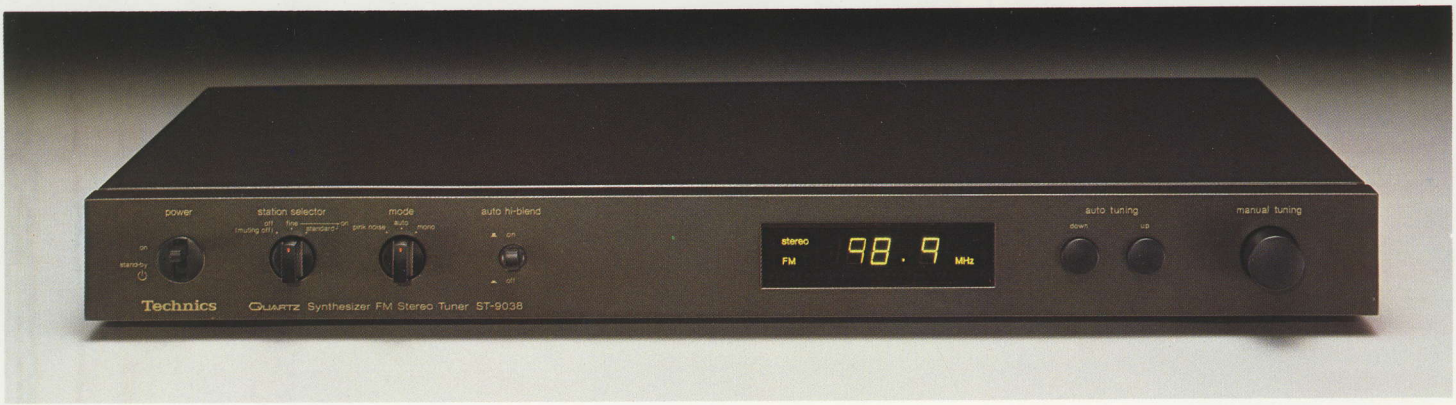
Technics ST-9038

Quartz Synthesizer
FM Stereo Tuner

SH-9038

Micom Programmable Unit

ST-9038 Quartz Synthesizer FM Stereo Tuner

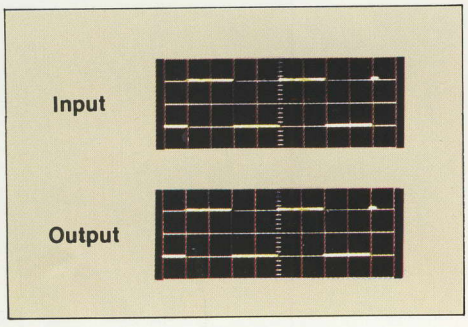


Quartz Synthesizer Tuning: State-of-the-Art in Tuning Accuracy

Like any other audio component, an FM tuner must primarily be designed as a reproducer of music. In the case of the ST-9038 Quartz Synthesizer FM tuner, several departures from conventional tuner technology have been incorporated toward this end—to achieve of a high degree of waveform fidelity, and thus a highly accurate reproduction of the musical program material being broadcast by the radio station. The most obvious departure is the use of quartz-controlled tuning. But in many other areas, the ST-9038 is decidedly unconventional, too. For example, in the IF section, careful arrangement of ceramic filters and a "SAW" filter has been used to achieve high selectivity along with uniform phase characteristics. And the use of 19 and 38 kHz signal cancellers promotes extremely low distortion in the high audio frequencies. In terms of operational elegance, the ST-9038 is equally impressive, with its unusual scanning and muting controls, and a choice of manual or automatic tuning.

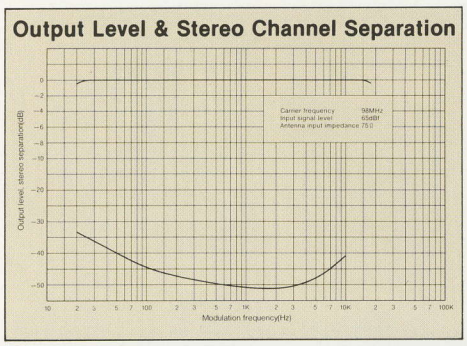
Quartz Synthesizer Tuning Helps Optimize Waveform Fidelity

The Quartz Synthesizer represents one of the most accurate tuning methods known to technology. Its unerring, drift-free accuracy permits you to receive precisely the signal you want to receive, by remaining "zero-centered" in your selected broadcast frequency. By eliminating the possibility of distortion due to mis-tuning or drift, waveform fidelity is considerably enhanced.

