RESOTUNE II(tm) *Electronic Drum Tuner*
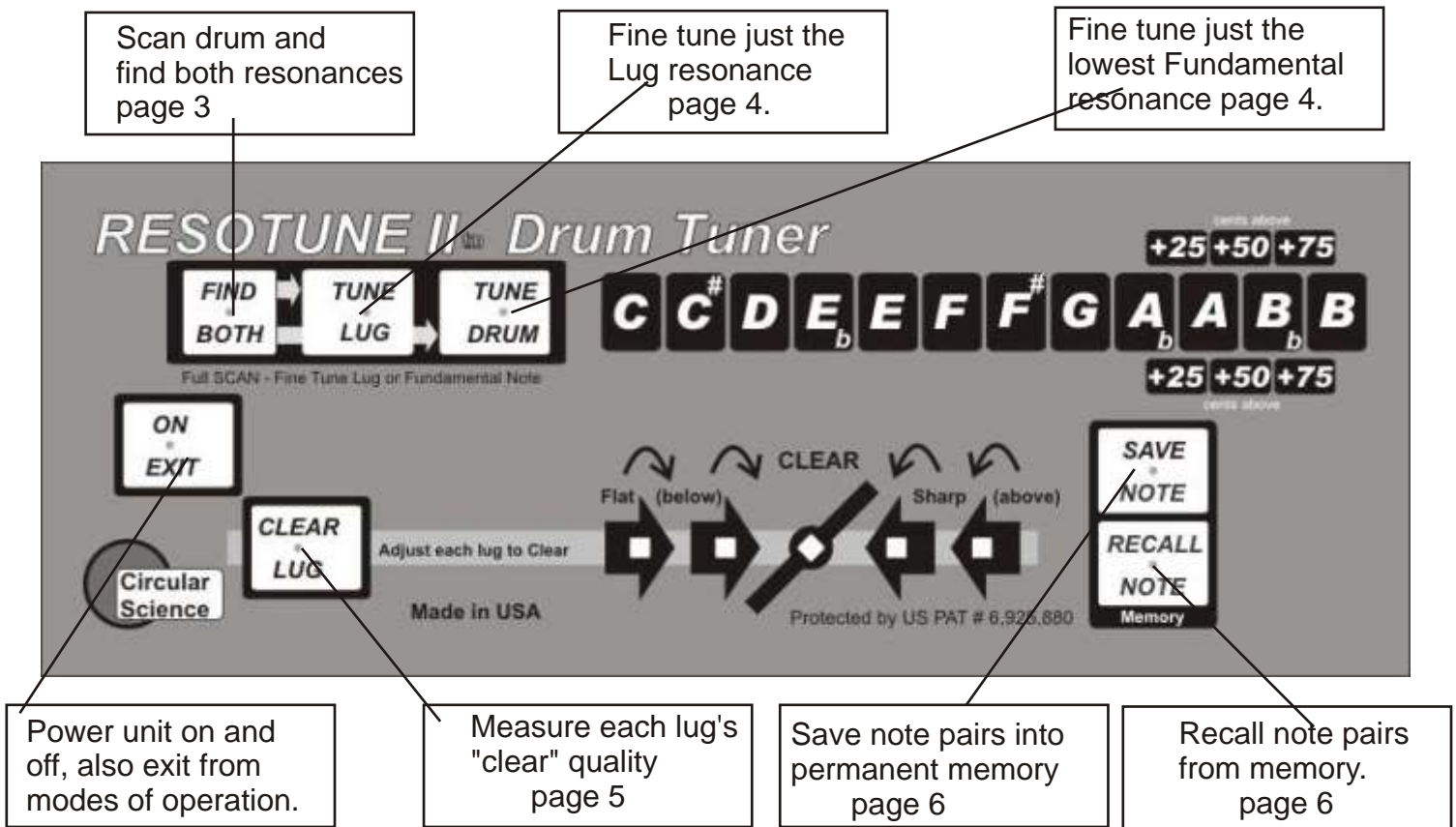
RESOTUNE uses a powerful microprocessor inside to perform complex measurements in response to a single button push freeing you up to concentrate on tuning decisions based on your personal preference. The first step when tuning a drum head is to measure the two lowest resonances and display both notes on the note display in real-time for easy adjustment. Change the lug tension while in either tune mode and RESOTUNE's note display will follow you and update the note result.

