Welcome At DirectDrive

This site is devoted to Analog Record Players - with Direct Drive. First introduced in 1969 during the 70's the Direct-Drive Turntable soon became sort of a standard in radio-stations and homes of true audiophiles throughout the whole world. In the end of the 70's japanese companies made some classic machines like the Technics SP-10MkII, the Sony PS-X9, the Trio/Kenwood L-07D or the Denon DP-100, with an almost unbelievable amount of creativity, material and quality.

Almost forgotten during the 80's the renaissance of Direct-Drive-Turntables started in the 90's as an instrument for creative DJ's. The emphasis here however is more on the now forgotten top-of-the-line models - battleships of the past, whose sound even by nowadays standards surely will please every true audiomaniac.

Granted, the performance of many of todays tables might be just as good as their vintage counterparts but it is the way these vintage machines spin the platter with their classic looks, strobes, lights and countless gimmics. This site shows you remarkable models and covers subjects like history, technical stuff, tuning, building a plinth, buying 2nd hand, prices, spare-parts, and many more stuff around Direct-Drives.

Welcome to the world of EMTs, Denons, Technics

I would be glad to hear from visitors of this site. If you have comments or questions don't hesitate to mail. I would also appreciate pictures, comments and data sheets regarding direct drive decks.

Mail me

DirectDrive - The Hows And Whys

What's up with that Direct-Drives?

If you believe most audiophiles or your local Linn-dealer these are products for clubs or radiostations which don't belong into the home of a true audiophile because they "do not sound". Quite the point a good Direct-Driven Turntable has not that much sound of his own usually less than most (not all) belt-driven suspended or high-mass turntables - not necessarily a bad thing in my opinion considering what HiFi ought to be about...

How does it work?

What are the advantages?

How does it sound?

How does it work?

In the end of the 60's engineers at National/Technics found that to better the reproduction of analog records you have to minimize the number of moving parts especially the number of bearings in a player-system. The first patent of a direct-drive for record-players goes back to 1929, it belonged to the suisse company Thorens - which is known among audiophiled mostly for its belt-driven players. So almost 40 years had to pass until - with the inventions of modern discrete regulation-circuits - it was finally possible to produce a direct-driven record-player of high quality.
With the first models the speed was regulated by reading the minute fluctuations of the platter with a tachometer and correcting the turning of the motor by comparing this signal with an electronic reference-signal. The drawback of this principle was that before correcting something a fluctuation already has to occur. These effects may be more or less audible depending on the quality of the deck.
Soon after that Denon introduced a new method by reading a difference-signal from a magnetic-ring inside the platter and thus generating a correcting-signal for the motor before any significant fluctuations in speed had occured. Later japanese players included a phase-locked-loop (PLL) around the reference- and the differential- circuits. That way the speed is corrected when a slight difference in phase of the two signals is detected, with only a minute and constant phase-difference between reference- and tachometer-signal left. The tendency for "trembling" of the first generation direct-drive turntables was almost

completely eliminated that way and speed-fluctuation depended almost entirely on a clean reference-signal and the quality of the motor-bearing-platter triumvirat itself. Instead of hall-genarators or sythesizer-circuits during the middle of the 70's quarz-crystal-oscillators were introduced, which managed to put out a "quarz-constant" reference-signal.

What are the advantages?

A huge advantage of a direct-drive record-player is the fact, that the whole mechanical system consists of just one moveable part (the combined motor-shaft/platter-bearing) which turns quite slow and has a big mass (the platter) attached to it - almost a mechanical ideal for quiet rotation. The resonance of the combined motor/bearing assembly lies in the range of 0,5 Hz due to its slow speed compared with the 50/60Hz resonance of the motor of a typical belt-driven turntable. All belt - or idler-driven record-players incorporate a lot of mechanical parts for adapting the fast speed of the motor to the comparably slow speed of the platter. Each of this parts implies an own sonic footprint by inducing resonances and suffering from bearing-tolerances in this more or less complex mechanical system. Another advantage of good direct-drive decks is speed-stability.
The german magazine "Audio" once measured the frequency of a 3kHz burst played through a belt-driven state of the art turntable system. There were 4Hz missing! To compensate for the effect of slowing the platter during heavy modulations you need a fast and precise regulation and rigid coupling between the motor and the platter. Compare this to your typical belt-drive deck... Some might argue that a very heavy platter won't slow down because of its sheer mass - this is not the case. Even worse - when the motor regulation tries to speed up this platter will react much slower than a light one. It's like driving a

mountaineous way with a truck - I would prefer a Porsche. Coupling the motor to a heavy platter with a string is questionable, too. Whoever changed the tension of the string of a Platine Verdier (platter weight around 50pds.) knows what I mean. Some enthusiasts take even tape instead of a belt to improve coupling the motor to the platter. Now speed stability may improve but there is no filtering of motor resonances any more...
Negative effects of the needle slowing the platter during heavy modulations are best avoided by incorporating a fast and precise speed-regulation, a not too heavy platter rigidly coupled to a strong motor (best the platter is bolted to the motor like with the Technics SP-10Mk2). With such a deck speed-fluctuations during playing a Wagner opera will eventually become neglectable.

How does it sound

Good direct-drive turntables tend to sound very neutral - they deliver what is on the record not less and not more, no foot-whipping effects like some scottish belt-drive - just pure information. Musicality is produced of course, but only if it's on the record. As this is true for the "top-of-the-line"- models covered on this site forget about most cheaper direct-drives of the same era that flooded the mass-market during the 70s and 80s. In the DirectDrive-Museum you will find some recommendable models. A good direct-drive machine delivers rock-steady positions of instruments, precise timing, high dynamics and razor sharp transients. Classical music has as much authority and weight like with the best high-mass belt-driven turntables - but without their timing-problems in the lower registers. The music lover who is ahead of spectacular effects should give a Technics SP-10MkII, an EMT 948 or a Denon DP-6000 a listen - he might well be surprised...

What does it cost?

A good Direct-Drive machine is very expensive to build. A SP-10MkII used to cost around 1000,- Dollars in the 70's, today that might be ten times as much. The EMT 948 pictured above carried a price-tag of 6000,- Dollars in the end of the 70's... Those machines were introduced to the stunning public during the heyday of japanese audio. The yen was low, production-costs were no object and lots of well-eduacated engineers were just waiting to put their expertise and creativity into a new "analog statement-product". At the end of the 70's almost every japanese audio-company had one or two of those flagships in their program, mostly for prestige and image-reasons. Obviously these battleships were calculated in a manner that they were subzidized by the huge sales of their little mass-market brothers. Today those machines seem to be THE ticket for a glimpse of analog nirvana. More about today's prices for differnet models in the DirectDrive-Museum.

How does it look?

Looking at those machines you clearly see the approach of a company to create a real statement-model, one that you will always associate with that company. No player in that days looked like the other, the designers wanted theit babies look unique and prestigous. Rosewood and brushed aluminium were the ingredients and cost was obviously no object. Build-quality was also exceptional, and these days noone dared to present a record-player without a strobe.

Some word about plinths and tonearms

If you want these machines sound as they can you need a dense and heavy plinth and a good decoupled stand. Many of the turntables in that days were developed as a simple chassis which the user could place into a plinth of his taste. Plinths offered by the companies looked good - but in most cases they suffered from resonnances and spoiled the sound of the players. Apparently plinths offered by Denon, JVC and Sony suffered from this. On the other hand having the possibility to make an own plinth means that you can somewhat tune the sound of your turntable for your own system and taste. You can also get the looks you like. Building your own plinth is covered here.
The same applies for tonearms which were mounted that days. Most recommended models which are covered in depth here were delivered without an arm, so the customer could install his own. So putting a decent, modern arm on such a turntable isn't a big problem.

Caveats and drawbacks

Yes, quite a lot. Almost 90% of the direct-drive record-players of the 70s and 80s were cheap and nasty machines - this is the real reason for the bad image of the Direct-Drive principle among most audiophiles. These players were composed out of light plinths, lots of plastic and cheap materials for platter and main-bearing and flooded the mass-market mostly because they were cheap. You won't see those models on this site.
As for the others most of them had absolutely no suspension, so you need to have a special turntable-table or - even better - a wall-mounted-shelf to decouple the player from its sorroundings.
You won't get any spare-parts for this machines, as right now most of them are more than 20 years old. A burned motor of a Denon usually means the end for that player unless you're lucky and find a second one

which you use for the job. Electronic parts like hall-generators, or some Op-Amps and trannies are getting more and more difficult to find these days. If you'll need these, prepare yourself for a long search. Some kind of service is still available for EMT - at not so nice prices... - and for the Technics SP-10.
BUT - most machines you will see here were built like a tank and if not seriously abused will play a whole lifetime.

DirectDrive - Owning A DirectDrive

Nowadays the only way to get a direct-drive turntable is buying it second-hand. Most of the machines now are 20 to 30 years old. Some of them were well used units doing 24hrs a day duty at radio-stations. With the compact-disc arrival in the 80's many of these players lost their job and ended in clubs or on the junk-yard. So today it's getting more and more difficult to find a good model and make it run really good.

Buying

Where do you get such a machine? 15 years ago it was no big deal buying a Technics, an EMT or a Denon from your local pro-audio-shop or radio-station. In the 80s almost every record-studio had some direct-drive player around, with most of them sold cheap in the 90's. Most of my machines were bought that way. Enter the 21st century some machines are really getting hard to find, some have actually become very rare at least here in Europe or the US. Of course you can try to find your dream on the WWW like at EBay but keep in mind that most machines sold there haven't got better during the years, so beware! Prices for those machines quite often have risen like a rocket, old EMT's, Denon's or Technics command huge prices now.
When buying such a machine take care of the following

- Is it complete, does everything work?

  If parts are missing, today it's almost impossible to get spare-parts. Parts like strobe-lights, spindles, special nuts and bolts, lights and switches are sometimes very hard to find. Check out all lights and knobs

work and do what they supposed to do. Keep in mind that even getting a manual or a service-manual for some players is a major challenge.

- Does the platter move horizontally? Can you move the spindle?

  If the platter moves horizontally or even excentrically keep your hands off! The main-bearing is gone and in most cases there is absolutely no way for repairing it.

- Do you hear wow or flutter? Does it run too fast/slow

  Wow and flutter is simply not existent on a good direct-drive deck. If nonetheless you detect wow and flutter or speed fluctuations the motor or motor-regualtion has faded away. Again spare-parts for hall-generators or quarz-regulations are very hard to get hold of these days. On some JVC's and almost all Denon's the difference-signal is generated by reading a magnetic-ring inside the platter. If there is something wrong with this magnetic-ring - and quite often it is indeed - you have no chance to repair the unit. Sometimes though only the magnetic-head is disaligned (the effect is that the platter will run way too fast), so this might turn out as some kind of bargain. But again - be very careful!

- Optical condition

  Very often you can better the cosmetics of your deck by yourself. With some marks though you have to decide by yourself whether you can live with that. An EMT from a german broadcasting-station was always well looked after technically by special service-people, but optically it might look horrible, technically it will work like new. If a wooden plinth is in bad condition quite often this does not matter at all if you can change it. Most plinths are not of great use for listening to music and you should build your own anyway.

- Tonearms, Carts

  Quite often you'll get offered a complete record-player coming with tonearm and cart. If the tonearm is in good condition and if you like that tonearm you can add some money for it. Most separate tonearms of the 70's however will play in the range of hmmmm a Rega RB-300, some even worse (sadly almost all tonearms supplied by the company that made the deck may fall under this category) Keeping this in mind pay around 100 to 150,- Dollars more for a

  - Audio Technica ATP-Series
  - Denon DA-Series
  - Lustre GST-801
  - SME 3009/S2
  - Technics EPA-500

  Pay considerably more for the following:
  - Fidelity Research FR64s / FR64fx
  - Grace GA704/714

    - SAEC WE-series
    - SME 3012/R
    - Technics EPA-100

  To judge the state and quality of a tonearm or cart is nearly impossible if you don't know the thing. Toneam-bearings can be checked by balancing the arm and putting little paper-pieces on the headshell (vertical movement) or very softly blowin from the side (horizontal movement). In both cases the arm should move. Check whether there's a point when the bearing seems to stick, too. Even with all that done you never can be sure... For carts: Even if the needle looks like new keep in mind that after 4-5 years the rubber sorrounding of the needle has dried or is gone. With Moving-Coil carts (an MM-cart you can junk anyway) that means repairing it for around 350,- to 500,- Dollars. If it's not a fancy Koetsu forget about it.

  BTW: EMTs are a different animal. It makes no sense in putting up a different arm or cart on these. Consider that when you buy an EMT.

Service

Service for most Direct-Drive decks is no big deal at all. 3 or 4 drops of oil a year (read the manual) for the main-bearing and an occasional cleanup is enough. Forget about cleaning the main-bearing If you don't have a service-manual you really should know what you're doing. Keep in mind that main-bearing means motor-shaft and think about it for 5 minutes... Most of the time the risk to damage the bearing is bigger than the possible positive result. EMT main-bearings for example require no service at all.

Building a plinth

A good plinth for your deck is a must, it should be dense, heavy so it will damp the deck's resonances. Back in the 70s few cared about that so most plinths from that time may look good but sonically they're a medium desaster. But for most Denons, Technics or Sony decks you can easily fix this by removing the motor from the original plinth and build a better one. Take the original as a template for your own massive construction...

Materials for plinths are:

- MDF

  MDF plinths have their own sonic fingerprint as MDF tends to damp higher frequencies more than lower frequencies - so quite often the result is kind of dull and "closed in" sounding. MDF may give good results when combined with other materials like some sort of metal. A MDF-Alu sandwich combines the advantages of both materials but it's hard to work with and very expensive. However MDF is quite cheap and easy to work with.

- Corian

Corian is a material developed by Dupont France for kitchen-benches. It's a composite that comes in an almost granite-looking surface and consists aluminium flakes. The more aluminium (bigger flakes) is in corian the better for your plinth. Sonically for many people corian seems to be the ticket. For my taste plinths made out of Corian tend to sound a bit too laid back, sometimes even a little lifeless. Drawbacks are the finish (not my taste...), high price, and the fact that corian is only available in quite thin sheets.

- Birch-plywood

  Birch-plywood is a standard-material for building a good quite neutral sounding plinth. It's not cheap, but sonically quite ideal, easy to work with and easy to get at your local lumber yard. Birch-plywood can be veneered or painted so the result will please your eyes (and that of your wife) too.

- Hardwood like mahagony, cherry, maple

  These are woods musical instruments are built from. Mahagony seems to sound more pronounced in the bass whereas maple is more brilliant. You can get excellent results with hardwood plinths if you chose a wood that fits to the sonics of your deck (your system, your taste...). The major drawback is the fact that it's not that easy to get pieces that big and they're very expensive.

- Marble, Stone, Obsidian

  Stone and marble has minimal damping-properties but it is very dense and has high weight. The sonics of stone-plinths are not to my taste. Obsidian (artificial stone) is a little better here. Anyway - expensive, and you need a specialist that builds one for you.

A short description of building a massive plinth made out of ply:

Get 20mm (0,75") thick sheets of birchply at your local lumberyard who might cut it to the right dimensions. Usually your plinth will be at minimum that thick as your deck (80-120mm / 3"-4") so you know how many sheets you need. The thicker your plinth will be the heavier it is and heavy is never wrong. Width and depth of your plinth is defined by the size of your deck, and the tonearm you want to mount on the deck (9", 10", 12"). Round the centre (armbearing) of your arm you should calculate a circle of at least 70mm (4") diameter so you're able to fix the arm easily. Leave at least 30mm (1,25") of wood to all necessary cutouts. Now cut out the top-shelf according to your deck - a template is very good to have - with your jig-saw. Then put in your deck to see whether everything fits and mark the distance of the effective tonearm-length measured from the spindle on the shelf. This is the centre of the tonearm-hole. You should leave at least 50mm (2") wood between the tonearm-hole and the cutout for the turntable. That means you might run into problems with some decks like the Technics SP-10 if you use a short (9") arm, the arm centre then has to move to the front. By the way if

you want to mount an SME3009 with a Technics SP-10 the SME-cutout hole must face straight-forward. Now cut out the arm-hole in the top-shelf with a diameter between 20-35mm (0,75"-1,4") depending on your arm.

Now take the top-shelf as a template for the other shelves. Keep in mind that the tonearm-hole on all other shelves should have a diameter of at least 70mm (4") that you're able to mount the nut to the tonearm's shaft afterwards. Keep in mind too, that many decks need less air goin downwards, so the deck's cutout can (and should) be smaller the lower you get. And keep in mind that with decks like the SP-10 where the nuts are tightened from the underside of the deck you have to leave space for the nuts, as you might want to be able to screw them after you're finished. It's quite good for the last one or two shelves to be left without a cutout as that puts even more weight to your plinth but remember that you might need to remove them if you want to change your tonearm or the deck itself - so don't glew them screw them... The other shelves are glued together, then after sanding the whole thing your plinth is ready for veneering or painting.

Here's one of my SP-10s ready with an SME IV.

Here you see another Technics SP-10 with SME 312 arm. The - satisfied - owner of the deck sended me the photos after completing his work.

On the Kaneta-Page you can see a different approach for building a plinth for a stripped off Technics SP-10.

Turntable Setup

Now your plinth is more or less sonically dead, but you have to isolate it against floor-noise. For me wall-shelves work wonders here but keep in mind that such a deck is quite heavy... There do exist lots of special turntable-tables from futuristical spiked-metal monsters to concrete blocks. With a heavy plinth you can experiment to put the plinth directly on the spikes of your wall-shelf or turntable-table or you can make use of different feet for your plinth:

- Rubber isolators

  were quite common and available from for example Audio Technica. Sonics will get warmer and softer but precision attack and dynamics might suffer a bit. Isolation against floor-noise is not very substantial.

