Tone Burst for t

The Pye Europa was one of the best designed mobile VHF transceivers of its era, in that it was small, self-contained with integral loudspeaker, and with all components and stages very accessible for ease of tuning, adjustment and maintenance.

The VHF high-Band version of the MF5FM was designed to provide

E. Chicken G3BIK gives the Europa a tone burst via its internal facility module.

a nominal 5 watts of rf output over the frequency range 146-174MHz, and the MF25FM gave 25 watts. In practice they could encompass the amateur 144MHz band, and many have found their way into such service.

A particularly useful aspect of the design was the provision of an externally removable facility module by which it was possible to make connection to various parts of the circuit, such as the microphone pre-amplifier before and after af compression, the demodulated af output before and after squelch, +12 volts regulated, and +10.2 volts regulated on both transmit and receive.

The article describes an easy-to-construct circuit which can be accommodated on the plug-in facility module without having to touch the main circuit, to provide a useful tone-burst oscillator to access the amateur repeater stations.

Facility Module

Fig.1 shows how the module may be withdrawn from the front panel in the absence of the special extractor tool, by simply inserting a small terminal-screwdriver into the 4mm diameter access-hole in the lower centre of the module, and gently pulling the module forward while exerting a downward pressure on the screwdriver to raise its tip, releasing the internal catch.

Fig.1. Removing the facility module.

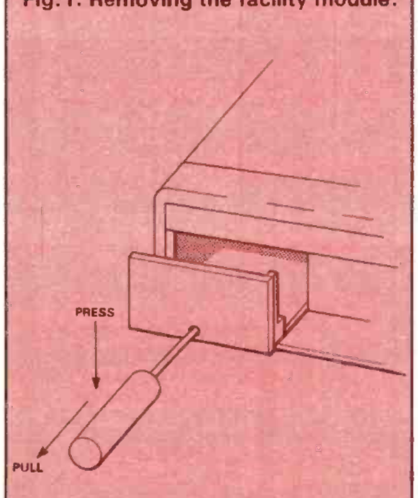
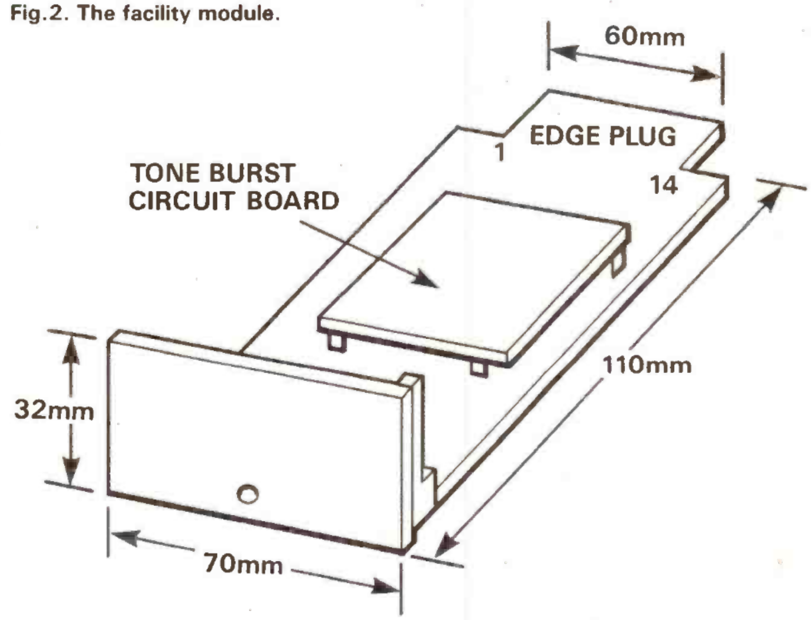


Fig.2. The facility module.



The mechanical details of an uncommitted facility module are shown in **Fig.2**. The main components of the module comprise a plastic-reinforced aluminium panel 70mm wide × 32mm high, an epoxy glass-fibre non-plated 60mm wide × 110mm long; and a 14-way gold-plated edge-plug integral with the rear of the board.

To re-install the module, locate the 'T' bracket on the rearmost underside of the board in the related slot within the main unit, and push the module forward until the internal catch engages when the module panel is flush with the main panel.