Tuning the lugs to specific notes is only part of drum tuning. RESOTUNE provides a new capability called "Lug Clearing". After the drum is tuned to the desired notes. This new measurement determines how closely the lugs are matched to each other, using a standing wave at a fixed note pitch. When the lugs are precisely "Cleared" to each other using this new measurement, the drum sound opens up for purest tonal quality. Much clearer than conventional note tuners can deliver measuring just pitch.

Scan drum and find both resonances page 3

Fine tune just the Lug resonance page 4.

Fine tune just the lowest Fundamental resonance page 4.

Power unit on and off, also exit from modes of operation.

Measure each lug's "clear" quality page 5

Save note pairs into permanent memory page 6

Recall note pairs from memory. page 6

C. 2018 Circular Science

READ THIS FIRST (please)

RESOTUNE makes precise sounds to vibrate the drum heads, then listens to the sound coming back to learn what note(s) the drum is currently tuned to, and how well the lugs are matched to each other. For this technique to return accurate results the drum must be free to vibrate as it will be when played, with the head at least rough tensioned so they vibrate freely without buzzing or rattling. Do not damp the bottom head while tuning the top.

Before starting on a drum that hasn't been played for a while, hit the drum a few times to unstick the head from the bearing edge. Head sticking isn't a problem for playing but can cause a very slight measurement error.

Place **RESOTUNE** above your drum as shown in the image below. Rest the front lip of RESOTUNE on top of the rim edge, with the rubber feet pushed up against the inner rim edge. This will precisely locate RESOTUNE relative to the lug and drum edge for accurate readings. Also center the lug being measured on the front of RESOTUNE.

Use the round wood struts to support the rear of the tuner above the drum head. For accurate note measurements both heads should be free to vibrate as they will in normal use. Since the fundamental note is influenced by the average tension of both heads, this (drum) note reading will change between only one head or two heads mounted. The lug resonance is local to each head so will not change significantly between one head being mounted or two.

For optimal tuning *RESOTUNE* should indicate the same Lug note when measured at each lug, by moving RESOTUNE to read each one. After they all indicate the same note pitch, you can use Clear Lug mode to fine match the lugs even more precisely, for most open "clear" sound quality.

FIND BOTH : Performs a full scan to identify fundamental and lug notes.

RESOTUNE automates the task of playing notes over a several octave range and then measures the actual sound coming back from the drum as it vibrates in response. *RESOTUNE* identifies the lowest fundamental (drum) note and the next higher (lug) note resonance. You can then use this note pitch information in Tune Lug, or Tune Drum modes to fine tune those notes. RESOTUNE uses Find Both at the start of every drum tuning session to learn how the drumhead is tuned.

You can run FIND BOTH with only one head mounted or with both heads mounted. The fundamental (DRUM) note pitch will change when a second head is mounted, because both heads vibrate up and down together at that lowest resonance. While changing heads with only one head mounted you can use the Lug Note (green display) target to rough tune but Drum Note (red display) measurement will not be accurate until both heads are mounted.

Press the [**ON**] button to turn *RESOTUNE* on. When *RESOTUNE* powers up, it will first display the serial number on red note LEDs and software revision on cents LEDs. The **TUNE DRUM** LED lights every time the note LEDs are used. Press the [**FIND BOTH**] button to begin a full scan. *RESOTUNE* will show scan progress on the note display by lighting the notes in sequence. When finished the fundamental or "drum" note resonance is displayed in red on the note display. The higher "lug" note is displayed in green.

When *RESOTUNE* finishes the **Find Both** scan it will automatically start **TUNE DRUM** mode to step from just below to just above the fundamental (Drum) note resonance, after it confirms that note pitch it jumps to **TUNE LUG** mode to fine tune just the Lug note. *RESOTUNE* will stay in Lug mode unless it determines that it needs to re-sample and update the Drum note. Then it will return to reading the Lug note.