- Woodcones

  Half balls out of hardwood. They tend to combine the advantages of spikes dynamically but without their drawbacks in tonality. You can experiment with the material under the cones too as their resonances (depending on material and mass) will affect the sonics too.

- Spikes

  Metal spikes under your plinth will make your deck play very precise, open with fast transients but quite often have the drawback of sounding a little harsh. The material on which the spikes rest should be dense and heavy - do your own experiments here.

- Air-Damping

  These feet are available for industrial purposes, but they're not cheap (50-60 bucks per foot). Sonically they are very good and available at RS-Components.

Keep in mind that your taste matters here but avoid to place your turntable near the speakers or in room corners where room-modes and resonances have their maximum.

Tuning

There's nothing good in this world what a tweaker can't do better, isn't it. Of course that's true for Direct-Drive decks too. But don't forget to listen to the deck at least for 8 weeks or so, to know the sound of your deck before you start tweaking as otherwise you cannot judge wether your tweaks work in the right direction.

Common tweaks for Direct-Drive turntables are:

- Record-clamps / -weights

  With a record-clamp first check out if it works with your turntable as you may find with quite a lot of spindles of these vintage-decks a record-clamp won't work at all. The same applies for weights, remember that it is very important that the weight is exactly centric. Weights put a load on the main bearing and might cause bearing-noise or put stress on your motor as all regulations try to reach speed within a short time during startup of the platter. A weak motor might even blow. Using a rubber mat dust-particles might get pressed in your records. I don't use weights and clamps.

- Platter-mat

  With many vintage machines you will find that after removing the original rubber mat from the platter it will ring like a bell. The stock rubber mats did a good job in damping this platter ring but quite often you will find sone rings on them so that the record is not supported very well. A good - and cheap - tweak is to put a thin felt-mat (Linn) upon the stock rubber-mat.
  On my SP-10s I use a thin cork-mat with a felt-mat (Linn) upon it.
  Hard mats made out of glass or acryle should be avoided with a ringin' platter. Puttin' these upon the stock rubber-mats makes them next to

useless.
However there are still a lot of damping-mats around which work very good with these decks. The Audioquest Sorbothane-mat, special mats made out of leather or combined felt-leather (the same material is used for the roofs of convertibles) all worked good. The dutch Record-Interface-Mat a sandwich construction is used by Mr. Van den Hul on his SP10, the expensive Verdier mat made out of rubber and lead works wonders if your motor can stand the extra weight.
With most other mats you may find the stock rubber-mat working better.

- Outsourcing - stripping the deck

  Outsourcing is a more radical tweak. Outsourcing means that you put all electronics out of the deck into an external housing. The result will be that - depending on the deck of course - it will run much smoother. Start with the power supply if it's not external yet and you reach app. 50% of the potential of outsourcing. Most quarzes work much better without the magnetic fields and mechanical vibrations of the power supply. If your turntable has a brake and if you don't need it, away with it it causes resonances too. Stripping the deck you can go that far that only the motor and the platter is left.

  Stripping a deck works by minimizing electrical, mechanical and magnetical influences caused by the electronics of your deck. Removing the often ringing chassis however means that you need to built a new switching panel. Often you will find that the whole work is not worth the sonic benefits but some people swear by it.

  Mr Akito Kaneta seemed to dislike the original chassis of his SP-10 too. You can see a Kaneta-SP-10 on the Kaneta-Pages.

- Electronics

  There are several possibilities to tweak the electronics in your deck. Disconnecting the strobe-circuit from the motor-regulation is a common tweak for the SP-10. You can also star-earth all boards, or build up a

complete new regulation. But the results here are not comparable to the others described above.

- The mains

  With some of the older DirectDrive turntables the mains turn out to be the enemy number one. Most early Servo-Circuits depend on quite a constant and clean mains-voltage. Start by using a good shielded mains cable and try out mains-filters. Decks like the Sony 2250 pictured above will thank you by really playing in another league.

Spare Parts

- An EMT-Guru
- Everything for EMT - New ones, used ones, parts, etc.
- The same with a 'profi' in their name
- Everything for a Technics SP-10 - new ones, used ones, modifications, parts

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DirectDrive Museum

History

A short history about the evolution of Direct-Drive turntables from 1970 until today.

Denon

Denon ist one of the oldest and profoundest japanese suppliers of professional Audio-Equipment. Turntables like the DP-5000, DP-6000 or DP-100 were originally built for professional broadcasting-studios but in the 70's HiFi-enthusiasts could easily buy one too.

EMT

EMT - this german company was specialized in professional audio-gear. Their transcription-turntables covered here became broadcast-standard during the 70's and the 80's.

Goldmund

Swiss company which produced some stunning machines, that set new standards for High-End turntables - both sonically and monetary.

Trio/Kenwood

Japanese company which introduced the famous L-07D in the late 70's one of the best built turntable ever.

Luxman

Japanese "High-End-Audio" company which made some beautiful machines in the 70's.

Micro

Micro-Seiki was a japanese company which was specialized in making turntables. Their most famous product was the venerable DQX-1000, on which you could put up to three tonearms.

Nakamichi

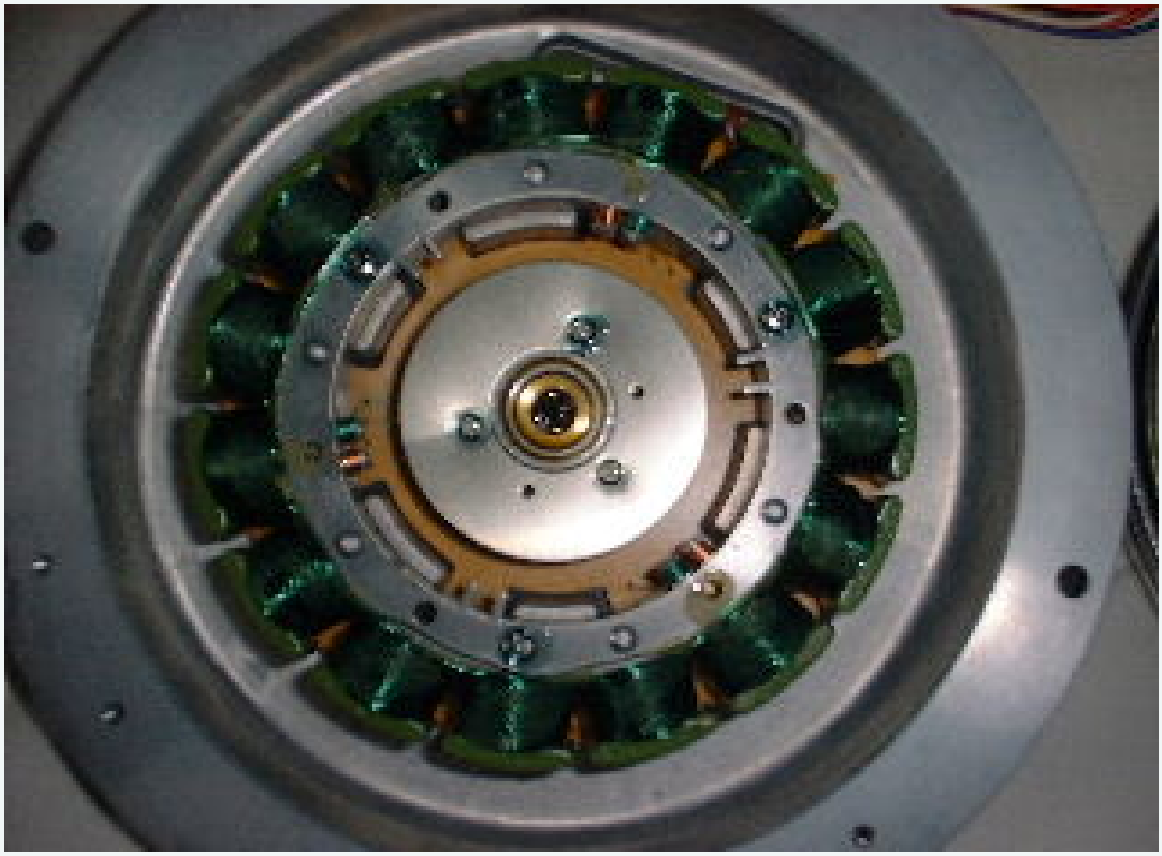
Nakamichi was a japanese company which in the 70s and 80s made some absolutely stunning turntables. In some aspects the level of the ingenious mechanics of these machines had never again been reached.

Sony

Now mostly recognized for walkmans or playstations in the 70's Sony put out some battleships like the legendary PS-X9.

Technics	Built the first direct-driven turntable. The SP-10 found his home at countless radio-stations throughout the whole world.		
Others	JVC/Victor, Pioneer and some other japanese companies made some very fine machines during the golden age of direct-drive turntables at the end of the 70's.		

DirectDrive - Tech Talk



Now here it gets technical. For all those around who really want to know how these machines work I try to explain it. I take the Technics SP-10Mk2 as an example as I know this machine quite good and because its motor-regulation is more or less represantative for most decks made in the late 70s. For those who want a look inside there are pictures of the motor and bearing of a Mk2. I have also provided some circuit diagrams of the electronics as you'll see more or less common 70s stuff...

A PLL-Quartz Motor-Regulation As Used By The Technics SP-10 Mk2

This is such a good and classical motor-control that it deserves to be covered in depth a little

A DC-generator integrated in the motor itself delivers a signal with a frequency proportional to the actual platter-speed. This signal then is converted with a frequency-to-voltage converter to deliver a speed-proportional current. This is then fed into the motor-controller to rgulate the motor. This loop alone assures quite a constant speed of the motor.
At the same time the signal of the DC-generator described above is fed into another stage where its phase is compared with a signal that is won by a programmable frequency divider which is fed by a highly contant reference-signal from a quarz-oscillator. The reference-signal is quarz-constant too. The slightest differences in phase between both signals will then be compensated and fed to the motor along with the output of the speed-control stage described above. That way only a very small and practically constant phase-difference between the position of the platter and the reference-signal is not compensated by this phase-locked-loop. Constant phase.difference by the way means that platter-speed is exactly equal to the quarz-generated reference signal.

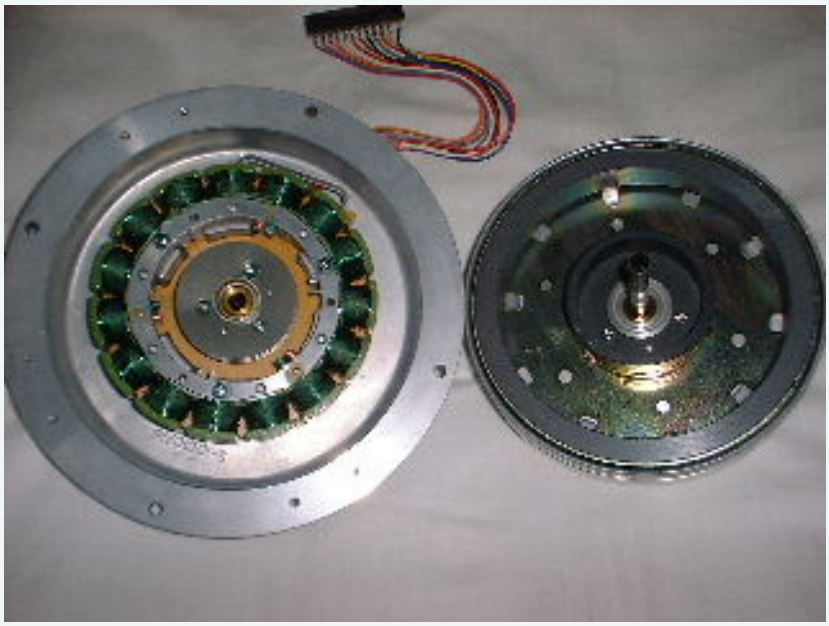
That said you see that platter-speed almost entirely dependeds from the reference-signal itself. To keep this as constant as possible a quarz-oscillator is used which is completely independent of mains-current, mains-frequency or temperature-changes. The output of this oscillator is fed to a frequency-divider which divides this frequency down according to the speed of the platter. So the reference-signal has almost constant frequency.

This frequency-divider is "programmable" - the factor of the divider can be changed by digital informations

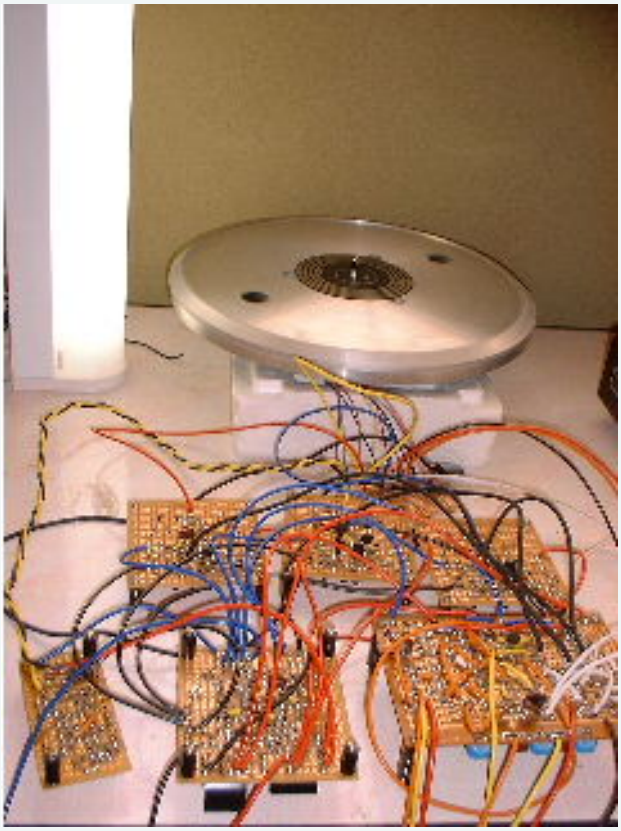
fed into its programmable sockets. Three digital informations representing 33,3, 45, 78 rpm are stored in a rom. They are selected by the speed-selector switch and then fed to the frequency-divider circuit. Thanks of these advanced control-circuits the player keeps platter-speed almost constant.

The SP-10Mk2 also features a strobe. The strobe of the SP10Mk2 is not fed by the mains as usual but by the 'quarz-constant' reference current. Another divider changes the signal in a way that together with the 190 strobe-stripes underneath the platter the strobe always seems to stand still. The advantage is that you need only one strobe-ring for all speeds and the user can't mix them up. Dirty mains which usually disturb the strobe are neglectable, too.
With a system like the SP10Mk2 platter-speed is far more constant than the mains current. If you see the strobe of an SP10Mk2 move than there IS something wrong with the regulation-circuit.
The SP10s regulation-circuits consisted of 108 transistors, 14 IC's, and 32 diodes and condensators. These are located on six circuit-boards with four of them under the platter and two of them in the separate housing of the power-supply.

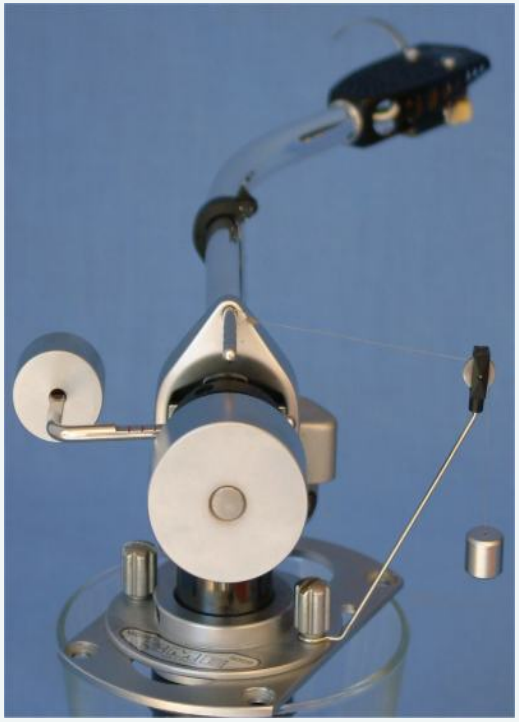
Take a look at the motor and the main-bearing of an SP10Mk2:



Sooo many cables:



DirectDrive Tonarme



Tonearms are some kind of divas. It's difficult to find the right one for your pickup, it's even more difficult to adjust them correctly, and even after weeks you're never sure that you've got it all right... Contrary to pickups there have not been huge improvements or new developments in the field of tonearms for the last decade. The last big improvements were made during the early 80s with the introduction of the Linn Ittok, the SME V and the Fidelity Research arms. Since then most new arms seem to be more a sort of refinement (sometimes remarkable) of the existing designs.
Here I want to introduce some tonearms which I personally know and own. Please be aware that my remarks regarding the sound of these arms reflect MY personal taste and are based on MY pickups and system, so don't take them for granted. There's nothing more subjective than your favourite toneam...

Adjustment

Is it important? It is, indeed. It is so important that a perfectly adjusted cheap arm will outperform any poor adjusted state-of-the-art tonearm. There is plenty of info around and bear in mind that the most important thing while doing your adjustments is: Keep cool and let your ears decide.

