

## Application Note 275: Dynamometers for Low Hand Grip Strength Measurements

This application note reports the performance of BIOPAC hand dynamometers SS25LA and TSD121C at grip forces below 1 kg. These devices are specified to register grip forces within the isometric range of 0 kg – 90 kg and 0 kg – 100 kg, respectively. Performance was measured using MP150, MP36/MP36R and MP45 data acquisition units.

### Device Parameters

Table 1 compares the parameters of two hand dynamometer transducer devices.

Parameter	SS25LA	TSD121C
MP unit	36/45	150
Housing	Plastic	Metal/Plastic
Sensing element	Carbon resistance	Precision Wheatstone Bridge
Hysteresis	5 - 10 gr or more	~ < 1 gr or better
Noise (stddev)—unfiltered	~ 3 g	~ 3 g
Measured Signal dynamic range (Figures 1 – 3)	0.02 – 0.7 kg	0.02 – 0.7 kg

Table 1 Dynamometer performance

### Measured Signal Dynamic Range

The noise of the hand dynamometers is usually well within the customer's standard deviation needs. The hysteresis may be an issue. Hysteresis measures how well the device recovers after any gripping; and is manifested by an offset in output level after release.

The desired dynamic range appears to be satisfied with either transducer; however, note that as signals approach the lower end of the dynamic range, the more that they will be affected by noise and, in the case of the SS25LA, hysteresis. Hysteresis can be an issue at grip force levels over 1 kg.

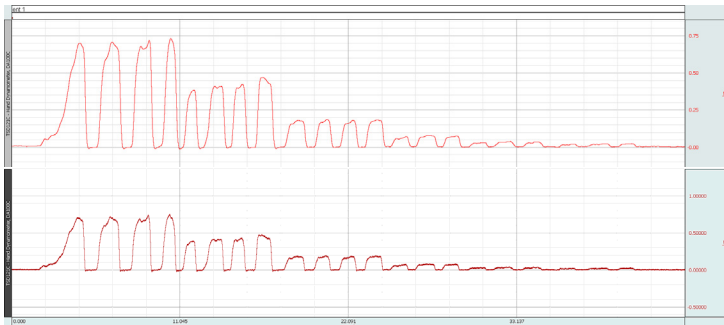


Figure 1a TSD121C with MP150

Series of clenches using the TSD121C with the MP150/DA100C. Top graph filtered using LPF: 3 Hz, 0.6 Q

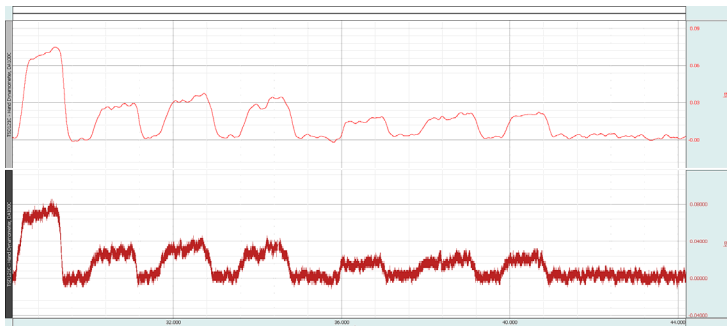


Figure 1b Expanded View

Expanded view of weaker clench forces shown in Fig. 1a.

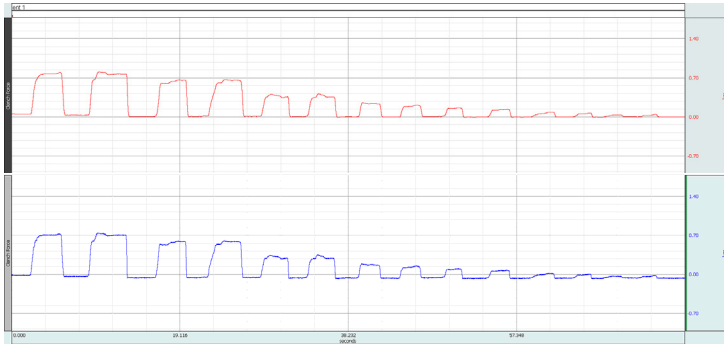


Figure 2a SS25LA with MP36

Series of clenches using the SS25LA with MP36/MP36R. Top graph filtered using LPF: 3 Hz, 0.6 Q and baseline adjusted.

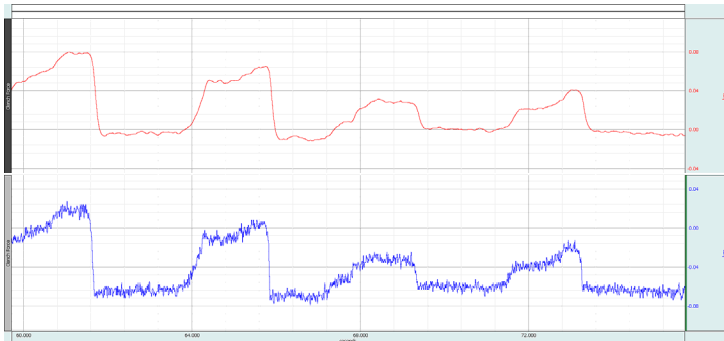


Figure 2b Expanded View

Expanded view of weaker clench forces shown in Fig. 2a.

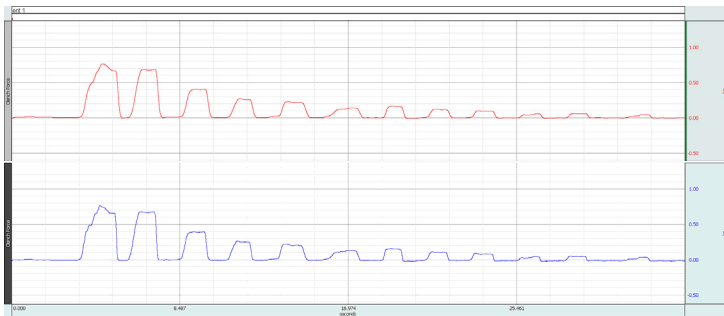


Figure 3a SS25LA with MP45

Series of clenches using the SS25LA with MP45. Top graph filtered using LPF: 3 Hz, 0.6 Q and baseline adjusted

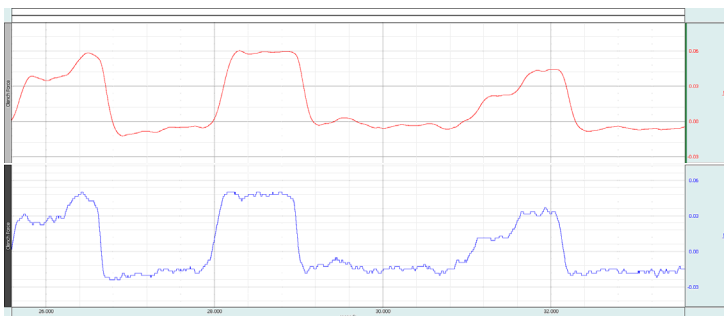


Figure 3b Expanded View

Expanded view of weaker clench forces shown in Fig. 3a.

Note the plot granularity at the bit level.