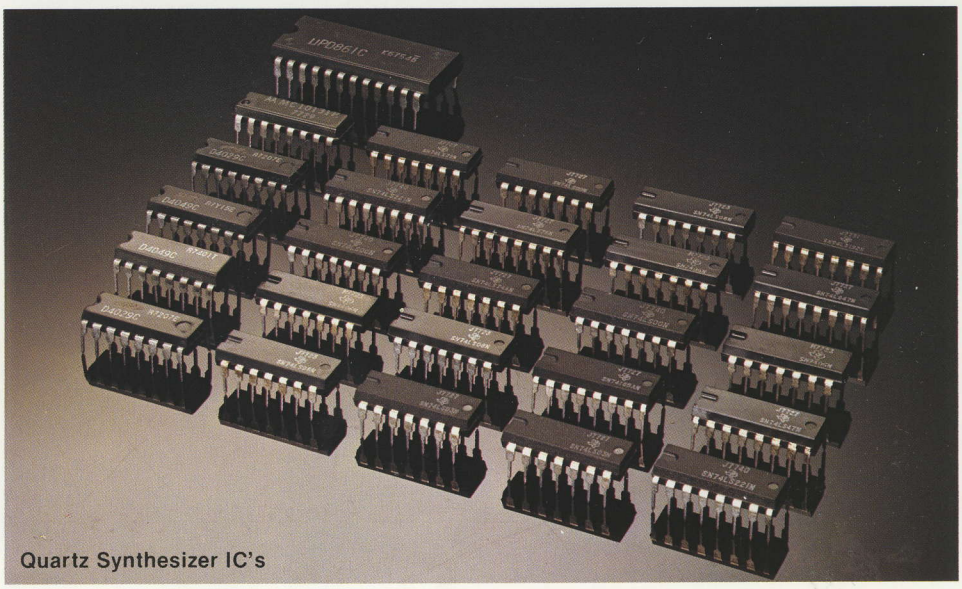


19 kHz Pilot and 38 kHz Subcarrier Cancel Circuits

The 19 kHz pilot and 38 kHz subcarrier signals are necessary for stereo broadcasting. However, they must be prevented from mixing with the audio output signal, as this would degrade waveform fidelity. Most tuners employ a low-pass filter, which attenuates the pilot and subcarrier signals, but at the same time can cause phase shift and distortion in the higher audio frequencies. The ST-9038 uses a more elegant signal-cancel method. By applying a phase-inverted signal back to the MPX stage, the 19 and 38 kHz signals are attenuated by −65 dB below the audio output level. As one benefit, overall frequency response is extremely flat and wide: 20—18,000 Hz (+0.1, −0.5 dB). But more important, very low distortion is maintained in the high audio frequencies.

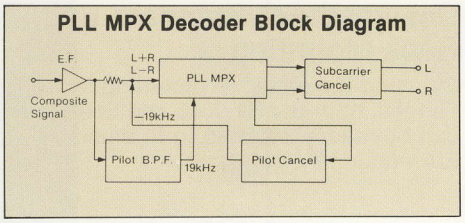



Quartz Oscillator


Quartz Synthesizer IC's

Reduction of "Jitter" Distortion

When the broadcast station's 19 kHz pilot signal becomes distorted (as by multipath), this can cause IM distortion components to appear in the audio signal. We call this "jitter distortion" because of the pattern it produces on a spectrum analyzer under test conditions. In the ST-9038, the 19 kHz signal is applied to the MPX IC after passing it through a narrow-band BPF and differential amplifier. This process "cleans up" the 19 kHz signal, and as a result, jitter distortion is kept very low. It is one of the reasons for the ST-9038's very clean sound.