Cables

The cable from the arm to your preamp is the most sensitive cable inside your audio-system. Think of the small signals of Moving-coils. I don't want to join the endless discussions about which is the best cable, but I would like to point out that channel-imbalances caused by poor connections or dirty pins, or HF-distortion caused by AC-cables wound round your tonearm-cable are really not necessary... In my opinion care should be taken for the rca-plugs which should be cleaned periodically. With older arms change the cable and use one with good plugs (Neutrik). Changing of the cables inside the armtube is not a job for the faint-hearted. You might destroy the bearings of the arm and you should leave that job to one who has done it (successfully) already.

Principle

Beside linear-arms like the Eminent, which I do not know well enough most tonearms work after two principles:

- Unipivots
  Almost free of friction and resonances these arms have a lot of advantages against their conventional brothers. Unipivot bearings last longer, and these arms tend to perform more independent from the pickup and turntable you use. A disadvantage is the floppy feeling which makes it hard to cue to a certain song... The sound of unipivots is best described as airy, effortless with wide stage and very good reproduction of low-level- signals. When it comes to stability and bass-reproduction the finest conventional arms sometimes have to offer a bit more.
- Arms with two conventional bearings
  The introduction of the Linn Ittok in the late 70s set a new definition how a tonearm should look like. A massive, one-piece arm-tube in connection with very precise ball-bearings was considered state-of-the-art. SME answered with the SME V, and Rega put out their RB-300. All of these arms sound very dynamic with good precision, rhythm and attack. These arms rock... On the other hand all these arms tend to suffer from resonances in the upper midrange and sometimes lack a bit of air and sound overly "dry".
  In between both are the old faithful SME 3009/3012 arms with their knife bearings which combine many of the advantages of the unipivots with that of conventional arms.

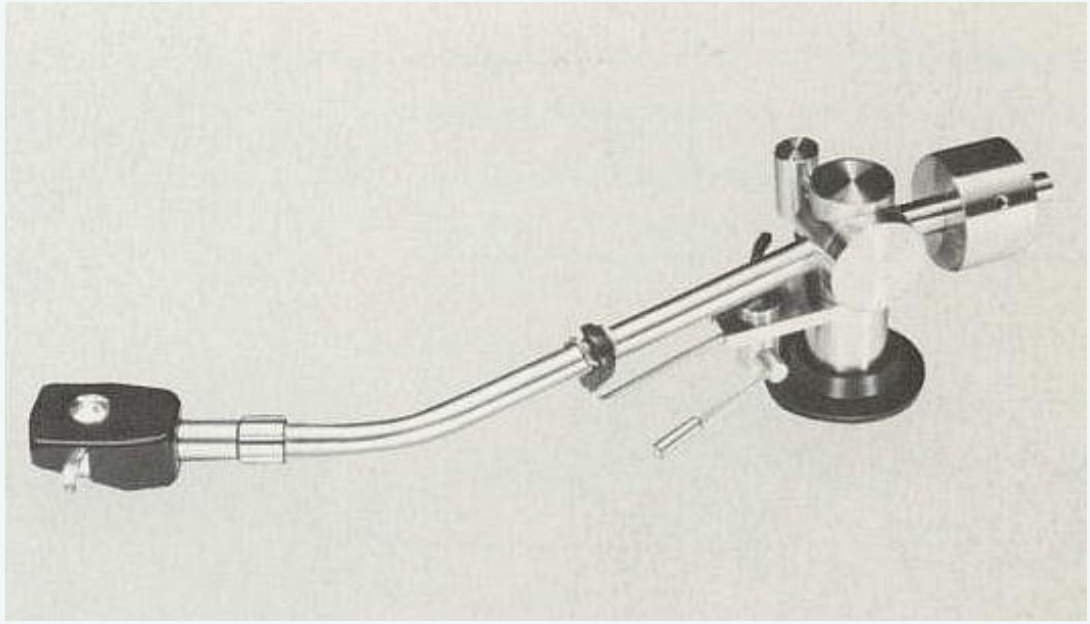
Audiocraft AC300Mk2

Pictured above is an Audiocraft/Ultracraft AC300Mk2. This unipivot had changeable arm-tubes in different forms (straight and S-shaped). The bearing is damped with silicone fluid. By turning a screw on top of the bearing you can tune the amount of damping to your pickup. Usually Pickups with low compliance need a bit more damping...). This arm plays very musically. Later versions had black anodized arm-tubes, these sound a bit "dark". Below you see the AC300 with S-shaped armtube.

As you see the bolting-nut needs quit a lot of room inside your turntable... Setting up these arms

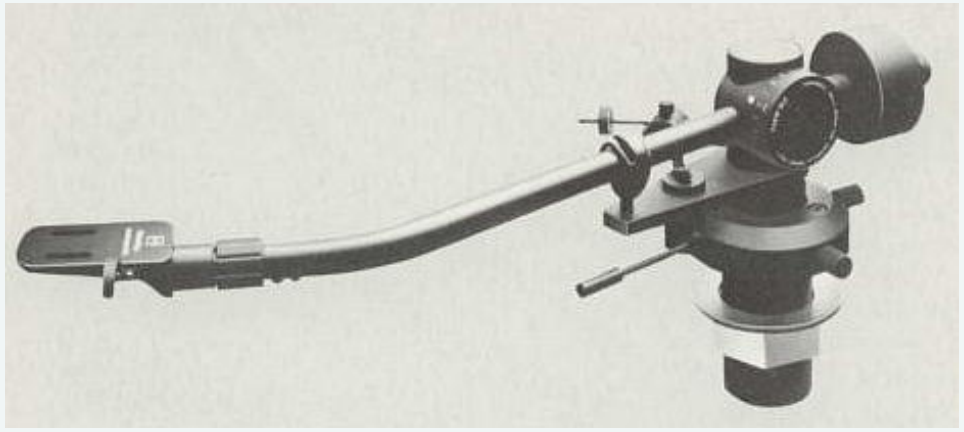
is not easy, as the VTA seems to be affected by the amount of damping you put to the arm.

Fidelity Research FR64s



Founded by Mr.Ikeda, once engineer at Grace, the FR64s still is a hot ticket for pickups like the SPU or the Denon DL-103. Note that 's' means steel-arm tube instead of alloy with the FR64 and not silver-wiring which was available for all Fidelity Research arms at extra cost. Silver wired arms feature a silver badge on the arm's package.

Fidelity Research FR64fx



Not that heavy, with anodized arm-tube. The anodization damps arm-resonances but it also

damps the highs... In my opinion this arm is not as good as the FR64s.

Grace G-707

The Grace G-707 was often seen on Linn turntables during the 70s. The silver ones in my opinion are preferable to the black anodized ones (see above...). As a low weight arm it should be a favourite for your Shure or Grado but the Denon DL-103 works very good in these arm.

Grace G-714

One of my favourites. An oil-damped unipivot made out of teak-wood in the 70s. Very fine sound even with low-compliance pickups like the Denon DL-103R. Top-notch appearance and in some ways simply a work of art.
Note that this arm comes without any anti-skating!

SAEC WE-308

Some kind of japanese SME. Like many japanese arms of the 70s it has a quite pronounced upper register. Not my taste. There is also a 308SX which should sound better. If you want to look at some SAEC-arms click here.

SME 3009/3012

It's the Ford T of tonearms - it runs and runs and runs... And really not bad. Here you find a gallery of the different SME 3009 and 3012s.

A few notes on the improved version of the SME 3009: You will find it difficult to mount a MC-cart on it cause tracking force is limited to 1,5g. Heavy systems cannot get balanced, too. Additional weights are available from SME, but they come at a hefty price. The models without detachable head-shell are a nightmare for mounting your cart... The best SMEs are the SME 3009R or SME 3012R (early Model IIs). They feature a steel-arm-tube instead of alloy and early models had metal-knife-bearings instead of nylon with the models of the 70s.
The long 3012 sounds a bit more refined and more adult than its short brother. Even today you can have your 3009 restored to original condition at SME in England.

SME IV/V

In my opinion one of the best arms ever build. Build quality is top notch an changing carts with these arms is a pleasure. All alignments - except azimuth - are easily done and reproducable. The sound of these is a class better than all other arms mentioned here. With some carts it might sound a little too "dry", but always lightning-fast and rock solid. The Van den Hul cable supplied with the SME V is too long and thins out the sound a little. in my opinion the considerable price difference between the two makes the IV the better choice.

DirectDrive Geschichte

History of Direct Drive starts in 1929 when Thorens took a patent for a grammophone with direct-driven platter. But 40 years had to pass until finally turntables with Direct-Drive made their way to recording-studios, radio-stations and homes of music lovers all over the world. The history of Direct-Drive turntables really starts with the introduction of the National/Technics SP-10 in 1969.

The Beginnings

The beginnings of the Direct-Drive era are connected with the brand National/Technics and their efforts to build a professional transcription turntable for broadcast users.
At the end of the 60s almost every radio-station in the world used an EMT deck. The EMT 930 was the ideal

transcription turntable capable of fast startup and rock steady turning the platter. This was achieved by using an idler drive rigidly coupled to a very heavy inner platter. By coupling a light outer-platter to the already turning inner platter a very fast start-up was possible. The drawbacks of those decks were the countless moving parts and bearings which all added resonances and all had to be regularily serviced to guarantee the 24hrs a day performance needed in professional broadcast centers. To optimize tracking records the engineers at Technics soo realized that this could only be achieved by reducing the numbers of moveable parts in a turntable. This meant also reducing the number of parts to service and it also meant that the deck would cost less as all those parts at the end of the 60s were getting quite expensive. Obviously engineers in Europe at that time had the same ideas as in 1968 Thorens/Germany introduced their belt-driven TD-125. Unlike its predecessor the famous TD-124 with combined belt-/idler-drive the TD-125 was a much simpler machine with only 3/4 of the parts of the 124. The TD-125 was one of the first decks to incorporate an electronic regualtion for the motor to achieve maximal steady turning of the platter. For professionals however the belt-drive was of no use cause the startup time was way too high with the rubber-belt slipping at the motor-pulley.
The japanese had more radical ideas. As strong, slow turning DC-Motors were already available and electronic regualtions getting cheaper almost every day they saw new possibilities: If the motor shaft would be identical to the platter-spindle ther would be only ONE moving part in the whole system which turns very slowly and had a high mass (the platter) coupled to it - mechanically this solution seemed almost ideal. The problem was that no motor runs completely smooth (a motor tends to "jump" from pole to pole) so the motor-turning had to be controlled electronically. An electronic reference-signal was compared to a

tachometer-signal of the underside of the platter and the difference-signal was used to regulate the motor. That way the Technics engineers achieved very steady and smooth turning of the SP-10's heavy platter. This regualtion together with quite a strong motor allowed a very fast startup-time, too.
The Direct-Drive turntable was born. Introduced in 1969 the National/technics SP-10 was an immediate success. Radio-stations all over the world used an SP-10 and only a few months later other japanese audio-companies like Nippon/Columbia (Denon), Victor (JVC) and Sony presented Direct-Drive turntables of their own.

Direct-Drive At Home

But the japanese companies thought further. At the end of the 60s the domestic-audio market all over the world began to explode. More and more music-lovers bought audio-systems and a market evolved where big money was to be made. Companies like Dual, Thorens or Garrard then were the traditional big names in turntables. By reducing the number of (then already) expensive mechanical parts the japanese were able to offer equal sounding and looking decks which costed considerably less to produce (and to transport!) at reasonable prices. Among the first was obviously National/Technics with their SL-110. During the 70s the domestic audio market was flooded by Direct-Drive japanese made decks causing big trouble for the then established european companies

Make A Good Thing Better

The first motor-regualtions developed by Technics or Sony weren't bad - but they had their problems: By reading the minute fluctuations from the platter by a tachometer the motor-turning a fluctuation had to occur before the motor-turning was corrected. The

first generation of Direct-Drive players had also some problems in genrating a clean reference-signal for the regulation.
In germany EMT had to react on the introduction of the SP-10 and EMT did it in the usual "no compromise" manner. 1974 the "Plattenabspielmaschine 950" was introduced at a price of around 4000,- Dollars. EMT had built the ultimate transcription turntable - built like a tank, with new features like backwards spinning and very good ergonomics EMT managed to get back lost parts of the professional market. The 950 and its little brother the 948 soon were used in broadcast-studios all over the world.
EMT incorporated a new motor-regulation by taking a Hall-generator's signal as reference and thereby achieving a very clean reference almost independent of mains-disturbances, temperature or other outer influences. The EMT regualtion was so good that they put just a tiny 200g. platter on the table, reaching a start-up time of just 0.2 seconds. Nippon/Columbia, known in the professional world under the brand name Denon set their DP-series against the EMTs and SP10s. With their DP-5000 the difference-signal was read by a tape-head from a magnetic ring under the platter. The FG-servo-controlled motor-regulation was thus feeded with a correcting-signal BEFORE any significant fluctuation of speed had even happened.
Other japanese companies introduced the PLL-principle. By putting the reference-generator and the tachometer in a phase-locked-loop, the turning of the motor was corrected when only a slight phase-difference between the reference-signal and the platter-position occured. This left just a very slight and more important almost constant phase-difference between both signals. The turning of the platter now just depended entirely on a clean reference-signal and in the mid70s the japanese began to incoroporate quarz-generators as the most precise devices in their decks.

All these 2nd generation decks are sonically much better then their fathers with some top-decks of that time achieving a performance which even by nowadays standards may satisfy a critical audiophile.

The Heydays And The End

At the end of the 70s the japanese audio-industry was in a unique position. They had gained control over the worldwide audio-market, the Yen was cheap and big numbers of well-educated engineers brought one innovation after the other out of their laboratories. The "golden age" of audio had risen - those were exciting times with many new models being developed and announced in regular intervals. At the end of the 70s there really was a sort of race between the mayor-players introducing ever bigger, better and more sophisticated turntables sometimes at very high prices. To understand this you have to know that the Compact-Disc at that time was close before introducing, almost every audiophile had a turntable already so the mid-class market was set. Apart from these reasons the analog flagships of that time were image- and prestige-products of the japanese companies often subzidized by their mass-market brothers.
Machines like the Sony PS-X9, the Trio/Kenwood L07D, the Technics SP-10MkII or the Denon DP-100 were built in a "cost-no-object" attitude that never again arises out of Japan. The best materials, excellent Build-quality, oversizing of all parts and innovative ideas were the characteristical ingredients of the top-decks at that time.
Those machines marked the end of an evolutionary process with non-measurable Wow & Flutter or noise-specifications and they had a sonic quality that even by nowadays standards is state-of-the-art. But 1982 the CD finally arrived and it was the beginning of the end for those machines. All japanese companies

concentrated their engineering efforts towards "digital". Production-costs had risen and the Yen was standing higher making export of audio-gear more expensive. This was the time when the cost-cutters arrived and soon dominated the engineers. The analog-battleships developed in the late 70s and early 80s were the first products that were killed by this new ideology. Like Dinosaurs they had become bigger and bigger and now they're end had come.
At the end of the 80s there was only Technics left with their famous SP-10 serving the professional market. EMT was bought by Barco and Denon quit production of their professional decks.
The decks for domestic market were just cheap plastic-cages with a motor in it and companies like Luxman or Micro Seiki were forced to switch to belt-driven turntables as there was soon no parts- supplier for high quality Direct-Drives in Japan any more
At that time only Nakamichi produced some top Direct-Drives. The Goldmund decks brought a short renaissance of the Direct-Drive among audiophiles but for most of us their prices were way too high.

Renaissance In The 90s

With the invention of new music-styles like Rap, Direct Drives became popular again. Now they served as a kind of "musical-instrument" for creative DJ's with the Technics SL-1210Mk2 becoming a sort of stndard-table in the clubs. Techniques like spinning or scratching needed decks with strong, durable motors and fast regulations of speed. You should never try to scratch on a Linn LP12 turntable... Technics soo presented a new SL-1210 which never was as good as the original just like the countless 1210-clones from Omnitronics, Vestax, etc.
In domestic high-end audio the Direct-Drive at that time apart from the Goldmund decks was simply dead. The renaissance of direct-drive decks at home began

when audiomaniacs started to buy these decks from radio-stations and privates who switched to CD discovering the sonic excellence of some of these decks when combined with a decent plint and a modern arm.
Another big group rediscovering direct-drive decks were the then "forty-something" age group. These people were young when these decks were new and many of them harbored dreams of owning one since their youth. These were the machines they couldn't afford then, but at the end of the 90s they were ready and able to plunk down the original retail-price for a Micro DQX-1000. Easily available through the Internet lots of Denons, Technics and others made their way to their new homes.

DirectDrive Today

The days whe you could buy a Denon DP-2000 for 100,- bucks are dfinitely gone. Most radio- stations have stored their whole analog-archive on CD's or computers and had long sold their last turntables. During the big throw-out-wave in the 90s it wasn't unusual to find an EMT 948 deck for around 500,- bucks with Technics SP10s were sold at almost every corner for 200 bucks or so.
Nowadays the prices are rising. For many good decks you must expect to pay as much as the prics when new. EMTs can be seen as sort of an alternative to stock options as they are highly sought after by audiomaniacs in Japan (an irony itself). The number of decks around is decreasing as many of these suffered from blown electrics or ended on the junk-yard. Top models from the 70s command high prices among audiophiles simply for nostalgic reasons (see above). Good transcription turntables like the SP10s or the big Denons offered without a plinth are still a reasonable deal at around 400-500 bucks as many audiophiles seem to shy away the work of builing an own plinth for

these decks. Right now the SP10Mk2 seems to be the audio-bargain of all times when it comes to set up a top analog-frontend.
The big prestige-decks like the Nakamichis or the Goldmunds won't get cheaper, too. Many audiophiles recognized that today there isn't anything quite equal to these decks. But if you really spend some time in the end you surely will find your dream. They are still around us - those wonderful DirectDrives.

