CONTENTS

Model 7PX3.5 & 7PX3.5/B RIAA Phono Preamplifier Operating Manual

NOTE: VERSION 3.5 IS IDENTICAL TO VERSION 3.0 IN OPERATION AND FEATURES . (PREAMPLIFIER VERSIONS 3.0 AND HIGHER REQUIRE POWER SUPPLY MODEL XPS7B WHICH HAS A HIGHER OUTPUT VOLTAGE THAN MODEL XPS7A. DO NOT USE THE MODEL XPS7B POWER SUPPLY ON PREAMPLIFIER VERSIONS EARLIER THAN 3.0 AS THE HIGHER VOLTAGE MAY CAUSE THE INPUT FUSES IN THE POWER SUPPLY TO BLOW.)

*Preamp Version: _____ Power Supply Model: _____

Preamp Serial No. _____ Power Supply S/N._____

Rev. 1 January, 1999

Model 7PX3.5 & 7PX3.5/B

RIAA Phono Preamplifier

Operating Manual

After Unpacking · Remove the Model 7PX3.5 from the protective plastic bag and check for any signs of shipping damage. Although the heavy construction and modern packaging of the 7PX3.5 make shipping damage highly unlikely, any claim must be reported immediately to your dealer or carrier. Save all packing materials for future use. At this time, carefully read through this operating manual to be sure that you understand the many unique features of the 7PX3 before placing it into your system and applying power. CAUTION: IMPROPER OPERATION OF THE INTERNAL GAIN SETTING SWITCHES CAN CAUSE DAMAGE TO YOUR LOUDSPEAKERS. SEE THE SECTIONS ON PHONO GAIN SETTING BEFORE OPERATING THESE SWITCHES. ALSO, READ THE SECTION ON SERVOS BEFORE USING THE 7PX3 IN YOUR SYSTEM.

Circuit Highlights · The circuits of the Model 7PX3.5 preamplifier represent the very latest in our evolution of Phono preamplifier design which began with our highly acclaimed SK-1 MC Step-up amplifier. The 7PX3.5 employs our new amplifier module called "Music Module™". We call them "Music " modules because of their exceptional musical qualities of tonal accuracy and harmonic integrity. The Music Modules™ are built with discrete components and are "universal" in application. Each module is optimized with selection of external components for its respective circuit function. The overall circuit configuration uses two low noise amplifier blocks separated by a passive RIAA equalization network. Components used in the RIAA network have been carefully selected for their exceptional sonic characteristics of tonal accuracy, their ability to preserve both low-level and high-level dynamics and detail; and, their ability to present a natural soundstage.

The power supply for each amplifier block is independently regulated, using high speed op-amps, selected for their exceptional sonic neutrality, in series regulation configurations. DC servos are used for each of the amplifier modules to allow direct coupled outputs and still maintain zero volts DC at the outputs under all operating conditions. See the section titled "DC Servos" for further details.

All components used in the 7PX3.5 have been selected only after extensive listening tests. Criteria for selection has been only the very finest sonic performance without regard to cost.

Model 7PX3.5/B · Specifications and operation of the Model 7PX3/B are identical to the Model 7PX3.5. The Model 7PX3.5/B includes balanced outputs via XLR connectors with an output impedance of 600 Ohms. (See section on System Polarity on page 5.

Front panel Controls · The push button *"mute"* control alternates between muted and non-muted main outputs. (see "Turn-on Delay" section below for more details).

Placement of the Preamplifier • The 7PX3.5 should be placed well away from components which generate strong magnetic fields, such as power amplifiers or motors. Because the strength of a magnetic field diminishes quite rapidly as you move away from the source, you should encounter little difficulty in properly locating the 7PX3.5 outside of hum inducing magnetic fields.

Applying Power* • The external power supply provides filtered DC of dual polarity to the 7PX3.5 mainframe via a high quality screw-lock connector. An IEC 320 AC connector supplies AC to the AC/DC converter. Before applying power, check the voltage indication on the external power supply to be sure that it is correct for your AC power. (Units wired for 220/240V operation can be changed to 120V operation with the voltage selector switch inside the power supply. The appropriate fuse must be installed if the operating voltage is changed.) Connect the DC screw-lock connector to the receptacle on the rear of the preamplifier, then connect the AC power cord to the receptacle of the power entry module on the rear panel of the AC/DC converter and turn on the AC power switch on the module. The LED in the AC/DC converter will glow green when it is on.

