TrackMan™ Pro
Presentation

ISG A/S
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1 Why TrackMan™ Pro from ISG?

ISG A/S sees the following benefits by choosing the TrackMan™ technology:

- **Accuracy and Reliability**
  - TrackMan™ is the industry leader in ball flight analysis
  - Every major manufacturer uses TrackMan™ for testing and fitting
  - TrackMan™ is also used by the USGA, R&A and PGA TOUR for testing and analysis
  - TV Broadcasts incorporate TrackMan™ data to analyze swings and ball flights
  - These partnerships would not be possible without superior accuracy and reliability

- **Ease of Setup/Use**
  - It takes longer for your computer to boot up than it does to setup TrackMan™
  - Motors level the radar to the exact position every time (no human error)
  - An integrated camera takes a picture of your range to align the system with any target
  - There are no test shots or measurements required to complete setup
  - Shots are triggered by the swing and ball. No false triggers (NOT triggered by sound)
  - Largest hitting area available. Hit shots from 6 to 20 feet in front of the radar. No need to move the radar or recalibrate because of divots or footprints.

- **User Friendly Applications and Programs**
  - Touch screen application for quicker navigation
  - Impressive 3D graphics of ball flight and club delivery
  - Colored graphics make it easy for the customer to compare clubs, swings or balls
  - Driver fitting software gives optimal numbers for each individual golfer
  - Approach Test and Practice allow for unmatched trajectory and distance control
  - Closest to the Pin and Driving Contest allow for engaged practice and new sales and marketing opportunities

- **Ability to increase sales and revenue**
  - Reliable data that matches what the customer sees leads to an increased close rate
  - TrackMan™ brand increases customer awareness and confidence in business
  - Numerous revenue stream opportunities through TrackMan™ programs
    - Find Your Distance (gap fitting)
    - Driver Fitting
    - Hybrid Fitting
    - Wedge Fitting
    - Ball Fitting
    - Practice (rental fee)
    - Instruction enhancement
    - And More

- **Association with TrackMan™ name/brand**
  - As seen on TV (Golf Channel, ESPN/ABC, 2008 US Open, 2007-08 British Open, others)
  - TrackMan™ marketing materials available to customers (video clips, case studies, etc)
  - Places instant credibility on business through association
  - Become a member of an elite group of organizations, teachers and fitters who use TrackMan™

- **Most comprehensive set of club and ball values available**
  - See list of all measured values given by TrackMan™ in Section 3 (begins on page 3)

- **Partnering with ISG**
  - Certainty of future development and support of TrackMan™ hardware and software
  - ISG is committed to maintain and strengthen our leadership within the industry
2 TrackMan™ Pro Highlights

TrackMan™ has set new standards for golf ball and golf club measurements. Based on Doppler radar technology, TrackMan™ measures the exact 3-dimensional club movement and ball flight, and provides precise measured data on the club delivery, ball launch and trajectory.

TrackMan™ Pro is the outdoor product – which is recognized by the industry to be the most reliable and accurate product on the market. Our customer reference list includes the golf industry’s top equipment manufacturers, PGA TOUR, USGA, R&A, Golf Clubs, Golf Academies, Top 100 Teachers, TOUR Pros, and more than 20 of the top collegiate golf programs among others.

The TrackMan™ Pro:

- Easy setup/start up (within 2 minutes)
  - Automatic leveling of radar (motorized legs)
  - Easy Targeting – Integrated camera takes picture of your range, just use the mouse to click on your target (flag, tree, mound, etc.)
- Largest hitting area – Hit ball anywhere from 6 to 20 feet in front of the TrackMan™ radar
- Measure entire ball flight (350 meter/yards+)
- World Class Accuracy
- No marking of the ball (spin is measured to an accuracy of +/- 20 rpm’s with no marking)
- Measure 5 different club delivery values
  - horizontal & vertical swing planes, club speed, attack angle, club path
- Calculate 2 club delivery values
  - dynamic loft, face angle
- Measure 12 different ball values
  - Ball speed, launch spin, launch angle vertical & horizontal, smash factor, carry (flat), landing angle, spin axis, max height, carry side, time, last data point
- Calculate bounce and roll based on selected ground condition – and thereby calculate 2 ball values
  - Total distance, total offline
- Operate under driving range conditions
  - Several balls in the air simultaneously
  - Several co-located systems
  - Rain/snow, direct sun, -5° to +45°C etc.
- Measure the carry on all types of golf shots from short pitches to drives
- Usable on compact driving ranges
  - Measure ball as far as possible – and calculates the remaining ball flight
- Usable indoors as TrackMan™ Launch
  - See specifications for TrackMan™ Launch
3 TrackMan™ Pro - Data

