

Installation and Operating Instructions for the AR Turntable.



Setting up the turntable

To protect it from damage in shipment, the turntable is packed with certain parts separated from each other. Setting up the turntable requires that these parts be mounted in their regular operating positions, and that the turntable adjustments be set correctly for the cartridge you will be using. Most of the steps in the set-up procedure are brief; all are easily done in a few minutes if the instructions are followed methodically. Do them in the following order:

1. mount arm on its spindle
2. install cartridge in shell
3. plug shell into end of arm
4. check drive belt
5. check arm length
6. set correct stylus force
7. adjust protective damping
8. connect turntable to amplifier

All of the tools and parts needed for these steps are packed with the turntable, except for the cartridge, which must be selected and purchased separately.

A number in brackets refers to the photograph to be consulted at that point in the set-up procedure.

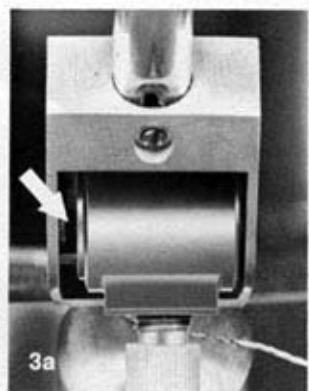
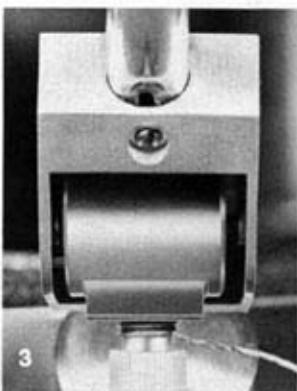
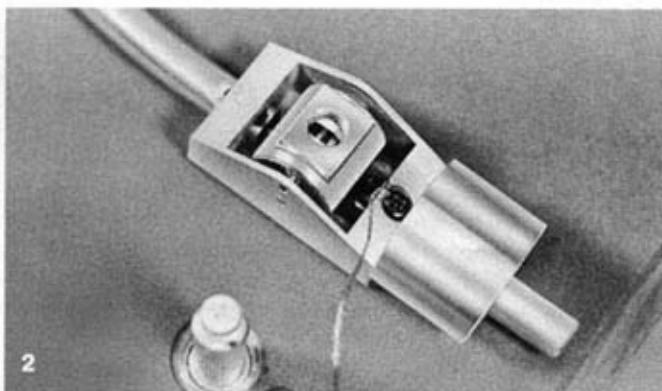
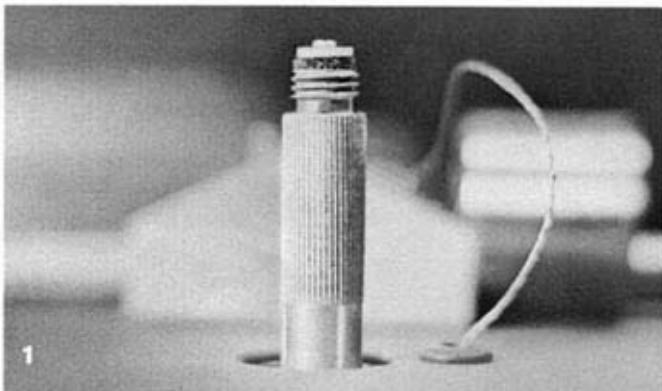
Mounting the arm on its spindle

The turntable is packed with the tone arm separated from its spindle to protect these parts from damage in shipment. *When they are assembled, the wire at the back of the arm must not be pulled.* Before doing this step, read the instructions all the way through; then do it carefully, taking your time and checking the photographs.

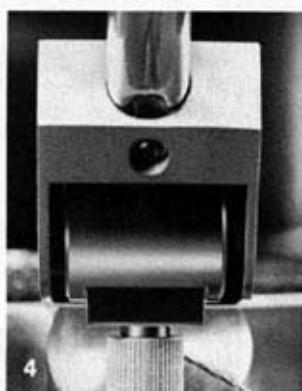
Do not remove the spindle from its well; there is a small steel ball in the well which is an important part of the turntable and must not be lost.

(1) At the top of the spindle are a foam rubber spring and plastic washer coated with oil; *do not wipe off the oil.* Clean away any bits of packing material or cardboard which may be sticking to the spring and washer. (2) There is a threaded hole in the arm pivot assembly that is the same size as the top of the spindle. Adjust the pivot assembly so that the hole is straight up. Looking down into the hole, slide the piece with the hole in it sideways so that the slot you can see through the hole is centered. *Be very careful in the next step to put no strain on the wire.*

Lift the arm just high enough to set it on top of the spindle with the threaded hole resting on the top of the spindle. Point the arm toward yourself, and tilt it up so that you can look at the pivot assembly. (3) Check this carefully: the part with the threaded hole in it should be centered over the brass part inside it, as shown in the photographs. Now start turning the spindle to screw it into the threaded hole. It will normally be somewhat hard to turn at first, but if it gets stuck after only a turn or two, stop, unscrew it and start over. (4) When the spindle is screwed into the arm as much as is shown in the photograph it will get tight. Stop turning the spindle and let go of it; the arm should stay in the position in which you have left it. Next, slowly unscrew the spindle just until the arm falls back on its counterweight, then snap the arm into the arm rest.



In picture 3a, too much of the brass part inside the pivot is showing on the left side. This is incorrect; both sides must be even as in picture 3.



(5) Check to see that the wire at the back of the tone arm is formed as shown in the photographs. If not, gently bend it to the proper shape.

Installing pickup cartridge

A special instruction sheet accompanying these instructions describes the correct method of installation of the cartridge in the plug-in shell which comes with the turntable. It is extremely important that the correct screws and standoffs be used with each cartridge, since failure to do so may affect the fidelity of the entire system.

