MOTOROLA

Professional Radio

P Series

Selling Guide

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Chapter 1

PRODUCT OVERVIEW

1.0 Introduction

This Selling Guide is intended to be a reference manual to help you sell the new Motorola P Series of Entry Level Professional Portable Radios.

This Selling Guide will allow you to answer the following questions:

- ☐ What products are in the P Series?
- ☐ What are the P Series product features?
- ☐ How do these features benefit my customers' business?

This Selling Guide complements the sales training and should be used in conjunction with a radio on a live system. This valuable hands-on experience will help you explain the benefits of the P Series to your customers.

GOOD SELLING!

1.1 How to use this Selling Guide

The Selling Guide is divided into three chapters -

Chapter 1 - The first chapter provides a general overview of the new Motorola P Series of Entry Level Professional Radios.

Chapter 2 - The second chapter describes the Features and Benefits of the product range and develops some ideas on how these features can benefit your customers' businesses.

Chapter 3 - The final chapter describes the Accessories available for the P Series and provides criteria for their correct selection.

2.0 The P Series of Entry Level Professional Portable Radios



Figure 1-1 The P Series of Entry Level Professional Portable Radios

Following the completion of extensive research with you our channel partners and your customers, Motorola have developed the P Series of Entry Level Professional Portable Radios.

Our customer-driven development process has ensured that these new radios meet the communication needs of your entry-level customers, allowing their businesses to operate more effectively and efficiently:

- ☐ High quality audio - helps to ensure that your customers' voice communications are understood first time
- ☐ Wide area coverage - keeps your customers in touch over a large range
- ☐ Easy to use - allows your customer to focus on the job in hand, not the radio in their hand
- ☐ Compact and Robust form factor - ensures that communications continue, even when the going gets tough.
- ☐ Affordable - for organisations where budget is paramount
- ☐ Expandability - supports field retrofit option board installation

With the P Series radios you are able to offer your customers a flexible communication solution that is easily customized using the programming software and a suitable personal computer.

2.1 Quality Assurance

The quality of Motorola's products is legendary and the new P Series of Professional Portable Radios is no exception.

2.1.1 Accelerated Life Testing

Each model in the P Series has passed, the rigorous Motorola Accelerated Life Test. This testing simulates 5 years hard use in the field and is a clear indication of Motorola's high build quality and product durability.

2.1.2 Environmental Protection

All P Series radios have been designed and tested by Motorola to meet the European standard specification IP54 and the US Military Standards 810 C,D and E.

IP54 : This standard demonstrates the radio's ability to withstand driving rain and dust directed at the radio from all directions.

Military Standards 810 C,D and E : These Military Standards ensure continued radio operation in rough environments. All radios in the P Series meet the following specifications :

- ❑ Low Pressure
- ❑ High Temperature
- ❑ Rain
- ❑ Humidity
- ❑ Salt Fog
- ❑ Dust
- ❑ Vibration
- ❑ Shock

2.2 Factory Mutual Approval (FM)

Factory Mutual (FM) radios have been approved by the Factory Mutual Research Corporation. All of the P Series of Professional Entry Level Radios are FM approved.

For details of the approval classifications, safety information and approved batteries, antennas and audio accessories, please refer to the FM Supplement 68P64111B10.

3.0 The P Series Radios

The P Series consists of two distinct tiers of entry level professional portable radios:

- ☐ P040 Entry Level Professional Radio
  - 4 Channels
- ☐ P080 Entry Level Professional Radio
  - 16 Channels
  - Display
  - Keypad

3.1 P040 Entry Level Professional Portable Radio

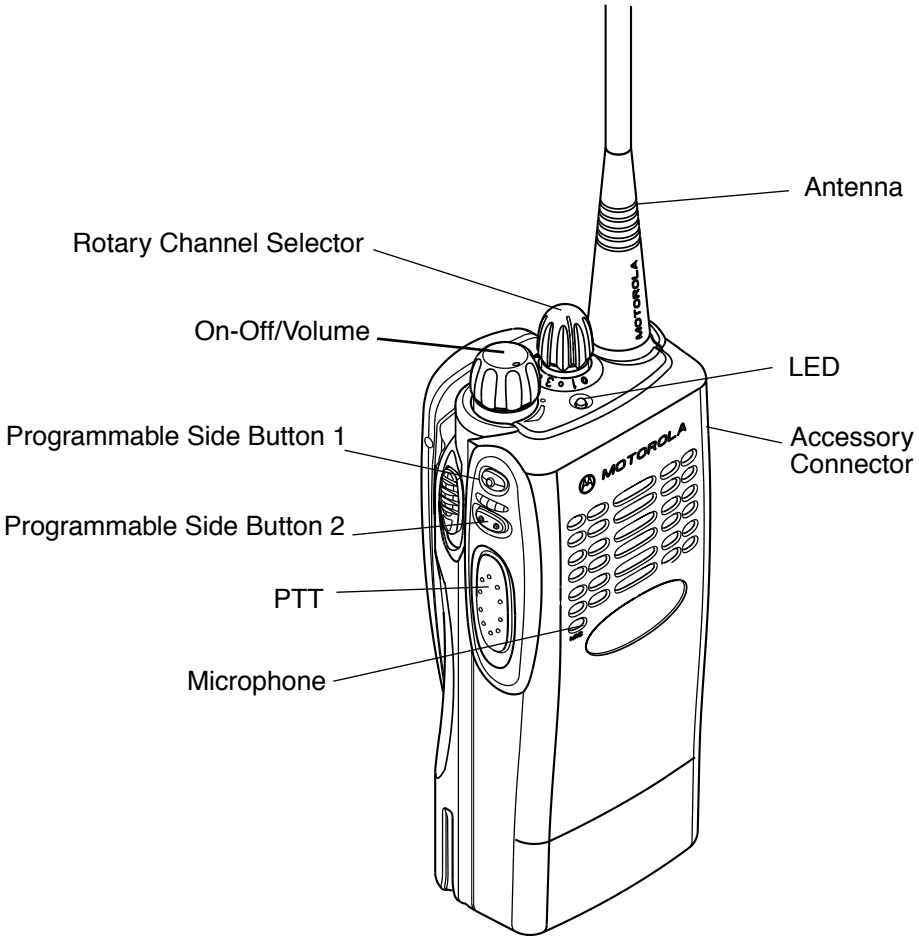


Figure 1-2 P040 Radio Description

3.2 P080 Entry Level Professional Portable Radio

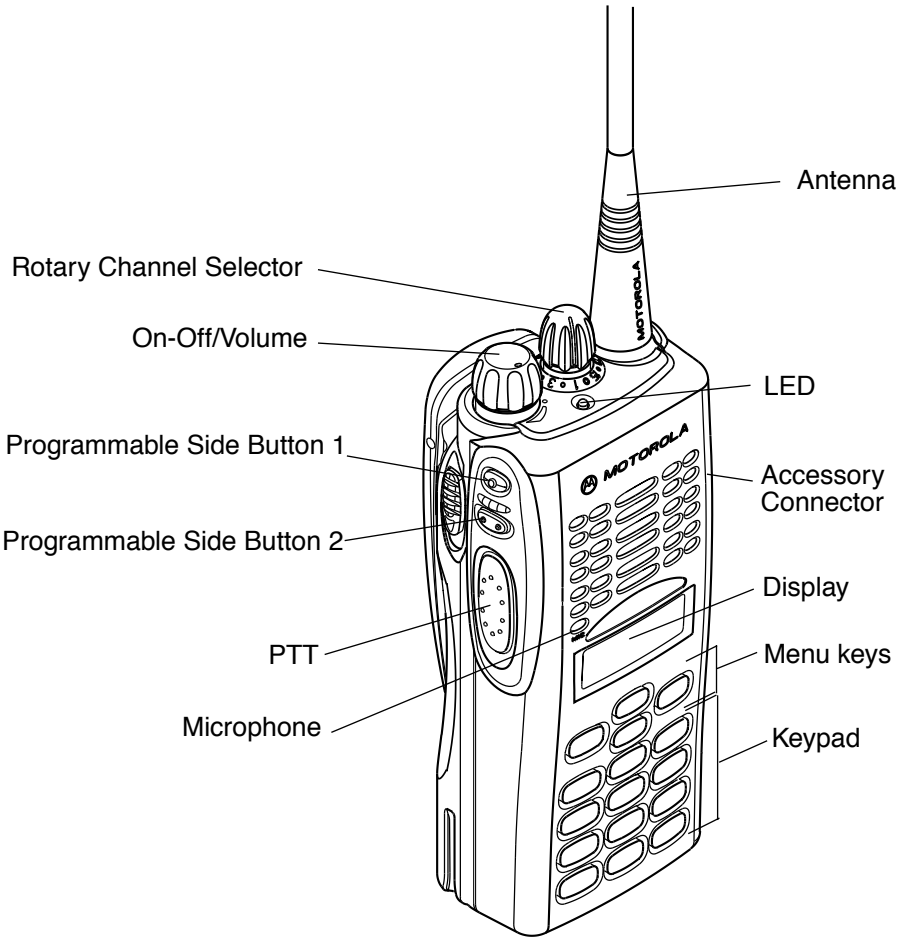


Figure 1-3 P080 Radio Description

3.3 Radio Comparison

The differences between the two P Series model tiers are summarised below:

