

Blue Bay Medical, Inc.  
Navarre, Florida USA, April 2019

# **Knee Arthrometer (KA)**

## Instructions for Use

A you tube video is available with user instructions in the subtitles at  
**<https://www.youtube.com/watch?v=qwRXdT4A9-Y&t=22s>**

### **Knee Arthrometry**

The KT1000<sup>TM1</sup> and the KT2000<sup>TM</sup>, as developed by Medmetric®, set the standard for the measurement of knee stability in the sagittal plane. This design, produced and marketed by Medmetric®, has been adopted practically universally in both research and clinical settings for quantifying knee anterior-posterior motion under various conditions.

Due to the limited availability of the Medmetric® KT2000 device, Blue Bay Research Inc. has been asked to recreate the KT measurement capability in an alternative device.

The Blue Bay Knee Arthrometer has been designed to precisely reproduce the measurement capability of the KT1000 and KT2000 devices with an updated touchscreen electronic interface for researching Knee Laxity and specifically Cruciate Ligament Deficiency and Repair.

The Blue Bay Research Knee Arthrometer measures the movement of the tibia relative to a reference on the patella.

The Arthrometer is strapped to the anterior of the lower leg with one reference pad in contact with the patella and another in contact with the proximal tibia.

A force is applied to a handle posteriorly and anteriorly and the change in the anterior position of the tibia is measured in relation to the patella.

The anterior-posterior knee laxity is useful for determining the functionality of the anterior cruciate ligament (ACL) and the posterior cruciate ligament (PCL).

### **Anterior and Posterior Movement**

Posterior movement from 0.5 mm to 2 mm of the tibia indicates a normal knee; whereas a PCL injury will result in a displacement of 2 mm or more.

Anterior movement of the tibia in most individuals, is less than 3 mm; whereas an ACL injury will result in a displacement of 3 mm or more.

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<sup>1</sup> Daniel DM, Malcom LL, Losse G, Stone ML, Sachs R, Burks R: Instrumented Measurement of Anterior Laxity of the Knee. *J Bone Joint Surg Am.* 1985 Jun;67(5):720-6.

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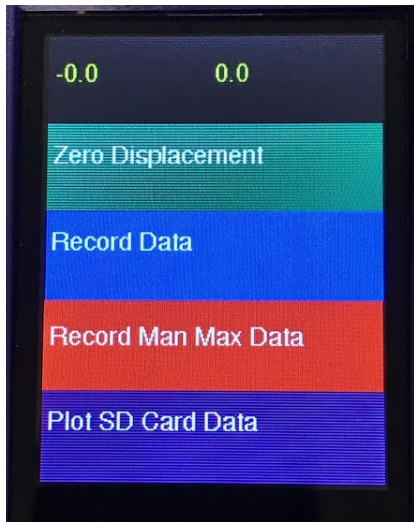
# Knee Arthrometer (KA)

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**Do not store the Knee Arthrometer at a temperature > 120°F**

**Warranty :** The Blue Bay Knee Arthrometer is warranted for 2 years including calibration and lithium batteries. Free return shipping is covered for any warranty work.

### Using the BBM Knee Arthrometer



- ← Load (force in lbs) & Displacement (mm)
- ← Zero Displacement at Current Position
- ← Records Displacement and Load onto SD Card
- ← Records Manual Maximum Displacement
- ← Plots Data that was saved onto SD Card

### Testing Procedure using the Knee Arthrometer:

1. Lay the patient supine (face upward) on an exam table.
2. Place the Thigh Support under both femurs to maintain knee flexion. The thigh support height can be adjusted to ensure knee flexion between 20-35 degrees.
3. Place the Foot Support Platform under the patient's heels. Allow the outside of the patient's feet to rest on the Foot Supports. This will maintain tibial alignment.
4. If the patient is in surgery or if the patient is having difficulty relaxing, place a Thigh Strap around the patient's thighs above the Thigh Support.
5. The examiner will check to make sure that that the edge of the thigh support is placed just proximal to the flexion crease behind the patient's knee.
6. The examiner will perform the Lachman Test on both of the patient's legs (start slowly and then feel endpoint).
7. The examiner will perform a (PCL Screen) on both of the patient's legs. The examiner will ask the patient to relax and determine if at 90°, the tuberosity is even with the patella.

