HME

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HOSPITALITY & SPECIALTY
COMMUNICATIONS

DX200

Wireless Intercom

Operating Instructions

Table of Contents

> Illustrations in this publication are approximate representations of the actual equipment, and may not be exactly as the equipment appears.

> HM Electronics, Inc. is not responsible for equipment malfunctions due to erroneous translation of its publications from their original English version.

FCC NOTICE

This device complies with Part 15 of the FCC rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) This device must accept any interference received, including interference that may cause undesired operation.

NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communication. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at his own expense.

Changes or modifications not expressly approved by HM Electronics, Inc. could void the users authority to operate this equipment.

MANDATORY SAFETY INSTRUCTIONS
FOR INSTALLERS AND USERS

Use only manufacturer or dealer supplied antennas.

The Federal Communications Commission has adopted a safety standard for human exposure to RF (Radio Frequency) energy, which is below the OSHA (Occupational Safety and Health Act) limits.

The term "IC:" before the certification/registration number only signifies that the Industry Canada technical specifications were met.

Base Station Antenna minimum safe distance: 7.9 inches (20 cm) at 100% duty cycle.

Base Station Antenna gain: This device has been designed to operate with an antenna having a maximum gain of up to 2dBi.

Antenna mounting: The antenna(s) used for the base transmitter must be installed to provide a separation distance of at least 7.9 inches (20 cm) from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter.

Antenna substitution: Do not substitute any antenna for the one supplied by the manufacturer or radio dealer. You may be exposing person or persons to excess radio frequency radiation. You may contact your radio dealer or the manufacturer for further instructions.

WARNING: Maintain a separation distance from the base station transmit antenna to a person(s) of at least 7.9 inches (20 cm) at 100% duty cycle.

You, as the qualified end-user of this radio device must control the exposure conditions of bystanders to ensure the minimum separation distance (above) is maintained between the antenna and nearby persons for satisfying RF exposure compliance. The operation of this transmitter must satisfy the requirements of Occupational/Controlled Exposure Environment, for work-related use. Transmit only when person(s) are at least the minimum distance from the properly installed, externally mounted antenna.

Hereby, HM Electronics, Inc. declares that the DX200 is in compliance with the essential requirements and other relevant provisions of R&TTE Directive 1999/5/EC.

$$C \in$$

This product operates in the 2400 to 2483.5 MHz frequency range. The use of this frequency range is not yet harmonized between all countries. Some countries may restrict the use of a portion of this band or impose other restriction relating to power level or use. You should contact your Spectrum authority to determine possible restrictions.

Waste Electrical and Electronic Equipment (WEEE)

The European Union (EU) WEEE Directive 2012/19/EU places an obligation on producers (manufacturers, distributors and/or retailers) to take-back electronic products at the end of their useful life. The WEEE Directive covers most HME products being sold into the EU as of August 13, 2005. Manufacturers, distributors and retailers are obliged to finance the costs of recovery from municipal collection points, reuse, and recycling of specified percentages per the WEEE requirements.

Instructions for Disposal of WEEE by Users in the European Union

The symbol shown below is on the product or on its packaging which indicates that this product was put on the market after August 13, 2005 and must not be disposed of with other waste. Instead, it is the user's responsibility to dispose of the user's waste equipment by handing it over to a designated collection point for the recycling of WEEE. The separate collection and recycling of waste equipment at the time of disposal will help to conserve natural resources and ensure that it is recycled in a manner that protects human health and the environment. For more information about where you can drop off your waste equipment for recycling, please contact your local authority, your household waste disposal service or the seller from whom you purchased the product.

Korea: 해당 무선설비는 전파혼신 가능성이 있으므로 인명안전과 관련된 서비스는 할 수 없음

Singapore:
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Complies with
IDA Standards
DA10582
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Taiwan:

注意！

依據低功率電波輻射性電機管理辦法第十二條經型式認證合格之低功率射頻電機，非經許可，公司、商號或使用者均不得擅自變更頻率、加大功率或變更原設計之特性及功。

第十四條低功率射頻電機之使用不得影響飛航安全及干擾合法通信；經發現有干擾現象時，應立即停用，並改善至無干擾時方得繼續使用。前項合法通信，指依電信規定作業之無線電信。低功率射頻電機須忍受合法通信或工業、科學及醫療用電波輻射性電機設備之干擾。

有毒有害物质或元素表

Table of Toxic and Hazardous Substances

部件名称 **Names of Parts**	有毒有害物质或元素 **Toxic and Hazardous Substances or Elements**					
	铅 **Pb**	镉 **Cd**	汞 **Hg**	六价铬 **Cr6+**	多溴联苯 **PBB**	多溴二苯醚 **PBDE**
BS200 基站 Top assembly BS200 (G27627-5Z1)	X	O	O	O	O	O
基站电路板 Audio PCB (G27616-1)	X	O	O	O	O	O
收发器电路板 Front Panel PCB (G26738)	X	O	O	O	O	O
收发器电路板 XCVR PCB (G28842-1A1)	X	O	O	O	O	O
AC40 电池充电器 AC40 (G27368)	X	O	O	O	O	O
电源器 (453G008) CCC P/S	X	O	O	O	O	O

O: 表示该有毒有害物质在该部件所有均质材料中的含量均在**SJ/T11363-2006**标准规定的限量要求以下。

O: Indicates that this toxic or hazardous substance contained in all of the homogeneous materials for this part is below the limit requirements in SJ/T11363-2006

X: 该有毒有害物质至少在该部件的某一均质材料中的含量超出**SJ/T11363-2006**标准规定的限量要求。

X: Indicates that this toxic or hazardous substance contained in at least one of the homogeneous materials used for this part is above the limit requirements in SJ/T11363-2006

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BP200 对讲机 Top Assembly BP200 (G26705-4Z1)	X	O	O	O	O	O
对讲机电路板 XCVR PCB (G27560-1F1)	X	O	O	O	O	O
HS15 耳机 HS15/D Headset (306G100-1 /306G101-1)	X	O	O	O	O	O
对讲机套 Pouch (107G065)	O	O	O	O	O	O
电池 Battery (104034)	O	O	O	O	O	O

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表的有毒有害物质

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	铅 **Pb**	镉 **Cd**	汞 **Hg**	六价铬 **Cr6+**	多溴联苯 **PBB**	多溴二苯醚 **PBDE**
WH220 头佩戴式耳麦 Top Assembly WH220 (G27593-2Z1)	X	O	O	O	O	O
耳机电路板 PCB (G28055-1D1)	X	O	O	O	O	O
电池 Battery (104034)	O	O	O	O	O	O

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SECTION 1.   INTRODUCTION

The DX200 provides private, secure communication. Each base station can register up to fifteen BP200 Beltpacs and/or WH220 All-in-one Wireless Headsets. Any combination of Beltpacs and/or WH220 Headsets can be registered. Four of the fifteen can transmit simultaneously. However, by connecting two or more base stations together, these numbers can be increased. For example, two base stations can support thirty Beltpacs/ Headsets, of which eight can transmit simultaneously. Beltpacs or Headsets may be used either in the push-to-talk or hands-free mode. The base station operator can stop all Beltpacs/Headsets from transmitting.

The DX200 can be used with RTS® and Clear-Com® cabled intercom systems. On the intercom channel, 2-wire and 4-wire cabled intercoms may be operated simultaneously. Also, using the AUX In and AUX Out connections, a second 4-wire intercom channel may be used.

A local headset can be used with the DX200. Using a local headset, the base station operator can talk to crew members on the cabled intercom channel, Beltpacs/Headsets only, or all channels.

The BS200 Base Station can be operated using standard DC electricity or a vehicle electrical system for mobile operation. A power supply and cable are included with the base station.

System Usage Example

1
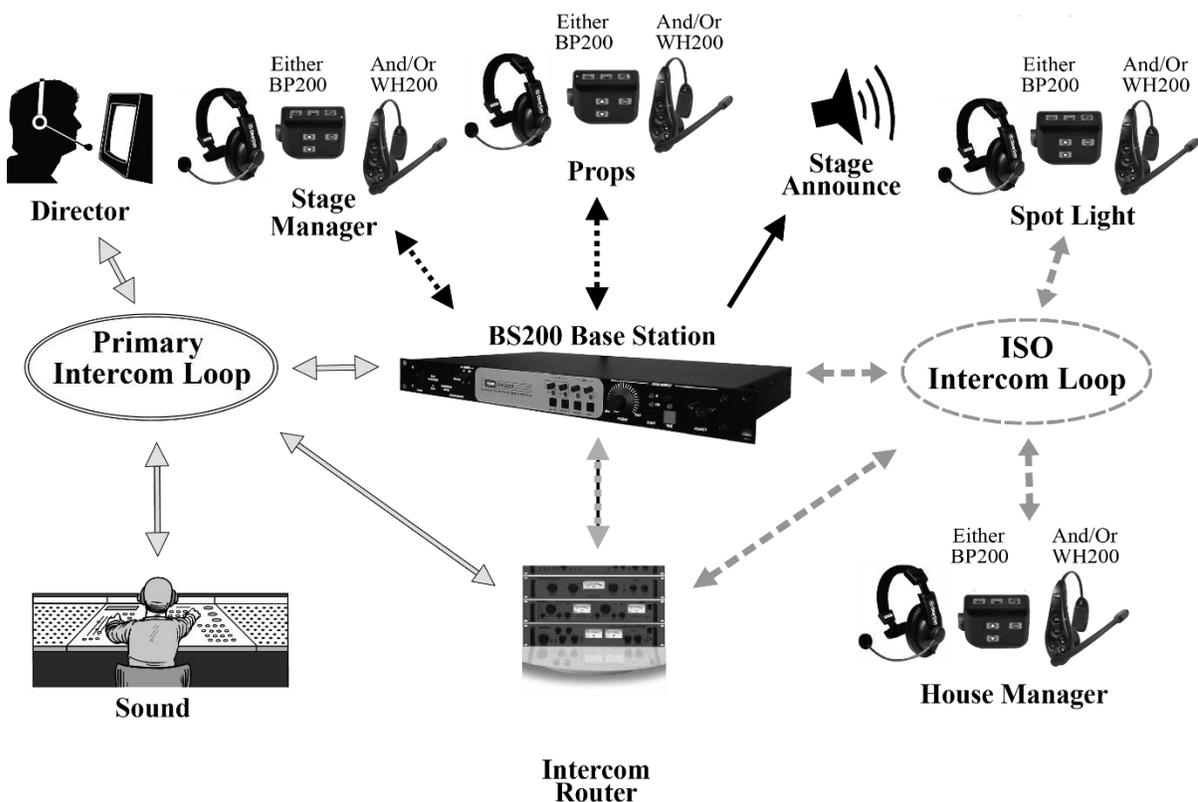
EQUIPMENT IDENTIFICATION

The following equipment is standard with the DX200 Wireless Intercom System.
As you unpack the equipment, check the enclosed shipping document to be sure you received all items listed.