3.1 The Club

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th>Club speed measured just before impact</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Accuracy</strong></td>
<td>+/- 1 mph</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Tour Pro average - Driver</strong></td>
<td>113 mph</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Tour Pro average - 5 Iron</strong></td>
<td>95 mph</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Correlations (primary)</strong></td>
<td>Ball speed</td>
<td>Carry</td>
<td>Total</td>
</tr>
</tbody>
</table>

Notes: Club speed varies a lot between the different tour players. Tiger Woods is amongst the players with the highest driver club speed – averaging around 124 mph. Highest measured Club Speed on TrackMan™ is 143 mph (Long driving championship).

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th>The angle of the swing plane of the club head - seen from ground and up. Similar to Hogan’s Plane of Glass.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Accuracy</strong></td>
<td>+/- 0.3°</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Tour Pro average – Driver</strong></td>
<td>48°</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes: A high value is a steep swing plane – Low value is a flat swing plane. No value is “the right value”, since its dependant on the player’s height, the length of the club etc. The primary goal is to have a consistent vertical swing plane.
### HORIZONTAL SWING PLANE

The swing plane of the club head – seen from above. Orientation left/right measured in relation to the target line.

**Accuracy**: +/- 0.3°

**Correlations (primary)**: Club path, Horizontal Launch Angle

**Notes**: Positive value means the swing would be characterized as in to out (for right handed player) – and negative value means the swing would be characterized as out to in. Measurement is similar to the base of the Plane Line in The Golfing Machine philosophy.

### ATTACK ANGLE

The angle of which the club head is “attacking” the ball just before impact – measured in relation to ground level.

**Accuracy**: +/- 0.5°

**Correlations (primary)**: Vertical Launch Angle, Spin Rate

**Notes**: Negative value is hitting down on the ball, and positive is hitting up on the ball. Very important in club fitting to understand a golfer’s capability. Note that there are big differences between pros. The most efficient drivers (distance) are hitting 4-6° up on the ball – while the less efficient drivers are hitting 5° down or more on the ball.

### DYNAMIC LOFT

The dynamic or effective loft of the club at the point of impact on the club face – calculated relative to vertical.

**Accuracy**: +/- 0.2°

**Correlations (primary)**: Attack Angle, Vertical Launch Angle, Spin Rate

**Notes**: When hitting down on the ball, the dynamic loft will normally be less than the static loft of the club. As a rule of thumb the Dynamic Loft = Static Loft + Attack Angle + arm/shaft angle at impact + shaft bend or lead/lag (typical +2° for a driver)
### CLUB PATH

The club head path measured at impact. Positive value if club head is moving to the right (inside/out for right handed player) and negative value is a club head moving to the left through impact.

<table>
<thead>
<tr>
<th>Accuracy</th>
<th>+/- 0.4°</th>
</tr>
</thead>
</table>

**Correlations (primary)**
- Horizontal Swing Plane
- Spin Axis
- Horizontal Launch Angle

**Notes:**
A shot with a Club Path value between -1° and +1° is considered to be straight towards the target. The typical amateur (high HCP) has an outside/in club path, as well as an outside/in horizontal swing plane.

### FACE ANGLE

The club head angle calculated at impact on the club face relative to target line. Positive value if the Club face is pointed to the right at impact.

