

# Accuphase

DDS FM STEREO TUNER

## T-1000

- Revolutionary DDS principle for local oscillator
- Dual-stage tuning front end easily handles high signal levels
- High-performance "Advanced DGL" FM detector
- DS-DC achieves ideal stereo demodulation with DSP technology
- FREQ.TRIM function reduces adjacent station interference
- 32 station memories also store reception settings
- Pulse tuning principle
- Digital output connector
- Balanced outputs
- Supplied remote control





**Witness the DDS revolution – Advanced RF technology and latest digital know-how join forces in this ultimate FM stereo tuner. The front end easily handles even very high signal levels. An “Advanced DGL” Detector delivers high performance and is fully adjustment-free. DS-DC based on digital signal processing assures ideal stereo demodulation performance. Choose between manually operated pulse tuning and 32-station memory. Explore the many other impressive features.**

The range of available program sources is getting ever more varied: SA-CD, CD, DVD, net-based music distribution, to name but a few. But FM broadcasts still have a special role to play, since they 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 recent years, many local stations have come onto the scene, covering community events and using the live broadcast medium to its best advantage.

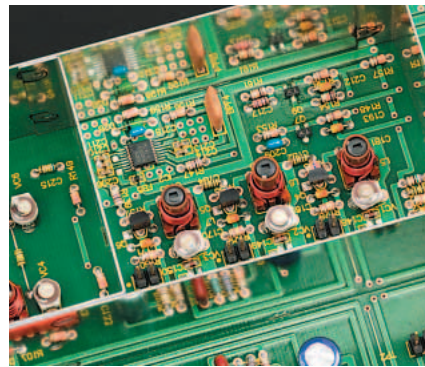
Many audiophiles and music lovers were wishing for the re-appearance of a truly high-class tuner to complement a modern-day audio system and provide the means to enjoy FM broadcasts with optimum sound quality. By developing new circuit components and applying its innovative thinking to circuit topology, Accuphase has created a product that meets and exceeds these expectations. The T-1000 is an FM stereo tuner of the highest order. It represents a bold fusion of advanced RF technology with latest digital finesse.

The newly developed front end employs the revolutionary DDS (Direct Digital Synthesis) principle in the local oscillator. In addition, the DS-DC type stereo demodulator performs all necessary operations through software-based arithmetic processing in a DSP microprocessor. This radically new approach to circuit design results in amazing S/N ratio and channel separation, elevating FM tuner performance to a new level. Convenient features such as a 32-station memory, digital output, and balanced output circuitry are further advantages that ensure pure signal transmission without any sound

quality degradation. The T-1000 is the ultimate luxury-class FM tuner representing a successful blend of sound quality, performance, and ergonomics.

**Dual-stage tuning front end easily deals with very high signal levels**

- Double-tuned antenna circuit prevents cross modulation interference at high input levels.
- FET-based RF amplifier is configured as a cascode circuit with low feedback.
- Input gate features an attenuator that prevents overload even in close proximity of strong transmitters.

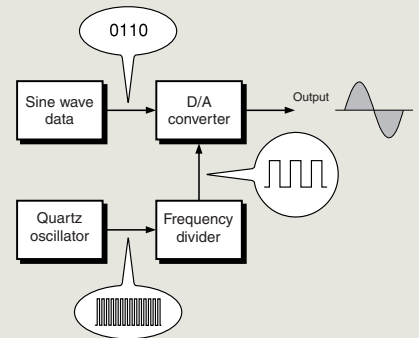


**Revolutionary DDS principle in local oscillator achieves exceptional S/N ratio**

An FM tuner amplifies the signal from the antenna input in an RF amplifier and then mixes it with

the signal from a local oscillator for conversion into the intermediate frequency (IF). In the T-1000, the local oscillator is a highly advanced DDS (Direct Digital Synthesis) circuit. Unlike conventional PLL circuits, DDS does not use feedback, allowing it to produce an output signal whose frequency accuracy is exactly the same as that of the quartz oscillator itself. Because no unwanted frequency modulation components are present in the IF stage, the Super Heterodyne front end achieves drastically improved S/N ratio.

**DDS (Direct Digital Synthesis)**



The output of the quartz oscillator is supplied to the frequency divider to create the timing (in other words 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.