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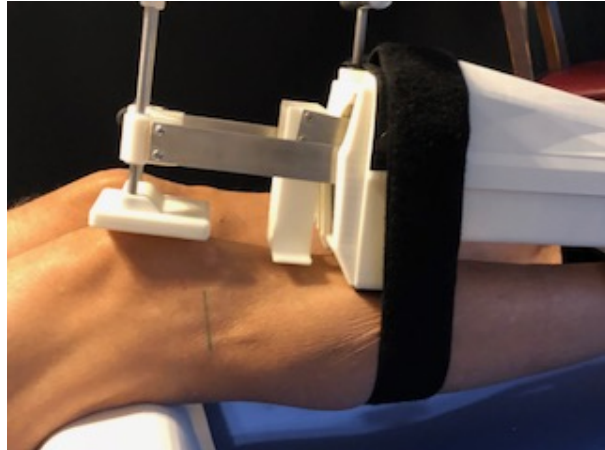
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- The examiner will perform a Quad Active Test on both of the patient's legs. The patient will position one foot so that it barely lays flat on table. The examiner will look at the leg from the side while holding a hand on the front of the patient's ankle. The examiner will then ask the patient to slide or push distally against the examiner's hand. A negative test means that the PCL is intact. The tibia of a knee with an injured PCL will move anteriorly (a positive test).

- Start with the Non-injured Knee** - Palpate the knee and locate the joint line and mark it's location on the skin.

- Position the Blue Bay Knee Arthrometer in the Proximal-Distal direction such that the distal edge of the Patella Reference Pad is directly above the joint line.



NOTE: If the pad is bothering the patient, it may be on the patellar tendon. If so, use the anterior pole of the patient's patella to line up the distal edge of the patella pad. The magnitude of the measurement obtained is affected by the proximal-distal position of the Arthrometer relative to the joint line. Therefore, it is important that the proximal-distal position remain consistent for all measurements.

- The examiner will place one hand on the patient's femur while placing the thumb and forefinger on the patellar pad.
- While holding the patellar pad and femur with one hand, the examiner will use the other hand to bring the proximal velcro strap under the patient's leg, pull it straight up and secure it onto the top of the knee arthrometer at the proximal end near the load handle.
- The examiner will then take the distal strap, bring it under the patient's leg and secure it on top of the knee arthrometer at the distal end.
- The examiner will turn the knee arthrometer on by pressing the button located at the distal end of the device. **Do not hold the arthrometer by the load handle while turning it on.** The knee arthrometer zeros itself when it is turned on.



