



# 5800 EIs

## STRINGING MACHINE

### 2 POINT MOUNTING



**OWNER'S MANUAL**

Issue 2 - January 2009

# OWNER'S MANUAL

# 5800 EIs

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## LIMITED WARRANTY

GAMMA SPORTS warrants to the original purchaser that the 5800 EIs stringing machine ("EQUIPMENT") purchased is free from defects in materials and workmanship for a period of five (5) years from the date of original purchase for mechanical parts (excluding electrical parts and string clamps), and for a period of one (1) year from the date of purchase for all electrical parts and string clamps. Should any defects develop under normal use within the specified time periods, GAMMA will at its option, repair or replace the defective EQUIPMENT provided it is returned to GAMMA prepaid at the purchaser's expense. This warranty does not apply to any damage or defect caused by negligence, abuse, misuse, unauthorized alteration, shipping, handling, or part wear and tear as a result of normal use.

Routine maintenance, adjustment, and cleaning required to ensure proper operation are the responsibility of the purchaser and are not covered under the terms of this warranty. These include, but are not limited to: String Clamp adjustment, as described on page 18, Quick Action Clamp Base adjustment, as described on page 18, and the cleaning procedures listed on page 19.

GAMMA's obligation under this warranty is limited to repair or replacement of defective EQUIPMENT, and no one is authorized to promise any other liability. GAMMA shall in no event be liable for any incidental or consequential damages.

To return defective EQUIPMENT, a return authorization (RA#) must be obtained from a GAMMA customer service representative. The RA# must be marked on the outside of the shipping carton being returned. All returns must be shipped prepaid by the customer to GAMMA. Please retain the original shipping carton and packing materials for any future shipments. GAMMA will not be responsible for machines which are not sent in the original undamaged packaging.

An Extended Warranty is available through a GAMMA customer service representative, call 800.333.0337 for details.

# FEATURES



## MACHINE FEATURES

- ❖ Electric Constant Pull Tensioner w/ 11 lbs. to 89 lbs. Tension Range
- ❖ Digital Tension Setting Display
- ❖ Professional Two Point Racquet Mounting System- Accomodates All Racquets Without Adapters
- ❖ Parallel Jaw Linear Gripper w/ Diamond Dust Coated Gripping Surfaces
- ❖ Professional Dual Action, Rotating, Diamond Dust Coated, Fixed String Clamps
- ❖ High Strength Extruded Aluminum Frame with Durable Anodized Finish and 2-Convenient Padded Tool Trays
- ❖ Unique Internal Drawer System for Storing Tools and Adaptors.
- ❖ Convenient Foot Actuated Tensioner Switch



# 5800 EIs

## Unpacking Instructions & Contents

### Instructions for Unpacking and Preparing for Assembly

The stringing machine is shipped in three cartons, a large master carton for the stringing machine base with tensioner module and accessories, a medium carton for the turntable and mounting system and a smaller carton for the floor stand post and base legs. **Please save the cartons and packing materials for possible shipments in the future.** Gamma Sports cannot be responsible for machines that are not returned, shipped in their original, undamaged packaging. The tools you will need to assemble the machine are provided with the machine. Due to the weight of the tensioner unit, you may need the assistance of someone to help lift the tensioner unit out of the carton.

Once the cartons are opened, remove all inner cartons and check to be sure that all parts are present and accounted for.

#### Contents of Base & Leg Carton

- (1) Lower Column
- (1) Upper Column with Flange Plate
- (4) Legs
- (1) Locking Knob Screw
- (4) M8 x 25 Flat Head Screws
- (4) M8 x 30 Cap Screws
- (8) M8 Nuts
- (6) M6 x 20 Cap Screws
- (1) M8 x 25 Cap Screws for Height Adjustment
- (1) String Reel Holder (M8 Threaded Pin), (1) Knob, (10) Spacers, & (2) M8 Washers

#### Contents of Mounting System Carton

- (1) Turntable Assembly w/String Clamp Bases and Mounting Stands
- (2) String Clamps

#### Contents of Large Master Carton (including accessory cartons packed inside)

- (1) Stringer Assembly Unit w/ Tensioner Module
- (1) Power Cord
- (1) Foot Pedal Tensioner Switch
- (1) Tool Kit (contains side cutter, bent nose pliers, needle nose pliers, starting clamp)
- (1) Straight Stringers Awl & (1) Pathfinder Specialty Awl
- (1) Tools for assembly and maintenance

# ASSEMBLY INSTRUCTIONS



## Base Leg Assembly

The stringing machine uses a four leg floor stand design. The legs must be assembled to the lower column before use. Remove all parts from the shipping carton to confirm that contents match the list of parts on Page 3.



## Base Leg Assembly (Cont.)

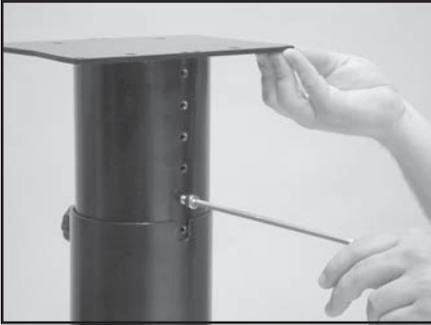
Align the holes in the leg flange with the matching holes in the lower column. Secure the leg with one M8 FLAT HEAD screw through the upper hole, and one M8 SOCKET HEAD cap screw through the bottom hole. Install one 8mm nut on each screw. Repeat this procedure for the three remaining legs.



