

# Yaesu FT-2000 HF – 6 m transceiver

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The much anticipated FT-2000 is the replacement for the FT-1000 series of transceivers. The FT-1000 and the FT-1000 MP have previously been reviewed in Amateur Radio. This transceiver is a worthy successor.

Over the seventeen years that the FT-1000 series was in production, significant changes have taken place in the design of the transceivers, not only in weight and size, but also in the change in technology from analogue (FT-1000) to digital (FT-1000 MP with audio Digital Signal Processing progressing on to the FT-1000 MP Mark-V with many more digital features including enhanced DSP).

As readers will appreciate, in the space available in Amateur Radio for this review, we are not able to fully review this complex transceiver, complete with measurements of all its technical capabilities. We have found from past experience that modern transceivers from the major manufacturers easily meet, if not exceed, their published specifications. Therefore, this review is a brief overview of the capabilities of the FT-2000 when used at a typical amateur location. We also thought it was beneficial for readers to have the review done by two active radio amateurs with somewhat different points of view. Although the reviewers mainly looked at the SSB capabilities of this transceiver, we have no doubt that the CW (built-in electronic keyer, full break-in, etc), AM, FM, RTTY and packet capabilities of the FT-2000 live up to specifications. If any readers buy, or have bought, an FT-2000, and have any differing views to those expressed here by the reviewers, we would be very pleased to hear from you.

## What does it do?

The FT 2000 is a very capable HF and 6 metre 100 watt output transceiver. It includes two general coverage receivers, a built-in switched-mode power supply, IF DSP for receiver bandwidth selection in the main receiver and analogue filters in the second receiver. Also, DSP filtering provides noise reduction and automatic notch filtering. All amateur bands are

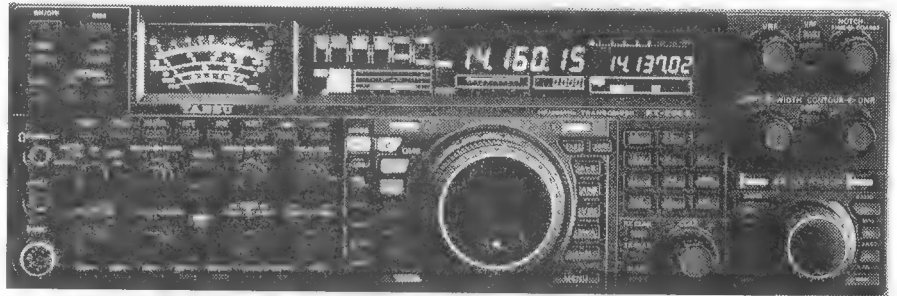


Photo 1- Front panel of the FT-2000 transceiver

provided from 160 m to 6 m, and the receivers cover from 30 kHz to 60 MHz. This is the first time that 6 m has been included in the FT-1000/2000 series of transceivers. The 6 m transmit power is 100 W.

The default SSB bandwidth is 300-2700 Hz, adjustable up to 3000 Hz. As well, there is a three band transmit audio equaliser, with a multiplicity of settings, and different settings for when using the speech processor. As usual, there is an automatic antenna tuner with its own memory system which compensates for an SWR of up to 3:1. You can select two antenna connections, for example one for HF and one for 6 m, plus a receive antenna input which could be used, say, as a separate receive antenna input for 160 m or simply for short-wave broadcast listening.

For the CW operator there is semi or full break-in and a built-in memory keyer, plus a different set of DSP receive filters. However, in the second receiver, a 1000 Hz analogue filter is standard for narrow CW with an option to fit a 500 Hz or 300 Hz Collins mechanical filter.

Infrequently needed adjustments and configuration settings are handled by the 147 menus which make it easy to set up the parameters you want for a particular operating mode. The menus for each function are grouped together to make for easier access.

A feature of the FT-2000 configuration is that, while it has a built-in ac power supply, it can be unplugged from a connector on the rear and 13.8 V dc can be connected directly to allow operation in the field when ac is not available. It is noted that Yaesu have changed the dc input connector from a standard 6-pin plug to a new 4-pin plug. No dc connector is offered as an option. Perhaps Yaesu may consider providing a 4-pin plug with the transceiver.

## First impressions

Both reviewers of the FT-2000 are happy owners of the original FT-1000D, and have used, at one time or another, all of the subsequent FT-1000 series of transceivers.

The first thing noticed when removing the FT-2000 from its strong packing carton is that it only weighs 15 kg, the same as the FT-1000 MP but 10.5 kg lighter than the FT-1000. This is due mainly to the change to the inherently lighter-weight, switched-mode power supply.