Table 1-1 The P Series Entry Level Professional Portable Radios Comparison

Features	P040	P080
On-off / volume control	√	√
Rotary Channel selector	√	√
Number of channels	4	16
LED Indicator (Red/Amber)	√	√
Textured Programmable Side Buttons	2	2
Textured “Push To Talk” Button(PTT)	√	√
Option board Support	√	√
7 Character alphanumeric display		√
Menu Navigation keys		√
Keypad with 0 - 9, * and #		√
Accessory Connector	√	√

3.4 Sales Models

Table 1-2 The P Series Sales Models

Model Description	Frequency Band	Frequency Range	Power Level	Model Number
P040	VHF	136 - 174 MHz	1 - 5 W	MDH34KDC9AA1_E
P040	UHF I	403 - 470 MHz	1 - 4 W	MDH34RDC9AA1_E
P040	UHF II	450 - 527 MHz	1 - 4 W	MDH34SDC9AA1_E
P080	VHF	136 - 174 MHz	1 - 5 W	MDH34KDH9AA1_E
P080	UHF I	403 - 470 MHz	1 - 4 W	MDH34RDH9AA1_E
P080	UHF II	450 - 527 MHz	1 - 4 W	MDH34SDH9AA1_E

Benefits :

Wideband operation and programmable channel spacing means that you only need to stock a minimal number of different sales models to cover all of your customers' needs.

Note : Not all of the product variants listed above are available in every country due to differences in the local market requirements. Please refer to your price pages for the complete list of models available in your country.

3.5 Sales Model Package

All P Series packaged sales models consist of the following items:

- ☐ Radio
- ☐ High Capacity NiMH (Nickel Metal Hydride) battery
- ☐ Antenna
- ☐ Belt Clip
- ☐ User Guide

Battery, antenna and Factory Mutual (FM) options are available; please refer to your Price Pages for details.

3.6 Customer User Guides

The User Guide provides useful information for your customers on how to start using their new P Series radio. A copy of this multi-lingual booklet is included in every sales model box

The User Guide contains essential radio safety and care information, as well as advice on battery changing and battery care.

IMPORTANT: It is important that your customers read and understand this information. Please ensure that your customers receive this booklet when they receive their radio.

The information contained within the User Guide is available in the following languages:

- ☐ Czech
- ☐ English
- ☐ French
- ☐ Hungarian
- ☐ Polish
- ☐ Romanian
- ☐ Russian
- ☐ Turkish

Chapter 2

FEATURES AND BENEFITS

1.0 Introduction

This chapter describes those radio features that offer particular benefits to your customers' businesses. The intention of this chapter is to provide you with the supporting information you need to sell the P Series radios effectively to your customers.

The following section provides a summary of the features and benefits in tabular form, providing you with a quick reference guide to the radio.

Should your customers require further information, the features and benefits are described in detail in Section 3.

2.0 Feature/Benefits Summary

The following tables provide an overview of the many benefits provided by the P Series radio feature set.

2.1 Radio Handset Mechanics

Table 2-1 Radio Handset Mechanics Features and Benefits Summary

Feature	P040	P080	Benefit
MIL-SPEC 810C, D & E tested and approved	√	√	Ensures that communications continue in tough operating environments
IP54 tested and approved	√	√	Enables workers to keep talking even during severe weather conditions
FM approval	√	√	Allows your customer's personnel to use their P Series radios to stay in touch, even in hazardous locations
Compact Form Factor	√	√	The radio fits easily into the palm of the hand and is convenient to carry.
Lightweight Form Factor	√	√	The radio is comfortable to hold for long periods of time and is unobtrusive when clipped onto the user's belt
Contoured battery	√	√	The contoured battery case makes the radio comfortable to hold and use.
Quick and easy battery removal/replacement	√	√	The battery can be quickly replaced (even with cold or gloved hands) to ensure minimal disruption to communications
Simple Accessory Connector	√	√	Allows the quick and easy installation of a range of plug-in accessories to further enhance the radio's role as a fundamental business tool.
High Build Quality	√	√	The high build quality associated with all Motorola products ensures that the radio keeps on working in the roughest environments
Field retrofit Option Board expandability	√	√	Plug-in third party option boards provide affordable add-on functionality

2.2 Radio Handset Ergonomics

Table 2-2 Radio Handset Ergonomics Features and Benefits Summary

Feature	P040	P080	Benefit
Rotary Channel Selector	√	√	Allows easy selection of channels, even with gloved hands and while the radio is attached to the user's belt.
Microphone Label	√	√	The location of the radio microphone is clearly labelled to prevent the user from accidentally obstructing it while transmitting.
LED Indicator	√	√	The user is constantly informed of the various states of radio operation, even in noisy environments.
Programmable Function Buttons	√	√	Enables the user to perform essential communication operations at a press of a button
Audio Indicators	√	√	Provides the user with instant and easily understood confirmation of the outcome of a function button press.
Volume Set Tone	√	√	Allows the user to adjust the speaker volume to the optimum level for the current working environment
Display		√	Provides the user with additional information and allows the user to access an extended set of features and benefits.
Display Backlight		√	Ensures that the user can easily to read the display even in low light conditions
Keypad		√	Enables the user to transmit DTMF tones over-air and initiate selective calls*
Intuitive Menu Navigation Keys		√	Enables the user to activate the required radio function quickly and with minimal training

* Selective calling is only possible if a suitable third-party option board has been installed within the radio (eg. SmarTrunk II)

2.3 Audio Enhancement

Table 2-3 Audio Enhancement and Benefits Summary

Feature	P040	P080	Benefit
Audio Processing Filter (APF)	√	√	Ensures messages are easier to understand by enhancing receive audio quality
X-Pand™	√	√	Provides telephone audio quality - helps to ensure that messages are easily understood first time
Audio Pre-emphasis/De-Emphasis	√	√	"Shapes" the Rx and Tx audio signal to increase clarity

2.4 General Operational Capabilities

Table 2-4 General Radio Operational Capabilities Features and Benefits Summary

Feature	P040	P080	Benefit
Programmable Channel Spacing	√	√	Ensures that your customer's investment is future-proof; allows migration to a system with different channel spacing without having to purchase new radios
Wide Band	√	√	Means that you only have stock a minimal number of models to cover all of your customer's requirements.
Multiple Communication Channels	4	16	Provides your customers with the communication capacity they need to operate efficiently.
Private Line™ (PL) Signalling	√	√	Enables your customers to divide their workforce into discrete communication groups, maximising efficiency and effectiveness.
Variable Squelch Settings	√	√	Allows the user to set the most appropriate squelch setting to eliminate unwanted background channel noise
Choice of Unmute/Mute Rules	√	√	Flexibility ensures that the most effective communication solution is provided to your customer
Monitor	√	√	Enables the user to check that the channel is free before transmitting
Busy Channel Lockout	√	√	Transmit is only allowed if the channel is free. This further enforces channel discipline by preventing users from talking over the top of each other.
Scanning	√	√	Simplifies multi-channel operation and ensures that the most important calls are always received.
Repeater Talkaround	√	√	Ensures that, in the absence of the repeater, communications continue at the press of a button.
Receive Only Channel	√	√	Enforces channel discipline by preventing users from talking over a central dispatcher
Time Out Timer	√	√	Enforces communication discipline and prevents a single user from "monopolising" a channel
Channel Alias		√	Improves ease-of-use and communication efficiency
High/Low Transmit Power Selection	√	√	Enables the end user to optimize communication coverage while conserving battery consumption and extending battery life.
VOX	√	√	Enables your customers to operate "hands free"
Phone System Compatibility		√	Means that your customer's radio fleet can communicate freely with wireline telephone users - improves customer satisfaction by providing a direct communication link with customers.
Front Panel Test		√	Allows your customer's users to verify the operation of their radios, without having to return them to a support centre.

3.0 Detailed Features/Benefits Description

The following sections describe in detail the significant benefits that your customers will derive from the key features provided by the new Motorola P Series of Entry Level Professional Radios.

An in-depth understanding will allow you to better explain the benefits to your customers and consequently help you to "make the sale".

