

KINEMATIC MEASUREMENT SYSTEM

WINDOWS RELEASE

Updated April 2001 Release 2001.1.4

POWER ♦ SPEED ♦ AGILITY

TESTING ♦ TRAINING

**"state of the art time measurement systems for sport and
rehabilitation".....**

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Welcome to the Kinematic Measurement System

Kinematic Measurement System has been developed as a "state of the art performance measurement system for sport and rehabilitation". It combines an inexpensive yet accurate contact mat with easy to use and powerful software specifically written for the measurement; collection and analysis of time related performance tests. Performance testing of your athletes can provide a great deal of information about their speed, power and agility as well as serve as a motivating training tool.

Results calculated and stored by the Kinematic Measurement System include run time, flight time, contact time, velocity, momentum, fatigue indexes and power output. Thousands of trials can be stored on the computer including the athlete's name, type of test, date, time and test results. All tests can be pasted to Microsoft Excel for data storage and processing.

The software will run on any IBM PC compatible computer using Windows 95/98/ME.

Time measurement is accurate to 1/1000 second. Digital microchip technology ensures the highest level of reliability and validity of measurement. More test options are constantly being added in response to customer feedback and attention to the sport science research. Upgrading to the latest version is easy so the Kinematic Measurement System you buy today will not be obsolete tomorrow. We offer an upgrade policy on software to our customers.

Not just testing! You can use the Kinematic Measurement System as a training tool to increase the speed and power of your athletes. Athletes can time themselves and compare their results with their peers. The instant display of the results informs the athlete as to his/her progress. For the jump testing you can set a target jump height or power output and the athlete receives instantaneous feedback on their performance. During plyometric training the contact time on the ground can be instantaneously provided to the athlete to improve training efficiency.

Easy to use. Operation of the Kinematic Measurement System is based on a simple menu system which coordinates data collection and storage. All you do is select the test you require then the computer instructs you how to run the that test.

Research and development has produced the ultimate in performance measurement for sport and rehabilitation. Gone are the days of the jump reach test and plyometric training without performance feedback. The Kinematic Measurement System measures records and stores time and related data with ease and accuracy.

Use any spreadsheet software package to analyze day to day test results. Modern spreadsheet packages provide good data analysis facilities together with performance plotting using extensive chart options.

About this manual

This manual is divided into two main sections. The first deals with the hardware ie. Contact mat, cables, lights and the second deals with the software eg. Computer program and data. At the end of this manual you will find a very useful section on **Commonly Asked Questions** and **Trouble Shooting**.

Getting Started

Installing the software

Three installation disks are provided. To install the software on your computer:

1. insert disk 1 into the floppy drive
2. click on the Start button, and select 'Run'
3. Enter 'A:\setup.exe' into the textbox labeled 'Open' or browse to the floppy disk and select 'setup.exe'
4. Click OK and follow the prompts to install the software.

Having installed the software you only have to plug our interface connection lead into your computer. Attach the mat or other switches to your computer, plug the end of the cable into the parallel printer port of your computer (25 pin, female D-shaped socket as per parts list.)

Downloading the Latest Version

Once you have purchased a license for the Kinematic Measurement System, you are entitled to free upgrades for the lifetime of the product. These can be obtained from the Innervations website www.innervations.com or contact us and we will mail you disks or CD versions of the latest software.

Kinematics Measurement System: The Hardware

Hardware in computer terminology is anything that you can physically touch. In the case of the Kinematic Measurement System it is the contact mat, cabling, computer and timer attachments.

Contact Mat

The contact mat uses two layers of conductive foil sandwiching a thin sheet of foam rubber holding the layers apart. When compressed the foil sheets contact closing the switch. This mat works very well however it is prone to damage from rough treatment. Please avoid:

- Sharply folding the mat
- Using spikes or studded shoes
- Using the mat on rough surfaces

For increased life of the mat:

- Place a piece of carpet, rubber or a towel over the top when using the mat
- If the floor surface is rough, place a protective sheet under the mat

Warning: The contact mat may be slippery under certain conditions, i.e. sweat. Please place suitable covering over the mat to avoid slipping off the mat or causing injury. Whilst this mat comes with an anti slip mat cover (Part No. KMS597) a large heavy-duty rubber type overlay mat up to 5 x larger in surface area than the contact mat, may be required for some test applications.

Cabling

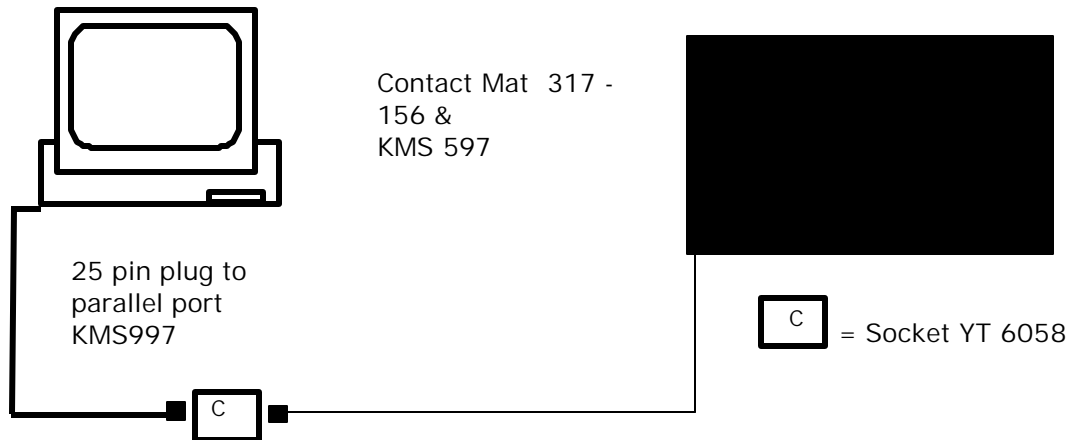
There are two types of cables in the Kinematic Measurement System.

