# Operating Manual

# BTR-24
# TR-24
# Wireless Intercom System

**TELEX**®

**Bosch Communications Systems**

# Table of Contents

# Section 1 - Introduction

## General Description

The Telex BTR-24 System is a full duplex (simultaneous talk and listen), multi-channel, wireless intercom system. The system offers a complete solution for up to 10, full duplex users per base station, many more if in push-to-transmit mode. With fast and easy set-up, durable beltpacks, 64 bit audio encryption, and professional grade headsets.

The main components of this system consists of the TR-24 beltpack and the BTR-24 base station.

The TR-24 beltpack offers the user three audio channels; Audio Channel 1, Audio Channel 2, and both audio's combined. The user can talk and listen on these channels or just turn off the talk button and listen only.

The beltpacks have the ability to communicate with each other in wireless, wired or master wireless modes. In wireless mode, beltpack communicate to each other using the base station as a relay. In wired mode, beltpacks turn off their wireless ability and communicate via an ethernet cable or a buildings ethernet backbone. Finally in master wireless mode, a beltpack can become base station and serve as the wireless relay for coverage over an area.

The beltpack uses an internal rechargeable Li-Ion battery that will provide up to 8 hours of uninterrupted operation.

The BTR-24 base station can support up to ten TR-24 beltpacks in full duplex mode and more if in push-to-transmit mode. The base station provides a central relay location which handles the audio traffic between beltpacks. The built-in base station intelligence called ClearScan™ automatically selects the best RF (Radio Frequency) channel for communications on start-up. The base station also uses an internal rechargeable Li-Ion battery that will provide up to 10 hours of uninterrupted operation.

## System Features

- No FCC License required.

- Easy base station and beltpack setup.

- Uses mature 2.4GHz IEEE 802.11 Wireless LAN Technology.

- A beltpack can serve as a base station if needed.

- Beltpacks can communicate to each other wired or wireless.

- Audio in the system is encrypted via a 64 bit DES algorithm.

- Base station automatically selects the clearest RF channel for the system, and sets the system on that channel. No user intervention is needed.

- Easy to read base station LED display to indicate the RF channel of the system.

- If desired, the user can select any one of the eleven standard 802.11 channels for the system to operate via a single button on the BTR-24 front panel.

- Durable, water resistant, ABS, beltpack cases.

- Dependable, rechargeable, wide temperature range, Li-Ion batteries.

- Low battery indications on the beltpack and base station.

- Base station and beltpacks can be powered from external AC or internal battery.

# Section 2 - BTR-24 Base Station

## Controls and Connections
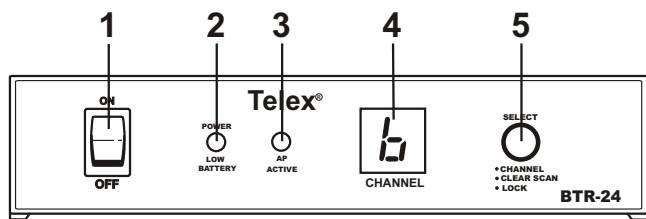


**Front View**
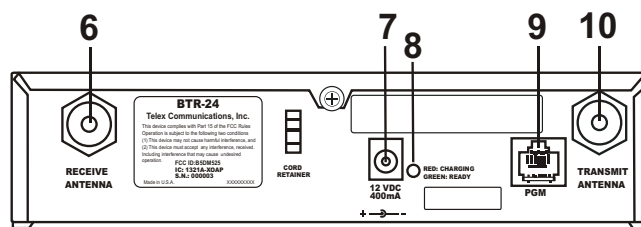


**Rear View**

1. **On/Off Switch** – Turns the power on/off to the base station.

2. **Power / Low Battery Light** – Indicates the base station has power, either from the internal battery or external power connected to the unit.

   **Battery Indication:**

   - GREEN  = Battery OK
   - RED  = Battery Low ( 30 minutes left)
   - No Light = Battery Depleted

3. **AP Active Light** – This green light flashing indicates that the AP has successfully booted and is operating.

4. **RF Channel Display** – Indicates the RF channel the unit is set on.

5. **Select Button** – Press the button to select the desired RF channel for the base station.

   - **ClearScan** – Press and hold the button until the decimal point starts to flash (about 3 seconds) then release. The unit will examine the RF channels available, then select the one with the least activity and set the AP on that channel. **NOTE:** On boot the unit will ClearScan and automatically select the cleanest RF channel.

   - **Lock** – Press and hold the button until the decimal point is on solid (about 10 seconds) then release. The AP will be locked on the channel displayed. To unlock, press and hold the button again until the decimal point is off. Lock makes the currently displayed channel difficult for a user to accidentally change.

6. **Receive Antenna Jack** – Reverse TNC receive jack.

7. **Charge/Power Jack** – Used to charge the internal battery or power the unit directly off a wall outlet. Accepts a 5.5mm x 2.5mm plug with the center positive. Must be supplied with a 12VDC regulated power supply with at least a 400mA current capacity.

8. **Charge Light.**

   - RED  = Battery is charging.
   - GREEN  = Battery is charged.

9. **Configuration Jack** – RJ-45 jack is used to interface the base station to an Ethernet cable. jack may be used for configuring the base station or connecting multiple base stations

10. **Transmit Antenna Jack** – Reverse TNC transmit jack.

# Section 3 - TR-24 Beltpack

## Controls and Connections
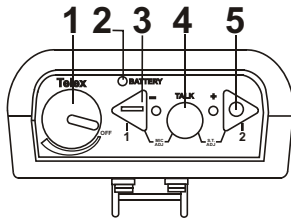
**Top View**
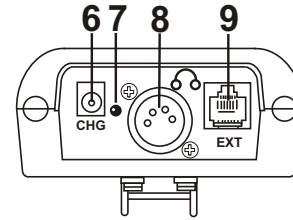
**Bottom View**

1. **Volume Control and Power Switch** – Turns the beltpack power on/off and controls headset volume.

2. **Battery Light/Power Light** – Indicates the beltpack has power, either from the internal battery or AC power connected to the unit.
   - GREEN = Battery Indication: battery OK
   - RED = Battery Low ( 15 minutes left)
   - NO Light = Battery Depleted

3. **Button One and Light** – Selects audio channel one. The channel light has two modes depending on the <TALK> button's state.
   - Light Solid = Talk and Listen enabled.
   - Light Flashing = Listen only enabled. (Push-to-TX)

4. **Talk Button** – Enables the headset microphone. The button has two modes:
   - Momentary = Pressed and hold for over ½ second.
   - Latch on/off = Tap button and the microphone path is enabled. Tap again to turn off.

5. **Button Two and Light** – Selects Audio channel two. The channel light has two modes depending on the <TALK> button's state.
   - Light Solid = Talk and Listen enabled.
   - Light Flashing = Listen only enabled. (Push-to-TX)

6. **Charge Jack** – Used to charge the internal battery or power unit directly off wall outlet. Accepts a 5.5mm x 2.5mm plug with the center positive. Must be supplied with a 12VDC regulated power supply with at least a 400mA current capacity.

7. **Charge Light**.
   - RED = Beltpack battery is charging.
   - GREEN = Beltpack battery is charged.

8. **Headset Connector** – Standard 4-pin XLR connector.

(1) Microphone Shield (-)
(4) Headphone Low (-)
(2) Microphone Audio (+)
(3) Headphone High (+)
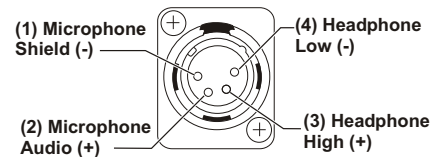
9. **Configuration Jack** – RJ-45 jack used to interface the beltpack to an Ethernet cable. Jack may be used for wired mode and configuring the beltpack.