## Base Leg Assembly (Cont.)

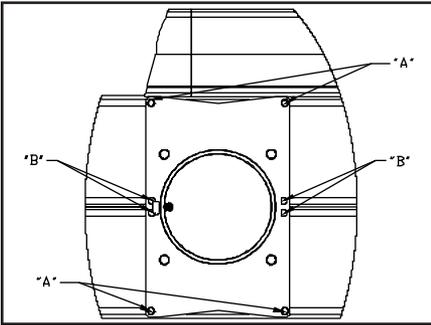
To complete the floor stand, screw the height adjustment locking knob ("A") into the side of the lower column. The locking knob should not protrude beyond the inside of the lower column at this time.

# ASSEMBLY INSTRUCTIONS



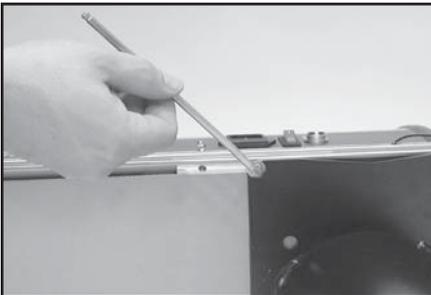
## Height Adjustment

The height of the machine is adjustable from 39" to 46" in approximate 1" increments. To change the height, remove the socket head cap screw from its current position and place it in the appropriate hole to set the desired height of the machine. Be sure to thread the screw completely into the upper column so the head of the cap screw rests in the notch of the lower column.



## Stand Upper Post Installation

With the height adjustment cap screw on the upper column facing the brake lever & string length meter, align the six holes marked "X" in the upper column flange with the threaded holes in the slide brackets of the machine base.

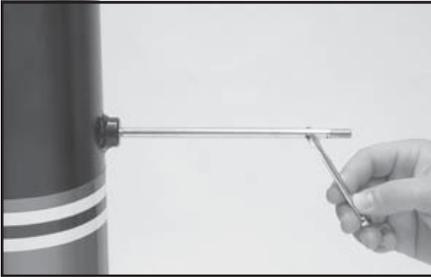


## Floor Stand Upper Column Installation (cont.)

Secure the flange to the base of the machine with the six M6 cap screws packed with the floor stand.

**USE CAUTION WHEN SECURING SCREWS TO SLIDE BRACKETS. CROSS THREADING OR OVER TIGHTENING MAY DAMAGE THE THREADS IN THE SLIDE BRACKET OR CAUSE THE THREADS TO STRIP OUT.**

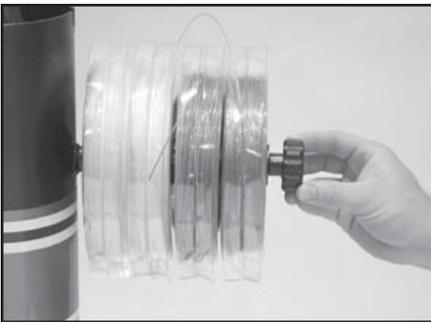
# STRING REEL HOLDER INSTALLATION



The string reel holder pin is an 8 mm rod with threads on both ends, and flat surfaces machined on one end. Thread the end of the pin without the flat surfaces into the threaded boss on the right side of the lower column. Using the M6 open end wrench positioned on the flat surfaces, securely tighten the pin to the lower column.

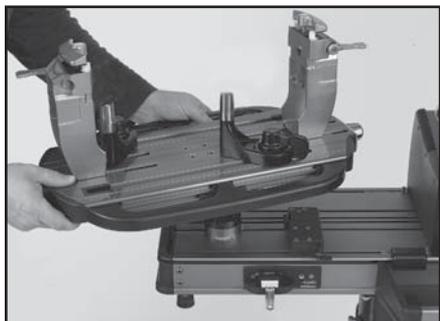


The string reel holder can hold up to 5 reels of string (depending on the size of the string reel). Before placing the first reel on the rod, slide two M8 washers over the pin and slide them to the boss on the lower column. After the first reel is placed onto the rod, place two spacers between each reel to provide enough space between reels and allow them to turn freely without rubbing against one another. (To provide a smooth feed to the String Length Meter, place the reels on the rod so the string spools off the reel from the underside of the reel.)



After the last reel is installed, place the remaining spacer(s) on the pin and attach the threaded knob to the end of the rod.

# ASSEMBLY INSTRUCTIONS



## **Turntable and Mounting System Installation**

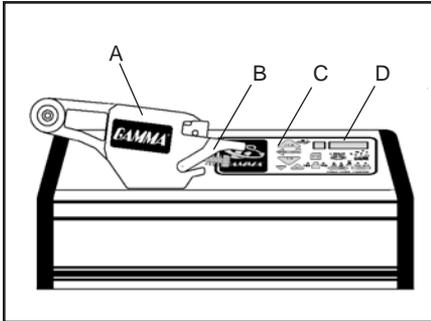
To install the turntable remove the four nuts underneath holding the mounting bolts in place. Position the turntable over the turntable pin and align the bolts with the holes in the flange. Secure them with the included allen wrench.