For the first pass in either tune mode, *RESOTUNE* displays each individual note step up to the loudest resonance then freezes the note display. The octave of that note will display on the Clear LEDs. *RESOTUNE* also displays the sound level coming back from the drum head on the Note display using the alternate color. You will see the level rise to a peak and then hold as *RESOTUNE* steps up past the peak resonance. After the first pass *RESOTUNE* turns off the extra information and only updates the note display at the end of each pass. This note display will follow along as you change the lug tension after each scan past the resonance. To target specific note tuning, read the display and adjust tighter or looser as needed. For large note changes adjust all the lugs a similar amount, until close. Then fine tune each individual lug. Fractions between full notes are displayed as +25/50/75 cents LEDs above the base note. The fractional note LEDs are located to the right end of the note display, just above and just below it. These fractional note LEDs also indicate fractional levels between full 6 dB per note LED steps during level mode.

After **Tune Lug** mode is displaying a stable peak LUG note, that note can be used as a "clear" reference for use in **Clear Lug** mode.

C. 2018 Circular Science

TUNE LUG and TUNE DRUM: Fine tune fundamental and lug notes.

You can measure just the Lug note or just the Drum note by pressing the **[Tune Lug]** or **[Tune Drum]** button. Lug note is more representative of each Lug's individual tension and best for small tuning adjustments. When close to your desired note use Tune Lug for fine tuning each lug. It is good practice to first make all the lugs agree at the same Lug note before changing to a different note. You don't have to follow any special pattern or order when tensioning, but large changes from the initial lug tension may require a second pass around the head to settle on a stable result. Even if you target the drum note, you need to confirm that all lugs are at the same lug note whatever that note may be for the desired drum note.

The fundamental drum note (red), is the lower "thud" sound your drum makes when you strike the drum head dead-center. The Lug Note (green) is a higher pitch and louder when you strike the drum head off-center. The after-ring or sustain is influenced by the Lug note pitch of both heads. One popular voicing technique is to tune the top and bottom heads to slightly different note pitches. This will cause the sustain to shift up or down after the initial attack. Use the Lug note (green) for this bottom head de-tuning. You can also get similar de-tuning effects from using different mass heads top and bottom which will make different note pitches for the same lug tension.
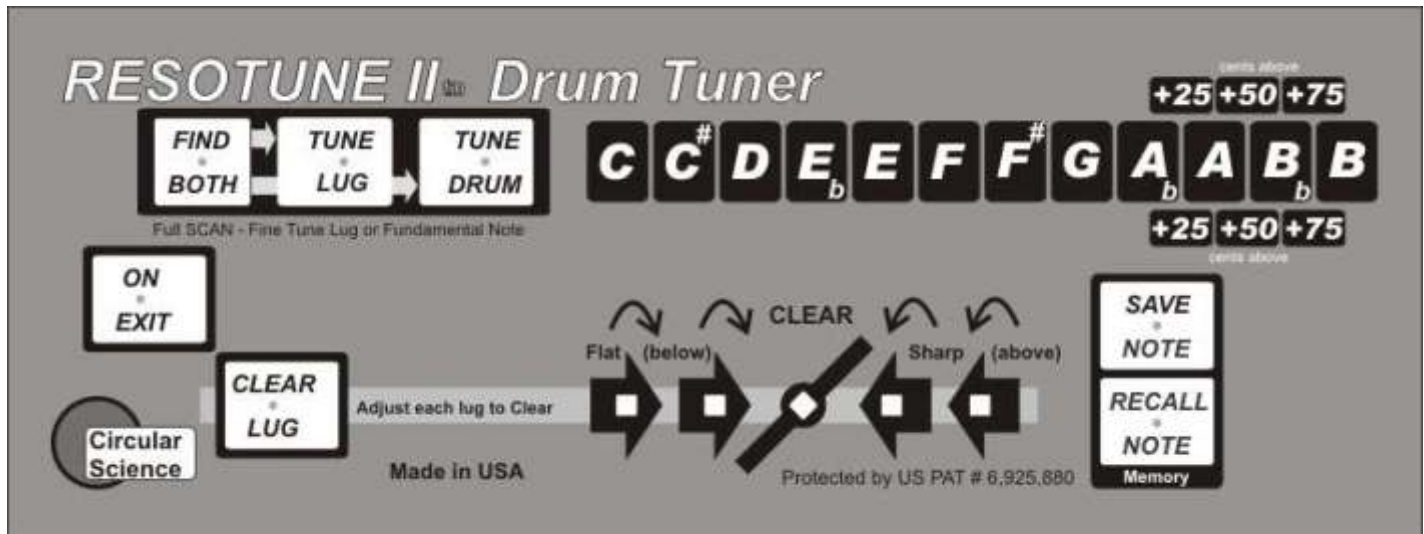
When tuning a new head to a formerly saved note pair, use the lug note (green) first since it will be less affected by the opposite head. The saved Drum note (red) that was measured with both heads mounted will not be accurate if only one head is mounted or the opposite head tension is way off. If you tune both the top and bottom head Lug notes to agree with the previously saved tuning, the Drum note will be correct unless you use different style or different mass heads than previous tuning session.

