

HF + 50 MHz ALL MODE TRANSCEIVER

FT-920

TECHNICAL OVERVIEW



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...leading the way.SM

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The world's top DXers have made Yaesu the brand of choice in the 1990s. Not just because of the major technology advances introduced by Yaesu starting with the FT-1000D, but also because of the many "little things" which go into the creation of a truly spectacular HF transceiver.

The introduction of Yaesu's new FT-920 has, with the inclusion of the 50 MHz band, signaled a new era in Yaesu HF transceiver design. But the challenges are not new; both the lowest amateur band (160 meters) and the highest band (6 meters) covered by the FT-920 have similar problems of high noise, strong local signal levels, yet the need for excellent noise figure (especially when using a Beverage antenna on Top Band).

The FT-920 was developed with these particular design challenges in mind. The result is a transceiver with a uniquely quiet receiver, thanks especially to the new-generation Digital Signal Processor's Noise Reduction circuitry and careful attention to dynamic range and noise bandwidth throughout the design. The world's top DXers know. . .signal-to-noise ratio is everything in a receiver, and a new champion has appeared in the marketplace: the FT-920!



Receiver Design Philosophy

At Yaesu Musen Co., Ltd. we have committed ourselves to the task of providing the world's top DXers, whatever their budget constraints might be, the ultimate in HF transceiver performance. And for DXers, who know that stations "logged" must first be stations "heard," the performance advantage begins with the receiver section.

Yaesu's receiver design philosophy involves the careful blending of analog and digital circuitry to produce a receiver superior to any all-analog or all-digital design. Only with Digital Signal Processing (DSP) can steep filter selectivity and advanced noise reduction be provided; yet it is rugged analog circuitry which protects the DSP from the ravages of high signal levels found in today's RF environment.

The FT-920's receiver front end begins with the passage of the incoming signal through the Automatic Antenna Tuner (if enabled), which acts as an impedance-optimization circuit as well as serving as a tracking bandpass filter. The signal next passes through one of two optimized RF preamplifiers before delivery to the quad-FET doubly-balanced first mixer. The 69 MHz first IF signal is stripped of images by a four pole monolithic crystal filter, and the signal then proceeds through the rest of the analog IF system. This rugged front end design is ready for action,

whether you find yours on the DX end of a pile-up, on top of a mountain in a VHF contest, or in the midst of strong European broadcast signals on the 40-meter band!

The Digital Signal Processing system takes over in the audio stage, improving the shape factor of the (already excellent) filters while providing for signal-to-noise ratio improvement via the Noise Reduction protocol. The DSP borrows heavily from the design pioneered in the FT-1000MP's acclaimed Enhanced Digital Signal Processing (EDSP), but the higher processing speed of the FT-920 produces the cleanest signal reproduction of any Yaesu product!

While other manufacturers unsuccessfully experiment with all-DSP rigs, or hold onto outdated all-analog designs, Yaesu's engineers have recognized the need to adapt the best of both the analog and digital worlds to produce a transceiver capable of high-end performance at a low-end price. Beginning at the RF front end, and not ending until the audio reaches your headphones, the Yaesu engineering team's total dedication to the needs of the world's elite DX and Contest community brings you the very best in amateur transceiver performance. If you've come to expect compromise, you won't find it at Yaesu, and you especially won't find it in the FT-920!

Ergonomic Design Philosophy

A truly great HF transceiver is more than just a collection of parts assembled by an engineering group. At Yaesu, we utilize the feedback and design suggestions provided by literally thousands of active HF operators—DXers, Contesters, Mobile Operators, and DX-peditioners—who help guide the Yaesu engineering team's approach to ergonomic design and, especially, the front panel layout. The FT-1000D, FT-990, and FT-1000MP have all received particularly distinctive recognition for their logical, carefully-thought-out front panel design.

The result of this cooperative effort is a transceiver—the FT-920—which is as easy to use on Saturday afternoon in an air-conditioned hamshack as it is at 4:00 in the morning on a lonely island in the Arctic. When milliseconds are important in an operating situation, the FT-920 is the rig for you.

The Latest in a Proud Tradition

The FT-1000D Deluxe HF Transceiver was the beginning of a new design direction for Yaesu Musen Co., Ltd., one which quickly propelled Yaesu to the top of the HF marketplace. Later generations of Yaesu HF equipment, including the FT-1000MP, FT-990, and the FT-900CAT, have built on the success of the FT-1000D. You've worked



Yaesu equipment in the hands of the world's best operators from M-V Island, Albania, Myanmar, Scarborough Reef, Pratas Island, Heard Island, and hundreds of other exotic locations. Now it's time for you to be a part of the Yaesu Experience with the latest breakthrough from our design group: the FT-920 HF + 50 MHz Transceiver!

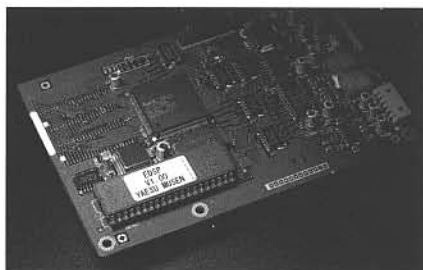
FT-920 CIRCUIT HIGHLIGHTS

The FT-920 combines the best of analog and digital technology for outstanding receiver and transmitter performance.

1. DSP (Digital Signal Processor)

(A) DSP Fundamental Structure

The FT-920 incorporates the same NEC® DSP chip used so successfully in the FT-1000MP, the μ PD77016, and turbocharged it to produce a processing speed of 33.6 MIPS (Million Instructions Per Second), the fastest DSP circuit in the amateur radio industry. The DSP board accepts analog audio input, either on transmit (microphone) or receive (demodulator output), and performs Analog-to-Digital Conversion (A/D) or Digital-to-Analog Conversion (D/A) via a two-channel processing bus system identical to that in the FT-1000MP. This technique allows the transmit and receive data to be processed independently without data "collisions" along a shared communication bus.



The basic architecture of the DSP system is portrayed in the Block Diagram below.

(B) DSP Circuit Features

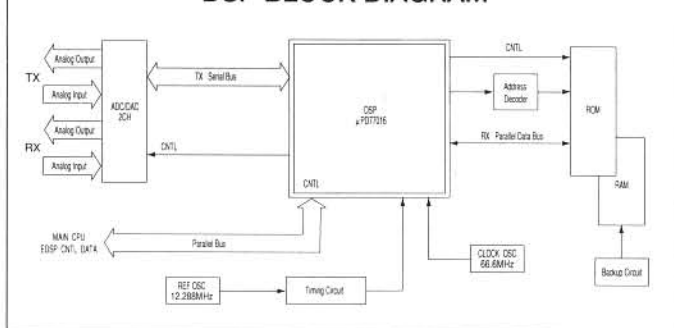
●Receive Mode

When the DSP is on, the analog audio from the demodulator is applied to the Analog-to-Digital Converter (ADC), a 16-bit device utilizing 64x over-sampling. The 48 kHz clock pulse for sampling is obtained by dividing the 12.288 MHz master reference oscillator by 256, resulting in a highly-stable clock signal. Due to the over-sampling, the actual clock frequency is $64 \times 48 \text{ kHz} = 3.072 \text{ MHz}$. The sampled data is then filtered using both IIR and FIR techniques, so as to ensure faithful reproduction of the original analog signal; this is particularly helped by the phase-linear characteristics of the FIR filter.

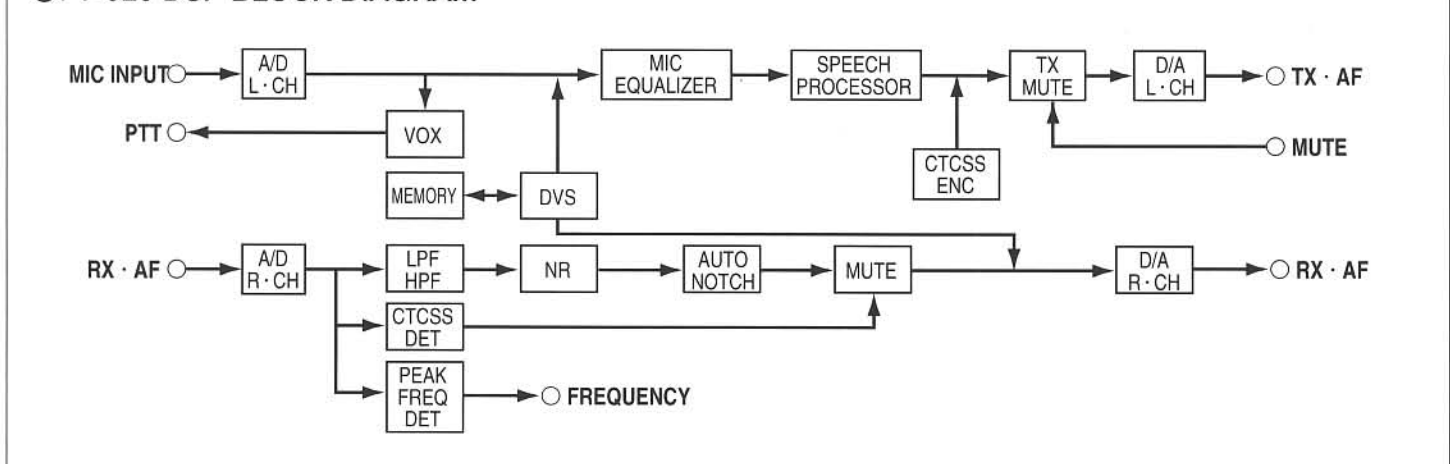
The digital signal is then subjected to different processing algorithms, depending on the task to be performed. Chief among these functions is the Band-Pass Filter (BPF), which is formed through the combination of the 42-position High-Pass Filter (HPF) and the 22-position Low-Pass Filter (LPF). The BPF's precise tuning algorithms are individually optimized for SSB and CW, so as to ensure that the minimum and maximum bandwidths for these very-different modes are suitable.