DirectDrive Museum - Denon

HOME

DirectDrive - The Hows And Whys

DirectDrive - Owning a DD

DirectDrive - Museum

DirectDrive - Tech-Talk

DirectDrive - Tonearms

Denon - founded in 1910 as a joint venture by Emile Berliner's Gramophone Company and Alexander Graham Bell's Columbia Gramophone Company, the Japan Gramophone Company produced Japan's first shellac disc 78rpm records and record players. In 1927, Columbia Gramophone Company became the sole parent, and the company was subsequently re-named Nippon Columbia. Over the course of the twenties and thirties, Nippon Columbia branched out to the far East markets, and also began sales of radio broadcast equipment. In 1938, Nippon Columbia established Denon as their professional equipment brand, concurrent with the introduction of the world's first direct-drive turntable for studio use shortly after 1939. Denon since made a few audio-legends like the venerable DL-103 which - since 40 years - seems to be very much appreciated among audiophiles. Beside Technics and Sony, Denon was among the first building Direct-Drive turntables for the professional market. In the 70's their broadcast-turntables like the famous DP-6000 were offered for the domestic market with pretty wood-plinths. These models were true "high-end" in the 70's considering their sound and their price. Denons are unique for their almost space-age-like round UFO-design. Or - as my wife use to say - the salad-bowl.

Denon DP-5000

The first big direct-drive from Denon was the FG-Servo controlled DP-5000 pictured here with the DK-100 plinth and a Fidelity Research arm. This model featured the unique regulation where a magnetic head reads the imprints of a magnetic tape under the platter..

Denon DP-6000

Pictured is a Denon DP-6000 with SME 3009/S2 arm in the original plinth. The DP-6000 is definitely a top-deck, but it's rarely seen on the 2nd-hand market today. This deck inspired M.A.Cotter for his famous Cotter B-1 turntable. A magnetic head reads a signal imprinted in a tape under the platter. This signal was then feeded in a Quartz-controlled PLL-circuit. Take care that the magnetic-ring inside the platter is in good condition. You can check this quite easily by watching the strobe. On a good one it virtually stands still- if not - hands off!. Apart of this the DP-6000 is build like a tank and virtually undestroyable. Today its price goes from 500,- bucks up to heaven. A very good player if mounted in a decent plinth. A near relative of the DP-6000 is the DP-7000:

Denon DP-3000

Pictured here with the venerable Grace G-714 tonearm. In Japan you can get those units for very low bucks. Its sonics and build-quaklity is not comparable to the big ones covered above but a DP-3000 in good working order is still a very good deck.

A DP-3000 without plinth. On the backside you see the magnetic head that feeds the regulation.

Denon DP-2000 / DP-2500

"

Two names - one deck. DP-2000 was the deck, DP-2500 the domestic package with plinth and arm as pictured here. There was a DP-2550 (slightly bigger plinth, no arm) and a DP-2800 (marble plinth), too. The DP-2000 is a fine deck, too. This budget-model has a different chassis than the more expensive ones. You can easily distinguish them by the silver front-plate and different knobs. As it is more common seen on the used market, it's considerably cheaper than a DP-6000 or DP-5000. It's sonics are not comparable to the big ones covered above. Again - beware of defective magnetic-rings as they are now quite common with these decks. The plinth of the DP-2500 is actually nothing more than a upside-down shoe-carton made out of wood - forget about it. As with all Denons you should build your own massive plinth and that done take care of getting rid of the nasty plastic covering of the electronics too.

Denon DP-1000

The little brother of the DP-2000 was the DP-1000. The plinth was available as DK-77

DP-1000 ¥33,000

●駆動方式：ダイレクトドライブ　●回転数：33 1/3，45rpm　●ターンテーブル：直径30cm，1.1kg，アルミダイキャスト　●モーター：8極ソリッドローター型　●ワウ・フラッター：0.03%（WRMS）　●SN比：60dB　●回転数調整範囲：±3%　●消費電力：11W　●寸法：W35.6×H13.2×D35.6cm

DK-77 ¥15,000

●型式：プレーヤーキャビネット　寸法：W51.0×H17.0×D42.0cm　●重量：5.0kg　●仕上げ：桧材　●備考：アームベース取り外し可能，ダストカバー，インシュレーター（高さ調節可能）付

Denon DP-100

The best of all Denons, if you can find one, grab it fast! Pictured above with a beautiful

rosewood plinth most DP-100's were sold to radio-stations without a plinth and then may look like this:

The DP-100 was Denon's answer to the EMT 950. Someone considers this deck as the best ever made Direct-Drive turntable. This is a very rigid, stable and heavy machine incorporating a well designed suspension. It goes for very high prices mostly on the japanese market.

Denon DP-80

Here you see one in a custom-made mahagony-plinth with SME and SAEC tonearms. The DP-80 is quite easy to find and works with a quatz-locked pll-regulation. Platter and chassis had a tendency to ring like a bell, so this is a candidate for stripping of the chassis. Even without that it's a very good deck in one range with the Technics SP-10. Its build-quality is stunning and most of these machines will last a lifetime. On the 2nd-hand market a good one might sell for around 500,- Dollars. Factory-plinth was the same as for the DP-75 it had the name DK-110 but as with all Denons there are better ways to mount your deck. This one really deserves this... As you see the tape-head with later Denons is located at the right side of the deck.

Denon DP-75

One of the last classic transcription decks. The DP-75M came along with a tonearm that looked good but sounded not as good as it looked. The DP-75 is more or less the same as a DP-80 not that bullet-proof but its build quality will make this deck last very long,

too. Like the DP-80 the DP-75 could be ordered with the DK-110 plinth. SAEC made a very good plinth for the DP-75/DP-80 too, but it's very rare and expensive. The DP-75 usually is cheaper than the DP-80.

Denon DN-308

Beside the popular DP-series there existed another branch of Denon turntables made entirely for the professional market - the DN-series: Pictured above is a DN-308F. Few of these decks were built and even fewer are seen on the used market outside of Japan. These were true transcription turntables for broadcasting stations and record studios.

Denon DN-307

Here you see a Denon DN-307F-T:

DirectDrive Museum - EMT

HOME

DirectDrive - The Hows And Whys

DirectDrive - Owning a DD

DirectDrive - Museum

DirectDrive - Tech-Talk

DirectDrive - Tonearms

EMT-decks were never meant for the domestic-market since EMT was the leading company for transcription-turntables sold to broadcast-studios all over the world. 1976 was the year when EMT made his first Direct-Drive deck - the "Schallplatten-Wiedergabe-Maschine 950" (ooh! what a name). The 950 and its little brother the 948 are real symbols of "Made In Germany". With their high prices and their dead-serious professional design no audiophile in the 70's or 80's had an EMT at home. That changed at the end of the 80's - at least here in Germany - when the broadcasting-studios got rid of their decks in favor of the CD and lots of people bought an EMT-deck for domestic use. Even today you get spare-parts for them in Lahr/Germany - at hefty prices.

EMT 950

The EMT 950 was introduced to a stunning public in 1976. It was a dead-serious approach towards a Direct-Drive transcription turntable. At that time EMT produced a tonearm - the 929 - and an excellent Moving-Coil Cartridge the famous TSD-15. The approach for the 950 was to develop a rigid, heavy suspension that was tuned to all moving parts of the deck - including arm and cart. The 950 had exellent MC-stepup-trannies and riaa-phonoamp on board - which worked wonders with the TSD-15 cart and put out a beefy 12V under full load. So this is really a plug-and-play deck where everything works together in such a way that the whole is better than the sum of the parts. Features of the 950 included backwards-spinning of the platter, syncronisation, remote-control, cueing-amps and even monitor-speakers. Electronics were printed-boards which were put in slots at the front of the machine. The 950's weight was around 150 pounds and it came in two versions: The narrow one (950 E) with all buttons in front of the platter and the "normal" one with all buttons arranged in an ergonomical way at the left of the platter.
The platter itself was extremely light and made out of resin (resonance is quite

similar to vinyl-discs). 2nd hand wise here in Germany you come across an EMT quite easily, since most broadcast-studios had got rid of them during the 80's. Since then a lot of machines made their way to the land of the rising sun with japanese audiomaniacs paying very high prices for these decks. An EMT 950 costs around 2000,- Dollars in Europe with restored or "like-new" machines reaching 3000,- Dollars.
The sound of this deck is very good, too. Even with the quite mediocre 929-tonearm and the almost 30 years old electronics you really get what you'd paid for. As everything works together perfectly you should check that your 950 has the STX-21 MC-transformer on board and use it with a TSD-15. Then forget about turntables and listen to the music...

EMT 948

Around 1979 the 948 was introduced as a little brother of the 950. It did not have all the gimmics of the 950, but the electronics are almost the same. The big difference of the 948 was its compact newly developed suspension, less mass

(nonetheless around 50pds. without plinth), and a compact chassis which allowed the unit to be used in mobile-studios and little rooms. The suspension of the 948 is unique with a ring located at the bottom which worked against the torque of the strong motor. Arm (929), Pickup (TSD-15) and electronics are the same as with the EMT 950. Sonically its performance is comparable to its big brother so if you don't need the ultimate look of the 950 the 948 is the ticket at around 1500,- Euros today. As with all EMT's assure yourself that the STX-21 MC-transformer is on board, plug in a TSD-15 and be happy. EMT's are obviously a tweaker's nightmare, anything you'll do will spoil the deck.

EMT 938

Introduced at the end of the 70's the "little" 938 is some kind of a cheaper, domesticated 948. The suspension is almost identical to the 948 with simpler electronics and no gimmics like push-button back-spinning but quite a pretty plinth (at least compared to the other EMT's).
So if you're looking for an EMT with a minimum of WAF here it is.
Audio-Electronics are quite good and work very well with the EMT TSD-15 cart, so take care the (active) MC stage is on board. There was a second version for Moving-Magnet carts which is not that desirable. Nowadays an EMT 938 changes his owner at around 1000,- Dollars. Not too bad if you consider the fully symetrical, good sounding RIAA-Phono-amp on board. Near relatives of the 938 are the Thorens TD-

524 (Thorens TP-16 tonearm) and TD-738 (Thorens TP-29 tonearm the same as the EMT 929...). These models aimed at the professional market and offered features like remote control and pitching (up to 25%!).

DirectDrive Museum - Goldmund

HOME

DirectDrive - The Hows And Whys

DirectDrive - Owning a DD

DirectDrive - Museum

DirectDrive - Tech-Talk

DirectDrive - Tonearms

Goldmund - located in Switzerland - made some turntables in the 80s that redefined the state-of-the-art. All decks featured here have direct drive starting with the Goldmind Studio introduced 1984. All decks featured motor-driven linear-arms developed by Pierre Lurne who later founded Audiomeca. All Goldmund-decks featured some kind of acoustic-suspension.

Goldmund Studio

Introduced in 1984 the Goldmund Studio was one of the few decks built in small numbers featuring the Direct Drive. Typical for Goldmund were the chosen materials like acrylic platter and plinth and the unique linear-arm. The T3 linear arm worked with an electronic regulation driving a motor (therefor the "second" arm). The price for the Studio was very high at around 7500,- Dollars so even now these decks are not cheap. Take care of the arm as it's quite fragile and very hard to adjust.

Goldmund Studietto

This Studietto belongs to Mr. Kostas Louizos. The Studietto is the little brother of the Studio but when introduced in the late 80s costed 4500,- bucks. For your money you got a very good turntable and a not so good linear-arm, the T5 which worked like the T3 but lacked a bit of bass. This is the same arm which was mounted to later Audiomeca turntables. You won't find good examples of this breed under 2000,- Dollars.

DirectDrive Museum - Trio/Kenwood

Trio/Kenwood was a major player in the game during the golden age of innovation and performance. Trio/Kenwood was the first company that made some efforts towards resonance-damping plinths. In the mid 70s Kenwood started to use materials like artificial stone and corian which led to the development of the legendary L-07D in 1980.

Trio/Kenwood KD-550

The KD-550 was a bit of a Rega of his time. In the 70s the KD-550 was one of the cheapest DirectDrive decks that you could fit with an arm of your likes. Sonically the KD-550 was just the ticket if you wanted to smoke your neighbours Thorens. With good solid plinth heavy platter and solid motor-regulation this deck stands to his guns even by todays standards. Used prices today have already reached the new price of the deck at 300,- Dollars.

Kenwood L-07D

Kenwood's statement in 1980. 70 pounds of ingenious engineer's work made out of aluminium and incorporating corian to the turntable market for the first time. The platter weighs a whopping 11 pounds and is fitted with a steel "mat". The main-bearing is supported by magnets underneath the platter. Sonically the L07 is a very fine deck with his - then innovative tonearm leaving some precision in the bass. But fit an SME V on this machine and place it on a well decoupled stand and this monster will play in the champion's league of today's turntables. Rarely seen, you have to pay around 1000,- Dollars for a nice one.

Kenwood KP-1100

Only available in Asia the KP-1100 was clearly inspired by the venerable L07 but looking much more like a conventional turntable. Look at the aluminium chassis pictured above and you will see that Trio was serious about resonances that days. Don't know what it's worth as I have never seen one on the used market.


SN比90dB、静寂の深さでCDと肩を並べます。
KENWOOD

DirectDrive Museum - Luxman

HOME

DirectDrive - The Hows And Whys

DirectDrive - Owning a DD

DirectDrive - Museum

DirectDrive - Tech-Talk

DirectDrive - Tonearms

Luxman is known for quite advanced electronics and is a brand name of the japanese Lux Corporation. In the 70s Luxman sold some fine decks with Direct Drive. In the 80s Luxman was a pioneer in developing vacuum stbilized platters where the record was pressed to the table by means of a vacuum pump.

Luxman PD-121

This one - pictured with a Grace GA-704 tonearm - is seen quite often nowadays as it was often sold at least here in Germany. The looks are definitely better than its sonics so a PD-121 usually can be had quite cheap at around 200-250,- Dollars. As with all Luxman decks it is almost impossible to put the deck into a different plinth a well decoupled table is a must with these.

Luxman PD-441

Simply said the PD-441 is a PD-444 without the possibility to mount two tonearms. Sonically it performs not as good as its big brother cause its plinth is lighter. 2nd hand wise it's condiderably cheaper and sells for the half of his big brother. Like many japanese decks of the late 70s - early 80s the massive platter rests on a magnetic bearing. The armbase rests on a sledge which makes it possible to change arms very fast - if you own more of these.

Luxman PD-444

Top-of-the-line Lux form the end of the 70s. Now this is a deck where you can mount your Fidelity Research FR66 or SME 3012 quite easily. Typical for all Lux decks: The plinth made out of brushed aluminium with rosewood sides. The PD-444 is a fine deck maybe a little overpriced at around 1000,- Dollars on the 2nd hand market.

DirectDrive Museum - Micro Seiki

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DirectDrive - The Hows And Whys

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DirectDrive - Tonearms

Micro Seiki had its roots as a fine-mechanical company in Japan founded in 1961 and specialized itself in building turntables and tonearms in the early 70s. When introduced in 1976 the Micro DDX-1000 soon became the darling of all HiFi-journalists with its unique possibility to mount up to three tonearms that made comparing arms and carts a breeze. In the beginning of the 80s Micro buried their Direct Drives but continued to produce monstrous Belt-Drive decks like the RX-5000.

Micro MR-711

This is the Micro that started it all back in 1972. The 10" tonearm is the MA-202. This is a very heavy deck made out of solid metal, platter weighing around 4pds the whole deck around 40pds. Speed control was achieved by using a moving coil that was induced by the platter. You can vary the speed by +-6% by opening a little box under the deck which houses the control knobs. These beautiful decks are rarely seen today so I cannot tell anything about prices.

Micro DD-100

Introduced in 1976 the DD-100 was the first quartz-controlled Micro Seiki. Build quality of these decks is simply exceptional as with most top-of-the-line Micros. These decks are rarely seen in Europe or the USA but are quite often seen in Asia.
Here you see the control-unit of a DD-100. The quartz-lock can be switched off like with the later DQX-1000.

Micro DDX-1000 / DQX-1000

The DDX-1000 was introduced in 1976, 1978 the DQX-1000 followed which featured quartz-control. Unique with the DQX-1000 was the fact that you could actually shut off quatz-control with a button on the control-box - a feature which some users obviously prefer. You cannot mix them as the DQX-1000 pictured above has only one strobe-ring whereas the DDX-1000 pictured here had two engraved into the platter. The DDX-1000 featured a very high torque motor that was manufactured for Micro by JVC. The design of the DDX-1000 was unique and the possibility to mount up to 3 arms on the deck was used by many audiophiles in Japan and Germany. Here in Germany almost every hifi-freak in the 70s harbored dreams about having one and fitting some SME, Audiocraft or Grace arm on it! So there are many people around that couldn't afford the deck then but now are ready and able to plunk down as much as 750,- to 1000,- Dollars for this deck.
However - nostalgic reasons aside - the sonics of these are not free of faults. The chassis and the platter tends to ring a little and the tonearm-bases weren't tight enough causing some more unwanted resonances. If you come across your dream make sure that it comes with three (fitting) bases as they are now highly sought after and very expensive. AX-1 was the name of the

base with round cut-out. AX-2 the name of the base with SME-cutout. Both were made out of aluminium alloy. There were also zinc/brass alloy variants of these bases which has a G after their name (i.e. AX-2G). A tabgle which shows you which arm for which base is here. Also take care of the feet as the rubber tends to break up after 20 years. Early DDX-1000 seem to corrode very easily depending on the athmosphere the table was stored. Later DDX-1000s and all DQX-1000s were coated with some kind of anti-corrosion sealant.
Good isolation is very important when using a DDX/DQX-1000. Wall-shelfs or sand-filled boxes make a good isolation stand for those beautiful machines. As for mods dampening out the aluminium plinth with tar-sheets and dampening the platter were the most common mods in the 80s.