The FT-2000 is similar in size to the FT-1000 MP Mark-V at 410 mm wide by 135 mm high and 350 mm deep. First impressions are the large, multi-coloured, analogue S meter; the large heavily weighted main receiver tuning knob (2 cm larger diameter than the knob on the FT-1000); and the bright, multi-

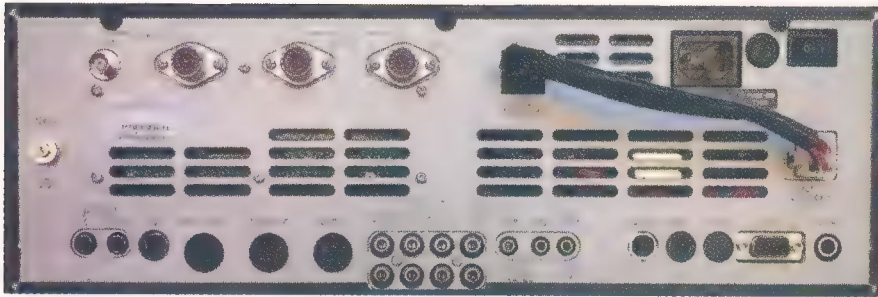


Photo 3 – Rear panel of the FT-2000.

coloured main display which includes a “block diagram” of the receiver front end, showing the antenna, attenuator, pre-selector, pre-amp, roofing filter and AGC settings in use. The display also shows the settings for DSP contour, notch, IF width and IF shift. These features of the main display give a quick and clear visual indication of receive parameters.

It is noted that one of the major features of the FT-1000 MP series, the shuttle-jog tuning control, which was concentric with the main tuning control and provided rapid up and down tuning, is missing. The ring at the rear of the main tuning control now adjusts the knob tension.

The multiplicity of knobs (26) and switches (77) on the front panel are all well spaced and easily operated, even with large clumsy fingers. It is noticed that, unlike the FT-1000 MP Mark-V, many of the controls are not illuminated when in use. Also, unlike all of the previous transceivers in the series which used white lettering, the labelling of the controls on the FT-2000 is in a silvery grey lettering which makes the labels harder to read.

### The FT-2000 on the air

As would be expected for such a complex transceiver, when the FT-2000 is first switched on and about to be used, it can appear rather daunting to the newcomer.

Because the reviewers are familiar with the FT-1000 series of transceivers, both were able to get the FT-2000 up and running and have initial contacts on-air without recourse to the manual.

However, it is from here that the fun starts. The reviewers both had entirely different first impressions of the FT-2000. One reviewer transmitted using the transceiver’s default settings on the transmit audio equaliser and the other reviewer was not very complimentary about the received muffled audio. So the battle began with the audio equaliser and the transmit settings. There are literally thousands of possible combinations. The reviewers’ experience indicates that it could take weeks of experimentation to arrive at the best possible settings to suit your voice and microphone. However, do not be deterred.

After much reading of the manual, and much on air and off air testing, the first reviewer finally achieved an acceptable result. However, when the positions were reversed, much more adjustment was required. Using an MD-1 Yaesu desk microphone (the eight-pin connector is compatible with earlier Yaesu microphones), the settings we finally arrived at with the speech processor not activated were as follows: menu 123, 100 Hz; 124, 10 dB; 125, 1 bandwidth; 126, 1000 Hz; 127, 0 dB; 128, 6 bandwidth; 129, 2400 Hz; 130, 10 dB; and 131, 1 bandwidth. With



Photo 2 - The main receiver part of the bright, multi-coloured main display which includes a “block diagram” of the receiver front end, showing the antenna, attenuator, pre-selector, pre-amp, roofing filter and AGC settings in use.

## TVI High Pass Filter with Braid Breaker.

### An inline TVI filter with Braid Breaker.

A large amount of TVI can travel down the outer braid of Coax as well as the centre conductor. The braid breaker isolates the centre conductor and braid from the TV/VCR/DVD. The High Pass filter cuts in at 50MHz. This filter has -80dBm attenuation at 40, 80 and 160 Metres.

### Pager Notch Filter:

A receive filter that can be used in an outdoor housing (Pictured) to be mounted close to your antenna on the mast, or can be used in a diecast box for indoor use near your transceiver or receiver. The filter is set to 148.5 MHz but may be tuned by the user across the 148 to 149 MHz Pager band. A selection of connectors are available including BNC and N Type. Where transmit is required this filter can be switched out of circuit by the use of coaxial relays linked to the PTT switch.

Contact us if you need a special filter, we manufacture here in Australia rather than overseas.

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the speech processor on, we found the following settings worked for us: menu 132, 200 Hz; 133, -10 dB; 134, 2 bandwidth; 135, 800 Hz; 136, -3 dB; 137, 1 bandwidth; 138, 1800 Hz; 139, 0 dB; and 140, 1 bandwidth.