NOTE: WHEN FIRST CONNECTING THE EXTERNAL POWER SUPPLY, ALWAYS CONNECT THE DC SCREW-LOCK CONNECTOR FIRST! (GREEN LED OFF). WHEN DISCONNECTING THE EXTERNAL POWER SUPPLY, ALWAYS DISCONNECT THE AC POWER FIRST! WHEN TEMPORARILY TURNING POWER OFF TO THE PREAMP, ALWAYS USE THE AC POWER SWITCH ON THE REAR PANEL OF THE AC/DC CONVERTER.

NOTE: PREAMPLIFIER VERSIONS 3.5 AND HIGHER REQUIRE POWER SUPPLY MODEL XPS7B WHICH HAS A HIGHER OUTPUT VOLTAGE THAN MODEL XPS7A. DO NOT USE THE MODEL XPS7B POWER SUPPLY ON PREAMPLIFIER VERSIONS EARLIER THAN 3.5 AS THE HIGHER VOLTAGE MAY TRIGGER THE OVERVOLTAGE CIRCUIT AND CAUSE THE INPUT FUSES IN THE POWER SUPPLY TO BLOW.

The 7PX3.5 has been designed for continuous operation from standard AC Power. Although turning the unit on and off with each use will not unduly harm it, we recommend that it be left continuously on when used on a day-to-day basis. This will prolong the lives of the electrolytic capacitors in the power supply, minimize thermal cycling of the components, and maintain the DC servos at zero volts. (see section on DC servos.) Power consumption is approximately 10 watts.

Turn-on Delay • The 7PX3.5 is equipped with a circuit which prevents DC pulses from reaching the outputs during turn-on and turn-off. Operation is as follows: When the AC Power switch is first switched on, the main outputs are clamped to the ground for approximately 45 seconds to allow internal DC operating voltages to stabilize. During this delay period, the LED indicator light will glow *Red*. After the delay, the LED will remain *Red* until the mute button is depressed once. This will disengage the muting FETs and the main outputs will be active. If the preamp is switched off, or if there is a power interruption during listening, the LED will immediately switch to red and the outputs will again be clamped to ground. Restoration of AC power will reset the 30 second delay. As this delay circuit actually senses the level of internal DC operating voltages, it cannot be fooled into false or unnecessary delay. Thus, a brief power interruption such as those caused by power substation switching will mute the 7PX3.5 only if it is of sufficient duration to deplete the primary DC storage capacitors. However, if AC line voltage is too low to maintain proper DC regulation, the mute circuit will remain activated.

NOTE 1: After the initial turn-on delay, the panel muting control activates a CMOS logic circuit to invert the muting mode from its previous state. There is a delay built into this control to eliminate false triggering due to bounce of the switch contacts. Thus, after the initial change, it is necessary to wait a couple of seconds before the next change is possible.

DC Servos · In order to maintain the DC level of the outputs as zero volts without using large blocking capacitors, DC servos are used in the 7PX3.5. The servo senses the DC voltage of the output and if different from zero, applies an inverse DC correction to the amplifier stage to return the output to zero. The servo, however, must ignore the audio signal which ideally comes very close to DC. Thus, the servo must be taken out of the circuit at a very low point to still enable the best bass performance. For the 7PX3.5, we have chosen a very low frequency to disengage the servos. For this reason it takes several minutes for the servo to finally settle at DC. If you are using direct coupled amplifiers and turn them on shortly after (or before) the preamp is turned on; you may observe some slow "breathing" of your woofers while the servos are settling. To avoid this situation leave the 7PX3.5 always on (which we highly recommend); or, allow several minutes to pass before turning on your power amplifier. Once the servos have settled. they can only be disturbed by improper operation of the system. Thus the following conditions should be avoided:

1) Changing the gain switches with the preamp power on.
2) Driving the output stage into clipping.

Input/Output Connections · Inputs and outputs are marked accordingly on the rear panel. A separate set of buffered tape outputs is provided for direct connection to a tape recorder without the need to route the signal through the line level preamplifier for recording. Also, an extra set of unused holes are provided for the experimenter who may wish to install a different set of chassis jacks in parallel with the original set.