Micro DQX-500

This is the pretty, little brother of the DQX-1000. It came out in 1984 and featured a carbon-arm the CF-1. Costing 500,- Dollars then many decks found their way in the home of audiophiles. Today many people buy this deck mostly out of nostalgic and for looks, so it's not cheap at around 350,- Dollars. Take care about the rubber feet, too.

Micro DD-100 / DDL-Series

Most turntables of the DDL-Series never made it to Europe or Northern America. The DDL-100 and especially the DDL-150 are nevertheless very fine turntables which look like a hybrid of the earlier DD-series and the popular belt-driven BL-series. All of them featured a heavy wooden-plinth and quite massive platters.

This is the DDL-100:

Here's a DDL-150 with Fidelity Research tonearm:

And this is the DDL-61 with an Ultracraft-arm. Take a look at the huge plinth:

Micro DDX-1500

The DDX-1500 was introduced in 1985. It is a very heavy deck with a metal plinth based on the belt-driven RX-1500. The platter of the DDX-1500 is cast aluminium not a machined platter as on the RX-1500. The DDX-1500 was the last Direct-Drive deck from Micro-Seiki and thus marked the end of an era. Nowadays if you get one be prepared to spend at least 1000,- bucks for this machine as these are real rare birds now. Sonically keep in mind that this model was quite an "Entry level RX1500" and hardly any improvement against a DDX/DQX-1000.

AXシリーズ

（SX-8000、RX-5000、RX3000、1500シリーズ、DQX-1000用）

AX-1G	MICRO	MA-202・303・505*・505X*・505S*・707X*
	AUDIO TECHNICA	AT-1005II
	AUDIO CRAFT	AC-300C・300A
	EXEL SOUND	ES-801
	FR	FR-24MKII・54・14
	GRACE	G-545F・707・840F・840FB・940・945SILVER
	DENON	DA-303・305・307・309・401
	PIONEER	PA-1000
	SAEC	WE-308N*・308SX*・407 23*・317*
	TECHNICS	EPA-99・121S・121L・101S・101L
	VICTOR	UA-5045
	ADC	LMF-1・2
	EMT	929
	ORTOFON	RMG-212、SMG-212MKII
AX-2G	SME	3009/SII、3009/SIII、3010R
AX-3G	MICRO	MA-505L・505LS・505LX
	AUDIO CRAFT	AC-400C・400A・400MKII
	GRACE	G-565F・860F・860FB・960
	DENON	DA-302・304・308
	SAEC	WE-308L
	EMT	997
	ORTOFON	RMG-309、RF-297
AX-4G	SME	3012、3012R
AX-5G	AUDIO TECHNICA	AT-1503II、1503III
	FR	FR-64、64S、64B、64FX
AX-6G	MICRO	MAX-282・237
	AUDIO TECHNICA	AT-1501II・1501III
	AUDIO CRAFT	AC-4000MC
	FR	FR-66S
	GRACE	G-660P
	LUSTER	GST-801
	SAEC	WE-506/30
	TECHNICS	EPA-100
	VICTOR	UA-7045・7082
AX-8G	MICRO	MA-505XII・SII・505MKIII・808X
	AUDIO CRAFT	AC-3000MC・300MKII
AX-9G	レギュラーサイズアーム用2点止めマウント（8000，5000，1500用） 9GA～9GF穴加工済み、下記以外のアームは特別加工。	
9GA	MICRO	MA-505XII・505SII・505MKIII・808X
	AUDIO CRAFT	AC-3000MC
9GB	SAEC	WE-308N・308SX
9GC	FR	FR-64・64S・64B・64FX
9GD	MICRO	MA-505・505X・505S・707X
	SAEC	WE-407/23
	AUDIO CRAFT	AC-300MKII
9GE	SME	3009/SII、3009/SIII、3010R
9GF	AUDIO TECHNICA	AT-1100・1010

㊟ *印のアームに別売アームスタビライザーを使う場合はAX-8Gをお使い下さい。

●AX-1G～6G、8G ¥12,000 ●AX-9G ¥34,000

Back

DirectDrive Museum - Nakamichi

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DirectDrive - The Hows And Whys

DirectDrive - Owning a DD

DirectDrive - Museum

DirectDrive - Tech-Talk

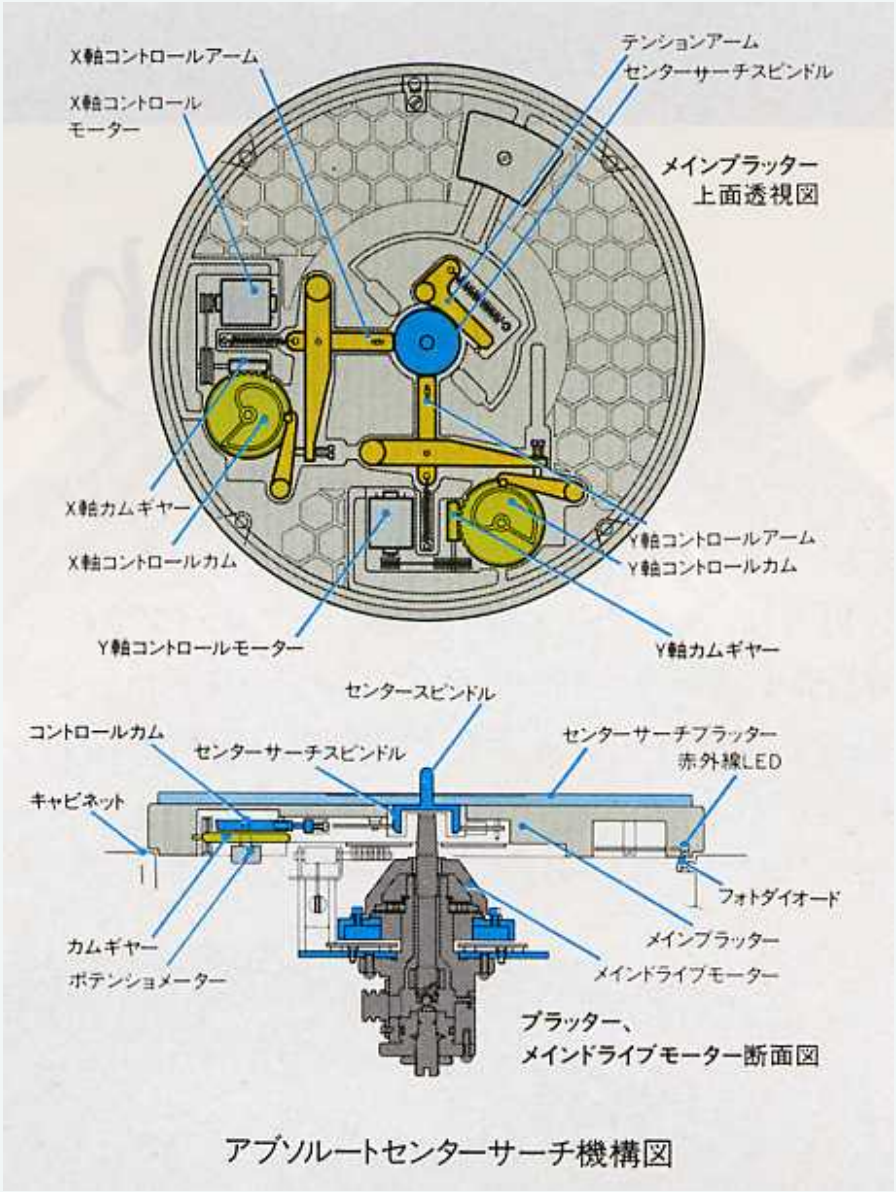
DirectDrive - Tonearms

Nakamichi entered the arena of big analog-players late. Having made its reputation in the 70s by producing state-of-the-art tape-decks like the legendary Dragon the big experience in advanced mechanics allowed Nakamichi to introduce some of the most innovative Direct Drive players ever built. The TX-1000 and the Dragon turntables are somewhat of a work in art which nowadasy sadly are almost forgotten. The idea of "Absolute Center Search" even today seems ingenious. These players are absolute top-notch and under some aspects even today they don't have found their successor.

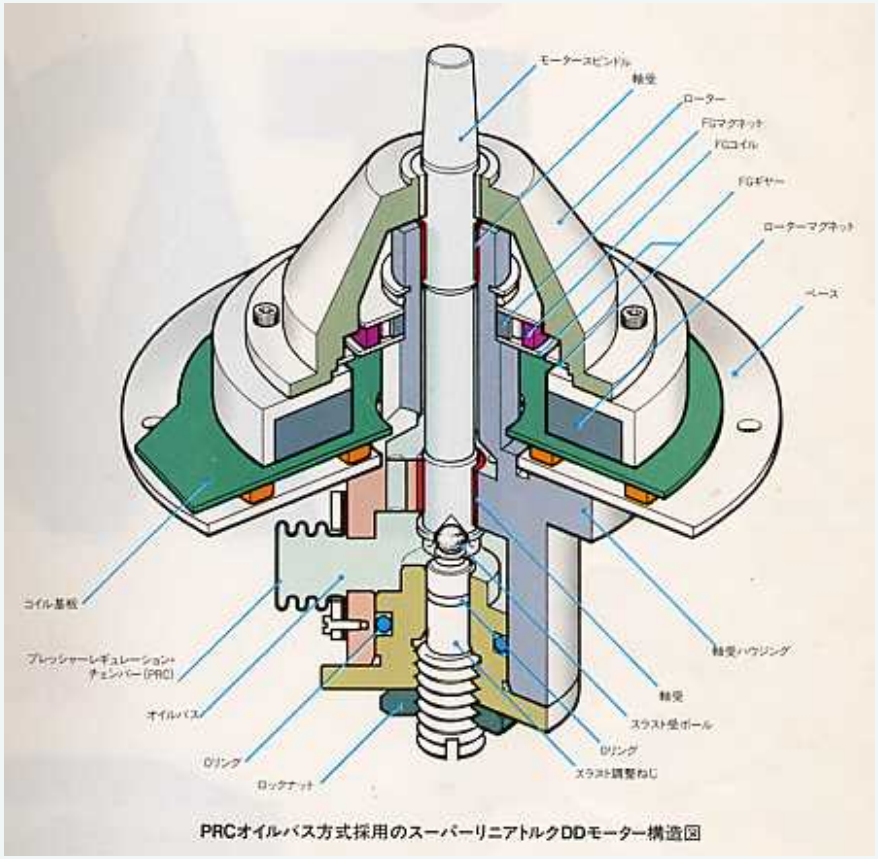
Nakamichi TX-1000

Without any doubt the TX-1000 was one of the most innovative turntables ever built. To compensate for not centrically made LPs it was possible to adjust the complete motor-bearing-platter assembly to the absolute center for every record. Made from heavy aluminium the TX-1000 didn't suffer from resonances. Below you see pictures of the platter-bearing assembly, the motor and its insulators.

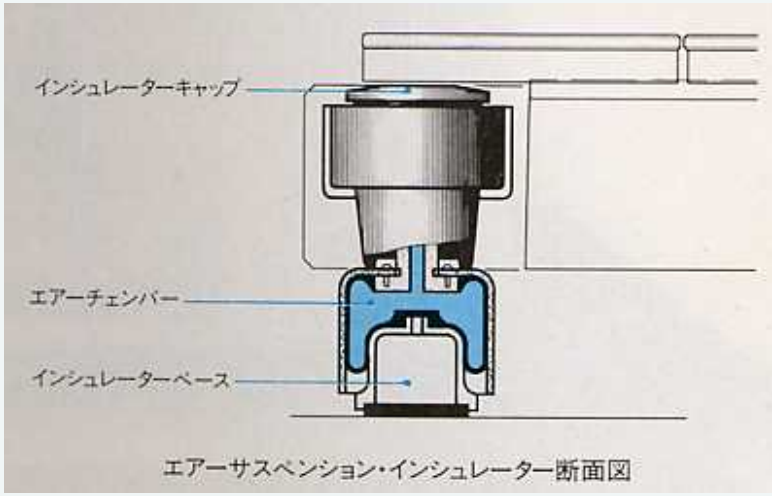

メインドライブモーターと
アームベースがマウントされたメインフレーム



アブソルートセンターサーチ機構図



PRCオイルパス方式採用のスーパーリニアトルクDDモーター構造図



エアーサスペンション・インシュレーター断面図

This model is very much sought after here in Europe commanmding prices at around 5000,- Dollars - if you're able to grab one. There actually were a lot of decks around of them in the 80s but it seems that if someone has one he usually won't sell it...

Nakamichi Dragon

This turntable completed the famous Dragon-Line of Nakamichi. Build-quality, design and mechanical engineering from another universe. Seldom seen it commands high prices too.

HOME | The Hows And Whys | Owning a DD | Museum | Tech-Talk

DirectDrive Museum - Sony

HOME

DirectDrive - The Hows And Whys

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DirectDrive - Tonearms

Today when you hear of the name Sony you think of walkmans, play-stations and mediocre mid-fi stuff. In the glorious 70s however Sony was a major player in the audio game. Or as a quote from a Sony-brochure from 1971 tells you: "We make aggregates and systems for those who are willing to put a reasonable amount of professionalism into their hobby". Sony early discovered the Direct-Drive. Around 1970/71 Sony put out the 2250 and the 5520 as a direct answer to National/Technics SP-10. These were professional players without a plinth. Later Sony concentrated more on the mass-market but always had some kind of prestige top-of-the-line deck in its program. The venerable PS-X9 was the king of them, the japanese answer to the EMT decks. Its introduction in 1978 however was too late to conquer the professional market.

Sony 2250 / 2251

This was Sony's direct answer to the SP-10. Introduced just a few months later in 1970 its construction wasn't as heavy and bullet-proof solid as the SP-10's but nevertheless many 2250s made their way to radio stations, clubs or as a reference player in recording studios. The servo regulation of the 2250 might tend to drift a little if you suffer from dirty mains. You should always use a shielded mains-cable and even a mains-filter to put out the whole potential a 2250 is capable of.
Nowadays only few 2250 are around on the 2nd hand market you can get a good one quite cheap which makes it a nice table for beginners.

Sony PS-5520

This is a scan from a 5520. The big brother of the 2250 was only available without a plinth. Obviously built more rigid and heavier the 5520 features an enormous platter and servo-regulation. Now these decks are extremely rare and as I never saw one I can give you no prices.

Sony TTS-6000

The TTS-6000 was Sony's flagship in the mid-70s. Derived from the 5520 it featured a different strobe and came complete with plinth and the S-shaped PUA-237 10"-tonearm. Here it is mounted in a custom plinth capable of two arms. Extremely rare machine, too.

Sony TTS-8000

A sturdy, robust, very fine built machine with the same arm as the later PS-X9. These decks are extremely rare outside of Japan.

Sony PS-X9

Top-model from the first Esprit-Series introduced in 1978. 80 pds. of japanese engineering-arts. Built just a few years this model clearly shows what the Sony-engineers were capable of if they could. A quarz controlled motor span a large 15" platter. Tonearm was a 12" model. The PS-X9 also featured a built in MC-PrePre and not too shabby riaa-phono-preamp. For domestic use its design was a little too "macho-looking" and only few decks found their way to audiophile's homes. For the professional market the PS-X9 came way too late. Denon, Technics and EMT already controlled the market for transcription turntables that days. When introduced it costed 2000,- Dollars including a very good MC cart the XL-55. Today you rarely see a PS-X9 outside of Japan, where it has a big following. Its sonics are very good indeed playing in the champion's league of Direct Drives and the other components of the deck like arm and electronics keep this level, too.

DirectDrive Museum - Technics

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DirectDrive - The Hows And Whys

DirectDrive - Owning a DD

DirectDrive - Museum

DirectDrive - Tech-Talk

National/Technics is one of the pioneers in developing Direct-Drive turntables. This was the brand name under which the big japanese company Matsushita became a big player in the audio business back in the 60s. 1969 Technics introduced the first direct-drive deck, the Technics SP-10. Successfull as it was Technics developed a number of decks in the 70s that are considered among the best Direct-Drives ever built. In common sense the sonics of the quarz-controlled models of the second half of the 70s are better than their ancestors. Besides the famous SP-Series which were all offered without a plinth there was also the SL-series with some of them offered without a tonearm which will make for quite a good deck even today.

Technics SP-10 Mk1

This is the grandfather of all Direct-Drive turntables the famous Technics SP-10Mk1. Rarely seen today its sonics do not match those of the later models in fact ist sonics are inferior to a Thorens TD-125. The motor was controlled by reading fluctuations of speed of the platter by a tachometer and comparing that signal to an electronic reference signal. So the speed has to drift a little before it is regulated again. These effects are audible with critical program like classical music or piano-concerts. The power-supply unlike the later SP-10MkII is located in the deck and the motor has not the ultimate torque of the later models. Rarely seen the Technics SP-10Mk2 is more interesting for collectors than for audiophiles. The price for a good model may even reach 400,- to 500,- dollars.