The setting of the transmit audio can certainly be complex. The settings we arrived at are very much a matter of personal opinion and depend upon many variables, including your voice, the microphone and the listener's receiver, hearing and expectations. You can, of course, do much of the adjustment running the FT-2000 into a dummy load and listening on another receiver, or by listening on the FT-2000's transmit monitor facility, in which case a pair of good quality headphones with good acoustic isolation are essential.

After some thought, we decided to do a frequency response test by feeding an audio oscillator into the microphone input and measuring the transmit power output. This is a simple procedure that requires equipment found in many amateur shacks. We decided to check at the final settings that we had set the equaliser to, and then at the transceiver's default setting. The difference is quite amazing. In both cases, 1000 Hz was taken as the reference.

At our final settings we measured: at 80 Hz, -2.5 dB; 120 Hz, +6 dB; 200 Hz, +2 dB; 300 Hz, -2.5 dB; 500 Hz, -2.5 dB; 1000 Hz, 0 dB; 1.5 kHz, +6 dB; 2 kHz, +8 dB; 2.5 kHz, +12 dB; 3 kHz, -2 dB; and at 3.5 kHz, -25 dB.

At the default settings, which you will note are much narrower, we measured: at 150 Hz, -25 dB; 200 Hz, -20 dB; 250 Hz, -12 dB; 300 Hz, -7 dB; 400 Hz, -1 dB; 500 Hz, 0 dB; 1 kHz, 0 dB; 2 kHz, +2 dB; 2.5 kHz, 0 dB; and at 3 kHz, -25 dB.

Who says that "black box" operation obviates the user from experimentation and testing? When properly adjusted, the speech processor (whose level is adjustable from the front panel) gives a worthwhile boost to the signal. Reports on the transmitted signal indicate that the suppressed sideband was well down (the specification is for at least 60 dB below peak output), further than with many other signals on the band.

The VOX works smoothly and all controls are on the front panel.

Both reviewers agreed that it was great to see a return of an analogue meter, although the S meter for the second

receiver is an LED bar graph. As well as acting as an S meter for the main receiver the analogue meter allows monitoring of power out, speech compressor level, ALC level, SWR, final amplifier voltage and final amplifier current.

Incidentally, the FT-2000 uses a pair of MOSFETs in push-pull in the final amplifier running from 13.8 volts. The power output is adjustable from 5 W to 100 W (2 W to 50 W using AM). The thermostatically-controlled cooling fan features five speeds and is very quiet in operation.

The inbuilt antenna tuning unit uses a stepper motor and has 100 memories. It is quite fast in operation.

The FT-2000 also includes a handy 15 second Digital Voice Recorder facility to record incoming signals. There is also a four-channel message memory of 20 seconds per channel for recording repetitive voice messages.

## Receiving

Let us now look at the main receiver of the FT-2000, and its many facilities to improve reception. First of all, note that one reviewer was not all that impressed with the quality of audio recovery of SSB and AM signals, whilst the other reviewer was quite pleased.

The first reviewer believes that, although the transmitted SSB signal is capable of producing relatively high quality audio, the receiver audio quality seems very restricted regardless of bandwidth settings. His tests with a signal generator fed with an audio oscillator showed that the top receive response for both SSB and AM was very little in excess of 2 kHz. He would have preferred a wider audio bandwidth. The second reviewer was quite satisfied with the SSB response.

The main receiver is triple conversion with a first IF at 69.450 MHz; the second receiver is double conversion with

the first IF at 40.455 MHz. The final IF frequency of the main receiver is at 30 kHz utilising 32-bit floating point DSP.

General sensitivity (SSB rated at 0.2  $\mu$ V on HF and 0.125  $\mu$ V on 6 m) and signal-to-noise ratio of the main receiver are excellent. Image rejection is quoted at 70 dB or better from 160 to 10 m, and 60 dB or better on 6 m.

Amateur band frequency changing is accomplished by pressing the required button on the group just to the right of the main tuning knob. In addition to a 100 memory capability, plus handy and colourful Quick Memory Bank buttons (five quick memories) close to the main tuning knob, a useful feature is the triple band stacking register. This means that each amateur band frequency selection button can select the last three frequencies when repeatedly pressed.

One interesting effect we noticed, that is as yet unexplained, is that when you change from upper sideband to lower sideband, or vice versa, the frequency display will change by 1.4 kHz. Thinking that there was a fault, or perhaps an incorrectly set menu item, we asked Vertex Standard about this effect. They replied that this was normal. However, they could give no reason. It seems the



Photo 4 – MD-200 microphone.

Yaesu top-of-the-line FTDX9000 family of transceivers do a similar thing except that the frequency change is 900 Hz. If we can find out why, we will let you know.

The SSB receive bandwidth is adjustable using the WIDTH control from 200 Hz to 4 kHz. On SSB the narrow (NAR) button brings in a default 1.8 kHz (menu settable from 200 Hz to 2200 Hz) bandwidth which disables the WIDTH control, but not the SHIFT or CONTOUR controls. A similar effect to the NAR button can be obtained by counter-clockwise rotating the WIDTH control.