SAW (Surface Acoustic Wave) Filter in the IF Stage Achieves "Flat Group Delay"

The IF section employs five stages of differential amplification with superb limiting characteristics. IF filtering is accomplished with two 4-resonator type ceramic filters, plus a SAW filter with independent and selectable group delay and amplification characteristics. The arrangement of these filters provides sharp selectivity, while at the same time maintaining uniform phase characteristics, or "flat group delay", within the signal. Both of these attributes play an important role in achieving high waveform fidelity. It should be noted that these filters achieve high *adjacent* channel selectivity, which is very important since the ST-9038 is designed to receive stations that are only 200 kHz apart on the FM band. You'll often find that you can tune in distant stations that you wouldn't be able to get on many conventional tuners that have higher sensitivity ratings.

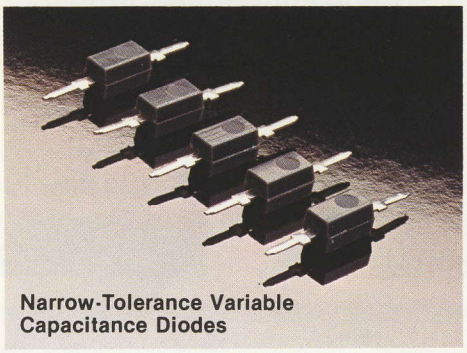
SAW Filter in the IF Stage

First Stage Differential, All-Stage Direct-Coupled AF Amp with SEPP Output

The audio-frequency amplifier used in the ST-9038 once again demonstrates heavy emphasis on waveform fidelity. Low-noise IC's are used throughout, with a differential amplifier in the first stage and a SEPP output stage, with all-stage direct coupling. With a regulated-voltage, balanced positive/negative power supply, the AF stage achieves outstanding waveform fidelity, along with the ability to handle overmodulated broadcast signals.

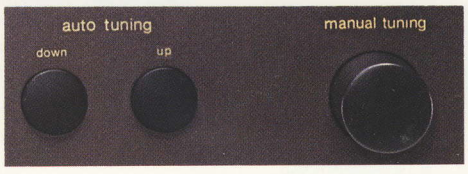
Purely Electronic Front End

Five specially selected, narrow-tolerance, variable capacitance diodes are used in the front end, taking the place of a conventional 5-gang tuning capacitor. RF amplification is accomplished with a dual-gate MOS FET. Frequency drift and interference are severely suppressed with double-tuned circuits and a buffer FET between the mixer and oscillator stages.


Narrow-Tolerance Variable Capacitance Diodes

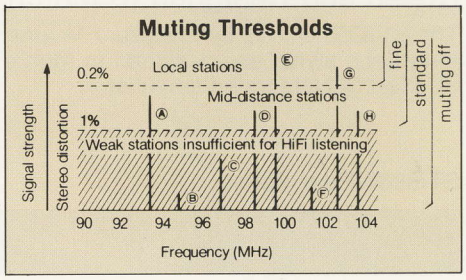
Accurate and Effortless Tuning

Stations on the FM dial are spaced 100 kHz apart, with nothing in between but inter-station noise. The quartz synthesizer system receives only those frequencies on which FM signals may be broadcast, in precise 100 kHz divisions through the 87.6—107.9 MHz FM band. With the digital read-out of the tuned MHz frequency, it becomes very easy to tune in precisely the frequency you want. Furthermore, the ST-9038 is equipped with "last one memory", which means that the station you were tuned to when the unit was turned off will come on again when the unit is turned back on. This is of course true of conventional tuners, but with the ST-9038, no drift can occur because of temperature differences. Even if the unit is unplugged or a power failure occurs, a self-contained Ni-Cad battery will "hold", the memory for about a week.



Choice of Manual or Automatic Tuning, and Two Muting Thresholds

These two features work together. First, on the front panel, you'll notice that there are "UP" and "DOWN" auto-tuning buttons. When you press either of these buttons, the tuner will automatically scan up or down the FM band and stop at the first station that fulfills the signal-quality requirements that you select with the muting function. The muting function (station selector) permits you to select "fine", in which only the strongest, cleanest stations will come through; "standard", in which slightly weaker, but still listenable stations will come through (corresponding to about 1% distortion at 1 kHz); or "step scan" (muting off), in which any station, regardless of quality, will come through. This last selection permits you to do some "station hunting" for weak or distant stations. If you find one, you can of course try to improve the sound quality by moving your antenna around, using the filters on your amplifier, etc. And when you want to move quickly up or down the dial, just turn the "manual tuning" knob, and tuning can be accomplished in the same way as with a conventional tuner.



