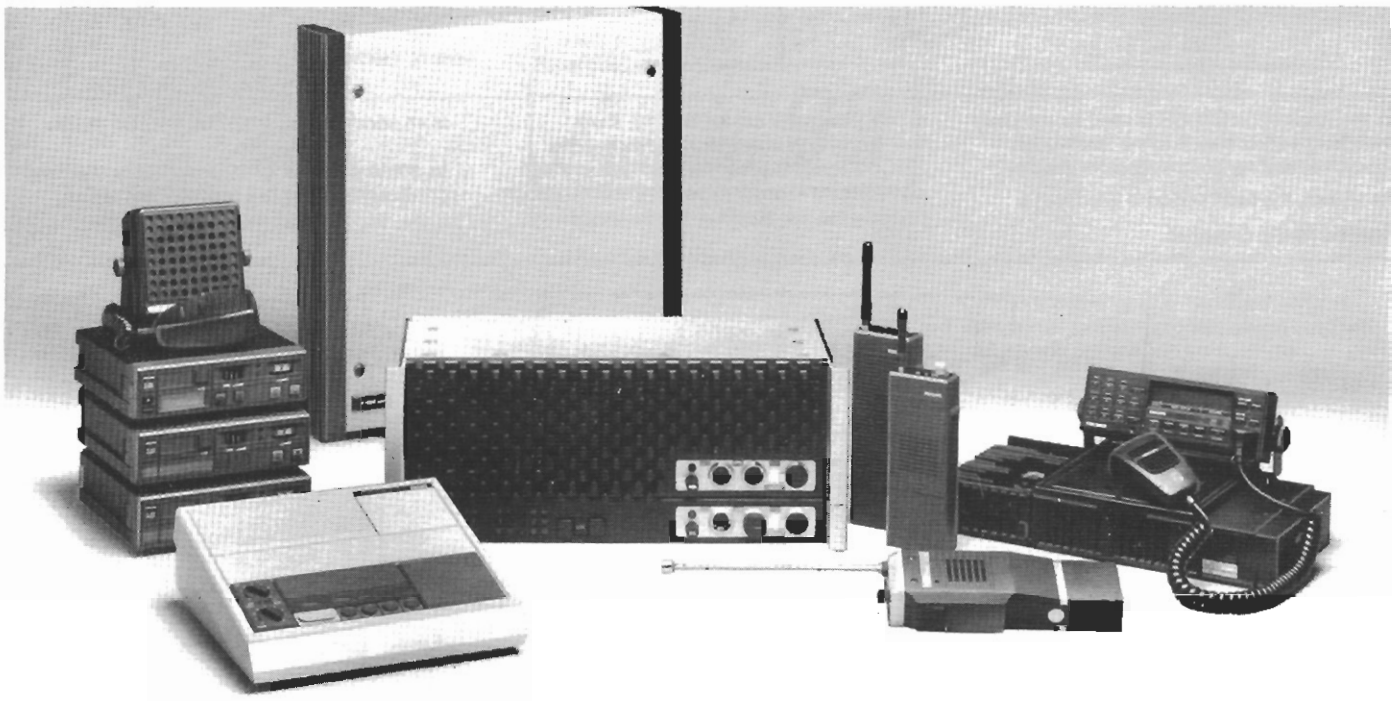
INFORMATION SHEET

CTCSS

CONTINUOUS TONE CONTROLLED SQUELCH SYSTEM



A proven method of achieving a number of signalling functions

Excludes other users' calls on a shared channel

Ideal for community repeater applications

Dependable remote switching of facilities

Shared radio channel

What is CTCSS?
CTCSS is an internationally recognised signalling system, previously known as Tone Lock or Tone Squelch, and stands for Continuous Tone Controlled Squelch System (EIA) or Continuous Tone Controlled Signalling System (MPT 1306).

How is CTCSS achieved?
In CTCSS applications the RF carrier frequency is continuously modulated at the transmitter with a low audio frequency tone. When the signals are received by a suitably equipped receiver the tone is used to provide one of several switching facilities as described overleaf.

The CTCSS tone frequencies are defined by international standards and fall within the range 67 Hz to 250.3 Hz. The tones are removed by filtering at the receiving station, thereby ensuring that messages heard by the operator are free from the signalling tone.

How is CTCSS engineered?
The CTCSS function is achieved by the addition of a module fitted to the transceiver and consists of a CTCSS tone encoder and /or decoder.

The CTCSS encoder is associated with the transmitter and produces a continuous tone which is present during each transmission.

The tone decoder, fitted to the receiver, acts as a switch controlling the receiver's audio path.

Why is CTCSS used?
CTCSS can be used to achieve a number of signalling functions including simple selective calling.

