MUSTANG
COMMUNICATIONS

MMA STYLE MODULE SPECIFICATIONS

Issue No.1

SCOPE OF THIS ISSUE:

Modules issued from approximately yr 2000 onwards for use with MMA GA (GMA & GTMA), VA, MDS ranges, and the DA.50 amplifier.

Mustang Communications Ltd
Eastfield Industrial Estate
Scarborough
England
YO11 3UT

Telephone U.K. 01723 582 555
Telephone International 44 1723 582 555

Fax U.K. 01723 581 673
Fax international 44 1723 581 673

Email info@mustang.co.uk
Web www.mustang.co.uk

The following data sets out the general specifications, features and operating principles of the range of input modules supplied for use with Mustang amplification in the following ranges:
MMA, GA (GMA & GTMA), VA, MDS, and the discontinued DA.50 amplifier. Modules of current specification are backward compatible to 1974.

Please note that the ***Standard Locking DIN input socket connections*** shown for each module may not be relevant or correct for all the amplifier ranges covered, depending upon actual amplifier specification, but may be taken as a guide. For absolutely correct detail, the appropriate generation of installation manual for the actual amplifier product range should be consulted

MODULE	FUNCTION
M.60	Multi-purpose balanced microphone & line, with phantom DC supply
M.60TB	Multi-purpose balanced mic/line, phantom DC. Treble & bass adjustment
L.50	Multi-purpose high level balanced line
M.6	Microphone 30-200 ohms, transformer balanced , with phantom supply
QM.6	Microphone 30-200 ohms, transformer balanced, three-tone chime, phantom supply
G.4	Phono-turntable pick-up with RIAA ceramic/magnetic equalisation
T.5	Line input, wide range sensitivity, unbalanced general purpose
L.5	Line input, transformer balanced, medium to high level input
TG.2	Tone generator - 1kHz tone pips and continuous tone
TG.3	Tone generator - 1kHz gongs
TG.5	Tone generator - Warble alarm and Dee-Dah alarm
XAM.2	Tuner, AM, fixed single station
VFM.3	Tuner, VHF. (For use with GTMA series units only)
VFM.4	Tuner, VHF. (For use with all except GTMA range amplifiers)
	Module developments from previous discontinued modules
PM.6	Phantom powered microphone module. Facilities now incorporated into standard M.6 module
CM.6	Two-tone chime microphone module. Superceded by QM.6 three-tone chime
M.7	Microphone - high impedance. Obsolete
TG.1	Continuous sine wave tone generator. Facilities now incorporated into standard TG.2 module
TG.4	Tone generator - Dee-dah alternating alarm. Facilities now incorporated into standard TG.5 module

Table 1. The current range of input modules

M.60 & M.60TB Multi-purpose microphone & Line modules with phantom supply

These modules feature a high quality input transformer for balanced microphone or line operation. They may be used with conventional dynamic microphones, or phantom powered microphones and line level devices.
The M.60TB consists of an M.60 microphone module together with a sandwiched treble/bass card. A Baxendall derived circuit offers independent adjustment of treble and bass frequencies - both cut and lift. The adjustments are accessible from the top of the module.
The modules feature continuously variable sensitivity between low impedance microphone level and 0dB line level, by means of a GAIN trimmer and switchable attenuators, and is set at despatch to 1mV sensitivity. Other switch functions include:-

- ON/OFF stabilised +15 volt supply for use with phantom microphones or pre-amplified microphones
- ON/OFF bass-cut switch to enhance speech clarity for paging and similar applications, or for amplification through horn loudspeakers.
- ON/OFF earth lift for assisting with earth-loop problems.

The sensitivity (GAIN) control pre-set is located at the top of the module and may be operated by a small screwdriver. Rotate clockwise to increase sensitivity. Rotate the treble and bass controls to increases sensitivity. The centre position of each adjuster represents approximately flat response.
The PCB also includes two 4-pole DIL switches to cover all settings. DIL-A may be identified at the top of the module adjacent to the gain trimmer, whilst DIL-B is at the bottom. The switch poles are numbered on each switch body and the “ON” position is also shown. The various switch bars may be operated by the use of a small pointed instrument, ball-pen, etc.

Standard Locking DIN input socket connections

Pin 1	in phase	Balanced input
Pin 2	signal earth	
Pin 3	out of phase	
Pin 4	0V	(Priority channel only)
Pin 5	Priority control operate	

DO NOT allow the cable braiding to contact the cable grip of the DIN connector, or a earth/hum loop will result, and interference suppression may be impaired.

