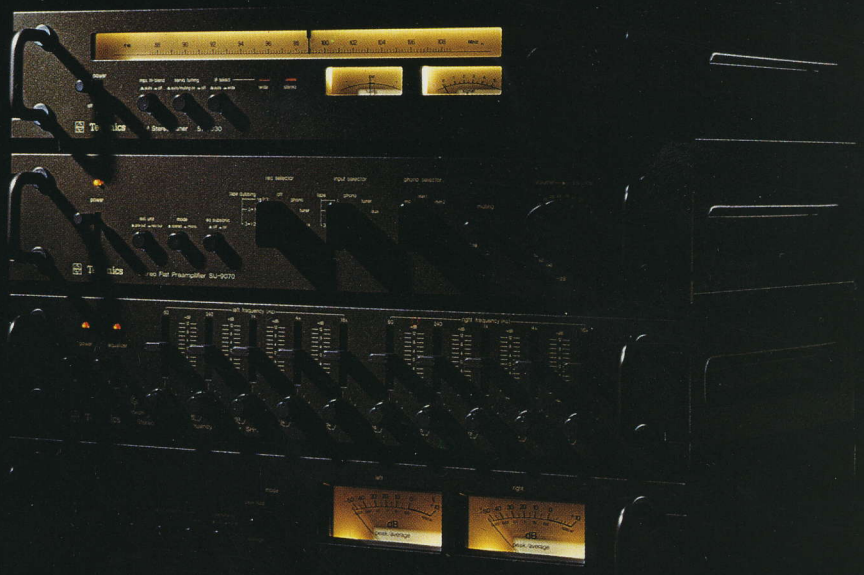
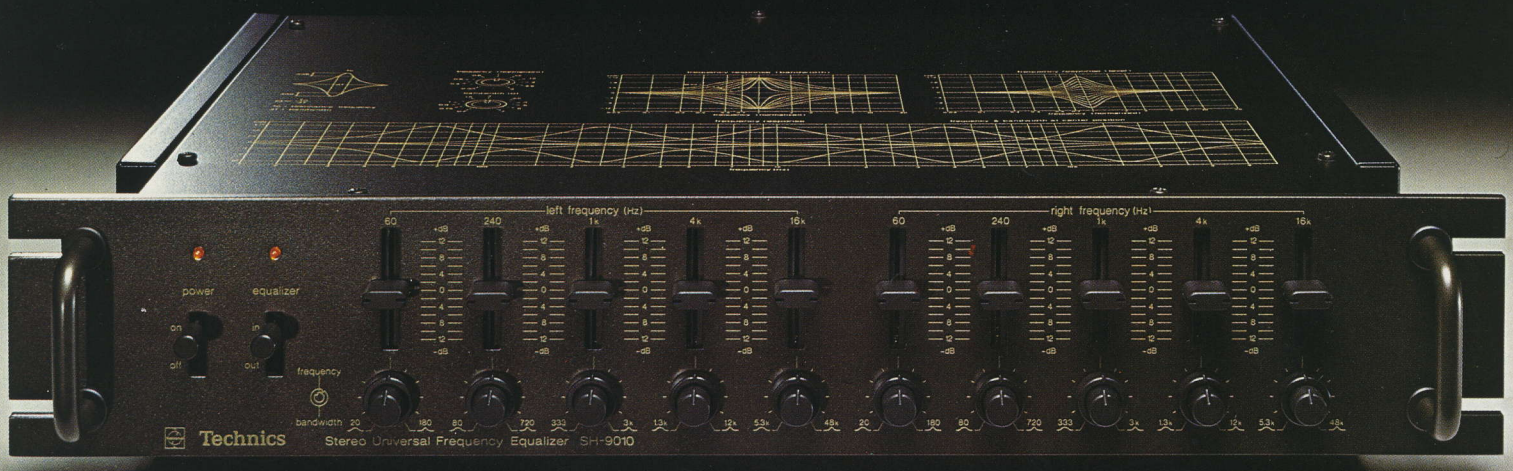
Technics SH-9010

Stereo Universal Frequency Equalizer





SH-9010 Stereo Universal Frequency Equalizer

The SH-9010 Permits Delicate Frequency Response Control Totally Unattainable with Conventional Tone Controls or Graphic Equalizer

