

OWNERS MANUAL FOR PRO-JECT RECORD PLAYERS

A guide to the design and the correct installation of Pro-Ject record players

Contents

The Design Principles behind Pro-Ject record players	page.3
The Turntable and Motor System	page.3, 4
The importance of setting the turntable level	page.5
The Tone-Arm	page.6
Vertical Tracking Angle, the Initial Adjustment	page.7
The Azimuth Adjustment	page.7
The Lateral Tracking Error	page.8, 9
The Down-Force or Tracking Weight and Bias Compensation	page.10
The Fine Adjustment of the Vertical Tracking Angle	page.11
Aligning the Tone Arm and Cartridge	page.12, 13
Fitting a new Cartridge to the Tone Arm	page.14
Adjusting the Lateral Tracking Error	page.15
Making the Connections and Speed Change	page.16, 17
Service and Packing	page.18

The Design Principles behind Pro-Ject record players

Before a record player can be designed, some important principles must be understood. The most important of these is that the stylus or diamond tip of the cartridge must exactly trace the undulations pressed into the groove walls of the record. For this to happen the pickup cartridge must be held absolutely rigid and stable, and the record must also be held absolutely rigid and stable. Then the only thing that is moving is the diamond tip, and as a result the output of the cartridge is a perfect electrical replica of the shape of the groove with nothing added and nothing taken away.

That is the theory. In practice the record is being rotated and so cannot be held rigid and the cartridge is mounted in a freely moving tone-arm, which also cannot be held totally rigid.

None the less the skill of the designer is to rotate the turntable at a constant speed whilst allowing it to have no lateral (side-to-side) motion and to design a totally rigid tone arm which allows the stylus to track across the record. The success of the designer in getting close to these ideals determines the ultimate performance and the quality of the musical experience.

But there is more. The designer may do a superb job, but he needs to be backed up by a factory that is capable of manufacturing components to very close mechanical accuracy and tolerances then assembling them with care before aligning them to absolute standards.

Over the next few pages we'll take a look at some of the essentials of record player design, and how Pro-Ject has created its outstanding turntable products.

The Turntable and Motor System

At first glance it would seem to be a simple task to rotate a turntable at the correct speed, but in practice there are a number of problems which can be difficult to overcome. The turntable platter is mounted onto a shaft which rotates upon a bearing assembly. First these bearings have to be extremely smooth in operation because any irregularities produce 'rumble', the effect of which is similar to that felt when driving a car along a gravel path. The small undulations cause the platter to move up and down an almost imperceptible amount but the movement is detected by the stylus and added to the signal as a distortion.

Secondly the bearing has to be very tight with virtually no slack, which would allow the shaft and platter to move from side to side. Again any sideways motion would be detected by the stylus as a 'wow'; the sort of effect that would be heard on a sustained piano note as a crude vibrato.

For much the same reason the turntable platter itself needs to be perfectly balanced and be of uniform structure. The Pro-Ject acrylic platters are particularly good in this respect. Obviously the rotational speed needs to be held constant and this is normally achieved using an AC synchronous motor which is locked to the mains supply frequency. (Close to absolute stability can be obtained by using a crystal-controlled supply such as the Pro-Ject Speed Box). Of course even the best motors have imperfections, and these include the small vibrations created within the motor bearings; small vibrations caused by noise and interference on the mains power lines and the so-called 'clogging' vibrations; a consequence of the motors having a finite number of poles giving an 'on-off-on-off' type of motion.

The Turntable and Motor System (continued)

Any of these vibrations reaching the stylus could degrade the sound, so it is good design practice to de-couple the motor assembly from the turntable platter by a belt drive using a carefully specified belt. The characteristics of this belt (compliance, surface finish, etc.) and the amount of tension determine the degree of isolation between the motor and platter, but a high-mass platter will always smooth out any tiny remaining speed irregularities as a result of the 'flywheel effect' which causes the rotational speed to settle to a constant value.



Almost every object resonates at some or other frequency. Tap any object and the “knocking” sound will be at a different note from object to object, because each has its dominant resonances. When an object resonates it actually vibrates to a larger than usual degree and, of course, in a record player any vibrations have the risk of being picked up by the stylus and added to the music signal. For this reason the turntable platters used by Pro-Ject are made from extremely well-damped materials, such as acrylic, which have no significant resonances within the audio frequency band; and so avoid adding any colourations to the sound.

The Tone-Arm

The design of a tone-arm is a demanding task. Earlier we said that a key design requirement is that everything be held absolutely rigid and stable. If a tone-arm has any flexibility between its pivot point and the stylus then any movements will be superimposed on top of the music signal, causing it to be degraded. In practice this means that the whole assembly should ideally be a homogeneous single piece which is rigid and free from flexing. Yet at the same time this arm needs to have a low-mass in order to work well with most modern pick-up cartridges.



Pro-Ject has met this requirement superbly on most of its turntables by using a carbon fibre tube, which is one piece from pivot to the cartridge mounting platform. In addition to being one piece, the carbon fibre arms are almost completely free from flexing, by virtue of the fibre alignment, and through their conical tube shape have a high order of rigidity and a freedom from the 'tube resonance', which can degrade the performance of conventional arm-tubes.