A two-parameter line-enhancer Noise Reduction system follows the BPF, providing a significant improvement of signal-to-noise ratio with remarkably low distortion of the desired signal.

DSP BLOCK DIAGRAM



●FT-920 DSP BLOCK DIAGRAM



And following the Noise Reduction stage is the Auto Notch circuit, which quickly and effectively eliminates steady carrier(s) which may be causing interference.

In the FM mode, a muting circuit in the DSP keeps the receiver quiet during CTCSS Decoder operation.

After the digital processing is completed, the digitized audio signal is converted back to analog audio by the Digital-to-Analog Converter (DAC). The DAC, like the ADC, uses a 4th-order $\Delta\Sigma$ process and 64x over-sampling to obtain the audio signal. Since an 8-pole interpolation filter and 2nd-order analog low-pass filter are installed in the DAC, no additional smoothing filter is needed.

●Transmit Mode

Voice audio from the microphone is digitized in the ADC, resulting in a high-quality digital voice signal to be processed. The digital voice signal is immediately detected

by the DSP VOX detector, to close the PTT (Push To Talk) line to ground when the front panel VOX switch is in the "On" position. The digital voice signal then is delivered to the Microphone Equalizer stage, which applies high-cut, low-cut, mid-cut, or bandpass shaping to the voice signal, if selected by the operator (via Menu #U-51). The voice signal is then applied to the Speech Processor stage, which provides a significant increase in "Talk Power" with extraordinarily low distortion compared to traditional designs. The signal then is converted back to analog form in the DAC, and proceeds to the transmit IF and RF stages.

In the FM mode, both CTCSS and DTMF tones are generated via the DSP system for repeater and control use.

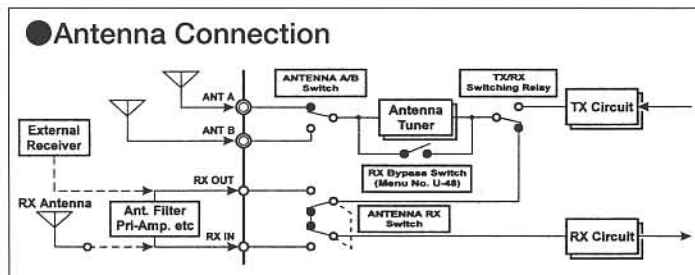
2. RECEIVER HIGHLIGHTS

The FT-920's receiver front end follows the basic architecture utilized in the FT-1000 series, including a doubly-balanced JFET mixer in an up-conversion design for excellent noise figure, dynamic range, and image rejection. The following sections will outline the leading-edge design features made available in the FT-920.

(A) Antenna Terminals

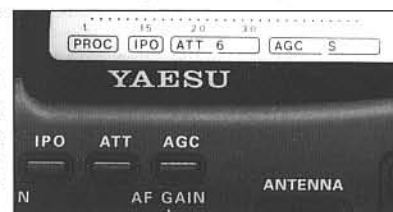
Because HF through 6 meter full-coverage antennas are generally not available, two separate SO-239 (Type "M") antenna jacks are provided on the rear of the FT-920. These allow, for example, connection of an HF antenna to Terminal A and a 50 MHz antenna to Terminal B. During operation, the last antenna (A or B) being used on a particular band will automatically be selected when you return to that band, so no additional operator intervention is required.

Additionally, a pair of RCA jacks (labeled RX IN and OUT) are provided on the rear panel; of the transceiver. These jacks are located in the receive line (when the RX Antenna switch is pushed), and they serve as ports for connection of a special amplifier, bandpass filter or preselector, or for connection of a receive-only antenna such as a Beverage. You may also use this feature for connection of a VHF or UHF receive converter, if desired.



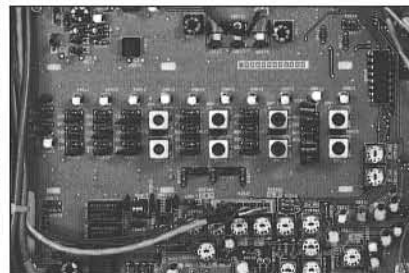
(B) ATT (Attenuator)

A three-position receiver input attenuator is provided, for use when very low noise figure in the receiver system is not needed. The attenuator's selections are in one S-unit (6 dB) steps, allowing the operator to choose 1, 2, or 3 S-units of attenuation. Simpler receivers often provide only a 20 dB attenuator, which may reduce the system sensitivity too much for many operating situations. The amount of attenuation is conveniently displayed on the LCD.



(C) Input Bandpass Filters

The RF active devices in the FT-920's front end are protected by a bank of eleven input bandpass filters, which provide high rejection of out-of-band signals which can cause intermodulation and degradation of noise figure. Narrow-bandwidth filters are included for protection of the 40, 20, 15, and 6 meter bands, because of the unique challenges these bands present to designers. These narrow filters make the FT-920 particularly well suited for use in multi-transmitter contest operations.



(D) Input Preamplifiers/Intercept Point Optimization (IPO)

Two input preamplifiers are provided on the FT-920, providing best noise figure and intercept performance over the wide frequency range covered by this transceiver. On the 12 meter through 6 meter bands, a 3SK131 dual-gate MOS FET preamplifier provides the low noise figure needed on these quiet bands. On the 160 through 15 meter bands, a pair of 2SK2218 junction FETs are used in a specially-tuned high-intercept amplifier stage which provides slightly less gain (not needed on the lower bands) along with excellent rejection of intermodulation distortion. These default assignments of preamplifiers to particular bands may be over-ridden by the operator via the Menu system, if it is desired to utilize, for example, the MOS FET preamp on 20 meters.

The input preamplifier stage may also be bypassed, when the lowered noise figure provided by the preamp is not needed (as is typically the case below about 14 MHz). The IPO key on the front panel activates this "bypass" mode, providing direct feed to the receiver's first mixer.

(E) RF AGC (Automatic Gain Control)

The AGC system utilized in the FT-920 controls the gain of the RF stage as well as that of the IF amplifiers. The AGC recovery time constant's default values include "Slow" for SSB and "Fast" for FM (when using the optional FM Unit), and the settings can, of course, be set manually to Slow, Fast, or Off by the operator at any time.

(F) First Mixer/Roofing Filter

The FT-920's first mixer utilizes four husky 2SK520 junction FETs in a quad doubly-balanced mixer configuration, providing wide dynamic range along with low noise figure. This is a design architecture virtually identical to that used so successfully in the FT-1000D and FT-1000MP transceivers. The 68.985 MHz first IF signal then immediately passes through a four-pole monolithic crystal roofing filter which strips image responses and sets an initial protection window for the stages to follow. The mixer's up-conversion configuration also helps suppress image responses.

(G) Analog IF Features: IF FILTERING, IF SHIFT, and IF NOISE BLANKER

●IF FILTERING

The main selectivity elements in the FT-920's (2nd) IF section are the stock 2.4 kHz 8-pole crystal filter, the optional 500 Hz CW filter (model YF-116C), and/or the optional 6 kHz AM filter (YF-116A).

●IF SHIFT

The IF SHIFT feature varies the 2nd Intermediate Frequency across the passband of the selected IF filter, thus

allowing the operator to eliminate high-side or low-side interference without changing the pitch of the incoming signal. Used in conjunction with the DSP's bandpass filter, it is a highly-effective tool on today's crowded bands.