SPECIFICATION

Input configuration	Transformer balanced. Centre tap may be switched free of earth.
Sensitivity	Variable 125uV @ 600 ohms to 2.6V @ 4k ohms by switch settings and trimmer.
Input overload margin	Nominally 35dB
Frequency response	-3dB @ 30Hz and 20kHz ref 1kHz
Treble & bass adjustm.	+/- 12dB @ 100Hz and 10kHz (M.60TB only)
Signal to noise ratio	Nominally 60dB @ 1mV
Bass-cut facility	Roll-off of approximately 6dB per octave below 200Hz. Switchable in/out
Phantom supply	+15V stabilised. Feeds via 2k7 ohm to each line. Factory set null. Switchable on/off.

M.60 & M.60TB DIL Switch functions

		DIL-A				DIL-B			
		1	2	3	4	1	2	3	4
Sensitivity variable	125uV - 2mV	off	on			off		on	on
Sensitivity variable	2mV - 20mV	on	off			off		on	on
Sensitivity variable	20mV - 300mV	on	off			off		off	off
Sensitivity variable	300mV - 2.6V	on	off			on		off	off
Bass cut filter in circuit					off				
Bass cut filter out of circuit					on				
Phantom supply on				on			on		
Phantom supply off				off					
Input transformer centre tap to earth							on		
Input transformer free of earth							off		

L.50 Multi-purpose high-level line module

This module features a high quality input transformer for balanced microphone or line operation. It may be used with a variety of input sources such as music equipment, remote amplification, and line level devices, etc. The module features continuously variable sensitivity by means of a gain trimmer and switchable attenuators, and is set at despatch to 775mV sensitivity. Other switch functions include:-

- ON/OFF bass-cut switch to enhance speech clarity for paging and similar applications, or for amplification through horn loudspeakers.
- ON/OFF earth lift for assisting with earth-loop problems.

A sensitivity (GAIN) control pre-set is located at the top of the module and may be operated by a small screwdriver. Rotate clockwise to increase sensitivity.
The PCB also includes 2 four-pole DIL switches to cover all settings. DIL-A may be identified at the top of the module adjacent to the gain trimmer, whilst DIL-B is at the bottom. The switch poles are numbered on each switch body and the “ON” position is also shown. The various switch bars may be operated by the use of a small pointed instrument, ball-pen, etc.

SPECIFICATION

Input configuration	Transformer balanced. Centre tap may be switched free of earth.
Frequency response	-3dB @ 30Hz and 20kHz ref 1kHz
Sensitivity	Variable 75mV to 100V @ 10k ohms by switch settings and trimmer.
Input overload margin	Nominally 32dB
Signal to noise ratio	Nominally 66dB @ maximum sensitivity
Bass-cut facility	Roll-off of approximately 6dB per octave below 200Hz. Switchable in/out

Standard Locking DIN input socket connections

Pin 1	in phase	Balanced input
Pin 2	signal earth	
Pin 3	out of phase	
Pin 4	0V	(Priority channel only)
Pin 5	Priority control operate	

DO NOT allow the cable braiding to contact the cable grip of the DIN connector, or a earth/hum loop will result, and interference suppression may be impaired.

L.50 DIL Switch functions

	DIL-A				DIL-B			
	1	2	3	4	1	2	3	4
Sensitivity variable 50mV - 600mV	on	on				off	off	
Sensitivity variable 500mV - 6V	on	on				on	off	
Sensitivity variable 6V - 100V	on	on				off	on	
Bass cut filter in circuit				off				
Bass cut filter out of circuit				on				
Input transformer centre tap to earth								on
Input transformer free of earth								off

M.6 Low impedance microphone module with Phantom supply (Later versions - M.6-2 onwards)

This module features a high quality input transformer for balanced line operation of dynamic microphones between 30 ohms and 600 ohms impedance, combined with a highly stable +15V DC supply for phantom powering of microphones. This facility was previously featured only in the PM.6 module.

The sensitivity is continuously variable by means of a trimmer resistor. Be careful to use a very small screwdriver blade. This control is marked “Gain” and is rotated anti-clockwise to increase sensitivity. When supplied, the gain is set to minimum (1mV for 200/600 ohm microphones) and should only be altered if found to be essential for correct operation. This will avoid prematurely overdriving the module into clipping distortion on peaks of sound. DO NOT force this control or intermittency will result. Generally an increase in gain will be necessary for 30ohm microphones.

On the component side of the board are three Molex style jumper sets. These operate as links which can be repostioned to enable/ disable various functions. Gently pull off the plastic bodied link and re-postion it on to the two pins adjacent to the required function, as follows:

PHANTOM When postioned in the OFF position, the module is for use with a conventional dynamic balanced microphone. In the ON position, (and with the 0V link in the Phantom position - see below) the phantom supply is energised. Dynamic microphones may still be used with the phantom supply operating, and without damage, though connection noises may occur if microphones are plugged/unplugged.

It will normally be necessary to reduce the “gain” of this module, too, for correct phantom operation.

BASS CUT If the jumper is repositioned to the BASS CUT location, then the specified bass roll-off will be enabled. Its operation is suitable for enhancing speech clarity for paging and similar applications, or for amplification through horn loudspeakers.

