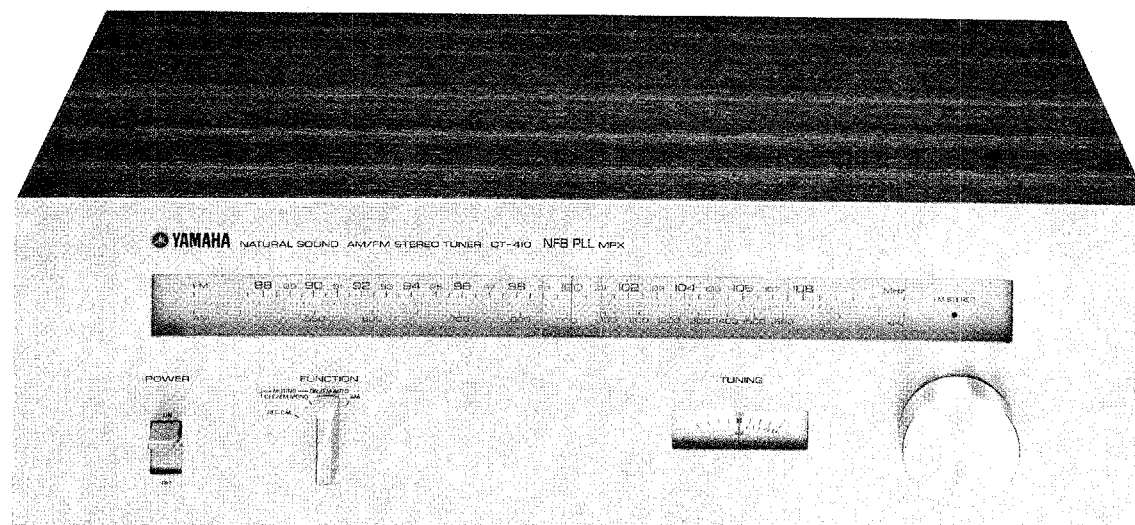
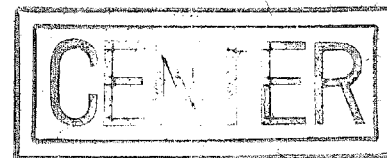


# YAMAHA CT-410

AM/FM Stereo tuner

*Owner's Manual*



# CT-410

## CONTENTS

Cautions-Read This Before Operating your CT-410 .....	4
Front Panel and Controls .....	5
Rear Panel and Connections .....	6
Connecting and Operating the CT-410 with Other Components .....	7
Specifications and Block Diagram .....	11
Schematic Circuit Diagram .....	12
Trouble Shooting .....	13

# CT-410

## SPECIAL FEATURES

### ① High Sensitivity for Great Station-Getting Power

To obtain the astonishingly high sensitivity of  $0.9 \mu\text{V}$  (with  $75 \Omega$  antenna), Yamaha has provided the CT-410 with a 'front end' RF stage which features a special junction-type field-effect transistor, one stage of RF amplification, a three-gang variable capacitor (frequency-linear for FM), and comprehensively effective suppression of interfering signals. This pays dividends in lifting distant stations above the background static, increasing program choice.

### ② High Selectivity and Equally High Audio Quality

To separate powerful stations next to one another on the dial, the CT-410 boasts a *five* stage IF section, with three stages of constant-current differential amplification and a wide-range ratio detector. Excellent radio performance is combined with really high tonal quality.

### ③ Ultra Low Distortion Stereo Multiplex Decoder

This Yamaha-developed circuit automatically locks into perfect synchronization with the input signal, to assure inherently low distortion. Use of negative feedback (employed in all high quality amplifiers to reduce distortion) gives the further reductions that limit the distortion typically contributed by this section to 0.05% even in stereo. The result is clear, pure stereo reception.

### ④ Smooth High Precision Tuning and Long Scale

The easy-to-read scale is long — and linear — for maximum convenience, and the mechanical precision of the dial and pointer is matched by the exact indication of station 'dead center' from the center-zero type FM tuning meter (doubling as signal-strength meter on AM).

### ⑤ Musical Tone for Tape Recorder Calibration

The CT-410 features a musical 333 Hz tone for optimum recorder level-setting, simply and easily, every time. The level corresponds to 50% modulation of the FM signal (a typical program level), and once you have found out where this should be set to give the best results with your tape recorder, you will be able to find the right level again immediately.

### ⑥ Surprisingly Good AM (Medium Wave) Reception

The high performance AM section will surprise you with the excellent musical quality and real enjoyment that can still be obtained from the crowded medium wave band. Yamaha has incorporated some of the recent advances in FM radio circuitry (ceramic IF filter and a stage of RF amplification, etc.) to give a noticeable improvement.