●IF NOISE BLANKER

The FT-920's IF Noise Blanker is designed to combat the particularly difficult impulse-type noise often encountered on six meters, and it is very effective, as well, on the HF bands.



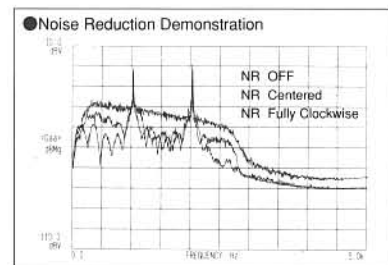
(H) DSP Receiver Features: NOISE REDUCTION, BANDPASS TUNING, and AUTO NOTCH

●DSP NOISE REDUCTION

Building on the highly-successful EDSP Noise Reduction circuitry pioneered in the FT-1000MP, the FT-920 utilizes a dual-parameter Noise Reduction circuit which significantly improves the receive signal-to-noise ratio. When used in conjunction with the IF Noise Blanker, the DSP Noise Reduction feature allows very weak signals (which otherwise would be inaudible)



to rise above the noise to a level allowing comfortable copy. And because of the very high speed at which the digital processing is taking place, very little distortion of the desired signal takes place.



●DSP BANDPASS TUNING

Digital filters, such as the Bandpass Filter utilized on the FT-920, can provide almost unity "Shape Factor" for difficult SSB, CW, or Digital mode interference situations. The FT-920 includes separate High-Cut and Low-Cut filters, adjusted by large front-panel controls, with separate tuning ranges for SSB and CW (so as to optimize the degree of tuning precision afforded the operator for these two very-different operating modes). Residual high-pitched SSB "buckshot" or "rumble," as well as extremely-strong-signal

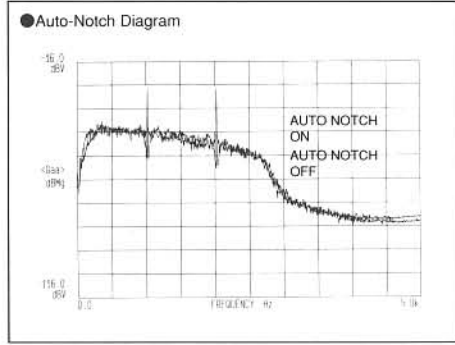
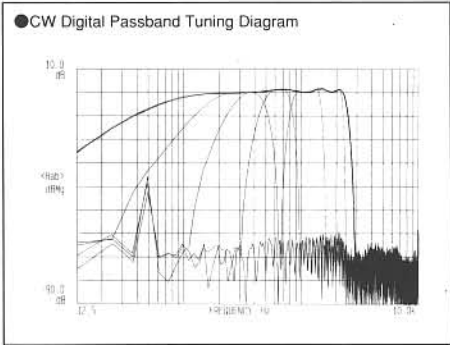
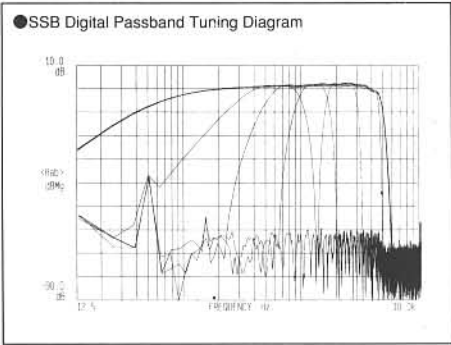


CW filter blow-through, can easily and totally be eliminated using these filters. And the Enhanced Tuning Scale provides the operator with a graphical scale which aids in quick setting of the optimum bandwidth.

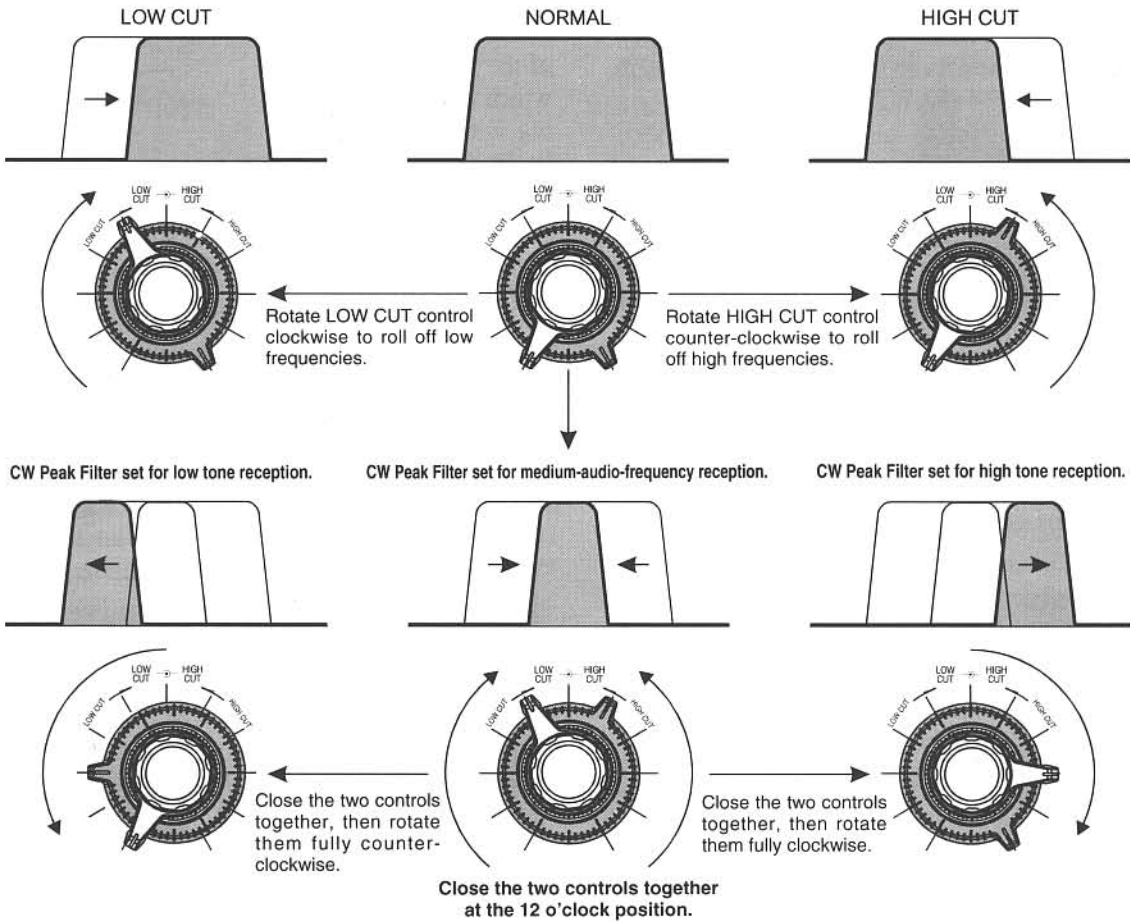
	STEP	Cutoff Frequency (SSB)	Cutoff Frequency (CW)
LPF	22	1.0kHz~4.5kHz	500Hz~2.25kHz
HPF	42	100Hz~1.9kHz	50Hz~950Hz

●AUTO NOTCH FILTER

For hands-free removal of annoying beat notes when operating on voice modes, the DSP AUTO NOTCH feature quickly removes one or more such interfering tones from the receiving passband.



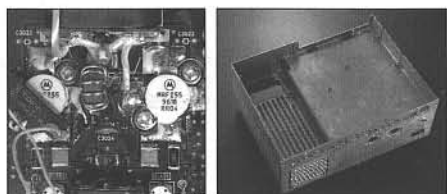
ADJUSTMENT OF DSP BANDPASS FILTER CONTROLS



3. TRANSMITTER HIGHLIGHTS

(A) 100 Watts of Power Output on 160 ~ 6 Meters

The FT-920's power amplifier stage uses an all-new design featuring rugged MRF255 MOS FET devices in a push-pull configuration, yielding consistent power output and excellent linearity. For high duty cycle applications such as contest work, Yaesu's engineers built the FT-920 into a large diecast aluminum chassis, which helps dissipate heat efficiently in conjunction with the thermostatically-controlled cooling fan. This conservative thermal design ensures the owner of many years of reliable operation at full power output.



(B) Power Control Techniques

●FRONT PANEL RF PWR CONTROL

The front panel RF PWR control provides smooth, precise adjustment of the power output to the level desired by the operator.

●INDEPENDENT POWER SETTINGS FOR EACH ANTENNA JACK

Via the Menu system, the power output applied to each antenna jack (A or B) may be set to one of three levels: 100W, 50W, or 10W. Therefore, you can, for example, set up Antenna jack A for 100 Watts output for "barefoot" operation, while setting Antenna jack B for 50 Watts output for driving a linear amplifier, if appropriate.