3.1 Mechanical Features

3.1.1 Compact Weight and Form Factor

The dimensions and weight of the new P Series radios are:

Table 2-5 Weights and Dimensions

Configuration	Height (mm)	Width (mm)	Depth (mm	Weight (g)
With standard NiMH Battery	137.0	57.5	37.5	429
With NiCd Battery	137.0	57.5	40.0	454

Their compact design means that the new P Series radios are comfortable to use and unobtrusive to carry. This is a significant benefit for workers who use and carry their radios all day, every day.

Every P Series radio comes with a convenient belt clip as standard.

The full range of carry accessories is described later in Chapter 3.

3.1.2 Option Boards

You can further enhance the functionality of the new P Series radios by installing a third party option board.

The P Series radios provide interfaces to support a range of different types of option board. The most important option board interfaces are:

Simple Selcall :

The Simple Selcall interface serves as a basic interface to the radio, it provides the following capabilities to an option board designer:

1. Per channel Enable/Disable (through CPS Option board enable)
2. Hardware Auto PTT (key-up) capability
3. Unmuted Receiver Audio Path, and Transmitter Audio Path Access
4. "SelCall Response" via Option Board Decode interrupt

Typical applications include :

- ❑ Voice Scramblers (eg. Transcrypt)

Full Serial (Simple and Advanced) :

The basic difference between Simple and Advanced Full Serial is in the number of commands supported. The Advanced Full serial supports more commands than the Simple Full Serial interface, thus allowing more radio feature controls accessible to the Advance Full Serial board.

The Full Serial interface acts as an advanced Bi-directional interface to the radio, it provides the following capabilities to an option board designer :

1. Serial Peripheral Interface (SPI) based Bi-directional Communication between the option board and the radio
2. Hardware Auto PTT (key-up) capability
3. Unmuted Receiver Audio Path, and Transmitter Audio Path Access
4. Download configuration data to the option board upon radio power up and channel change
5. Provides high level software interface between radio and option board
6. Capable of updating the radio status to the option board
7. Message Control from option board to radio.

Typical applications include :

- ❑ Trunking Application (ie: SmartTrunk II)

For information regarding the operation of these third-party option boards, and the considerable benefits they provide, please contact the appropriate supplier. Recommended third-party supplier internet sites are:

SmarTrunk Systems Inc http://www.smartrunk.com/

Transcrypt International http://www.transcrypt.com/

3.2 Ergonomic Features

3.2.1 Rotary Channel Selector

The rotary channel selector knob is conveniently located on the top of the radio to allow easy operation, even when the radio is attached to the user's belt and is being operated from above.

The channel positions are clearly labelled, allowing the user to instantly determine the selected channel.

The knob itself has been designed to make it easy to operate, even when the user's hands are cold or gloved.

3.2.2 Microphone Label

The built-in radio microphone is clearly labelled "MIC".

This prevents users from obstructing the microphone while transmitting and clearly indicates which part of the radio the user should speak into to ensure optimal audio clarity.

3.2.3 LED Indicator

The LED Indicator is conveniently located on the top of the radio, making it easy for the user to see at all times, even when the radio is being worn on a belt.

The LED Indicator provides instant visual feedback to the user regarding power-up, power level, transmit/receive state, scanning and battery state.

Different modes of LED Indicator operation can be selected using the CPS to provide different types of information. The information provided by the different LED Indicator modes is summarised below:

Normal Operation :

Table 2-6 Normal Operation

LED State/Colour	Indication
Power Up Temporary continuous GREEN	Radio performing self test
TX/RX Continuous RED Blinking RED	Radio Transmitting Radio receiving carrier
Scan* Blinking GREEN	Scan Active
Low Battery Blinking RED while transmitting	Low Battery Level

Tx Power Operation:

As above except when the radio is transmitting, the following operation occurs to indicate whether high or low power is selected:

Table 2-7 Tx Power Operation

LED State/Colour	Indication
TX/R	
Continuous RED	High Power
Continuous GREEN	Low Power

Tx Battery Operation:

As above except when the radio is transmitting, the following operation occurs to provide detailed information about the battery charge state:

Table 2-8 Tx Battery Operation

LED State/Colour	Indication
TX/RX	
Flashing GREEN	Battery is fully charged
Continuous GREEN	Optimal battery charge level

Table 2-8 Tx Battery Operation (Continued)

LED State/Colour	Indication
Continuous ORANGE	Battery half charge level
Continuous RED	Low battery charge level
Flashing RED	Very low battery charge level

3.2.4 Programmable Side Buttons

The two programmable side buttons may be programmed (using the CPS) to allow quick and easy activation of up to four functions. Each button can activate two different functions by differentiating between a short and a long press:

- ☐ Short Press - quickly pressing and releasing the buttons.
- ☐ Long Press - pressing the button for a defined period of time (set using the CPS) before releasing.

Please note that some functions (ie. Monitor and Volume Set) are activated by a "press and hold" button operation. In this case, the button does not differentiate between a short and long press and can only be programmed to activate the single function.

The two side buttons are physically separated by a moulded ridge in the radio housing, allowing the user to easily locate the required button without having to look at the radio. Typically, the user will be able to feel this ridge even while wearing gloves.

Quick fingertip identification of the correct button is further assisted by the different texture patterns moulded onto the buttons themselves.

To eliminate user uncertainty, the radio provides audio feedback to indicate whether the button activation has been successful:

Table 2-9 Side Buttons Audio Feedback

Tone Format	Meaning
single high pitch	OK
single high pitch tone/double high pitch tone	toggle function on/off
single low pitch tone	failure

The functions that can be assigned to the side buttons are summarised in the following table:

Table 2-10 Side Button Programmable Features

Function	Description	P040	P080	Benefit
Monitor	Allows the user to bypass the current squelch criteria setting and listen to the channel activity	√	√	Enables the user to decide when it is OK to transmit without disrupting an ongoing conversation
Volume Set	Generates a tone to allow the user to set the speaker volume to the desired level	√	√	Enables the user to set the radio volume to an appropriate level for the current working environment
Toggle scan On/Off*1	Turns scanning on or off	√	√	Provides a quick and easy method of starting and stopping the scanning function.
Nuisance Delete*1	Temporarily deletes the landed channel from the scan list. To reinstate the channel, simply stop and re-start scanning.	√	√	Enables the user to ignore irrelevant conversations and focus on meaningful information
Toggle High/Low Power	Switches between the high and low transmit power settings	√	√	Provides the user with a means of optimizing battery life (eg. switch to high power only when working at a remote location)
Toggle Repeater Talkaround*2	Switches the radio between "normal" and "talkaround" operation	√	√	Enables the user to quickly resume communications when either the repeater fails or the user moves out of the repeater coverage area
Toggle Tight/Normal Squelch*3	Switches between the "Tight" and "Normal" squelch settings	√	√	Enables the user to quickly set the optimum squelch setting for the current operating environment
Light	Turns the display backlight on or off		√	Enables the user to set the most appropriate display setting for the light conditions
Phone	Switches between "normal" and "phone" operation		√	Enables the user to easily change the radio operating mode
Speed Dial	Enables instant access to specific entries in the phone address list		√	Facilitates rapid phone call set-up
Keypad Lock On/Off	Enables /disables the radio front keypad		√	Enables the user with a convenient method for preventing accidental keypad presses.

*1 See section 3.4.6 for a description of the Scan function

*2 See Section 3.4.7 for a description of the Repeater Talkaround function

*3 See Section 3.4.2 for a detailed description of Tight/Normal Squelch

3.2.5 Audio Indicators

A key goal of the P Series radios is to maximise the efficiency of your customer's workforce by enabling them to keep in touch without distracting them from their work.

To support this goal, the radio provides audio feedback to inform the user of it's operating status, without requiring the user to take his eyes away from his current task

The specific information provided by Audio Alerts includes :

- ❑ Tx Low Battery : this alert tone is sounded after a transmission, when the PTT has been released, when the low battery threshold has been reached.
- ❑ Rx Low Battery : this alert tone is produced at regular intervals (set using the CPS) while the radio is receiving a call, and the low battery threshold has been reached.

The P series radios provide many other types of convenient audio feedback; descriptions of other Audio Alerts are included in the other sections of this chapter.

Note : You are able to set the optimum Alert Tone volume for your customer's working environment using the "Tone Volume Offset" field in the CPS.