Technics SP-10 Mk2

This is the legend with thousands of them on daily duty in radio-stations, recording-studios, clubs and audiophiles. The PLL-Quarz controlled motor-regulation works almost perfect the motor has unbelievable torque which won't even slow down when 500 carts with 2,0ponds each would be put on the platter.
The electronics of the SP-10Mk2 consists of an impressible 108 transistors, 14 ICs and 32 diodes and condensators.
Construction and build quality was almost perfect and achieved such a steady turning of the platter that even most of todays decks simply fail to have. Sonically the SP-10 has a razor-sharp precision, an effortless authority, stable imaging even with loud orchestra-passages and astounding dynamics. For me it's one of the best decks ever built and compared to its sonic qualities its price on the 2nd hand market is quite moderate at

400,- Dollars up. SP-10Mk2s are quite common even today as masses of them where used everywhere in professional and home audio. There is also a professional version of this deck it goes by the name SP-10Mk2P which featured adjustable speeds. Below you see the power-supply SH-10EP and the combined regulator and phono-preamp SH-10U which houses parts of the motor-electronics.

Some SP-10s were modified by broadcasting-stations - mostly some kind of remote-control was established. Take care that this remote-control comes with the deck! A BBC-version SP-10Mk2 without remote-control will not start at all!

Technics SL-1000

This is the domestic version of the SP-10Mk2 comin with a not so bad plinth made out of

obsidian (SH10-B3 and SH-10B7). If you come across a SL-1000 on the 2nd hand-market you'll discover that unlike the naked SP-10Mk2 these decks will fetch very high prices around 1200-1500,- Dollars. The plinth and the tonearm EPA-100 do not justify these high prices sonically.

And finally here is the professional version of the SL-1000, the SL-1000P:

Technics SP-10 MkIII

Now this is the ultimative SP-10 introduced in 1981 mostly for asian audiomaniacs. It was sold at the same time like the Mk2 which remained the standard for professionals until the end of the 80s. The platter weighs a whopping 20pds and is bolted to the motor. There are rumours that the motor of the Mk3 had such a high torque that it was able to spin the platter with a man standing on it... Mk3s are very expensive and outside of asia they're almost impossible to find.

Technics SP-10 / Kaneta

Akito Kaneta modified a Technics SP-10 and published the results. The result is an advanced concept. For details look at the Kaneta-Pages.

Technics SP-12

Now this is a real rare bird, the almost unknown Technics SP-12.

Technics SP-15 / SP-20 / SP-25

These are the little brothers of the SP-10 with the SP-20 introduced in 1976 seems to be a bit of a mystique deck as I never came across one.

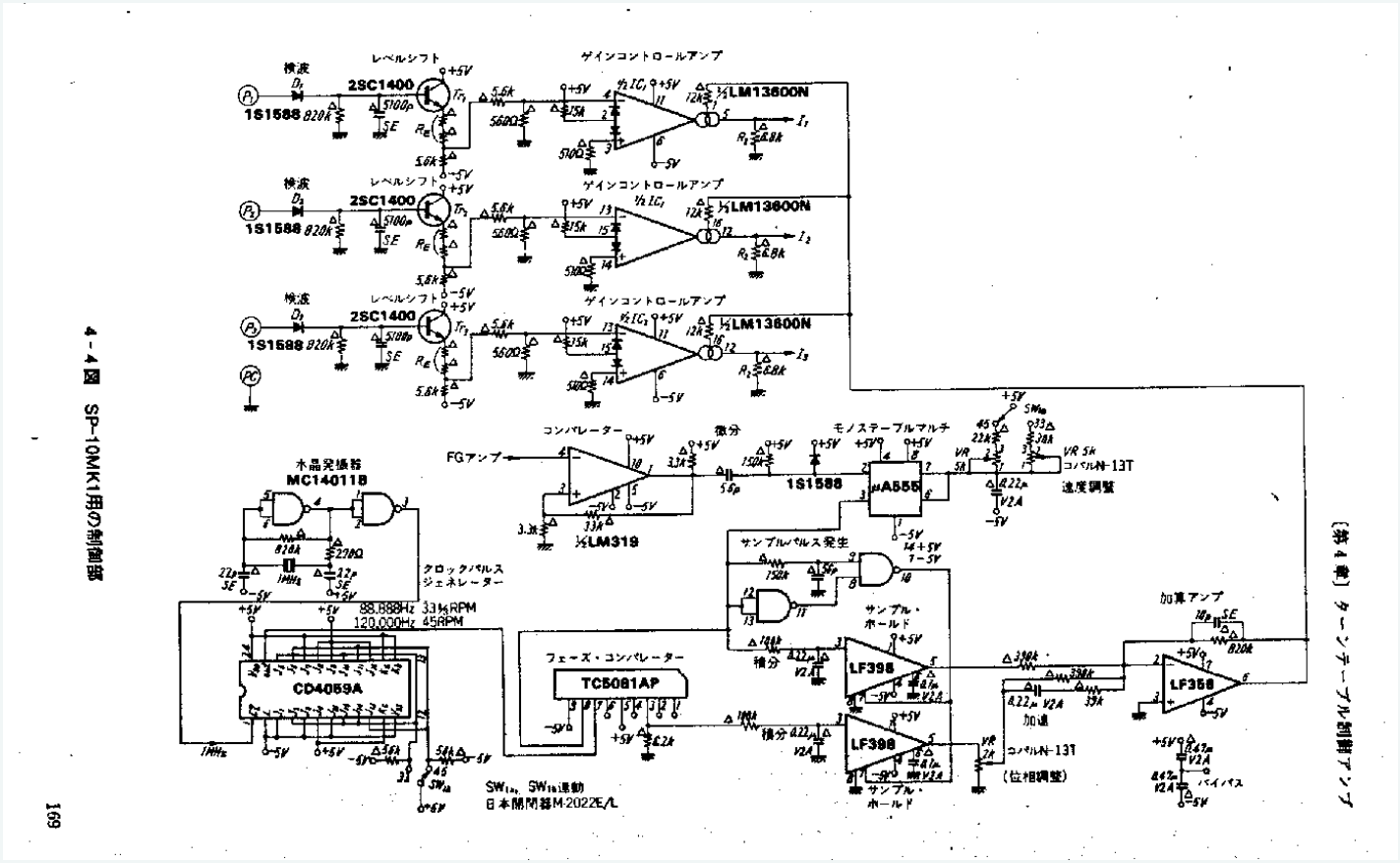
The SP-15 from 1979 and the SP-25 are very good decks but lacking the last bits of bullet-proof build-quality and sonic performance of the SP-10. As they are not considerable cheaper than the original I would opt to go for an SP-10Mk2. Above you see an SP-25 in its full glory complete with plinth and the EPA-500 tonearm which featured changeable armtubes. As the armtube together with all weights is changed you have the possibility to change between various carts in a few seconds. Keep in mind that armtubes for the EPA-500 now are very rare and hard to find.

DirectDrive Kaneta

Der japanische Professor Akito Kaneta, hierzulande bekannter unter dem Namen Kaneda investierte viele Gedanken in die Modifikation der Technics SP-10 Familie. Heraus kam eine einizigartige Motorsteuerung und ein Bauvorschlag für eine Zarge. Vielen Dank an H.Aschenbrenner vom Auditorium23 für das mir zur Verfügung gestellte Material.

Die Motorsteuerung

Die Motorsteuerung publizierte Herr Kaneta in einem seiner zahlreichen Bücher. Auszüge aus diesem (japanisch geschriebenen) Buch mit der Schaltung und Platinenlayouts finden Sie hier. Auf eine Quartzregelung wurde zugunsten eines sehr genauen Referenzspannungsgenerators verzichtet. Insbesondere für etwas betagtere Technics SP-10Mk1 erscheint diese Motorsteuerung eine sehr überlegenswerte Alternative zu sein. Probleme könnten aber bei der Beschaffung der etwas antiquierten Bauteile auftreten. Hier die Schaltungen:



mk1 mk2 mk3

Die Zarge

Das Chassis des SP-10 wurde entfernt, die Elektronik ist in separaten Gehäusen untergebracht. Herr Kaneta bevorzugte - wie viele japanische Enthusiasten - den langen SME3012 Tonarm. Die unten abgebildete Zarge wurde nach Originalplänen von H.Kaneta aus Lindenholz angefertigt.

Eine Menge Holz:


Die fertigen Boards:

Von unten nach oben:



Das Top-Board etwas näher:

Und jetzt fast fertig:

Von der Seite:

Der Motor ist eingebaut:

Fertig:

und Preise, Ersatzteilversorgung und vieles mehr rund um den Direktantrieb behandelt.

Herzlich willkommen in der Welt der EMT's, Denon's, Technics'.

Ich freue mich über Anregungen/Korrekturen/ Meinungen zu dieser Site. Nobody's perfect... Auch über Daten und Bilder von hier nicht abgebildeten Plattenspielern würde ich mich freuen.

Mailen Sie mir

Das Prinzip

Ende der 60er Jahre kamen japanische Ingenieure bei National/Technics zu dem Ergebnis, daß für eine weitere Verbesserung der Schallplattenwiedergabe die Anzahl der Lager minimiert werden mußte. Patentiert wurde der Direktantrieb für Plattenspieler bereits 1929. Ironischerweise gehörte das Patent Thorens, einer Firma, die heute nahezu als Synonym für Plattenspieler mit Riemenantrieb und Subchassis gilt. Doch erst 40 Jahre später, mit der zunehmenden Verbreitung moderner Regelungselektronik war es möglich, einen Direktantrieb hoher Qualität zu realisieren. Bei den ersten Modellen wurde durch den Vergleich eines Referenzsignals mit einem Tachometersignal ein Differenzsignal erzeugt, welches für die Motorsteuerung heran- gezogen wurde. Nachteil dieser Art der Regelung war, daß diese letztendlich erst aktiv wurde, wenn bereits eine Drehzahlabweichung stattgefunden hatte. Diese Effekte sind hörbar, bei schweren Teller weniger, bei leichten Tellern oft deutlich. Andere Hersteller wie Denon verwendete zur Abtastung des Differenzsignals Magnetköpfe, die einen Magnetring innerhalb des Plattentellers abtasteten und daraus ein Differenzsignal für die Steuerung generierten, bevor überhaupt eine nennenswerte Abweichung von der Nenndrehzahl stattgefunden hatte. Bei späteren Modellen erfolgte die Regelung mittels einer zusätzlichen Phasenverriegelung (PLL: Phase Locked Loop) mit einem Referenzsignal. Eine solche Regelung spricht bereits an, wenn zwischen der Drehposition des Plattentellers und dem Referenzsignal eine minimale Phasenabweichung auftritt, zudem bleibt diese

Phasenabweichung konstant. Das gefürchtete Zittern duch dauerndes Nachregeln gehörte ein für alle mal der Vergangenheit an. Die Genauigkeit des Antriebs hing jetzt nur noch von der Genauigkeit des Referenzsignals ab. Anstelle von Synthesizern und Hall-Generatoren wurde Ende der 70er Jahre vermehrt Quartzregelungen eingeführt, womit das Referenzsignal "quartzkonstant" wurde.

Vorteile

Die Vorteile des Direktantriebs liegen darin, daß das gesamte System nur ein einziges bewegliches Teil (der auf gemeinsamer Achse montierte Gleichstrom-Langsamläufer) mit für die Laufruhe günstigem großem Trägheitsmoment aufweist. Zudem rotiert dieses Teil sehr langsam und besitzt daher eine Resonanzfrequenz von c.a. 0,5 Hz im Gegensatz zu den 50Hz mit denen der Motor eines Riemenläufers resoniert. Im Gegensatz zu Riemen- oder Reibradantrieb sind keinerlei mechanische Zwischenglieder für Drehmomentwandlung erforderlich, die mit ihren Lagertoleranzen und Eigenresonanzen den Abtast- vorgang stören können. Hier besitzt jedes Teil eine eigene mehr oder weniger ausgeprägte Resonanz.
Ein weiterer Vorteil eines gut gemachten Direktläufers liegt in der erreichbaren Drehzahlkonstanz. Die Reibung der Nadel in der Rille bremst bei starken Rillenmodulationen den Plattenteller. Messungen der Zeitschrift Audio zeigten, daß nach der Abtastung eines 3kHz Bursts 4Hz fehlten! Solche Effekte können mit Motorregelungen nur dann schnell genug ausgeglichen werden, wenn Antrieb und Teller möglichst verlustfrei miteinander gekoppelt sind. Dies ist bei Riemenläufern meist nicht der Fall. Der Weg, über Erhöhung der Tellermasse genügend Schwungmasse bereitzustellen, funktioniert leider genausowenig. So träge das System abbremst, so

träge reagiert es leider auch auf eine etwaige Beschleunigung durch die Motorregelung. Würden Sie lieber mit einem Porsche oder mit einem LKW auf einer Alpenstraße fahren? Eine Ankopplung des Motors an einen schweren Plattenteller mittels Faden (String) ist vor diesem Hintergrund übrigens besonders fragwürdig. Selbst bei einer Platine Verdier (Tellergewicht c.a. 25kg) machen sich verschiedene Spannungen des Antriebsstrings bezüglich Drehzahlkonstanz dramatisch bemerkbar. Eine starre Ankopplung des Tellers an die Motoreinheit setzt bei Riemenläufern ein möglichst unelastisches Material (Tonband, o.ä.) voraus. Dieses überträgt aber nunmehr sämtliche Resonanzen des Motors auf den Teller...
Entscheidend für das klangliche Gesamtergebnis ist somit die möglichst präzise und schnelle Regelung des Motorstroms in Verbindung mit einer starren Ankopplung der Motoreinheit an ein nicht zu hohes Massenträgheitsmoment der Teller-/Motoreinheit, sowie eim möglichst hohes Drehmoment des verwendeten Motors. Diese Voraussetzungen erfüllen gute Direktläufer und liefern eine nahezu perfekte Plattendrehung. Negative Effekte durch erhöhte Nadelreibung bei hohen abzutastenden Amplituden treten bei einem solchermaßen realisierten System praktisch überhaupt nicht auf. Perfekt gelöst wurde die starre Ankopplung des Tellers an den Motor übrigens beim Technics SP-10Mk2. Hier wird der Teller mir dem Subteller verschraubt.

Wie klingt's

Gute Direktläufer klingen sehr neutral, man hört das was auf den Scheiben drauf ist - keine Effekte wie bei der bekannten schoottischen Fußwipp-Maschine sondern pure Information. Dies gilt aber ausschließlich für die "Top of the line"-Modelle dieser Zeit, die hier vorgestellt werden. Die preiswerten Massenprodukte

für Einsteiger kann man bezüglich Klang getrost vergessen... Im DirectDrive-Museum wird auf die empfehlenswerten Modelle näher eingegangen. Zu den Tugenden guter Direktläufer gehört eine ruhige, stabile Raumabbildung, ein äußerst präzises Timing, und eine vergleichsweise hohe Dynamik und Impulsfestigkeit. Die Wiedergabe über gute Direktläufer hat die Authorität eines Masselaufwerks, ohne dessen Timing-Probleme im Bassbereich. Wer also auf anmachende Effekte beim Plattenhören verzichten kann, sollte sich einmal unvoreingenommen einen Technics SP-10MkII, einen EMT 948 oder einen Denon DP-6000 anhören. Er wird überrascht sein.

Was kostet's

Einen guten Direktläufer zu bauen ist sehr, sehr teuer. Ein Technics SP-10 kostete in den 70ern c.a. 1000,- Euro, das wären heute das Zehnfache, der abgebildete EMT 948 kostete in den 70ern c.a. 6000,- Euro. Diese Geräte entstanden alle in einer Zeit in der die japanische HiFi-Industrie Ihre Blütezeit erlebte. Der Yen stand günstig, die Arbeitskosten waren niedrig und eine riesige Menge gut geschulter Ingenieure wartete nur darauf, ihr Wissen anzuwenden. Nahezu jeder japanische Hersteller von HiFi hatte zu dieser Zeit ein oder zwei Prestige- Laufwerke im Porogramm. Oftmals waren diese so kalkuliert, daß die Massenprodukte diese Boliden subventionierten. Heute sind die ehemaligen Flaggschiffe (noch) eine einmalig preisgünstige Eintrittskarte ins analoge Nirvana. ... Was empfehlenswerte Modelle heutzutage so kosten erfährt man im DirectDrive-Museum.

Wie sieht's aus

Unter Design-Aspekten muß man hier berücksichtigen, daß es sich hier um die Flaggschiffe des jeweiligen

Herstellers handelte. Jeder Hersteller war hier bestrebt, sich vom anderen durch ein wiedererkennbares und unverwechselbares Design zu unterscheiden. Edelholz und poliertes Aluminium waren seinerzeit die verwendeten Materialien, der verschwenderische Umgang damit war Pflicht. Es gab zu dieser Zeit nicht ein Top-Modell ohne Stroboskop. Die Fertigungsqualität ist exemplarisch.

Zargen und Tonarme

Über den guten Klang entscheidet eine robuste, schwere Zarge und ein gut entkoppelter Stellplatz. Bei vielen hier vorgestellten Laufwerken handelt es sich um sog. Einbaulaufwerke. Das heißt, daß der Käufer lediglich das Chassis erwirbt und dieses dann selbst in eine Zarge einbauen muß. Die Qualität vieler herstellerseitiger Zargen entsprach nicht annähernd der Qualität des Laufwerks. Dies gilt insbesondere für Modelle von Denon, JVC und Sony. Andererseits bietet die Möglichkeit, die Zarge individuell an zufertigen auch große Vorteile. Man kann auf diese Weise den Klang eines Laufwerks auf die Kette daheim und den eigenen Geschmack ab- stimmen und erhält auch optisch ein Unikat. Auf den Bau von Zargen wird hier genauer eingegangen.
Die Tonarme, die auf Direktläufern zu dieser Zeit montiert waren, genügen heutigen Ansprüchen ebenfalls meist nicht mehr. Bei den Modellen, die hier vorgestellt werden, handelt es sich fast ausnahmslos um Modelle, die herstellerseitig ohne Tonarm ausgeliefert wurden, so daß die Montage eines modernen Arms normalerweise kein Problem darstellt.