●LINEAR AMPLIFIER TUNING PULSE GENERATOR

The Menu system also allows you to tune an external linear amplifier using a Tuning Pulse Generator, which produces a low-duty-cycle high-speed pulse string which, to the observer, resembles a long single tone. This allows the amplifier to be tuned up at the "full drive" level but at a low duty cycle, which keeps transceiver and amplifier components cooler. The pulse length, spacing between pulses, and the duration of pulsed tuning may all be set independently via the Menu.

●QUICK LOW-POWER FEATURE

By pressing and holding in the (current TX) VFO selector for 1/2 second, you can quickly change from 100 Watts of power output to 10 Watts. This can be a handy tool for instant evaluation of a propagation path by comparing signal strength at low power output.

(C) DSP Transmitter Features: VOICE RECORDER, SPEECH PROCESSOR, MICROPHONE EQUALIZER, VOX, and TONE SYSTEMS

●DIGITAL VOICE RECORDER

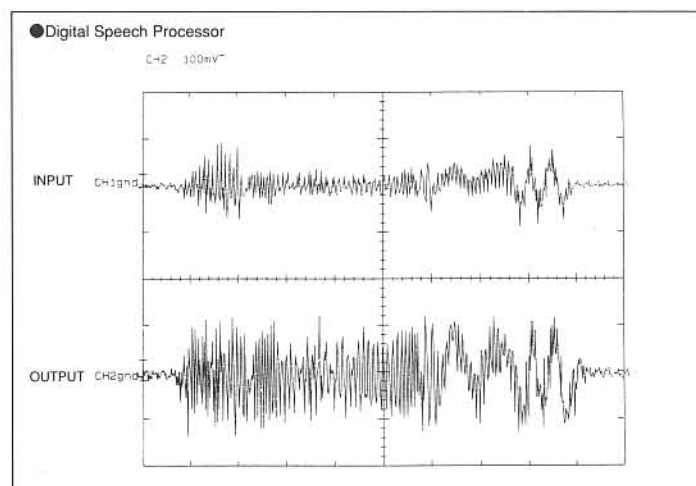
For the first time in a transceiver in this price class, Yaesu's

engineers have built in a high-quality Digital Voice Recorder for the FT-920. Utilizing the high processing speed, low distortion, and extensive memory of the DSP system, the Digital Voice Recorder provides two 8-second or four 4-second transmit memories, for repetitive messages such as "CQ Contest. . ." or repetitive contest reports. On receive, up to 16 seconds of recording time is provided. Recording and playback of messages is a simple procedure, thanks to the front-panel REC and PLAY keys.



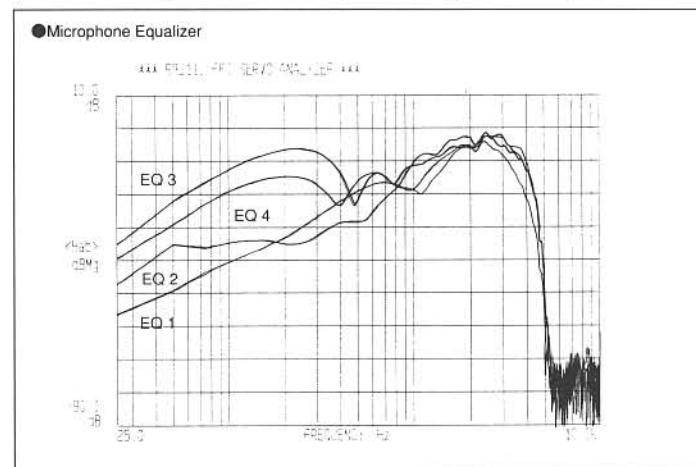
●DIGITAL SPEECH PROCESSOR

New in the FT-920 is a high-quality Digital Speech Processor, which provides approximately 6 dB of increased "talk power" when activated. The low-distortion characteristics of the FT-920's DSP yields greatly enhanced intelligibility at the other end of the communications circuit.



●MICROPHONE EQUALIZER

Another tool which provides increased useful power output is the Microphone Equalizer, which offers four different frequency response contours (similar to those provided in the elite-class FT-10000MP). These response contours provide high-cut, low-cut, mid-cut, and bandpass responses, one of which is likely to match the spectrum generated by your own



voice. This circuit thereby “focuses” the voice energy, reducing wastage of power output in non-productive frequencies. The result is a bigger signal from you in a pile-up! Important Note: Yaesu Musen Co., Ltd. assumes no responsibility for increased costs of sending QSL cards to rare DX stations!!!

• DSP-BASED HIGH-SPEED VOX CIRCUITRY

Up to now, most all VOX circuits have been based on analog designs, which always introduce some degree of time delay in the activation of the transmitter. The FT-920's leading-edge VOX design, however, detects voice modulation input

digitally, and uses the lightning-fast switching capability of the DSP system to initiate transmission immediately. The result is dramatically more smooth and efficient VOX operation.

• FM TONE SYSTEMS

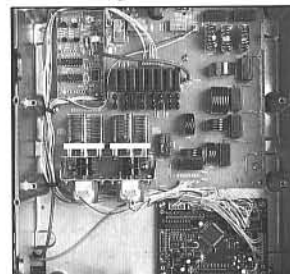
Rounding out the features provided by the DSP system is the comprehensive set of FM-mode Tone Systems offered on the FT-920. For repeater operation, CTCSS Encode and Decode systems are provided, and for autopatch and control applications a DTMF generator is also included in the DSP feature package.

4. AUTOMATIC ANTENNA TUNER

The FT-920's design includes an efficient Automatic Antenna Tuner, which is designed to handle Standing Wave Ratios (SWR) of up to 3:1 in the HF spectrum, and up to 2:1 on 50 MHz. Pressing the [TUNER] key for 1/2 second activates the tuner at a lowered power level (50 Watts), stores the new tuner settings into one of 100 special tuner memories, then automatically returns the transceiver to the “100 Watt” condition.

Because reactances can change rapidly across a band, particularly on the low frequencies, the Automatic Antenna tuner's memory “window” is 10 kHz wide, thereby allowing a number of memory settings to be stored for the 160- and 80-meter bands. As you move from one “window” to another while tuning the band, the Tuner will automatically adjust itself to the previously-optimized setting for that band segment, thus reducing or eliminating re-tuning as you QSY.

The FT-920's Automatic Antenna Tuner may be activated both on transmit and receive. When active on receive, the Tuner acts as an RF bandpass filter, protecting the receiver front-end switching diodes from strong out-of-band signals. This feature can provide significant additional protection from 2nd-order intermodulation effects from strong local broadcast stations, as well as being extremely helpful in multi-transmitter contest environments such as Field Day.

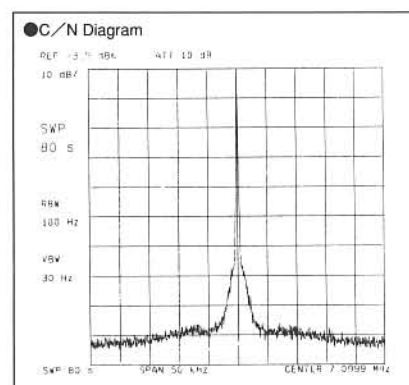
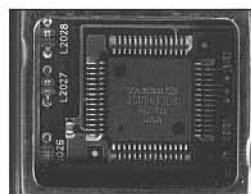


5. LOCAL OSCILLATOR DESIGN

Yaesu's HF product line is renowned for its excellent signal-to-noise performance both on receive and transmit, and the FT-920 follows in the proud tradition of the FT-1000D and FT-1000MP by incorporating a super-low-noise DDS (Direct Digital Synthesizer) as the primary local oscillator for the transceiver.

The DDS provides excellent Carrier-to-Noise (C/N) ratio compared to traditional PLL designs, while providing 1 Hz tuning steps which tune as smoothly as an analog VFO.

Moreover, the extra-ordinarily fast “lock-up” time of the DDS promotes the outstanding digital mode performance, including CW QSK without truncation.



6. CONTROL SYSTEM

The “brains” of the FT-920 are contained within a 16-bit Central Processing Unit (CPU), with extensive memory, allowing lightning-fast execution of commands executed by the operator.

(A) SHUTTLE-JOG™ Tuning Dial

Immediately in back of the Main Tuning Dial is Yaesu's exclusive Shuttle-Jog™ Dial, which is a convenient, easy-to-use tool for rapid navigation around the band.

Just grasp the Jog Dial and “lean” it slightly to one side or the other from its spring-loaded center position. The transceiver will tune in the direction you rotate the dial, and will scan faster as you lean the Shuttle-Jog™ dial further. It's quick, it's easy, and it's only found in Yaesu products!



