OWNERS MANUAL

THE EMINENT TECHNOLOGY MODEL ONE

AIR BEARING STRAIGHT LINE TRACKING TONEARM

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THE EMINENT TECHNOLOGY MODEL ONE AIR BEARING TONEARM IS A DELICATE AND PRECISE INSTRUMENT WHICH REQUIRES MAINTENANCE TO RETAIN ITS HIGH PERFORMANCE CAPABILITIES. IT IS IMPORTANT FOR THE USER TO UNDERSTAND THE REQUIREMENTS OF THIS TONEARM. THIS PRODUCT IS DESIGNED AND MANUFACTURED BY PEOPLE WHO APPRECIATE AND ENJOY MUSIC. IT IS UNIQUE IN ITS APPROACH, DESIGN AND OPERATION. THIS MANUAL SHOULD BE THOROUGHLY REVIEWED BEFORE USING THIS PRODUCT.

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INTRODUCTION

The Model One is an air bearing straight line tracking tonearm for precise reproduction of analog records.

It is a uniquely conceived tonearm designed to be installed on turntables with universal mounts. It can be adapted to both solid mount (direct drive) turntables and spring suspended mount turntables. This product is designed and manufactured by Eminent Technology, Inc.

The large surface area air bearing uses some of the tightest tolerances in tonearm manufacturing today and is much more rigid at audio frequencies than metal bearings. Unique choice of materials was determined through extensive listening tests, measurements, and work in stress and resonant analysis of materials.

The tonearm leadwire is important due to the requirement that it must be flexible and interface with very low impedance transducers. Multi-stranded oxygen free litz wire was chosen with gold plated connectors in the audio chain.

Resonances within the arm were carefully measured during the prototyping stages. Results lead to the use of large diameter thin wall aluminum tubing with foam filled damping. Interface connections are made with heavy wall aluminum brackets and socket head cap screws with ABS damping. The headshell is

machined from solid high impact strength ABS stock. It incorporates a unique expanding collet design which grips over 1 sq. in. of inside surface area of the tonearm tube when locked into place.

Counterbalance weights are provided for cartridges which weigh up to 12 grams. Additional counterweights can be used for heavier cartridges (to 20 grams). These weights are isolated by rubber from the spindle. The air bearing spindle is machined to within (±.0003") tolerances and is hard coat anodized to prevent wear when the arm is moved without air.

This arm does not pivot at low frequencies. The air bearing is a rigid system which provides support vertically and horizontally and allows no motion outside of these two planes of operation. (The mechanical servo, and small surface area air bearing type arms behave like a pivoted arm at and close to their resonant frequencies.) This is a true high mass arm which works well with most cartridges.

This arm has high horizontal inertia and medium vertical inertia which splits the resonant frequencies and lowers their peak amplitudes (See Technical Section) at those frequencies. Resonance in one plane will not start resonance in another plane (or rotational motion) which helps improve imaging and phase response.

The mounting provisions allow the use of larger and stronger hardware than that of conventional arms. This product can be completely maintained while mounted on the turntable.

OPTIONAL AIR PUMP

The Eminent Technology air pump is an industrial type air supply. It utilizes two diaphragms operating out of phase and a surge tank to produce an extremely smooth airflow. It is quiet enough to be used in most listening rooms.

SPECIFICATIONS:

TONEARM:

Type:	Straight line tracking air bearing
Length:	7" pivot to stylus distance
Tracking Error:	0°
Effective Mass:	(high) variable in both planes. 40 grams horizontal, 10 grams vertical.
Height Adjustment At Pivot:	.75" equal to ± 2½° of vertical angle adjustment
Overhang Adjustment at Tonearm:	Slot with 5/8" range.
Resonance Damping:	Tonearm tube and spindle are closed cell foam filled.
Maximum Cartridge Weight:	Counterbalance weights supplied for up to 12 grams. Additional weight available to 20 grams.
Maximum tracking Force Available:	Cartridge weight plus 7 grams, infinitely variable.
Tracking Force Calibration:	None. User must supply scales.
Sidethrust Correction:	Not required with tangentially tracking arm (See technical section)
Pivot Damping:	None for vertical or horizontal motion. Air bearing for other directions of motion.
Cuing:	Mechanical with rubber damping. Adjustable.
Cartridge Leadwires:	7/42 stranding color coded litz in vinyl jacket.
Capacitance:	30 p.f.
Resistance:	.9 ohm

Azimuth Adj.:	±2°
Headshell weight:	5 grams
Spindle Weight:	14 grams
Tonearm Tube Weight:	11 grams
Counterbalance Weight:	15 grams "small" 30 grams "large"
Air Bearing Surface Area:	6.8 sq. in.
Air Filter:	.01 micron rating, moisture trap
Air Bearing Pressure Requirements:	3 psi @ 50 cu. in./min.

MATERIALS:

Tonearm tube:	6061-T6 hard anodized .5" O.D. .035 wall aluminum tubing
Spindle tube:	6061-T6 hard anodized aluminum .6110 O.D. .014" wall
Headshell:	ABS Composite, machined from solid stock.
Counterbalance weights:	303 stainless steel, both rubber isolated.
Overall Tonearm Weight:	400 grams, .9 lbs.

AIR PUMP - OPTIONAL

Power Requirement:	120 Vac. 50 - 60 Hz. 8.5watts

MOUNTING THE TONEARM ON A TURNTABLE

This section is intended only as a guideline to be used for installation of the tonearm to a turntable. In time we will obtain more detailed information on how to install the tonearm on specific turntables. The user can call or send us a postcard for more information.

POSITIONING THE ARM

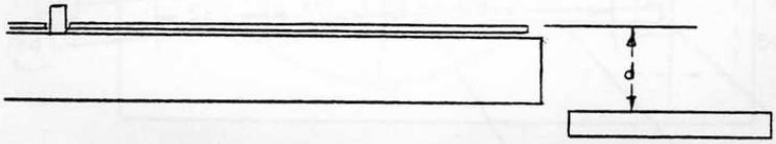
HEIGHT

When the arm is being positioned for height, (the amount of height above the standard mounting board the channel of the arm must be spaced in order to position the vertical pivot point of the bearing) it is important to locate the center of the air bearing tube (spindle) just above (approximately 1/8") the surface of a record with any pad to be used in place. This will set the VTA adjustment in the middle of its range and will be close to the ideal point for the vertical pivot. The amount of spacing required is found by making the following measurements:

Measure the distance from the flat surface (top) of the mounting board on the turntable to the top of the platter including the record pad to be used. If this distance is one inch, then the spacer thickness should be 1/2 inch. If this distance is higher, add an equal amount to the spacer.

If the distance is lower, subtract that amount from the spacer. (Ex. If this distance measured is 1¼ inches, the spacer thickness should be 3/4 inch).

See sketch.



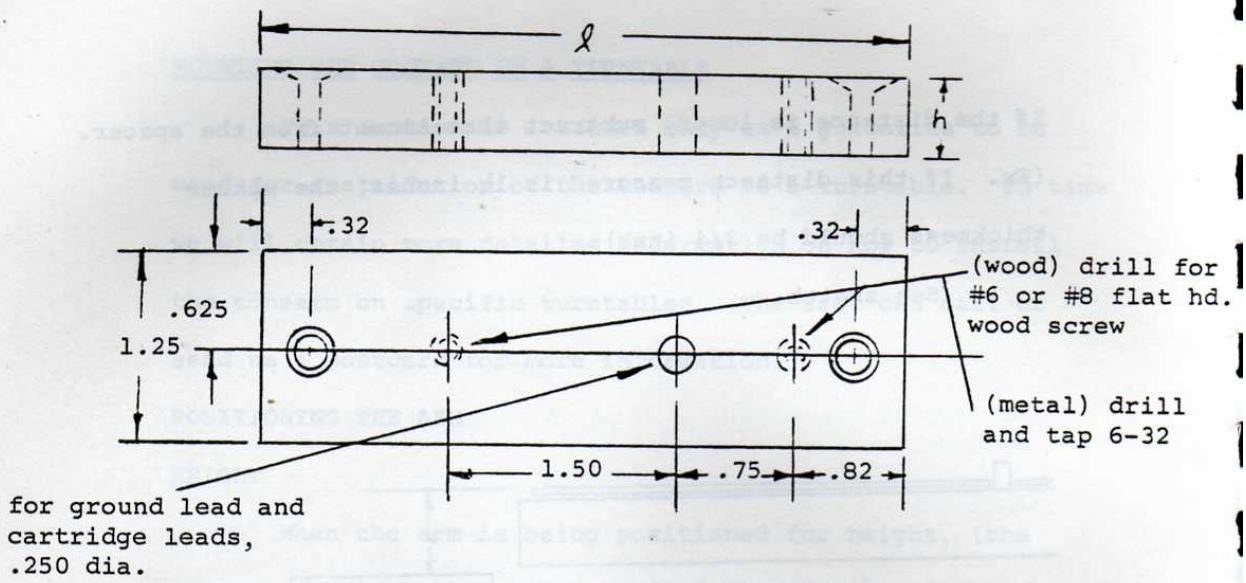
for Systemdek II X turntable, mtg board → platter (w/o mat) = 1 3/32"
sub-chassis → platter = 1 15/32 sub-chassis → Audioquest mat 1 19/32 − ½ = 1 3/32

LENGTH AND WIDTH OF THE SPACER

The length of the mounting spacer should be as long as is allowed by the mounting area provided on the turntable. Its width should be 1¼ inches.

MAKING THE SPACER

The spacer can be made out of hardwood at a cabinet shop or metal (aluminum preferred) from a machine shop. It should be first made with at least 2 drilled or tapped holes for mounting to the tonearm. Its surfaces must be parallel and flat.