BS200 Base Station

115/230 Volt AC Power Supply
(1 per Base Station, with Power Cord)
(1 per AC40A Battery Charger, with Power Cord)

Base Station Antennas
(2 per Base Station)

WH220 All-in-one
Wireless Headset

BAT41 Battery

BP200 Beltpac

CC-15-MD4 Headset

Beltpac Pouch

AC40A
Battery Charger

OPTIONAL EQUIPMENT

HS4-3 Earpiece & Lapel Microphone

Disposable Earpiece Cover for HS15

Disposable Earpiece Cover for WH220

CC-15-MD Single-Muff Headset

CC-15-MD Dual-Muff Headset

HS16 Lightweight Headset

HSI6000 Headset Adapter

BAT41 Rechargeable Battery

XLR Headset Adapters:

o   **MD-XLR4M** Mini-DIN to 4-Pin Male

o   **MD-XLR4F** Mini-DIN to 4-Pin Female

o   **MD-XLR5F** Mini-DIN to 5-Pin Female

AC50
Battery Charger

BAT50 Battery

AC50
Power Supply

MAIN EQUIPMENT FEATURES

Beltpac Features
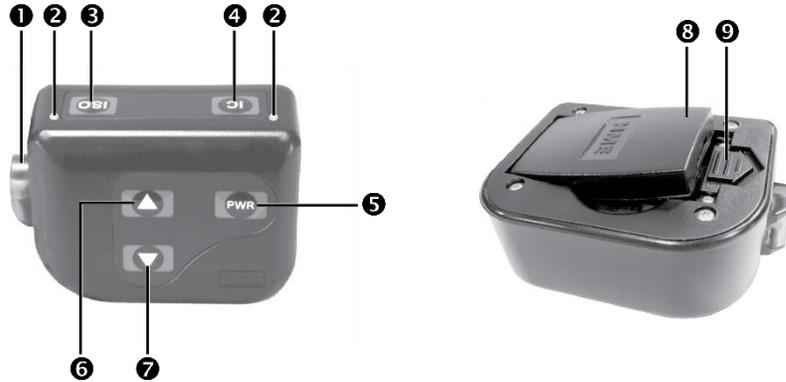
1. Headset cable connector
2. Beltpac power and transmit lights
3. **ISO** (Isolate) button
4. **IC** (Intercom) button
5. **PWR** (Power) button

6. Volume-up ▲ button
7. Volume-down ▼ button
8. Battery
9. Battery release latch

WH220 Headset Features
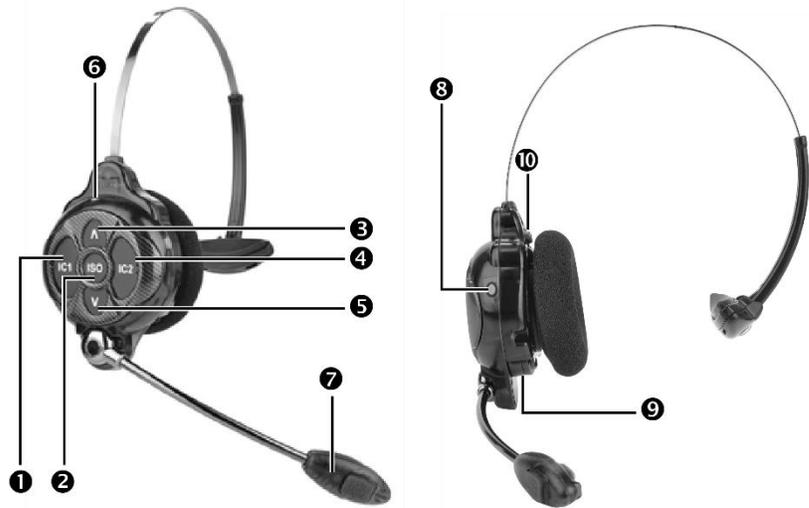
1. IC1 button
2. ISO (Isolate) button
3. Volume-up button
4. IC2 button
5. Volume-down button
6. Power/mode light

7. Microphone
8. Power button
9. Battery
10. Battery-release latch

Base Station Features


Front Panel

1. **POWER** switch
2. **CLEAR/BAND** button
3. **STATUS** display
4. **UNLATCH** button
5. **IC** (Intercom) receiver level control and indicator light
6. **ISO** (Isolate) receiver level control and indicator light
7. **2W** and **4W** indicator lights
8. **SND** and **RCV** (Send and Receive) controls
9. **AUX IN** and **OUT** (Auxiliary In and Out) controls
10. **LOCAL HEADSET VOLUME** control

11. **LOCAL HEADSET ISO** indicator light
12. **LOCAL HEADSET IC** indicator light
13. **LOCAL HEADSET MIC LEVEL** control
14. **LOCAL HEADSET TALK** indicator light
15. **LOCAL HEADSET** cable connector
16. **RESET** button (recessed)
17. **REGISTER** button
18. **2W/4W** button
19. **4W ONLY** button
20. **AUX IN** button
21. **ISO+** button
22. **LOCAL HEADSET IC/ISO SELECT** button
23. **LOCAL HEADSET TALK** button

Rear Panel

24. **CLEAR-COM / RTS TW** button
25. **CH1/CH2** RTS channel select button
26. **TERM OFF/TERM ON** local termination select button
27. **2-WIRE** intercom connector (female)
28. **NULL** control
29. **2-WIRE** intercom connector (male)
30. **4-WIRE** connector

31. **0° ANTENNA** connector
32. **90° ANTENNA** connector
33. **AUX IN** connector
34. **AUX OUT** connector
35. **8-OHM SPKR** 2-pin Phoenix connector
36. **12-14VDC** Power connector
37. Chassis ground connector

4

AC40A BATTERY CHARGER SETUP

The AC40A is the charger for Beltpac.

IMPORTANT! – Before installing the system, connect the AC power supply to the AC40A Battery Charger and plug it into an electrical outlet. Charge all the batteries for the Beltpacs while the other equipment is being installed. Charging time is about 2.5 hours.

Connect AC Power Supply

- Attach the AC power supply cable connector to the screw connector on the battery charger.
- Plug the power cord connector into the AC power supply.
- Plug the power cord into an electrical outlet.

The red lights on the charger will come on and go off, and then the yellow lights will turn on and remain on.

Power supply cable connector · Power cord connector · To electrical outlet

AC40A Battery Charger · AC power supply · Power cord
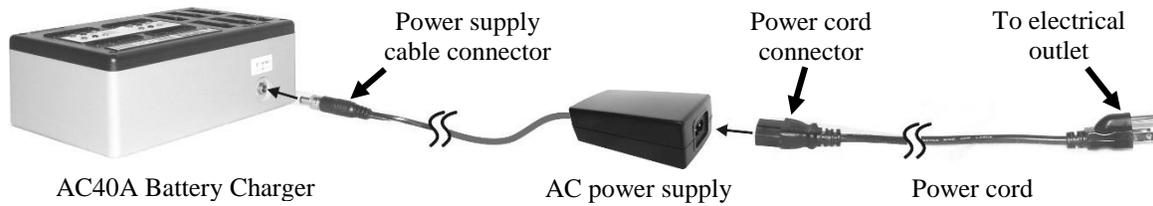
Charging the Batteries

Up to four batteries can be charged simultaneously. The battery status lights next to each charging port are explained below.
Up to six fully charged batteries can be stored in the battery storage ports.

- Insert a battery in each of four charging ports until it clicks in place.

- A <u>yellow light</u> adjacent to each charging port illuminates while the port is empty. When a battery is in a charging port, an adjacent <u>flashing yellow light</u> indicates **CHARGE PENDING**, which indicates that the battery is too hot. Adjust the room temperature or move the charger to a cooler area. When a battery is in a charging port, an adjacent, steady yellow light indicates **CHARGE FAILED**. If this happens, follow the instructions on the side of battery charger.

- A <u>red light</u> adjacent to a battery port indicates that the battery in the port is **CHARGING**. A <u>green light</u> adjacent to an inserted battery indicates a **READY**, fully charged battery.

Store the fully charged batteries in storage ports.

Batteries should not be left in charge ports after being fully charged. A yellow light may illuminate if a battery is left in a charge port for more than three weeks. It does <u>not</u> indicate a faulty battery.

Charged batteries in storage ports

Empty charging ports

Battery in charging port
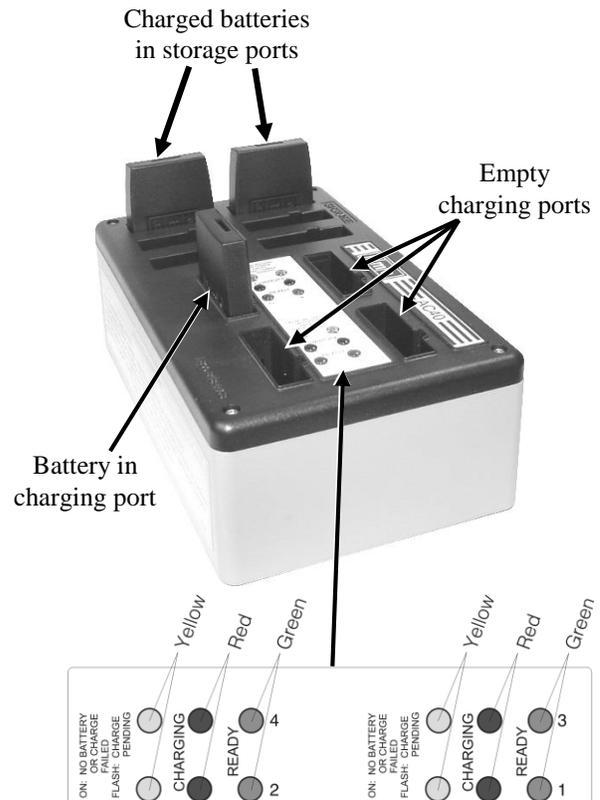
AC50 BATTERY CHARGER SETUP

The AC50 is the charger for All-in-One headsets.

Before installing the system, connect the AC power supply to the battery charger and plug it into an electrical outlet. Charge all the batteries while the other equipment is being installed. Charging time is about 2.5 hours.

Connect AC Power Supply

To connect the AC power supply to the battery charger:

1. Connect the AC power supply cable connector to the power connection on the battery charger.
2. Connect the AC power cord to an electrical outlet.

The red lights on the charger will briefly display, and then the yellow lights will appear and remain on.


Charging the Batteries

Up to four batteries can be charged in the battery charger at one time. The battery status lights next to each charging port indicate the battery status. Up to four fully charged batteries can be stored in the battery Storage ports. Insert a battery in each of four Charging ports until it clicks in place.

- A yellow light next to a Charging port indicates that the port is **EMPTY**.

- A red light next indicates that the battery port is **CHARGING**.

- A green light indicates that the battery is **READY**.

- A steady yellow light indicates that the **CHARGE FAILED**. If a charge fails, refer to the instructions on the side of battery charger.

- A flashing yellow light next indicates **CHARGE PENDING**, which means the inserted battery is too hot. Adjust the room temperature or move the charger to a cooler area.

- Store fully charged batteries in storage ports.

IMPORTANT: Batteries should not be left in charge ports after being fully charged. A battery left in a charging port for more than three weeks may display the yellow indicator light, but it does not indicate a faulty battery.

Batteries in Charging ports

Batteries in Storage ports
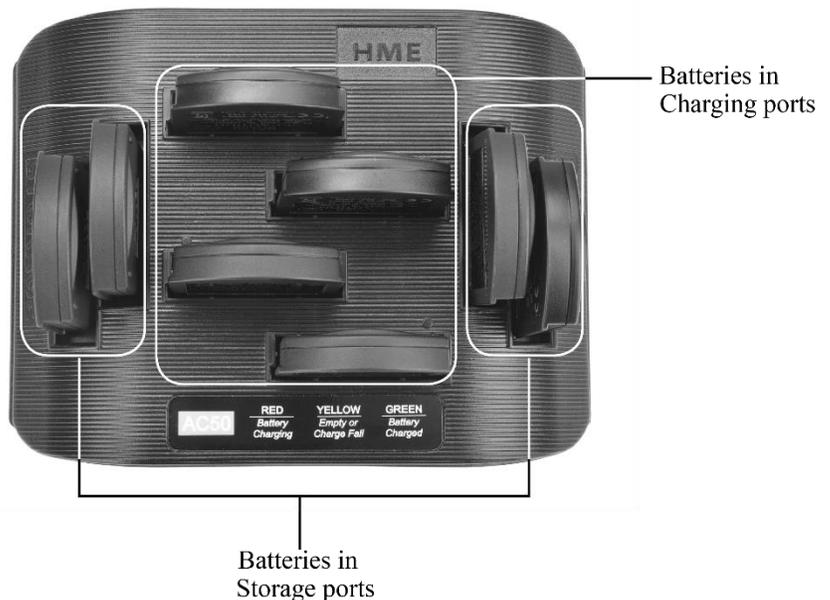
BASE STATION SETUP

The following description is for a basic, stand-alone DX200 system setup.

