

# *Torrent*<sup>TM</sup> *E-Rack*<sup>TM</sup>

## Swim Speed Analyzer



## Swim Speed and Performance Analysis

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# **Safety Precautions:**

**Absolutely no deviation from safety precautions permitted!**

**All users must read entire manual before using the Torrent Speed Analyzer!**

**It is the responsibility of all users to ensure that all safety precautions are followed.**

**NEVER wrap any line around any part of the human body.**

**Attach line only to a belt and never wrapped around a body part.**

**Be sure line is free from any objects and the slack is taken up before starting a run.**

**Keep fingers, hands, hair, clothing, and other objects away from the line when in use.**

**The Torrent Speed Analyzer must be placed on the ground, table or other stable fixture. There are only about 8 ounces (226 grams) of force applied to the line in normal operation but care must be taken to avoid knots or tangling that could result in the line catching on the Analyzer or other object that could cause sudden large forces on the line when in use.**

**Do Not Drop or allow to be pulled off a table as internal components could be damaged.**

**Do Not Immerse or allow Speed Analyzer to be pulled into pool.**

**Protect from heavy splash.**

**The Torrent Speed Analyzer weighs approximately 12 lbs. Dropping the Torrent Speed Analyzer may result in severe damage to its internal and/or external components. Dropping the Torrent Speed Analyzer on any part of a person's body may cause injury.**

**Internal Gel Cell battery must be charged only with charger provided.**

**Do not charge while analyzer is in use at the pool side.**

## CARE AND MAINTENANCE

**Housing:** Housing is made of welded stainless steel and requires no special maintenance. Wipe dry with soft cloth after use. Do not use solvents for cleaning. Housing is water resistant but not sealed. **Do not immerse. To protect from heavy splash, unit may be set back from pool.**

**USB Cable:** The USB cable connects to a Data Acquisition Unit in the Speed Analyzer and to the computer. Care should be taken to avoid damage to the cord. It is connected through a waterproof strain relief. If strain relief is broken, it must be replaced with identical strain relief to prevent damage to the internal data acquisition unit. USB cable should not be run with or placed next to a power cord to avoid extraneous electromagnetic interference that could interfere with digital communication. Do not use extension USB cables. USB cable may be replaced if damaged with equivalent cable not more than 10 ft in length.

**Line:** Line is made of high performance Spectra fiber (SpiderWire Ultracast 50 lb) which is inert to pool chemicals and has a tensile strength of 50 lbs but requires special knots to tie. Bowline and Palomar knots work well. There are about 100 meters of Line on the reel. Wear or damage at the end of the line may be repaired by cutting off the damaged portion and reattaching the snap hook. Do not shorten line by more than 25 meters to assure sufficient line remains for use. New line may be purchased at any sporting goods outlet or from Hector Engineering. The snap hook at the end of line should be retained and used with new line.

**Battery and charger:** Battery is 1.3 amp-hours 12 V and should last indefinitely when properly maintained by periodic charging with provided charging unit. Replacement should be with identical battery only. Supplied charger is designed to charge battery to full charge and then switch to maintenance charge and may be left on for extended times. It is recommended that the battery be charged over night after each session use to maintain optimal performance.

**Internal Components:** Internal components are selected to give long lasting maintenance free service and normally will not require user maintenance. If for any reason the Speed Analyzer appears to malfunction, remove from service, record the problem in detail and call the manufacturer. The only user serviceable parts are the battery, line and USB cable.

**Storage:** Wipe dry and store sitting on rubber feet in dry location with USB cable secured with strap provided to prevent damage. Store where it cannot be knocked or kicked over as the shock of a sudden drop on concrete may damage or loosen internal components.

# Torrent E-Rack Swim Speed Analyzer

The Speed Analyzer is a portable pool side instrument and software designed to provide researchers a method of studying swimming performance, and swim coaches a simple and reliable method to measure important aspects of a swimmer's speed and stroke characteristics **off the starting block, off the wall and in open swim**. It consists of a stainless steel enclosure containing a reel with line that connects to a swimmer, a speed sensor, motor, battery, electronic power interface, electronic signal conditioning hardware, electronic flash hot shoe, and Data Acquisition Hardware for interfacing with Torrent Data Acquisition Programs. Data is automatically displayed on a computer screen, and options are available to store data to a spread sheet for further analysis and record keeping.

**The Torrent E-Rack Speed Analyzer is capable of measuring, graphing and displaying in real time a swimmer's Distance, Time, Speed, and stroke characteristics over any distance up to 50 meters.** The number of strokes, strokes per meter, meters per stroke, and acceleration with each stroke can be determined directly from the recording. Data can be saved to an Excel CSV file for synchronizing with Dartfish Video Analysis Software so that complete stroke by stroke analysis can be done. A photo strobe hot shoe is built in for synchronizing data with video. These features are built into a rugged stainless steel enclosure and make the **Torrent E-Rack Swim Speed Analyzer the fastest and most convenient and portable method for analyzing speed and stroke.**

## Installation and Computer Set-up

Install DasyLab\* version 10 or DASyLab Run Time version (provided) in laptop computer to be used at the pool side. Copy Torrent Program folder from disc provided into your preferred location. We recommend C:\ since this is the location other E-Rack programs have or will be located. Install Measurement Computing DAQ Software from disc supplied. Follow MCC DAQ installation and set-up instructions. Connect The Speed Analyzer USB cable to computer. Give computer time to recognize the new hardware. Run InstaCal (C:\Program Files\Measurement Computing\DAQ\InstaCal) so that the built-in Data Acquisition unit is recognized. For convenience, create a short cut to InstaCal on the Desktop. This software allows DASyLab to communicate with the data acquisition unit in the Speed Analyzer. Speed Analyzer Program is now ready to run. Just click the DasyLab short cut on the desktop and open the Swim Speed Analyzer program. The screen view will be as in figure 1 below.