**Beltpack Button Combinations (All have voice prompts):**

Wireless Mode .................Press <Talk> until unit is done booting

Wired Mode .....................Press <TWO> until unit is done booting.

Master Wireless Mode .....Press <ONE> until unit is done booting.

Momentary Mode.............Press <ONE> + <TALK> + <TWO>
(Push-to-TX full time)     for 3 seconds. Press the three buttons again to go back to the default "Push-to-Latch" mode.

Microphone Gain ............Press <ONE> + <TALK> for 3 seconds. Keep <TALK> held down and use <ONE> to decrease the gain, <TWO> to increase it. Release all buttons for at lease 1 second to set.

Sidetone Level.................Press <TALK> + <TWO> for 3 seconds. Keep <TALK> held down and use <ONE> to decrease the level, <TWO> to increase it. Release all buttons for at least 1 second to set.

# Section 4 - Specifications

## System Technical Specifications

RF Technology..........................................................................................IEEE 802.11 (WiFi)
Frequency Band of Operation .............................................................2.412 to 2.462 GHz
FCC License ..............................................................................No License Required
Encryption Technology.........................................64 bit (DES) Digital Encryption Standard

Audio Frequency Range...........................................400 Hz to 5500 Hz (+/- 1dB)
Dynamic Range...................................................................................>75 dB
Beltpack Headset Output .........................................200 mW into 300 Ohms (1% Distortion)
Beltpack Microphone Gain Adjustment .....................................10 Levels with Voice Prompts

Antenna (TR-24)..........................................................................Internal Dipoles
Antenna (BTR-24)..............................................Multiple omni and Directional available

BTR-24 (Base Station) Battery ........................................Lithium-Ion Rechargeable
BTR-24 Battery Life..............................................................10 Hr (Typical)
BTR-24 Recharge Time ........................................................10-14 Hr (Typical)
BTR-24 Low Battery Indication ..................................30 minutes of battery life left (Typical)

TR-24 (Beltpack) Battery.................................................Lithium-Ion Rechargeable
TR-24 Battery Life .................................................................8 Hr (Typical)
TR-24 Recharge Time..............................................................6-8 Hr (Typical)
TR-24 Low Battery Indication....................................15 minutes of battery life left (Typical)

BTR-24 (Base Station)Size.........................6.00" L x 7.63" W x 1.72" H (15.24cm x 19.37cm x 4.37cm)
BTR-24 Weight...................................................................2 lb 11 oz (1.2 kg)

TR-24 Size ..................................................5.25" L x 3.75" W x 1.68" H (13.33cm x 9.53cm x 4.27cm)
TR-24 Weight....................................................................12.5oz (354g)

Carry Case Size...................................23.50" L x 8.50" W x 20.50" H (59.70cm x 21.60cm x 52.07cm)
Carry Case Weight .......................................(Not Loaded with Equipment)12 lb 8 oz (5.44 kg)

# Section 5 - Operation

## Wireless Mode

### Description

The TR-24 has the ability to be booted in one of three modes. These modes are wireless, wired and master wireless. This section will discus the wireless mode.

The wireless mode is the most used mode of the beltpack. The wireless mode is set by holding the <TALK> button down as the unit boots. Then release it once a channel LED has lit indicating communication has started. In this mode the beltpack's radio is active and the bottom RJ-45 Ethernet connection is deactivated. The beltpack communicates to other beltpacks wireless via a base station (This base station could be another beltpack if it was set to boot in master wireless mode.). The base station serves as a "relay" for audio packets going between beltpacks. One base station can serve up to ten beltpacks in full duplex mode (simultaneous talk and listen).



**Figure 5-1**
**Ten Beltpacks in Wireless Mode**
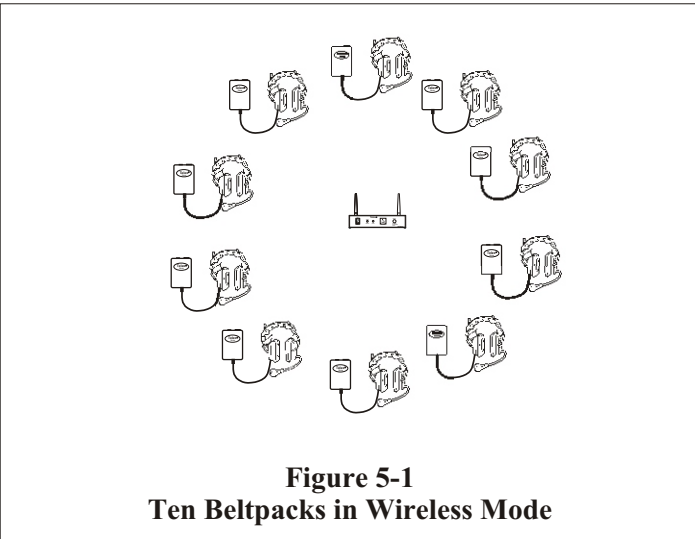
With ten beltpack in full duplex, up to 28 additional beltpacks can work off the base station if these beltpacks are in Push-to-TX mode. In Push-to-TX mode the beltpacks are listen only and the beltpacks' channel lights are flashing until the <TALK> button is active. At that point the beltpack transmits full time and is in full duplex mode until user disables the <TALK> button again.

**NOTE:** Only ten full duplex beltpacks can work off a base station. Thus the number of full duplex beltpacks on that base must be reduce by the number of Push-to-TX beltpacks that could become full duplex if their users press the talk button.

For example, a base station has 6 full duplex beltpacks and 28 Push-to-TX beltpacks. Up to 4 of the 28 Push-to-TX beltpacks could go to full duplex at the same time without reaching system limitations. If 5 of the Push-to-TX were to become full duplex, for a total of 11 full duplex beltpacks, the system would go beyond its loading limit and all users will start to experience drop outs and delays in audio.

Multiple base stations can also be utilized in an installation. The base stations have the ability to communicate to each other via an Ethernet network connected to the RJ-45 jack on the rear panel. The connection between bases could be a direct connection via an Ethernet cable (100m, 328ft Max.) or connected via the building's Ethernet infrastructure (See "Network Information" in the "Wired Mode" discussion for details.). Due to the base station's wired interconnection, the beltpacks of the various base stations can communicate with each other.

Ten full duplex beltpacks is still the limit even if multiple base stations, connected via Ethernet, in non-overlapping RF coverage areas, are in a system.



**Figure 5-2**
**Two Ethernet connected base stations in two different locations.**
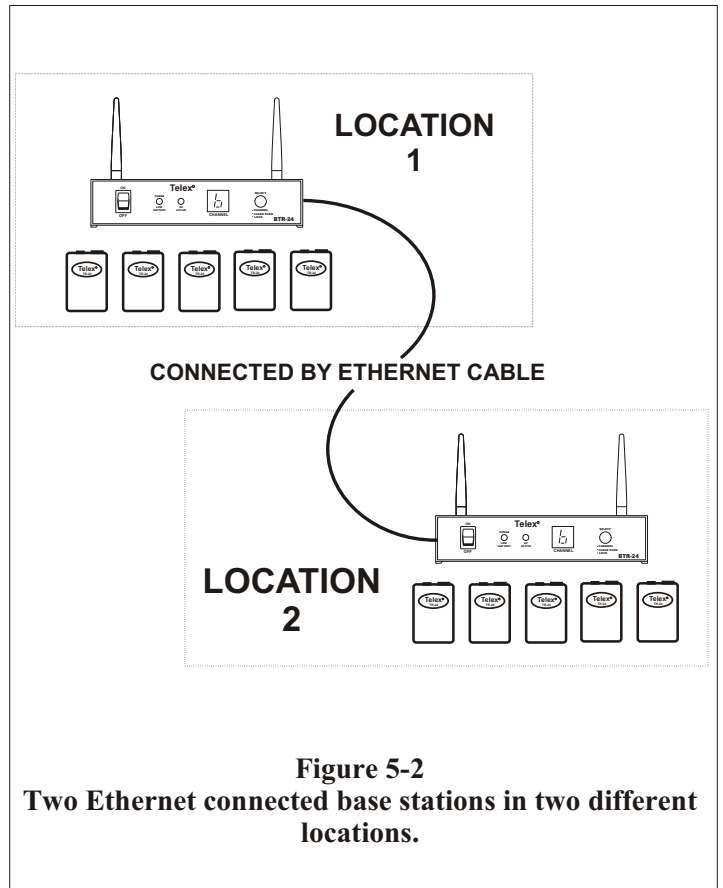
## Set-up

Below are instructions for the set-up and operation of a single BTR-24 with up to ten TR-24's.

