

Accuphase

DDS FM STEREO TUNER

T-1100

- Double-tuned front end easily handles high signal levels
- Revolutionary DDS principle for local oscillator
- Variable bandwidth IF filter prevents interference
- Multipath reduction function
- Digital FM detector keeps distortion and noise to a minimum
- DS-DC achieves ideal stereo demodulation with DSP technology
- MDS plus type D/A converter
- 20-station memories also store function settings





The ultimate FM stereo tuner — Latest RF technology and advanced digital processing techniques come together on the highest plane. All functions after the intermediate frequency (IF) stage are performed by DSP software, including the variable bandwidth IF filter, multipath reduction (MPR) function, digital FM detector and DS-DC stereo demodulator. Pulse tuning principle allows manual tuning and 20-station memory tuning. Digital output increases connection options.

The range of available program sources is getting ever more varied: Compact Discs, analog records, and net based music distribution, to name but a few. But the FM tuner still has a special role to play, since broadcasts cover the entire spectrum from live performances of time-honored classical works to the latest hits. The FM band provides a rich choice of music all day long. In addition, many local stations have recently come onto stage using the live broadcast medium to best advantage.

The T-1100 is a successor model to the highly praised T-1000. Thanks to a blend of latest RF circuit design with sophisticated digital signal processing implemented by a high-speed, high-precision DSP chip, it has become possible to move most major functions of the tuner into the digital domain without sacrificing performance or sound quality. Audiophiles and music lovers can now enjoy FM stereo at its best.

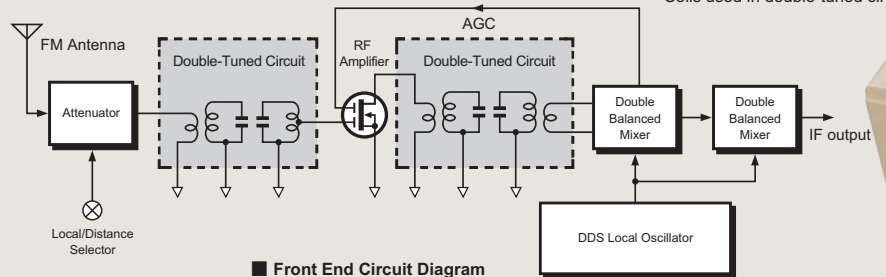
The newly developed front end features a double-tuned circuit that optimizes sensitivity and selectivity, as well as the revolutionary DDS (Direct Digital Synthesis) principle for the local oscillator. All functions after the intermediate frequency (IF) stage are implemented using digital signal processing in completely new and innovative ways. This comprises the variable bandwidth IF filter, multipath reduction function, digital FM detector and DS-DC stereo demodulator. The result is an FM tuner unlike any other, offering further enhanced performance and sound quality. Other attractive features include a 20-station memory, a coaxial output for digital signal connection, two sets of line and balanced analog outputs, and a supplied Remote Commander for operation convenience. In sum, this is a lavishly designed FM tuner that will meet and surpass even the highest expectations.

Double-Tuned Front End Eliminates Problems With High Input Signal Levels

- An attenuator in the input stage enables the tuner to operate at its optimum point also when input levels are extremely high, such as in the vicinity of a broadcast tower or when using a cable network.
- Two-stage double-tuned front end eliminates intermodulation distortion with strong signals.
- Dual-gate MOS-FETs in the RF amplifier stage ensure excellent third-order intermodulation characteristics.
- Two-stage double-balanced mixer suppresses undesired signal components.
- Revolutionary DDS local oscillator achieves amazing S/N ratio.



Coils used in double-tuned circuits

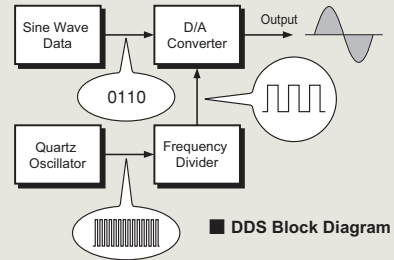


■ Front End Circuit Diagram

DDS (Direct Digital Synthesis)

The signal from the antenna input is routed to an RF amplifier and then mixed with the signal from a local oscillator for conversion into the intermediate frequency (IF). The local oscillator here is a highly advanced DDS (Direct Digital Synthesis) circuit.

- The output of a quartz oscillator is supplied to the frequency divider to create the timing (namely the sampling frequency) with which the sine wave data are read out.
- Using this sampling frequency, the sine wave data are read in the D/A converter to create the analog waveform output.
- Because there is no feedback loop, the frequency purity of the D/A converter output can be kept identical to that of the quartz oscillator.



