DEVIL XBT

Probe Correction

TURO TECHNOLOGY PTY LTD

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Revision History

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Date	Revision	Description
21 Feb 2012	3	Corrected fall rate coefficient for FastDeep.
24 June 2007	2	
03 Oct 2006	1	Original document

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1 Issue

The correct probe type has to be selected to ensure the temperature and depth are correctly calculated. But there is nothing to prevent an incorrect probe type being selected.

So a problem arises when the probe type entered in the Devil software is not the same as the probe that was dropped, eg a Deep Blue probe was launched, but a Fast Deep was set up in the Devil software configuration. This may result in incorrect temperature being recorded. The error will be small (generally less than 0.05°C) and will vary from one Devil box to another. The drop rate depends on the probe type, so the depth values might also be incorrect.

2 Post Processing Correction

Each time a probe is dropped a Scale and Offset is calculated and is stored in the .nc file. A recent file with Scale and Offset for the correct probe is needed.

Steps:

1. The resistance values in the .nc file are "calibrated" values. These "calibrated" values were calculated using the Scale and Offset supplied in the .nc file and applied to "raw" values. Use the Scale and Offset to back-calculate the "raw" resistance values.
2. Use correct Scale and Offset values from a recent file (where the correct probe value for the required probe type was used) to calculate the correct "calibrated" resistance values.
3. Apply the standard function to convert new correct "calibrated" resistances to new temperatures.
4. Depth values are recalculated using the drop equation for the correct probe and assuming the sample rate is exactly 10 Hz.
5. Place the new correct temperatures in both temperature fields in the .nc file. The procTemperature is the working copy with spikes removed, bad data set equal to NaN etc. Place the correct depths in the .nc file.

3 Example

A Fast Deep probe was selected in the Devil Configuration, but a Deep Blue probe was launched.

Step 1

Back-calculate to determine the uncalibrated raw resistance values:

```
fd      = "fast deep" probe type
db      = "deep blue" probe type
raw     = "uncalibrated resistance" (is independent of probe
        type)

r(fd)   = resistance reported when set for fast deep
```

```
r(db)    = resistance reported when set for deep blue
scale(fd) and offset(fd)
         = scale and offset reported when set for fast deep
scale(db) and offset(db)
         = scale and offset reported when set for deep blue
```

use:

```
r(fd)    = raw*scale(fd) + offset(fd)
```

to back-calculate `raw`:

```
raw      = (r(fd) - offset(fd))/scale(fd)
```

Step 2

Use the historic Scale and Offset from a previous drop that was done correctly to calculate the correct resistance for the correct probe type deep blue:

```
r(db)    = raw*scale(db) + offset(db)
```

Step 3

Apply the standard resistance (data) to temperature (temp) equation:

```
double   temp;
double   Coef1 = 0.12901230E-2,
         Coef2 = 0.23322529E-3,
         Coef3 = 0.45791293E-6,
         Coef4 = 0.71625593E-7;

temp     = (1/(Coef1 + Coef2*log(data) + Coef3*log(data)*log(data)
         + Coef4*log(data)*log(data)*log(data))) - 273.15;
```

Step 4

The depth equation is:

$$depth = b*T - a*T^2;$$

Where `depth` is in metres, `a` and `b` are the drop equation coefficients for the probe type and `T` is in seconds (first sample is at 0.0sec, second sample is at 0.1sec, etc).

Coefficients:

Probe	**a**	**b**
T-4	0.00225	6.691
T-5	0.00182	6.828
T-6	0.00225	6.691
T-7	0.00225	6.691
Deep Blue	0.00225	6.691
Fast Deep	0.00182	6.346
T-10	0.00216	6.301
T-11	0.0002557	1.7779

Step 5

Enter the new values to the .nc file.