- After 20 seconds a beltpack voice prompt will announce "wireless" in the headphone.

- Audio channel one's light will activate indicating communication has started.



**Figure 5-3**
**Front and Rear of BTR-24**

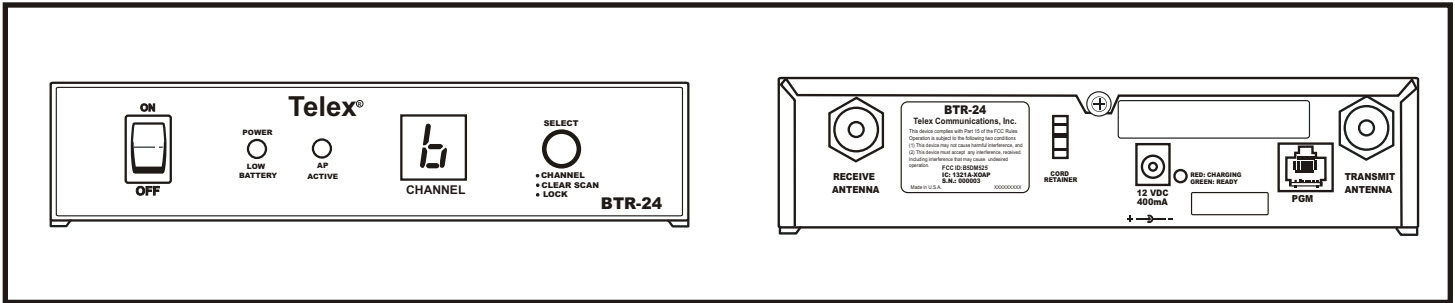1. Prior to use the TR-24 and BTR-24 should have their battery packs fully charged. Refer to the "Battery Charging Instructions" near the end of this section.

2. Plug the BTR-24's external power supply into an AC outlet if available. If external power is not available then the unit can run off internal battery.

3. Connect the antennas to the BTR-24.

4. Place the BTR-24's antennas in a location where they will have the best line-of-site to the area of coverage.

**NOTE:** The BTR-24 system operates in the 2.4 GHz spectrum. Keep coaxial cables as short as possible to reduce signal loss in the cable.

5. Power the BTR-24 by turning the power switch to ON.

   - The power light should immediately light solid.

   - After 20 seconds the base station will clear scan the spectrum and place the unit on the best RF channel.

   - After the scan, the AP Active light will flash, indicating a successful boot.

   - After the boot the user may clear scan again, manually set a RF channel or lock a channel. See section 2, "BTR-24 Controls and Connection", for details.

6. Plug headsets into the TR-24 beltpacks.

7. When the BTR-24 has finished booting, power-up the TR-24 beltpacks in wireless mode. The wireless mode is entered by holding the <TALK> button down as the unit boots. Once a beltpack was booted in a mode (wireless, wired, master wireless), the beltpack will always boot in that mode until the user sets a different boot mode.

   - The power light should immediately light solid.

## System Operation

By following the previous setup instruction, the system should now be up and running. Please read the following information for optimization / best performance of that system.

**Beltpack position -** When operating the system, wear the beltpack on the hip. Place it in a position that allows for greatest visibility to the BTR-24 antennas. The internal antennas for the TR-24 are on the sides of the beltpack case. For best visibility of antennas, do not place other objects within 6 inches (15cm) of the beltpack on the belt.



**Figure 5-4**
**Beltpack on Hip**

**Beltpack Audio Channels** -Press the <1> button for audio channel one only. Press the <2> for audio channel two only. Press both <1> and <2> buttons simultaneous to select both. Use the talk button to select between enabling / disabling the headset microphone path. The channel light(s) will blink if the microphone path is disabled. The light(s) will be solid if the microphone path is enabled. See table below for talk modes:

| <TALK> Mode | Description | Activation |
|---|---|---|
| Push-to-Latch/ Momentary | Microphone is enabled until the button is tapped again. | Tap <TALK> button. Tap again to turn off. |
| (default mode) | If held down for 1/2 second the microphone path is disabled on release. | <TALK> held down for over 1/2 second. |
| Momentary Only (Push-to-TX) | <TALK> button enables the audio path for only as long as it is held down. The beltpack will be in this mode until reset to push-to-latch mode. | Press <1> + <TALK> + <2> until voice prompt indicates momentary mode (about 3 seconds). Do again to go back to push-to-latch mode. |



**Figure 5-5**
**Top View of TR-24**

The sidetone (amount of your own voice fed back to your earphones) and microphone gain of the beltpacks may need adjusted from the factory defaults. The defaults are:

- Microphone Level = 4
- Sidetone Level = 2

**Microphone Level Adjust** – Press <1> + <TALK> until a voice prompt indicates microphone adjust mode has been entered (about 3 seconds). Keep holding <TALK> down and use the <1> button to decrease the level, <2> button to increase the level. Voice prompts will indicate the current level setting. Release all buttons for at least one second and the level will be set.

**Sidetone Level Adjust** – Press <TALK> + <2> until a voice prompt indicates sidetone adjust mode has been entered (about 3 seconds). Keep holding <TALK> down and use the <1> button to decrease the level, <2> button to increase the level. Voice prompts will indicate the current level setting. Release all buttons for at least one second and the level will be set.

## Wired Mode

### Description

The TR-24 has the ability to be booted in one of three modes. These modes are wireless, wired and master wireless. This section will discuss the wired mode.

The wired mode is set by holding the <2> button down as the unit boots. Then release it once a channel LED has lit indicating communication has started. In this mode the beltpack's radio is deactivated and the bottom RJ-45 Ethernet connection is active. The beltpacks communicate to each other via an Ethernet network connected to the RJ-45 jack on the bottom of the unit. No base stations are required for beltpacks to communicate with each other in this mode. The connection between beltpacks could be a direct connection via an Ethernet cable (100m, 328ft Max.) or connected via the building's Ethernet infrastructure (See "Network Information" for more discussion of details.).