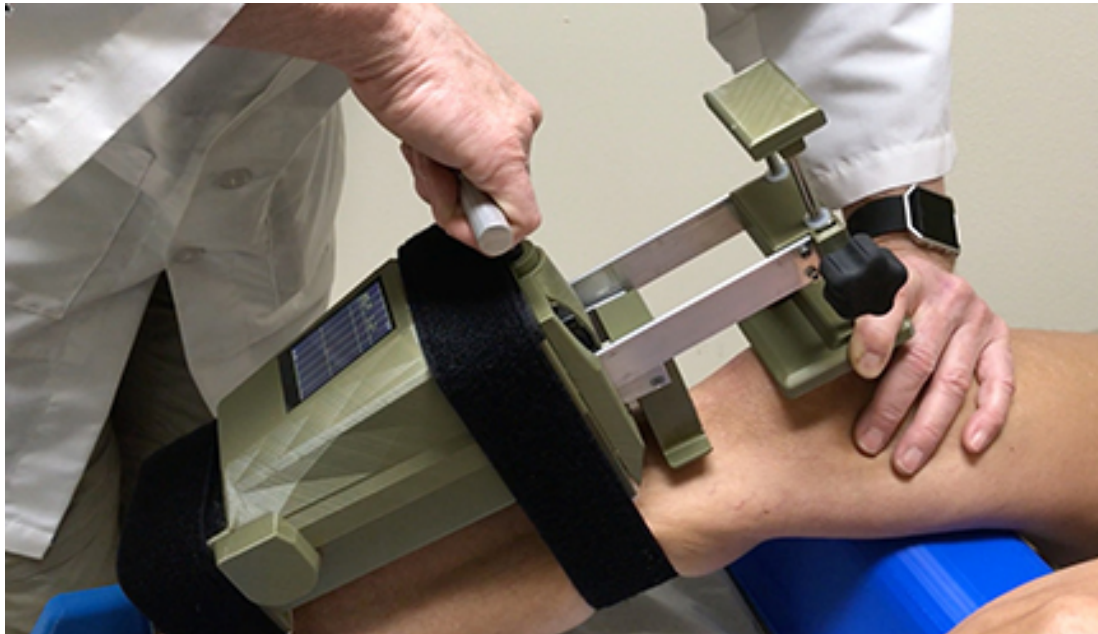
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15. The time will display for 1 second. If needed, the time can be adjusted by touching the screen once. "Set Time" will appear on the menu along with Set Graph Color and Set Compliance Denominator. HH and MM will display above a + and - sign to allow adjustment of the time forwards and backwards. YYYY MM and DD will display above + and - to adjust the year, month and day forward or backwards. Make sure date and time are correct.
16. Zero the displacement measurement by touching "Zero Displacement" on the screen.

NOTE: As shown below, the femur will be stabilized with one hand during the entire knee arthrometer test.



17. The examiner will push on the load handle once until beep sounds (15 lbs posterior). The touch screen should return to zero (or close to zero).
18. The examiner will repeat #17 above two (2) times until reproducible displacement measurements are obtained (displacement is at the top of screen to the right).

NOTE: If the readings are not reproducible after pushing on the load handle 3X (posteriorly), rotate the KA on the patient until 3 stable displacement readings are obtained.

19. The examiner will then tap "Zero Displacement"
20. The examiner will tap "Record Data". While stabilizing the femur, the load handle will be pulled up slowly until three (3) beeps sound (15, 20 and 30 lbs anterior). Then the examiner will push the load handle down until the 4th beep sounds (15 lbs posterior).

