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Quartz PLL

DIRECT DRIVE TURNTABLE

PLC-590

OPERATING INSTRUCTIONS

KUT

IMPORTANT NOTICE

The serial number for this equipment is located on the rear. Please write this serial number on your enclosed warranty card and keep in a secure area. This is for your security.

series 20®

WARNING: TO PREVENT FIRE OR SHOCK HAZARD, DO NOT EXPOSE THIS APPLIANCE TO RAIN OR MOISTURE.

Thank you for buying the Series 20 PLC-590 Quartz PLL Direct Drive Stereo Turntable.
The PLC-590 is a turntable whose speed is controlled with a high degree of precision by a PLL servo control system that employs a DC Hall motor and a quartz oscillator.
When you have assembled the high-performance tonearm and attached it to the turntable, you have a hi-fi component that will always give you the best in record reproduction and the ultimate in satisfaction.
Before using your turntable, please read these operating instructions and make sure that you understand them.

CONTENTS

FEATURES

High-performance Quartz PLL Hall Motor

The platter speed is controlled by a quartz phase-locked loop (PLL) system which phase-compares the output signal from the high-precision quartz oscillator with that of a frequency generator incorporated in the Hall motor rotor. The combination of this system with a center shaft machined almost to perfection (less than 0.2μ deviation from a perfect circle), bearings, and a large platter with an inertial mass of 350 kg/cm^2 makes for a smooth yet accurate speed of revolution as well as for such superb characteristics as:

- Wow and flutter: less than 0.025% (WRMS)
- Signal-to-noise ratio: 75dB (DIN-B)
- Speed deviation: ±0.002%
- Time drift: less than 0.0003%/h
- Temperature drift: less than 0.00004%/°C

Another superlative feature is that the servo system operates to compensate for any tendency to deviate from the rated speed, whether faster or slower. This system is backed up by a bi-directional drive circuit and together they cut down drastically the amount of time required to reach the rated RPM when changing speeds.

All-electronic Brake

When you want to bring the platter to a standstill, current passes in the reverse direction to the motor and this causes the speed to fall off rapidly. Just before the speed is cut off completely, the turntable's all-electronic brake swings into action and shuts off the power to the motor. Compared with mechanical devices that use brake shoes, this electronic system does not apply any direct physical load to the turntable and so features excellent durability.

Pitch Control and Large, Easy-to-See Pitch Indicator

The pitch control allows you to adjust the musical steps when you are playing a musical instrument or practising along with a record. You can vary the platter's speed and make it up to 6% faster or slower than its rating simply by setting the Quartz LOCK switch to OFF and then turning the SPEED ADJ. switch (maximum adjustment of this is almost equivalent to a semitone). At the same time, you can read out the speed deviation accurately on the large pitch indicator.

Useful Attachable and Detachable Tonearm Board

You can attach just about any 14-inch class tonearm sold on the market to your PLC-590. So what you can do with surprising ease is compare and contrast different tonearms because you can change over the boards — all you have to do is remove the board's four screws. The PLC-590 comes with an accessory mounting board which has already been machined to accommodate the SME-3009/II tonearm and the Pioneer PA-1000 tonearm. This means that you do not have to do any machining yourself.

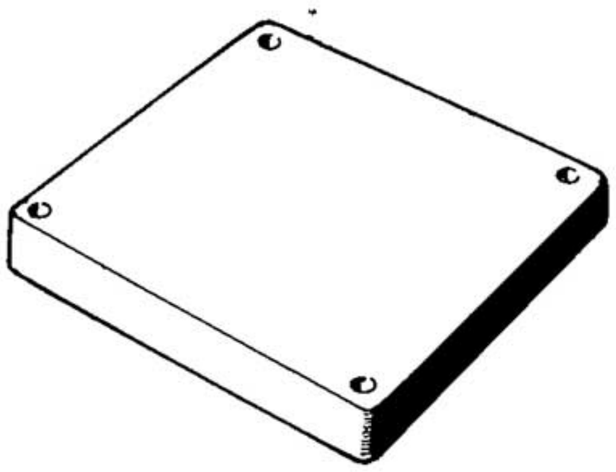
Black Metallic Aluminum Die-cast Cabinet

The cabinet is made of die-cast aluminum and the outer panels feature a dual construction. All this adds up to a solid cabinet weighing 4.7kg whose large insulators are very effective in minimizing external vibrations and providing excellent resistance to resonance that might impair the hi-fi quality of the record reproduction. The cabinet is colored with a black metallic finish which gives the turntable an air of distinction. In other words, the PLC-590's design and top-class performance make it a hi-fi status symbol that any audiophile would be eager and proud to own.

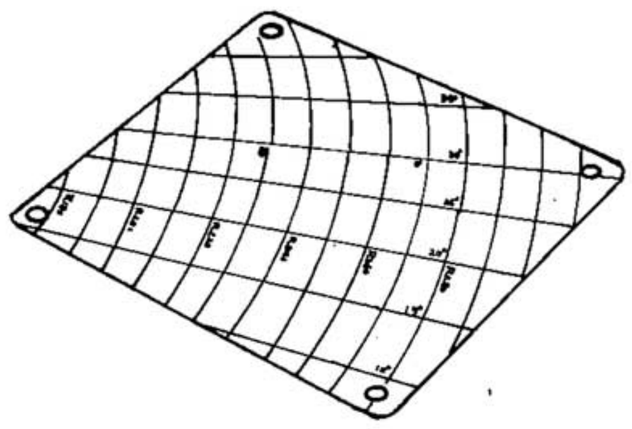
**SME-3009/II:* *this is a 14-inch tonearm and typical of the models offered by SME of the U.K.*
**PA-1000:* *this is a top-line carbon fiber pipe tonearm manufactured by Pioneer.*

NAMES OF THE ACCESSORIES

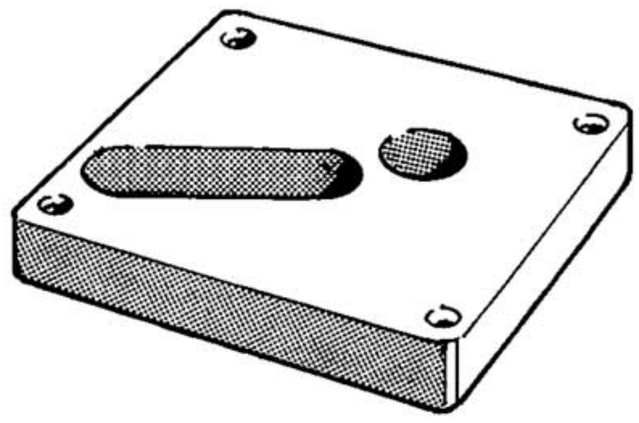
The PLC-590 comes with the following parts. Make sure that you understand exactly what each accessory is for.



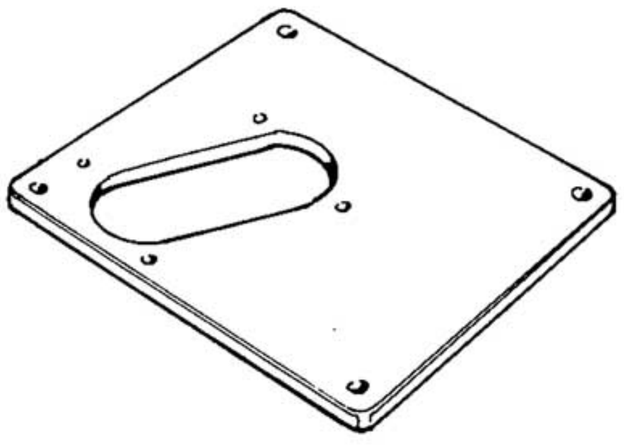
Regular tonearm mounting board
This board is used when mounting any make of tonearm except the SME-3009/II and the PA-1000. Drill before attaching.



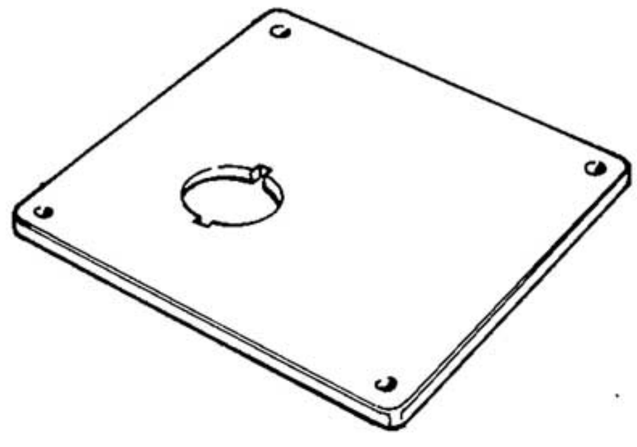
Regular tonearm mounting papers (2)
This paper is used to determine the tonearm's mounting position. It is placed over the tonearm mounting board.



Machined mounting board
This mounting board has two holes drilled in it to accommodate the SME-3009/II tonearm and the PA-1000 tonearm made by Pioneer.