**(Note: Each time the Speed Analyzer is connected to a running computer or the computer is rebooted with the Analyzer attached, you must wait a short time (up to 90 seconds depending on the computer) before loading DasyLab and running programs. This gives the computer time to recognize the data acquisition hardware and install its configuration. Failure to allow this time may result in the program not loading properly but will do no harm. If it doesn't load, just close, wait a short time and reload. If another Torrent machine has been run on this computer then run InstaCal first so the computer will recognize that a different Daq unit is in use.)**

\*DASyLab is a trademark of National Instruments Ireland Resources Limited

# Set up and run Torrent Swim Speed Analyzer

**It is suggested that at the outset, a folder is established for each swimmer and all data including screen prints and Excel files for each swimmer are stored to their own folder for future reference.**

Unwrap USB cord from storage position and place Speed Analyzer on the pool deck for off the wall swimming or on a sturdy tripod behind the starting block at waist high to the swimmer for off the block testing. Do not allow Speed Analyzer to fall into the water and protect from heavy splash. Attach laptop computer to Analyzer with included USB cable. **Do not use an extension cable.** Waist belt provided should be positioned on the swimmer so that its extension line is in the middle of the lower back. Extension line provides a convenient method of attaching to the snap hook of the Analyzer. **Do not wrap any lines around any body part.** Although there are only about 8 ounces of force on the line, **if the line should become entangled with other structures injury could result.**

## The Screen Display (see Figure 1)

Controls at the top of the screen are Start/Stop, Pool Length Button, Save to File Button, Flash Button, and Manual Rewind Button. The chart recorder displays a graph of Distance, Speed and Timing Mark when selected by double clicking the channel button at the bottom of the chart.

Clicking **Start Button** starts program running. **Stop button** will stop the recording.

**Pool Length Button** selects between 25 and 50 meter pools. For 25 meter pool setting, the average speed is calculated over 5 to 20 meters. For the 50 meter pool setting, the average speed is calculated between 5 and 45 meters. Otherwise, speed is calculated between 5 meters and the point the swimmer stops.

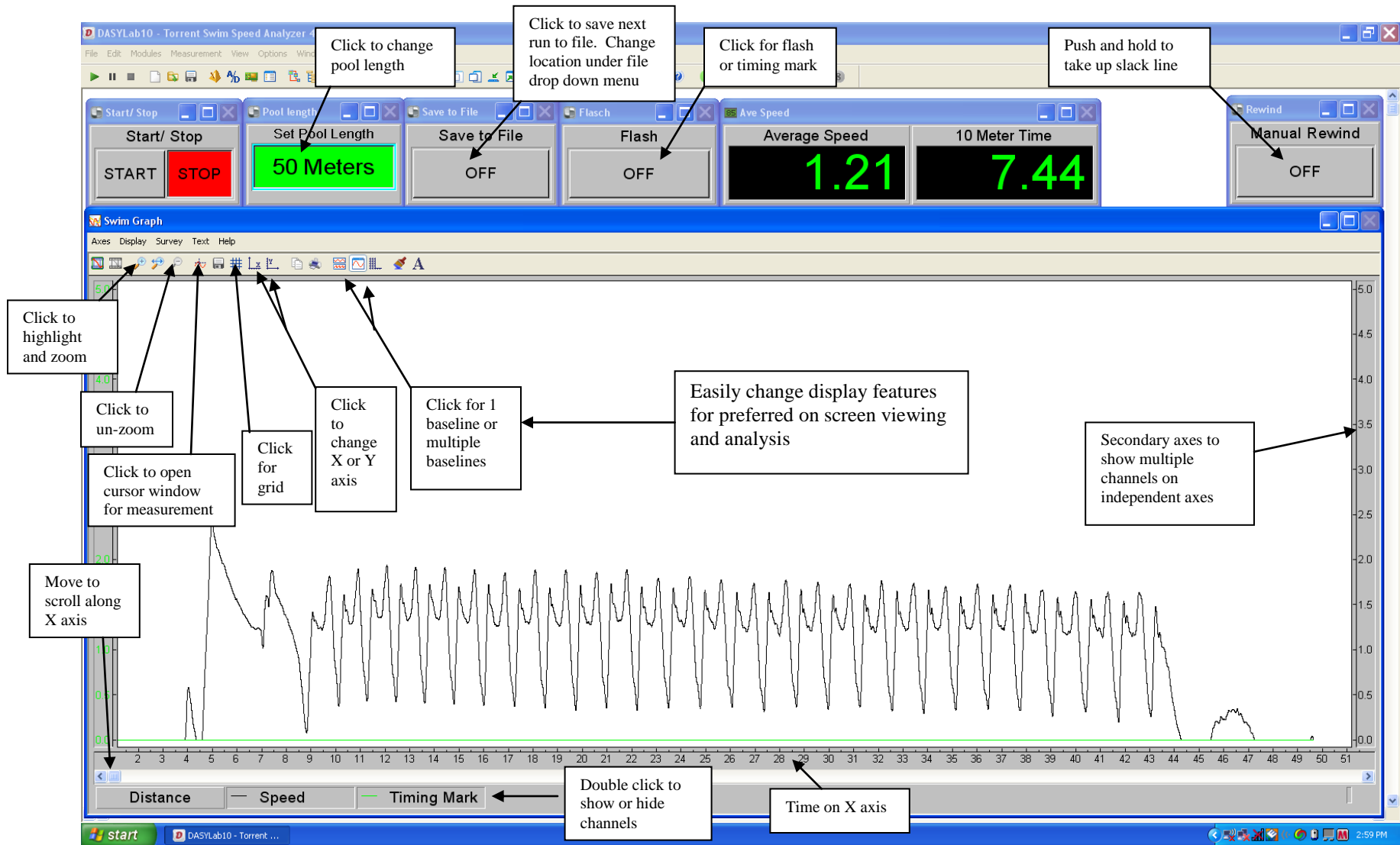
**Save to File Button** causes the speed data to be stored to an Excel file specified under the file drop down menu.