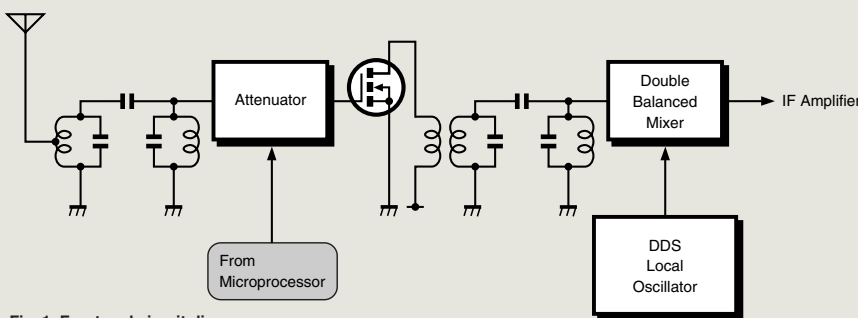
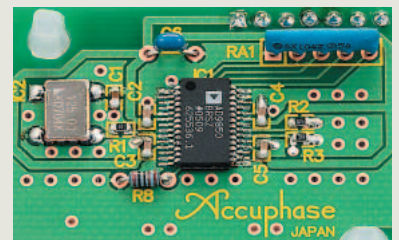
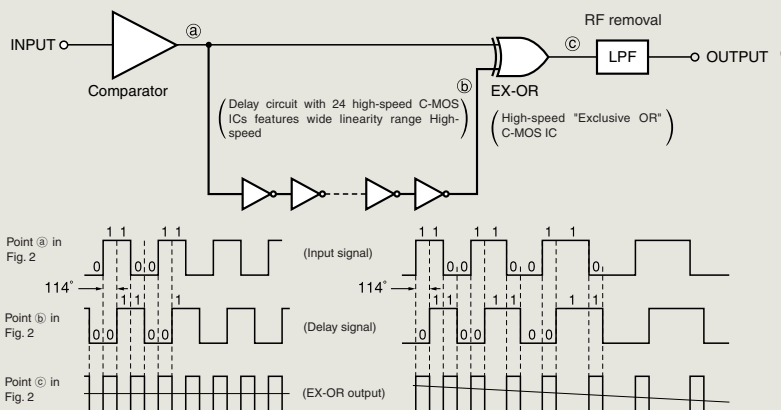


Fig. 1 Front end circuit diagram

**High-performance Advanced DGL Detector**

The FM (frequency modulation) detector is a so-called Advanced DGL (Differential Gain Linear) detector developed by Accuphase. This circuit delivers superb performance (minimal distortion, high S/N ratio) while requiring absolutely no adjustment, assuring optimum reliability.

As shown in the diagram at right, the input stage employs a high-speed comparator in the 2.5 MHz wide-band amplifier, to eliminate beat interference. The delay circuit achieves outstanding stability through the use of 24 high-speed C-MOS ICs.



When input signal ① is non-modulated, the EX-OR output ③ is at parity and the averaged output of the low-pass filter is 0 (zero).

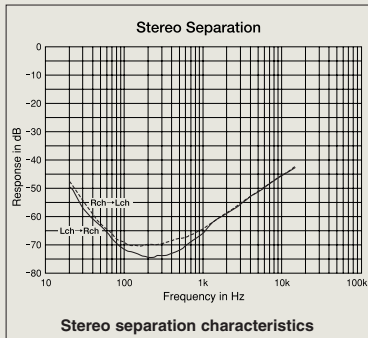
(EX-OR output is open if 10 or 01, closed if 00 or 11)

When input signal ① is modulated, the EX-OR output ③ is at non-parity. The integral value after the low-pass filter represents the potential change indicated by the slanted line (audio signal).

## 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-1000 features another Accuphase innovation called DS-DC (Direct Synthesis - Double Cancellation). The demodulator comprises the two technologies described at right. Since all operations are carried out through software-based arithmetic in a DSP (Digital Signal Processor), ideal demodulation performance can be achieved, resulting in previously unheard-of channel separation.



