

OWNER'S MANUAL AM/FM DIRECT ENTRY COMMUNICATIONS RECEIVER

RADIO SHACK LIMITED WARRANTY

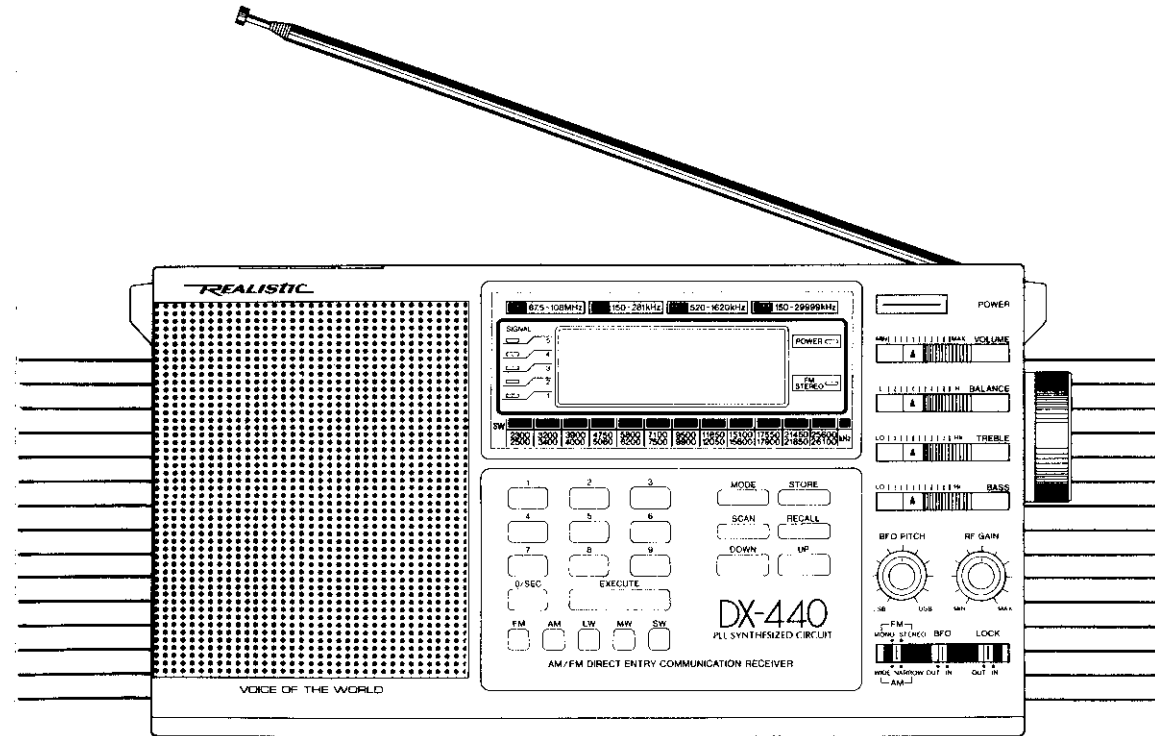
This product is warranted against defects for 90 days from date of purchase from Radio Shack company-owned stores and authorized Radio Shack franchisees and dealers. Within this period, we will repair it without charge for parts and labor. Simply **bring your Radio Shack sales slip** as proof of purchase date to any Radio Shack store. Warranty does not cover transportation costs. Nor does it cover a product subjected to misuse or accidental damage.

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This warranty gives you specific legal rights and you may also have other rights which vary from state to state.

We Service What We Sell

Please read before using this equipment



RADIO SHACK
A Division of Tandy Corporation
Fort Worth, Texas 76102

Cat. No. 20-221A

REALISTIC[®]

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INTRODUCTION

You now have the world at your fingertips. Just press the buttons of your DX-440 to listen to a variety of voices from around the world. In addition to your local AM and FM broadcast stations, you can now enjoy broadcasts from London, Tokyo, Paris, Berlin, and Moscow.

This entertainment grade, general purpose, communications receiver covers an extremely wide range of frequencies that also include shortwave and special services such as marine and navigation. If you understand international Morse code, you can listen in and decode a wide variety of transmissions.

The radio uses the latest solid-state technology to provide programming, a large liquid crystal display (LCD), and a host of other convenient features. Because this product is so versatile, please take a few minutes to review the material in this manual before you proceed. You'll enjoy the radio much more if you do.

Welcome to the world of the short-wave listener.

For your own protection, we urge you to record the serial number of this unit in the space provided below. The serial number is located inside of the battery compartment

Serial Number _____

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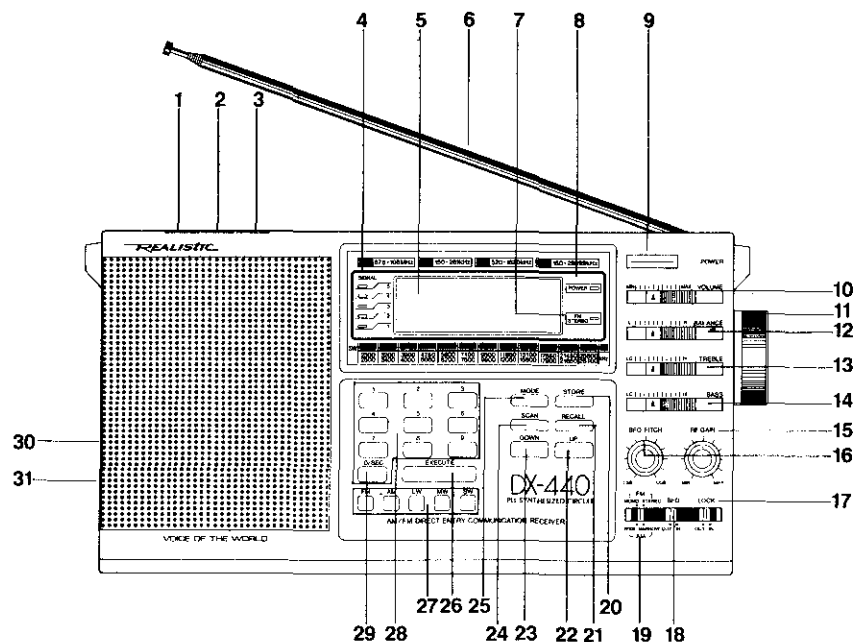
Realistic is a registered trademark of
Tandy Corporation.

FEATURES

- **Wide Tuning Range**—lets you receive more stations from more places than ever before.
- **Fast Response LCD**—shows you the frequency you select in large, easy-to-read numbers.
- **Direct Access Keypad**—lets you instantly tune in any desired frequency from 87.5 to 108 MHz on the FM band and from 150 kHz to 29,999 kHz on the AM band.
- **Up to 9 Storable Frequencies**—give you instant response for your favorite stations or transmission sources.
- **Multiple Power Source Operation**—means you can use it virtually anywhere in the world.
- **Supplemental Tuning Controls** — allow adjustment for maximum clarity of the selected frequency.
- **Dual Function Mode Switch**—allows you to display the frequency or the time on the LCD panel.
- **Scanning Control**—lets you check the various transmissions on a certain band and lock on to the chosen frequency.
- **Full Range Tone Controls**—lets you customize the sound for clarity and listening comfort.
- **Stereo Headphones Jack** — lets you listen to FM Stereo programs in full stereo.

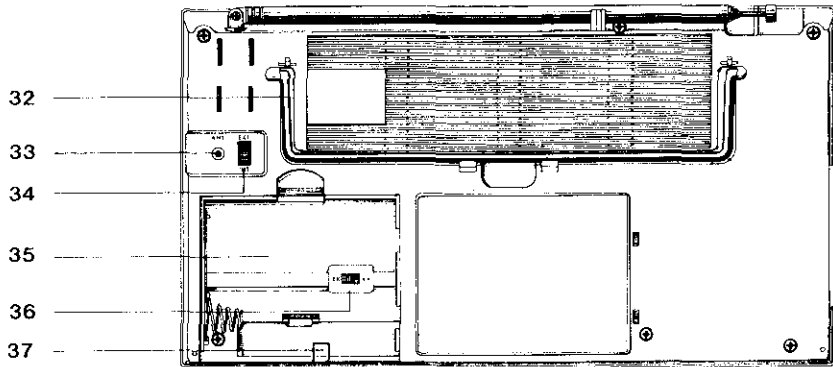
CONTROL LOCATIONS

1. LIGHT Button
2. TIMER Button
3. SLEEP Button
4. SIGNAL Strength Indicators
5. LCD Display
6. Telescopic Antenna
7. FM STEREO Indicator
8. POWER On Indicator
9. POWER Switch
10. VOLUME Control
11. Dual-Function Tuning Control
12. BALANCE Control
13. TREBLE Control
14. BASS Control
15. RF GAIN Control
16. BFO PITCH Control
17. LOCK Switch
18. BFO OUT/IN Switch
19. FM/(MONO/STEREO)/AM(WIDE/NARROW) Mode Selector
20. STORE Button
21. RECALL Button
22. UP Button
23. DOWN Button
24. SCAN Button
25. MODE Button
26. EXECUTE Button
27. Band Selectors
28. Number Entry Buttons
29. Time Mode/SEC onds Reset button
30. STEREO headphones Jack (3.5mm)
31. DC IN 9V Jack



- 32. Folding Stand
- 33. EXTERNAL Antenna Jack
- 34. EXTERNAL/INTERNAL Antenna Selector

- 35. Battery Compartment
- 36. 9k/10kHz Step Switch (beneath batteries)
- 37. Battery Removal Strap

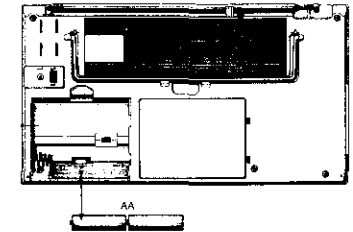


CHOOSING A POWER SUPPLY

You can operate the DX-440 using:

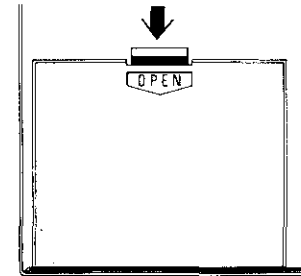
- Six alkaline D batteries and two AA batteries.
- Household AC (with an optional AC adapter)
- A 12-Volt DC automotive battery (with an optional DC adapter)

that you can lift them easily for replacement.)



