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PERFORM Operating Document

ProtoKinetics Movement Analysis Software (PKMAS) Zeno Walkway Mat for Gait Analysis

PC-POD-FA-008-v01

Revision History

Version	Reason for Revision	Date
01	New POD	July/10/2020

1. Overview

The content of this PERFORM Operating Document (POD) provides guidelines for:

- Operation of the PKMAS hardware and software
- Setup and safety measures to consider with participants
- Data processing and export

2. Definition of Terms and Abbreviations

CoM	Centre of Mass
COP	Centre of Pressure
.csv	Comma-Separated Values file type
ft	Feet unit of measurement
m	Metre unit of measurement
PKMAS	ProtoKinetics Movement Analysis Software
Sus	Suspended
.txt	Text file type
USB	Universal Serial Bus

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3. Introduction

The PKMAS Zeno Walkway Mat system serves as an analysis tool for gait and balance in the research, clinical, and training domains. The PKMAS software can also be used with the GAITRite electronic walkway system.

The Zeno Walkway at PERFORM is a mat with ten sensor pads connected in series; each pad measures 2ft by 2ft and contains 48 sensors resulting in a full mat size of 20ft by 2ft with 480 sensors. The sensors are positioned to provide contiguous measurement capability throughout the mat.

To use the Zeno Walkway, the Analysis Laptop with the PKMAS software installed must be used in conjunction with the mat hardware. External hardware such as video, inclinometer, and foot switches may be additionally connected to the laptop and used with the mat.

This document will explain the standard setup of the PKMAS Zeno Walkway Mat without additional peripherals connected.

4. Setting Up

4.1 Area Setup

The PKMAS Zeno Walkway Mat system requires ample space to safely operate with participants. Ensure the area you intend on using the mat in is sufficiently spacious. The mat is 20ft long (approximately 6m) so it is recommended that the space to use this equipment is at least 25ft long (approximately 7.5m) and 5ft (approximately 1.5m) wide. For use of the mat at PERFORM, using one of the Multifunction Labs is recommended.

4.2 Hardware Setup

There are three layers to Zeno Walkway Mat hardware:

- Base layer
- Sensor layer
- Cover layer

Unroll the base layer. Unroll the sensor layer on top of the base layer with the sensors fitting in with the cutouts of the base layer as shown below:

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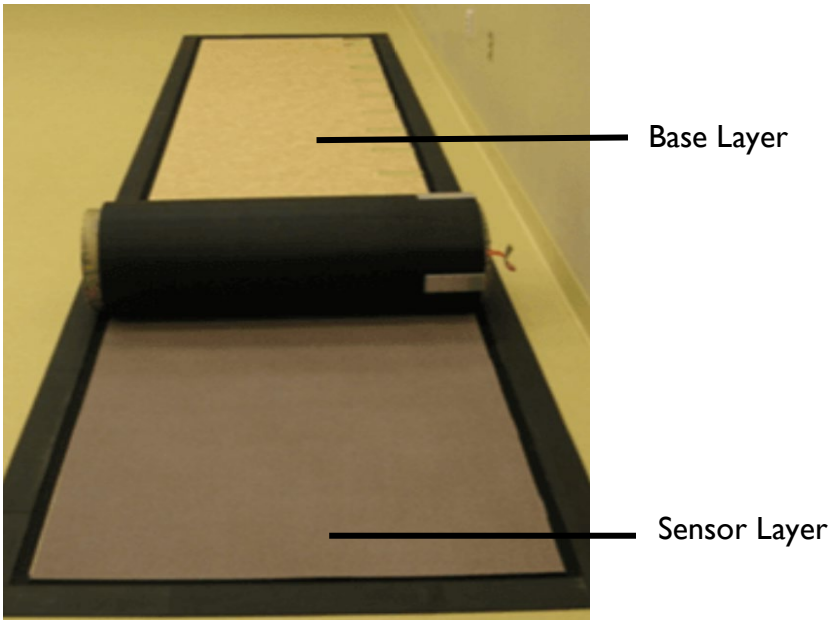


Match the Velcro colours of the cover layer with the Velcro colours of the base layer (i.e. cover layer purple with base layer purple, cover layer black with base layer black) and unroll the cover layer on top of the sensor layer. Ensure that the cover layer Velcro has been secured with the base layer Velcro throughout the entire mat. The assembled mat is shown below:

Plug in the AC adapter to a wall outlet, AC adapter jack and USB cable from the mat into the hardware box, and the USB cable from the hardware box into an Analysis Laptop USB port.