Clicking the **Flash Button** during a trial flashes a strobe light attached to the hot shoe and simultaneously adds a timing mark to a data channel which is used to synchronize the data with video or for marking events during the swim that the coach wishes to note.

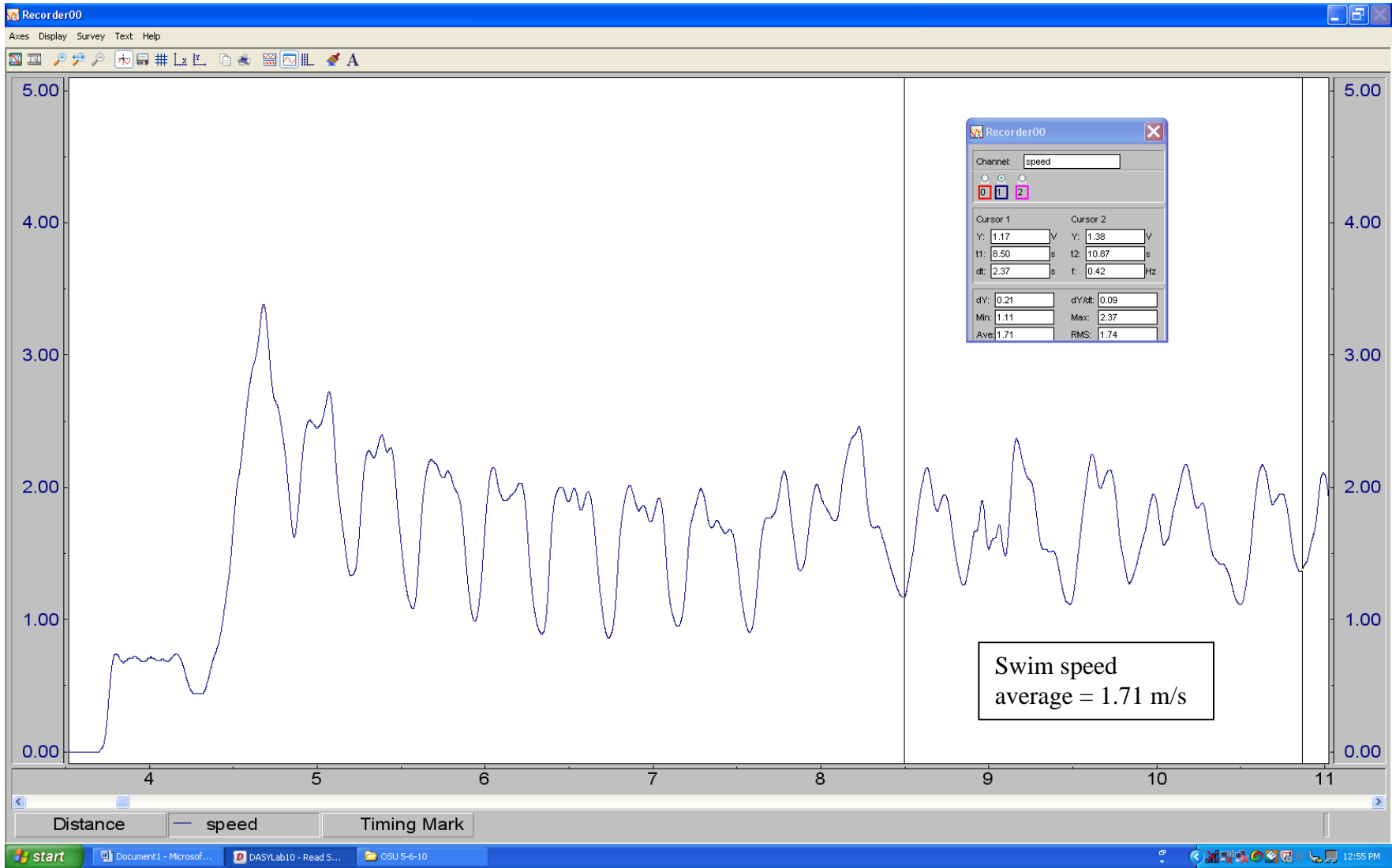
When the **Manual Rewind Button** is pressed and held, the rewind motor rewinds the line. This is useful to tension the line just before the start of a swim. It works the same as the rewind button at the rear of the Analyzer. The rewind button on the Analyzer is used to rewind the line when the program is not running, but may be used at any time.

