MAGIC TOUCH MR33

COMPUTERIZED FREELENGTH CONTROL SYSTEM

Built by:

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1.0 DESCRIPTION of FEATURES

   1.1 **Moyer MAGIC TOUCH Free Length Control System:** The **MAGIC TOUCH** reduces scrap by measuring and controlling the springs' free length. Use the **MAGIC TOUCH** with a Moyer pitch controller or CNC interface to maintain a consistent free length. Add a Moyer sorting chute to sort the springs according to length.

Some features of the new **MAGIC TOUCH** include:

-bigger, brighter VFL display
-patented feedback calculation *
-industrial strength linear touch probe
-three and five way sorting capability *
-two way high speed sorting capability *
-broken tool detection *
-quota shut down
-statistical printouts
-real time SPC analysis
-simple menu set up and programming
-freeze screen function for high speed production *
-has been run at over 18,000 parts per hour
-real time Histogram with continual update *

*Moyer innovations

Scrap reduction is easy with the Moyer MAGIC TOUCH.

1.2 Length Measurement: The Moyer **MAGIC TOUCH** applies a patented measuring method. A multi-sampling process increases the accuracy of length measurement s. A digital filtration process reduces the effects of electrical noise and mechanical vibrations.

1.3 Pitch Correction: Select from two pitch control methods: "AUTO," or "%TOL".

1.3.1 AUTO: "AUTO" mode is an intelligent control method. In "AUTO" mode, the **MAGIC TOUCH** proportionally adjusts the pitch based upon the variation from the target mean free length. The adjust knob is initially set by the operator. A good place to start is with the dot set at the 12:00 position, or midway of its travel. The **MAGIC TOUCH** checks each adjustment to determine if the correct amount of adjustment was made. If correction was too much, the amount of pitch adjustment automatically decreases a little. If the correction was too small, the amount of pitch adjustment automatically increases a little. The gage also monitors the three sigma of the last 50 springs coiled. The **MAGIC TOUCH** limits each pitch adjustment to a fraction of this 3-sigma value. This "flyer rejection" improves centering. The adjust knob setting is only a target setting. The **MAGIC TOUCH** monitors the free lengths for particular patterns, and adapts it's reaction to them. The **MAGIC TOUCH** internally calculates the best pitch adjustment, yielding minimal free length variation. The gage continually optimizes the pitch control calculation to compensate for changes in the wire or the coiling process. Adjustable targeting reduces rate variation in various applications. Contact Moyer for more information.

1.3.2 %TOL (Barrier Avoidance): In "%TOLERANCE" mode, the position of the adjust knob and the "%TOL" value determines the amount and frequency of adjustment. A spring length that exceeds the predetermined percent of tolerance triggers an adjustment to center the process. The position of the adjust knob determines this amount of adjustment. A small amount of adjustment is recommended to optimize centering in this mode. Select "% TOL" over "AUTO" only when running low performance material or on coilers with mechanical problems. Use "AUTO" first, as auto mode usually provides a better yield.

1.4 FIVE WAY SORTING: This feature allows sorting the good springs into three groups, and sorting the bad springs into two groups. It is a very popular feature as it allows for grinding to closer tolerances than ever before. Good group tolerances can be even (33% each), or center weighted (25% long, 50% center, & 25% short) about the overall tolerance.

Example: The gage is set for 5 way sorting at 33%. If the total "good" spring tolerance is +/- 0.015", then the 0.030" total tolerance is divided into three good spring groups of 0.010" each. Shorts are anything shorter than -0.015", longs are anything longer than 0.015", and the remaining groups are -0.015" to -0.005", -0.005" to 0.005", and 0.005" to 0.015". As with three way sorting, the two outer groups, long and short, may have very long and very short springs. Consequently, the outer groups are sometimes thrown away or manually 100% inspected. The three inner groups are easily ground.

Sort limits are shown on a bar-graph on the "setup" screen and on the "run" screen.

1.5 HIGH SPEED TWO WAY SORTING: This feature allows sorting the springs into two groups, GOOD and BAD. It is a very popular feature for higher speed coiling, as it allows for sorting a stream if springs. !! NOTE !! At high speeds it is usually necessary to sort 2 or more springs at a time to ensure that the out of spec spring is removed.

2.0 DESCRIPTION of ACCESSORIES

2.1 Moyer   MAGIC TOUCH: This is the main control unit where all accessory equipment, such as sorting chutes, pitch controllers, etc. connect. The gage contains all operational controls such as on/off, configure, and set up.   Portions of the **MAGIC TOUCH** are protected under U.S. patent #4,719,586 and copyrights.

2.2 Moyer PROBE Mount: An articulated TOUCH PROBE MOUNT (with base) allows the best positioning of the **MAGIC TOUCH** for reliable and accurate measurement.

2.3 PROBE TIPS: TOUCH PROBE TIPS are available in various sizes or may be easily made in house.

2.5 Pitch Controller Assembly: The complete assembly includes a pitch drive motor and necessary hardware. We have several sizes and types of pitch controllers available. Standard systems are available for most coilers. Moyer engineers will design special controller systems per request. A cable connects the pitch drive motor to the **MAGIC TOUCH** "ADJUST" output socket. <u>Most CNC coilers do not require a pitch controller assembly.</u>

2.6 Read Switch Assembly: The assembly includes a actuator mounted on a lock collar, proximity (read) switch, and hardware for mounting the switch inside the coiler. The actuator mounts on any shaft that makes one revolution per spring. The cable with a three pin plug connects to the **MAGIC TOUCH** "READ" output socket.   Position the read switch to detect the actuator just before cut-off. <u>Most CNC coilers do not require a read switch assembly.</u>

2.7 Moyer Three Way Sorting Chute: This chute sorts springs into three groups: short, long, and good. The chute comes complete with all the necessary cabling and plugs for connecting to the **MAGIC TOUCH's** "SORT" output socket. The Three Way chute is available in these throat sizes: 3.375" x 4.000", 3.375" x 8.000", 7.450" x 8.000", and 7.450" x 16.000". <u>Custom sizes can be provided if needed.</u>