## **String Clamp Installation**

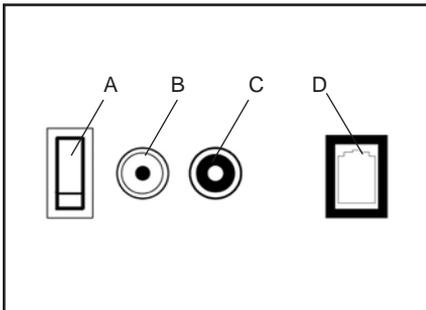
The post of the string clamp and tube of the string clamp base are treated with grease to provide protection against corrosion during shipping and while in storage. Remove any excessive grease with a clean cloth prior to use. The post and tube may also be cleaned with isopropyl alcohol. After this type of thorough cleaning, the post and tube should be treated with a light coating of machine oil to protect the surfaces against corrosion and to ensure smooth operation.

# POWER CONNECTION & CONTROLS



## Front Panel Features

- A - String Gripper
- B - Tension Button
- C - Control Panel
- D - L.E.D. Tension Display



## Back Panel Features

- A - Lighted Power Switch
- B - A/C Power Cord Socket
- C - Foot Pedal Switch Receptacle
- D - String Length Meter Receptacle

## Instructions for Power Connection and Controls

**CAUTION !** Before connecting to the power supply, check the voltage source that the machine is being connected to. The acceptable range of input voltages for this machine is between 100 V and 240 V @ 50 to 60 Hz. If you have any questions regarding the input voltage supply for your area, please ask your electric utility company.

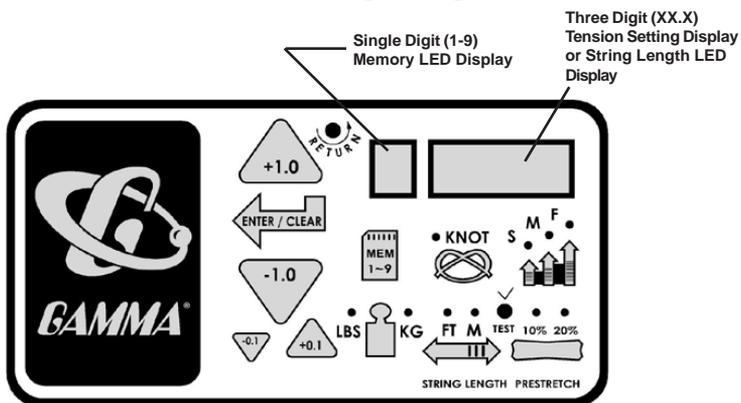
To install the power cord, insert the female end of the power cord into the AC Adapter and then insert the female end of the cord from the AC Adapter into the A/C Power Cord Socket "C" located on the back panel of the tensioner. Plug the male end of the power cord into a grounded power outlet. When using extension cords, use grounded heavy duty extension cords rated for 15 AMP service.

To connect the foot pedal switch, insert the male pin at the end of the foot pedal switch cord into the Foot Pedal Switch Receptacle "B" located on the back panel of the tensioner.

Switch on the machine by pressing the Lighted On-Off Power Switch on the back panel. At start-up, the LED will display a countdown from "9.0" to "0.0" while the machine performs a self diagnostics check at start-up.

**WARNING! FOR INDOOR USE ONLY. TO BE USED BY ADULTS OR UNDER ADULT SUPERVISION ONLY. NEVER OPEN UNIT WITH POWER CONNECTED.**

# CONTROL PANEL FUNCTIONS AND FEATURES



**Tension Index Buttons** - Changes tension setting in +/- 1.0 or +/- 0.1 Lb or Kg increments. Holding the button down will scroll the tension setting values up or down. Tension settings entered with the tension index buttons are placed into temporary memory setting "0".



**Clear Button** - Clears display to enter a new tension or to reset String Length Meter measurement



**Test Button & Racquet Strung** - Press once for approximate number of racquets strung. Press again to return. Press and hold for 5 seconds and the machine does an internal diagnostic check, such as the one performed at start-up.



**Lbs/Kgs Button** - Changes tension display from Lbs to Kgs. Each press of the button toggles back and forth between Lbs and Kgs.



**Pre-Stretch Function** - Pulls string 10% or 20% over the tension setting (up to 90 lbs / 40.8 kgs), releases the string, and repulls to the tension setting. Each press of the button toggles between 10%, 20% or no pre-stretch.



**Memory Button** - Indexes from 9 preset tension settings that can be stored in memory. Settings are retained even if machine is turned off. Each press of the button indexes to the next memory setting. Memory settings 1-9 must be entered using the keypad followed by pressing the "ENT" button.



**Enter Button** - Saves displayed tension for Memory setting - when tension is entered using the keypad display flashes until this button is pressed to save the setting. Also Clears display for String Length Meter measurements



**Knot Function** - Increases pulling tension by 10% over the setting value (max 90 lbs / 40.8 kgs) for one pull. During the pull the LED stays lit to indicate the Knot function is enabled.

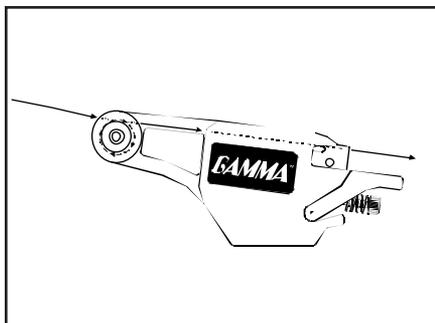


**Speed Button** - Changes pulling speed of winder from Fast (default) to Medium to Slow. Slow speed is recommended for low stretch strings, such as Kevlar. Each press of the button toggles between Fast, Medium and Slow speeds.



**String Length Meter Button** - Enables string length meter function. Each press of the button toggles back and forth between Meters and Feet measurement. To switch back to tensioning function, press the "Lbs/Kgs" button.

