BroadWeigh™

LOG100 Demonstration

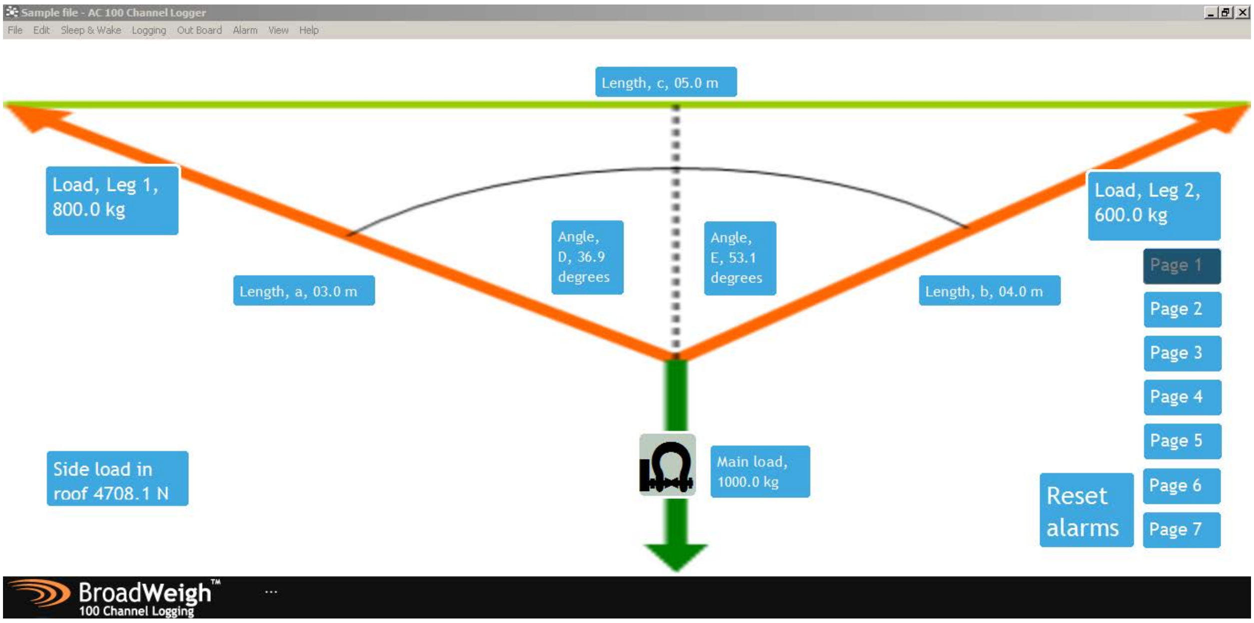
For the launch of BroadWeigh's latest hardware and software upgrade in October 2015 at PLASA, London, UK, we developed a two-leg bridle set-up on the exhibition stand of our UK distributor, AC Entertainment.

The aim was to show some of the more complex uses of LOG100 with the mathematical functions. What it actually achieved was that we discovered some of the limitations of the calculation method. Very small changes of length or even twist in the bridles shifted the load enough to make a measurable difference. This really demonstrated that when you really need to know a load, the only way is to measure it.

This walkthrough project is designed to show some possibly slightly less than obvious uses for LOG100. We hope that you see something useful for your applications and would be interested in seeing anything that gets used no matter how complex or simple.