#### 1 Pilot Tone Direct Synthesis

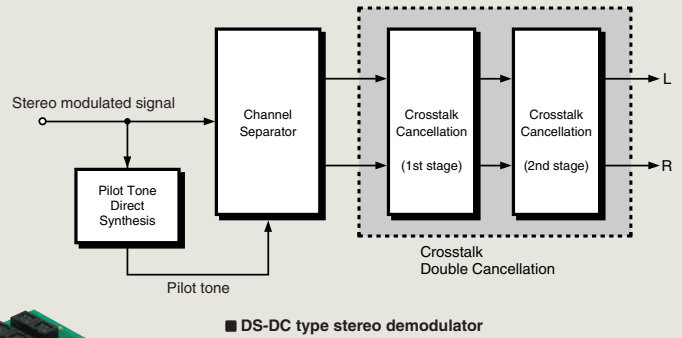
Commonly, an FM tuner employs a PLL circuit to extract the pilot tone and obtain the frequency and phase components from the input signal (stereo-modulated signal). If the level of the pilot tone decreases, noise will be heard and stereo separation becomes extremely poor.

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

\* Identification here means to analyze the signal and determine 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.



#### Supplied Remote Commander RC-33

Allows tuning, storing and recalling stations, and controlling all other functions of the tuner.

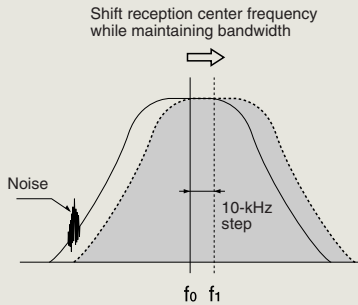


## FREQ.TRIM function is great for avoiding interference

When the FREQ.TRIM function is set to ON, the filter center frequency ( $f_0$ ) bandwidth is maintained, but the reception frequency ( $f_1$ ) can now be changed in fine steps (10 kHz intervals).

In situations where there are two closely adjacent stations that are interfering with each other, this makes it possible to move away from the area of interference while still staying tuned to the desired station.

The reception frequency indication also switches to 10-kHz steps when the FREQ.TRIM button is ON.



■ Display example with "FREQ.TRIM" ON (10 kHz step)

■ All function settings are also stored in memory with a station (for up to 32 stations).

■ Accuphase original pulse tuning system provides that traditional manual tuning feel.

■ Two sets of analog outputs (balanced and unbalanced)

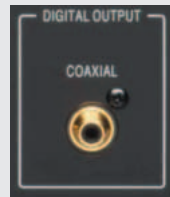
■ High-quality digital output connector (coaxial)

■ Versatile array of other functions:

- FILTER button reduces noise on weak stereo stations
- Muting circuit can be defeated (MUTE OFF)
- Stereo reception can be forced to monophonic (MONO)
- Confirmation beep when operating tuning knob and function buttons

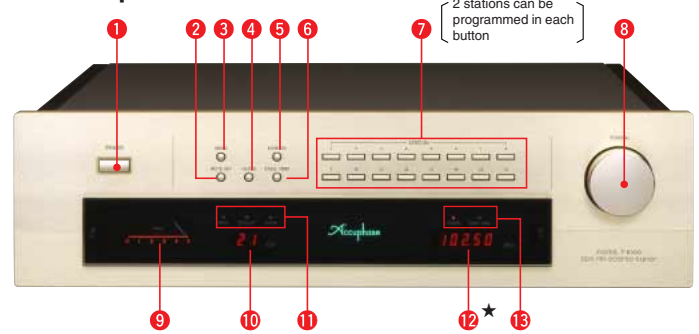


Pulse tuning system

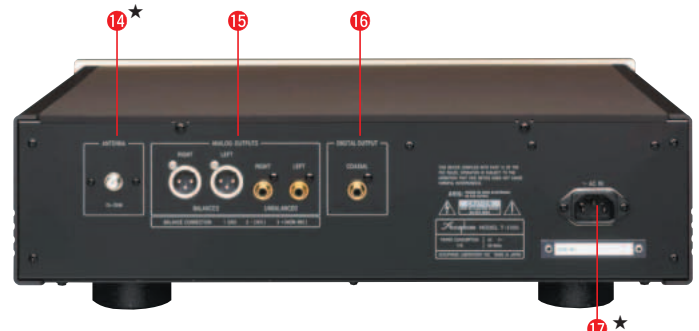


Digital output connector

## Front panel



## Rear panel



- |                                      |   |
|--------------------------------------|---|
| 1 Power switch                       | 10 Station number indicator                       |
| 2 Muting on/off button               | 11 Indicators (MONO/MUTE OFF/FILTER)              |
| 3 Forced monophonic operation button | 12 Reception frequency indicator★                 |
| 4 Stereo noise filter button         | 13 Indicators (STEREO/FREQ.TRIM)                  |
| 5 Memory button                      | 14 Antenna input connector (IEC or F type)★       |
| 6 FREQ.TRIM button                   | 15 Analog output connectors (BALANCED/UNBALANCED) |
| 7 Station buttons (32 stations)      | 16 Digital output (COAXIAL)                       |
| 8 Tuning knob                        | 17 AC power connector (for supplied power cord)★  |
| 9 Signal strength meter              |   |