Any professional's or serious audiophile's system includes some means of adjusting the frequency response of the programs to be played or recorded. The tone controls on a preamplifier or integrated amplifier, and the graphic equalizer which has been available for some years as a separate unit, are designed to provide such control of frequency response. But both of these methods have serious limitations:

Tone Control Limitations
Tone controls are designed to act upon the sounds at the two ends of the audio frequency spectrum. However, it is normally not at the very ends but on the center side of the ends that some sort of sound compensation is required. When normal tone controls are utilized to make such adjustments, the result is an unavoidable increase or decrease in the level at some other place where such adjustment is not necessarily desired. The result is a loss of the naturalness of the music. This is exactly why many audiophiles prefer to listen to their music with the tone controls in the defeat position.
A variety of methods have been devised to overcome this difficulty. Variable turnover frequencies have been provided and sometimes an additional tone contol for the midrange has been added. However, all of these methods are clearly insufficient.

Graphic Equalizer Limitations
The graphic equalizer is used for controlling frequency response in professional recording studios and theaters, and compared with tone controls is considerably more versatile. The graphic equalizer divides the frequency spectrum into several bands and controls frequency response by boosting or attenuating each band as necessary. However, the performance of the graphic equalizer—as well as its price—depends upon the number of bands the frequency spectrum is split into, and the best professional units which allow control at intervals of $^1/_3$ octave are quite expensive. Naturally, as the number of bands is reduced, performance also is adversely affected.

The Stereo Universal Frequency Equalizer Opens Up Completely New Control Capabilities

Conventional equalizers, as useful as they are in audio work, all suffer from two critical drawbacks which severely limit their scope of applications.
First, each slide pot boosts or attenuates a fixed, immovable frequency band. We speak of "fixed center frequencies." No matter how these frequencies are chosen and spaced, however, it is only in rare cases that they will be at precisely the spot where boost or attenuation is desired.

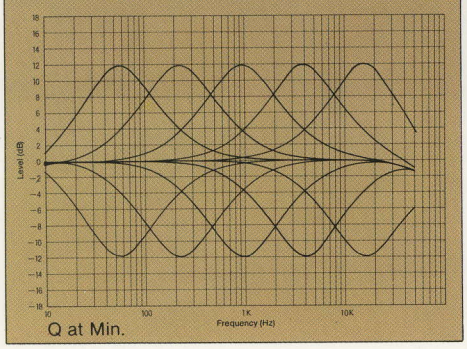
Technics Offers Variable Center Frequencies

In a radical departure from the circuit principles found in conventional equalizers, Technics has designed the SH-9010 with variable frequencies; by turning the control knob below each slide pot, the center frequency can be moved up or down by as much as 1.6 octaves. The five slide pots provided for each channel thus cover the following ranges:

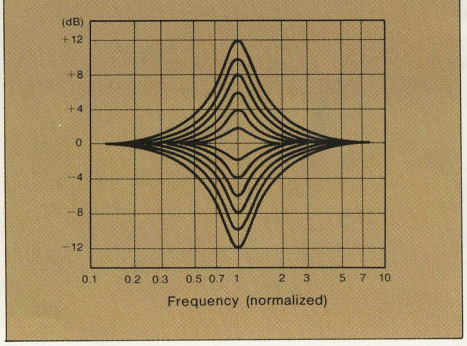
Normal Center Frequency	Variable Between
60Hz	20Hz—180Hz
240Hz	80Hz—720Hz
1kHz	333Hz—3kHz
4kHz	1.3kHz—12kHz
16kHz	5.3kHz—48kHz

As this adjustment is continuous, center frequencies can be set at accurately the desired points. What's more, settings are independent for each stereo channel. This flexibility gives the user unlimited freedom in coping with every imaginable equalization problem.
Between every two adjacent frequency ranges, there is an area of overlap a little over an octave in width. By moving both center frequencies to the same spot, available boost or attenuation can be further enlarged.
Frequency response graphs shown elsewhere on these pages indicate some of the fascinating possibilities afforded by this unique Technics feature.
Unlike conventional equalizers, the Technics SH-9010 has no "blind spots" between adjoining bands. Yet this is only one of its two outstanding flexibility features that make it such a pliant tool in the hands of the experienced audio technician and demanding audiophile. The other:

