Section 4 1- 2.983 Application for type acceptance - User Operating Instructions

4.1 - (d)(9) Operating instructions for the LMM4113D operating instructions

A copy of the operating instructions supplied with this equipment is included on the following thirty pages.

The instructions come in two parts:

1. Mobile Radio Users Guide - Pages 41 to 71

2. Data Users Guide for 4000 Series Mobiles - Pages 72 to 94

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MOBILE RADIO USER GUIDE
75 - M4113

Publication Reference OI/18/1.1

linear modulation

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Telephone (816) 241-8400 Fax (816) 920-1144

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Important Information

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Federal Communications Commission (FCC) Regulations

- You are required to obtain a station licence before transmitting from your mobile radio equipment.
- The mobile radio transmitter power output must not exceed the output necessary for satisfactory technical operation taking into account of local conditions and the area to be covered.
- The mobile radio transmitter frequency and parameters should be checked by authorized service personnel before use, and at least yearly thereafter.

Safety Information

- Proper use of this mobile radio will result in exposure to radio frequency electro-magnetic energy substantially lower than the limits recommended by the FCC.
- DO NOT operate this equipment with the antenna close to or touching eyes, face or exposed body parts.
- KEEP any radio equipment containing a transmitter out of reach of children.
- AVOID holding the transmit (PTT) switch in the on position when not transmitting.
- DO NOT use this equipment near unshielded electrical blasting caps or in an explosive atmosphere.

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Repairs, Modifications and Maintenance

- If any operational difficulties should arise while using this product, report them to authorized service personnel as soon as possible.
- This system contains no user serviceable parts. Unauthorized adjustments or modification will void the warranty and may lead to emissions outside FCC limits.
- DO NOT connect an external RF power amplifier to this equipment.

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Contents

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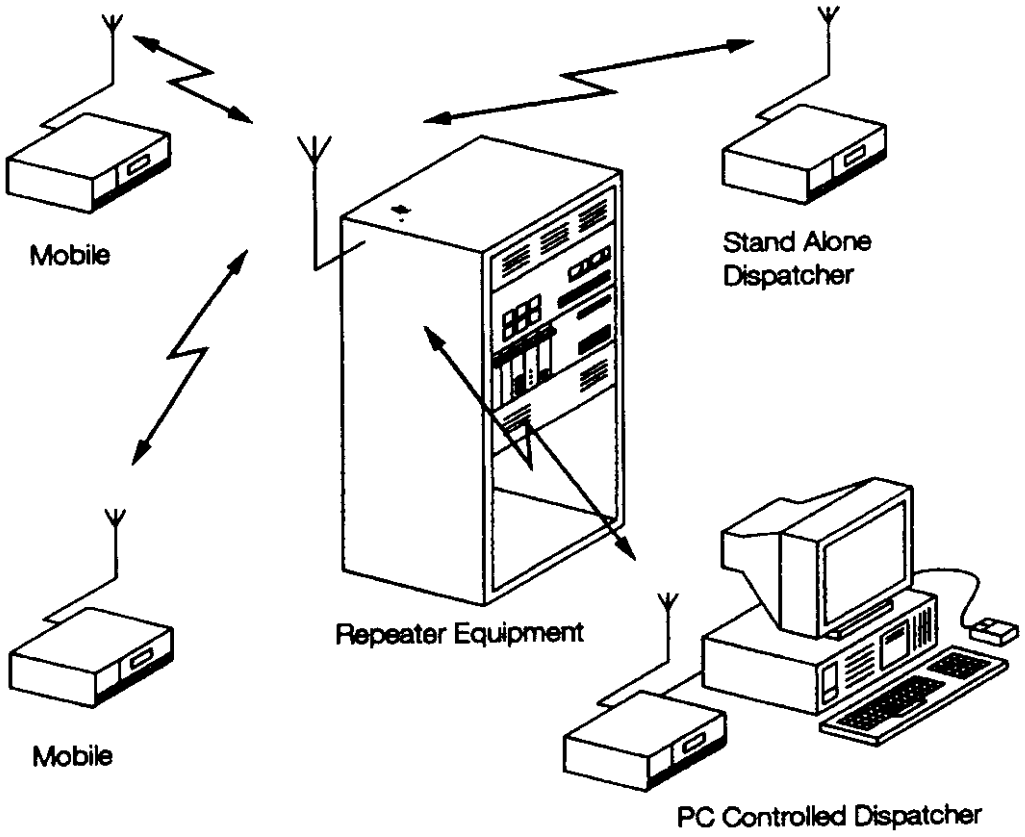
About Your Mobile Radio

This guide describes the operation of the mobile radio unit which forms part of the Linear Modulation Technologies Trunked mobile radio system. In addition to mobile and/or portable radios the system will comprise of one or more dispatchers and one or more repeater channels. All transmissions to and from a dispatcher, a mobile unit or a portable unit pass through a repeater channel. In many circumstances the dispatchers will be controlled by PC's running Linear Modulation Technologies own dispatcher software.



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About Your Mobile Radio

Operation of the mobile radio unit only is covered in this guide. For operation of the stand alone or PC dispatchers refer to the Dispatcher User Guide (Reference No. LM/OI/8.1).

In addition to making straightforward speech calls to other radios and to the dispatchers, your mobile radio is capable of a wide variety of other functions. However, not all of these functions may be available, since the operation of the radio unit depends upon the way both the unit and the system have been customized.

Controls and Displays

These are shown in the illustration on page 8. The four character display is used to display two digit identities, two digit status codes, call times and also a number of information and warning messages. A complete list of these messages is given on page 25.

Operating Procedures

Operating procedures are described in detail in the following pages. Most operations are described using a simple flow diagram supported by some descriptive text. The information provided in the diagram is enough to get you started. For the complete picture you should also read the accompanying text.

Confidence Tones

The mobile radio uses a range of audio confidence tones during operation. These are designed to assist you in using the mobile radio in circumstances where you may not always be able to see the display. Confidence tones are indicated in the operating flow diagrams by the use of 'speaker' symbols. A detailed description of the tones is not provided since they are programmable and may vary for each user.

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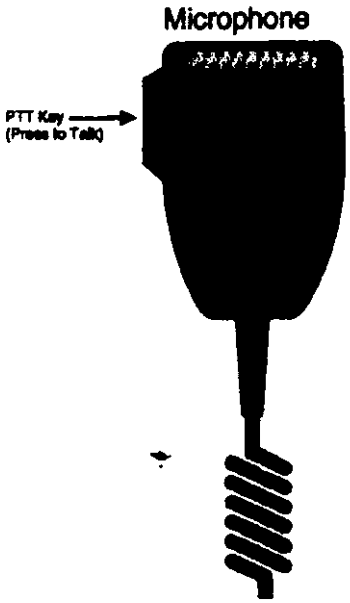
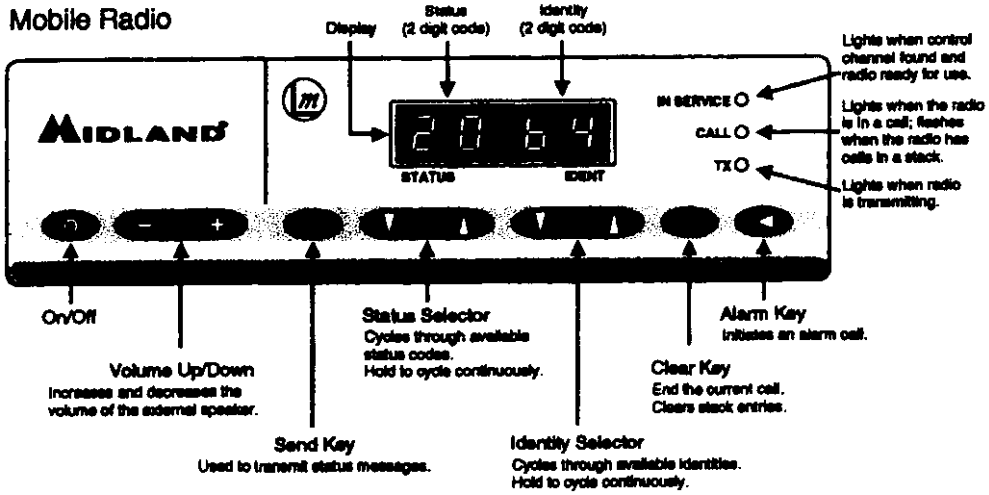
Location of Controls