# STRING GRIPPER OPERATION

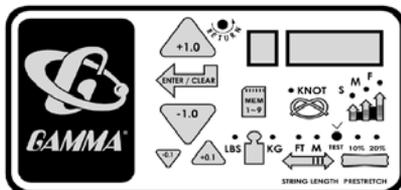


## String Gripper Operation

To insert a string into the linear string gripper, wrap the string clockwise around the roller guide and insert the string between the diamond dust coated string gripper plates. Excessive slack in the string should be removed before applying tension. Pull the string perpendicular to the gripper plates and begin tensioning. As tension is applied, the grippers will engage to hold the string. For adjustment of the parallel plates, see "Setting the Gripper Plate Spacing" on page 17.

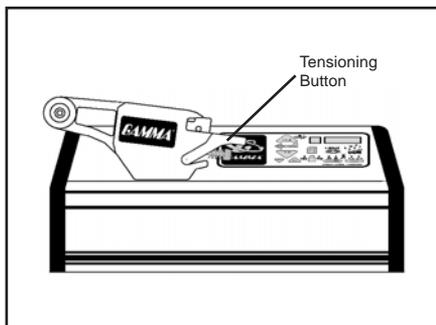
**CAUTION! CHILDREN SHOULD NEVER BE PERMITTED TO OPERATE THIS MACHINE WITHOUT ADULT SUPERVISION.**

# TENSIONER OPERATION



## Setting the String Tension

String tensions may be entered and stored into one of nine memory storage settings (See section on Control panel Functions and features) by using the tension index buttons. While tension setting is entered, the value displayed will be temporary until the "Enter" button is pressed to store it in one of the nine permanent memory settings.

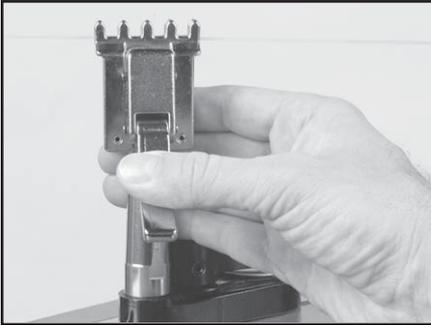


## Tensioning a String

After wrapping the string around the roller guide and guiding it between the gripper jaws, while gently pulling the string perpendicular to the gripper plates, press the tensioning lever switch at the end of the gripper or press the foot pedal switch to activate the tensioner. The tensioner will start pulling at full speed and then slow down as the tension in the string approaches the tension setting. When the tension in the string reaches the tension setting, the LED display will begin to flash, and the string will

be ready to clamp off. In the event that one of the keys on the control panel are accidentally pressed while tensioning a string, the tensioner will automatically reverse and release the string being tensioned.

# STRING CLAMPS



## String Clamp Operation

The string clamps are a dual action design where the string clamp and clamp base operate independently of one another.

To clamp a string, lift the clamp head and place the string between the jaws and depress the string clamp lever to secure the string. The clamping pressure applied to the string should be adjusted as needed (see Page 18) to provide sufficient pressure to secure the string when subjected to the desired pulling tension. The diamond coated gripper plates provide for increased friction reduced clamping pressure while securing

between the clamps and the string to allow for and holding the string under tension.



## Clamp Base Operation

To lock the string clamp base to the turntable, rotate the clamp base locking lever clockwise. To release the string clamp base from the turntable, rotate the clamp base locking lever counter-clockwise.

The Locking Lever should be tightened enough to prevent clamp base slippage on the turntable, when the desired tension is placed on the string. To go from the loose position to the clamped position and back, generally requires the rotation permitted by the slot in the clamp base.

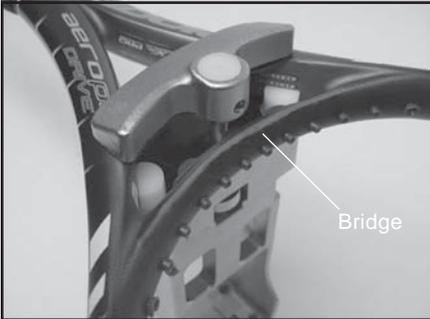
# MOUNTING THE FRAME



## Adjusting the Inner Racquet Supports

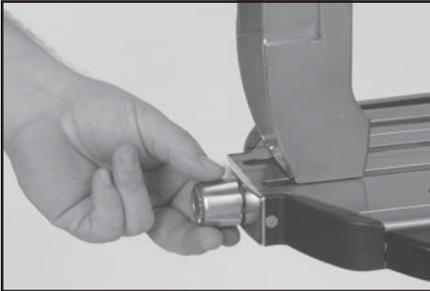
The white racquet supports are adjustable to accommodate all racquets and provide maximum support to the racquet frame. Screw the the pads up or down so they contact the frame at a maxium height without blocking the grommet holes.

# MOUNTING THE FRAME



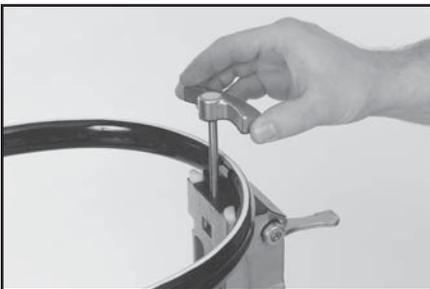
## Special Throat Mounting

Racquets with a bridge that is thinner than the rest of the frame or are tapered from head to throat require special mounting to ensure the frame is not damaged. The white support pads need to be moved from the inside of the racquet bridge to the throat of the racquet.