You can exit TUNE mode by pressing [**ON/EXIT**] to pause, or press any another function button to start that other mode. You can start **TUNE LUG** or **TUNE DRUM** at any time but unless you have run [**FIND BOTH**] first *RESOTUNE* may lock onto an incorrect resonance. When in doubt just run [**FIND BOTH**] again.

You can identify and fine tune resonances higher than the standard Lug Note by holding the [**TUNE LUG**] button down for 1 second, then releasing. *RESOTUNE* will load the former Lug note into the Drum note memory and start scanning up from just above that last known Lug note. This will capture the next higher resonance, load it into Lug note, and fine tune around it. You can repeat this "**Tune next Higher**" operation to identify and fine tune several higher overtones. This is very advanced and not necessary to get good tuning results. You can perform a similar "**Tune next Lower**" function by holding down the [**TUNE DRUM**] button 1 second, but if you request "Tune next Lower" when already on the lowest fundamental, *RESOTUNE* will search lower but not find a new lower resonance, because there isn't one.

CLEAR LUG : Measures clear quality of each lug one at a time

"Clearing" the drum lugs is what makes the *RESOTUNE* advantage. This is a completely different process than just tuning to a target note pitch and performed after you have finished tuning you drum to a desired note pitch. *RESOTUNE* uses patented technology to set up a standing wave in the drum head and measure the effect of each lug separately on this standing wave to determine each lug's optimal "clear" quality. When all the lugs are fine adjusted for optimal "clear" they are precisely matched to each other better than possible from simple note pitch sniffers.

RESOTUNE grabs the Clear note references while fine tuning in **Tune Lug** mode. This current most resonant Lug note is used to clear the lugs to. This reference data is held in short term memory. Press the **[CLEAR LUG]** button to start the Clear function anytime after Tune Lug mode has identified the reference Clear note. The Clear display LEDs will literally show you which direction to turn the lug being measured for optimal Clear quality. *RESOTUNE* must by physically located by the lug it is measuring. While clearing each lug on the first pass around the drum head, adjust each lug at least one red LED sharp (tight) and one red LED flat (loose), before centering the Lug on green/CLEAR. If RESOTUNE reads a better clear quality during this first pass around, it will update it's internal reference. To insure all lugs still agree with each other perform a second pass around all the lugs to confirm the lugs all still read green (clear).
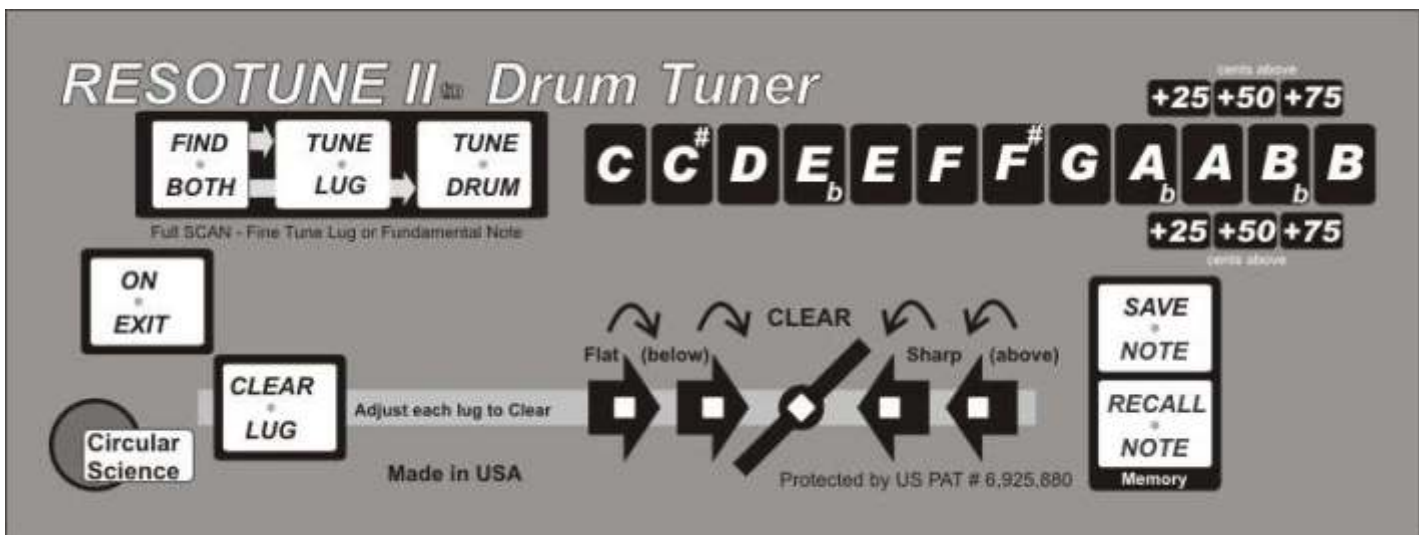