CTCSS is a fail-safe system since the required facility is only activated when the designated continuous sub-audio tone is being received. The loss or failure of the tone will de-activate the selected facility.

Where is CTCSS used?
CTCSS is used in radio system applications where it provides a method of:

(i) remotely selecting a facility e.g. talkthrough

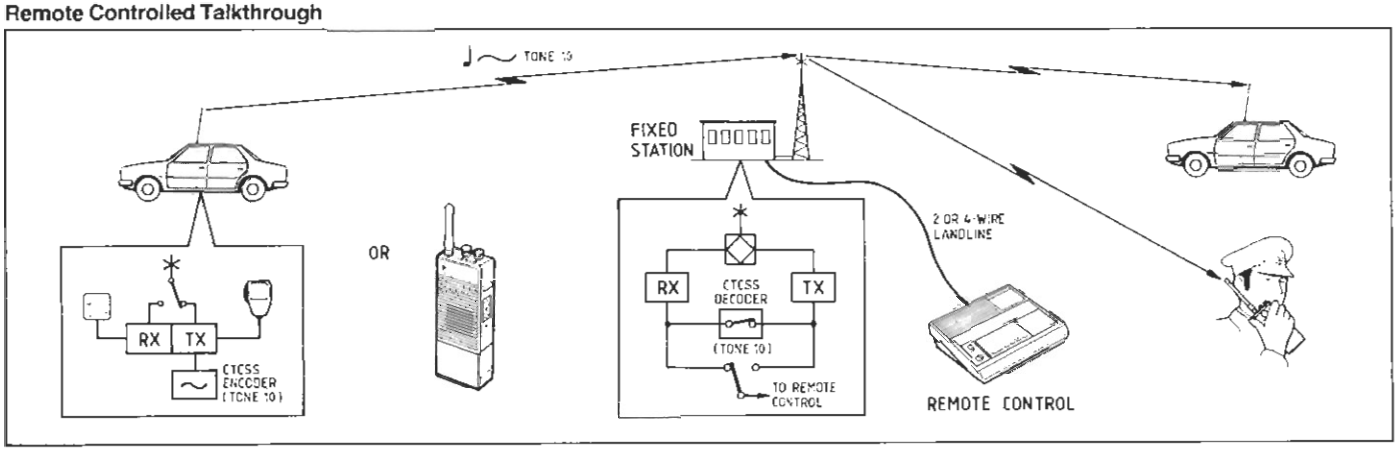
(ii) minimising co-channel interference

(iii) simple selective calling

(iv) gaining access to a common repeater station.

PHILIPS

Remote Controlled Talkthrough

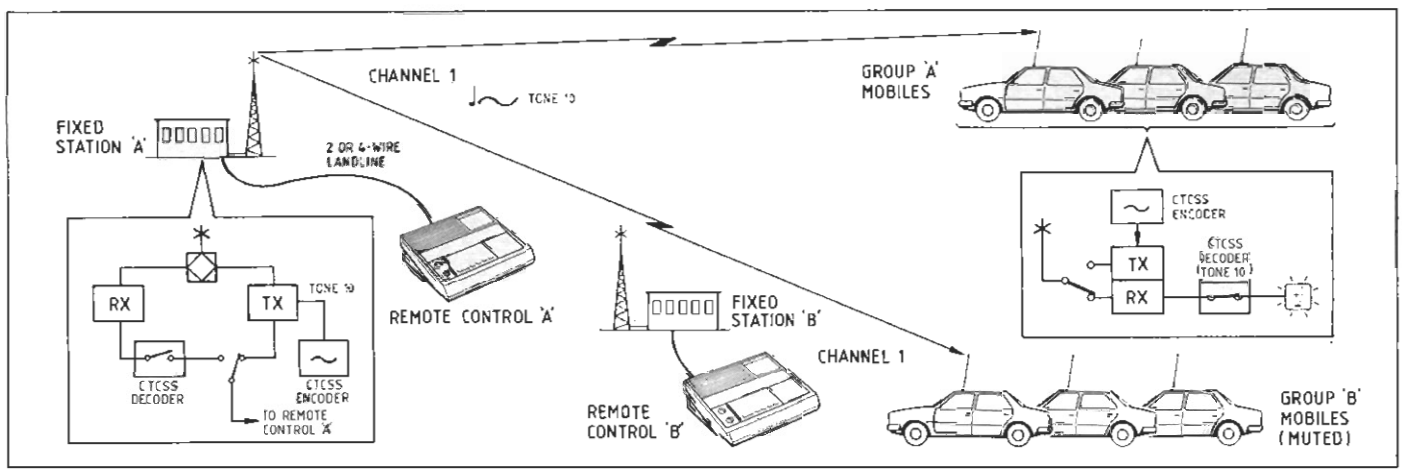


In this application CTCSS is used for remotely switching a fixed station to the talkthrough mode, i.e. turning it into a repeater station.