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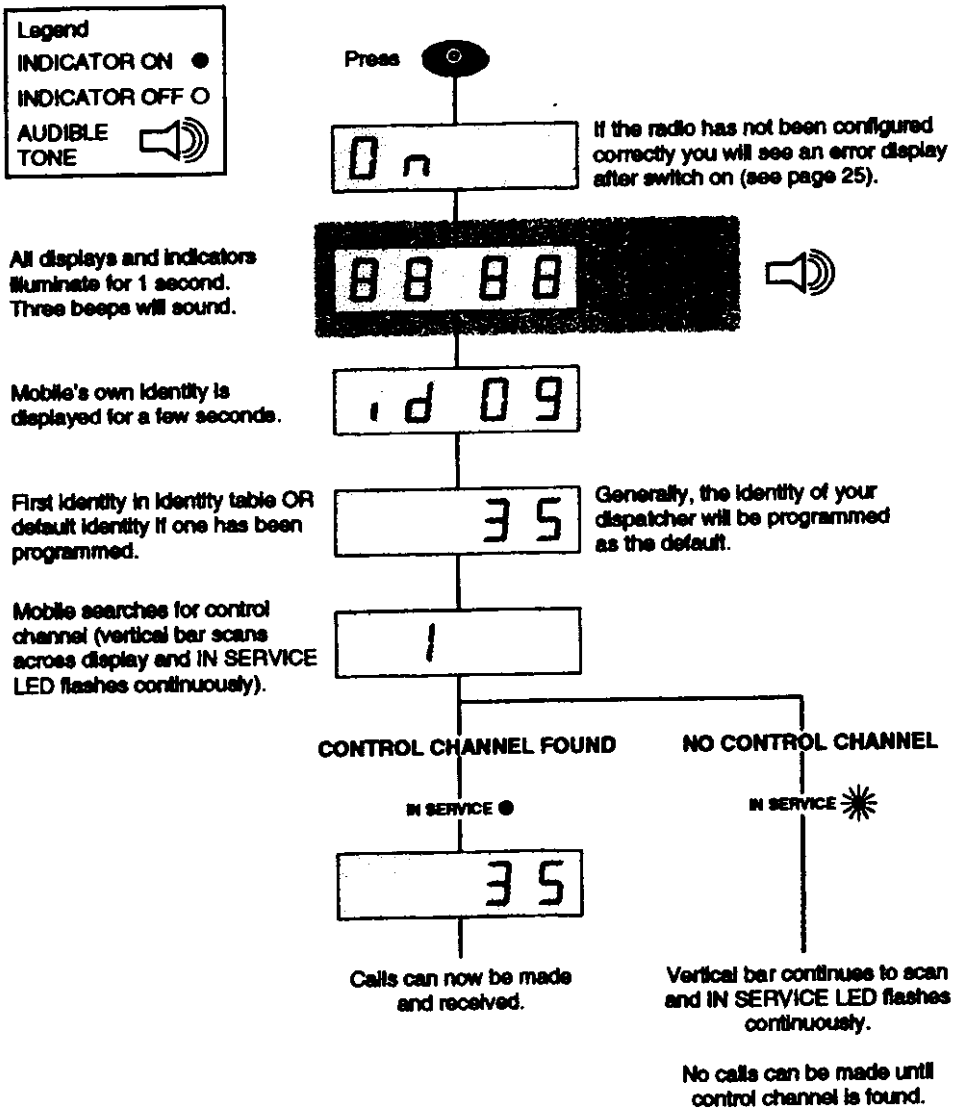
Switching On



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Making a Call

The mobile radio can be programmed with 99 addresses. These are labelled 01 to 99. Each address can either correspond to an individual member of your fleet, to a group of members of your fleet, to all your fleet or to a telephone number (if allowed by the network provider). It is possible however that not all 99 addresses will be programmed. This depends upon the size of your fleet and the facilities you have access to. When your mobile radio is installed, you will be given a list of those addresses that you have been programmed to call. An identity table is provided on page 26 for you to record these.

To call another user, group of users or a telephone simply select the appropriate address using the Identity Selector and press the PTT key on the side of the microphone. If the call is unsuccessful, you will see a fault displayed, and hear the associated audible warning. Fault displays are listed with the other information displays on page 25. Some users, in particular dispatchers, cannot be called directly. When you call these users you will see the message 'Cb' (Call Back) in the display. This indicates that the call has been queued in their radio's call stack (see page 16). They will then call you back when convenient.

Once the call has been successfully established, you can start your conversation. To talk, press and hold the PTT key, and speak clearly in a normal voice into the microphone. To listen, simply release the PTT key. You are only allowed to transmit continuously for a limited time, after which your transmitter will be turned off. When this happens, the TX indicator will go out and an audible warning will be generated. To continue talking, release and repress the PTT. Each time either user releases the PTT the other user receives a 'bleep' which indicates that he can now press his PTT and speak.

The system also limits the time a call can last for. When a call is in progress, the display shows the call time remaining, and an audible warning is given 10 seconds prior to the end of the call. If neither user presses the PTT for a while, the call will automatically end.

If the person you are calling doesn't answer (e.g. if they are not in their vehicle) then when the call is cleared down, you identity will be queued in their radio unit's incoming call stack. When the person you have called returns to their vehicle they can identify you as a caller call you back.

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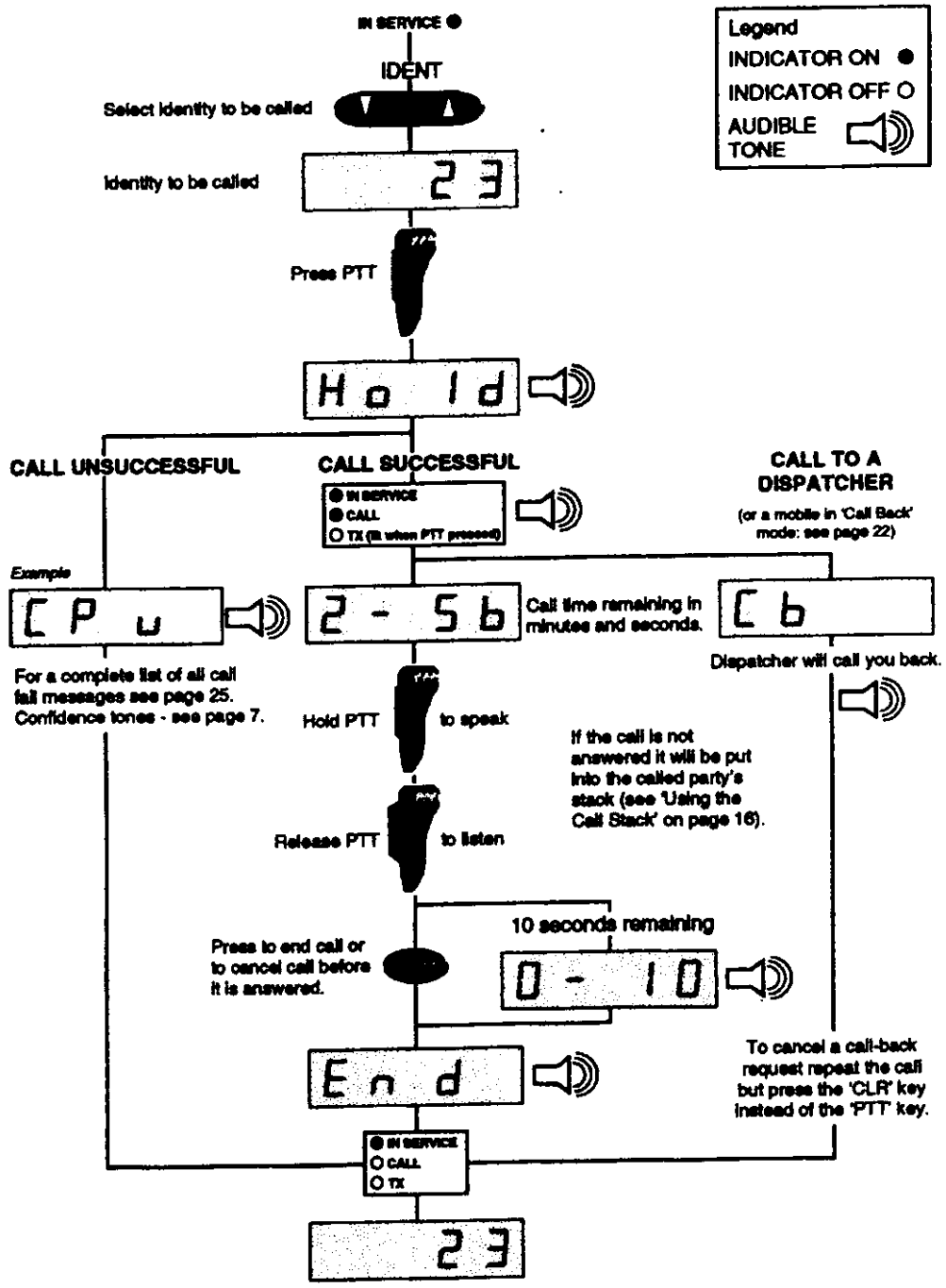
Making a Call