N.B. The mat can be used barefoot, with socks on, with footwear on, and with mobility aid devices such as walkers and canes. **For maintenance purposes, running and footwear where concentrated pressure is applied such as high-heel footwear are strictly prohibited on the mat.**

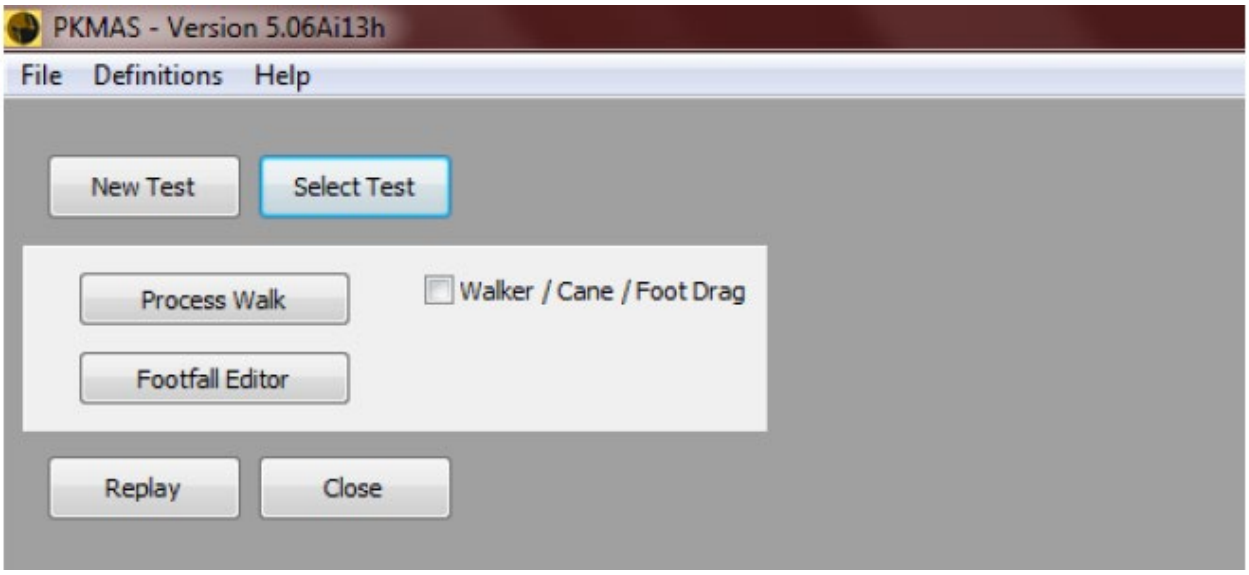
4.3 Software Setup

Plug in the licensed PKMAS software dongle into a USB port. The dongle must be plugged in to use the required software.

5. Software Use

5.1 Collection

The figure below shows the main screen of PKMAS. This is where mat calibration begins.



Clear the walkway mat of any objects; the mat is then calibrated before use by clicking *New Test* from the main navigation screen shown above then *OK* to accept the software warning. Collect the first trial by clicking *Start Walk* then *End Walk* when the trial has completed. Click *Yes* when asked to save the walk to the database. You may now enter participant information. The software is set up to collect the first trial before entering any participant information. Repeat the previous steps for all other trials. Save the trials to the appropriate participant.