(B) Twin Large Tuning Dials

For maximum ease of tuning, the FT-920 utilizes two large tuning dials for the Main and Sub VFO registers. For Split applications, the operator may choose which VFO will be used for Receive or Transmit by simply pushing the convenient RX and TX combination LED/Switches, located adjacent to the tuning dials. The Sub VFO Dial is also used for setting of the “Clarifier” (RIT/XIT) offset during operation on the Main VFO.



(C) Keyboard Frequency Entry with Two VFO Registers

Instant band change is provided via the front panel keyboard, which allows one-touch band change with two VFOs per band. Therefore, you can have one VFO set to 14.195 MHz on SSB, then press the [14] key for instant QSY to 14.025 MHz on CW-Narrow.



The keyboard also provides direct frequency entry, for quick, easy, and precise setting of any frequency within the operating range of the transceiver. You may enter frequencies directly either for the Main or Sub VFOs.

(D) Extensive Memory System with Alpha-Numeric Labels

The FT-920's Memory System provides 127 memory channels total, allocated in a number of user-friendly ways.

●99 CHANNELS OF STANDARD MEMORY

Each memory channel stores frequency, mode, bandwidth, Clarifier information, antenna jack selection, antenna tuner on/off status, repeater CTCSS tone and frequency shift data, and alpha-numeric labels.

●5 QUICK MEMORY BANK CHANNELS (QMB)

The QMB channels provide one-touch storage and recall of prime operating frequencies.

●10 SPLIT FREQUENCY MEMORIES

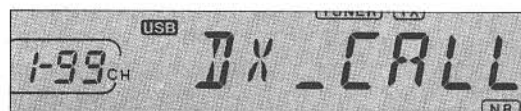
These channels are used when the transmit and receive frequencies must be different (for example, for 40-meter DX nets, etc.).

●11 “CALL” CHANNELS

You can use these to store and recall one “most important” frequency on each amateur band.

●2 “BAND EDGE” MEMORIES

Use these memories to set upper and lower band scanning limits.



(E) Flexible Scanning System

The FT-920 includes a wide variety of scanning provisions. The scanner can be programmed by the operator ① to stop without resumption of the scan, ② to pause until the incoming signal disappears, after which scanning will resume, or ③ to halt and hold on a frequency for a programmable time period (1~60 seconds), after which scanning will resume automatically.

The available scanning modes include:

●VFO SCANNING

In this mode, the FT-920 scans upward or downward in frequency without limits.

●CHANNEL SCANNING

In this mode, the FT-920 scans through the programmed QMB channels.

●MEMORY CHANNEL SCANNING

In this mode, the FT-920 scans through all memory channels, or just within the current "Memory Group" (if you so desire), and can also be instructed to "Skip" certain channels where beacon or other constantly-transmitting stations are stored.

●MEMORY SCAN (PMS)

In this mode, the FT-920 scans within the Upper and Lower band limits specified by the special "PMS" memories.

(F) Additional Control System Highlights

Other convenience features provided on the FT-920 include:

●VFO TRACKING

You may "slave" VFO-A and VFO-B together, so that both VFOs will tune in tandem.

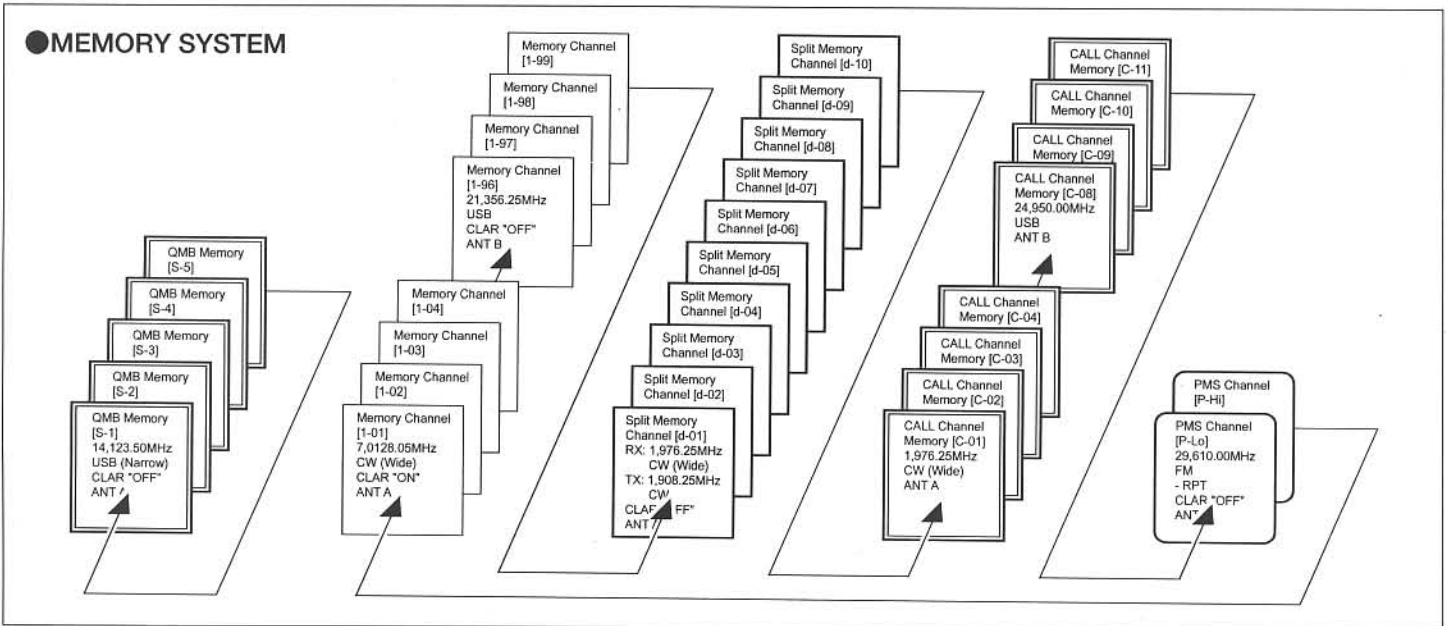
●QUICK SPLIT

You may set up the FT-920 so that, when you activate the "Split" function for the two VFOs, they will automatically be offset by a programmable shift (such as 5 kHz). This will prevent you from accidentally calling on top of the transmitting frequency of a rare DX station, for example.

●WATCH

The Dual Watch feature is basically a two-frequency scanning system, which allow you to monitor one frequency while periodically checking another frequency (on a different band, if you wish) for activity. This is particularly useful when watching for beacon stations to appear during sporadic band openings.

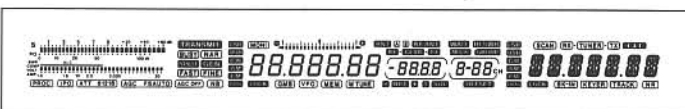
●MEMORY SYSTEM



7. DISPLAY AND METERING

(A) OMNI-GLOW™ LCD Display

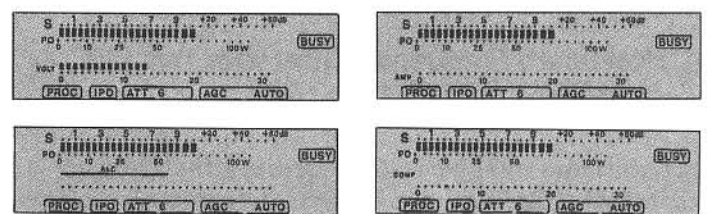
Yaesu's exclusive Omni-Glow™ display provides excellent contrast, low eye fatigue, and crisp resolution over an extraordinarily wide range of viewing angles.



(B) Digital Status Metering with Peak-Hold Feature

The Omni-Glow™ display includes a very-high-speed metering system for all aspects of transceiver operating status, including signal strength, power output, ALC level, antenna system SWR, speech processor compression level,

final amplifier supply voltage, and final amplifier transistor drain current. The meter system includes a convenient peak-hold system that permits the operator to measure peak measurement values easily and quickly, without guesswork.



(C) Enhanced Tuning Scale

A particularly noteworthy capability of the display area is the Enhanced Tuning Scale, which may be set by the operator to display special aspects of transceiver

performance. These include ① DSP bandpass filter width on a relative scale, ② clarifier offset (graphical representation), ③ frequency resolution below 10 Hz, and ④ it can also serve as an FM discriminator center meter.



8. CW OPERATOR DREAM FEATURES

In keeping with a long Yaesu tradition, the FT-920 includes leading-edge features for the CW operator. Besides the features shown below, remember that the DSP's Bandpass Filter can be set up for a minimum bandwidth of about 50 Hz, allowing razor-sharp selectivity for use on tough circuits.