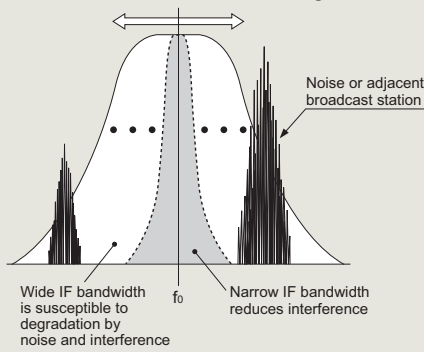
■ DDS Block Diagram

Variable Bandwidth IF Filter Improves Interference Performance

The IF BANDWIDTH selector of the T-1100 provides a choice of six settings (50, 75, 100, 150, 250, 500 kHz). Normally, a wider bandwidth setting is preferable in terms of performance characteristics, but by restricting the bandwidth, noise can be reduced in certain situations, making it easier to obtain a good quality signal from a station affected by interference from a strong adjacent station.

The variable bandwidth IF filter is implemented using a FIR (Finite Impulse Response) type digital filter with perfectly linear phase characteristics, thereby eliminating the phase shift that can occur with conventional IF bandwidth filters.

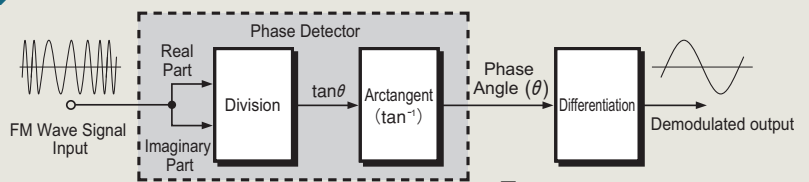
■ IF bandwidth switchable in 6 stages



■ IF bandwidth is selected by turning knob (with LED indication)

Ideal Digital FM Demodulation Principle

The FM demodulator circuit is a crucial component that has a significant effect on distortion and noise characteristics of the tuner's audio output. In the T-1100, the imaginary part of the digitized FM signal is divided by the real part to extract the tangent of the phase angle (θ). By calculating the arctangent from this, the phase angle can be determined. Differentiation is then used to obtain the time variation resulting in the FM demodulated output (audio output).



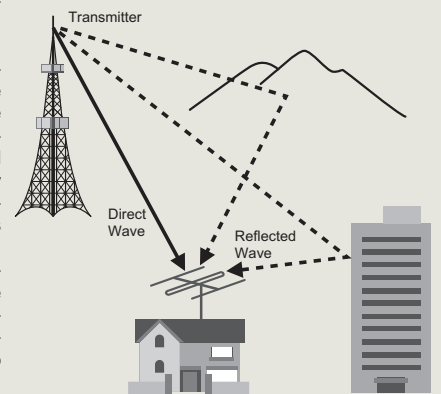
■ Digital FM Demodulator

Multipath Reduction Function (MPR) Minimizes Reflections

Multipath reception refers to a condition where the same broadcast signal reaches the antenna via several different propagation routes. In the case of FM, this occurs when the signal travels to the antenna in a straight line, but is also reflected and therefore slightly delayed by buildings, mountains or other tall obstructions. When the direct waves and reflected waves are received together, distortion and noise occur.

The high-speed, high-precision DSP chip in the T-1100 makes it possible to perform multipath reduction (MPR) through signal processing that effectively suppresses the harmful reflected components. This technique which is based on adaptive filtering principles ensures that only the desirable direct wave components are received, resulting in high-quality audio output.

■ FM Propagation Characteristics

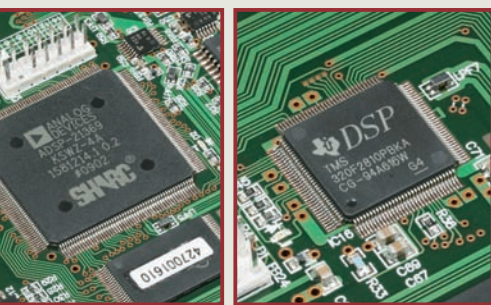




■ **Supplied Remote Commander RC-410**
 Provides access to all functions of the tuner (except power switching), as well as (Accuphase) amplifier volume control.



■ **Intermediate frequency (IF) signal from front end is digitized by high-precision A/D converter**



■ **Functions after intermediate frequency (IF) stage (variable bandwidth IF filter, multipath reduction, digital FM detector, DS-DC stereo demodulator) are performed through fully digital signal processing by a high-speed, high-accuracy DSP chip, providing drastically improved performance. The end result is an FM tuner of the highest order.**

1 Pilot Tone Direct Synthesis

A conventional FM tuner uses a PLL circuit to extract the pilot tone and obtain the frequency and phase components from the input signal (stereo-modulated signal). If the level of the pilot tone decreases, noise will be heard and stereo separation becomes extremely poor.