2.8 Moyer Five Way Sorting Chute: This chute sorts springs into five groups. The total good spring length tolerance is divided into three good groups. The Five Way chute is available in the following throat sizes, 3.375" x 4.000", 3.375" x 8.000", and 7.450"x 10.000". The chute plugs into the gage via two cables. These cables connect to the **MAGIC TOUCH's** "SORT" and "AUX1" sockets.   You can also use your Moyer five-way sorting chute as a three-way chute on newer as well as older gages that lack five way sorting capability. Moyer sorting chutes are made of durable stainless steel and quarter-inch aluminum; and they offer the most modern designs available.   <u>Custom sizes can be provided if needed.</u>

2.9 Coiler Kill (safety): The coiler kill kit includes two 3 pin sockets and relay mounted on a pc board, and a 3 pin cable. It turns off the coiler if one of the following conditions occur: (1) a specific number of consecutive bad springs are coiled, (2) broken tooling or wire has been detected, or (3) a quota of good springs are coiled. The 3 pin cable connects to the **MAGIC TOUCH's** "AUX1" output socket.   <u>Most CNC coilers do not require a read switch assembly.</u>

When using a five-way chute with coiler kill, connect the two pin plug from the chute to one of the sockets on the coiler kill board . Connect the 3 pin plug from the coiler kill cable to the "AUX1" socket.

3.0 NAMES and FUNCTIONS of BACK PANEL

3.0.1 **PRINTER:** The 25 pin plug on the Moyer printer cable plugs into this socket. The printer cable and **MAGIC TOUCH** can be used with most Epson or IBM compatible printers. For your convenience, we keep Seiko Instruments' Inc. DPU-414 printers in stock.

3.0.2 **SER I/O:** This is used to connect a data collection device directly into the **MAGIC TOUCH**.   A nine pin connector plugs into this socket. Output is "DataMite" compatable.

3.0.3 **ON OFF/FUSE/115-230 VAC LINE:** This is the power switch (on/off), fuse holder (5 amp 250 volt fast blow), and main power socket that requires using the supplied grounded plug. In plants with extreme electrical noise, extra grounding is recommended

3.0.5 **ADJUST:** The three pin plug from the pitch drive motor plugs into this socket.

3.0.6 **SORT:** The three pin plug from the air valve, three way sorting chute, or the five way sorting chute plugs into this socket.

3.0.7 **AUX 1:** The two pin plug from the five way sorting chute or the three pin plug from the coiler kill cable plugs into this socket.

3.0.8 **AUX 2:** The two pin plug from the touch probe air valve plugs into this socket.

3.0.9 **PROBE:**   The six pin plug from the **MAGIC TOUCH PROBE**, plugs into this socket.

3.0.10 **READ:** The three pin plug from the read switch plugs into this socket.

3.1 NAMES and FUNCTIONS of FRONT PANEL
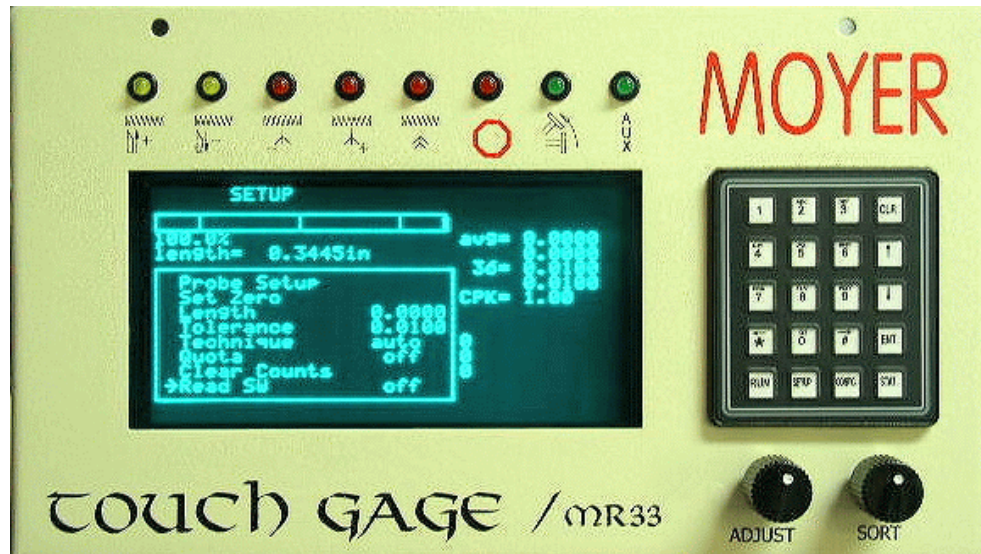
3.1.1 **Adjust Knob:** In run mode, it controls the amount of pitch adjustment. In test mode, it is used in testing the gage and probe for proper functional operation.

3.1.2 **Sort Knob:** In run mode, it sets the amount of time the sort device is activated. Changing the sort time also changes maximum activation time of the touch probe. In test mode, it is used in testing the gage and prob for proper functional operation.

3.1.3 **VFL** (Vacuum Flourescent Display)**:** The VFL displays data and menus for running production, set-up, configure, and hardware tests. The **MAGIC TOUCH** boasts a big 3.5" x 6" screen to give you the information you need without the hang-up of continually switching screens. The new display also has brighter illumination, making it easier than ever before to read.

3.1.4 **Key Pad:** The Key Pad is used to select options from menus, and to enter options and numbers. The bottom row of keys change displays and brings up menus. Moyer's 20-key control pad offers easy-to-use versatility not found on many competitors' gages.

4.0 RECEIVING and INSTALLING the MAGIC TOUCH

4.1 **Unpacking:** Before accepting the shipment from the carrier, inspect all cartons for damage. If a carton is damaged, open the carton in front of the carrier and check the contents. Each part will be shipped with approved packing. Check carefully that no parts are lost in the packing materials. In all cases, report any missing parts or damage to the carrier and to Moyer Process & Control immediately.

4.2 **Installation: WARNING**: Do not connect power cord until instructed.

4.2.1 **Gage Placement:** Place the **MAGIC TOUCH** so the operator has good access to and visibility of the front of the gage. Avoid subjecting the gage to excessive shock, oven heat or other hazardous environments. Place the gage where its use will not subject the operator to danger from moving parts. Normal coiler vibration is not considered excessive.