(A) Full Break-In

Thanks to the very fast switching time provided by the DDS, the FT-920 is capable of seamless QSK operation without truncation of the characters.

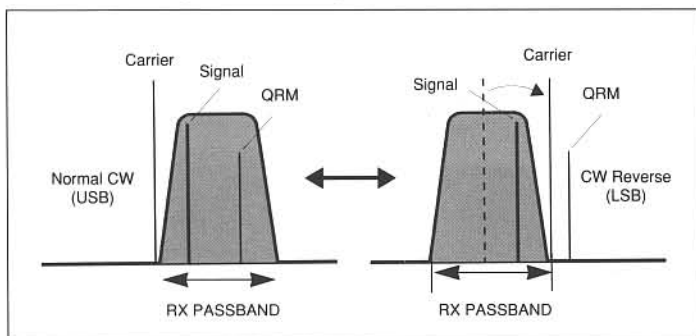


(B) Built-In Electric Keyer

The FT-920's internal iambic keyer provides a sending range of 6 ~ 60 WPM, with independent capability to set the dot:space and dash:space ratios for whatever "feel" you prefer. The keyer also includes a defeatable auto-space function, and the CW-mode "VOX" Delay may be set, on CW, independently from that which you use on SSB!

(C) CW Reverse

The CW Reverse feature allows the operator to select either USB-side or LSB-side reception in the CW mode. This allows one to escape troublesome interference, and it also allows the operator to change modes effortlessly on the lower bands, where earlier transceivers were locked into the CW mode using USB-side injection.



(D) Multi-Display Panel

Finally, the display includes a handy "Multi-Display Panel" area, which can be set up to show repeater offset magnitude, CW pitch frequency, or the current clarifier frequency offset.

(D) CW Pitch/SideTone

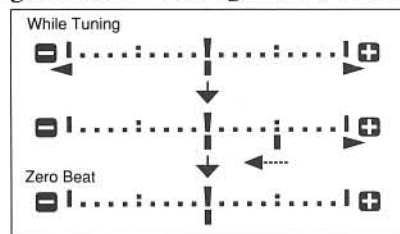
The CW Sidetone is designed so as to correspond precisely with the pitch of your transmitted signal, and it may be adjusted using the front panel CW PITCH control over the range 300 ~ 1050 Hz. Other transceivers may not allow you to set such a low pitch, thereby denying the operator of the increased selectivity afforded by listening in the low audio frequency range.

(E) CW Spot

The CW Spot feature sends a steady tone which is precisely the same as that corresponding to the pitch of your transmitted signal. Adjusted in conjunction with the front panel CW PITCH control, this is an extremely effective tool in DX pile-up operation.

(F) CW Tuning Meter

The FT-920 includes a high-tech CW Tuning Meter, which monitors the incoming signal and produces a graphical representation of the offset from your own transmit frequency, thus allowing precise "zero beat" capability.



(G) Built-In Message Memory Keyer

The FT-920's electronic keyer includes four message memories which will store up to 50 characters each, plus two additional memories which will store up to 20 characters each. The message memory can send sequential contest numbers, and the numbers may also be set up to be truncated, if desired ("A" for "1" or "T" for "0," for example).

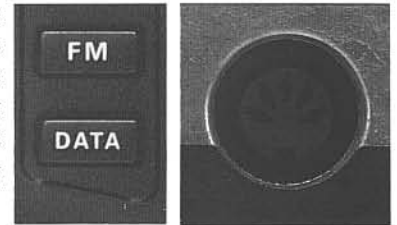
(H) Two Key Input Jacks

The FT-920 includes two KEY jacks which may be set up, for example, to allow "Paddle" input via one jack and "Straight Key" input via the other jack. The latter input is especially useful for applying the output from an external memory keyer or from a computer-generated keying line.

9. DATA MODE OPERATION

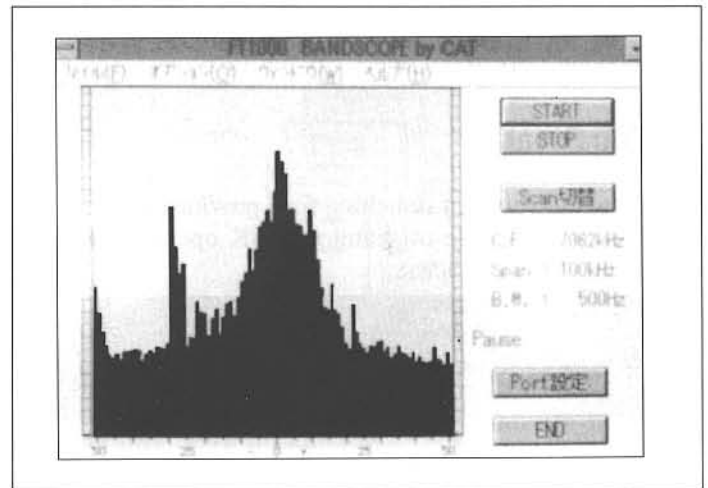
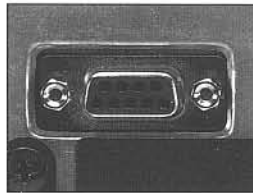
Digital mode operation was never easier than with the FT-920! A dedicated DATA mode allows either AFSK or FSK input via a rear-panel DIN connector, which also includes fixed-level receiver audio, PTT, and Ground lines. AFSK/FSK operation with either USB or LSB-side injection is provided, as well as AFSK operation on FM for 28 or 50 MHz use.

During DATA mode operation, the microphone input on the front panel is cut off, thus eliminating the possibility of a "live mic" condition interfering with your communication!



10. PERSONAL COMPUTER CONTROL

The FT-920's rear panel includes a convenient DB-9 computer port for use with an external personal computer. The RS-232C interface is built into the transceiver, so you only need a standard serial data cable to connect to your computer's COM port. Yaesu's CAT System protocol is supported by most major contest and DX logging software.



11. REAR PANEL CONNECTORS AND SWITCHES



12. SPECIFICATIONS

General

RX Frequency Range : 100.00 kHz ~ 29.99999 MHz,
48.00000 MHz ~ 56.00000 MHz
TX Frequency Range : 160 ~ 6 m amateur bands only
Operating Temperature Range : -10 °C ~ +50 °C
Frequency Stability : ± 10 ppm
 ± 2 ppm (w/optional TCXO-7)
Frequency Accuracy : $< \pm 7$ ppm (FM $< \pm 500$ Hz)
 $< \pm 3.5$ ppm (FM $< \pm 460$ Hz w/optional TCXO-7)
Emission Modes : LSB, USB, CW, FSK, AM, FM (option)
Frequency Steps : 10 Hz/100 Hz/1 Hz for SSB and CW,
100 Hz/1000 Hz/10 Hz for AM and FM

Transmitter

Power Output : Adjustable up to 100 W (25 W AM carrier)
Modulation Types : SSB : J3E Balanced, filtered carrier
AM : A3E Low-level (early stage)
FM : F3E Variable reactance
FSK : J1D, J2D Audio frequency shift keying
Maximum FM Deviation : ± 2.5 kHz (narrow), ± 5.0 kHz (wide)
FSK Shift Frequency : 170, 425, and 850 Hz
Packet Shift Frequency : 200 Hz

Receiver

Circuit Type : Double-conversion Superheterodyne
(Triple-conversion for FM)
Intermediate Frequencies : 68.985 MHz, 8.215 MHz (455 kHz for FM)
Sensitivity :

	SSB	AM	FM
100 kHz ~ 150 kHz (IPO ON)	—	—	—
150 kHz ~ 250 kHz (IPO ON)	5 μ V	40 μ V	—
250 kHz ~ 500 kHz (IPO ON)	4 μ V	32 μ V	—
0.5 MHz ~ 1.8 MHz (IPO OFF)	2 μ V	16 μ V	—
1.8 MHz ~ 24.5 MHz (IPO OFF)	0.2 μ V	2 μ V	—
24.5 MHz ~ 28.0 MHz (IPO OFF)	0.13 μ V	1.3 μ V	—
28.0 MHz ~ 30.0 MHz (IPO OFF)	0.13 μ V	1.3 μ V	0.25 μ V
48.0 MHz ~ 54.0 MHz (IPO OFF)	0.13 μ V	1.3 μ V	0.25 μ V

Selectivity (-6dB/-60 dB) :

SSB, CW 2.4 kHz/5.0 kHz
CW 500 Hz/1.8 kHz w/optional CW filter YF-116C
AM 6 kHz/14 kHz w/optional AM filter YF-116A
FM 12 kHz/25 kHz w/optional FM Unit FM-1

Automatic Antenna Tuner

Impedance Range : 16.7 Ω ~ 150 Ω unbalanced (1.8 MHz ~ 28 MHz)
25.0 Ω ~ 100 Ω unbalanced (50 MHz)
Frequency Range : 160 m ~ 6 m amateur bands
Matching Time : < 30 seconds
Matched SWR : < 1.4:1

Specifications subject to change, in the interest of technical improvement,
without notice or obligation.