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Receiving a Call

When you are called by another user a 'ringing' tone will sound and the identity of the calling party will be displayed. To answer the call you simply press the PTT key on your microphone, and then start your conversation.

The call time remaining will be displayed in the same way as it is when you make a call, and a warning will be given 10 seconds prior to the end of the call.

If neither user presses the PTT key for a while the call will automatically end.

If you fail to answer the call because you are not in your vehicle, it will be entered into your call stack (see 'Using the Call Stack' on page 16).

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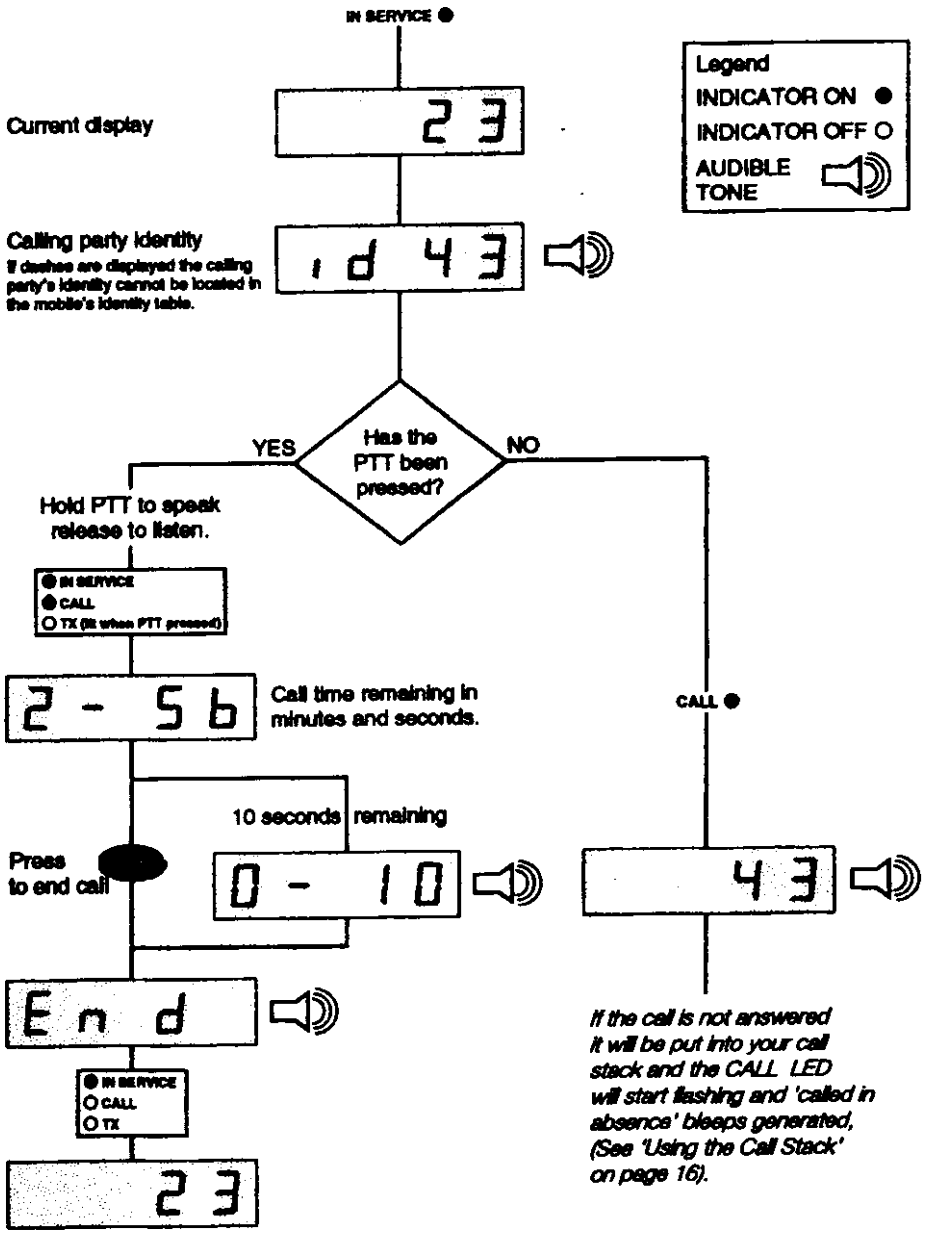
Receiving a Call



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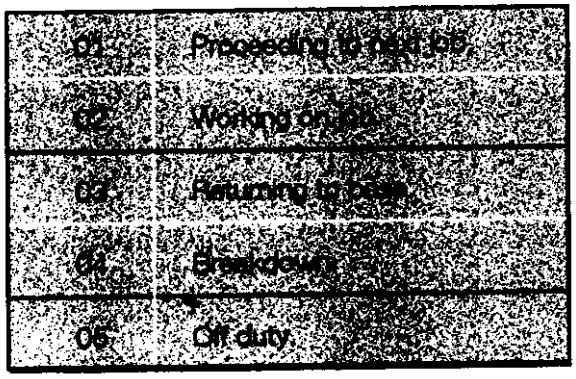
Making a Status Call

Status calls enable routine information to be transmitted quickly and easily. They consist of a two digit code number between 01 and 26. Your fleet manager allocates meanings to the codes as required, and these will be given to you in a table similar to that shown below:



A sample table is provided on page 28 for you to note down your own status codes.

Your current status can be set using the 'STATUS' selector keys. This can either be interrogated by a dispatcher, or sent to another user by selecting their identity, and pressing the 'SND' key on the front panel of the mobile radio. Your status can be cleared by pressing the 'STATUS' keys until the status digits displayed are blank.

When a status call is received, the status code and the identity of the user who sent it are put in the stack. See 'Using the Call Stack' on page 16 on what to do when you receive a status message.