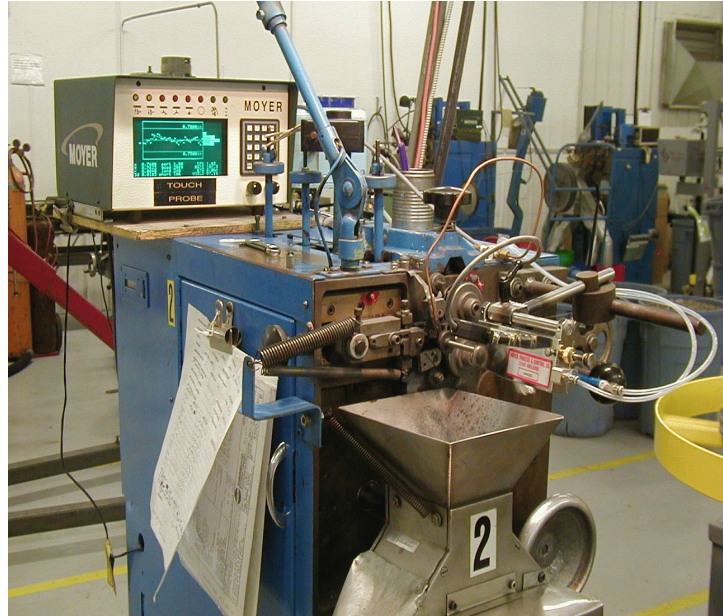4.2.2 **TOUCH PROBE & MOUNT:** Coil a spring by hand until wire feed quits. Attach the TOUCH PROBE to the mount base. Move the mount mounting hardware so the TOUCH PROBE can line up with end of the spring. Tighten the lock on the TOUCH PROBE mount.

Mark the location of the holes on the coiler thru the holder base. Drill and tap holes on the coiler as marked for 1/4-20 screws. After tapping, file the coiler face to remove burrs, then mount the base & TOUCH PROBE mount to the coiler.

4.2.4 **Pitch Motor:** Non CNC coilers and some CNC coilers require a pitch control motor for the MAGIC TOUCH to control the free length of the springs. There are 2 basic types. Those with gear reducers, and those who make attachment directly. Further, most in the USA operate on 117Vac and most outside the USA operate from 24Vdc. Generally, attach the pitch control motor so it can effectively perform the same task as an operator making fine corrections to the spring's free length. Contact MOYER for further assistance in making sure you have the proper correction system and have attached it properly.

4.2.5 **Sorting Chute:** Position the chute so the back of the funnel is as close to the front of the coiler as possible. This is usually beneath the cut off mechanism. Align the chute so after cut off, the springs fall into the throat of the chute without bouncing out.

Make a mounting assembly to connect the chute to the coiler. A bracket is included on the chute. Due to the variety of coilers in the industry, an adapting bracket may be required. Moyer now offers a chute stand that has adjustable height from 24" to 42" and can rotate horizontally as well as vertically.

The 3pin cable from the three way chute plugs into the **MAGIC TOUCH's** "SORT" output socket.

The 3pin cable from the five way chute plugs into the **MAGIC TOUCH's** "SORT"output socket. Connect the 2pin plug to the **MAGIC TOUCH's** "AUX1" output socket.

When using a five way chute with coiler kill, connect the two pin plug to one of the sockets on the coiler kill board. Connect the three pin socket on the coiler kill board to the **MAGIC TOUCH's** "AUX1" output socket using the supplied cable.

5.0 USING the MAGIC TOUCH

5.0.1 GENERAL INSTRUCTION

SELECTING SCREENS: For the setup screen, press the "SETUP" key. For the configure screen, press the "CONFIG" key. For the run screen, press the "RUN" key. For the stats screen, press the "STAT" key.

SELECTING OPTIONS: Move the "->" cursor to select the option you want. NOTE: This does not execute the option. The "->" cursor moves from option to option. You must select an option with either the up and down arrow keys.   The "ENT" key executes the selected option.

ENTERING NUMBERS: For entering or changing a number, a reverse video block (blinking block) cursor will highlight the last digit of the number. The "CLR" key will remove that digit and move the remaining digits one place to the right, while filling the left with '0'. The '0' thru '9' keys will shift the number one place left and insert the digit pressed. The up and down arrow keys increase and decrease the number by one.   You must press the "ENT" when you finish changing a numeric value. The **MAGIC TOUCH** will hold its memory if turned off. The **MAGIC TOUCH** will only erase a previous setup if you turn it on while pressing and holding the "SETUP" key on the key pad.

ENTERING TEXT: For entering or changing a letter or word, a reverse video block cursor will highlight the last letter of the word. The "CLR" key will remove that letter and move the block cursor one place to the left. The right arrow key (->) and left arrow key (<-) will move back and forth through the text. Numbers and letters are entered by pressing the required key until the desired letter appears. After choosing a letter or number, press the right arrow key to move the cursor one place to the right, then enter the next letter or number. You must press the "ENT" when you finish entering your text. The **MAGIC TOUCH** will hold its memory if turned off.
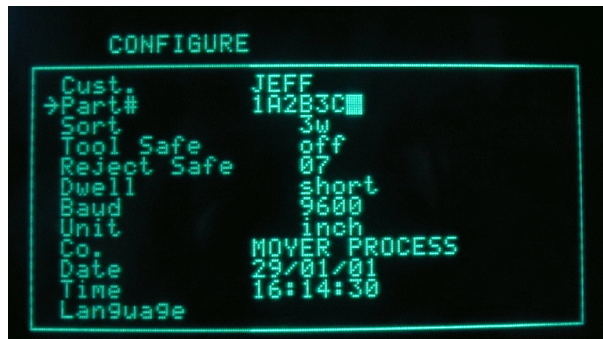
5.1 CONFIGURING YOUR MAGIC TOUCH

5.1.1 **ENTERING CONFIGURE:** Turn the gage on. Press and release the "CONFIG" key to enter this screen. The gage is now in the CONFIGURE menu. You can select an option by using the up and down arrow keys to move the cursor to that item. This menu allows you to set or change the following options:

5.1.2 **Cust.:** Enter the customer name by moving the cursor to **Cust.** and pressing the "ENT" key. Use the letters listed on the key pad and the right arrow key (->) and the left arrow key (<-) to enter your customers name. EX: to enter the name XYZ, Inc., press the "9" three times to see the "X". Now press the right arrow (->) key to move one space to the right. Press the "9" four times to see the "Y". Again, press the right arrow (->) key. Then press the "0" key four times to see the "Z". Up to 17 characters can be entered. Press the "ENT" key when done.