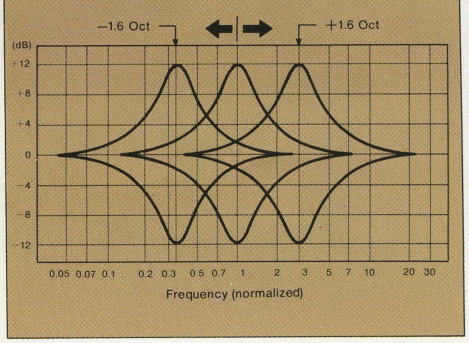
5-Band Equalization



Band Level Control



Center Frequency Control

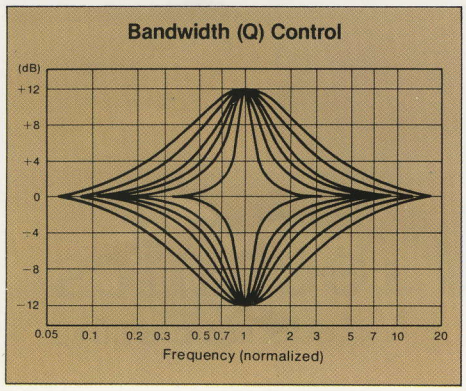


Variable Bandwidth ("Q") of Each Band

As shown in the illustration below, "Q" is an expression of the steepness with which attenuation or boost slopes near the center frequency. The higher the value of Q, the steeper the slope (and the narrower the bandwidth covered).
In conventional equalizers, Q has fixed value, slope steepness is constant and unalterable. Equalization jobs in actual audio work, however, are often greatly hampered by this inflexibility. A slight boost (or attenuation) over a relatively wide spectrum, for instance to improve sonic balance in an orchestral recording, calls for a gradual slope (a low Q) in order to remain unobtrusive. Noise or hum reduction jobs, on the other hand, are often concerned with only a very narrow band in which noise is present and require a very steep attenuation slope over a narrowly defined band (high Q). In many cases, a fixed equalizer bandwidth forces an unacceptable compromise upon the audio technician.
Not so in the Technics SH-9010. Here, the Q for each band is continuously adjustable from 0.7 (a very gradual slope covering a relatively wide band) to 7 (a very steep gradient limited to a quite narrow band). Some sample graphs are shown elsewhere on next page, illustrating the range of adjustment possibilities available.
As with the variable center frequencies, "Q" adjustment is also independent for each band of each stereo channel.
The SH-9010 thus offers an infinite number of combinations of three types of adjustment:

1. Boost or attenuation by up to 12dB at five points in the frequency spectrum, in both stereo channels.
2. Precise setting of any or all of these five bands to any frequency, with more than an octave of overlap between two adjacent bands.
3. Free adjustment of "Q" (or bandwidth) for each frequency band, within the range of Q = 0.7 to 7.

Equalizer In/Out Switch for Instant Comparisons
In position "out" of this switch, the entire equalizer network is bypassed and the source signal heard without any modification. This permits instant comparisons between "raw" and "equalized" sound. An indicator lamp lights up in "equalizer in" position.



Detent Stops in Neutral Position
At its "0" position, where no boost or attenuation takes place, each slide pot has a detent. The neutral position can be easily found without as much as reading the scales.

Two Pairs of Outputs
On the rear panel, one pair of input jacks and two pairs of outputs are provided, permitting equalized output to be supplied to a power amplifier and a tape deck, for example. An auxiliary AC outlet is also provided, for powering another system component.

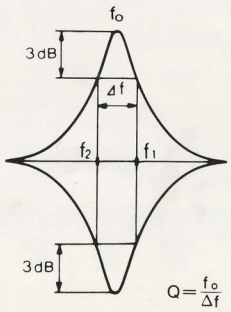
Some Typical Applications of The Universal Frequency Equalizer

Instead of Amplifier Tone Controls
A number of preamplifiers of very high quality are now on the market in which tone controls have been purposely omitted—SU-9070 is one example. The Technics Universal Frequency Equalizer, installed downstream from the preamp, will give immensely greater control flexibility than any system of amplifier tone controls.