**Figure 5-6**
**Ten TR-24's communicating via Ethernet Backbone.**

Up to ten beltpacks, in full duplex (simultaneous talk and listen), may communicate with each other over a Ethernet network. In fact do to the flexibility of the BTR-24 system, wired beltpacks connected via a hub to a network could communicate to a BTR-24 connected to the same network. This base station could then be connected wirelessly to other TR-24s operating in wireless mode.
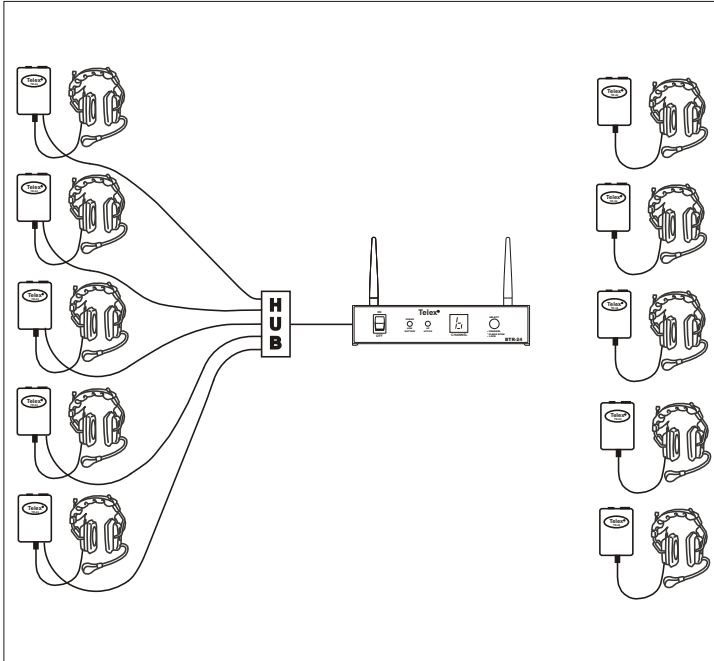


**Figure 5-7**
**Five Wired TR-24's communicating with 5 wireless TR-24's**

## Set-up

Below are instructions for the set-up and operation of a TR-24s connected via an Ethernet backbone.

1.  Prior to use the TR-24 should have their battery packs fully charged. Refer to the "Battery Charging Instructions" near the end of this section.

2.  Plug the TR-24's external power supply into an AC outlet if desired. If external power is not desired then run off internal battery.

3.  Connect the TR-24(s) to each other via an Ethernet backbone. Use category 5e or better Ethernet cables that are wired to standards T-568A or T-568B (Most all Ethernet cables are built to these standards).

    **NOTE:** Either straight through or crossover Ethernet cables my be used. The beltpack and base station automatically detect which type is connected.

4.  Plug headsets into the TR-24 beltpacks.

5.  Power-up the TR-24 beltpacks in wired mode. The wired mode is entered by holding the <1> button down as the unit boots. Once a beltpack was booted in a mode (wireless, wired, master wireless), the beltpack will always boot in that mode until the user sets a different boot mode.

    *   The power light should immediately light solid.

    *   After 20 seconds a beltpack voice prompt will announce "wired" in the headphone (The "wired" announcement will be followed by the software version within the unit.).

    *   Audio channel one's light will activate indicating communication has started.

**Beltpack Audio Channels** - Press the <1> button for audio channel one only. Press the <2> button for audio channel two only. Press both <1> and <2> buttons simultaneous to select both. Use the talk button to select between enabling / disabling the headset microphone path. The channel light(s) will blink if the microphone path is disabled. The light(s) will be solid if the microphone path is enabled. See table below for talk modes:

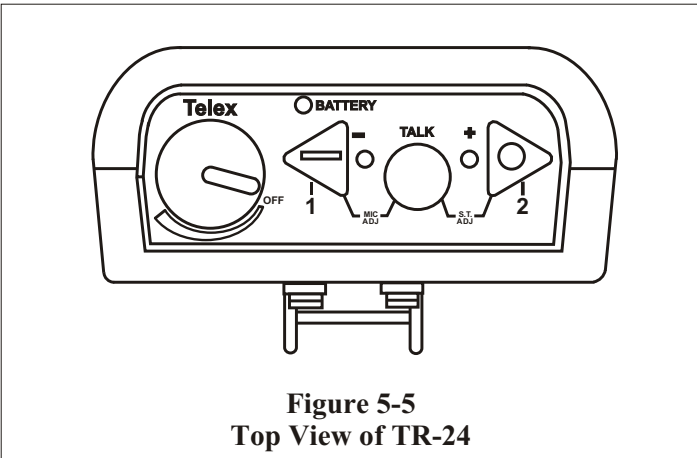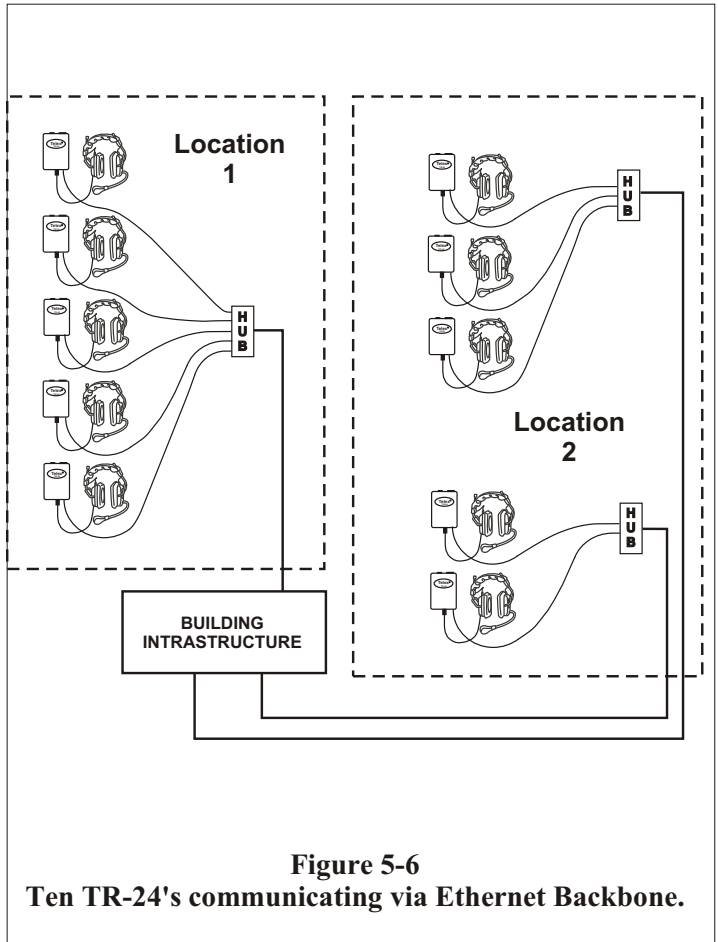| <TALK> Mode | Description | Activation |
|---|---|---|
| Push-to-Latch/ Momentary<br><br>(default mode) | Microphone is enabled until the button is tapped again.<br>If held down for 1/2 second the microphone path is disabled on release. | Tap <TALK> button. Tap again to turn off.<br><br><TALK> held down for over 1/2 second. |
| Momentary Only (Push-to-TX) | <TALK> button enables the audio path for only as long as it is held down. The beltpack will be in this mode until reset to push-to-latch mode. | Press <1> + <TALK> + <2> until voice prompt indicates momentary mode (about 3 seconds). Do again to go back to push-to-latch mode. |



**Figure 5-8**
**Top View of TR-24**

The sidetone (amount of your own voice fed back to your earphones) and microphone gain of the beltpacks may need adjusted from the factory defaults. The defaults are:
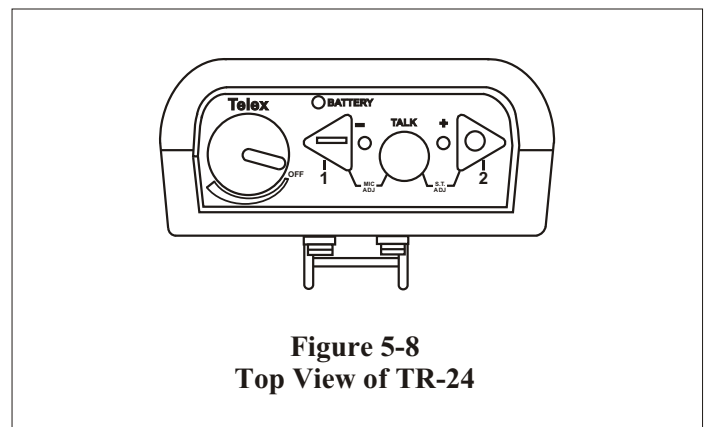
- Microphone Level = 4
- Sidetone Level = 2

**Microphone Level Adjust** – Press <1> + <TALK> until a voice prompt indicates microphone adjust mode has been entered (about 3 seconds). Keep holding <TALK> down and use the <1> button to decrease the level, <2> button to increase the level. Voice prompts will indicate the current level setting. Release all buttons for at least one second and the level will be set.