SME-3009/II aluminum plate
Use this plate when mounting the SME-3009/II tonearm.



Aluminum plate for PA-1000
This aluminum plate is used when mounting the Pioneer PA-1000 tonearm.

Hexagonal wrench
Use this wrench to tighten the screws for fastening the tonearm board.

Arm rest
Use this arm rest if there is not one provided with the tonearm you intend to use.

Screws for tonearm board (4)
These four screws are used to mount the tonearm board into position.

Nylon washers (4)
These four washers are used to mount the regular tonearm mounting board into position.

45 RPM adaptor
Place this adaptor over the center shaft when playing EP (large hole) records at 45 RPM.

Screws (4) and washers (4) for SME-3009/II
The four screws and washers are used to fix the SME-3009/II into place.

SME-3009/II aluminum plate, the machined mounting board and the screws for the tonearm board have been attached to the unit before shipping.

INSTALLATION

When installing your PLC-590, avoid the following locations which are liable to downgrade the turntable's performance or cause damage.

LOCATIONS TO BE AVOIDED	POSSIBLE PROBLEMS, DAMAGE
• Locations exposed to direct sunlight, high temperatures or high humidity	• Can cause rust or interfere with insulation
• Locations with surfaces which are not flat	• Can impair normal operation of turntable (stylus jumps)
• Dusty or dirty locations	• Can cause scratches and noise
• Locations susceptible to a great deal of vibration, such as the top of speakers, etc.	• Can cause howling. Can also cause stylus to jump which will damage the record
• Locations close to the power transformers of amplifiers	• Can cause hum, noise
• Locations where you might use alcohol, insect sprays or any volatile liquids	• Can cause corrosion of the cabinet's front panel, or of the dust cover

MOUNTING PROCEDURE

MOUNTING THE SME-3009/II

The PLC-590 comes with a special aluminum plate and the machined mounting board for audiophiles who wish to mount the SME-3009/II. Simply mount the SME-3009/II's bed plate on the aluminum plate, and you don't have to go to the trouble of drilling a hole. Use the screws and washers that come with the PLC-590 to mount the bed plate. Follow the procedure outlined in the SME-3009/II's instruction booklet.

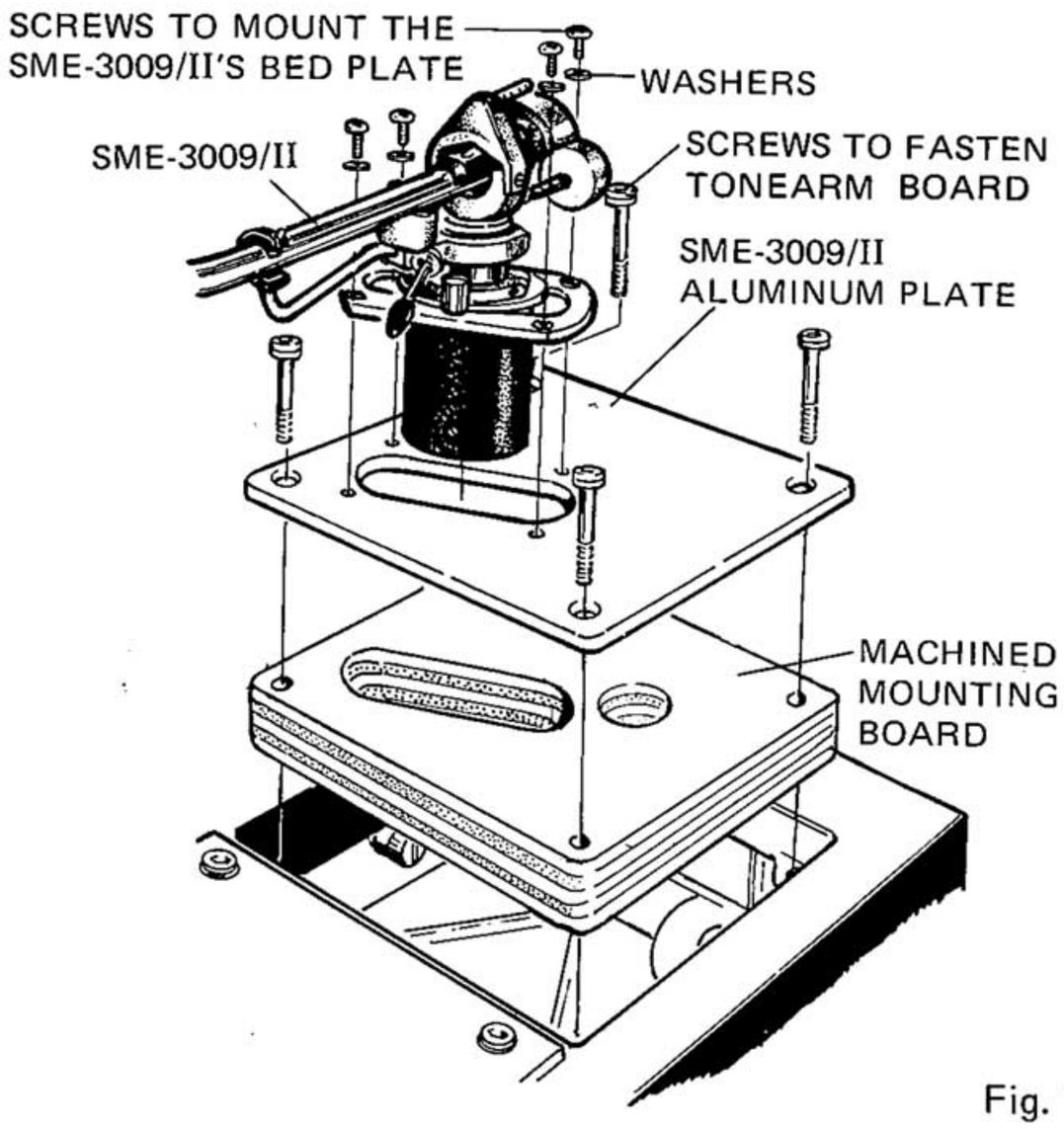


Fig. 1

MOUNTING THE PIONEER PA-1000

Take out the machined mounting board which is attached to the turntable when shipped from the factory. Turn it through 180 degrees and place the aluminum plate used to mount the PA-1000 on top (Fig. 2). Follow the procedure outlined in the PA-1000's instruction booklet. After you have mounted the tonearm on the mounting board and aluminum plate, secure to the PLC-590 with the four mounting screws.

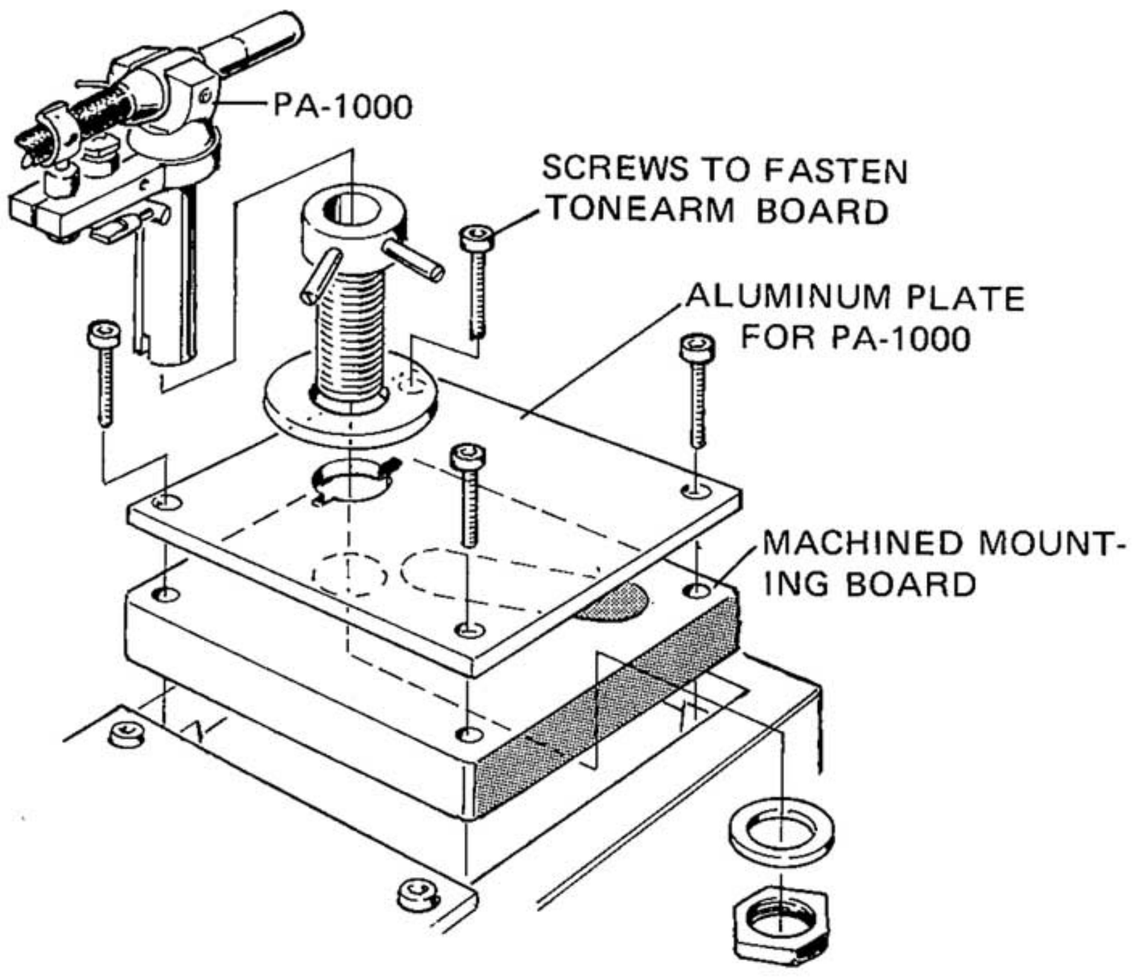


Fig. 2

USING THE MOUNTING PAPER

The mounting paper has gradations marking the angles to the center shaft of the tonearm axis and the distance from the center shaft. (See Fig. A)