As shown, the fixed station is fitted with a CTCSS decoder set for tone 10. It will, therefore, only accept the corresponding CTCSS tone frequency from any associated out-stations in order to switch the fixed station from send/receive to the talkthrough mode.

In some markets it is mandatory to use tone-controlled access to a repeater station.

Shared Radio Channel



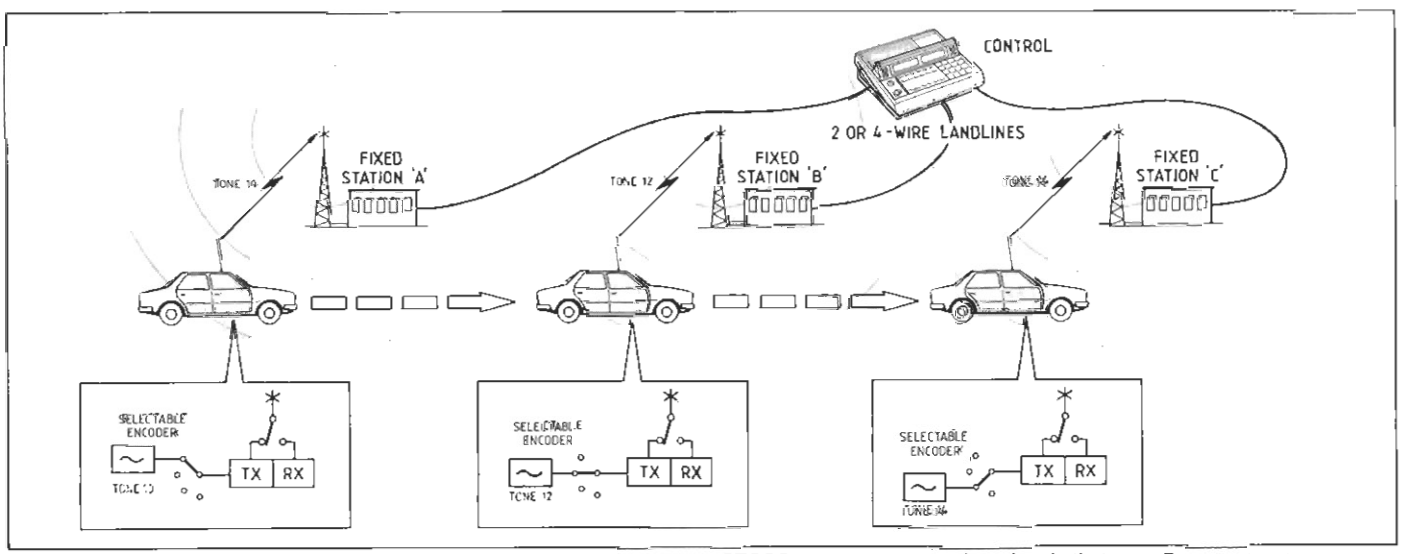
This CTCSS facility permits a number of radiotelephone users who have their own radio system to share time on a common channel with minimum inconvenience to each other.

The presence of a CTCSS tone during transmissions ensures that only users in a particular organisation whose radiotelephones are fitted with decoders set for the same tone will hear the message, other co-channel users' receivers remaining muted.

This application of CTCSS is also suitable for minimising the interference from unknown co-channel users.

With shared radio channel systems correct observance of radio procedure is important, e.g. 'listen-out' to ensure the channel is free before transmitting.

Selective Calling of Fixed Stations



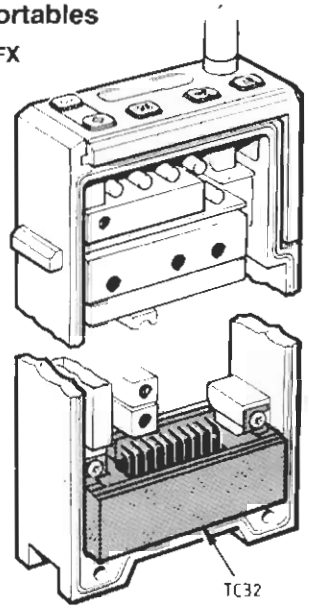
In single channel radio systems where a number of fixed stations are required to provide a wide range of radio coverage, CTCSS is employed for selectively calling a particular fixed station, thereby avoiding inferior reception at the control point due to multiple receive paths.