Connections and setup for multiple, daisy-chained base stations are described on .

Connections with 2-wire and 4-wire intercoms, and other auxiliary equipment are described in the **INTERCOM AND AUXILIARY EQUIPMENT SETUPS** on .

Equipment Connections
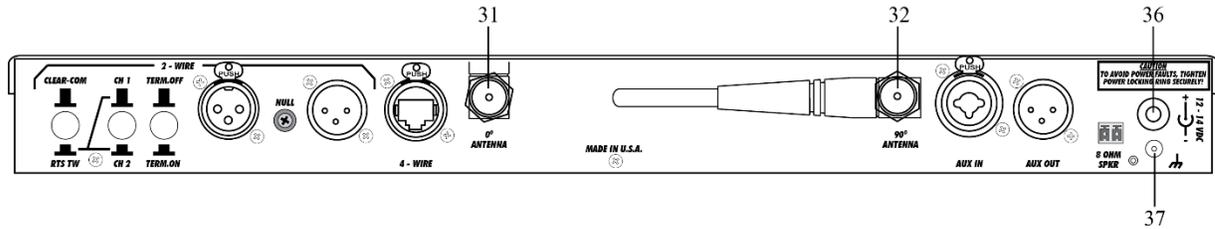
Rear Panel
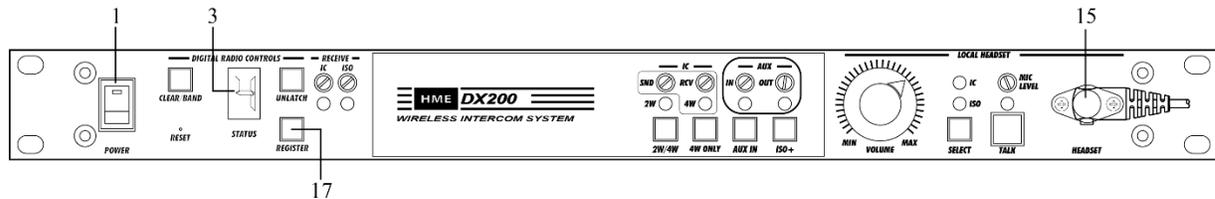
Front Panel

Step 1. Connect the two enclosed antennas to the antenna connectors (#**31** and #**32**) on the rear panel of the base station. Position the antenna at the **0° ANTENNA** connector (#**31**) vertically. Position the antenna at the **90° ANTENNA** connector (#**32**) horizontally, pointing to the left as indicated on the panel. Turn (clockwise) the sleeve on each of the antenna connectors to tighten them securely in place.

Step 2. On the rear panel of the base station, plug the connector at the end of the AC power supply cord into the **12-14VDC** power connector (#**36**). Turn (clockwise) the nut on the cable connector to secure it to the base station. Plug the large female connector of the AC power cord into the power supply. Plug the other end of the AC power cord into an electrical outlet.

Step 3. Plug a headset into the **HEADSET** connector (#**15**) on the front panel of the base station.

Step 4. Press the **POWER** switch (#**1**) to turn on the base station. The red light on the switch should go on.

Interference Avoidance

Headset interference, sometimes heard popping sounds, may occur whenever other equipment such as WI-FI systems, wireless DMX systems or other HME Base Stations use the same frequency band. If these systems can be limited to one portion of the band, then the DX200 can be set to the opposite half of the 2.4 GHz to 2.48 GHz band. To avoid this type of interference, select the upper part of the frequency range on one Base Station (or more), and the lower part of the frequency range on the other(s) as follows:

Step 1. Turn on the Base Station power. An *"8"* will appear on the **STATUS** display for a few seconds.

Step 2. After the *"8"* disappears and the **STATUS** display is blank (primary base) or if it displays a double bar (secondary base), press and hold the **CLEAR/BAND** button. Then, while you are still holding the **CLEAR/BAND** button, press and hold the **REGISTER** button and wait for a **L**, **H** or **A** to appear. Release both buttons.

NOTE: Base stations are shipped in the **A** (default) position.

Step 3. Press the **CLR/BND** button to cycle through parts of the frequency band; **L** = Low end, **H** = High end and **A** = All.

Step 4. Wait until *"c"* appears on the display.

Step 5. Initialize each Base Station and register all Beltpacs/Headsets to be used with each Base Station as instructed on .

NOTE: *"c"* will only appear on the **STATUS** display if you are setting the frequency band the first time or if you are changing the setting. If you stop at **L**, **H** or **A** that was already set, an *"8"* will appear for a few seconds and the **STATUS** display will turn blank.

If you change a base station's existing frequency band setting, you will have to re-register all beltpacs and/or all-in-one headsets registered to that base station.

Multiple Base Stations

This mode of operation can be used to expand the number of users communicating through multiple HME Base Stations operating in the same portion of the 2.4 GHz to 2.48 GHz frequency band. Two or more base stations can be "daisy-chained" together with 2-wire connector cables (#**27** and #**29**) on the rear panel of each base station (following Clear-Com®/RTS® standards).

NOTE: The base station does not provide or require 2-wire line power.

The cable connectors must be 3-pin XLR type with the following pin connections:

	RTS® Mode	**Clear-Com® Mode**
	Pin 1 = Common	Pin 1 = Common
	Pin 2 = Channel 1	Pin 2 = N/C
	Pin 3 = Channel 2	Pin 3 = Audio
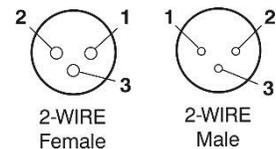
If you are "daisy-chaining" multiple base stations:

Step 1. Press **TERM** button in (**TERM ON**) to terminate the last base station in the daisy chain. Be sure this is done to **only one** base station.

Step 2. For each base station, follow all the steps under **Equipment Connections** on .

Step 3. Follow the procedures on to set each base station as primary or secondary, select frequency bands and initialize each base station.
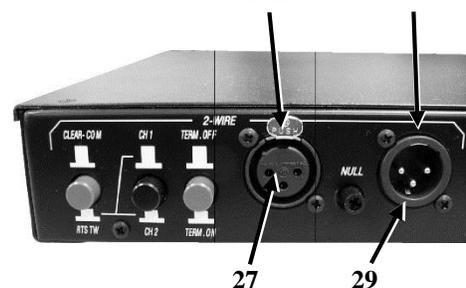
Primary and Secondary Base Station Settings

One base station must be designated as "primary" while others are designated as "secondary". You can have one primary and up to three secondary base stations. Secondary base stations are assigned numbers 1, 2, or 3 during initialization to differentiate them in frequency offset.

- Label the base stations as **Primary**, **1**, **2** and **3**.
- Start with all base stations and Beltpac/Headsets powered off.

Configure each secondary base station as follows:

1. Remove the six screws from the top and three screws from each side of the top cover, and then remove and set aside the cover.
2. Locate the DIP switch on the transceiver circuit board inside the base station. Set DIP switch #4 to the **ON** position. Leave #s 1 and 3 in the **OFF** position.

DIP switch inside
secondary base station
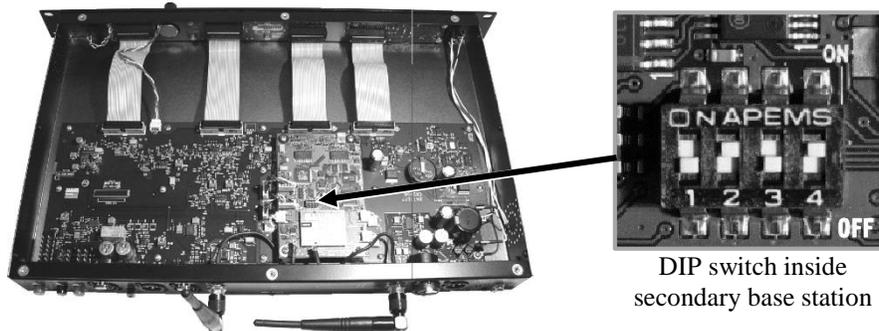
3. Replace the cover and screws on the base station.
4. The **primary** base station DIP switch #4 should be in the **OFF** position.

Base Station Initialization

For multiple HME base stations to operate without interference, they must all be properly initialized before performing other setups. After initializing each base station, register each Beltpacs/Headsets to be used with that base according to the procedures on .

NOTE: Base stations must be set up for split-band operation prior to initialization. If a different frequency band needs to be selected to avoid interference, the primary base station must be set to this frequency band before base station initialization begins. (See Interference Avoidance on page 8.)

Initialize each base station and register all Beltpacs/Headsets as follows:

1. Power on the primary base station. Register any Beltpacs/Headsets to be used with the primary base station (See). Turn off each Beltpac/Headset after it has been registered.
2. Power on one **secondary** base station. The **STATUS** display will show a double bar, indicating the secondary base is ready to be initialized.

Double bar

Small "o"

Base station ready to be initialized

**Small "o" indicates primary base
is open for registration**

3. Press the **REGISTER** button on the primary base. The **STATUS** display will show a small "o".

4. To assign a number and initialize it to a secondary base station, press the **REGISTER** button on the secondary base. Pressing the button repeatedly cycles through numbers 1, 2, and 3. When the desired number appears, stop pressing and wait. During initialization, the **STATUS** display will continue showing the secondary number. When initialization is completed, the display will show one bar, indicating that the secondary has initialized to the primary.

Secondary base number
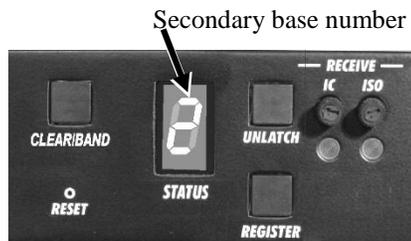
Secondary 2 searching for primary

One bar
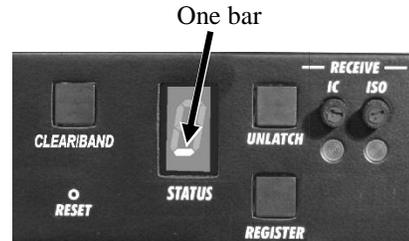
Secondary is initialized to primary

5. Press the **REGISTER** button on the primary. The **STATUS** display will go blank.

6. Register Beltpacs/Headsets to the secondary (See). After registration, turn off the secondary base and all Beltpacs/Headsets.

7. Repeat these steps for each remaining secondary base. Use a different number for each. Only the active primary base and secondary base to be used should be powered on during initialization. All other equipment should be turned off.

8. After all secondary bases are initialized and Beltpacs/Headsets are registered, power up all bases. Press reset on the primary base and let it recover. Turn on the primary Beltpacs/Headsets, and let them link. Press the reset on each secondary base (one at a time), and let it initialize to the primary (indicated by a single bar). Turn on the Beltpacs/Headsets associated with the secondary bases one group at a time until they have all linked. Follow with the next group. At this point, all bases and Beltpacs/Headsets should be powered up, linked and ready for use.

9. Proceed with normal system configuration, setting functions and levels as required.

10. If it becomes necessary to replace a secondary base, use the procedure above to initialize the new secondary. After initialization you will have to register any Beltpacs/Headsets associated with the old secondary to the new secondary.