- 1 Four-wire data cable connecting the various switches (Part Nos. KMS687 & KMS1397.)

- 2 A modular connector to DB25 cable that allows the switch cable to be connected to the parallel port of any IBM compatible computer (Part No. KMS997.)
A US 6/6 Double Adapter allows you to join the cables in different Combinations (Part No. YT 6056.)

Note - When inserting or removing plugs ALWAYS hold onto the plug itself. **DO NOT PULL ON THE CABLES.**

To use only the contact mat with the software follow the below diagram.



Caution: Do not plug in or unplug cables to the computer when the power to the computer is ON.

Timer Attachments

Now the Kinematic Measurement System can be used with various timer attachments additional to the contact mat. These attachments are referred to as switches and are used to detect time events. These include:

- Infra red light beam and reflector
- Hand/foot switch
- Sound activated switch

Infra Red Light Switch

These lights are high quality, industrial, pulsed infra red polarized light, in this set up Part No. 'Omron 57E3F2R2C4' photo electric cells have been configured. They use an infrared beam, which is emitted by the unit and reflected back to a receiver in the same unit. The beam is pulsed at a certain frequency so that the unit knows the light it receives is in fact what it emitted and not transient light from the environment.

The light switches have an operating range of up to 3 metres (9 feet) between the unit and the reflector. However, it is advisable to place the reflector as close to the light as possible to make it easier to align the beam. The distance should however be great enough so as not to interfere with the athlete's path between light and reflector.

Adjust the height of the light, to best capture, the passing body. That is at the hip level in running tests, as this will minimize interference from the arms and legs. When aligning the light with the reflector

look along the beam and you should see a red reflection in the reflector when they are aligned. An LED indicator will illuminate on top of the infra red light when the beam is correctly aligned. The LED pilot on each light will go off when the infra red beam is broken as any mass is passed through it.

To determine if the computer is registering the light switches select **Switch Status** under **Options** in the Main Menu and the computer will report their current status. The switch will be OFF when the lights are correctly aligned.

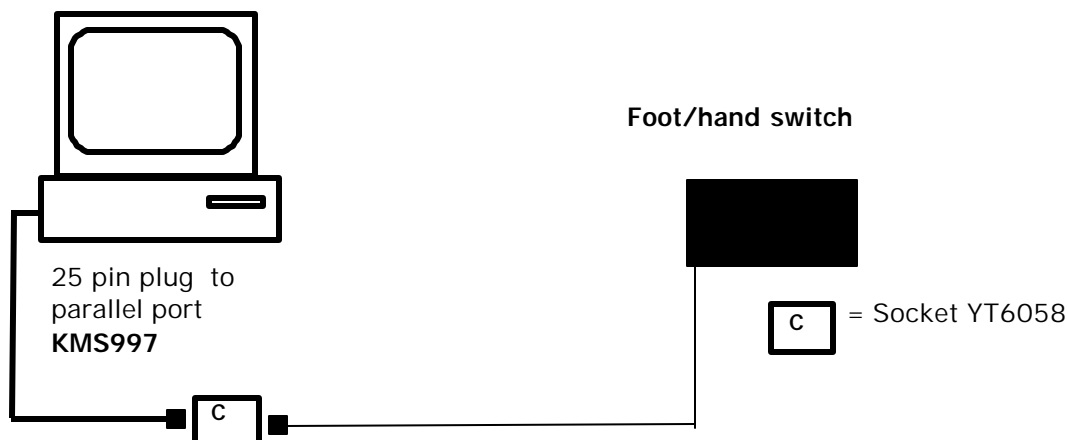
Note - None of the tests will proceed if any of the switches are already ON. When the light beam is blocked or not aligned the switch is held in an ON state.

Hand/Foot Switch

This switch can be used for standing starts and triggered with either the hand or the foot. It can be triggered in two ways: a) switching it ON by pressing downwards or b) holding it ON for more than 2 seconds. For b) the program detects that the switch has been held ON and therefore waits for it to go OFF (released) before starting the timer.

If you would like to use only the foot/hand switch with the software, follow the below diagram.

To use only the foot/hand switch with the software follow the below diagram.