Mounting the tonearm

The position of the tonearm axis is located on the circumference of a circle whose radius from the center shaft is the effective length of the tonearm minus the value of the tonearm's overhang. As long as the tonearm is positioned along this circumference, it will function normally. When actually determining the tonearm's position, please take special care to avoid allowing the tonearm to come into contact with the dust cover. Also, make sure that nothing is allowed to impair its operation. When the tonearm's instruction manual specifies the mounting angle follow that direction.

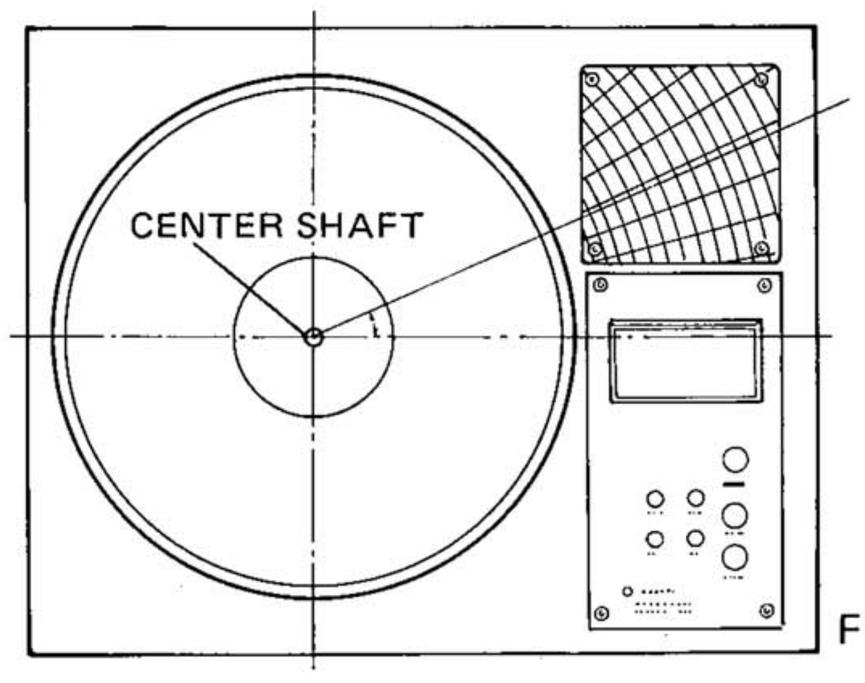


Fig. A

Example: Mounting a tonearm whose overhang is 15mm and whose effective length is 237mm.

First, find out the radius of the circle:
237mm (effective length) — 15mm (overhang) = 222mm
Next, position the axis of the tonearm so that it coincides with the circumference of the circle marked on the mounting paper with a value closest to 222mm.
Place the tonearm on this line to see that nothing will impair its operation after it has been mounted.
Pinpoint the final position. Finally, use the position you have chosen as the center from which to draw a circle whose diameter is the same value as the tonearm axis diameter.

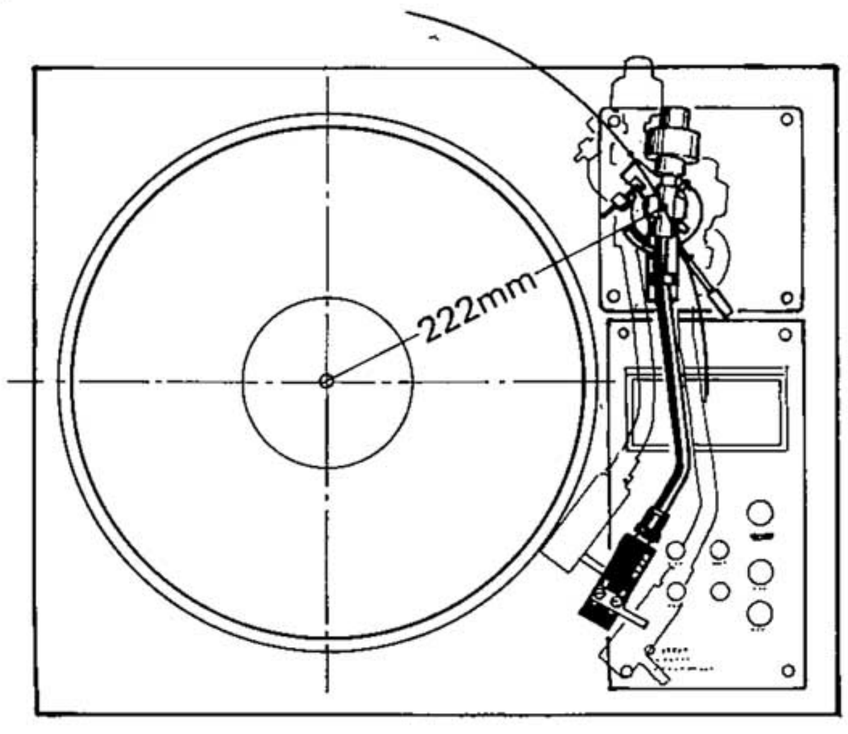


Fig. B

MOUNTING A REGULAR TONEARM

1. Remove the machined mounting board and the SME-3009/II aluminum plate

By the time your PLC-590 leaves the factory, the machined mounting board and the aluminum plate have already been mounted. Use the accessory hexagonal wrench to undo the four screws that hold it in place, and then remove the machined mounting board and the aluminum plate.