Before the cartridge is screwed down into the shell, the small clips at the ends of the wires in the shell should be pushed onto the corresponding cartridge connecting pins. Identify the appropriate pins from the cartridge manufacturer's instruction sheet and follow this color code:

Left channel: white and green (green is ground)

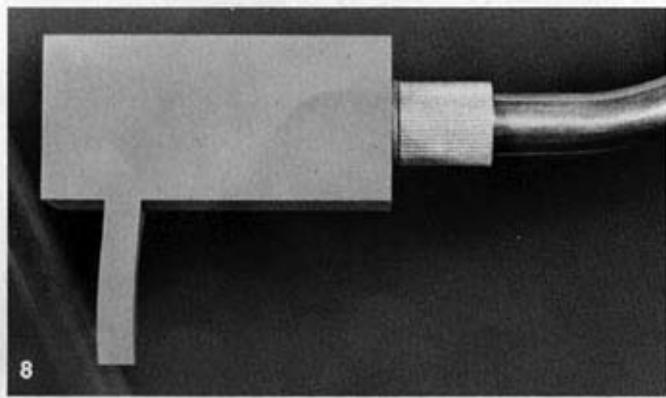
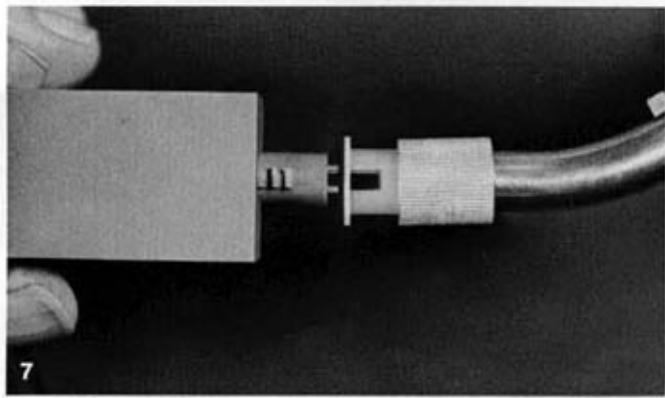
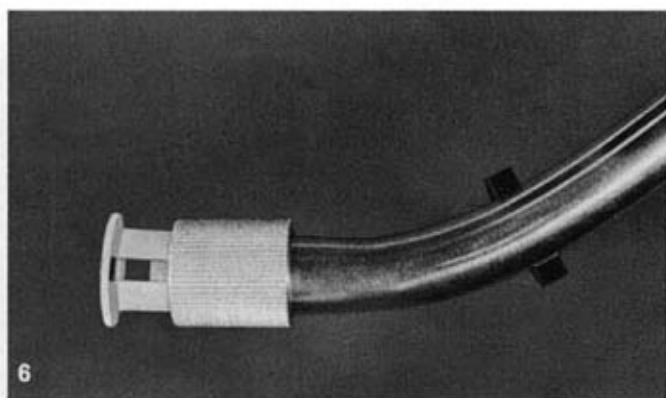
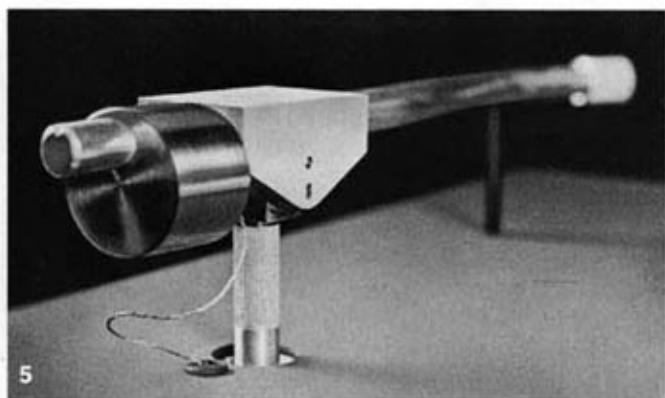
Right channel: red and black (black is ground)

If you are using a monaural cartridge connect the terminals to the white and green wires, using green as the ground wire.

Save the screws and other hardware left over when you have installed the cartridge, as you may need some of them if you get a different kind of cartridge in the future. Also, a spare arm counterweight set screw, which should be saved, is in the envelope.

Attachment of shell to tone arm

Hold the tone arm down in its rest whenever the cartridge shell is installed or removed. This protects the pivots inside the arm. (6) To install the shell, place the arm in the arm rest, holding it there firmly, and push back the knurled collar so that you can see the white plastic sleeve. (7) Line up the small projections on the tubular part at the rear of the shell with the notch in the white plastic sleeve. (8) Push the shell all the way against the sleeve and hold it in this position while turning the knurled collar until it is tight. Do not release the tone arm from its rest. The collar should be turned to a comfortable tightness, but without any strain or forcing.



Outer platter and turntable mat

Before installing the outer platter check to see that the drive belt is in the correct position, without twists. (9) The belt should be wound around the upper pulley (for 33 1/3 rpm operation) and the inner platter. If this is the case, the outer platter and turntable mat may be set in place. The side of the turntable mat with the ridge in it should face upward.

Arm length adjustment

The arm is adjusted at the factory to the correct length for cartridges which meet industry dimensional standards. Some cartridges do not conform to these standards, requiring that the arm be lengthened or shortened slightly to play records with least distortion.

After the cartridge is installed and the outer platter and turntable mat are in place, the arm length can be checked using the plastic guide supplied with the turntable marked, "AIM TOWARD PIVOT".

(10) Place a record on the turntable mat and put the hole in the plastic guide over the center spindle of the turntable, aiming the other, pointed end of the guide at the arm pivot as shown in the photograph.