# CT-410

## CAUTIONS-READ THIS BEFORE OPERATING YOUR CT-410

1

The CT-410 is a high performance AM/FM stereo tuner with excellent selectivity, sensitivity, and several special features. This manual is required reading if you are to get the best from it.

2

Do not drop or otherwise jar the CT-410, which is a precision instrument.

3

Do not place the CT-410 where it will be exposed to direct sunlight, excessive heat (for instance over a radiator or on top of an amplifier which generates a fair amount of heat), cold, moisture, or dust.

4

Do not use chemical solvents (such as benzene or alcohol) to remove traces of dirt. Wipe only with a soft, slightly damp cloth.

5

Do not attempt to carry out internal adjustments or repairs. Leave this to your local service representative.

6

Do not assume your CT-410 is faulty before checking the 'Trouble Shooting' list on page 13 for common operating errors.

7

Operate all switches and knobs in accordance with the instructions. Avoid applying undue force, which should never be necessary, and do not attempt to use intermediate settings.

8

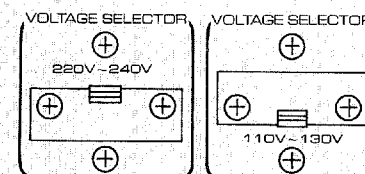
If your CT-410 has a voltage selector on the rear panel, check that it is set to your local voltage **BEFORE** you plug in the AC supply. If not properly set, turn the knob to the correct position. Voltage settings: 110, 120, 130, 220, 230, and 240 V. Use the next *higher* voltage setting if your voltage is not included (i.e. 120 if your voltage is 115 V).

9

Models intended for N. America have no voltage selector, and are set for 117 V AC, 60 Hz.

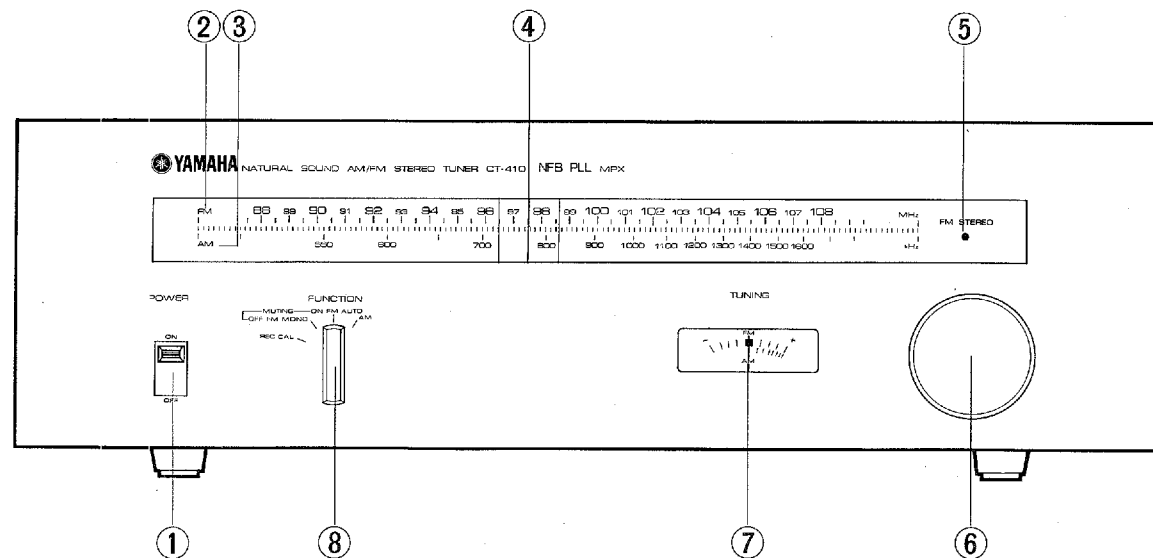
10

Keep this manual in a safe place for future reference, and refer to it frequently until you are perfectly familiar with all CT-410 controls and functions.



# CT-410

## FRONT PANEL AND CONTROLS



### 1 POWER ON/OFF Switch

Switch ON to connect the main electrical supply. The tuning scale and meter will illuminate, a visual reminder that the main electrical supply has been connected. If they go out, with the POWER switch still ON, this can mean that the power fuse has blown.

### 2 FM Tuning Scale

This scale is frequency linear, so that stations are spread out evenly across the dial, not bunched together at one end. The units are MHz.

### 3 AM Tuning Scale

This scale, marked clearly in kHz, is used when tuning in AM stations.

### 4 Tuning Indicator

This pointer indicates accurately the frequency of the station to be tuned in. The slide-rule type pointer ensures high precision for rapid station location.

### 5 FM STEREO Indicator Lamp

This lamp illuminates when FM stereo broadcasts are being received. It goes out, however, if the FUNCTION selector is turned to the MUTING OFF/FM MONO setting.