When using the WIDTH control, it is almost essential to follow it with the SHIFT control to keep the audio response balanced.

The FT-2000 has a manual notch filter that provides a depth of more than 60 dB and is very effective in all modes. The digital notch filter (DNF) automatically notches out multiple interfering tones in the passband, but its effectiveness is reduced with noise or signals in the passband.

The CONTOUR control alters the shape of the IF filter passband to either enhance or suppress particular frequencies to improve the sound of a received signal.

The DNR (Digital Noise Reduction) control works well and really helps to read signals through the noise. The further clockwise you turn the control the more noise reduction takes place. However, it can take a substantial part of a second before the new setting acts, so don't think it is not working. Just be patient as you search for the optimum setting.

The FT-2000 includes three selectable roofing filters at 3, 6 and 15 kHz bandwidth allowing early bandwidth selection and help in reducing adjacent signal interference when receiving in a crowded band.

The NB (Noise Blanker) control is quite effective on impulse noise, and the level of blanking can be set via a NB potentiometer which is concentric with the SQUELCH control.

Three levels of AGC (Fast, Medium and Slow) are front panel selectable, and the delay and hold characteristics are menu selectable over a wide range. Again the reviewers differed on the settings.

Another useful receiver feature is VRF (variable RF pre-selector) which shifts the front end selectivity to reject strong off-frequency signals. This is quite effective in use.

The IPO feature enables either selecting bypassing the RF pre-amplifier to feed the received signal direct to the first mixer, or adding 10 dB or 17 dB low distortion pre-amplifiers. The ATT (attenuator) control is either off, or provides 6, 12 or 18 dB attenuation (what a pity that modern transceivers do not go the extra step and provide a 24 dB level of attenuation as well).

The second receiver, unlike the main receiver, is not DSP but analogue. In operation, the reviewers found it much easier and better to operate than the second receiver on any of the previous FT-1000 models, particularly because it has its own separate RF and AF gain controls. Using headphones you can have the audio from each receiver in separate ears.

No doubt because of the inclusion of 6 m capability, the FT-2000 has provision for full FM operation, including CTCSS tone generation and decode capabilities, as well as automatic receiver offset for 6 and 10 m FM operation. The FT-2000 also has an output at 10 dBm for transverter operation on the higher bands.

As with the previous FT-1000 series transceivers, the FT-2000 has a 4-pin DIN socket on the rear panel for RTTY FSK operation. Also, there is a 5-pin DIN socket on the rear panel to accept AFSK packet input.

## Operating Manual

The 128-page manual that comes with the FT-2000 is well presented, and is quite suitable for the newcomer or the experienced radio amateur. It has a solid cover which should survive much handling.

As always with such a complex radio, we strongly suggest that the new owner settle down to reading the manual from cover to cover before first switching on the FT-2000. Even for the very experienced operator, the manual is a 'must read' if you want to get the best out of this transceiver.

## MD-200a8x microphone

The reviewers were also supplied with this desk-top deluxe microphone. This

very expensive unit has provision for two inserts but comes with one. This means that you can, for instance, add your favourite Heil DX microphone insert at a later date.

The frequency response of the insert is adjustable from flat to accentuation of the high frequencies over a 180 degree turn of the adjustment wheel.

It is a large microphone with a retro appearance reminiscent of a 1940's style broadcast studio microphone. Both reviewers used this microphone for a time with the FT-2000 with good results.

## Conclusion

Both reviewers agree that this FT-2000 transceiver is a worthy successor to the FT-1000 series of transceivers, and fully and successfully makes use of current DSP technology.

Vertex Standard Australia stated that updated firmware for the transceiver is not available for download from the web and user installation. A search of the web would seem to indicate that some amateurs in other countries have downloaded and installed new firmware. Let's hope that as Yaesu updates the firmware for the FT-2000, and no doubt this will happen as the transceiver continues to be developed, they find a way for users to download and install the new firmware themselves.

The list price for the FT-2000 is \$3,988, but is available from some dealers at a considerably lower price. If you are going to buy one, shop around! The MD-200 is listed at \$622.

Optional extras for the FT-2000, some of which are not yet available in Australia, include the SB-2000 external speaker with audio filters; the DMU-2000 data management unit to generate video displays (requires external computer monitor and keyboard, and provides audio scope, oscilloscope, spectrum scope, logging and rotator control capabilities); and the  $\mu$ -tuning high-Q narrow bandwidth pre-selectors (the average Australian user of the FT-2000 most likely will not require these expensive options).

The review transceiver and microphone were kindly made available by Vertex Standard Australia Pty Ltd. Our thanks to Yoshi and his team.

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