

**HF Radio-Telephone Interconnect  
IPC-500C  
(4 or 6-digit selective call)  
Reference Manual**

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This manual applies to the IPC-500C Radio-Telephone Interconnect equipment fitted with software specific to 4 or 6-digit selective calling applications. In the case of 6-digit selective calling, the IPC-500C is connected to a personal computer (PC), which provides setup and call validating information to the radio-telephone interconnect.



This manual does not cover the PC or the software used to communicate with the IPC-500C in 6-digit selective calling applications.

The manual describes how to use the Codan IPC-500C radio-telephone interconnect equipment. It contains nine chapters:

Chapter 1 provides lists of all terms, abbreviations and units used in this guide.

Chapter 2 introduces the IPC-500C and describes its controls and displays.

Chapter 3 describes the installation and setup procedures.

Chapter 4 explains how to use the IPC-500C.

Chapter 5 describes the IPC-500C mode indications.

Chapter 6 describes how to program the (4-digit) IPC-500C remotely.

Chapter 7 contains advanced technical information for the use of technicians.

Chapter 8 contains information on the System Control Signals.

Chapter 9 includes the major circuit diagrams and assembly drawings. They are provided in A3 size.





An index is included in the rear of the manual.

## Standards and icons

The following standards and icons are used in this manual:

<b>This typeface</b>	<b>Means</b>
<b>Bold</b>	the name of a button, knob or LED and a segment of text from the display
<i>Courier</i>	a whole screen display
<i>Italic</i>	a cross-reference or text requiring emphasis

<b>This icon</b>	<b>Means</b>
	a step within a task
	a warning—it is possible that you will seriously damage yourself or the equipment
	a caution—your actions may lead to loss of data, privacy or signal quality
	a note providing information that may be of special interest to you

# Definitions

## Acronyms and abbreviations

<b>This term</b>	<b>Means</b>
ACA	Australian Communications Authority
AUSTEL	The organisation (now known as ACA) that previously provided authorisation for the equipment to be used on the telephone network in Australia
BCD	Binary coded decimal
DOTAC	Australian Department of Transport and Communication
DTMF	Dual tone multi-frequency
EEPROM	Electrically erasable programmable read only memory
FSK	Frequency shift keying
HF	High frequency
LCD	Liquid crystal display
LSB	Lower sideband
NC	Not connected
PC	Personal computer, IBM compatible
P-P	Peak to peak voltage
PSTN	Public switched telephone network
PTT	Press-To-Talk (microphone)
RF	Radio frequency
RVA	Recorded voice announcement
Rx	Receive
SELV	Safety extra low voltage
SMA	Spectrum Management Authority (now called ACA, see above)
SSB	Single sideband
Tx	Transmit
USB	Upper sideband
VOX	Voice operated switching



## Glossary

<b>This term</b>	<b>Means</b>
Address	Code identifying a selcall number or short form number.
Balancing	The automatic process followed by the IPC-500C to ensure that the connection between the telephone line and the transceiver circuit functions correctly.
Beacon call	A call used for checking signal conditions.
Cadence	The beat or measure of something rhythmic, for example, the tones produced on a phone line.
Control interface	A cable, incorporating interface components, connecting two items of equipment that allows control information to be passed between the equipment.
DTMF	Dual tone multi-frequency—the technology used by modern push-button telephone systems for dialling numbers. Also, the technology used in the microphone used with the IPC-500C.
Handshake	An extra signal transmitted along a wire when data is transferred from one device to another. The signal tells the other device that data is ready to be transferred, and that the receiver is ready to accept it.
HF	High frequency—the range of frequencies over which the radio can operate (2–30 MHz).
ID	Identity—in this system, the identity of a Codan unit e.g. selcall ID.
IPC-500C	The radio-telephone interconnect—the device that allows the radio network and telephone network to be connected.
Line hybrid	The part of the IPC-500C circuit used to balance the telephone line.
Mobile	An HF transceiver able to access the IPC-500C to make or receive telephone calls. In this handbook, mobile includes transceivers at fixed places as well as those in a vehicle.
PSTN	Public switched telephone network—the telephone system.
Revertive	The tone sent back by a receiving transceiver to tell the sender that it has received the transmission.
RS232	An industry standard for the serial interconnection of computers and computer related equipment. It defines the electrical characteristics of the signals.
Selcall	A transmission technique that allows calls to be directed to the target radio rather than all users on the system. (The conversation that may follow can be heard by any listener tuned to the same frequency.)
Selective beacon call	A call used for checking signal conditions to a selected transceiver.

<b>This term</b>	<b>Means</b>
Short form	Telephone numbers stored in the IPC-500C memory and used instead of entering the full telephone number.
Simplex	Radio conversation that can only proceed in one direction at a time.
Transceiver	A radio that is a combined transmitter and receiver.
VOX	Voice operated switching—the means whereby the voice is detected and used to switch the transceiver between transmit and receive accordingly.

## Units

<b>Measurement</b>	<b>Unit</b>	<b>Abbreviation</b>
Attenuation	decibels	dB
Frequency	hertz	Hz
Impedance	ohm	$\Omega$
Power	watt	W
Voltage	volt	V

## Unit multipliers

<b>Unit</b>	<b>Name</b>	<b>Multiplier</b>
$\mu$	micro	$10^{-6}$
m	milli	$10^{-3}$
d	deci	$10^{-1}$
k	kilo	$10^3$
M	mega	$10^6$

## About this issue

This is the first issue of the *HF Radio-Telephone Interconnect IPC-500C (4 or 6-digit selective call) Reference Manual*. It combines and replaces the separate *Codan Model IPC-500C User's Guide and Installation manual* for both the 4-digit (Codan part number 15-04064) and the 6-digit (Codan part number 15-04065) selective calling options.

This manual applies to IPC-500C Radio-Telephone Interconnect equipment fitted with software specific to 4 or 6-digit selcall applications.

This chapter introduces the Codan IPC-500C Radio-Telephone Interconnect equipment and explains briefly what it does and how it works.

### About the IPC-500C

The IPC-500C Radio-Telephone Interconnect allows HF transceivers (usually mobiles) to make or receive telephone calls automatically, without the need for an operator. A manual mode of operation can also be supported, if required. It provides an interface between the 4-wire (2 x Tx and 2 x Rx) radio lines and the 2-wire telephone line.

For telephone calls to be placed automatically from a mobile transceiver, the transceiver must be fitted with selective calling facility. The IPC-500C can be set up to work with either 4 or 6-digit selective call addresses. This is determined by the EPROM inside the IPC-500C.

Both configurations support free dialling access to any telephone number of up to sixteen digits.

Some transceivers cannot provide direct entry of a telephone number. To allow for these and to provide a form of abbreviated dialling, telephone numbers can be stored in the IPC-500C. These may be accessed by a 2-digit short form code. The IPC-500C can store up to 98 telephone numbers in separate locations for general use. The 99th location is generally reserved for beacon calls.

When set up to work with 4-digit selective call addresses, the IPC-500C (connected to a transceiver) can function without an external computer. This is known as a stand-alone configuration and is the normal mode of operation. Programming of IPC-500C parameters e.g. selective call address, stored telephone numbers, scan program details and valid selcall addresses are carried out using a DTMF keypad microphone connected to the front panel of the IPC-500C. Call logging information is available from a serial port on the rear panel.

When set up to work with 6-digit selective call addresses, the IPC-500C must be connected to an external computer running a Codan proprietary application program. This mode of operation would generally be used by service providers for a private or public network. Computer hardware and application software is available to support up to eight IPC-500C radio systems in parallel, connected to one computer. This allows up to eight calls to be made simultaneously. Programming of parameters, such as selective call address, stored telephone numbers and scan program details are carried out from the computer. Call logging information and valid selcall addresses are stored on the computer.

## System requirements

Both the mobile transceiver and the IPC-500C must have selective calling (selcall) facilities.



Note that selcall is not required in the base station transceiver for radio-telephone interconnect operation, as the IPC-500C performs selcalling when in Automatic mode. Selcall is required for manual calling of other stations.

In addition, in 6-digit systems where called number information is to be encrypted, each transceiver requires a registration serial number to be embedded within its own software before it will operate in this system.

To call a mobile from a telephone, a DTMF telephone must be used rather than a rotary dial (decadic) type. Most modern push-button telephones are DTMF.

Calls can be received by any kind of telephone.

## Conditions of use

It is a condition of AUSTEL Permit No. A90/43D/0110 allowing connection to a carrier's telecommunications network, that only HF SSB radios approved by the Australian Department of Transport and Communication (DOTAC) may be used with the IPC-500C.



Note that radio matters previously the responsibility of DOTAC were for a period administered by the Spectrum Management Authority (SMA) and are now under the control of the Australian Communications Authority (ACA).

# Controls and indicators

The controls and indicators of the IPC-500C are shown in Figure 2-1 below and outlined in the table following.

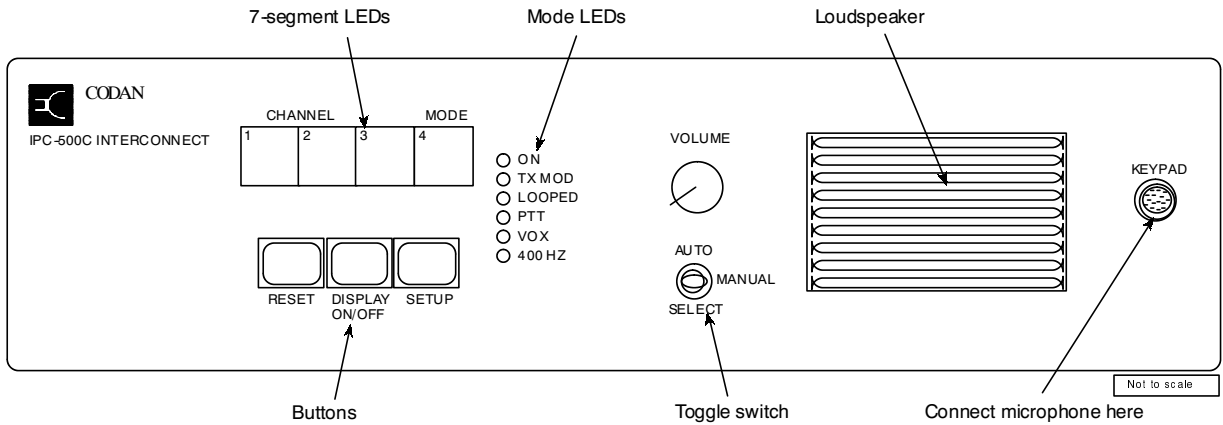


Figure 2-1: IPC-500C front panel

## LED (7-segment) displays

There are four LEDs, each consisting of seven segments, which allows any digit from 0 to 9 to be displayed.

Table 2-1: LED 7-segment displays

LED	Function
<b>Digit 1</b> —Channel	Displays the first digit of the selected channel
<b>Digit 2</b> —Channel	Displays the second digit of the selected channel  Channels 1 to 15 (or 81 to 95 with JP4 fitted) are valid channels  If the IPC-500C is connected to a transceiver and operating in Automatic mode, the channels will change every 750 ms as they are scanned (there is also another version of software that allows ten channels to be scanned at 600 ms per channel)
<b>Digit 3</b>	Shows the telephone number dialled by an IPC-500C  Each digit is shown here momentarily  Also used in Setup mode to display the digits and verify them as they are programmed
<b>Digit 4</b> —Mode	Indicates what the IPC-500C is doing at any time  This information is useful to a technician, but is not essential for a user

## LED indicators

The following LEDs indicate the status of the IPC-500C.

