Technical Note

Ballistic Measurement System – Parameter Calculations

The measurement parameters calculated by the BMS software apply to the currently selected section of data or the entire dataset if no subset has been selected.

Peak Force - highest single force sample within the whole data set or selected subset.

Peak Force/mass - Peak force divided by measured mass. Note measured mass is the actual mass on the forceplate during the test including any additional load such as the barbell. It is not the body mass of the athlete recorded in the squad file.

Mean Force - average of all of the force samples of the whole data set or selected window.

Mean Force/mass - Mean force divided by measured mass. Note measured mass is the actual mass on the forceplate during the test including any additional load such as the barbell. It is not the body mass of the athlete recorded in the squad file.

Peak Power - highest power calculated as a single sample of the force data that is largest.

Peak Power/mass - Peak power divided by measured mass. Note measured mass is the actual mass on the forceplate during the test including any additional load such as the barbell. It is not the body mass of the athlete recorded in the squad file.

Mean Power - average of all of the power samples of the whole data set or selected window.

Mean Power/mass – Mean power divided by measured mass. Note measured mass is the actual mass on the forceplate during the test including any additional load such as the barbell. It is not the body mass of the athlete recorded in the squad file.

Peak Velocity - highest velocity calculated as a single sample of the velocity data that is largest.

Minimum Velocity - lowest velocity calculated as the single sample of the velocity data that is smallest. Note – when CMJ, COJ or DJ template is selected minimum velocity is calculated as lowest velocity prior to takeoff.

Peak Displacement - highest displacement calculated as the single sample of the displacement data that is largest.

Minimum Displacement - lowest displacement calculated as the single sample of the displacement data that is smallest.

Unloading Force - minimum force recorded during the eccentric phase.

Force@Ecc2Con - force at the transition from eccentric to concentric which is the zero crossing of the velocity data.

Force@Peak Power - force corresponding to the same sample number (time) of the peak power.

Velocity@Peak Power - velocity corresponding to the same sample number (time) of the peak power.

Power@Peak Force – power corresponding to the same sample number (time) of the peak force.

Velocity@Peak Force - velocity corresponding to the same sample number (time) of the peak force.

Jump Height Derived From Flight Time - jump height calculated from the flight time using the equation: $d = gt^2 / 8$

Where: d = jump height

g = 9.81 m/s/s

t = flight time

Jump Height Derived From Peak Velocity - jump height calculated from the peak velocity using the equation: $d = v^2 / 2g$

Where: d = jump height

v = peak velocity

g = 9.81 m/s/s

Max RFD – Rate of Force Development (RFD) as the largest positive change in force over any 30 ms Epoch.

RFD 30ms – RFD over the initial 30 ms from the start of the concentric phase.

RFD 90ms - RFD over the initial 90 ms from the start of the concentric phase.

RFD 150ms - RFD over the initial 150 ms from the start of the concentric phase.

RFD 200ms - RFD over the initial 200 ms from the start of the concentric phase.

RFD 250ms - RFD over the initial 250 ms from the start of the concentric phase.

Avg Ecc RFD - change in force from the minimum (unloading force) to the force at the end of the eccentric phase divided by the time between these two points.

Avg Conc RFD – difference between force at the start of the concentric phase and peak force during the concentric phase divided by the time between the two points.

Total Impulse - area under the force time curve calculated as the sum of each force sample multiplied by the period between samples which is the inverse of the sample frequency.

Impulse 0-100 ms - total impulse for the first 100 ms from the start of the selected dataset. Note: for CMJ, COJ, DJ and Isometric templates impulse is calculated from start of the concentric phase.

Impulse 0-200 ms - total impulse for the first 200 ms from the start of the selected dataset. Note: for CMJ, COJ, DJ and Isometric templates impulse is calculated from start of the concentric phase.

Impulse 0-250 ms - total impulse for the first 250 ms from the start of the selected dataset. Note: for CMJ, COJ, DJ and Isometric templates impulse is calculated from start of the concentric phase.

Impulse 0-300 ms - total impulse for the first 300 ms from the start of the selected dataset. Note: for CMJ, COJ, DJ and Isometric templates impulse is calculated from start of the concentric phase.

Total Eccentric Impulse - total impulse (summed force x time) over the eccentric phase. That is from the start of the eccentric to the zero crossing of velocity from negative to positive.

Total Concentric Impulse - total impulse (summed force x time) over the concentric phase. That is from the start of the concentric phase to the point of takeoff.

Tm to Pk Fc - Time to peak force measured as the period between the start of the selected dataset and the time at which peak force occurs. Note: for CMJ, COJ, DJ and Isometric templates time is calculated from start of the concentric phase.

RPD - rate of power development calculated as the peak power divided by the time to peak power.

Tm to Pk Pw - Time to peak power measured as the period between the start of the selected dataset and the time at which peak power occurs. Note: for CMJ, COJ, DJ and Isometric templates time is calculated from start of the concentric phase.

Start of Eccentric – if force is recorded start of the eccentric phase for CMJ and DJ is defined as the sample or time point at which the force drops below the measured body weight.

Start of Concentric - start of the concentric phase is defined for CMJ and DJ as the sample or time point of the transition from eccentric to concentric which is the zero crossing of the velocity data.

Takeoff - sample or time point at which the force drops below the force threshold set under options. By default this is 20N.

Landing - sample or time point at which the force rises the force threshold set under options. By default this is 20N.

Eccentric Time - time period between the start of eccentric phase and the start of the concentric phase.

Concentric Time - time period between the start of the concentric phase and takeoff.

Ecc+Con Time – sum of the eccentric time plus the concentric time.

Contraction Time - equal to the sum of eccentric time plus the concentric time (Ecc+Con Time).

Flight:Contract - flight to contraction ratio is calculated as flight time divided by contraction time. This is equivalent to reactive strength index (RSI).

Unload Force – minimum force during the countermovement.

Unload force time – time at which the unload force occurs.

Unloading time – difference between the time of minimum force (unload force time) and the start of the eccentric phase.

Unloading RFD – difference between the force at the start of the eccentric phase and the unloading force divided by the unloading time.

Yielding time – difference between the time of minimum force (unload force time) and the time of minimum velocity.

Yielding RFD – difference between the force at the time of minimum velocity and the unloading force divided by the yielding time.

Braking time – difference between the time of the end of the eccentric phase (zero crossing from negative to positive velocity) and the time of minimum velocity.

Braking RFD – difference between the force at the end of the eccentric phase and the force at minimum velocity divided by the braking time.

Force@100ms – force at 100ms from the start of the concentric phase.

Force@200ms – force at 200ms from the start of the concentric phase.

%Fmax@100ms – force at 100ms from the start of the concentric phase as a percentage of the peak concentric force.

%Fmax@200ms – force at 200ms from the start of the concentric phase as a percentage of the peak concentric force.

Symmetry Measures

Peak Force – left side force at peak force divided by right side force at peak force.

Minimum Force – left side force at minimum force divided by right side force at minimum force.

Concentric Impulse – total impulse on the left side during the concentric phase divided by total impulse on the right side during the concentric phase.

Eccentric Impulse – total impulse on the left side during the eccentric phase divided by total impulse on the right side during the eccentric phase.

Force at transition –left side force at the transition from eccentric to concentric divided by right side force at the transition from eccentric to concentric.