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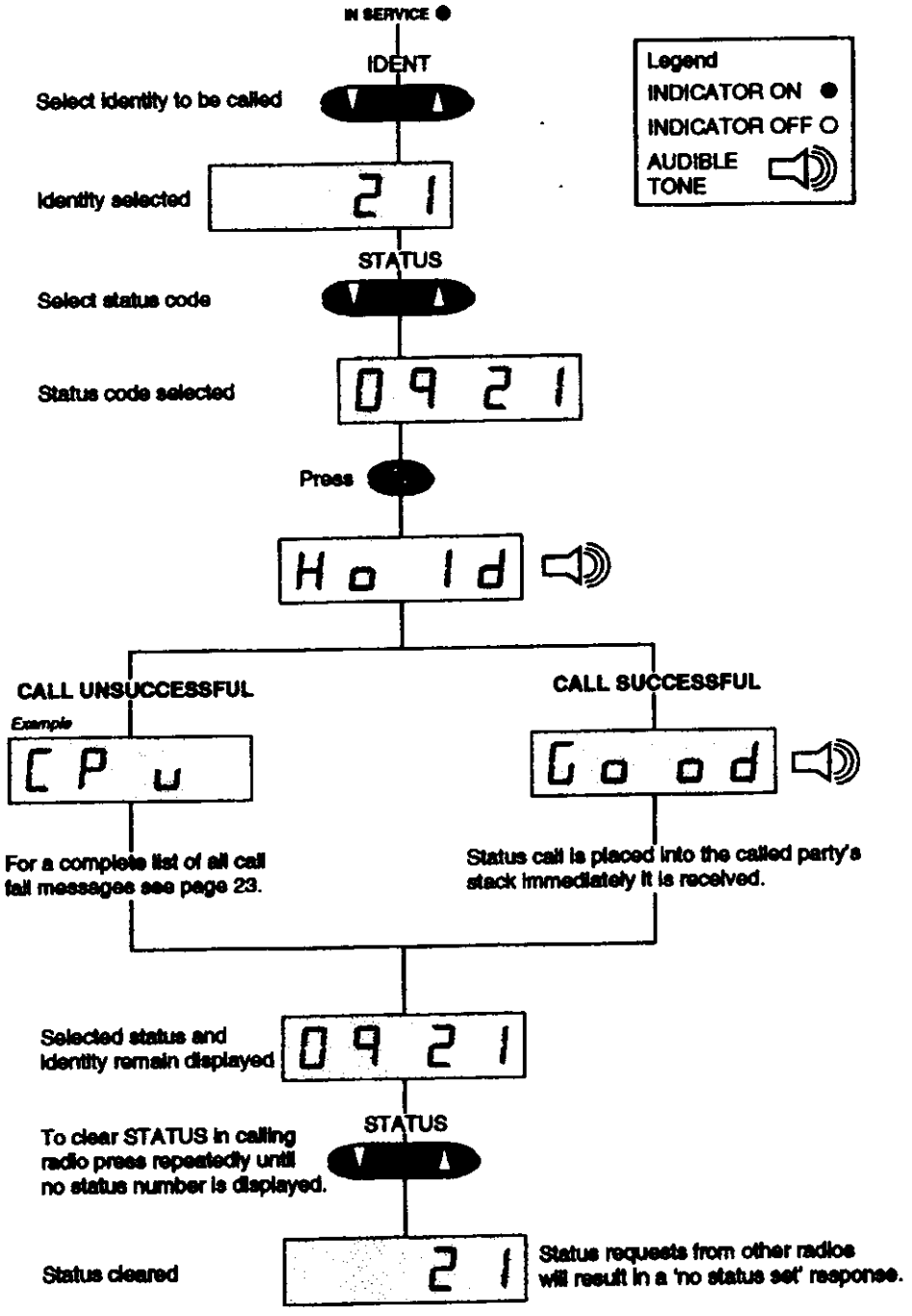
Making a Status Call



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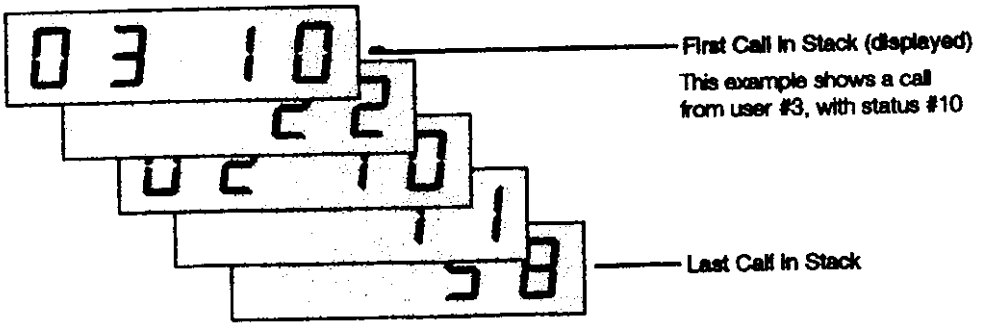
The Incoming Call Stack

The 'call stack' provides a simple method for monitoring calls made to your mobile radio while you are away from your vehicle. On your return you can see any calls made to you and can elect to return those calls if necessary.

If incoming speech calls are not answered, the identity of the caller is placed in the call stack. Status calls are placed in the stack immediately upon receipt. You can tell the difference between speech calls and status calls in the stack since status calls will indicate the call status in addition to the caller's identity (see example below).

Up to 10 calls can be stored in the stack, with the first call displayed at the top and the last at the bottom.



If there are calls in the stack, the 'CALL' indicator will flash a 'called in absence' tone will be continually repeated and the first call in the stack will be displayed. The stack will store ordinary speech, emergency speech and status calls. You can reply to calls in the stack simply by pressing the PTT key on the microphone. The call will not be cleared from the stack when it is replied to, but you can clear it by pressing the 'CLR' key. Each call in the stack is dealt with in turn until the stack is cleared. Each call can be dealt with in turn or by selection using the 'STATUS' up/down keys. You can return calls to all identities in the stack regardless of whether they were speech or status calls. Emergency calls not answered will always go to the top of the stack.

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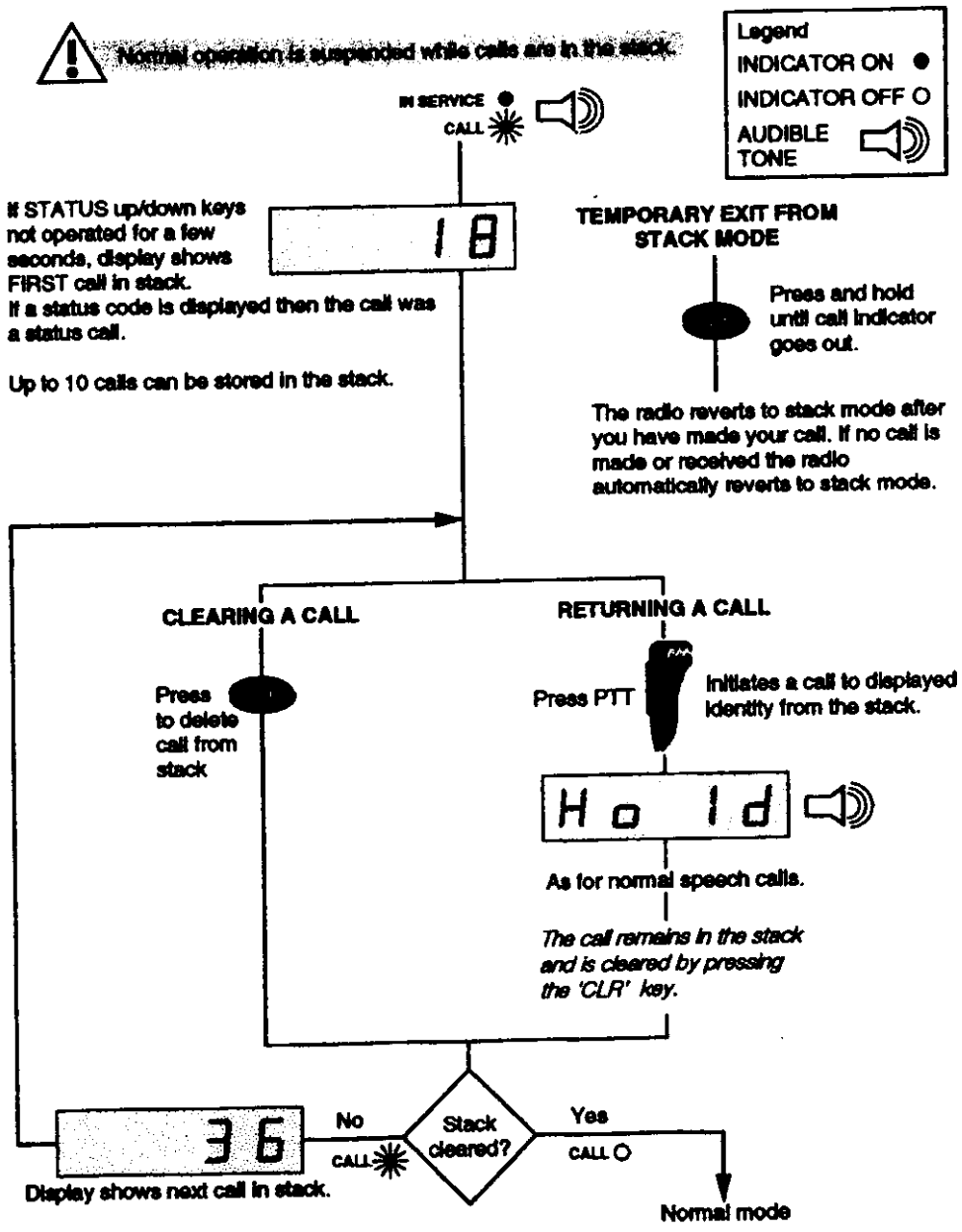
Using the Call Stack