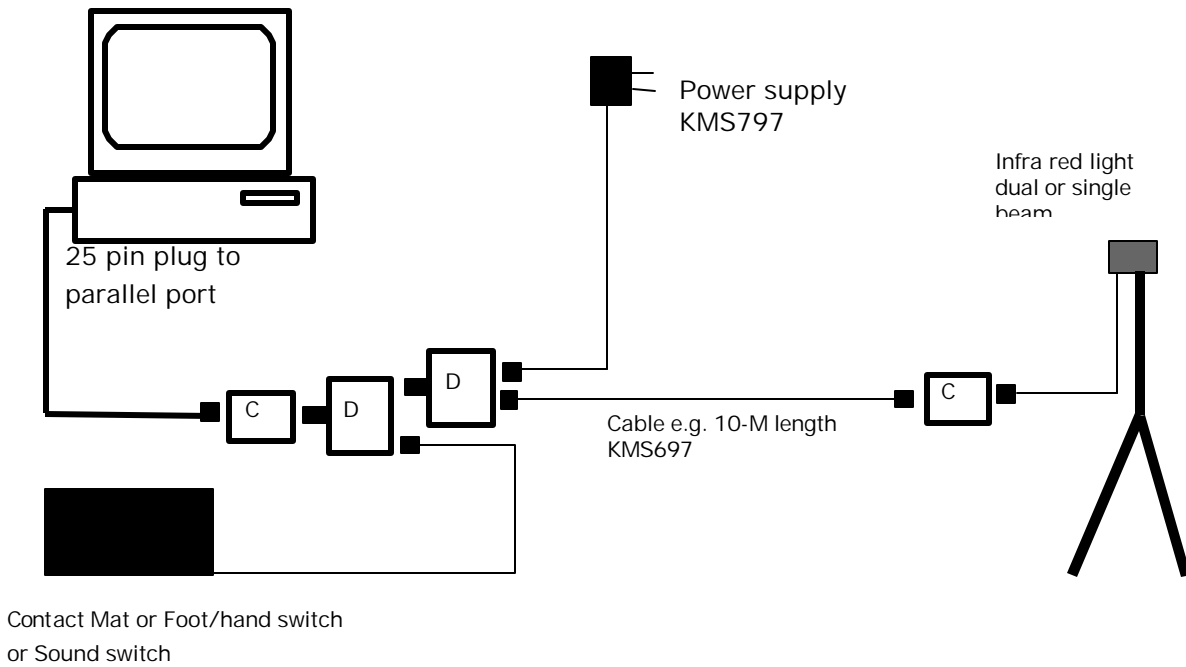
Sound Activated Switch

This switch can be activated by any loud noise such as a starting gun or shout. It has been tuned however so that other noise will not trigger it. The triggering noise must be loud and very close to the microphone tip. For use, place the box on the ground and pin the microphone tip close to the trigger source. This may be the handle of the starting gun however it does not need to be right next to the hammer. This may damage the microphone due to powder burns. Refer Part No. KMS1097

Sample Combinations using the Timer Attachments

Connecting all the various lights, mechanical switches and power supply can appear quite confusing at first, there is however a simple rule of thumb to follow. All switches and the power supply should be plugged in pointing back to the computer. Only the lead from the computer and the one end of the 10M joining cables should be plugged into the couplers from the computer side. If you do not connect the system up correctly, the lights will not illuminate and the system will not function. Here are a few examples to illustrate the rule of thumb.