NOTE: The quality of the interconnect cables is extremely critical in realizing the full sonic potential of the 7PX3.5. This is particularly important between the tonearm and the preamp where the signal is at a very low level and unequalized for the RIAA compensation. We recommend that you use the very best interconnect cables available. Where there is a choice, use the shortest possible cable that will conveniently connect you components.

System Grounding · The chassis of the 7PX3.5 is connected internally to the circuit ground plane at a single point. (Located at the left rear circuit board mounting bracket) To properly ground your pick-up system, simply connect the ground wire from your turntable/tonearm to the grounding post on the rear panel marked "chassis ground". Always plug the AC power cord into a grounded outlet if available. Do not attempt to defeat the power grounding pin as it connects your system to "earth" ground and greatly aids in minimizing noise problem due to static charges or RFI.

System Polarity · All amplifier modules (except the balanced output inverters in the 7PX3.5/B) are non-inverting. Thus all signals processed will retain their correct polarity. XLR connectors used on the 7PX3.5/B are wired as follows: pin 1 - circuit ground (neutral), pin 2 - positive polarity and pin 3 - negative polarity. (The XLR connector body is mechanically and electrically connected to chassis ground.)

Internal Switches • DIP (Dual Inline Package) switches are used inside the 7PX3.5 to set the input characteristics and gain of the Music Modules™ for the Phono amplifiers. The top cover must be removed to gain access to these switches. See the Phono Gain sections for detail information on the setting of these switches. WHEN SETTING THESE SWITCHES, ALWAYS BE ABSOLUTELY CERTAIN THAT EACH SWITCH IS PUSHED FIRMLY AGAINST THE STOP AT THE END OF ITS TRAVEL.

NOTE: Always remember to replace either the metal top or the acrylic top panel on the 7PX3.5 after setting the switches or changing resistors. The top serves two important purposes: shielding from EMI, and preventing dust and debris from collecting inside which could adversely effect the performance. Slightly better sonic performance can be achieved when operating the 7PX3.5 with the acrylic top panel. *However, shielding from external fields will be lost.* Also, the acrylic top panel can hold and conduct a static electric charge. DO NOT TOUCH OR ATTEMPT TO CLEAN THE ACRYLIC TOP PANEL WHILE THE SYSTEM IS OPERATING! LARGE DC PULSES CAN BE GENERATED AT THE OUTPUTS WHICH MAY DAMAGE YOUR LOUDSPEAKERS.

Phono Gain Setting • The Model 7PX3.5 Phono Preamplifier provides separate gain settings for each type of Phono cartridge currently available. Set the gain in accordance with the output level of your cartridge. Use Table I below as a guide. CAUTION: DO NOT CHANGE THE GAIN SETTINGS WHILE YOUR SYSTEM IS OPERATING! RESULTING TRANSIENTS CAN DAMAGE YOUR LOUDSPEAKERS OR BLOW PROTECTION FUSES. It is best to turn the AC power to the preamplifier off when changing the Phono gain settings.

Table I - Phono Gain vs. Cartridge Output

Cartridge Output (5 cm./sec.-1 KHz.)	Gain (switches 1-10)	Forward Switchbanks - B Switches **ON**
Low: 0.2 - 0.5	High (63 dB)	1, 3 & 5.
med.: 0.6 - 1.9	Medium (50 dB)	2, 4, 6, 8, & 10.
High: 2.0 - 5.0	Low (37 dB)	7 & 9.

NOTE 1: THE PHONO AMPLIFIERS WILL NOT GIVE PROPER PERFORMANCE UNLESS THE SWITCHES ARE SET EXACTLY IN THE COMBINATION LISTED ABOVE FOR THEIR RESPECTIVE GAIN APPLICATION. BE SURE THAT EACH SWITCH TOGGLE IS SET FIRMLY IN EITHER ITS "ON" POSITION OR ITS "OFF" POSITION AS REQUIRED.

NOTE 2: IF THE GAIN IS SET TOO HIGH FOR YOUR PARTICULAR CARTRIDGE TYPE, YOU RISK OVER-DRIVING THE AMPLIFIER STAGES AND CAUSING CLIPPING AND DISTORTION. IF THE GAIN IS SET TOO LOW FOR YOUR PARTICULAR CARTRIDGE TYPE, YOU WILL NOT BE GETTING THE BEST SIGNAL-TO -NOISE PERFORMANCE.