**Sidetone Level Adjust** – Press <TALK> + <2> until a voice prompt indicates sidetone adjust mode has been entered (about 3 seconds). Keep holding <TALK> down and use the <1> button to decrease the level, <2> button to increase the level. Voice prompts will indicate the current level setting. Release all buttons for at least one second and the level will be set.

## Network Requirements

These network requirements apply to interconnect BTR-24s as well as TR-24 in wired mode. In general the TR-24 and BTR-24s following the same rules as other Ethernet networked devices. These rules are:

1. All TR-24s and BTR-24 must have unique IP (Internet Protocol) addresses. This means no TR-24s or BTR-24s in a network should have the same IP address. Also, no other devices on the wired network should have the same IP addresses as the BTR-24s and TR-24s to be used.

2. Use category 5e or better Ethernet cables that are wired to standards T-568A or T-568B (Most all Ethernet cables are built to these standards.).

3. If direct connecting TR-24s or BTR-24s together, without the use of a building's network infrastructure, do not use more than 100m (328ft) of Ethernet cable between devices.

4. If using an existing building's Ethernet network, consult your network administrator as to the locations you plan on connecting your TR-24 or BTR-24s to the network. They can then check to make sure distance limitations of the network are met and that existing in-house router/switchers are set to pass TR-24 and BTR-24 packets.

   **NOTE:** All TR-24 and BTR-24 devices will appear to have the same MAC address to a network.

| Description | IP Type | Destination IP | Protocol |
|---|---|---|---|
| Audio 1 Packet | Multicast | 239.192.168.1 | UDP |
| Audio 2 Packet | Multicast | 239.192.168.2 | UDP |
| Audio 1 + 2 Packet | Multicast | 239.192.168.3 | UDP |

**TR-24/BTR-24 Wired Data Packets**

## Master Wireless Mode

### Description

The TR-24 has the ability to be booted in one of three modes. These modes are wireless, wired and master wireless. This section will discuss the master wireless mode.

The master wireless mode is set by holding the <1> button down as the unit boots. Then release it once a channel LED has lit indicating communication has started. In this mode the beltpack's radio is active and the bottom RJ-45 Ethernet connection is deactivated. This beltpack not only still functions as a beltpack, its now acting as a base station as well. One master beltpack can serve up to 9 other full duplex beltpacks.



MASTER TR-24 SERVING AS A BASE STATION
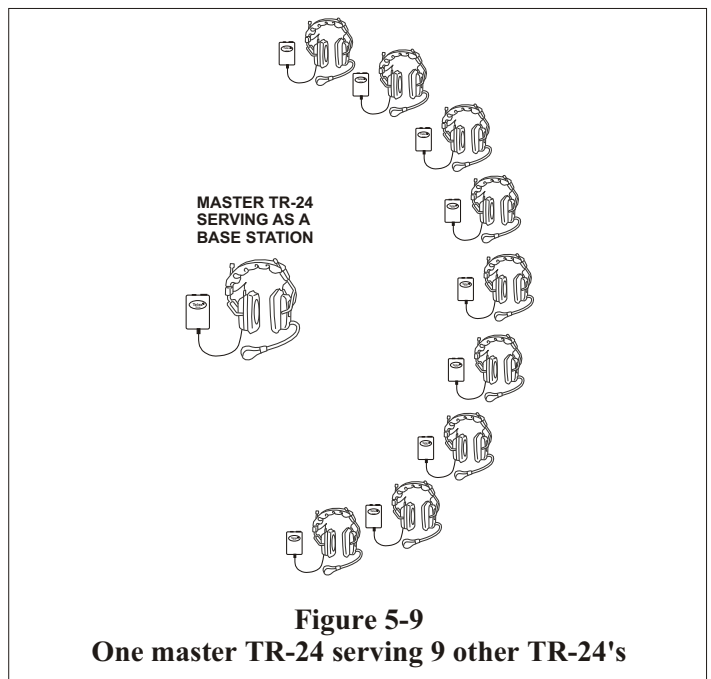
**Figure 5-9**
**One master TR-24 serving 9 other TR-24's**

### Set-up

Below are instructions for the set-up and operation of a single master TR-24 serving as a base station for up to nine other TR-24s.

1. Prior to use the TR-24s should have their battery packs fully charged. Refer to the "Battery Charging Instructions" near the end of this section.

2. Plug the master TR-24's external power supply into an AC outlet if desired. If external power is not desired then run off internal battery.

3. Place the TR-24's in a location where it will have the best visibility to the other TR-24s.

4. Plug a headset into the master TR-24 beltpack.

5. Power-up the master TR-24 beltpack in master wireless mode. The master wireless mode is entered by holding the <1> button down as the unit boots. Once a beltpack was booted in a mode (wireless, wired, master wireless), the beltpack will always boot in that mode until the user sets a different boot mode.

   • The power light should immediately light solid.

   • After 20 seconds a beltpack voice prompt will announce "master wireless" in the headphone.

   • Audio channel one's light will activate indicating communication has started.

6. Plug headsets into TR-24 beltpacks.

7. When the master TR-24 has finished booting, power-up the TR-24 beltpacks in wireless mode. The wireless mode is entered by holding the <TALK> button down as the unit boots. Once a beltpack was booted in a mode (wireless, wired, master wireless), the beltpack will always boot in that mode until the user sets a different boot mode.

   • The power light should immediately light solid.

   • After 20 seconds a beltpack voice prompt will announce "wireless" in the headphone.

   • Audio channel one's light will activate indicating communication has started.

## System Operation

By following the previous setup instruction, the system should now be up and running. Please read the following information for optimization / best performance of that system.
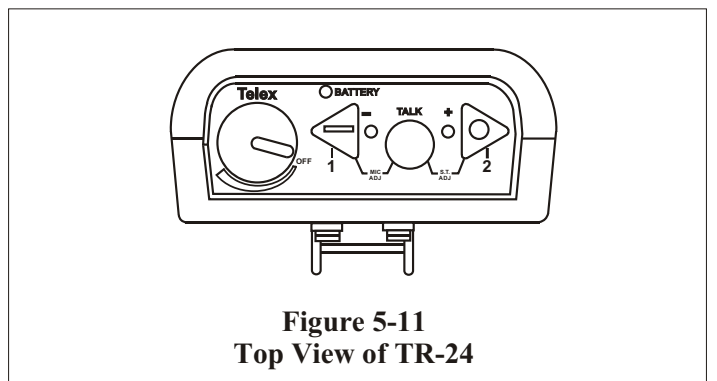
**Beltpack position -** When operating the system, wear the beltpack on the hip. Place it in a position that allows for greatest visibility to the master TR-24 antennas. The internal antennas for the TR-24 are on the sides of the beltpack case. For best visibility of antennas, do not place other objects within 6 inches (15cm) of the beltpack on the belt.