1. Foot/Hand Switch or Contact Mat or Sound Switch with one light

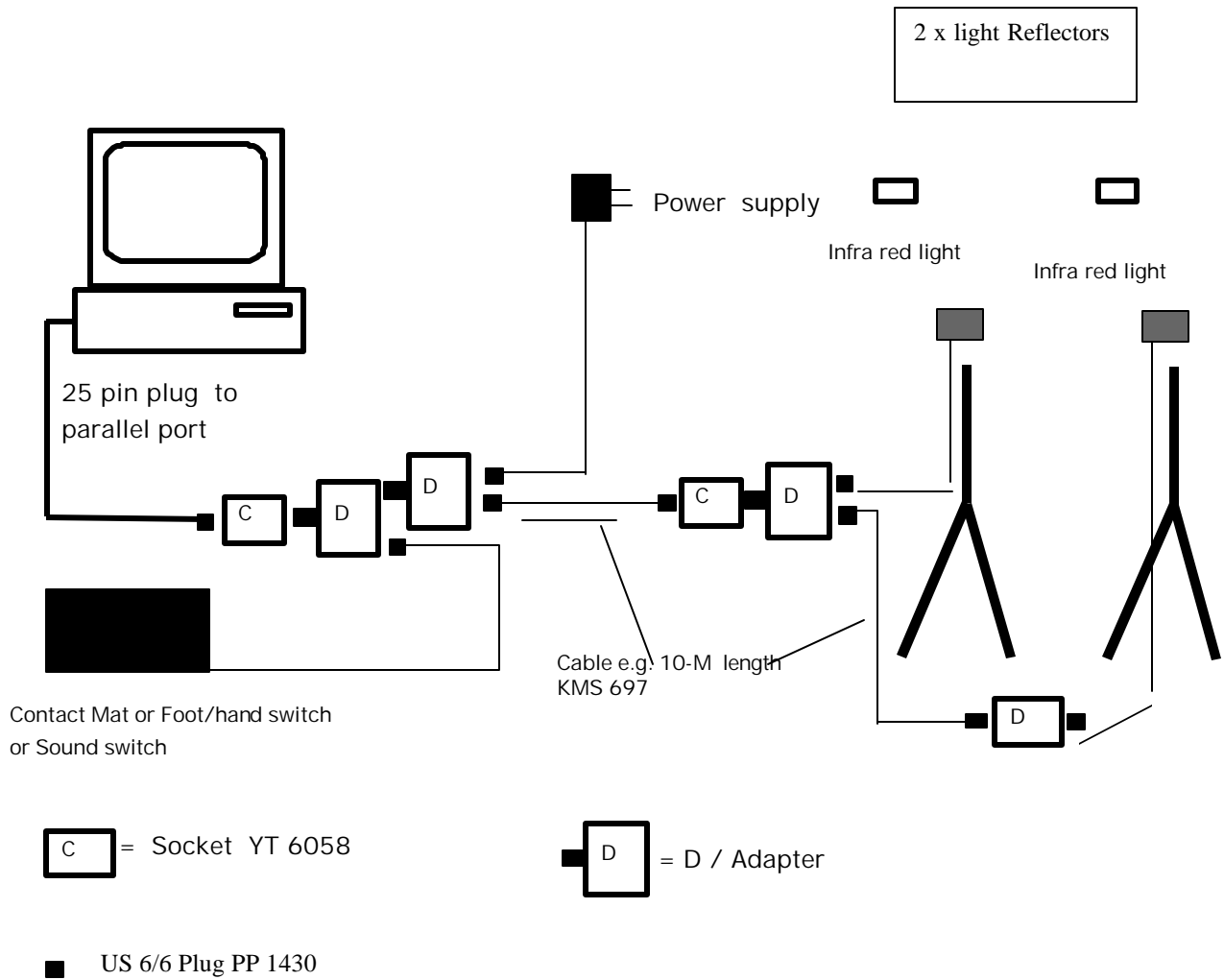


C Socket YT 6058

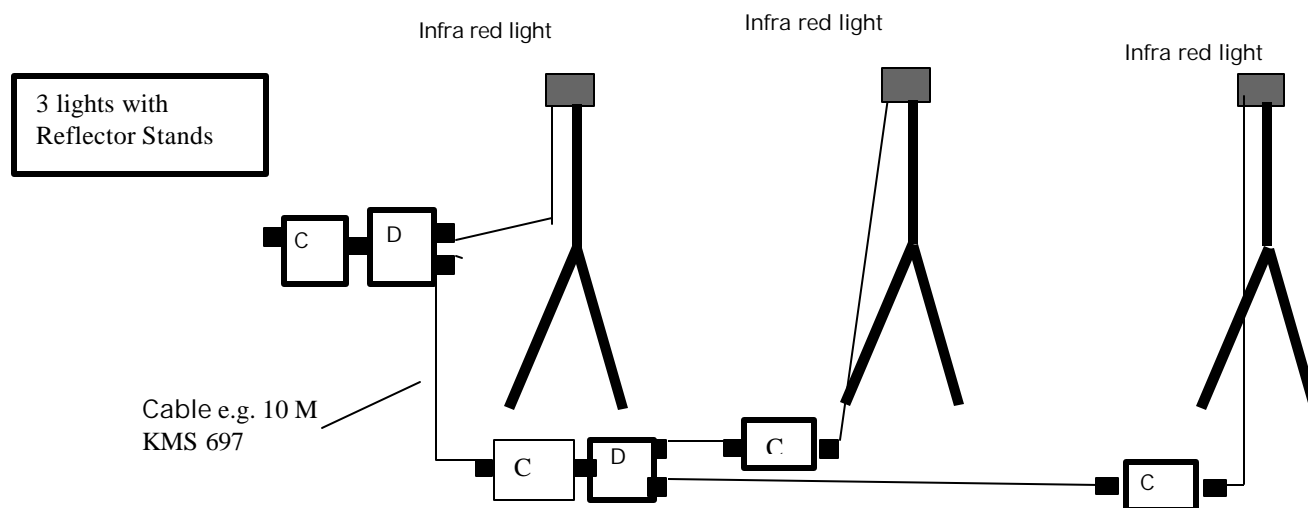
D = D / Adapter KMSYT6056

■ US 6/6 Plug PP 1432

2. Foot/Hand Switch or Contact Mat or Sound Switch with two lights



3. This diagram illustrates how to connect additional lights



Kinematic Measurement System: The Software

Software consists of the programs that run on the computer. This program is called the **Kinematic Measurement System (KMS)**

The Kinematic Measurement program is a Windows program with a Toolbar & a pull down menu system.

KMS Main Menu / Pull-Down Menu System

The menu system consists of a **main menu** across the top of the screen and pull down submenus. Use the arrow keys or capital letter of each option to highlight your selection then press Enter. Following is a summary of the menu options.

File Edit View Tests Tools Window Help

File

The pulls down options are all standard Windows functions they are:

New
Open
Save
 Save As
Exit

These are standard Windows functions

- Basically we start by opening a New RTF document which we copy and past test results to.
- On completion of tests we may Save these RTF documents in any created folder format which we can Open at any time in the future.
- However most users tend to Open a New RTF document which they copy and past test results to.

- They then may Save these test results to a Microsoft Excel format. Hence Excel is the most common data storage and retrieval format used. Tests are normally printed out via Excel files too.
- * **To learn how to do tests we start by opening a New RTF document**

Edit

The pulls down options are:

Cut

Copy

Paste

Select All

These too are standard Windows functions

View

Subject Info

- Click & open then add or delete Subjects

Timer

On- Screen Switch

- Click & open this function it is a handy on screen test set up function

Toolbar

- Activates or de activates the Toolbar functions the KMS uses

Status Bar

- On the bottom line of the screen this function activates or de activates the name of the Subject selected for any Test.