INSTALLING BATTERIES

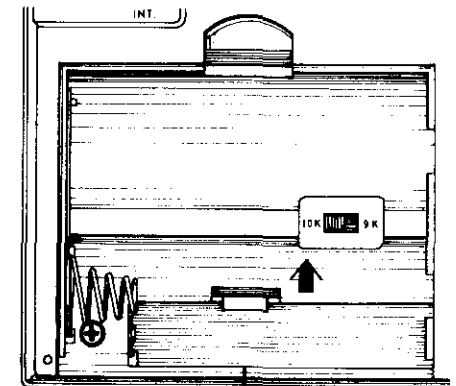
1. Press the latch on the battery compartment cover in the direction of the OPEN label, and lift the cover off.



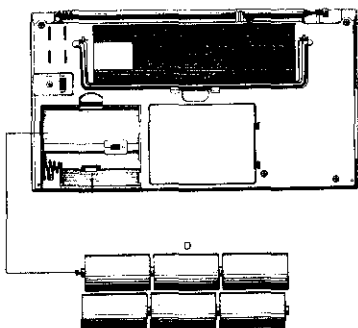
Note: Before installing the next set of batteries, verify that the frequency step selector switch is set to the position correct for your country. In the USA, move the switch to the 10K position. In other countries, set it to 9K.

2. Insert two AA alkaline batteries (such as Radio Shack® Cat. No. 23-552) in the smaller battery chamber within the main compartment. Position them as illustrated on the back of the radio.

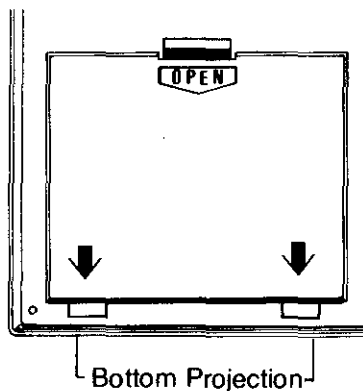
(Place these batteries and the next set of batteries on top of their respective battery removal ribbons so



3. Insert six D batteries in the main battery compartment. Position them as shown in the illustration on the back of the radio. For best results, use alkaline batteries such as Radio Shack® Cat. No. 23-550.



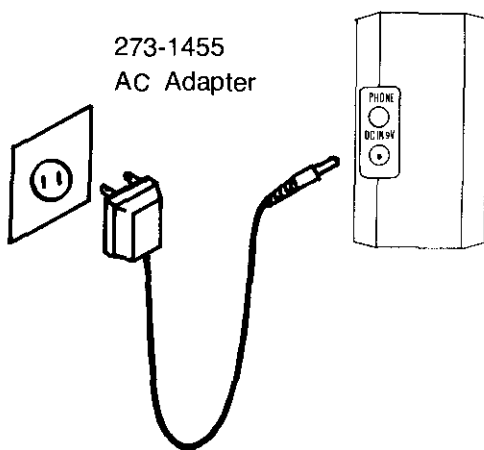
4. Insert the bottom projections on the edge of the battery compartment cover inside the lower edge of the compartment opening. Lower the cover, and snap the top latch down until it clicks closed.



USING HOUSEHOLD AC

You can power the DX-440 from household AC using an optional AC adapter, Cat. No. 273-1455. Plug the small connector of the adapter into the DC IN 9V socket on the side of the unit. Plug the adapter into a standard household outlet.

Note: When you use AC, the DX-440 automatically disconnects the internal batteries.

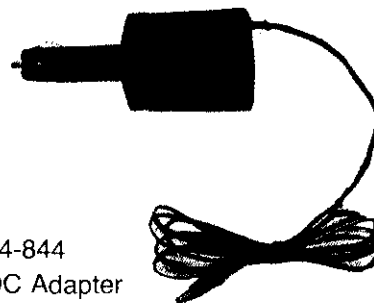


USING AN AUTOMOTIVE BATTERY

You can operate the DX-440 in a car, boat, or recreational vehicle that is equipped with a 12 Volt DC, negative ground battery. Use a DC adapter (Cat. No. 14-844).

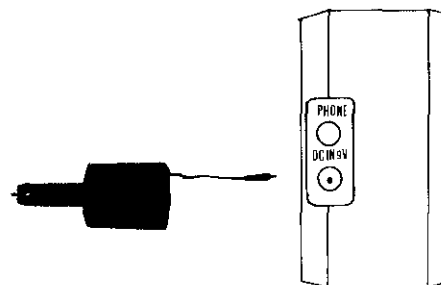
Note: When you connect the adapter, the DX-440 automatically disconnects the internal batteries.

Caution: Do not let the adapter's barrel plug contact any metal parts of the vehicle when the adapter is plugged into the lighter socket of the vehicle but not yet plugged into the DX-440. A harmful short can occur that can damage the adapter or the vehicle's electrical system.



14-844
DC Adapter

Insert the adapter plug into the jack marked DC IN 9V on the side of the DX-440. Plug the other end of the adapter into the lighter socket of the vehicle.



PRELIMINARY SETTINGS

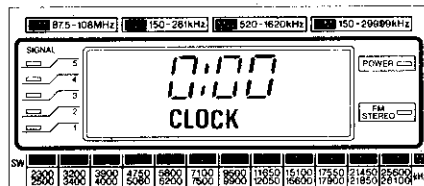
SETTING THE CLOCK

The display shows the time in a 24-hour mode except when you are tuning a station or performing some other operation. The radio uses the 24-hour mode

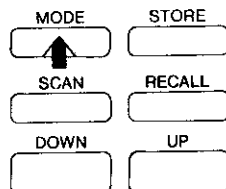
because most shortwave stations schedule their broadcasts on the basis of Greenwich Mean Time which is a 24-hour clock.

The clock starts when you install the two AA batteries. The display shows CLOCK 0:00.

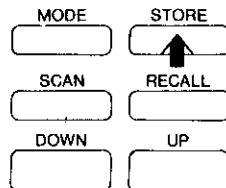
Note: If after installing the two AA batteries the display does not show CLOCK 0:00, remove the batteries and install them one minutes later. The display will show CLOCK 0:00.



1. Press the MODE button.

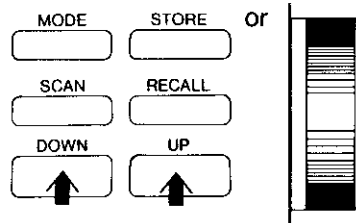


2. Press the STORE button. CLOCK flashes in the display for five seconds.



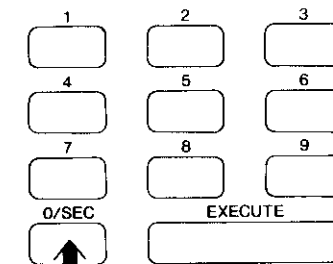
3. During this period press the UP or DOWN buttons to reach the correct time in hours and minutes (or, rotate the tuning knob to quickly reach the correct setting).

Note: digit of time can be adjusted only when "CLOCK" is flashing in the display.



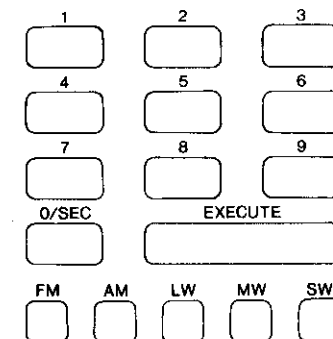
4. Press the O/SEC button. The display shows the minutes and seconds setting. Press the STORE button to reset the seconds to 00 and the display, return to the hours and minutes.

Note: When "CLOCK" is flashing, O/SEC button does not function.



SELECTING A BAND AND TURNING ON POWER

The radio has five band select buttons beneath the EXECUTE button.

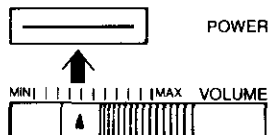


| Band (Button) | Frequency | | Service |
|------------------|-----------|-----------|---------------------------|
| | Min | Max | |
| FM | 87.5 | 108 MHz | Normal FM broadcasts |
| AM | 150 | 29999 kHz | Entire AM Band |
| LW | 150 | 281 kHz | Longwave |
| MW | 520 | 1620 kHz | Normal AM broadcasts |
| SW | 2300 | 26100 kHz | Shortwave in 12 sub-bands |

Note: Each time you select SW, the radio steps through 12 sub-bands, each band covering as little as 100 kHz to as much as 500 kHz. The sub-bands cor-

respond to the wavelengths of each band. Refer to "The Shortwave Hobby" section for additional information.

1. Press the POWER button. The POWER indicator lights. The display shows the last band and frequency you selected.



2. Press the band button of your choice. The display shows the band you selected and a random frequency within that band.



TUNING THE RADIO

ADJUSTING THE ANTENNA

Locate the band to which you want to listen in the following chart. Adjust the antenna as indicated.