**Figure 5-10**
**TR-24 Beltpack on Hip**

**Beltpack Audio Channels** -Press the <1> button for audio channel one only. Press the <2> for audio channel two only. Press both <1> and <2> buttons simultaneous to select both. Use the talk button to select between enabling / disabling the headset microphone path. The channel light(s) will blink if the microphone path is disabled. The light(s) will be solid if the microphone path is enabled. See table below for talk modes:

| <TALK> Mode | Description | Activation |
|---|---|---|
| Push-to-Latch/ Momentary<br><br>(default mode) | Microphone is enabled until the button is tapped again.<br>If held down for 1/2 second the microphone path is disabled on release. | Tap <TALK> button. Tap again to turn off.<br><br><TALK> held down for over 1/2 second. |
| Momentary Only (Push-to-TX) | <TALK> button enables the audio path for only as long as it is held down. The beltpack will be in this mode until reset to push-to-latch mode. | Press <1> + <TALK> + <2> until voice prompt indicates momentary mode (about 3 seconds). Do again to go back to push-to-latch mode. |



**Figure 5-11**
**Top View of TR-24**

The sidetone (amount of your own voice fed back to your earphones) and microphone gain of the beltpacks may need adjusted from the factory defaults. The defaults are:

- Microphone Level = 4
- Sidetone Level = 2

**Microphone Level Adjust** – Press <1> + <TALK> until a voice prompt indicates microphone adjust mode has been entered (about 3 seconds). Keep holding <TALK> down and use the <1> button to decrease the level, <2> button to increase the level. Voice prompts will indicate the current level setting. Release all buttons for at least one second and the level will be set.

**Sidetone Level Adjust** – Press <TALK> + <2> until a voice prompt indicates sidetone adjust mode has been entered (about 3 seconds). Keep holding <TALK> down and use the <1> button to decrease the level, <2> button to increase the level. Voice prompts will indicate the current level setting. Release all buttons for at least one second and the level will be set.

## Tour Group Example

A good example of a master wireless mode application is a tour group within a noisy manufacturing environment.

As shown in the Figure, a single TR-24 is set to boot in "master wireless". This beltpack would be worn by the tour guide. The rest of the beltpacks are set to boot in "wireless" mode and Push-to-TX (Push-to-TX beltpacks have their <TALK> button set to momentary only). The tour group would wear these beltpacks.

The group size could be up to 28 people (or more) when the beltpacks are in Push-to-TX mode. This is because when in Push-to-TX mode the beltpacks are listen only, until the <TALK> button is active. At that point the beltpack transmits full time and is in full duplex mode until user releases the <TALK> button again. The group's TR-24s could also be used in push-to-latch mode (full duplex) for this application, but due to the greatly increase bandwidth requirement for this talk mode the group's size would be limited to 9 (Ten total if you include the tour guide's master beltpack).

**NOTE:** Only 9 full duplex beltpacks can work off a master beltpack. Thus the number of full duplex beltpacks working off that master beltapck must be reduce by the number of Push-to-TX beltpacks that could become full duplex, at the same time, if their users press the talk button.
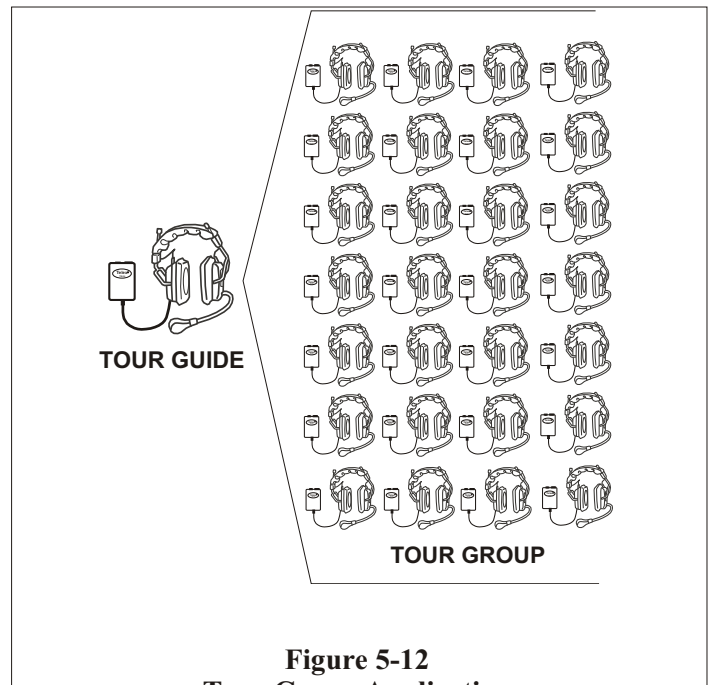


**Figure 5-12**
**Tour Group Application**

## Battery Charging Instructions

Charge the BTR-24 and TR-24 internal battery as follows:

1. Ensure the TR-24 beltpacks are in the "OFF" position.

2. Ensure the BTR-24 base stations are in the "OFF" position.

3. **TR-24 beltpack:** Plug the charger into the charge jack on the bottom of the beltpack. The beltpack should be charged in a room temperature location. The LED on the bottom of the unit indicates the charge status.

   - RED = Charging
   - GREEN = Charging Done

   A fully discharged beltpack will need to charge for at least 6 – 8 hours.

   Beltpacks may be left on charge indefinitely.

4. **BTR-24 base station:** Plug the charger into the charge jack on the bottom of the base station. The base should be charged in a room temperature location. The LED on the bottom of the unit indicates the charge status.

   - RED = Charging
   - GREEN = Charging Done

   A fully discharged base station will need to charge for at least 10 – 14 hours.

   The BTR-24 may be left on charge indefinitely.

# Section 6 - Encryption Code and Password

## Encryption Code

The BTR/TR-24 system uses a 64 bit DES (Digital Encryption Standard) encryption algorithm to encrypt all audio in the system. The beltpacks in the system have a "key" that the algorithm uses as the basis for the encryption. The same "key" must be used in all beltpacks on the system for communication to occur. The base station only relays the audio, and as such, does not need any encryption code set. The beltpack key can be anything from numbers to sentences to hexadecimal letters. For example the phrase, "The BTR-24 system works great for our customers", could be the "key" for the encryption. The only criteria is the phrase/numbers/letters be no more than 80 characters long (this includes spaces and punctuation).

This encryption is running on all units from the factory and does not have to be "activated" by the user. The user may want to change their key to something unique. Please see the "Logging into a unit" instructions in this section for details on changing the encryption key.

## Login Password

When a user logs into a beltpack or base station, he or she must enter a user login and password in order to proceed to the user menu.

- Login: **telex**
- Password: **legacy**

The login of "telex" cannot be changed, but for increased security the password can be changed via the user menu. Please see the "Logging into a Unit" instructions in this section for details on changing the password.

## Software Version

Below the password prompt on the user configuration menu screen (See Figure 6-1), the software version of the unit is displayed. Pay close attention to the revision letter and the date. These are the two items that change if the software changes. The line below the software version indicates the system type. All the units should indicate TR-24/BTR-24 on this line.

In addition to the software version being displayed on the user configuration screen, if a beltpack is booted in wired mode, it will announce the software revision letter one second after the "wired" voice prompt is heard.

## Logging into a Unit

**Computer Requirements:**
**Hardware**

- Monitor
- Keyboard & Mouse
- Network card (10 BaseT or 100 BaseT)

- Ethernet straight thru or crossover cable (Use the green cable supplied with the system.)

**Operating System**
Microsoft® Windows® 95/98, NT, 2000, XP

**Software**
Telnet or similar application that lets you communicate to a specified IP Address (Most all computers have telnet or a similar program installed on them by default).

The following instructions use Telnet and Windows® 2000 to log into the beltpack. Other applications and operating systems will be similar.

1. Unplug any current RJ-45 network connections from the computer.

2. With the mouse, right click the **My Network Places** con, then select **Properties**.

3. Select **Local Area Connection** and then right click. Select **Properties**.

4. Select **Internet Protocol (TCP/IP)** and click on the **Properties** button.

5. Now select **"Use the following IP address:"** option. Make a note of your current settings on this screen (so you can place them back when done logging into the beltpacks).