Automatic Hi-Blend Cleans Up Weak Stereo Signals

When you are receiving a weak, distant stereo broadcast, background hiss can be greatly reduced with the hi-blend function, which works automatically. Whenever signal-strength drops below a fixed threshold, and as a result background noise would become unacceptably high, the automatic hi-blend combines the higher frequencies into essentially a monophonic audio signal. This cancels out much of the high-frequency hiss, while still maintaining full stereo separation in the lower frequencies. If you wish, the hi-blend function can be defeated with a front-panel switch.

Pink-Noise Generator

The pink-noise generator is a valuable tool for making level checks and adjustments in your audio system. It becomes most useful when you intend to record FM broadcasts. The output level corresponds to a 50% modulation level in FM broadcasts, so you can use it to adjust input levels on your tape deck. They will be properly set when the deck's level meters deflect to the −6 dB position.

Other Features

- A 16-pin bus line connection permits connection of the optional SH-9038 Micom unit for programming station changes, on/off, "absentee" recordings of FM broadcasts, etc.
- Die-cast cabinet (front, top, sides) for sealing out high-frequency interference and cross-modulation.
- Jacks for connecting an oscilloscope or other multi-path detecting device. Multi-path can also be detected by connecting these jacks to the "aux" inputs on your amplifier. In the "aux" amplifier setting, you will hear multi-path, so you can adjust your antenna to minimize it.
- Rear-panel output level control for matching tuner volume with other components connected to your amplifier.

SH-9038 Micom Programmable Unit (Optional for use with ST-9038 tuner)

Stereo System Computerization is Now a Reality

In an age when many things are progressing toward sophisticated computerized control, Technics offers the SH-9038 Micom Programmable Unit. As an optional companion unit for the ST-9038 tuner, the combination will allow you to program an entire stereo system. While not an audio processor itself, it is designed to let you get more enjoyment out of your system than you ever imagined possible.

32-Step Programmable Memory Function Includes FM Station Selection

Designed to be used with the ST-9038 Quartz Synthesizer FM tuner, the Micom can be programmed to remember up to eight different FM stations on the ST-9038 tuner. You can then set the Micom to tune in any of these stations, in any order, at any time of the day on selected days, for a one-week period. Besides FM station selection and tuner on/off, you can also program the unit to turn on or off any of three additional components plugged into the AC outlets of the power unit, such as your amplifier, tape deck, etc. All together, the Micom can be programmed to remember up to 32 individual steps in the following order: day-of-the-week, time, station, AC line, on/off. You program the unit in the "write" mode, and then get a display of the program in the "read" mode. You also have the option of "overriding" your program (manual), or allowing it priority (auto). For example, if you have programmed the unit to turn station "ABC" on at 9:00, "ABC" will come on at 9:00 regardless of what station you were listening to beforehand. However, if you want to listen to station "XYZ", and don't want the unit to switch to "ABC" at 9:00, just turn the program mode to "manual", and the program will be overridden. You have this same option when it comes to switching on or off the other components connected to the unit.

The Microprocessor: A Successful Adaptation of Computer Techniques

The brain behind the various programming functions of the SH-9038 is our own microprocessor chip. Designated MN1400, the one-chip microprocessor contains a 1024 × 8-bit ROM (read-only memory), and a 64 × 4-bit RAM (random-access memory). Additionally, two CMOS IC's, functioning as 8-bit RAM's, provide memory capacity for up to eight pre-selected stations.

Clock Function

The switching operations are correlated with the Micom's digital clock. The easy-to-read timepiece is built into the front panel, and gives continuous indication of minute and hour, with the day of the week indicated by an LED. Adjustment of the clock can easily be made with separate hour and minute buttons. Another button selects the day of the week.