Table 2-2: LED indicators

LED	Function
<b>On</b> (green)	Indicates that the IPC-500C has power
<b>TX MOD</b> (red)	Indicates that RF power is being transmitted by the transceiver The intensity of the red LED indicates the modulation level
<b>Looped</b> (yellow)	Indicates that the telephone line is looped, that is, the IPC-500C has put a DC termination on the telephone line or ‘taken the phone off the hook’
<b>PTT</b> (red)	Indicates that the IPC-500C is activating the <b>PTT</b> input of the associated transceiver
<b>VOX</b> (red)	Indicates that the IPC-500C has detected voice from the telephone
<b>400 Hz</b> (red)	Indicates that the IPC-500C has detected audio frequencies in the range of approximately 370 to 470 Hz on the telephone line; telephone service tones fall within this range of frequencies

## Buttons, knobs and switches

The following buttons, knobs and switches are located on the front panel of the IPC-500C and are used to control the interconnect:

Table 2-3: Controls, buttons and switches

Control	Function
<b>RESET</b>	Resets the IPC-500C microprocessor (momentary action switch)
<b>DISPLAY ON/OFF</b>	Switches the LED displays off (push in) to conserve power to the IPC-500C when it is unattended (latching action switch)
<b>SETUP</b>	Puts the IPC-500C into a mode in which you can enter parameters to be stored (latching action switch)
<b>VOLUME</b>	Controls the volume of the internal loudspeaker, which allows monitoring of speech through the IPC-500C  Turn this knob completely anti-clockwise to conserve power when the IPC-500C is unattended
<b>MANUAL/AUTO/ SELECT</b>	Selects between automatic and manual modes of operation  Also used in the <b>Manual</b> position to manually connect a telephone party to a radio party  In the <b>Select</b> position, the IPC-500C immediately loops the telephone line; when it is released (the switch has a spring return), the IPC-500C balances the line hybrid (mode 2)



## Front panel connection

The **KEYPAD** socket on the front panel is shown on Figure 2-1. It is used to connect a DTMF microphone (via a 6-way socket) to the IPC-500C.

## Rear panel connections

The rear panel connections are listed below.

Table 2-4: Rear panel connections

Connector	Function
<b>Transceiver</b>	Connects the IPC-500C, via a DB25P male connector, to a Codan transceiver or remote control system via Control Interface cable 08-04973-001, 08-04973-002, 08-05208-001 or 08-05208-002
<b>Port</b>	Connects the IPC-500C, via a DB25S socket, to an external RS232 'call logging' printer or computer terminal
<b>Modem</b>	Connects the IPC-500C, via a DB15P plug, to an external modem to provide remote access for adding, editing or deleting short form telephone numbers and valid transceiver self addresses (IDs)

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### Installation

The IPC-500C connections are described in the section *Rear panel connections* on page 2-7. The IPC-500C and transceiver are usually mounted together but may be cabled up to five metres apart if necessary.

The IPC-500C must be connected to a transceiver and to any or all of the following:

- “call logging” printer or terminal
- computer (mandatory with 6-digit)

Various parameters need to be set up in the IPC-500C:

- selcall self IDs
- channel scanning
- short form phone numbers
- time and date
- validating or invalidating selcall IDs

## Connecting the IPC-500C to the transceiver using DB25P connector

The DB25P connector is used to connect the transceiver to the IPC-500C. Refer to the Interconnection Diagram, 04-PC101, provided at the rear of this manual.

Table 3-1: Transceiver connections

Pin	Function
1	Chassis (connected to 0 V)
2	NC
3	PTT (open collector, Tx = 0 V)
4	NC
5	NC
6	Audio out (balanced)
7	NC
8	Audio out (balanced)
9	Link busy
10	NC
11	Channel select BCD 6
12	NC
13	Audio in (unbalanced) 1 V P-P required
14	0 V
15	+ 12 V in
16	Channel select BCD 2
17	+ 12 V in
18	Channel select BCD 3
19	Channel select BCD 0
20	NC
21	Channel select BCD 1
22	Tx modulation LED +
23	Channel select BCD 5
24	Tx modulation LED –
25	Channel select BCD 4

## Logging connection

A logging device such as a printer may be connected to the 25-way **Port** socket on the rear of the IPC-500C. The logging device must be an RS232 compatible serial device. In 6-digit selective calling applications, an IBM compatible PC running Codan proprietary application software is connected via the **Modem** port.

### Serial printer/terminal configuration

The logging device must be set up for the following RS232 serial configuration:

Table 3-2: RS232 serial configuration for logging device

Parameter	Value
Baud rate	1200
Parity	None
Data bits	8
Stop bits	1
Handshake	None

### Serial printer/terminal cable connections

Cable connections are defined for connection either to a standard 25-way RS232 connector or an IBM PC 'AT' type 9-way connector.

Table 3-3: Cable connections

25-way IPC-500C logging port (plug)	25-way computer serial port (socket)	9-way computer serial port (socket)	Pin function
Pin 2	Pin 3	Pin 2	TxD1, data from IPC-500C
Pin 3	Pin 2	Pin 3	RxD1, data to IPC-500C
Pin 7	Pin 7	Pin 5	Signal ground

## Computer connection

A 6-digit selective calling IPC-500C system must be connected to a computer using the 15-way **Modem** connector on the rear panel. For call log recording and selcall validation, the computer must include a PCL-844 intelligent 8-port RS232 ISA bus card.

## Computer configuration

The computer must be set up for the following RS232 serial port configuration:

Table 3-4: RS232 serial port configuration for computer

Parameter	Value
Baud rate	1200
Parity	none
Data bits	8
Stop bits	1
Handshake	none

## Computer cable connections

Cable connections are defined for connection either to a 15-way port or to an IBM-PC 'AT' style 9-way D connector.

Table 3-5: Computer cable connections

15-way IPC-500C port (socket)	9-way computer serial port (socket)	Pin function
15	2	TxD2, data from IPC-500C
7	3	RxD2, data to IPC-500C
8 & 10	5	Signal ground

## Internal switch options and VOX sensitivity control

Open the top cover of the IPC-500C to expose the main printed circuit board and to view the ‘top hat’ links shown in Figure 3-1 below.

### Link positions

The positions and functions of the links are explained in the following table.

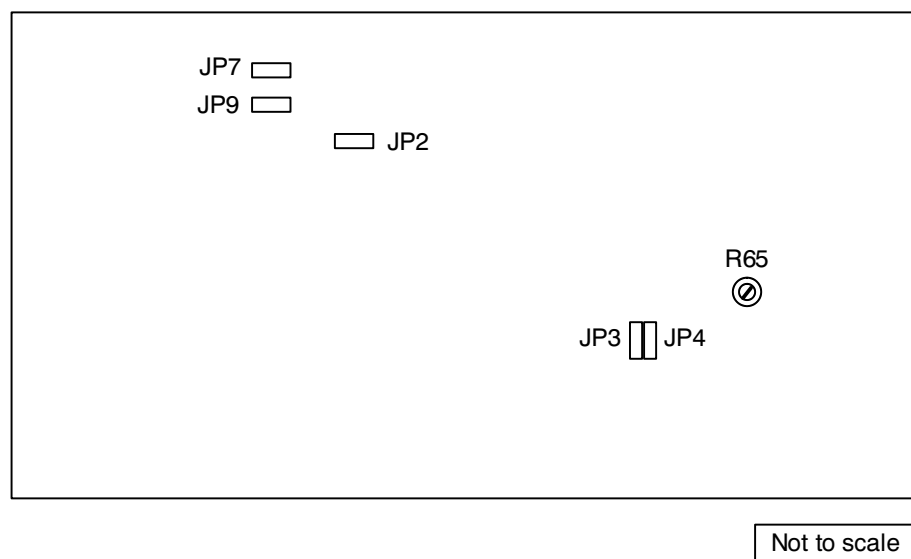


Figure 3-1: Internal links

Table 3-6: Internal links

Link	Link status	Means
JP2	Installed	Transceiver <b>PTT</b> enabled
	Removed	Transceiver <b>PTT</b> disabled
JP3	Installed	Decadic dialling
	Removed	DTMF dialling
JP4	Installed	Scan channels 81...95
	Removed	Scan channels 1...15
JP7	Not used	
JP9	Installed	Link busy line connected
	Removed	Link busy line disconnected



Note that R65, shown in the illustration, is a potentiometer used to adjust VOX sensitivity.



## VOX sensitivity

The factory setting of voice operated switching (VOX)—approximately 3/4 turn clockwise— will provide good 2-way communication in most environments. There are situations where higher or lower than normal telephone signal levels may reduce the VOX performance, but you should only adjust the VOX if a problem exists.

To adjust VOX:

- Initiate a call between the mobile and telephone party.
- Monitor call progress on the IPC-500C speaker.
- If the telephone caller's voice does not reliably operate the **VOX** LED on the front panel, turn potentiometer R65 slightly anti-clockwise to increase sensitivity.
- If the **VOX** LED remains on for more than two seconds after the telephone caller stops speaking, turn R65 slightly clockwise to decrease sensitivity.
- If these adjustments fail to improve the situation, contact your Codan representative.

## Power supply



The IPC-500C must be properly earthed, otherwise damage to the equipment may result.

The low voltage circuits are connected to the metal case of the IPC-500C. As a result the following issues must be considered.

The IPC-500C may be powered, via the transceiver, by an extra low voltage (ELV) power supply (such as Codan type 9113 or 9114). If this is connected to a properly earthed general purpose outlet, the mains cable supplied with the power supply establishes a satisfactory safety earth.

If the general purpose outlet does not have a mains earth, then the earth terminal on the power supply must be connected to the building protective earth with an earthing conductor having a cross-sectional area of not less than 2.5 mm<sup>2</sup>.

If a lightning protection device (Option TB) is used on the telephone line circuit, then an earthing connection between the rear panel of the IPC-500C and the building protective earth must be made with an earthing conductor having a cross-sectional area of not less than 2.5 mm<sup>2</sup>.

Alternatively the IPC-500C may be powered, via the transceiver, by a battery, a safety extra low voltage (SELV) power supply or approved plug pack. Unless lightning protection is required, these do not require any extra earthing. If lightning protection is required, then earth as per directions above.

For remote control applications with the 8570/8571, the following power arrangements apply.

Table 3-7: Power supply arrangements for remote control applications

<b>Codan model</b>	<b>Serial number series</b>	<b>Comments</b>
8570/8571 remote control system	'A' series	Connection is made with control interface 08-04973-002 and power must be derived from an approved plug pack
	'B' series without option SB	Connection is made with control interface 08-05208-001 and power is supplied from the remote control unit itself
	'B' series with option SB	Connection is made with control interface 08-05208-001 or 08-05208-002 and power must be derived from an approved plug pack

## Setup (4-digit)

This section is applicable only for the 4-digit IPC-500C. In the 6-digit version, all of these parameters may be set up using the attached computer.