Haben Direktläufer auch Schwächen?

Ja und wie. In den 70er und 80er Jahren gab es hunderte Billigdreher mit Direktantrieb die das

schlechte Image des Direktantriebs erst begründeten. Schlechte Zargen, billigste Materialien für Teller und Lager sind bei diesen Großserienmodellen leider an der Tages- ordnung. Auf diese Modelle wird hier nicht weiter eingegangen. Es exitieren kaum Direktläufer mit gefedertem Subchassis. Ein entkoppelnder Plattenspielertisch oder Wandhalter ist für die meisten Modelle Pflicht. Für die meisten Dreher auf dieser Site gibt es keinerlei Ersatzteile mehr. Ein durchgebrannter Motor eines Denon bedeutet das sichere Ende dieses Drehers es sei denn man findet einen zweiten zum Ausschlachten... Die Bauteile in den Regelungsplatinen sind heute nur noch schwer bis gar nicht aufzutreiben. Serviceadressen gibt es noch für EMT und Technics. Aber keine Angst - gerade die außerordentliche Robustheit vieler Modelle ist geradezu legendär. Werden Sie sachgemäß behandelt. halten Sie meist ein Leben lang.

- Ist das Gerät komplett, funktionieren alle Features?

  Fehlen Teile am Gerät, ist es heute meist nicht mehr möglich diese als Ersatzteile zu bekommen. Dies betrifft Teile, wie Stroboskopbeleuchtungen, Tellerspindeln, Schrauben, Schalter und natürlich auch Verschleißteile. Sämtliche Schalter und LED's am Gerät müssen funktionieren. Manuale und Servicemanuale sind meist auch nicht mehr erhältlich!

- Hat der Teller Höhenschlag?

  Wenn der Plattenteller nur minimalsten Höhenschlag besitzt, oder gar unrund läuft, Finger weg! Hier ist das Tellerlager hinüber und das ist in der Regel irreperabel.

- Besitzt das Gerät Gleichlaufschwankungen

  Gleichlaufschwankungen haben bei Direktläufern prinzipbedingt meist ihre Ursache in einer defekten Motorregelung. Defekte Bauteile für Hallgeneratoren oder gar Quartz-Steuerungen sind heutzutage kaum mehr aufzutreiben. Bei JVC und Denon-Plattenspielern tasten Tonköpfe eine Magnetschicht im Teller ab, um hieraus ein Tachometer-Signal zu generieren. Ein Defekt hier ist irreperabel. Manchmal ist allerdings auch nur der Tonkopf dejustiert, hier kann man dann ein Schnäppchen machen... Aber bei 90% aller angebotenen Dreher gilt auch hier - Finger weg!

- Optischer Zustand des Geräts

  Diesen kann man oft noch selber verbessern. Hier muß man auch entscheiden, inwieweit man mit rein optischen Macken leben kann. Ein regelmäßig gewartetes Rundfunkgerät ist oft optisch in einem erbärmlichen Zustand, technisch aber top. Der Zustand der Holzzargen bei Einbaugeräten ist eigentlich nur für Sammler interessant. Die meisten taugen eh nicht zum ernsthaften Musikhören und sollten durch eine Eigenkonstruktion ersetzt werden.

- Tonarme, Tonabnehmer

  Oft werden diese Plattenspieler zusammen mit Tonarmen und Tonabnehmern angeboten. Dies kann den Wert eines solchen Plattenspielers erhöhen, falls der Tonarm in gutem Zustand ist und falls man diesen überhaupt will. Gängige Tonarme aus den 70er Jahren erreichen in etwa die Qualität eines Rega RB-300, bei herstellerseitigen Tonarmen oft nicht einmal das. Bis zu 200,- Euro Aufpreis gegenüber einem nackten Laufwerk sind bei gutem Zustand für folgende Tonarme realistisch:

  - Audio Technica ATP-Serie
  - Denon DA-Serie
  - Lustre GST-801

- SAEC WE-Serie
- SME 3009/S2
- Technics EPA-500

Etwas mehr Aufpreis ist für folgende Arme realistisch, deren Performance liegt in etwa auf Linn Ittik-Niveau:

- Fidelity Research FR64s / FR64fx
- Grace GA704 / GA714
- SME 3012/R
- Technics EPA-100

Den Zustand eines Tonarms oder Tonabnehmer zu beurteilen, ist bei unbekannten Geräten fast unmöglich. Tonarmlager kann man überprüfen, in dem man den Tonarm ausbalanciert und die Horizontalbewegung mit kleinen Papierschnipseln, die aufs Headshell plaziert werden, checkt. Der Tonarm muß reagieren. In der Vertikalrichtung muß sich der Tonarm schon durch leichtes Anpusten bewegen. Für Tonabnehmer gilt, daß der Nadelträger eines Tonabnehmers nach 4-5 Jahren unabhängig vom Zustand der Nadel ausgetauscht werden muß, da der Dämpfungsgummi in dieser Zeit meist porös geworden ist. Bei Moving-Coil-Systemen - und nur um die sollte es eigentlich gehen - ist dieser Austausch sehr kostspielig (mehr als 350,- Euro) und rentiert sich daher meist nicht.

Eine Ausnahme stellen hier hier alle EMT-Modelle dar, hier ist es nicht sinnvoll Tonarme anderer Hersteller zu kombinieren.

Pflege

Die Pflege bei guten Direktläufern reduziert sich auf ein absolutes Minimum. Die meisten begnügen sich einmal im Jahr mit 3-4 Tröpfchen Öl (steht in der Bedienungsanleitung), ansonsten kann man Sie getrost sich selber überlassen. Das Reinigen und Neuölen des Tellerlagers ist übrigens nicht so einfach zu bewerkstelligen, wie bei Riemenläufern, meist ist eine Reinigung aber auch unnötig! Ohne Servicemanual oder genaue Kenntnisse der Lager-/Motorkonstruktion riskiert man hier einen Lagerschaden. EMT-Tellerlager sind im übrigen völlig wartungsfrei.

Die Zarge

Die Zarge für Direktläufer MUSS resonanzarm (dämpfend) und vergleichsweise schwer konstruiert sein. Die Bedeutung der Zarge für den Klang des Plattenspielers wurde in den 70er Jahren oft nicht ausreichend erkannt. Als Folge davon sind viele Zargenkonstruktionen japanischer Hersteller aus dieser Zeit zwar hübsch anzusehen, aber unbrauchbar. Allerdings hat man mit Ihnen eine Schablone für den Laufwerksausschnitt bei Eigenkonstruktionen... Als Material für den Selbstbau von Zargen kommen folgende in Frage:

- MDF

  Eine MDF-Zarge leidet unter dem frequenzabhängigen Resonanzverhalten von MDF. Meist werden bei reinen MDF-Zargen die

Höhen zu stark bedämpft, was sich in einem dumpfen, im Bass langsamen Klangbild äußert. Zudem variiert die Zusammensetzung von MDF sehr stark und kaum eine MDF-Zarge wird genauso wie die andere klingen. Interessant kann MDF in Verbindung mit Metall sein. Ein MDF-Aluminium Sandwich vereint die Vorteile beider Materialien, ist aber sehr teuer und für den Privatmann kaum selber herstellbar. Vorteile von MDF sind der geringe Preis und die leichte Bearbeitbarkeit.

- Corian

  Corian ist ein Material, daß zur Herstellung von Küchenarbeitsplatten dient. Es handelt sich wie MDF um ein Komposit-Material besitzt aber einen mehr oder weniger hohen Aluminiumanteil. Für den Zargenbau kommt Corian mit hohem Aluminiumanteil (große Flecken) zum Einsatz. Das akustische Ergebnis kann überzeugend sein. Für meinen persönlichen Geschmack klingen Corian-Zargen aber oft überdämpft und leblos. Nachteil ist das Finish (Geschmackssache), der hohe Preis und die Tatsache, daß Corian nur in sehr dünnen Dicken ange- boten wird.

- Birkensperrholz

  Das Standardmaterial zum Zargenbau. Nicht billig, aber akustisch ziemlich ideal, leicht zu bearbeiten und leicht zu bekommen. Die Optik kann mit Furnier, Beize oder Lack leicht den eigenen Anforderungen angepaßt werden. Birkensperrholzzargen klingen tonal ziemlich neutral und lebendig.

- Harthölzer wie Mahagoni, Kirsche, Ahorn

  Diese Hölzer werden auch im Instrumentenbau verwendet. Mahagoni klingt hier eher satter, Ahorn brillanter. Mit solchen Hölzern kann man excellente Ergebnisse erzielen, wenn einem das Resonanzverhalten (der Klang) des Laufwerks bekannt ist, da man diesen mit Hilfe dieser Hölzer in bestimmte Richtungen tunen kann. Nachteil ist der sehr hohe Preis und die Tatsache, daß man diese Hölzer schwer in den gewünschten Maßen bekommt.

- Marmor, Stein, Kunnststein

  Naturstein dämpft nur minimal, besitzt aber eine hohe Dichte und ein hohes Gewicht. Mir gefällt der Klang von Natursteinzargen nicht. Eine Natursteinzarge kann man sich nur vom Steinmetz anfertigen lassen. Kunststein und Schiefer (amorphe Struktur) dämpfen etwas mehr sind aber auch nicht so mein Fall.

Beispielhaft sei hier kurz der Bau einer Holzzarge beschrieben:

Am besten läßt man sich mind. 20 mm dicke Bretter im Baumarkt im gewünschten Maß zuschneiden. Normalerweise wird sich die Gesamtdicke der Zarge an der Höhe des entsprechenden Laufwerks orientieren, also etwa 8-12cm dick sein. Entsprechend viele Bretter benötigt man. Höher und damit

schwerer ist bei Direktläufern selten verkehrt! Die Breite und Tiefe der Zarge ist abhängig vom Laufwerk (klar!) und dem verwendeten Tonarm (9", 10", 12" Arme) bzw. kann man auch gleich Montagemöglichkeiten für mehrere Arme vorsehen, falls das gewünscht ist. Um den Drehmittelpunkt des Tonarms sollte man ein Loch mit 8cm Durchmesser kalkulieren, um den Tonarm bequem von unten festschrauben zu können. Zusätzlich sollte man noch einen Rand zu allen Ausschnitten von mind. 30 mm Breite vorsehen. Das oberste Brett erhält nun den Ausschnitt für das Laufwerk. Dies erfolgt nach Anzeichnen entsprechend einer Schablone mit der Stichsäge. Danach wird das Laufwerk provisorisch eingesetzt und der Abstand Tellerspindel - Armdrehpunkt angezeichnet. Dies dient als Mittelpunkt für die Tonarmbohrung. Hier sollten mind. 50 mm Abstand zumn Laufwerk und zum Zargenrand eingehalten werden, d.h. bei kurzen Armen wandert der Drehpunkt entsprechend nach vorne. Bei manchen Laufwerken tun sich in Kombination mit kurzen Armen Probleme auf: Einen SME-Ausschnitt für einen SME 3009 wird man mit einem Technics SP-10 kaum hinkriegen. Bei den runden Denon's ist dies weit einfacher... Nun wird mittels Rundsäge oder Förstnerbohrer ein Loch mit c.a. 20-35mm je nach Tonarm in das oberste Brett gebohrt.

Das oberste Brett dient nunmehr als Schablone für alle weiteren, wobei man hier beachten sollte, daß das Tonarmloch bei allen weiteren Brettern nunmehr mind. 80mm Durchmesser aufweisen sollte. Im unteren Bereich benötigen viele Laufwerke weniger Luft, d.h. man kann (und sollte) den Laufwerkausschnitt je weiter man nach unten kommt, verringern. Jedoch ist bei Laufwerken, die von unten verschraubt werden, wie der Technics SP-10 darauf zu achten, genug Platz um die Schrauben zu lassen, um das Laufwerk auch mal wieder ausbauen zu können... Die letzten 1 oder 2 Bretter sollten bis auf die Tonarmbohrung massiv sein, um weiteres Gewicht zu gewinnen. Nun werden die Platten mit Holzleim zusammengeleimt, die Ränder plangehobelt und geschliffen und fertig ist das Werk zum Lackieren, Beizen oder Furnieren.

Hier einer meiner SP-10 mit SME IV. Die Zarge wurde einfach klar lackiert.

Unten ein weiterer SP-10 mit einem SME 312 Arm in einer nach dieser Anleitung gebauten Zarge. Das Foto hat mir der - zufriedene - Besitzer freundlicherweise naach dem Bau zugesandt.

Ein alternatives Zargenkonzept, bei dem das Chassis des SP-10 entfernt wurde wird auf der Kaneta-Seite vorgestellt.

Die Aufstellung

Eine solche Zarge ist zwar akustisch relativ "tot", muß aber noch gegen Trittschall entkoppelt werden. Die besten Erfahrungen habe ich hier mit Wandhaltern gemacht, die das entsprechende Gewicht allerdings auch tragen können müssen. Es existieren jedoch mannigfaltige geeignete Unterbauten vom stählernen bespikten Laufwerkstisch bis zum Betonklotz. Man kann viele Laufwerke durchaus ohne weiteren Zwischenboden oder Füße auf die Spikes eines Laufwerkstischs oder Wandhalter stellen, ansonsten existieren mehrere Möglichkeiten für die Fußkonstruktion.

- Gummidämpfer

  gab es früher in mannigfacher Ausfertigung von z.B. Audio Technica. Das Klangbild wird weicher, jedoch leidet meist die rhythmische Präzision und Stabilität der Musikwiedergabe, die Dynamik nimmt ab. Die erreichbare Tritt- schalldämpfung ist nicht berühmt.

- Holzcones

  Halbkugeln aus Hartholz - gibt es in Bastelläden. Klingen tendenziell wie Spikes aber ohne deren tonale Härten. Oft der beste Kompromiß

zwischen Dynamik und ausgewogener Tonalität. Der Boden auf dem die Holzcones stehen beeinflußt mit seinem Resonanzverhalten (Masse, Material) die Musikwiedergabe.

- Spikes

  Gibt es in hunderten von Ausfertigungen meist aus Metall. Rhythmisch schnelles, anspringendes, stabiles Klangbild, aber Gefahr von tonalen Härten. Die Performance ist hier auch abhängig davon auf welchem Unter- grund die Spikes stehen.

- Luftdämpfer

  Gibt es für den Industriebedarf, sie sind nicht billig. Diese Dämpfer haben hervorragende akustische Eigenschaften und dämpfen wirkungsvoll Trittschall. Sie sind erhältlich bei RS-Components kosten aber pro Stück gut und gerne 50-60 Euro...

Insgesamt entscheidet hier maßgeblich der persönliche Geschmack und die häuslichen Möglichkeiten. Achten sollte man noch darauf, daß Laufwerke nicht in der Nähe von Lautsprechern oder in Raumecken gestellt werden, da hier Raumresonanzen ihr Maximum erreichen und bei hohen Lautstärken durchaus ein Laufwerk zum Schwingen bringen können.

Tuning

Es gibt auf dieser Welt nichts gutes, was man nicht noch besser machen kann - das gilt auch und gerade für Direktläufer. Jedoch sollte man vor etwaigen Tuning-Maßnahmen erstmal 8 Wochen zufrieden Musik hören, bis sich das Klangbild auch im Hirn eingebrannt hat. Ansonsten hört man zwar bei Tuning-Maßnahmen durchaus Unterschiede kann jedoch oft nicht mehr beurteilen, ob und wieviel es denn gebracht hat...
Die beliebtesten Tuning-Maßnahmen bei Direktläufern sind:

- Plattenklemmen / Gewichte

  Vor dem Einsatz einer Plattenklemme oder eines Gewichts, daß während des Abspielens auf der Platte plaziert wird, sollte man erstmal checken, ob das überhaupt möglich ist. Die Tellerspindeln dieser Zeit erlauben nämlich oft weder das Zupacken einer Plattenklemme noch das exakt zentrische Aufsetzen eines Gewichts. Bei Gewichten steigt die Belastung des Tellerlagers (und auch die Geräusche des Tellerlagers), bei Modellen mit schwachen Motoren können diese sich in die ewigen Jagdgründe verabschieden, da beim Hochlauf die Regelung den Motor überfordert. Beim Einsatz mit Gummimatten besteht die Gefahr Staubpartikel in die Platte zu pressen. Ich verwende kein's von beiden.

- Tellermatte

  Bei vielen Modellen aus japanischer Produktion klingt der Teller wie die

sprichwörtliche Glocke. Die damals verwendeten Gummimatten dämpften die Tellerresonanzen auf ein erträgliches Maß, besaßen aber oft viele "Ringe und Riefen". Für guten Kontakt mit der Platte ist eine möglichst glattflächige Oberfläche der Matte von Vorteil. Oft erreicht man schon eine deutliche Verbesserung durch Auflegen einer möglichst dünnen Filzmatte (Linn) auf die serienmäßige Gummimatte.
Auf meinem SP-10 benutze ich eine dünne Korkmatte und darauf eine Linn-Filzmatte.
Der Einsatz von "harten" Matten aus z.B. Metacrylat verbietet sich bei klingelnden Tellern von selber, auf eine Gummimatte aufgelegt bringt's meist nicht mehr viel.
Eine andere Möglichkeit besteht darin, das Resonanzverhalten einers Tellers mit einer Glasmatte regelrecht zu "bündeln" und dieses Resonanzspektrum dann mittels einer daraufgelegten Kork- oder Filzmatte stark zu bedämpfen.
Spezielle dämpfende Matten funktionieren mit den meisten Direktläufern sehr gut und sind - wenn auch teuer - wirklich zu empfehlen. Mit Erfolg auf allen Laufwerken ausprobiert hab ich die "Record Interface Mat" aus Holland - eine leider schon lange nicht mehr erhältliche Sandwichkonstruktion, die auch von Herrn Van den Hul auf seinem SP-10 genutzt wird. Ebenfalls gut gehen Ledermatten oder Filz-Leder-Konstruktionen (Cabrio-Ver- deckstoff). Die besten Ergebnisse erzielte ich mit der bei H. Aschenbrenner erhältlichen Verdier-Matte, eine Gummi-Blei-Konstruktion. Ursprünglich von H.Verdier nach einer Idee von H.Shindo für seine eigenen Laufwerke entwickelt, leistet diese Matte auf vielen Direktläufern erstaunliches.