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Using the Call Stack

When calls are in the stack, normal operation of the mobile radio is suspended and you must deal with the calls in the stack.

The stack can be dealt with in four ways.

To call back the identity displayed simply press the PTT key. This action will not clear the call from the stack.

To clear a specific call from the stack wait until it is displayed and then push the CLR key.

To move around the stack use the STATUS up/down keys. The display will return to the oldest non-emergency entry, or the oldest emergency entry if there is one, after a short delay.

To temporarily leave the stack mode to make another call, push and hold the CLR key until the call indicator goes out. You will return to stack mode automatically once you have made the call, or after a short delay if you do not make one.

Note - incoming Emergency calls not answered will always go to the top of the stack.

If a call is received whilst your radio is in stack mode you can reply to the call as normal. Once the call is finished however, the radio will revert to stack mode.

Duplicate calls from the same identity will be combined, maintaining the stack position of the FIRST call.

Note - Once the stack is full, additional calls will not be recorded.

If you exit from stack mode and make a call to an identity that already has a call in your radio unit's incoming call stack, the call will be cleared from the stack unless it had an attached status. Calls with an attached status must be cleared by first displaying them (using the STATUS up/down keys if necessary) and then by pushing the CLR time.

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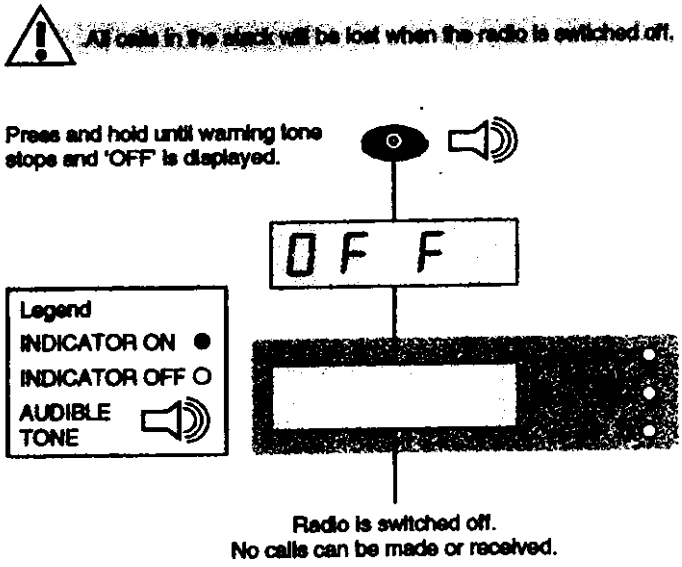
All calls in the stack will be lost when the radio is switched off.
Press and hold until warning tone stops and 'OFF' is displayed.
OFF
Legend
INDICATOR ON
INDICATOR OFF
AUDIBLE TONE
Radio is switched off.
No calls can be made or received.

Draft

Making an Emergency Call

Emergency calls are given a greater priority than other calls, and should be used only in emergencies (as defined by your fleet manager).

To make an emergency call:

1. Press the ALARM key on the front panel, *or*
2. Select an ID programmed with an emergency RQE call and press the PTT.

Either action will result in a call being set up with the called party which is usually an emergency dispatcher.

1. ALARM KEY. When using the 'ALARM' key, depending on the way in which your mobile radio has been programmed, a voice call will either be set up immediately with the called party, or a call back request will be entered into the call stack of the called party.

The mobile radio can be configured so that all displays and confidence tones are suppressed during an emergency call, so that an attacker would not know that an alarm has been set off. The microphone can also be made permanently live during an emergency call so that the dispatcher can hear what is going on without you having to hold the PTT key.

If the emergency call is unsuccessful, the mobile radio will go on trying until it succeeds in making a call. To cancel the call press the 'ON/OFF' key. This does not turn the mobile radio off, but it does clear the emergency call.

2. Call from CALL TABLE. In the case of emergency calls selected from the Call Table using the 'IDENT' up/down keys the call is similar to a UID call except that it has the highest priority.

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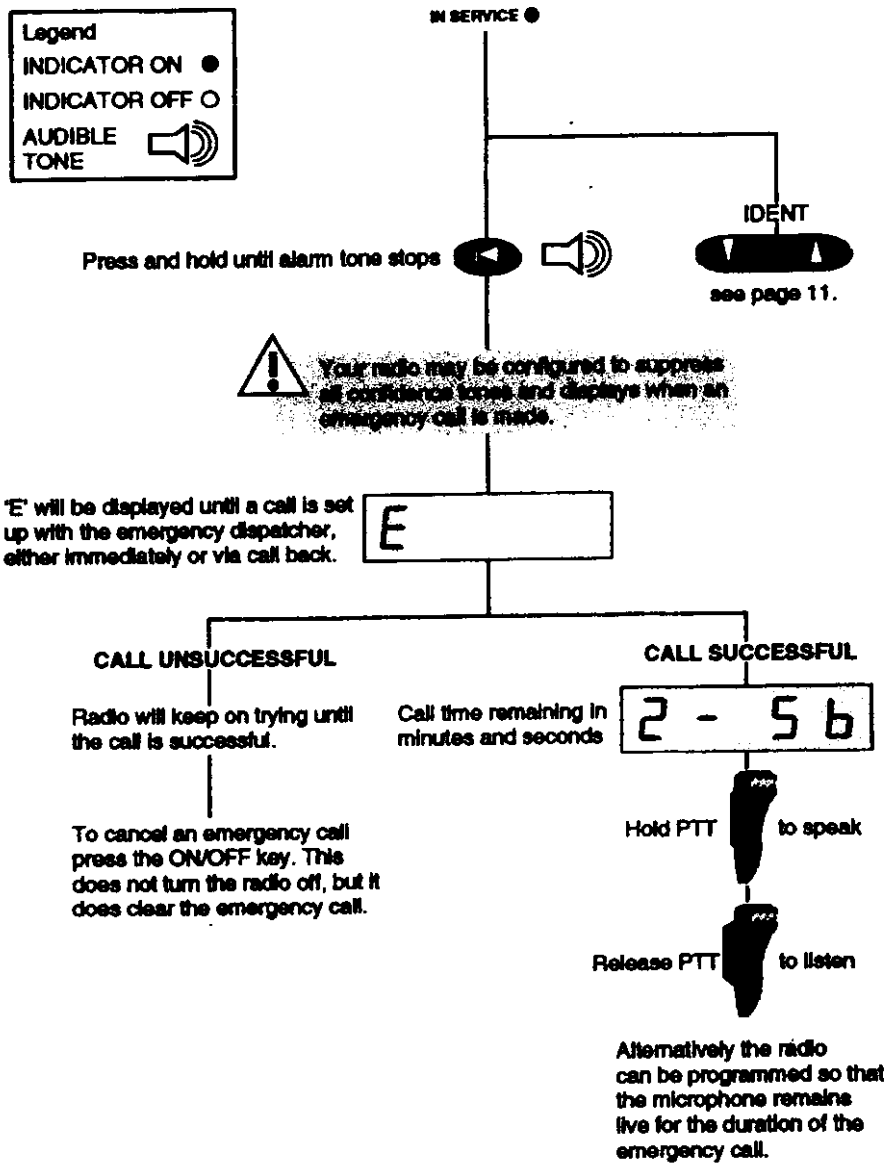
Making an Emergency Call



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Additional Features

Priority Users

Your mobile radio can be programmed to make priority speech calls. These are identical to normal speech calls except that they are allocated a channel more quickly when the network is busy.