The Steps taken to Align a Record Player

The importance of setting the turntable level

One of the first steps in setting up any record player is the need to ensure that the turntable assembly is perfectly level. This is because the overall performance and all the other adjustments have been calculated from the datum or reference point of a perfectly level record platter. If the turntable is tilted to one side then the force of gravity will not be acting vertically but will be applying a force in the direction of the tilt. The effects of this force can be quite insidious and very audible.

One audible effect can be an increase in the wow & flutter. These are respectively the slow and quick cyclical changes in speed as the platter rotates, and even if these changes are small they will be audible particularly on piano music. The force due to gravity will also effect how the stylus tracks the record groove because with a sloping record surface the stylus will try to run down the slope, causing it to press harder on one groove wall than the other.

There are also other potential problems. Suspended turntables are designed to work in the vertical plane with a resonance or natural frequency tuned well below any audio frequency. If the platter does not “bounce” with a pistonic action only in the vertical plane then there will be other secondary motions some of which will be in the audible frequency range.

Obviously these suspension problems are avoided with non-suspended turntables, but there will still be a degrading effect upon the main bearing which should have minimal rotational friction and hold the platter in a fixed position in all planes with minimal play and as little vibration as possible. All such bearings are designed to work with the turntable level so that all the forces are acting vertically downwards. Tilt the table and you add a horizontal force which will compromise performance and over the long term cause the bearing to wear unevenly.



Before leveling the record player the supporting table, cabinet or shelf should be made as level as possible because any leveling made on the record player is designed to be a fine adjustment to bring it to a near perfectly level position. If the supporting surface is seriously out of level it may be a good idea to use one of the adjustable tables which your hi-fi dealer can provide as an accessory. The spirit level should also be positioned in a number of locations because the turntable needs to be level in both planes; both front-to-back and side-to-side.

The Tone-Arm



The design of a tone-arm is a very demanding task. Earlier we said that a key design requirement is that everything be held absolutely rigid and stable. Because if a tone-arm has any flexibility between its pivot-point and the stylus then any movements will be superimposed on top of the music signal causing it to be degraded; the sound becomes muddled and “out of focus”. In practice this means that the whole assembly should ideally be a homogeneous single-piece, which is rigid and totally free from flexing. Yet at the same time this arm needs to have a low-mass in order to work well with most modern pickup cartridges.

Pro-Ject has met this demanding requirement superbly by using a carbon fibre tube which is formed in one piece from pivot to the cartridge mounting platform. It has, by virtue of the fibre alignment, an almost complete freedom from flexing; and gains, through its conical tube shape, a high order of rigidity and a freedom from the 'tube resonance' which can degrade the performance of many conventional arm-tubes.

The ideal record playing system works within a mechanical closed loop. So the turntable platter is rigidly coupled to the chassis or sub-chassis, so when the chassis moves up or down so does the platter. The arm mounting pillar should be rigidly coupled to the chassis; the arm tube should be 'rigidly' coupled to the mounting and the cartridge should be rigidly mounted to the arm-tube. In this way if one component moves all the linked components move so there is no relative disturbance between the stylus-record contact. Pro-Ject gets close to this ideal by using 'virtually zero-play' bearings for the arm-tube mounting, which allow free movement of the arm in the vertical and horizontal planes but absolutely no movement at the arm pivot point.

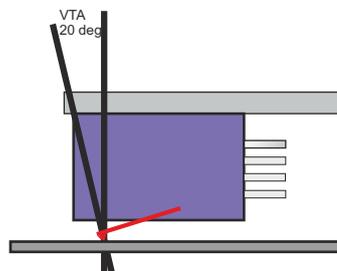
Setting up the Tone Arm and Cartridge to give the best performance

Over the next few pages we'll explain why the tone arm needs to be adjusted in order to perfectly trace the groove of the vinyl record. When the record player is provided with a pre-fitted cartridge then there are only two adjustments required and they are simple to perform. However, when a new cartridge is fitted then either you or your hi-fi dealer will need to perform a series of adjustments. Full details of these adjustments and how to perform them are given in the next section.

Vertical Tracking Angle, the Initial Adjustment

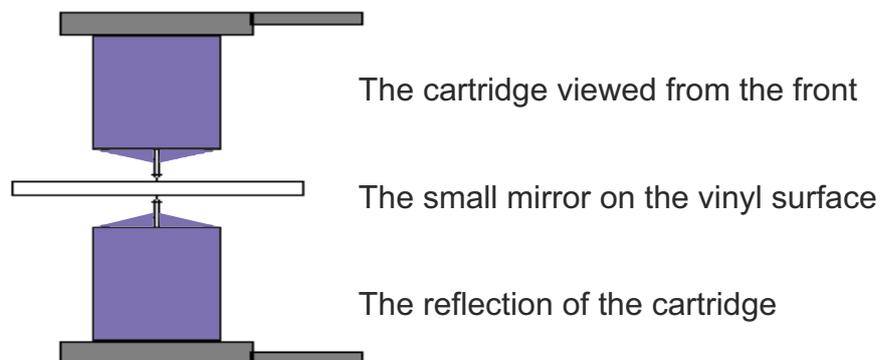
When an original record master is cut the cutter sits at a slight angle to the record surface, because the cutter head needs to be lifted slightly above the record surface. This angle is called the Vertical Tracking Angle (VTA) and can vary from record to record. In the 1960s most records were cut with a VTA of 15 degrees, but by the 1980s the standard became 20 degrees. Yet even though there are standards, many successful cutting engineers still make their own choice of VTA as well, in order to give the sound the particular character which is their trademark.