Stop-Watch Function

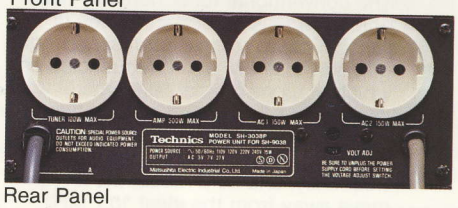
This feature comes in handy when you're recording. When in the stop-watch mode, the clock gives a readout in minutes and seconds, up to a total of 59:59, at which point it resets to 00:00, and the cycle is repeated. There is also a hold function, which you can use to stop the clock while the tape deck is in the "pause" mode. With the stop-watch, you have a precise record of recording time, and don't have to guess about time remaining before tape run-out.

Die-Cast Cabinet Provides Shielding Effect

The SH-9038's die-cast cabinet prevents it from causing interference in other components. Conversely, extraneous outside signals that might affect the microprocessor's accuracy are kept out.

Power Unit for SH-9038

Front Panel

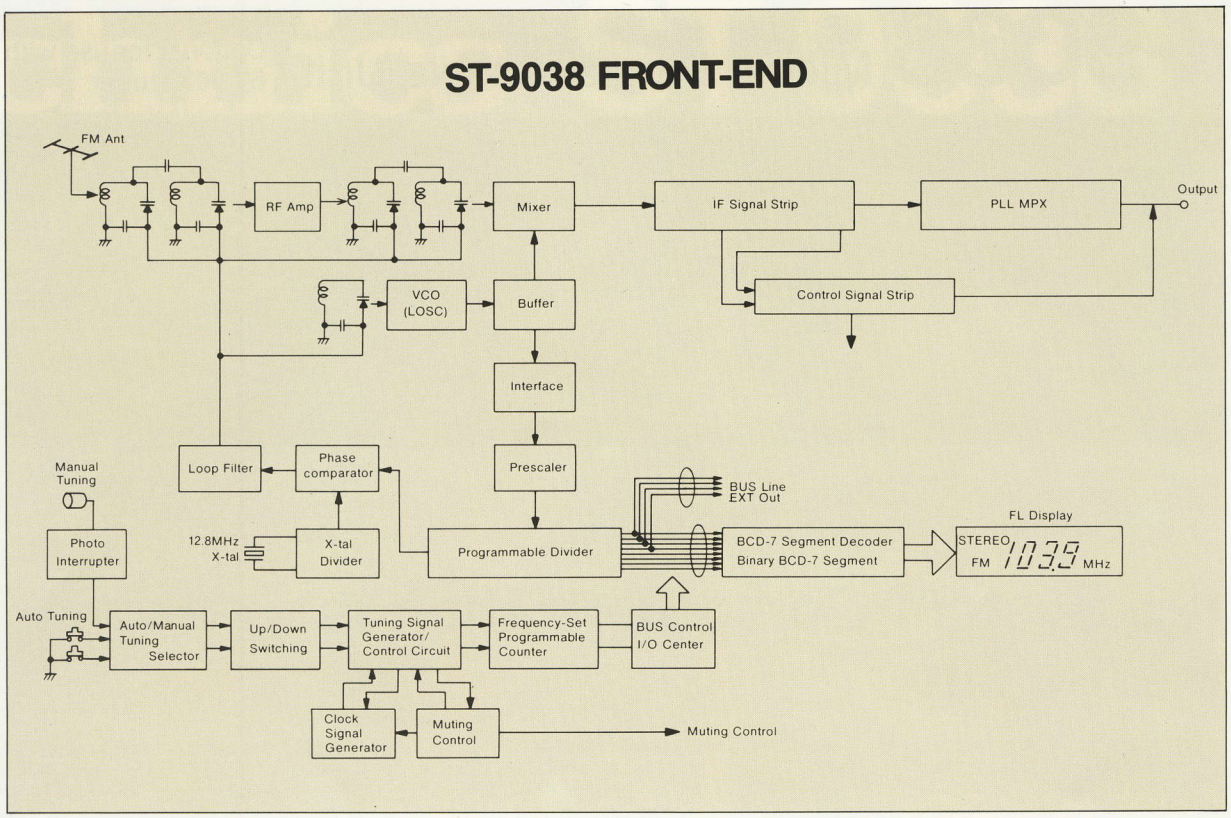


Rear Panel

Dimensions (W × H × D)	225 × 97 × 166 mm (8-27/32" × 3-13/16" × 6-17/32")
Weight	3 kg (6.6 lb)

Programming: Here's How Easy It Is.