3.2.6 Display

The P080 models have a built-in LCD display which supports :

- ❑ 7 "starburst" format characters : enables your customer's workforce to use their radios more efficiently by supporting Channel Aliasing and menu-based function activation
- ❑ 9 icons : the top row of the display consists of intuitive icons that provide the radio user with quick visual indication of the radio's current operating status. The different icons are described below in table 2-11

Table 2-11 Icon Description

Symbol	Name and Description
	**Companding Indicator** Indicates that companding is active.
	**Power Level Indicator** “L” is lit up when your radio is configured to transmit in Low Power, while “H” is lit up when your radio is configured to transmit in High Power.
	**Phone Indicator** Indicates that you are performing a Phone operation.
	**Scan Indicator** Indicates that you have activated the Scan feature.
	**Priority 1 Scan Indicator (● flashing)** During Scan, indicates that there is some activity on a Priority 1 channel.
	**Monitor Indicator** Indicates that you are monitoring the selected channel.
	**Talkaround Indicator** When lit, indicates that you are not transmitting through the repeater. When not lit, you are transmitting through the repeater.
	**Programming Mode Indicator** Indicates that you are editing one of the Program Lists.
	**Keypad Lock Indicator** Indicates that your keypad is locked.
	**Option Board Indicator** Indicates that an option board is activated.

The Display is illuminated to ensure continued ease of operation in poor light conditions.

The **Auto Backlight** function, programmable via the CPS, causes the display to be automatically illuminated whenever a keypad button is pressed. After a short period of inactivity the illumination automatically turns off to conserve battery power.

It is also possible to programme one of the side buttons to activate the display backlight.

3.2.7 Keypad

The P080 has a 3 x 4 CCITT keypad that supports the following functions:

- ☐ Telephone communications - the keypad generates DTMF tones which enable communications with telephone users, provided that the appropriate "telephone interconnect" infrastructure has been installed and configured.
- ☐ Infrastructure access - some third-party infrastructure equipment requires a DTMF "access tone" to be sent before dialling can commence. This prevents unauthorised use of the communication system.
- ☐ Selective calling - requires a suitable third-party option board to be installed inside the radio (eg. SmarTrunk II)

The keys are clearly labelled for quick and easy operation.

Using the CPS, **Key-press Confirmation Tones** can be enabled to provide the radio user with audible indication that a key-press has been successfully completed. This eliminates operator uncertainty and the associated frustrated repeat key presses

The keypad operation can be configured for live or buffered dialling :

- ☐ **Live Dialling** : the radio automatically keys up the radio and transmits the DTMF tones as the keypad buttons are pressed
- ☐ **Buffered Dialling** : the DTMF tones are stored up and sent when the radio user presses the PTT button.

When used to communicate with a telephone system, the keypad can be configured as a "Hot Keypad", automatically switching the radio into phone mode as soon as a keypad button is pressed. This function increases ease of use and operator efficiency.

3.2.8 Menu Navigation Keys

The P080 has four Menu Navigation Keys on its front panel, which enable the radio operator to navigate through the hierarchy of Function Menus.

As with the keypad buttons, Key-press Confirmation Tones can be enabled to provide the radio user with audible indication that a key-press has been successfully completed.

The Menu Navigation Keys are described below in Table 2-12.

Table 2-12 Menu Navigation Keys

Key	Function
	**Exit :** Use this button to leave the current menu and move back to previous level in the menu hierachy (short press) or exit Menu Mode entirely (long press)
	**Menu/Select :** Use this button to enter the Menu Mode. When in Menu Mode, use this button to make Menu selections
	**Scroll Up :** Use this button for scrolling through menu choices while in Menu Mode. May also be used as a backspace when editing
	**Scroll Down :** Use this button for scrolling through menu choices while in Menu Mode. May also be used to move the cursor right or inserts a space when editing

3.3 Audio Quality Enhancement

3.3.1 Audio Processing Filter

The Audio Processing Filter (APF) is basically an audio high pass filter that can be programmed to be either on or off using the CPS.

You will need to decide whether or not to activate the APF, depending upon the typical profile of the receive audio on your individual customer's systems:

The default APF setting is "off". If the receive audio contains mainly low frequency components, APF should be remain turned off for optimum audio clarity.

If the receive audio contains mainly high frequency components, APF should be turned on to enhance the audio clarity.

3.3.2 X-Pand™ Voice Compression

X-Pand™ voice compression combines **two** audio quality enhancement features:

Companding :

Companding ensures more efficient communications by delivering clear audio that is easier to listen to and understand. This feature saves time by reducing the need to repeat messages.

Companding is the term used to define **comp**ressing the audio signal on transmission and exp**anding** the audio signal on reception. The overall effect is to reduce noise in the received signal, providing crisper, clearer audio clarity.

Companding and Low Level Expansion (see below) are mutually exclusive; enabling one automatically disables the other.

IMPORTANT: TO BENEFIT FROM COMPANDING, ALL RADIOS ON THE SYSTEM MUST HAVE THE FEATURE SWITCHED ON.

Low Level Expansion (LLE):

Low Level Expansion cuts out the unwanted noise usually heard during pauses in conversations, thus making communications easier to understand.

Low Level Expansion and Companding are mutually exclusive; enabling one automatically disables the other.

Low Level Expansion is enabled by default (ie. the radios ship with LLE activated) and is automatically disabled when Companding is selected in the CPS.

The X-Pand™ technology also maximizes communication coverage by enabling low-level signals, that would otherwise be "lost" amongst the background channel noise, to be heard.

3.3.3 Audio Pre-emphasis and De-emphasis

The Audio Filter IC within the radio's circuitry performs RX and TX audio shaping (ie. filtering, amplification and attenuation) to improve overall audio quality and increase voice clarity.

Pre-emphasis is performed on transmission whereas de-emphasis is the complimentary process performed on reception. The CPS allows the flexibility of selecting pre-emphasis, de-emphasis, both or neither on a per-personality basis.

3.4 General Operational Capabilities

3.4.1 Private Line™ Signalling

Motorola Private Line™ enables your customers to effectively manage their communications resources by allowing different groups of radio users to share a common channel, without disrupting each other's conversations.

In technical terms, Private Line™ (PL) is a "squelch code" that acts as a filter on the communication channel - if PL is being used, only communications with the appropriate PL are heard; communications with the wrong PL are filtered out.

To fully understand the benefits of PL, imagine that one of your customers is a large Do-It-Yourself (DIY) retail outlet:

After consulting with the customer you agree that the anticipated communications traffic can be supported by a single channel system (i.e. transmit and receive frequency pair). However, the workforce consists of several distinct groups of sales assistants working within the various different store departments.

You decide to configure the customer's radios to support several different PL codes, to differentiate between the different departments. You configure the radios with 4 different personalities, each assigned to a different position on the rotary channel selector knob. To the end user, it appears that the radio supports four distinct channels. In reality each “channel” is a different personality using the same frequency channel. This is shown in table 2-13:

Table 2-13 Channel Examples

Channel	Department
1	Plumbing
2	Lighting
3	Timber
4	Hardware

The squelch on channel 2, for example, will only open when the "lighting" PL code is present.

This allows the staff working the Lighting department to use channel 2 without having their concentration interrupted by communications from the other departments. Similarly, conversations between the Lighting department staff will not disturb the other groups.

If the store manager receives a customer query relating to the availability of a hardware product, he can simply click to position 4 on the channel selector knob and talk to the Hardware department, without disturbing the staff in other departments.

PL is often a licensing requirement for community repeaters where several different companies share a common repeater infrastructure. PL prevents communications from one company being heard by the others (and vice versa).

The Motorola Private Line™ signalling system actually consists of two different signalling schemes:

- ❑ TPL - Tone Private Line - sub-audio tones continually transmitted with the audio signal (also called CTCSS - Continuous Tone Controlled Signalling System)
- ❑ DPL - Digital Private Line - sub-audio digital code continually transmitted with the audio signal

Another benefit of using PL is that it eliminates the annoying "squelch tail" typically associated with two-way radio communications. The elimination of the squelch tail improves the quality of communication and means that conversations are easier to follow and understand.

The squelch tail is a short burst of channel noise heard by the receiving radio when the PTT is released on the transmitting radio. This is caused because the receiving radio does not immediately recognise that the transmission is over and squelch is momentarily held open, even though carrier is not present.

PL prevents this by generating a reverse burst (for TPL) or a "turn off code" (for DPL) at the transmitting radio when the PTT is released. The receiving radio instantly recognises the reverse burst (or turn off code) and squelches the speaker audio.

The reverse burst (or turn off code) can be enabled or disabled using the CPS.

The P Series CPS allows you to program different transmit and receive PL codes on a per-channel basis. TPL codes within the frequency range 67.0Hz to 254.1Hz (inclusive) are supported, as well as the standard EIA/TIA-603 codes (including 2 non-standard codes).

3.4.2 Variable Squelch Settings

The Squelch setting, programmed into the radio on a per-channel basis, sets the criteria for unmuting the radio speaker.

The Squelch setting ensures that the radio user only hears the necessary conversations - unwanted channel noise is effectively filtered out.