5.1.3 **Part#:** To enter the part number of the job running, move the cursor to this option and press the "ENT" key. Use the numbers and letters on the keypad to enter the part number, and the right arrow key (->) to move one space right and the left arrow key (<-) to move one space left. EX: to enter part number AR126, press the "2" key two times for the A. Then press the "->" key to move one space right.   Press the "7" key three times for the R, then press the "->" key to move one space right. Press the "1" key for the number 1, then the "->", and so on until you have your complete part number entered. When finished, press the "ENT" key to lock in the entry.

5.1.4 **SORT:** Select between 3way, 5way 33%, 5way 50%, or 2way AIR, by moving the cursor to SORT and pressing the ""ENT" key. Continue pressing until the option you want appears on the screen.

5.1.5 **TOOL SAFE:** Turn the broken tool detection on and off by moving the cursor to "TOOL SAFE" and pressing the "ENT" key.

5.1.6 **REJECT SAFE:** Select the automatic shut off (coiler kill) number by moving the cursor to "REJECT SAFE" and pressing the "ENT" key. Enter the number of consecutive bad springs you want to shut the coiler off. To turn this option off, enter 0.

5.17 **DWELL:** Select between NORMAL (segment coiler) and CNC (needed by some BHS Torin coilers), by moving the cursor to DWELL and pressing the "ENT" key.

5.1.8 **BAUD:** Set this by moving the cursor to BAUD and press "ENT" . Use the number keys to enter the baud rate needed. Be sure to use the correct baud rate for the device you have.

5.1.9 **UNIT:** Select between inch and millimeter by moving the cursor to UNIT and pressing the "ENT" key. All data and settings convert, so you need not reset the MAGIC TOUCH gage.

5.1.10 **Co.:** Enter your company name by moving the cursor to Co. and pressing the "ENT" key. Use the letters listed on the numbered key pad and the right arrow (->) and left arrow (<-) keys to enter your company name. EX: to enter the name XYZ, Inc., press the "9" three times to see the "X". Now press the "->" key to move one space to the right. Press the "9" four times to see the "Y". Again, press the "->" key. Then press the "0" key four time to see the "Z". Up to 17 characters can be entered. Press the "ENT" key when done.
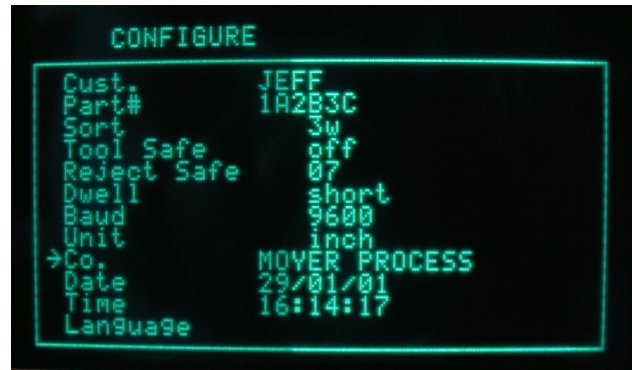
5.1.11 **DATE/TIME:** Change the date or time by moving the cursor to "DATE" or "TIME" and pressing the "ENT" key. Enter new values as needed.

5.1.12   **LANGUAGE:**   MAGIC TOUCH can display data on the screen and to the printer in four languages. Select between English, French, German, and Japanese by moving the cursor to "LANGUAGE" and pressing the "ENT" key.

5.2   SETTING YOUR MAGIC TOUCH

5.2.1 **ENTERING SETUP:** For a first setup or for setting up a new job, press and hold the "SETUP" key while turning the gage on. Continue holding until the MAGIC TOUCH displays the "SETUP" options menu.

5.2.2 **TOUCH PROBE PLACEMENT:** Coil a spring, but do not cut it off. Attach the TOUCH PROBE in such a way that it is aligned with the end of the spring, where you want to measure the length. The tip should be used that is compatible with the end of the spring or area os the spring where you want to made the length measurement.

5.2.3 **TOUCH PROBE SETUP:** With the Read SW OFF: Move the cursor to 'Probe Setup' and press enter.

5.2.3.1 **SETTING STROKE:** Using the inner stroke limiter adjustment and the 'extend' function, adjust the total travel. You should have enough travel so the springs clear the tip when cut off.

5.2.3.2 **SETTING END OF TRAVEL:** Once the total travel is set, with a spring coiled out, adjust the outer stroke limiter adjustment so it will stop the travel, a little past the minimum free length. You should check this after making length changes.

5.2.3.3 **CHECKING SNUBBER SETTINGS:** Make sure the FRL is adjusted for 40 to 55 psi. If a lubricator is not in use, put 2-3 drops of air tool oil daily in the air line for probe lubrication. Use the 'Cycle & Graph' function to see the position and velocity curve. Adjust the flow controls for smooth travel. If the velocity is too fast, the velocity graph line will be highlighted, indicating excessive velocity. For maximum probe life, adjust the required snubber to keep these speeds at or below these settings.
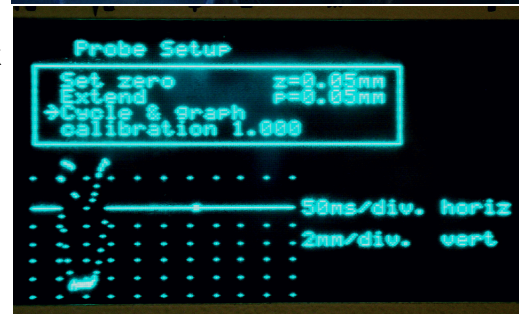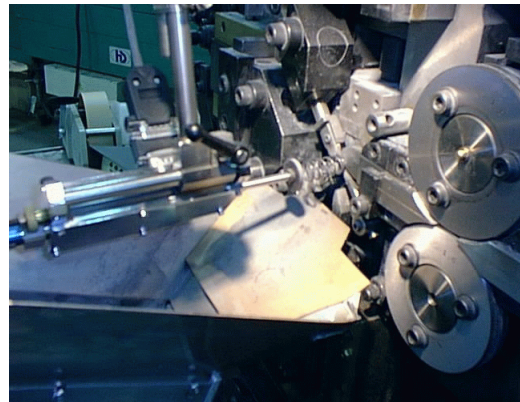
Press the 'SETUP' key to exit TOUCH PROBE SETUP and re-enter SETUP

5.2.4 **SET ZERO:** With the Read SW OFF: After having properly set the touch probe on a sample spring, Select the "Set Zero" option and press "ENT". This teaches the MAGIC TOUCH what nominal spring length is like. The MAGIC TOUCH gage considers a perfect spring. We will fine tune later.