(11) If the dimensions of the cartridge are standard and the arm length is correct, the tip of the needle will fit into the small dimple of the plastic guide. The fit need not be perfect, as long as the needle comes down anywhere inside the dimple. If the needle does not rest in the dimple, first check to be sure that the guide is still pointing at the pivot. If it is, then the arm length should be adjusted. (12) To do this, loosen the set screw under the sloped front section of the arm pivot assembly, and gently slide the entire tubular section of the arm forward or backward. *Do not pull hard, or you will jerk the arm out of the mounting and break the arm wires.* If the arm does not move freely, use a slight twisting motion to move it in or out of its mounting.

Be sure to tighten the set screw after adjusting the length.

Setting correct stylus force

First, tighten the spindle adjustment until the front end of the arm does not fall when you release it. Put the arm in a position over the middle of its record-playing area. Tap the side of the cartridge shell very lightly, first on one side and then the other. The arm should move equally freely in both directions from this position; if necessary, readjust the dress of the shielded cable at the back of the arm until there is equal freedom of sidewise motion. (Despite its small size, this wire can exert enough sidewise force on the arm to interfere with proper groove tracking if it is not bent properly).



9



10

Do not unscrew the spindle, but force the arm down to a position approximately parallel with the record surface. In this way the damping system cannot influence the stylus force measurement.

Weigh the stylus force with the stylus force gauge, following the instructions packed in the gauge box. It is never necessary to make the set screw very tight; do not do so now, as you will be loosening and tightening it a few times when setting the stylus force. Any stylus force required, down to $\frac{1}{2}$ gram, may be used with the AR tone arm. A list of the optimum force for most current cartridges follows. To determine the optimum stylus force for other cartridges, we recommend HiFi/Stereo Review Test Record No. 211, available from HiFi/Stereo Review, 1 Park Ave., New York, N.Y. 10016 at \$4.95.

About $\frac{1}{32}$ " movement of the counterweight produces $\frac{1}{4}$ gram change of stylus force. It is therefore quite possible to unbalance the gauge just by a slight movement of the counterweight when the set screw is tightened. If the screw is lost, a spare will be found in the envelope containing the cartridge mounting hardware.

Stylus force requirements for current cartridges

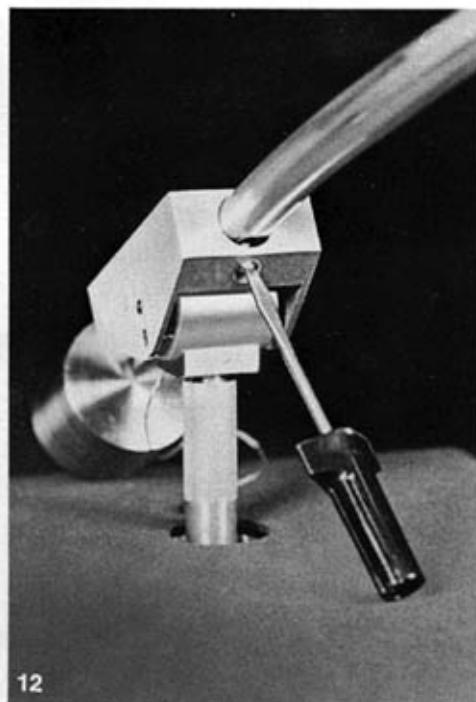
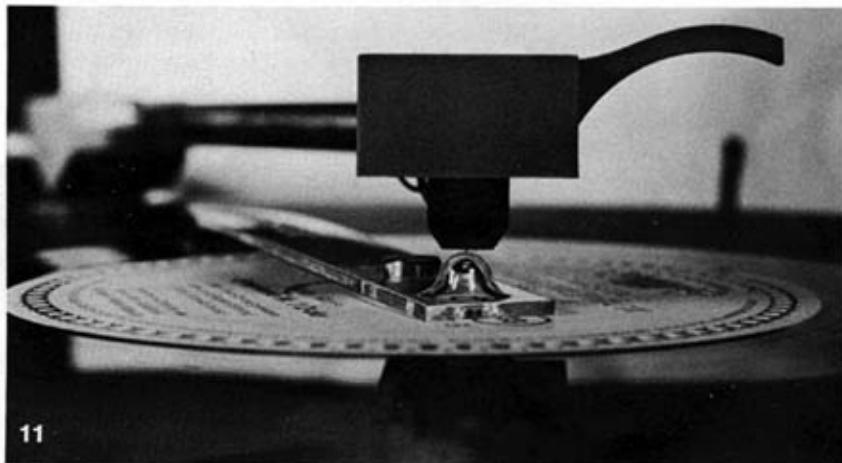
This list of stylus force requirements was made on the basis of tests in AR's laboratory, using the AR turntable. The force shown for each cartridge is the minimum value at which no significant improvement in performance could be achieved with higher stylus force, on the following three tests:

1. the low-frequency tracing band of HF/SR Test Record 211
2. the high-frequency tracing band of the same record
3. the frequency response band of CBS STR-100 test record, output automatically recorded.

(Some of the cartridges would pass some of the tests at lower forces. All of the cartridges would play at lower forces on discs that have no heavily recorded passages.)

There are variations in individual samples of cartridges; we tested several unselected samples of the same model, bought in retail stores. Occasionally there will be a manufacturing change in a particular model which increases or decreases the stylus force required.