Options

- this Window allows you to input the following parameters

Bounce Delay (mS)

Target Time (s)

Target Number

By clicking with your mouse on any of these options these we open all these functions on your screen & a tick **⓪** is activated at the time this function is performed. By clicking on the selected option again the tick **⓪** is de activated and that screen displayed option closes too.

Tests

Select from this Test from the pull down Menu Options

StopWatch

Running

Jumping

First Step Quickness

Contact Time

Gait Analysis

* **Remember to set all Test parameters first, refer:**

- **View > Options settings**
- **If setting any timing gate test parameters then prior to opening the required Tests selection go to:**
- **Tools> Gate Setup & edit the required gate numbers & distance between each gate measured from the starting gate position**

Tools

Select from this Tools pull down Menu Options

Gate Setup

- Edit the required gate numbers & distance between each gate measured from the starting gate position

Timing Resolution

- Displays the Test Timing Resolution and the accuracy of the PC that the KMS software is operating on.

Window

Select from this Windows pull down Menu Options

Cascade

Tile Horizontal

Tile Vertical

Arrange Icons

- This Window also displays the KMS functions opened at any time

Help

Select from this Help pull down Menu Options

Contents

- Provides a on screen Tests Table of Contents

Search For Help On

- Opens Find setup Wizard Window with all options

About KMS

- Open this function to register your software license
- Provides details of licensed software

Print the Data

Print the data you have just collected, or a file on disk if no data has been collected or loaded as yet. If you have already collected and saved some data this option will print the current file. If you want to print a file on disk, open it first then select print. **Tests are normally printed out via Excel files.**

If you encounter a **Printer Error** check to see that

- 1 the printer is correctly attached to the computer
- 2 there is paper in the printer
- 3 printer is turned ON and switched "on-line"

Note: The Kinematic Measurement System uses the printer port LPT1 that is most likely to be the only printer port on your computer. If you wish to print:

- 1 Turn OFF the computer and printer
- 2 unplug the lead attaching the contact mat to the computer
- 3 Plug in the printer cable lead
- 4 Switch ON the computer and printer

Stopwatch

This option is the simplest function to use in the Kinematic Measurement System. The program operates in the same manner as a manual stopwatch, however the start and stop buttons are replaced by the switch input. After selecting *stopwatch* from the **T**ests menu.

The functions in this Window titled, stopwatch is:

Start **S**top **S**plit **R**eset **C**opy

Running Tests

This allows you to run specific tests, which involve a start switch and single gate or multiple gates stop switches. Examples of single stop tests include the 40-metre dash, all race timing and single stop time agility tests. Examples of multiple stop tests include all timing applications, which involve split times.

Single Gate

This test involves a single start switch and a single stop switch. This is ideal for timing such activities as a 40-metre dash or an agility test. The system measures the time between the two switch pulses and reports it. If you have entered the distance between the start and stop points and the weight of the subject, average velocity and average momentum will also be calculated:

$$\text{Velocity} = \text{distance} / \text{time} \qquad \text{momentum} = \text{velocity} \times \text{body weight}$$

When using the contact mat or foot/hand switch as a start switch, ensure that the subject holds the switch ON for at least two seconds prior to starting. The system will sense that the switch is being held ON and will reset and wait for the switch to go OFF as the signal to start timing.

Multiple Gate

This test involves a single start switch and multiple stop switches. This is ideal for timing activities where you require split times. For example, if you placed contact mats at each end of a 10-m agility run the system would be able to determine the time and average velocity between each point. The system measures the time between each consecutive switch pulse and reports it. Prior to running the test you must enter the number of stop gates that will be used and the **distance between the start and each consecutive gate**. The computer calculates the average velocity and average momentum for each section as well as the overall average.

$$\text{Velocity} = \text{distance} / \text{time} \qquad \text{momentum} = \text{velocity} \times \text{body weight}$$

Once again, when using the contact mat or foot/hand switch as a start switch, ensure that the subject holds the switch ON for at least two seconds prior to starting. The system will sense that the switch is being held ON and will reset and wait for the switch to go OFF as the signal to start timing. Each subsequent contact with the mat will register as a split or stop time.

First Step Quickness

This option allows you to test and train quickness of movement after receiving a visual stimulus. The computer will indicate a direction to move (ie. forward, back, left or right) and then time the subject as they release a switch (contact mat, foot/hand switch, and light beam). This time includes both reaction time and movement time. The test can also be set up to record the time to move to a certain point and trigger a switch. This is excellent for developing first step quickness and reaction time.

Power Tests

Jumping Tests

This Window has 3 test options

Single

Target **T**ime

Target Number

This allows you to run specific tests, which involve jumping activities. Either single or multiple jumps can be measured with the calculation of time in the air, height of jump, power output, contact time etc.

Single Jump / Counter Movement Jump (Plyometrics)**Single Jump**

This test implements a vertical jump test. When you are ready to begin the test the subject steps onto the contact mat. Click on the Start button window for this test and then jump. When the Subject jumps vertically up and lands back on the mat again, the system measures the time that they are in the air. It is important that the subject leave the mat with the knees and ankles extended and that they land in a similarly extended position. If they tuck the legs they will extend the time in the air and produce erroneous results. If the test is completed correctly the height that the body's centre of gravity rises to can be calculated. This is an accurate indication of jump height.