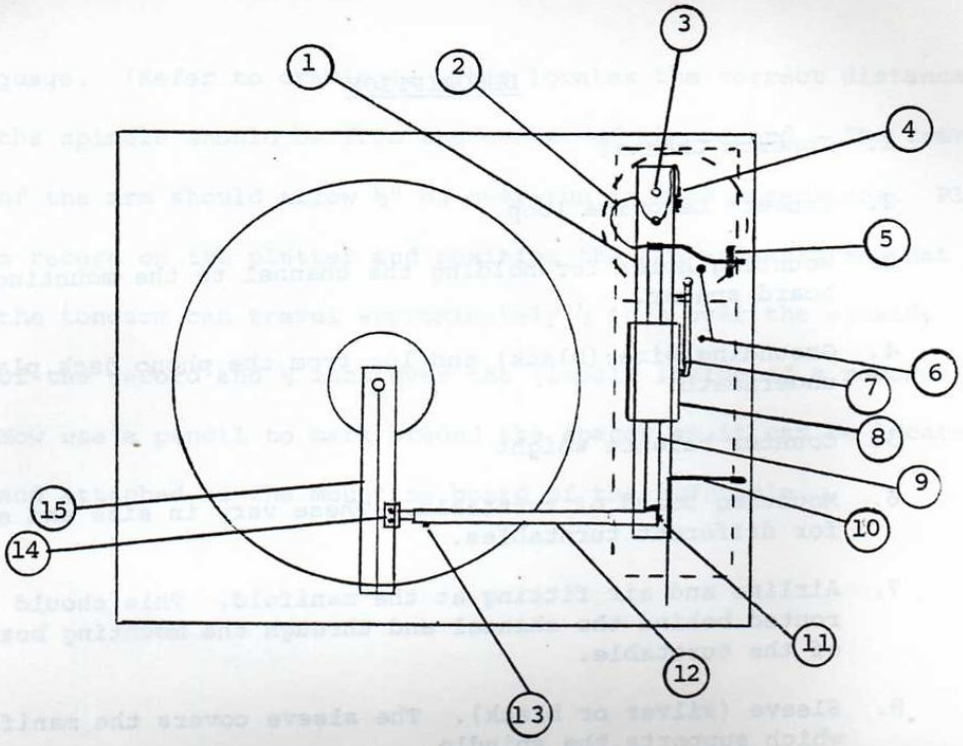


Have the mounting spacer made before proceeding to the next step with at least the holes necessary to mount it to the channel. A closely matching black paint is Borden "Krylon" #1613 semi-flat black.

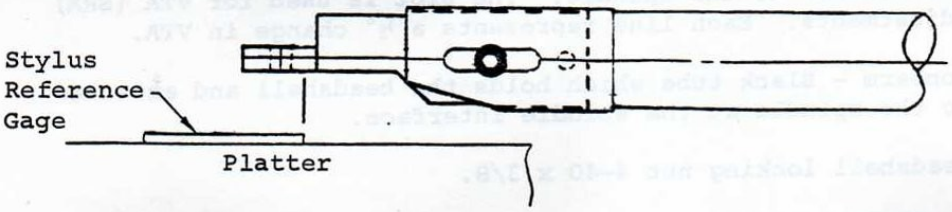
POSITIONING THE TONEARM - DISTANCE FROM THE PLATTER

The mounting spacer should be complete and attached to the channel for this step. Place the stylus reference guage on the platter. (Do not install a cartridge in the headshell.)

The arm should be placed on the turntable in the position normally occupied by a conventional tonearm parallel to the right side edge of the turntable.



Install the headshell in the tonearm tube and center it in the middle of the slot (used for overhang) using the innermost screw position of the headshell.



Then line up the headshell (tonearm assembled completely) over the stylus reference gage such that the position of the mourting platform of the headshell between its screw locations and back (see figure above) is directly over the back edge of the stylus reference

DESCRIPTION

1. Tonearm Channel

2. Tonearm Leadwire loop

3. Mounting holes for holding the channel to the mounting board spacer.

4. Grounding wire (black) and lug from the phono jack plate underneath.

5. Counter balance weight

6. Mounting Board of turntable. These vary in size and shape for different turntables.

7. Airline and air fitting at the manifold. This should be routed behind the channel and through the mounting board of the turntable.

8. Sleeve (silver or black). The sleeve covers the manifold which supports the spindle.

9. Spindle-tube which forms part of the air bearing.

10. Cuing Bar - Lever raises and lowers arm. This works only when air is applied to the bearing.

11. Spindle Interface - Black right angle bracket which connects the tonearm to the spindle. The slot is used for VTA (SRA) adjustments. Each line represents a ½° change in VTA.

12. Tonearm - Black tube which holds the headshell and attaches to the spindle at the spindle interface.

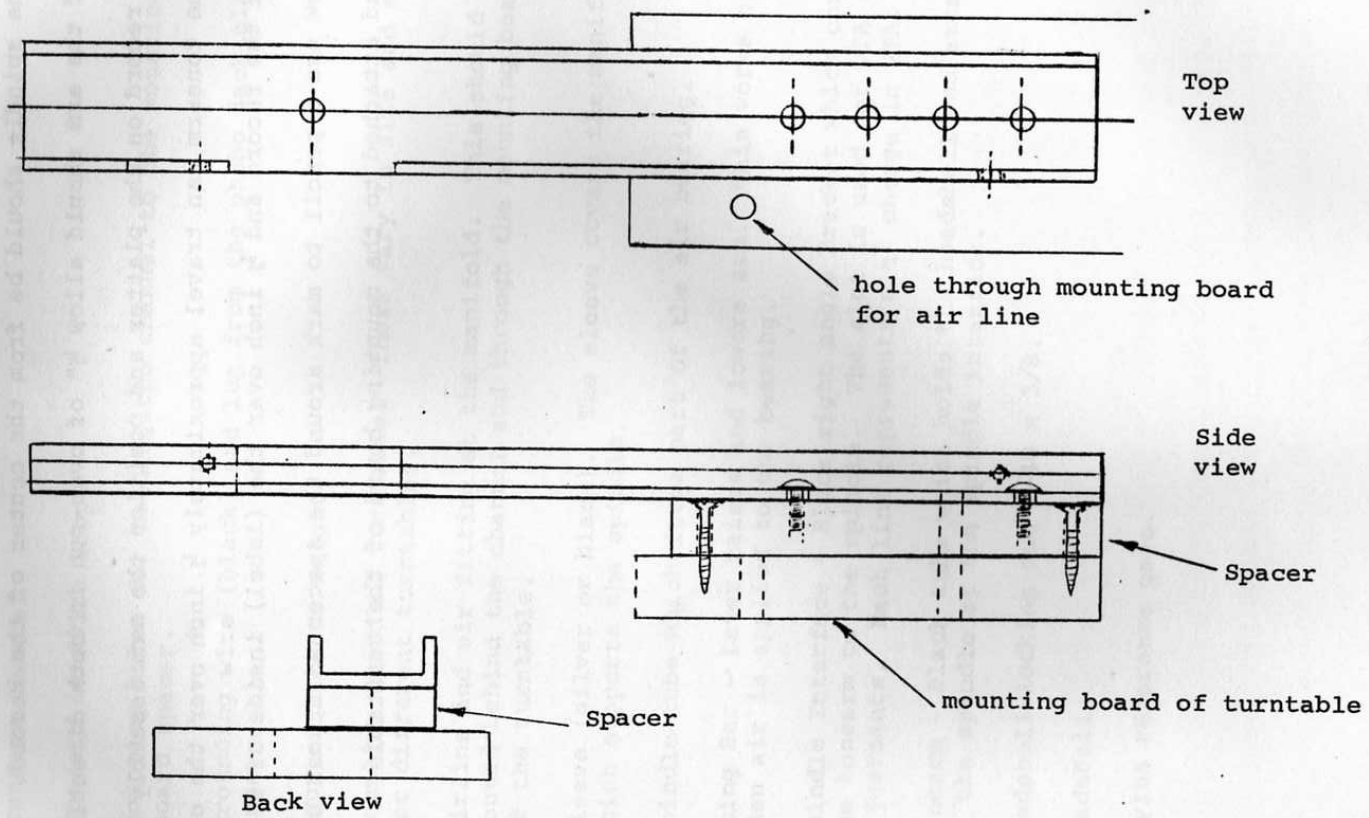
13. Headshell locking nut 4-40 x 3/8.

14. Headshell

15. Stylus reference gage.

guage. (Refer to drawing). This locates the correct distance the spindle should be from the center of the record. The travel of the arm should allow ½" of over-run in both directions. Place a record on the platter and position the arm assembly so that the tonearm can travel approximately ½ inch over the outside of the record and ½ inch over the (label) inside of a record. Now use a pencil to mark around the spacer so it can be located and attached to the mounting board of the turntable.