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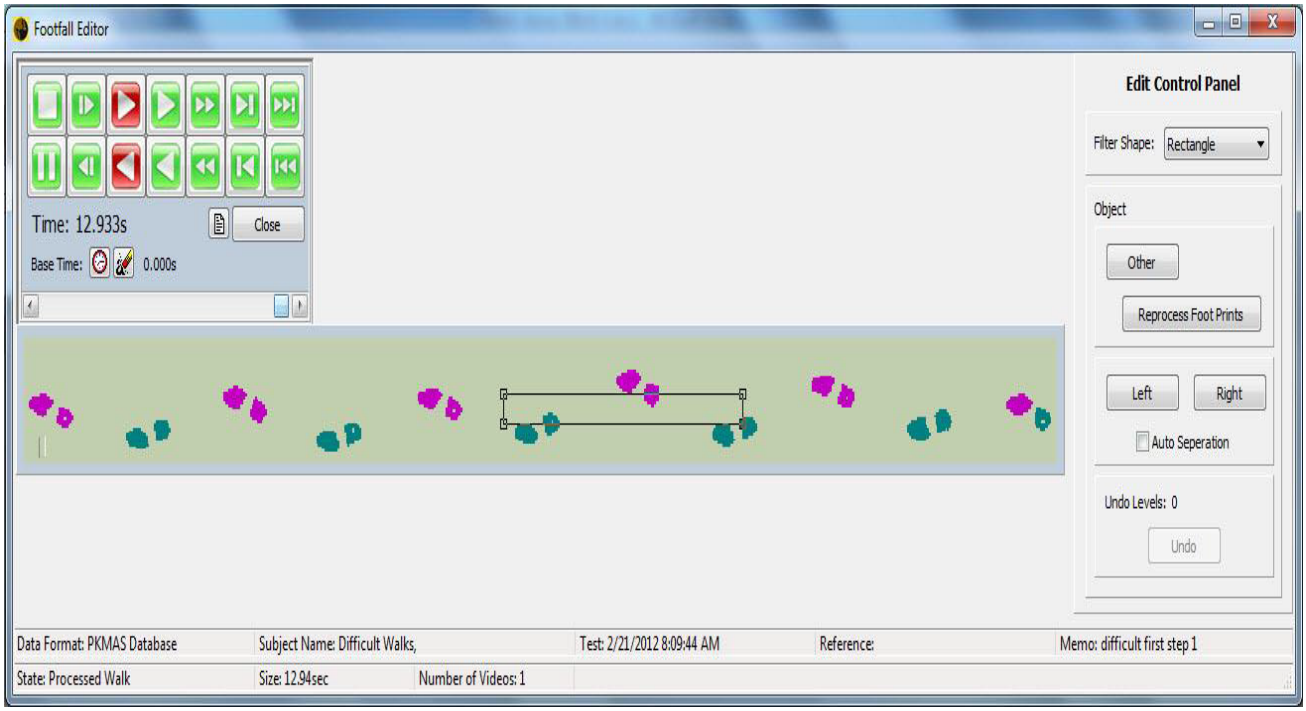
N.B. It is good practice to have a spotter walk off the mat beside with the participant for participant safety reasons.

5.2 Processing

Clicking *Select Test* and find the desired trial and double click on it. The trial will be listed as *Sus* meaning that the trial is suspended and it has not been processed. Click *Process Walk* on the main page. You can do your footfall editing now. *Footfall Editor* (shown below) allows you to replay and edit the trial of interest. For any suspended trials, you must click on *Process Walk* first. The software will not allow you to go into *Footfall Editor* without processing the trial.



The software automatically attempts to process the trial and classify footfalls either as left, right or other. If incorrect, you may reclassify footfalls and objects by enclosing the selection ellipse or rectangle around the object and selecting the correct object label from the *Edit Control Panel*.

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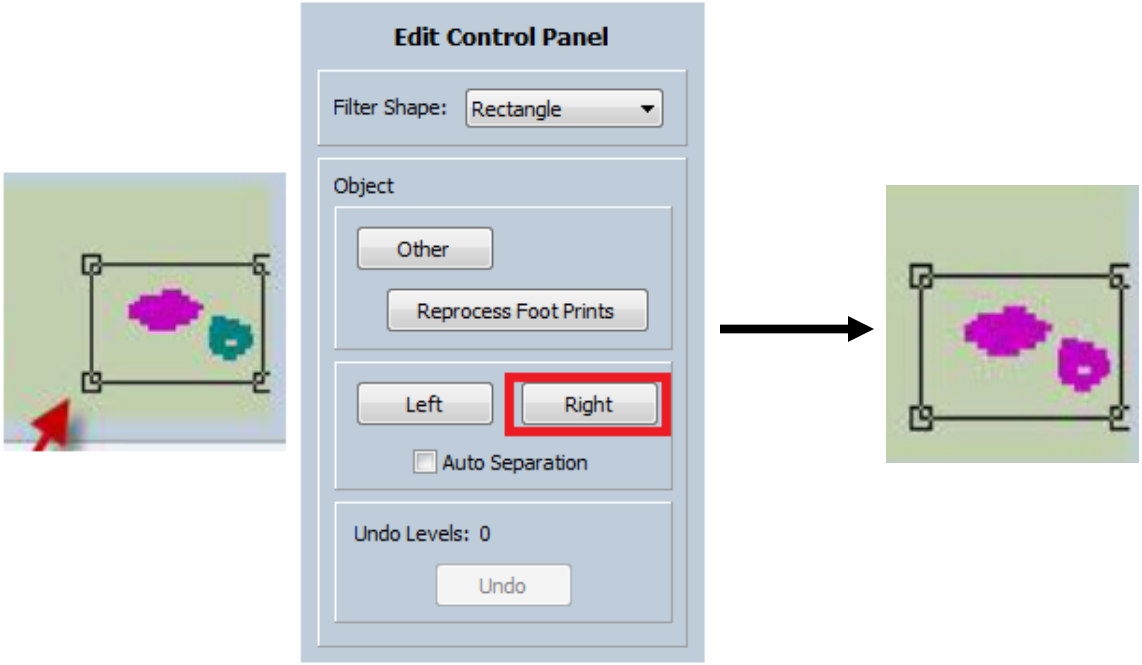

Any footfall (whole or partial) you need to delete or mobility aid devices and foreign objects that the mat picked up must be classified as *Other*. Once a trial has been processed (correctly or not), it will be labeled as a *Walk*.