Input Impedance & High Frequency Response of MC Cartridges · Due to mechanical resonances of the stylus/cantilever assembly at very high frequencies, most MC cartridges demonstrate a rising high frequency response starting somewhere between 10 Khz and 25 Khz. Typically this rise will reach a peak of 6 to 12 dB at the resonant frequency which usually occurs in the vicinity of 40 Khz. Above the resonant frequency, output response falls sharply as the high frequency response limit of the cartridge is reached. This high frequency response peak is audibly discernible in wide bandwidth systems and creates considerable phase error of the signal at high frequencies. Coupled with the very wide bandwidth of many of these cartridges, it can also needlessly stress high frequency performance of other components in the music reproducing system.

Some cartridge manufacturers attempt to reduce this upper treble rise with additional damping of the cantilever suspension system. While this approach may succeed in reducing the extreme high frequency response, it frequently causes a dip of the response curve in the "brightness" region, and a reduction of the natural "live" quality of music. Fortunately, recent trends by cartridge manufacturers favors less mechanical damping and raising the resonant frequency to higher values.

One popular approach employed by cartridge users to treat this problem involves loading the low-output MC cartridge with very low value resistors (less than 100 Ohms). While this approach has the effect of ameliorating the audible high frequency distortion (because of the low reactive impedance of the cartridge generator the actual response curve is very little changed), it has the undesirable side effect of reducing midrange dynamics, spatial ambience cues, and the natural sense of "liveness" of the real performance. Very low loads can also cause a signal loss at all frequencies, resulting in less than optimum signal-to-noise performance of the electronics used.

A better approach to solving this problem involves using a relatively high load resistance (1000 to 47K Ohms) and compensating for the high frequency response rise electronically with a high frequency contouring network. A properly designed RC network as a load for the cartridge can provide a high load impedance at low and middle frequencies, with a frequency dependent and decreasing load as the frequency approaches the mechanical resonant frequency of the cartridge generator assembly. This method provides both a low pass 6 dB per octave filter, and a modicum of dynamic damping selectively applied to the region of the resonant frequency.

With the **High Frequency Contour** capabilities of the Model 7PX3.5 Phono Preamplifier the user can choose a quick, lucid sounding cartridge having low mechanical damping and compensate electronically for any high frequency rise which might be present. The following diagrams present a graphic confirmation of the results.

Effect of High Frequency Contour on MC Cartridge Response

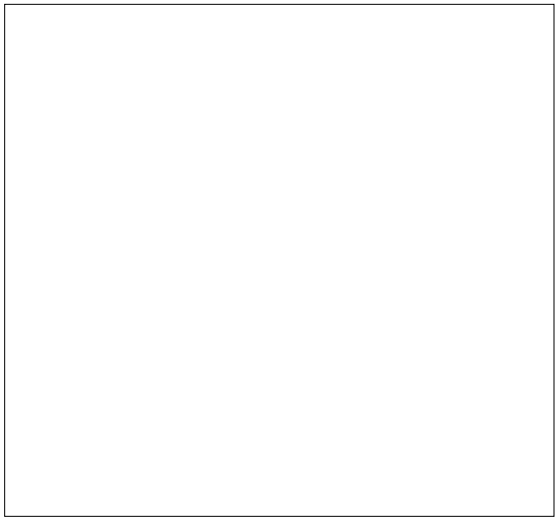

Figure 1. Reference square wave response from a function generator in the L and R channels. The 45 degree line at the lower center portion of the display is an X-Y plot of the L Channel (vertical axis) vs. the R Channel (horizontal axis), and shows ideal phase (time) correlation between the two channels.

Figure 2. square wave response of a typical low output MC cartridge when playing an unequalized 5 KHz square wave. Cartridge load is 437 K Ohms. Note the excessive overshoot and ringing of the square wave. The X-Y plot shows considerable phase error at high frequencies due to the mechanical resonances of the cantilever assembly.

