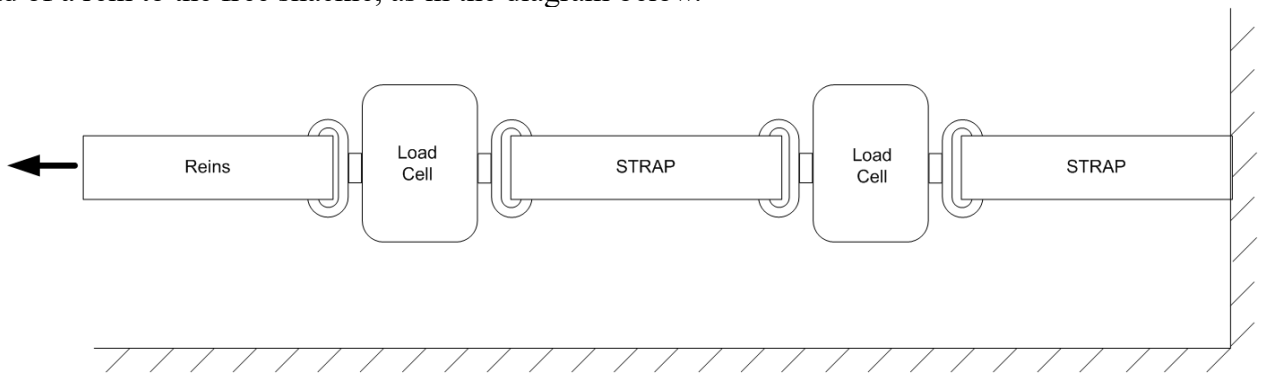
Testing Telerein.

We have received requests from time to time enquiring about technical aspects of Telerein. Two in particular come to mind, how to check if it is working properly, the other about the colours presented to the rider by the Light Emitting Diodes (LEDs)
This first section of this note provides sufficient information to allow an owner to verify that the device is working to specifications. If any of the tests described fail, then it is likely that the unit will need to be sent back for repair.
The failure rates for Telerein have been very low, the few that have occurred have been due to cable failures, in one of those instances it was due to riderless horse.
All of the tests following assume that Telerein is fully charged, and that it has been in a stable temperature environment for half an hour.
The second section provides a brief explanation about the LEDs and the colour spectrum.

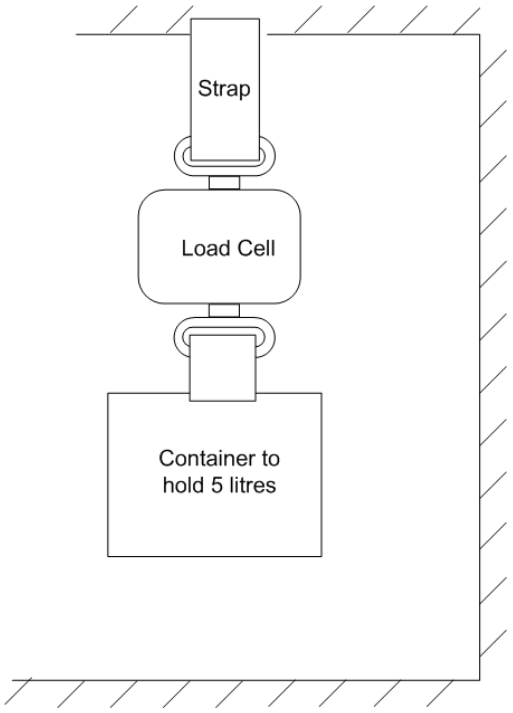
TEST ONE.
Put the unit on a flat surface, placing the load cells some distance from the poll unit. Turn the unit on, making sure that the load cells are not disturbed while the LEDs cycle through the start up sequence (blinking red, followed by the sequence of colours presented to the rider).
Both LEDs should settle on violet.

TEST TWO.
Link the load cells together, using the fixed strap on one load cell to link it to the other. Connect one end of a rein to the free shackle, as in the diagram below.



