

Phono Input Impedance Matching

Resistance: The pushbutton next to the Phono 1 input jacks provides two options for the Phono 1 input resistance: 47k and 100 kohms. The 47k setting (obtained when the button is pressed in, flush with the surface of the rear panel) is correct for most moving-magnet and induced-magnet design cartridges. The 100k setting is preferred with some cartridges which are designed for extended ultrasonic response (those particularly designed for playing discrete four-channel records).

Capacitance: Five selections of input capacitance are available by adjustment of the rear panel rotary switch. In order to make an optimum choice, you should first discover (1) what total load capacitance is recommended by the manufacturer of the cartridge, and (2) how much capacitance is contributed by the wiring between the cartridge and the preamp. The latter consists of the capacitance of the wiring in the tone arm plus the capacitance of the cables connecting the turntable to the preamp. The accompanying tables provide listings of arm and cable capacitance and of the termination requirements for many phono cartridges. In cases of doubt, check the literature supplied with your turntable or arm, or contact the manufacturer. Similarly, the optimum total load capacitance for the cartridge may be listed in the literature supplied with the cartridge, or may be given in published reviews; if in doubt, write to the manufacturer or importer of the cartridge.

Then, from the total load capacitance recommended for the cartridge, *subtract* the capacitance supplied by the tone arm and associated phono signal cables. The difference which remains is the capacitance which should be supplied by the phono input; set the capacitance selector switch to the value nearest the computed difference. If the required capacitance lies midway between two values on the selector switch, either value may be used depending on the response of the other parts of your system (see next paragraph).

If you are unable to obtain correct information, either with regard to the cartridge manufacturer's recommended load capacitance or with regard to the capacitance of the tone arm and phono signal cables, then you may determine the best input impedance setting by experiment. For most cartridges the preferred input resistance is 47 kohms. The effect of varying capacitance may be explored while playing recordings with strong high-frequency content. Listen for differences which lie primarily in the top octave (10—20 kHz) which contains overtones and high harmonics which give a sense of airiness or lightness to the sound. Use recordings which contain cymbals or other high-frequency sounds to sensitize the playback system to changes in the upper frequencies. With some cartridges the effect of varying capacitance will be dramatic, and you may find the optimum setting to be fairly obvious. Other cartridges are affected more subtly by the load capacitance. If no obvious effect is heard as the capacitance is varied, then a modest setting is probably best—say, 50 or 100 pF. Combined with the typical arm and cable capacitance of 100 to 150 pF, this will yield a total load of around 200 pF which is optimum for many cartridges.

Should your cartridge be one of the very few which require non-standard load resistance, Apt Corporation can supply a special termination socket for internal installation in the moving-coil pre-preamplifier plug of the Holman Preamplifier. For resistance values of less than 47 kohms, this device plugs in directly without modification to the preamplifier. If you have a need for this service, see the attached accessories order blank.

Tone Arm and Cable Capacitance of Popular Turntables, Arms, and Cables

Make	Model	Capacitance in pF
ADC	LMF-1, LMF-2	220 (Both models are available with optional 100 pF cables.)
AR	XA, XB, XB-77	135
B&O	All models back to 3000 including 1900, 2400, and 4002	180
BIC	911, 912, 914, 916, 918 All other models	125 160-180
BSR	710, 810	225
Decca	Decca	300
Denon	All models	100
Dual	1209 and contemporaries 1225, 1226, 1228, 1237, 1242, 1246, 1249 502, 504, 510, 521, 604, 621, 704, 721	240 100 180
Dynavector	DV505	50 (37 pF/m cable, arm supplied with 1 m.)
Empire	598I, 598II 698	210 100 with 4' cable 210 with 5' cable
Fidelity Research	FR54 FR64s, FR66s	150 100
GAS	5'	165
Garrard	SL-55, 95 All current models	180 110
Goldens	old, 1 m. new, 2 m.	55 125
Grace	All models	80
Handic	All models	100
Harmon Kardon	ST-6, ST-7, ST-8	110
Infinity	Black Widow	80
JVC	All models	85
Kenwood	All models	100
Lenco	L133, L236, L830DD L833DD	82 25
Marantz	All models	90
Mayware	Formula 4	120
Micro-Seiki	All tables and arms	100
Mitsubishi	All models	100
Phillips	GA222, GA437 GA212, GA312	100 160
Pioneer	All models	100
Rabco	SL8E	125
Revox	B790	205
Rotel	All models	100
SAEC	WE308	100
Sansui	All models	85
Sanyo	All models	100

Scott	All models	100
Shure	3009II 3009II 3009III	125 with 4' cable 75 with CD-4 cable 300 with 4' cable as supplied (75 by deleting the capacitor supplied in the male connector)
Sony	All models	70
Stanton	All models	95
Stax	UA-7	80
Technics	All models	80
Thorens	105, 110, 115 Other models back to TD-124	230 200
Verion	MDA	165/1.5 m.
Yamaha	YP-800 YP-B4, D6, D8, D10, 211	80 125