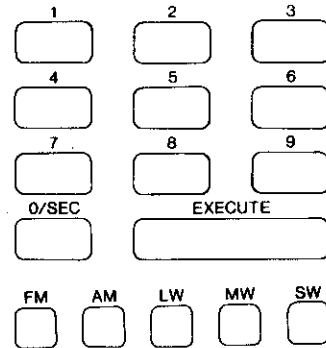
| BAND | FREQUENCY RANGE | ANTENNA | |
|-------|------------------|---|--|
| MW | 520 - 1620 kHz | Internal - Rotate radio for best reception | |
| LW | 150 - 281 kHz | Internal - Rotate radio for best reception | |
| FM | 87.5 - 108 MHz | Telescopic - Extend fully Swivel for best reception | |
| AM/SW | 2300 - 26100 kHz | Telescopic - Extend fully Do not swivel | |

You can select a frequency using four tuning methods:

- Direct Tuning
- Manual Tuning
- Scan Tuning
- Memory Tuning

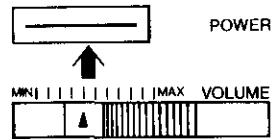
DIRECT TUNING

You can "key in" any frequency within the range of the radio by selecting the band in which that frequency operates and then pressing the number buttons of that frequency.

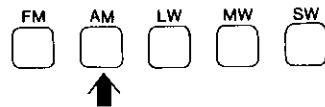


Example: To tune to 7305 kHz on the AM band

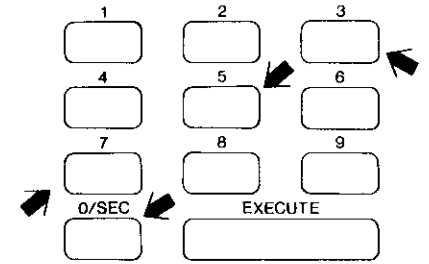
1. Press the POWER button to turn on the radio.



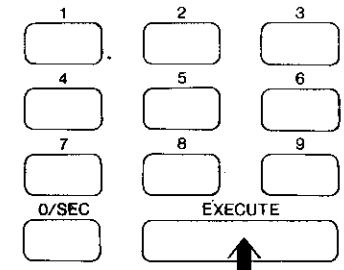
2. Press the AM band button.



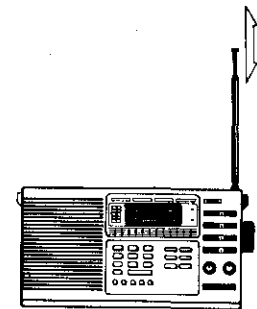
3. Press [7], [3], [0], [5]. As you press each button, the LCD shows the number.



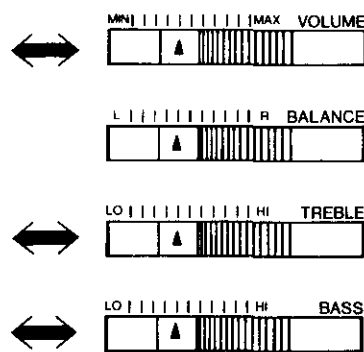
4. Press the EXECUTE button within five seconds. The display shows the frequency and meter band of SW.



5. Extend the antenna fully straight up for the best AM (SW) reception.

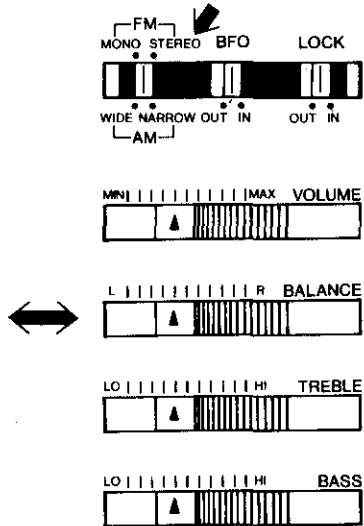


6. Adjust the VOLUME and TREBLE/BASS tone controls for the desired sound level.



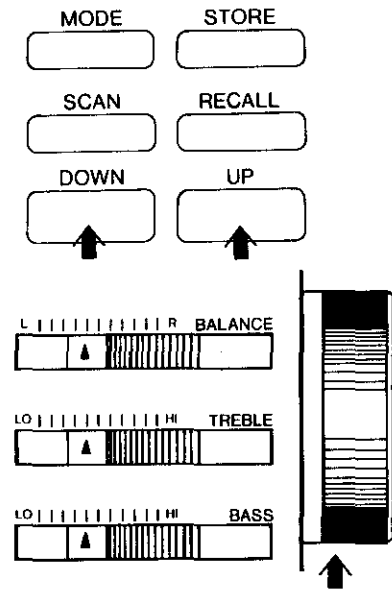
Note: If you select the FM band and tune to an FM stereo station, move the FM mode switch to STEREO and adjust the BALANCE control for the best stereo headphone reproduction.

The built in speaker is monaural. For the best sound result when listening with the built in speaker, do not forget to return the BALANCE control to the mid position.

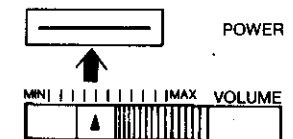


CONTINUOUS TUNING

If you do not know the exact frequency of the station you want to listen to, you can check the broadcasts on a band using the UP/DOWN buttons or the tuning knob.



1. Press the POWER button to turn on the radio.

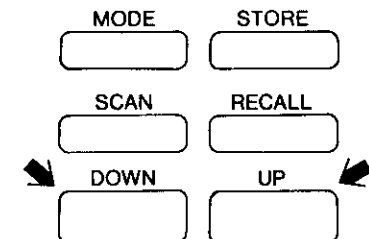


2. Select a band.

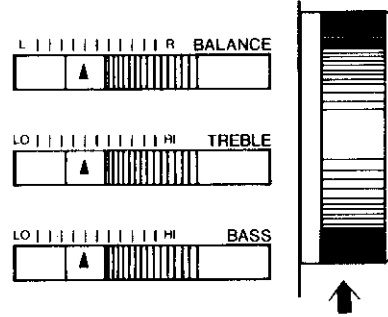


3. a. Repeatedly press the UP or DOWN button until you reach the frequency you want or reach a station you want to listen to. Press and hold the UP or DOWN buttons to rapidly change frequencies.

or



b. Rotate the tuning knob in either direction until you reach a desired frequency or station with all five SIGNAL indicators light to obtain best reception.

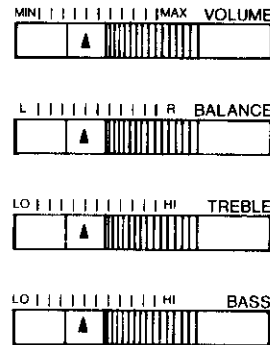


Note :
When you repeatedly press an UP or DOWN button, the frequency on the FM band changes by .05 MHz each time you press a button. On all other bands, the frequency changes by 1 kHz.

When you turn the TUNING knob slowly in the AM band, the display changes in 1 kHz increments. Slightly faster turning of the knob causes the display to change in 10 kHz and very fast turning of the knob causes changes in 100 kHz increments. Turn the knob quickly until the display nears the desired frequency. Then, turn it slowly for precise tuning.

When you press and **hold** an UP or DOWN button, the frequency on the FM band changes by .50 MHz. On all other bands, it changes by 10 kHz.

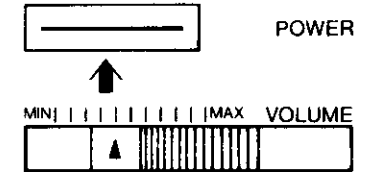
4. Adjust the VOLUME, TREBLE, BASS and BALANCE



SCAN TUNING

Use scan tuning to quickly locate a station or to monitor several stations within a band.

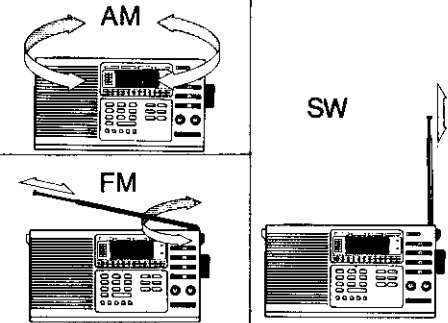
1. Turn on the radio.



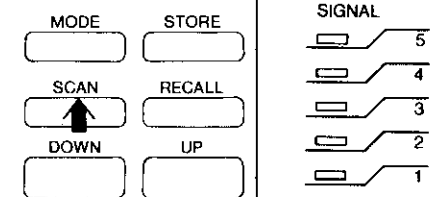
2. Select a band.



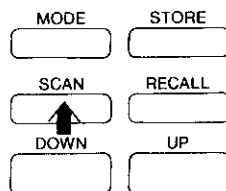
3. Adjust the antenna or radio position according to the chosen band.



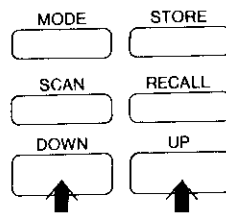
4. Press the SCAN button. The radio begins to scan the frequencies in the band, from lowest to highest. It stops when it reaches a station. The signal strength of the station registers on the SIGNAL indicators. When all five indicators light, SIGNAL is the best.



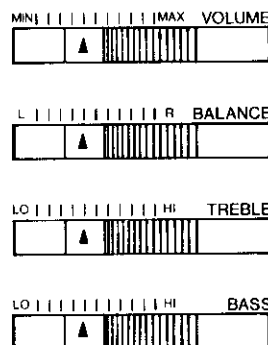
5. Press the SCAN button again to resume upward scanning. When the radio reaches the upper frequency limit of the band, it continues scanning starting again at the lowest frequency on the band.