The P Series radios support two different types of Squelch :

- ❑ Carrier Squelch : the radio speaker unmutes whenever carrier is detected on the channel
- ❑ PL Squelch : the radio speaker unmutes when the appropriate receive PL code is detected on the channel

The Squelch feature uses a threshold value to determine whether a received signal is strong enough to produce a clear communication; if the signal strength exceeds the threshold , the radio unmutes. The radio can be programmed to allow the user to change this threshold value between:

- ☐ Normal Squelch : to be used under normal operating conditions, where channel noise levels are low.
- ☐ Tight Squelch : selecting tight Squelch increase the Squelch threshold value. This means that only the strongest signals will cause the speaker to unmute. Tight Squelch should be enabled when channel noise signals are sufficiently strong to cause the speaker to unmute while Normal Squelch is selected.

The radio user can toggle between Normal and Tight Squelch by using either the programmable side buttons or the menu and navigation keys.

The Monitor function bypasses the Squelch setting and allows the radio user to listen to all channel activity.

3.4.3 Mute/Unmute Rules

Using the CPS, it is possible to programme the P Series radios with different mute/unmute rules. This allows you to match the radios to your customer's specific requirements.

The CPS allows you to select, on a per-channel basis, the rule that the radio uses to open and close its speaker. The choice of rules is:

Table 2-14 Mute/Unmute Rules

Rule	Mute/Unmute Operation
Standard Unmuting/ Standard Muting	The radio speaker unmutes on reception of the appropriate PL code and mutes on loss of the appropriate PL code
And Unmuting/ Standard Muting	The radio speaker unmutes on reception of the appropriate PL code AND carrier is detected, and mutes on loss of the appropriate PL code.
And Unmuting/Or Muting	The radio speaker unmutes on reception of the appropriate PL code AND carrier is detected, and mutes on loss of the appropriate PL code OR loss of carrier.

Note : These Mute/Unmute rules are only available when the specific radio personality has its Receive Squelch Type set to TPL or PL.

3.4.4 Monitor

The Monitor function increases the effectiveness of your customer's communication system by allowing the radio user to listen to the communication channel before transmitting. The user is therefore able to ensure that she only transmits during a quiet period and avoids interrupting any ongoing conversations involving other workers.

This function is particularly useful on a PL system, where several different groups of workers share the same channel. The Monitor function bypasses the PL squelch filter and allows all conversations on the channel to be heard.

The Monitor function can be assigned to one of the programmable side buttons - all channel activity is heard as long as the appropriate side button is pressed.

Some community repeater licenses insist that users are able to monitor the channel before transmitting.

Note : It is not possible to Monitor a channel if the corresponding radio personality has been programmed for Busy Channel Lockout. If the radio user presses the Monitor button while on a channel with Busy Channel Lockout enabled, the audio error tone will sound.

3.4.5 Busy Channel Lockout

The Busy Channel Lockout feature helps to ensure effective and efficient communications by preventing radio users from transmitting over the top of ongoing conversations.

Busy Channel Lockout also increases system privacy by preventing radio users from activating the Monitor function and listening to conversations that are not intended for them. This is particularly relevant to your customers who share a community repeater with other organizations.

The P Series radios support two different sets of criteria for activating Busy Channel Lockout:

Table 2-15 Channel Busy Lockout Criteria

Criteria	Operation
On Busy Channel	Prevents transmission on the current channel when carrier is detected. This prevents the user from interrupting any ongoing conversation on the channel.
On Busy Channel with Wrong PL	Prevents transmission on the current channel when carrier is detected with a PL code that does not match the current channel receive PL code setting. This prevents the radio user from interrupting any ongoing conversation on the channel OTHER THAN a conversion involving the appropriate PL group.

Busy Channel Lockout may be configured on a per-channel basis.

Note : if Busy Channel Lockout has been configured for a channel, the radio user will not be able to activate the Monitor function on that specific channel.

To better understand the benefits of Busy Channel Lockout, consider the following hypothetical customer application:

A security firm have approached you to help them increase the effectiveness of their staff at a local shopping mall. You have discovered that the shopping mall is already supported by a community repeater which is used by shops based in the complex, and suggest equipping the security guards with P Series radios.

The terms and conditions for using the community repeater licence state that the customer's radios must not interrupt the conversations of the other organizations, or be capable of eavesdropping.

You are able to meet these requirements by supplying your customer with P Series radios with "Busy Channel Lockout" enabled on all channels. This will allow the security staff to communicate without interfering with, or over-hearing, the conversations involving the other organizations.

If you program the radios for Busy Channel Lockout on Busy Channel, only one member of the security team will be able to transmit at any time. This configuration would prevent a member of the security team from transmitting when ANYONE else is transmitting, regardless of whether the transmitter is another security guard or someone from one of the shops.

If, however, the customer wishes to allow his team members to interrupt each other (eg. "break through" an ongoing conversation in the event of an emergency) then you would programme the radios for Busy Channel Lockout on Wrong PL. This configuration would prevent a security guard from talking over somebody from another organization, but would permit talking over another security guard.

3.4.6 Scanning

Scanning greatly simplifies the operation of the radio for those of your customers who have multiple channel systems. This feature ensures that incoming calls are not missed, even when they originate from more than one channel.

The ability to start and stop Scanning can be assigned to one of the programmable side buttons, allowing the radio operator to use scanning when it is most appropriate.

Alternatively, on a P080 model, Scanning can be started and stopped using the menu and navigation keys.

The benefits that your customers can derive from the Scanning-related features are summarised in the following table.

Table 2-16 Scanning Features

Feature	Benefit
Scanning	Enables calls originating on multiple channels to be received.
TalkBack	Enables the radio user to join conversations discovered on other channels
Designated Tx Channel	Allows the radio user to respond to a received call on a designated "home" or "emergency" channel
AutoScan	Simplifies radio operation
Priority Channel Scan	Ensures that priority calls are received
Priority Scan Alert	Makes the radio user aware that the received call is likely to be important
Scanned Channel Discovery Alert	Enables radio users (especially those with non-display models) to resume an ongoing conversation
PL Scan Lockout	Minimises radio user distraction caused by non-relevant conversations

The remainder of this sub-section provides a more detailed description of the Scanning-related features and benefits.

A **"Scan List"** consisting of the channels that should be monitored for activity is programmed into each radio. A different Scan List can be assigned to each channel personality, with each Scan List capable of containing up to 16 different member channels.

When scanning is activated, the radio automatically cycles around each channel in the list checking for relevant voice activity. While searching for activity, the radio is said to be in **"Active Scan Mode"**

When relevant activity is discovered on one of the scan list channels, the scanning process is temporarily suspended and the radio is said to be in **"Landed Scan Mode"**. When the scan has "landed" on a channel, and the squelch conditions are met, the speaker unmutes and the radio user hears the conversation on that channel.

When the conversation ends, the radio waits for further activity for a programmable period of time (the duration of the **"Scan Hang Timer"**). If no further activity is discovered, the scan process is resumed and the radio switches back into Active Scan Mode.

Scan **TalkBack** enables the radio user to join in with a conversation discovered during scanning. The radio user has until the Scan Hang Timer expires to reply to a voice communication on the relevant landed channel.

An alternative to replying on the landed channel is to specify a **Designated Tx Channel** using the CPS. To help understand how this works, consider the following situation:

- ❑ A radio user initiates scanning by pressing one of the programmable side buttons and the radio lands on channel 2, where a relevant conversation is taking place.
- ❑ The radio user wishes to join the conversation and pushes the PTT button. Channel 4 has been set as the Designated Tx Channel and hence the radio user begins transmitting on channel 4 (which would typically be the radio user's "home" or "emergency" channel)

To simplify the radio operation for your customer's staff, **AutoScan** can be programmed on a per-channel basis. This feature automatically activates Scanning when the radio user switches to a channel with AutoScan enabled.

To further enhance the scanning process, it is possible to nominate the first channel in the scan list as a **Priority Scan Channel**. Typically, the Priority Scan Channel is an "emergency" or "supervisor" channel used for urgent or important communications.

If a Priority Channel has been appointed, it is checked for activity after each other member channel is checked. ie the order in which the radio checks each Scan List channel for activity is:

Scan List Channel 1

Scan List Channel 2

Scan List Channel 1

Scan List Channel 3

Scan List Channel 1

Scan List Channel 4

Scan List Channel 1

etc

Priority Scanning ensures that your customer's important calls are received.

The Priority Scan Channel is regularly monitored, even when the radio has landed on a non-priority channel. ie, when activity has been discovered on a non-priority channel and the conversation is being listened to, the radio continually switches to the priority channel to check for activity.

This continual checking does, however, cause momentary breaks in the audio being received from the non-priority channel. The time interval between checks on the Priority Channel is determined during programming by the **"Priority Sample Time"**

If activity is discovered on the Priority Channel while the radio has landed on a non-priority channel, the non-priority transmission is dropped and the radio switches to the Priority Channel. This priority override capability ensures that your customer's workforce always hears the most important communications.