Counter Movement Jump (CMJ)

When you are ready to begin the test the Subject steps onto the jump platform and then jumps onto the mat. When the subject jumps vertically up and lands back on the mat again, the system measures the time that they are in the air.

Power output is also calculated based on jump height and the mass of the subject. The absolute power is the average power output during the jumping movement and the relative power is adjusted for body weight.

$$\text{Jump height} = (g \times \text{flight time} \times \text{flight time}) / 8$$

If the subject starts standing on the mat the formula developed by Harman, et al, Journal of Applied Sport Science Research, 5(3): 116-120. 1991 is used.

$$\text{Absolute power (W)} = 21.1 \times \text{jump height (cm)} \times 23.0 \times \text{body weight (kg)} - 1,393$$

If the subject lands on the mat and then jumps the normal projectile motion equations are used.

$$\text{Absolute power (W)} = \text{body weight} \times g \times \text{jump height} / (\text{contact time}/2)$$

$$\text{Relative power} = \text{power} / \text{body weight}$$

Where:

$$g = \text{gravitational acceleration (9.81m/s/s)}$$

For CMJ the subject does not begin by standing on the mat but rather, lands on it and then jumps immediately, the contact time prior to the jump is also measured. The flight to contact ratio is calculated as the flight time divided by the contact time. This test can be used to assess drop jump performance. Two mats can be joined in series if it is required for the athlete to take off from one mat and land on another. Please contact Innervations for details on the second mat option.

If there is a problem with false readings eg. When the athlete shuffles on the mat prior to jumping, increase the bounce delay time.

Jump for Target Time

This test implements a vertical jump test but with multiple jumps. Prior to the test you must select a subject and their weight or enter this information along with the target duration of the test. This is the time period over which the subject will jump continuously.

When you are ready to begin the test the subject steps onto the contact mat and the system will register that they are standing on the mat. Instruct the subject to begin jumping for maximum height. Each time they land the knees should flex to about 90 degrees and they should jump again immediately.

Each time the subject jumps vertically up and lands back on the mat again, the system measures the time that they are in the air and the time they are in contact with the mat. As with the single jump test, it is important that the subject leave the mat with the knees and ankles extended and that they land in a similarly extended position. If they tuck the legs they will extend the time in the air and produce erroneous

results. The total time in the air (total flight time) and the total time on the ground (total contact time) are measured and the number of jumps counted. The total jump height and average per jump are calculated as well as absolute and relative power output.

The power output for each individual jump is calculated and indicates the jump efficiency ie. How high can the subject jump for a given period on the ground generating the jump forces. The first three jump heights and the last three jump heights are recorded. They are then averaged and a "fatigue index" calculated. This may indicate the subject's ability to maintain good jump height over time ie. Jump endurance. A similar process is completed for contact time and percent change from the start to the end of the test is calculated. This may indicate that the subject spends more or less time on the ground as they fatigue. Formulae are as follows:

$$\text{Jump height} = (g \times \text{flight time} \times \text{flight time}) / 8$$

Power for each jump during the set is calculated as

$$\text{Absolute power (W)} = \text{body weight} \times g \times \text{jump height} / (\text{contact time}/2)$$

After the set is completed, a better indication of the average power over the set is calculated according to the formula developed by Bosco, et al, European Journal of Applied Physiology, 50: 273-282. 1983.

$$\text{Relative power} = g \times g \times \text{total flight time} \times (\text{total flight time} + \text{total contact time}) / (4 \times \text{number of jumps} \times \text{contact time})$$

Where:

$$G = \text{gravitational acceleration (9.81m/s/s)}$$

$$\text{Absolute power} = \text{relative power} \times \text{body weight}$$

$$\text{Fatigue index for flight} = \text{final flight time} / \text{initial flight time} \times 100$$

$$\text{Fatigue index for contact} = \text{final contact time} / \text{initial contact time} \times 100$$

Jump for Target Number

This test implements a vertical jump test but with multiple jumps. Prior to the test you must select a subject and enter the target number of jumps to be completed.

When you are ready to begin the test the subject steps onto the contact mat and the system will register that they are standing on the mat. Instruct the subject to begin jumping for maximum height. Each time they land the knees should flex to about 90 degrees and they should jump again immediately.

Each time the subject jumps vertically up and lands back on the mat again, the system measures the time that they are in the air and the time they are in contact with the mat. As with the single jump test, it is important that the subject leave the mat with the knees and ankles extended and that they land in a similarly extended position. If they tuck the legs they will extend the time in the air and produce erroneous results. The total time in the air (total flight time) and the total time on the ground (total contact time) are measured and the number of jumps counted. The total jump height and average per jump are calculated as well as absolute and relative power output.