6. You can fine tune the station using the UP or DOWN buttons. Tune so that the most SIGNAL indicators light for best reception.



7. Adjust the VOLUME/TREBLE/BASS and BALANCE controls.



MEMORY TUNING

You can store up to nine different frequencies and have them available for instant selection.

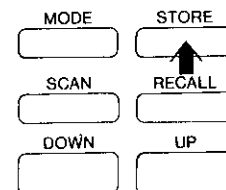
To Store a Frequency

1. Turn on the radio.

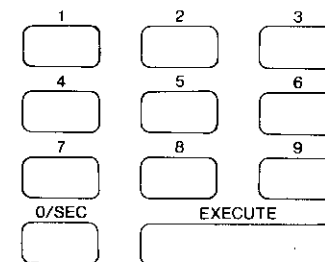


2. Tune to any frequency using any of the previously mentioned techniques.

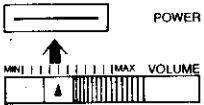
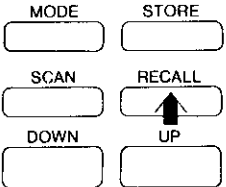
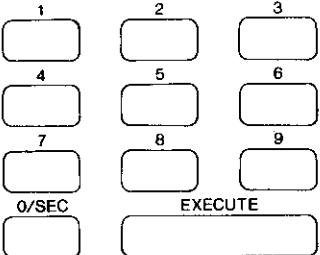
3. Press the STORE button. The word STORE flashes on the display for five seconds. During this period, press one of the nine number buttons. The display shows the storage number you selected and stores the chosen station in that memory location.



Note: You do not have to store your first station as location 1. You can choose any location as your first choice.



To Recall a Frequency

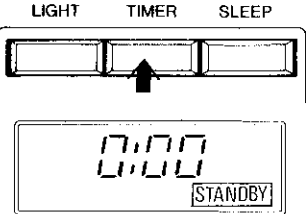
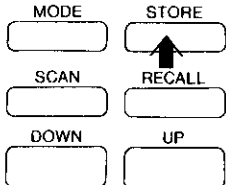
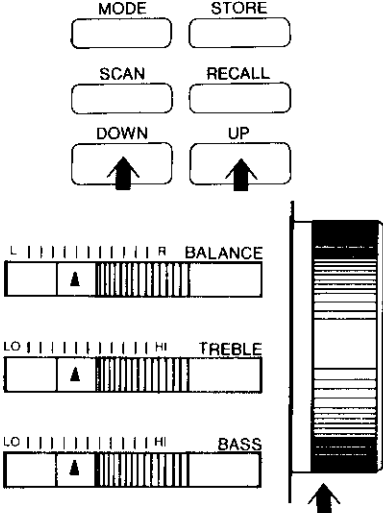
| | |
|---|---|
| <p>1. Turn on the radio.</p> |  |
| <p>2. Press the RECALL button. The display flashes MEMO for five seconds.</p> |  |
| <p>3. During this time, press the storage number button for the desired station. The radio instantly tunes to that station and displays the frequency and the storage number.</p> <p>Note: If you make no selection while STORE or MEMO flashes, the radio returns to the normal playing mode.</p> |  |

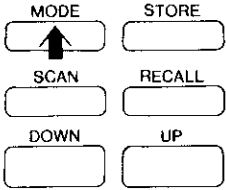
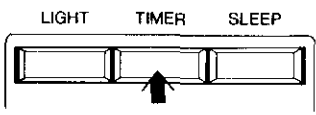
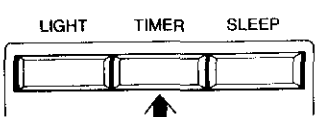
CLOCK RADIO OPERATION

You can use the DX-440 to wake you up to your favorite station everyday. And before you retire for the evening, you can set the timer so that the radio

turns itself off after an interval between 10 and 90 minutes. Make the following settings with the power off.

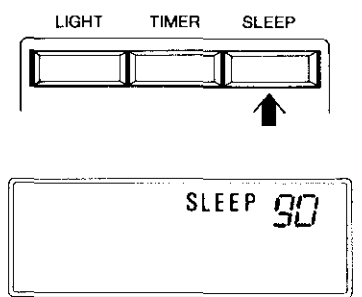
SETTING THE ALARM

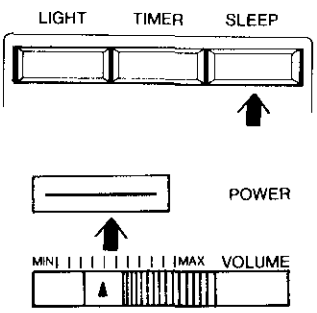
| | |
|--|--|
| <p>1. Press the TIMER button. The display shows 0:00 and STANDBY for five seconds.</p> |  |
| <p>2. During this period, press the STORE button. STANDBY starts to flash for five seconds.</p> |  |
| <p>3. During this period, use the UP and DOWN buttons or the tuning knob to reach the daily turn-on time, using a 24 hour clock, displayed in hours and minutes. For example, to set the radio to turn on at 1:24 P.M. each day, use the buttons or turn the knob until the display shows 13:24.</p> |  |

| | |
|---|---|
| <p>4. When you reach the desired turn on time, press the MODE button to lock the setting. STANDBY stops flashing. In a few seconds, the display reverts to the clock mode and shows the current time.</p> |  |
| <p>5. Press the TIMER button once. STANDBY disappears.</p> |  |
| <p>6. To check the daily turn on time, press it again to display the STANDBY TIMER all the time.</p> |  |

USING THE SLEEP TIMER

To have the radio turn itself off after a period of 90 minutes or less, proceed as follows:

| | |
|---|---|
| <p>1. Press the SLEEP button. The display shows SLEEP 90 in the upper right corner.</p> |  |
|---|---|

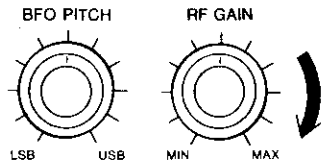
| | |
|---|---|
| <p>2. If you want fewer than 90 minutes playing time, press the SLEEP button again. Each time you press the button, the playing time reduces by 10 minutes.</p> <p>To turn off the radio before it normally turns itself off, press the POWER button.</p> |  |
|---|---|

SPECIAL TUNING TECHNIQUES AND CONTROLS

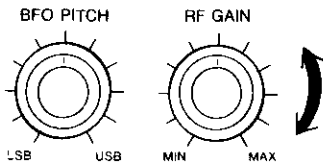
In addition to the standard tuning operations described previously, use the following controls for special operations.

RF GAIN CONTROL

This control adjusts the receiver's sensitivity. For shortwave reception, rotate the control to the MAX position. This provides the maximum sensitivity. When you listen to the MW, standard AM band, or LW band, rotate the control only as far as needed to obtain a good signal. If you turn the knob further you might hear a distorted signal. For weak stations, rotate the control to the MAX position.

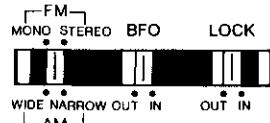


If you encounter interference, adjust the control in both directions until you obtain the best compromise between your station and the interference.

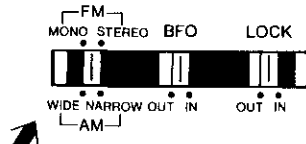


AM NARROW/WIDE SELECTIVITY SWITCH

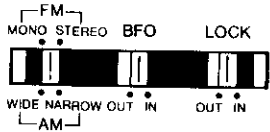
Some stations transmit their signal so that very little space exists between their airspace and the station next to them on the band. If, while tuning, you encounter interference, caused by the signal from an adjacent station, press the button for the band you are listening to and select the NARROW position. The interference is reduced or muted.



For full reception, leave the switch in the WIDE position.

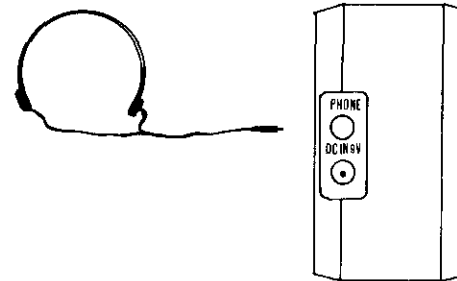


If you plan to listen to Morse code, referred to as CW (continuous wave), set the BFO switch to IN position. If you encounter too much noise as you tune, set the AM NARROW/WIDE switch to NARROW position.

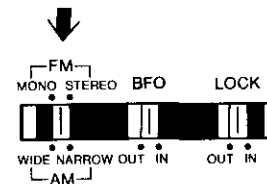


USING HEADPHONES

While not a control, you might consider using headphones to obtain the best reception. Many stations broadcast marginal signals. Only headphones can capture the subtle difference between the signal from such stations and the surrounding noise often encountered at night. Be sure that the headphones terminate in a 1/8 inch plug. Insert the plug into the PHONES jack on the side of the radio. When you plug the headphones in, you silence the speaker.



Because the radio can receive stereo FM, when you listen to FM stereo broadcasts, be sure your headphones are designed for stereo operation so that you can obtain the full benefit of this feature.

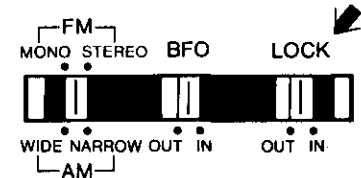


USING THE LOCK CONTROL

Use this switch to prevent unauthorized use of the radio or to ensure that any station you might be monitoring remains tuned in.

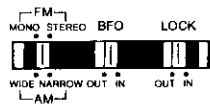
When you move the LOCK switch to the IN position, you disable the POWER button and the tuning controls. If the radio is on when you use the LOCK switch, you cannot turn off the radio or change the current frequency.

