Five Pager – Quick Field-Check on Strong Motion Sensors

Here we will describe how to check your strong motion sensor in the field.

For this paper we used a Q330 with 24-bit and a 2g Episensor, but it should also possible for all other kind of digitizer and strong motion sensors.

When you order an strong motion sensor you can specify the range of the sensor, our sensor here is an strong motion sensor up to ±2g. Which only mean that the output is at a maximum for the acceleration of ±2g. Or in our case at a positive acceleration of +2g we have an output voltage of 20V and at an negative acceleration of -2g we have an output of -20V.

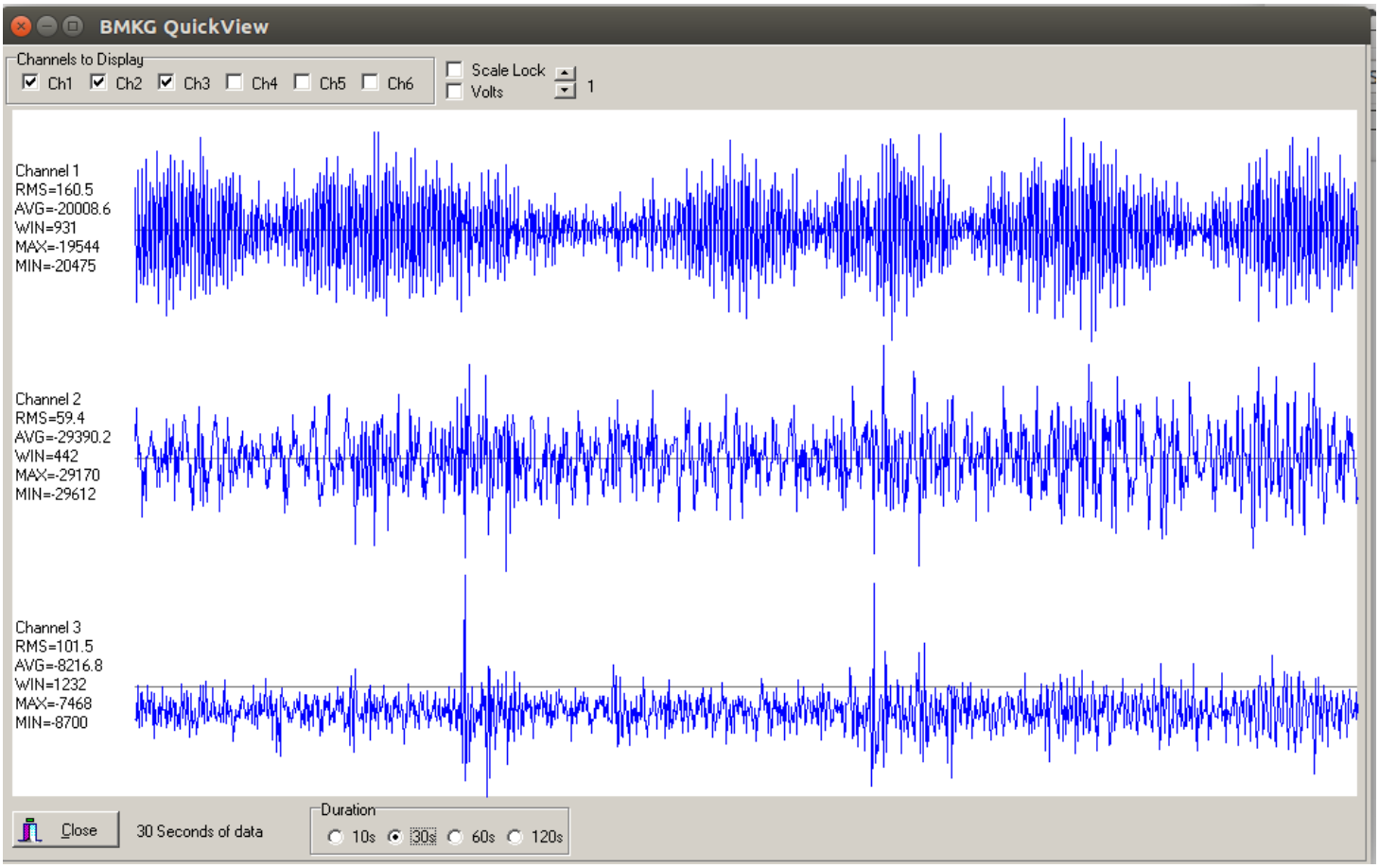
For our digitizer with 24bit we have 16777216 digits → 8.388.607 digits for positive signal and -8.388.608 digits for negative signals.

For this simple test we only need to rotate the sensor around his axises and check on our software the value for the input at the digitizer.

We are using *Quickview* from the Willard Software delivered with the Q330 digitizer.

Just run Willard, open in *Status* the *Quickview* Software.

Choose the correct channels for the strong motion sensor show in *Quickview*.



Next step is to rotate your sensor.

First do it with the z-axis, put the sensor upside down. The felt gravitation on the z-axis will be -2g, which means that you will measure around - 8.388.608 digits, which means full range for the negative value.

