MODE SWITCH

The mode switch is read by typing "s" without ***enter***. The DSTS-4A returns wait_sw and will wait until the operator lifts or depresses the mode switch. Lifting the mode switch returns "mode_up", and depressing it returns "mode_dn", either being followed by "ack". If the operator fails to move the mode switch, the DSTS-4A can be returned to remote operation by sending any character. When this is done, "nak" will be returned indicating the operator failed to respond to the switch request.

INPUT PULSE COMMAND

Typing "I" alone (no cr-lf) will return the data as displayed on the top line of the DSTS-4A display (frequency, width, period, P-P voltage), followed by a cr-lf and the characters "ack". There may be a small delay between the end of the data stream and the “ack” if the DSTS-4A is connected to a depth sounder with a low pulse repetition rate. The data is returned in the raw form, without leading zero’s, decimal points or scale factors. The frequency is returned in hundreds of Hz, i.e., a 204.6 KHz output would return 2046, and voltage is returned in tens of volts, i.e., 730 volts would return 73. Depth is in tenth’s of a unit, so 213 is 21.3 depth units. Pulse width and period are in microseconds and milliseconds, respectively.

OUTPUT PULSE COMMAND

Typing "o" will return the data as displayed on the bottom line of the DSTS-4A display (frequency, width, period, reply level), followed by a cr-lf and the characters "ack". There may be a small delay between the end of the data stream and the “ack” if the DSTS-4A is connected to a depth sounder with a low pulse repetition rate. The data is returned in the raw form, without leading zeros, decimal points or scale factors. Refer to the above paragraph, INPUT PULSE DATA, for information on this.

This command is useful in verifying the DSTS settings.

NOTE: The depth returned by the “o” command will be the *fish depth* if the DSTS-4A is in the *fish echo mode*, otherwise it is the bottom depth.

DSTS MODE COMMAND

Typing ‘m’ will output the operating mode of the DSTS-4A in the following order:

Depth calibration, number of pulses processed since reset, bottom or fish echo, width Auto track or manual width, Auto frequency or manual track, CW or pulsed output, and filter settled or not settled.

The calibration factor is a number from 0 to 2. Zero indicates the depth is in feet, 1 indicates fathoms, and 2 indicates meters. The number of pulses processed since last reset are sent next. This is a value between 1 and 255. Bottom and fish echo modes are indicated by “bot” of “fsh”. If the DSTS is an Auto Track mode, “awt” is sent to indicate width tracking mode, and “aft” for the frequency tracking mode. Manual frequency and width are indicated by “mft” and “mwt”. The state of the frequency filter is “set” if it has settled, and “nst” if it is not settled. The same number of parameters are sent regardless of the operating mode.

USING DATA COMMANDS

The commands discussed here are the under "DATA COMMAND LIST". A data command is composed of a single letter followed by the data, terminated with a cr-lf. The data is echoed to the terminal, and the command is completed by pressing the ***enter*** key, sending a carriage return/line feed to the DSTS-4A. If the command is accepted, the string "ack" is returned to the terminal. If not, "nak" is returned. For the commands requiring numerical input, the data must consist of five or fewer digits. Leading zero's have no effect. Any numerical data after an alphabetical character is discarded. The numerical data is not checked for incorrect input unless the first character is not a number. For example, "d123" will set the depth to 12.3 units. Typing "d123r4" will also set the depth to 12.3 units and return "ack". However, typing "dq123" will set the depth to zero and return "nak".

DATA COMMAND LIST

LETTER	FUNCTION
dxxxx	Sets the bottom depth in tenth’s of the selected units.
Dxxxx	Sets the fish depth in tenth’s of the selected units.
lxxx	Sets the reply level. 000 = min, 255 = max. Level is 0.30 dB/step. **Note** that this is a lower case L as in level .
fxxxx	Sets the reply frequency in 100 Hz units. Also turns off the frequency Auto Track mode. To return to the frequency Auto Track mode, use the ‘A’ command.
wxxxxx	Sets the bottom echo width in microseconds. Also turns off the width Auto Track mode. To return to the width Auto Track mode command, use the ‘a’ command.
Wxxxxx	Sets the fish echo width in microseconds.
Pxxxxx	Accepts five characters for display in a text window.