Attach either the free strap or the end of the rein to a fixed object.
Leaving the whole system slack (lie it on a flat surface), turn on Telerein and wait until the start up sequence is complete.
Take the free end of the setup and gently pull on it. During this process the load cells should be fully suspended. This places both load cells under the same tension, as you increase the tension, the left and right LEDs should slowly work there way up the colour scale, changing colour at around about the same time.

TEST THREE.
Taking each load cell in turn, attach the strap to a horizontal support, leaving the load cell hanging freely. On the bottom shackle attach an empty container that will hold about 5 litres of water when full. See the diagram below.

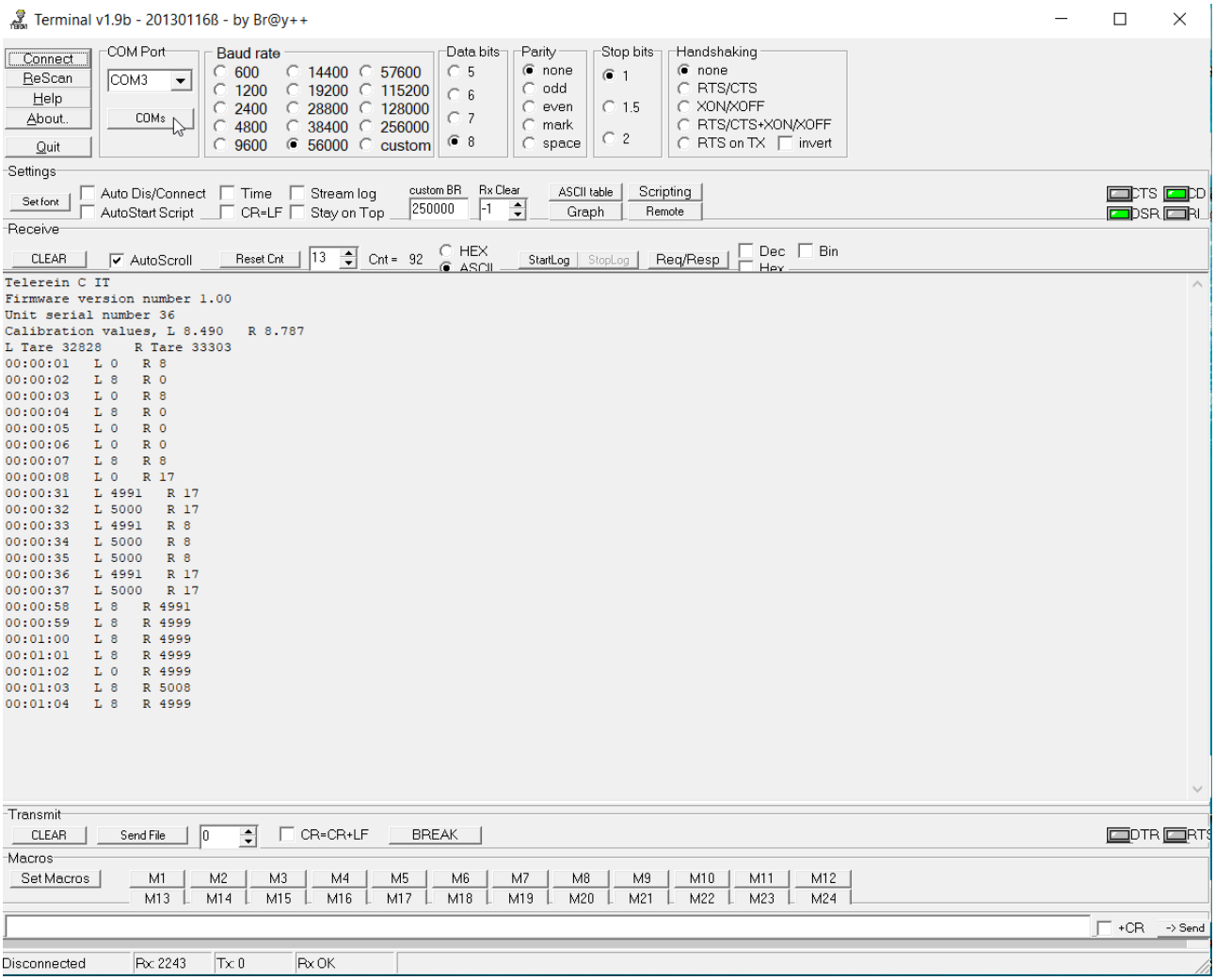


Turn on Telerein and wait for it to complete its start up sequence. The additional weight of the container is “zeroed out” (commonly known as tared), the load cells thus effectively see zero grams force. You may now slowly pour water into the container (weigh it using digital kitchen scales) You should observe the LED colours change at the specified gram force. Put in sufficient water at each step to take you through each of the colour transitions.

Violet	0-199gm
Blue	200-499gm
Green	500-999gm
Yellow	1Kgm-1.499Kgm
Orange	1.5Kgm-2.99Kgm
Red	>3Kgm

TEST FOUR
This is a more complex test if the user is not familiar with using a computer, but it is objective, and provides information that is not available in the previous tests. For that reason, if a unit does not appear to be functioning as it should, this test is perhaps the most useful to the person that will eventually be investigating the fault, since the file saved at the end of the process may be forwarded to them for analysis.
It is an extension of TEST THREE, the difference being that the poll unit is connected to a PC.
It relies on the data logging ability of the unit when connected via USB to a computer. This example assumes a Windows based PC and a program called Terminal V1.9b. If using iOS or Linux operating systems, any good terminal program will do the same job. The only requirement is that the program is able to save a file of the received data.

Download and install Bray terminal from https://sites.google.com/site/terminalbpp/
Start the software, and set up the parameters Baud rate, Data bits, Parity, Stop bits, Handshaking, and ASCII set as shown in the image below.