ASSEMBLY DRAWING FOR MOUNTING SPACER

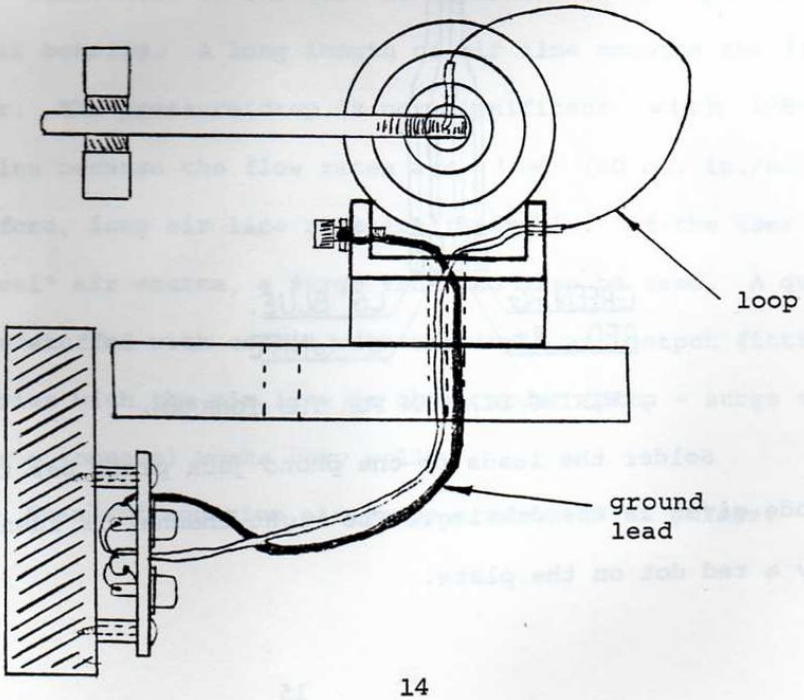


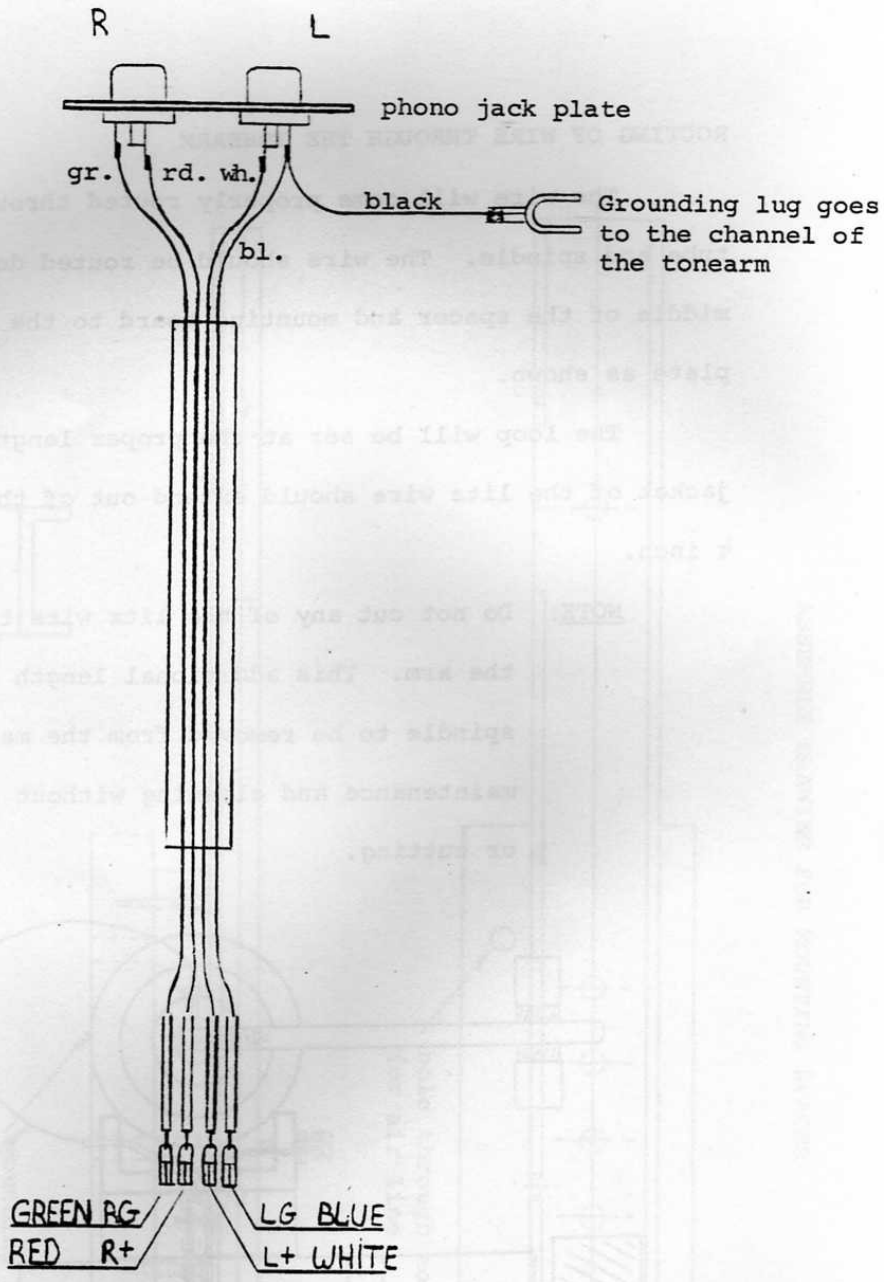
ROUTING OF WIRE THROUGH THE TONEARM

The wire will come properly routed through the tonearm tube and spindle. The wire should be routed down through the middle of the spacer and mounting board to the RCA phono jack plate as shown.

The loop will be set at the proper length and the vinyl jacket of the litz wire should extend out of the channel about ¼ inch.

NOTE: Do not cut any of the litz wire that comes with the arm. This additional length allows the spindle to be removed from the manifold for maintenance and cleaning without unsoldering or cutting.





WIRING DIAGRAM FOR THE TONEARM

Solder the leads to the phono jack plate per the color code given in the drawing. The right channel is identified by a red dot on the plate.

AIR PUMP

RECOMMENDATIONS FOR AN AIR SOURCE

NOTE: ANY PUMP USED WITH THIS PRODUCT MUST BE TURNED OFF WHEN THE ARM OR SYSTEM IS NOT IN USE. THE FILTER SUPPLIED WITH THE ARM MUST BE USED WITH THIS PRODUCT AT ALL TIMES.

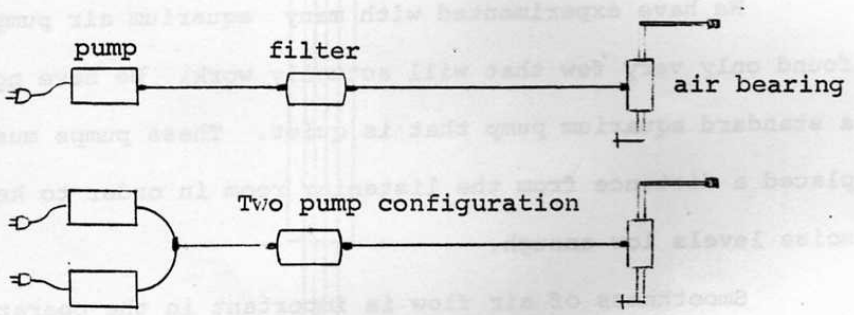
If the owner chooses to supply his/her own air source, we offer the following suggestions:

We have experimented with many aquarium air pumps and found only very few that will actually work. We have not found a standard aquarium pump that is quiet. These pumps must be placed a distance from the listening room in order to keep noise levels low enough.

Smoothness of air flow is important in the operation of the air bearing. A long length of air line smooths the flow of air. The pressure drop is not significant with 1/8" I.D. air line because the flow rates are low (50 cu. in./min.). Therefore, long air line runs are favorable. If the user wants an"ideal" air source, a surge tank can also be used. A quart bottle stuffed with cotton with air input and output fittings in series with the air line in this order (pump - surge tank - filter - tonearm) works very well.

Standard aquarium air pumps produce 60 Hz pulses.

These can be smoothed by the above methods. If aquarium pumps are chosen and the recommendations show that two are required, these should be run out of phase. This can be done by running them in parallel with a "T" air fitting and listening to the output. Flip over the plug of one air pump and listen to the output. Then reverse the plug, when the pumps are out of phase, the output of air at the fitting will be much smoother.



RECOMMENDED AIR PUMPS

1. Silent Giant. . . . . .(2 required), (quiet)
2. Hagen "Optima". . . . . .(2 required), (noisy)
3. WISA Model 201 . . . . . .(1 required), (quiet)
4. Hartz Mountain "Vibra Power". .(2 required), (noisy)

The user can also attach the air bearing arm to a shop type air compressor with excellent results. The compressor would need to turn on only once for hours of listening because the arm can operate from the storage tank. The regulator should

be set on 3 to 5 psi. Higher pressure will not damage the bearing; but it is not necessary. Remember that the included filter must be used with any pump application.

EMINENT TECHNOLOGY AIR PUMP

THIS PUMP MUST BE TURNED OFF WHEN THE TONEARM OR SYSTEM IS NOT IN USE. WE RECOMMEND USING A SWITCHED OUTLET ON A PREAMP OR A SWITCHED TRACK LINE IN THE SYSTEM TO TURN IT OFF.

The Eminent Technology air pump is designed to provide an optimum air supply to the tonearm and be extremely quiet.

USE

The air pump should be used only in its upright position. The air line and power cord come out of the side. If the pump is not properly positioned, it will be noisy.

We have found that the best location for any of the pumps would be a closet or in another room if possible.

Another good location would be close to or behind the speaker system.

The user will have to experiment to find the optimum position for the air pump.

Air line is available from an aquarium supply store.

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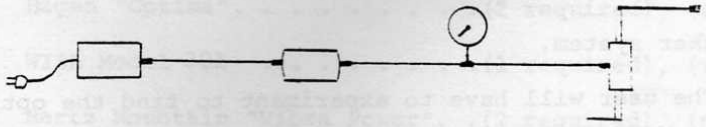
USE OF A PRESSURE GUAGE

A pressure guage is not necessary for use with this product. If the user wishes to use one, several options are available.

Most heating and air conditioning suppliers offer a pressure guage which has a scale range from 0-5, 0-15, or 0-30 psi. Any of these would be acceptable. These are usually used for checking gas pressures in propane or natural gas heaters and stoves. Ask them for the necessary fittings to adapt the guage to 1/8" I.D. air line.

Another possibility is an automotive manifold vacuum/pressure checking guage available from most hardware stores with an automotive section. These guages will have scales which range from 0-30" Hg. (vacuum) and 0-10 psi (pressure) on one scale. The air line used in the tonearm will directly interface with these guages.



A pressure guage can tell you about the long-term performance of the pump. It can also tell you if the filter is clogging when the pressure drops and if the capillaries

within the tonearm manifold are clogging (see maintenance section) if the pressure increases. Both problems are easy to solve. Proper pressures should be between 2.5 and 3.5 psi when used with any of the recommended air pumps.

TONEARM USE AND OPERATION

ADJUSTING THE TURNTABLE SUSPENSION SYSTEM.

If the turntable used does not have a sub-base which is suspended by springs, then the only adjustment necessary is to level the turntable. This can be done with shims; or if the turntable has adjustable feet which can raise and lower the turntable, these can be used. We highly recommend the use of accessory leveling feet (Audio Technica or equivalent) if the turntable does not have that capability. The tonearm must be level to perform at its best.

If the turntable has a spring suspended sub-base, then this should first be leveled (adjusted) after installing the tonearm. We recommend leveling the suspension and platter of the turntable within itself with the tonearm installed and then using feet below the turntable to level the entire system using the tonearm as a guage for true level. (unless the suspension system of the turntable is very easy to adjust).

When the arm is installed on a spring suspended turntable, the suspension system will usually have to be adjusted to re-level the platter and arm within itself. This is because the arm is lighter than most conventional pivoted arms and its center of gravity is closer to the front of the turntable. In some cases weight (lead from a fishing tackle supplier) will have to be added at the back of the turntable. (Use double

sided adhesive foam tape to adhere the weight to the suspension system). If the suspension system is easy to adjust, this can be used to find the true level of the turntable when it is installed in the system and ready for use. If not, use the adjustable type feet.

LEVELING THE TURNTABLE USING THE TONEARM

The most accurate level available is the tonearm itself (much more accurate than a bubble level). The horizontal plane (direction of travel of the arm from the inside to the outside of the record) is the only plane that must be level. If the arm is level for horizontal movement, everything else will be set.