If activity is discovered during Active Scan Mode, and the radio lands on the Priority Channel, it can be programmed to sound the **"Priority Scan Alert"**. This alerts the radio user that the current conversation is likely to be important.

If, during scanning, the radio repeatedly lands on a channel that is of no interest to the radio user, the radio can be configured to allow the user to temporarily remove that channel from the scan list. This feature is called **"Nuisance Delete"** and can be activated by simply pressing one of the programmable side buttons.

Nuisance Delete increases the productivity of your customer's workforce by preventing staff from being unnecessarily distracted from their tasks.

If Nuisance Delete has been activated and one of the channels has been removed from the scan list, the nuisance channel can be re-instated by simply stopping and restarting scan.

Another useful scan-related feature is the **"Scanned Channel Discovery Alert"**. If this feature has been enabled (using the CPS) the radio will sound an audible alert when the radio user selects (using the rotary channel knob) the channel that last unmuted during scanning.

This feature informs the radio user which channel was last active during scanning and allows him to continue communicating with the same group of people.

Scanned Channel Discovery Alert is particularly useful on the P040 radio where no visual channel indication is provided when the radio lands during scanning.

Scanning can be made more efficient and convenient for the radio user by enabling **"PL Scan Lockout"**. This clever feature enhances Scan performance by temporarily removing a channel from the Scan List when activity is discovered with the wrong PL code. The channel is reinstated after a predetermined number of scan cycles or when activity has ceased. To understand the benefit of this feature, consider the following scenario:

- ☐ During Scanning, the radio discovers activity on channel 5. However, the radio user is not part of the PL Group currently talking on channel five.
- ☐ PL Scan Lockout effectively causes the radio to temporarily ignore channel 5 and focus attention on other the other channels in the Scan List, where more relevant conversations may take place

PL Scan Lockout is particularly useful when the radio has landed on a non-priority channel but continues to monitor the Priority Channel for activity. If there is activity with the wrong PL on the priority channel, the intermittent check on the Priority Channel is temporarily suspended. This means that the short breaks in the non-priority channel audio (caused when the radio moves off to check the priority channel) temporarily cease.

3.4.7 Repeater Talkaround

You may have customers who need to extend their communications coverage. This may be necessary to communicate over distances beyond the "back-to-back" range of the P Series radios, or to eliminate a communications "blind spot" created by a hill or large building. The communication requirements of such a customer can be fulfilled by employing a repeater.

To better understand the requirement for Repeater Talkaround, consider the following typical customer scenario :

Consider a dockyard where Worker A needs to communicate with Worker B. A repeater is necessary to overcome the blind spot created by a large warehouse. This situation is described below in Figure 2-1.

When Worker A presses the PTT, the radio transmits on frequency F1. The repeater receives Worker A's communication on frequency F1 and re-transmits it on frequency F2. The radio being used by Worker B receives the call on frequency F2. Similarly, when Worker B replies on F1, the repeater re-transmits on F2 for Worker A to receive.

In summary, all radios using the repeater transmit on frequency F1 and receive on frequency F2. This mode of communication is often called "semi-duplex".

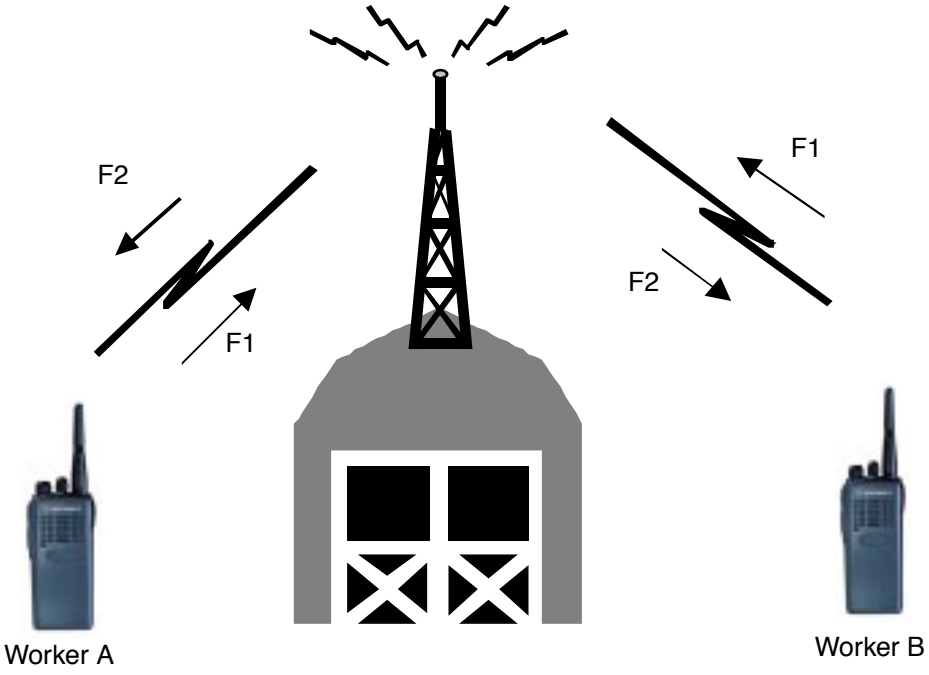


Figure 2-1 Repeater Operation

However, if the repeater is taken offline for maintenance or a group of workers moves outside the repeater coverage area, communications can no longer continue using different transmit and receive frequencies (ie. if Worker A transmits on F1, the call will be missed because Worker B is listening on F2). Repeater Talkaround provides a simple solution to this problem.

Now consider the scenario presented in Figure 2-2. Worker A and Worker B are working at a remote location, outside the coverage area of the repeater. While their radios are configured for repeater operation, they are unable to communicate.

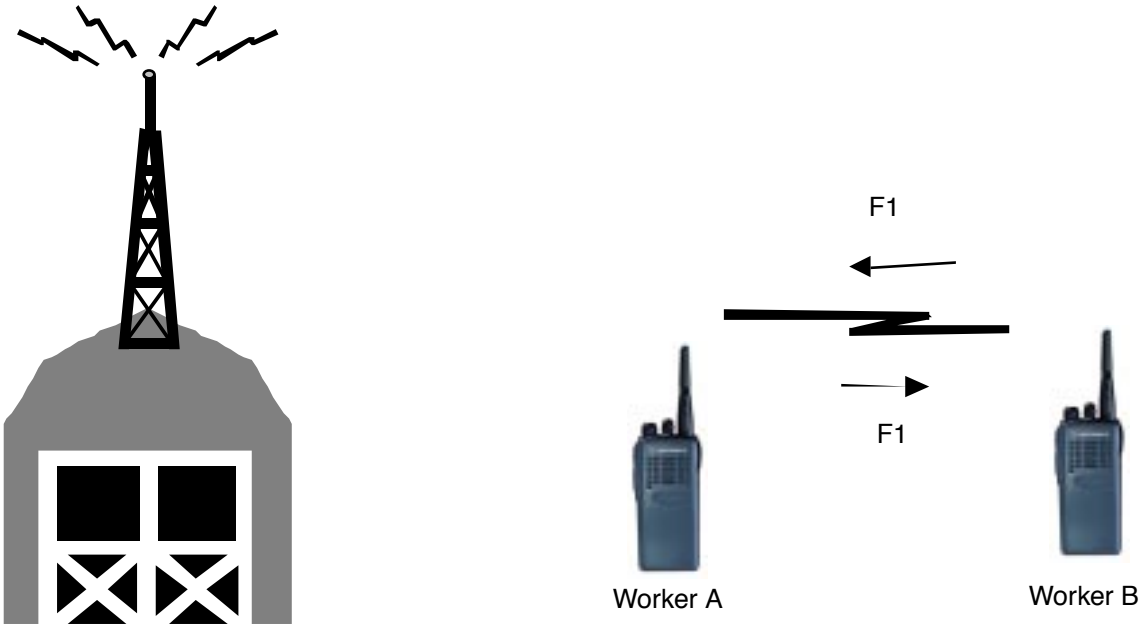


Figure 2-2 Repeater Talkaround

In order to communicate with each other, Worker A and Worker B simply switch their radios into Repeater Talkaround mode (one of the side buttons may be programmed to toggle between repeater operation and Repeater Talkaround).

When Repeater Talkaround is activated, the radio's transmit and receive frequency are automatically configured to be the same, bypassing the repeater. This is often termed "back-to-back" or "simplex"communication.

Later, when the two worker move back into the repeater coverage area they simply switch their radios back to repeater operation to communicate with their other colleagues.