For a walk that has already been processed, you can go to *Footfall Editor* right away and edit footfalls. If you click *Process Walk* then *Yes* when asked to reprocess current walk data. The walk automatically processed by the software will appear again and any footfall edits you made previously will be lost. This comes in handy if you make a large editing error and want to start over with the original trial data.

N.B. During editing, the *Edit Control Panel* sometimes goes out of view. To bring it back into view, click the Restore down/Maximize window button (this is the button left of the button that closes the program) twice.

5.2.1 Process Walk and Footfall Editor

Both *Process Walk* and *Footfall Editor* bring up the *Footfall Editor* window. The only difference between the two options is that *Process Walk* will initially automatically process your trial for you (i.e. do the computations and try to identify left and right footfalls).

5.3 Replaying Trials

Closing *Footfall Editor* will bring up the main window of the software. Click *Replay* which brings up the view that allows you to replay trials with any edits that you may have made. The figure below shows the controls that are available in *Replay*.

The controls legend is as follows:

STOP | FRAME FORWARD | SLOW PLAY FORWARD | NORMAL PLAY FORWARD | FAST PLAY FORWARD | NEXT STEP | END OF PASS | FIRST STEP

PAUSE | FRAME BACK | SLOW PLAY BACK | NORMAL PLAY BACK | FAST PLAY BACK | PREVIOUS STEP | START OF PASS | LAST STEP

 The *Set Base Time* control will only display data between "Base Time" and "Time". The rest of the data is ignored for replay view. This does not delete data outside of "Base Time" and "Time" but rather the data will not appear in the current view.

 The *Erase Base Time* control will reset the "Base Time" to 0.000 seconds.

These two controls are beneficial when dealing with trials when the participant walks over the same area of mat multiple times and footfalls overlap thus making data processing more difficult. Using the Base Time controls enable you identify each individual footfall clearly and make necessary changes during processing more easily.