To release the LOCK function, set LOCK switch to out position

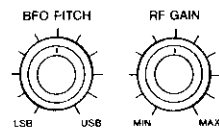


SPECIAL SSB/CW RECEPTION TECHNIQUES

Many stations transmit unmodulated telegraph transmissions in the shortwave band. To receive these special Morse code characters, the radio uses a special circuit, a *beat-frequency oscillator*, to modify the transmitted signal so that you can hear it. This particular type of telegraph transmission is called *continuous wave (CW)* transmission.



Many stations transmit voice signals with a suppressed carrier in the *single side band (SSB)*, part of the radio transmission spectrum that lies to the side of the primary frequency signal. Amateurs tend to transmit voice below 10 MHz use the *lower side band (LSB)*. Above 10 MHz, they use the *upper side band (USB)*. Commercial utility stations generally use the USB. A carrier has to be added to make these signals audible.

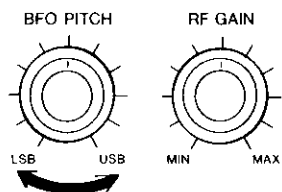


TO RECIEVE CW

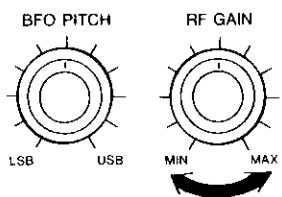
| | |
|--|--|
| 1. Turn on the radio. | |
| 2. Extend the antenna fully straight up. | |
| 3. Set the BFO switch to IN. | |

| | |
|--|--|
| 4. Rotate the BFO PITCH control to the midpoint. | |
| 5. Rotate the RF GAIN control to the MAX position | |
| 6. Press the AM band button to select the AM band. | |
| 7. Tune in the CW station using the tuning knob, or enter the frequency using the direct access buttons. | |

8. Adjust the CW tone using the BFO PITCH control.

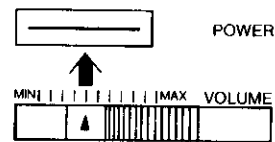


9. Reduce strong signals by using the RF GAIN control. This also reduces interference and noise.

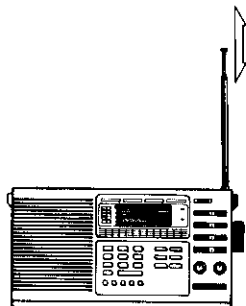


TO RECEIVE SSB VOICE

1. Turn on the radio.



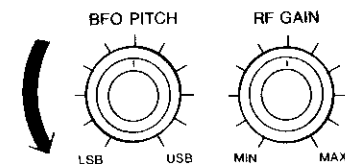
2. Extend the antenna fully, in a straight up position.



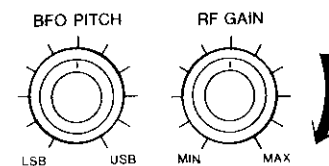
3. Set the BFO switch to the IN position.



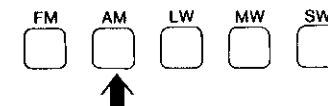
4. Rotate the BFO PITCH control to the LSB position for stations below 10 MHz or to the USB position for stations above 10 MHz.



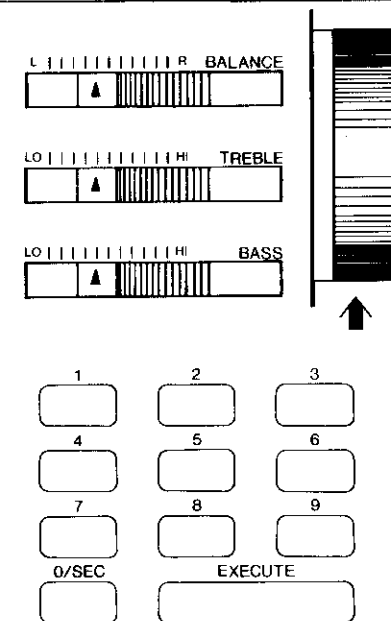
5. Rotate the RF GAIN control to the MAX position.

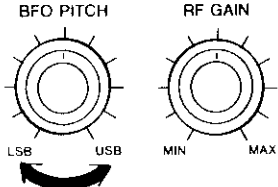
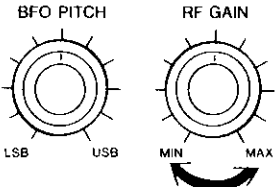
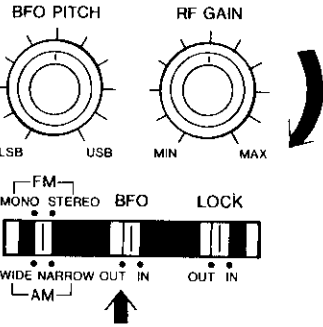


6. Press the AM button to select the AM band.




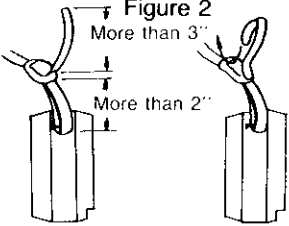

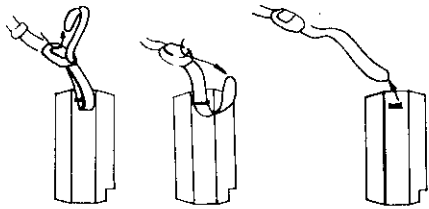
7. Tune in the SSB station using the tuning knob, or enter the frequency using the direct access buttons.



| | |
|--|--|
| <p>8. Rotate the BFO PITCH control to adjust the signal quality.</p> |  |
| <p>9. Rotate the RF GAIN control to dampen strong signals. This can improve signal clarity as well.</p> |  |
| <p>Note: Before choosing another band, set the RF GAIN control to MAX, and move the BFO switch to the OUT position.</p> |  |

USING THE SHOULDER STRAP

To Attach The Shoulder Strap

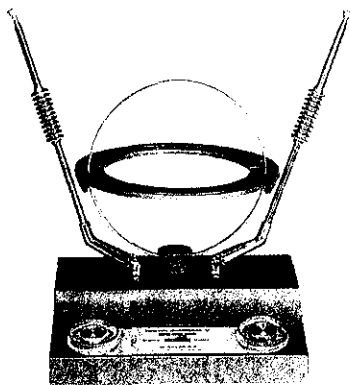
| | |
|---|--|
| <p>1. Insert about five inches of the end of the strap into the strap hanger.</p> | |
| <p>2. Pull the free end of the strap upward, and insert the end into the lower edge of the strap buckle as shown in Figure 1.</p> |  <p style="text-align: center;">Figure 1</p> |
| <p>3. Pull at least three inches of the strap end through the buckle. See Figure 2. Then bring the end of the strap beneath the upper end of the buckle. Refer to Figure 3.</p> |  <p style="text-align: center;">Figure 2 More than 3" Figure 3 More than 2"</p> |
| <p>4. Pull the free end taut. Be sure that at least two inches of strap extend from the upper end of the buckle. Slip the extra strap beneath the belt loop. See Figure 4.</p> |  <p style="text-align: center;">Figure 4 More than 2"</p> |
| <p>To remove the shoulder strap, follow Figures 5, 6, and 7 to reverse the procedure.</p> |  <p style="text-align: center;">Figure 5 Figure 6 Figure 7</p> |

CHOOSING AN ANTENNA

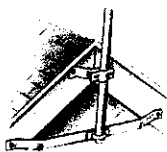
The radio uses a telescoping antenna and an internal ferrite bar antenna for reception of signals between 150 kHz and 1620 kHz. These antennas provide acceptable reception for most situations. However, if you use an external antenna, you can receive more signals, and the signals you receive will be better.

FM BAND

- Use a set of VHF-TV rabbit ears. Those made for TV/FM coverage can help get better performance on the FM band.



- Use an outdoor FM antenna. This type, specially designed for optimum FM performance, requires rooftop (or similar location) mounting.



- Use a combination TV/FM antenna.

Note

- To use an external antenna, equipped with 300-ohm twinlead, connect the twinlead's terminals to a 300 to 75-ohm matching transformer, Cat. No. 15-1253. Then insert the 75-ohm connector of the transformer into an F-to-RCA adapter, Cat. No. 278-252. Finally, insert the RCA type plug of the adapter into the RCA antenna jack of the receiver. Be sure to move the antenna switch to EXT.

- If your antenna uses 75 ohm coaxial cable, attach the connector of the cable to Cat. No. 278-252, which also terminates in a RCA type plug. Insert the RCA plug into the ANT jack, and move the switch next to the jack to EXT.

AM - SHORTWAVE BANDS

For AM reception, you can use many different types of antennas. Unfortunately, no single antenna can effectively cover the entire frequency range of the DX-440, from 150 kHz to 29999 kHz.

A general purpose shortwave antenna, such as Cat. No. 278-758, can provide better reception than either of the built-in antennas. However, if you want the best possible reception on one specific band, your antenna must be a certain length.

Refer to the following charts. The first chart indicates the length of wire required for optimum performance on the

specified band. The second chart gives you the required length of wire to receive the amateur radio operator's bands.

| Frequency | Antenna Wire Length (feet) |
|-----------------------|----------------------------|
| 150 kHz - 500 kHz | 1440 |
| 520 kHz - 1600 kHz | 441 |
| 1600 kHz - 4500 kHz | 153 |
| 4500 kHz - 12000 kHz | 57 |
| 12000 kHz - 29999 kHz | 22 |

| Wave Length - Ham Band | Antenna Wire Length (feet) |
|------------------------|----------------------------|
| 160 meter | 246 |
| 80 meter | 117 |
| 40 meter | 66 |
| 20 meter | 33 |
| 15 meter | 22 |

To calculate antenna length for a specific frequency

You can determine the exact length of wire you need for a specific frequency using the following information. Then, obtain bare copper wire, stand-off insulators, and an appropriate length of lead-in wire. Be sure to use a static discharge unit to guard against lightning damage. For complete information, refer to *The Radio Amateur Handbook*, published by the American Radio Relay League.