Use the arm for the level by trying to establish neutral balance. (This cannot really be done because most of the mass of the arm is above the center of the pivot point and the arm will not quite balance out). Use a small weight (or cartridge with stylus guard) on the headshell and the two counterbalance weights and come as close as possible to a floating condition. You will see the arm's tendency to move in one direction or the other as it is pushed back and forth. Adjust the suspension system or feet until the arm has no tendency to move toward the inner or outer portion of the record. It is now level. (You can see the effects of the leadwire stiffness at the extreme ends of travel. This is normal.)

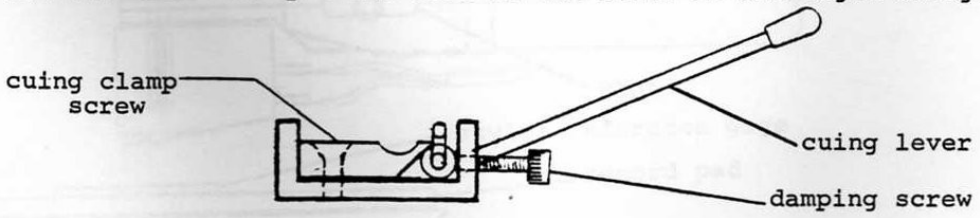
USING THE CUING LEVER

The cuing mechanism in the Model One is purely mechanical and it takes practice to get used to its operation. We recommend using the stylus guard of the cartridge to protect it during all setup and adjustment procedures required for this product. You should protect your stylus until you are comfortable operating the cuing mechanism. Note: The cuing lever works properly only with the air on.

ADJUSTING THE CUING MECHANISM

The damping adjustment screw should be used for minor changes in stiffness of operation and the cuing clamp screw used for larger changes. Refer to the maintenance section for more information on the cuing clamp and lubrication.

The damping adjustment (6-32 x 3/8) screw can be finger tightened while testing the smoothness of operation of the lever. The lever action should be free enough to allow easy movement of the lever while retaining enough stiffness to hold the arm and cartridge up above the record in its rest position. The arm will slowly drift down if the screw is not tight enough.



Note: If the cuing lever is too long, it can be cut to the proper length with wire cutters or needle nose pliers with cutters. Remove the black cap and cut it to the desired length. It should be as long as possible for best operation.

Note: Do not lower the arm below the surface of the platter at the outer edge of the record. This could damage your stylus.

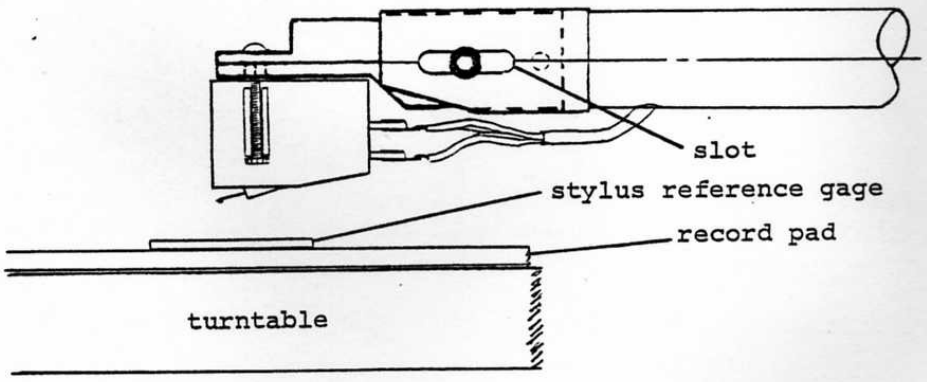
USING THE STYLUS REFERENCE GAGE

The stylus reference gage is used to align the cartridge over the centerline of the record as well as insure that the cartridge is mounted exactly in line with the tonearm tube (perpendicular to the centerline).

Use the stylus guard during these alignment procedures. Do not lower the stylus directly on the reference gage.

The center hold of the gage is purposely made small. You must use a pair of scissors to open up the hole by placing one of the blades in the hole and rotating. Gradually open the hole until it tightly slips over your turntable record pin.

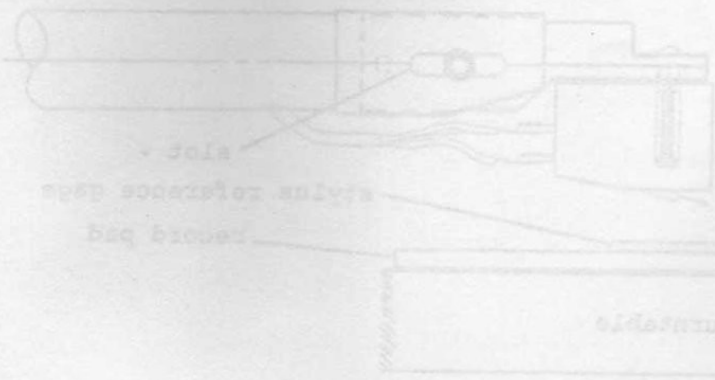
Place the stylus reference gage on the spindle. Rotate the gage around until the stylus (air pump on) will track straight down the centerline. You may have to move the channel slightly by loosening its mounting screws to get this exact. Use



the slot in the tonearm tube to set overhang. If the stylus tip will travel down the centerline and the edges of the cartridge body line up with the parallel lines on the reference gage, you have established correct alignment.

AZIMUTH

Many tonearms do not provide an ability to adjust azimuth. In the Model One, the slot in the headshell provides about $\pm 2°$ of azimuth adjustment. Set VTA/SRA at the back of the tonearm, then rotate the headshell to find the optimum perpendicular position for the stylus. Note: Both VTA and azimuth adjustments can be done by critical listening or with a distortion analyzer and test record. Some cartridges are more sensitive than others to these adjustments. Both are equally important.



SETTING THE TRACKING FORCE

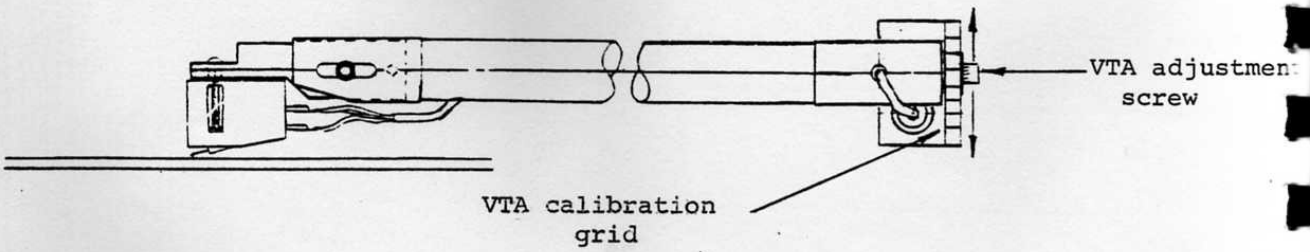
The owner must provide his/her own scales to set the tracking force. Determine the number of counterbalance weights necessary to balance the cartridge.(The large counterbalance will support cartridges which weigh up to 8 grams. Adding the small counterbalance weight allows cartridges which weigh up to 12 grams). It is best to use the large weight by itself when possible unless the cartridge has very low compliance ($< 15 \times 10^{-6}$).

Set the scales on the platter of the turntable at the desired force and move the weight(s) back (to reduce tracking force) along the stem until the desired tracking force is reached. The weight(s) will usually end up close to the end of the counterbalance stem.

SETTING VTA (SRA)

The vertical tracking angle (some prefer stylus rake angle) adjustment is made by loosening the (6-32 x ½) socket head screw at the back of the tonearm interface bracket and sliding the tonearm up or down. Do not over-torque this with an allen wrench. It can be finger tightened to sufficient torque.

Each line on the interface represents a ½° change in vertical tracking angle. The best approach is to listen to selections and make large changes (1°) until you arrive at a position you like. Then make very small changes around a given setting.



MAINTENANCE SECTION

Your dealer is skilled in maintaining this product and it is best to consult them concerning problems. We hope you will use your dealer for service. The factory is available for technical advice and help concerning problems and we will be glad to offer assistance.

CLEANING THE AIR BEARING

We recommend cleaning the bearing once a month using the following procedure: Dip a cotton ball in rubbing alcohol and wipe down the air bearing spindle while the air is on all along its length, top and bottom. This will greatly extend the life of the bearing before more intense cleaning procedures must be used.

If the bearing sticks while traveling across the record and causes skipping, it is most like due to one of the following reasons:

1. Not enough air supplied to the bearing. This can be the air pump (see air pump maintenance) or the filter.

CHECKING THE FILTER

The filter can be checked by removing it from the line and hooking the air pump directly to the air bearing. If the bearing then works, the filter is clogged and needs replacing. Contact your dealer. Do not operate the bearing for long periods of time without the filter (hours).

2. If the air supply to the bearing is good (over 2 psi at the manifold), then the other possible causes of failure are dirt buildup on the spindle or manifold or clogged capillaries within the manifold.

CLEANING DIRT FROM THE SPINDLE

For this operation the air pump should be on. Take a

toothbrush, dip it in rubbing alcohol and vigorously brush the spindle on both ends. Then wipe the alcohol off with a soft cloth. If this restores operation, then nothing else needs to be done. If this does not work, you must clean the inside walls of the manifold. Sometimes the dirt buildup on the spindle must be removed by scraping on the surface with a single edge razor blade. If residue comes off when this is done, the spindle is not clean. Clean it again with a toothbrush.

CLEANING THE MANIFOLD

First you must remove the spindle from the manifold. Pull the spindle out of the manifold in the direction toward the outside edge of the record. The lead wire must be pulled up from below the turntable to obtain enough length. With the inside of the manifold exposed (leadwire will be through the middle), take a toothbrush dipped in alcohol and vigorously brush the inside walls of the manifold. You cannot damage the surfaces of the air bearings by too much cleaning. Then push a soft cloth into the manifold and gently dry it. This almost always restores normal operation.

3. If the pump is working normally and the pressure is too high at the input (over 3.5 psi with the Eminent Technology pump) and the tonearm does not work, then the capillaries are clogged within the manifold.