ENTER AND CR-LF

When the word ***enter*** is used, it refers to the computer’s `enter’ key, and is the cr-lf hex 0x0D-0x0A character sequence that is normally generated. Data entry is terminated with ***enter***.

MORE ON “ack” AND “nak”

Each time a command is successfully completed, the string “ack” is sent by the DSTS-4A to the terminal. If the command is not successful, the DSTS-4A sends the characters “nak” to the terminal. A command is successful if the DSTS-4A accepts the command or data command. If the result of the command has no effect, “nak” will be returned. For example, a lowercase “x” places the DSTS in the remote mode. If another lowercase “x” is sent, nothing can happen because the DSTS-4A is already in the remote mode, and a “nak is returned. Data commands are different. If a lowercase “d” is sent to the DSTS-4A, it waits for a numeric input. Nothing will happen until the ***enter*** key is pressed. If no data is present when ***enter*** is pressed, the depth will not be changed, and “nak” is returned. If correct data followed the “d”, then the depth is set and “ack” returned to the terminal.

COMMAND RESPONSE SPEED AND PACING IMPROVEMENTS

The command response time has been much improved in this version of the RS-232 software. When communicating with the DSTS-4A via the RS-232 link, always wait for an “ack” after sending a command. The “ack” indicates the DSTS-4A has finished processing the character(s) and is ready to accept another command. This will prevent missed commands or corrupted data. The DSTS-4A will not accept a continuous stream of data (from a disk file) due to the limited amount of RAM available. Normally it does no good to send commands any faster than the pulse rate of the depth sounder under test. Data commands may be sent without any pause between characters, but please wait for an “ack” before proceeding with the next command. If a “nak” is received, re-send the command until an “ack” is received.

SENDING A FILE TO THE DSTS-4A USING MICROSOFT TERMINAL

Use the Microsoft Windows Terminal program. Set up the terminal program as follows: Under the “Settings” menu select “Communications...” and set 9600 Baud, 8 data bits, no parity, and XON/XOFF flow control. Select OK and select the “Settings-Text Transfers...” Menu. Under “Flow control”, select “Line at a time” and under “” select “Wait for Prompt String. Enter ack in the box to the right. Select OK. Use an ASCII text editor to make a text file using only one command per line. To send the file, select the “Transfers” menu and choose “Send Text File...”. Click on the box marked “Strip Line Feed”. Select the file to send and choose OK. The data will be sent to the DSTS as fast as it can be processed. If an error is encountered, click on the “pause” button to resume. Occasional errors may happen with fast (<50 mS period) input pulse rates. To create a slowly changing depth pattern, make an ASCII file containing a series of depth commands with only one command per line. In the terminal program, change the menu “Settings... - Flow control - Transfer a Line at a Time” to “Delay Between Lines”. Choose the delay that gives the desired rate of depth change.

SENDING MULTIPLE COMMANDS TO THE DSTS

Sending repeated depth commands to the DSTS between input pulses has no effect other than to tie up the RS-232 port. Commands have no effect until the DSTS receives an input pulse. For instance, the last command depth sent will be the one that is executed. However, any number of **different** commands may be sent and will execute when the next input pulse is encountered. For instance, the depth and width for bottom and fish echoes may be rapidly sent between pulses, and all will be simultaneously executed on the next input pulse.