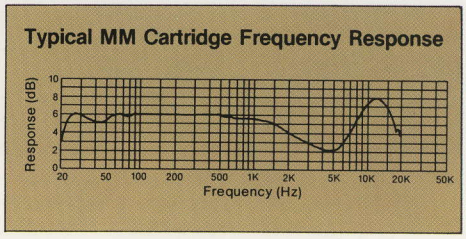
Flattening of Overall System Response
While components of a system, when measured individually, may exhibit nearly ideal response curves, the total system including speakers and installed in a listening room often suffers obvious dips and peaks. The equalizer can restore flat overall response with a high degree of precision.

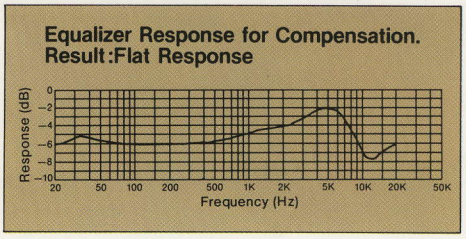
Suppression of Standing Waves
Parallel walls of a listening room cause standing waves to form, usually in the bass-to-medium range, which can be extremely annoying because of the boominess that they impart to the sound. An attenuation setting of the equalizer, usually in combination with a narrow bandwidth setting, can usually remove this boomy quality.

Compensation for Frequency Non-Linearities of Phono Cartridges
Moving magnet (MM) type cartridges often exhibit two kinds of non-linear frequency response: mid-range slumping, and high end peaking. The former occurs over a fairly wide range of frequencies, while the latter is rather narrow and sharp. With normal methods, it is extremely difficult to correct this difficulty, but the SH-9010 handles this task with ease.



Definition of "Q" Where f_o is the resonance frequency and Δf is the bandwidth between the -3 dB level points (f_1, f_2).





Restoration of Sonic Balance in Re-Recording Older Program Material
Old SP's and early LP's often sound unsatisfactory because recording equalization standards employed in their production differed from those used today (or were determined merely by the recording engineer's whim). The Universal Frequency Equalizer can restore a great deal of sonic balance and make them very listenable. With rare collector's items, it is common practice to re-record them on tape with improved equalization.

Denoising of Program Material
Annoying hum, hiss, scratchiness, tonearm resonances, high end distortions and other "garbage" fortunately occupies portions of the frequency spectrum which are not of critical importance to the musical information. The Universal Frequency Equalizer can be a miraculous tool in cleaning up such programs, especially with its freely variable frequency band and attenuation slope settings.

Improved Signal-to-Noise Ratio in Tape Recordings
By boosting the high end when recording, and applying an equivalent amount of attenuation in playback, annoying tape hiss can be forced down below audibility level.
(The high end boost must not exceed the tape's "headroom", however, as this would trade noise against distortion.)

Bandwidth Limitation and Sonic Balancing in Live Recording
In live recording, the frequency range occupied by the music is usually known in advance, being determined by the instruments used. In such cases, it is often advisable to suppress the musically irrelevant frequency extremes, thereby avoiding noise that may otherwise try to creep into those unoccupied bands.
The equalizer can also be quite helpful in improving the instrumental or vocal balance in live ensemble recording, as microphone settings must often compromise on account of hardware or room limitations.