- Outsourcing

  Outsourcing ist ein radikaler Umbau des Plattenspielers, bei der lediglich der Motor im eigentlichen Chassis verbleibt und sämtliche elektronischen Bausteine in gesonderte Gehäuse verlegt werden. Hierdurch steigt meist die Laufruhe des Laufwerks - teilweise enorm. Zunächst sollte man das Netzteil - wenn nicht eh schon extern - outsourcen, hiermit hat man meist schon 50% des Outsourcing-Potentials erreicht. Störungen durch den Netztrafo wie Beeinflussung anderer Baugruppen (Quartz!) oder Vibrationen werden hierdurch vermieden. Viele Laufwerke enthalten eine Bremse, die ebenfalls mechanische Resonanzen weitergibt. Im Privatbereich benötigt man diese eh nicht, also raus damit. Man kann bei entsprechenden Fähigkeiten aber auch noch weiter gehen und alle Baugruppen des Plattenspielers, bis auf Tellerlager und Motor aus dem Chassis entfernen. Radikalisten entfernen selbst das Chassis selber und bauen ein eigenes Bedienfeld...

Auch Akito Kaneta fand offensichtlich keinen Gefallen am originalen Chassis des Technics SP-10.
Ein SP-10 ala Kaneta wird auf der Kaneta-Seite vorgestellt.

All diese Maßnahmen bringen wirklich etwas, da insbesondere Beeinflussungen der Motorsteuerung durch andere Bau- gruppen minimiert werden. Inwieweit der Aufwand das Resultat lohnend erscheinen läßt, muß jedoch jeder selbst entscheiden.,,

- Elektronik

  Auch hier existiert Tuning-Potential. Tuning-Maßnahmen erstrecken sich vom Abklemmen des Stroboskops (beim Technics SP-10 ist auch das Stroboskop quartzgesteuert, der Quartz kann sich nunmehr völlig der Motorsteuerung widmen), über sternförmige Erdung aller Platinen an einem definierten Punkt bis zum kompletten Aufbau eigener Steuerungen. Hier ist jedoch meist nicht so viel rauszuholen wie beim Outsourcing.

- Das Netz

  Das Netz ist gerade bei früheren Direktläufern, wie dem oben abgebildeten Sony 2250 ein nicht zu unterschätzender Feind. So ganz netzunabhängig arbeiten gerade die frühen Servo-Regelungen selten. Daher sollte man zunächst einmal die serienmäßigen Netzkabel durch geschirmte Leitungen ersetzen und evtl. ein (gutes) Netzfilter einsetzen, um Störungen von der empfindlichen Regelungselektronik fernzuhalten.

Bezugsquellen

- Ein EMT-Kenner
- Alles für EMT - Neugeräte, Gebrauchtgeräte, Ersatzteile
- Dasselbe mit Profi im Namen
- Alles für Technics SP-10 - Neugeräte, Gebrauchtgeräte, Modifikationen, Ersatzteile

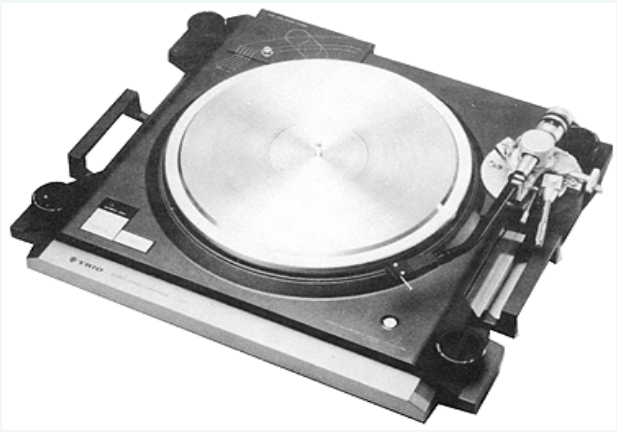
sehen.

Goldmund

Schweizer Hersteller, der in den 80er Jahren mit seinen direktangetriebenen Laufwerken neue Maßstäbe setzte - sowohl klanglich, als auch preislich.

Kenwood

Japanischer HiFi-Hersteller, der Ende der 70er mit dem L-07 einen der besten jemals gebauten Direktläufer vorstellte.



Luxman

Renommierter japanischer Hersteller von edlen HiFi-Komponenten. Anfang der 80er Jahre trat Luxman als Pionier von Plattenspielern mit Vakuum-Ansaugpumpen in Erscheinung.

Micro

Micro-Seiki war ein japanischer Hersteller, der sich auf die Produktion von Plattenspielern spezialisiert hatte. Bekannt ist insbesondere das Modell DQX-1000, daß die Möglichkeit bot, bis zu 3 Tonarme auf einem Laufwerk zu montieren.

Nakamichi

Nakamichi war ein japanischer Hersteller, der in den 70ern und 80ern DER Hersteller für hochwertige Kassettendecks war. Weniger bekannt sind die innovativen Laufwerke von Nakamichi, die in vielen Dingen, alles was vorher oder nachher angeboten wurde, in den Schatten stellte.

Sony

Japanischer Hersteller von Großserien-HiFi, der in den 70ern jedoch auch einige Prestige-Produkte wie den legendären PS-X9 anbot.

Technics	Der erste Hersteller, der Laufwerke mit Direktantrieb in Großserie fertigte. Der SP-10 war in zahllosen Rundfunkstationen in der ganzen Welt im Einsatz.	
Andere	JVC/Victor, Pioneer und andere japanische Hersteller von Audio Equipment stellten Ende der 70er alle Boliden vor, von denen einige hier verewigt sind..	

Ein im Antriebsmotor selbst integrierter Wechselspannungsgenerator liefert als Istsignalgeber ein Signal mit stren drehzahlproportionaler Frequenz. Aus diesem Signal wird in der Drehzahlregelstufe mit Hilfe eines Frequenz/Spannungsumsetzers eine drehzahlproportionale Steuerspannung gewonnen. Diese Steuerspannung wird der Motorstufe zugeführt und bestimmt so den Motorstrom. Schon diese Regelschleife stellt eine weitgehend konstante Drehzahl sicher.
Gleichzeitig wird aber das Signal des im Motor integrierten Istsignalgebers einer Phasenvergleichsstufe zugeführt. Dort wird es mit einem Signal verglichen, welches über einen programmierbaren Frequenzteiler aus dem hochkonstanten Ausgangssignal eines Quartzoszillators abgeleitet wird. Die Referenzspannung weist deshalb ebenfalls Quartzkonstanz auf. Schon die geringste Phasenverschiebung zwischen Istsignalfrequenz und Referenzfrequenz erzeugt in der Phasenvergleichsstufe eine Kompensationsgröße. Diese Phasenkompensation gelangt zusammen mit dem Ausgangssignal der Drehzahlregelstufe zur Motorsteuerstufe. Auf ndiese Weise bleibt als einzige Regeldifferenz dieser phasenstarr verriegelten Regelschleife (PLL: Phase Locked Loop) ein geringer aber praktisch konstanter Phasenwinkel zwischen Plattentellerposition und quartzkonstantem Referenzsignal übrig. ERin konstanter Phasenwinkel bedeutet in diesem Zusammenhang aber nichts anderes, als daß die Drehzahl des Plattentellers mit der Referenzfrequenz exakt übereinstimmt.

Die Drehzahl des Plattentellers selbst hängt damit entsprechend der beschriebenen Arbeitsweise der Regelschaltung nur von dem Referenzsignal selbst ab. Damit diese Referenzfrequenz von allen schädlichen Einflüssen unabhängig konstant bleibt, wird für ihre Erzeugung ein QWuartzoszillator verwendet, dessen

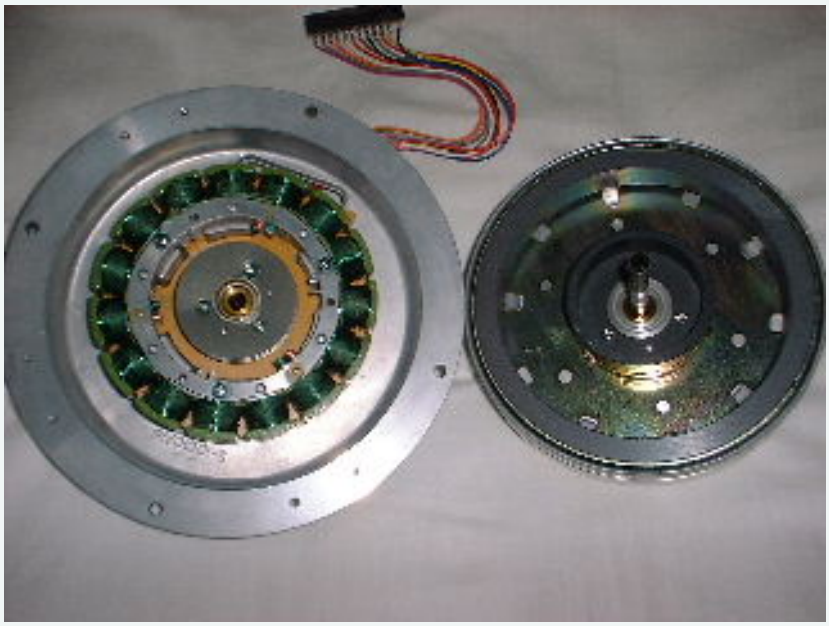
Frequenz weder von Netzfrequenz und Netzspannung noch von Temperaturschwankungen nennenswert beeinflusst wird. Das Ausgangssignal des Referenzoszillators durchläuft einen Frequenzteiler, der die Frequenz auf einen der gewünschten Plattentellerdrehzahl entsprechenden Wert herunterteilt. So bleibt die hohe Frequenzkonstanz des Quartzsignals auch für das Referenzsignal erhalten.

Der Frequenzteiler des SP-10 ist "programmierbar" - also eine Teilerschaltung, deren Teilerfaktor durch an seinen Programmieranschlüssen anliegende digitale Informationen verändert werden kann. 3 solcher Informationen sind in einem Festwertspeicher vorhanden und können mit dem am Bedienfeld angebrachten Tasten angewählt und dem Frequenzteiler zugeführt werden. Die Informationen sind so gewählt (Surprise, surprise...), daß der Frequenzteiler, die den Tellergeschwindigkeiten 33,33, 45 oder 78 U/min entsprechende Referenzfrequenz liefert. Dank der Motorregelschaltung hält der Plattenspieler dann die gewählte Geschwindigkeit mit höchster Genauigkeit ein.

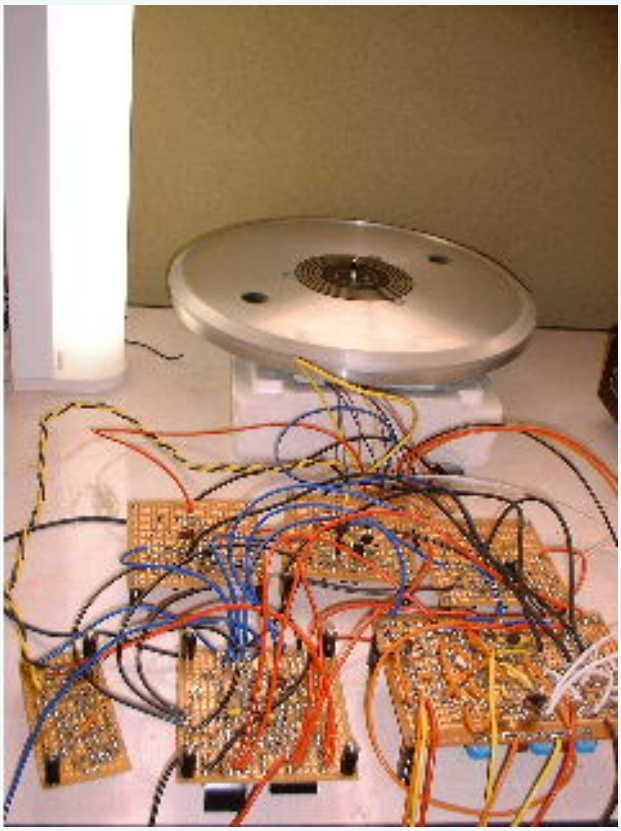
Auch beim SP-10 kann die Plattenteller-Drehzahl mit Hilfe eines Stroboskops optisch überwacht werden. Das Stroboskop wird nicht, wie sonst üblich, mit der Frequenz des Lichtnetzes, sondern ebenfalls mit dem quartzgenauem Referenzsignal angesteuert. Eine weitere geeignete Teilerschaltung arbeitet dieses Signal so auf, daß sich in Verbindung mit dem auf den Plattenteller angebrachten 190 Stroboskopstreifen immer ein stehendes Bild ergibt. So benötigt man zur Kontrolle der korrekten Geschwindigkeit nur einen Stroboskopring, so daß Verwechslungen ausgeschlossen sind und Fehlanzeigen aufgrund schwankender Netzfrequenz werden vermieden.
Bei dermaßen hochwertigen Antriebssystemen ist die Konstanz der Plattentellerdrehzahl weit besser als die

der Netzfrequenz. Wandert bei einer solchen Anordnung das Stroboskopbild ist der Geschwindigkeitsregelkreis nicht mehr eingerastet. Der Schaltungsaufwand ist erheblich: Der SP-10 enthält in seiner Urform 108 Transistoren, 14 IC's und 32 Dioden und Gleichrichter. Sie verteilen sich auf 6 Leiterplatten, von denen 4 unterhalb des eigentlichen Laufwerks und zwei in der in einem getrennten Gehäuse untergebrachten Stromversorgungseinheit angeordnet sind.

Und so sieht ein Motor und das Lager eines SP-10Mk2 aus:



Sooo viele Kabel:



Die Gründe, warum Tonabnehmer immer wieder anders beurteilt werden, hat Ihre Ursache oft darin, daß ein nicht zum Abnehmer passender Arm verwendet wurde und daß die Justagearbeiten nicht sauber ausgeführt wurden.

Kabel

Das Tonarmkabel ist das sensibelste Kabel innerhalb eines Audio-Systems. Bedenken Sie, daß bei MC-Systemen nur winzigste Spannungen zum Vorverstärker fließen. Die Diskussion welches Kabel an dieser Stelle am besten klingt, überlasse ich gerne anderen (ich verwende gerne RG-58 und RG-174 Koax-Kabel), aber Kanalungleichheiten aufgrund schlechter Lötstellen oder verdreckter Tonabnehmeranschlußpins oder Einstreuungen aufgrund direkt danebenlaufender Stromkabel müssen wirklich nicht sein.
Nach meiner Erfahrung sind insbesondere die Steckverbindungen sehr sensibel und sollten periodisch gereinigt werden. Bei älteren Armen bringt ein Austausch der Aussenverkabelung mit guten Steckern (Neutrik) mehr als man denkt. Tonarmkabel sollten an der Zarge befestigt werden und in einer Schlaufe zum Armsockel geführt werden. da sonst bei ungünstiger Verlegung Resonanzen zum Arm übertragen werden können.
Ein Austausch der Innenverkabelung geht meist einher mit der kompletten Demontage eines Arms. Die Gefahr dabei den Arm zu zerstören ist vorhanden und man sollte dies jemandem überlassen, der dies schon einige Male (erfolgreich) praktiziert hat.

Bauformen

Neben den Tangentialarmen, auf die ich mangels Erfahrung nicht näher eingehen will, existieren bei Drehtonarmen 2 prinzipielle Bauweisen:

- Einpunkt-Spitzengelagerte Arme
  Vorteile dieser Arme ist die prinzipielle Reibungs- und Resonanzarmut des Spitzenlagers, sowie dessen Lebensdauer. Auch ist die Performance vieler Einpunkter unabhängiger vom Laufwerk und vom verwendeten Tonabnehmer. Nachteil sind das "schwabbelige" Handling bei der Justage und im Gebrauch. Klanglich bestechen die meisten spitzengelagerten Arme durch Unangestrengtheit, Feindynamik und Luftigkeit. Tiefe, kontrollierte Basswiedergabe gehört aber nicht unbedingt zu den Stärken dieses Prinzips.
- Arme mit spearaten Lagern für die Horizontal und Vertikalbewegung
  Die verbreitetere Bauform. Mit Erscheinen des Linn Ittok in den 80ern wurde der Drehtonarm sozusagen neu definiert. Ein massives, stabiles Armrohr in Verbindung mit exterm präzisen Kugellagern galt von nun als State Of The Art. SME antwortete mit dem V, Rega mit dem RB-300. All diesen Armen ist ein tiefreichender, kontrollierter Bass, gute Grobdynamik und schnelle rhythmisch präzise Wiedergabe zu eigen. Leider geht dies einher mit mehr oder weniger ausgeprägten Resonanzen im Mittel- und Hochtonbereich, worunter die Wiedergabe

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