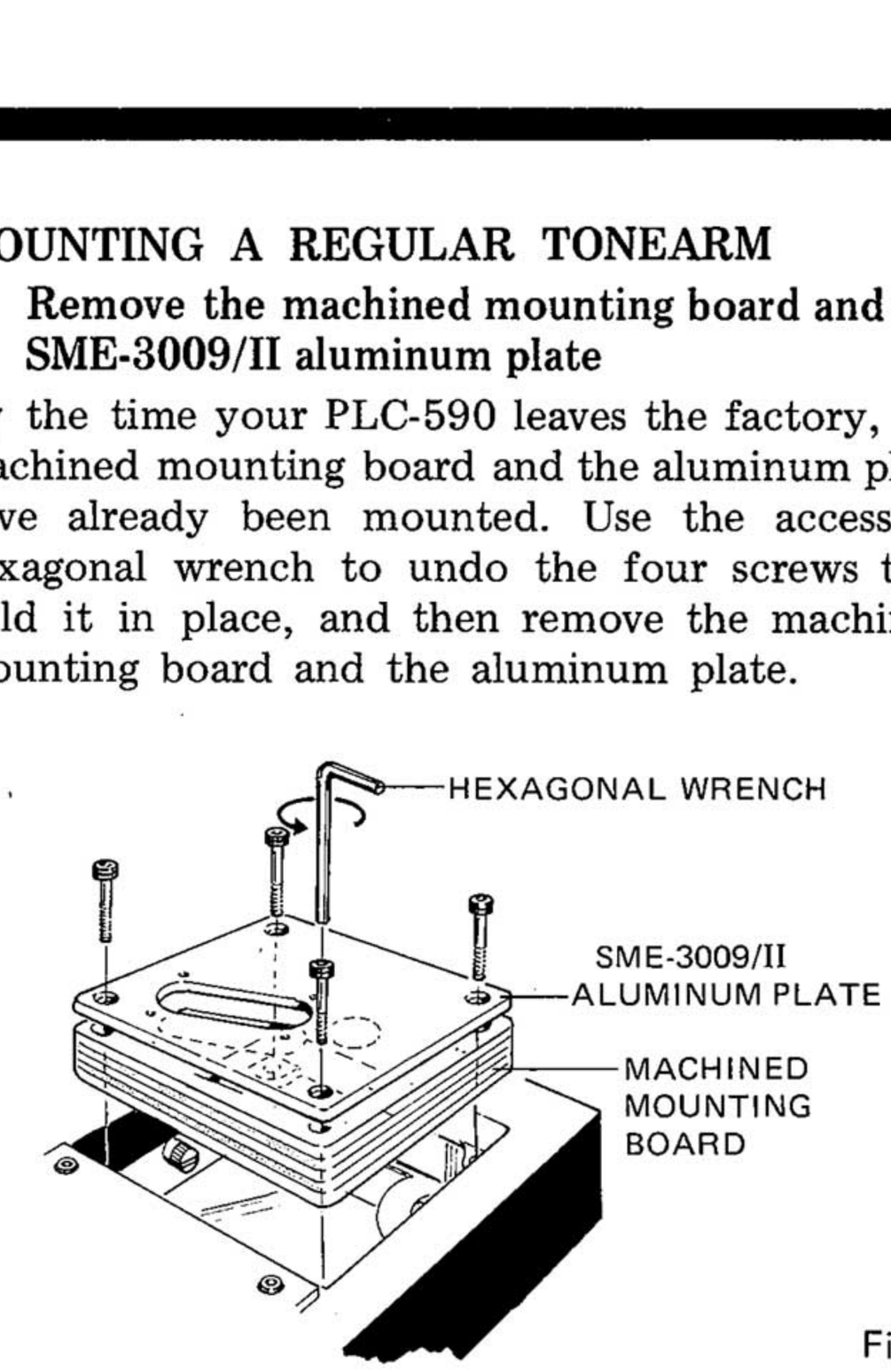


Fig. 3

2. Mount the mounting paper

As illustrated in the figure, align the holes in the accessory mounting paper with those on the tonearm mounting board immediately underneath. There is an arrow (⇩) on the bottom of the regular tonearm mounting board which should point toward you if you are in front of the turntable. Use the screws to fasten the two accessories into place.

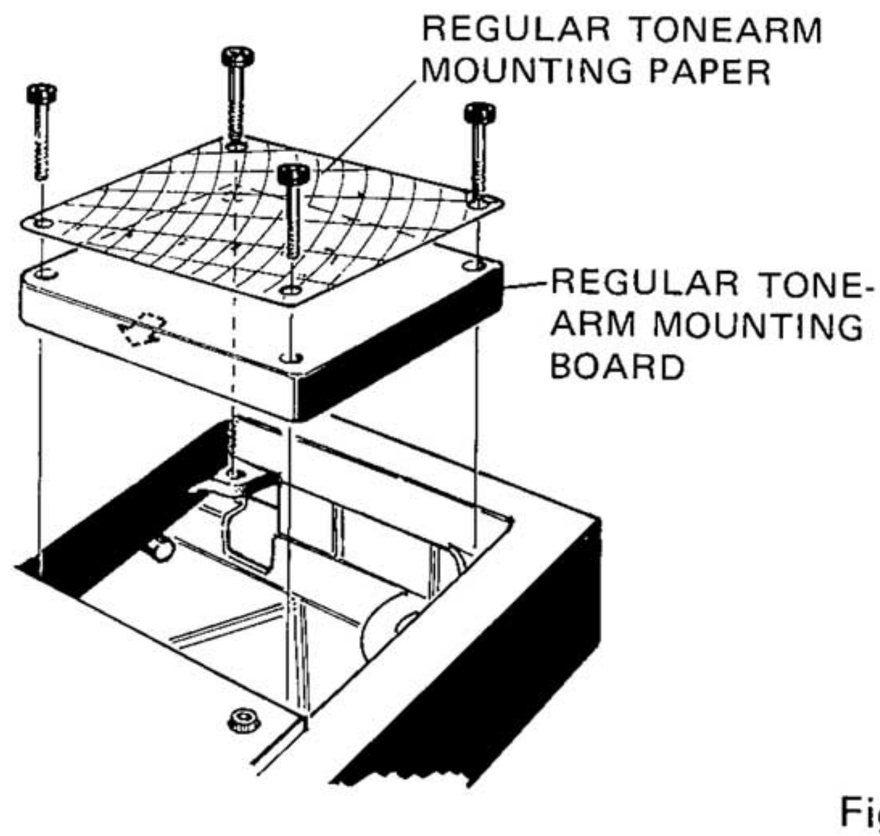


Fig. 4

3. Mark the paper

Following the instructions outlining the mounting of the tonearm, find the center of the tonearm on the paper, and mark. Then, using the pair of compasses, draw a circle on the paper in accordance with the diameter of the tonearm axis.

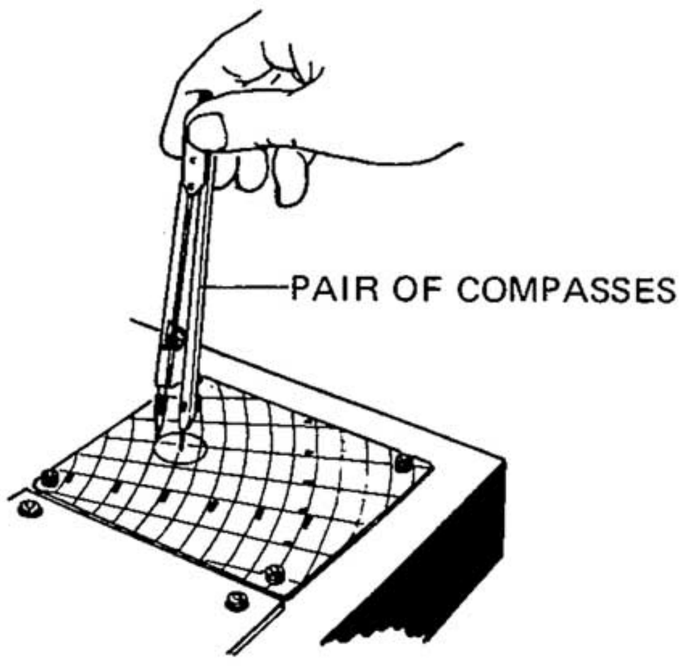


Fig. 5

4. Marking the mounting board

Use the card punch to mark the mounting board at the center of the tonearm axis.

5. Drilling the board

Remove the mounting board by undoing the screws. Fasten it so that it does not move, and drill a hole whose diameter is the same value as the tonearm axis diameter.

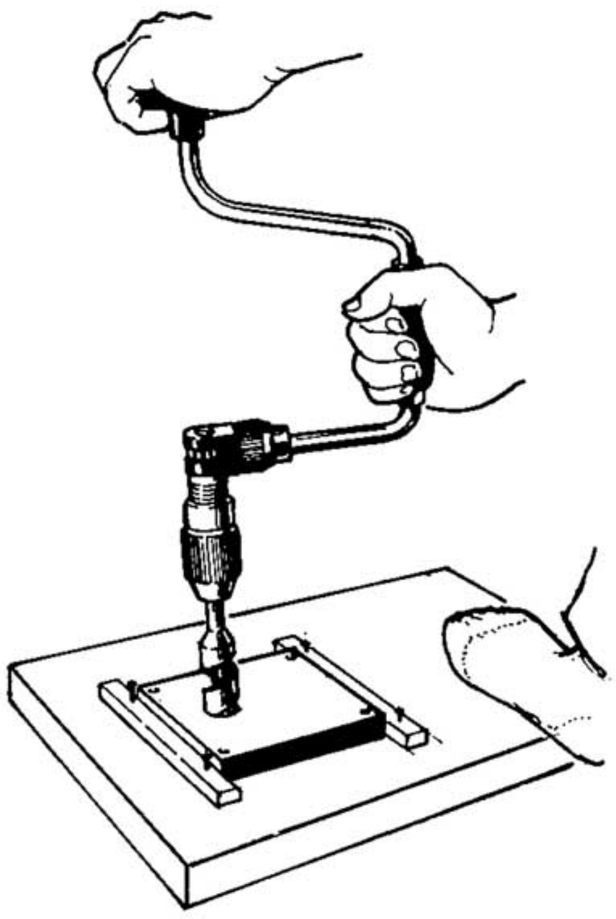


Fig. 6

6. Mounting the tonearm

Follow the procedure outlined in the tonearm's instruction booklet, and secure the tonearm to the mounting board. Connect the tonearm's ground lead protruding from the output cable to the ground terminal inside the PLC-590's cabinet (Fig. 7).