Bandwidth (Q) Control

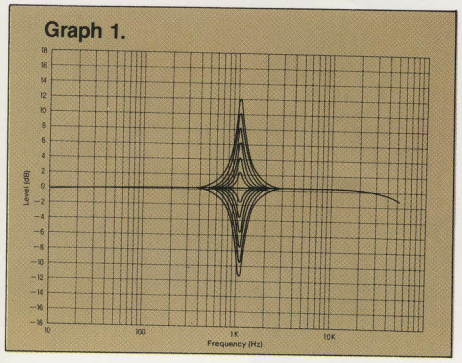
Center Frequency Control

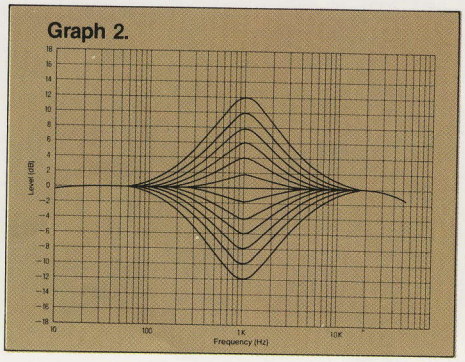
Slide Pot

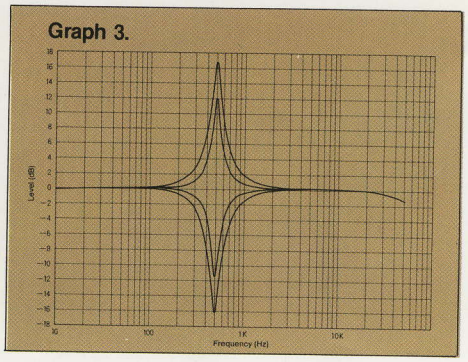
Variations in Level, Center Frequency, and Q permit an Astoundingly Wide Range of Audio Processing

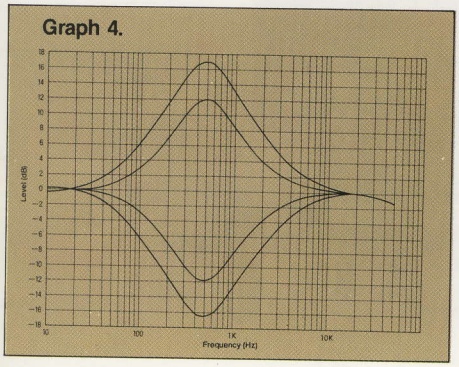
By properly adjusting the SH-9010, delicate changes in frequency response can be achieved. A few examples:

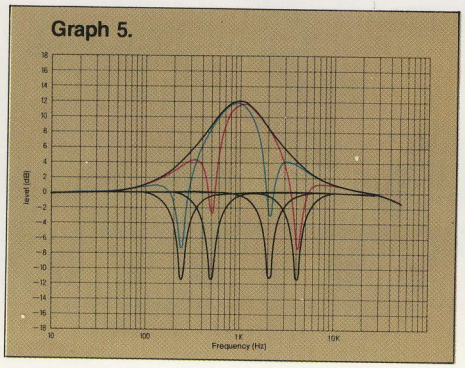
- By adjusting level and Q together, a wide variety of peaks and dips can be created. Graph 1 shows Q at maximum and the level control at various positions. Graph 2 shows Q at minimum, with the level control at various positions.
- Greater degree of boost and attenuation is obtainable by "stacking" center frequencies. The inner line in Graph 3 shows the center frequency of just one band. The outer line shows what happens when the center frequencies of two bands are made to coincide. Q is at maximum for both. Graph 4 shows the same effect, but with Q at minimum.
- Complex frequency response curves can be achieved by combining peaks and dips. In Graph 5, the broad black curve shows the peaks when Q is at minimum, while the other black curve shows the dips when Q is at maximum. The red and black lines shows the composite of the two. In Graph 6, the broad black curve shows the peaks when Q is at minimum, while the other black curve shows the peaks with Q at maximum. The red and blue lines show the composite.