Four circular cut-outs in the plastic reinforcement allow direct access to the aluminium panel of the module, for mounting of components such as switches or lamps.

Figs. 3 and 4 give the electrical connections of the module's rear edge-plug, and microphone's 5-way DIN socket respectively.

Tone-burst Oscillator

Repeater stations on the amateur bands are normally quiescent until activated by an incoming tone signal of the appropriate frequency and time duration.

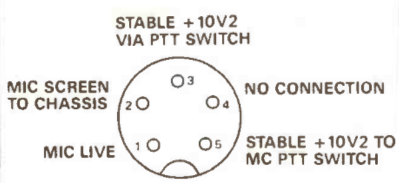
To access a repeater, the caller must first transmit a 250 millisecond (quarter-second) burst of tone at

the Pye Europa

Fig.3. Edge-plug electrical connections viewed from underside

14	Chassis/0V negative dc supply rail.	
13	Stab. + 10.2V when PTT transmit.	Pin 21 on Rx board
12	Squelched audio from af preamp.	Pin 13 on Rx board.
11	Stab. + 10.2V rail	Pin 20 on Rx board.
10	No connection	
9	Regulated + 12V dc supply rail.	Pin 22 on Rx board.
8	Squelched audio to Vol.Control	
7	Stab. + 10V rail for TX	Pin 10 on Tx board.
6	Mic preamp post-comprsn,pre-clipg.	Pin 8 on Tx board.
5	No connection	
4	No connection	
3	Mic 'live' input.	Pin 1 on handset socket.
2	Unsquelched af from detector.	Pin 5 on Rx board.
1	Chassis/0V negative dc supply rail.	

Fig.4. The microphone DIN socket connections (from outside).



1750Hz.

The circuit shown in **Fig.5** is designed to provide such a tone-burst transmission from the Pye Europa, either manually at the press of a button or automatically when the press-to-talk switch on the microphone is pressed.

While the latter is more convenient, the purist might argue that it causes a tone to be transmitted more often than is required by the repeater, which may be mildly irksome to the listener at the receiving end.

A change-over switch mounted on the front-panel of the facility module allows the operator to choose between the two methods.

By feeding the tone-burst signal into the transmitter in parallel with the microphone and at the appropriate voltage level, the fm deviation produced by the tone modulation is similar to that on speech peaks, with the advantage of being able to hear the tone from within the microphone as an assurance that the tone-burst is functional.

The tone-burst circuit is constructed as a separate unit, and its dc supplies and signal connections are picked up by flying-leads from the solder-lands of the edge-plug on the facilities module.

Pin 11 of the edge-plug provides a regulated +10.2V to the tone-burst unit, to ensure stability of tone frequency.

IC1 is a low power cmos version of the well proven 556 dual timer the first section of which is configured as a monostable, whose output pin 5 is normally low (0 volt) until receipt of a trigger pulse at pin 6 which causes the output to go high (+10V), where it remains for a period of approximately 250 milliseconds.

The time period during which the output of the monostable is high, is determined by the combination of R4 and C4, given by:

$$T \text{ secs} = 1.1(RC)$$
$$= 1.1 \times (1.0 \times 10^6 \times 0.22 \times 10^{-6}$$
$$= 242 \text{ ms}$$

Output pin 5 is directly connected to the reset terminal pin 10 of the second timer of IC1, which is arranged to act as a multivibrator with a repetition frequency of 1750Hz. Oscillatory action can only occur when its reset pin is high ie during the 250 ms period of the preceding monostable.

Frequency of oscillation is determined by the components R5,RV1, and C10, given by:

Frequency F Hz = 1/T where T secs $= 0.7\,(R5 + 2 \times VR1)C10$

and assuming VR1 is set to 6.33 kΩ $= 0.7 \times (4700 + 2 \times 6330) \times 0.047 \times 10^{-6}$

$T = 0.5711$ secs
$F = 1/T =$ **1750 Hz**

The variable resistor RV1 allows for adjustment of the tone frequency to compensate for component tolerances, but no provision is made for fine adjustment of tone-burst time-duraton because it is not critical.