   Enter the following:
   a. IP address: 192.168.1.40
   b. Subnet Mask: 255.255.255.0
   c. Default gateway: 192.168.1.1

6. Once the above information is entered, hit the **OK** button. Hit the **OK** button on the next screen out if needed. Depending on your computer, you may need to reboot the computer for the IP address changes to take effect.

7. Plug one end of the supplied green Ethernet cable into the computer.

8. Start a "command prompt" console window by clicking on "Start" then moving the mouse arrow to Programs, then Accessories and finally clicking on "Command Prompt".

9. Press and hold down the "2" button on the beltpack. Keep holding the "2" button and turn-on the beltpack. Hold the beltpack button down until the green LED next to the "2" button lights up (about 20 seconds), then release button (Places the beltpack in wired mode).

6-1

10. Plug the other end of the Ethernet cable into the beltpack.

11. Type, telnet 192.168.1.X at the computer's command prompt, then press <ENTER>. Fill in for X the last digit of the IP address that is on the back label on the TR-24.

12. After about 20 seconds the beltpack will respond with a login request. Enter the following:

- Login: **telex <ENTER>**

- Password: **legacy <ENTER>**

    **NOTE:** The password entry does not give user feedback to the screen.

**NOTE**: If the computer says, "failed to connect", turn off the TR-24, check computer settings, and go back to step 6.

## User Menu Options

Once successfully logged into the base station or beltpack you will be presented with the following screen:



**Figure 6-1**
**User's Menu Screen**

The four options on this screen are as follows:

### 1. Enter new password

This option allows the user to change this TR-24's password. The default from the factory is **legacy**. The user is never allowed to change the login name of **telex**.

### 2. Display current encryption Key

Displays on the screen the current encryption key of the beltpack.

### 3. Enter new encryption key

The user must change the encryption key if this option is selected. Since a base station acts only as a relay for the audio packets it is not necessary to change its encryption key.

1. When "3" is selected the phrase, "Enter new encryption key" appears.

2. Now enter the new encryption key. The maximum length is 80 characters. Any combination of letters/numbers/punctuation may be used. Even a sentence such as, "My system is the best in the studio", may be used as the key. The key is upper and lower case sensitive.

**NOTE:** A character is letters, numbers, punctuation, spaces, etc.

**NOTE:** The "backspace" keyboard button may not work on all computers using Telnet, use the delete button instead if this is the case.

**CAUTION: Write down the key or use one that you can remember, because ALL beltpacks must have the same key entered in order for communication.**

3. Press <ENTER> after the key is typed. This will place the key in the software. Reboot the beltpack for the new encryption key to take effect.

### 4. Exit

This exits the login and closes the connection to the base station or beltpack.

# Section 7 - Battery Care/Long Term Storage

## Battery Care

To ensure the long life and safe handling of the Li-Ion battery within the BTR-24 and TR-24 please following the following precautions:

1. Store the TR-24s and BTR-24 in a clean, cool, dry location away from heat.

2. Do not store for extended periods of time in direct sunlight.

3. Do not disassemble the battery packs within the TR-24 or BTR-24.

4. Do not apply solder directly to the pack.

5. Do not puncture/crush or subject the TR-24 or BTR-24 to excessive impact.

6. Dispose of unit in proper recycling location for a device with a Li-Ion battery.

## Long Term Storage

"Long term storage" of the system is defined as no use of the system for 1 month or longer. Due to the internal Li-Ion batteries of the TR-24 and BTR-24, care should be taken in long term storage. Use the following steps to ensure the best performance of the system after it comes out of storage.

1. After the last event:

   • If the TR-24 or BTR-24 batteries were used for four hours or less then **do not** recharge the internal TR-24 or BTR-24 batteries. (Please see the discussion of "Li-Ion batteries" in the follow part of this section as to why)

   • If the TR-24 or BTR-24 batteries were used for more then four hours then recharge the internal TR-24 or BTR-24 batteries for two hours then take them off charge (Please see the discussion of Li-Ion batteries in the follow part of this section as to why)

2. Store the TR-24s and BTR-24 in a clean, cool, dry location away from heat. The temperature of the storage location **should not** rise above room temperature. The recommended temperature range of the storage location is 32 - 77 F (0 – 25 C).

3. Every 6 months charge the BTR-24 and TR-24 for three hours then take off charge. Do not fully charge. This prevents the battery from over discharging and helps maintain the battery's performance.

## Li-Ion Batteries

The Li-Ion batteries used in the TR-24 and BTR-24 are excellent batteries for portable, indoor/outdoor applications. They have a high energy density (energy per weight) compare to other rechargeable battery technologies (NiCd, NiMH, Alkaline, Gel Cells), are low maintenance, and offer superior performance at low temperatures.

For best performance after long-term storage, Telex recommends the batteries be charged to 30% - 50% of capacity before being placed in storage. This is the typical battery capacity left after 4 – 6 hours of full duplex use. Li-Ion batteries retain nearly all their capacity if stored for long term in dry, cool temperatures with only 30% to 50% charge. They can lose up to 20% capacity if stored for long term right after being fully charged.

# Section 8

Please reread the operation and encryption/password section of this manual to make sure you have completed system set-up properly. The following contains troubleshooting tips that may be helpful in solving the problem.

If you are unable to solve the problem, contact the manufacturer or dealer from whom you purchased the system for assistance.

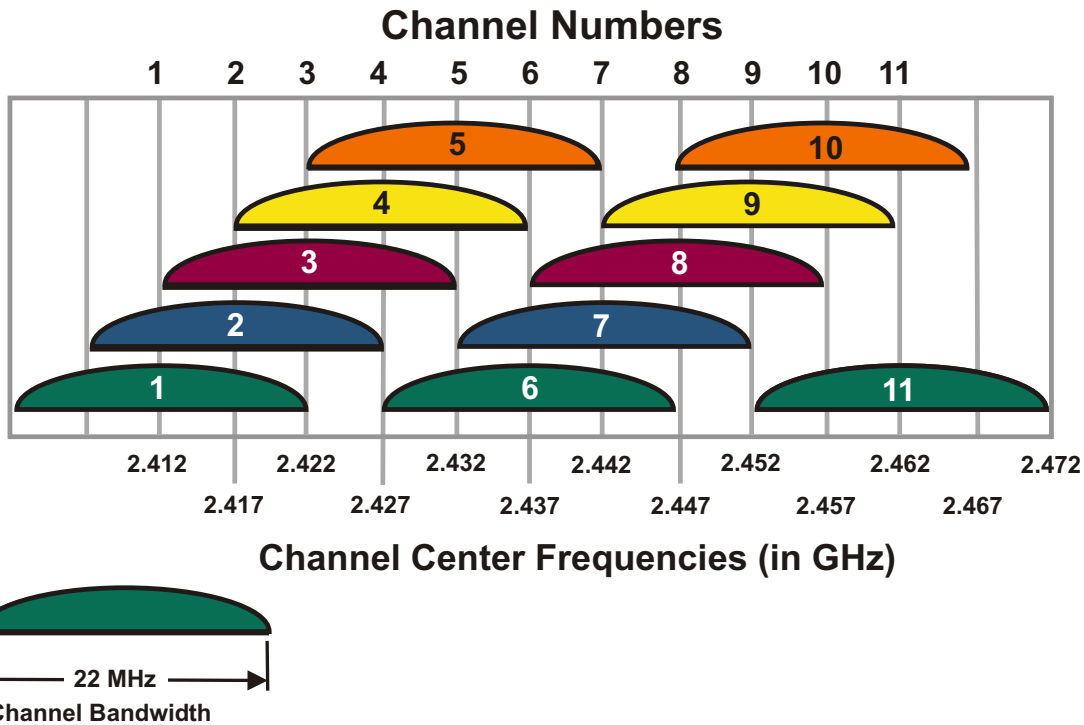| Problems | Possible Cause | Solution |
|---|---|---|
| RF range of all the beltpacks is less than normal and/or beltpacks are experiencing "break-up" of audio in an area where they have worked well in the past. | • Antenna is not connected to the BTR-24. | • Connect the antenna(s) to the BTR-24. If antenna has cables, make sure the correct cable of the antenna goes to the corresponding connector on the BTR-24. The BTR-24 front label indicates the transmit and receive connectors. |
| | • The two antenna connections are not connected to the right connectors on the BTR-24. | • The BTR-24 rear label indicates the transmit and receive connectors. If the antenna has cables the cables are labeled as to their connection point. |
| | • WiFi RF interference has occurred. | • Find the source of the interference and shut it down. Sources of WiFi interference could be: Laptop/Desktop computer with its wireless card on or WiFi AP in or near the press box. |
| | | • If the interference cannot be found or shut off then press and hold the <SELECT> button for 3 seconds (until the decimal point flashes), then release. The unit will do a clear scan and place itself on the clearest channel. The beltpacks do not have to be turned off, they will follow the BTR-24 to the new channel within a few seconds after the clear scan is done. |
| | • Non-WiFi RF Interference has occurred. | • Find the source of the interference and shut it down. Sources of interference could be: Microwave oven in, 2.4GHz cordless phone nearby, using a Bluetooth headset near the BTR-24 or beltpack. |
| | | • If the interference cannot be found or shut off then manually select a different RF channel by hitting the <SELECT> button. Make sure the new channel is at least several channels away from the old channel for the best chance of avoiding the RF interference. The beltpacks do not have to be turned off, they will follow the BTR-24 to the new channel after a few seconds. |