Illustration 2: Normal Setup

Illustration 1: Head-down

In the picture above we see the sensor in an normal setup position and after rotate the sensor 180 degree. In the screen-shot below we see the Channel 1, which is our z-axis has an MIN of -8.834.009 digits. Which is near the expected number of 8.388.608.

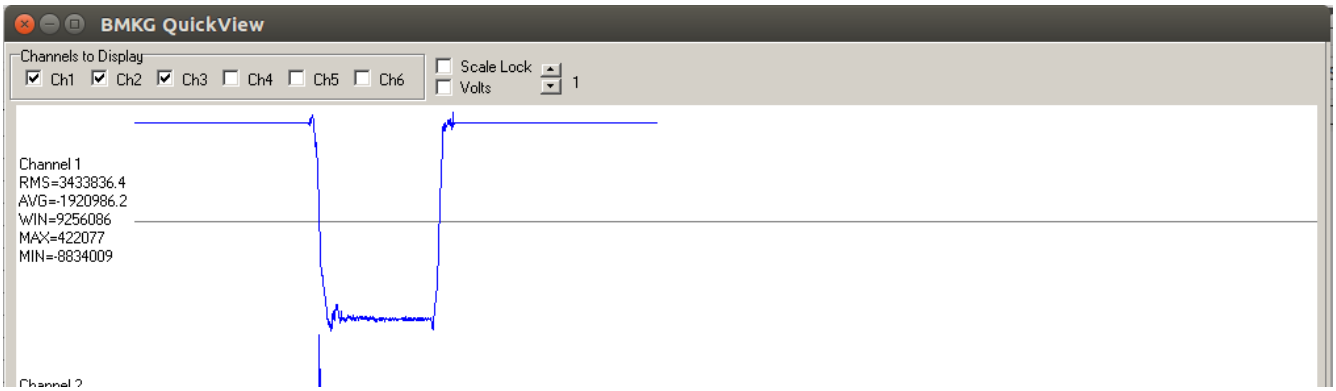


Illustration 3: z-axis

Second do it with the y-axis, hold the sensor first for some second with the y-axis up, see the arrow on the sensor, then hold the sensor with the y-axis down. We should see an value from 4.194.304 to -4.194.304.

Illustration 5: y-axis up

Illustration 4: y-axis down

In the picture above we see the sensor with the y-axis up and then rotated with the y-axis down. Which means the we rotated the sensor in 180 degree. In the screen-shot below we see the Channel 2, which is our y-axis has an MAX value of 4.404.560 digits and an MIN of -4.363220 digits. Which is near the expected number of -4.194.303 digits to 4.194.303 digits.

Illustration 6: y-axis

Third do it with the x-axis, hold the sensor first for some second with the x-axis up, see the arrow on the sensor, then hold the sensor with the x-axis down. We should see an value from 4.194.304 to – 4.194.304.

Illustration 7: x-axis up

Illustration 8: x-axis down

In the picture above we see the sensor with the x-axis up and then rotated with the x-axis down. Which means the we rotated the sensor in 180 degree. In the screen-shot below we see the Channel 3, which is our x-axis has an MAX value of 4.271.772 digits and an MIN of -4.258.594 digits. Which is near the expected number of -4.194.303 digits to 4.194.303 digits.

Illustration 9: x-axis

In case you use an different kind of setting for the strong motion sensor, you can find some expected results in the table below. Still calculated with an 24bit digitizer. If you use an digitizer with more or less bit, you need to recalculate your expected results.

When you rotate the sensor you need to do it slowly to avoid an overshoot of the value. As an rule of thumb we assume the sensor is still working properly if the value are in an 10% tolerance to the expected value. If we have an much bigger difference you should contact the next service center.

1g Setting		
	Normal setup.	Head – down(felt -2g on axis)
Z-axis	0 digits	-8.388.608 digits
	Y – axis up (felt 1g on axis)	Y – axis down (felt -1g on axis)
Y-axis	8.388.608 digits	-8.388.608 digits
	X – axis up (felt 1g on axis)	X – axis down (felt -1g on axis)
X -axis	8.388.608 digits	-8.388.608 digits

2g Setting		
	Normal setup.	Head – down(felt 2g on sensor)
Z-axis	0 digits	-8.388.608 digits
	Y – axis up (felt 1g on axis)	Y – axis down (felt -1g on axis)
Y-axis	4.194.304 digits	-4.194.304 digits
	X – axis up (felt 1g on axis)	X – axis down (felt -1g on axis)
X -axis	4.194.304 digits	-4.194.304 digits

4g Setting		
	Normal setup.	Head-down(felt 2g on sensor)
Z-axis	0 digits	-4.194.304 digits
	Y – axis up (felt 1g on axis)	Y – axis down (felt -1g on axis)
Y-axis	2.097.152 digits	-2.097.152 digits
	X – axis up (felt 1g on axis)	X – axis down (felt -1g on axis)
X – axis up	2.097.152 digits	-2.097.152 digits

Illustration 10: Expected values for 1g, 2g and 4g sensors

Unfortunately there is an disadvantage of this test, because you need to open the screw that fix your sensor to the pier, and after this test the sensor need to be fixed again. But in case you are not sure about the proper function of the sensor this is an good first check directly at the station.