Player Analysis Technology Approval report

Catapult Vector

Test code: PAT-19-022

Serial no: n/a

Software versions:
OpenField 2.3.1 Build #52420

Firmware version:
Vector S7: 606
Vector Receiver: 606
Vector Anchor: 6.06

Issue date: 1 November 2019

Objective: To test and evaluate Catapult Vector Player Analysis Technology according to Rule 31 of the 2019 Rules of Tennis.

Result: Approved

SUMMARY

The Catapult Vector S7 'pod' is inserted into a Catapult Vector Vest worn by the player. The pod and Vest contain electronic sensors to record position, orientation, velocity and acceleration of the body and player heart rate. Real-time wireless data transfer is possible when the pod is paired to a Catapult Vector Receiver unit, which in turn is connected to an auxiliary device, e.g. a laptop or a smartphone running the Catapult Vector app.

Coaching information available on the auxiliary devices includes average and peak velocity, distance travelled, player location heat maps and heart rate.

Restrictions on the access by a player to Catapult components during periods when coaching is not and is allowed are as follows:

COMPONENT	NO COACHING	COACHING
Catapult Vector S7 pod	Permitted	Permitted
Catapult Vector Vest	Permitted	Permitted
Catapult Vector Anchor	Permitted	Permitted
Catapult Vector Receiver	Permitted	Permitted
Auxiliary device, e.g. laptop or smartphone	Not permitted	Permitted

MAIN COMPONENTS

The main components of the system are described in table 1 and depicted in figure 1.

COMPONENT	FUNCTION(S)
Catapult Vector S7 pod	Record, store and transmit data
Catapult Vector Vest	Record and transmit data
Catapult Vector Anchor	Transmit data
Catapult Vector Receiver	Receive data
Catapult Vector app	Analyse, transmit and communicate (display) data
Catapult OpenField software	Analyse, transmit and communicate (display) data
Catapult OpenField Cloud	Analyse and communicate data
Auxiliary device, e.g. laptop	Communicate and transmit data

Table 1. Description of the components of the Catapult system.

Figure 1. Components of the Catapult system (from left to right): Catapult Vector S7 pod; Catapult Vector Vest, Catapult Vector Receiver, auxiliary device (laptop). Not to scale.

DATA CAPTURE AND TRANSMISSION

A Catapult Vector S7 'pod' (see figure 1) containing electronic sensors (GPS/LPS receiver, triaxial accelerometer, triaxial gyroscope and triaxial magnetometer) is inserted into a Vector Vest worn by the player. The sensors in the pod measure the position, acceleration and orientation of the player. The pod is 81 x 43.5 x 15.9 mm in size, with a mass of 54 g. The Vector Vest has integrated electronic sensors to measure heart-rate.

Data capture is started by pressing the power button (see figure 2). Five LEDs on the pod identify:

- Battery level;
- GPS status;
- Vector vest heart-rate connectivity;
- Vector receiver / LPS connectivity;
- Bluetooth connectivity.

When used outdoors, the pod will automatically search for, and lock onto, GPS satellite signals. When used indoors, Vector Anchors can be positioned around the playing area and calibrated to provide Local Position System (LPS) data. In both cases, the positional data is used to measure player displacements, velocities and accelerations.

Figure 2. Catapult Vector S7 pod power button and status LEDs.

Data can be transmitted in real-time to auxiliary devices in two ways. The first method uses a Catapult Vector Receiver unit (see figure 1) connected to an auxiliary device (e.g. a PC or tablet) running Catapult OpenField software. This method uses unique firmware on both the pod and Receiver unit to create a secure connection. The second method connects the pod to a smartphone or smartwatch running the Catapult Vector app (see figure 3) via Bluetooth. To ensure data security, the app requires the user to log in using registered credentials before the Bluetooth connection between the pod and auxiliary is established. Data are also stored on the pod and can be downloaded to the auxiliary device via a USB cable. The data transfer is managed through Catapult's OpenField software (see figure 3). The pod (and data) are assigned to a pre-registered user account prior to data transfer.

Figure 3. Catapult smartwatch app (left) and OpenField software (right).

During real-time data transfer, the OpenField software and Vector app process and visualise some of the data captured and transmitted by the pod. This excludes the inertial sensor data due to bandwidth limitations. Start times, end times and descriptions of specific activities or drills (e.g. training sessions, matches) can be defined at this point, through either the OpenField software or Vector app.

Once a session has ended, the data are transferred to Catapult's OpenField Cloud service through an active internet connection (with end-to-end encryption). OpenField Cloud synchronises, e.g. the GPS/LPS data from the pod and timing data from the app, and further processes the data.

COMMENTS

Start/stopping data capture is player-driven. Transmission of data between the pod, vest and auxiliary device is either over a secure wireless or wired connection. Transmission of data from the auxiliary device to Catapult's OpenField Cloud service is via an encrypted wireless or wired internet connection. These limit the system's susceptibility to hacking.

Data are assigned to a registered user account via proprietary software installed on an auxiliary device. The user account also permits access to the data through Catapult's OpenField web services, protecting against unauthorised access.

DATA PROCESSING AND COMMUNICATION

The auxiliary device displays coaching information, such as session times, average and peak accelerations and velocities. Further data processing and communication are available via the Catapult OpenField Cloud and web services, which requires both an internet connection and for the user to log in to their account. Coaching information, such as distance travelled and player location heat maps, are accessible using these tools.

A user can nominate a third-party (e.g. a coach) access to their data, subject to that individual having a registered account.

COMMENTS

The pod and vest do not have a means to communicate data collected. An auxiliary device is required for real-time data transfer, processing and communication.

Coaching information is available on the auxiliary device. Therefore, players must not have access to auxiliary devices, e.g. smartphone, tablet, laptop, when coaching is prohibited.

ADDITIONAL INFORMATION

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NOTE Approval does not attempt to, nor does it in fact, establish the accuracy or reliability of data or fidelity of its transmission.