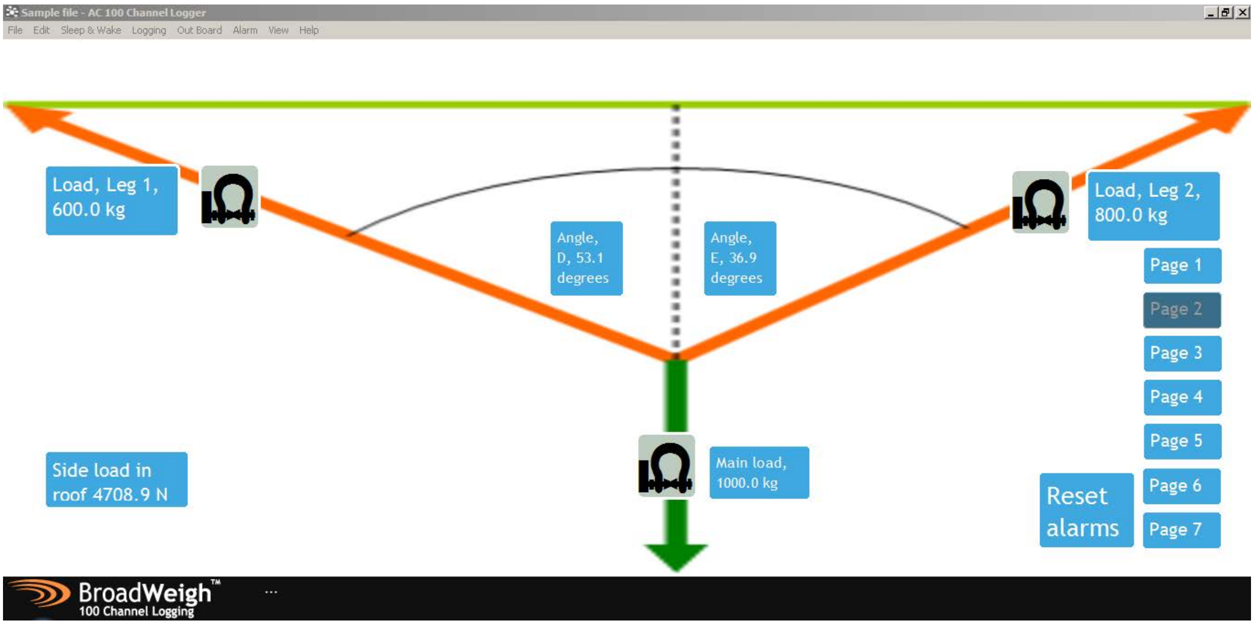
To open the file, simply double click on the *'BroadWeighDemonstration.lpj'* file on any computer that has an up to date version of LOG100 installed. You will then see the normal 'all channels' page. If you then click on 'view > visualisation' (or mapping) you will be able to start navigating the pages below. If you would like to see how the channels have been set up then you can have a look at 'edit > configure project'.

Page 1, Bridle Calculation



This page shows the load in the legs of a two-leg bridle. It is based on the load cell on channel 1 and the lengths a, b and c which are entered into LOG 100 channels 4, 5 and 6.
Essentially, it's some trigonometry based on the cosine rule and then resolving forces. (The calculations are available at the end of this document). You can enter different lengths into channels 4, 5 and 6 to see how the loads in the legs would change.