5.2.5 **LENGTH:** To **enter the length of a nominal spring**, the "Read SW" option must be off. Select the "LENGTH" option and press "ENT" to change the length value. The MAGIC TOUCH gage considers a perfect spring as having no length. To display and print the actual length of the spring, enter that length here, otherwise enter zero.   To **change the length on the fly**, the "Read SW" option must be on. Changing the value changes the actual sort tolerance to your new value. Always check production to verify quality.

5.2.6 **TOLERANCE:**   To **enter initial tolerance**, select 'Tolerance' and press "ENT". Enter your tolerance and finish by pressing "ENT". This tells the MAGIC TOUCH gage how to

sort the springs.   You may **change the tolerance on the fly**. Always check production to verify quality.

   5.2.7 **Read SW:** Select this option and press "ENT" to turn the read switch on and off. With the "Read SW" option turned on, the operator has the ability to make changes to everything in all screens, except the zero and sort points. The read switch is automatically turned on when switching from the setup screen to the run screen. When changing from the run screen to the configure or stats screen, the gage will automatically continue sorting and adjusting whether this option is on or off. When switching from the run screen to the setup screen, the gage will continue to sort and adjust <u>only</u> if this option is turned on.

   5.2.8 **LONGER:** <u>With the Read SW ON</u>: To cause the springs to be controlled longer without altering the Length value, select 'Longer' and press the "ENT" key. Each time you press 'ENT' the target length will be increased by 5% of your tolerance.

   5.2.9 **SHORTER:** <u>With the Read SW ON</u>: To cause the springs to be controlled shorter without altering the Length value, select 'Shorter' and press the "ENT" key. Each time you press 'ENT' the target length will be decreased by 5% of your tolerance.

   5.2.10 **TECHNIQUE:** To change the type of pitch correction, select between "auto" or"%" by pressing the "ENT" key. In "auto", adjustments are made based on the last spring coiled. In "%", adjustments are made based on the percent entered. If 25% is entered, adjustments will be made when the length of the spring exceeds 25% of your sort tolerances.

   5.2.11 **QUOTA:** To enter or change the quota shut off, move the cursor to "QUOTA" and press "ENT". Enter the quota by pressing the number keys, then press "ENT". The coiler kill kit will automatically shut off the coiler when the programed number of parts have been coiled.

   5.2.12 **CLEAR COUNTS:** Select "CLEAR COUNTS" and press "ENT" to reset the counters to 0.

   5.2.13 **SORT:** Set the "SORT" knob for the amount of time you wish to activate the chute. For example, if you are running 46 parts per minute, a correct setting would be at mid scale.

   5.2.14 **ADJUST:** Set the "ADJUST" knob to control the pitch adjustment time. Start with the dot on the knob at mid scale if using AUTO technique. Otherwise, state it at a low value.

   5.2.15 **Pitch Motor Check:** Check for correct motor direction by pressing the "1" (IN) key and the "2" (OUT) key. If the motor turns the wrong direction, reverse the switch on the motor. These keys will work in any of the four screens.

5.3   STATS SCREEN

5.3.1 **ENTERING STATS:** After setting up your MAGIC TOUCH gage, press and release the "STAT" key. The gage is now at the STATS menu. You can choose an option by using the up and down arrow keys to move the cursor to that item. This menu includes the following items.

5.3.2 **MCS delay:** To set the timing or frequency for each Machine Capability Study, move the cursor to this option and press the "ENT" key. Enter the amount of time in seconds or frequency by using the numbered keys on the key pad and press the "ENT" key again.

5.3.3 **SPC delay:** To set the timing or frequency for each Statical Process Study, move the cursor to this option and press the "ENT" key. Enter the amount of time in minutes or frequency same as above.

5.3.4 **Freq. / Time:** The **MAGIC TOUCH** gage has the capability of changing between frequency of parts, or how many parts are ran before a sampling is taken, and time, or how many seconds and minutes passes before a sampling is taken. Toggle between **Freq.** and **Time** by moving the curser to this option and pressing the "ENT" key.

5.3.5 **Print +/-:** Move the cursor to this option and press the "ENT" key. Enter your print tolerances here as you wish them to reflect on your study. Print tolerances may or may not be the same as sort tolerances depending on CPK requirements

5.3.6 **start MCS:** To start a machine capability study, move the cursor to this option and press the "ENT" key. This study can also be started by pressing and holding the "*" key for just over one second while in the run screen.

5.3.7 **start SPC:** When the Machine Capability Study is complete, the gage will automatically start the Statistical Process Control study. This study can also be started by pressing the "*" key for under one second while in the run screen.

5.3.8 **Pause MCS/SPC:** To temporarily pause or stop either the MCS or SPC study, move the cursor to Pause study and press the "ENT" key.   This will cause the printer to feed one line and stop. To resume the study, press the "ENT" key again. The study will continue from the current data. This study can also by paused while in the run screen by pressing the "CLR" key.

5.3.9 **Abort MCS/SPC:** To completely stop either the MSC or SPC study, move the cursor to this option and press the "ENT" key. The printer will feed one full page and stop. This study can also be stopped while in the run screen by pressing and holding the "CLR" key.

5.3.10 **RS232:** Turn the serial output on, move the cursor to this option and press the "ENT" key.