## Mounting Post Adjustment

Place the racquet frame over the white racquet supports. Screw the the post outward until the racquet supports are positioned on the inside surface of the racquet frame.

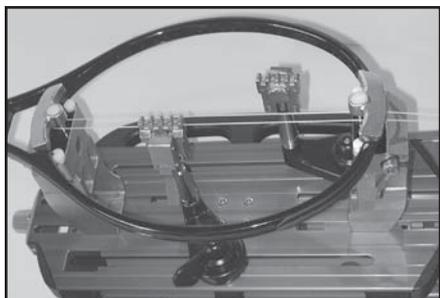


## Installing the Racquet Hold Down

With the lever in the up position, insert the racquet hold down into the hole in the center of the mounting post.

Depress the racquet hold down lever to secure the racquet frame.

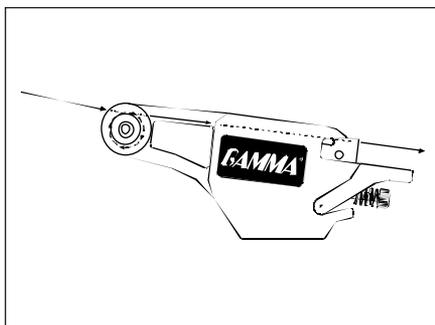
# STRINGING THE FRAME



## Getting Started

To begin stringing the main strings, thread the two ends of the string through the two center holes at the appropriate end of the frame and continue through the opposite center holes. Thread one end of the string through the adjacent grommet hole and pull excess by hand.

Secure one of the strings using a string clamp.



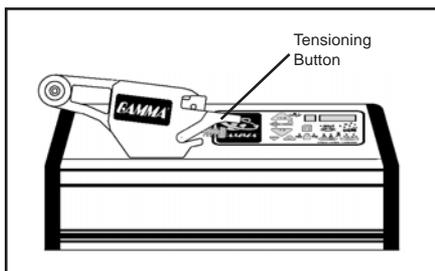
## Pulling Tension

To apply tension, wrap the string being tensioned clockwise around the roller guide and position the string between the gripper jaws.

The string must pass over the roller guide before being placed between the gripper jaws to ensure that the proper tension is applied to the string.

Pull the string until all slack is removed before pressing the tension lever switch.

**WARNING: KEEP FINGERS AWAY FROM ROLLER GUIDE WHILE TENSIONING STRING. TO RELEASE TENSION BEING APPLIED TO THE STRING PRESS THE PUSH TENSION LEVER SWITCH OR ANY BUTTON ON THE KEYPAD IN CASE OF EMERGENCY.**

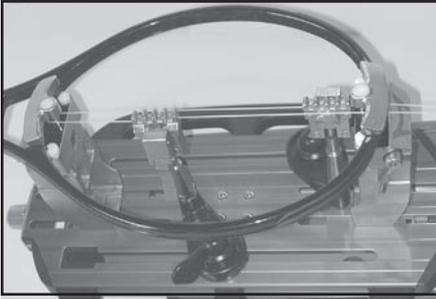


To apply tension to a string, press the tension lever switch or the foot pedal switch. The string gripper will move to the right, away from the racquet, and gradually apply tension to the string. When the set tension has been attained, the gripper will stop moving. As the tensioned string relaxes, the gripper will continue to pull intermittently, to maintain the set tension.

To release the string after clamping, press the tension lever switch or foot pedal switch.

If the string gripper does not release the string, push the gripper plates to the right to help disengage and release the string from the gripper.

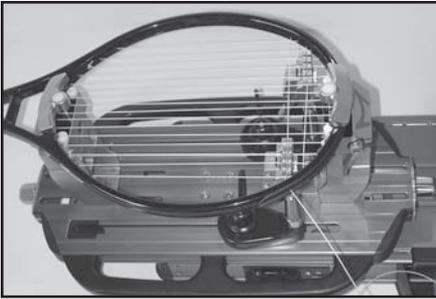
# STRINGING THE FRAME



## Clamping the First Main String

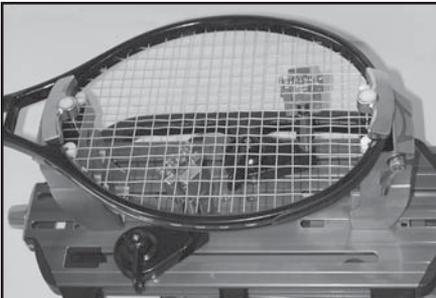
Secure the tensioned main string using the remaining fixed clamp. Repeat the procedure for all of the remaining main strings and tie off following the racquet manufacturer's recommendations.

Follow the manufacturer's recommended stringing pattern for one or two piece stringing. This will determine the starting point for the cross strings. If applicable, tie the first cross string using an appropriate starting knot.



## Weaving the Cross Strings

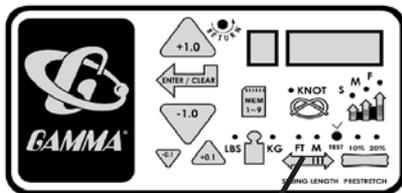
Weave the cross strings over and under the main strings being careful to alternate the weave direction of each consecutive cross string so as to be opposite of the previously installed cross string.