11. If it becomes necessary to replace a primary base, follow the above procedure completely. Before initialization of the secondary bases, clear the previous secondary initialization as follows. For each secondary, press the **CLEAR/BAND** button and the **RESET** button simultaneously. Continue holding the **CLEAR/BAND** button after releasing the **RESET** button until the clear code "**c**" (lower case) appears on the **STATUS** display. Any Beltpacs/Headsets associated with the old primary will have to be registered to the new primary after secondary base initialization. All Beltpacs/Headsets associated with secondary base stations also have to be registered again.

12. If the primary base is shut down or if the primary base is powered off for more than 30 seconds, all secondary bases will drop their Beltpac/Headset connections and begin searching for the primary. If the primary is not found in 30 seconds, the secondary will automatically revert to primary-mode operation and reconnect the Beltpacs/ Headsets. At this point, the secondary **STATUS** displays will show three bars. Once the primary powered on, it will be necessary to press **RESET** on all secondary bases to allow them to find and initialize to the primary again. This makes it important that all bases be connected to the same AC circuit to prevent this situation in the event that the system is shut down at the end of a day and powered up the next day.

Three bars
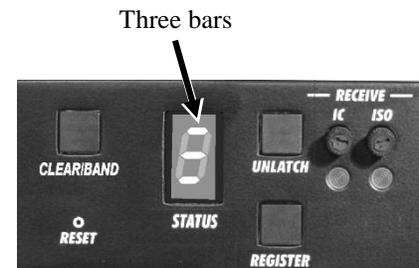
Secondary base operating in primary mode when no primary base is found

NOTE: You cannot register Beltpacs/Headsets to a base that is set in primary mode, and then switch the base mode to secondary for initialization. Once in secondary mode, the base cannot recognize the Beltpacs/Headsets registered during primary operation. For secondary bases, the Beltpacs/Headsets must always be registered after secondary base initialization, with the primary base remaining active and the secondary base displaying one bar.

BELTPAC / WH220 HEADSET SETUP AND REGISTRATION

The first time you operate the DX200 system, you must register each Beltpac and/or WH220 Headset for use with a specific base station. The base station will then recognize all registered and powered on Beltpacs/Headsets, and it will differentiate between them and other electronic equipment operating on the same frequencies. If a Beltpac/Headset is added, replaced or repaired later, the new one must be registered and the old one remains in memory. A maximum of 15 Beltpacs and/or Headsets can be registered to a single base station at one time. If the maximum number of 15 is exceeded, you must clear all current registrations and re-register all active Beltpacs/Headsets.

NOTE: The following two pages are for Beltpac setup and registration. WH220 Headset setup and registration instructions are on .

Set Up Beltpacs

Before registration, set up all Beltpacs as follows.

Step 1. Insert a fully charged battery in the Beltpac with the metal contacts on the end of the battery inserted first. Press it in until it snaps.

Step 2. Place the Beltpac in the pouch.

Step 3. Plug the headset cable connector into the Beltpac.

Register Beltpacs

Beltpacs must be within 6 feet (1.83 meters) of the base station during registration. Before you begin, be certain the base station power is on and each Beltpac to register is turned off. Beltpacs that are already registered can be turned on or off.

NOTE: If you are setting up multiple, daisy-chained base stations, the following steps must be repeated for Beltpacs registration to each base station.

Step 1. Put the headset, of the Beltpac being registered, on your head.

Step 2. Press the **REGISTER** button on the front panel of the base station (#**17** on base station front panel illustration).

- The **STATUS** display (#**3** on base station front panel illustration) will show a small "**o**" for open.

  NOTE: If you wait too long before going on to Step 3, the base station will go out of the registration mode and you will have to repeat Step 2.

Step 3. Press and hold the **ISO** button on the Beltpac while you press and release the **PWR** (power) button to turn the unit on, then release the **ISO** button. This will cause the Beltpac to enter the registration mode.

- The two power lights at the corners of the Beltpac near the **IC** and **ISO** buttons will begin blinking red, then they will blink green two or three times and turn off.

- *Wait!* There may be a short delay.
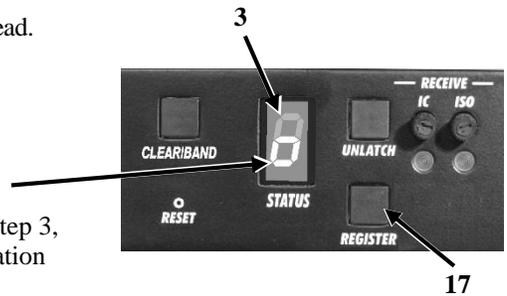
If registration is successfully completed:

- A voice message in the headset will say "Power on, Beltpac #, Version #, Begin registration, Registration complete, …"
- After a delay of up to 15 seconds, the **STATUS** display will show the ID number assigned to this Beltpac for about 10 seconds.
  NOTE: ID numbers are assigned sequentially as 0 thru 9, A, b, C, d and E.
- The power light on the Beltpac, next to the **IC** button, will remain on steady green.
- **Repeat Steps 1 to 3 on** **for each Beltpac to be registered.**

If registration failed:

- A voice message in the headset will say "Power on, Beltpac #, Version #, Begin registration, …" Both power lights on the Beltpac will be blinking red, and there may be a delay of up to 90 seconds before you hear "Registration failed" and the **STATUS** display goes blank.
- Press **RESET** (#**16**) on the base station. To press **RESET**, insert a small paper clip or similar object into the **RESET** hole at the lower-left corner of the base station front panel. When the **STATUS** display (#**3**) goes blank, press the **REGISTER** button (#**17**) and register the Beltpac again. If registration fails again, call your dealer for assistance.
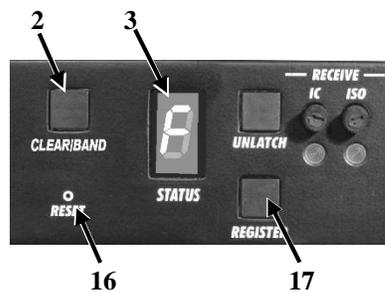
If you try to register more than 15 Beltpacs and/or Headsets to a base station:

- An **F** (for registration "Full") will appear on the **STATUS** display (#**3**) on the base station, and you will hear "Registration failed" in the Headset.
- Clear all current registrations by pressing the **CLEAR/BAND** button (#**2**) and **RESET** (#**16**) simultaneously. To press **RESET**, insert a small paper clip or similar object into the **RESET** hole at the lower-left corner of the base station front panel. Continue holding the **CLEAR/BAND** button after you release **RESET**, until the clear code "**c**" (lower case) appears on the **STATUS** display.
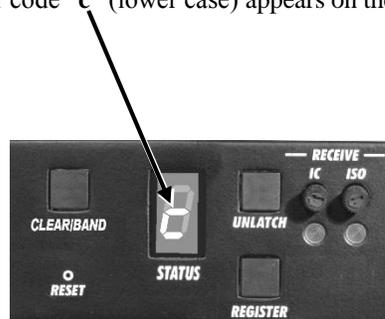
- Register all active Beltpacs, one at a time. Previously registered Headsets must also be re-registered.

Power light

Power button
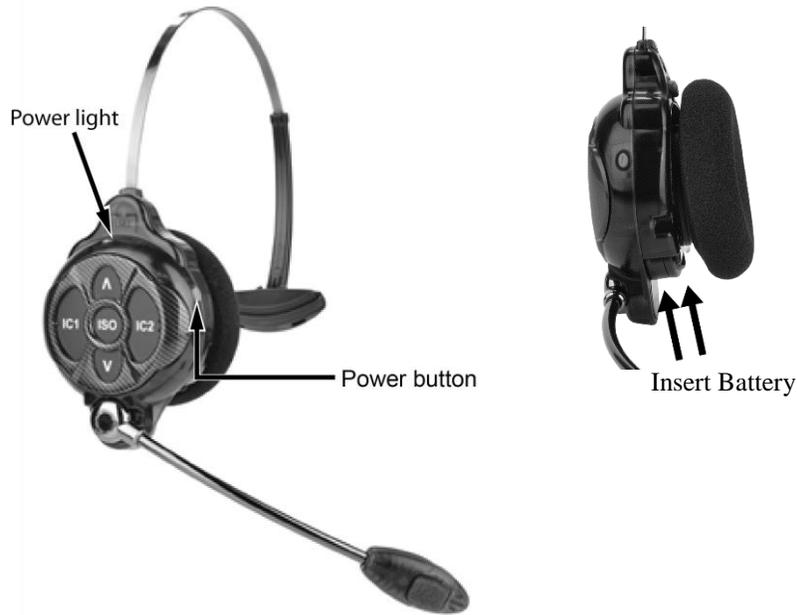
Insert Battery

Set Up WH220 Headsets

Before registration, insert a fully charged battery in each Headset with the metal contacts on the end of the battery inserted first. Press it in until it snaps.

Power On/Off

- **To turn power on**

  Press and release the power button on the inside of the Headset housing. A voice message in the earpiece will say "Headset #" and the power light on the opposite side of the earpiece will go on.

- **To turn power off**

  Press and hold the power button for approximately 3 seconds. A voice message in the earpiece will say "Headset off", and the power light on the opposite side of the earpiece will turn off.

Register WH220 Headsets

Headsets must be within 6 feet (1.83 meters) of the base station while you are registering them. Be certain the base station power is on, and each Headset to be registered is turned off before you begin. Headsets that are already registered can be on or off.

NOTE: If you are setting up multiple, daisy-chained base stations, the following steps must be repeated for Headsets being registered to each base station.

Step 1. Place the Headset on your head.

Step 2. Press the **REGISTER** button on the front panel of the base station (#**17** on base station front panel illustration).

Step 3. The **STATUS** display (#**3** on base station front panel illustration) will show a small "**o**" for open.

> **NOTE:** If you wait too long before going on to Step 3, the base station will go out of the registration mode and you will have to repeat Step 2.

Step 4. Press and hold the **ISO** button on the Headset while you press and release the power button to turn the unit on, then release the **ISO** button. This will cause the Headset to enter the registration mode.
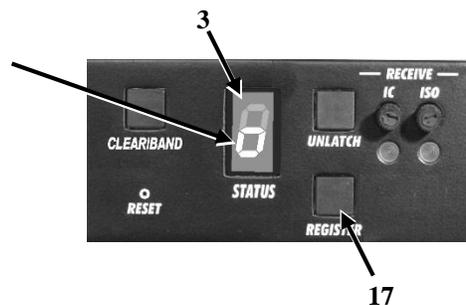
- The Headset power light will begin blinking red, then will blink green two or three times and go off.

   Wait!   There may be a short delay.

If the registration is successfully completed:

- A voice message in the Headset will say "Power on, Headset #, Version #, Begin registration, Registration complete, …"
- After a delay of up to 15 seconds, the **STATUS** display will show the ID number assigned to this Headset for about 10 seconds.

   NOTE: ID numbers are assigned sequentially as 0 thru 9, A, b, C, d and E.

- The power light on the Headset will remain on steady green.
- Repeat Steps 1 to 3 above for each Headset to be registered.