5.3.11 **LIMIT:** Select the control limit type by moving the cursor to LIMIT and pressing the "ENT" key. Modified control limits often produce better looking charts. If the CPK is less then one, the LIMIT reverts to natural.
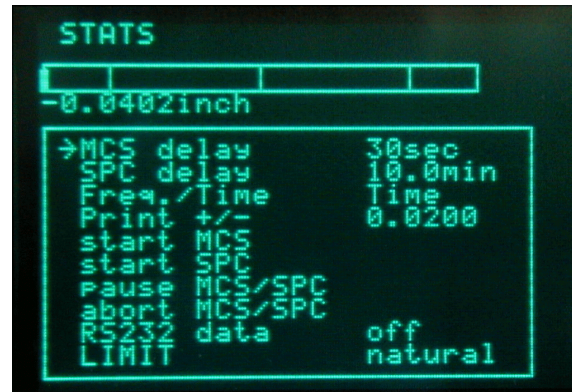
5.4 RUNNING YOUR MAGIC TOUCH

5.4.1 **START RUNNING:** If not is Setup, press the "Setup" key then make sure th 'Read SW ' is on. Cut off the spring used to set Zero. Measure this spring and correct is needed using the 'Longer' or 'Shorter' commands. Start coiling spring. Catch a spring close to the length you want as s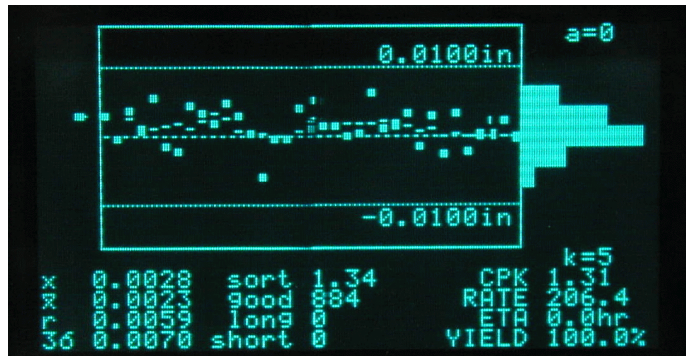hown on the screen. Compare its actual length to your target length. Correct if needed by using the 'Longer' or 'Shorter' commands in the 'Setup' menu. **WARNING !! Large changes may require resetting the travel limits.**

5.4.2 **PITCH CORRECTION:** Occasionally you may want to increase or decrease the amount of correction for further reduction of scrap. The **MAGIC TOUCH** has built-in self-improvement, so coil 50 to 100 springs before you change the "ADJUST" knob setting. You will find the section on Statistical Process Control very helpful in determining if the adjust knob setting needs to be changed. Please be sure to read that section.

5.4.3 **STATS:** To do a Machine Capability Study, press and hold the "*" key for just over one second (printer required). When the MCS is done, the **MAGIC TOUCH** will automatically continue taking Statistical Process Control study samples. To pause the SPC study, press and release the "CLR" key. The printer feeds one line. To continue a paused study, press and release the "*" key. To abort the studies before they are finished, press and hold the "CLR" key until the printer feeds through one page.

5.4.4 **DEFINITIONS:** Explanations of the RUN Screen

X	Last coiled spring length
x	A average length of the last 5 spring
r	Range of the last 5 springs
3o	Three sigma calculated from the last 50 springs
SORT	Maximum time the sort output stays activated
00	Number of out of tolerance spring in a row
GOOD	Count of good springs coiled since counts last cleared
LONG	Count of long springs coiled since counts last cleared
SHORT	Count of short springs coiled since counts last cleared
CPK	An index of process quality
RATE	Speed of the coiler in springs per minute
ETA	Estimated time for the job to complete (quota must be set)
YIELD	Percent of good springs coiled, based on total springs run

6.0 Statistical Terms

6.1 **Normal Distribution:** A bell-shaped curve that has few points (or measured spring lengths) at either end and most of the points (spring lengths) in the middle represents normal distribution. If a line is drawn through the middle to the base line, the two parts should be similar in shape and nearly equal in area to be a normal distribution. The **MAGIC TOUCH** measures the "Normality" of the production using the Geary's test for normality, or "Z". This is important. Calculated process limits at mean + 3 sigma and mean - 3 sigma are valid only if the process forms a normal distribution. In most cases, a properly running coiler and gage will coil springs whose lengths form a normal distribution.

6.2 **Standard Deviation or Sigma:** Standard deviation is a term used in statistics to describe the spread of data within a distribution. As manufacturers, we want this spread to be as little as possible from the middle or mean. Sigma is the Greek letter that denotes standard deviation (spread). The **MAGIC TOUCH** calculates this spread several different ways. It calculates and displays the spread of the last 50 springs each time it measures a spring. This enables the **MAGIC TOUCH** to make intelligent adjustments. The **MAGIC TOUCH** also calculates the process spread in the Machine Capability Study. The **MAGIC TOUCH** uses both the classic sum of the squares method (3sigma(v) on the printout) and the simpler approximation using Ranges (3sigma(r) on the printout).   The 3sigma(v) calculation is effected by trend; where the 3sigma(r) calculation is not. Together, they provide an important way of judging the effectiveness of adjustment.

6.3 **Mean or Average:** The Mean or Average of a process is the value calculated by adding all the lengths and dividing by the number of lengths. The **MAGIC TOUCH** calculates the mean of the last 50 springs each time it measures a spring. This is necessary for intelligent adjustment. It calculates and displays the mean of the last five springs (Xbar) for the operator. The **Magic Touch** calculates the mean of each five spring sample for the Xbar and R Chart print outs. This is called Xbar (the average of X values). The X represents an individual measurement in statistics. The mean of the parts is calculated and printed in a   Machine Capability Study (MCS) and Statistical Process Control study (SPC).

6.4 **Range or R:** Range, or R, is another way of measuring the spread of data sampled from a distribution. The range of a sample is the difference between the longest measurement in the sample and the shortest measurement in the sample. The **MAGIC TOUCH** calculates and displays the range of the last 5 springs (R). It prints the range(R) of each five part sample in its studies.

6.5 **Control:** The control of a process refers to whether or not that process is predictable. It has nothing to do with adjustment. In fact, if one thinks of the gage and coiler as one machine, an adjustment is something an operator does to the **MAGIC TOUCH** target length or coiling point, not something that the gage does to the pitch mechanism. Gages don't actually adjust, they maintain and operators adjust. Statistical techniques offer a way to determine if a process is of predictable quality and is consistent. You can determine if something has changed and/or if the parts are still the same by analyzing the samples taken at different times during a production of springs.   More information about control is given in "6.6 Charting".