The priority call to a particular mobile radio is made by selecting the identity which has been programmed for this.

VIP Users

You cannot call a VIP user directly. You can however return a call to a VIP user if their identity appears in your call stack.

'Call Back' Mode

Call Back mode is a programmable feature which is chosen from three types of operation. Call Back mode enable calls to be saved and returned on a strict one by one basis; a new caller cannot break in but must take his place in the stack.

In 'Call Back' mode your mobile radio will enter calls into the stack immediately they are received. When this happens the calling radio will see the 'Cb' (Call Back) message in the display- if fitted (see page 25). Thus a call to you appears identical to a call to a dispatcher.

1. Auto ACK-B
   If this is the programmed type, then if a call is stacked and the mobile radio is called by another caller, then that call is also stacked and a Call Back message is sent to the caller.
2. ACK-B On Pressel
   If this is the selected programmed type, then it is enabled by holding down the PTT key when switching the mobile radio on. All calls are then stacked, up to the limit of ten and a Call Back message is sent to each caller. The facility is disabled by switching the mobile radio off and then on again.
3. Permanent ACK-B
   The operation of this type is similar to ACK-B On Pressel except that there is no need to hold the PTT key pressed when switching the mobile radio on.

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Additional Features

Group Calls

Making group calls
Select the identity associated with the group required and then make the call in the same way as you would for a normal voice call.

Only one user can talk at any one time but all users in the group will be able to listen. If the originator of the group call ends the call (by pressing the 'CLR' key) all other users in the group will have their call ended also. A recipient can however end their part in a call by pressing the 'CLR' key after pressing the PTT.

Receiving group calls.
An unanswered group call will not be placed in the stack.

'Late Joiner' enabled in base station.
If your mobile radio is not immediately available when a group call is made to a group of which you are a member, then you will be 'pulled' into the 'group call' if it becomes available during the call. When clearing from a 'group call' to make a call to another party you only have five seconds to make that call, otherwise you will be 'pulled' back into the group call.

'Group Select'.
Two types of group membership can be programmed into your mobile radio. 'permanent' and 'selectable'. A call made to your radio with a group call identity that you have programmed as 'permanent' will always cause your radio to join that group call (assuming you are not busy on anther call). If however a call is made to your radio using a group identity which is programmed as 'selectable' you will only respond to that group call if you have selected that group address for display on your front panel..

Additional Features

Telephone Calls

You can make a telephone call by selecting an identity which has been set up to connect you to a preprogrammed telephone number. You can connect to a telephone number of your choice by overdialling procedure using a DTMF microphone facility.

A telephone call is made in the same way as a normal call. Once the call is established, you must press the PTT key to talk, and release it to listen.

To end the call and hang up the line, press the 'CLR' key.

Data Calls

The 75-M4113D is fitted with an internal data modem. This enables data to be transmitted and received provided a suitable printer or data terminal is connected. Refer to the Data User Guide (Publication Ref:OI/17)

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Information Displays

On	Displayed when radio is switched on.
OFF	Displayed when radio is switched off.
id	Prefixes the calling party identity when receiving a call. ('Id Ph' indicates calling party is a telephone.)
Hold	Displayed when the system is attempting to connect a call.
Good	Indicates a successful status call.
End	Displayed when a speech call is ended.
E	Displayed during an emergency call (your radio may be programmed to suppress all displays during an emergency call).
Cb	Your call has been placed into the dispatcher's call stack. You will also see this display if you call a mobile that is in Call Back mode.
	Scanning vertical bar indicates that radio has lost Control Channel, and is searching for it again.
CPu	Called party is unavailable. Normally this occurs because their radio is switched off or they are out of range of the system.
CPb	Called party is busy on another call. Try again later.
FAIL	The system was unable to connect the call. Try again.
Err	No response, or unexpected response from the system. This message is normally displayed when the mobile cannot establish a link with the base station. Attempt the call again.
Err 1	'Err' followed by a number indicates a configuration error. After a few seconds the radio will switch off automatically. Contact your service representative.
- -	Indicates an incoming call from an identity that cannot be translated within the radio's call table.

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Identity Table

Enter your list of identities in the following tables:

Identity	User

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Identity Table

Enter your status codes and their associated meanings in the table below:

Code	User
99	Temporary Group

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Status Table

Enter your STATUS codes and their associated meanings in the table below:

Code	Meaning

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Status Table

Enter your STATUS codes and their associated meanings in the table below:

Code	Meaning

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Glossary of Terms

Call Stack See 'Stack'.

Confidence Tones These are audible tones which are sounded when specific facilities are accessed using the mobile radio, or when errors are reported.

Control Channel This is the channel used to establish speech and high speed data (HSD) calls. Status calls (also called SDM1 calls) and Short Data Messages (also called SDM2 calls) are also transmitted on the control channel. Once a voice or high speed data call has been set up the call is transferred automatically to one of the Traffic Channels on the radio site.

Dispatcher A radio unit which can be used to co-ordinate a fleet of users. It is normally in a fixed location (e.g. headquarters building), but may be mobile. Most dispatchers are controlled by PCs running Linear Modulation's dispatcher software.

Emergency Call A special high priority call for use when you are under attack, or some other emergency occurs.

Emergency Dispatcher This is the dispatcher which your mobile radio is programmed to call when you press the 'ALARM' key, or press the alarm footswitch (if fitted).

Fleet A collection of users. Normally you will only make calls to radios within your 'fleet' but your mobile radio can also be programmed to make calls to radios in another fleet.

Group Calls A call made to a group of users simultaneously. Only one user in the group can talk at any one time, but all users can listen. Provides a sort of 'conferencing' facility.

Identity This is the two digit identification assigned to individual radios. You must know the identity of another radio before you can make a call to it. Specific identities are also assigned to groups of users, and to private or public telephone lines. The two digit identities are actually shortform codes which are used to represent the unique identities used by the radios. The two digit identities are therefore only unique across a fleet of users.

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Glossary of Terms

Linear Modulation A high performance modulation technique which enables narrower channel spacing to be used than is possible with FM or digital radio systems.

Mobile A mobile radio unit.

Preferred Dispatcher This is the dispatcher assigned to handle your calls, and provide you with help if required.

PTT Press to talk key on the microphone. You must hold this down to transmit, and release it to receive.

Repeater A transmitter, a receiver and associated control equipment. Repeaters are mounted at a fixed radio site (a hilltop or a large communications tower). Repeaters at each fixed radio site are connected together (typically in groups of two or five) by additional control equipment. Reproacher on different sites may also be connected together (networked) to provide inter-linked radio coverage.

Stack If calls received are unanswered, your mobile radio places them into a queue so that they can be replied to later. Up to 10 calls can be stored in the stack.

Status A two-digit code which can be transmitted to another radio. Status codes are used to help reduce unnecessary voice traffic. For example, rather than calling up the dispatcher and telling them that you are taking a lunch break you can simply send a status code.

Status Call A call which sends a status code using the control channel.

Traffic Channel Speech and high speed data calls are allocated a traffic channel by the system.

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MOBILE DATA USER GUIDE
4000 Series

Publication Reference OI/17/1.1

Linear Modulation

MIDLAND USA

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Telephone (816) 241-8400 Fax (816) 920-1144

Data User Guide-4000 Series

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Important Information

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Federal Communications Commission (FCC) Regulations

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- The mobile radio transmitter frequency and parameters should be checked by authorized service personnel before use, and at least yearly thereafter.