Page 2, Bridle Measurement

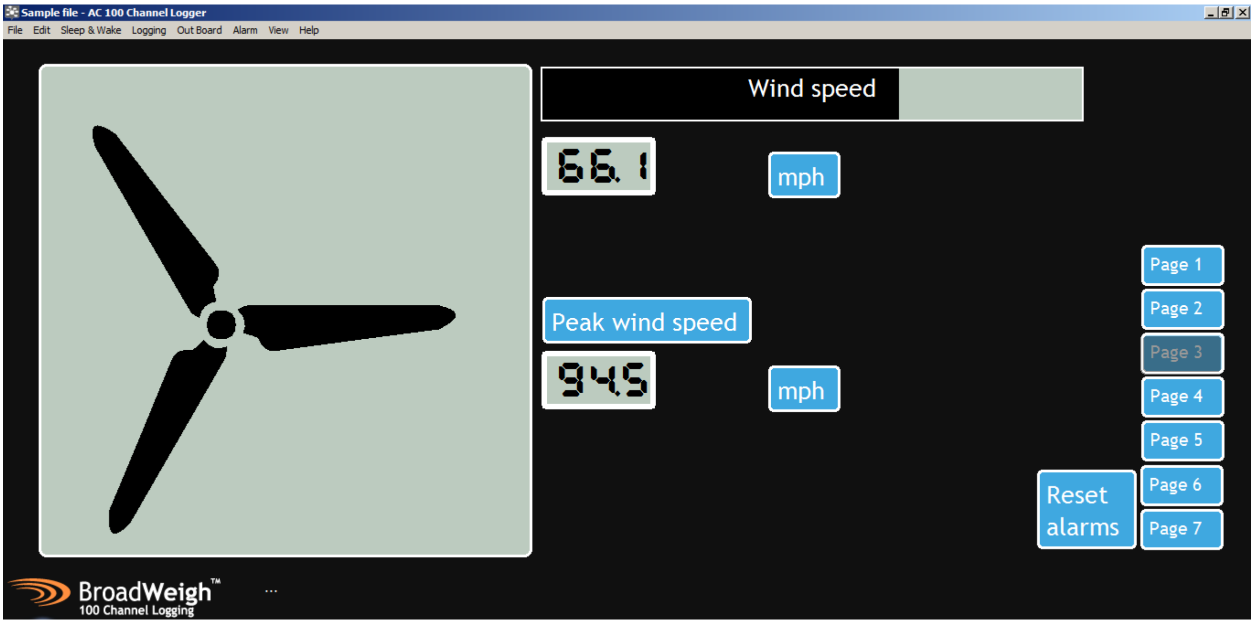


As a check for the previous page we made this page with the load cells in the legs as well. Interestingly, we found at PLASA that it didn't quite add up. Using relatively low loads the amount of twist in the bridle leg and manufacturing tolerances meant that even with an apparently even load (2m per leg) the load was not evenly distributed.

One of the things this showed at PLASA was the limitations of the calculation method. You are always going to have to make certain assumptions and guesses which will limit the accuracy of the calculation. When you really need to know the load, the only thing to do is measure it!

The data for these legs can be entered in channels 1, 22 and 23.

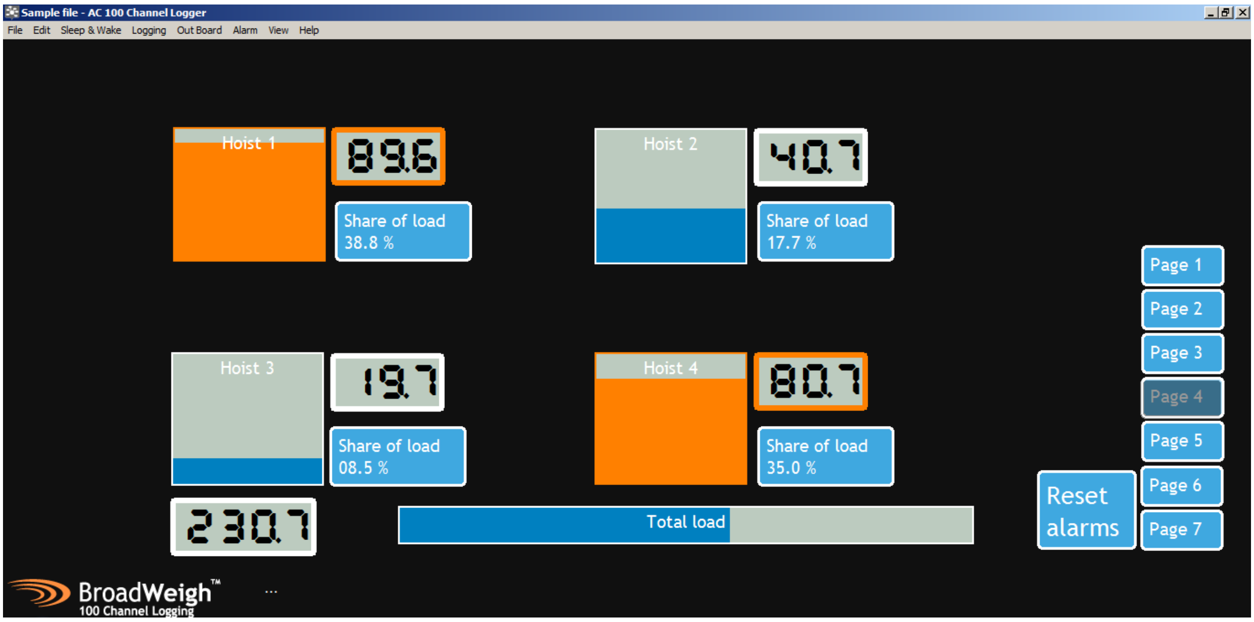
Page 3, Wind Speed Sensor



This page shows a method of displaying data from a WSS Wind Speed Sensor. The source for this is a SIM channel with heavy filtration to make it look a little more like real data. Alarms are set at 70 (warning) and 90 (overload).