Desired Setting	Program Start	Day of Week?	Time of Day?	FM Station?	Tape Recording?	On or Off?
How to Operate	Set Program Mode Selector at WRITE.	Push button for desired day (s) of week (e.g. Monday = 2)	Push buttons (4 digits) for desired time, in 24-hour method. (e.g. for 9:38 p.m. push 2-1-3-8)	Push button for one of 8 pre-selected FM stations.	To record on deck 1, push AC1. For deck 2, push AC2. Push both to record on both decks.	Push "on" button (Off button turns equipment off at programmed time.)



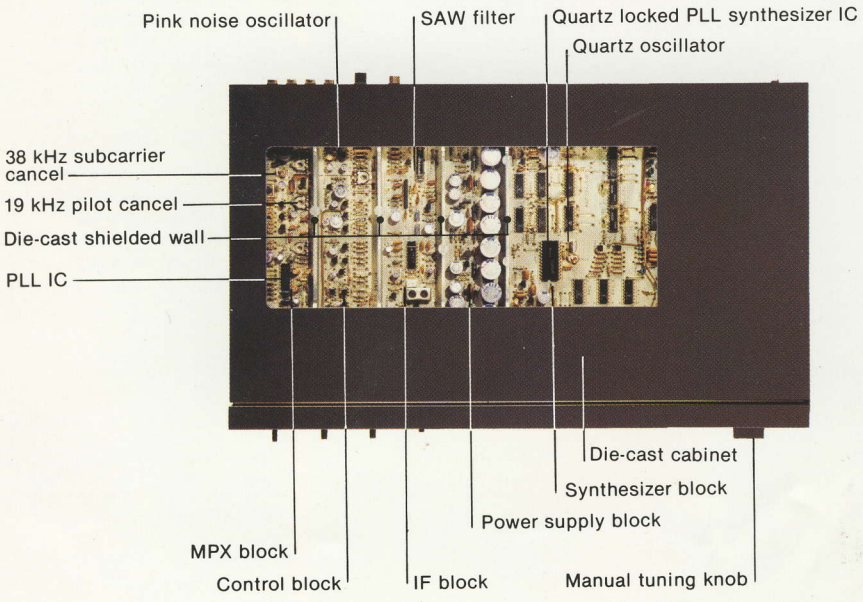
The Principles of a Quartz Synthesizer FM Tuner

When you dial the tuning knob of a conventional FM tuner, you are causing changes in the oscillation frequencies of the "local oscillator" circuit. In the "mixer" stage, this oscillation frequency is combined with the frequency of the FM station in such a way that an intermediate frequency (IF) is produced. Ideally, this intermediate frequency should always be 10.7 MHz. It is then isolated from whatever unwanted signals may be present by a series of IF filters.

The conventional tuner normally uses one, or more commonly a series of variable capacitors which respond not only to those FM band frequencies on which stations are actually broadcasting, but to any and all in-between frequencies. Therefore, the tuner can drift away from the exact broadcast frequency, and as a result, the IF can move away from the ideal 10.7 MHz. This can happen with temperature change, the passage of time, and of course accidental mis-tuning.

The ST-9038 works on an entirely different principle, which we call "quartz synthesizer." Here, the oscillation of a quartz crystal (which is one of the most stable references in the entire world of electronics) becomes the reference for *both* the local-oscillator frequency and the broadcast frequency. With the quartz synthesizer, only the frequencies on which a broadcast signal might exist can be received—at precisely spaced 200 kHz steps on the 88—108 MHz FM band. And only the proper local-oscillator frequency can be generated, so that the IF will be exactly 10.7 MHz for any broadcast you tune in. Because the quartz oscillator is so stable, drift becomes virtually non-existent. The tuner can not come out of alignment because there is nothing to retune or adjust. The selected frequency is digitally displayed on the front of the unit. There is no dial, no pointer, no string mechanism. So there can not be reading errors or mis-alignment of indicators.