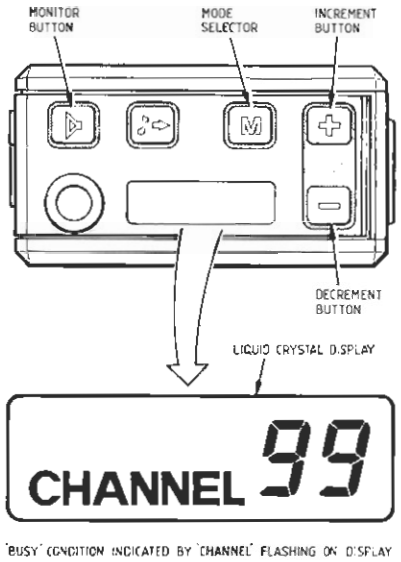
Each station is fitted with a CTCSS decoder and allocated a discrete tone frequency.

The roaming station, e.g. a mobile, is fitted with an encoder which has a number of switch-selectable CTCSS tones. Each encoder tone corresponds to individual fixed station decoders in that area. By selecting the appropriate CTCSS tone the mobile operator can select the fixed station which provides the best communication with control for any given location within the area covered.

Portables

PFX





'BUSY' CONDITION INDICATED BY 'CHANNEL' FLASHING ON DISPLAY

PFX is a frequency synthesised VHF or UHF handheld portable designed to accommodate a wide range of accessories and signalling options.

Offering up to 99 channels, the PFX is compatible with CTCSS signalling module type TC32.

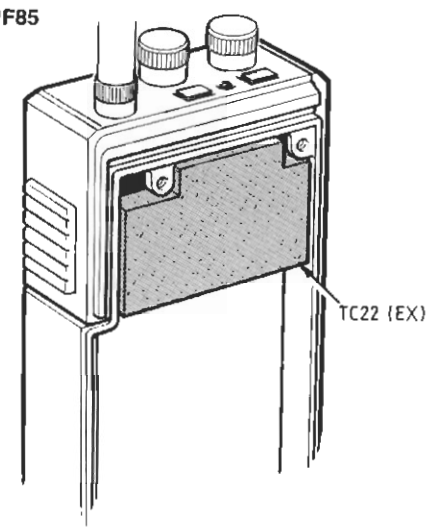
Versions include:
Fixed CTCSS on all channels
Switched CTCSS on per channel basis.

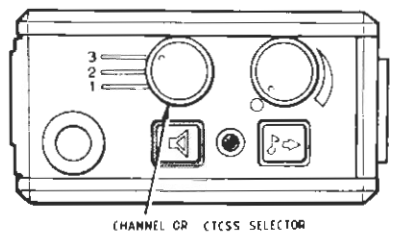
Options available:
encode/decode, encode only and lockout.

TC32 can be combined with sequential signalling module type TC35.

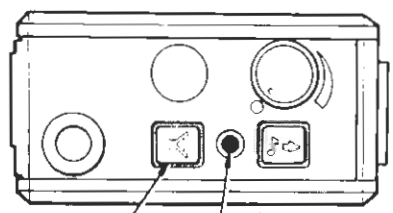
For full details of PFX and accessories please refer to Publication Reference Numbers PT TSP846 and PT TSP825.

PF85





PF85 3 CHANNEL/FIXED CTCSS OR SINGLE CHANNEL/SELECTABLE CTCSS



PF85 SINGLE CHANNEL/FIXED CTCSS

PF85 is a VHF or UHF handheld portable designed to accommodate a wide range of signalling options and accessories.

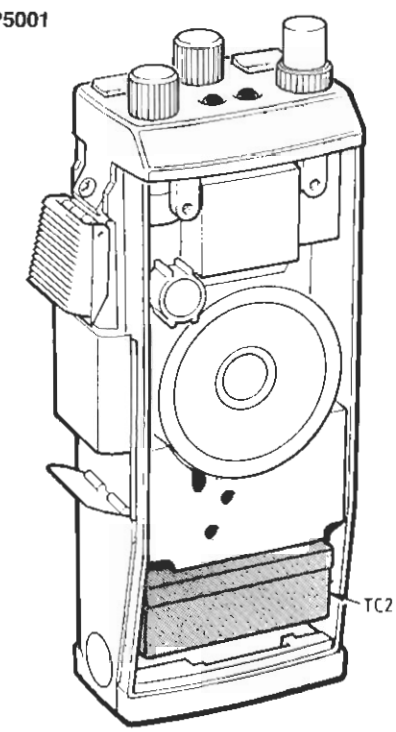
Versions include:
single channel, fixed CTCSS
single channel, switched CTCSS
3-channel, fixed CTCSS.