3.4.8 Receive Only Channel Personality

Using the CPS you are able to programme channels to be Receive Only (ie. the radio user is unable to transmit on those channels designated Receive Only).

This feature allows your customer to effectively manage his communication system. For example, consider the following customer requirement:

You are asked to implement a simple, reliable communications system for a major road construction project. After a detailed analysis of the communication requirements, you identify several critical operations that need careful co-ordination.

One of the critical tasks is positioning large concrete bridge supports. This operation requires the precise co-ordination of several teams of workers (eg. crane operators, ground-based labourers, architects and surveyors, etc.). A site manager is responsible for co-ordinating these different teams of people.

This particular requirement calls for guaranteed one-way communication from the manager to the other groups. You therefore propose to programme channel 1 as Receive Only on all radios except the site manager's.

3.4.9 Time Out Timer

The Time Out Timer (TOT) enforces communication discipline by limiting the amount of time that a radio can constantly transmit. This prevents a single radio user from tying up the entire channel for long periods of time and ensures more efficient channel use.

The TOT is activated, and it's duration is set, using the CPS. The duration of the timer can be set to between 15 and 180 seconds.

The TOT is started when the radio operator presses the PTT. If the TOT expires, the transmission is curtailed and the user must release and re-press the PTT to continue transmitting.

3.4.10 Channel Alias

The P080 radio has a 7-character display that allows a meaningful name to be assigned to a channel. This simplifies end-user operation and enables more efficient communications amongst your customer's mobile workforce.

To better understand the benefits of Channel Alias, imagine that you have been asked to set up a simple communications system for medium sized factory. Working closely with the customer, you have identified a number of distinct groups within the workforce, each with different communication needs.

To support these workgroups, you create a number of different channels:

Table 2-17 Channel Alias example

Channel	Channel Alias	Workgroup
1	SOS	The "emergency" channel, reserved for critical situations.
1	STORES	Members of staff working in the materials stores
2	LINE 1	Supervisors supporting Production Line 1
3	LINE 2	Supervisors supporting Production Line 2
4	WRHOUSE	Members of staff working in the warehouse
5	SECURTY	Security personnel
6	FACILTY	Members of the facilities support department

In reality these channels may be differentiated by TX/RX frequency and PL code (ie. some channels share the same frequency but have different PL codes, whereas other channels are on completely different frequencies). However, this technical differentiation is hidden from the end-users; they simply have to select the appropriate channel alias to communicate with the team of people they need to talk to.

So, to talk to the workers in the materials stores, the end-user simply clicks through the different channels (using the rotary selector) until "STORES" is displayed, and pushes the PTT button.

Similarly, if the factory manager has Scanning activated (see earlier section for description of Scanning), and a call involving the warehouse staff is taking place, "WRHOUSE" is displayed and the manager knows immediately with which group of people she is communicating.

3.4.11 High/Low Transmit Power

The P Series radios support two different output power settings. If required, one of the radio side buttons can be programmed to allow the user to switch between these two settings.

The ability to choose between high and low transmit power enables your customer's workers to either:

- ❑ Select the low power setting to maximise battery life
- ❑ Select the high power setting to maximise communication range

For example, consider the requirements of a forestry worker:

While working relatively close to his fellows workers, he selects the low power setting to conserve battery power.

However, when he is working at a remote location, he simply selects the high power setting to ensure that he is still in touch with the rest of the team.

3.4.12 VOX

The VOX feature built into all P Series radios enables your customer's staff to operate the radio in hands-free mode. This increases the productivity of the workforce by allowing calls to be made and received without the need for staff to have to stop working and put down their tools.

This capability would be of significant benefit to a construction site worker, allowing him to receive or give instructions while operating a crane (or other piece of machinery).

Another typical application is a supermarket, where floor staff need to liase with warehouse staff to ensure shelves are kept stocked. The VOX capability means that the floor staff have their hands free to move or count stock, while the warehouse staff are free to drive forklifts or carry boxes.

VOX operation requires the use of a special headset - calls are automatically made whenever the radio user talks into the headset microphone.

Once the headset is fitted to the radio via the side accessory connector, all received audio is automatically routed to the headset.

This means that the radio users gain the inherent benefits of wearing a headset - received calls are not shared with everyone else in the vicinity. This additional benefit is particularly relevant to the earlier supermarket scenario, allowing floor staff to communicate without annoying their customers.

Once activated, the VOX feature intelligently senses background noise and automatically adapts itself to ensure optimum performance for any background noise level.

3.4.13 Phone System Compatibility

The P080 models are capable of interfacing with telephone systems, provided that the appropriate infrastructure is available (ie. third-party "Telephone Interconnect" interface modules).

This integrated communications solution means that your customer's mobile staff don't need to find a wired telephone (or carry an expensive cellular phone) to stay in touch with their office-based colleagues.Furthermore this telephone capability provides them with a direct communications route to their customers and suppliers.

Consider the hypothetical case of a security firm, who have been contracted to patrol a large shopping centre. The contract demands that the security guards have immediate communication access to the emergency services in the event of a major incident. Once the appropriate Telephone Interconnect equipment has been installed, the security staff will be able to call up the police, fire or ambulance services directly from their P080 radios, saving time, money and, maybe, lives.

The radio can be switched into **Phone Mode** by making the appropriate selection from the menu or by pressing the appropriate programmable side button. Also, if the **Hot Keypad** option has been programmed, the radio will enter Phone Mode as soon as the radio user presses any keypad button.

When Phone Mode has been activated, the radio user is able to generate DTMF tones directly from the keypad (the radio may be configured for either buffered or live dialling).

To simplify operation and maximise efficiency, the P080 has a built-in **Contact List** that can be edited by the radio user. The Contact List can be used to store those telephone numbers most frequently used by the radio user.

The Phone List supports up to 25 entries, with each entry having a maximum length of 16 numbers.

The first nine entries in the Contact List can be referenced using the convenient **Speed Dial** feature. One of the side buttons may be programmed as a Speed Dial button. Once the Speed Dial button has been pressed, the radio automatically enters Phone mode and user merely has to press a keypad button to select the required entry.

For example, consider the following Contact List:

Entry 1 : 45679936589

Entry 2 : 54789875

Entry 3 : 7799642334

Entry 4 : 9887620785623

Using Speed Dial, the user simply presses the appropriate side button followed by keypad button 3 to call up entry three, then presses the PTT to send.

Using the CPS you can configure the radio to meet the exact requirements of the phone system being used by your customer. For example, you are able to modify the following connection parameters:

- ❑ Access and Deaccess Codes
- ❑ Tone Duration
- ❑ Tone Interval
- ❑ PTT Sidetone

A typical Telephone Interconnect system is described below in Figure 2-3.

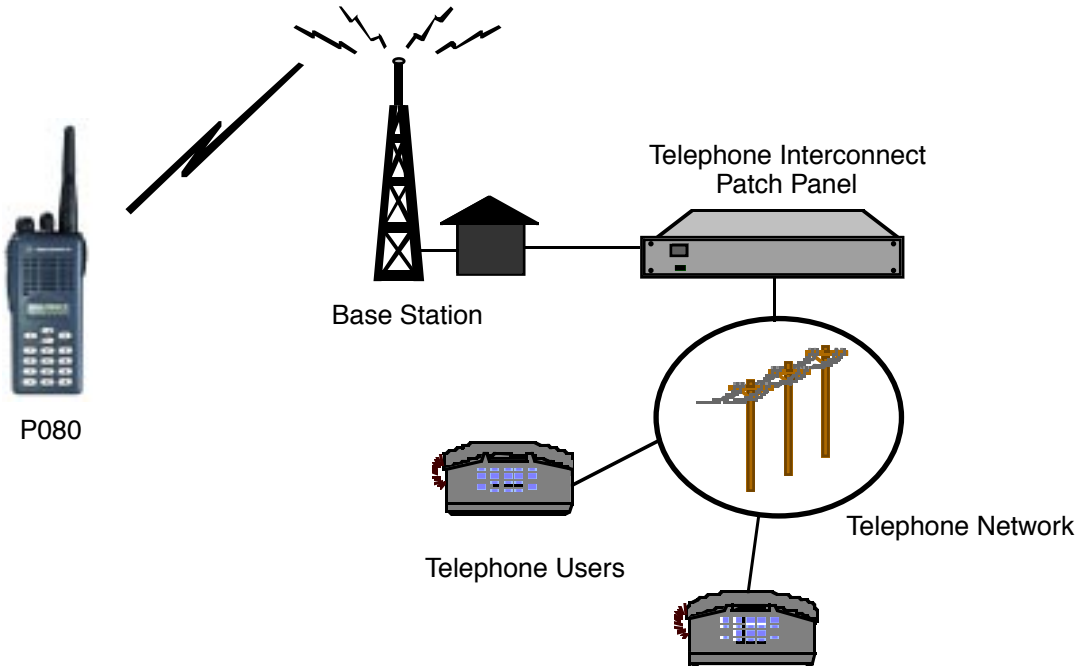


Figure 2-3 Typical Telephone Interconnect System

Chapter 3
ACCESSORIES

1.0 Batteries

A new range of batteries have been specifically developed for the new P Series of Entry Level Professional radios. They are available with 2 types of battery chemistry:

- ❑ Nickel Metal Hydride (NiMH)
- ❑ Nickel Cadmium (NiCd).