If your record player is delivered with a fitted tone-arm and pickup cartridge then the correct VTA will have been set by the factory and no further adjustment is needed. However, if the tone-arm or cartridge are changed then the VTA will need to be set and this is done in two steps. The first simple step is to check whether the arm and the head-shell are parallel to the record. Most manufacturers of cartridges mount the stylus cantilever so that a Vertical Tracking Angle of about 20 degrees is achieved when the arm is parallel to the record. If the arm is not parallel to the record you should loosen the locking collar on the base-board (as shown in the next section of this manual) and then carefully move the arm up or down until the arm tube is parallel to the surface of the record.

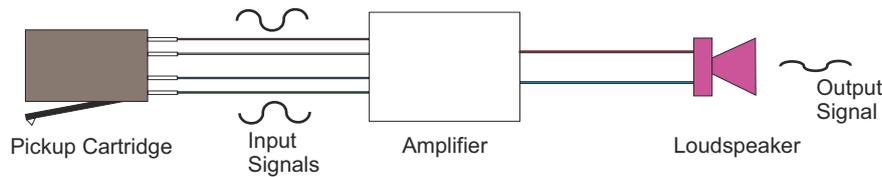


The Azimuth Adjustment

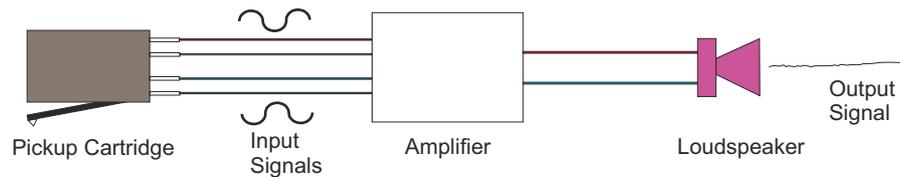
Because the music is recorded into the two walls of a 'V' shaped record groove, it is obviously essential that the stylus of the pickup cartridge sits perfectly vertical in the groove - rather than leaning into one or other of the walls. This adjustment is called the Azimuth Adjustment and can be checked by viewing the position of the stylus diamond tip in the record groove. Another easier method is to put a small mirror on the record disk in front of under the stylus whilst viewing the cartridge from the front. When the alignment is correct the cartridge and its reflection will be perfectly in line with each other (as shown in the drawing below). Adjustment instructions will be detailed shortly.



For the more experienced listener there is another very accurate method of adjusting the azimuth. Simply swap one pair of the cartridge wires around (effectively reversing the polarity of one channel) then switch the amplifier to mono (or use a “Y” cable adapter to turn the stereo signal into a single mono signal).



Azimuth Not Correctly Adjusted



Azimuth Correctly Adjusted

Then play a track on a mono recording (available from “collectors” record shop or use a test disc from a specialist supplier) and carefully rotate the arm until you get the lowest level of sound from the loudspeakers; ignoring the little bit of high-frequency “tizz” that will always be there.

When finished, remember to reverse the cartridge wires back to their original positions and you are done.

The Lateral Tracking Error

This is another adjustment which will not be necessary with a system supplied from the Pro-Ject factory with a fitted cartridge but none the less it is helpful to understand why a special alignment has had to be made.