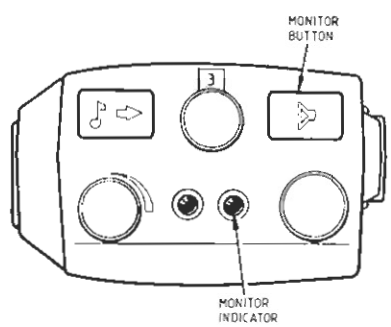
CTCSS module type TC22(EX) is designed for fitment within the standard frame of the PF85 and offers a choice of encode only or full encode/decode facilities.

TC22(EX) can be combined with sequential signalling module type TC35.

For full details of PF85 and accessories please refer to Publication Reference Numbers PT TSP824 and PT TSP825.

P5001



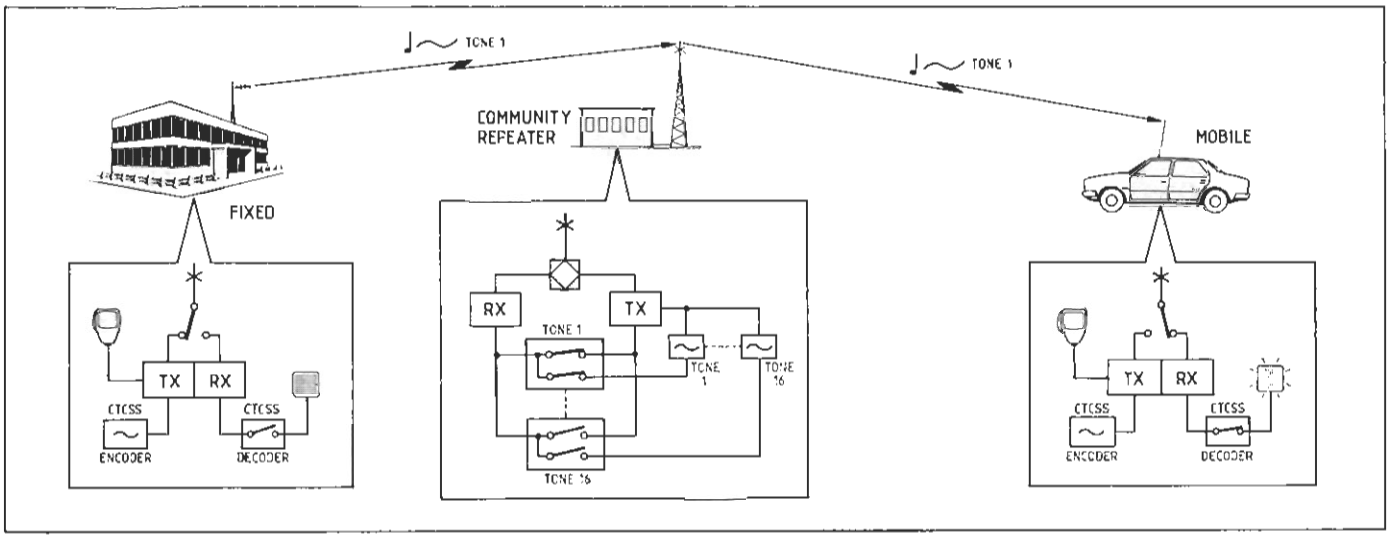


P5001 is a VHF AM handheld portable designed to accommodate a wide range of accessories and signalling options.

There is a choice of single, or up to six channels. Signalling options include CTCSS module type TC2 which offers encoder/decoder functions or encode only.

For full details of the P5001 radiotelephone, accessories and battery chargers please refer to the separate publication.

Community Repeater

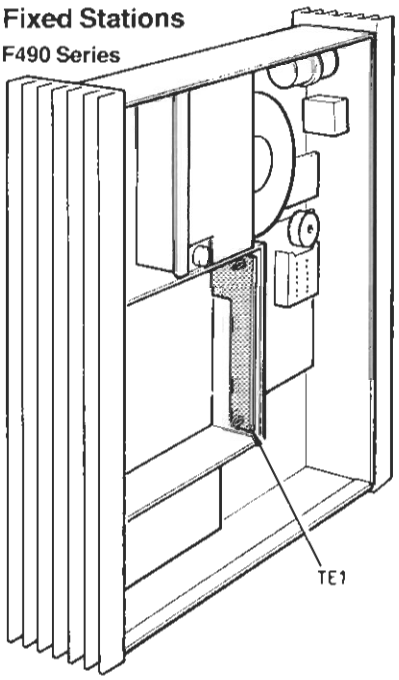


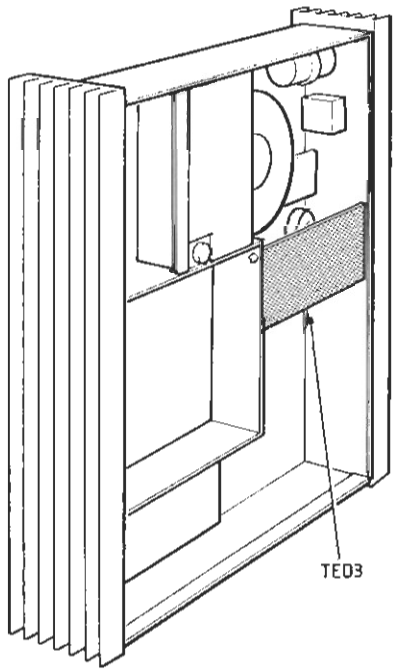
This facility allows radiotelephone users to share a common base station operating in the repeater mode. The system is ideal for organisations which require comparatively small amounts of 'air-time' for the passing of messages.