<table>
<thead>
<tr>
<th>Accuracy</th>
<th>+/- 0.2°</th>
</tr>
</thead>
</table>

**Correlations (primary)**
- Horizontal Swing Plane
- Horizontal Launch Angle
- Spin Axis
- Club path

**Notes:**
To have the ball curve left – the face angle value has to be less than the club path value (club head closed compared to club path). To have the ball curve right – the face angle value has to be greater than the club path value (club head open compared to club path).

**NOTE:** The face angle does not have to be negative to create a ball curving left or positive for the ball to curve right. It is the relationship between the face and path that creates the fade or draw.
### 3.2 The Ball

#### BALL SPEED

<table>
<thead>
<tr>
<th>Accuracy</th>
<th>+/- 0.1 mph</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Tour Pro average - Driver</strong></td>
<td>167 mph</td>
</tr>
<tr>
<td><strong>Tour Pro average - 5 Iron</strong></td>
<td>135 mph</td>
</tr>
<tr>
<td><strong>Correlations (primary)</strong></td>
<td>Club speed, Ball type, Club COR, Dynamic Loft, Impact location on clubface</td>
</tr>
</tbody>
</table>

**Notes:** A high ball speed is primarily generated from a high club speed. However, the impact location on the club, the dynamic loft and the attack angle also plays a role in producing the ball speed. The most efficient drivers from a distance perspective have high club speed combined with a positive attack angle. This will minimize the spin, give a high launch and maximize the distance. Tiger Woods are amongst the tour players with the highest driver Ball Speed – averaging around 184 mph. Highest measured Ball Speed on a TrackMan™ is 210 mph (Long driving competition).

#### SMASH FACTOR

<table>
<thead>
<tr>
<th>Accuracy</th>
<th>+/- 0.02</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Tour Pro average - Driver</strong></td>
<td>1.47 to 1.50</td>
</tr>
<tr>
<td><strong>Tour Pro average - 5 Iron</strong></td>
<td>1.42</td>
</tr>
</tbody>
</table>

**Notes:** The maximum smash factor achievable is limited by the COR of the club head (set by USGA). For higher lofted clubs the smash factor will be less than 1.48 for center hits. This is because the ball is being hit up (higher launch) and not out. There is less compression between ball and club.

#### SPIN RATE

<table>
<thead>
<tr>
<th>Accuracy</th>
<th>+/- 20 rpm</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Tour Pro average - Driver</strong></td>
<td>2650 rpm</td>
</tr>
<tr>
<td><strong>Tour Pro average - 5 Iron</strong></td>
<td>5600 rpm</td>
</tr>
<tr>
<td><strong>Correlations (primary)</strong></td>
<td>Dynamic Loft, Attack Angle</td>
</tr>
</tbody>
</table>

**Notes:** Spin is the fuel that keeps a ball airborne. Too much spin and the ball stalls out. Too little spin and there is not enough lift to keep the ball airborne. Each shot needs a certain amount of spin in relationship to the ball speed, launch angle and purpose of the shot.
**SPIN AXIS**

The spin axis is the axis around which the ball is spinning. The tilting of the axis dictates if the ball will draw or fade. The value is +/- in degrees relative to the horizon. Positive value when the ball is going right – and negative when it’s going left.

<table>
<thead>
<tr>
<th>Accuracy</th>
<th>+/- 1.0°</th>
</tr>
</thead>
<tbody>
<tr>
<td>Correlations (primary)</td>
<td>Club path</td>
</tr>
<tr>
<td></td>
<td>Face angle</td>
</tr>
</tbody>
</table>

*Notes:* The value is calculated based on the initial ball flight and club delivery. As a rule of thumb the ball will swerve 0.7% off line per 1° spin axis, i.e. For a 200 yards shot with +5° spin axis starting at the target line, the ball will land 7 yards to the right.

**VERTICAL LAUNCH ANGLE**

The launch angle measured just after impact in relation to the horizon.

<table>
<thead>
<tr>
<th>Accuracy</th>
<th>+/- 0.1°</th>
</tr>
</thead>
<tbody>
<tr>
<td>Correlations (primary)</td>
<td>Dynamic loft</td>
</tr>
<tr>
<td></td>
<td>Attack Angle</td>
</tr>
</tbody>
</table>

*Notes:* There are big differences between individual pros. The launch angle for at driver ranges from 6-15°, but the most effective drivers among the players are launching at 11° or higher – in combination with low spin rates. The optimal launch angle for a driver is individual for each player and is primarily dictated by club speed and attack angle. The TrackMan™ driver fitting application takes the mystery out of finding the optimal launch angle for each player.