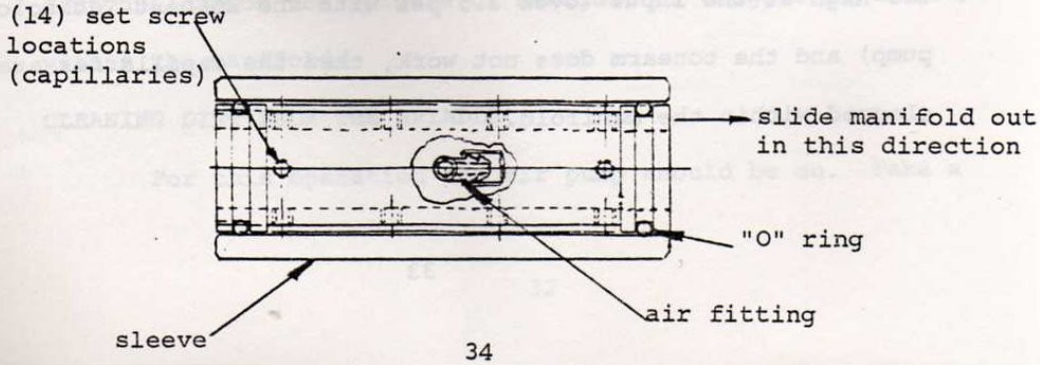
CLEANING THE CAPILLARIES

Remove the spindle as described above. The manifold can either be taken off of the channel, which means unsoldering the leadwire, or removed on the channel.

Either way, the manifold is removed by pushing very hard with your thumb against the manifold while holding the sleeve. The manifold will slide out of the sleeve. It is held in by two O-rings which need to be lubricated with grease before re-installing.

NOTE: The air fitting must be removed from the sleeve or the O-rings will hit the threaded portion of the fitting as it is sliding out.

When the manifold is out of the sleeve (14) 6-32 x 1/8 set screws will be exposed. The threaded portion of the manifold is designed to allow air to spiral around the <u>outside</u> of the set screw and maintain the precise length and size of air passage required for an efficient air bearing. Remove the set screws. These holes and the set screws should be cleaned with a pipe cleaner and alcohol. Re-assemble the air bearing assembly (4 holes up) and normal operation should be restored.



AIR PUMP MAINTENANCE

Inside the enclosure of the pump there are two diaphragms. If one of these breaks, it can be replaced by your dealer or returned to the factory.

NO OUTPUT

If the pump fails completely, it is probably the result of a bad line cord or open coil in the transformer. Return the complete assembly to the factory for replacement.

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CUING MECHANISM

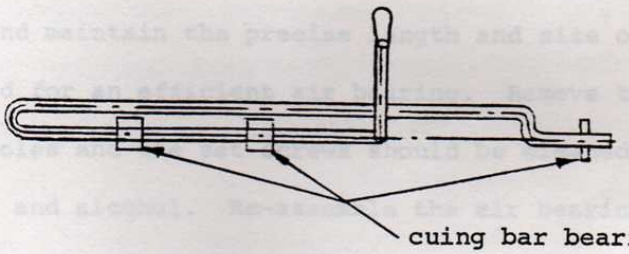
ADJUSTING AND LUBRICATING THE CUING LEVER

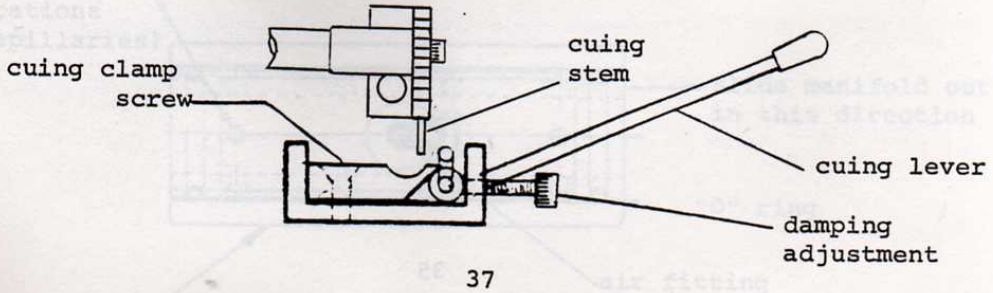
If the cuing lever becomes too stiff (and adjustments do not help) the bearings can be lubricated with grease by removing the cuing clamp.

To remove the cuing lever and bearings, remove the cuing clamp screw and remove the lever with its three bearings. Lubricate the shaft, where the bearings are located, with grease.

To assemble, with all three bearings on the lever, push the inner bearing under the manifold sleeve about ¼ inch using a small screwdriver. Then reassemble the cuing clamp with one bearing at each end.

If the bearing movement is too free, remove the cuing clamp and wrap a 1-inch length of 3/8 inch wide electrical





tape around each bearing and re-assemble. Then tighten the cuing clamp down. This will help compress the bearings and increase the stiffness.

NOTE: The cuing clamp might not rest on the channel when tight. This is normal. However, you must make sure that it clears the cuing stem (nylon post that comes down from the tonearm interface) or the arm will stop when the stem hits the cuing clamp.

MODEL D-12, D-13, AND D-14 DISPOSABLE FILTERS

GENERAL INFORMATION

THESE DISPOSABLE FILTERS HAVE BEEN DESIGNED TO REMOVE OIL AEROSOLS, SMOKE, AND CONDENSED MOISTURE FROM COMPRESSED AIR LINES.... THE MODEL D-12, WITH ¼" NPS(F) BY ¼"NPT(M) PORTS, IS DESIGNED FOR DIRECT APPLICATION TO A PAINT SPRAY GUN.... THE MODEL D-13, WITH ¼"NPT(F) PORTS, IS DESIGNED FOR GENERAL INDUSTRIAL AND LABORATORY APPLICATIONS.... AND THE D-14 WITH ¼"NPT(M) BY ¼"NPT(F) PORTS, IS DESIGNED FOR A DIRECT APPLICATION TO AN AIR BLOW GUN.

THE FILTERS SHOULD BE INSTALLED AS CLOSE AS POSSIBLE TO THE ACTUAL POINT OF AIR USAGE, TO SUPPLEMENT RATHER THAN REPLACE EXISTING MOISTURE TRAPS, FILTERS, DRIERS, AND INTER-COOLERS. THE CONVENTIONAL EQUIPMENT SHOULD REMOVE MOST OF THE CONTAMINATION, AND OUR FILTER WILL REMOVE ANY CONDENSED MOISTURE, OIL AEROSOLS, SMOKE, OR OTHER PARTICULATES THAT MIGHT PASS THE CONVENTIONAL EQUIPMENT.

INSTALLATION

THE D-12 FILTER, WITH ITS ¼"NPS(F) PORT, SHOULD BE ATTACHED DIRECTLY TO THE INLET OF THE PAINT SPRAY GUN, AND TIGHTENED TO A LEAKPROOF SEAL BY HAND.... THE D-14 FILTER, WITH ITS ¼"NPT(F) PORT, SHOULD BE ATTACHED DIRECTLY TO THE AIR BLOW GUN.... WHEN INSTALLING FILTERS, GRASP THE HOUSING BY HAND, DO NOT USE A VISE, PLIERS, OR ANY MECHANICAL MEANS, AS THE HOUSING COULD BE DAMAGED.

OPERATION AND MAINTENANCE

THE RECOMMENDED MAXIMUM OPERATING PRESSURE IS 100 PSI.... AND AS THE PLASTIC HOUSING WILL BE ADVERSELY AFFECTED BY AROMATIC HYDROCARBONS, INCLUDING SOLVENTS, KETONES, ETC., DO NOT ATTEMPT TO CLEAN THE FILTER, OTHER THAN A QUICK WIPE OFF WITH SOLVENT.

UNDER AVERAGE CONDITIONS, THE FILTER WILL ABSORB APPROXIMATELY ONE FLUID OUNCE OF CONDENSED MOISTURE, AND IT IS RECOMMENDED THAT THE FILTER BE CHANGED AT LEAST ONCE A WEEK. WITH RELATIVELY DRY INDUSTRIAL OR LABORATORY AIR, THE EFFECTIVE LIFE OF THE FILTER SHOULD BE SEVERAL WEEKS. (NOTE:) When used with the air bearing, this filter should last approximately one year with average use.

LIMITED WARRANTY

MOTOR GUARD CORPORATION ASSUMES THE RESPONSIBILITY OF PROVIDING EQUIPMENT AND MATERIAL THAT IS FREE OF DEFECTS IN WORKMANSHIP AND MATERIAL.

SHOULD THIS PRODUCT FAIL DUE TO A DEFECT IN WORKMANSHIP OR MATERIAL, MOTOR GUARD CORPORATION WILL REPAIR, OR AT ITS OPTION, REPLACE THE PRODUCT WITHOUT CHARGE, OTHER THAN THE TRANSPORTATION CHARGES, PROVIDED THE PRODUCT IS RETURNED TO THE ADDRESS BELOW, TRANSPORTATION PREPAID, WITHIN ONE YEAR OF THE DATE OF PURCHASE.

THIS LIMITED WARRANTY DOES NOT COVER DAMAGE TO THE PRODUCT THROUGH NEGLECT, MIS-USE, OR ACCIDENT, NOR DOES IT COVER ANY LOSS, DAMAGE, OR EXPENSE EITHER DIRECT OR INDIRECT, OR CONSEQUENTIAL, ARISING FROM THE NON-FUNCTION OR MALFUNCTION OF THIS PRODUCT.

THIS LIMITED WARRANTY NOTICE REPLACES ANY OTHER WARRANTY OR GUARANTEE INFORMATION ENCLOSED WITH THIS PRODUCT OR APPEARING IN LITERATURE REFERRING TO THIS PRODUCT.

MOTOR GUARD CORP. - 2110 ADAMS AVE. P.O. BOX 1834 - SAN LEANDRO, CA 94577 - 415-569-9766

TECHNICAL SECTION

INSTRUMENTATION LIST

The following list details the test equipment used to develop and measure the performance of the tonearm:

MAKE	MODEL NUMBER	DESCRIPTION
Tektronix	5111	Storage Scope
Tektronix	5B10	Time Base
Tektronix	5A18N	2-Channel Amplifier
Tektronix	5A15N	1-Channel Amplifier
Tektronix	C59B	Camera
Tektronix	TM515	Power Supply + case
Tektronix	DC504	Counter/Timer
Tektronix	AF501	Bandpass Filter/Amplifier
Tektronix	5A22N	Differential Amplifier
Nicolet	440B	Digital Spectrum Analyzer
Bruel & Kjaer	2209	Spl Meter & Amplifier
Bruel & Kjaer	1613	Bandpass Filter
Bruel & Kjaer	4332	Accelerometer
Bruel & Kjaer	ZR0020	Integrator
PCB	308B	Accelerometer & Power Supp.
Gould		Strip Chart Recorder
BPI	1600	Wow & Flutter Meter
Bruel & Kjaer	QR2009	Test Record
Bruel & Kjaer	QR2010	Test Record
Bruel & Kjaer	QR2011	Test Record
CBS	STR 100	Test Record
CBS	STR 101	Test Record
CBS	STR 112	Test Record
CBS	STR 120	Test Record
CBS	STR 130	Test Record
CBS	STR 140	Test Record
CBS	STR 150	Test Record
CBS	STR 170	Test Record
Audio Technica	AT6606	Test Record
Shure	TTR 103	Test Record
Shure	TTR 109	Test Record
Shure	TTR 110	Test Record
BLH	1200B	Digital Strain Indicator
TESTDATA/INMET	T201B	Strain Gage Transmitter
TESTDATA/INMET	Series-10B	Telemetry Receiver
Micro-Measurements	CEA-06-125UT-350	Strain Gage
Micro-Measurements	EA-06-250-MQ-350	Strain Gage
Micro-Measurements	EA-06-250-TR-350	Strain Gage
BLH	FAQ	Strain Gage SR-4 Type
General Electric		Variac

ANTI-SKATING FORCES IN CONVENTIONAL AND STRAIGHT LINE ARMS.