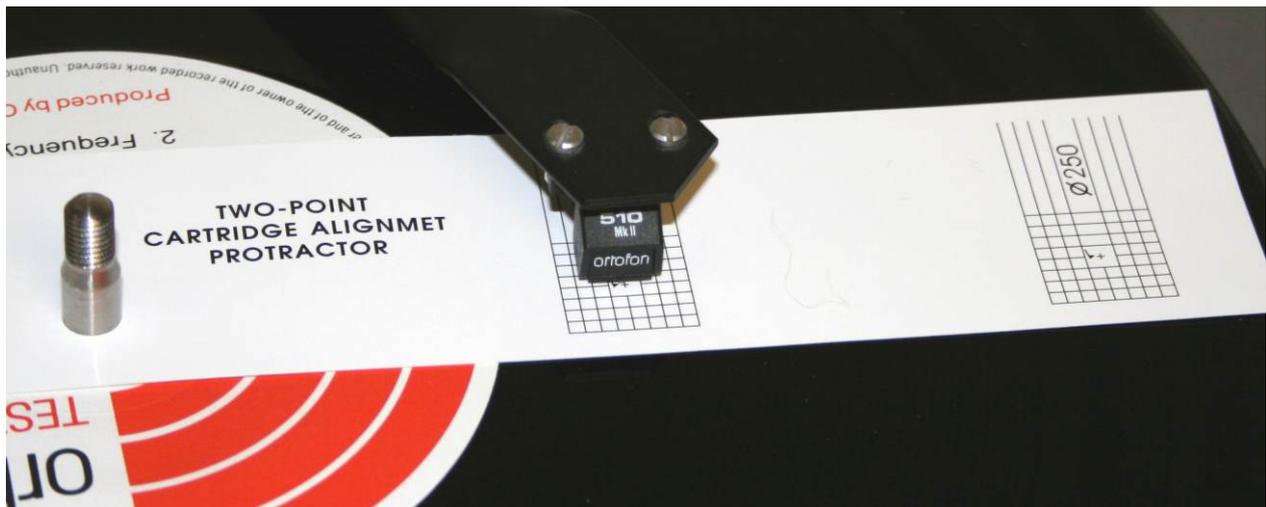
When the recording is cut into the lacquer disc (from which the master pressing is made), the disc rotates and the cutter head moves laterally from the outside of the lacquer to the inside. The cutter diamond is mounted in a parallel tracking arm that moves across the record so that the cutter is held at a constant 90 degree angle with the groove. However most record players are fitted with radial arms which pivot from one corner of the turntable so that the playback stylus moves across the record along a fixed radius. The stylus cannot follow the exact path made by the cutter because the lateral angle varies depending upon the position across the record surface.

In fact, what happens is that because the stylus is not exactly in line with the groove but at an angle with the groove, so the stylus is touching one groove wall a tiny distance ahead of where it is touching the other groove wall. This 'tracking error' means that there will be a time difference between the signals of the left and right channel. What is needed is a way of aligning the arm and cartridge in such a way that this time difference is minimised and thus inaudible at every point on the track from the start to the finish of the record.

The Lateral Tracking Error (continued)

Of course one easy way of avoiding this problem would be to use a very long tone-arm. For example with a 9 inch long tone-arm the angle would be about 6 degrees at the worst position but with an arm 60 inches long the worst error would be about 0.7 degrees; an insignificant amount. But, of course, such an arm would be hopelessly impractical; have far too high a moving mass and be far from stiff. None the less even increasing the arm length from 9 inches to 12 inches reduces the tracking error by a third; and Pro-Ject manufactures arms of both these popular sizes.

In aligning the arm and cartridge there are three main specifications which should be considered. These are the effective tone-arm length; the overhang and the offset angle of the head-shell relative to the arm tube. (The overhang is the distance between diamond tip and centre of the spindle. The effective tone-arm length is the distance between arm pivot and diamond tip.) The mathematics of how the stylus traverses the record disc are quite complex but in practice the task of alignment is made very simple by the use of an alignment protractor which is a piece of printed card or plastic which slots through the spindle and sits on the turntable platter. This protractor has a number of lines radiating out from the spindle and labeled from 0 to 5 degrees plus a series of vertical parallel lines. These reference points are positioned at distances of 63 mm and 125 mm from the spindle. This alignment is a good compromise across the whole of the record and ensures that almost zero distortion is achieved.



The error is reduced by turning the cartridge in the head-shell (by slightly loosening the mounting bolts in the slotted holes) and by moving the cartridge back and forth along the slotted holes to change the overhang. These adjustments give some flexibility in the mounting position to ensure the best alignment allowing the stylus to track the record groove accurately. However there will always be a slight error and different designers approach this problem in different ways with some noting that the highest level of distortion will be in the inner grooves near to the label and so they align for the best accuracy in that region.

The Down-Force

The down-force onto the record groove is also known as the Tracking Weight or the Vertical Tracking Force and is a figure normally dictated by the manufacturer of the pickup cartridge. It is important that the pickup is never used with a down-force that is too light as the stylus could skip off the track and the groove walls could be damaged.

As no two cartridges (of the same model type) are ever exactly the same it is possible to optimise the down-force by making a small adjustment in each direction and listening to the results each time. When the down-force is adjusted you will hear small changes to the tonal balance; to the imaging and to the way loud passages are reproduced.

The stylus pressure is quite critical for if it is too low the stylus will fail to hold on to the groove wall and mis-tracking will occur, damaging both stylus and record. If it is too high the stylus will wear out the groove wall faster than necessary.

The cartridge manufacturer actually chooses a precise down-force, which places the coils or magnets centrally in the generator assembly. Any deviation from that down-force will change the performance as the generator becomes misaligned and the suspension works outside its planned range. The result is a drop in performance. However all manufacturer products differ from the designer's drawing by a small amount (the manufacturing tolerance) which is why a slight adjustment of the down-force can sometimes bring about improvements in the performance.

The down-force is set by balancing the weight of the cartridge with a so-called counterweight; then reducing the amount of counterweight so that a defined portion of the cartridge weight bears down on the stylus. This simple adjustment is covered in the next section.

The Bias Compensation or Anti-Skating Force

A stereo record is played back by reading the lateral and vertical movement across a 45 degree groove so it is essential that the diamond tip of the stylus should have the same contact with both groove walls.