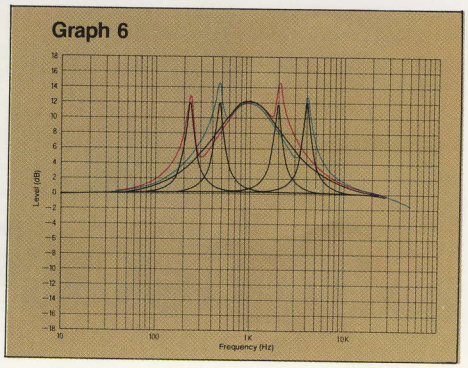










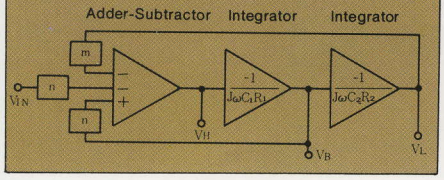


The Technology behind Variable Center Frequencies and Bandwidth

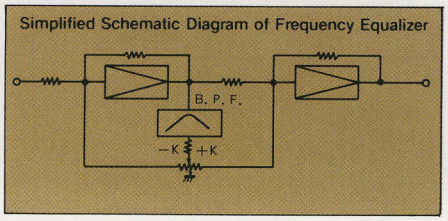
Conventional bandpass filters employ induction coils, and these do not permit variations in bandwidth or frequency. Moreover, they display some undesirable characteristics in regard to noise and distortion parameters. For these reasons, the SH-9010 is equipped with a newly developed type of active filter called "dual integration filter," using operation amp ICs.
The hardware for each filter consists of one adder-subtractor and two integrators. Its function is best explained as the sum of a high-pass filter, a bandpass filter (B.P.F.), and a low-pass filter, operating in series. By varying the resistances in each feedback loop, center frequency f_0 and bandwidth "Q" can be altered independently, and a change in one does not cause a variation in the other.

No conventional filter circuit can achieve this flexibility.
Similarly elaborate circuit construction has been adopted for the attenuation/boost of each band.
The complex filter circuitry described above is here shown in simplified form as the "B.P.F." block. In addition, there are two amplification stages. Assuming that the slide pot is in +K position, the B.P.F. block operates in parallel with the input resistance of the 2nd amp. As composite impedance drops, this results in higher gain and thus a boost of that particular band. Conversely, with the slide pot in −K position, negative feedback occurs in the 1st amplification stage, reducing gain and thus causing a dip in this band. The circuit is laid out in such a way that precisely symmetrical attenuation and boost are obtained with slide pot settings symmetrical relative to center. With the slide pot in center position, the bandpass filter's output is grounded, meaning that the filter has no effect whatsoever and that the incoming signal is passed on as it is.
To decouple the equalizer circuitry from influences of equipment connected upstream and downstream, a high impedance buffer amplifier and an output amplifier of low output impedance have been included.

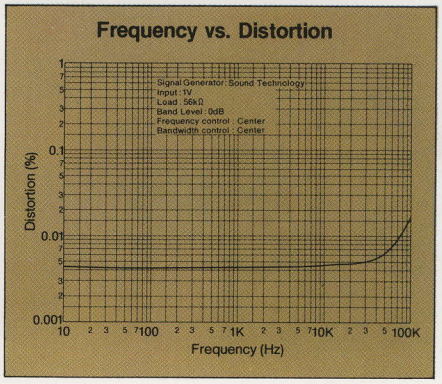
Simplified Schematic Diagram of Dual Integration Filter