If registration failed:

- A voice message in the Headset will say "Power on, Headset #, Version #, Begin registration, …" The power light on the Headset will be blinking red, and there may be a delay of up to 90 seconds before you hear "Registration failed" and the **STATUS** display (#**3**) goes blank.
- Press **RESET** (#**16**) on the base station. To press **RESET**, insert a small paper clip or similar object into the **RESET** hole at the lower-left corner of the base station front panel. When the **STATUS** display (#**3**) becomes blank, press the **REGISTER** button (#**17**) and register the Headset again.   If registration fails again, call your dealer for assistance.
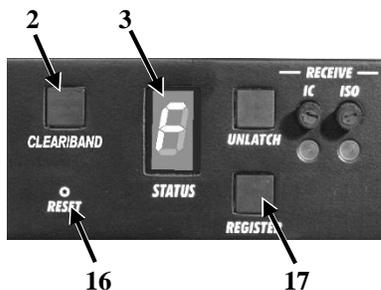
If you try to register more than 15 Headsets and/or Beltpacs to a base station:

- An **F** (for registration "Full") will appear on the **STATUS** display (#**3**) on the base station and you will hear "Registration failed" in the Headset.
- Clear all current registrations by pressing the **CLEAR/BAND** button (#**2**) and *RESET* (#**16**) simultaneously. To press **RESET**, insert a small paper clip or similar object into the **RESET** hole at the lower-left corner of the base station front panel. Continue holding the **CLEAR/BAND** button after you release **RESET**, until the clear code "**c**" (lower case) appears on the **STATUS** display.

- Register all active Headsets, one at a time. Previously registered Beltpacs must also be re-registered.

NOTICE

You have completed the stand-alone system setup.

The instructions under INTERCOM AND AUXILIARY EQUIPMENT SETUPS on the following pages are for setting up additional equipment which you may want to use with your DX200, such as a 2-wire intercom, 4-wire intercom, an external speaker or other auxiliary audio equipment. Instructions are also provided for daisy-chaining two or more base stations together.

INTERCOM AND AUXILIARY EQUIPMENT SETUPS
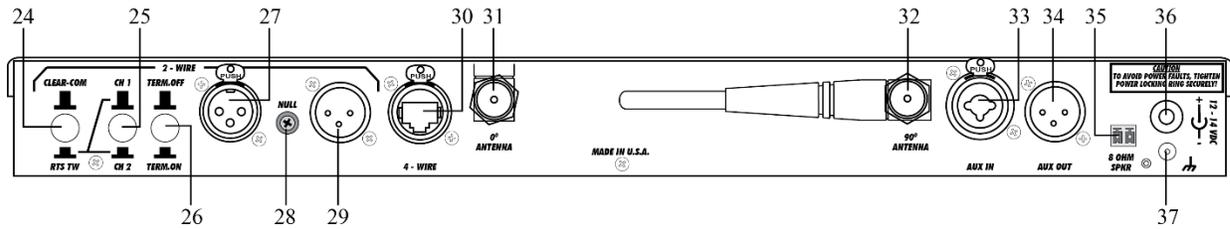
Rear Panel
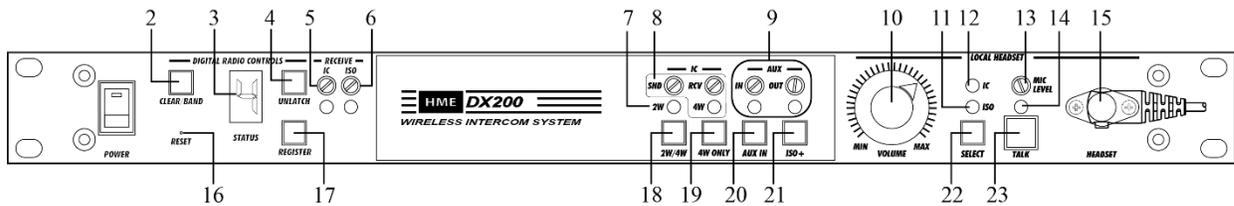
Front Panel

2-Wire Intercom

Step 1. If using a 2-wire intercom, plug it into the base station at **#27** or **#29** (depending on whether a male or female connection is required).

Step 2. Depending on whether you are using a Clear-Com® or RTS® compatible 2-wire intercom system, position the **CLEAR-COM / RTS TW** button (**#24**) as follows:
>   **In position** = RTS® Mode   **Out position** = Clear-Com® Mode

Step 3. If you selected **RTS TW**, position the **RTS CHANNEL** select button (**#25**) to the desired channel as follows:
>   **Out position** = Channel 1   **In position** = Channel 2

Step 4. Press the **2W/4W** button (**#18**) on the front panel of the base station. The **2W** and **4W** lights (**#7 & #8**) above the button should go on. Turn the Beltpac/Headset power on. Press the **IC** button on the Beltpac/Headset and speak into the microphone. If you hear a delayed echo of your voice, adjust the **NULL** control (**#28**) while you are speaking until the echo is eliminated.

4-Wire Intercom

Step 1. If using only a 4-wire intercom, plug it into the **4-WIRE** connector (**#30**).

Step 2. Press the **4W ONLY** button (**#19**). The **4W** light (**#7**) above the button should turn on.

Step 3. Adjust the **NULL** control (**#28**) while you are speaking until the echo is eliminated.

Step 4. Adjust the 4-wire intercom send and receive levels with the **SND** and **RCV** controls (**#8**).

Pin designations for the RJ45
4-WIRE connector are as follows: Pins 1, 2, 7 & 8 = N/C
   Pin 3 = Intercom Out +
                                          Pin 4 = Intercom In +
                                          Pin 5 = Intercom In –
                                          Pin 6 = Intercom Out –
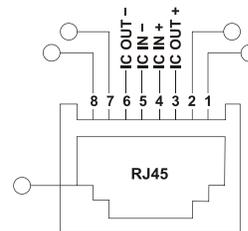
NOTE: If no 2-wire intercom will be used, you **must** press the **4W ONLY** button (**#19**) or a squeal will be heard in the headsets.

The numbers (#_) below refer to items on the illustrations on .

Auxiliary Equipment

Step 1. If using auxiliary equipment, such as another intercom, CD player or other audio source, connect its output cable connector (male) to the **AUX IN** connector (#**33**), and connect its input cable connector (female) to the **AUX OUT** connector (#**34**) (if applicable).

The cable connectors must be 3-pin
XLR type for balanced +20dBV   Pin 1 = Ground
maximum audio input/output with   Pin 2 = Audio +
the following pin connections: Pin 3 = Audio −

AUX IN
Female

AUX OUT
Male
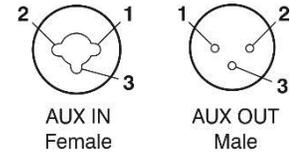
Step 2. If the auxiliary equipment provides audio input only, press the **AUX IN** button (#**20**). The light above the button (#**9**) should turn on. Listen to the audio input in your headset as you adjust the **IN** control (#**9**) above the light to the desired level.

Step 3. If the auxiliary equipment requires two-way communication, have someone listening at the auxiliary unit. Press the **ISO+** button (#**21**) on the front panel of the base station. The light above the button should turn on. While speaking into your headset microphone, adjust the **OUT** control (#**9**) above the light to the desired listening level at the auxiliary unit. Listen to the audio input in your headset as you adjust the **IN** control (#**9**) above the light to the desired level.

Step 4. **ISO+ Only Setting -** If you require **ISO** audio output to the **AUX OUT** connector (#**34**), but do not want it broadcasted to other beltpacs or headsets, configure your equipment as follows:

- Turn the base station off.
- Remove the six screws from the top and three screws from each side of the base station top cover, and lift the cover off and set it aside.
- Locate the DIP switch on the transceiver circuit board inside the base station. Set DIP switch #3 to the **ON** position. Leave #s 1 and 4 in the **OFF** position in secondary base station mode.
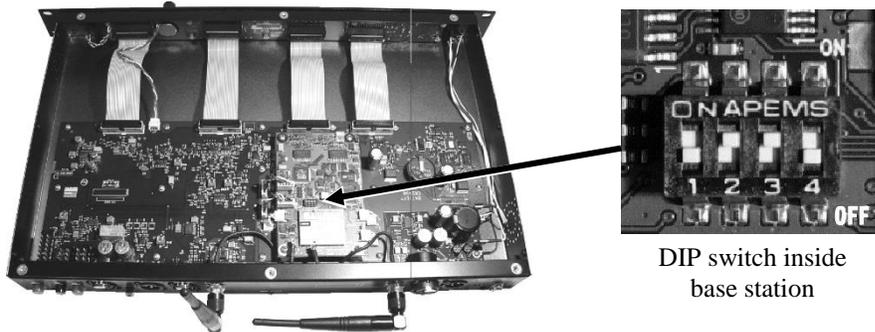
DIP switch inside
base station

- Replace the cover and screws on the base station.
- Turn the base station on.

8-Ohm Speaker

Step 1. If an external 8 ohm speaker will be used, connect its cable wires to the **8 OHM SPKR** 2-pin Phoenix connector (#**35**).

Step 2. Adjust the speaker volume with the **LOCAL HEADSET VOLUME** control knob (#**10**).

   NOTE: Either a local headset or an external speaker can be used, but not both. The **LOCAL HEADSET VOLUME** control knob is the adjustment for both.

BASE STATION OPERATION

Front Panel Controls, Indicators and Connector
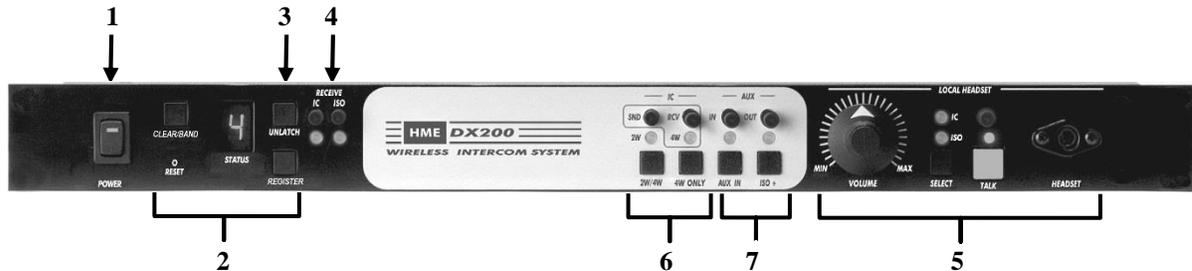
1. **POWER Switch**

   Press the upper portion of the switch to turn the power on (the switch illuminates). Press the opposite portion to turn the power off. The light will go off. All settings will be restored when the power is again turned on.

2. **Beltpac or Headset Registration Controls and Status Indicator**

   Use these controls to register each Beltpac and/or Headset used with a specific base station, as described on pages 11 - 14.

3. **UNLATCH Button**

   Use this button to unlatch all Beltpac/Headset transmitters. (Beltpac/Headset users can "latch" their units on, to talk and listen to each other in the Hands-free mode. Base station operators can use the **UNLATCH** button to stop Beltpac/Headset conversations.)

4. **IC (Intercom) and ISO (Isolate) Receiver Indicators and Controls**

   Lights indicate whether Beltpac/Headset reception is **IC** or **ISO**. Use **IC** and **ISO** controls to independently adjust **IC** and **ISO** receive levels.

   NOTE: This adjustment does not affect communication between Beltpacs and Headsets.

5. **Local Headset Connector, Indicators and Controls**

   - Adjust the microphone level control (above the **TALK** button) to mid-point. The level can be adjusted during use as needed.
   - Adjust the receive level by turning on a Beltpac/Headset, speaking into the microphone and listening through the local headset earpiece while adjusting the **VOLUME** control on the base station to the desired level.
   - With either the **2W/4W** or **4W ONLY** button engaged, use the **SELECT** button to select communication via **IC** or **ISO+** connectors. Above the **SELECT** button, the indicator light will be lit for the selection you have made. **IC** will allow you to communicate via the intercom channel as well as Beltpacs/Headsets. If **ISO** is selected and the **ISO+** button has been pressed (See #**7** in the illustration above), you will communicate via the **AUX OUT** connection as well as to Beltpacs/Headsets.

     NOTE: If neither **2W** nor **4W** is on, this will have no effect. It will stay on **ISO**.