When the record turns, a centripetal or rotational force will be applied to the arm and cartridge which will push the cartridge towards the spindle. Because the arm is fixed at one end it will move radially and so the stylus will apply an increased pressure on the groove wall which carries the sound of the left channel. The bias compensation is simply a counteracting force applied at the other end of the arm which cancels out the centripetal force. This compensating force is provided by a small weight hanging from a thread to give a sideways pull. Again the correct amount of compensation required has been measured by the manufacturer using a test record with a groove-less section. The side thrust compensation is then adjusted until the stylus tracks perfectly, moving neither towards the spindle or towards the periphery of the record; hence the expression anti-skating force. The manufacturer then plays a test record which has a sine-wave recording for both channels and makes the final adjustment to ensure that the output of both channels is a clean undistorted waveform.

Incidentally the centripetal force is the opposite of the better known centrifugal force. The former is a force pushing towards the spindle whilst the latter is a force pushing outwards. Because the stylus floats free of the record it will experience the centrifugal force on the groove wall thus creating an equal but opposite force pulling towards the centre; the centripetal force. With most Pro-Ject tone arms this force is generated by a small weight which is hung on one side of the arm tube.

The Fine Adjustment of the Vertical Tracking Angle

Earlier we described how the Vertical Tracking Angle should be set by making sure that the cartridge and arm-tube were sitting in parallel with the record surface. However once the down-force has been set the Vertical Tracking Angle may have changed because the cantilever arm of the cartridge (which carries the stylus) may have moved in or out of the cartridge body and if that has happened the angle at which the stylus sits in the groove will have changed. In fact a small change of down-force can move the stylus an appreciable amount especially if the cartridge is very compliant (has a very soft suspension).



This picture shows how the arm pillar slides up and down through the support collar and is locked in place by the allen screws.

The final adjustment of the Vertical Tracking Angle can only be achieved by careful listening. Lowering the arm in the support collar will cause the cartridge to lean back slightly and will generally give a richer and less detailed sound heading towards dullness. Raising the arm causes the cartridge to lean forward and will generally give a more detailed sound heading towards thinness.

Step-by-Step adjustment of the Tone Arm and Cartridge

Pro-Ject uses several types of Tone-Arm so again the instructions for aligning the arms and for fitting cartridges vary slightly with each model. Many of the lower cost record players are delivered with the cartridge already fitted so the instructions for fitting cartridges can be ignored until such time as it is desired to make a change.

In the next section of this manual we will take you through all the practical steps needed to align the Tone Arm and Cartridge assembly.

This procedure is quite simple, but if you have any doubts about undertaking these steps you should consult the retailer who supplied the record player. The retailer will be more than happy to undertake the alignment on your behalf.

These adjustments should always be made with the power off and disconnected as any unexpected movement of the platter could cause expensive damage to the cartridge stylus.

The steps taken to align the Tone Arm and Cartridge

The majority of Pro-Ject record players are supplied with the cartridge already fitted so you'll only need to set the tracking weight and the bias weight as shown in the simple steps below...



Cartridge down-force or tracking weight adjustment

This adjustment is made to set the pressure that the stylus tip applies to the record groove. The down-force pressure is set by first balancing the tone-arm with the stylus cover removed from the cartridge.

With a gentle pushing action, turn the counterweight along the rear end of the tone-arm tube, ensuring that the white scale markings are visible to the front.



Balancing the Arm

Now move the arm so that the cartridge is positioned to the side of the platter then lower the arm-lift and carefully rotate the counterweight until the arm tube is in a balanced position.

When the arm is perfectly balanced return it to the rest position. Now hold the counterweight, but do not move it, and gently turn the scale ring until the zero is in line with the anti-skating notched shaft.



Setting the Tracking Weight or Downforce

Check once again that the arm is balanced and then rotate the whole of the counterweight counter clockwise (seen from the front) to adjust the down-force figure to match the cartridge manufacturer's recommendations. One mark on the scale represents 1 mN (or 0,1g / 0,1 Pond) of down-force.

To obtain the downforce setting information for factory fitted cartridges, see the original product manual or visit the product pages of www.henleydesigns.co.uk for details.



Anti-skating force or bias adjustment

Once the down-force is set it is necessary to apply a small force to the side of the arm to stop it swinging to the centre of the record. This force is applied by a small weight which hangs on a thread to the side of the arm. Take the anti-skating weight and hook the loop in the thread over a groove in the small rod that protrudes from the rear of the tone-arm's bearing mounting and then hang the thread through the hook of the wire support. This is the correct setting for the factory fitted cartridge.

To obtain the anti-skate setting information for factory fitted cartridges, see the original product manual or visit the product pages of www.henleydesigns.co.uk for details.

Aligning versions of Tone Arms with fixed counterweights

In addition to the straight (normally carbon-fibre) tube designs of arm on the previous page, Pro-Ject also fits two other types of tone-arm. The “S” shaped arm used on players such as the “RPM 1.3 Genie” and the Uni-Pivot arm used on players such as the “Essential” or “Xperience Basic+”. These arms require a slightly different procedure which is described below.