Figure 3. Square wave response of same cartridge as Fig. 2 (47K Ohm load), but with the High Frequency Contour feature engaged. Note the significant reduction in amplitude (V1 and V2) of ringing and greatly reduced phase error at high frequencies as shown in the X-Y display.

MC Cartridge Loading & High Frequency Contour · The Model 7PX3.5 has the High Frequency Contour feature placed in front of the gain block and integrated into the cartridge loading format (see Figure 1 below and the section headed "INPUT IMPEDANCE AND HIGH FREQUENCY RESPONSE OF MOVING COIL CARTRIDGES"). This approach provides some additional advantages compared to conventional resistive loading. First, it lowers the high frequency burden on the RIAA amplifier. Second, it provides a frequency dependent load which gives dynamic damping to the cantilever assembly only at the very high frequencies where resonances occur. Thus, high frequency intermodulation distortion generated within the cartridge is lowered without interfering with dynamics and accuracy of the vital midrange and low frequencies.

Figure 1. 7PX3.5 & 7PX3.5/B Input Circuit (simplified).

Because the cartridge source impedance (DC coil resistance) is part of the RC network which sets the High Frequency Contour turnover frequency in the 7PX3.5 , you must know both the recommended HFC frequency (from the table on page 9) and the cartridge generator impedance as supplied by the cartridge manufacturer. (Most low output cartridges have a generator impedance of 3 to 5 ohms. However, some are as high as 50 or 60 Ohms.) Once these two figures are known, use the table below to determine the appropriate settings for your cartridge.

Table 2 · High Frequency Contour Settings

Cartridge Imped. (Rc)	Rear Switchbanks (A) Switches **ON** for Recommended Contour Frequency 15 KHz.	20 KHz.	25 KHz.	30 KHz.	35 KHz.	40 KHz.
2-9 Ohms	10	9 & 10	8 & 10	7 & 10	7, 9 & 10	7, 8 & 10
10 - 19 Ohms	N/A	8 & 10	7 & 10	7, 9 & 10	7, 8, 9 & 10	6, 8, 9 & 10
20 - 39 Ohms	9 & 10	8, 9 & 10	6 & 10	6, 8, 9 & 10	5 & 10	5, 7, 8, 9 & 10

NOTE: SWITCH 10 ENGAGES THE HFC CIRCUIT BY PLACING THE SHUNT CAPACITOR INTO THE CIRCUIT. IF YOU CHOOSE NOT TO USE THE HFC FEATURE, SET SWITCH 10 OFF AND SWITCHES 4 through 9 ON (FOR THE LOWEST CIRCUIT SOURCE IMPEDANCE).

Input Impedance (Resistance) Values - MC Cartridges · The benefit of a very low input impedance recommended by many MC cartridge manufacturers is provided for by the High Frequency Contour RC network of the 7PX3.5 as described above. Thus, to preserve midrange and low frequency dynamics and accuracy, we recommend that most low output MC cartridges be loaded with as high a load as is practical. As a simple practice, we recommend that cartridges with a generator impedance higher than 10 Ohms should be loaded at a nominal 47K Ohms.

Desired Input Impedance (RI)	Rear Switchbanks (A) Switches **ON**
47,000 Ohms	None
1,000	3
500	2
300	2 & 3
100	1
75	1, 2 & 3

Input Impedance Values - MM Cartridges • Most moving magnet or moving iron types of cartridges are designed for a 47,000 Ohm load. However, this group of cartridges will typically require a small capacitive load to achieve flat frequency response. Input capacitance to the 7PX3.5 is approximately 200 pF. If additional input capacitance is desired, small value capacitors can be inserted into the resistor sockets as described above to achieve the desired total. Follow the cartridge manufacturers specifications for the appropriate capacitance loading value for your cartridge. Be sure to include the capacitance of your interconnect cables as indicated in the formula above.

Input Impedance R or C Sockets · When an input impedance value other than those provided by the switchbanks is desired, resistors or capacitors of the appropriate value can be inserted into the sockets provided internally on the Phono circuit board. To use this feature, the required components can be easily inserted into the socket with the aid of a long-nosed pliers. The following formula can be used to determine the value of the resistors required:

$R_i + (47{,}000 \times R) / (47{,}000 + R)$

$C_i = 200 + C_I + C$

Where:

R_i = desired resistive input impedance in Ohms.