The stylus force required by a cartridge is not an index of its quality. Using less than the correct stylus force degrades performance and *increases* record wear, since the needle will not stay in proper contact with the groove walls. It is far better to use a little bit too much stylus

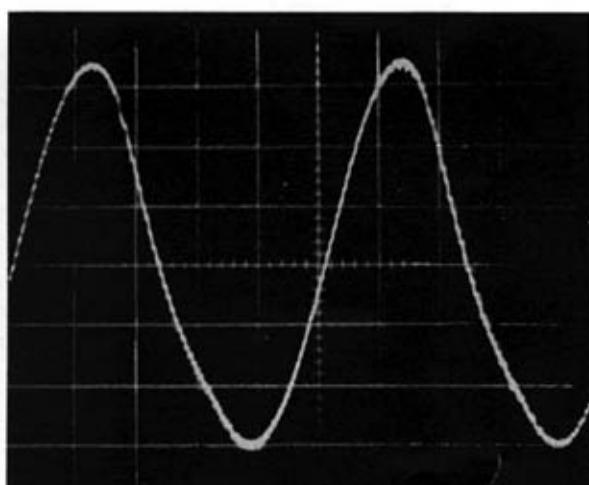


force than too little. The force should be measured by an accurate stylus force gauge whether or not the arm adjustments are calibrated.

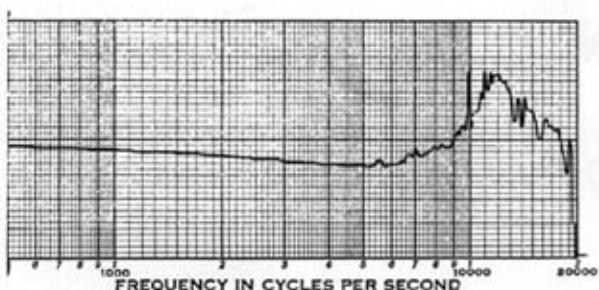
CARTRIDGE	STYLUS FORCE
ADC-1, 4E	1 $\frac{1}{4}$ grams
ADC 10/E	1 $\frac{1}{4}$ grams
ADC 660, 660E	1 $\frac{1}{2}$ grams
Dyna Stereodyne III	2 $\frac{1}{2}$ grams
Elac STS 322	2 grams
Elac STS 444	1 $\frac{1}{4}$ grams
Empire 808 series	2 $\frac{1}{2}$ grams
Empire 880 series	1 $\frac{1}{2}$ grams
Empire 888 series	1 $\frac{3}{4}$ grams
Empire 999VE	1 $\frac{1}{4}$ grams
Ephonics	2 grams
GE VR-1000-3	3 grams
Grado BT series (high compliance setting)	2 $\frac{3}{4}$ grams
Grado FTR	3 grams
IMF Goldring 800	1 $\frac{1}{2}$ grams
Ortofon S-15/T	1 $\frac{1}{4}$ grams
Ortofon SPU/T, SPE/T	2 $\frac{3}{4}$ grams
Pickering V-15/AM series	1 $\frac{1}{2}$ grams
Pickering XV-15/AM, 750 (including brush)	2 $\frac{1}{2}$ grams
Shure V-15	1 $\frac{1}{4}$ grams
Shure V-15 type II, M91, M75MG type II	1 gram
Shure M44	1 $\frac{3}{4}$ grams
Shure M55, M75, M75E	1 $\frac{1}{2}$ grams
Shure M7-N21D	1 $\frac{3}{4}$ grams
Stanton 481AA	1 $\frac{1}{4}$ grams
Stanton 500, 500A	2 grams
Stanton 581, 681 (including brush)	2 $\frac{1}{4}$ grams



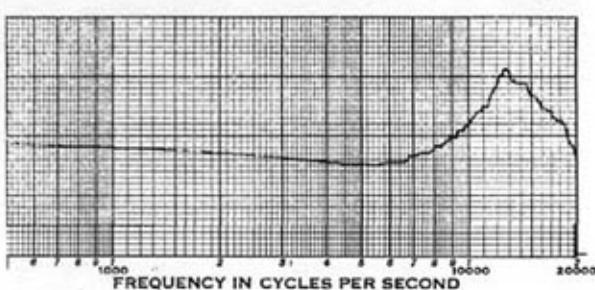
Cartridge output on HF/SR low-frequency tracing test, using too little stylus force.



Cartridge output on same test with correct stylus force.



Cartridge frequency response on CBS STR-100 test record, at 1/4 gram too little stylus force. Low-frequency test band of HF/SR 211 was traced satisfactorily at this force.



Frequency response of same cartridge at 1/4 gram higher stylus force.

Adjusting protective damping

After the stylus force has been set, the rate of fall of the tone arm should be adjusted. To adjust the rate of fall, lift the arm and ascertain that the damping is still sufficient to prevent the arm from falling. Then unscrew the spindle a small amount at a time until it takes two or three seconds for the arm to come down when lifted about 3 inches above the record. *Do not unscrew the spindle arm more than this; if you do, the damping release action will be degraded.*

The damping system protects the needle in case the arm is dropped accidentally; it gives you time to catch the arm before the needle hits. *Do not drop the arm intentionally on the record.*

There is a reduction in damping when the needle is about one inch above the record, so that the damping is released automatically during play. To be certain that the damping is released, lower the cartridge shell just below the level of the turntable mat before setting it on the record.

Many newer cartridges require so little stylus force that the damping system is unnecessary. If you wish to disable the damping completely, please write for instructions on how to do so.

Hints on record care

The material below is taken from HIGH FIDELITY SYSTEMS: A USER'S GUIDE, by Roy F. Allison, available at \$1.00 postpaid from Acoustic Research, Inc., 24 Thorndike Street, Cambridge, Massachusetts 02141

Depending entirely on how you treat them, your records may be ruined after two or three playings, or they may be almost like new after you've enjoyed them dozens of times.

Modern pickup cartridges press down on a record with a force that is only a small fraction of an ounce, it is true. Yet because the areas of contact between the needle and record groove walls are so exceedingly small, the pressure developed at these contact points may be thousands of pounds per square inch — enough to deform the record groove surface appreciably. In order to minimize the permanent effects of this deformation (and, accordingly, reduce record wear), your pickup cartridge and arm should be adjusted for the lowest stylus force at which they will trace heavily-recorded passages well without buzzes or fuzziness.