0V LIFT In the NORMAL position, the transformer is conventionally balanced about 0V. In the PHANTOM postion, the configuration is for balanced phantom supply and must be in this position (with the PHANTOM jumper also set to ON) for phantom powering to be enabled.

If this jumper is removed completely (or parked on one pin only) and the Phantom jumper set to OFF, then the configuartion is dynamic balanced floating, which may be useful where signal earth conflicts are being experienced. This is occasionally referred to as “lifting the earth”.

Standard Locking DIN input socket connections

Pin 1	in phase audio (& +15V DC Phantom power)	Balanced input
Pin 2	0V return (cable braid)	
Pin 3	out of phase audio (& +15V DC Phantom power)	
Pin 4	0V	
Pin 5	Priority control operate	(Priority channel only)

DO NOT allow the cable braiding to contact the cable grip of the DIN connector, or a earth/hum loop will result, and interference suppression may be impaired.

SPECIFICATION

Input configuration	Transformer balanced. Centre tap optionally to 0V by pin header & jumper link
Phantom supply	Optionally, by pin header and jumper link: 15V DC stabilised. Factory set null.
Sensitivity	Variable 100uV @ 30 ohms to 1mV @ 200 ohms.
Input overload margin	46dB to 26dB
Frequency response	-3dB @ 55Hz and 20kHz ref 1kHz
Signal to noise ratio	Nominally 60dB @ 1mV
Bass cut	Optionally, by pin header and jumper link: Roll-off of approximately 6dB per octave below 200Hz

PM.6 Combined low impedance microphone and phantom DC supply

The PM.6 module is fully superceded by the standard M.6 module (from issue M.6-2 onwards). The PM.6 module is described here for completeness.

This module offers a high performance transformer balanced input combined with a highly stable +15 Volt DC supply for the phantom powering of microphones.

Standard Locking DIN input socket connections

Pin 1	in phase audio (& +15V DC)	Balanced input
Pin 2	0V return (cable braid)	
Pin 3	out of phase audio (& +15V DC)	
Pin 4	0V	(Priority channel only)
Pin 5	Priority control operate	

DO NOT allow the cable braiding to contact the cable grip of the DIN connector, or a earth/hum loop will result, and interference suppression may be impaired.

SPECIFICATION

Input configuration	Transformer balanced. Primary side held at +15V above signal earth by on board stabiliser and feed resistor to each input leg. Factory set DC balancing. Signal earth to amplifier input socket.
Sensitivity	Variable 100uV @ 30 ohms to 1mV @ 200 ohms.
Input overload margin	46dB to 26dB
Frequency response	-3dB @ 55Hz and 20kHz ref 1kHz
Signal to noise ratio	nominally 60dB @ 1mV
Bass cut option	Cut green wire link to introduce bass roll-off of approximately 6dB per octave below 200Hz

CM.6 Combined low impedance microphone module and ding-dong chime

CM.6 has been generally superceded by QM.6 module, and the following details are to assist maintenance and service requirements. Original details and assistance are freely available by contacting our service department.

The CM.6 consisted of an original specification M.6 module combined with a two-tone chime generator board.
Please note that the original specification M.6 did not feature phantom powering, molex jumpers for bass-cut or 0V earth lift.
The green wire link for the bass cut is located on the print side of the board. The flying lead of the CM.6 should be connected to the printed circuit board pin marked "- trigger" adjacent to the module rear support on the main circuit board. This is the trigger connection and operates simultaneously with priority access and therefore the CM.6 should always be used in a priority module position. Injection of the "ding-dong" signal relative to the microphone signal is adjusted by the small trimmer resistor marked "INJECTION" and the best setting will be found by experiment.
The trimmer resistor on the chime PCB marked "PITCH" adjusts both the speed and pitch of the chime sequence simultaneously.

Standard Locking DIN input socket connections

Pin 1	in phase audio	Balanced input
Pin 2	Signal earth	
Pin 3	out of phase audio	
Pin 4	0V	(Priority channel only)
Pin 5	Priority control operate	(Priority channel only)

DO NOT allow the cable braiding to contact the cable grip of the DIN connector, or a earth/hum loop will result, and interference suppression may be impaired.