This formula results in a half-wave antenna.

$$\text{Length of a 1/2 wave antenna} = \frac{468000}{\text{Desired Frequency (kHz)}}$$

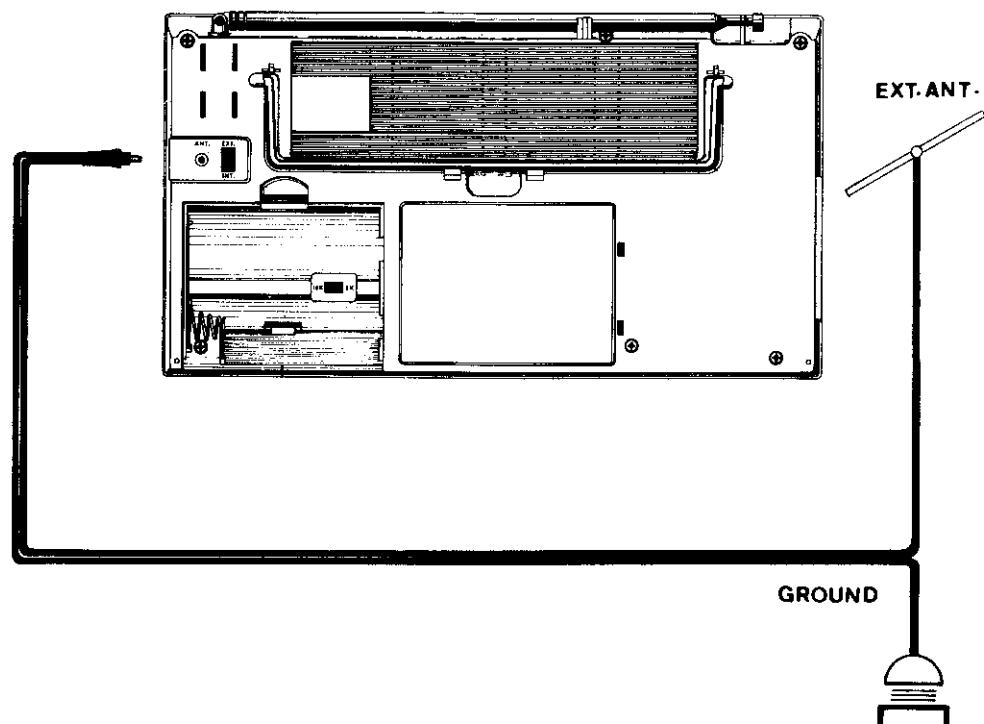
For example, to pick up international shortwave signals in the 19 meter band, 15100 to 15600 kHz, pick a representative frequency, such as 15350 kHz. The formula then becomes:

$$\frac{468000}{15350} = 30 \frac{1}{2} \text{ feet}$$

SYSTEM GROUNDING

To ensure the best reception, always connect a ground wire to the external antenna jack. Connect the single wire lead-in to the center terminal of the RCA plug. Connect a suitable earth ground to the outer terminal of the plug.

A suitable earth ground can be a clamp around a metal water pipe or a copper rod driven several feet into the earth. Radio Shack sells a copper ground rod (Cat. No. 15-530) and the appropriate hardware.



BAND ALLOCATION

To avoid interference and confusion, certain portions of the radio spectrum have been set aside for specific purposes. Perhaps the most familiar example is 540 - 1600 kHz, the standard AM broadcast band.

Ham radio operators use the following bands:

| | | |
|------------|---|---------------------|
| 160 meters | = | 1,800 - 2,000 kHz |
| 80 meters | = | 3,500 - 4,000 kHz |
| 40 meters | = | 7,000 - 7,300 kHz |
| 20 meters | = | 14,000 - 14,350 kHz |
| 15 meters | = | 21,000 - 21,450 kHz |
| 10 meters | = | 28,000 - 29,700 kHz |

International broadcasting stations have several bands set aside for them:

| | | |
|-----------|---|---------------------|
| 49 meters | = | 5,800 - 6,200 kHz |
| 41 meters | = | 7,100 - 7,500 kHz |
| 31 meters | = | 9,500 - 9,900 kHz |
| 25 meters | = | 11,650 - 12,050 kHz |
| 19 meters | = | 15,100 - 15,600 kHz |
| 16 meters | = | 17,550 - 17,900 kHz |
| 13 meters | = | 21,450 - 21,850 kHz |
| 11 meters | = | 25,600 - 26,100 kHz |

Note that broadcasts and hams share 7,100 - 7,300 kHz, and interference is heavy in that range.

Broadcasts in tropical regions have special bands set aside for them. In such areas shortwave is the only way to reach isolated locations:

| | | |
|------------|---|-------------------|
| 120 meters | = | 2,300 - 2,500 kHz |
| 90 meters | = | 3,200 - 3,400 kHz |
| 75 meters | = | 3,900 - 4,000 kHz |
| 60 meters | = | 4,750 - 5,060 kHz |

The rest of the shortwave range is filled with marine, aeronautical and military stations. Such stations usually use either SSB or CW, and can be found outside the amateur and broadcast bands.

THE SHORTWAVE HOBBY

Shortwave listening is a hobby with thousands of participants worldwide. While no special knowledge is required for SWL, you will find your enjoyment increases with experience and special techniques for listening.

Random tuning on your DX-440 is a good idea if you've never owned a Communications Receiver before. In this way you can get acquainted with the various bands and the stations that can be heard. But after you've been listening for a while you'll discover that you can get more enjoyment by organizing your listening efforts.

Doing a little bit of library research can increase your skill as a SWL. Read up on radio propagation and theory; try to understand the conditions which make long distance reception possible. In your local library you can find such valuable references as the World Radio Television Handbook and the Radio Amateur's Handbook. Current information can be found by consulting periodicals dealing with communications and electronics.

Keep up to date on news events around the world. There's much interesting listening just tuning to the international service of a nation where an important event is taking place.

Ham radio operators can be found in the bands listed in our Band Allocations section. You'll find that hams mainly

use Morse code (or CW, as they refer to it) and SSB. The ham bands are divided up into CW and SSB sections in the following manner:

3,500 - 3,800 kHz: CW
3,800 - 4,000 kHz: SSB
7,000 - 7,150 kHz: CW
7,150 - 7,300 kHz: SSB
14,000 - 14,200 kHz: CW
14,200 - 14,350 kHz: SSB
21,000 - 21,250 kHz: CW
21,250 - 21,450 kHz: SSB
28,000 - 28,500 kHz: CW
28,500 - 29,700 kHz: SSB

These boundaries are not precisely observed everywhere in the world, so don't be too surprised to find an SSB signal in the CW portion of a band and vice-versa.

Some of the ranges where aircraft may be flying international routes use shortwave for their communications. Most transmissions are in SSB, although some AM is still heard. Some of the ranges where aircraft can be heard include:

4,650 - 4,750 kHz
6,545 - 6,765 kHz
8,815 - 9,040 kHz
10,000 - 10,100 kHz
11,175 - 11,400 kHz
13,200 - 13,360 kHz
15,010 - 15,100 kHz
17,900 - 18,030 kHz

Ships and coastal stations can also be heard on shortwave. Most communications are in SSB and CW. One interesting range is 2,000 - 2,300 kHz, where the Coast Guard and many small boats can be heard. One frequency to watch is 2,182 kHz, which is an international distress and emergency channel. Other bands in which to tune for ships are:

4,063 - 4,139 kHz
4,361 - 4,438 kHz
8,195 - 8,181 kHz
12,330 - 12,420 kHz
13,107 - 13,200 kHz
16,460 - 16,565 kHz

LISTENING NOTES

If you have never tuned a shortwave receiver before, you may be a bit confused by the wide variety of signals that can be heard. To help you find your way around the bands, here is a summary of what to expect.

The 150 - 540 kHz range is known as the long wave band. You'll find reception here best at night in your location. The majority of stations use Morse code, although you will hear AM used for weather broadcasts. The largest number of stations in this range are beacons for aircraft and marine navigation. Beacons transmit their call letters continuously in Morse code at a slow speed.

A manual on air or marine navigation, available from your public library or a marine supply store, will contain lists of these beacons and their locations. Weather broadcasts on AM often identify themselves by their location instead of by call letters (such as "New Orleans Radio"). Many ship stations also use this range, with 500 kHz set aside by international agreement for distress and emergency calls.

International broadcast stations can be found in the bands indicated in our section on Band Allocations. Many such stations operate in English, and often can be heard during the evening hours (between 6:00PM and Midnight, your local time). Programming usually consists of news, commentaries, local music, and features on life in their

respective countries. Among the stations that are listener favorites worldwide are Radio Japan, the British Broadcasting Company, Israel Radio, Radio Nederland in Holland and Radio Australia. You'll soon discover which stations will be your personal favorites.

In tropical areas of the world, static makes reception on the standard AM broadcasting band very difficult. This has resulted in special Tropical Bands set aside for nations located in tropics. Programming here is intended for local audiences and much of what can be heard is a treat - exotic languages, beautiful and unusual music, etc. Some English can be heard, however, from stations in Africa or the Pacific.