Both battery technologies meet various operational requirements depending on the application and use of the radio. The genuine Motorola batteries ensure that the quality, reliability and performance of the radio are not compromised.

1.1 Nickel Metal Hydride (NiMH)

This technology operates similar to and provides a similar capacity to Nickel Cadmium batteries.

Advantages

- ❑ Lighter weight than comparable Nickel Cadmium batteries.
- ❑ Less prone to memory effect than Nickel Cadmium.
- ❑ Fewer toxic metals – environmentally friendly.

Disadvantages

- ❑ Self discharges at approximately 30% per month when stored.
- ❑ Nickel Metal Hydride will not operate at such low temperatures as Nickel Cadmium.

1.2 Nickel Cadmium (NiCd)

This well proven chemistry provides the best performance at extreme temperatures but suffer from memory effect and provides the lowest power to weight ratio of the two available chemistries.

Advantages

- ❑ High number of charge / discharge cycles.
- ❑ Good performance at low temperatures.
- ❑ Easy to recharge after prolonged storage.
- ❑ Capable of sustained high rate of charge and discharge.

Disadvantages

- ❑ Memory effect will develop if battery is not fully discharged at each cycle.
- ❑ Battery does not performed well if it is left in the charger and is only used for brief periods of time.
- ❑ Must be recycled since Cadmium is toxic.

1.3 Selecting the right battery

The selection of the correct battery for a particular application will depend on many factors. A typical procedure for battery selection is shown below:

- ☐ Identify if the product will be operated in an intrinsic safe environment.
- ☐ Identify the required operating temperature range. For example, inside all day in air-conditioned office or inside a food freezing plant.
- ☐ Having chosen the required performance, select the most appropriate radio battery combination.
- ☐ For most effective radio performance use only Motorola branded batteries.

Table 3-1 Battery Specifications

Radio Weight: (gm)		
With standard NiMH Battery	429	
With NiCd Battery	454	
Average Battery Life @5/5/90 Cycle	**Low Power**	**High Power**
With standard NiMH Battery	10 hours	8 hours
With NiCd Battery	10 hours	8 hours

Table 3-2 Battery Selection

Part Number	Description
PMNN4018	NiMH High Capacity Battery
PMNN4019	NiMH High Capacity Battery FM
PMNN4021	NiCd High Capacity Battery

1.4 Battery Terminology

Memory Effect

Failing to fully discharge a battery on regular basis causes an accumulation of tiny gas bubbles and the formation of irregular shaped crystals, which adhere to the cell plates. These irregular shaped crystals drain the battery of its true capacity capability.

The result is the battery will only charge to the level at which it was last discharged.

For example, a person over many months routinely uses 70% of the battery capacity. In a Nickel Cadmium battery that originally had a run time of 8 hours the run time could be reduced to only 5.6 hours after memory effect had set in.

To avoid the memory effect, use all of the available battery capacity completely.

2.0 Charger, Single Unit

The dual-chemistry chargers developed for the Entry Level Professional Radios provide a flexible and rapid charging solution to maximize the life of the batteries. Their compactness makes them easy to handle and carry away. The intelligent functions such as battery chemistry detection and constant monitoring of the battery status allow easy operating and optimum charging as and when necessary.

Table 3-3 Battery Chargers

Part Number	Description
Single Unit Charger complete with power supply:	
MDPMTN4038	120V Single Unit Charger with US Plug
MDPMTN4037	230V Single Unit Charger with UK Plug
MDPMTN4036	230V Single Unit Charger with Euro Plug

Benefits

- ❑ The dual-chemistry charger can be used for all batteries in the product range – a cost-effective solution.
- ❑ Rapid charging times allow more batteries to be charged during a workshift.
- ❑ Easy to use – indications provide useful information.

3.0 Antennae

A large choice of antennae is available allowing to adapt to the various user applications and coverage requirements. These antennae cover the frequency ranges with different lengths and styles, ensuring maximum radio performance.

Benefits

- ☐ Short antennae reduce the overall product size and are less obtrusive.
- ☐ Long antennae provide a greater communication range – useful for users working in remote locations.

The antennae available are shown in the tables below:

Table 3-4 VHF Antennae

Part Number	Length	Frequency
PMAD4014	14 cm	136-155 MHz
PMAD4023	14 cm	150-161 MHz
PMAD4015	14 cm	155-174 MHz
PMAD4012	9 cm	136-155 MHz
PMAD4025	9 cm	150-161 MHz
PMAD4013	9 cm	155-174 MHz

Table 3-5 UHF Antennae

Part Number	Length	Frequency
PMAE4002	9 cm	403-433 MHz
PMAE4003	9 cm	430-470 MHz
NAE6483	17 cm	403-520 MHz
PMAE4006	9 cm	465-495 MHz
PMAE4007	9 cm	490-527 MHz
PMAE4008	14 cm	465-527 MHz

4.0 Carrying Accessories

All carry accessories offer the generic benefit of "hands free" carrying. They allow users to have their radio in the most convenient and productive position at all times. With both hands free between calls, the user may continue working, thus increasing productivity and safety.

Carry accessories keep the radio in very close proximity providing continuous communication within arms reach. Users avoid losing or misplacing radios and know exactly where to find their radio when they need to make or answer a call hence minimizing time to answer or set up calls. Avoiding the chance of losing or misplacing radios cuts down replacement costs.

The benefits of using carry accessories are:

- ❑ Radio is always within arms reach.
- ❑ Reduced chance of radios being lost or misplaced.
- ❑ Radio can be carried "hands free".
- ❑ Radio is easily accessible in emergency situations.

4.1 Spring Belt Clips

They are attached to the back of the radio battery and the spring mechanism is designed to stand up to the rigorous of daily usage. A belt clip is included with every radio.

The spring action ensures the radio is held securely in place, whilst still allowing easy fitting and removal.

The spring belt clips for the P series of radio are available in 2 different sizes:

- ❑ HLN9844 Spring 1.5 inch Belt Clip
- ❑ HLN9714 Spring 2 inch Belt Clip

4.2 Carry Cases

Carry cases ensure convenient, "hands free" carrying and provides protection for the radio. Two types of material are available with different options to meet the user needs. Different designs ensure the microphone; speaker, buttons and controls are always easily accessible.

Standard Leather Cases

Rugged, heavy duty design which can have either a belt loop or a swivel attachment. The swivel attachment allows fast fitting and removal.

Nylon and Soft Leather Cases

These lightweight cases mould to the shape of the radio providing protection without significantly increasing the size and weight of the radio.

Benefits

- ❑ All cases provide additional protection and help radios stay clean and dry.
- ❑ The nylon cases can be easily washed to keep them looking clean – useful for hire fleets or when the radio is used in dusty environments.

A range of universal carry accessories is also available. For a complete list of Carrying Accessories, please refer to your Price Pages.

5.0 Audio Accessories

All audio accessories are fitted onto the side radio accessory connector. Remove the accessory dust cover and push the accessory plug firmly into the connector on the radio. Once fitted to the radio, all audio is routed to the accessory which means incoming audio will not be heard through the radio loudspeaker.

5.1 Remote Speaker Microphone (RSM)

The Remote Speaker Microphone provides the capability of talking and listening without repeatedly putting down and picking up the radio or permanently hand-carrying the unit. It allows more freedom, convenience and comfort. When operating in noisy environments, the RSM ensures having the audio output closer to the user.

Benefits

- ❑ Discreet radio operation – the radio can be hidden from view.
- ❑ Body worn appliances allow users to work with both hands free between calls – increasing productivity and safety.

5.2 Earpieces and Headsets

The Audio Accessory range also includes earpieces and headsets.

The choice of Earbuds/Earpieces include the following options: volume control, microphone and Push-To-Talk. These unobtrusive and comfortable ear-mounting earpieces ensure discrete listening of the radio messages.

Two different types of headsets are also available:

- ❑ Lightweight headset with boom microphone
- ❑ Heavy-duty headset with noise canceling boom microphone.

They provide the user with the ability of receiving and transmitting radio messages, even operating in high noise environments when wearing the heavy-duty headset.

For a complete list of Motorola audio accessories and part numbers, please refer to your Price Pages.