   - For open communication, press and release the **TALK** button quickly to "latch on". To "latch off", press and release the button again quickly.
   - For momentary communication, press and hold the **TALK** button for more than one second. In this mode, the selected channel will remain open only as long as you are pressing the **TALK** button.
   - The **TALK** light indicates the **TALK** mode is active via the local headset.
   - Use the **TALK** control knob to adjust the outbound audio level from the local headset microphone.
   - Use the **VOLUME** control knob to adjust the input to the local headset earpiece.

> **The following base station indicators and controls are used only if 2-wire or 4-wire intercoms, or other auxiliary equipment is being used with the DX200, as described under INTERCOM AND AUXILIARY EQUIPMENT SETUPS on pages 16 and 17.**

6. **2Wire/4Wire IC Indicators and Controls**

   The **2W/4W** button turns on/off both 2-wire and 4-wire intercoms simultaneously. The 2W light above the button indicates intercom on/off status. The **4W ONLY** button turns on/off the 4-wire intercom alone. The **4W** light above the button indicates intercom on/off status. Use the **SND** and **RCV** controls in the outlined area to adjust the 4-wire intercom send and receive levels.

7. **AUX IN and ISO+ Indicators and Controls**

   The **AUX IN** button enables audio input from auxiliary equipment connected to **AUX IN** to Beltpacs/Headsets and local headset. The **ISO+** button enables the **ISO** audio output to auxiliary equipment connected to **AUX OUT**, from Beltpacs/Headsets and local headset. When the **IN** light is on, only **AUX IN** is active. When the **OUT** light is on, **AUX IN** and **ISO+** are both active. The **IN** and **OUT** controls adjust auxiliary inbound and outbound audio levels.

   NOTE: If your equipment was set up for "**ISO**+ only" operation (see page 17, Step 4) when **ISO+** is on, outbound audio will only be output to auxiliary equipment connected to **AUX OUT**. It is not broadcast to other Beltpacs/Headsets. The local headset will always communicate to Beltpacs/Headsets whether in the "**ISO**+ only" mode or not.

BELTPAC OPERATION

The Beltpac control buttons have a snap action. They will activate when pressed firmly. It's best to use your fingertips (not fingernails) to press the buttons.

Power lights

Power On/Off

- **Power On —** Press and release the **PWR** (power) button.
  A voice message in the earpiece will say "Power on, Beltpac #, Version #", and the red power lights at the corners of the **IC** and **ISO** buttons will turn on. After a short time, one light will turn off and the other will change to green, indicating the Beltpac is ready for use. The **STATUS** indicator on the base station will momentarily indicate the ID of the Beltpac.

- **Power Off —** Press and hold the **PWR** button for approximately 2 seconds.
  A voice message in the earpiece will say "Power off", and the green power light will go off.
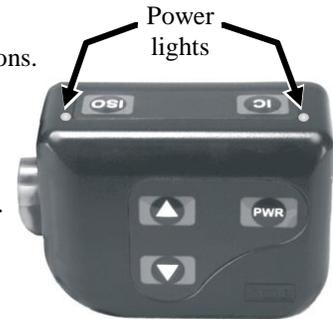
NOTE: While the Beltpac is transmitting, the green power light will be flashing.
The green power light will be on steady whenever the Beltpac is ready but not transmitting.

ISO (Isolate) and IC (Intercom)

Use the **ISO** button to communicate with other Beltpac/Headset users and the base station operator. Pressing **ISO** on the Beltpac will send audio to **AUX OUT** if **ISO+** button on the base station is on. The ISO feature can be locked out, causing the **ISO** button to function the same as the **IC** button.

Use the **IC** button to communicate via the intercom channel and with the base station operator, or anyone listening to a local speaker connected to the base Station. Pressing **IC** on the Beltpac will send audio to the hardwired intercom if the intercom is on.

- **Push-To-Talk Mode —** To set the Beltpac for push-to-talk (PTT) communication (with the power off), press and hold the volume-down ▼ and **ISO** buttons while you press and release the **PWR** (power) button. You will hear "Power on, Beltpac #, Version #, Hands-free off" in the headset. Press and hold the **IC** or **ISO** button while talking.

- **Hands-free Mode —** To set the Beltpac for hands-free communication (with the power off), press and hold the volume-up ▲ and **ISO** buttons while you press and release the **PWR** (power) button. You will hear "Power on, Beltpac #, Version #, Hands-free on" in your headset. When set up for hands-free communication, the Beltpac can be operated in either hands-free or PTT.

- **ISO Lockout Mode —** To set the Beltpac with the ISO feature locked out (with the power off), press and hold the **IC** button while you press and release the **PWR** (power) button. You will hear "Power on, Beltpac #, Version #, ISO off" in your headset. When set up for the ISO Lockout mode, the **ISO** button will operate the same as the **IC** button in either hands-free or PTT communication.
  To reset the ISO feature for normal **ISO** button communication (with the power off), press and hold the **ISO** and **IC** buttons while you press and release the **PWR** (power) button. You will hear "Power on, Beltpac #, Version #, ISO on" in your headset.

NOTE: The above settings are saved in memory and only need to be repeated when you want to change between hands-free and PTT operation. When changing modes, if both power lights begin blinking, turn the Beltpac off and begin again. Hands-free and Push-To-Talk mode settings affect both **IC** and **ISO**. Individual adjustment is not possible.

- **Push-To-Talk Mode Operation —** Press and hold the **IC** or **ISO** button for more than one second. In PTT operation, audio will be transmitted only while you are pressing the **IC** or **ISO** button.

- **Hands-free Mode Operation —** Quickly press and release the **IC** or **ISO** button to "latch" the transmitter on in the hands-free mode. Talk and listen as in a normal telephone conversation. Press and release the **IC** or **ISO** button again to "unlatch", to end the conversation. If either button is held down for more than a half second, the Beltpac will function as PTT. All Beltpacs/Headsets can be unlatched by the base station operator, by pressing the **UNLATCH** button on the base station.

NOTE: In hands-free mode, pressing the **IC** button while latched in **ISO** will latch on **IC**. Pressing the **ISO** button while latched in **IC** will latch on **ISO**.

Volume Up/Down

- **Volume Up Adjustment —** Each time you press and release the volume-up ▲ button, you will hear a higher pitch beep in the earpiece as the volume increases one step. If you press and hold the volume-up button, you will hear beeps of ascending pitch as the volume steps up to maximum. When maximum volume is reached, you will hear "maximum" repeating until you release the volume-up button.
- **Volume Down Adjustment —** Each time you press and release the volume-down ▼ button, you will hear a lower pitch beep in the earpiece as the volume decreases one step. If you press and hold the volume-down button, you will hear beeps of descending pitch as the volume steps down to minimum. When minimum volume is reached, you will hear rapidly repeating beeps until you release the volume-down button.

Sidetone Adjustment

To adjust headset sidetone (the volume level of your own voice as you speak into the microphone), press and hold the **IC** button while you press the volume-up ▲ or volume-down ▼ button.
If you reach the maximum volume level, you will hear "Maximum" in the headset. If you reach the minimum volume level, you will hear double beeps. Your sidetone setting will be saved in memory and does not require an adjustment each time the Beltpac is turned off and on.

NOTE: This adjustment only affects the level of your voice in your own headset, not the manner in which others hear you.

Microphone Gain Adjustment

Some users talk louder or softer than others. To allow for this, microphone gain adjustment is provided.

To increase microphone gain — Press the volume-up ▲ button while holding down the **ISO** button in the normal operating mode.

To decrease microphone gain — Press the volume-down ▼ button while holding down the **ISO** button in the normal operating mode.

NOTE: The microphone gain increase can be monitored through sidetone or preferably by someone else on a Beltpac/Headset or at the base station.

Change Batteries

When a battery becomes weak, a voice in the earpiece will say "Change battery". When this happens, take the Beltpac out of its pouch and remove its battery. Slide the arrow-shaped battery-release latch in the direction of the arrow. Pull up on the end of the battery near the battery-release latch and lift the battery out of the Beltpac, or turn the Beltpac over and catch the battery in your hand.

When replacing a battery in the Beltpac, replace the battery in the same position as the removed. Press the top of the battery carefully into the battery holder until it snaps in place under the battery-release latch.

Recharge batteries according to the instructions on page 5.

Battery   Battery
release latch

21
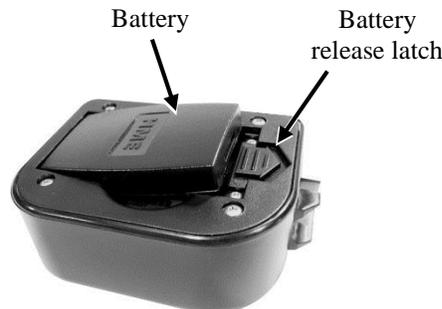
WH220 HEADSET OPERATION

The Headset control buttons will activate when pressed lightly. It's best to use your fingertips (not fingernails) to press the buttons.

Power lights

Power On/Off

- **Power On —** Press and release the power button on the inside of the headset housing. A voice message in the earpiece will say "Power on, Headset #, Version #" and the power light will go on. The **STATUS** indicator on the base station will momentarily indicate the Headset ID number.

- **Power Off —** Press and hold the power button for approximately 3 seconds. A voice message in the earpiece will say "Power off", and the power light will go off.

Power button

ISO (Isolate) and IC (Intercom)

Transmit light
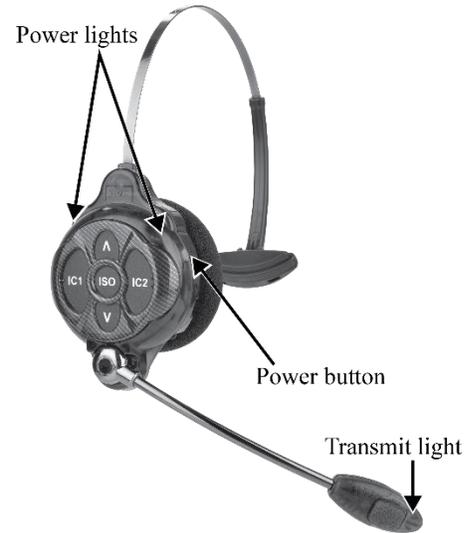
Use the **ISO** button to communicate with other Headset/Beltpac users and the base station operator. Pressing **ISO** on the Headset will send audio to **AUX OUT** if **ISO+** button on the base station is on. The ISO feature can be locked out, causing the **ISO** button to function the same as the **IC** button.

Use the **IC1** or **IC2** button to communicate with the base station operator or anyone listening to a local speaker connected to the base station. Pressing **IC1** or **IC2** on the Headset will send audio to the hardwired intercom if the intercom is powered on.

- **Push-To-Talk Mode —** To set the Headset for Push-To-Talk (PTT) communication (with the power off), press and hold the volume-down ▼ and **ISO** buttons while you press and release the power button. You will hear "Power on, Headset #, Version #, Hands-Free off" in the earpiece. Press and hold the **IC1**, **IC2** or **ISO** button while talking.

- **Hands-Free Mode —** To set the Headset for Hands-Free (HF) communication, (with the power off), press and hold the volume-up ▲ and **ISO** buttons while you press and release the power button. You will hear "Power on, Headset #, Version #, Hands-Free on" in the earpiece. When set up for Hands-Free communication, the Headset can be operated in either HF or PTT.

- **ISO Lockout Mode —** To set the Headset with the ISO feature locked out (with the power off), press and hold the **IC1** button while you press and release the power button. You will hear "Power on, Headset #, Version #, ISO off" in your Headset earpiece. When set up for the ISO Lockout mode, the **ISO** button will operate the same as the **IC1** button in either hands-free or PTT communication.
  To reset the ISO feature for normal **ISO** button communication (with the power off), press and hold the **ISO** and **IC1** buttons while you press and release the power button. You will hear "Power on, Headset #, Version #, ISO on" in your Headset.