The power output is calculated and indicates the jump efficiency ie. How high can the subject jump for a given period on the ground generating the jump forces. The first three jump heights and the last three jump heights are recorded. They are then averaged and a "fatigue index" calculated. This may indicate the subject's ability to maintain good jump height over time ie. Jump endurance. A similar process is completed for contact time and the percent change from the start to the end of the test is calculated. This may indicate that the subject spends more or less time on the ground as they fatigue. Formulae are as follows:

$$\text{Jump height} = (g \times \text{flight time} \times \text{flight time}) / 8$$

Power for each jump during the set is calculated as

$$\text{Absolute power (W)} = \text{body weight} \times g \times \text{jump height} / (\text{contact time}/2)$$

After the set is completed, a better indication of the average power over the set is calculated according to the formula developed by Bosco, et al, European Journal of Applied Physiology, 50: 273-282. 1983.

$$\text{Relative power} = g \times g \times \text{total flight time} \times (\text{total flight time} + \text{total contact time}) / (4 \times \text{number of jumps} \times \text{contact time})$$

where:

$$G = \text{gravitational acceleration (9.81m/s/s)}$$

$$\text{Absolute power} = \text{relative power} \times \text{body weight}$$

$$\text{Fatigue index for flight} = \text{final flight time} / \text{initial flight time} \times 100$$

$$\text{Fatigue index for contact} = \text{final contact time} / \text{initial contact time} \times 100$$

For a detailed explanation of the use of the Kinematic Mat System for the evaluation of strength, power, endurance and elasticity in jumping, please refer to a paper by Dr. Carmelo Bosco, titled "Evaluation and control of basic and specific muscle behaviour" Part 1 appeared in Track Technique, Number 123 pp. 3930-3933,3941 and Part 2 appeared in Track Technique, Number 124 pp. 3947-3951,3972.

Contact Tests

Three tests are available under the Contact Tests option. The tests include:

Contact Time (suggested Bounce Delay setting 5 mS.)

Contact time is a single measurement of time that a contact mat is ON. For example if the subject runs over the mat or lands and jumps from the mat, the time of which they are in contact with the mat will be recorded.

Fast Feet test (suggested Bounce Delay setting 5 mS.)

Fast feet test indicates neural speed and coordination. The subject moves the feet alternatively up and down as quickly as possible. The frequency of movement is measured. Before starting the test enter the duration of the test in seconds. One foot should be placed on the mat and one to the side. The system will register the foot on the mat and tell you when it is ready. Instruct the subject to begin moving the feet up and down on the spot as rapidly as possible. The number of foot contacts are recorded and the frequency calculated in Hertz (contacts per seconds) as follows:

$$\text{Frequency} = \text{contacts} / \text{duration of test}$$

Gait Analysis Test (suggested Bounce Delay setting 5 mS.)

This test is useful for assessing imbalance in the muscles of the legs. The subject jogs on the contact mat and the average flight and contact times for each leg are measured. The ratios for contact time and flight time are also calculated.

Enter the desired duration of the test. The time should be at least 30-60 seconds or long enough to produce a representative average. Instruct the subject to begin jogging on the spot just behind the mat. **When they have established a consistent pattern** they should **jog forward with the right leg contacting on the mat first** and continue jogging on the spot on the mat. This test can also be done using right to left hopping movements. The flight and contact times for each leg are measured and the ratio right to left is calculated:

Right to Left Flight Ratio = (average right flight time / average left flight time) x 100

Right to Left Contact Ratio = (average right contact time / average left contact time) x 100

Options

View

Options

This is where the operation of the timing system can be customized.

First ON – The first ON signal and subsequent OFF is recorded as the representative timings and the second ON/OFF combination is ignored. **A good option for the fast feet and first step quickness tests if the pressure contact mats only are used.**

Second ON – The second ON signal and subsequent OFF is recorded as the representative timings and the first ON/OFF combination is ignored.

Average ON and OFF – The first and second ON signals are averaged and this time is recorded as the representative ON signal. Also, the first and second OFF signals are averaged and this time is recorded as the representative ON signal. **This option could be used with timing sprints using light gates as the average of the ON times will be recorded as the gate time.**

Longest ON – The signal which had the longest time between the ON and subsequent OFF signal is recorded as the representative timings and the other ON/OFF combination is ignored. **This is the recommended option for timing sprints and first step quickness tests, using light gates, as the trunk passing through the beam should produce the longest ON signal.**

Skip false switch change – The middle OFF and subsequent ON signals are assumed to be a bounce or false signal and are removed. **This is possibly the best option for any mat tests as it will effectively remove any switch bounces that occur both on landing and takeoff. Therefore it is recommended that this option be used for any of the jump tests and the contact time test**

Set Bounce Delay

Bounce delay is the minimum time between switch changes, which should be interpreted as a true reading. If this time is not exceeded the signal will be ignored. This is an important setting because it reduces the problem of switch bounce. Switch bounce can occur when any mechanical switch acts, however the time between signals is generally very small eg. Approx. 100 m Sec. You should set bounce delay set to 20mS Max for any contact mat tests. Refer Options on Page 15.

Frequently Asked Questions

Q. I cannot run a test and the computer keeps telling me one of the switches is ON. What do I do?

A. Check the cable and switch connection. Is any object in contact with the mat? Is one of the lights not correctly aligned? If you are using timing lights check that the battery terminal polarity is correct. Red + Black-

Q. Can I print to a normal printer?

A. Yes. If you have a parallel printer and cable simply unplug the KMS cable to the parallel port and plug in your cable. The programs, including KMS will print. Normally most users prefer to print after the tests have been pasted to a Microsoft Excel file format.