RESOTUNE's provides a higher resolution "fine clear" mode when you press press the **[Clear Lug]** button a second time while in standard resolution mode. In this higher sensitivity mode, additional resolution is displayed on the notes display above the Clear display. Ignore the Tune Drum or Tune Lug LEDs that are lit to power the note LEDs on. This high sensitivity mode may be too sensitive for some larger low tension drums. It will be most useful for high tension drums like snares or very small toms. Be careful where you place your free hand while making these fine adjustments since even being near the drum head can alterthese very sensitive measurement.

When the drumhead is adjusted completely "clear", the lugs are precisely in tune with each other. A drum head that is "not clear" will make slightly different overtones from each of the several lugs, instead of each lug making the same exact overtones. This causes a dissonant, less musical tonal character. When "clear" the drum makes the lowest number of extraneous overtones for the purest, most open, sound. Even though these overtone notes are not on musical intervals, less of them sounds cleaner than a chaotic mix of too many notes. Clearing both heads to the exact same Lug note increases the sympathetic coupling between the two heads when struck. This results in a louder, more resonant voice with longer sustain. De-tuning the two heads slightly apart, higher or lower reduces the coupling for a less resonant sound with faster decay.

You can stop and restart [**Clear Lug**] mode and it will return to the same internal clear reference as was last used. This clear references can change if you run [**Find Both**], [**Tune Lug**], or **[RECALL Note]** which loads a new short term clear reference.