- **Lights-off Mode —** To prevent the power and transmit lights from coming on during headset operation, press and hold the **IC2** button while you press the power button to turn the headset on.
  To return the lights to their normal functions, turn the power off and on again without pressing the **IC2** button.

NOTE: The above settings are saved in memory and only need to be repeated when you want to change between HF and PTT operation. When changing modes, if both power lights begin blinking, turn the Headset off and begin again. Hands-Free and Push-To-Talk mode settings affect both **IC** and **ISO**. Individual adjustment is not possible.

- **Push-To-Talk Mode Operation —** Press and hold the **IC1**, **IC2** or **ISO** button while speaking. In PTT operation, audio will be transmitted only while you are pressing the **IC1**, **IC2** or **ISO** button.

- **Hands-Free Mode Operation —** Quickly press and release the **IC** or **ISO** button to "latch" the transmitter on in the HF mode. Talk and listen, as in a normal telephone conversation. Press and release the **IC** or **ISO** button again to "unlatch" and end the conversation. If either button is held down for more than a half second, the Headset will function as PTT. All Headsets/Beltpacs can be unlatched by the base station operator by pressing the **UNLATCH** button on the base station.

NOTE: In Hands-Free mode, pressing the **IC1** or **IC2** button while latched in **ISO** will latch on **IC**. Pressing the **ISO** button while latched in **IC** will latch on **ISO**.

Volume Up/Down

- **Volume Up Adjustment —** Each time you press and release the volume-up ▲ button, you will hear a higher pitch beep in the earpiece as the volume increases one step. If you press and hold the volume-up button, you will hear beeps of ascending pitch as the volume steps up to maximum. When maximum volume is reached, you will hear "maximum" repeating until you release the volume-up button.
- **Volume Down Adjustment —** Each time you press and release the volume-down ▼ button, you will hear a lower pitch beep in the earpiece as the volume decreases one step. If you press and hold the volume-down button, you will hear beeps of descending pitch as the volume steps down to minimum. When minimum volume is reached, you will hear rapidly repeating beeps until you release the volume-down button.

Microphone Gain Adjustment

Some users talk louder or softer than others. To allow for this, microphone gain adjustment is provided.

To increase microphone gain — Press the volume-up ▲ button while holding down the **ISO** button in the normal operating mode.

To decrease microphone gain — Press the volume-down ▼ button while holding down the **ISO** button in the normal operating mode.

NOTE: The microphone gain increase can be monitored through sidetone, or preferably by someone else on a Headset/Beltpac or at the base station.

Change Batteries

When a battery becomes weak, a voice in the Headset will say "Change battery". When this happens, remove the battery from the headset by pressing battery-release button (blue) and sliding the battery out.

When replacing a battery in the Headset, replace the battery in the same position as the battery you removed. Press the top of the battery carefully into the battery holder until it snaps in place.

Recharge batteries according to the instructions on page 5.

Battery release latch

Battery

SECTION 4.   ADAPTIVE FREQUENCY HOPPING

Background

The Clear-Com DX wireless intercom systems utilize a **Frequency Hopping Spread Spectrum** (FHSS) radio in order to provide robust communications.

This system operates in the unlicensed 2.4 GHz band. With the proliferation of other devices over the past few years in the same 2.4 GHz band, instances where these devices and systems can interfere with each other has greatly increased.

To further complicate matters, the European Union has introduced new radio standards for equipment operating in this band in an attempt to reduce interference between equipment from different manufacturers. This European Telecommunications Standards Institute (ETSI) harmonized European standard is known as EN 300 238 v1.8.1.

CLEAR-COM Adaptive Frequency Hopping

In order to reduce interference with other equipment and comply with these new regulations, Clear-Com has implemented an **Adaptive Frequency Hopping** (AFH) mode for the new DX EU base stations. The key idea behind AFH is using only the good frequencies, or channels, unoccupied by other equipment. The system scans for other signals and avoids these signals during operation. Since the radio environment is constantly changing, there is a continuous process of scanning for used frequencies and updating the list of good channels.

The Clear-Com system utilizes 46 discrete frequencies, or channels, within the 2.4 GHz spectrum in order to communicate voice and data. The process of deciding which channels should be used is a 3-stage process. The process includes scanning for occupied channels, the broadcast of a channel exclusion list and the use of the exclusion list. The process is completed in three steps coexisting in time.

Below is the process is shown in Time. First, the system performs a channel scan to determine occupied channels. This list is then broadcast to the communicator. The communicators and base station will use this list during period three. The process is continuous, and as is illustrated below, the list could be constantly changing. Depending on the radio environment, a maximum of 46 channels, and a minimum of 15 channels may be used by the system at any time.

Time $\Rightarrow$

Ch. 1	Ch. 2	Ch. 3	Ch. 4	Ch. 5	Ch. 6	Ch. 7	Ch. 8
Scan	Broadcast	Use					
	Scan	Broadcast	Use				
		Scan	Broadcast	Use			
			Scan	Broadcast	Use		
				Scan	Broadcast	Use	
					Scan	Broadcast	Use

For instructions describing the process of setting the base to AFH or another scanning mode, see **Interference Avoidance**, pg. 8. Available settings include:

High (**H**) - Scans the Higher frequencies.

Low (**L**) - Scans the Lower frequencies.

All (**A**) - All frequencies are scanned.

AFH (**E**) - (European Mode) Advanced Frequency Hopping searches for the best frequency.
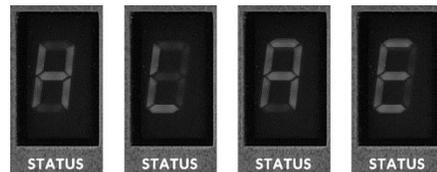
Operation in Severe Environments

During normal operation, the fact that the system is constantly changing the channel list in use is transparent to the user. It is possible, however, that in an environment with severe interference that the system may experience a slight degradation. In the AFH mode, the Clear-Com system will use a minimum of 15 channels. If the environment is very crowded and less than 15 channels are truly available, there could be increased radio 'packet loss' due to the high interference. The following symptoms may be observed with AFH systems in a highly congested radio environment:

- This may result in system 'busy' indications. Channel lists are updated every few seconds, and in a severe environment it is possible that these lists get missed by the communicator.

- Slight degradation in audio fidelity between the headsets and base station. This would be due to the same symptom as the 'busy' indications. The HD audio processing is tolerant to this condition, which is why the degradation may only be slight.

- Longer times to register. Registration may take longer, since the headset has to acquire the channel list from the base station. If the base station has excluded a lot of channels, this takes longer as the communicator does not have the exclusion list and looks for the base on channels it is not using.

- Initial sync time increase. For the same reason registration may take longer, the initial headset sync on power up may take longer.

Required AFH Equipment

In order to utilize AFH, the base station must be set to European mode. The headsets and belt packs must also be AFH capable. AFH capable headsets and belt packs will have the letters 'AFH' labeled on the belt pack and headsets. AFH communicators will auto detect if the system is in AFH mode and adjust their operation accordingly.

Non-AFH Equipment

Headsets and belt packs that are not AFH capable must be operated with either a non-AFH base station or an AFH base station selected to operate in All, High or Low band mode. Headsets and belt packs that are not AFH capable will not have the letters 'AFH'.

AFH Model Chart

Model #	AFH Part #	Non AFH Part #	Comments
BP200	G29663-2B10	G26705-XXX	All BP200 Beltpacks with G26705-XXX part #'s are non AFH compatible.
BP210	G29663-2B10	G28703-XXX	All BP210 Beltpacks with G28703-XXX part #'s are non AFH compatible.
WH210		G28741-XXX	All WH210's are non AFH and will not work with Base in AFH mode.
WH200		G27593-XXX	All WH200's are non AFH and will not work with Base in AFH mode.
WH220	G29090-8D13		ALL WH220's are AFH compatible.
Part number is located on label under the battery on beltpacks and wireless headsets			

Interference Mitigation

Certain techniques can be used in an attempt to mitigate interference between different equipment in the 2.4 GHz spectrum. Some of these are:

- **Physical separation**. If possible, equipment operating in the 2.4 GHz spectrum should be operating as far as physically possible from the HME base station. A Wi-Fi access point or router is a common piece of equipment that could interfere with the DX410 system, or vice versa. These two pieces of equipment in particular should not be located close together.

- **Spectral separation**. Most Wi-Fi access points allow the administrator to set the channel and bandwidth that system operates on. Some systems employ an 'auto' mode, in which the Wi-Fi access point will automatically selected the channel. With Wi-Fi access points, it is sometimes advantageous to manually select a channel number to keep the Wi-Fi transmission at a fixed location.

NOTE: If the Clear-Com system does not have AFH, then the base station should be set to operate in the region of the 2.4 GHz band where the Wi-Fi access point is not operating. For example, if the Wi-Fi access point is set to Wi-Fi channel 1, the base station should be set to operate in the 'High' band. If the Wi-Fi access point is set to channel 11, the base should be set to operate in the 'Low'.

- **Spectral efficiency**. Wi-Fi systems employ a standard sometimes referred to as 802.11. The number "11" is simply the number given to the standard by the Institute of Electrical and Electronics Engineers (the IEEE). Modern Wi-Fi routers will allow operation employing the 802.11n mode. This mode will allow higher data rates, but it also may consume twice the number of radio channels. If the Wi-Fi router is set to 802.11n mode, it is best to limit Wi-Fi bandwidth to 20 MHz.

- **Alternate band selection**. While most Wi-Fi systems operate at 2.4 GHz, which is the same band as the DX410 system. Most allow operation at 5 GHz. If possible, move any Wi-Fi access points and equipment to 5 GHz. This of course requires all Wi-Fi equipment to be 5 GHz capable, and most older equipment may only allow 2.4 GHz operation. Selection of 5 GHz may also not be desirable if the Wi-Fi network is for customer access.

Non-Overlapping Channels for 2.4 GHz WLAN

802.11 channel width 22 MHz

2.4 GHz   2.483 GHz

Channel 1 2412 MHz   Channel 6 2437 MHz   Channel 11 2462 MHz

802.11 40 MHz ch. width

2.4 GHz   2.483 GHz

Channel 3 2422 MHz   Channel 11 2462 MHz
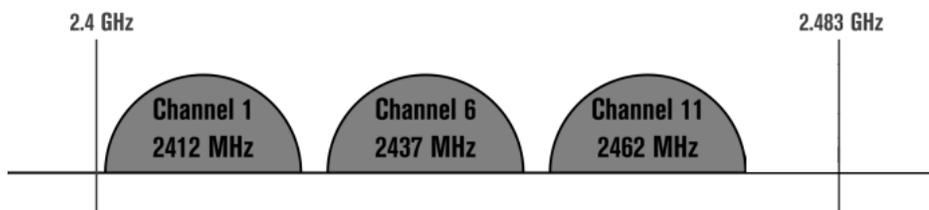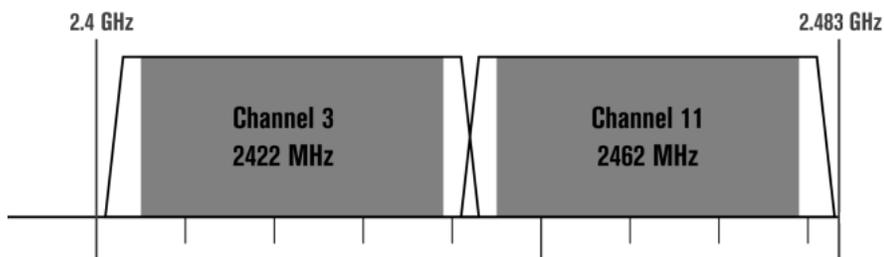
SECTION 5.   TROUBLESHOOTING

If you are unable to correct any of the problems described below, contact your dealer for assistance.