| Problem | Possible Cause | Solution |
|---|---|---|
| When the BTR-24 power switch was turned on nothing happens. The power light does not light. | • Internal battery is completely exhausted | • Plug the AC power plug into the BTR-24. Allow the unit at least 5 minutes for the internal battery to receive an initial charge. Then turn the unit on and run it off AC power. |
| When the BTR-24 power switch was turned on, the unit's power light came on but the system never booted-up after 25 seconds. | • Internal battery is nearly exhausted.<br><br>• On boot, an error was encountered and the unit could not finish boot-up. | • Charge the battery or run off external AC power.<br><br>• Power down the BTR-24, wait two seconds, then power-up again. |
| Can't change the RF channel the BTR-24 is on. | • The base station may be set to channel lock. This is indicated by a solid decimal point in the bottom right of the display. | • Hold the <SELECT> button down for about 10 seconds. This unlocks the RF channel lock button. A user could also reboot the BTR-24, but the beltpacks would need to be turned off until the BTR-24 finished booting, then turned on. |
| When the TR-24 beltpack power was turned on, the unit's power light came up, but the "1" button light never came up and communication never started. | • Internal battery is nearly exhausted.<br>• On boot, and error was encountered and the unit could not finish boot-up | • Charge the battery.<br>• Power down the TR-24, wait two seconds, then power up again. |
| Headphone audio from another beltpack(s) is loud and distorted. | • Microphone gain on the other beltpack(s) is set to high. | • Press and hold the <TALK> button and "1" button until the voice prompt indicates "MIC ADJUST" on the offending beltpack. While holding the <TALK> button, press and hold the "1" button to lower microphone gain. The factory setting is at the voice prompt "four" level. |
| Headphone audio from another beltpack(s) is too low. | • The headset's microphone on the other beltpack(s) is too far from the user's mouth.<br><br>• Microphone gain on the other beltpack(s) is set too low. | • Adjust the headset's microphone on the suspected beltpack so it is one index finger width straight out from the user's mouth.<br><br>• Press and hold the <TALK> button and "1" button until the voice prompt indicates "MIC ADJUST" on the suspected beltpack. While holding the <TALK> button, press and hold the "2" button to raise the microphone gain. The factory setting is at the voice prompt "four" level. |

# Section 9 - RF Channels

## 802.11 RF Channels

The BTR-24 system has the ability to operate on any one of eleven RF channels. Although there are several different frequency channel settings, there is overlap between the channels. There are three non-overlapping channels available in the FCC regulatory domain. When choosing frequency channels for systems in the vicinity of each other, you should choose frequency channels that do not overlap (e.g. Channels 1, 6, and 11).

**Channel Numbers**

1  2  3  4  5  6  7  8  9  10  11

**Channel Center Frequencies (in GHz)**

2.412   2.422   2.432   2.442   2.452   2.462   2.472

2.417   2.427   2.437   2.447   2.457   2.467

**22 MHz**

**Channel Bandwidth**

## TR-24 & BTR-24 RF Channelization Scheme

# Section 10 - Regulatory Information

## Regulatory Information

The TR-24 and BTR-24 comply with Part 15 of FCC rules and Canada RSS-210. Operation is subject to the following conditions:

1. This device may not cause harmful interference.

2. This device must accept any interference received, including interference that may cause undesired operation.

3. Use only the manufacturer or dealer supplied antenna(s), beltclips and/or accessories for this device.

4. The BTR-24 base station complies with FCC radiation exposure limits set forth for an uncontrolled environment. The antennas used with this equipment should be installed and operated with a minimum distance of 20cm between the antenna and your body.

5. This device and its antenna(s) must not be co-located or operated in conjunction with any other antenna or transmitter.

To assure continued compliance with FCC regulations, any changes or modification not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

# Section 11 - Accessories and Replacement Items

| Model Number | Part Number | Description |
|---|---|---|
| TR-24 | PRD000065000 | TR-24 Beltpack and US Power Supply. **NOTE:** User must provide the IP address of all TR-24/BTR-24s in system with order. |
| RPT-3 | 302054007 | 3 ft. coax with TNC reverse polarity plug connector. |
| RPT-10 | 302054008 | 10 ft. coax with TNC reverse polarity plug connector. |
| TNC-RP | 302054009 | TNC reverse polarity coupler. Coupler is a reverse polarity jack to jack. |
| CC-24 | 302054010 | Carry Case for BTR-24 System. |
| RA-3 | 302054003 | Omni Antenna (3dB) with TNC reverse polarity connector. |
| RA-7 | 302054004 | Omni Antenna (7dB) with TNC reverse polarity connector. |
| RA-5 | 302054005 | Omni Antenna (5dB) magnetic mount with TNC reverse polarity connector. |
| FP-11 | 302054006 | Flat Panel Directional antenna (11dB) with TNC reverse polarity connector. |
| AB-24 | 302054013 | Antenna mounting bracket for TNC reverse polarity conector with 6 ft coax cable. |

# Section 10 - Accessories and Replacement Items Continued

| Model Number | Part Number | Description |
|---|---|---|
| BTR-24 | PRD000066000 | BTR-24 Base Station and US power supply.<br>**NOTE:** User must provide IP address of all TR-24/BTR-24's in system with order. |
| SYS-243 | SYS000007000 | System includes Carry Case, 3 TR-24 Beltpacks, 1 BTR-24 Base Station, Omni antennas, rack mounts, 3' Ethernet cable, and US power supplies. |
| ANT-FP | 302054001 | Dual Diversity, Flat Patch Antenna with Dual Coax, 11dBi |
| ANT-FPM | 302054000 | Metal Tilt and Swivel Antenna Mounting bracket for ANT-FP Antenna. Use for permanent mount of ANT-FP Flat Panel Antenna. |
| XOB | 302054002 | Nylon Belt, Adjustable |
|  | 550257 | Communications Cable, Ethernet CAT. 5e Cable, 3 ft. |
| LG-PS | 532091000 | Charger for base and beltpack, 100-240 VAC input, 12VDC, 410mA output, 5.5 x 2.5 x 11mm jack |

**TELEX**®

**Bosch Communications Systems**

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