SPECIFICATION

Input configuration	Transformer balanced. Centre tap to signal earth on module, and to amplifier input socket.
SensitivityVariable	100uV @ 30 ohms to 1mV @ 200 ohms.
Input overload margin	46dB to 26dB
Frequency response	-3dB @ 55Hz and 20kHz ref 1kHz
Signal to noise ratio	nominally 60dB @ 1mV
Bass cut option	Cut green wire link to introduce bass roll-off of approximately 6dB per octave below 200Hz
Chime frequencies	Variable - approximately 1000/888Hz
Chime duration	Variable - approximately 2 seconds

QM.6 Combined low impedance microphone module, triple chime, and phantom supply (from issue QM.6-1 onwards)

This consists of a version of an M.6 module combined with a three-tone chime generator board.
For information on gain adjustment, bass cut, 0V earth lift, phantom supply, etc., see M.6 details above. The flying lead of the QM.6 should be connected to the printed circuit board pin marked "- trigger" adjacent to the module rear support on the main circuit board. This is the trigger connection and operates simultaneously with priority access and therefore the QM.6 should always be used in a priority module position. Injection of the "ding-dang-dong" signal relative to the microphone signal is adjusted by the small trimmer resistor marked "CHIME INJECT" and the best setting will be found by experiment.
The trimmer resistor on the chime PCB marked "CHIME PITCH" adjusts both the speed and pitch of the chime sequence simultaneously.

Standard Locking DIN input socket connections

Pin 1	in phase	Balanced input
Pin 2	signal earth	
Pin 3	out of phase	
Pin 4	0V	(Priority channel only)
Pin 5	Priority con trol operate	

DO NOT allow the cable braiding to contact the cable grip of the DIN connector, or a earth/hum loop will result, and interference suppression may be impaired.

SPECIFICATION

Input configuration	Transformer balanced. Centre tap to signal earth on module, and to amplifier input socket.
Sensitivity	Variable 100uV @ 30 ohms to 1mV @ 200 ohms.
Input overload margin	46dB to 26dB
Frequency response	-3dB @ 55Hz and 20kHz ref 1kHz
Signal to noise ratio	nominally 60dB @ 1mV
Bass cut	Optionally, by pin header and jumper link: Roll-off of approximately 6dB per octave below 200Hz
Chime frequencies	Variable - approximately 1000/888/626Hz
Chime duration	Variable - approximately 2.5 seconds

M.7 High impedance microphone/general purpose module

Obsolete module but shown here for completeness.
This module is for use either with high impedance microphone or ancillary sound sources with low level equalised outputs. Two pre-set sensitivities are available, selected by two alternative connections at the input socket. The 50mV connections would normally be used either for microphones or low output tape head pre-amplification etc. The 15mV connections provides extra sensitivity but as with all input modules this could lead to early onset of clipping distortion on peaks of sound if care is not exercised. The green wire link on the component side of the board provides a bass cut filter if cut. Its attenuation is approximately 3dB per octave below 200Hz and is suitable for enhancing speech clarity for paging and similar applications, or for amplification through horn loudspeakers. Bend the cut ends of the link apart to prevent accidental contact.

Standard Locking DIN input socket connections

Pin 1	50mV (.05V) input	
Pin 2	signal earth (cable braiding)	
Pin 3	15mV (.015V) input	
Pin 4	0V	}
Pin 5	Priority control operate	} (Priority channel only)

DO NOT allow the cable braiding to contact the cable grip of the DIN connector, or a earth/hum loop will result, and interference suppression may be impaired.

SPECIFICATION

Input configuration	Unbalanced audio relative to signal earth
Sensitivity	Selectable at input socket 15mV @ 33k ohm or 50mV @ 47k ohm
Input overload margin	26dB
Frequency response	-3dB @ 55Hz and -1dB 20kHz ref 1kHz
Signal to noise ratio	Nominally 60dB
Bass cut option	Cut green wire link to introduce bass roll-off of approximately 6dB per octave below 200Hz

G.4 Magnetic and ceramic pick-up module for record players

This module is a variable sensitivity module suitable for mono or stereo magnetic or ceramic (crystal) pick-ups. The sensitivity when supplied is set to minimum - "C" (suitable for ceramic cartridges) by means of the small trimmer resistor. By rotating the control carefully anti-clockwise by means of a very small screwdriver blade towards the "M" position, the sensitivity will increase to a level suitable for magnetic cartridges. DO NOT force this control or intermittency will result. Be careful to establish the type of cartridge in use and adjust the module accordingly. If incorrectly determined, the result will be either exceptionally low or high amplification of the signal. In the latter case severe distortion will arise and the front volume control operation will probably be cramped between position 0 and 1. Be careful to maintain the correct stereo signal phasing on the input plug, as, if the left and right signals are out of phase the result will be strangely hollow and un-natural amplification with distortion. Always adjust the trimmer resistor to the minimum sensitivity possible for normal operation of the front volume control.

Standard Locking DIN input socket connections

Pin 1	input left or right or mono
Pin 2	signal earth (cable braiding)
Pin 3	input left or right or mono

DO NOT allow the cable braiding to contact the cable grip of the DIN connector, or a earth/hum loop will result, and interference suppression may be impaired.