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- DO NOT operate this equipment with the antenna close to or touching eyes, face or exposed body parts.
- KEEP any radio equipment containing a transmitter out of reach of children.
- AVOID holding the transmit (PTT) switch in the on position when not transmitting.
- DO NOT use this equipment near unshielded electrical blasting caps or in an explosive atmosphere.

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Contents

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Overview

This guide describes the operation of the 4000D series mobiles. The 4000D series trunked mobile is fitted with an internal modem. This enables the use of a wide range of data services to be used on the Linear Modulation ADNT radio system. It is designed to allow data to be exchanged with other mobile data users.

The 4000D offers a range of data facilities:

Voice call	allows the attached peripheral to place voice calls to other mobiles.
Status call	sending a numeric token (1 to 26) to indicate various events (e.g.'job completed', 'at lunch').
Short data messages	short messages transferred via the 'control channel'.
Long data messages	Longer messages transferred via a traffic channel at a relatively low speed of 1200 baud.
High Speed data	Large amounts of data at speeds up to 14400 baud.

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RS232 Port

1 Configuration

The 4000D mobile is fitted with an RS232 connector configured as a Data Communications Equipment (DCE). The RS232 Interface operates at 19200 baud, no parity, eight data bits and one stop bit. These port settings are fixed, & cannot be changed. The mobile uses hardware flow control (RTS/CTS) only, software flow control is not supported.

2 Connections

The following connections are provided:

pin	name	Description
1	NU	
2	RXD	Receive data, output which the 4000D uses to send data to the peripheral.
3	TXD	Transmit data, input which the 4000D uses to receive data from a peripheral
4	NU	
5	GND	Signal ground (0v).
6	NU	
7	RTS	Request to send, input which the peripheral uses to stop the 4000D sending data.
8	CTS	Clear to send, output which the 4000D uses to stop the peripheral from sending data.
9	NU	

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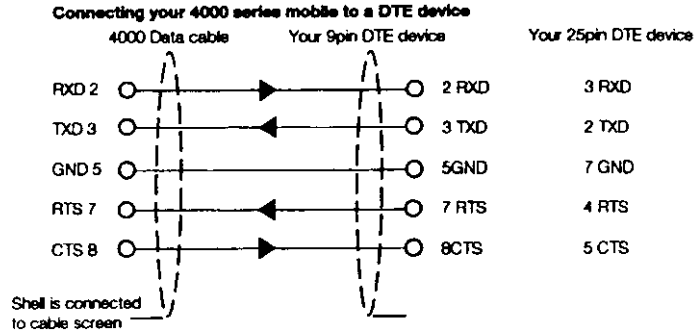
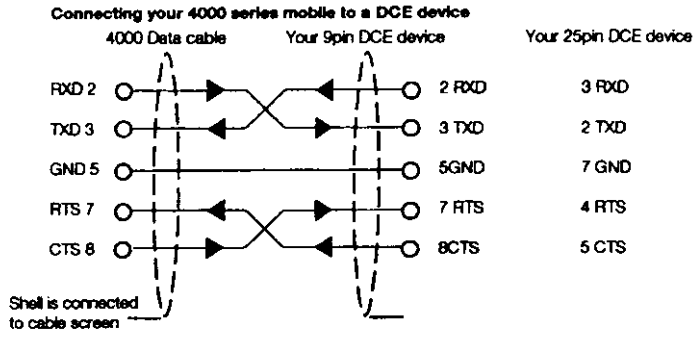
RS232 Port

In order to connect a device to the mobile's serial port, you need to know if it isa DCE or a DTE.

Connecting a DCE to DTE



Connecting a DCE to DCE



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Functions

1 Full ident calling

The RS232 port allows the user (or peripheral) to call any mobile in the fleet, identified by its ident. The user can make normal voice calls, high priority calls, or emergency calls in this fashion. Note that the mobile does not support calls between mobiles of different prefixes.

2 Data Communication

A variety of data facilities are available with the mobile, suitable for a multitude of different applications. Data communication can make much more efficient use of the available radio channels than traditional voice based communications, and is recommended for busy systems.

The mobile can be used in conjunction with a wide range of data equipment including printers, hand-held terminals, personal organisers and portable computers.

2.1 Standard Speed messages (1200 BPS)

2.1.1 Status Messages (SDM1)

Status messages (short data message type 1) are five bit codes which are sent over the control channel at 1200 BPS, using FFSK. SDM1 messages can between any two mobiles. Users can allocate their own meaning to the available status codes 01 to 26. The status code set on a mobile can be interrogated by another mobile (usually the despatcher) by sending status code 30. The mobile being interrogated will then reply with its status.

Other status codes are used by the system to implement special system functions. These are shown in the table below.

Status Code	Meaning
00	Call back request
27	Emergency request
28	No status set.
29	Reserved
30	Interrogate
31	Cancel call back request.

Draft

Functions

2.1.2. Short Data Messages Type 2 (SDM2)

These are messages of up to 22 bytes which are sent over the control channel at 1200 bps using FFSK. The whole message is buffered by the mobile prior to transmission. If the mobile is not programmed to allow SDM2 messages then the message will be sent on a traffic channel as an LDM (see below) message.

Heavy SDM2 traffic will increase the time taken for other calls to be set up, therefore the System Operator may disable this type of message facility for certain users.

This type of message can be used for applications such as simple message paging, customer record requests, or security pass Authorization.

2.1.3 Long Data Messages (LDM)

These are messages of up to 1200 bytes in length, they are sent over a traffic channel at 1200 bps. The whole message is buffered by the mobile prior to transmission. The call will clear down automatically at the end of the message. Messages that exceed the size of the mobile's message buffer will be truncated.

The system must be configured to allow data calls to be made.

This type of message can be used for applications such as sending job sheets to field service technicians, placing requisitions to a central warehouse, or dispatching fire and ambulance services to an address

2.1.4 High Speed Data

These are messages which are sent over a dedicated data traffic channel using the 4000D's internal modem. Their length is determined by the allowed call time. The internal modem has a proprietary variable rate error correcting protocol built in. Consequently, you should not use any other protocol such as Kermit, Zmodem, Ymodem, Xmodem etc. The system must be configured to allow high speed data calls to be made. The message data can consist of any type of data, including ASCII text, bitmap images, compressed video, or digital voice.

2.1.5 Dynamic Regrouping

As well as the groups pre-programmed in the mobile's personality, mobiles can be temporarily assigned to a group that they do not normally belong to. Typically a dispatcher will use this facility to assign a number of mobiles to a temporary group for a specific operation. All calls to that group will then include those mobiles. Regrouped mobiles can make calls to the temporary group using ID 99. The temporary group replaces the sixteenth entry in the group table. The normal functions of ID99 and group table entry sixteen are not available during Dynamic Regrouping. Turning a mobile off and on clears the Regroup instructions.

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Command Set

Commands to the mobile are framed with the characters STX and ETX, using the standard ASCII values of 02 and 03 respectively. Commands are not actioned until they are terminated with an ETX character.

Commands to the modem use AT style commands.

1 Mobile Commands

The table below details the mobile's command set, it is assumed that all commands are frames using STX & ETX, and *ident* refers to a four strings that represents the 13 bit code used by the system to uniquely identify a mobile or group of mobiles.

Command	Description
#0	Disable terminal mode.
#1	Enable terminal mode, Incoming calls are sent to the DTE. In this mode the mobile's call stack is inoperative.
A *ident*	Setup a voice call to mobile *ident*.
B *ident data*	Send data message to mobile *ident*, using SDM2 or LDM formats.
C *ident status*	Send *status* (range 0..31) to mobile *ident*.
D	Set call back mode (all incoming calls are stacked).
E	Clear call back mode.
F *ident group*	Dynamic regroup. Make mobile *ident* a member of *group*.
T *ident data*	Send *data* to mobile *ident*, using LDM message format.
X *ident*	As command A, but high priority.
Y *ident*	As command A, but emergency.