Meters at the top of the display capture and hold the **Average Speed** and the **10 Meter Time**. Other distances can be programmed on request.

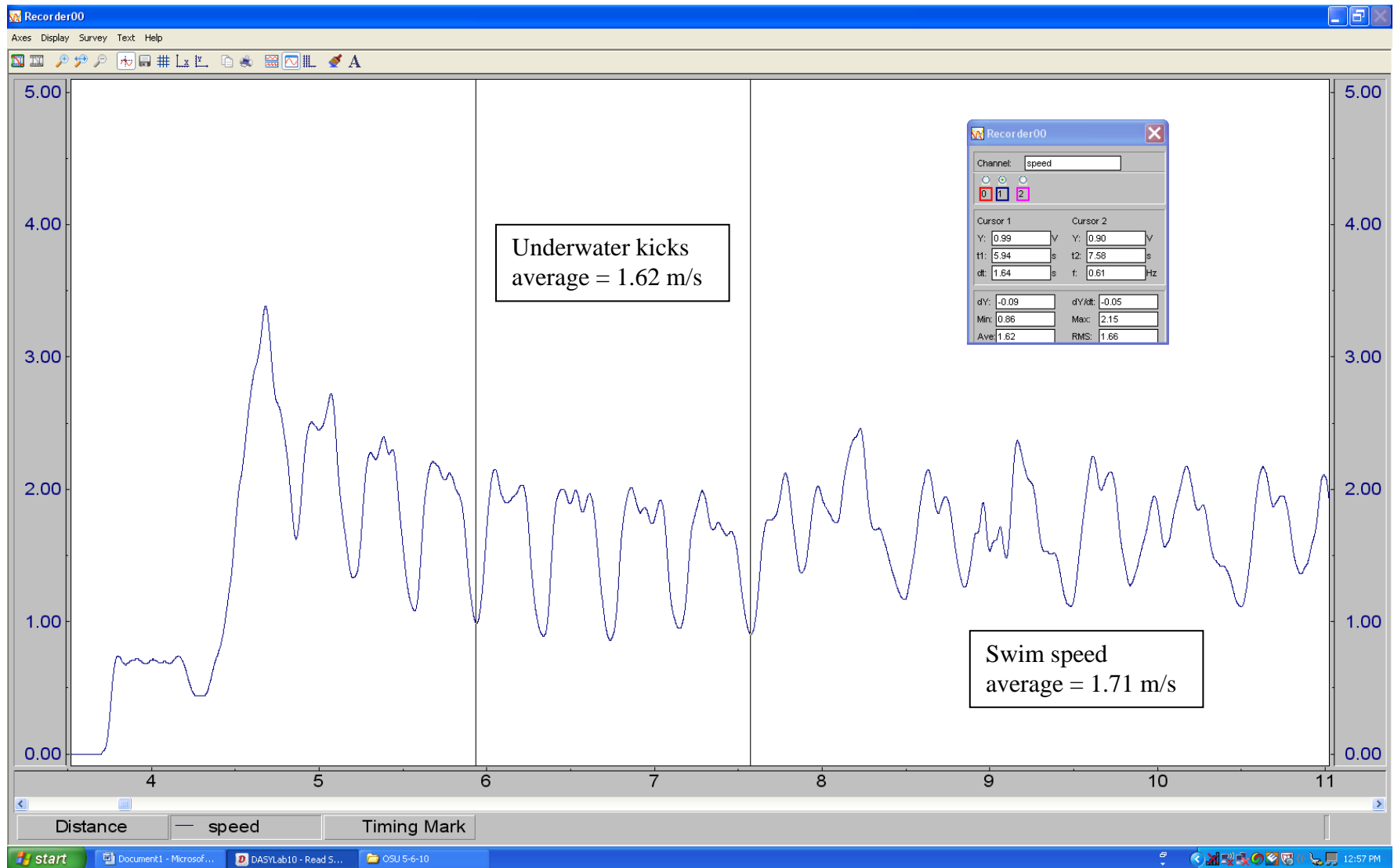
**On screen analysis** may be accomplished by opening a cursor window as shown in **Chart Displays** in figure 2, 3 and 4. Cursors may be moved to bracket any part of the record on any channel to obtain difference, average, minimum and maximum values for that portion of the record.