Several parameters may need to be set up. All parameters are stored in non-volatile EEPROM. The parameters that you may need to set up are:

- IPC-500C Selcall self-ID code—the 4-digit selcall address of the IPC-500C unit (always required)
- channel scan—required if the IPC-500C is to operate in automatic mode; you can program up to eight channels in any sequence (special software is available to enable ten channels to be programmed)
- short form phone numbers—up to 98 telephone numbers can be stored and accessed in abbreviated form
- time and date—required if telephone call activity is to be logged
- validating or invalidating selcall IDs—only mobiles with valid selcall IDs may make telephone calls via the IPC-500C

## Set up procedure

You must first place the IPC-500C in Setup mode before you can alter any of the parameters.

### Entering Setup mode

To alter any of the parameters:

- Attach a DTMF microphone to the **Keypad** connector.
- Apply power to the IPC-500C and ensure the display is switched on by pressing **Display On/Off**.

On initial power up, or after **Reset**, the display shows the version of software fitted (such as 1.06) for about one second before changing to mode 1 (see Chapter 5, *IPC-500C mode indications*).

- Press **Setup**.

The display shows four dots, which indicates that the IPC-500C is in Setup mode. You can now alter any of the parameters, as explained in the remainder of this chapter.

### Leaving Setup mode

To leave Setup mode after you have finished altering any parameters:

- When the display shows four dots, press **Setup** to exit Setup mode.

An automatic reset is generated and the version of software fitted is displayed for about one second before changing to mode 1 (see Chapter 5, *IPC-500C mode indications*).

- Use the **Auto/Manual** toggle switch to select Auto or Manual mode, as required.

### Programming selcall self ID code



This step is always required.

There are some issues to be considered when assigning self ID codes (see page 3-12, *Programming short form telephone numbers*).



Always allocate the first two digits of your IPC-500C self ID code to be different from that of mobiles or other bases in your network. This will avoid conflict between selcall addresses and accessing short form telephone numbers. For example, if the IPC-500C has a self ID code of 1201 with a short form number in position 34, and there is a mobile in the same network with a self ID code of 1234, conflict will occur. The short form number in the IPC-500C would be accessed by selcalling 1234. This would also call the mobile with that self ID code. The IPC-500C should have been assigned a self ID code that did not start with 12.

To program the self ID code of the IPC-500C:

- Enter Setup mode (see page 3-9, *Entering Setup mode*).
- Check that the toggle switch is at **Auto** (program mode).
- Enter the selcall memory access code (1245534) using the DTMF microphone keypad.

A beep will sound after the last digit is entered and **Digit 1** LED will show a square in its upper segments.

- Enter the required 4-digit selcall self ID code.

**Digit 4** (Mode) shows each digit as it is entered. Another beep will sound after the last digit is entered. Each digit is then replayed in turn to verify that it has been correctly programmed into EEPROM. A further beep confirms that the entry is verified.

**Digit 3** (Channel) indicates the number of digits in the selcall self ID. The entire display then reverts to four dots.

If you press **#** before entering any digits, an error beep will sound.

If the programmed ID is incorrect, enter the access code and program the 4-digit selcall self ID code again.

- Exit Setup mode (see page 3-9, *Leaving Setup mode*).

## Programming scan channels

Channels will be scanned in the sequence in which they are programmed. Up to eight channels may be programmed. (Ten channels may be programmed if special software is purchased.)

Channel numbers 01 to 15 are valid for programming (alternatively, link JP4 may be fitted. This makes channel numbers 81 to 95 valid).

If you make a mistake during the following procedure, press **\***. A long error beep will sound and the display will revert to four dots. Start the programming sequence again.

To program the channel scan sequence:

- Enter Setup mode (see page 3-9, *Entering Setup mode*).
- Switch the toggle switch to **Auto**.
- Press **\*** followed by **00** using the DTMF microphone.

When **00** is entered, it is displayed on **Digit 1** and **Digit 2**. The unit beeps after the second **0** is entered.

- Enter two digits for the first channel required in the scan.

Note that channels 1 to 9 must be entered as 01 to 09. As each digit is entered, it is displayed twice on the display; once on **Digit 4** (Mode) as it is written into memory, and again after a short delay on **Digit 3** as it is verified.

- Enter two digits for each of the remaining channels to be scanned.
- After the last channel is entered, press **#**.

The display will show four dots.



Up to eight channels may be programmed. If you try to enter more than this, the unit will emit a long error beep and the display will revert to four dots. You must then restart the programming sequence as the scan table will have been cleared.

- Exit Setup mode (see page 3-9, *Leaving Setup mode*).

## Reviewing the channel scan sequence

To review the channel scan sequence:

- Enter Setup mode (see page 3-9, *Entering Setup mode*).
- Switch the toggle switch to **Manual**.
- Press **\*** followed by **00** using the DTMF microphone.  
A beep sounds after the second **0**.
- Press any key except **#**.

The number of scan channels programmed will be displayed on **Digit 3**. The next key press will show the first stored digit of the first scan channel. This is displayed on **Digit 4**. Subsequent key presses show all stored digits until the last one is displayed. Pressing a key after the last digit has been displayed ends the review and the display reverts to four dots.

If you want to abort the review at any time, press **#**. The display reverts to four dots.

- Exit Setup mode (see page 3-9, *Leaving Setup mode*).

## Programming short form telephone numbers

Short form numbers may only be entered into positions 01 to 98. Position 00 initiates group calls and position 99 initiates a beacon call.



Note that because the last two digits of the selcall address are used for selection of the short form numbers, there are some restrictions on the short form numbers that can be allocated to each station. For example, if the selcall address of the IPC is 1243 then 43 should not be used as a short form number (see page 3-9, *Programming selcall self ID code*).

If channels are shared with other networks, be careful not to allocate short form addresses that duplicate those of other users.

To program telephone numbers:

- Enter Setup mode (see page 3-9, *Entering Setup mode*).
- Set the toggle switch to **Auto**.
- Press **\*** followed by the two digit short form number (01 to 98) using the DTMF microphone.

The first digit will be displayed on **Digit 1** and the second on **Digit 2**. A beep will sound after the second digit is entered.

- Enter the corresponding full telephone number (up to 16 digits), entering the digits in the order in which they are to be dialed.

As each digit is entered it is displayed twice—once on **Digit 4** (mode) as it is written to memory, and again after a short delay on **Digit 3** as it is verified.



If you enter more than 16 digits, a long error beep will sound and the display reverts to four dots. Repeat the programming step for that number as the entry will have been cleared.

- After the last digit is entered, press **#**.

The display reverts to four dots.

- Repeat the procedure above for each of the short form numbers to be programmed.
- If you want to delete or leave a short form number position empty, press **#** without entering a telephone number.

For example, to leave short form number 07 empty, enter:

**\* 0 7** (beep) **#**

- Exit Setup mode (see page 3-9, *Leaving Setup mode*).

## Reviewing short form telephone numbers

You may want to review the telephone numbers to ensure they have been entered correctly.

To review the numbers:

- Enter Setup mode (see page 3-9, *Entering Setup mode*).
- Set the toggle switch to **Manual**.
- Press **\*** followed by the short form number (01 to 98), using the DTMF microphone.

A beep will sound after the second digit.

- Press any key except **#**.

The number of stored digits is indicated on **Digit 3**. Where the number of stored digits is 10 or greater, a decimal point to the left of the digit indicates this. For example if six digits are stored, a **6** is displayed; if sixteen digits are stored **.6** is displayed.

If you want to abort the review at any time, press **#**. The display reverts to four dots.

- Press any key except **#**.

The first stored digit of the telephone number is displayed on **Digit 4** (mode). Press any key repeatedly to show all stored digits until the last one is displayed. Press the key again to return the display to four dots. This indicates that the read-out of that short form number is completed.



- If you want to review another number, press **\*** followed by the digits of the next short form number to be read.
- Exit Setup mode (see page 3-9, *Leaving Setup mode*).

## Setting the time and date

The date and time are logged to the computer in 6-digit selective calling systems. This enables you to view the time, date and duration of calls. In 4-digit systems this information is fed to the serial port and can be logged from there to a serial printer or other recording device.

You must use 24 hour format to enter the time. For example, 4 p.m. is 1600.

To set the time and date:

- Enter Setup mode (see page 3-9, *Entering Setup mode*).
- Set the toggle switch to **Select** and release it.

The switch automatically returns to **Manual**. A single dot appears in the left-most digit.

- Press **\*** on the DTMF microphone.
- Enter the time and date in 24 hour format as shown in the example below:

4:25 p.m. on 15 Jan 1998 is entered as:

yy	mm	dd	hh	mm
98	01	15	16	25

As each digit is entered, it is displayed on **Digit 1**. Wait until each digit is displayed before entering the next digit. If you make a mistake, press **\*** and enter the entire date and time again. When the last digit is entered the clock re-starts and the display reverts to a single dot.

If you want to abort the operation at any time, press **#**. The display reverts to four dots.

- Exit Setup mode (see page 3-9, *Leaving Setup mode*).



If a logging device is connected, leaving Setup mode (by releasing **Setup**) logs the date and time.

## Validating, invalidating and reviewing selcall IDs

The IPC-500C can be set up to allow telephone calls to be made via the IPC-500C from mobile stations with specific (valid) selcall ID numbers only. This is set up by entering a selcall ID number range and then validating, invalidating or reviewing that range of numbers.

On IPC-500C 4-digit selective calling units, validating, invalidating or reviewing of selcall ID numbers can be performed remotely via a telephone line and modem. A terminal (or PC) and a second telephone modem are required at the local end.

If a mobile with an invalid ID tries to access the IPC-500C, the IPC-500C denies access and resumes scanning.



We recommend that you invalidate all ID numbers when you first set up the system. To do this, enter **0000** as the start and **9999** as the end of the range. You can then validate specific numbers or ranges as required.

To validate, invalidate or review a single number, enter it as both the start and end of the range. If the end of the range is lower than the start, an error beep is transmitted and you must start the process again.

### Selecting the range

- Enter Setup mode (see page 3-9, *Entering Setup mode*).
- Set the toggle switch to **Select** and release it.

A single dot appears at the left of the display.

- Using the DTMF microphone, enter the number corresponding to the beginning of the range of interest.

The numbers are displayed as they are entered. A brief time after the last number is entered, the left-most display digit will show “\_”, and the remaining digits will be blank.

- Enter the number corresponding to the end of the range of interest.

The numbers are displayed as they are entered. After the last number is entered, the display will show:    .

To choose only one number, enter it as the beginning and again as the end of the range. The display will show:    .

## Validating, invalidating and reviewing selcall IDs

To validate, invalidate or review selcall IDs:

- Perform the tasks that you want from the list below.

### To

Invalidate all numbers in the range  
Validate all numbers in the range  
Review all valid numbers

### Continue from

Invalidating all numbers  
Validating all numbers  
Reviewing valid numbers

## Invalidating all numbers

To invalidate all numbers in the range:

- Press **0** on the DTMF microphone.

As each number is invalidated it is displayed for an instant. If there are only a few numbers in the range, they are displayed too rapidly to be read. If the full ID range of 10,000 numbers are invalidated, the process takes about 2.5 minutes. The display of blocks of around 500 to 1000 numbers takes approximately 10 seconds. When the task is finished a dot on the leftmost digit is displayed.

- To end this task, press **#** on the DTMF microphone.

Four dots will now be displayed.

- Continue from *Leaving Setup mode*.

## Validating all numbers

To validate all numbers in the range:

- Press **1** on the DTMF microphone.

As each number is validated it is displayed for an instant as described above. When the task is finished a dot on the leftmost digit is displayed.