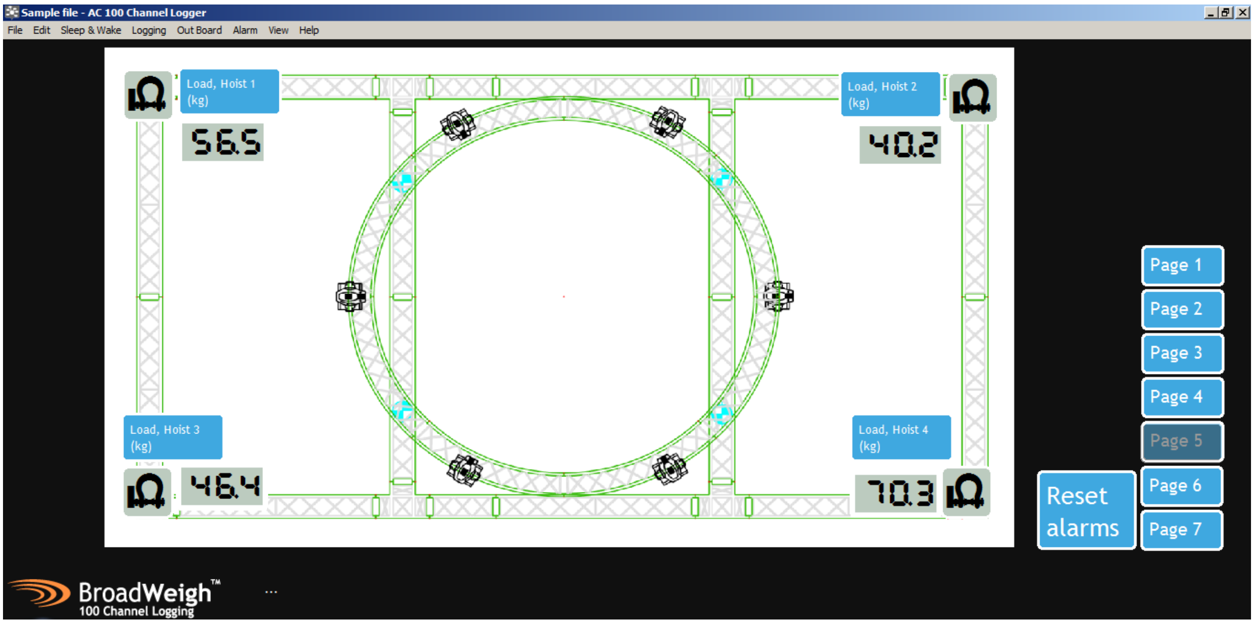
There is also a peak hold. Alarms are set at 75 (warning) and 95 (overload).

Page 4, 4 Hoist Simple Display



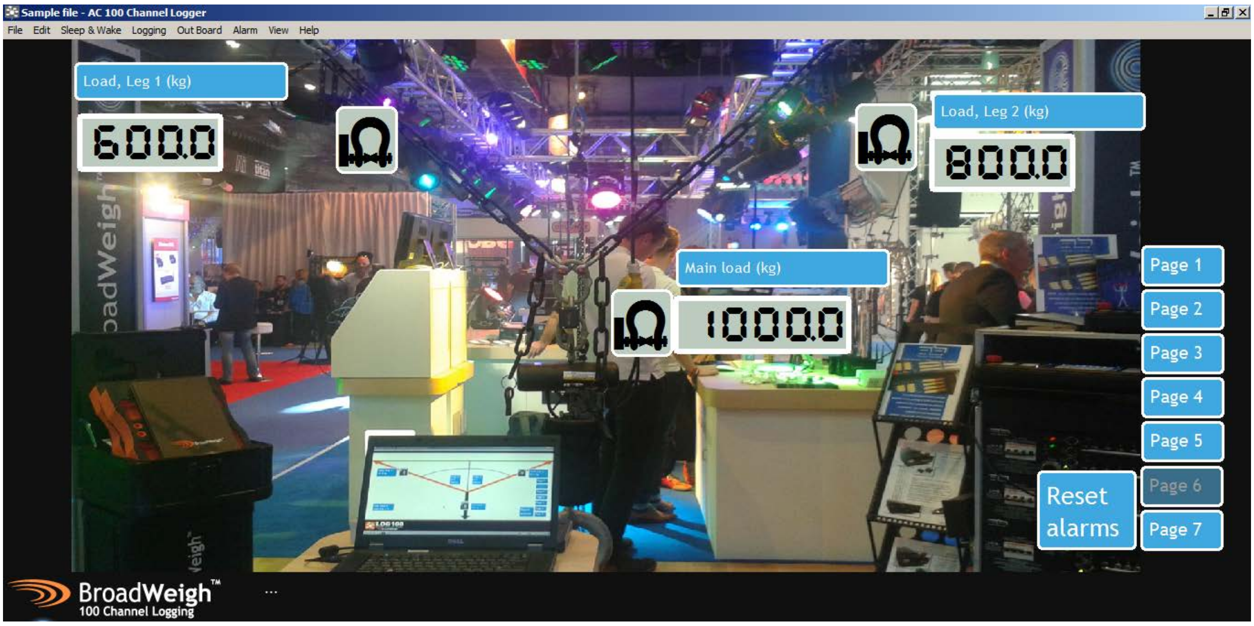
This shows a graphical and numeric representation of the loads on four theoretical hoists.
We are also displaying the percent share of the total load on each hoist. There is also a bar and display for the total load. Alarms set at 80 (warning) and 99 (overload).