Organisations participating in the Community Repeater scheme share a common radio channel and are allocated discrete CTCSS tone frequencies. Once access is gained by a user (e.g using Group B, tone 1), the other organisations within the scheme are locked out until the transmission is terminated. This allows a certain amount of privacy to users as the receivers of other organisations within the scheme are effectively excluded, their loudspeakers being muted and their transmitters disabled.

Fixed Stations

F490 Series





Fixed station radiotelephones type F493 (VHF AM), type F494 (VHF FM) and type F496 (UHF FM) are remotely-controlled base stations derived from the M290 series of mobile two-way radio equipment.

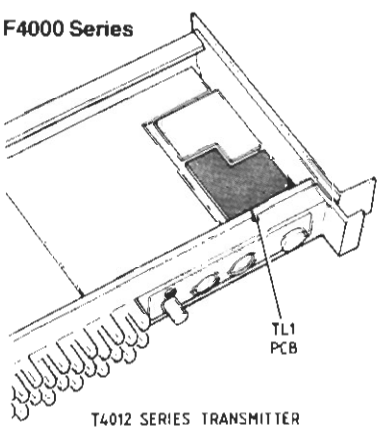
CTCSS signalling PCBs, types TE1 and TED3, are compatible with the F490 series and application plans are described in separate publications. For additional information on the F490 series, please refer to Publication Reference Number PT TSP758.

TE1 is a plug-in PCB fitted within the F490 series fixed station, offering single tone frequency encode only facility.

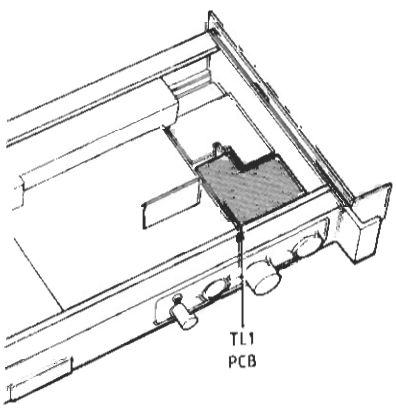
TED3 is also fitted internally and set for decode only function. For full encode/decode, TE1 and TED3 PCBs must be fitted. See Equipment Code Manual for ordering details.

Control of CTCSS equipped fixed stations is achieved remotely using type M80 series control equipment or locally using the optional, handheld, controller type MC490.

F4000 Series



T4012 SERIES TRANSMITTER



R4000 SERIES RECEIVERS

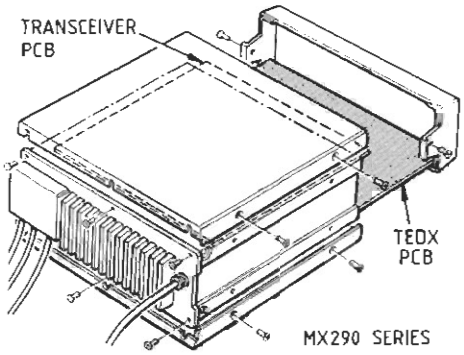
A full range of VHF AM, VHF FM and UHF FM transmitters and receivers designed for fixed station applications.

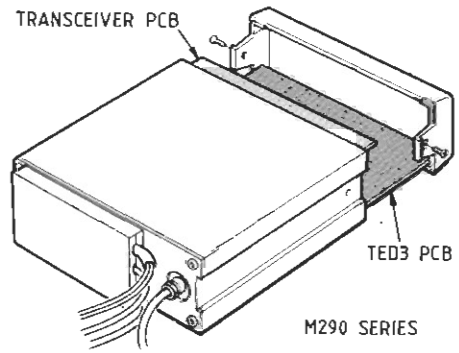
CTCSS printed circuit board type TL1 is internally fitted within the transmitters and receivers, and set for encode only and decode only respectively.