Further, you should not play any part of a record repeatedly. Give the groove walls a chance to recover from this deformation before playing the record again. A day's rest should be enough.

Make it a habit to look at the needle occasionally, to see that it hasn't been bent by rough handling, and that it hasn't accumulated a ball of dust which might interfere with its motion. Bent needles must be replaced immediately; dirty ones should be cleaned by gently coaxing away the dirt with a very soft brush. The needle should be replaced after two years of use, even if it doesn't appear to need it.

Records become warped easily. Severe warping, even if it does not make the record unplayable, accelerates record wear by increasing stylus force on the upward slope of the warp and decreasing it on the downward slope. You can keep warping under control by storing records on edge, in rows of only one record size; keeping moderate sidewise pressure on each row, between flat surfaces; keeping the records aligned in each row; and replacing records in the proper row immediately after playing them.

Perhaps the worst record problem, however, is dust and dirt. Records acquire static charges very easily as they are played. Even the act of removing a record from its jacket can generate a charge on it. When so charged, a record attracts dust particles from the air and from the turntable mat. These particles settle down in the grooves, whence they are impossible to remove with a cloth — even a damp cloth. When the needle encounters this dirt it makes those familiar crackling sounds in the loudspeaker and, at the same time, grinds up the dirt and roughens the groove walls permanently.

There are many liquids on the market which are supposed to prevent the build-up of static charges on records. Some are claimed to have "lubricating" properties also. Some, if used as directed, build up sludge deposits which do far more harm than good. There are two with which we have had good results; these are the liquid supplied with the Dust Bug, and with that applied by the Disc-Preener (provided it is applied lightly). The Dust Bug and Disc-Preener are distributed by Elpa Marketing Industries, Inc., New Hyde Park, N.Y.

In addition, it is necessary to remove dirt which settles in the groove even when the record has no significant static charge. This can be done with a brush having bristles shaped specifically for the job, such as the Dust Bug.

Very dirty records can best be cleaned by washing them carefully in a dilute solution of mild dishwashing detergent, rinsing thoroughly, and blotting them dry with a clean turkish towel.

Never touch the groove area with your fingers when handling records. Use only the outer edge and center area. With a little practice you'll find it easy to remove a record from its jacket, play it, and put it back without touching the groove area.

Records should be insulated from the outer packet of heavy cardboard by an inner sleeve of hard, glossy paper, cellophane, or flexible plastic. If you lose or tear the inner sleeve it should be replaced; plastic sleeves for this purpose, and the products listed above, can be bought at many record stores and high-fidelity component dealers.

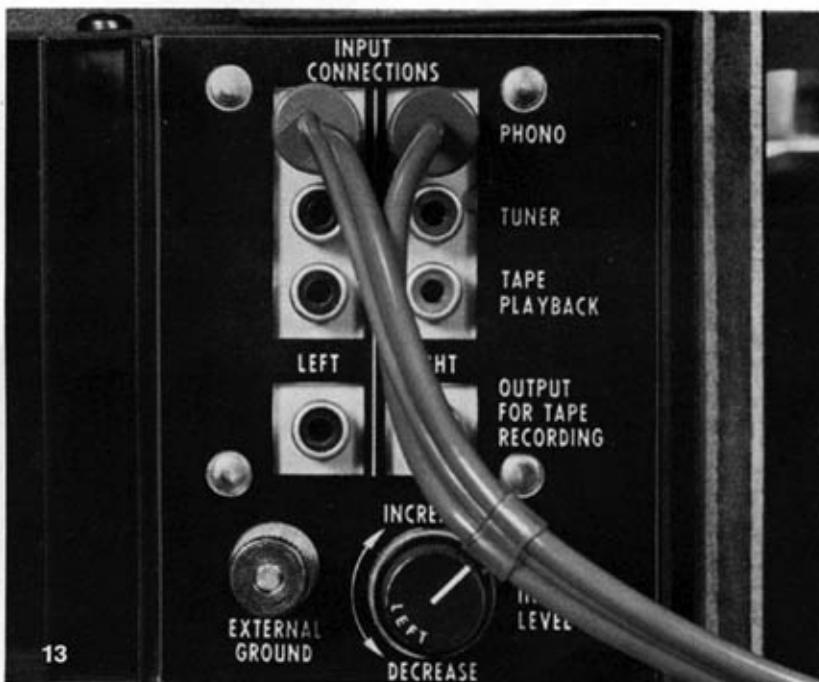
Connecting turntable to amplifier

Insert the power plug into a 110/120 volt a.c. socket, either in the wall or on the rear panel of the amplifier you are using. The turntable motor is switched on by pushing the slide switch on the top plate of the turntable to the *left*. If you wish to do so, you can use a "switched" outlet on your amplifier and leave the switch on the turntable in the "on" position, turning it on and off automatically when the amplifier is turned on and off. (13)

NOTE: A small amount of vibration can be felt in the motor pulley even with this switch in the "off" position. This is entirely normal, perfectly safe and no cause for concern.

For stereo playback, insert the two phono plugs into the right and left phono inputs of your amplifier. The red banded plug goes into the right channel socket. On the AR amplifier, the matching colors are on the amplifier sockets already.

If you are using a stereo cartridge in a monaural system (only one speaker system), a simple method of connecting the turntable is to connect the two phono plugs in parallel with a "Y" adapter, which can then be plugged into the input of the amplifier. If such an adapter is not available, plug the gray connector into the phono input and the red one into any unused input socket.



The mounting location of the AR turntable is not at all critical, outside of the need to protect the cartridge from hum-inducing fields. Because of the isolation achieved by its suspension, the AR turntable is not sensitive to external shock or acoustic feedback. In order to take advantage of its insensitivity to jarring the turntable must be placed on a flat surface, so that the base does not rock. It is also important that it be placed on a reasonably sturdy piece of furniture which does not wobble or rock when jarred. Creaky floors can sometimes create a problem of groove-jumping; isolating the turntable from the floor by placing it on a wall-mounted shelf will usually cure the most extreme case.