Page 5, 4 Hoist Displayed on Plan



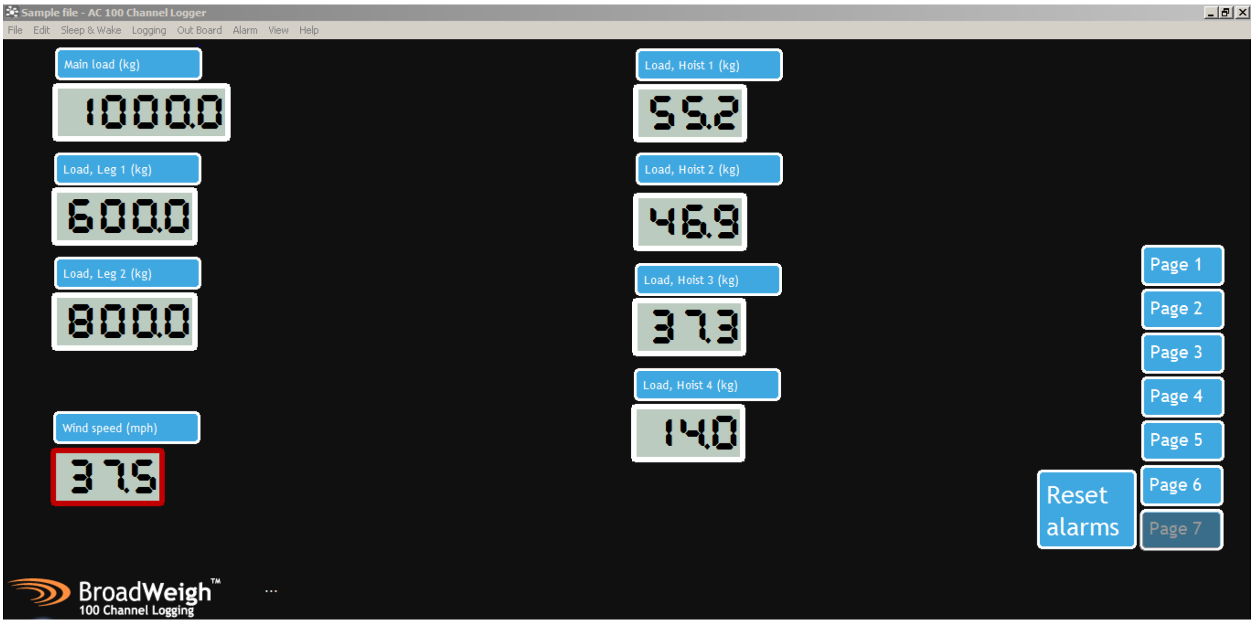
Similar to page 4 but just displayed on a plan with no bar graphs.
Also note that the shackle icons are linked to the relevant channel's data and therefore warnings and alarms.

Page 6, Bridle Measurement shown on photo



Essentially the same as page two but put on the photo taken at PLASA this year.