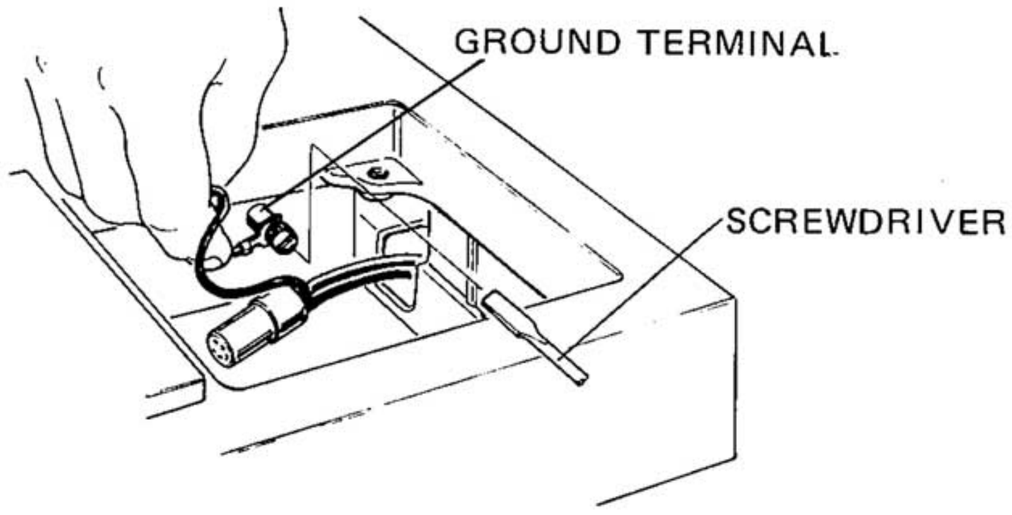


Fig. 7

7. Fix the mounting board into place

After dealing with the output terminals, replace the board and screw into position with the four screws using the hexagonal wrench. Make sure the washers are sandwiched between the heads of the screws and the board.

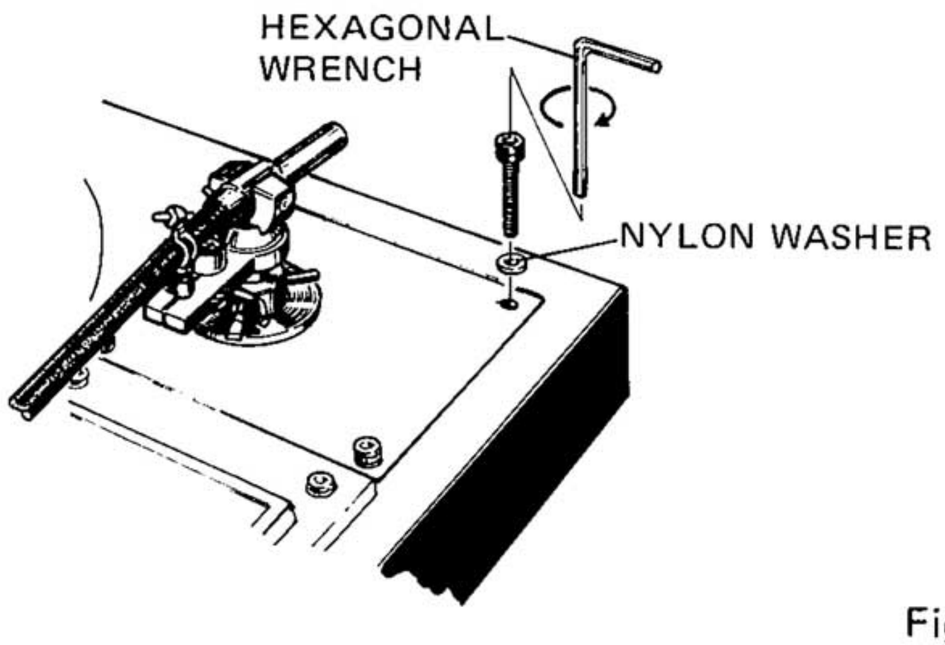


Fig. 8

USING THE ACCESSORY ARM REST

Use the PLC-590's accessory arm rest if you have mounted a tonearm which is not equipped with its own arm rest. There is a strip of adhesive tape on the bottom of the rest. Peel this strip off and stick the arm rest on to the control panel.

NOTE: You can adjust the height of the arm rest. Simply loosen the screw at the side with a screwdriver and adjust the height of the arm rest to match that of the tonearm when it is parallel with the record surface.

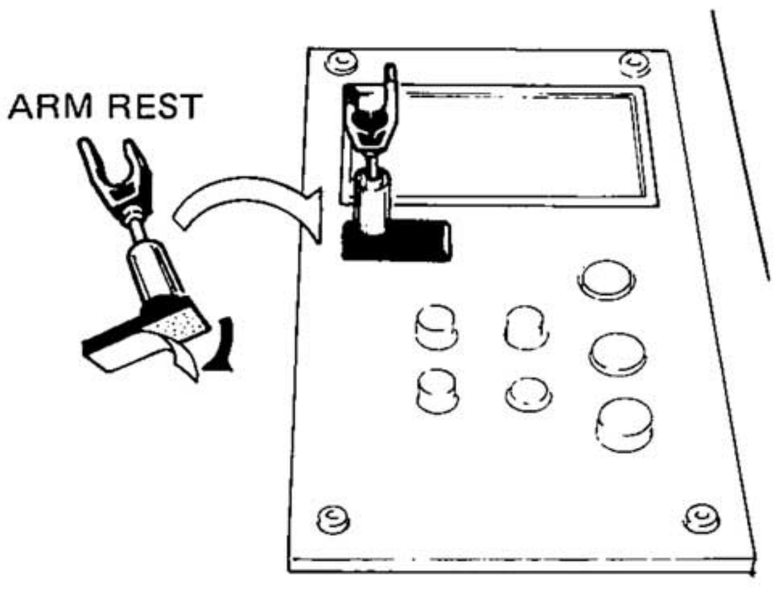


Fig. 9

ASSEMBLY PROCEDURE

1. MOUNTING THE PLATTER

Slip the platter over the center shaft, bearing in mind that it is a weighty component and that, when mounting, excessive pressure should not be applied to the center shaft.
Then, place the platter mat over the platter.

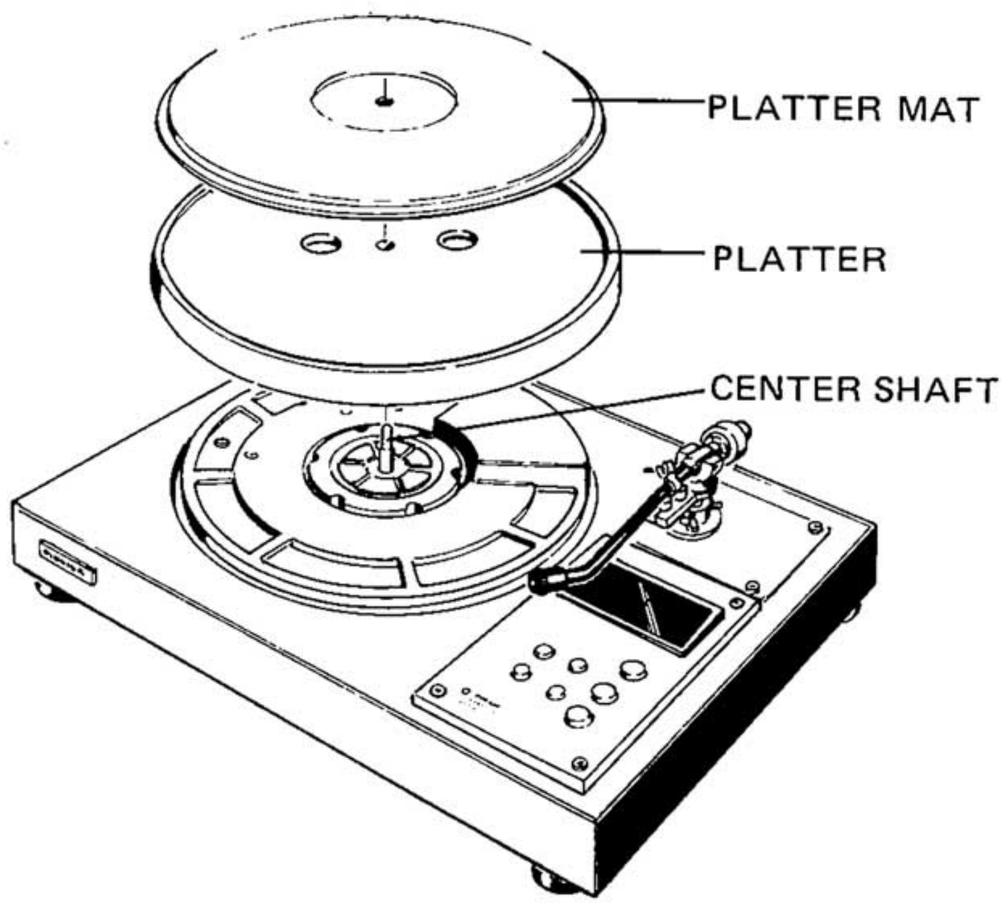


Fig. 10

2. ATTACHING AND REMOVING THE DUST COVER

Attach the dust cover by inserting the hinges into the fittings on the rear panel of the cabinet. It will fall smoothly into place if attached from behind the turntable.
To remove the dust cover, first open it fully and then lift it straight up.