In the ST-9038, the quartz synthesizer tuning method is combined with two types of tuning operation, automatic and manual. Automatic scanning (with UP and DOWN sensor buttons) means that you can scan the dial, in exact 200 kHz steps, until you arrive at a station that fulfills the signal-quality conditions that you select with the muting function. There's also manual tuning, which permits you to move quickly up and down the dial, as you do with conventional tuners. Both in principle and execution, the Technics ST-9038 can safely be called one of the most technologically advanced FM tuners that today's "state-of-the-art" has achieved.



Styled and Designed to Match the SU-8080 Integrated Amplifier

The ST-9038 Quartz Synthesizer FM tuner and SH-9038 Micom Programmable Unit have been styled and designed to form a harmonious system with the Technics SU-8080 DC integrated amplifier.

Designed For Standard EIA Rack Mounting

By using the included mounting flanges, both the ST-9038 and SH-9038 can be readily adapted to fit standard EIA equipment racks.

ST-9038 Rear Panel

SH-9038 Rear Panel

Technical Specifications (DIN 45 500)

ST-9038

Frequency range	87.6 ~ 107.9 MHz
Sensitivity (±40kHz deviation)	
S/N 30 dB	1.2μV (75Ω)
S/N 26 dB	1.1μV (75Ω)
S/N 20 dB	1.0μV (75Ω)
IHF usable sensitivity	1.2μV (IHF '58)
IHF S/N 46 dB stereo quieting sensitivity	20μV (75Ω)
Total harmonic distortion	
MONO	0.1% (1 kHz)
STEREO	0.15% (1 kHz)
S/N (±40kHz deviation)	
MONO	72 dB (75 dB, IHF)
Frequency response	20 Hz ~ 18 kHz +0.1 dB, −0.5 dB
Alternate channel selectivity	75 dB
Capture ratio	1.0 dB
Image rejection at 98 MHz	95 dB
IF rejection at 98 MHz	105 dB
Spurious response rejection at 98 MHz	105 dB
AM suppression	55 dB
Stereo separation	
1 kHz	45 dB
10 kHz	35 dB
Carrier leak	
19 kHz	−60 dB (−65 dB, IHF)
Channel balance	
250 Hz ~ 6300 Hz	±0.5 dB
Limiting point	1.0μV
Bandwidth	
IF amplifier	250 kHz
FM demodulator	1000 kHz
Antenna terminal	75Ω (unbalanced) F-type co-axial
Output voltage & impedance	0 ~ 1.5 V (variable)
Power consumption	12 W
Power supply	AC 110/120/220/240 V 50/60 Hz
Dimensions (W × H × D)	450 × 53 × 293 mm (17-23/32" × 2-3/32" × 11-17/32")
Weight	5.9 kg (13.0 lb)

SH-9038

Functions	Weekly program with a 1 chip 4-bit microprocessor (programming possible for an entire week)
Program content	Day, Time (hours, minutes), FM channel, AC outlets (for amp and tuner use, AC1, AC2) on-off.
Program writing, recall, and reset	Full program reset capability Individual program step recall, content checking capability Rewriting of individual program steps and cancelling capability during writing
Program steps	Maximum of 32 steps/1 week's worth of time programming
Controlled AC outlets (maximum specifications)	tuner 100W amp 500W AC1 150W AC2 150W
Clock function	AC line frequency synchronous type Weekly clock (day and time indication) Power off indication
Timer	Individual second time counter capability, maximum indication 59 minutes 59 seconds Reset, Start, Hold capability
In combination with Technics ST-9038	
FM Pre-set	8 FM station pre-set capability (with memory power cut-off compensator)
Other functions	Auto operation priority function (with program mode in the "Auto" position)
Power consumption	15W
Power supply	AC 110/120220/240V 50/60 Hz
Dimensions (W × H × D)	450 × 53 × 285 mm (17-23/32" × 2-3/32" × 11-7/32")
Weight	4.5 kg (9.9 lb)

Technics
Matsushita Electric

Specifications subject to change without notice. Printed in Japan