Antenna Impedance : 50 Ω unbalanced
Power Consumption (Approx.) : RX (no signal) 2.0 A,
RX (signal present) 2.5 A,
TX (100W) 22A
Supply Voltage : DC 13.5V ± 10 %, negative ground
Dimensions (W x H x D) : 410 x 135 x 316 mm w/o knobs
Weight (Approx.) : 11.5 kg

Harmonic Radiation : at least 50 dB below peak output (HF),
at least 60 dB below peak output (VHF)
SSB Carrier Suppression : at least 40 dB below peak output
Undesired Sideband Suppression : at least 50 dB below peak output
Audio Response (SSB) : not more than -6 dB from 400 to 2600 Hz (DSP off)
3rd-order IMD : -31 dB @ 100 W PEP, or better (14 MHz)
Microphone Impedance : 500 ~ 600 Ω

Squelch Sensitivity :

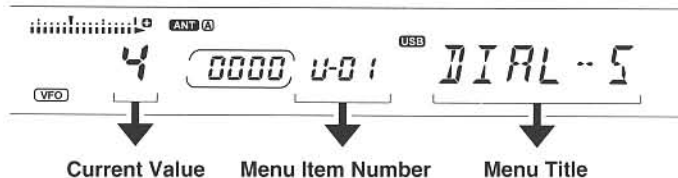
< 2 μ V (@ SSB, CW, AM 1.8 MHz ~ 56 MHz, IPO OFF)
< 0.32 μ V (@ FM 28 MHz ~ 56 MHz, IPO OFF)
IF Rejection : < 70 dB (HF), < 50 dB (VHF)
Image Rejection : < 70 dB (1.8 MHz ~ 56 MHz)
IF Shift Range : ± 1.2 kHz
AF Notch Rejection : 35 dB or better
Clarifier Tuning Range : ± 9.99 kHz
Maximum Audio Output : 1.5 W (@ 4 Ω , THD 10%)
Audio Output Impedance : 4 ~ 8 Ω

13. MENU MODE SUMMERY CHART

(A) Menu Operation

- ① Press the [MENU] key once momentarily. The Menu Item number will start blinking, and a brief title for the Memory Item will appear at the far right side of the display.
- ② Rotate the **VFO-B Tuning Dial** to select the Menu Item you wish to work on.
- ③ When you have chosen the desired Menu Item number, press [ENT] on the keypad momentarily. The current value or condition for the Menu Item chosen will be shown in the main frequency display area.

- ④ Again rotate the **VFO-B Tuning Dial**, or press the front panel [UP▲] or [DOWN▼] keys, to change the value or condition for the Menu Item.
- ⑤ When you have made your selection, press [ENT] to lock in your setting. You may now select another Menu Item number to work on (by rotating the VFO-B Tuning Dial) or press [MENU] to exit and resume normal operation.



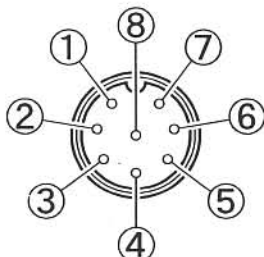
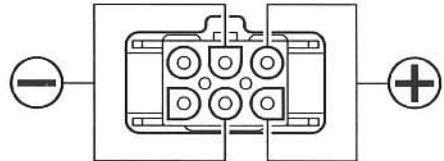
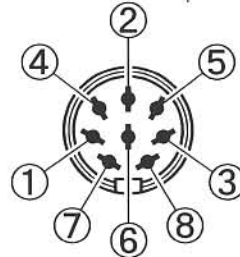
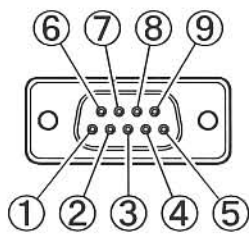
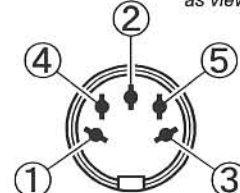
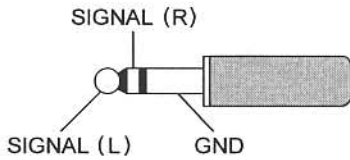
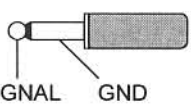
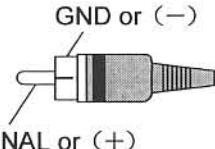
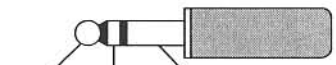
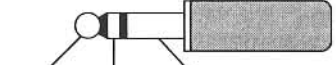
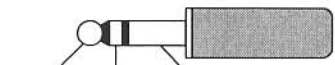
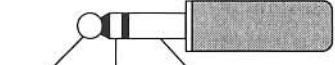
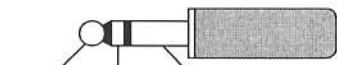
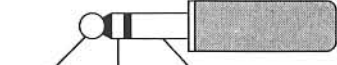
Menu Mode Summary Chart

Menu #	Function of Menu Item	Available Choices	Default
U-01	VFO Dial Speed	X2, X4	X4
U-02	Up/Down Switch Steps	0.5 kHz ~ 1000 kHz/Step	100 kHz
U-03	Step Switch Function	Toggle/Momentary	Toggle
U-04	Quick Split Offset	Off/-100 kHz ~ +100 kHz	Off
U-05	TX When Spot is Pressed	On/Off	Off
U-06	Beep Frequency	Off/220 Hz ~ 7040 Hz	880 Hz
U-07	"Peak Hold" Metering	0(Off) ~ 2000 ms.	Off
U-08	Display Dimmer Control	On/Off	Off
U-09	Multi-Panel Display Item	Clarifier/Pitch/Offset	Clarifier
U-10	Enhanced Tuning Scale	Clar./DSP/Tuning/Fine Tuning	DSP
U-11	Memory Channel Group 1	1 ~ 99	99
U-12	Memory Channel Group 2	{(Last # in Grp. 1)+1} ~ 99	Off
U-13	Memory Channel Group 3	{(Last # in Grp. 2)+1} ~ 99	Off
U-14	Memory Channel Group 4	{(Last # in Grp. 3)+1} ~ 99	Off
U-15	Scanning Mode	Carrier Drop/Delay/Halt	Carrier Drop
U-16	Hold Time for "Delay" Scan	1 ~ 60 Seconds	5 Seconds
U-17	Resume Time after Carrier Drop	0 ~ 10 Seconds	1 Second
U-18	Dual Watch Polling Interval	3 ~ 15 Seconds	10 Seconds
U-19	Scanning Speed	1 ~ 100 ms./Step	10 ms.
U-20	Electronic Keyer Mode	Keyer 1/Keyer 2/Bug	Keyer 1
U-21	Keyer Dot:Space Ratio	0 (0:1) ~ 127 (12.7:1)	10 (1:1)
U-22	Keyer Dash:Space Ratio	0 (0:1) ~ 127 (12.7:1)	30 (3:1)
U-23	Keyer Envelope Delay	0 ~ 30 ms.	5 ms.
U-24	Semi-Break-in PTT Hold Time	0 ~ 5100 ms. (5.1 seconds)	0 ms.
U-25	Contest Number	0000 ~ 9999	0000
U-26	Contest Number "0" Format	0 (Zero)/T/O (Oh)	0 (Zero)
U-27	Contest Number "1" Format	1/A	A
U-28	Contest Number "2" Format	2/U	2