You'll find time standard stations quite useful. These stations give out the exact time of day at specified intervals. The National Bureau of Standards operates station WWV in Fort Collins, Colorado on 2,500, 5,000, 10,000, 15,000, and 20,000 kHz. A man's voice gives the time each minute along with periodic reports on shortwave reception conditions. The National Bureau of Standards also operates another station, WWVH, on the same frequencies as WWV, in Hawaii. WWVH uses a woman's voice to give the time. Sometimes you can hear these two stations simultaneously. Other time standard stations are Canada's CHU on 3,330, 7,335 and 14,670 kHz and VNG in Australia on 4,500 and 12,000kHz. Several other nations have similar stations.

FREQUENCY CONVERSION

Your communications receiver is calibrated in Megahertz (MHz) and Kilohertz (kHz) - as most communications-type receivers are. You should be familiar with these terms:

Megahertz: Millions-of-hertz (or cycles-per-second). A Megahertz is 1,000,000 hertz (Hz for short) or 1,000,000 cycles-per-second. Mega means million.

Kilohertz: Thousands-of-hertz. A kilohertz is 1,000 hertz. We use the abbreviation kHz. Kilo means thousand.

Meter: The term meter, as applied to shortwave listening, refers to the wavelength of a radio frequency. In many parts of the world, frequencies are listed in meters, for example, international shortwave stations in the 19 Meter band. European radio equipment and stations often refer to the wavelength of a station or band (in meters), rather than frequency (in MHz or kHz).

The relationship of these three terms is:
1 MHz (million) = 1,000kHz (thousand)
To change 9.62 MHz to kHz, we multiply by 1000.

$$9.62 \times 1000 = 9620 \text{ kHz}$$

To go the other way, from kHz to MHz, divide by 1000. A station at 3780 kHz is

$$\frac{3780}{1000} = 3.780 \text{ MHz}$$

To convert MHz to meters, use this formula:

$$\text{Meters} = \frac{300}{\text{MHz}}$$

Example: What is the wavelength of 7.1 MHz?

$$\frac{300}{7.1 \text{ MHz}} = 42.25 \text{ meters}$$

COUNTRY LOG

The following listing contains some of the more frequently heard stations on shortwave. The stations listed can be heard throughout the North American Continent. All stations operate in English unless otherwise specified. Most of these stations do not broadcast continuously.

Obviously, reception will vary on the different frequencies according to the time of day and season of the year. Remember that reception from different parts of the world varies with the time of day and the frequency to which your DX-440 is tuned. Consult the section on Changes in Reception for a more detailed explanation of these variations.

Remember also that the 7,000 - 7,300 kHz range is shared by hams and international broadcasts; consequently, interference is severe in that range.

While every effort has been made to ensure the accuracy of this list, stations can and do change frequencies. Check periodicals on communications and electronics for more current information on station frequencies and schedules.

This list only contains broadcasting stations which operate on fixed frequencies with regular schedules. Ham military, marine and aeronautical stations operate on varied frequencies with irregular schedules.

These listings can change at any time and are here for your reference only.

No attempt has been made to provide an accurate up-to-date listing. For a yearly up-to-date listing, check the *world radio television hand book*.

| kHz | STATION | LOCATION | REMARKS |
|-------|--------------------------------------|--------------------------------|------------------------|
| 3,223 | Radio SR | Swaziland | |
| 3,265 | Radio Mozambique | Maputo, Mozambique | Programs in Portuguese |
| 3,300 | Radio Cultural | Guatemala City, Guatemala | Religious Programs |
| 3,380 | Radio Iris | Esmeraldas, Ecuador | Programs in Spanish |
| 3,385 | FR3 | Cayenne, French Guiana | Programs in French |
| 3,396 | Radio Kaduna | Kaduna, Nigeria | |
| 4,750 | Radio Bertoua | Bertoua, Cameroon | |
| 4,755 | Imo Regional Radio | Imo, Nigeria | |
| 4,777 | Radio-TV Gabon | Libreville, Gabon | Programs in French |
| 4,795 | Radio Nueva America | La Paz, Bolivia | Programs in Spanish |
| 4,820 | Radio Paz y Bien | Ambala, Ecuador | Programs in Spanish |
| 4,832 | Radio Reloj | San Jose, Costa Rica | Programs in Spanish |
| 4,855 | Radio Clube do Para | Belem, Brazil | Programs in Portuguese |
| 4,890 | National Broadcasting Commission | Port Moresby, Papua New Guinea | |
| 4,915 | Voice Kenya | Nairobi, Kenya | |
| 4,920 | Australian Broadcasting Commission | Brisbane, Australia | |
| 4,945 | Radio Colosal | Neiva, Colombia | Programs in Spanish |
| 4,965 | Radio Santa Fe | Bogota, Colombia | Programs in Spanish |
| 4,980 | Ecos del Torbes | San Cristobal, Venezuela | Programs in Spanish |
| 4,990 | Radio Barquisimeto | Barquisimeto, Venezuela | Programs in Spanish |
| 5,020 | Solomon Islands Broadcasting Service | Honiara, Solomon Islands | |
| 5,057 | Radio Gjrokaster | Gjrokaster, Albania | Programs in Albanian |
| 5,950 | Guyana Broadcasting Service | Georgetown, Guyana | |
| 5,954 | Radio Casino | Puerto Limon, Costa Rica | |
| 5,960 | Radio Canada International | Montreal, Canada | |
| 5,980 | Radio RSA | Johannesburg, South Africa | |
| 6,005 | CFCX | Montreal, Canada | |
| 6,025 | Radio Malaysia | Kuala Lumpur, Malaysia | Programs in Chinese |
| 6,045 | Radio Australia | Lyndhurst, Australia | |
| 6,055 | Nihon Shortwave Broadcasting Company | Tokyo, Japan | Programs in Japanese |

| | | | |
|--------|---|-------------------------------|----------------------|
| 6,060 | Radio Nacional | Buenos Aires, Argentina | Programs in spanish |
| 6,075 | Radio Sutatenza | Bogota, Colombia | Programs in Spanish |
| 6,090 | Radio Luxembourg | Ville Louvigny, Luxembourg | |
| 6,095 | Polskie Radio | Warsaw, Poland | |
| 6,105 | Radio New Zealand | Wellington, New Zealand | |
| 7,140 | Trans World Radio | Monte Carlo Monaco | |
| 7,170 | Radio Noumea | Noumea, New Caledonia | Programs in French |
| 7,300 | Radio Tirana | Tirana, Albania | |
| 9,475 | Radio Cairo | Cairo, Egypt | |
| 9,515 | Voice of Greece | Athens, Greece | |
| 9,525 | Radio Korea | Seoul, South Korea | |
| 9,530 | Spanish Foreign Radio | Madrid, Spain | |
| 9,535 | Swiss Radio International | Berne, Switzerland | |
| 9,540 | Radio Prague | Prague, Czechoslovakia | |
| 9,570 | Radio Bucharest | Bucharest, Rumania | |
| 9,575 | Italian Radio and Television Service | Rome, Italy | |
| 9,610 | Radio-TV Algeria | Algiers, Algeria | Programs in Arabic |
| 9,620 | Radio Berlin International | Berlin, East Germany | |
| 9,645 | Radio Norway | Oslo, Norway | |
| 9,720 | Radio Iran | Tehran, Iran | Programs in Farsi |
| 9,745 | HCJB | Quito, Ecuador | |
| 9,770 | Austrian Radio | Vienna, Austria | |
| 9,800 | Radio Kiev | Kiev, USSR | |
| 9,835 | Radio Budapest | Budapest, Hungary | |
| 10,040 | Voice of Vietnam | Hanoi, Vietnam | |
| 11,655 | Israel Radio | Jerusalem, Israel | |
| 11,690 | Radio Kuwait | Kuwait, Kuwait | |
| 11,705 | Radio Sweden | Stockholm, Sweden | |
| 11,720 | Radio Moscow | Moscow, USSR | |
| 11,735 | Radio Sofia | Sofia, Bulgaria | |
| 11,745 | Voice of Free China | Taipei, China | |
| 11,815 | Radio Japan | Tokyo, Japan | |
| 11,825 | Radio Tahiti | Papeete, Tahiti | Programs in Tahitian |
| 11,835 | 4VEH | Cap Haitien, Haiti | |
| 11,845 | Radio Canada International | Montréal, Canada | |

| | | | |
|--------|---------------------------------------|-------------------------------|---------------------|
| 11,850 | Deutsche Welle | Cologne, West Germany | |
| 11,890 | Voice of Chile | Santiago, Chile | |
| 11,900 | Radio RSA | Johannesburg, South Africa | |
| 11,910 | BBC | London, England | |
| 11,930 | Radio Havana Cuba | Havana, Cuba | |
| 11,935 | Radio Portugal | Lisbon, Portugal | |
| 11,945 | Radio Peking | Peking, China | |
| 11,955 | Voice of Turkey | Ankara, Turkey | |
| 11,980 | Radio Moscow | Moscow, USSR | |
| 15,038 | Saudi Arabian Broadcasting Service | Riyadh, Saudi Arabia | Programs in Arabic |
| 15,084 | Voice of Iran | Tehran, Iran | Programs in Farsi |
| 15,135 | Radio Moscow | Moscow, USSR | |
| 15,165 | HCJB | Quito, Ecuador | |
| 15,190 | ORU | Brussels, Belgium | |
| 15,205 | All India Radio | New Delhi, India | |
| 15,260 | BBC | London, England | |
| 15,265 | Finnish Radio | Helsinki, Finland | |
| 15,275 | Radio Sweden | Stockholm, Sweden | |
| 15,305 | Swiss Radio International | Berne, Switzerland | |
| 15,310 | Radio Japan | Tokyo, Japan | |
| 15,320 | Radio Australia | Melbourne, Australia | |
| 15,400 | BBC | London, England | |
| 15,430 | Radio Mexico | Mexico City, Mexico | Programs in Spanish |
| 15,465 | Radio Pakistan | Islamad, Pakistan | Programs in Urdu |
| 17,720 | Radio France International | Paris, France | |
| 17,825 | Vatican Radio | Vatican City | |
| 17,860 | Austrian Radio | Vienna, Austria | |
| 21,495 | Israel Radio | Jerusalem, Israel | |
| 21,525 | Radio Australia | Melborne, Australia | |
| 21,625 | Israel Radio | Jerusalem, Israel | |
| 21,645 | Radio France International | Paris, France | |
| 21,735 | Radio-TV Morocco | Rabat, Morocco | Programs in Arabic |
| 25,650 | BBC | London, England | |
| 25,790 | Radio RSA | Johannesburg, South Africa | |

TROUBLESHOOTING

The DX-440 is a ruggedly built electronic unit with all parts conservatively rated. However, you should treat it with care; don't subject it to excessively rough handling. You will find it will give you long life enjoyment if kept free from excessive humidity.