### 6 Tuning Knob

The tuning knob is large, and the precision tuning mechanism eliminates backlash, for smooth and positive station selection.

### 7 TUNING Meter

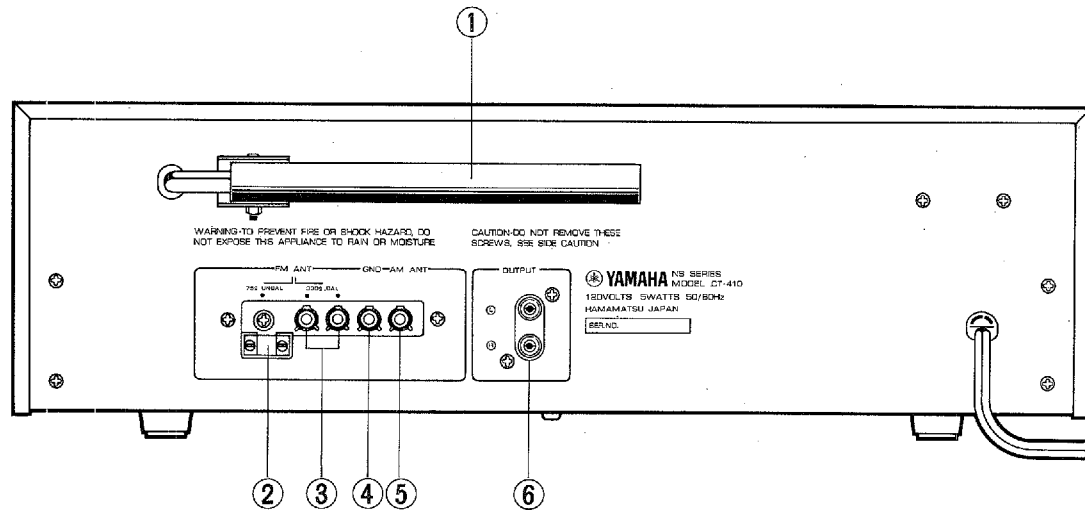
This meter doubles as an FM tuning meter, when the indicator points to dead center as soon as the station is perfectly in tune, and as an AM signal-strength meter, when it will deflect towards the right. On AM, tune for the maximum deflection of the indicator.

### 8 FUNCTION Selector Switch

This selects whether FM or AM broadcasts are to be received, and if FM, then whether automatically in STEREO (provided the broadcast is in stereo, of course), or in MONO, and also offers a REC CAL position for tape recorder calibration.

# CT-410

## REAR PANEL AND CONNECTIONS



### ① AM Bar Antenna

This rod is a special indoor antenna for AM reception. It should be folded out, away from the chassis of the CT-410, to get the best results. In most situations this bar antenna will give satisfactory reception, but in locations remote from the broadcasting station, or where the terrain (hills or mountains) or the environment (steel-frame buildings, etc.) are unfavorable, an external antenna may give noticeably better results.

### ② FM ANT (for 75 Ω Coaxial Cable)

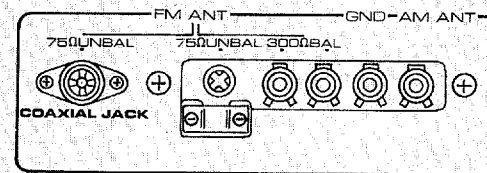
The two terminals indicated (2) are intended for use with 75 Ω coaxial cable. Models intended for certain areas can only be provided with the bracket on the right. Others also feature the coaxial socket on the left. Coaxial cable, in which the central core is shielded by an outer braided sheath, reduces losses in signal strength between the antenna and the CT-410, and also reduces the amount of interference picked up.

### ③ FM ANT (for 300 Ω Balanced Feeder)

This is the pair of terminals used with ordinary twin-type feeder wire, like that used in the internal FM antenna provided with the CT-410. Although the high sensitivity of the CT-410 means that an indoor antenna can often give satisfactory results with local stations, a proper FM antenna will always give better results.

### ④ GND (Ground) Connection

Connection of a ground or 'earth' lead can make a worthwhile difference to AM reception, effectively increasing sensitivity and reducing interference, particularly hum.