6.6 **Charting:** The **MAGIC TOUCH** is capable of using natural, modified-natural, and modified control limits. Take, for example, natural control limits. "UCLx" is the upper control limit of the Xbar values. "LCLx" is the lower control limit of the Xbar values. "UCLR" is the upper control limit of Range values.

6.6.1 Sample statistics are taken to determine the overall quality of the parts in production.

6.6.2 After enough samples have been taken from a distribution of parts, you can calculate the control limits: UCLx, LCLx, and UCLr. Also the statistics mean and standard deviation of

the distribution of parts can be estimated. This is part of what a Machine Capability Study does.

6.6.3 As additional samples are taken from the distribution, their statistics should never exceed the limits calculated by the Machine Capability Study. This is part of what a Statistical Process Control study does.

6.6.4 Additional analysis is also often done by looking for trends and shifts in the actual chart. Because of its closed loop adjustment technique, the **MAGIC TOUCH** will seldom, if ever, allow a noticeable trend or shift to occur. If further study is desired, a good book on industrial quality control is recommended.

If all the Xbar and R values fall within the calculated control limits (UCLx, LCLx, & UCLr), then the process is "IN CONTROL".   It is in fact predictable. It will probably continue to run the same (with all Xbar and R values within the control limits), as long as nothing changes. Conversely, something has probably changed if an Xbar or R value has exceeded a control limit.

7.0 Statistical Studies

7.1 **MCS Overview:** The machine capability study determines if a machine is running parts that have a normal distribution, are in control, and are capable of meeting the print requirements. When a machine capability study is done, data is collected into subgroups. The data is then analyzed using Xbar and R charts.

7.2 **MCS Features:** The **Magic Touch** produces a print out titled "Machine Capability Study". It has the following features:

(1) Customer name and job number, entered through the configure and stat screen

(2) Date in day/month/year (military) format.

(3) Time of day using a 24 hour clock.

(4) "Mode": the first 2 digits of mode represent the position in which the adjust knob was set. 0 equals full counter clockwise and 99 equals full clockwise. The letter "P" means proportional "auto" feedback and "B" means "%TOL" feedback. The last two digits represent the internal gage adjustment value.

(5) "Good" is the number of good springs coiled since the counters were cleared.

(6) "Yield" is the % of good springs coiled since the last sample was taken.

(7) "Ranked Data" is the actual lengths of the sample, sorted from longest to shortest. The sample is the last five springs coiled. The **Magic Touch** will not sample individual spring more than once, and the samples are always contiguous (taken one after another), even at the fastest possible coiling speeds. This is important if Xbar and R charting is to be effective.

(8) "Xbar" is the average length of the sample.

(9) "Range" is the spread of the sample lengths.

(10) "Overall yield" is the % of good springs coiled since the set up.

(11) "Study yield" is the % of good springs coiled during the study.

(12) "Mean" is the average of the 100 springs sampled in the study.

(13) "3sigma(v)" is three times sigma calculated using the sum of the squares (variance) and represents long term variation.

(14) "Min_x" is the shortest measurement in the study.

(15) "Max_x" is the longest measurement in the study.

(16) "Z" is the Geary's test for normality value. If a distribution is normal, it should be between +1.96 and -1.96.

(17) "Avg_dev" is the average deviation calculated from the study.

(18) "3sigma(r)" is three times sigma calculated using ranges and represents short term variation.

(19) "UCLx" is the upper control limit for Xbars.

(20) "LCLx" is the lower control limit for Xbars.

(21) "Rbar" is the average of the sample ranges.

(22) "UCLr" is the upper control limit for the ranges.

(23) "CPK" is an index of process quality.

(24) "r/v" is the ratio of sigma(r) over sigma(v). It is a handy tool to monitor adjustment effectiveness.

(25) "Xbar chart" is a standard Xbar chart. It has micro-spacing of Xbar values and the 50% interval with count used to monitor adjustment effectiveness.

(26) "Range chart" is a standard Range chart with micro- spacing.

(27) "Histogram" is a true histogram as opposed to a frequency distribution. It has ideal interval spacing and the median two datum are indicated by "MM" for easy interpretation.

(28) The last line of the study analyzes the study for centering, control, and normality. Because some customers did not like the word 'normal' we use the word 'Gaussian' (their

meanings are the same).

7.3 **SPC Overview:** A process capability study is the long term study of the sample data taken by the **Magic Touch**. It is plotted against the machine capability studies' control limits to see if the process is remaining in control and is predictable. The **Magic Touch** titles it's process capability study "Process Xbar & R Chart". It contains the same data and features as the Machine Capability Study, except control limits do not change. It uses the limits as calculated in the most recent Machine Capability Study.

8.0 Interpretation of Statistical Printouts

The **Magic Touch** provides some very useful information on the screen and via the printer. This section explains standard SPC data as well as some Moyer additions.

8.1 **Adjust setting:** The best setting of the "Adjust" control can be determined from the printouts. The ratio r/v (sigma(r)/sigma(v)) should be greater than 0.80 but less than 1.00. If this ratio is greater than 1.00, the gage is probably over controlling. If this ratio is less than 0.80, the gage is probably under controlling. (**A MOYER INNOVATION**)

The number of times "X" is printed between the two broken lines on the Xbar chart is printed at the right end of the second broken line in the Xbar chart printout. It should be 9, 10, or 11.   If the count is 12 or greater, the gage is probably over controlling. If the count is 8 or less, the gage is probably under controlling. The broken lines are titled "50%" because half of the 20 Xbar values should fall between them. (**A MOYER INNOVATION**)

Examine the last two digits of the mode column. Check to see if this value is getting larger, getting smaller, or staying the same. This value represents the **Magic Touch's** internal correction value. If the **Magic Touch** thinks that it is over controlling, this value will be getting smaller. If the gage thinks that it is under controlling, this value will be getting larger.

If the r/v ratio and the number of Xbars between the 50% confidence lines on the Xbar chart indicate the gage is over controlling, and the last two digits of the mode column is staying the same or getting bigger, then turn the "Adjust" knob on the front of the **Magic Touch** counter clockwise to reduce the control level. Wait fifty or more springs and run another Machine Capability Study to see the results.

If the r/v ratio and the number of Xbars between the 50% confidence lines on the Xbar chart indicate the gage is under controlling, and the last two digits of the mode column is staying the same or getting smaller, then turn the "Adjust" knob on the front of the **Magic Touch** clockwise to increase the control level. Wait fifty or more springs and run another Machine Capability Study to see the results.