In a conventional pivoted tonearm, the resulting frictional forces at the stylus are not always in line with the arm bearing causing the stylus to be pulled in a direction tangent to the groove toward the center of the record. This force (sometimes called skating or sidethrust) is influenced by many things (record surface velocity 33 & 45, position of the arm with respect to the record, record surface friction, shape and polish of the stylus, vertical tracking force, etc.) The correction for it is usually made by some mechanism in the tonearm.

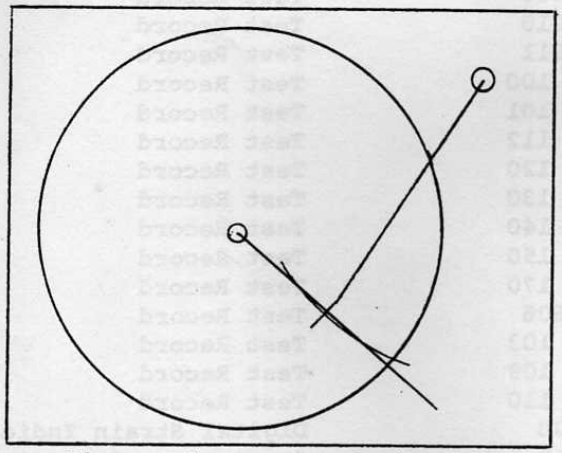
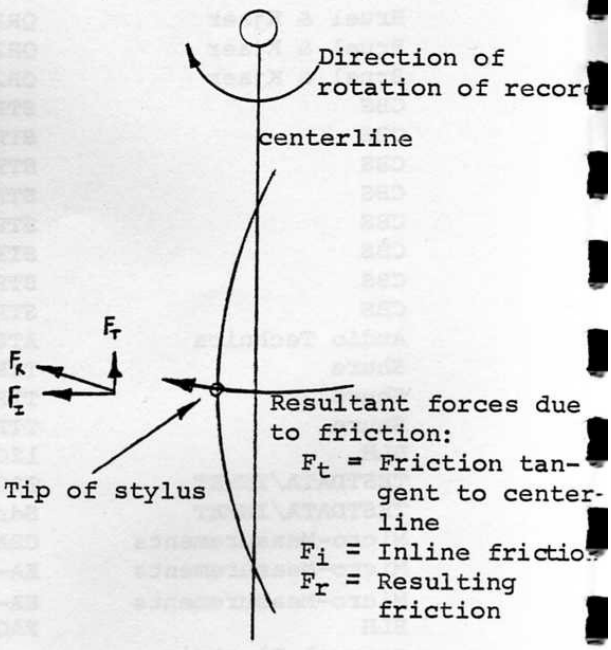


Figure shows arc of pivoted arm as it tracks record and deviation from the centerline.



The inward skating or frictional forces tend to move the stylus up the inside wall of the record groove, reducing the effective tracking force at the tip causing slight mistracking. When a mechanical force is applied to improve tracking ability from a pivoted arm, this must work through the cartridge suspension system, moving it slightly out of its center position causing slight channel imbalance and more important, larger angular tracking error, equivalent to an arm with improper geometry and its associated problems. We performed a survey of conventional pivoted arm anti-skating forces and the average was .2 grams of sidethrust applied for each gram of tracking force although there was wide variation and some linear, some not.

In the case of the Model One tonearm, the antiskating force is not necessary because the frictional force at the stylus tip is always in a line directly ahead of the tonearm. (See Figure). The only forces left to act against the stylus as a result of the tonearm are the forces required to accelerate the system ($F = MA$), the frictional forces, and the imbalance forces (a function of how level the arm is).

With a properly setup Model One tonearm, (the arm must be level) these combined forces measure around .1 gram or less for small accelerations and do not change with vertical tracking force.

This means that a given cartridge will work against lower horizontal forces in the Model One tonearm (.1 gram or less) as opposed to those of a conventional arm (.2 grams/gram VTF). These figures apply if you use records that are not severely out of round.

For vertical forces while tracking warps, the cartridge suspension system must work against the tonearms moment of inertia about its vertical axis of rotation. For the Model One, these forces will be similar to those of a conventional tonearm which has medium effective mass (10 grams).

Warp/Wow

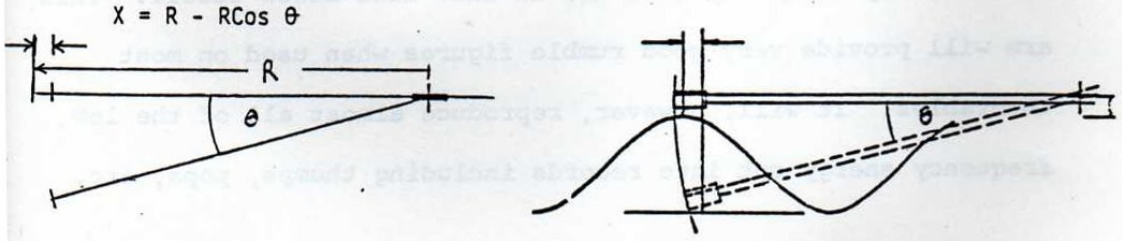
As a tonearm travels over a warp in the record, it moves over an arc equal to the angle θ, as shown in the figure below. The effective length of the arm changes by the cosine "θ" multiplied by the length of the tonearm. When the arm goes over the warp, the position of the stylus moves ahead or behind the centerline of the record because of the arc it must go through. This change in position changes the pitch or frequency of the sound being reproduced.

General relationships for a given warp size.

1. The longer the tonearm, the less significant warp wow becomes.
2. Warp wow increases with increasing θ.

For the Model One the pivot point is fixed by the air bearing just above the surface of the record, which minimizes warp wow.

The height adjustment on the Model One tonearm will not affect warp wow. The lines on the interface bracket between the spindle and tonearm can be used as a reference for vertical tracking angle adjustments. These lines are spaced at ½° increments. With most conventional pivoted arms, raising or lowering the arm involves raising or lowering the pivot point which does affect warp wow.



THE EFFECTS OF A WARP ON TONEARM LENGTH

LOW FREQUENCY RESONANCE MEASUREMENTS

The goal of the design of this tonearm was to provide higher horizontal inertia to reproduce low frequency energy present in records today and have lower vertical inertia (higher vertical natural frequency) to stay away from likely vertical warp frequencies.

The rise in response at resonance is 0 to 4dB using the B & K 2010 test record and 5-8 dB using the CBS STR 120 test record.

The resonance is very well controlled because a resonance in one plane will not affect or start resonance in the other plane.

Vertically, with almost any compliance cartridge the natural frequency will be above likely warp frequencies (.55 Hz x number of bumps). Horizontally the natural frequency will be low to maintain good phase response for high horizontal low frequency information cut into a record. Warps will not excite the horizontal resonance and our tests show that there is very little horizontal "rumble" present in records. The fundamental eccentricity frequency (.55 Hz) is also well below cutoff. This arm will provide very good rumble figures when used on most turntables. It will, however, reproduce almost all of the low frequency energy cut into records including thumps, pops, etc.

CALCULATING THE RESONANT FREQUENCY OF A TONEARM

$$F_{res} = \frac{1}{2\pi\sqrt{C_o (M_a + M_c)}}$$

C_o = Compliance of Cartridge in cm/Dyne

M_c = Mass of Cartridge (gms.)

M_a = Mass of Arm

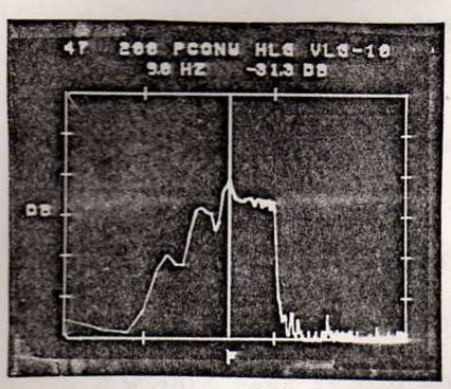
10g Vertical
40g Horizontal

MEASURED TABLE OF RESONANT FREQUENCIES FOR VARIOUS CARTRIDGE COMPLIANCES AND COUNTERWEIGHT COMBINATIONS

Cartridge Compliance	Natural Frequency Vert.	Horiz.	Counterweights
45×10^{-6} cm/dyne	10Hz	3.5Hz	Only Large
15×10^{-6} cm/dyne	13Hz	5.5Hz	Only Large
15×10^{-6} cm/dyne	12Hz	4.5Hz	Small & Large

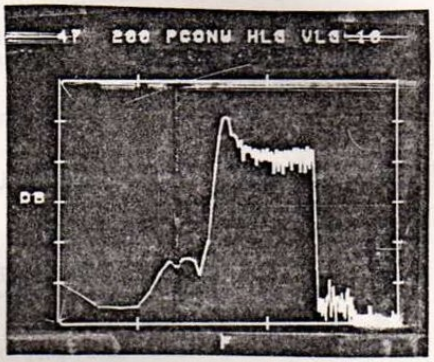
LOW FREQUENCY RESONANCE TEST RESULTS

Cartridge Compliance 45 x 10^{-6} CM/Dyne



2 20 200Hz

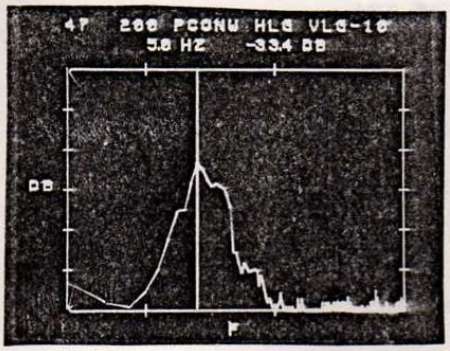
Vertical resonance 4dB rise
at 9 Hz using B & K 2010
5Hz to 20 Hz sweep



2 20 200hz

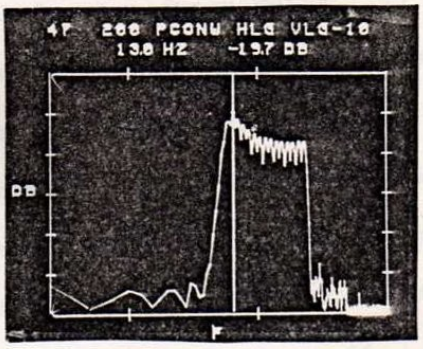
Vertical Resonance 8dB rise
at 9 Hz using CBS STR 120
8 Hz to 40 Hz sweep

Cartridge Compliance 15 x 10^{-6} CM/Dyne



2 20 200Hz

Horizontal resonance 5dB rise
at 5.0 Hz using B & K 2010
3 Hz to 15 Hz sweep



2 20 200Hz

Vertical resonance 7dB rise
at 13 Hz using CBS STR-120
10 Hz to 40 Hz sweep

TONEARM RESONANCE TEST WITHIN THE AUDIBLE RANGE

There are many ways to test a tonearm for audible resonance problems. We have done work in this area and offer these easy tests with the hope that comparisons will be made. These test methods were applied in the design of this tonearm.