**HORIZONTAL LAUNCH ANGLE**

The launch angle measured just after impact in relation to target line.

<table>
<thead>
<tr>
<th>Accuracy</th>
<th>+/- 0.1°</th>
</tr>
</thead>
<tbody>
<tr>
<td>Correlations (primary)</td>
<td>Club path</td>
</tr>
<tr>
<td></td>
<td>Face angle</td>
</tr>
</tbody>
</table>

*Notes:* Horizontal launch angle measures the amount of push or pull in degrees. If the horizontal launch angle is negative the ball has started left of the intended target and if it is positive it has started right of the intended target.
### MAX. HEIGHT

The measured maximum height (apex) of the ball during flight.

<table>
<thead>
<tr>
<th>Accuracy</th>
<th>+/- 0.3 %</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Tour Pro average - Driver</strong></td>
<td>34 yards</td>
</tr>
<tr>
<td><strong>Tour Pro average - 5 Iron</strong></td>
<td>32 yards</td>
</tr>
</tbody>
</table>
| **Correlations (primary)**       | Dynamic loft  
                                     | Ball speed  
                                     | Spin rate |

Notes: The apex will vary depending on build of club (shaft flex/profile, club head design). Irons with the same head design and build typically apex at almost the same height.

### LANDING ANGLE

The angle in which the ball is landing relative to the horizon.

<table>
<thead>
<tr>
<th>Accuracy</th>
<th>+/- 0.6°</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Tour Pro average - Driver</strong></td>
<td>39°</td>
</tr>
<tr>
<td><strong>Tour Pro average - 5 Iron</strong></td>
<td>50°</td>
</tr>
</tbody>
</table>
| **Correlations (primary)**       | Vertical Launch Angle  
                                     | Ball speed  
                                     | Spin rate |

Notes: Keep it below 38° for a driver. Get it higher than 45° for control on approach shots.

### CARRY

The carry - measured to same level as launch (carry flat).

<table>
<thead>
<tr>
<th>Accuracy</th>
<th>+/- 1 foot at 100 yards</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Tour Pro average - Driver</strong></td>
<td>269 yards</td>
</tr>
<tr>
<td><strong>Tour Pro average - 5 Iron</strong></td>
<td>195 yards</td>
</tr>
</tbody>
</table>
| **Correlations (primary)**       | Vertical Launch Angle  
                                     | Ball speed  
                                     | Spin rate |
### CARRY SIDE

The carry side – measured in relation to target line.

<table>
<thead>
<tr>
<th><strong>Accuracy</strong></th>
<th>+/- 1 foot at 100 yards</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Correlations (primary)</strong></td>
<td>Horizontal Launch Angle Spin axis</td>
</tr>
</tbody>
</table>

### TOTAL

The calculated total distance – equals carry plus calculated bounce and roll.

<table>
<thead>
<tr>
<th><strong>Correlations (primary)</strong></th>
<th>Carry Landing Angle Ground conditions</th>
</tr>
</thead>
</table>

### TOTAL SIDE

The total side calculated in relation to target line

<table>
<thead>
<tr>
<th><strong>Correlations (primary)</strong></th>
<th>Horizontal Launch Angle Spin axis Ground conditions</th>
</tr>
</thead>
</table>
4 TrackMan™ Applications

The TrackMan™ software consists of the following applications:

1. **Shot Analysis**
   a. Basic application used to gather standard data on the player, club and ball.
   b. Used for equipment or player testing, with a focus on efficiently gathering and evaluating performance statistics (research or case studies)
   c. Great for comparing and analyzing data of different swings, ball flight and/or equipment

2. **Find Your Distance**
   a. An easy way to find the exact distance for each club
   b. Makes gap fitting a customer’s entire bag a simple process
   c. Leads to return business through identifying problem areas of customer’s bag
   d. PDF report can be made into a bag tag listing the yardages for the customer