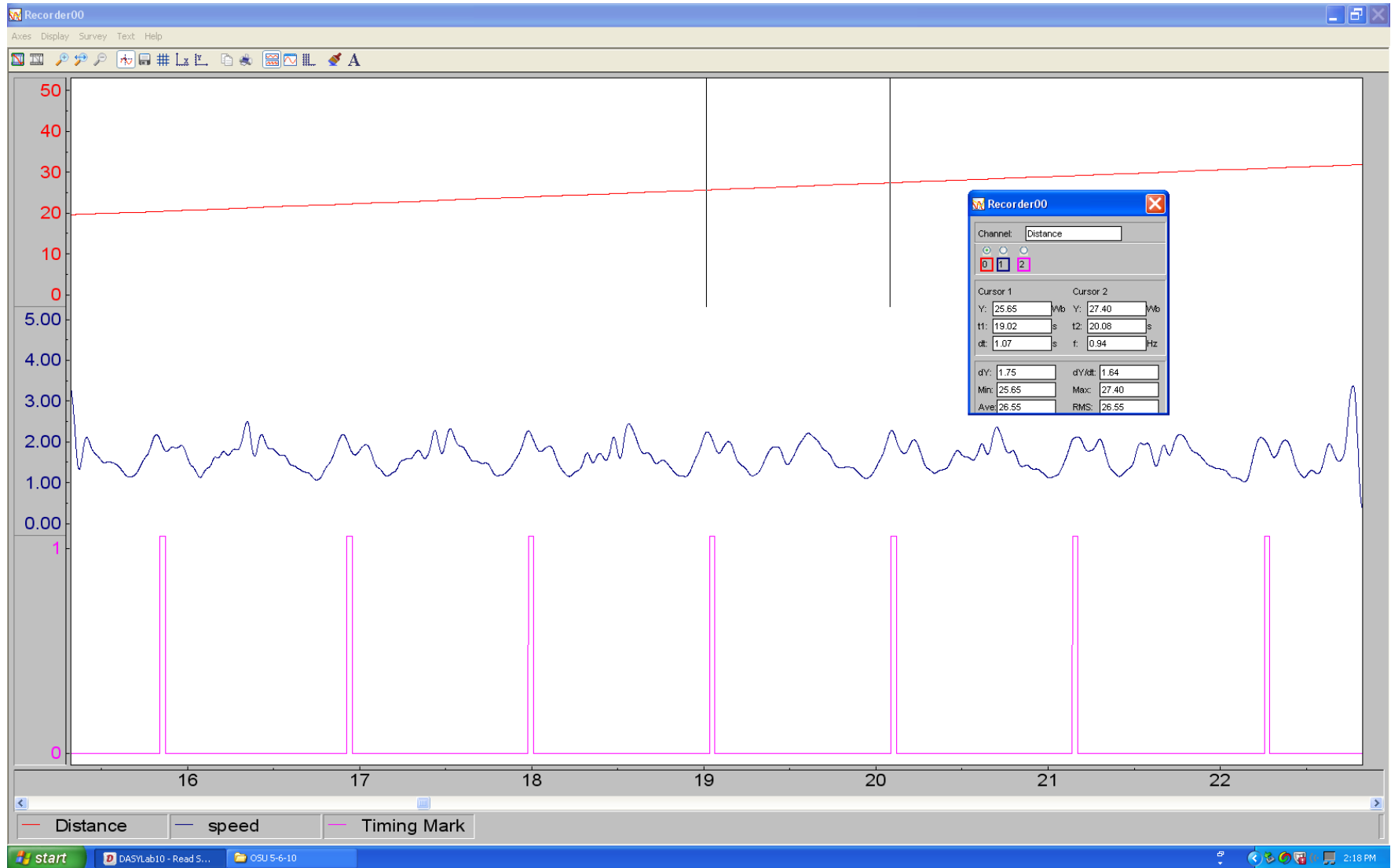
**Figure 1. Screen display with breast stroke speed recording. Note that after completing the recording, individual channels may be displayed or hidden, expanded and measured in X or Y axis without losing data. Data will be held in graph until start of next trial.**



**Figure 2. Cursor window open with cursors enclosing 5 swim strokes. Cursor window displays average between cursors along with min and max values between cursors.**



**Figure 3. Cursor window open with cursors enclosing 4 underwater strokes of same swim as in figure 2. Note that the underwater strokes average .09 m/s slower than the swim strokes in the previous figure. This results in the swimmer losing about 14.76 centimeters distance (= 5.8 inches) during the swim.**



**Figure 4.** On this graph cursors first marked two right arm strokes of same swim as in figure 2, then the cursors were moved to the distance channel and the distance between two right arm strokes is measured to be 1.75 meters as displayed by box labeled dY. Note that the coach has marked the right arm activity with a timing mark signal (lower channel). Multiple strokes can be averaged by including bracketing many strokes with the cursors and dividing the distance by the number of strokes.

## Run Program and record data

To run the program and record distance, speed and timing mark, attach the Speed Analyzer snap hook to the extension line ring and position swimmer in start position.

Push start button. Tell swimmer to get set.

Press rewind button on the screen or on the Analyzer to take up loose line after swimmer is set so speed is captured from the precise start.