With DS-DC, the waveform of the pilot tone in the input signal is identified as is* and generated directly by the DSP arithmetic. Therefore the pilot tone can be extracted reliably even when a high level of noise is present. Impressive stereo separation can be achieved even when the pilot tone level is low.

*Simply analyzing the signal and determining similarities.

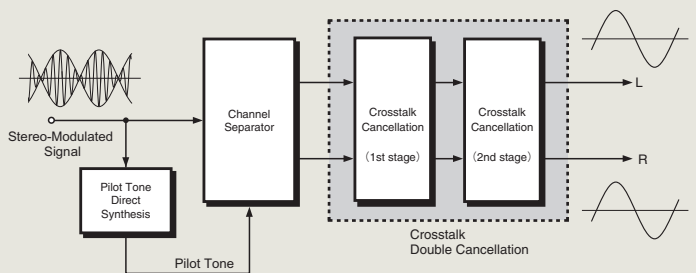
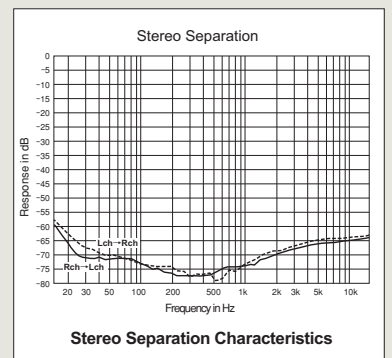
2 Crosstalk Double Cancellation

After the input signal has been separated into the left and right components, the circuit eliminates crosstalk using a dual approach that also takes phase components into consideration. The result is extremely thorough left/right separation.

DS-DC (Direct Synthesis – Double Cancellation)

DS-DC principle with DSP ensures ideal stereo demodulation for amazing channel separation

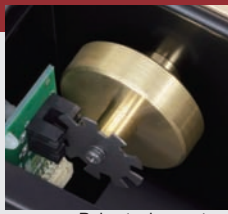
The stereo demodulator in the T-1100 features another Accuphase innovation called DS-DC (Direct Synthesis – Double Cancellation). The demodulator comprises the two technologies described below. Since all operations are carried out through software-based algorithms in Digital Signal Processor, ideal demodulation performance can be achieved, resulting in previously unheard-of channel separation.



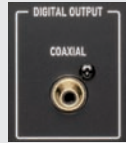
■ **DS-DC Type Stereo Demodulator Circuit**

Versatile Array of Functions

- 20-station memory with all function settings
- Accuphase original pulse tuning system provides traditional manual tuning feel
- Confirmation beep when operating tuning knob and function buttons
- High-quality digital output connector (coaxial)
- MUTE button allows turning muting ON or OFF during tuning
- MODE button allows selection of desired reception mode



Pulse tuning system



Digital output connector

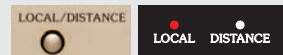
- STEREO: Normal stereo reception
- BLEND: Left and right signals are mixed, to reduce noise particularly in the upper frequency range
- MONO: Stereo broadcast reception forced to monophonic



MODE button

- Attenuator function for reducing input level

LOCAL: Attenuator ON



Attenuator function

- Meter for monitoring signal status

Signal strength as well as multipath condition and effect of multipath reduction (MPR) can be verified.

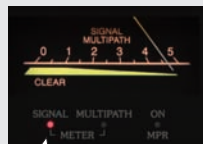


Meter function selection and MPR ON/OFF switching

Signal strength indication

Multipath level indication

Multipath reduction (MPR) ON



SIGNAL indicator lit

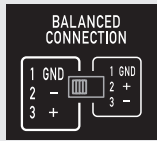
MULTIPATH indicator lit

MULTIPATH/MPR indicators lit

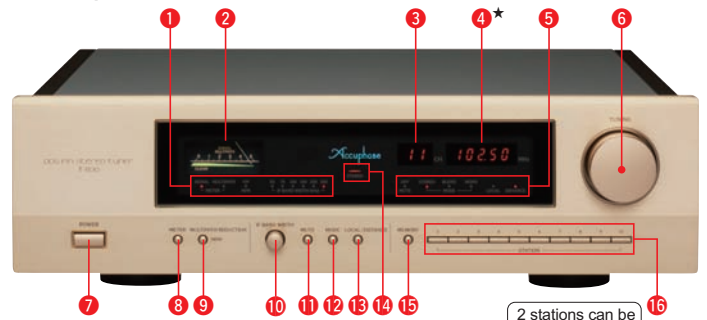
- Two sets of analog outputs: balanced and line

- Phase selector for balanced output

- In the factory default condition, the switch is set to the left side (pin 3 positive).
- If the connected preamplifier or integrated amplifier uses a "pin 2 positive" arrangement, change the setting of the switch.