The amount to increase or decrease the "Pitch" knob setting comes from experience and trial and error.   It should also be noted that too little control can sometimes result in Xbar values above the UCLx line or below the LCLx line on the Xbar chart. Too much control can sometimes result in R values which are above the UCLr line on the Range chart. Once you've generated a Machine Capability Study which shows a proper level of adjustment, it is then time to examine a few other items on the study.

8.2 **Control Test:** If the bottom line indicates that the process is in control and centered, then no corrective action is required.

If the process is not centered, a severe feedback problem exists. For some reason, the feedback from the gage is not centering the process over a large number of parts. You may have a defective linkage, loose set screw, damaged pitch rod thread, bent pitch rod or pitch tool, bad flex shaft, or even a broken gage. Refer to the trouble shooting section in the back of the manual to help locate the problem.

If the process is centered but not in control, and you have tried varying the adjustment control with no help, then the process is truly out of control.

Out of control conditions usually require some corrective action. Try checking the following:
  (1) wire quality
  (2) worn, loose, or incorrect tooling
  (3) unpowered payoffs
  (4) incorrect feed roll pressure
  (5) machine problems
When a process is "out of control", there is something causing it. If that cause is corrected

or eliminated, the process will run with an improved quality. Therefore, Xbar & R charting is a powerful tool for process improvement.

8.3 **Capability Test:** If the statistics indicate that the parts are all within the quality requirements, the process is considered "Capable" of producing all good parts. A process may be "Capable" but not in "Control", or it may be in "Control" but not "Capable". A coiler may coil predictable springs with a maximum length variation of only +/-0.002 inch, but if the print requires +/-0.001 inch, it is not capable. If an out of control process is capable, try using modified control limits (if allowed).

What if the process is not capable?

(1) Employ sorting to eliminate non-conforming parts. The **Magic Touch**, with a chute or air valve, is capable of sorting springs into three or five groups according to length. Sorting to eliminate nonconforming parts is common. If the load is a very important print requirement, and if length tolerances have been established which will ensure good loads, it may be adequate to sort or reject springs outside of these tolerances. Some rejected springs may be salvageable , but the limits ensure all non-sorted springs are good.

(2) Employ sorting to subdivide the process. The **Magic Touch**, with the proper chute, may sort your springs into five groups. If the amount of grind is an important print requirement, if relatively wide length tolerances have been established to hold the loads, and if the amount of length variation is too much for a consistent grind, you probably should sort the springs into five groups. Each group can be ground separately. In this case, five way sorting has been used to group even the good springs according to the variation of the free length. This provides three groups of springs to be ground with very little free length variation. Consequently, one difficult process can be broken up into three easy processes.

(3) Attempt to tighten or improve the process at another step. This action may require using half tolerance wire, a powered dereeler, in-line heat treating, a set removal operation, heat setting, or a Moyer Computerized Grinder Length controller. Manual or automatic 100% sorting should be considered a last resort and is rarely necessary.

NOTE: Problems can arise from sorting and are often due to the nature of truncated normal distributions. Sometimes problems are real, such as when stack up arises because too many parts are close to, but not exceeding the print tolerance. Problems may be imaginary, such as when final inspection calculates process limits using usual techniques and estimate that some parts must be out of tolerance. However, extensive manual inspection finds only acceptable parts.

9.0 Hardware Test / Troubleshooting

If trouble should ever arise with the MAGIC TOUCH GAGE, there are several methods that one can use to find and correct problems. The 'HARDWARE TEST' mode of the Magic Touch GAGE can help to troubleshoot the gage. This mode will allow an operator to test the LED's, keypad, AC/DC outputs, CNC, printer and serial ports and the probe. To use the Magic Touch GAGE'S hardware test mode, follow these easy steps.
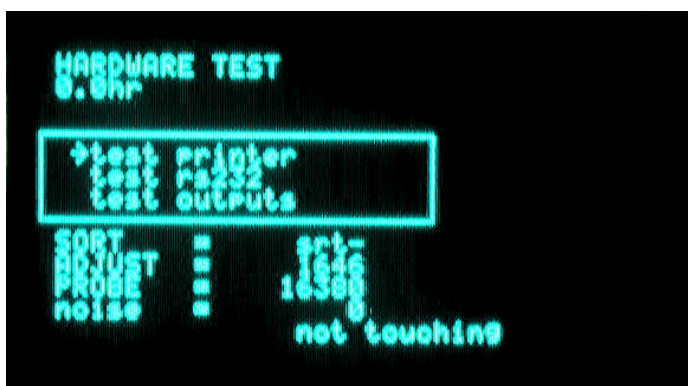
9.1 **ENTERING TEST:** Turn off gage. Press and hold the "4" key while turning on the MAGIC TOUCH GAGE. Release after a few seconds. The gage now displays the"HARDWARE TEST" screen.

9.2 **test printer:** To test the printer output, cable, and printer, move the cursor to this option and press the "ENT" key. Your device will show "AbCd0123456789".

9.3 **test rs232:** To test the RS232 (serial) output, cable, and terminal, move the cursor to this option and press the "ENT" key. Your device will show "AbCd0123456789".

9.4 **test outputs: NOTE: Be sure to disconnect the pitch motor from the pitch rod before preforming this test.** Rotate the SORT knob from limit to limit to select a desired output. Press the "ENT" key to activate that output. The output will stay activated for as long as you are holding the "ENT" key. Each time an output is activated, the proper LED will light. This also confirms the SORT pot is working.

9.5 **ADJUST POT CHECK:** While watching the **"ADJUST="** display on the screen, turn the ADJUST knob from limit to limit. The display value should go smoothly from about 0 to about 4095.

9.6 **PROBE = :** Displays current probe position. Should display from 0 to 16380. If you move the probe tip, you should see this number change with respect to the position.

If you get this far, it is probably not your gage, but could be an incorrect set up or configuration. For further assistance call Moyer Process & Control at (260) 495-2405, your local Moyer representative, or E-Mail us at moyercompanies.com.

!!!WARNING!!!
Beware of
Copy-"cat"
gages.
Only Moyer Gages
provide Moyer Quality!