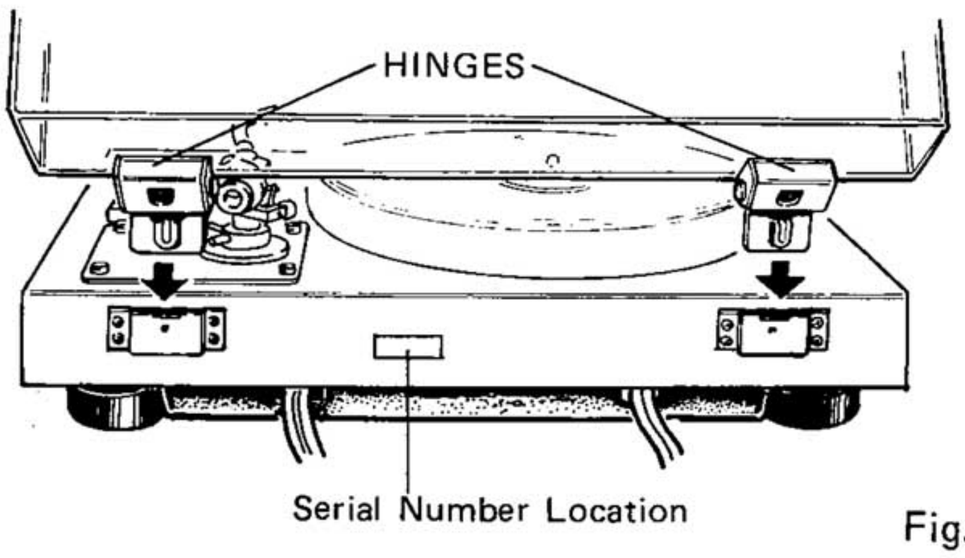


Fig. 11

CARE AND MAINTENANCE PRECAUTIONS

MOUNT PLATTER FOR CORRECT MOTOR OPERATION

If the motor is run with the platter removed, it will not operate properly. It will, however, act normally once the platter is mounted.

DO NOT TAMPER WITH THE MOTOR

The PLC-590's motor is finished to a very high level of precision, and therefore you should not remove the motor cover and touch any of the parts inside. In the unlikely event that the motor should break down, do not attempt to repair it yourself but get in touch with your nearest Series 20 service center or service station.

CLEANING THE CABINET

When the cabinet or the dust cover is dusty or dirty, wipe it clean with a polishing cloth or a soft, dry cloth. Never clean with furniture wax, benzine, insecticides or other volatile liquids since they may corrode the front panel.

LUBRICATION

There is no need to worry about lubrication since the PLC-590 employs oil-less bearings.

ADJUSTING THE INSULATORS

The PLC-590 has four feet, which also serve as insulators and which can be used to adjust the height of the turntable. Turn them clockwise to lower the turntable, and counterclockwise to raise the height. Adjust where necessary.
Turning the insulators 360° lowers, or raises, the height by roughly 0.5mm.

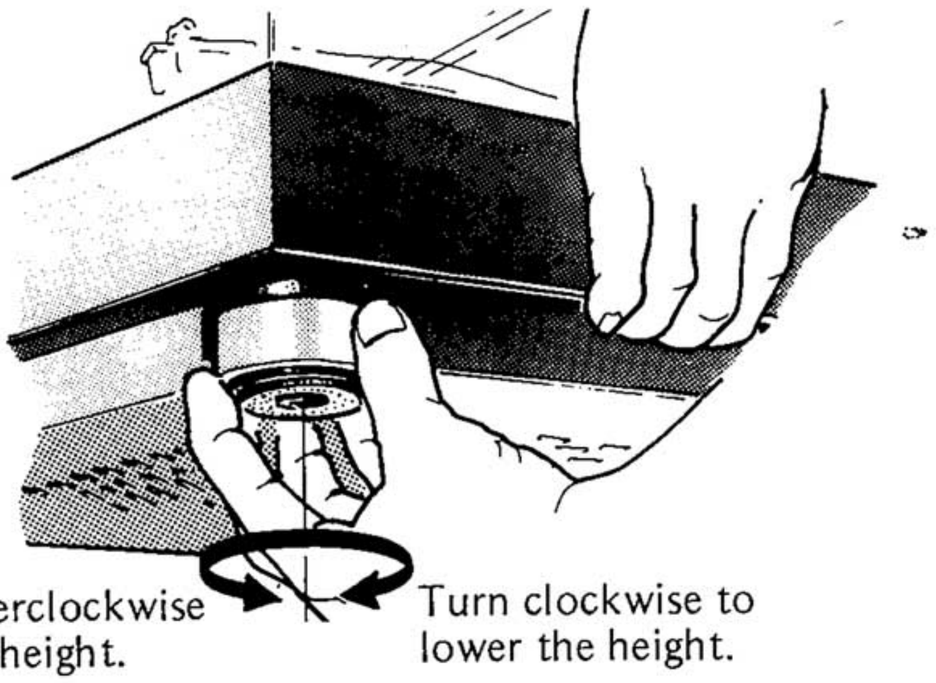
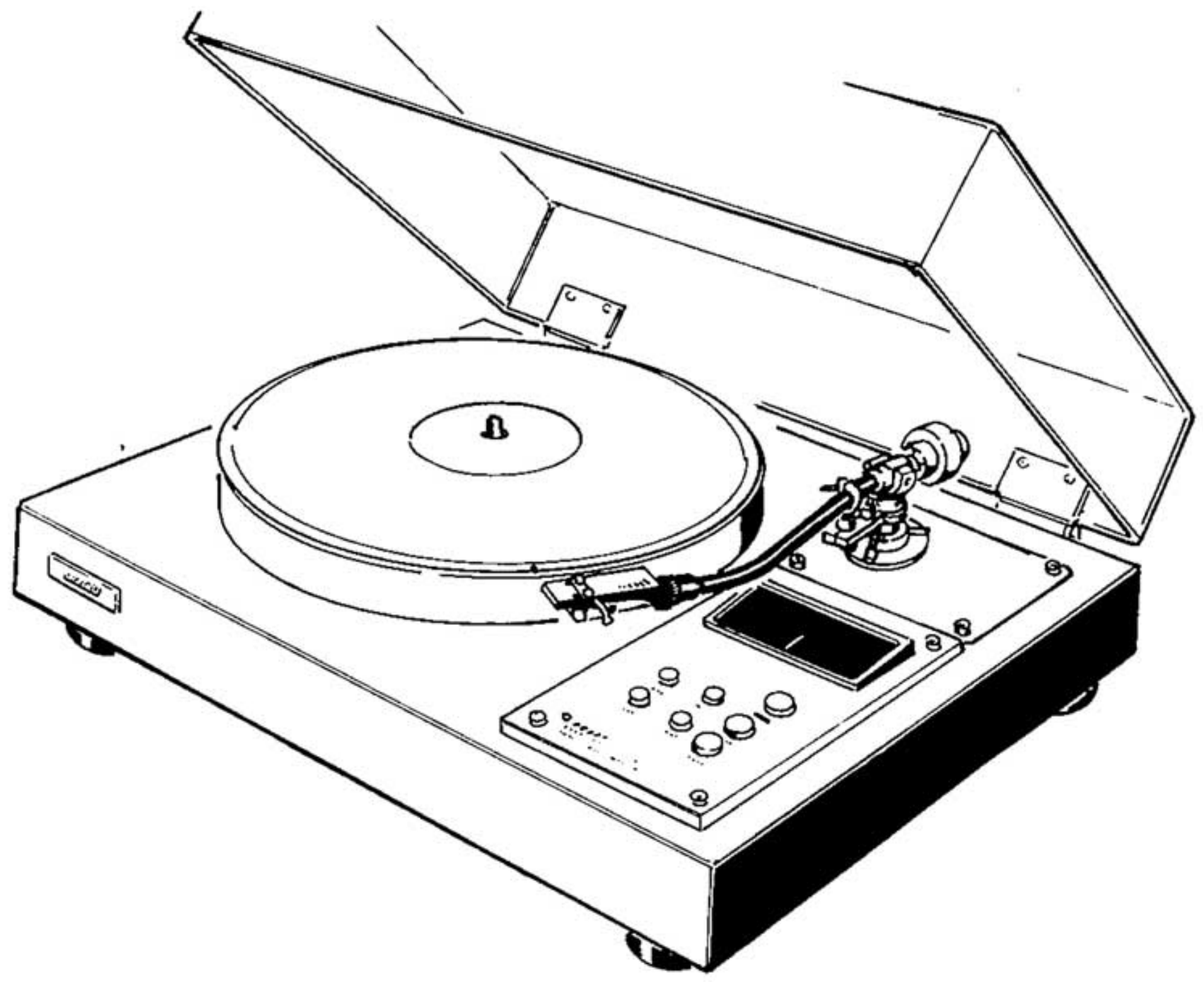


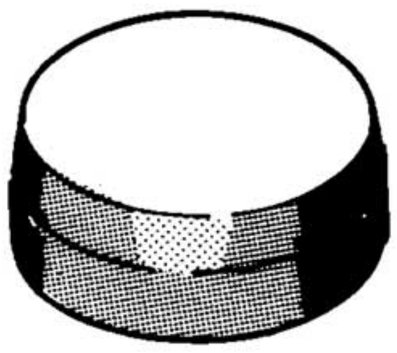
Fig. 12

NAMES OF PARTS AND THEIR USES



45 RPM ADAPTOR

Place this adaptor over the center shaft when playing EP (large hole) records at 45 RPM.