- To end this task, press **#** on the DTMF microphone.

Four dots will now be displayed.

- Continue from *Leaving Setup mode*.

## Reviewing valid numbers

To review all valid numbers in the range:

- Press **2** on the DTMF microphone.

Valid numbers are displayed in sequence for about one second each, starting at the lowest number in the range. When the task is finished a dot on the leftmost digit is displayed.

- To end this task, press **#** on the DTMF microphone.  
Four dots will now be displayed.
- Continue from *Leaving Setup mode*.

### **Leaving Setup mode**

To leave Setup mode after you have finished the set up:

- Exit Setup mode (see page 3-9, *Leaving Setup mode*).
- If you want to invalidate, validate or review selcall IDs in a different range, repeat the steps from page 3-15, *Selecting the range*.

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# 4 Using the IPC-500C

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## Overview

### Telephone call protocol

Telephone calls made or received by an HF transceiver using the IPC-500C are still radio conversations and normal radio protocols must be observed, particularly by the person using the telephone.

For example, only one person may speak at a time. The person talking should use the word “OVER” when ready to hand back to the other person.

### Privacy warning



The conversation is carried over an HF radio path, which means that it may be intercepted by anyone tuning to the frequency in use.

### Call logging

If a mobile calls a telephone, the IPC-500C records the following details:

- date
- time
- ID of caller
- telephone number called
- terminating party—Rad(io), Tel(ephone) or Tim(ed out)
- duration of the call



If the telephone is not answered (N), engaged (E), or if the caller ID was invalid (I), this is indicated in place of the call duration.

An example of a typical entry is:

10/10/97	17:09.32	1884	08895 38779	Rad	00:05.57
----------	----------	------	-------------	-----	----------

In 6-digit selective calling applications, this information is recorded in a call log file within the PC. In 4-digit selective calling applications it is made available to the RS232 port for transmission to a printer or other logging device.



If a telephone party calls a mobile, the ID of the caller will be shown as AUTO, and a telephone number will not be recorded.

## Line balancing

When calls are made between a transceiver and telephone, using the IPC-500C as the interface, it is always necessary to balance the 4-wire transceiver line to the 2-wire telephone line. Balancing ensures that the audio level heard on transceiver and telephone are equal to within acceptable limits and that no distortion occurs. If the line is not balanced properly, parts of the conversation may be lost or become distorted or the IPC-500C may release the circuit prematurely.

The IPC-500C balances the line automatically by emitting a 1100 Hz balancing tone for up to ten seconds. If the line cannot be balanced because of line difficulties the telephone caller can control the direction of conversation to work around this problem (see page 4-6, *Caller controlled calls*).

## Recorded message

A recorded message is played when a call is made from the mobile. This recorded message alerts the telephone party to the fact that the call is not a normal telephone call and therefore normal radio protocol should be followed. It also explains that a tone will be heard. This is the balancing tone.

Another function of this message is to prevent the caller from speaking during the balancing process. The message has been created specially and has been stripped of its 400 Hz components. If the caller were to speak directly after picking up the handset, the 400 Hz components of their speech could 'confuse' the IPC-500C, which may interpret the 400 Hz components as telephone network service tones. It might therefore continue to function as though the telephone was still ringing and had not been answered.

## Ending a call

A call can end in one of four ways:

- the telephone party dials **99** before hanging up (recommended method)
- clearback tones are received from the telephone exchange to indicate that the connection has been hung up (these tones are provided by the telephone systems in some countries)
- the IPC-500C detects that VOX activity has ceased for a period of one minute
- a valid FSK disconnect (EndCall) selective call is received from the radio

## Time-outs

During a call the IPC-500C emits a short beep every 15 seconds, providing no transmission is occurring at that time. A double beep is transmitted at 30 seconds and 15 seconds before the end of the call duration time, indicating to the caller that the call is about to be terminated. If no transmission has been made during the last minute the IPC-500C times out and hangs up its line.

## Call duration

Calls are limited to six minutes duration on the 4-digit IPC-500C. You can extend the time by pressing **00** on the telephone within a two second period. A further six minutes is then possible. You can extend the call duration as many times as you wish.



Special software is available for 30 minute call duration.

On the 6-digit IPC-500C, the call duration is programmable from the PC, with a maximum of 15 minutes. The sequence of digits used to extend the call is also programmed from the PC.

## Including third and subsequent parties

It is possible to bring other parties into the conversation at any time by dialling the selcall number(s) of the other party or parties.



## Operating modes

The IPC-500C can operate in one of two modes:

- **Auto**—enables it to function without operator intervention. In this mode the radio channels are constantly scanned.
- **Manual**—in this mode, an operator has to manually establish the call from a telephone instrument connected in parallel with the IPC-500C. It does not respond to ‘ringing voltage’ applied to the line from the telephone exchange, and will not dial out when requested to do so by the correct selcall signal received from a mobile (see page 4-12, *Using the IPC-500C in manual mode*).

The mode is selected by a toggle switch on the front panel.

The following sections assume the unit is in automatic mode. To select this mode:

- Set the front panel toggle switch to **Auto**.

## Making a call to a mobile from a telephone

Calls to mobiles from a telephone can be controlled in one of three ways:

- voice operated
- caller controlled
- unattended mobile

### Voice operated calls

This mode is used when the mobile HF transceiver is attended and the line can be balanced automatically. You can use selective calling and the selective beacon facility in this mode—refer later in this section.

To make a voice operated telephone call to a mobile HF transceiver:

- Dial the telephone number of the IPC-500C.

After four rings the IPC-500C should answer and you will hear a line balancing tone for up to ten seconds. Do not speak while this tone is present.

If the line is balanced successfully, you will then hear receiver noise. If the IPC-500C is scanning several channels, the receiver noise will change as the channel is changed.

If the line cannot be balanced properly, you will need to control the call from the telephone (see page 4-6, *Caller controlled calls*).

- Select a radio channel by entering the desired channel number on the telephone keypad.

You must always enter two digits, and they must be entered within two seconds of each other. For example, to select channel 4, enter 04.

If a channel is not selected within one minute, the IPC-500C automatically disconnects the line. To warn of impending disconnection, a short beep is transmitted after 15 seconds followed by a double beep after 30 and 45 seconds.

### Using the selective beacon facility

Both models of the IPC-500C can support selective beacon calls from the telephone party. This is only supported in the 4-digit model from version 1.07 of the main control EPROM 90-20555-xxx. The selective beacon is used to test the quality of the channel that you want to use. The quality will depend upon the selected frequency, the time of day and the distance that you are calling.

To use the beacon:

- Use your telephone keypad to enter the beacon address, as follows:

\* N N N N # \*

where NNNN is the selcall address of the mobile you want to call.

If the beacon is successful, four long beeps are transmitted, then you can place the selcall (see page 4-5, *Calling a mobile using selcall*). If the quality of the selected channel is poor, select another channel then send another beacon call.

If beeps are not returned, this indicates that the channel is unable to reach the desired mobile. This may be because the mobile is out of range or turned off. Select another channel, then try again.

### Calling a mobile using selcall

If you want to contact a particular mobile using selective calling:

- Listen to make sure the channel is clear of voice and data traffic.
- Use your telephone keypad to enter the selcall address as follows:

\* N N N N # #

where NNNN is the selcall address of the mobile you want to call.



Selcall addresses may consist of four digits in the 4-digit IPC-500C or six digits for the 6-digit IPC-500C.

The receiver noise will mute after \* is pressed. After the second # is entered, the selcall FSK tones are transmitted by the IPC-500C.

If you make a mistake while entering the selcall code, press \* and start again. You must press a key at least once every ten seconds or the selcall transmission will not occur and you will hear the receiver noise again.

If the selcall is successful, reverberative tones from the called station will be audible in the handset.

## Continuing the conversation

When you have reached the mobile and the call has been answered:

- Speak into the telephone handset *using correct radio procedure*.

While you are speaking the receiver noise should cease in the handset. This indicates that the VOX has operated and you are transmitting to air.



Always remember that whatever you say could be heard by anyone tuned to the same frequency.

- When your call is completed, press **99** within a two second period to instruct the IPC-500C to disconnect the line.

You will hear five long beeps in the handset.

- Hang up the phone during or after these long beeps.

## Caller controlled calls

If the telephone link is poor or if the line balancing is unsuccessful, you can override the VOX and control the direction of transmission yourself. You can do this at any time, even if the call has begun as a voice operated call.



The telephone party can control the call, regardless of which party initiated the call.

To control the direction of the call:

- Select the channel (see page 4-4, *Voice operated calls*).
- Press **#** on the telephone.

Receiver noise should cease and you can speak your message. After completing your message:

- Press **#** again.

You will again hear receiver noise, followed by the transceiver operator. Note that your transmissions are limited to 30 seconds using this procedure. After this time the transmission will stop and you will hear receiver noise.

- Continue the conversation, pressing **#** after each person says “OVER”.

Once you have begun this manual ‘toggle’ mode of operation, the IPC-500C will no longer change automatically from receive to transmit in response to your speech. You can re-enable VOX mode at any time by pressing **00** within a two second period.

- When your call is completed, press **99** within a two second period to instruct the IPC-500C to disconnect the line.

You will hear five long beeps in the handset.

- Hang up the phone during or after these long beeps.

## Unattended mobile

If the mobile transceiver you have attempted to contact is unattended and the radio can store telephone numbers, you can lodge your telephone number in the selcall memory of the mobile. The mobile operator will then be able to return your call later.



You can lodge your telephone number with an unattended mobile without having to hang up, redial the IPC-500C and select the channel again.

To register your number following a call to an unattended mobile:

- Enter the following sequence:

**\* N N N N N N # T T T T T T T T #**

where NNNNNN is the mobile's selcall number and TTTTTTTT is your telephone number (can be up to 16 digits).



For the 4-digit IPC-500C, enter a maximum of four digits (NNNN) for the selcall number.

If communication has been established you will hear revertive tones.

- When your call is completed, press **99** within a two second period to instruct the IPC-500C to disconnect the line.

You will hear five long beeps in the handset.

- Hang up the phone during or after these long beeps.

## Lodging a short form number

Up to 99 telephone numbers (called short form) can be pre-stored in the IPC-500C. If the required number is already resident in the IPC-500C as a short form number, the telephone caller can lodge the appropriate short form number instead of the full number. The called station can then return your call later.

To lodge a short form number:

- Enter the sequence:

**\* N N N N N N # SS #**

where SS is the short form number (01 to 98). In most systems 99 is used for making beacon calls and is not available for allocation to a short form telephone number.



For the 4-digit IPC-500C, enter a maximum of four digits (NNNN) for the selcall number.

If communication has been established you will hear revertive tones.

- When your call is completed, press **99** within a two second period to instruct the IPC-500C to disconnect the line.

You will hear five long beeps in the handset.

- Hang up the phone during or after these long beeps.

## Receiving an unattended call at your mobile

If your radio is unattended and has the capability, callers can lodge their telephone numbers in your mobile's selcall memory to await your return.

The indication of such a call having been received, and the procedure for returning the call depend on the make and model of your transceiver. Refer to the transceiver manual for instructions.

## Making a call to a telephone from a mobile

(Refer to your transceiver manual for full instructions.)

To call a telephone from your mobile transceiver:

- Select the channel you want to use and ensure it is free from voice and data traffic.
- If you want to check the quality of the radio channel, send a beacon call to the IPC-500C.