If you have problems—(we hope you don't),—check the following:

FREQUENCY DISPLAY

No/incorrect display

- Weak microprocessor or radio batteries.
- Microprocessor fails to initialize. This may happen when you first install (or replace) batteries. Remove the microprocessor batteries, wait for about one minute, and re-install.

Display is dim

- Weak microprocessor or radio batteries.
- Environment is inappropriate for operation; temperature is too high or too much humidity.

RADIO

No sound

- Check the VOLUME control setting.
- Headphone jack is plugged in.
- Weak radio batteries.
- AC adapter cord not firmly plugged.
- DC power cord is not correctly inserted into cigarette lighter socket in vehicle operation.
- AC jack or external DC jack is plugged in when trying to operate on batteries.

Weak or intermittent sound

- Weak radio batteries.
- Antenna adjustment insufficient.
- Weak signal. Try moving the unit near a window when operating inside a vehicle or in a metal frame building.
- Tuning slightly off-frequency. Use UP or DOWN key to fine tune.

Frequency cannot be keyed in when direct tuning.

- EXECUTE was not pressed within 5 seconds.
- Microprocessor failed to initialize. Remove the microprocessor batteries, wait one minute and re-install.

Scanning or memory frequency cannot be keyed in

- EXECUTE was not pressed after the frequency was keyed in.

Will not scan on AM

- Limit frequencies are not keyed in.

Scanning stops where there is no clear signal

- Birdies—the internally generated signals mixed with external signals. A telescopic antenna is likely to pick up these undesirable signals; use an outdoor antenna.

A few of the most common birdies are:

455 kHz 3,844 kHz 9,000 kHz
10,245 kHz 18,000 kHz 20,490 kHz
21,835 kHz 21,868 kHz

Scanning does not stop automatically

- Weak signal.
- RF GAIN is not set to MAX

Memorized frequency cannot be recalled

- Wrong band is set. Switch bands.
- Memory has been erased. Re-enter the frequency.

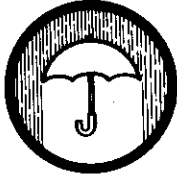



SLEEP does not function

- The SLEEP button is not pressed
- The power switch is set to on

If none of the above suggested remedies solves the problem, return your set to your nearby Radio Shack store for assistance.

CARE AND MAINTENANCE

Your DX-440 is an example of superior design and craftsmanship. The following suggestions will help you care for the DX-440 so that you can enjoy it for years.

| | |
|--|---|
| <p>Keep the product dry. If it does get wet, wipe it dry immediately. Liquids might contain minerals that can corrode the electronic circuits.</p> |  |
| <p>Use and store the product only in normal temperature environments. High temperatures can shorten the life of electronic devices, damage batteries, and distort or melt plastic parts.</p> |  |
| <p>Handle the product gently and carefully. Dropping it can damage circuit boards and cases and can cause the product to work improperly.</p> |  |
| <p>Keep the product away from dust and dirt, which can cause premature wear of parts.</p> |  |

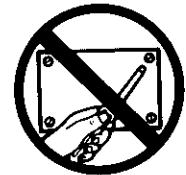
Wipe the product with a dampened cloth occasionally to keep it looking new. Do not use harsh chemicals, cleaning solvents, or strong detergents to clean the product.



Use only fresh batteries of the recommended size and type. Always remove old or weak batteries. They can leak chemicals that destroy electronic circuits.



Modifying or tampering with the product's internal components can cause a malfunction and might invalidate the product's warranty. If your product is not performing as it should, take it to your local Radio Shack store. Our personnel can assist you and arrange for service if needed.



SPECIFICATIONS

| | |
|-------------------------|--|
| Semi conductors: | 1 pc. LSI 7 pcs. ICs 8 pcs. FETs 44 pcs. Transistors 59 pcs. Diodes 7 pcs. LEDs |
| Circuit: | |
| FM | superheterodyne |
| AM(LW,MW,SW) | Dual conversion superheterodyne |
| Frequency range: | |
| FM: | 87.5MHz - 108MHz |
| AM: | 150 kHz - 29999 kHz |
| LW: | 150kHz - 281kHz |
| MW: | 520kHz - 1620kHz |
| SW: | divided into 12 shortwave bands 120M 2300kHz - 2500 kHz 90M 3200kHz - 3400 kHz 75M 3900kHz - 4000 kHz 60M 4750 khz - 5060 kHz 49M 5800 kHz - 6200 kHz 41M 7100kHz - 7500 kHz 31M 9500 kHz - 9900 kHz 25M 11650 kHz - 12050 kHz 19M 15100kHz - 15600 kHz 16M 17550kHz - 17900 kHz 13M 21450kHz - 21850kHz 11M 25600kHz - 26100kHz |
| Antennas: | |
| LW/MW | Built in ferrite bar antenna. |
| SW | Swivel telescopic antenna. External antenna terminal. |
| FM | Swivel telescopic antenna. External antenna terminal. (Not apply to W. Germany) |
| Output: | 1200mW (10% THD) |

| | |
|-----------------------|--|
| Jacks: | 1. DC jack for external power (9V) 2. Headphones Jack - 3.5φ for mini stereo headphones. |
| Power sources: | 1. For Power when not playing radio : (AA size) penlight battery such as Radio Shack 23-552 or 23-582 (not supplied) for memory/clock back-up (3V). 2. For Power to play radio : a. (D size) battery such as Radio Shack 23-550 or 23-580 (not supplied) × 6pcs. (9V) b. AC adaptor 9V/400mA center negative |
| Dimension: | $11\frac{1}{2}'' \times 6\frac{3}{10}'' \times 2\frac{9}{25}''$ (292mm × 160mm × 60mm) |
| Weight: | 1.7kg. (3.75 lbs or 60 oz) without batteries. |
| Accessories: | Shoulder strap |

ADDENDUM

Cat. No. 20-221A

DX-440 AM/FM DIRECT ENTRY COMMUNICATIONS RECEIVER

The following specifications for sensitivity, image rejection, and selectivity are provided for your reference:

Sensitivity:

(for 20 dB Signal-to-Noise ratio):

| | | | | |
|----|------|-----|------|-----------------|
| AM | 150 | kHz | 1260 | $\mu\text{V/m}$ |
| | 300 | kHz | 560 | $\mu\text{V/m}$ |
| | 600 | kHz | 320 | $\mu\text{V/m}$ |
| | 1.4 | MHz | 280 | $\mu\text{V/m}$ |
| | 3.1 | MHz | 4 | μV |
| | 7.1 | MHz | 4 | μV |
| | 15.1 | MHz | 4 | μV |
| | 28.1 | MHz | 4 | μV |

(for 10 dB Signal-to-Noise ratio):

| | | | | |
|-----|------|-----|-----|-----------------|
| SSB | 150 | kHz | 100 | $\mu\text{V/m}$ |
| | 300 | kHz | 40 | $\mu\text{V/m}$ |
| | 600 | kHz | 25 | $\mu\text{V/m}$ |
| | 1.4 | MHz | 22 | $\mu\text{V/m}$ |
| | 3.1 | MHz | 0.4 | μV |
| | 7.1 | MHz | 0.4 | μV |
| | 15.1 | MHz | 0.4 | μV |
| | 28.1 | MHz | 0.4 | μV |

(for 30 dB Signal-to-Noise ratio):

FM 87.5 to 108 MHz $4 \mu\text{V}$

(to be continued on the back)

Image Rejection Ratio:

| | | | | |
|--------|------|-----|----|----|
| AM/SSB | 150 | kHz | 48 | dB |
| | 300 | kHz | 65 | dB |
| | 600 | kHz | 65 | dB |
| | 1.4 | MHz | 60 | dB |
| | 3.1 | MHz | 60 | dB |
| | 7.1 | MHz | 60 | dB |
| | 15.1 | MHz | 60 | dB |
| | 28.1 | MHz | 60 | dB |

FM 87.5 to 108 MHz 40 dB

| | | | |
|----------------------------|--------|---------|-------------|
| Selectivity: AM/SSB | | - 6dB | - 50dB |
| | Wide | ± 3 | ± 7 kHz |
| | Narrow | ± 2 | ± 4 kHz |
| IF AM/SSB/CW | 1st | 55.845 | MHz |
| | 2nd | 450 | kHz |
| FM | | 10.7 | MHz |

Frequency Stability:

Within 1 kHz per hour after 60 minutes warm up.

RADIO SHACK

Fort Worth, Texas 76102

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