Cartridge tracking weight adjustment

Place the counterweight halfway along the support rod at rear of arm with the securing screw uppermost.

Now place the Stylus pressure gauge directly onto the platter (removing any mat), with metal tip facing but NOT over the centre spindle and then remove the plastic stylus cover and carefully place the tip of stylus on point marked 15 (this represents 15mN or 1.5 grams pressure - for the OM5E, as provided on the Essential turntable). The aim now is to get the stylus gauge to become level, as this will mean that the stylus is exerting the correct downward pressure.



Carefully move the counterweight along the rod away from the bearing to add more pressure or towards the bearing to reduce the pressure. During this process keep lifting the stylus away from the gauge in order to prevent any damage to the stylus.



Once the gauge is balanced you should lock the counterweight into position using the hexagonal key provided.

For Factory fitted cartridges the settings are:-

Essential models	15.0mN
RPM 1.3 Genie	18.0mN
Xperience Basic+	25.0mN

Anti-skating force or bias adjustment

Once the down-force is set it is necessary to apply a small force to the side of the arm to stop it swinging to the centre of the record. This force is applied by a small weight which hangs on a thread to the side of the arm.

Take the anti-skating weight and hook the loop in the thread over the second groove (for Genie & Essential, the outermost groove for Xperience Basic+) in the small rod that protrudes from the rear of the tone-arm's bearing mounting, and then hang the thread through the hook of the wire support. This is the correct setting for the factory fitted cartridge.

The pictures show the anti-skate weight mounted on the two types of tone-arm.



Fitting a Cartridge to the Tone Arm

Some of the more expensive Pro-Ject record players are supplied without a cartridge fitted so the simple steps for installing a cartridge shown below should be followed. These steps should also be followed if you decide to fit a replacement or alternative cartridge.

Note that these instructions should be followed in conjunction with those provided by the manufacturer of the cartridge. Although most cartridges are installed in the same manner there are exceptions so it is always a good idea to read the instructions first.

! Safety First Warning !

Please read these instructions several times to ensure that you understand all the steps. The cartridge stylus is fragile so keep the stylus cover in place except for when the cartridge has to be lowered onto a record. Be careful when moving the tone-arm as the bearings at the mounting end can easily be damaged.



Fitting & connecting the cartridge

Pro-Ject arms will accept all cartridges which have a 0.5 inch (1.27 cm) spacing between the mounting holes. The mounting is done using the screws and nuts provided with the cartridge. The cartridge is mounted to the arm by passing each screw through the slot in the arm assembly and loosely fitting the nuts.



Now fit the four coloured wires to the pins on the cartridge as shown. The cartridge will normally have its pins colour coded the same as the wires but in other cases follow the following code:

White left channel positive [L+]
Red right channel pos. [R+]
Green right channel return [R-]
Blue left channel return [L-]

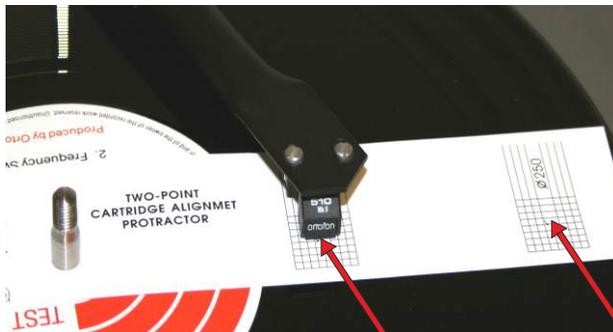


Adjusting the vertical tracking angle (VTA)

First put a record on the platter and then move the arm off its rest and lower it so that the stylus point is resting in the record groove. Now view the tone-arm from the side and ensure that the tube of the tone-arm is parallel to the surface of the record. If it is not parallel you need to slightly loosen the two hexagon screws in the tone-arm base to allow the arm pillar to slide up or down until the arm tube has been set parallel. Then carefully re-tighten the hexagon screws. **Do not over-tighten these screws; finger tight is normally sufficient.**

The Lateral Tracking Error

In order for the stylus tip to follow the record groove precisely the cartridge needs to be aligned on the end of the tone-arm at the correct angle. This is a two-step procedure which is done with the Alignment Protractor Card provided. Pro-Ject also has a special Cartridge Alignment Tool (The Align-IT) which can be used. Full details can be obtained from your retailer.



The Alignment Card should be fitted over the centre spindle and laid flat on top of a vinyl disc. As shown in this picture there are two calibration points, one near the centre of the disc and one near to the outside edge.

The cartridge should be moved along the slots so that the stylus tip rests on the correct overhang mark as shown. Now gently twist the cartridge around its mounting so that the side of the cartridge body are parallel to the lines drawn on the protractor. Now move the cartridge to the second alignment point on the protractor and repeat the adjustment. You may need to slightly adjust the overhang to ensure good alignment at both positions on the protractor.

Once this has been done you should carefully tighten the mounting bolts and then re-check the alignment again in case the cartridge has moved. If all is correct you should now adjust the azimuth setting and then finally check the down-force setting again.