If the beacon call is successful, a beacon revertive consisting of four long tones interrupted by short tones will be heard. If the quality of the selected channel is poor, select another channel then send another beacon call.

- At the radio, follow the instructions for your make and model of transceiver.

The exact procedure depends on whether the telephone is a short form number stored in the IPC-500C or is being directly dialled by the caller. The short form number is a standard selcall. For example, if the self ID of the IPC-500C is 5001, sending a standard selcall to 5001 will dial short form 01, 5002 will dial 02, and so on.

- If the selcall is successful, revertive tones will be received from the IPC-500C; otherwise, try again.
- Listen for service tones from the speaker.

The service tones will be superimposed on the recorded voice message. They vary from country to country. The tones may be:

- **Busy tone**—alternating on and off every 0.4 seconds.
- **Congestion tone**—alternating on and off every 0.4 seconds, with every alternate burst at reduced level.

The busy and congestion tones are recognised by the IPC-500C within ten seconds. It will transmit five beeps then disconnect the line.

- **Number unobtainable tone**—alternating on for 2.5 seconds and off for 0.5 seconds.
- **Ring tone**—repeating 0.4 seconds on, 0.2 seconds off, 0.4 seconds on, 2 seconds off.

The number unobtainable and ring tones time-out in 30 seconds if the phone is not answered. After this time the IPC-500C transmits five beeps then disconnects the line. In either case, try to make the call again later.

## Successful call

If the ring tone stops within 30 seconds, the IPC-500C interprets this as the phone having been answered. The telephone subscriber is advised by a Recorded Voice Announcement that a radio-telephone call is being made. There could be a delay of up to 12 seconds while the recorded message is being played to the telephone party and the radio party will hear nothing. This period is followed by the balance tone.

You may now press **PTT** on the microphone and begin speaking. Listen for the called party to answer. If the telephone party is unaccustomed to radio protocol, you should explain the need for them to wait until you have finished speaking before replying, and to say “OVER” when ready to hand the conversation back to you.

At the end of the conversation, if the telephone party does not clear the circuit properly, you should instruct the IPC-500C to disconnect the line by sending a disconnect call or ENDCALL (see page 4-2, *Ending a call*). Follow the instructions for your particular make and model of transceiver. You should hear revertive tones followed by five beeps to confirm the disconnection—if not, try again.



## Using the IPC-500C in manual mode

The IPC-500C can be used in manual mode, and must be used in this way if the transceiver(s) in the system do not have selective calling. In this mode, the IPC-500C basically acts as a telephone–radio switchboard.

You must have a telephone connected in parallel with the IPC-500C to use this mode.

To select Manual mode:

- Set the front panel toggle switch to **Manual**.

## Answering incoming telephone calls

The IPC-500C operator answers incoming telephone calls using the parallel telephone, then contacts the required mobile via the transceiver.

If the telephone party is unaccustomed to radio protocol, the operator should explain the need to wait until the other party has finished speaking and the need to say “OVER” when ready to hear a reply from the mobile.

To switch the caller to the mobile:

- Set the toggle switch to **Select** and release it.

This balances the line manually.

- Hang up the telephone immediately.

This ensures that the line balancing occurs between the IPC-500C and telephone party, rather than the operator’s telephone instrument.

A tone of up to ten seconds duration is transmitted. After this tone the conversation can proceed as for automatic operation.

## Mobile request to dial telephone

In systems where the IPC-500C is attended, the mobile operator contacts the IPC-500C operator (either by voice or selcall contact to the attached radio) and asks to be connected to a particular telephone number. The IPC-500C operator dials the required number and, when it answers, proceeds to connect the radio and telephone parties as described above.

## 5 IPC-500C mode indications

The IPC-500C displays a single mode digit (**Digit 4**) to show what it is doing at any time. This is useful for fault reporting purposes. The meaning of the digit shown at **Digit 4** is explained in the following table. Two examples of typical sequences follow the table.

Table 5-1: IPC-500C mode indications

No.	Mode	Description of mode
<b>0</b>	<b>Initialisation</b>	Initialising after <b>Reset</b> button is pressed  The IPC-500C stays in this mode for less than one second
<b>1</b>	<b>Idle</b>	In <b>Auto</b> mode, the IPC-500C controls the transceiver scan and is ready to detect ring voltage on the telephone line or a selcall transmission
<b>2</b>	<b>Line balance</b>	This mode is entered after detecting four bursts of ring voltage or when the toggle switch is released from the <b>Select</b> to the <b>Manual</b> position  The IPC-500C remains in this mode between two and ten seconds until line balance is achieved
<b>3</b>	<b>Channel selection</b>	Entered after mode 2, when a telephone caller has dialled the IPC-500C  Receiver audio is applied to the telephone line  The IPC-500C remains in this mode up to one minute to allow time for a channel to be selected before returning to mode 0; when a valid channel is selected it proceeds to mode 4
<b>4</b>	<b>Conversational</b>	Normal simplex voice traffic is enabled (entered from modes 2, 3 or 9)  Will time-out after six minutes unless extended  Enters mode 5 if DTMF is detected
<b>5</b>	<b>Selcall entry</b>	Waits until the correct selcall DTMF sequence is completed or until timed out  As the selcall transmission takes place, a dot appears after the 5 before returning to mode 4 at the end of the transmission
<b>6</b>	<b>Selcall Decode</b>	Entered from mode 1 when a selcall is detected  If the selcall has the correct ID, the phone number is stored and mode 7 is entered; otherwise, exits to mode 0

No.	Mode	Description of mode (Cont.)
7	<b>Dial out</b>	<p>Entered from mode 6</p> <p>Initially loops the line</p> <p>Dials after detecting dial tone or delays up to ten seconds then dials out, pausing (for PABX line access) for two seconds after the first digit; at this time a dot appears after the 7</p> <p>The unit waits for a 400 Hz service tone, initiates a recorded voice message when the tone is detected, then enters mode 8</p> <p>If 400 Hz is not detected within 30 seconds, goes to mode B</p>
8	<b>Service tone analysis</b>	<p>Analyses on/off period of 400 Hz service tones</p> <p>If interpreted as busy (engaged) tone, enters mode B</p> <p>If interpreted as ringing tone followed by more than three seconds of silence (meaning that the phone has been answered), the IPC-500C enters mode 9</p> <p>While in mode 8, the recorded voice message plays continuously</p> <p>The IPC-500C goes to mode B after 30 seconds if the ringing tone does not cease for the required three seconds</p>
9	<b>Line balance</b>	<p>Functionally the same as mode 2</p> <p>A short beep is transmitted at the end of this mode to announce entry to mode 4</p> <p>The recorded voice message is also terminated in this mode</p>
B	<b>Disconnect</b>	<p>Five beeps are transmitted to line and to air to indicate imminent line disconnection</p> <p><b>Digit 4</b> LED displays square in upper half</p> <p>The IPC-500C exits to mode 1</p>

## Typical sequences

This section includes two examples of sequences that may be encountered.

### Example 1

A telephone caller dials the IPC-500C. It answers and balances the line. The caller selects a channel then selectively calls a mobile. The mobile responds and a conversation takes place until the caller commands the IPC-500C to disconnect the line.

The sequence of modes entered are shown below:

<b>Mode</b>	<b>Sequence of events</b>
1	IPC-500C idle, controlling transceiver scan, waiting for incoming telephone call or selcall transmission
2	Telephone call detected and answered Line balanced
3	IPC-500C waits for caller to select channel
4	Waiting for next action
5	Selcall number being entered
5•	Selcall number entered
4	Conversation taking place
B	Call ended Line disconnected
1	IPC-500C idle, controlling transceiver scan, waiting for call or selcall transmission

**Example 2**

A mobile radio operator selectively calls the IPC-500C and requests connection to a phone number. The call is successful: the number is dialled, someone answers and the line is balanced. After the conversation, the mobile operator commands the IPC-500C to disconnect the line.

The sequence of modes entered is shown below:

<b>Mode</b>	<b>Sequence of events</b>
1	IPC-500C idle, controlling transceiver scan, waiting for call or selcall transmission
6	Selcall detected and ID confirmed
7	IPC-500C loops the line then dials the telephone number
7•	Service tone detected, recorded voice message initiated Waits for telephone to answer
8	Recorded voice message plays continuously Service tone analysed Telephone answered
9	Line balanced Recorded message ends
4	Conversation taking place
B	Call ended Line disconnected
1	IPC-500C idle, controlling transceiver scan, waiting for call or selcall transmission

## 6 Programming the IPC-500C remotely

---

The IPC-500C can be programmed from a remote location. This feature is exclusively used with 4-digit selective calling units.

Remote programming allows you to program short form telephone numbers and validate selcall ID numbers via a modem.

### Requirements

Before remote programming can be carried out, the IPC-500C must be programmed with a password. This password must be known to the remote operator (see page 6-2, *Entering the password*).

A Hayes-compatible telephone modem is required at the IPC-500C, and a similar modem and dumb terminal (or IBM compatible PC running terminal emulation software) is required at the remote location.

## Entering the password

To program the password into the IPC-500C:

- Enter Setup mode, (see page 3-9, *Entering Setup mode*).

- Set the toggle switch to **Select** and release it.

A single dot appears at the left on the display.

- Press \* on the DTMF microphone.

A second dot appears on the display.

- Enter a password of up to 15 digits.



Make sure the password is one that you can easily remember, but that no one else can guess. If necessary, write down the password, but do not keep the password near the IPC-500C. Once entered, the password cannot be reviewed.

As each digit is entered, it is shown twice on the display—once on **Digit 4** (mode) as it is written into memory and again, after a slight delay, on **Digit 3** as it is verified.

If you make a mistake while entering the password, press \* and enter the whole password again.

- Press the # key after the last digit of the password.

The display should show four dots.

- Exit Setup mode (see page 3-9, *Leaving Setup mode*).

An automatic reset is generated and the version of software fitted is displayed for about one second before changing to mode 1 (see Chapter 5).

- Use the **Auto/Manual** toggle switch to select Auto or Manual mode, as required.

## Setting up the remote terminal

You will need to use general communications software such as Windows Terminal or ProComm. The actual software that you use depends on the kind of computer or terminal you have.

The remote terminal must be set up for ANSI-BBS emulation using the following configuration:

Table 6-1: Configuration of remote terminal using ANSI-BBS emulation

Parameter	Value
Baud rate	1200
Parity	none
Data bits	8
Stop bits	1
Handshake	none

## Making a remote connection to the IPC-500C

- At the terminal prompt, enter the command string:

**ATDTnnnnnnnn,,,,,,,,,19**

where: **AT** = Hayes 'Attention' command  
**DT** = Hayes 'Dial and Tone' commands  
**nnnnnnnn** = Telephone number of the IPC-500C  
**,,,,,,,,** = 20 second delay (2 seconds per comma), which gives the IPC-500C time to answer the call, balance the line and activate the local modem  
**19** = number commanding the IPC-500C to enter remote programming mode

- Press **Enter**.
- Wait about 30 seconds until the modem connection is made and the following message is displayed:

CONNECT 1200

- Press **Enter**.

A prompt appears, requesting you to enter the password.



## Entering the password



You are only allowed one attempt at password entry and any incorrect entry will result in the line being disconnected. If this happens you must make the remote connection to the IPC-500C again.