## 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.

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

### Frequency range and tuning step width

|                         |   |
|-------------------------|---|
| <b>Model for Europe</b> | 87.50 MHz - 108.00 MHz<br>(in 50-kHz channel steps) |
| <b>Model for USA</b>    | 87.5 MHz - 108.0 MHz<br>(in 100-kHz channel steps)  |
| <b>Model for Japan</b>  | 76.0 MHz - 90.0 MHz<br>(in 100-kHz channel steps)   |

### Monophonic

- **Sensitivity** Usable sensitivity 11 dBf (IHF)  
50 dB quieting sensitivity 17 dBf (IHF)
- **S/N ratio** (80 dB input, A-weighted) 90 dB
- **Total harmonic distortion** (80 dB input,  $\pm 75$  kHz deviation)  
20 Hz 0.02%  
1 kHz 0.02%  
10 kHz 0.02%
- **Intermodulation distortion** (80 dB input,  $\pm 75$  kHz deviation) 0.01%
- **Frequency response** 10 - 15,000 Hz  $\pm 0$  -2.0 dB
- **Alternate channel selectivity (IHF)**

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

- **Capture ratio** 1.5 dB
- **RF intermodulation** 80 dB
- **Spurious response rejection** 120 dB
- **Image rejection** 100 dB
- **AM suppression** (65 dBf input) 80 dB
- **Subcarrier suppression** 70 dB
- **Output voltage** ( $\pm 75$  kHz deviation) 1.0 V

### Stereo

- **Sensitivity** 40 dB quieting sensitivity 29 dBf (IHF)  
50 dB quieting sensitivity 37 dBf (IHF)
- **S/N ratio** (80 dB input, A-weighted) 85 dB
- **Total harmonic distortion** (80 dB input,  $\pm 75$  kHz deviation)  
20 Hz 0.04%  
1 kHz 0.04%  
10 kHz 0.04%
- **Intermodulation distortion** (80 dB input,  $\pm 75$  kHz deviation) 0.03%
- **Frequency response** 10 - 15,000 Hz  $\pm 0$  -2.0 dB
- **Stereo separation** 100 Hz 50 dB  
1 kHz 50 dB  
10 kHz 40 dB
- **Stereo trigger voltage** 28 dBf

### General

- **Antenna input** 75 ohms, unbalanced (IEC or F type connector)

- **Standing wave ratio** 1.5
- **Tuning principle** DDS synthesizer tuning  
32-station random memory tuning
- **FM detection principle** Advanced DGL
- **Stereo demodulation principle** DS-DC
- **Digital output (EIAJ CP-1201)**  
Coaxial 0.5 Vp-p, 75 ohms  
Sampling frequency 48 kHz
- **Output impedance**  
BALANCED (XLR type connector)  
200 ohms (100 ohms/100 ohms)  
UNBALANCED  
200 ohms
- **Meter** Signal strength
- **Power requirements** AC 120 V/230 V, 50/60 Hz  
(Voltage as indicated on rear panel)
- **Power consumption** 17 watts
- **Maximum Dimensions** Width 465 mm (18-5/16")  
Height 140 mm (5-1/2")  
Depth 402 mm (15-13/16")
- **Mass** 11.8 kg (26.0 lbs) net  
17.0 kg (37.5 lbs) in shipping carton
- **Supplied Remote Commander RC-33**  
Remote control principle: Infrared pulse  
Power supply: 3 V DC (IEC R6 batteries  $\times$  2)  
Dimensions: 55  $\times$  194  $\times$  18 mm  
Weight: 100 g (including batteries)

## Notes

- An FM antenna is required to use the T-1000. Please consult your dealer regarding antenna installation.
- In dwellings with shared antenna systems, confirm that the antenna outlet carries FM signals.
- Use a 75-ohm coaxial cable with IEC type or F type plug for the antenna connection.

- Supplied accessories:
- AC power cord
  - Audio cable with plugs
  - Remote Commander RC-33

• Specifications and design subject to change without notice for improvements.

<http://www.accuphase.com/>



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G0505Y PRINTED IN JAPAN 850-0147-00 (AD1)