# CT-410

## CONNECTING AND OPERATING THE CT-410 WITH OTHER COMPONENTS

### 5 AM ANT (External AM Antenna Terminal)

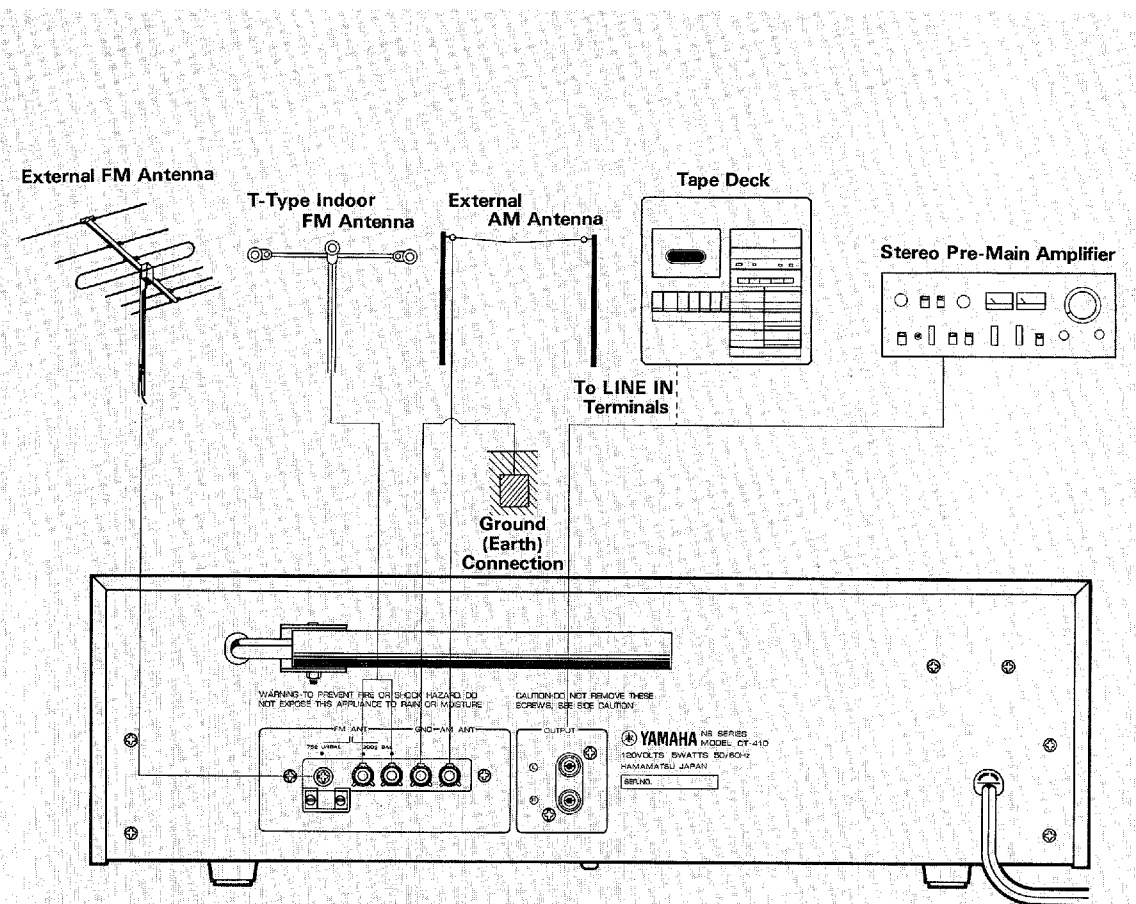
In areas where the bar antenna proves inadequate for satisfactory AM reception, or wherever reception of remote or low strength stations is required, an external antenna should be connected to this terminal.

### 6 OUTPUT Terminals

The output terminals of the CT-410 provide a fixed level signal, suitable for most types of integrated stereo amplifiers or tape recorders. The REC CAL output also comes from these terminals.

### 7 VOLTAGE Selector

Models for areas outside continental N. America are provided with the voltage selector shown. If your CT-410 has one, check that the voltage indicated is the same as your local main electrical supply, and if not, PUT IT RIGHT before you plug in. Detailed instructions are given in the CAUTIONS section at the front of this manual.



## CONNECTIONS TO A STEREO AMPLIFIER

Use the pin-plug cables provided with the CT-410 to connect the OUTPUT terminals on the rear panel to the TUNER or AUX terminals of your preamplifier or integrated (pre + power) amplifier. Make sure that you connect the LEFT (upper) output terminal of the CT-410 to the left-channel input terminal, and the RIGHT to the right-channel.

You can record directly from the CT-410 with a tape recorder: use pin-plug cables to connect the OUTPUT terminals to the tape recorder LINE IN terminals. Check that the LEFT (upper) output terminal is connected to the left-channel input terminal, and the RIGHT to the right-channel. See also the instructions for using the REC CAL setting of the FUNCTION switch, which can be particularly useful when recording direct from the CT-410.