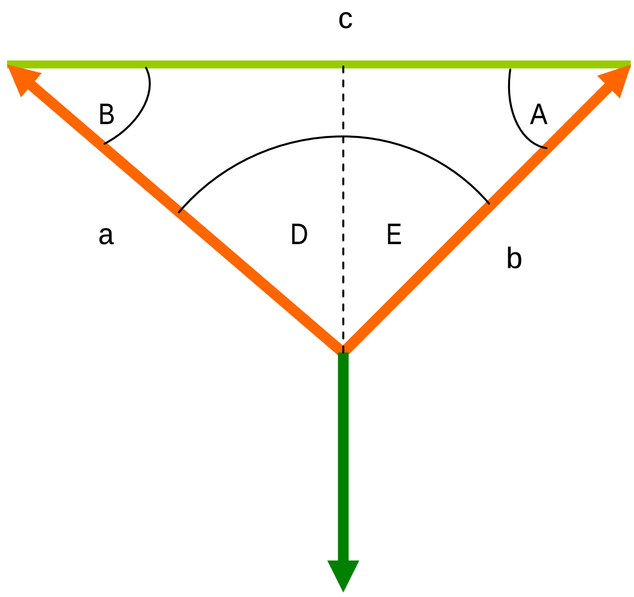
Page 7, Main Data Channels



There are a lot of data channels on the main page making it difficult to see exactly what you want to. Here we have just put the main 8 data channels in an easy to read display.
In this format we can put the channels in any order, anywhere on the page giving real flexibility.

PLASA Show, October 2015

Bridle Calculation



Where;
a, b, c are lengths/distances in metres
A, B, D and E are angles in radians
(C=D+E)

$$D = \frac{\pi}{2} - B$$

$$E = \frac{\pi}{2} - A$$

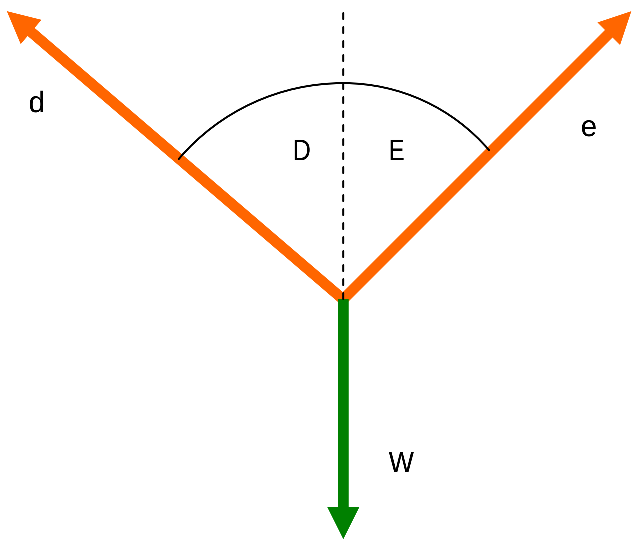
From the cosine rule:

$$A = \cos^{-1}\left(\frac{b^2 + c^2 - a^2}{2bc}\right)$$

$$E = \frac{\pi}{2} - \cos^{-1}\left(\frac{b^2+c^2-a^2}{2bc}\right) \qquad \text{(i)}$$

$$B = \cos^{-1}\left(\frac{a^2 + c^2 - b^2}{2ac}\right)$$

$$D = \frac{\pi}{2} - \cos^{-1}\left(\frac{a^2+c^2-b^2}{2ac}\right) \qquad \text{(ii)}$$



Where;
W is load read from BW shackle (known load)
d and e are loads in bridles (the unknowns)
D and E are angles which are derived above
For equilibrium, the sum of all forces in any direction must be zero, therefore vertically:

$$W = d\cos D + e\cos E \qquad \text{(iii)}$$

And horizontally

$$d\sin D = e\sin E \qquad \text{(iv)}$$

$$d = \frac{e\sin E}{\sin D}$$

Put that into (iii)

$$W = \frac{e\sin E\cos D}{\sin D} + e\cos E$$

$$W = e\left(\frac{\sin E}{\tan D} + \cos E\right)$$

$$e = \frac{W}{\left(\frac{\sin E}{\tan D} + \cos E\right)} \qquad \text{(v)}$$

From (iv) we have:

$$d = \frac{\sin E}{\sin D}\left(\frac{W}{\left(\frac{\sin E}{\tan D} + \cos E\right)}\right) \qquad \text{(vi)}$$