## Completing the String Job

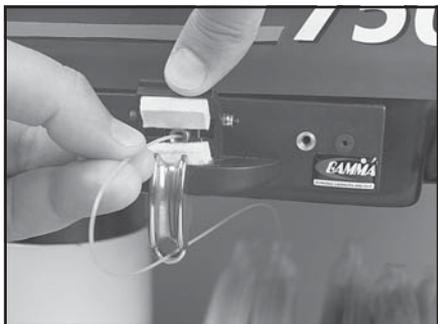
Once the final cross string is tensioned and clamped, tie off at the appropriate hole specified by the racquet manufacturer. Remove the frame from the mounting system by loosening the shoulder supports and frame supports.

# STRING LENGTH METER OPERATION



SLM button

To enable the String Length Meter (SLM) function, press the String Length button on the keypad. When the String Length button is pressed, one of the LED indicators above "M" or "FT" will light up to indicate that the SLM function is enabled. Pressing the String Length button will toggle between "M" and "FT" to set the measurement units for either Meters ("M") or Feet ("FT"). Measurements are displayed in 0.1 increments.



To measure a length of string from a reel or set of string, insert the end of the string through the loop from the backside of the loop from the string guide attached to the front of the SLM. Lift the clamp pad and insert the string through the entry hole on the face plate of the SLM. Continue to feed the string into the entry hole until it exits the SLM through the hole on the right side and release the clamp pad. (In addition to aligning the strings with the entry to the SLM, the felt clamp pads apply a slight amount of pressure to the string and wipe down the surface of the string to prevent debris from entering the SLM).

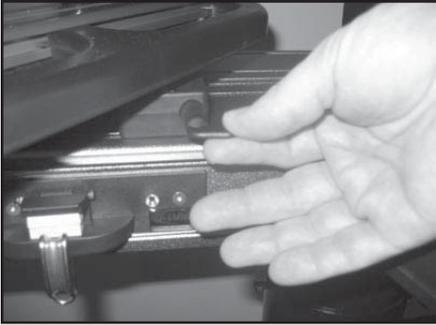


When the end of the string exits through the hole on the right, press the "C" or "Entry/Clear" button on the keypad to "Zero" the display, and the length of string will be measured from the point on the string located at the edge of the exit hole. Pull the end of the string at a slow steady rate and the SLM will begin measuring the length of string as it is pulled through the SLM and indicate the measurement on the LED display. When the desired length of string is measured, cut the string at the edge of the exit hole.

**NOTE: When reaching the end of a string, pull the string through the SLM slowly to avoid inaccurate measurement.**

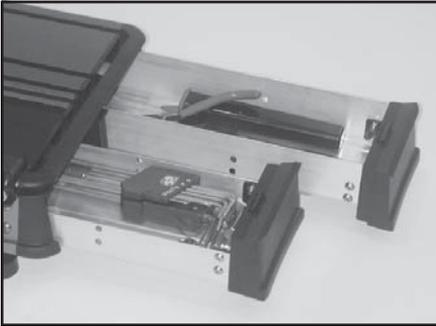
The string length meter was designed to measure strings between 1.10 mm (18 ga) and 1.45 mm (15 ga) at an accuracy of +/- 0.3% of the indicated value and +/- 2 inches (50 mm) absolute. When measuring strings smaller than 1.10 mm (such as badminton strings) the error will be -2.5% of the indicated value (up to 6" short in 40 ft) and +/- 2 inches (50 mm) absolute.

# ADDITIONAL FEATURES



## Turntable Brake

The turntable may be locked in any position. Flip the lever to the right to lock the turntable brake and flip the lever to the left to release the turntable brake.



## Storage Drawers

There are two storage drawers located in the base of the machine. The drawers open from the right side of the base and lock into the end cap with a spring loaded latch.

To open the drawers depress that latch in the face of the drawer and slide it to the right. To close the drawer simply slide the drawer back inside the base and the latch will automatically lock into place.



## Cutting Block

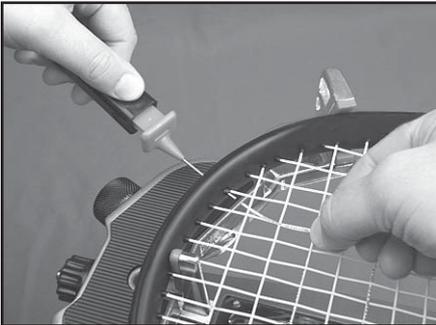
A cutting block is provided to provide a surface for cutting a point on the strings using a razor blade cutter.

# PATHFINDER AWL

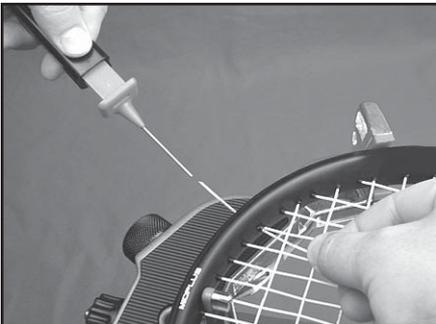


The machine includes the Pathfinder stringing awl which creates a pathway between or around strings to make inserting a string through tight grommets easier and quicker.

Insert the awl through the grommet hole in the same manner as for traditional awls. The Pathfinder awl must be in the closed position before insertion.

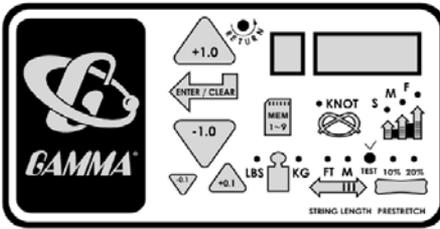


Once the awl is inserted, pull the handle of the awl outward while holding the tip section in place, leaving the outer sheath in the grommet hole. Insert the end of the string into the center of the sheath.