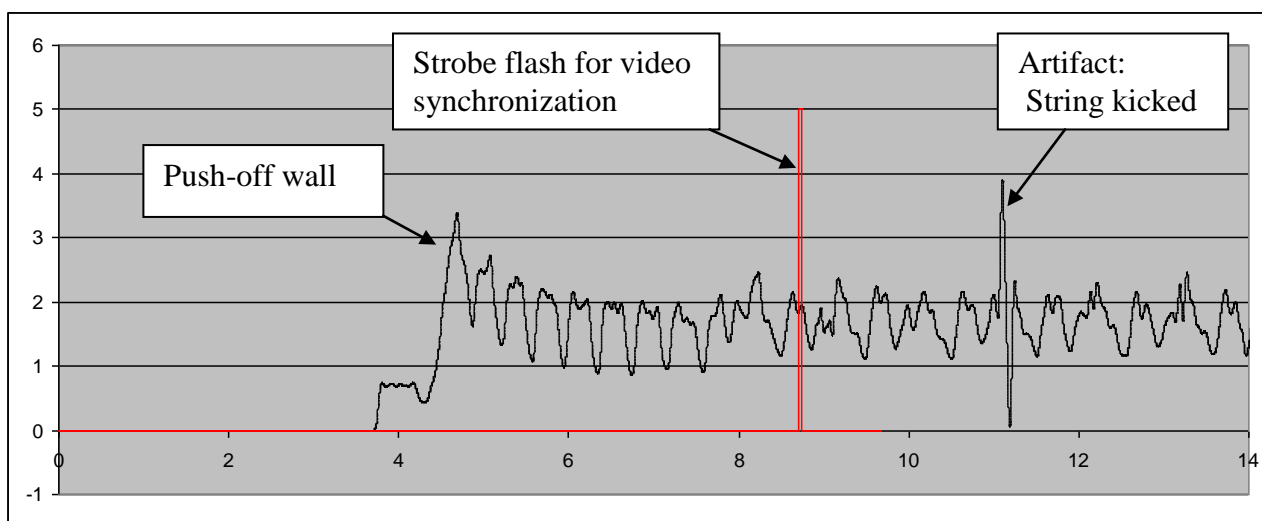
Instruct swimmer to start. Distance, Speed and manually triggered Timing Marks will be recorded until the swimmer stops at the end of the swim.

After the swimmer stops, the rewind motor will automatically rewind the line as the swimmer swims at about 1 m/s returning to the start where the program stops and screen values are held.

Save screen displays by executing a print screen command and copying to a word document.

## SYNCHRONIZING WITH VIDEO

When wishing to synchronize recording with video, the photographic strobe provided must be inserted into the hot shoe on the Speed Analyzer and the **Save to File Button** clicked. At any time during the swim trial while the underwater video camera is recording, the onscreen **Flash Button** may be clicked to cause a flash that is recorded on one frame of the video and simultaneously recorded on the Torrent speed data channel. The speed information and the strobe synchronization signals are recorded. The Excel file is displayed as in Fig. 2 as it would appear for video analysis. When the saved file is imported into Dartfish Video Analysis Software, the data can be accurately aligned with the video so that the effect of swimming technique on performance can be determined.



**Figure 5S. Part of Excel graph of Speed with video sync marker signal. Video marker can be manually triggered at any point in the trial and serves to provide a marker for precisely aligning the Torrent file data with video graphics when imported to Dartfish Video Analysis Software.**

The strobe synchronization can also be used to mark on the chart record the time of any visual event during the swim. For example, a mark could be placed when a hand hits the water to identify which stroke on the recording is caused by that hand. See Figure 4 above.

## Torrent Swim Speed Analyzer Specifications

### **Physical:**

L x W x H: 18" x 5.25" x 4.75"

Weight: 12 lbs

Case: welded 304 Stainless Steel

Cable: 100 meters high performance 0.012" Spectra Cable

Portable, works in any orientation, no external power required during operation

May be used on the deck or elevated on sturdy tripod or table behind the starting blocks

### **Electrical:**

Power: 1.3Amp Hr 12 volt Gel Cell (TR1.3-12) runs rewind mechanism

Comes with charger (Power Stream PST-3P10-12VB)

**Speed:** Speeds up to 13.3 meters/second

**Auto Rewind:** Automatically rewinds line at end of run at >1m/s.

**Line Resistance:** Nominal drag and rewind force of ~.5 lb (~.23 kg)

### **Data Recording and Storage:**

Records on-screen data in graphical form with on-screen analytical tools

Records to Excel file by clicking on-screen button.

Data can be recalled from Excel file by Torrent program for future analysis.

### **Video Analysis:**

Unit has built in hot shoe and on screen control for photo strobe for adding timing marks to recorded data and video for later analysis with Dartfish Video Analysis Software. On-screen button allows marking of events on data channel.