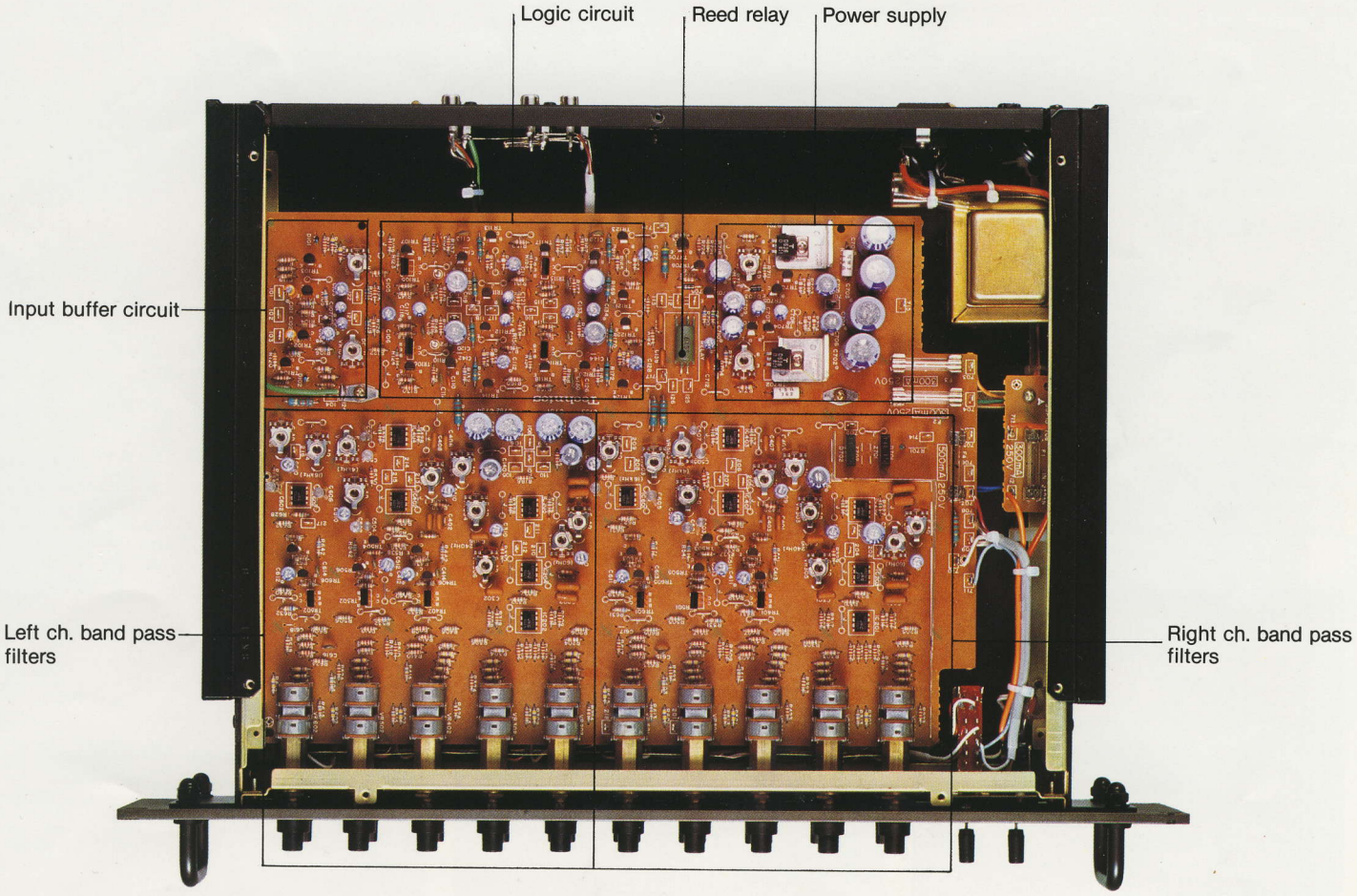


Simplified Schematic Diagram of Frequency Equalizer

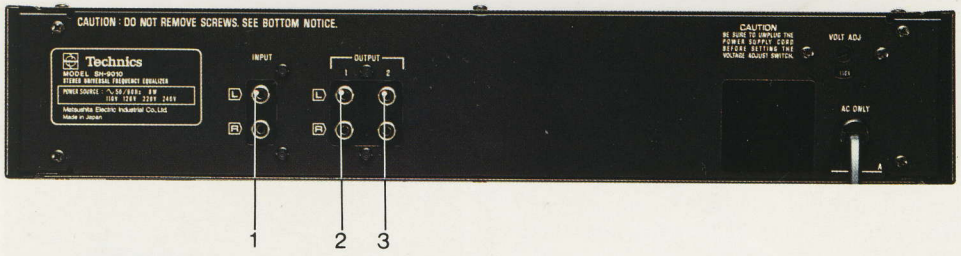


Frequency vs. Distortion



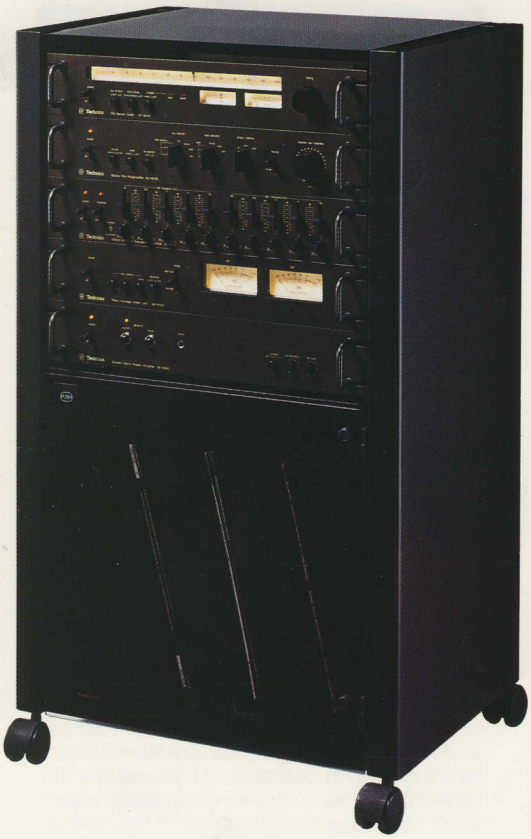


Rear Panel Facilities



1. input terminals
2. Output terminals 1
3. Output terminals 2

The "Flat" Component System is dedicated to ultimate performance at an affordable price.



Ultimate performance. Because in creating the "flat" system Technics engineers separated the basic amplifier/tuner into five components. Researched and developed each component to state-of-the-art perfection. Then recombined the components into a system that provides a magnitude of performance once thought to be purely theoretical. Affordable price. Because each component is priced far lower than what you'd expect, considering its extraordinary quality. And because the five-way breakup lets you buy just the equipment that you need—or can afford—right now. With the possibility of adding the rest of the system in the future.

The "Flat" Component System consists of:

ST-9030: FM Stereo Tuner
SU-9070: Stereo DC Preamplifier
SH-9010: Stereo Universal Frequency Equalizer