Table 1

N	Vout, mV	N	Vout, mV	N	Vout, mV	N	Vout, mV	N	Vout, mV	N	Vout, mV
0	0.0075	43	0.0330	86	0.1460	129	0.6440	172	2.8440	215	12.5590
1	0.0077	44	0.0342	87	0.1510	130	0.6670	173	2.9440	216	13.0010
2	0.0080	45	0.0354	88	0.1560	131	0.6900	174	3.0480	217	13.4580
3	0.0083	46	0.0366	89	0.1620	132	0.7140	175	3.1550	218	13.9310
4	0.0086	47	0.0379	90	0.1670	133	0.7400	176	3.2660	219	14.4200
5	0.0089	48	0.0393	91	0.1730	134	0.7660	177	3.3800	220	14.9270
6	0.0092	49	0.0406	92	0.1790	135	0.7920	178	3.4990	221	15.4510
7	0.0095	50	0.0421	93	0.1860	136	0.8200	179	3.6220	222	15.9940
8	0.0099	51	0.0435	94	0.1920	137	0.8490	180	3.7490	223	16.5570
9	0.0102	52	0.0451	95	0.1990	138	0.8790	181	3.8810	224	17.1380
10	0.0106	53	0.0467	96	0.2060	139	0.9100	182	4.0180	225	17.7410
11	0.0109	54	0.0483	97	0.2130	140	0.9420	183	4.1590	226	18.3640
12	0.0113	55	0.0500	98	0.2210	141	0.9750	184	4.3050	227	19.0090
13	0.0117	56	0.0518	99	0.2290	142	1.0090	185	4.4560	228	19.6780
14	0.0121	57	0.0536	100	0.2370	143	1.0450	186	4.6130	229	20.3690
15	0.0126	58	0.0555	101	0.2450	144	1.0810	187	4.7750	230	21.0850
16	0.0130	59	0.0574	102	0.2530	145	1.1190	188	4.9430	231	21.8260
17	0.0135	60	0.0594	103	0.2620	146	1.1590	189	5.1160	232	22.5930
18	0.0139	61	0.0615	104	0.2720	147	1.1990	190	5.2960	233	23.3870
19	0.0144	62	0.0637	105	0.2810	148	1.2420	191	5.4820	234	24.2090
20	0.0149	63	0.0659	106	0.2910	149	1.2850	192	5.6750	235	25.0590
21	0.0155	64	0.0680	107	0.3010	150	1.3300	193	5.8740	236	25.9400
22	0.0160	65	0.0710	108	0.3120	151	1.3770	194	6.0810	237	26.8520
23	0.0166	66	0.0730	109	0.3230	152	1.4260	195	6.2950	238	27.7950
24	0.0171	67	0.0760	110	0.3340	153	1.4760	196	6.5160	239	28.7720
25	0.0177	68	0.0780	111	0.3460	154	1.5270	197	6.7450	240	29.7830
26	0.0184	69	0.0810	112	0.3580	155	1.5810	198	6.9820	241	30.8300
27	0.0190	70	0.0840	113	0.3710	156	1.6370	199	7.2270	242	31.9130
28	0.0197	71	0.0870	114	0.3840	157	1.6940	200	7.4810	243	33.0350
29	0.0204	72	0.0900	115	0.3970	158	1.7540	201	7.7440	244	34.1960
30	0.0211	73	0.0930	116	0.4110	159	1.8150	202	8.0160	245	35.3970
31	0.0218	74	0.0960	117	0.4260	160	1.8790	203	8.2980	246	36.6410
32	0.0226	75	0.1000	118	0.4410	161	1.9450	204	8.5900	247	37.9290
33	0.0234	76	0.1030	119	0.4560	162	2.0140	205	8.8910	248	39.2620
34	0.0242	77	0.1070	120	0.4720	163	2.0840	206	9.2040	249	40.6420
35	0.0251	78	0.1110	121	0.4890	164	2.1580	207	9.5270	250	42.0700
36	0.0259	79	0.1150	122	0.5060	165	2.2330	208	9.8620	251	43.5480
37	0.0269	80	0.1190	123	0.5240	166	2.3120	209	10.2090	252	45.0790
38	0.0278	81	0.1230	124	0.5420	167	2.3930	210	10.5670	253	46.6630
39	0.0288	82	0.1270	125	0.5610	168	2.4770	211	10.9390	254	48.3030
40	0.0298	83	0.1320	126	0.5810	169	2.5640	212	11.3230	255	50.0000
41	0.0308	84	0.1360	127	0.6010	170	2.6540	213	11.7210		
42	0.0319	85	0.1410	128	0.6220	171	2.7480	214	12.1330		

N is the value used for the amplitude control word.

Output voltage V.S. control word. Reply level = 50 mV.
Ampl Vernier set to CAL (max CCW) position. Load set to LOW'.
Measured with 24" RG-58 into 28pf/1meg scope.