3. **Driver Fitting** (see below description)

4. **Approach Practice**
   a. Practicing of distance and dispersion control
   b. Immediate feedback on distance from pin
   c. Learn new shots, practice different trajectories

5. **Approach Test**
   a. Test of a golfer’s approach shot skills
   b. 10 shots – with scoring according to distance from pin
   c. Points, HCP-calculation, bulls-eye statistics

6. **Long Drive Contest** (new for v4.0)
   a. Create head to head driving competitions
   b. Adjust fairway width for increased difficulty
   c. Great program for marketing the ability of TrackMan™ through a game

7. **Closest to the Pin Contest** (new for v4.0)
   a. Create head to head accuracy contests
   b. Adjust green size for increased difficulty
   c. Great program for marketing the ability of TrackMan™ through a game
4.1 Driver fitting

The Driver Fitting application sets a new standard for individual driver optimization. For the first time ever in golf history, determining the optimal driver to any given swing type has become a streamlined and scientific process no matter if the player is a 24 handicap or a professional golfer.

Through extensive research over the last 2 years, investing more than 8 man-years, by analyzing the full trajectory data and associated 3D club movements from more than 100,000 shots ranging from robot testing, professional golfers and amateurs at all levels, ISG have managed to identify how the parameters of the club, the ball and the swing interacts to produce a given ball flight. The first result of this research is the Driver Fitting application.

Based on a minimum of three shots with a reference club – typically the clients own club - players swing profile as well as ball profile is determined. The swing profile is primarily the player’s attack angle and club speed, which is not easily changed by changing the club.

By using a proprietary club/ball collision model, the TrackMan™ optimizer determines the optimal launch conditions achievable by the client, and these are shown as small numbers in the upper left corner and a red/green dot will indicate if the current value is within the optimal range.

The driver fitting can be set to either optimize for longest carry or longest total distance.

Note that the optimum and achievable launch conditions changes significantly depending on swing profile as illustrated in the launch chart to the right for a 90 mph club speed.

The club fitter is then identifying equipment that enables the player to obtain the optimal launch parameters.

By using the normalization function the trajectories can be displayed on top of the optimal trajectory area making it very easy to determine whether the shots are close to optimum. To further ease the selection of the club that will perform the best for the client the average trajectory can be shown for each club.
5 Other Information

5.1 Optional PC solution

The TrackMan™ software can most likely be used with any PC as long as it fulfils the minimum specifications\(^1\).

\(^1\) System requirements:
- Intel® Pentium® M processor 1.1 GHz (Dual Core recommended)
- Microsoft® Windows XP Professional or Home Edition with Service Pack 2
- 1GB of RAM (2 GB recommended for new computer purchases)
- 500MB of available hard-disk space required for installation
- USB2 High Speed compatible port
- Integrated graphics card with 256 MB of memory. (dedicated memory card with 256 MB is recommended to get full 3D experience)

However, due to possible incompatible drivers, web cams or other hardware that might conflict with the TrackMan™ drivers or hardware, we cannot guarantee that the software will run trouble free on all PCs. We therefore recommend using one of the following PCs that have been tested thoroughly with the TrackMan™ system:

- Dell ATG D630 – Dell ATG E6400 available soon
- Panasonic Toughbook CF-30

5.2 Approvals and Certifications

Since TrackMan™ is transmitting radio frequencies – it has to submit to certain international communication standards.

TrackMan™ is operating in the internationally reserved band – 10.500 GHz to 10.600 GHz. This band is reserved for short range communication.

TrackMan™ is transmitting at 10 mW, which is 200 times less power than a cellular phone and 100 times lower than the wireless Ethernet on a laptop. With that low power, it’s obvious that TrackMan™ constitutes no health care issues for the individual user of the system.

TrackMan™ is
- FCC §15 certified
  - FCC is Federal Communications Commission, which is the govern body of all communications equipment in the US, Canada and Mexico.
- CE compliant – which is the equivalent European communications authority.
- RoHS Compliant