To enter the password and continue:

- Enter the password before ten seconds has elapsed.

An asterisk appears on the screen as each password digit is entered.

- Press **Enter** after you have entered the last digit of the password.



A three minute disconnect timer operates from when the password is correctly entered or from completion of the last command given.

You may disconnect the line at any time (thus terminating remote programming) by entering the appropriate menu option whenever the IPC-500C is waiting for input. When the call is terminated, the IPC-500C returns to normal scanning operation.

## Using the menu

When you have entered the correct password, the following menu appears:

```
MENU
Q Quit
S Display/ Change S.F. Nos
V Display/ Change Val. Nos

Q, S or V?
```

The options on this menu allow you to quit the program, edit short form numbers or edit selcall IDs.

To select an option:

- Enter the letter that you want (**Q**, **S** or **V**, as required).

## Viewing and editing short form numbers

Use option **S** to view, enter or edit short form telephone numbers:

- Enter **S** at the prompt to select **Display/Change S.F. Nos.**

The following question is displayed:

S.F. No? \_

- To display the first short form telephone number, type **01** and press **Enter**.

If a short form number has already been programmed, it is displayed as in the example below:

S.F. No 01: tttttttttttt      Tel. No? \_

The prompt is at **Tel. No** and you can now enter a telephone number to replace the existing one shown.

If you want to clear the number at this location, enter **E**.

If a short form number does not exist the display will read:

S.F. No 01: Empty      Tel. No? \_

In this case you can enter a new telephone number at the **Tel. No?** prompt.

## Displaying another short form number

If you want to display another short form telephone number:

- Press **Enter** to move the prompt to **S.F. No**.
- Press **Enter** to increment the short form number by one, or type **nn** and press **Enter** to view short form number **nn**.
- Continue to add or change telephone numbers in the same way.



When the short form number displayed is **99** the next number will be **01**.

## Returning to the menu

To end programming of short form numbers and return to the menu:

- Enter **Q** or press **Esc** from the **Tel. No?** prompt to return to **S.F. No**.

The word **-Error** appears on the previous line.

- Enter **Q** to exit to the menu.

If you enter an illegal character the word **-Error** appears on the previous line and the menu is displayed.

## Editing selcall IDs

Use option **V** to validate, invalidate or review selcall IDs.

- Enter **V** at the prompt to select **Display/Change Val. Nos.**

The following text is displayed:

```
Start range _
```

- Enter the lower ID number of the desired range.

After the fourth digit, the screen shows:

```
End range _
```

- Enter the higher ID number of the desired range.

For a single ID, enter the same number in both **Start Range** and **End Range**.

After the fourth digit, the screen shows:

```
Start range xxxx
End range   yyyy
I   Invalidate
V   Validate
D   Display
```

- Enter the letter that you want (**I**, **V** or **D**), depending on the action you want to take.

To exit to the menu without completing any of these processes, enter any number in **Start Range** and **End Range**, then type **D**.

The program returns to the menu as soon as the selected process is completed.

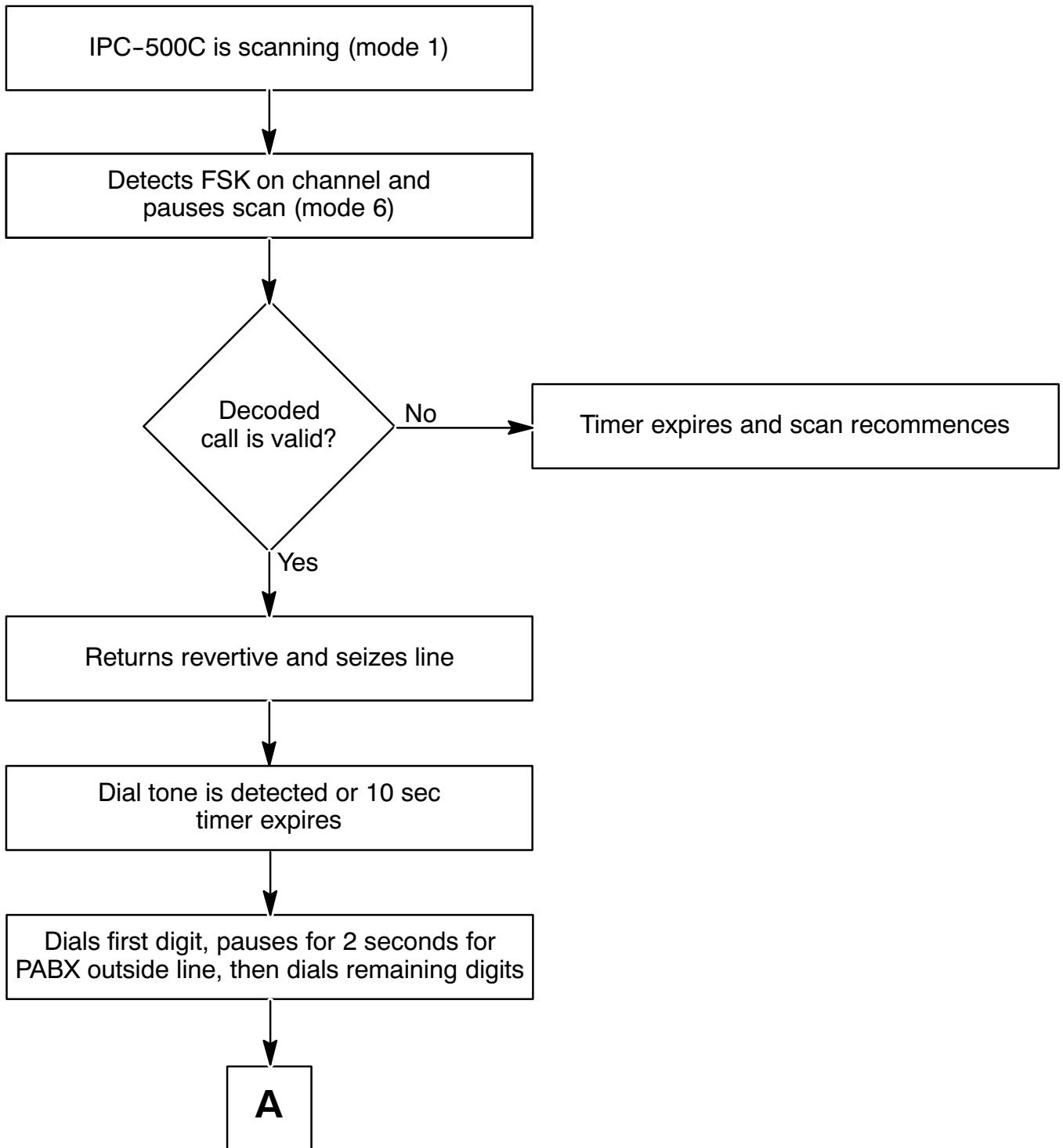


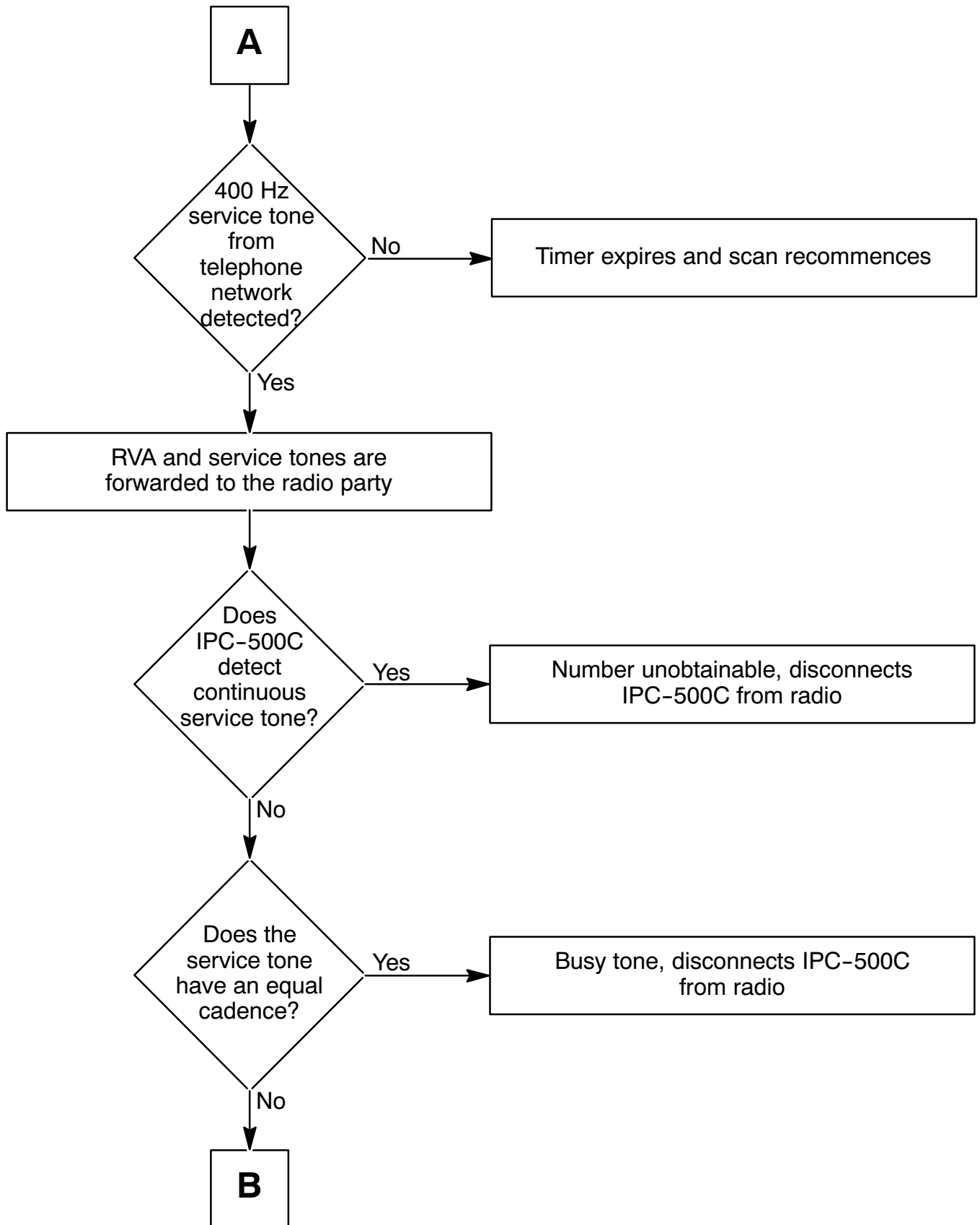
Substantial time is required to display or edit ranges of many numbers and it is not possible to disconnect the line while this is active.