SH-9020: Peak/Average Meter Unit
SE-9060: Stereo/Mono DC Power Amplifier

Movable Custom Rack, Model SH-999K

Elegant custom rack for Technics "Flat" components or other 45cm units. Side panels black grain veneer, glass top and front door. Record compartment holds several dozen LP's. Four sturdy casters for mobility and easy access to back panel connections.

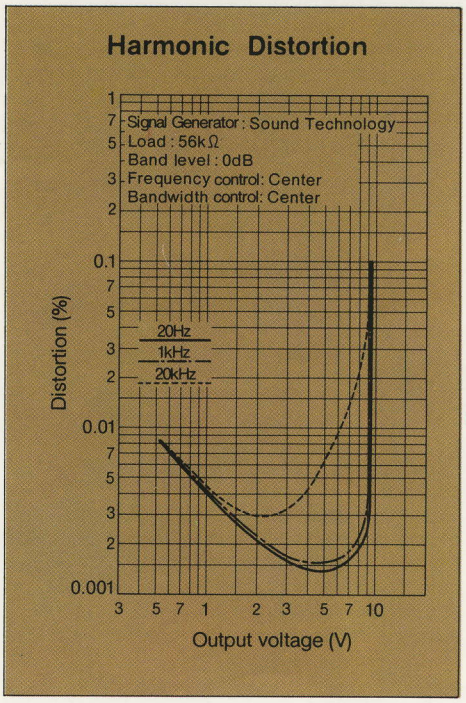
Dimensions (W×H×D) 540×969×400 mm

Technical Specifications

Output voltage/impedance	
rated	1 V/300 ohms (1 kHz)
max.	5 V/300 ohms (1 kHz)
Total harmonic distortion	0.02%
Input sensitivity/ impedance	1 V/47 kilohms (1 kHz)
Frequency response	10 Hz ~ 20 kHz +0, −0.2 dB 10 Hz ~ 70 kHz +0, −3 dB
Gain	0 ±1 dB
Signal-to-noise ratio (IHF:A)	90 dB, 87 dB (DIN 45500)
Band level control	+12 dB ~ −12 dB (5 elements ×2)
Center frequency control	+1.6 oct. ~ −1.6 oct. (5 elements ×2)
Bandwidth (Q) control	0.7~7.0 (5 elements ×2)
Center frequency	60 Hz, 240 Hz, 1 kHz, 4 kHz, 16 kHz

GENERAL

Power consumption	8.0 W
Power supply	110/120/220/240 V
Dimensions (W×H×D)	450×92×364 mm
Weight	6.0 kg



Technics
Matsushita Electric

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