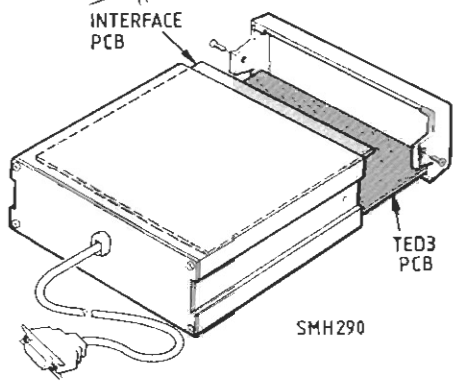
For details of the F4000 Series, please refer to the separate publications.

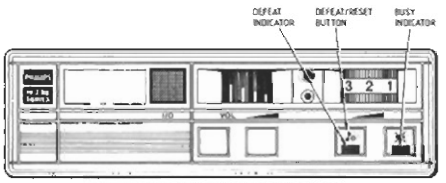
Mobiles

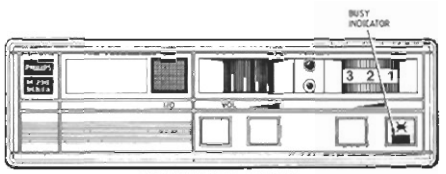
M290/MX290 Series Radiotelephones

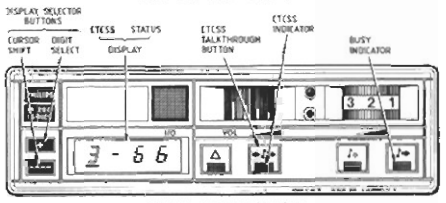


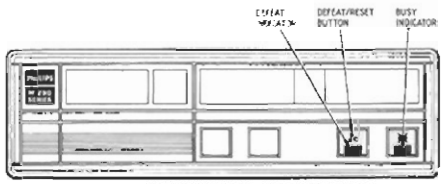












The current range of front-mounted radiotelephones consists of the M290 series and the MX290 series. Signalling options compatible with these mobiles include the CTCSS modules TED3 and TEDX.

TED3
A single frequency CTCSS module. The frequency, options of encode/decode, encode only, decode only, transmit inhibit and receiver lock-out are all internally selectable by means of an 8-way dual in-line (DIL) switch fitted on the TED3. The module can be supplied with or without a defeat/reset switch. TED3 is contained in a single PCB which fits directly into the mobile radiotelephone.

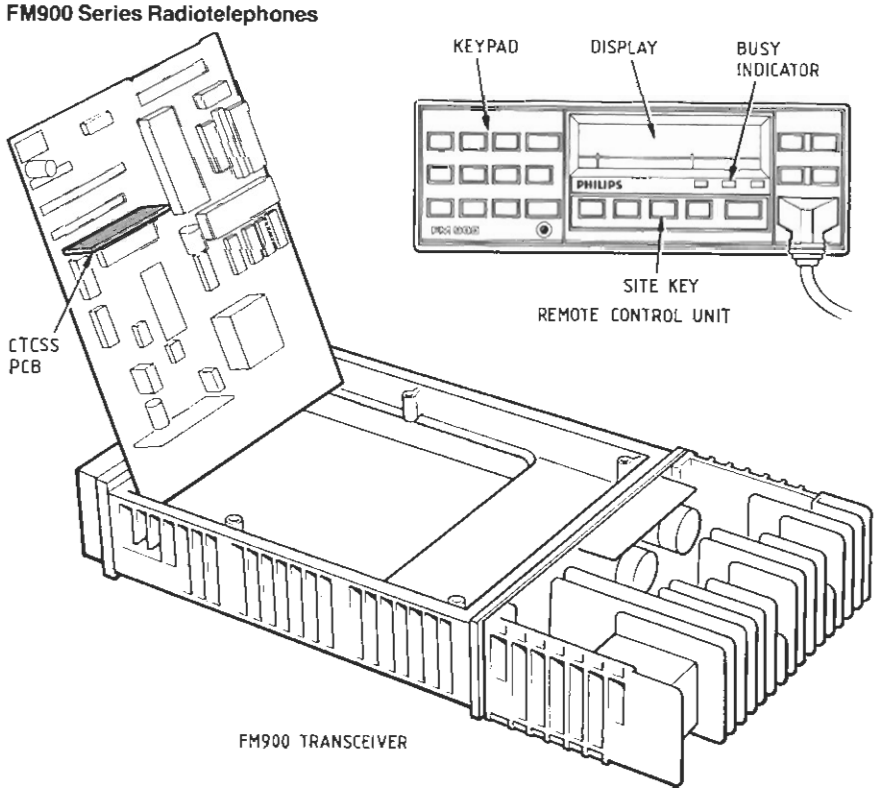
TEDX
A multi-frequency CTCSS Module. Any 9 of the standard 38 frequencies can be programmed and are operator selectable via the mobile fascia panel controls.