Adjusting the azimuth

The cartridge stylus tip must sit vertically in the record groove in order to trace the groove walls correctly. This vertical position is called the azimuth setting.

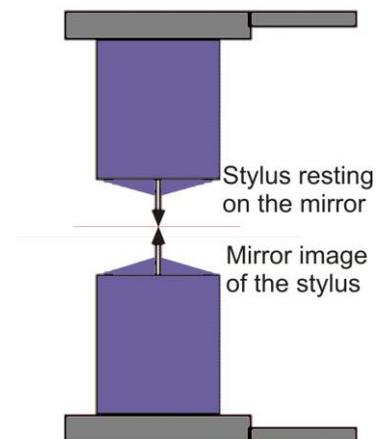
There are two methods of checking the azimuth. The first, and most precise method, is to use a good magnifying glass to view how the stylus tip sits vertically in the record groove. Normally the top surface of the cartridge body will also be parallel to the record surface, but in practice this is not always the case.

The second method requires the use of a small mirror which is put under the stylus whilst viewing the cartridge from the front.

When the alignment is correct the cartridge and its reflection will be perfectly in line with each other. If adjustment is needed you should slacken off the small screw, at the bearing end of the arm just enough to be able to revolve the arm tube without needing to apply any force.

Do not remove the screw completely! When satisfied with the azimuth setting you should re-tighten the screw.

! Safety First Warning !
Never adjust the arm tube whilst the stylus tip is still in the record groove! You will cause damage to the stylus cantilever. The arm must always be lifted to make the adjustment and then lowered again to re-check the azimuth alignment.



Connecting a Turntable

The section below details how to connect your turntable into an existing system. Turntables should be treated like any other source, with one exception. The output from a turntable is low compared to other Line-level sources (such as CD players), so it needs to be amplified by a phono stage before reaching a normal amplifier. Phono stages are available as separate accessories, or in some cases built into turntables or amplifiers. You should make sure you only use one phono stage in a system.

Connecting to the amplifier

Most Pro-Ject players have RCA phono sockets at the rear, under the tone-arm base, to which you fit interconnect cables, making sure that the left and right channels are connected the right way round. An earth or ground wire may be connected from the screw terminal between the sockets on the plinth to the similar terminal on your amplifier; if you encounter “hum” problems when using the player.

The interconnect cables should be plugged into the Phono input sockets on your amplifier (sometimes called “disc”). Check the amplifier's instructions to see that the phono input offers the correct matching and sensitivity to suit the cartridge. If your amplifier does not have an input suitable for phono cartridges you will need to fit one of the Pro-Ject “Phono Box” range models between the player and your existing amplifier.

The picture alongside shows the rear panel connections for the Pro-Ject Phono Box.



Mains power connection

Most Pro-Ject record players are supplied with a separate power supply, which has been manufactured to match the mains power of your country. Take the output cable of the power supply and plug it into the matching socket on the back of the plinth or motor housing, checking the label on this supply to ensure you have the correct model, before plugging it into the mains supply.

The pictures alongside show the two alternative connections. The upper picture is the connection to the separate motor housing whilst the lower picture shows the alternative design with the connector fitted in a small housing under the plinth.

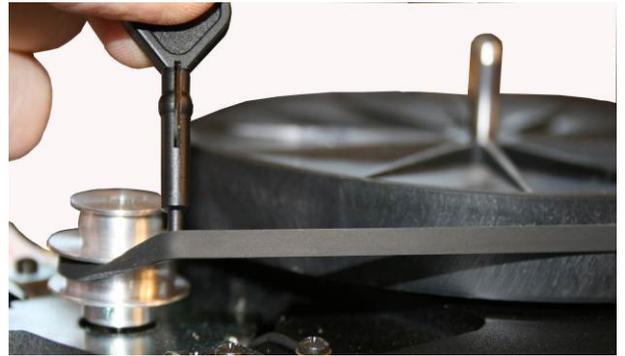
Then you can start and stop the turntable by pressing the power switch on the plinth or on top of the motor housing; depending upon the model.



Changing the replay speed

A speed change is made by moving the drive-belt from the smaller motor pulley (33 $\frac{1}{3}$ rpm) to the larger pulley (45 rpm). You should avoid contaminating the belt by touching it and instead use the tool provided to hook over the belt and then move it to a new position.

You can also operate the player at 78 rpm by purchasing a special pulley which is available through your dealer. Alternatively you can use one of the Pro-Ject controllers which can change the speed electronically without the need to move the belt. Again full details can be obtained from your dealer.



Fitting the acrylic lid

For those models that have an acrylic lid it can be fitted by carefully sliding the two hinge prongs into the matching holes moulded into the lid. Then adjust the two screws on the right side of the plinth (as viewed from the back) until there is sufficient friction to allow the lid to remain up after it is lifted. If the lid movement is too stiff the two screws can be loosened slightly. For optimum sound quality you may want to remove the lid when listening to music.