Suspend the two load cells, hanging them by their straps (see TEST THREE) The calibration mass must apply an even load to the freely hanging load cell arm, if necessary make up a hook that occupies the internal width of the arm, and hang the empty container from a central point some distance below the hook.
Connect a PC to the poll unit using a micro USB connector. Power up the poll unit by holding the white push button in for 12 seconds and wait until the two large LEDs stop blinking before commencing.
Go to the PC and in the terminal program click on 'ReScan' to determine which com port is in use, click on the port being used in the "COM port" box, and click on 'Connect'.
You should observe a data stream, updating once a second. You wont see the startup text shown below.
Both left and right data streams should be close to zero, they will drift with time. The Analogue to Digital converter in the poll unit has a sensitivity of around 8-10gms/bit, so expect to see that value, or multiples of it, in the data stream.
Click on "StartLog" in the receive panel, opening a window where you can name a file and location in which to save it.
Pour the 5 litres of water into the suspended container after half a minute, and the corresponding channel should jump up to around 5000, leave for half a minute.
Do the other load cell in a similar fashion, starting with an empty container..
When complete, click on "StopLog" , saving the file.



LED COLOURS.

The LEDs mix three colours, Red, Blue, and Green, in an additive process, to provide the spectrum of colours.

They have three separate R G B dies on a base, over which a diffuse plastic dome is placed.

In order to generate a spectrum of colours, R, G and B are mixed together in different proportions.

The colour appearance depends on having the right wavelengths, the correct relative intensity, and good blending.

None of these may be obtained precisely. The colours are dependant on the physics of LEDs, and are difficult to obtain precisely. Green is particularly bad, it often has a broad spectrum, and the human eye is most sensitive to green.

Each colour is generated on a separate die, which are relatively large, and spaced a little way apart.

If looking on axis at the diffuse dome, the colour blending is not too bad, but the further off axis you are, the more apparent the physical spacing of the three RGB dies is.

The most difficult colours to distinguish is yellow, largely due to the poorly performing green LED.

In practice, Pulse Width Modulation is used to control the relative intensity of each colour, and it is possible using this method to get reasonable results, but that cannot compensate for the factors discussed above.