SPECIFICATION

Input configuration	Two unbalanced audio inputs, passively mixed relative to signal earth.
Sensitivity	Variable 4mV to 90mV @ 47k ohm.
Equalisation	RIAA
Input overload margin	47dB to 68dB @ 1kHz
Signal to noise ratio	60dB to 68dB

T.5 CD/Tape/Radio general purpose unbalanced line input module
(from issue T.5-1 onwards)

This module would be selected for use with most tape players, radio tuner units, mixers, pre-amplifiers, etc., with output signal levels of between 50mV and 5V. Two pre-set sensitivities are provided by alternative connections at the input socket and the equipment manufacturers handbook should be consulted to determine the most suitable connection. A variable level control provides a further 20dB of attenuation. The 50mV connections would not normally be used for signal levels greater than approximately .75Volt as the input overload margin would be exceeded leading to premature clipping distortion on sound peaks.

Standard Locking DIN input socket connections

Pin 1 775mV input (variable 500mV - 5V)
Pin 2 signal earth (cable braiding)
Pin 3 50mV input (variable 50mV - 500mV)
Pin 4 0V (Priority channel only)
Pin 5 Priority control operate (Priority channel only)

DO NOT allow the cable braiding to contact the cable grip of the DIN connector, or a earth/hum loop will result, and interference suppression may be impaired.

SPECIFICATION

Input configuration	Two unbalanced audio inputs relative to signal earth, unmixed.
Sensitivity	Selectable at input socket 50mV @ 47k ohm or 775mV @ 400k ohm
Level control	20dB additional attenuation. Factory set at 0dB attenuation
Input overload margin	26dB (46dB)
Frequency response	-3dB @ 20Hz and -1dB 25kHz ref 1kHz
Signal to noise ratio	nominally 65dB (85dB)

L.5 Balanced floating line input module
(from issue L.5-1 onwards)

This module would be selected for use with sound mixers and zero level output (775mV nominally), amplifier loudspeaker outputs, and existing loudspeaker line systems up to 100V. One particularly useful feature is that the input connections are totally free of earth thereby automatically preventing earthing and earth/hum loop problems. A Level control and two general sensitivity ranges are provided by alternative connections at the input socket and the equipment manufacturers handbook or the installation contractor should be consulted to determine the most suitable connection. The 250mV-2.5V connection would NOT NORMALLY be used with amplifiers EXCEEDING the following ratings -

15 Volt line output i.e. 50/70/100V
15 watts into 16 ohms
30 watts into 8 ohms
55 watts into 4 ohms

No damage is likely to be caused to the module if these ratings are exceeded though distortion will tend to occur on sound peaks. If in doubt, use the 3.5V-42V connection. The loading provided by the L.5 module is negligible.

Standard Locking DIN input socket connections

Pin 1	3.5V - 42V input	floating
Pin 2	300mV - 3.5V input	free of
Pin 3		earth
Pin 4	0V	
Pin 5	Priority control operate	(Priority channel only)

SPECIFICATION

Input configuration	Dual sensitivity, transformer balanced, floatings.
Sensitivity	Selectable at input socket 0.3V-3.5V @ 10k ohm or 3.5V-42V @ 150k ohm
Input overload margin	30dB (50dB)
Frequency response	-3dB @ 30Hz and -1dB 20kHz ref 1kHz
Signal to noise ratio	nominally 85dB (105dB)

XAM.2 AM Single station tuner

This circuit module is a completely self-contained crystal-controlled, AM radio tuner incorporating RF, IF, and AF amplification, two RF tuned circuits to aid image rejection, a ceramic filter for greater selectivity, an IF rejection filter, AGC, and a control to pre-set the AF output.

The crystal oscillator used in this circuit commits the module to the reception of one station only, and all tuned circuits are set on manufacture to optimise on performance at this frequency. Therefore no adjustments except to the AF output pre-set resistor should be made.
For optimum results, the antenna system should be fitted with a 75 ohm downlead which will connect directly to amplifiers with a standard 75 ohm coax antenna socket. If the module cannot be used in the dedicated input module position, and where signal strength permits, the coax may be connected to the corresponding locking DIN socket as follows -

Pin 1 Inner
Pin 2 braid
Pin 3 N/C

DO NOT allow the cable braiding to contact the cable grip of the DIN connector, or a earth/hum loop will result, and interference suppression may be impaired.

To assist in setting the system up, a signal strength arbitrary voltage test pin is located at the top rear. Tune or orientate the antenna for the highest reading.