General Information

The information which follows, while not required to set up the turntable, should be familiar to the owner.

Cleaning the belt. If any oily substance should get on the drive belt, remove the belt and clean it with tissue soaked in methyl alcohol (wood alcohol); rubbing alcohol should *not* be used. The pulley and inner platter surfaces on which the belt rides should also be wiped clean with the alcohol. After the belt is cleaned, dust it in ordinary talcum powder—this is important! Without the talcum powder, the turntable will not start properly. We suggest that you clean and powder the belt once each year.

Hum from external equipment. It is hardly likely that the AR turntable will ever have "hum", since it is a mechanical device which turns the record while supporting the cartridge. The electrical signal from the cartridge passes directly into the amplifier through the wires provided, whether the turntable motor is on or off. Some cartridges are sensitive to the fluctuating magnetic fields which surround power transformers in amplifiers, tuners and other equipment. If you encounter such interference, which usually is audible as hum which can be made louder and softer with the amplifier volume control, try changing the relative positions of the turntable and the equipment causing the hum.

Extremely loud hum usually means that a ground connection has been broken (or omitted) somewhere along the way. If you ever think that the turntable motor has something to do with the hum you may hear, turn the motor off with the slide switch to see if it makes any difference.

Record center holes. The National Association of Broadcasters specifies that turntables used for broadcast work must meet certain standards in performance and dimensions. The AR turntable meets these standards, except for starting time, including the tolerance limits of the center spindle, which are $+0, -0.0005"$, with a nominal diameter of $0.2830"$. Some records have center holes smaller than are specified by industry standards, and there may be a few which are tight on the spindle of the AR turntable. Usually, this is because small scraps of plastic material are left sticking to the record at the edge of the center hole when the record is stamped. These scraps can easily be removed by inserting and twisting the point of a pencil in the center hole; a letter opener usually works even better.

If the spindle of the AR turntable were made undersize, all records would slip on easily, but records made correctly would then be allowed to slip from side to side.

Changing speeds. The speed is changed from 33 $\frac{1}{3}$ rpm to 45 rpm on the two speed model by lifting the outer platter and turntable mat and moving the drive belt to the other pulley section. The larger pulley is for 45 rpm. Do not try to start the turntable without the outer platter in place or the belt is liable to come off. It is unnecessary to adjust the exact position of the drive belt on the pulley or inner platter; this takes care of itself. Try to avoid hitting the pulley when removing or replacing the outer platter.

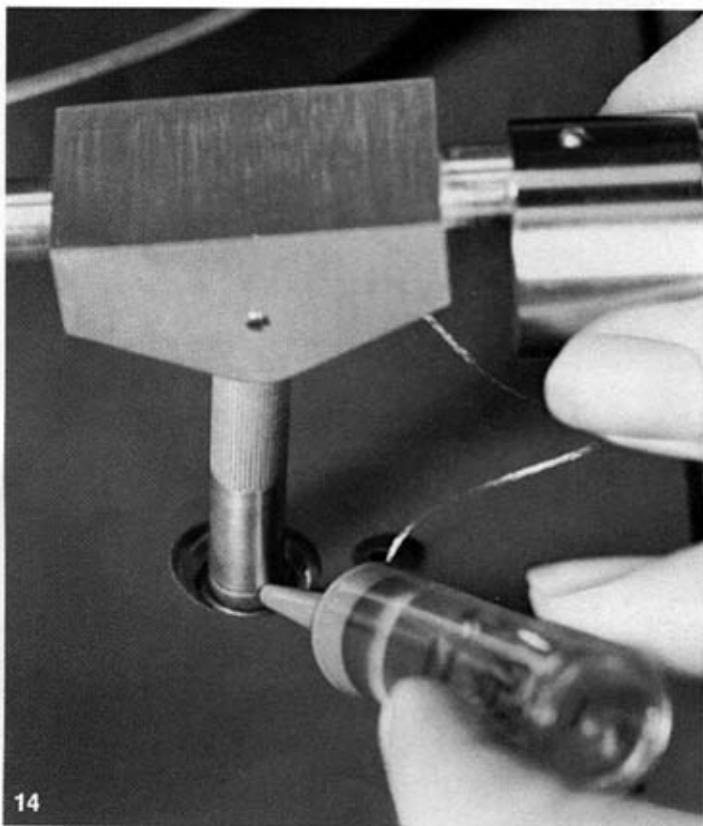
A slight amount of vibration can normally be felt in the drive pulley when the motor is off. This is normal and harmless.

Lubrication. Oil is provided in a squeeze bottle packed in the accessories tray at the bottom of the turntable carton. It should be used once a year, in the following way:

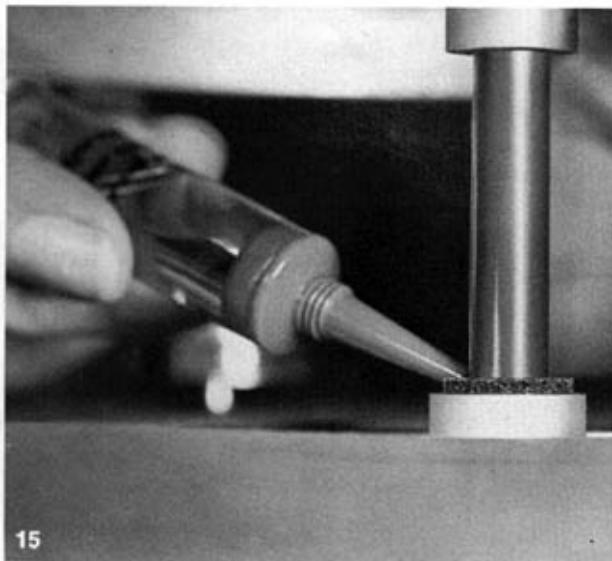
- a. lift the tone arm assembly about $\frac{1}{2}$ ", and apply a few drops to the top of the spindle near where it enters the well. (14)
- b. lift the inner platter *straight up* about two inches (it is not necessary to take the platter out of the bearing) and put a few drops of oil on the spindle. (15)

Make sure that you do not get oil on the belt. If you do, the belt must be cleaned and powdered as explained under "Cleaning the belt". Rather than use too much oil "just to be sure", consider that the space between the spindle and the bearing wall is very, very small; there simply is no room to use more than a very small amount.