### **Recorded variables:**

Continuous recording of speed from push-off to 50 meters

## TROUBLE SHOOTING

**If Program Stops:** In the event a spurious signal or other event causes the DasyLab program to give an interrupt error or the computer loses connection to or recognition of the Speed Analyzer do one of the following: **(Note: Each time the Torrent Speed Analyzer is connected to a running computer or the computer is rebooted with the Trainer attached, you must wait up to 90 seconds before loading DasyLab and running programs. This gives the computer time to recognize the data acquisition (DAQ) module and install its configuration. Failure to allow this time may result in the program not loading properly but will do no harm. If it doesn't load, just close, wait a short time and reload. In the event it still doesn't recognize the DAQ, open InstaCal to install the DAQ configuration)**

- a. if an interrupt error only, close box and continue. When information box is closed DASYLab will be stopped. Then click Start and continue to run worksheet.\*
- b. if (a) doesn't work or recognition of the Daq is lost, close DASYLab, disconnect USB Cable and wait a short time for the computer to recognize the hardware has been disconnected then reconnect it. Wait 90 seconds. Open DASYLab and load worksheet and continue.\*

**Important:** If line is out when the unit is stopped, press the rewind button on the rear of the unit to rewind the string. When rewinding the line be sure it is not tangled or knotted. Line must not have knots.

# Limited Warranty

## General Terms

This Statement of Limited Warranty includes Warranty Information and the terms of Warranty replacement or repair. The warranties provided by Hector Engineering Co., Inc. in this Limited Warranty apply only to a Machine you purchase for your use, and not for resale. The term "Machine" means a Torrent Speed Analyzer manufactured by Hector Engineering Co., Inc., including its options, features, conversions, upgrades, or peripheral products or any combination of them, but only if they were manufactured by Hector Engineering Co., Inc. The term "Machine" does not include any computer or computer peripheral used with the Machine and also does not include any software programs, whether pre-loaded with the Machine, installed subsequently, or otherwise. Throughout this Limited Warranty, the terms "you" or "your" refer to the original purchaser of the Machine and the terms "we" or "us" refer to Hector Engineering Co., Inc. **Nothing in this Statement of Limited Warranty affects any statutory rights of consumers that cannot be waived or limited by contract.**

## What this Warranty Covers

Hector Engineering Co., Inc. warrants that each Machine is free from defects in materials and workmanship for a period of one year from date of installation (the "Warranty Period"). Hector Engineering Co., Inc. warrants that the Machine will perform the functions as specified in the instruction manual for the Machine. The Warranty Period for the Machine starts on the original date of installation. The date on your invoice or sales receipt for the Machine is the original date of installation unless Hector Engineering Co., Inc., informs you otherwise. Unless Hector Engineering Co., Inc. specifies otherwise, these warranties apply only in the country or region in which you purchased the Machine.

**THESE WARRANTIES ARE YOUR EXCLUSIVE WARRANTIES AND REPLACE ALL OTHER WARRANTIES OR CONDITIONS, EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OR CONDITIONS OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. SOME STATES OR JURISDICTIONS DO NOT ALLOW THE EXCLUSION OF EXPRESS OR IMPLIED WARRANTIES, SO THE ABOVE EXCLUSION MAY NOT APPLY TO YOU. IN THAT EVENT, SUCH WARRANTIES ARE LIMITED IN DURATION TO THE WARRANTY PERIOD. NO WARRANTIES APPLY AFTER THAT PERIOD. SOME STATES OR JURISDICTIONS DO NOT ALLOW LIMITATIONS ON HOW LONG AN IMPLIED WARRANTY LASTS, SO THE ABOVE LIMITATION MAY NOT APPLY TO YOU.**

## What this Warranty Does Not Cover

This warranty does not cover the following:

1. any software programs, whether pre-loaded or shipped with the Machine, or installed subsequently;
  2. failure resulting from misuse, accident, modification, unsuitable physical or operating environment, or improper maintenance by you;
  3. failure caused by a product for which Hector Engineering Co., Inc. is not responsible; and
  4. any non-Hector Engineering Co., Inc. products, including those that Hector Engineering Co., Inc. may procure and provide with or integrate into a Hector Engineering Co., Inc. Machine at your request.
- The warranty is voided by removal or alteration of identification labels on the Machine or its parts. Hector Engineering Co., Inc. does not warrant uninterrupted or error-free operation of a Machine. Any technical or other support provided for a Machine under warranty, such as assistance with "how-to" questions and those regarding Machine set-up and installation, is provided **WITHOUT WARRANTIES OF ANY KIND.**

## How to Obtain Warranty Service

Warranty service will be provided by Hector Engineering Co., Inc. Warranty service may be obtained by contacting Hector Engineering Co., Inc., 123 E. Dewey Dr. Ellettsville, IN 47429 (812-876-5274) or e-mail [dhector@bluemarble.net](mailto:dhector@bluemarble.net).