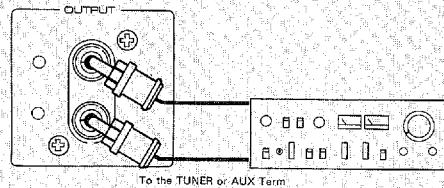
## ADJUSTING THE AM BAR ANTENNA

The high efficiency ferrite bar antenna provided with the CT-410 is all that is required for satisfactory reception except in low signal strength areas, so that usually no external AM antenna will be needed. The bar antenna is hinged so that it can swing out: try swinging it while watching the TUNING meter. Set it at the angle which gives the

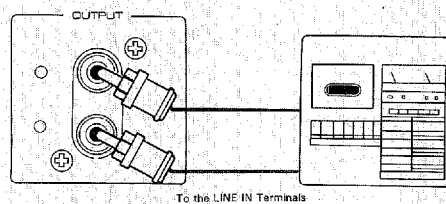
maximum deflection of the pointer to the right for the weakest station you will normally be listening to.

In a metal-frame building, or in locations remote from the station or where reception conditions are unfavorable, an external AM antenna should be connected to the AM ANT terminal. Even better results will be obtained if at the same time a good ground (earth) connection is made. A good ground connection can sometimes be made to a water pipe. However, under NO circumstances should you attempt to make a ground connection to a gas pipe. Your dealer will advise you.

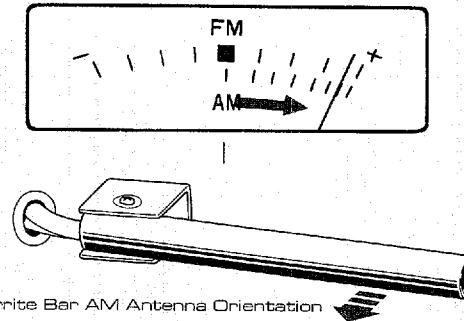
Amplifier Connections



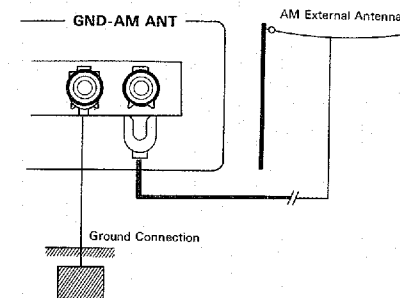
Tape Recorder Connections



## TUNING



External AM Antenna Connection



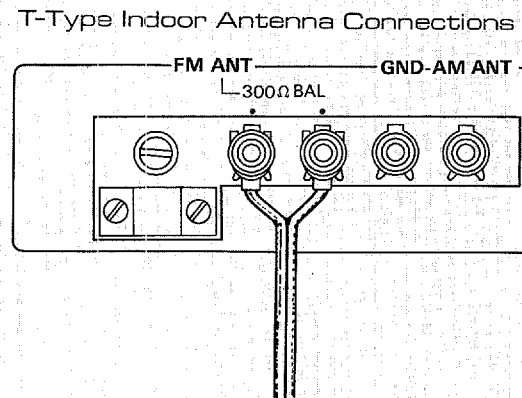


## AM RECEPTION

- (1) Set the FUNCTION switch on the front panel to AM.
- (2) Turn the tuning knob until the tuning indicator is at the desired station's frequency.
- (3) Adjust the tuning knob to give the maximum deflection to the right on the TUNING meter.

## CONNECTING AN FM ANTENNA

First, connect the T-type internal (indoor) antenna provided with the CT-410 to the 300  $\Omega$  BAL Terminals on the rear panel. The two arms of the 'T' should be tacked at full stretch to the

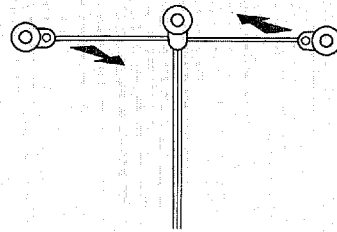


ceiling or walls of your room. Try them in different positions, and choose that which gives the best reception for the weakest stations to which you will normally be listening. If you cannot obtain satisfactory reception even varying the angle of the horizontal T through a full 180°, this is an indication that you need an external FM antenna.

The T-type antenna is adequate only in high signal strength areas under favorable conditions. In all other cases, an external multi-element FM antenna is needed. To ensure the very best results, a motor driven antenna assembly with remote control of orientation is best, but the CT-410 has sufficient sensitivity to operate extremely well with a fixed antenna.

External antennas are available for use with the

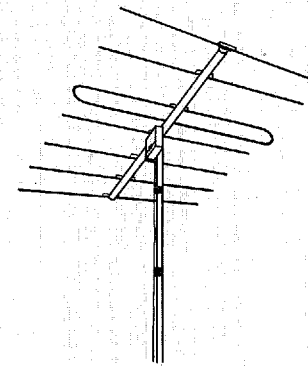
Orientation of T-Type Antenna



300  $\Omega$  and 75  $\Omega$  terminals: the latter will use the shielded coaxial cable which reduces losses and interference. Antennas intended for 300  $\Omega$  balanced feeder wire can also be used with 75  $\Omega$  coaxial cable, but a matching transformer is necessary at the antenna. Coaxial cable should be used where the antenna must be located some way from the CT-410, or where interference from automobile ignition, etc., is troublesome.