SPECIFICATION

Input configuration	Fixed frequency radio tuner system, in the range 1.5MHz to 600kHz. Factory set.
Sensitivity	Better than 6uV @ 75 ohms for 26dB S/N
Controls	Audio gain
Features	Automatic RF/IF gain control Quad tuned 470kHz IF Double tuned RF pre-selector

VFM.3 VHF/FM Multi-station station tuner APPLICABLE TO GTMA RANGE AMPLIFIERS ONLY

This module is designed for use with the dedicated station selector PCB which is factory fitted to dedicated tuner amplifiers. This PCB features 4 helical potentiometers which are used to set the desired stations.
The module must be used in the dedicated VHF tuner module socket, and the connection cable links to the selector PCB.
For optimum results, a proprietary VHF antenna system should be used, complete with 75 ohm downlead. The amplifier will feature a standard coax socket.
Construction is of two circuit boards mounted back to back on which is contained a complete tunable VHF radio tuner, including RF, IF, and AF amplification, FM demodulation, AGC, variable squelch, supply stabilisation, and AFC. User adjustments are provided for variable squelch, and AF output, and all other adjustments are factory set. Connection pins are provided for the purpose of disabling the AFC to assist initial tuning of weak stations. Upon manufacture, the squelch is adjusted such that this is defeated by signals greater than 8uV, ensuring full attenuation of RF noise when the transmitting station closes down.

SPECIFICATION

Input configuration	Voltage tuned VHF radio tuner system, for the range 88MHz to 108MHz. External selection. 75 ohm input.
Sensitivity	Better than 3uV @ 75 ohms for 40dB S/N
Image rejection	70dB
AGC threshold	Operates for signals greater than 25uV
AFC capture limits	250kHz @ 25uV
Module adjustments	Audio gain
Squelch	- factory set to 8uV

Installation & adjustment of tuner modules - GTM.3 and GTMA units only

The AM and VHF modules described above are inserted into module positions 5 and 6 respectively, and antenna signals from the rear coaxial socket are routed via a splitter PCB to these dedicated positions.
The AM module is crystal controlled and therefore has no adjustments for frequency. The VHF module, in conjunction with the front panel music selector switch can provide up to 4 programs. To tune into a station, set the selector switch to position A and adjust the corresponding helical pre-set resistor on the selector PCB, until the required station is located. This multi-turn adjuster is mounted on the extreme right of the PCB on which the selector switch is mounted, inside the amplifier. See Fig.1 Adjustment is clockwise to increase frequency up to 108MHz and anti-clockwise to lower frequency to 88MHz. Repeat this process for each switch position.

It is normally necessary to tune to the centre frequency of the required VHF station and this is most easily accomplished by shorting the two PCB pins at the top of the VHF module in order to defeat the AFC, for each tuning operation. Now, by turning the pre-set carefully a position will be found where the station is received without distortion. Removing the short will re-instate AFC and account for frequency drift caused by temperature change etc. It is possible that when attempting to tune a weak station, which is transmitting on a frequency adjacent to a much stronger station, that the AFC when re-instated will cause the module to lock onto the stronger station.
There are two possible ways of overcoming this:- firstly by the use of a more directional antenna beamed at the weaker station.

Alternatively, it should be possible to de-tune to the opposite side of the weak station. In any event, check that the tuner locks onto the correct station by turning the amplifier off and on - the tuner will briefly sweep through all the stations and may still lock onto the stronger signal.
Signal strength comparison measurements may be made by connecting a high resistance voltmeter between the earth link (central) and AGC link (rear) at the top of the module. With antenna disconnected, the reading should be in the order of 4.5Volts DC. With the antenna re-connected, and a signal tuned in, this reading will drop by an amount dependent upon signal strength, although not linearly. With AFC disabled as above, this AGC reading will enable a more accurate tuning to any particular station.
Squelch adjustments are facilitated by the small pre-set potentiometer at the bottom of the module. The squelch threshold level may be reduced by turning this control VERY SLIGHTLY anti-clockwise.
Audio output may be adjusted by turning the pre-set potentiometer which is situated towards the top of the module.
Whilst tuner modules behave identically to other modules in the range, the following points should be noted.

a) The XAM.2 tuner is a single station receiver whose frequency is fixed and determined by a crystal. The station chosen in advance by the user (assuming sufficient signal strength exists at the intended location) CANNOT be altered by adjustments. The module may be exchanged however at any time for a nominal charge.

b) Only one XAM.2 module can be used in a GTM.3 or GTMA amplifier, and it must always occupy module position 5.

c) Only one VFM.3 module can be used in a GTM.3 or GTMA amplifier and it must occupy module position 6. The flying lead of this module should connect to the polarised pin set on SWPC.1 switch PCB (the front selector switch).

d) The four VHF stations selectable by the front switch are tuned-in on installation by adjustment of the corresponding pre-sets on SWPC.1. See Fig.1 and APPENDIX D for identification.
Adjust clockwise to increase frequency.

e) Position 'F' of the music selector switch is for acceptance of auxiliary music signals from input socket No.4. A suitable module must be inserted in Module position 4 for this purpose.

Antenna Requirements
A single 75 ohm standard coax socket is provided on the rear panel for acceptance of a composite VHF/MW radio signal. We would recommend a loaded whip antenna for medium wave reception, and a suitable one is manufactured by:

Aerial & Cable Equipment Ltd., 343-345 High Street, Cheltenham, Gloucestershire, England, GL50 3HS
Telephone 01242-511511 Fax 01242-221888

For VHF reception, a multi element array would be appropriate though as these are directional, a compromise between stations required, their relative signal strengths and relative geographic locations must be considered.