This microprocessor controlled module can also be used for combined CTCSS and sequential tone signalling and the programming of a wide variety of options. Typically the selectable CTCSS function is used to select different fixed or repeater stations.

CTCSS modules type TED3 and TEDX, when fitted in a system module housing type SMH290, are compatible for the Reporter, Olympic and Europa radiotelephones. Conversion units types P200 PU (transportable role), AC200 PU (desk-top fixed station role) and the AC90 PU (simple fixed station role), accept radiotelephones equipped with CTCSS modules.

For details of the M290 series and MX290 series radiotelephones please refer to the separate publications.

FM900 Series Radiotelephones



The FM900 series is a range of remote mounted VHF or UHF FM frequency synthesised radiotelephones with microcomputer control offering a channel capacity of up to 120 channels and a wide range of signalling options.

CTCSS is provided by fitting a small hardware module to the synthesiser/control board in the main transceiver. Options, which are software controlled, include single fixed tone or different tones per channel. The pre-programmed tones may be altered via the integral keypad located on the remote control unit.

To change a tone, enter required tone code number and press 'Site' key. To display a tone code press 'Site' key. The CTCSS decoder is automatically 'defeated' when the microphone is removed from its mounting and is 'reset' when returned.

For details of the FM900 series radiotelephones please refer to the separate publication.

Technical Data

CTCSS

CATALOGUE SECTION
CONTROL/SIGNALLING

Publication Ref. No. PT TSP363 (Issue 1)
Printed in England May 1987 5M

General

Code Tones
Total of 38 sub-audio tones with EIA spacing in the range of 67.0 – 250.3 Hz

Encode Build-up Time
50 ms from initiation to 90% of final amplitude at modulator input

Decode Response Time
250 ms to 75% of pre-determined audio amplitude at receiver output

Deviation Levels

Channel Spacing	Peak Audio Deviation	Lock Tone Deviation
FM		
12.5 kHz	± 2.5 kHz	0.3–0.6 kHz
20/25 kHz	± 5 kHz	0.5–1.0 kHz

AM 10% to 20%

Power Supply
Powered from associated radiotelephone

CTCSS Groups
38 CTCSS frequencies are divided into three groups, A, B and C. The selection of the tone frequencies must be taken from the same group.

CTCSS Tones (Hz) (Standard EIA spacing)		
Group A	**Group B**	**Group C**
77.0	71.9	*67.0
88.5	82.5	74.4
100.0	94.8	79.7
107.2	103.5	85.4
114.8	110.9	91.5
123.0	118.8	97.4
131.8	127.3	
141.3	136.5	
151.4	146.2	
162.2	156.7	
173.8	167.9	
186.2	179.9	
203.5	192.8	
218.1	210.7	
233.6	225.7	
250.3	241.8	

NOTE: In existing systems 67.0 Hz is in Group A

Apply to your local representative or Head Office for advice on which tone frequencies should be chosen for equipment operating on 50 Hz or 60 Hz mains supplies.

For a first CTCSS system on a channel in a new area select sub-audio tone frequencies from about the middle of either group A or group B and for each subsequent addition, work downward in frequency for FM and upward in frequency for AM.

In areas where CTCSS systems already exist, a careful check of frequencies in use must be made to ascertain which are free for use on the channel being equipped.

Community Repeater
For community repeaters, tones from group B only are used, normally in the perferred order shown below.

User Order	Group B Tones (Hz)	
	AM	**FM**
1	118.8	118.8
2	127.3	110.9
3	136.5	103.5
4	146.2	94.8
5	156.7	82.5
6	167.9	71.9
7	179.9	127.3
8	192.8	136.5
9	210.7	146.2
10	110.9	156.7
11	103.5	167.9
12	94.8	179.9
13	82.5	192.8
14	71.9	210.7
15	225.7	225.7
16	241.8	241.8

Glossary

Indicator

Busy 
Signifies that an RF carrier is present, without a CTCSS tone, or with a tone of another frequency. Under these conditions the indicator 'flashes' or remains on 'steady', depending on installed equipment.

Controls

Defeat/Reset 
A push-button facility for overriding the muting function of the CTCSS decoder.

Monitor 
A push-button facility combining Defeat/Reset and Squelch Defeat functions.

Encoder Enable/Disable
An optional push-button facility available for enabling or disabling the CTCSS Encoder

Optional Facilities

Transmit Inhibit
A facility which prevents the operation of the transmitter during 'Busy' periods

Receiver Lockout
A facility preventing the operation of 'Defeat' or 'Monitor'.

Lockout
This facility combines the 'Transmit Inhibit' and 'Receiver Lockout' facilities.

Typical figures based on normal operating conditions.

Our policy is one of continuous improvement; therefore the right is reserved to change specifications without notice.

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