Front panel



Rear panel



- LED indicators METER MPR IF BAND WIDTH
- Meter (Signal strength/Multipath)
- Station number readout
- Reception frequency readout*
- LED indicators MUTE MODE LOCAL DISTANCE
- Tuning knob
- Power switch
- Meter function button SIGNAL/MULTIPATH
- Multipath reduction (MPR) ON/OFF button
- IF bandwidth selector knob
- Muting circuit ON/OFF button
- Mode selector button STEREO/BLEND/MONO
- LOCAL/DISTANCE selector button
- Stereo reception indicator
- Memory set button
- Station buttons (20 stations)
- Antenna input connector (F type)*
- Phase selector for balanced output
- Analog output connectors BALANCED LINE
- Digital output connector COAXIAL
- AC power connector (for supplied power cord)*

Remarks

- *This product is available in versions for 120/230 V AC. Make sure that the voltage shown on the rear panel matches the AC line voltage in your area.
- *The shape of the AC inlet and plug of the supplied power cord depends on the voltage rating and destination country.
- *The reception frequency range, number of display digits, and tuning frequency steps differ in models for different countries. The antenna connector may also be an IEC type or F type connector. Please verify that you have the correct model for your area.

T-1100 Guaranteed Specifications

[Guaranteed specifications are measured according to EIA standard RS-490.]

Frequency range and tuning step width

| | |
|-------------------------|---|
| Model for Europe | 87.50 MHz - 108.00 MHz (in 50-kHz steps) |
| Model for USA | 87.5 MHz - 108.0 MHz (in 100-kHz steps) |

Monophonic

- Sensitivity** Usable sensitivity 11 dBf
S/N 50 dB quieting sensitivity 17 dBf
- S/N ratio** (80 dBf input, A-weighted) 90 dB
- Total harmonic distortion** (80 dBf input, ± 75 kHz deviation)
20 Hz 0.02 %
1 kHz 0.02 %
10 kHz 0.02 %
- Intermodulation distortion** (80 dBf input, ± 75 kHz deviation) 0.01 %
- Frequency response** 10-15,000 Hz +0 -2.0 dB
- Capture ratio** 1.5 dB
- RF intermodulation** 80 dB
- Spurious response rejection** 120 dB
- Image rejection** 100 dB

Alternate channel selectivity

| Interference signal | Selectivity |
|---------------------|-------------|
| 400 kHz | 70 dB |
| 300 kHz | 30 dB |
| 200 kHz | 10 dB |

- AM suppression** (65 dBf input) 80 dB
- Output voltage** (± 75 kHz deviation) 1.0 V

Stereo

- Sensitivity** S/N 40 dB quieting sensitivity 29 dBf
S/N 50 dB quieting sensitivity 37 dBf
- S/N ratio** (80 dBf input, A-weighted) 85 dB
- Total harmonic distortion** (80 dBf input, ± 75 kHz deviation)
20 Hz 0.04 %
1 kHz 0.04 %
10 kHz 0.04 %
- Intermodulation distortion** (80 dBf input, ± 75 kHz deviation) 0.03 %
- Frequency response** 10-15,000 Hz +0 -2.0 dB
- Stereo separation** 100 Hz 60 dB
1 kHz 60 dB
10 kHz 50 dB
- Stereo trigger level** 21 dBf
- Subcarrier suppression ratio** 70 dB

General

- Antenna input** 75-ohm coaxial (F type connector)
- Standing wave ratio** 1.5
- Tuning principle** DDS synthesizer tuning
20-station random memory tuning
- FM detection principle** Digital FM demodulation principle
- Stereo demodulation principle** DS-DC
- Digital output** (IEC60958)
COAXIAL: 0.5 V_{P-P} 75 ohms
Sampling frequency: 48 kHz/24 bits
- Output impedance**
BALANCED (XLR type connector): 100 ohms (50 ohms/50 ohms)
LINE (unbalanced): 50 ohms
- Meter** Signal strength/multipath switchable
- Power requirements** AC 120 V/230 V, 50/60 Hz
(Voltage as indicated on rear panel)
- Power consumption** 20 W
- Maximum Dimensions**
Width 465 mm (18-5/16")
Height 140 mm (5-1/2")
Depth 406 mm (16-0")
- Weight** 13.0 kg (28.7 lbs) net
19.0 kg (41.9 lbs) in shipping carton

Notes

- An FM antenna is required to use the T-1100. Please consult your dealer regarding antenna installation.
- In residences with shared antenna systems, confirm that the antenna outlet carries FM signals.
- Use a 75-ohm coaxial cable with F type plug for the antenna connection.

- Supplied accessories:**
 - AC power cord
 - Audio cable with plugs (1 m)
 - Remote Commander RC-410



ACCUPHASE LABORATORY, INC.