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Command Set

2 Mobile Responses

Command	Description
0	Transaction successful (general acknowledgement)
1	Wait for channel, [ACKI(1)]
2	No acknowledge received, call failed (LDM mode only)
3 *time*	Call connected, call duration *time* in (hex) seconds.
4	Call could not be connected, [ACKV(0) or ACKX(0)]
5	Call cleared by network.
7	Call queued. [ACKQ(1)].
8	Network busy, call failed [ACKV(1) or ACKX(1)].
9	Call back received [ACKB]
D	Call cleared by this mobile.
M *ident data*	Message *data* received from mobile *ident.*
C *ident status*	*Status* call received from mobile *ident.*
C *ident 32*	Unique call received from mobile *ident.*
C *ident 33*	Group call received from mobile *ident.*
C *ident 34*	Emergency call received from mobile *ident.*

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Command Set

3 Modem Commands

Modem commands must begin with the sequence AT, multiple commands may appear on the same line, the command sequence is terminated by a carriage return or line feed.

Command	Description
AT	Confidence check, modem responds 'OK'.
ATD *ident*	Setup a high speed data call to mobile *ident.*
ATF0	Autorate, all speeds are available, connection will be made at the highest common speed between modems.
ATF6	Force connection at 4800bps
ATF8	Force connection at 9600bps
ATF10	Force connection at 14400bps
ATH	Off-line
ATI1	Request firmware checksum
ATI3	Request firmware version
ATI4	Request model number
AT\N0	Enables standard accuracy, i.e. error correction off.
AT\N1	Enables high accuracy, i.e. error correction on.
ATO	On-line
AT&F	Restore factory defaults for S registers
AT&W	Write current profile to non-volatile memory.

No command exists for call cleardown, this is signalled by the DTE generating a 'break' condition on the txd line into the modem.

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Command Set

4 Modem responses

Code	Verbose	Description
0	OK	Last command was successfully executed
1	CONNECT	Data connection achieved.
3	NO TRAINING	No train
4	ERROR	Invalid command enter
6	RADIO ERROR	The mobile has not responded within the timeout period.
7	BUSY	Called party is busy
8	NO ANSWER	Call setup has failed
15	ABORTED	This party has hit break.
20	CALL CLEARED	Call cleared by remote user of network
21	CALL FROM:	Incoming call setup
22	CALL TO:	Outgoing call setup
23	QUEUED	Call queued by system
24	CALL CLASH!	Invalid call setup.
25	OLD CALL!	Invalid call setup.

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Command Set

5 Modem Profiles

The modem supports the following profiles:

The current/active profile, this is held in RAM.

The stored profile, this is held in non-volatile memory.

The factory default profile (held in ROM).

On power up the current profile is set to the stored profile. The factory default profile can be recalled using the AT&F command. The current profile can be stored to non-volatile memory using the AT&W command.

The AT&W and AT&F command cannot be successfully combined with other AT commands.

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Examples

Making a High Speed Data Call

Each mobile radio has a particular identity. As with voice calls, you must make a call to a known identity. Group data calls are not possible.

1 Ensure that your modem is connected to both the data terminal (PC), as described in the installation procedure.

2 Ensure that both the mobile radio and the data terminal are powered up.

3 Run a suitable terminal program or application on your data terminal (if appropriate - see Suitable Terminal Software) or application software.

4 Ensure that the recipient of the call has also completed steps 1-4 of 'Receiving a HSD call'.

5 Use your terminal program to dial the ident you wish to call; either using the dialling features of your application, or by typing ATD <*ident*>(note that ATDT or ATDP will not work).

6 When the call has been successfully set up, the mobile radio display will change to HSdt* and CONNECT will appear on your terminal screen (assuming your modem is programmed to allow messages).

7 You now have a link to the recipient's data terminal which is fully error corrected. Use your terminal program to initiate file transfer.

8 If you wish to abort the data call, use your terminal program to abort the transaction by sending 'BREAK'.

** only on models equipped with a display*

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Examples

Receiving a High Speed Data Call

1 Ensure that your modem is connected to both the data terminal and the mobile radio as described in the installation procedure.

2 Ensure that both the mobile radio and the data terminal are powered up.

3 Run a suitable terminal program on your data terminal (if appropriate - see Suitable Terminal Software) or application software.

4 Use your terminal program to go 'on line', by typing ATO.

5 When the call has been successfully set up, the mobile radio display will change to HSdt* and CONNECT will appear on your terminal screen (assuming your modem is programmed to allow messages).

6 You now have an error corrected link from the sender's data terminal. Use your terminal programe to capture incomong information.

7 When you have finished your transfer, use your terminal program to end the transaction by sending 'BREAK'.

**See Service Manual for more details on how to make a suitable application.*

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Examples

Status calls (SDM1)

To send status code 22 from mobile 0711 to 0703.The following string would be entered at mobile ident 0711:

^BC070322^C

The sending mobile would acknowledge this message by sending ^B0^C to its terminal. The receiving mobile (ident 0703) would add status 22 to its stack, or if in terminal mode, it would output the string ^BC071122^C to its terminal.

Short data messages (SDM2)

To send the message 'Trevor, go home' from mobile 0703 to mobile ident 4321, the following string would be entered at the sending terminal:

^BB4321Trevor, go home^C

The sending mobile would acknowledge this message by sending ^B0^C back to the terminal. The receiving mobile (ident 4321) would output the string ^BM0703Trevor, go home^C to its terminal.

Long data message (LDM)

To send a long message from mobile 0703 to mobile 0711, the following string could be used:

^BT0711

This string is far too long for a short data message, so we must instead send it using a long data message^C.

The transmitting mobile would output the following strings to its terminal:

^B0^C (acknowledge)
^BD^C (call cleared down)

The receiving mobile would send ^BM0703This string is far too long for a short data message, so we must instead send it using a long data message^C.

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Trouble Shooting

If your data call is unsuccessful, it is probably due to one of the following:

- You have moved out of the system's coverage area
- The called party has moved out of the system's coverage area
- The called party is in the middle of another call
- The called party is switched off
- The called party modem is not 'on line'
- The base station's data channel is busy

The modem response will indicate the type of problem - see *Replies from the Modem'* on page 14.

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Glossary of Terms

ADNT	Advanced Digital Network Trunking
ARQProtocol	Automatic Repeat Request. Requests re-transmission of data blocks which are received erroneously.
Asynchronous	All the switching operations are triggered by a free-running signal so that successive stages are triggered by completion of operation of the preceding stage.
Base Station	This is the 'nerve centre' of the network, and comprises the control circuitry and switching equipment required to operate the radio network. It performs a similar role to an exchange in a telephone network. Sometimes referred to as a Repeater or a Mobile Relay.
Bit Rate	Speed of data transmission.
BPS	Bits per second
Data Compression	A method of condensing information so that more data can be transmitted in the same time period at the same bit rate.
DCE	Data circuit terminating equipment
DTE	Data Terminal Equipment, e.g. a PC.
FCC	Federal Communications Commission. The regulating body for radio transmissions in the USA.
Half Duplex	The communications channel can only operate in one direction at a time, i.e. the modem can either receive or transmit data but not both simultaneously.
Identity Id	This is a four digit identification assigned to individual radios. You must know the identity of another mobile radio before you can make a data call to it.
LDM	Long data message
LM	Linear Modulation.

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Glossary of Terms

Modem	The modem operates by converting data from the PC to which it is connected into audible tones, which are then transmitted across the radio link. The receiver takes these tones and converts them back into usable data. These processes are called modulation and demodulation respectively, hence the term modem.
QAM	Quadrature Amplitude Modulation.
QPSK	Quadrature Phase Shift Keying - QAM with constant amplitude.
RS232	A standard serial data interface used to connect printers and data terminals.
RU	Radio Unit.
SDM	Short data message.
Serial Port	An equipment connector which can input or output serial data.
Synchronous	The timing of all switching operations is controlled by clock pulses.
TCC	Trunking channel controller.
Trellis	Data coding scheme on top of QAM.
V32	A CCITT recommendation for data modems.

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