IMPACT TEST

A simple and sometimes most revealing test is an impact test. This can be done to any tonearm installed on a turntable.

With the tonearm installed and a cartridge mounted and connected to a system, the gain of the system should be turned up very high. Then tap or strike the tonearm with any small hard object (pencil, pen). The system and cartridge will reproduce the fundamental and any other resonances within the arm. The best result would be a "thump" heard when the arm was hit with almost no ringing. Poorly designed arms will ring with a clearly audible tone.

TWO TONEARM TESTS

This test involves the use of a second tonearm to measure the resonance (play on top) of the tonearm being tested while it is playing a record. The second tonearm is connected to a system (or spectrum analyzer) and the resonant frequencies of the tested arm will be reproduced by this arm.

Two cartridges are needed. The test arm should have a

low compliance cartridge installed in it. Low compliance cartridges with their stiffer cantilevers transfer more vibrational energy to the tonearm than high compliance cartridges. This provides a more crucial test.

The test arm should be installed on a turntable ready to play. It does not need to be connected to any amplifier. A record with high amplitude wide range music or a test record with pink noise (B & K 2011) can be used.

The second tonearm is positioned so its stylus tip can sit on the headshell of the test arm. (In our case we mounted the tonearm on a wooden block). This is the one that will be listened to and will play the headshell of the test tonearm. It is through the second tonearm that you will hear or measure any resonance that occurs in the test arm while playing the record. This includes the effects of bearings and other mechanical properties. The second arm should be set at a low tracking force and use a high compliance cartridge. It can play any part of the test arm and reveal resonance problems within individual parts. All resonance must originate from the headshell as a result of forcing functions from the stylus. There could, however, be mechanical or bearing noise from some tonearms.

CALIBRATION

Use the second tonearm and its cartridge to play a

test record and set up full scale readings (reference levels) on the spectrum analyzer. When this arm plays the resonance in the test arm, these levels can be measured with respect to the reference level in the record and direct comparisons can be made in terms of frequency content and amplitude. If a resonance measures 40 dB down, this means that the amplitude of the resonance will be 40 dB (which is audible) below the actual music levels.

EXPLANATION OF RESONANCE

Most structures, specifically metal tubes, have resonant frequencies. The resonant frequency is a function of the stiffness of the material. At the resonant frequency the tube can be made to bend or twist (torsional resonance) very easily with very little energy input. For a tube there is usually a fundamental bending resonant frequency and a fundamental torsional resonant frequency and these may or may not be the same. At all other frequencies the tube is very strong relative to its resonant frequencies. The resonant frequency can be excited (from the forces of a phono cartridge) at many multiples of the fundamental frequency, so music almost always excites the resonance. Here the theory actually coincides with reality. Our results are almost identical using wide band orchestral music and pink noise. When bending occurs, it must be terminated

and this is where the strength of bearings and damping materials come into play. Damping materials, which are usually soft, are statically not strong at all. They are strong (stiff) at audio frequencies and are used because they can dissipate vibrational energy (usually as heat) and reduce the amplitude of the resonance. Bearings should be coupled to something which can damp out or terminate the resonance.

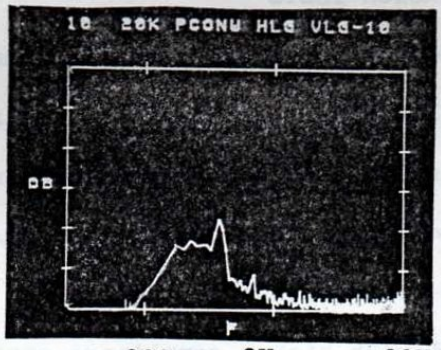
A cartridge is a velocity measuring device. Its signal could be converted to displacement by integration or acceleration by differentiation. None of this is really necessary and an audio preamplifier will not accomplish this. (With tone controls you might come close.) When the output signal of the second tonearm is fed through a preamplifier, the resonance you hear will be the same ones that affect the audible characteristics of the tonearm.

There are many more refined methods of running resonance tests on tonearms. The use of strain gages and accelerometers are excellent laboratory methods, but this equipment is not readily available to the audiophile. The above method (2nd tonearm) gives results which are essentially identical to those given with an accelerometer or strain gage when the data is converted to displacement. The accelerometer has an advantage below 250 Hz where the two tonearm test is not useful. (Combined

effects of low frequency resonances of the two tonearms). Strain gages have the advantage of being able to identify bending and torsional mode shapes which are not available with the other methods.

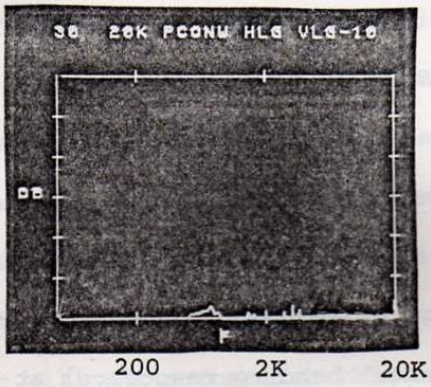
RESULTS OF TWO TONEARM TESTS ON THE MODEL ONE PROTOTYPE TESTS

The first test displays the resonance of a complete tonearm with undamped tone arm tube. The top of the graph is OdB. The test record is B & K 2011 wide band pink noise. There is a range of resonance from about 200 Hz to 800 Hz with a peak (fundamental bending resonance) at 750 Hz.



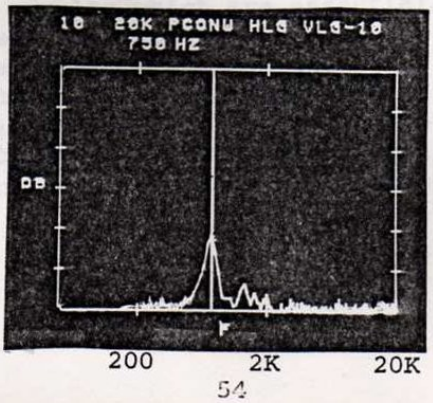
The second test places the stylus (again an undamped tonearm tube) on the interface bracket between the spindle and the tonearm tube to determine the location of the movement. If the bearing was deflecting, movement would still be seen

at this point. Clearly there is no bearing movement. This indicates that the arm has a very rigid bearing system with a need to damp the fundamental resonance within the tonearm tube.

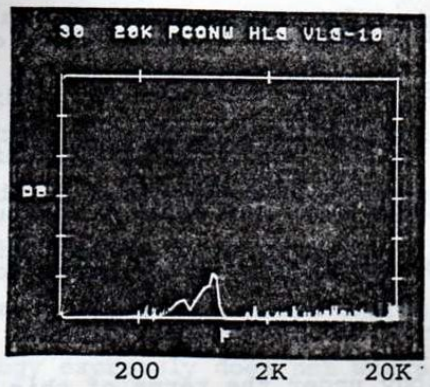


PRODUCTION VERSION TESTS

The production version uses internal tube damping to lower the amplitude and broad reasonance range in the undamped tube. The results are shown below (pink noise) using a worst case cartridge (compliance of 8 x 10^{-6} cm/dyne) and a high level signal. This resonance centered at 750 Hz will be much lower in level with higher compliance cartridges and with lower recording levels. Note the improvement over the undamped arm.



This test uses the same cartridge as above with the production tonearm and shows resonance levels using high level orchestral music as a signal source. Fundamental resonance is -46 dB at 750 Hz.



WARRANTY

Eminent Technology, Inc. warrants the Model One Tonearm to be free from defects in performance, materials and workmanship for a period of 30 days from the date of purchase. Within that period, any failure of the Model One Tonearm will be corrected without charge for parts, labor or transportation from the factory. After this period, pending receipt of the warranty form, filled out and mailed to Eminent Technology postmarked no later than one month after purchase, the above warranty will be extended to three years for parts and one year for labor. This warranty is transferable. The obligation of Eminent Technology under the terms of this warranty does not extend to:

(1) Any Model One not installed or operated in accordance with the instructions contained in this manual.

(2) Any Model One while under performance testing or after being used in such a test by any facility or personnel not authorized by Eminent Technology.

(3) Any other component part connected to or operated in conjunction with the Model One.

(4) Any traumatic damage, accidental damage or damage incurred in shipping or to defects which upon examination by Eminent Technology and in its sole opinion have been caused by abuse, neglect, improper or abnormal installation or operation for extended periods in industrial applications.