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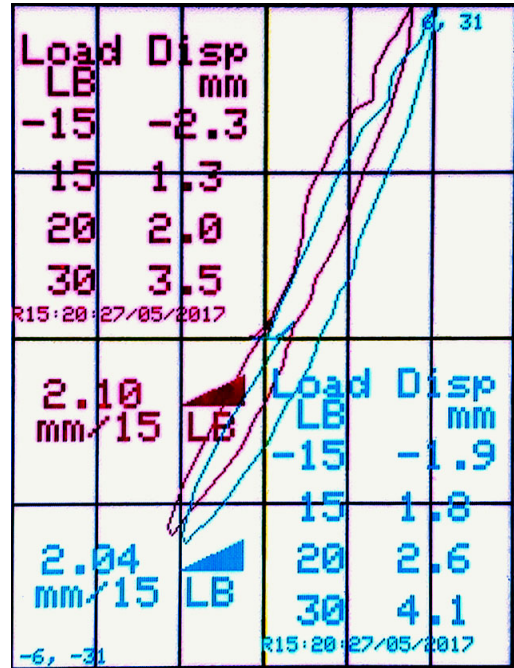
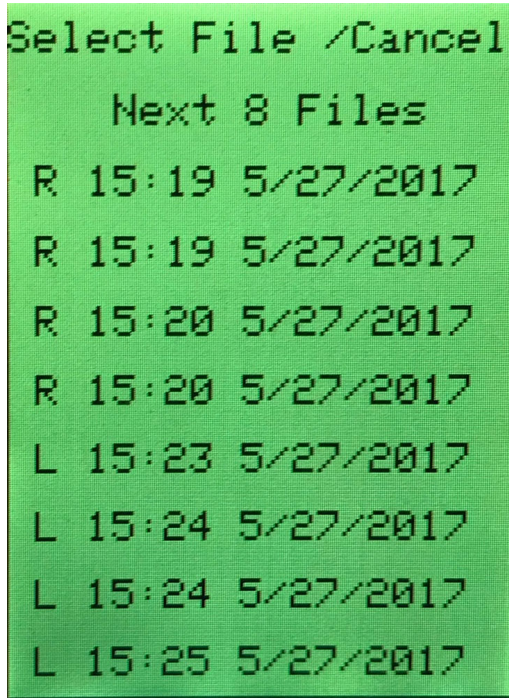
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21. The screen is then tapped again to obtain the load-vs-displacement curve.
22. The examiner will tap the screen to save the data as right knee or left knee or choose not to save file.
23. If save is chosen, select “Yes” to compare the current curve with a curve previously saved. Optionally, you can touch “No” and return to the main menu.
24. If “Yes” is chosen, the screen will display dates and times for previous data.
25. Tap the desired comparison curve file on the display. Files are displayed with a “L” for left, “R” for right or “MR” (Man Max Test Right) along with time and date. The Man Max displays the maximum and minimum displacement.
26. Tap the screen again to return to the main menu.
27. If the examiner wishes to compare two previous curves that have been saved on the SD card, the user will touch **Plot SD Card Data** on the main menu. For example, the data for the patient’s right and left leg can be compared.
28. The examiner will select one or two curves, by touching the desired file, one file at a time. If only one curve is desired, select the same curve twice.
29. The two curves will then display on the screen for comparison purposes.
30. The compliance index is also displayed for each curve in mm/5 lb.
31. Tap the screen again to return to the main menu.
32. For the ACL Manual Maximum Displacement Test, touch “Zero Displacement” and then “Record Man Max Data”. The Lachman Test will then be performed on the patient by pulling up on the patient’s calf near the knee with the examiner’s free hand while stabilizing the patella pad and patient leg with the other hand. The screen will display the maximum and minimum displacement values, in millimeters (mm).

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### Displacement Data and Curve

-15 lb, 15 lb, 20 lb, 30 lb  
 (Compliance Index at bottom mm/15 lb)

### Manual Max Data



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### **Device power:**

Turn the Arthrometer on by pressing the switch and turn it off by pressing the switch again.

### **Charging the Knee Arthrometer**

Recharge the Arthrometer's lithium batteries by plugging a standard micro USB charging cable (supplied) into the distal end of the KA device. The cable is plugged into a USB-type phone charger adapter (not included). A yellow light behind the charger means that the KA is still charging. The yellow light changes to green when the KA is fully charged. It is acceptable to leave the KA plugged in after it is finished charging. The KA will stay charged for about 12 hours if running continuously.

### **SD Card:**

One SD card is included. The text (.txt) files that are saved include date, time, load and displacement data. The files can be opened in a text reader, MS Word, MS Excel, etc. The file name on the SD card will be named with the day of the year and the time. For example, on March 20 2019, at 10:40:29, the filename will read **07910402** (meaning the 79th day of the year at 10:40 and 29 seconds). The filename changes at 10-second intervals. NOTE: In order for the dates to display in reverse chronological order, replace the SD Card with a new one at the beginning of each new year.

NOTE: It may be helpful to record the time of the patient test to keep track of corresponding patient data.

Once the text file has been opened, it will display the year (2018), the date (1016) and the time (10:40:29) at the top. For example: **20181016104029**. The continuous reading of load (pounds) and displacement (mm) will be recorded in the text file as well.