## Limited Warranty (Continued)

### What Hector Engineering Co., Inc., Will Do to Correct Problems

When you contact Hector Engineering Co., Inc., for service, you must follow the problem determination and resolution procedures that we specify. An initial diagnosis of your problem can be made either by a technician over the telephone or electronically by access to a support website. You are responsible for downloading and installing designated software updates from a support web site or from other electronic media, and following the instructions that Hector Engineering Co., Inc., provides. Software updates may include basic input/output system code (called "BIOS"), utility programs, device drivers, and other software updates. If your problem can be resolved with a Customer Replaceable Unit ("CRU"), Hector Engineering Co., Inc., will ship the CRU to you for you to install. If the Machine does not function as warranted during the Warranty Period and your problem cannot be resolved over the telephone or electronically, through your application of software updates, or with a CRU, you must return the machine to Hector Engineering Co., Inc., for repair. Hector Engineering Co., Inc., at its discretion, will either: 1) repair the Machine to make it function as warranted, or 2) replace the Machine with one that is at least functionally equivalent. If Hector Engineering Co., Inc. is unable to do either, you may return the Machine to Hector Engineering Co., Inc., and request a refund. As part of the warranty service, Hector Engineering Co., Inc. may also install selected engineering changes that apply to the Machine. Hector Engineering Co., Inc., at its sole discretion, may elect to use one or more of its authorized service providers or authorized agents to perform any work covered by this Limited Warranty.

### Exchange of a Machine or Part

When the warranty service involves the exchange of a Machine or part, the item Hector Engineering Co., Inc., replaces becomes Hector Engineering Co., Inc.'s property and the replacement becomes your property. You represent that all removed items are genuine and unaltered. The replacement may not be new, but will be in good working order and at least functionally equivalent to the item replaced. The replacement item assumes the warranty service status of the item it replaces.

### Your Additional Responsibilities

Before Hector Engineering Co., Inc., exchanges a Machine or part, you agree to remove all features, parts, options, alterations, and attachments not under warranty service.

You also agree to:

1. ensure that the Machine is free of any legal obligations or restrictions that prevent its exchange;
2. obtain authorization from the Machine's owner to have Hector Engineering Co., Inc. service a Machine that you do not own;
3. where applicable, before service is provided: (a) follow the service request procedures that Hector Engineering Co., Inc., provides; (b) backup or secure all programs and data contained in the Machine; and; (c) provide Hector Engineering Co., Inc., or its authorized agent, with sufficient, free, and safe access to your facilities to permit Hector Engineering Co., Inc. to fulfill its obligations; and
4. with regard to information about individuals: (a) ensure all information about identified or identifiable individuals ("Personal Data") is deleted from the Machine (to the extent technically possible); (b) allow Hector Engineering Co., Inc., or its authorized agent, to process on your behalf any remaining Personal Data as Hector Engineering Co., Inc., or its authorized agent, considers necessary to fulfill its obligations under this Limited Warranty (which may include shipping the Machine for such processing to other service locations around the world); and (c) ensure that such processing complies with all laws applicable to such Personal Data.

### Limitation of Liability for Machine in Transit

Hector Engineering Co., Inc. is responsible for loss of or damage to, your Machine while it is in transit only in those cases where Hector Engineering Co., Inc., is responsible for the transportation charges. Hector Engineering Co., Inc. is not responsible for any of your confidential, proprietary, or personal information contained in a Machine which you return for any reason. You should remove all such information from the Machine prior to its return.

## Limited Warranty (Continued)

Circumstances may arise where, because of a default on Hector Engineering Co., Inc.'s part or other liability, you are entitled to recover damages from Hector Engineering Co., Inc. In each such instance, regardless of the basis on which you are entitled to claim damages from Hector Engineering Co., Inc. (including, but not limited to, material breach, negligence, misrepresentation, or any other contract or tort claim), except for any liability that cannot be waived or limited by applicable laws, Hector Engineering Co., Inc., its suppliers, resellers, agents, and service providers, collectively, are liable for no more than the purchase price you paid for the Machine.

**UNDER NO CIRCUMSTANCES IS HECTOR ENGINEERING CO., INC., ITS SUPPLIERS, RESELLERS, AGENTS, OR SERVICE PROVIDERS LIABLE FOR ANY OF THE FOLLOWING EVEN IF INFORMED OF THEIR POSSIBILITY: 1) THIRD PARTY CLAIMS AGAINST YOU FOR DAMAGES; 2) LOSS OF, OR DAMAGE TO DATA; 3) SPECIAL, INCIDENTAL, CONSEQUENTIAL, RELIANCE, EXEMPLARY, EXPECTANCY, OR INDIRECT DAMAGES; OR 4) LOST PROFITS, BUSINESS REVENUE, GOODWILL, OR ANTICIPATED SAVINGS. SOME STATES OR JURISDICTIONS DO NOT ALLOW THE EXCLUSION OR LIMITATION OF INCIDENTAL OR CONSEQUENTIAL DAMAGES, SO THE ABOVE LIMITATION OR EXCLUSION MAY NOT APPLY TO YOU.**

### **Governing Law**

Both you and Hector Engineering Co., Inc., consent to the application of the laws of the State of Indiana, without regard to its conflict of law principles, to govern, interpret, and enforce all of your and Hector Engineering Co., Inc.'s rights, duties, and obligations arising from, or relating in any manner to, the subject matter of this Limited Warranty..

**THESE WARRANTIES GIVE YOU SPECIFIC LEGAL RIGHTS AND YOU MAY ALSO HAVE OTHER RIGHTS WHICH VARY FROM STATE TO STATE OR JURISDICTION TO JURISDICTION.**

### **Jurisdiction**

The jurisdiction for any action, dispute, or controversy related to or arising out of this Limited Warranty or the Machine shall be in the courts of Monroe County, Indiana, USA