Q. How do I contact Innervations if something goes wrong or I have a question?

A. Innervations provides unlimited telephone, email, internet or FAX support. Please contact us, full details are all listed at the end of this manual

Trouble Shooting

Symptoms	Cause	Remedy
Computer does not register contact with the mat	Interface cable not plugged in correctly	Check cable from contact mat to parallel port of computer
	Contact mat or cables damaged	Contact Innervations for a replacement
Computer misses some switch changes	Bounce Delay is too long	Set bounce delay to half the minimum possible time between switches
Computer counts two or more events as the athlete breaks the beam.	Bounce Delay is too short	Set bounce delay to half the minimum possible time between switches

Porta Kit 4 gate components

Kinematics Measurement System Feb 2000 Release

Works with any PC using W95 or later Versions

Innervations KMS 4 Gate Porta Kit + options 2000 price list

- This Porta Kit can be expanded to accommodate as many extra timing lights sets that may be required over any distance. However we recommend plugging in an extra battery every 100M to eliminate any possible voltage drop. The timing lights need a minimum supply of 10V DC.
- * We only supply a 240 V AC 50 Hz / 12V 350 m A Battery charger with our Porta Kits supplied to Australia. Mains supplies and power plug connections vary from country to country so, other than in Australia, all that is required is the purchase of a low cost lead acid or Gel type 12V DC battery charger with a 350 mA or greater charging output. All other connections supplied are standard international connections.
- **Optional Extras to this Porta Kit are:**
- Heavy Duty non-slip Bridgestone Pressure contact mats 70 x 50 x 1.2cm Each mat weighs 5 Kg.
- Additional sets of timing light complete with all fittings.
- **Prices below do not include freight or import duties and taxes.**

Item Descriptions	Length Metres	Part No.	No Req.
KMS 4 Gate Porta Kit Total weight 18 KG			
Porta Trolley 62 x 38 x 42cm (with retractable handle) Includes all the following:		ZAG-33001	1
2 Pair Flat Telephone Flex Cable with...	1 x 10M	WB-1620	1
US 6/6 Plug Connections		PP-1433	1
D25 Plug		PP-0840	1
D25 Backshell		PM-0848	1
Pressure Contact Mat 29"x15"		317-156	1
Mat Cover		KMS597	1
Pressure Mat US6/6 Socket Interface with:		YT-6058	1
3AG In Line Safety Fuse Assembly		SZ-2015	1
Spare 3AG Quick Blow Fuses 2 Amp		SF-2194	3
KMS Software			1
2 Pair Flat Telephone Flex Cable with:	2M		3
US 6/6 Plugs		PP-1433	6
12V 1.3AH Sealed Lead Acid Battery		SB-2480	1
12V Battery Charger 350mA		MB-3517	1
Test Light Switch (for connection testing)		KMS1017B	1
Hand held starting 120 dB switch		KMS1017	1

4 x pairs 9 (8 Stands) of First 3 Section Tripod Camera Stands Complete including:		2176	8
Infra Red Photo Electric Cell & Reflector		57E3F2R2C4	4
Cell & Reflector Mounting Brackets		KMS 297	8
6/6 Socket connection interface		YT-6058	4
2 Pair Flat Telephone Flex Cable with...	10M	KMS 697	3
US 6/6 Plugs		PP-1433	6
Telephone plug Adapters		YT-6056	8

Optional Accessories

Timing light sets comprising :

4 x pairs of First 3 Section Tripod Camera Stands		2176	2
Infra Red Photo Electric Cell & Reflector		57E3F2R2C4	1
Cell & Reflector Mounting Brackets		KMS 297	2
6/6 Socket connection interface		YT-6058	1
2 Pair Flat Telephone Flex Cable with...	10M	KMS 697	1
US 6/6 Plugs		PP-1433	2
Telephone plug Adapters		YT-6056	2

Porta Trolley 62 x 38 x 42cm (with retractable handle)		ZAG-33001	1
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Heavy duty non slip Pressure contact mat:

* Bridgestone 50 x 70 x 1.2cm 5 Kg solid rubber type Model SRM487S0IR

Optional Extras Special note

* Heavy-Duty non-slip Bridgestone Pressure contact mats Model SRM487S0IR
70 x 50 x 1.2cm Each mat weighs 5 Kg. We recommend that at least one of these mats should be purchased with our KMS 4 Gate Porta Kit. This non slip and heavy duty mat is normally only used in the gym or the test laboratory for all tests in the KMS Menu except the sprint timing light tests only.

Innervations Wants Your Suggestions

Customer satisfaction is Innervations' number one priority. If you have any problems in using the Kinematic Measurement System software please do not hesitate to contact us immediately.

If you feel that certain capabilities or options are needed to be included in the system then chances are a number of other customers would also like such facilities. We will always endeavor to respond to any of your suggestions because this improves our product and increases your efficiency.

Kinematics Mat System will be upgraded annually and those who have previously purchased the system, like you, will be able to upgrade at very competitive prices. Please contact you're nearest Innervations representative for upgrade information.

Innervations specializes is testing and training devices for athletes, for both sport and rehabilitation.

For more information about any other products that *Innervations* offers, please contact us.

Innervations

1313 W. Abbott Street

Muncie IN 47303

United States of America

Telephone (765) 215 8045

Facsimile (765) 747 5098

Email info@innervations.com

Website www.innervations.com

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