The external antenna should be located as close as convenient to the CT-410, and as high as possible. It should be oriented to give the best reception conditions possible for the weakest station you will normally be listening to. If this direction is not too critical, you can orient the antenna for minimum interference from automobile ignition, etc., instead.

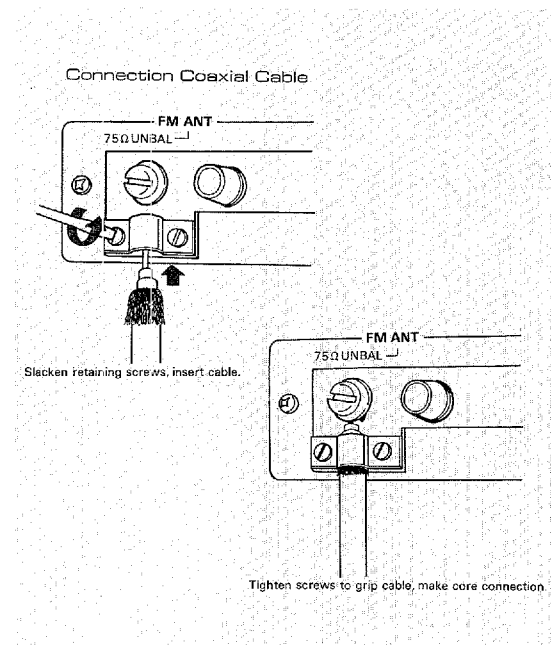
Typical External FM Antenna



### CONNECTING COAXIAL CABLE

The method of connection will vary depending upon whether your CT-410 is fitted with a coaxial cable socket, or only the connection bracket plug terminal. If the former, and your antenna cable has a coaxial plug, just plug in. If the latter, connect as follows:

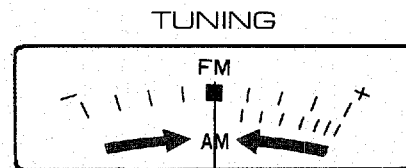
- (1) Strip insulation from outside the braided sheath, and bend back *outside* the insulation. Expose the projecting central core wire as shown.



- (2) Slacken the two retaining screws, insert the coaxial cable, and re-tighten the screws so that the clip grips the exposed braided sheath.
- (3) Connect the central core wire to the 75Ω terminal. Be sure to prevent the outside braiding from coming into contact with the inner core.

### FM BROADCAST RECEPTION

- (1) Set the FUNCTION switch on the front panel to FM AUTO.
- (2) Turn the tuning knob until the tuning indicator is at the desired station's frequency.
- (3) Adjust the tuning knob to bring the pointer of the TUNING meter exactly to the *center* of the scale. This will ensure optimum tuning.
- (4) When the broadcast is in stereo, the STEREO-indicator lamp will light, and will automatically go out when MONO broadcasts are being made.



- (5) MUTING of the inter-station noise will be effective on this setting, so that you can tune from station to station against a quiet background. The MUTING circuit also suppresses the signals from stations that would be too weak to give satisfactory stereo reception.

### MUTING OFF/FM MONO

With this setting the MUTING will be OFF, and all stations (including the weakest, along with the interstation noise) will be received, but only in MONO. If you are troubled by 'hiss' noise when listening to a weaker FM station on the FM AUTO setting in stereo, the noise can be greatly reduced, but of course you will no longer be able to enjoy stereo reproduction, if this setting is used.