The negative-going voltage transition required to trigger the monostable is derived by inversion from the positive dc supply system, taking advantage of the fact that pin 13 of the edge-plug rises from 0V to +10.2V during transmit, by way of the press to talk switch.

Transistor Q1 is arranged as a voltage inverter, which is normally non-conducting. It conducts when its base is connected through R1 to the positive supply rail, which happens when the push-button switch SW1 is pressed while switch SW2 is in the manual position, or whenever the ptt switch on the microphone is pressed while the switch SW2 is in the automatic position.

On changing from the non-conducting to the conducting state, the voltage level at the collector of transistor Q1 falls from high to low. That transition is differentiated by capacitor C3 and resistor R3 to present a brief negative-going pulse to the trigger pin 6 of the monostable, which in turn initiates and sustains the 1750 Hz multivibrator for 250 milliseconds.

The 10V to peak voltage-level of the multivibrator output signal is attenuated by a factor of about 100 via the RC low-pass filter network comprising R6,R7 and C11 to produce a pseudo-sinusoidal output signal of circa 100 millivolts peak to peak, which is similar in magnitude to the output signal from the microphone on speech peaks.

This signal is fed to pin 3 of the edge-plug on the facility module,

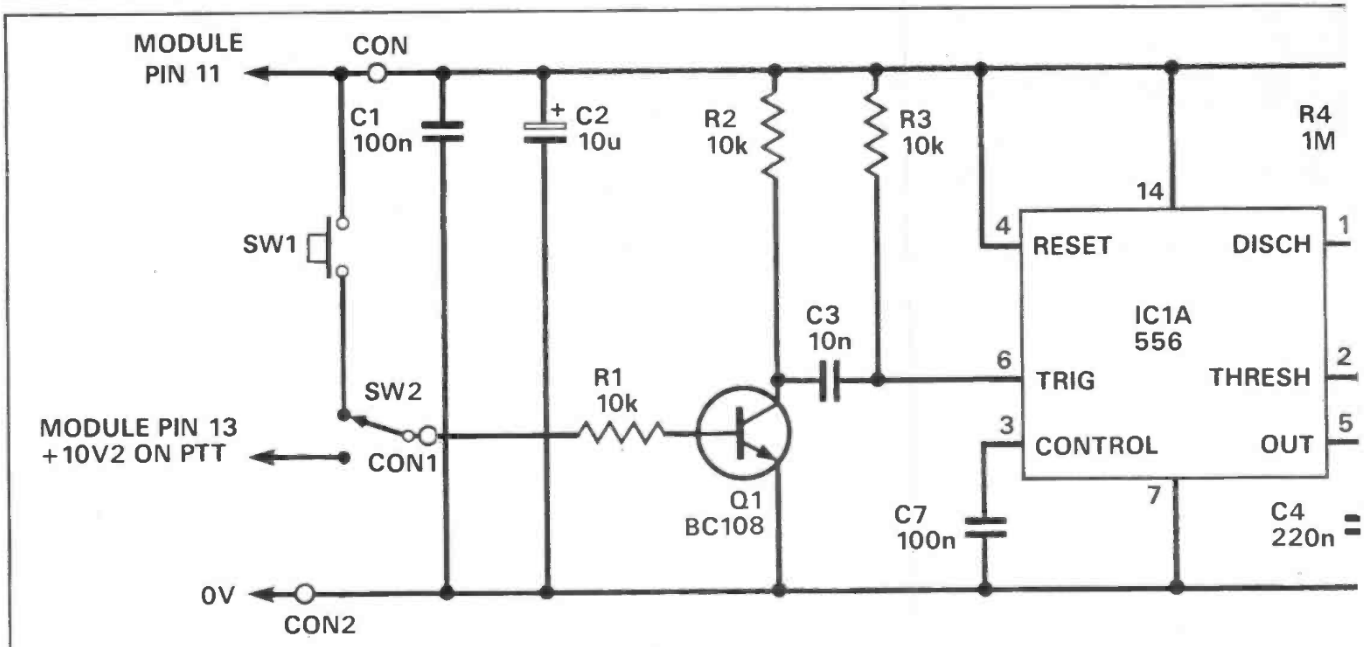


Fig.5. The circuit diagram.

which connects directly to the microphone 'live' terminal on the microphone input socket, so modulating the transmitter to radiate the tone-burst signal. C9 at the output of the multibivrator prevents any dc from reaching the microphone.