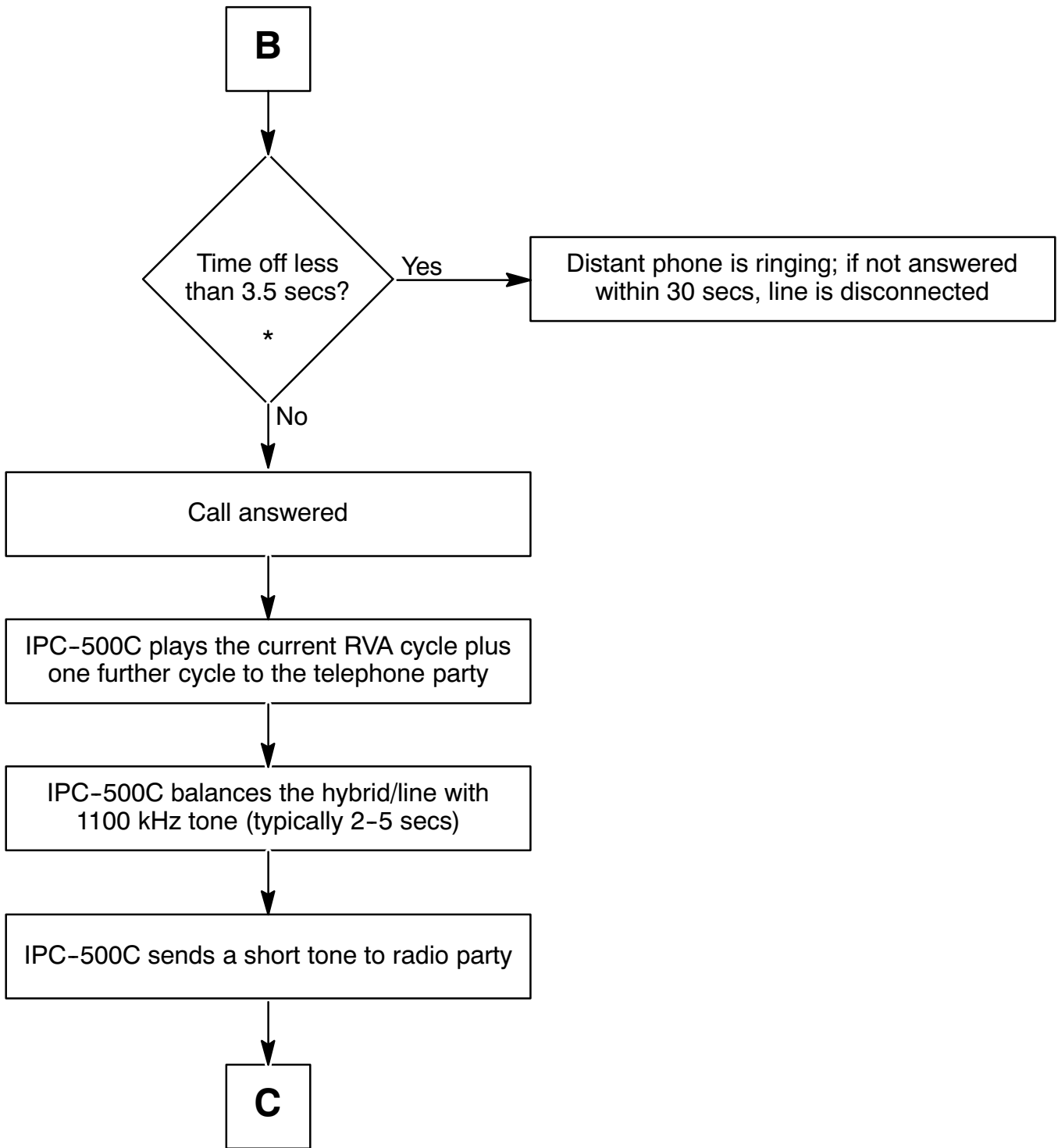
### Call establishment sequence

These charts provide a detailed analysis of the steps followed by the IPC-500C when a call is being established.