VFM.4 VHF/FM Single selectable station tuner

These modules consists of two circuit boards mounted back to back on which is contained a complete tunable VHF radio tuner, including RF, IF, and AF amplification, FM demodulation, AGC, variable squelch, supply stabilisation, and AFC. User adjustments are provided for variable squelch, and AF output, and all other adjustments are factory set.
The module feature an on-board helical potentiometer for accurate selection of a single station.
Connection pins are provided for the purpose of disabling the AFC to assist initial tuning of weak stations.
Upon manufacture, the squelch is adjusted such that this is defeated by signals greater than 8uV, ensuring full attenuation of RF noise when the transmitting station closes down.
The module may be used in any module position. A 75ohm coaxial downlead from the antenna system should be connected to the locking DIN input plug as follows -

Pin 1 inner
Pin 2 braid
Pin 3 N/C

DO NOT allow the cable braiding to contact the cable grip of the DIN connector, or a earth/hum loop will result, and interference suppression may be impaired.

To tune into a station, adjust the helical pre-set resistor (accessible at top rear) clockwise to increase frequency up to 108MHz or anti-clockwise to lower frequency to 88MHz until the required station is located.

It is normally necessary to tune to the centre frequency of the required station and this is most easily accomplished by shorting the two PCB pins at the top of the module in order to defeat the AFC, for each tuning operation. Now, by turning the pre-set carefully a position will be found where the station is received without distortion. Removing the short will re-instate AFC and

account for frequency drift caused by temperature change etc. It is possible that when attempting to tune a weak station, which is transmitting on a frequency adjacent to a much stronger station, that the AFC when re-instated will cause the module to lock onto the stronger station.
There are two possible ways of overcoming this:- firstly by the use of a more directional antenna beamed at the weaker station. Alternatively, it should be possible to de-tune to the opposite side of the weak station. In any event, check that the tuner locks onto the correct station by turning the amplifier off and on - the tuner will briefly sweep through all the stations and may still lock onto the stronger signal.
Signal strength comparison measurements may be made by connecting a high resistance voltmeter between the earth link (central) and AGC link (rear) at the top of the module. With antenna disconnected, the reading should be in the order of 4.5Volts DC. With the antenna re-connected, and a signal tuned in, this reading will drop by an amount dependent upon signal strength, although not linearly. With AFC disabled as above, this AGC reading will enable a more accurate tuning to any particular station.
Squelch adjustments are facilitated by the small pre-set potentiometer at the bottom of the module. The squelch threshold level may be reduced by turning this control VERY SLIGHTLY anti-clockwise.
Audio output may be adjusted by turning the pre-set potentiometer which is situated towards the top of the module.

SPECIFICATION

Input configuration	Voltage tuned VHF radio tuner system, for the range 88MHz to 108MHz. On board selection. 75 ohm input.
Sensitivity	Better than 3uV @ 75 ohms for 40dB S/N
Image rejection	70dB
AGC threshold	Operates for signals greater than 25uV
AFC capture limits	250kHz @ 25uV
Module adjustments	Audio gain Squelch - factory set to 8uV

TG.1 Sine wave tone generator
The TG.1 module is fully superceded by the standard TG.2 module (from issue TG.2-1 onwards). The TG.1 module is described for completeness.

This module is useful for the setting up and matching of sound system components, or it may be used as an alarm tone. External triggering may be enabled by connection of a distant “make” switch to the tone trigger pin and signal earth pin at the Locking DIN input socket, or alternatively the module may be internally triggered by bridging a wire link between the two pins on the module itself. The tone will be generated for the duration of the “make” switch contact, and as the external triggering is at a very low current level, the cable used to connect it need only by a very light duty twin conductor of any length.
Whenever the TG.1 is oscillating, a signal of approximately 1V RMS at 47K ohm source impedance will appear at the channel input socket and this may be used to drive a remote amplifier etc.

Standard Locking DIN input socket connections

Pin 1	Tone trigger
Pin 2	signal earth
Pin 3	1V RMS auxiliary signal output
Pin 4	0V (Priority channel only)
Pin 5	Priority control operate (Priority channel only)

Pins 5 and 1 may be connected together to provide simultaneous triggering and priority operation, when returned to 0V

SPECIFICATION

Tone character	Uninterrupted sine wave
Triggering	On PCB or external make switch
Tone duration	Duration of trigger
Auxiliary output	1V RMS @ 47k ohm
Adjustment	Tone pitch 750-1350Hz

TG.2 1kHz time pips and test-tone generator (later versions - TG.2-1 onwards)

The TG.2 module now incorporates the facilities of the earlier TG.1 module.
This module is triggered externally via the appropriate channel by any pair of “make” switch contacts. Either continuous pips or a series of up to 10 pips or a continuous tone or tone burst may be triggered depending on the connections and jumper settings. The pip group or tone burst may be triggered by momentary or permanent switch contacts. Triggering takes place at a very low current level and the cable may be of any length and of very light duty twin conductor type. The PITCH of the tonemay be adjusted by the trimmer on the module, using a very small screwdriver blade. DO NOT force this control.