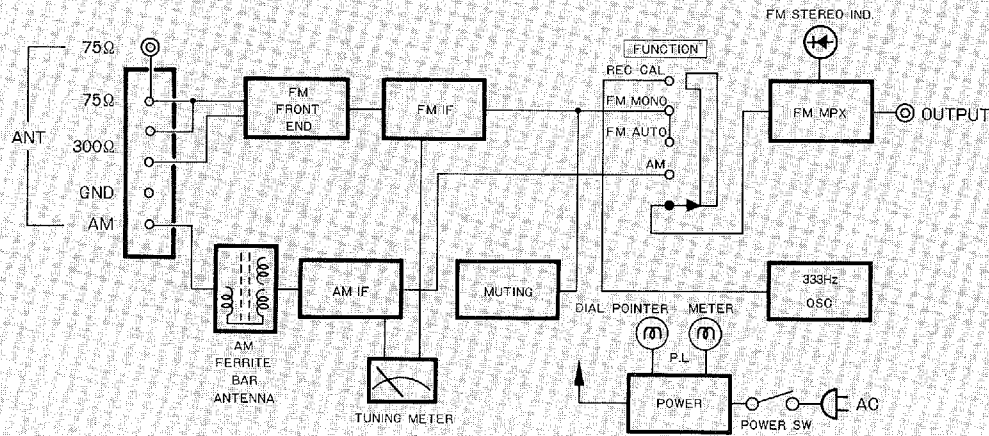
### REC CAL POSITION

In this position, instead of broadcast reception, the CT-410 output will consist of a 333 Hz musical signal corresponding to 50% modulation. When using a tape deck to record from the CT-410, the tape recorder input level controls should be adjusted to give a level of -6 VU on the tape deck level meters. This can be increased to as high as -2 VU depending on the tape deck and the kind of tape being used. Once you have determined the ideal setting for your tape deck, the REC CAL position enables you to find it again quickly and conveniently.

# CT-410

## SPECIFICATIONS AND BLOCK DIAGRAM

### BLOCK DIAGRAM



### SPECIFICATIONS

#### FM Section

Tuning Range	88 to 108 MHz
Usable Sensitivity (IHF 98 MHz)	1.8 $\mu$ F (10.3 dBf) (300 $\Omega$ )
	0.9 $\mu$ F (75 $\Omega$ )

#### Quieting Characteristic (for 50 dB signal-to-noise)

Mono	3.5 $\mu$ V (300 $\Omega$ )
Stereo	40 $\mu$ V (300 $\Omega$ )

Image Rejection (98 MHz)	55 dB
IF Rejection (98 MHz)	75 dB
Spurious Rejection (98 MHz)	75 dB
AM Suppression	56 dB
Capture Ratio	1 dB
Selectivity (IHF)	70 dB

Signal-to-Noise Ratio	
Mono	77 dB
Stereo	71 dB

#### Total Harmonic Distortion

Mono	400 Hz	0.15%
	50 Hz to 10 kHz	0.3%
Stereo	400 Hz	0.25%
	50 Hz to 10 kHz	0.8%

#### Stereo Separation

400 Hz	40 dB
50 Hz - 10 kHz	30 dB
Frequency Response	
50 Hz - 10 kHz	$\pm$ 0.5 dB
20 Hz - 15 kHz	+0.5 dB, -1.5 dB
Sub-Carrier Suppression	40 dB
Muting Signal Level	5 $\mu$ V

#### AM Section

Tuning Range	525 - 1,605 kHz
Sensitivity (IHF, bar antenna)	52 dB/m
Selectivity (1,000 kHz)	25 dB
Signal-to-Noise Ratio	48 dB (at 80 dB/m)
Image Rejection (1,000 kHz)	50 dB
IF Rejection (1,000 kHz)	40 dB
Spurious Rejection (1,000 kHz)	45 dB
Total Harmonic Distortion	0.6% (at 80 dB/m)

#### Audio Section

Output Level/Impedance(1kHz)	
FM (400 Hz, 100% mod.)	500 mV/5 k $\Omega$
AM (400 Hz, 30% mod.)	125 mV/5 k $\Omega$
Recording Calibration Output	250 mV/5 k $\Omega$ (333 Hz)