C. 2018 Circular Science

You can save note pairs already in short term memory at any time for reuse later by simply pressing the [**SAVE NOTE**] button. *RESOTUNE* compares the new note pair to all of the previously saved note pairs. If the notes are already in memory, *RESOTUNE* will ignore the save request and show a "save failed" display by ramping red LEDs across the note display from right to left. *RESOTUNE* indicates a good note pair save by ramping the green note LEDs from left to right. If the note pair was already saved but the clear reference data has changed, it updates the previously saved note pair with the new clear reference data, into the former memory location, and gives you a good save display indication. RESOTUNE can save up to 48 unique note pairs. If the memory is full and you try to save more, it will give a combination display of both green LEDs ramping left to right followed by red LEDs ramping right to left, then ignores the save request. Ignore the TUNE DRUM or LUG LEDs lit when the note LEDs are used for alternate display purposes..
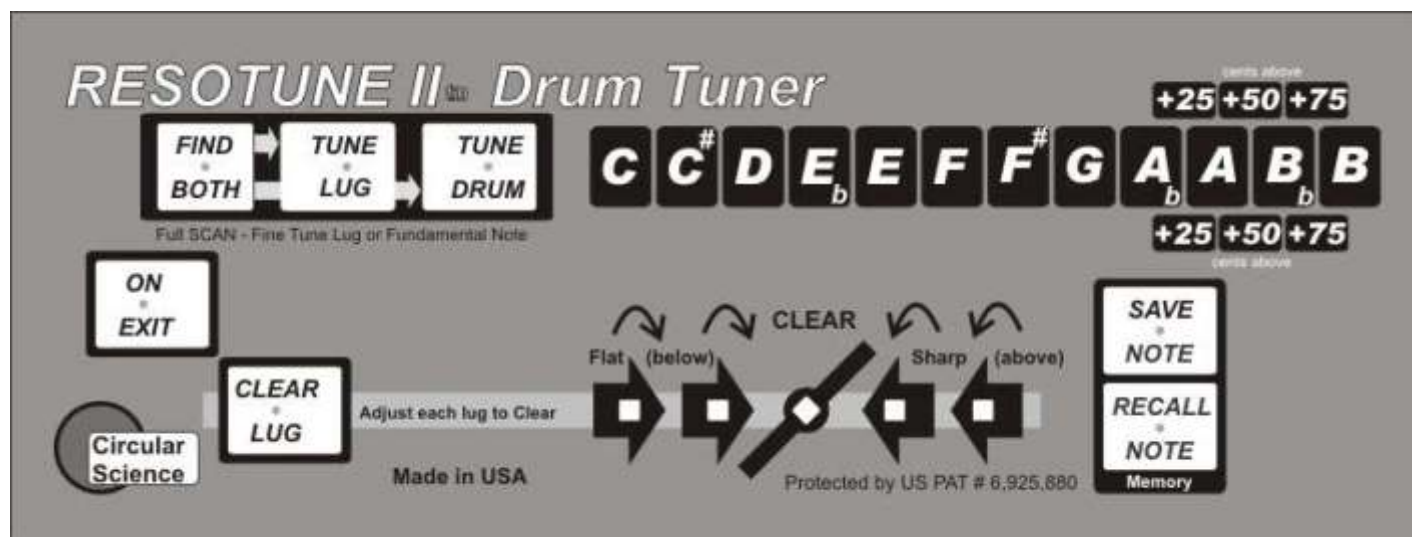
RECALL NOTE: Manage and recall formerly saved note pairs

RESOTUNE uses non-volatile memory that can hold up to 48 note pairs, when the unit is turned off. Those notes are secure even when the batteries are removed. These saved note pairs are held in last-in first-out order.

Press the [**RECALL NOTE**] button to play and display the last saved note pair. *RESOTUNE* alternates between playing the LUG note (green) and DRUM note (red). While the lug note is playing a return level display is presented using the red note LEDs. The CLEAR quality display also shows the octave of the note playing. When the drum note is playing a loudness level is displayed using the green note LEDs. The TUNE DRUM and TUNE LUG LEDs light up to support the note display not indicate operational mode.

Press [**RECALL NOTE**] again to step through and view the next pair of saved notes from memory. A strong level return for both notes can help you identify that you have the correct saved note pair for that drum.

If you press [**TUNE LUG**] or [**CLEAR LUG**] buttons while displaying a saved note pair, *RESOTUNE* will exit from RECALL mode, and start the selected function, using the saved note pair being displayed. To exit without jumping to another mode press [**ON EXIT**] button.

To erase a previously saved note pair that you no longer want, first press [**RECALL NOTE**] to step through the saved note pairs until you have the note pair that you want to erase displaying in the note display. While still in Recall mode press and hold the [**Save Note**] button for more than one second. The selected note pair will be erased and *RESOTUNE* will exit Recall mode. Shorter presses will be ignored.
.

Drum Note vs. Lug Note relationship. Despite having the capability to measure and fine tune either the Lug Note or the Drum note to fall precisely on a full note, these resonances will never be an exact number of steps apart so only one of the two can be perfectly on note. Drums are not considered "pitched" instruments so this tuning to notes is a secondary concern that affects voicing and how the drums fit together with each other and the rest of the band.