SPEED ADJUSTMENT KNOB (SPEED ADJ.)

Turn this knob, with the Quartz LOCK switch set to the OFF position, to increase or decrease the platter speed. Turn it in the (+) direction to increase the speed, and in the (–) direction to decrease the speed.

QUARTZ LOCK SWITCH

When this switch is depressed (ON▬), the quartz PLL circuit becomes operational and the speed of the platter is locked accurately to the rated speed (45 or 33-1/3), depending on the setting of the speed buttons.
(When set to the ON position, the illuminated meter scale goes off, and the words 'Quartz Lock' light up).

33-1/3 RPM BUTTON

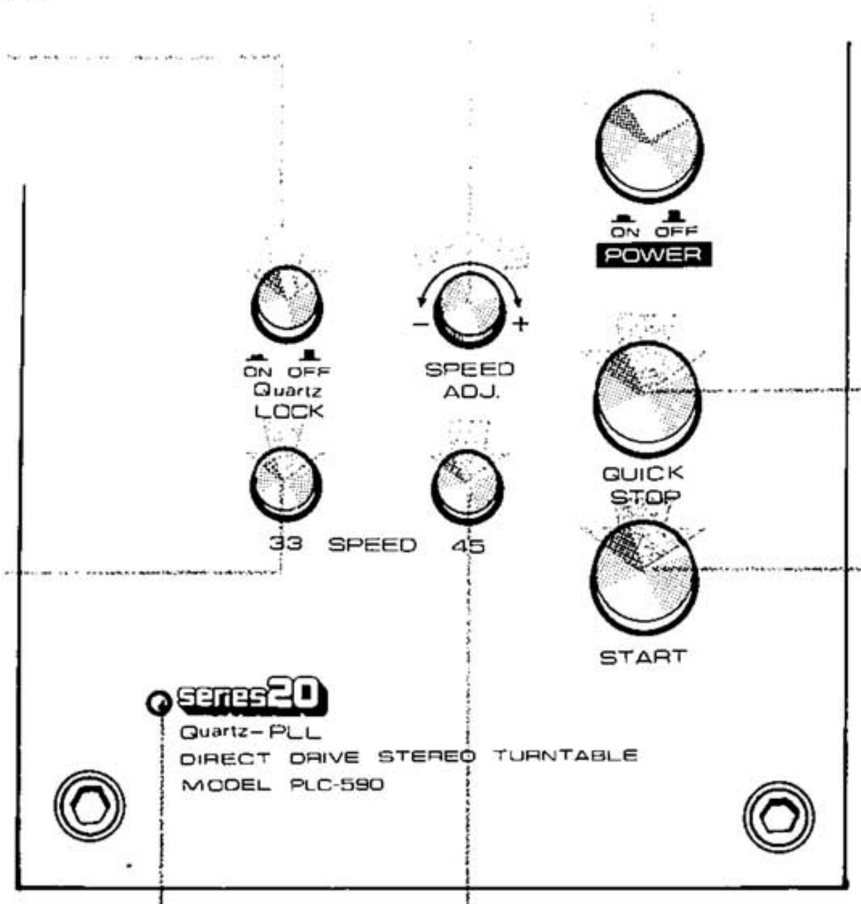
Depress this button when playing a 33-1/3 RPM record.

45 RPM BUTTON

Depress this button when playing a 45 RPM record.

POWER INDICATOR

This indicator lights up as soon as the POWER switch is depressed and power is supplied to the turntable.



POWER SWITCH

Power is supplied to the PLC-590 when this switch is depressed (ON▬). (The power indicator lights up and the speed is indicated on the meter panel). Releasing this button cuts off the power, and the platter stops.

QUICK STOP BUTTON

Depress this button to turn the motor off.

START BUTTON

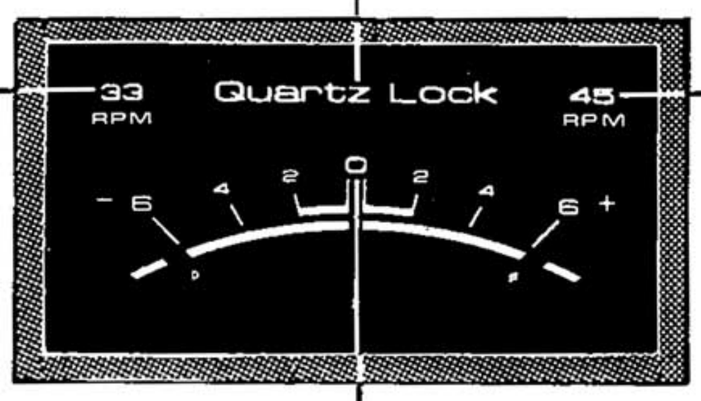
The platter starts to rotate when this button is depressed.

QUARTZ LOCK INDICATOR

When the Quartz LOCK switch is depressed to the ON position, and the platter speed is locked to the rated speed (45 or 33-1/3 RPM) depending on the setting of the speed buttons, then this indicator lights up.

33-1/3 RPM INDICATOR

This lights up to indicate that the platter is rotating at a speed of 33-1/3 RPM.

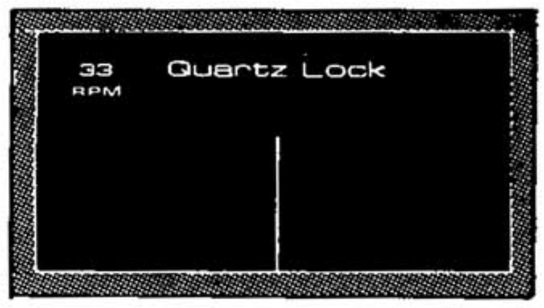


45 RPM INDICATOR

This lights up to indicate that the platter is rotating at a speed of 45 RPM.

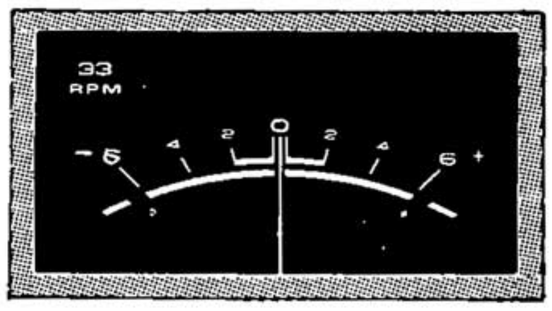
PITCH INDICATOR

When the Quartz LOCK switch is released (OFF position), then the pitch indicator scale is illuminated. You can read out the percentage of the RPM deviation (%) from the rated platter speed indicated at the top left or right of the meter when turning the speed adjustment knob.



QUARTZ LOCK ON

This is how the panel looks when the Quartz LOCK switch is depressed (ON position): the Quartz Lock indicator and the speed indicator both light up.



QUARTZ LOCK OFF

This is how the panel looks when the Quartz LOCK switch is released (OFF position): the speed indicator and the pitch indicator meter scale are both illuminated.

USING THE SPEED ADJUSTMENT KNOB

Under normal circumstances it is unnecessary to adjust the platter speed because when the Quartz LOCK switch is in the ON position, the Quartz oscillator provides the reference signal that keeps the platter at the rated speed. Nevertheless, there may be times when you want to vary the pitch of the record being played. This is why the PLC-590 is equipped with a speed adjustment knob and a pitch indicator.

Turning the Quartz LOCK switch to the OFF position shuts down the quartz oscillator that provides the PLL circuit's reference signal. This action also actuates the high-precision RC oscillator which adjusts the platter speed, and the PLL circuit receives its reference signal from this oscillator instead of from the quartz oscillator. When the platter speed is varied, the output frequency of the RC oscillator is varied, too. The amount the speed is increased, or decreased (in either case this is expressed as a percentage on the meter) is maintained accurately by the PLL circuit.

Release the Quartz LOCK switch and listen to the sound, all the while turning the speed adjustment knob. Turn this knob in either direction until you find the pitch you like. Turning it in the (+) direction increases the pitch, while the pitch decreases if it is turned in the (—) direction.

Use this knob to change the pitch of a record and compensate for any slight deviations in the notes in cases when you want to practise on the piano or other instrument in tune with the music on the record. This may be necessary because pianos are tuned to high international standards and also because there are slight differences in sound when delivered from different orchestras.

