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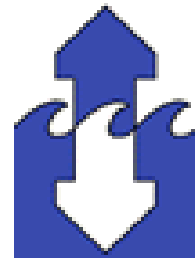
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INNOVATUM SMARTRAK DATA OUTPUT STRING

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1. DESCRIPTION OF STRING

Data is output asynchronously at the end of each computation cycle (0.1 to 0.5 sees) as an ASCII string of 80 characters(operator selected) terminated by <CR> and <LF>.

Default RS232 parameters are 9600 baud, 8 bits, 1 stop bit and no parity. No hardware or software handshaking is implemented. It is strongly recommended that every single output string is logged for subsequent post-processing.

Characters	Description
1 - 2	Space characters (20h)
3 - 4	Day of month (1 to 31)
5	Space character (20h)
6 - 8	Month of year (first 3 letters)
9	Space character (20h)
10 - 13	Year (all 4 digits)
14 - 15	Hour of day (24 hour clock)
16	: character (3Ah)
17 - 18	Minutes of hour (0 to 59)
19	: character (3Ah)
20 - 21	Seconds of minute (0 to 59)
22 - 24	Relative heading (+ or -) in degrees i.e. vehicle heading minus target heading

25	Mode	1 = passive 2 = active DC 3 = active AC
26	Solution	0 = no signal 1 = valid direction only 2 = valid horizontal displacement only 3 = valid horiz. & vert. displacements
27 - 30		Signal strength & polarity (logarithmic scale)
31 - 33		Video overlay (percentage of horiz. displacement) i.e. -99 to +99 equals full left to full right
34 - 35		Video overlay (percentage of maximum depth) i.e. 00 to 99 equals minimum to maximum
36	Source type	0 = single 1 = complex
37 - 41		Horizontal displacement of target in metres (from centre of array to centre of target where -ve = target to left and +ve = target to right)
42 - 45		Probable maximum error of horizontal displacement in metres
46 - 49		Vertical displacement of target in metres (from Innovatum reference to centre of target)
50 - 53		Probable maximum error of vertical displacement in metres
54 - 58		Vertical displacement from skids to top of target in metres (equals "depth of bury" ONLY if vehicle skids are level with seabed)
		OR
		Burial ("depth of bury") in metres (ONLY if altimeter option is both installed and enabled)
59 - 64		In <i>passive</i> mode - total normalised radial magnetization of target. In <i>active</i> mode - estimated magnitude of current flowing in target. (in active DC mode, +ve indicates current flowing in same direction as vehicle heading)
65 - 69		Altitude in metres referenced to vehicle skids
70 - 72		Pitch angle (+ or -) in degrees
73 - 75		Roll angle (+ or -) in degrees

76 - 78	Absolute heading in degrees (from system's own fluxgate compass or from an external gyrocompass if interfaced and enabled)
79 - 80	Time split in 0.01 seconds if enabled (to be added to time of day if required)
81	<CR> character (0Dh)
82	<LF> character (0Ah)

A typical 80 character data string would therefore be as follows:

"16 May 198915:33:27 2 13-4.4-6 250-0.150.051.980.05 1.01 -5146 0.31 1 -5 47 00"

Date	= 16 May 1989
Time	= 15:33:27
Relative heading	= +2 degrees
Mode	= 1 (passive)
Solution	= 3 (valid horizontal and vertical displacements)
Signal strength	= -4.4
Horizontal overlay	= -6
Vertical overlay	= 25
Source type	= 0 (single)
Horizontal displacement	= -0.15 metres
Horizontal error	= +/- 0.05 metres
Vertical displacement	= 1.98 metres
Vertical error	= +/- 0.05 metres
Skids to top	= +1.01 metres
Magnetization	= -5146
Altitude	= +0.31 metres
Pitch	= +1 degree
Roll	= -5 degrees
Absolute heading	= 47 degrees
Time split	= 0.00 seconds

2 PROCESSING OF SMARTRAK DATA

The Innovatum SMARTRAK data output string contains a large number of parameters in order to allow maximum flexibility in an external data processing system. This in turn means that some quality control checks must be incorporated into the external system before any individual parameter can be used for further processing with other parameters.

The most common requirement is to use the vertical displacement from the bottom of the appropriate sensors to the centre of the target. When combined with fixed offsets, data from altimeters or profilers and pitch/roll sensors, this parameter can be used to calculate "depth of burial" along the length of the target.

The best quality vertical data is always obtained when the sensor array is centred

over the target and perpendicular to it - any significant horizontal or relative heading offsets will decrease the accuracy of the calculated displacement. This means that a typical quality control procedure on any given Ultra-system data output string might consist of the following checks:

SOLUTION = 3
VERTICAL ERROR < 0.15
-1.00 < HORIZONTAL < +1.00
-20 < RELATIVE HEADING < +20
SIGNAL RANGE >3

Only if all the tests are passed should the VERTICAL value be used to derive "depth of burial" using fixed vertical offsets and/or pitch, roll and altitude data. Similar quality control checks may also be required on data from the latter three sensors to ensure that the calculation of depth of burial is not compromised by poor quality or invalid components.

If any given string should fail any of these tests, the associated VERTICAL value should not be used to derive any other measurement. It is important that the value of any such measurement, whether displayed, printed or logged, should indicate in some way that the data from that particular string was invalid and not just remain at the previous valid value or be defaulted to zero.

For the majority of applications, it is recommended that any data logging format should include the following parameters as an absolute minimum:

- SOLUTION	- ALTITUDE
- VERTICAL	- PITCH
- VERTICAL ERROR	- ROLL
- HORIZONTAL	- SIGNAL RANGE
- RELATIVE HEADING	

This would allow complete post processing of vertical data at any future date. It may also be useful to record additional parameters from the Innovatum data string (such as SKIDS TO TOP (or BURIAL), MAGNETIZATION (or CURRENT), HORIZONTAL ERROR, SIGNAL STRENGTH, HEADING, SOURCE, MODE etc.) if the logging system has sufficient capacity but these are not normally regarded as essential.

The SMARTRAK interfaced altimeter is a "single beam echo-sounder", and as such should not be used to derive "True depth of burial". Depth of burial should be derived from the VERTICAL measurement, and referenced to a "Mean Seabed Level" which is normally obtained via scanning profilers. A single point echo sounder could be looking into a hole, or at a berm or boulder.

The error figures attached to the horizontal and vertical measurements may be used to "smooth" the data. The error is a statistical figure, where the real result may be assumed to be within the upper and lower limits for 60% of all data points. There is no "weighting" for any point within the error band.