Construction

The tone-oscillator can be constructed either as a 70mm×45mm printed-circuit board, or hard-wired on copper strip-board of similar dimension.

A suitable pcb layout is given in **Fig.6**.

Components should be mounted horizontally because of the height restriction in the transceiver, and care must be taken with the placing of capacitors C1,2,5,6 to ensure adequate decoupling as a safeguard against adverse effects from the strong local rf field while transmitting. C1 should be connected as directly as possible between the emitter of Q1 and the top end of its collector load-resistor R2; and C5 directly between dc supply pins 14 and 7 of IC1.

DC supply is taken from the stabilised +10.2V rail of the transceiver, which remains available at pin 11 of the edge-connector during both receive and transmit, with negative/chassis at pins 1 and 14. Current demand is negligible and well within the scope of the transceiver's regulated power supply.

After assembly, the circuit unit is then bolted or glued to the upper side of the facility module base-board, and the two switches SW1 and SW2 can be conveniently mounted onto the vertical panel through the circular cut-outs in the plastic reinforcement.

Finally, a few flying leads are required to connect the finished circuit to the solder-lands on the edge-plug of the module and to the panel-mounted switches, as indicated in **Fig.5**.

Testing

Ideally, to avoid unnecessary transmissions during setting-up the tone-burst oscillator, the unit should be tested prior to re-installation of the facility module plus tone-burst circuit in the transceiver.

In the absence of an external 10 volt dc supply unit, a 9 volt battery is temporarily connected to pins 11 and 14 of the edge connector on the module, the positive going to pin 11.

If an oscilloscope is available, the output signal of the tone-burst circuit may be examined by connecting the CRO probe to edge-plug pin 3, with the timebase set to 0.5 millisec/div, and the amplifier gain to 50 millivolts/div.

To produce a constant tone output, the junction of C3, R3 and Pin 6 of IC1 is temporarily connected to the zero-volt/chassis rail at Pin 1 or 14 of the edge-connector, and a square-wave signal should appear on the screen where it will remain for as long as IC1 trigger-pin 6 is grounded.

The time-period for one cycle of the required 1750Hz signal is 1/1760 = 0.57 milli-second, so the frequency-setting variable resistor RV1 on the circuit board is adjusted until one cycle of the oscillatory square-wave fills approximately 1.2 horizontal divisions on the screen.

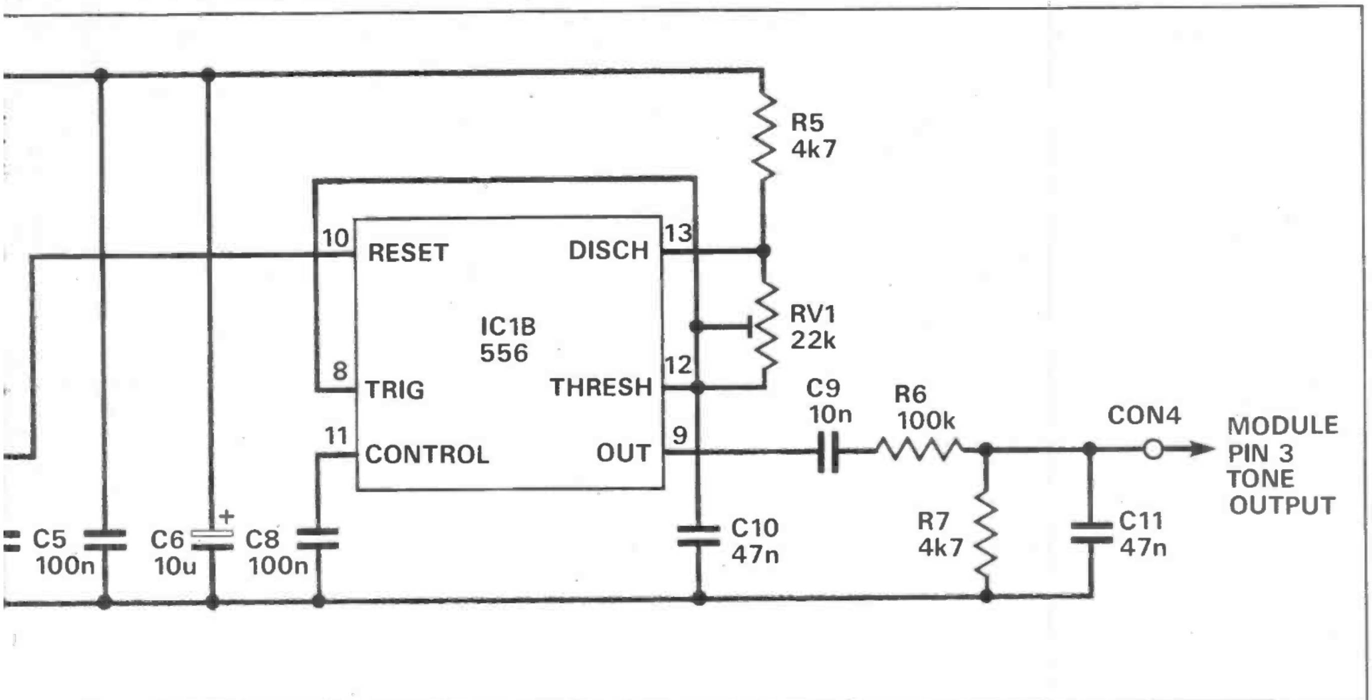
Peak to peak amplitude of the trace should be about two vertical divisions, ie 100 millivolt.