Menu Mode Summary Chart

Menu #	Function of Menu Item	Available Choices	Default
U-29	Contest Number "3" Format	3/V	3
U-30	Contest Number "5" Format	5/E	5
U-31	Contest Number "7" Format	7/B	7
U-32	Contest Number "8" Format	8/D	8
U-33	Contest Number "9" Format	9/N	9
U-34	Contest Number Size/Format	No Leading 0/nnn/nnnn/Off	No Leading 0
U-35	HF Repeater Tone Type	CTCSS/Burst	CTCSS
U-36	VHF Repeater Tone Type	CTCSS/Burst	CTCSS
U-37	(TX) Tone Frequency	Off/67.0 ~ 250.3 Hz/1750 Hz	Off
U-38	(RX) Tone Frequency	Off/67.0 ~ 250.3 Hz	Off
U-39	HF Repeater Shift	0 ~ 5 MHz	100 kHz
U-40	VHF Repeater Shift	0 ~ 5 MHz	500 kHz
U-41	Automatic Antenna Selection	Auto/Manual/Off	Auto
U-42	RTTY Generator Tone Pair	2125/1275 USB/2125/1275 LSB	2125 LSB
U-43	RTTY Shift	170/425/850 Hz	170 Hz
U-44	Shift Polarity	Normal/Reverse	Normal
U-45	Packet Freq. Display Offset	-3.0 ~ +3.0 kHz	+2.125 kHz
U-46	Packet Subcarrier Frequency	1170/1700/2125/2210 USB/LSB	2125 USB
U-47	RF Preamp (Band-by-Band)	JFET/MOSFET	JFET(160-15m)
U-48	ATU Enabling on RX	On/Off	Off
U-49	Max. PO: Antenna-A	100/50/10 W	100 W
U-50	Max. PO: Antenna-B	100/50/10 W	100 W
U-51	DSP Voice Equalizer	Hi/Mid/Low/Bandpass/Off	Off
U-52	Linear Tuning Start	Begins when [Ent] is pressed	—
U-53	Linear Tuning PO:Ant. A	100/50/10 W	100 W
U-54	Linear Tuning PO:Ant. B	100/50/10 W	100 W
U-55	Linear Tuning Time	3 ~ 60 Seconds	10 Seconds
U-56	Linear Tuning Space Time	0 ~ 3000 ms.	100 ms.
U-57	Linear Tuning Pulse Time	0 ~ 3000 ms.	100 ms.
U-58	Rx LSB Carrier Offset	-300 ~ +500 Hz	0
U-59	Tx LSB Carrier Offset	-300 ~ +500 Hz	0
U-60	Processor LSB Offset	-300 ~ +500 Hz	0
U-61	Rx USB Carrier Offset	-300 ~ +500 Hz	0
U-62	Tx USB Carrier Offset	-300 ~ +500 Hz	0
U-63	Processor USB Offset	-300 ~ +500 Hz	0
U-64	VOX Hang Time	0 ~ 3 Seconds	1 Second
U-65	VOX Gain	0 ~ 15 (Arbitrary scale)	15
U-66	VOX Anti-Trip	0 ~ 15 (Arbitrary scale)	5
U-67	Quick Menu	All Menu Items	Off
U-68	FM Scanning Steps	off/0.5 ~ 50 kHz	10 kHz
U-69	CW Filter	On/Off	Off
U-70	AM Filter	On/Off	Off
U-71	ATU Auto-Retuning	On/Off	On
U-72	ATU Fast Tuning	On/Off	Off
U-73	RX Ant. Jack Circuit Path	Open/Connected on Tx	Open

14. PLUG/CONNECTOR PIN OUT DIAGRAM

<div><div>MIC</div><div><div><div>① UP</div><div>② +5V</div><div>③ DOWN</div><div>④ FAST</div><div>⑤ GND</div><div>⑥ PTT</div><div>⑦ MIC GND</div><div>⑧ MIC</div></div><div>as viewed from front panel</div></div></div>	<div><div>DC 13.5V</div><div><div>as viewed from rear panel</div></div></div>
<div><div>BAND DATA</div><div><div><div>① +13V</div><div>② TX GND</div><div>③ GND</div><div>④ BAND DATA A</div><div>⑤ BAND DATA B</div><div>⑥ BAND DATA C</div><div>⑦ BAND DATA D</div><div>⑧ LINEAR</div></div><div>as viewed from rear panel</div></div></div>	<div><div>CAT</div><div><div><div>① N/A</div><div>② SERIAL OUT</div><div>③ SERIAL IN</div><div>④ N/A</div><div>⑤ GND</div><div>⑥ N/A</div><div>⑦ N/A</div><div>⑧ N/A</div><div>⑨ NC</div></div><div>as viewed from rear panel</div></div></div>
<div><div>DATA</div><div><div>as viewed from rear panel</div><div><div>AFSK-FSK SWITCH</div><div><div>AFSK</div><div><div>① DATA IN</div><div>② GND</div><div>③ PTT</div><div>④ DATA OUT</div><div>⑤ BUSY</div></div><div>FSK</div><div><div>① SHIFT</div><div>② GND</div><div>③ PTT</div><div>④ DATA OUT</div><div>⑤ BUSY</div></div></div></div></div></div>	<div><div>PHONES</div><div></div></div> <div><div>EXT SPKR</div><div></div></div> <div><div>RCA PLUG</div><div></div></div>
<div><div>KEY</div><div><div><div>FRONT</div><div>KEYER SWITCH: "ON"</div><div><div>DOT DASH COMMON</div></div><div>KEYER SWITCH: "OFF"</div><div><div>KEY KEY GND</div></div></div><div><div>REAR</div><div>KEYER SWITCH: "ON"</div><div>PDL-KEY SWITCH: "PDL"</div><div><div>DOT DASH COMMON</div></div><div>KEYER SWITCH: "OFF"</div><div>PDL-KEY SWITCH: "PDL"</div><div><div>KEY KEY GND</div></div><div>KEYER SWITCH: "ON"</div><div>PDL-KEY SWITCH: "KEY"</div><div><div>KEY PTT GND</div></div><div>KEYER SWITCH: "OFF"</div><div>PDL-KEY SWITCH: "KEY"</div><div><div>KEY PTT GND</div></div></div></div></div>	

15. OPTIONS



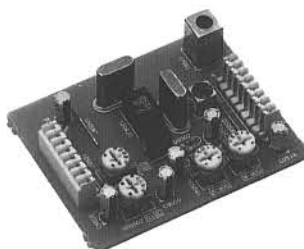
■ Desk-Top Microphone
MD-100A8X



■ External Speaker w/Audio Filters
SP-8



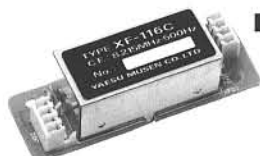
■ Stereo Headphones
YH-77STA



■ FM Unit
FM-1



■ AC Power Supply, Linear Type (25A)
FP-1030A



■ 500 Hz CW Filter
YF-116C



■ 6 kHz AM Filter
YF-116A

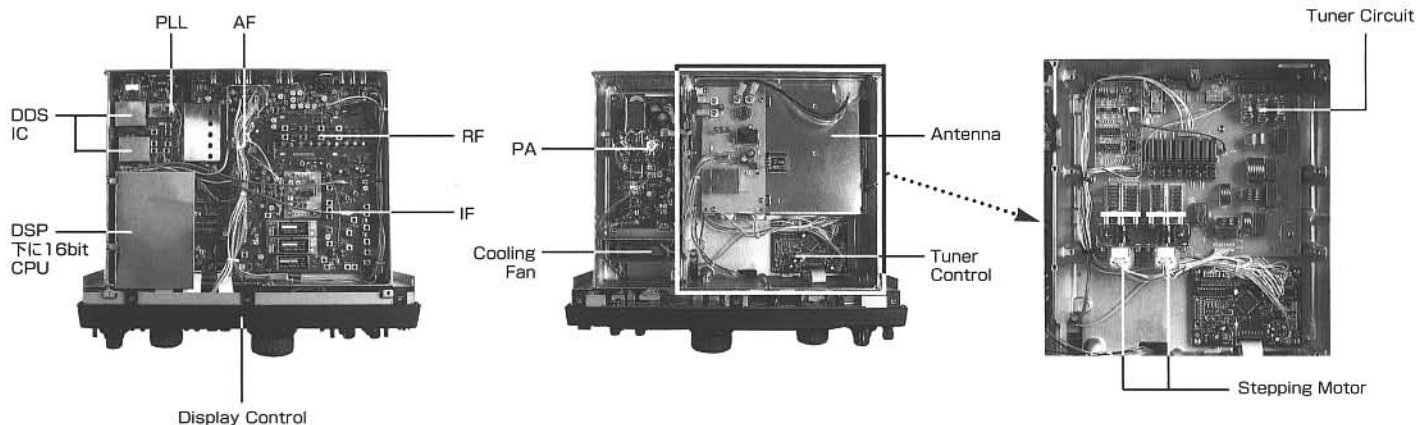


■ High-Stability Reference
Oscillator Unit (2ppm)
TCXO-7



■ 1000 Watt Solid State HF+50 MHz Linear Amplifier
VL-1000

16. INTERNAL LAYOUT



YAESU

...leading the way.SM

About this brochure. We have made this brochure as comprehensive and factual as possible. We reserve the right, however, to make changes at any time in equipment, optional accessories, specifications, models, and availability. Various accessories shown may not be available in some countries. Some information may have been updated since the time of printing. Please check with your Authorized Yaesu Amateur Dealer for complete details. Specifications guaranteed only within amateur bands.

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