For a concert tom with only one head mounted the first apparent overtone that *RESOTUNE* captures is resonance mode (2,1) at 2.14x the fundamental frequency. This is 13 full notes and a fraction above the fundamental note. When we mount a second similar weight and tension bottom head, the Lug note is now vibrating in (1,1) mode which is only 1.59x the fundamental note pitch, so roughly 8.5 full notes higher. Since the Lug note stays the same, when two heads are mounted the fundamental pitch is shifted higher. This ratio for one head concert toms is fixed, but the ratio for two headed drums has another variable, namely the relative mass and relative tension of the two heads. The lug note resonance is mostly local to each head, while the lower fundamental drum note involves both heads vibrating together. Any two head drum can be fully characterized by three notes. The top Lug note, the bottom Lug note, and the combined Drum note. It is not possible to tune all three of these resonances on whole notes, but it is possible to get the top Lug note on key and pull the Drum note on key by de-tuning the bottom head up or down as necessary. Just because you can do this does not mean you should. We expect far more benefit from clearing drum heads for the purest sound quality when played at any note.

Your style when playing a run across the multiple toms in you kit, may suggest targeting one resonance or the other to tune toms on note. If you hit the center of the toms when playing a run across them consider tuning the fundamental Drum note on key, if you strike the toms off-center for runs, consider tuning the lug note on key. Assuming 10-12 significant resonances per head, with none falling on even harmonics, or musical intervals the classification of drums as "non-pitched" instruments is well justified. When we hit the drumhead it makes a complex combination of different note pitches. To get a consistent repeatable sound between head changes or re-tuning, make both lug notes the same as before, and clear the heads. There can be more than one successful combination of lug notes to voice a given drum or kit, so we do not agree with suggestions that there is only one correct voicing. Now that you have the ability to easily return back to a previous note combination, invest some time in experimenting to determine your own personal favorite drum voicing note combinations for your specific drum kit..

AUTOMATIC SHUT DOWN

To preserve battery life an internal timer keeps track of button presses and program activity. If no button has been pressed, or *RESOTUNE* measurements have not changed for a predetermined time interval, *RESOTUNE* will exit from that program and idle in standby mode. After another short interval with no activity *RESOTUNE* will turn itself completely off.

LOW BATTERY INDICATION

RESOTUNE II measures the battery voltage when it first turns on and if it detects low voltage (<1V per nominal 1.5V cell) it blinks the red power led. *RESOTUNE* will continue working with low battery voltage but measurements may be compromised so no new permanent saves to non-volatile memory will be performed until normal battery voltage is restored. *RESOTUNE* will continue working with low voltage for a while longer but will shut itself completely off when the battery drops below minimum reliable operating voltage.

C. 2018 Circular Science

FIGURE 2.

TUNING BASS KICK DRUMS

Tuning the bass/kick drum is similar to tuning smaller toms, but the larger diameter drum will generate lower note pitches. Typical kick drums have tall rim lips that can cause *RESOTUNE* to sit too high above the drumhead for good acoustic coupling and accurate measurement. We provide a strut assembly that allows *RESOTUNE* to sit down lower, closer to the drum head, while still not touching, for accurate kick drum measurements. The back side of *RESOTUNE* is supported above the drum head by two sets of standard wood struts, attached together with screw clamps. Extend these out as long as needed to fit your kick drum, then tighten the screw clamps until firm. For tuning mid sized toms, remove the screw clamps and use just one set of rear struts at a time. *RESOTUNE* now uses larger screw clamps, one per pair of struts.

You can make your own custom length struts from 1/2" wood dowels available from your local hardware store. The two-part strut approach we provide is more compact for easier storage and transport.

Just like when tuning smaller toms, we want the opposite head to be free to vibrate for the most accurate measurements. Support the drum at least a few inches above the floor which should be adequate to prevent the flat surface from damping the opposite head and causing note pitch errors. Tilting the drum at a slight angle relative to the floor, will also reduce acoustic coupling and damping caused by the floor.

We generally play the kick drum with a fixed location foot pedal beater, adjusted to strike the batter head roughly dead center. That strike location will mainly excite the lowest pitch fundamental note, much more than the other higher overtones. Since the higher resonances are not being excited as much, clearing the bass/kick drum will have less impact on it's general sound quality than for the other drums in your kit, that you play by striking anywhere across their entire heads. You should "clear" the bass/kick drum whenever you change the heads, but they do not require regular re-clearing maintenance as often as the other drums in your drum kit. As you would expect, the batter head (the one you hit), needs pitch tuning more often than the opposite, resonant head.