Connecting a low-frequency counter if available instead of the CRO probe, should make setting of the 1750Hz tone frequency that bit more accurate.

With the CRO still connected, but with the temporary zero-volt connection removed from the junction of C3,R3 and IC1 pin 6, and with switch SW2 in the manual position, pressing the push-button switch SW1 should cause the oscillatory signal to appear on the screen for brief period of time.

The CRO timebase is then switched from 0.5 msec/div to say 100 msec/div, and the 250 millisecond time interval of the tone-burst signal should span between 2-3 horizontal divisions.

With switch SW2 now in the automatic position, a temporary connection between pins 11 and 13 of the edge connector should again



produce a 250 msec burst of tone signal to appear on the screen, thereby simulating the PTT switching operation.

In the event of neither a CRO or a low-frequency counter being available, it should still be possible to montor and adjust the tone frequency by listening to the signal at pin 3 of the edge-plug by means of an earpiece or headphones, or by connecting the signal into an audio-amplifier, and comparing it audibly with the tone produced on a piano or electronic keyboard when the A^2 key is played.

A^2 frequency is 1760Hz which is close enough to the required 1750Hz for practical purposes, and its location is the nineteenth white key above middle-C on a piano keyboard.

With the facility tone-burst module now re-installed in the Pye Europa transceiver, and with the appropriate repeater channel selected, pressing either the push-button with the change-over switch in its manual position, or the microphone PTT switch while in the automatic position, should activate the repeater and cause it to be heard on the loudspeaker.

While theoretically the frequency of the tone oscillator should be independent of the supply voltage, it is possible if required to obtain access to the installed module for fine adjustment of the frequency-setting RV1, by removing the upper cover plate of the Europa, and lifting upwards the hinged receiver board.

The upper cover plate section is fastened by the two screws at its rear corners, the removal of which allows the cover to be lifted off, so giving access to the receiver circuit-board.

This is retained by three small screws along its rear edge, one at each corner and one central, which when removed allow the board to hinge forward and upwards to latch into the vertical position for convenient access to the module below.

Apart from the mechanical aspects, there is no reason why this tone-burst circuit should not perform equally well for transceivers other than the Pye Europa.

Components

Resistors

0.25W Metal Film

R5,R7	4k7
R1,2,3	10k
R6	100k
R4	1MO
RV1	22k Min Preset

Capacitors

25V dc working

C3,9	10n ceramic
C10	47n ceramic
C1,5,7,8	100n ceramic
C4	220n ceramic
C2,6	10μ electrolytic

Semiconductrs

Q1	BC108
IC1	556 cmos low-power

Panel-Mounting Switches

SW1	Min push to make
SW2	Min spdt

Fig.6. The layout and components.