If you lose the bottle of oil which comes with the turntable, you can use any #10 machine oil without additives, such as Golden Shell 10W.



14



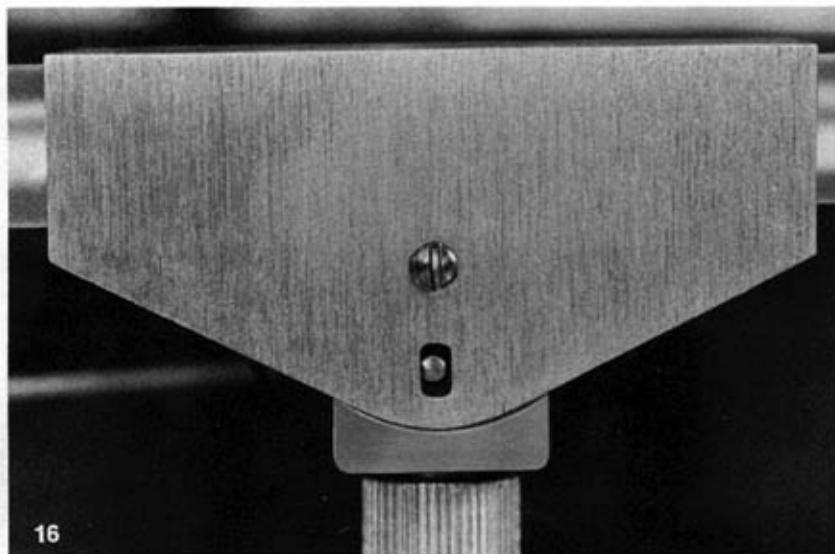
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Dust. It is very important that records be kept clean and free of dust. The plastic dust cover of the AR turntable, if used when the turntable is not in operation, prevents dust from collecting on the record mat, from which it can be transferred by static electricity to the record itself. The dust cover cannot be used while a record is played. It can be cleaned with a wax such as Johnson's *Pledge*.

Pivot set screws. The pivot set screws should not be touched unless you have reason to believe that adjustment is needed because of the following symptoms:

- a. if the set screws are too tight the arm will be a little sluggish over its range of vertical free play (approximately $\frac{3}{8}$ "). The needle force gauge, for example, will act as though it is sticking.
- b. if the pivot set screws are too loose, it will be possible to make the aluminum arm assembly wobble excessively by a slight twisting motion of the fingers applied to the curved arm section. There is a small pin which is visible through a slot on the side of the curved housing toward the turntable platter (16); the pivot screws should only be loose enough to permit visible vertical movement of the pin in the slot.

Only one of the pivot set screws needs to be adjusted; the outside one is easier to watch while it is being turned.



16

Replacement parts. Replacement turntable parts may be bought directly from AR. Check, money order or cash should accompany order. The following prices are postpaid within the United States.

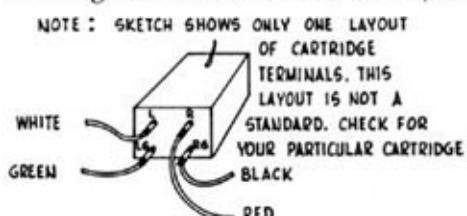
Needle force gauge	\$1.00
Cartridge shell	\$2.00
Turntable mat	\$2.00
Dust cover	\$3.00
Drive Belt	\$2.00
*Pulley for 50-cps current	\$4.00
*Two-speed conversion kit (60 cps)	\$4.00
*Two-speed conversion kit (50 cps)	\$5.00

*When ordering these parts, please specify the serial number of your turntable. The serial number will be found on the guarantee card attached to the bottom cover.

Good design requires that a tone arm and pickup shell be made as light as possible. The AR shell therefore is of a light plastic, but is strong enough to hold any cartridge securely. Threads in the cartridge mounting studs can be stripped, however, or the studs can be broken off, by excessive tightening of the screws. You may turn the screws reasonably tight without fear of damage, but do not overtighten them. Extra shells can be purchased directly from AR, Inc., 24 Thorndike St., Cambridge, Mass. 02141, at \$2.00 postpaid.

Wires are coded as follows. Red—right channel “hot”; Black—right channel ground; White—left channel “hot”; Green—left channel ground. For proper connection to stereo cartridges other than four-terminal units, refer to the cartridge manufacturer’s instruction book.

Clips at the ends of the cartridge shell wires should be put on the cartridge terminal pins before the cartridge is installed in the shell (see sketch). Extra clips are supplied with the mounting hardware. After the



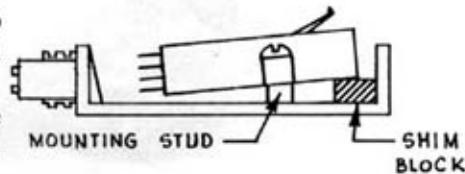
cartridge is put in the shell, push the wire loops gently up into the shell and make sure that the clips do not touch one another.

Screws in four sizes and standoff bushings in three sizes are supplied for mounting cartridges. In the table below, both screws and bushings are identified by numbers in ascending order of length. No. 1 screws and No. 1 bushings are shortest. No. 4 screws and No. 3 bushings are the longest. In addition, a small bar or shim block is supplied

to raise the front end of some cartridges, as shown in the sketch.