45 rpm "Singles" adapter

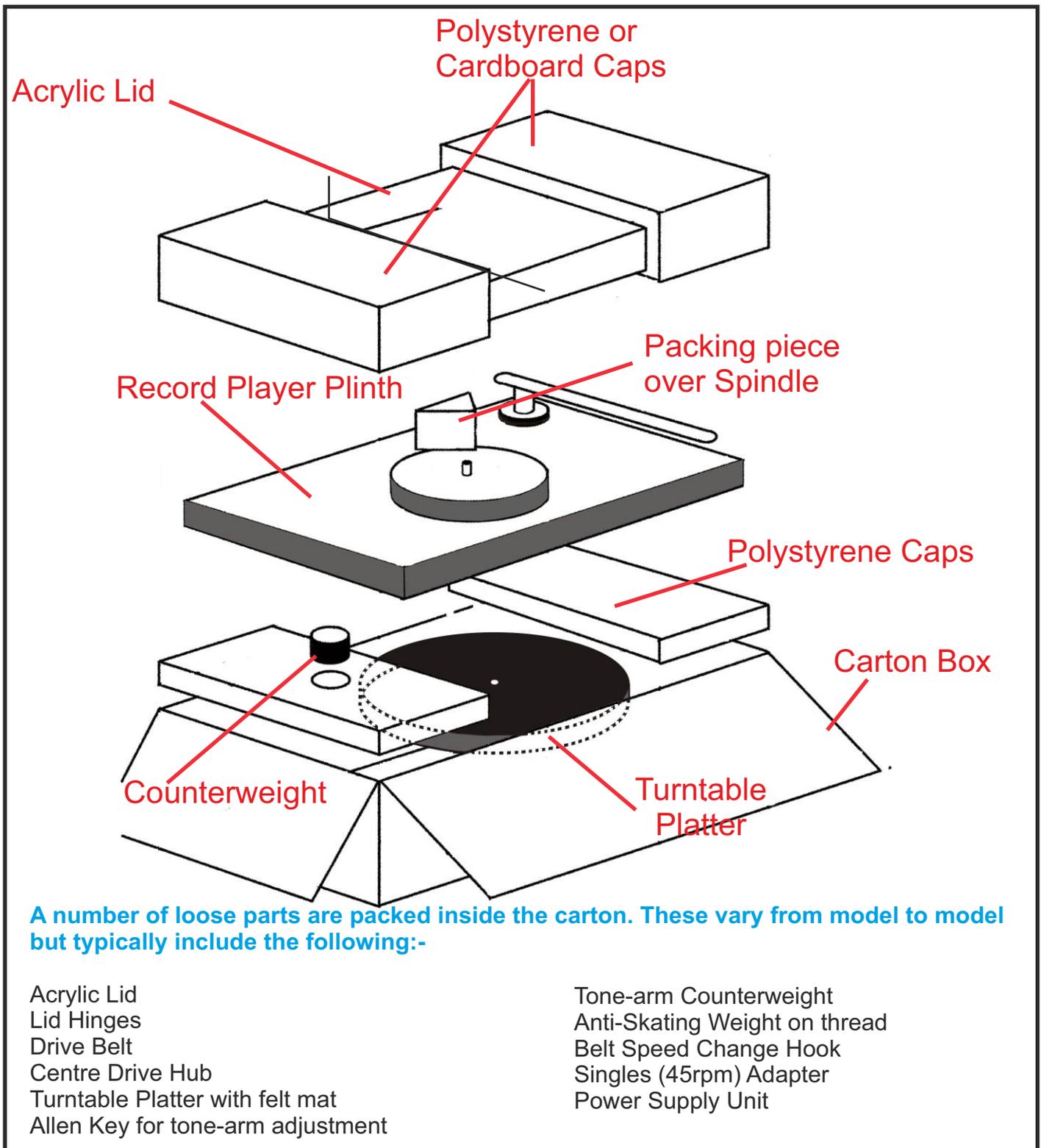
Vinyl singles with the larger juke-box style centre can be played by fitting them over the adapter provided. There are two versions made by Pro-Ject; both fit onto the disc in the same way as shown in the picture



Servicing and Re-Packing your record player

Should you encounter a problem which you are not able to alleviate or identify you should contact your retailer for further advice. Only when the problem cannot be resolved should the unit be sent to the Pro-Ject distributor in your country.

Never return a record player without making sure that it is safely disassembled and correctly re-packed in the original packaging as the precision components can easily be damaged during transportation. The drawing below shows the packaging of a typical Pro-Ject record player although each model is slightly different. In particular you should always remove and pack separately the lid cover; the feet; the counterweight; the turntable platter; and the belt. Always replace the transport screws for the motor if originally fitted; the transport lock on the tone-arm and, most importantly, fit the cartridge protection cap over the stylus.



Warranty

The manufacturer accepts no responsibility for damage caused by not following these instructions for set-up and use and/or by transportation without the original packaging. Modification or changes to any part of the product by unauthorized persons releases the manufacturer from any liability over and above those of the lawful rights of the customer.

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Pro-Ject has a policy of continually upgrading and improving its products so changes may occur to the design and specification without any prior notice.

For more information, visit: www.henleydesigns.co.uk