While holding pressure on the string, slowly pull the sheath out of the grommet hole to leave the end of the string exposed.

# MAINTENANCE & ADJUSTMENTS



## Tension Calibration Procedure

Each stringing machine has been checked and calibrated at the factory using accurate load sensing devices to ensure that the machine pulls at the correct tension. However, if you suspect that your machine may not be pulling at the correct tension you can check the pulling tension with a calibrator and make adjustments if needed.

Most tension calibrators (such as a Gamma Tension Calibrator) function by clamping off the string attached to one the end of the calibrator and applying tension to the string located on the opposite end of the calibrator. The tension measured by the calibrator will then display the tension being applied to the calibrator by the machine. If the calibrator and tensioner do not match then you can adjust the tensioner as follows:

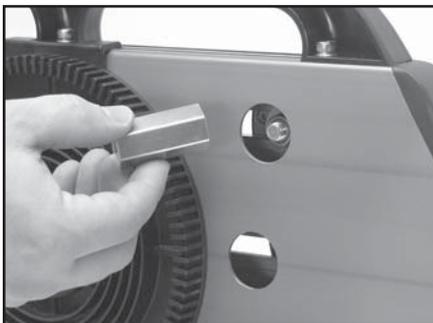
(1) Turn the machine off and restart the machine while holding down the Test button until count down is complete. 22 lbs should appear on the display. (2) Apply tension to the calibrator. (3) If the tension reading on the calibrator does not match the tension displayed on the machine, use the tension indexing buttons to match the display to the calibrator reading and press the Enter/Clear button (4) Release the tension applied to the calibrator and 44 lbs should appear on the display. (5) Repeat steps #2-#4 for 44, 66 & 88lbs. (6) After completing the adjustment at 88lbs the display will show 00 lbs. (7) Restart the machine without holding any buttons and the calibration adjustment will be complete.

## Switching the Buzzer Off and On

The stringing machine is equipped with a buzzer that sounds when any key or button is pressed, when the tensioner has pulled a string to the end of its travel and is not yet at tension, or when there is a problem with the some function of the machine. The buzzer can, however, be disabled if desired for normal keypad entries.

To disable the buzzer, turn the machine on and while the display is counting down from 9 to 0, press and hold the Enter/Clear button for at least 5 seconds. The buzzer will be disabled and will remain disabled. It can be enabled again by following the same steps listed above.

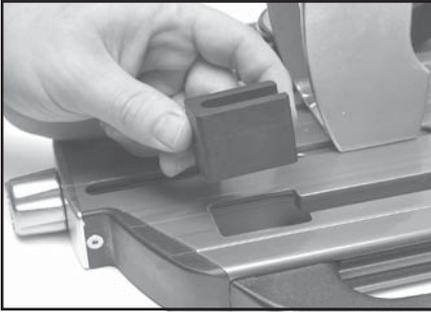
**NOTE:** Even when disabled, the buzzer will sound if the tensioner has pulled a string and reached the end of the track prior to reaching the desired tension in the string, or if there is some other problem with the machine that requires attention. This is meant to alert the user of a problem, and can not be disabled.



## Adjusting the Clamp Base

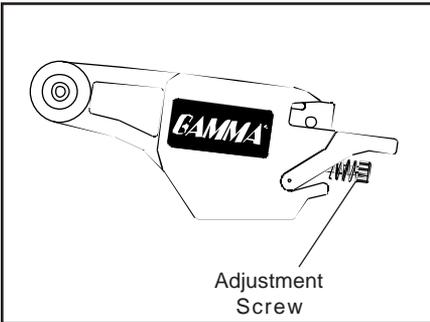
In the event the Locking Lever rotation is insufficient to ensure smooth operation of the clamp base, very minor adjustments to the Clamp Base Locking Nut can be made with a 17mm socket. Tighten or loosen the locking nut in very small increments to provide more clamping pressure or running clearance as needed.

# MAINTENANCE & ADJUSTMENTS



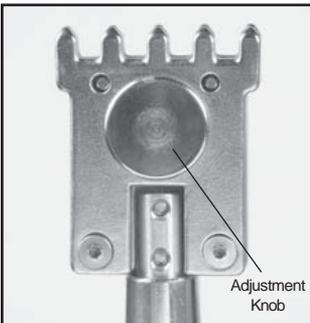
## Quick Action Clamp Base Removal

Quick Action clamp bases can be removed from the turntable for maintenance or cleaning by removing clamp stop located at the end of the slot in the turntable. To remove the clamp stop, remove the two screws holding the clamp stop in place from the underside of the turntable. Lift the clamp stop out of the slot, slide the clamp base to the end of the slot and lift it out. Replace the clamp base and clamp stop in reverse order.



## Gripper Plate Spacing Adjustment

The parallel plates of the string gripper are adjustable to accommodate varying string gauges and types of string. If the string slips through the gripper plates while pulling tension, rotate the gripper adjustment screw counter-clockwise. If the string is damaged while pulling tension, rotate the gripper adjustment screw clockwise. The gripper is properly adjusted when there is enough pressure to securely hold the string without causing damage to the string. If you move the gripper to the right hand end of the track it is easier to access the screw.



## Adjusting the String Clamp Jaw Spacing

The string clamps will need minor adjustments according to what string type, construction, and gauge you are using.