Load Requirements of Popular Moving-Magnet-Type Phonograph Cartridges

Manufacturer	Model	Load Resistance in Ohms	Load Capacitance in pF
Acutex	All models	47k	250
ADC	QLM, ZLM Models with III suffix All other models	47k 47k 47k	275 150 275
AKG	All models P6, P7, P8	47k	470
Audio Technica	All AT	47k	275
B&O	MMC-3000, 4000, MMC-20 series MMC-6000	47k 100k	200 100
Empire	2000Z, 2000T All other 2000 series 4000 series	47k 47k 100k	300 500 100
Grado	All F and G series	47k	*
Micro-Acoustics	2002-e, 530-mp, 282-e	47k	200
Ortofon	M20, VMS, FF and Concorde models	47k	400**
Pickering	Models with Q suffix All XV-15, V-15 series	100k 47k	100 275
Shure	V15 Type IV V15 Type III M24H M95, M93, M91, M75, M70 series	47k 47k 100k 47k	250 400 100 400
Sonic Research	Sonus models	47k	400
Stanton	Models with Q suffix 500, 600, 680, 681, 881 series	100k 47k	100 275

*Cartridges thus marked are claimed by their manufacturers to be insensitive to capacitive loading. Therefore, use the 200 pF setting on the preamplifier for these types.

**These cartridges may be shipped with termination capacitors inserted on the back of the cartridge. Be certain to account for this added capacitance if they are present.

This list is compiled of currently-available phono cartridges which are designed for direct connection to conventional moving-magnet phono inputs. For older models, the cartridge manufacturer should be able to supply the most appropriate loading requirement information.

These lists of arm and cable capacitance and of cartridge load requirements have been generally compiled from manufacturer's data, and, as such, Apt has no control over the accuracy of the data.

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Moving-Coil and Ribbon Cartridges

Moving-coil and ribbon cartridges range greatly in sensitivity, internal impedance, required load impedance, and frequency response. For this reason, universal pre-preamplifier designs must be seriously compromised, or must have many difficult-to-make user adjustments.

Therefore, Apt Corporation offers separate models of pre-preamplifiers for installation in an internal socket in the Apt/Holman Preamplifier. Each of the models is matched to the requirements of one or a small range of cartridges. This level of matching allows considerable optimization of such performance parameters as noise and frequency response.

Some moving-coil cartridges are designed for direct connection to conventional phono inputs. Many of these can be terminated by the 47 kohm input load, and are insensitive to the input capacitance setting (for these types, 200 pF capacitive loading is recommended). However, some require other loads, such as 100 ohms. For these types, Apt can supply an input termination board for the phono 2 input. See the accessories list accompanying this sheet.

Manufacturer	Model	Recommended Input System	
		Load Resistance in Ohms	Load Capacitance in pF
Coral	777EX	Pre-preamplifier Model 202-B	
Decca	London MkV1 Gold	47k	200
	London MkV1 Plum	47k	200
Denon	DL103 series	Pre-preamplifier Model 201-A	
Dynavector	10A, 20A, 20B	100	
EMT	XSD-15	Pre-preamplifier Model 201-C	
Entre-1		Contact Apt Customer Service	
Fidelity Research	FR-1 MkIIIF	Pre-preamplifier Model 202-D	
G A S	Sleeping Beauty	Pre-preamplifier Model 202-B	
Grace	F9-F, F9-U	100k	80
	All other F8, F9 series	47k	250
N A D	9000	47k	200
Nagatron	HV9100	Contact Apt Customer Service	
Ortofon	MC-10, MC-20, MC-30	Pre-preamplifier Model 202-A	
Satin	M-18E, M-18X, M-18BX, M-117G	100	
Signet	Mk111E, Mk112E	Pre-preamplifier Model 201-B	
Supex	SD-900 E+ Super	Pre-preamplifier Model 202-C	
	SD-901	47k	200

Pre-preamplifiers

Because the class of cartridges called moving-coil differ greatly in their internal impedance, as well as their required load impedance, sensitivity, and frequency response, Apt Corporation offers a number of different plug-in pre-preamplifiers to satisfy the requirements of the various types.

Each of the pre-preamplifiers consists of a plug-in circuit card for which a mating connector is provided inside the Holman Preamplifier. The Phono 2 input is converted by the installation of the circuit card and by the cutting of four jumper wires to a moving-coil input. A connector to convert back to the moving-magnet function is supplied. Installation is straightforward and may be performed by the end user or by the dealer.

Model	Cartridge(s)
201-A	Denon DL103 series
201-B	Signet Mk111E, Mk112E
201-C	EMT XSD-15
202-A	Ortofon MC-10, MC-20, MC-30
202-B	G.A.S. Sleeping Beauty, Coral 777EX
202-C	Supex SD-900 E+ Super
202-D	Fidelity Research FR-1 MkIIIF

Specifications

All specifications of the Apt/Holman Preamplifier apply, with the following additions:

- 2.14. The phono 2 input level for 0.5 Vrms output is adjusted in each model to produce sensitivity equal to the conventional moving-magnet input sensitivity.
- 2.15. The phono 2 input impedance is adjusted in each model to provide optimum termination.
- 3.6. The frequency response is the complement of the cartridge for overall flat response.
- 5.10. The equivalent input noise with the specific design cartridge connected is less than 77 dB below 500 microvolts input at 1 kHz, A-weighted for 201 models, and less than 80 dB below 500 microvolts input at 1 kHz, A-weighted, for 202 models (typ. 82 dB).

Note: The specifications given, like those of the Apt/Holman Preamplifier brochure and Owner's Manual, conform to the requirements of IHF Standard A-202. Specifications written to other standards or where no standard is stated are generally not comparable.

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