Unless noted otherwise, standoff bushings (where required) are to be placed between the cartridge shell mounting studs and the cartridge. Turn the bushings onto the screws to hold them in place.

Combinations of standoff bushings and screws shown in the table below must be used to obtain proper alignment of the cartridge in the shell.



Cartridge	Standoffs	Screws	Cartridge	Standoffs	Screws
ADC — All Models	None	No. 2	Ortofon S-15T ¹⁰	No. 1	No. 4
B&O SP 12	None	No. 1	Ortofon SL-15	None	No. 1
Dyna Stereodyne II, III	No. 1	No. 1	Ortofon SPU/T ⁵	No. 2 plus 3	No. 3
Elac 200, 210, 310, 322 ¹	No. 1	No. 1	Shure M3 ⁶	None	No. 2
Elac STS 444	None	No. 3	Shure M44, V-15, M55-E ⁶	None	No. 3
Emp. 808, 999 Series, 888 Series	None	No. 1	Shure V15 Type II, M75	None	No. 3
Emp. 880 Series ¹	No. 1	No. 1	Shure M7, M8, M33, M77 ⁶	No. 2	No. 2
Euphonics ^{2, 8}	None	No. 1	Shure M91	No. 1	No. 1
Gen. Elec. GC, VR-225, VR-227	None	No. 2	Stanton-Pickering 380, 381, U38AT, 400, 481	No. 2	No. 1
Gen. Elec. VR-1000	No. 3	No. 2	Stanton-Pickering 500, 500A, V-15 Series ²	No. 2	No. 1
Grado Mark Series, Type A ⁴ , Type B ²	None	No. 3	Stanton-Pickering 581, 681 Series ⁹	No. 1 plus 3	No. 3
Grado FTR	None	No. 3	Stanton-Pickering XV-15 Series	No. 1	No. 1
IMF Goldring ¹	No. 2	No. 2			

¹Standoffs must be put between screw heads and cartridge.

²A U.S. penny must be glued inside shell above cartridge to obtain proper needle force.

³One U.S. penny and one U.S. nickel must be glued inside shell above cartridge to obtain desired needle force.

⁴Shim block (see sketch above) must be used under front of cartridge.

⁵Requires small extra counterweight section and special shim block, available free directly from AR, Inc., 24 Thorndike Street, Cambridge, Mass. 02141. Front mounting holes of cartridge must be used in order to obtain proper overhang adjustment.

⁶It may be desirable to tilt cartridge body with paper or thin cardboard shim blocks placed as shown in illustration above.

⁷Cartridge body should be connected to left channel ground pin.

⁸Terminal clips supplied by cartridge manufacturer must be soldered on cartridge shell wires.

⁹No. 1 standoffs go between screw heads and cartridge; No. 3 standoffs plus large standoff block supplied by cartridge manufacturer go between cartridge and mounting studs in shell. Special cartridge shell with cutaway in front, which permits mounting cartridge deeper in shell, available free directly from AR Inc., 24 Thorndike Street, Cambridge, Mass. 02141.

¹⁰Requires small extra counterweight section, available free directly from AR, Inc., 24 Thorndike St., Cambridge, Mass. 02141.

SETTING STYLUS FORCE. Cartridge manufacturers recommend a range of permissible stylus force settings rather than a specific setting. In general the lower end of such a recommended range is optimistic; the needle will stay in the record groove, but it will not trace heavily-recorded music without severe distortion. It has been our experience that no cartridge will operate satisfactorily in any arm at less than 1 gram stylus force. Most require much more. A list of stylus force requirements for most current cartridges is enclosed.



TECHNICAL SPECIFICATIONS OF THE AR TURNTABLE

The AR turntable is guaranteed, as a condition of sale, to meet NAB (National Association of Broadcasters) specifications for broadcast equipment on wow, flutter, rumble, and speed accuracy.*

In addition, the AR turntable meets what we consider to be even more stringent requirements, in terms of flutter and rumble indices that are weighted according to hearing sensitivity. Different rumble frequencies and different wow or flutter rates have a profound effect on perceptibility. We do not publish these weighted index ratings, however, since there are no Standards to which they can be compared.

A statement of conformity to NAB specifications is far more rigorous than any statement of flutter or rumble figures unqualified by a description of measurement conditions. The NAB stereo Standard for professional broadcast equipment calls for a rumble level in each channel at least 35 db below 1 cm/sec. in the plane of modulation at 100 cps, *with the ballistic characteristics of the meter specified* (the same as a VU meter), *and with the playback equalization specified*. Many reports on turntables list rumble figures as much as 20 db in excess of the NAB Standard; this is only possible because the very carefully spelled-out conditions of the NAB Standard have not been followed. The 35-db figure, when it is applied to both lateral and vertical rumble, is a very exacting standard.

Similarly, the NAB Standard on flutter and wow prescribes the exact methods of measurement. The NAB Standard for broadcast playback equipment is 0.1% maximum wow and flutter combined *when measured as specified*. It is easy to achieve much lower figures on measured wow and flutter by changing conditions of measurement—for example, by using a meter with different ballistic characteristics than those specified by the NAB.

The NAB Standard for speed accuracy of broadcast playback equipment is $\pm 0.3\%$, or 21 lines per minute drift on a standard 216-line stroboscope card. All AR turntables are tested to meet this standard, and to keep within the NAB limit with an extra 5 grams of stylus force (equivalent to the drag of a dust bug). Line voltage variations have no effect on the speed of the AR turntable, since the drive motor is synchronous.

* Disc Recording and Reproducing (National Association of Broadcasters, 1771 N Street, N.W., Washington, D.C.), March 1964.