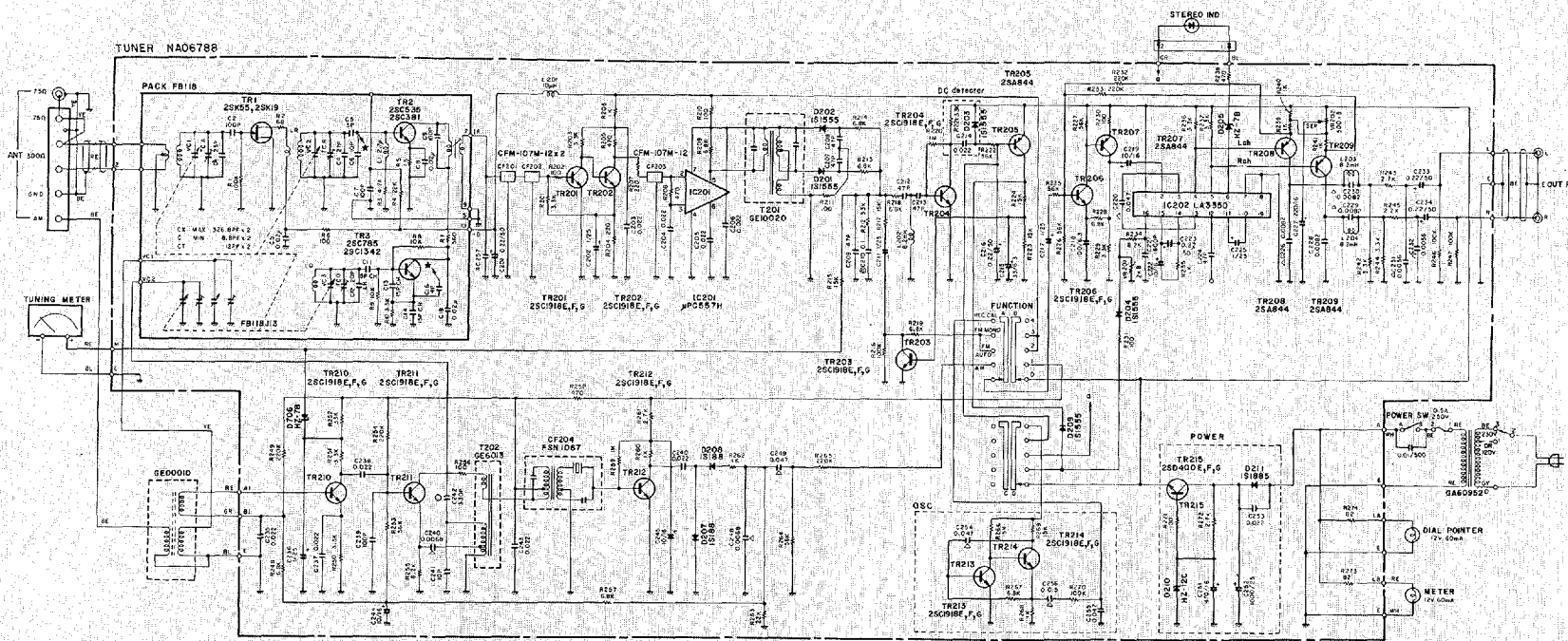
#### General

Semiconductors Used	2 ICs, 17 transistors, 1 FET, 8 Diodes, 3 Zener Diodes, 1 LED, and FM 6-Element Ceramic Filter.
Power Supplies	120 V AC, 60 Hz (USA and Canada) 110-130/220-240 V AC, 50/60 Hz (other areas)
Power Consumption	4 Watts
Dimensions (W x H x D)	435 x 137 x 350 mm
	17-1/8" x 5-3/8" x 13-3/4"
Weight	5.7 kg (12 lb 9 oz)

*Specifications subject to Change without notice.*

# CT-410

## SCHEMATIC CIRCUIT DIAGRAM



XC257-ADJ		
GENERAL Model	CC26, CC28	FRONT END PAIR
Autumn, Model	0.015μF	FB118H
European Model	0.020μF	

# CT-410

## TROUBLE SHOOTING

Before assuming that your CT-410 is faulty, check the following trouble-shooting list, which details corrective action you can take yourself, without having to call a service representative.

	Fault	Cause	Cure
AM Broadcast Reception	A persistent 'hum' occurs when the station is tuned in	Known as modulation hum, this can affect whole areas where reception conditions are unfavorable.	In certain areas, this cannot be eliminated, but sometimes changing the CT-410's position will give an improvement.
	Intermittent crackling or continuous background 'roaring'	Atmospheric electricity or electrical storms, possibly fluorescent lighting or other electrical equipment	Difficult to eliminate, an external antenna and good ground connection will give considerable improvement
	High pitched whistles etc., particularly at night	Signals from adjacent stations are interfering with reception	Nothing can be done to cut out this interference, but try turning down the TREBLE control on your amp.
The CT-410 is being operated alongside a TV set		Increase the distance between the TV and CT-410	
FM Broadcast Reception	Occasional crackling interference (particularly with remote, weak signal stations)	Electrical noise from automobile or motor cycle ignition systems	Set up an external FM antenna, located as high and as far from the road as convenient, and use coaxial cable feeder
		Interference from other electrical equipment, particularly thermostats	Fit an interference suppressor to the offending item of electrical equipment
	Noisy interference becomes particularly marked for stereo broadcasts, and spoils enjoyment	FM stereo broadcasts are inherently more liable to this at remote, low signal strength locations.	Set up an external FM antenna. If you are already using an external FM antenna, increase the number of elements in the antenna array
			Listen at the MUTING OFF/MONO setting
	The FM STEREO indicator flickers when listening to stereo	Signal input from the antenna is too weak	Use an external FM antenna suited to your local signal strength
		You are not perfectly tuned in to the station	Tune in correctly (see the section on FM Broadcast Reception)
	Reception suffers from unclear, distorted sound, although an external FM antenna is being used	Signal input from the antenna is too strong	Connect an attenuator between antenna and CT-410  Try reverting back to the T-type FM indoor antenna provided
During stereo test transmissions, sound which should come from only one channel can be heard faintly from the other	This is known as crosstalk, and normally occurs to some extent	Provided the 'leakage' of one channel into the other is very small compared with the normal level for that channel, this does not constitute a fault	



SINCE 1887  **YAMAHA**  
NIPPON GAKKI CO., LTD. HAMAMATSU, JAPAN