To adjust the gap (clamping pressure) between the clamp jaws, insert the string through the racquet as if you were beginning the main strings. Clamp the strings and pull tension. If the string slips through the jaws of the clamp, tighten the clamp by compressing the clamp jaws together by hand while turning the Adjustment Knob, in the clockwise direction. If the clamp leaves impressions or damages the string, it may be excessively tight and should be adjusted by turning the Adjustment Knob counter clock-

wise to open the gap between the jaws. The clamp jaws should be cleaned periodically to be free from dirt, oil, and any string coating for them to grip properly. Knife sharpening stones are excellent for removing build-up on the diamond coated surfaces and are available.

**Note:** The string clamps supplied with your stringing machine can accommodate tight string patterns such as badminton. Depending on the string pattern, the clamp may spread the strings slightly which will not compromise the quality of the string job. String clamps designed specifically for badminton racquets are available.

# TROUBLESHOOTING TIPS

## **PROBLEM**

## **SOLUTION**

String slips in clamps

- Adjust gap between clamp jaws
- Clean clamp jaws

String slips in gripper

- Adjust gripper jaws spacing
- Clean gripper jaws

String clamp base slips on turntable

- Adjust clamp base

Electrical system does not function

- Check power source
- Check power cord connection

String tension too tight or too loose

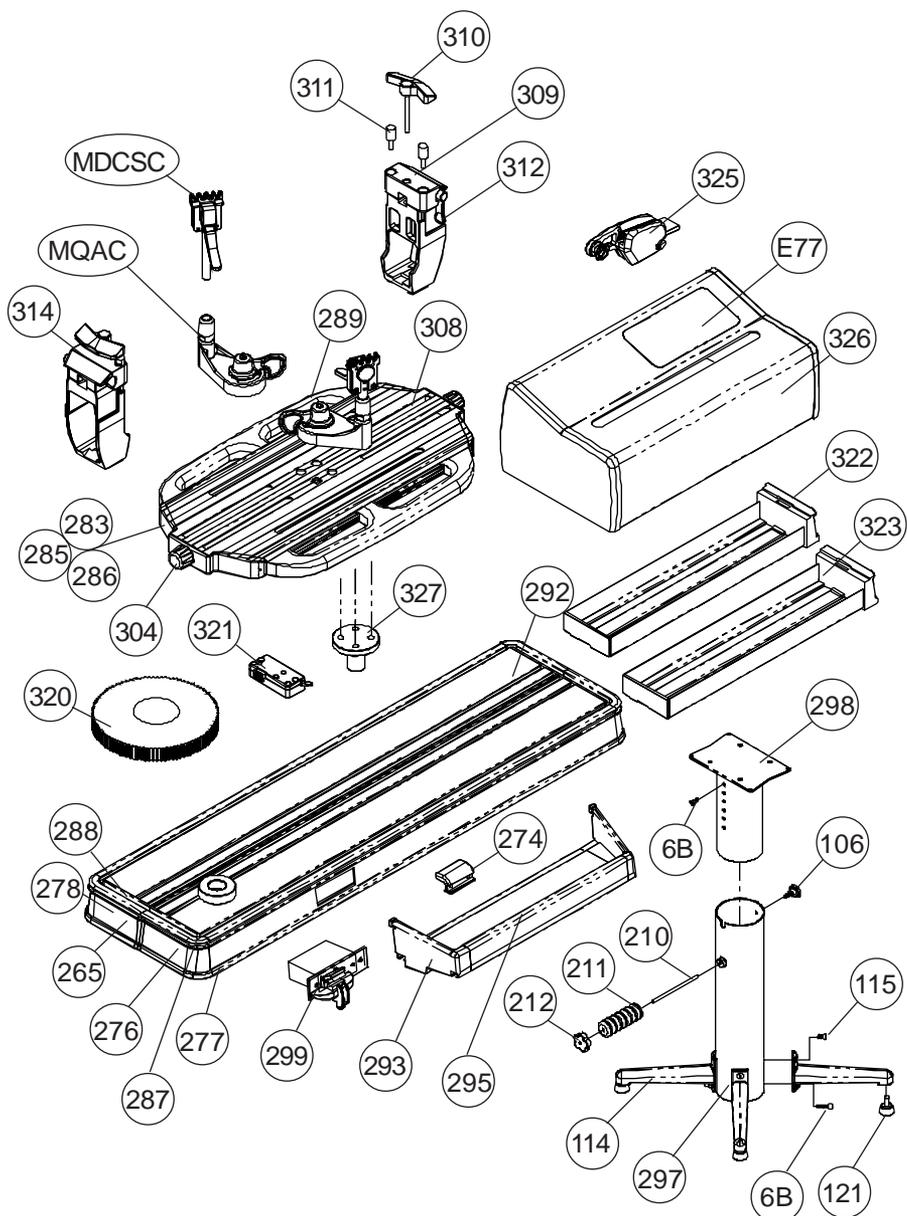
- Check tension using a tension calibrator, adjust machine calibration if necessary

## **CARE & CLEANING**

With time and use, the clamping surfaces of your machine may become oily or dirty and result in string or clamp slippage while stringing. Periodic cleaning of the String Clamps, String Clamp Base, and String Gripper is recommended using a cleaning solvent such as isopropyl alcohol and a mild abrasive tool such as a toothbrush.



# PARTS SUMMARY





## **GAMMA SPORTS**

200 Waterfront Drive

Pittsburgh, Pennsylvania 15222

Phone: 800.333.0337 Fax: 412.323.0317

Visit our website at [www.gammasports.com](http://www.gammasports.com)