C. 2018 Circular Science

BATTERY REPLACEMENT INSTRUCTIONS
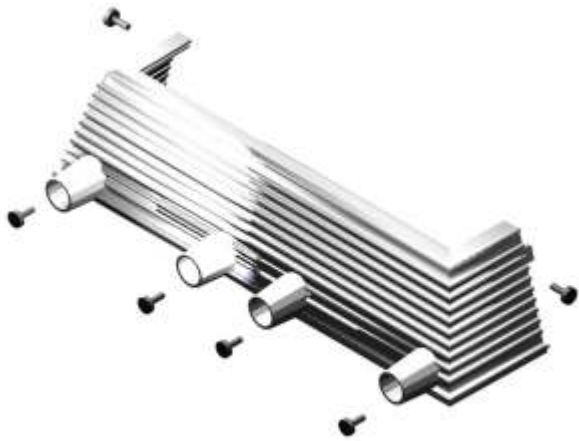
To replace the 4 standard AA size batteries remove the front half of the molded plastic clamshell package. This is secured by 6 screws total, one screw on each side near the top where the front and back section mate together and one screw in each of the four front strut ports. When all these screws are removed the front can be lifted off. With the front removed you can now slide the face plate/top control board assembly out. Flex the board up slightly so the microphone clears the hole in the bottom plate. You can leave the speaker wires attached, but flip the control board upside down to gain access to the battery holder. There is a composite panel loosely secured to the battery holder to hold the batteries in place during shipping. Observe the alternating alignment of the cells as marked on the battery holder.

You can press the **[ON]** button while the unit is apart to confirm that the batteries are installed properly and working. To re-assemble reverse the previous steps. Slide the top control board into the top slots in the back half of the plastic clamshell package, Flex the board up as needed so the microphone clears the bottom plate, then seat the mic in the mic hole in the bottom plate. When the control panel is properly seated in place slide the front half of the plastic clamshell on paying attention to slots for both the bottom metal, and top control panel. When the the clamshell halves are mated snugly to each other, reattach with the four screws in the strut ports. Then finish with the two screws on the sides.

TECHNICAL SPECIFICATION

Tuning Range: Lowest Note: C# -0   17.3 Hz
                         Highest Note: C -4 261.6 Hz

Tuning System :   Equal Temperament

Note Step size :   25 cents (1/4th note)

Timebase Resolution :   7 Mhz internal oscillator

Power Source: 4 x standard AA batteries

Dimensions: 2.5" H x 6" W x 10" L
                         6.35 CM H x15.24 CM W x 25.4 CM L

Weight: 2 lbs 6 oz (shipping weight 3 lbs)
                         1.1 Kg

All specifications are subject to change. .

Designed and manufactured in the USA by Circular Science

C. 2018 Circular Science

LIMITED WARRANTY

> *Circular Science warrants RESOTUNE II against defects in materials and workmanship for a "Warranty Period" of three (3) years from the date of original purchase. The guarantee is given in accordance with legal requirements.*

Serial Number and software rev level

___ ___ ___

Software Rev# displayed on cents leds   REV_____   ___ ___ ___

RESOTUNE II Drum Tuner

FIND ➡ TUNE ➡ TUNE
BOTH   LUG   DRUM

Full SCAN - Fine Tune Lug or Fundamental Note

C C# D E♭ E F F# G A♭ A B♭ B

+25 +50 +75   cents above

+25 +50 +75

S/N displayed on Note leds

S/N ____ - ____ - ____

___ ___ ___ ___ --___ ___ ___ ___ --___ ___ ___

When first powered on the software revision level will be displayed using the fractional note (cents) leds. You can look up the latest software revision level on the SPECS page of our website RESOTUNE.com.

We reserve the right to continue software development and you can get your unit reprogrammed with newer software by returning the unit to the factory. Check our web store for the nominal charge and details.

RESOTUNE II units display a unique digital serial number using the note display when first powered on. This serial number can not be altered or removed to conceal identification. Make a note of this digital serial number in the blank spaces above , and keep this somewhere safe in case you ever need to identify or prove ownership of your unit. If misplaced you can contact us for serial number data.

Circular Science - 7489 Highway 503- PO Box 297- Hickory, MS- 39332- 601-646-2767

C. 2018 Circular Science