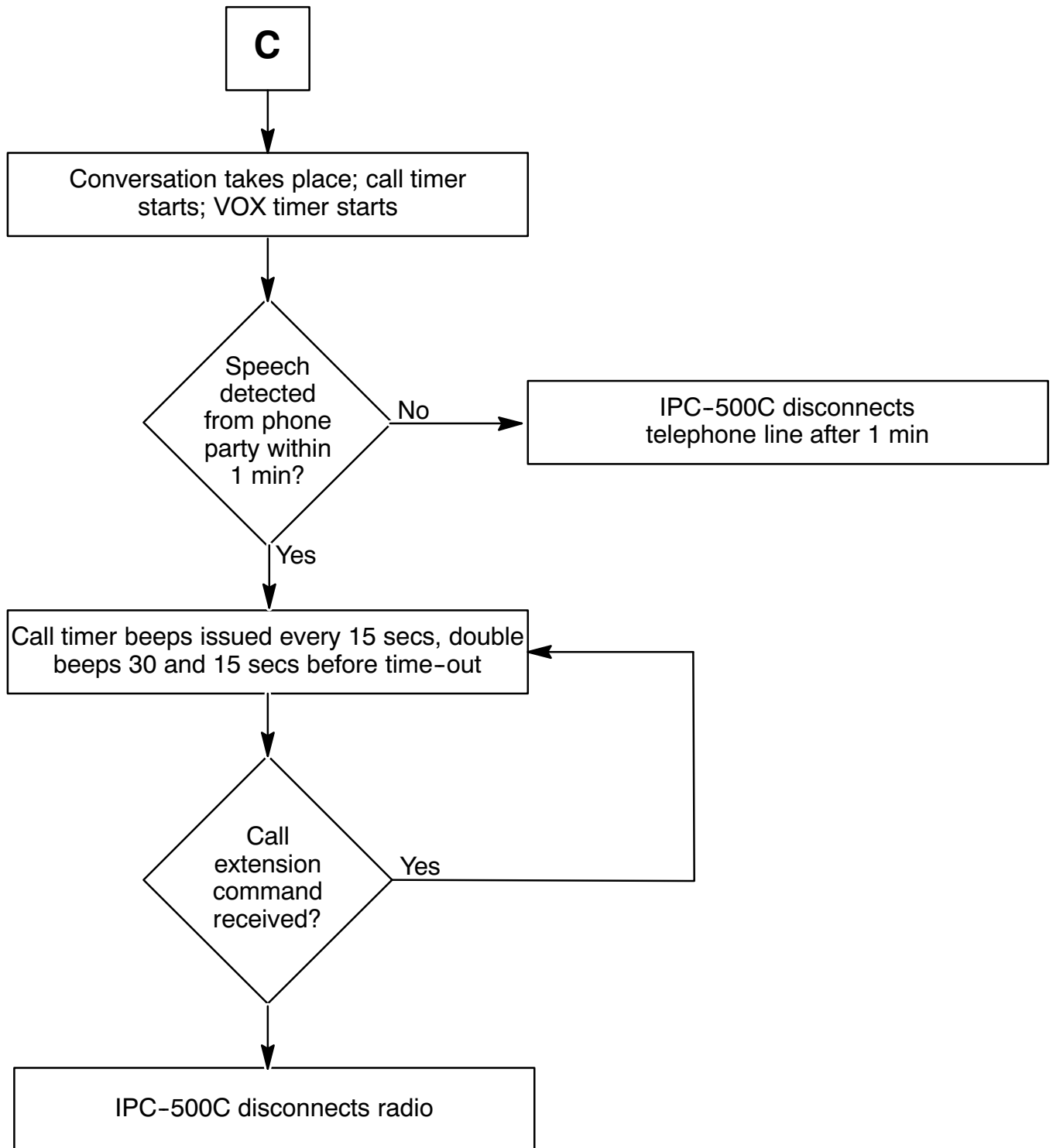
## Radio to telephone call





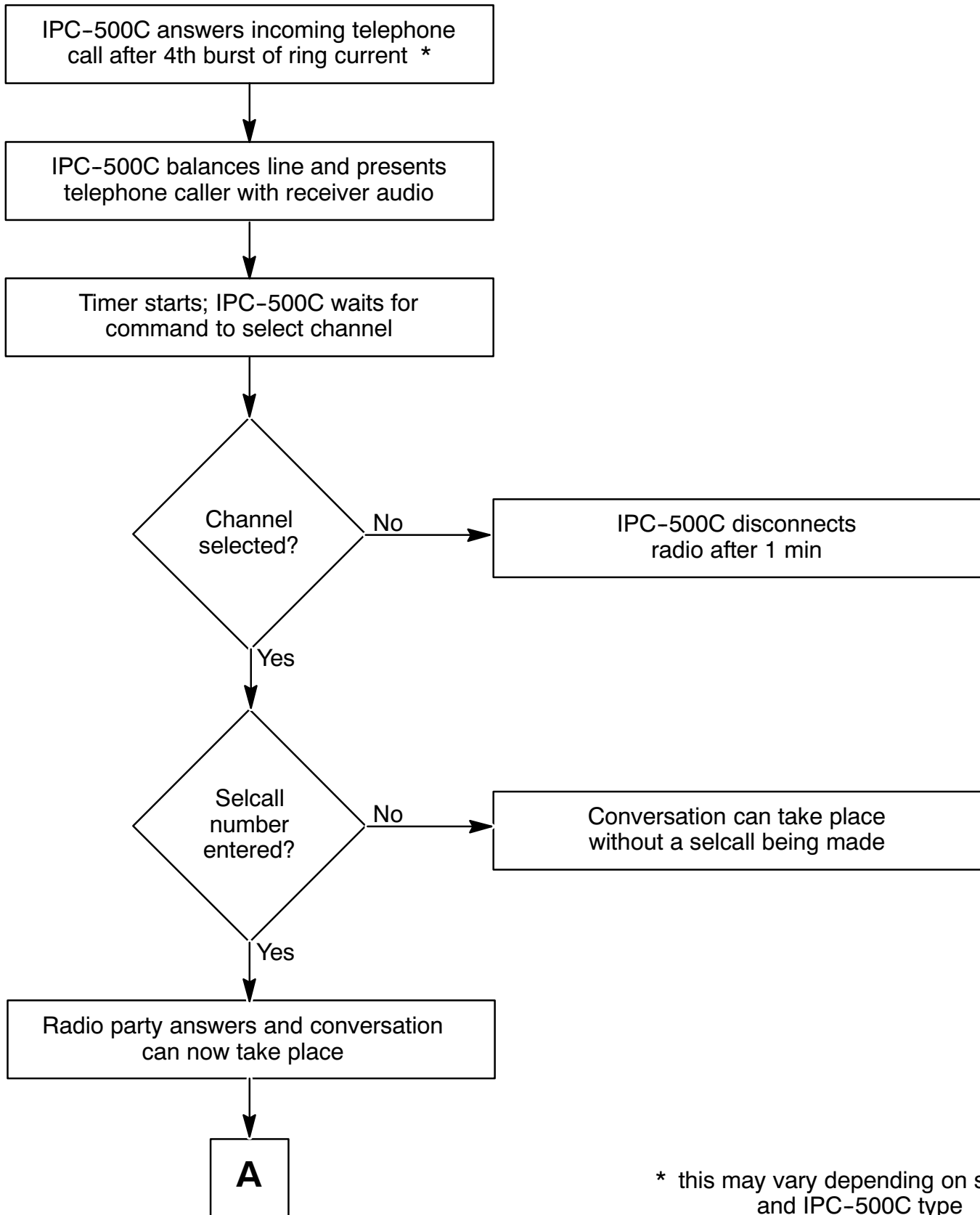


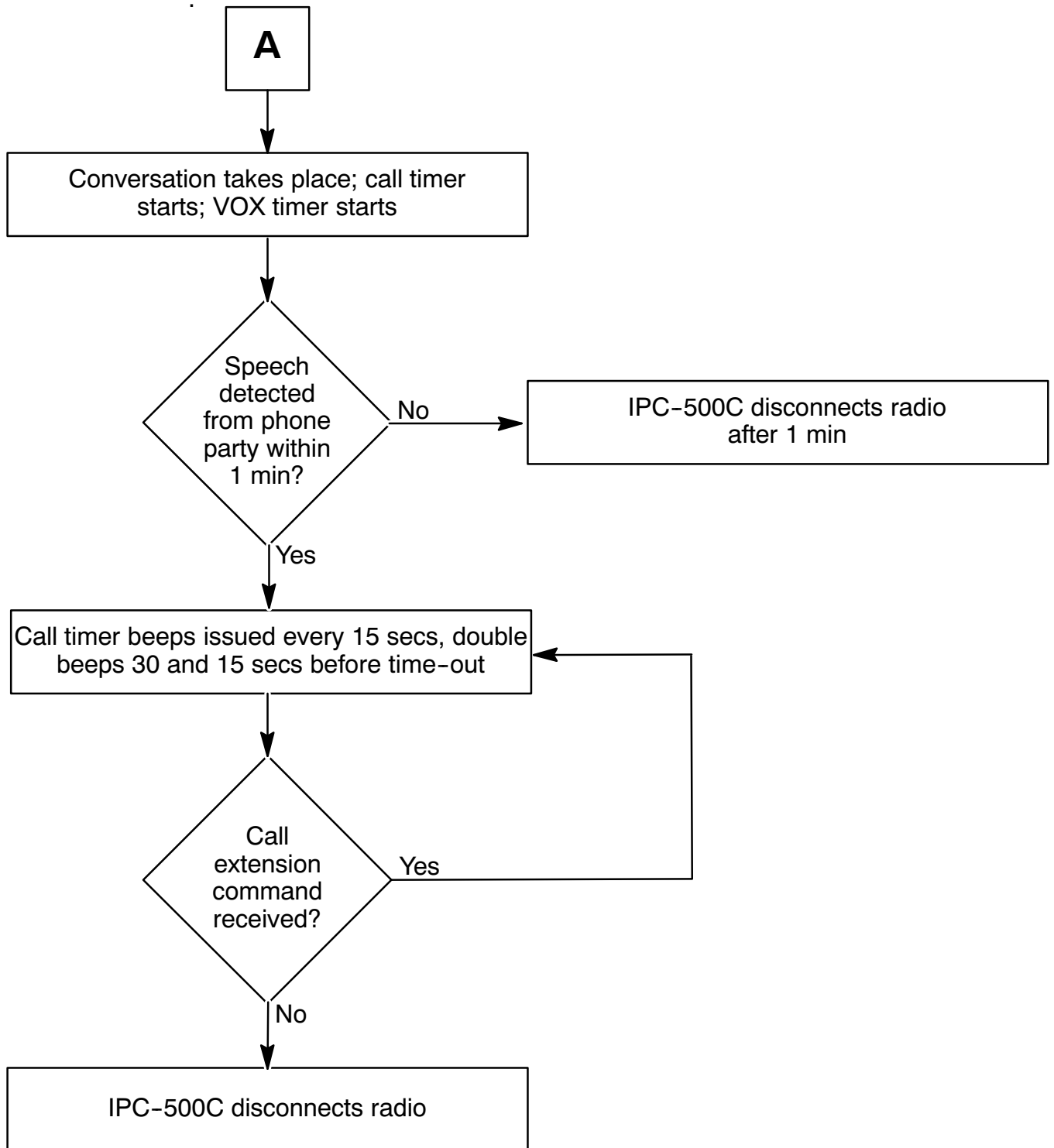
\* For extended cadence software, this time will be less than 4.5 secs





# Telephone to radio call





## Troubleshooting

Table 7-1: Problems and possible causes

<b>Problem</b>	<b>Possible causes</b>
Unit fails to respond to selcalls or telcalls	Unit either busy (already occupied on call in progress), busied externally by other equipment (e.g. data modem), ID or scan program incorrectly programmed or selcall decoder requires alignment (see page 7-9, <i>FSK signal filter alignment</i> and <i>FSK decoder alignment</i> )
Unit keeps playing RVA after subscriber answers: times out after 30 seconds and disconnects	The 400 Hz detector is tripping This is caused by either the RVA level to line being too high or the audio levels from the phone system being too high before balancing (requires line attenuator)
Unit fails to balance line, balance tone continues for some 10-12 seconds Unit operation is unreliable and receive audio is at a low level	Either the telephone line is poor quality or it is too noisy or the audio level too high A line attenuator could be used (typical 6 dB), or VOX should be disabled using # key to change transmission direction
Unit too sensitive to phone party audio, VOX opens on very low level	The VOX should be adjusted or audio from the telephone line may need attenuating (fit a line attenuator)
Unit fails to answer incoming telephone call	IPC-500C is in busy condition from other equipment (e.g. data modem) Line is not connected PSTN relays fail to operate in IPC-500C
Unit fails to detect telephone network service tones, even when the service tones are present (400 Hz LED not illuminated)	The 400 Hz detector may need alignment or offsetting (see page 7-10, <i>400 Hz tone decoder alignment</i> )
Call log fails to provide valid time and date readout (random characters presented)	The real time clock adjustment should be checked (see page 7-10, <i>Real time clock alignment</i> )

## Realignment procedures



This section contains technical information to enable realignment of the IPC-500C if it becomes necessary. These adjustments should only be carried out by a qualified technician. Damage to the IPC-500C may otherwise result.

The following equipment is required:

- oscilloscope (CRO)
- frequency counter
- alignment tool (non-metallic)

### Selcall decoder alignment

The selcall decoder (SC500I) PCB is positioned centrally within the IPC-500C (see Chapter 9, drawing 04-PC100).

#### FSK signal filter alignment

- Connect a high impedance (x10) CRO probe to TP1 (near IC6) on the SC500I PCB. Use TP2 (or mounting screw on IC8 voltage regulator) for earthing of the probe.
- Using the alignment tool, adjust VR1 trimpot on SC500I for  $177.2 \pm 0.1$  kHz as measured on a frequency counter.

For networks employing WA2 selcall protocol, adjust VR1 trimpot for  $168.8 \pm 0.1$  kHz.



A metallic adjustment tool loads the oscillator, so remove the tool before measuring the frequency accurately.

#### FSK decoder alignment

- Set the CRO sensitivity to 0.5 V/cm with DC coupling.
- Connect a x1 CRO probe to TP3 (or R28 lead closest to edge of board) of SC500I. Centre the CRO display on the horizontal centre line, then move the CRO probe to TP4 (or R31 lead closest to centre of board).
- Send a selcall to the IPC-500C from another transceiver.
- While the selcall signal is in progress, adjust VR2 on SC500I so that the square wave signal excursions (approximately 1 V P-P) are equal on both sides of the horizontal centre line.

## 400 Hz tone decoder alignment

- Connect a frequency counter with a high impedance (x10) probe to TP2 on the motherboard (see Chapter 9. drawing 08-PA101).
- Connect the earth lead to TP3.  
You may need to place a capacitor (approximately 100 nF) in series with the probe to obtain a stable reading.
- Adjust trimpot R84 for 415 Hz  $\pm$  1 Hz, as measured on the frequency counter.
- If the telephone network service tones are considerably higher in frequency (e.g. USA or Canada) then adjust R84 for the appropriate higher frequency or until the service tones are detected.

## Real time clock alignment

- Connect a frequency counter with a high impedance (x10) probe to TP1 on the motherboard (refer to drawing 08-PA101).
- Connect the earth lead to the chassis.
- Install JP11 and press **Reset** to place clock into test mode.
- Adjust trimcap C104 for 32.768 kHz  $\pm$  1 Hz, as measured on the frequency counter.
- Remove JP11 and press **Reset** to clear test mode.

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## System control signals

At many installations, the IPC-500C is used with a dedicated radio. At other sites it is used as an accessory, and may be part of a radio network that includes a data modem, for example. In these situations, it may be necessary to suppress the operation of the IPC-500C at times to avoid conflict with data, or other transmissions. Similarly, it may be necessary to prevent other system activity while the IPC-500C is in use.

Two signal lines (LINK BUSY and IPC BUSY) and a cable (08-05185-001) are provided for this purpose. These prevent a call from being answered by the IPC-500C if data transmission is taking place, and prevent the modem from being used if the telephone is in use.

### LINK BUSY

Grounding the LINK BUSY (LBSY) line stops scanning and prevents the IPC-500C from answering an incoming call from the public telephone system.

### IPC BUSY

An isolated relay contact (IPC BSYA and BSYB) closes whenever the IPC-500C is 'off-hook' in response to an incoming telephone call.

## System control and other connections—DB15P modem connector

Table 8-1: System control connections

Pin	Name	Function
1	Spare2	Not used
2	AF in	Paralleled with J7/13
3	AFO2	Paralleled with J7/6
4	Spare1	Not used
5	SO	Reset U3, U4 and U21
6	LBSY	0 V prevents answer
7	RXD2	Connects to modem
8	Chassis	Connected to 0 V
11	IPC BSYA	IPC 'busy' contact
12	IPC BSYB	IPC 'busy' contact
13	AFO1	Paralleled with J78
14		Not connected
15	TXD2	Connects to modem



# 9 Drawings

The drawings included here are the major mechanical and electrical drawings needed to maintain the IPC-500C.

Table 9-1: List of drawings

<b>Title</b>	<b>Drawing</b>	<b>Drawing No.</b>
<b>Telephone interconnect</b>	System configurations (4-digit)	03-00877
<b>Telephone interconnect</b>	System configurations (6-digit)	03-00932
<b>Remote programming</b>	System configuration (4-digit)	03-00894
<b>Control interface</b>	Circuit diagram	04-02983
	PCB Assembly	08-04973
<b>Cable and control interface 8570, 9323 and 9360</b>	Circuit diagram	04-03086
	PCB Assembly	08-05208
<b>IPC-500C interconnect</b>	Circuit diagram	04-PC101
	PCB Assembly	08-PA101
	Display circuit diagram	04-PC102
<b>SC-500I selective calling board</b>	Circuit diagram	04-PC100
<b>Recorded voice announcement</b>	Circuit diagram	04-PC092

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## Calling a mobile from a telephone

To call a mobile from a telephone:

- Dial the telephone number of the IPC-500C.
- Enter the channel number you want in the format N N.
- If you want to send a selective beacon to test the quality of a channel, enter \* N N N N N N # \*.
- Enter the selcall number of the mobile that you want to call in the format \* N N N N N N # #.

If the mobile is unattended you can lodge either your full telephone number or short form number with the mobile.

Full telephone number	* N N N N N N # T T T T T T T T # (the telephone number can be up to 16 digits)
Short form telephone number	* N N N N N N # S S #

- Following your conversation, disconnect the call by dialling 99.

## Calling a telephone from a mobile

- Enter the details as required below.

These may be found in the handbook for your transceiver and from the IPC-500C service provider.

Channels scanned by IPC-500C	
Selcall number for the IPC-500C	
Sending a beacon	
Sending a call	
Disconnecting a call	

### **Calling a telephone from a mobile**

- Select a channel that is scanned by the IPC-500C.
- If you want to test the quality of a particular channel, send a selective beacon to the IPC-500C on that channel.
- Send the call.

You will need to include the telephone number that you want to call. Refer to the specific instructions provided with your transceiver.

- Listen for connection to the telephone network.
- Following your conversation, disconnect the call using the appropriate commands.

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