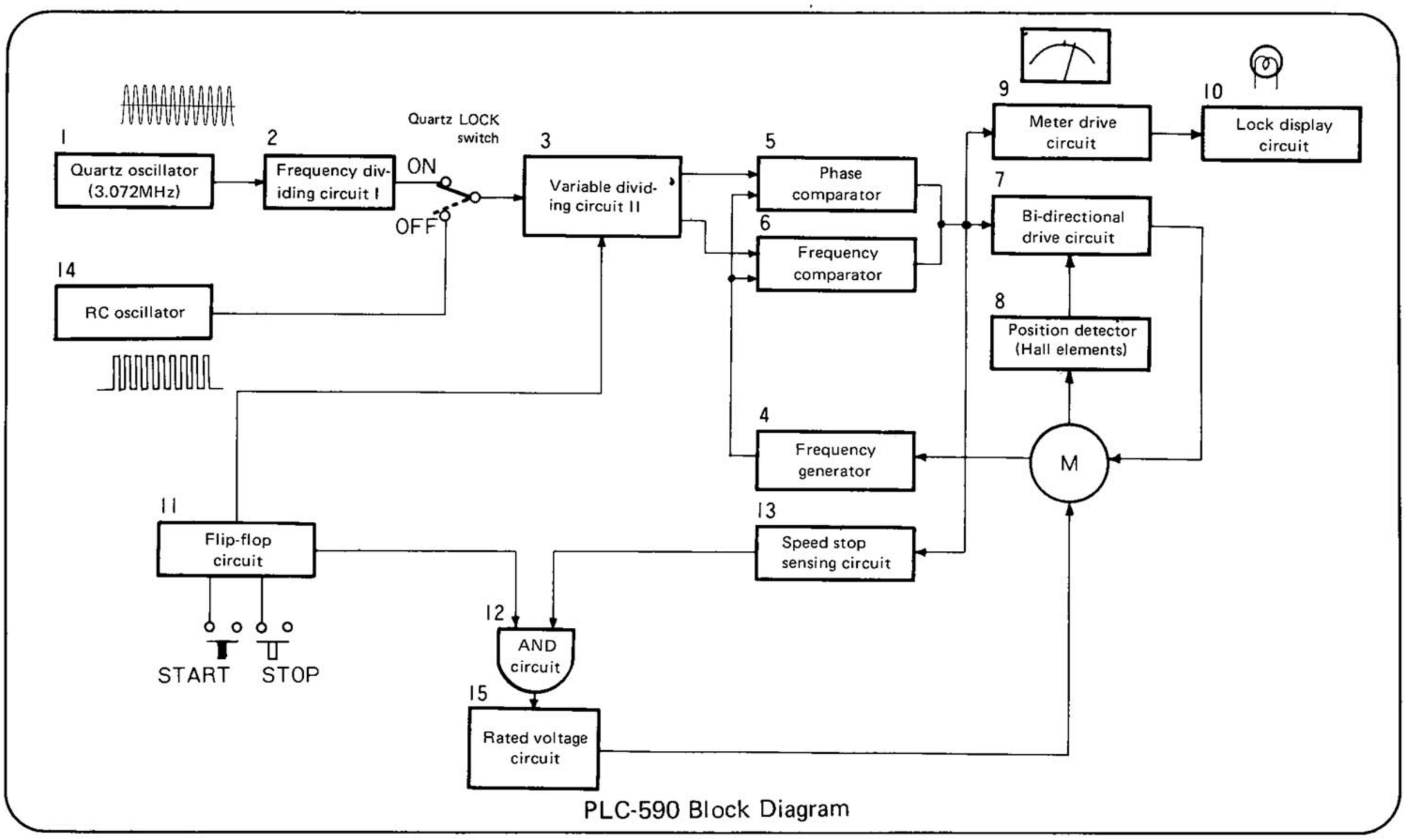
As you turn the knob, the deviation from the rated speed is expressed as a percentage on the meter. The speed can be increased, or decreased, a maximum of 6% from its rating. This range is roughly equivalent to a semitone on the musical scale.

OPERATING PRINCIPLES

The PLC-590 employs a quartz PLL-controlled Hall motor which derives its reference signal from a quartz oscillator. Its operating principle is outlined opposite with the help of a block diagram.

1. **Quartz oscillator:** This produces a reference signal which controls the speed of the phono motor. It assures a very high level of stability and precision because its crystal is not subject to changes in the temperature or humidity, or to variations caused by ageing. It could be described as the heart of the PLC-590.
2. **Frequency dividing circuit I:** The oscillator employs a higher frequency (3.072MHz) than is required in actual practice so that it may function both stably and rationally. Frequency dividing circuit I divides this high frequency signal by an integral number to obtain a frequency of 6kHz.
3. **Variable dividing circuit II:** This divides the 6kHz signal to obtain a reference frequency corresponding to one of the two platter speeds (45 or 33-1/3 RPM). The signal from the frequency generator will be compared with this signal.
4. **Magnetic pulse sensing frequency generator:** Magnetic induction occurs in the motor sensing speed plate when the rotor magnets pass over it, and this produces an alternating current signal corresponding to the speed of the platter.
5. **Phase comparator:** The phase of the alternating current signal from the platter frequency generator is compared with the phase of the reference signal obtained from the variable dividing circuit II. The control voltage equivalent to the difference between the two phases is detected and this actuates the bi-directional drive circuit. In this way the platter (motor) is phase-locked to ensure servo control.
6. **Frequency comparator:** In the same manner as the phase comparator, the frequency of the signal from the platter frequency generator is compared with the reference frequency derived from the quartz oscillator. This circuit is in parallel with the phase comparator and it improves the motor's transient characteristics as well as other PLL characteristics.
7. **Bi-directional drive circuit:** This circuit controls the motor speed in response to the outputs of the phase and frequency comparators. An accelerative or decelerative torque is applied to the platter depending on the needs of the motor at any given instant. This system provides external forces which tend to change the platter speed, and it provides instant change to the selected speed when switching from 45 or 33-1/3 RPM or vice versa.
8. **Position detector:** Three Hall elements are installed at 120° phase angles inside the motor. As the rotor turns, the Hall elements emit voltages corresponding to the polarity of the magnets contained in the rotor. Transistor switching in the bi-directional drive circuit is controlled by these voltages (wound rotor switching).
9. **Meter drive circuit:** This circuit drives the meter by converting the motor's frequency detection signal through the control system to a voltage, and it ensures that the meter's speed indications are always accurate.
10. **Lock display circuit:** When the Quartz LOCK switch is set to the ON position and the platter attains its rated speed, the pilot lamp lights up to indicate 'Quartz Lock ON'. This circuit does not operate when the platter speed deviates from its rating.
11. **Flip-flop circuit:** This circuit applies the START or STOP indication signal to the motor. Switching the power switch ON keeps this circuit at the STOP side.
12. **AND circuit:** Once the START button is depressed, the flip-flop circuit reverts to the START side, and a signal is sent to the AND circuit.
13. **Speed stop sensing circuit:** When the STOP button is depressed, the flip-flop circuit reverts to the STOP side and it sends a 'stop' signal to the motor and the AND circuit. The motor then slows down rapidly and the frequency generator's frequency falls. The speed stop sensing circuit applies a 'stop' signal to the AND circuit when it receives a signal which is lower than the preset frequency. This signal, together with the other signal kept in the flip-flop circuit, actuates the AND circuit. It also turns the rated voltage circuit off and shuts down the motor.
14. **RC oscillator (for speed adjustments):** This circuit provides a signal of variable frequency for platter speed adjustments. It is necessary to vary the reference frequency derived from the quartz oscillator when you want to vary the pitch of the sound reproduced from a

record. If the Quartz LOCK switch is set to the OFF position, the speed of the motor will be locked to the frequency obtained from this circuit, and you will then be able to vary the platter speed freely using the speed adjustment knob on the control panel. You can increase or decrease the platter speed up to a maximum of 6% of its rating.



PLC-590 Block Diagram

SPECIFICATIONS

MOTOR AND TURNTABLE

Motor ..... Quartz PLL Hall motor
Turntable Platter ..... 320mm diam. aluminum alloy die-cast
Internal Mass ..... 350kg/cm^2 (including platter mat mass)
Speeds ..... 33-1/3 and 45 rpm
Speed Control Range ..... ±6%
Wow and Flutter ..... Less than 0.025% (WRMS)
Signal-to-Noise Ratio ..... More than 75dB (DIN-B)
(with Shure cartridge model Type III)

ROTATIONAL CHARACTERISTICS

Build-up Time ..... Within 180° rotation at 33-1/3rpm
Speed Deviation ..... Less than 0.002%
Speed vs. Load Characteristics .. Stable up to 120 grams drag load
Speed Drift ..... Less than 0.0003%/h at 33-1/3rpm
Less than 0.00004%/degree temp. change at 33-1/3rpm

SUBFUNCTIONS

Pitch indicator
All-electronic brake
Free stop hinges
Insulator feet

SEMICONDUCTORS

ICs 6
Transistors 26
Diodes 13
Hall elements 3

MISCELLANEOUS

Power Requirements ..... AC 120V 60Hz
Power Consumption 12W
Dimensions ..... 490(W) x 185(H) x 406(D)mm
19-5/16(W) x 7-5/16(H) x 16(D)in
Weight ..... 14.5kg/31 lb 15 oz

ACCESSORIES

45rpm adaptor 1
Arm rest 1
Hexagonal wrench 1
Regular tonearm mounting board 1
Regular tonearm mounting papers 2
SME-3009/II aluminum plate 1
Aluminum plate for PA-1000 1
Machined mounting board 1
Screws for SME-3009/II 4
Washers for SME-3009/II 4
Nylon washers 4
Operating instructions 1

NOTE:
Specifications and design subject to possible modification without notice, due to improvements.

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