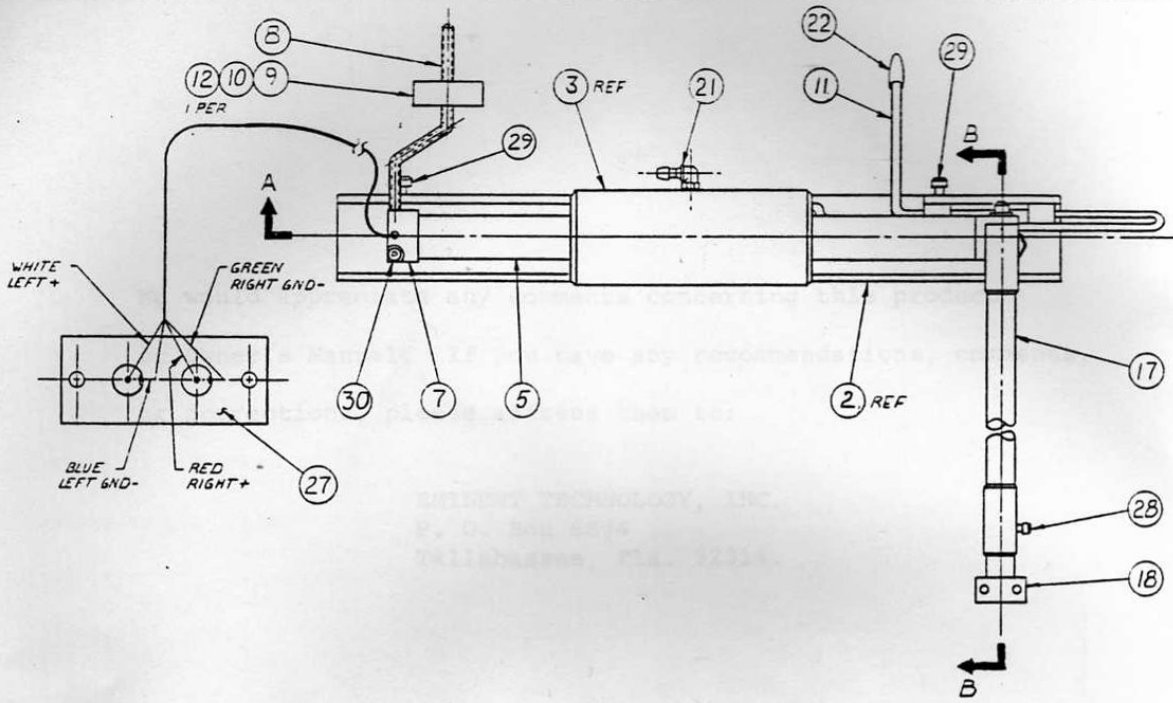
This warranty is not applicable if any part of the Model One has been removed or taken apart, repaired, altered or modified

by anyone not receiving prior authorization in writing by Eminent Technology nor if the serial numbers have been defaced or rendered illegible.

If an Eminent Technology product is removed from any country in which the original consumer purchase was made, Eminent Technology distributors and authorized dealers in any subsequent country are not obligated by the terms of this warranty. Eminent Technology reserves the right to incorporate design refinements and changes to its existing products without notice or obligation. If practical, these design modifications will be incorporated into existing units for a reasonable charge.

Eminent Technology expressly does not warrant or insure for loss of use of the tonearm due to failure or periods of repair. Warranty repairs will be carried out by the factory. The Model One must be returned prepaid in its original factory carton to:

EMINENT TECHNOLOGY, INC.
P. O. Box 6894
Tallahassee, Fla. 32314.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12 10 9
1 PER
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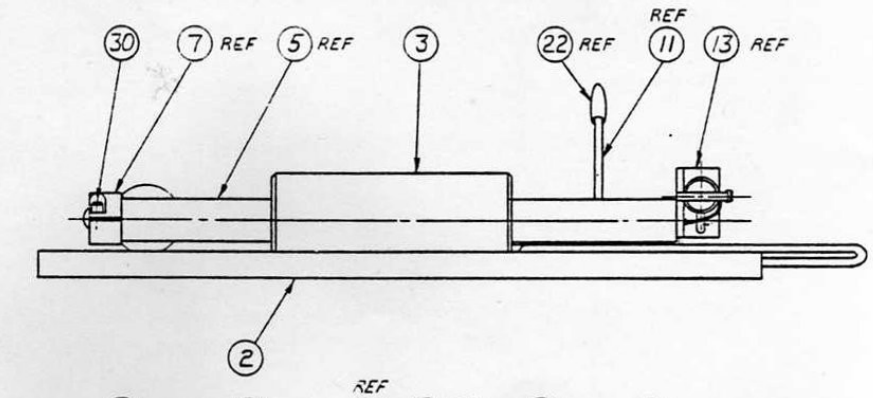
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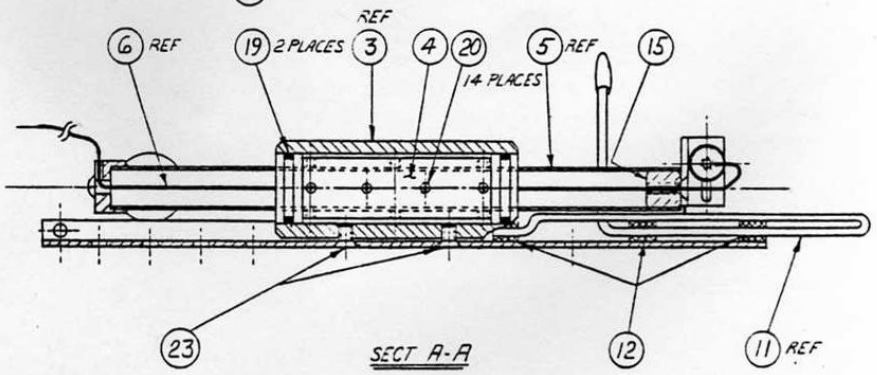
5 REF
3
22 REF
11
REF
13 REF
2


6 REF
19 2 PLACES
REF
3
4
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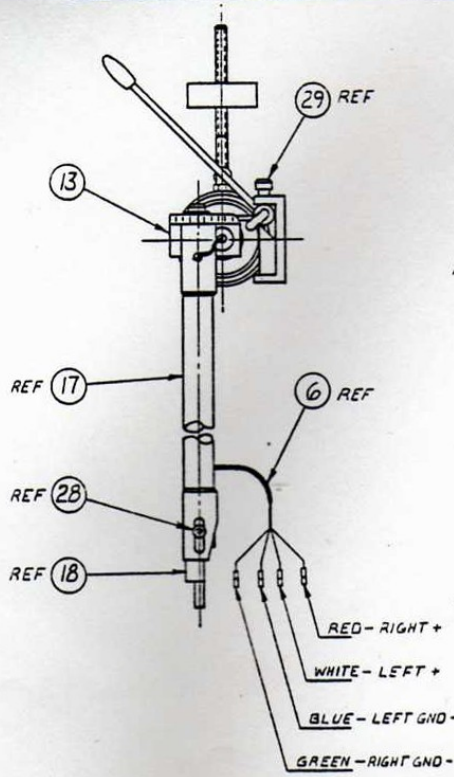
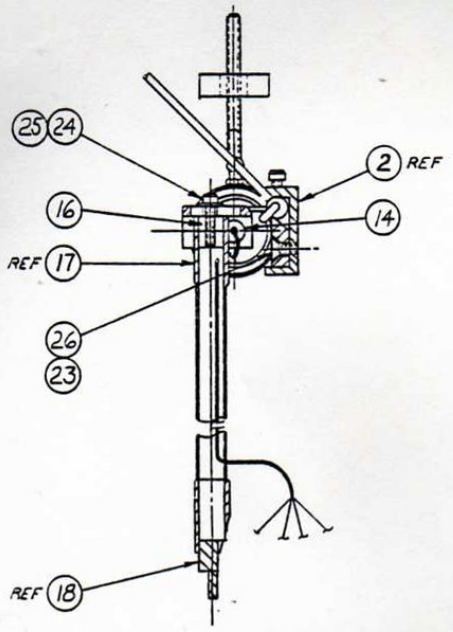
14 PLACES
5 REF
15
23
12
11 REF

SECT A-A





SECT B-B

—	—	2	31	3501 FRU		RCA JACKS
—	—	1	30			COUNTER BAL. CLAMP SCR .112-40 x .375 SOC
—	—	2	29			CUING ADJ SCR / GROUNDING
—	—	1	28			HEADSHELL LOCK SCR.
—	—	1	27	8302011P02		PHONO JACK PLATE
—	—	1	26	8304003P01		CUING CLAMP
—	—	1	25			WASHER – TONEARM
—	—	1	24			TONEARM LOCK SCR .138-32 x .500 SOC. HD.
—	—	3	23			FLT HD SOC SCR .190-32 x .375 LG
—	—	1	22			CAP – CUING BAR
—	—	1	21	XL230-2		AIR FITTING
—	—	14	20			SET SCR. – MANIFOLD .138-32 x .125 SS.
—	—	2	19	2-117N1000-70		O-RING
—	—	1	18	8302012P01		HEADSHELL, CARTRIDGE MOUNT
—	—	1	17	8302013P01		TONEARM TUBE
—	—	1	16	8302018P01		TONEARM TUBE PLUG
—	—	1	15	8302004P01		TONEARM PLUG – END
—	—	1	14	8304000P02		COUNTER SUNK SOC. HD .190-32 x .375 FLT.
—	—	1	13	8302019P01		TONEARM INTERFACE
—	—	5	12	8304000P01		BUSHING – 10mm m O.D. F.L. x .375 LG
—	—	1	11	8304006P06		CUING BAR
—	—	1	10	8304008P02		COUNTERBALANCE WEIGHT – LARGE
—	—	1	9	8304008P01		COUNTERBALANCE WEIGHT – SMALL
—	—	1	8	8304004P01		COUNTERBALANCE STEM
—	—	1	7	8304005P01		COUNTERBALANCE PLUG
—	—	1	6	7/42 SN/P		LEADWIRE
—	—	1	5	8302002P01		SPINDLE
—	—	1	4	8302001P01		MANIFOLD
—	—	1	3	8304002P01		SLEEVE
—	—	1	2	8304001P01		BOTTOM CHANNEL
—	—	X	1	8304000G01		TONEARM ASSY
G03	G02	G01	ITEM NUMBER	PART NUMBER		DESCRIPTION
QTY						

PART LIST

①	ASSY IDENT NO.
	8304000G01

DWG TYPE: FINAL ASSY

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES

ALL SURFACES 125√

MATL. N/A

CONTRACT		
SIGNATURES		YR – MO – DA
DRAWN		84-1-22
CHECKED		
ENGRG	F. Bruce Thigpen	84-4-27

EMINENT TECHNOLOGY, INC.
1030 MERRITT DRIVE TALLAHASSEE, FLA. 32301

TITLE: TONEARM ASSY

SIZE	FSCM NO.	DWG NO	REV
D	NA	8304000	

SCALE 1/1 WT NA SHEET 1 OF 1