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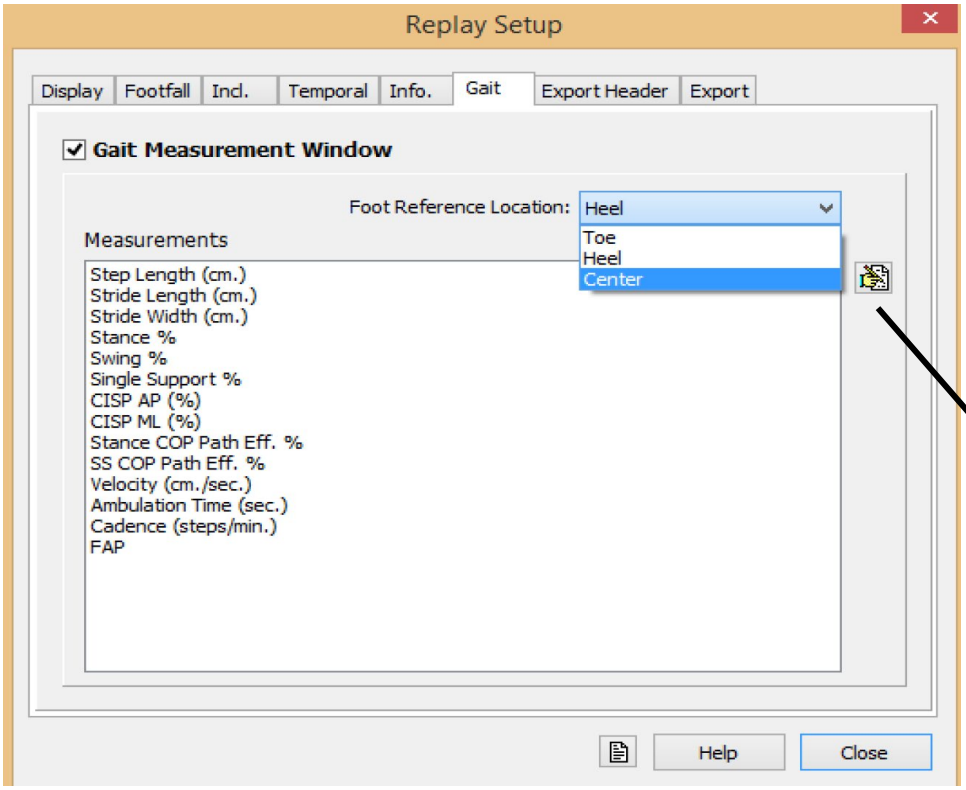
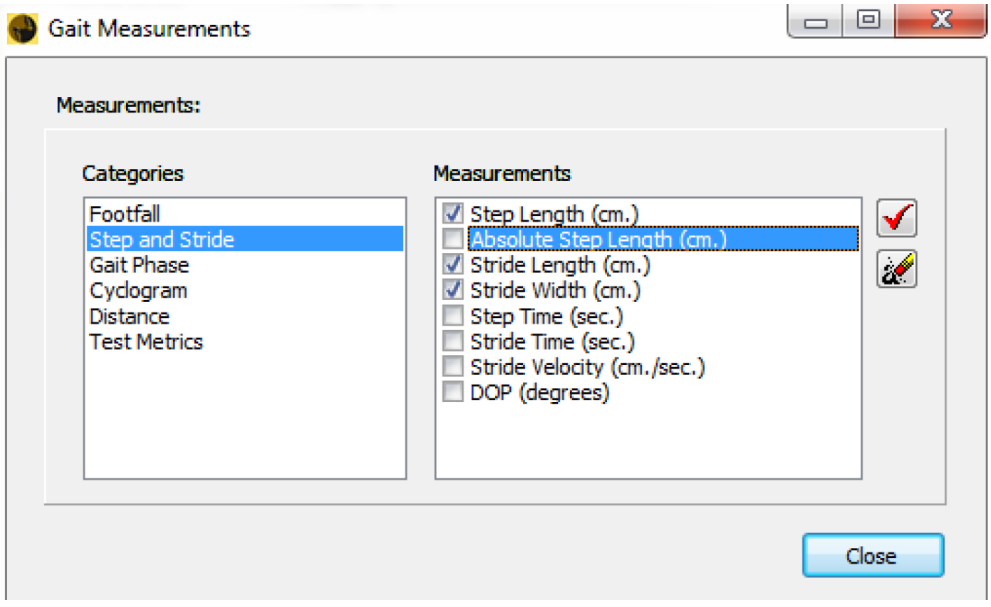
5.4 Exporting Trial Data

Export settings can be customized for each walk. By default, all possible gait outcome measurements are set to be exported for each trial. To change this, click on the *Setup* icon in the main window then the *Gait* tab, then *Edit* icon on the right.



Go through the categories and check off or uncheck any measurements as desired.



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The *Gait Measurements* window located on the right side of the *Replay* window has options pertaining to how to export data. The file format, whether to include individual steps, and which base time to use are the options available to set in the *Gait Measurements* Window.

Gait Measurements — Export Stats Only — Auto Base Time

		Step Length (cm.)	Stride Length (cm.)	Stride Velocity (cm./sec.)
#Samples		5	5	5
#Samples	Left	2	2	2
#Samples	Right	3	3	3
Mean		63.759	124.088	72.097
Mean	Left	61.827	123.240	73.027
Mean	Right	65.047	124.654	71.476
Ratio	L/R	0.950	0.989	1.022
S.D.		4.918	7.347	4.293
S.D.	Left	3.625	2.838	0.407
S.D.	Right	5.965	10.135	5.944
%CV		7.713	5.921	5.954
%CV	Left	5.863	2.303	0.557
%CV	Right	9.171	8.131	8.316
1	Right 1	62.643	117.245	66.053
2	Left 1	59.264	121.233	72.740
3	Right 2	60.658	120.512	70.544
4	Left 2	64.390	125.247	73.315
5	Right 3	71.839	136.204	77.831

Click the Export to Excel icon to open the gait parameter data in Microsoft Excel. In Excel, under *File*, click *Save As* and rename the file to a name that suits your experiment and save it to a location of your choice. The gait data of the trial is now saved in a .csv file format. There is also the option of exporting the file to a .txt file format by clicking on the Export to File icon. This will generate a .txt file of the gait parameter data in the default PKMAS directory.

Checking off *Export Stats Only* will only export data computed from an entire walk and omit data for individual steps. The fields that will be exported when this option is selected are highlighted in yellow in the figure above. To include individual footfall data in the export, uncheck this option.

When checked off, the Auto Base Time option will update the time with the first contact time of the current pass' first footfall. This is beneficial to separate footfalls from different passes.