R = actual value of resistor to be inserted in Ohms.

C_i = desired capacitive input impedance in pF.

C_I = capacitance of interconnect in pF.

C = actual value of capacitor to be inserted in pF.

NOTE: Values of R_i below 1000 Ohms need not be calculated, as the actual input resistance will be very close to the value of the resistor inserted into the sockets. Use either 1/4 Watt carbon composition resistors or high quality metal film resistors for this application. Leave all switches numbered 1-3 of the rear switch banks in their OFF (Open) positions when using resistors plugged into the sockets.

RECOMMENDED LOADINGS FOR VARIOUS LOW-OUTPUT MOVING COIL CARTRIDGES

Cartridge	Minimum Input Impedance (Ohms)	High Frequency Contour (KHz.)
Alpha 1	1K	15
Alpha 2	1K	20
Alpha Genesis 1000	1K	15
Benz Micro MC-1	1K	25
Benz Micro MC-3	1K	35
Benz MC Ruby	47K	40
Carnegie I/II	1K	25
ClearAudio Accurate	47K	25
ClearAudio Veritas	47K	25
Dynavector Diamond 17D2MR	47K	40
Dynavector Ruby 23SMR	47K	25
Kiseki Purple Heart Sapphire	1K	20
Koetsu Black	1K	20
Koetsu Rosewood Signature	1K	20
Koetsu EMC-Rosewood/Signature	1K	35
Koetsu Irushi Mk II	47K	35
Koetsu Pro-IV	47K	35
Linn Asak DC 2100K	1K	20
Linn Asaka	47K	35
Linn Troika	47K	35
Ortophon MC-3000	47K	40
Scan-Tech Clavis	47K	30
Scan-Tech Parnassus	47K	40
Spectral MCR-Signature	47K	35
Sumiko Transfiguration AF-1	47K	30
van den Hul Grasshopper III	47K	40

NOTE: These recommendations are based on listening tests and measurements performed on a small number of samples only. As cartridges of a given model will vary somewhat in performance parameters, particularly as they age; use these values as starting points and adjust values up or down accordingly to achieve optimum sonic results in your system. The High Frequency Contour network is electrically out of the circuit with switch 10 of the rear switchbanks in the OFF positions, should you choose not to use this feature.

1 Dec. 92

Care and Maintenance · The 7PX3.5 is designed for long life and will require very little maintenance to keep it in top performance.

Here are some helpful tips:

-The face panel and mute button are anodized surfaces and can be cleaned with any household cleaner or mild solvent without damage. Soap and water are about the best. DO NOT USE CLEANERS WITH ABRASIVES! THE SURFACE WILL BE SCRATCHED!

-The Oak side bars have a catalyzed lacquer finish with a coat of clear paste wax. The luster will diminish with age but can be restored at any time with a new coat of clear paste wax.. Avoid getting the wax onto the metal parts as it will change their appearance. DO NOT USE SOLVENTS ON THE WOOD FINISH AS THEY CAN DISSOLVE THE FINISH!

- When inserting or removing the resistors in the internal sockets, always use a long-nosed pliers.

Warranty and Service · The 7PX3.5 is guaranteed to its original registered owner to be free of operating defects for a period of three years from the date of purchase. Units requiring attention during this period will be repaired free of charge . Shipping to the factory for inspection or repair must be paid by the owner. Routine check-ups are not included in the warranty but are available at a nominal cost. This warranty is void if modifications or repairs are made without prior authorization from the manufacturer, or if the unit has been subjected to misuse, accident, negligence, abusive or abnormal operation, or where the serial number plate has been removed, altered or defaced.

In the event that you believe that your 7PX3.5 requires service or inspection, it is best to consult with the factory prior to shipment. Pack the unit in its original shipping container and packing materials, and insure it for its full value. (IT IS NOT NECESSARY TO RETURN THE POWER CORD WITH THE UNIT. IF RETURNED, ROLL IT IN TO A SMALL COIL AND PLACE IT IN ONE OF THE REAR CORNERS OF THE SHIPPING CARTON, HELD SECURELY IN PLACE BY THE FOAM CORNER BLOCKS) insure the package for its full replacement value. The factory will not be responsible for damage caused by the shipper and repairs will be made at the owner's expense if insurance is not provided.