- **Red light on base station power switch does not come on**.

  Be certain power cords are properly connected to base station, power supply and electrical outlet.

- **Beltpac/Headset power lights do not turn green, and "out of range" is heard.**

  Be certain your base station power is on. Turn Beltpac/Headset and base station power on and off.

  You may be too far from the base station. The range varies with each location's layout.

- **When trying to register, it keeps saying registration failed.**

  Check to be sure that the **STATUS** display only goes blank, and does not show a registration number. Follow the instructions on clearing the registrations as found on , and repeat the registration procedure.

- **Others cannot hear me when I talk.**

  Be certain you are pressing the **IC** or **ISO** button on the Beltpac/Headset, or the **TALK** button on the base station. Be certain the appropriate **IC** or **ISO** setting is selected under **LOCAL HEADSET** on the base station. If you are using a Beltpac or local headset, be certain the headset connector is correctly plugged in to the Beltpac or base station.

- **People on the 4-wire intercom cannot hear me or I cannot hear them.**

  Be certain the cables are securely connected and the 4-wire intercom is on. If using a local headset, be certain the **IC** setting is selected under **LOCAL HEADSET** on the base station.

- **People on the RTS/ClearCom systems cannot hear me or I cannot hear them.**

  Be certain the cables are securely connected and the 2-wire intercom is on. If using a local headset, be certain the **IC** setting is selected under **LOCAL HEADSET** on the base station.

- **The 2-wire intercom is on and there is a loud squeal whenever I try to talk.**

  This can occur if no intercom is connected to one of the 2-wire connectors. This can also occur if two or more base stations are daisy-chained and the **TERM ON/OFF** button in one of the base stations has not been set properly. Contact your dealer.

- **Settings are not retained when the base station power is turned off and on again.**

  The internal battery may be low. Contact your dealer.

- **Echo cannot be completely nulled when connected to a 2-wire wired intercom.**

  Terminate the base station then lift the termination on the wired intercom and readjust the **NULL** control.

2400MHz cordless telephone interference — If there is a 2400MHz cordless telephone nearby, interference may occur. However, because the DX200 is a frequency-hopping system, this problem is unlikely. If it does occur, changing frequencies on the telephone may alleviate the problem. If not, move the phone as far as practical from the base station, or use another type phone.

In the event of an electrical power outage — (such as from a lightning storm or power generator failure) If you experience problems with your HME equipment after the electricity returns, unplug the AC power supplies from their electrical outlets and wait 15 seconds, then plug them back in.

SECTION 6.   DX SERIES LED AID

Powering on any DX base station will produce on the LED display the number "8" for approximately 3 seconds.
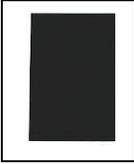
Blank display indicates the base is ready for operation.

You can register belt packs under this condition.

Single horizontal bar indicates the base is in <u>secondary</u> mode and registering to a base has been initiated and successfully linked with a primary base. **You can register beltpacs in this mode.**
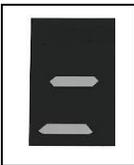
Two horizontal bars indicate that the base is in secondary mode and ready to be synced with a primary base. **You cannot register beltpacs in this mode you must sync to a primary base first.**

Three horizontal bars indicate the base is in secondary mode and has been linked with a primary base but the primary base is **no longer** available to the secondary. It takes a few seconds for the secondary to recognize that the primary is not available and revert to a primary state. **However, you can register belt packs under this condition.**

Syncing Secondary to Primary Bases Feature

To sync the bases, perform the following steps: Press the **REG** or **REGISTER BELT-PAC*** button on the primary base and then press the **REG** or **REGISTER BELT-PAC*** button on the secondary base to begin the sync process. As you repeatedly press the **REG** or **REGISTER BELT-PAC*** button on the secondary you will see the numbers 1, 2, and 3 cycle through on the display. The numbers indicate the three available quadrants. **Note: The primary is in the 0 quadrant by default.** To select a quadrant simply release the button at a desired number and wait. If successful, you will briefly see a blank display followed by a single horizontal bar in the secondary LED display. For additional secondary bases, assign each base to its own quadrant. Refer to the appropriate equipment manual for primary to secondary conversion.

After the bases are synced when the secondary is powered up the number "8" will appear followed by one of the numbers below on the secondary base LED display:
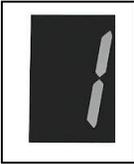
The number "1" indicates the quadrant the secondary has been placed in.

The number "2" indicates the quadrant the secondary has been placed in.

The number "3" indicates the quadrant the secondary has been placed in.

The lower case "c" will appear when the registry on the base station is cleared. To clear the registry power down the base. Hold down the **CLR/BND** or **RESET REGISTRATION*** button first and then power the base on when you see the "8" on the LED display release the **CLR/BND** or **RESET REGISTRATION***. If done successfully you will see a small "c" on the LED display. **NOTE: The display indicates that the registry of a base station has been cleared of all beltpacs and secondary base stations that were registered to the base station.**

Another method to clear the registry would be to start by holding down the **CLR/BND** or **RESET REGISTRATION*** button first and then pressing the **RESET** button until you hear a small click and then release the **CLR/BND** or **RESET REGISTRATION*** button. If done successfully you will see a small "c" on the LED display. We recommend you use a very small paper clip.
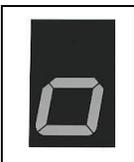
The lower case "o" will appear when the **REG** or **REGISTER BELT-PAC*** button is pressed and indicates that the base is ready to register a beltpac.

When registering beltpacs on DX bases that can carry 15 beltpacs please note that the numeric count displayed on the LED will be in hexadecimal. This means that the LED will represent the first 10 beltpacs as 0 to 9. Beltpac 11 will be represented by the letter A, beltpac 12 will be represented by the letter B and on up to beltpac 15 as E. Please see below.

Beltpac or Headset	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Registry	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E

The letter "F" will appear when the base registry is at its maximum of 15 registered belt packs. You will need to clear the registry to add a beltpac. To clear the registry power down the base. Hold down the **CLR/BND** or **RESET REGISTRATION*** button first and then power the base on when you see the "8" on the LED display release the **CLR/BND** or **RESET REGISTRATION***. If done successfully you will see a small "c" on the LED display.

Spectrum Friendly Feature

Spectrum Friendly option: Hold down the **CLR/BND (**or **RESET REGISTRATION*)** button first then press and hold down the **REG** (or **REGISTER BELTPAC*)** button till you see the letter "A" or "L" or "H". Then release both buttons and quickly press the **CLR/BND** (or **RESET REGISTRATION*)** to cycle through the "A" or "L" or "H". options. Stop at your selection and wait for the LED display to go blank and a lower case c will appear on the status LED.

After this procedure is performed all bases, beltpacs and communicators will need to be re-registered to the base.

2400 to 2483.5 MHz is the operating frequency range.

2401.92 to 2439.94 MHz is the operating frequency range.
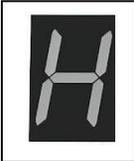
2443.39 to 2481.41 MHz is the operating frequency range.

SECTION 7.   TECHNICAL DATA

EQUIPMENT SPECIFICATIONS

Base Station

GENERAL —

Frequency Range: ....All, 2400 to 2483.5 MHz
Low, 2401.92 to 2439.94 MHz
High, 2443.39 to 2481.41 MHz
Frequency Response: ....200 Hz to 3.5 kHz
Power Requirements: ....100-240VAC, 50-60Hz or 12-14VDC
Temperature Range: ....32-122°F (0-50°C)
Size: ....19" x 1.72" x 17.13" (1-RU) (48.26 x 4.37 x 43.51 cm)
Weight: ....9.2 lbs. (4.18 kg) maximum
# of Beltpacs per Base:....................15 can be registered
Any 4 can have simultaneous full-duplex communication at one time
4-Wire I/O: ....RJ45, 600Ω balanced, level adjustable, simultaneous operation with 2-wire
2-Wire I/O: ....XLR-3M, XLR-3F, externally-switchable RTS® or Clear-Com® mode,
200Ω, level adjustable, null adjustable
Auxiliary Input: ....XLR-3F/¼" (6.35 mm) combo jack, 600Ω balanced, level adjustable
Auxiliary Output: ....XLR-3M, 600Ω balanced, level adjustable
8Ω Speaker Output:........................1W into 8Ω
Headset Connector: ....4-pin mini-DIN
Electret microphone
Headset Output:.............................250mW into 32Ω
Front Panel Controls: ....Power switch
Clear/Band, Reset, Unlatch and Register buttons,
IC and ISO Receive level adjustments, IC 2W/4W and 4W-Only buttons,
IC4W-Only Send and Receive level adjustments,
Auxiliary In and ISO+ buttons, Auxiliary In and Out level adjustments,
Rotary knob for volume adjustment,
Headset IC/ISO Select button and Headset Talk button
Front Panel Indicators: ....Status indicator, IC and ISO Receive LEDs,
IC 2W and 4W-Only LEDs, Auxiliary In/Out LEDs,
Headset IC/ISO select LEDs, Headset PTT LED
Rear Panel Controls: ....Clear-Com®/RTS® mode switch, RTS® Channel 1/2 switch,
2-wire channel line null adjustment
Antenna Type: ....External ½ -wave dipole (R-TNC connector)
RX/TX horizontal/vertical diversity
System Distortion:..........................<2%
Communication Security:................64-bit encryption dual-slot diversity

TRANSMITTER —

Type: ....Frequency hopping, spread spectrum
Transmit Power: ....100mW burst
Modulation Type: ....Gaussian filtered FSK, TDM
Frequency Stability: ....13 ppm
Harmonics/Spurious: ....Exceeds FCC and ETSI specifications over temperature

RECEIVER —

Type: ....Frequency hopping, spread spectrum
RF Sensitivity: ....<−90dBm w 10^{-3} BER
Frequency Stability: ....13 ppm
Distortion: ....<2%

Beltpac

Frequency Range: ....2400 MHz – 2483.5 MHz
* Antenna: ....Internal, horizontal/vertical diversity
Frequency Response: ....200 Hz to 3.5 kHz
Transmit Power: ....100mW burst
RF Sensitivity: ....<−90dBm w 10^{-3} BER
Battery Requirements: ....3.6V lithium ion, rechargeable
Battery Life: ....Hands-free – up to 14 hours
                                                 PTT – up to 20 hours
Temperature Range: ....32-122°F (0-50°C)
Weight: ....7.4 oz (.21 kg) with battery and pouch
Headset Connector: ....4-pin, mini-DIN
Microphone: ....Electret
Headset Output: ....160mW into 32Ω
Controls: ....Power, Volume-up ▲, Volume-down ▼, IC, ISO
Indicators: ....Dual-color LED (red/green)

WH220 Headset

*
Frequency Range: ....2400 MHz – 2483.5 MHz
Antenna: ....Internal
Frequency Response: ....200 Hz to 3.5 kHz
Transmit Power: ....100mW burst
RF Sensitivity: ....<−90dBm w 10^{-3} BER
Battery Requirements: ....3.6V lithium ion, rechargeable
Battery Life: ....Hands-free – up to 14 hours
                                                 PTT – up to 20 hours
Temperature Range: ....32-122°F (0-50°C)
Weight: ....5.7 oz (.16 kg) with battery
Microphone: ....Electret
Headset Output: ....160mW into 32Ω
Controls: ....Power, Volume-up ▲, Volume-down ▼, IC1, IC2, ISO
Indicators: ....Transmit LED (red/green), Power LED (red/green)

NOTE: Beltpacs/Headsets will follow the frequency range determined by the setting on the Base Station (e.g. All, Low or High).

BLOCK DIAGRAM

DX200 Base Station