Standard Locking DIN input socket connections

Pin 1	trigger for continuous pips or uninterrupted tone
Pin 2	signal earth
Pin 3	trigger for one group of of pips, or for tone burst
Pin 4	0V (Priority channel only)
Pin 5	Priority control operate (Priority channel only)

Pins 5 and 1 (or 3) may be connected together to provide simultaneous triggering and priority operation, when returned to 0V

SPECIFICATION

Tone character	Continuous 1kHz sine wave tone or interrupted 1kHz sine wave. 100mS on, 900mS off.
Triggering	External make switch, momentary or continuous
Tone duration	Duration of continuous trigger, or approximately up to seconds single cycle for momentary.
Timer	Duration of group of pips or of tone burst set by TIMER trimmer approximately 1second to 10 seconds
Pitch adjustment	Approximately 750-1350Hz
Mode Selection	Pips or uninterrupted tone by Molex style pin header and jumper

TG.3 Repeating gong generator (later versions - from issue TG.3-1 onwards)

This module is triggered externally via the appropriate channel by any pair of make contacts. Either continuous gongs or up to 10 seconds of gongs may be triggered depending on the connections. The timed duration of gongs may be triggered by momentary or permanent switch contacts. Triggering takes place at a very low current level and the cable may be of any length and of very light duty twin conductor type. The frequency of oscillation may be adjusted by the trimmer resistor on the module, using a very small screwdriver blade. DO NOT force this control.

Standard Locking DIN input socket connections

Pin 1	Continuous trigger for gongs
Pin 2	Signal earth
Pin 3	Momentary trigger for timed group of gongs
Pin 4	0V (Priority channel only)
Pin 5	Priority control operate (Priority channel only)

Pins 5 and 1 (or 3) may be connected together to provide simultaneous triggering and priority operation, when returned to 0V

SPECIFICATION

Tone character	1kHz gongs at 1 second intervals
Triggering	External make switch, momentary or continuous
Tone duration	Continous gongs for duration of continuous trigger, or a timed single group of gongs using momentary trigger.
Timer adjustment	Approximately 1 second to 10 seconds by PCB trimmer
Pitch adjustment	Approximately 750-1350Hz

TG.4 Alternating alarm tone generator

The TG.4 module is fully superceded by the standard TG.5 module (from issue TG.5-1 onwards). The TG.4 module is described for completeness.

This module is triggered externally via the appropriate channel input socket by any pair of “make” switch contacts connected between the trigger and signal earth pins of the Locking DIN input socket. The alarm signal will be generated for the duration of trigger contact and as triggering takes place at a very low current level, the cable may be of any length and of very light duty twin conductor type.
Whenever the alarm generator is operating, an auxiliary signal output will appear at the input connector. The frequencies of oscillation are adjusted by the trimmer resistor on the module. Use a very small screwdriver blade and DO NOT force this control.

Standard Locking DIN input socket connections

Pin 1	trigger
Pin 2	signal earth
Pin 3	1V RMS auxiliary signal output
Pin 4	0V (Priority channel only)
Pin 5	Priority control operate (Priority channel only)

Pins 5 and 1 may be connected together to provide simultaneous triggering and priority operation, when returned to 0V

SPECIFICATION

TG.4 Tone character	Alternating fixed frequency tones of 1000Hz & 700Hz approximately, at 0.5 second intervals
Triggering	External momentary make switch
Tone duration	Duration of trigger
Auxiliary output	1V RMS @ 33k ohm
Adjustment	Tone pitch

TG.5 Warble and Dee-Dah alarm tone generator (later versions - from issue TG.5-1 onwards)

This modules now also incorporates the features originally provided by the TG.4 module.
The TG.5 is triggered externally via the appropriate channel input socket by any pair of “make” switch contacts connected between the trigger and signal earth pins of the Locking DIN input socket. The alarm signal will be generated for the duration of trigger contact and as triggering takes place at a very low current level, the cable may be of any length and of very light duty twin conductor type.
Whenever the alarm generator is operating, an auxiliary signal output will appear at the input connector. The frequencies of oscillation are adjusted by the trimmer resistor on the module. Use a very small screwdriver blade and DO NOT force this control.

Standard Locking DIN input socket connections

Pin 1	trigger
Pin 2	signal earth
Pin 3	1V RMS auxiliary signal output
Pin 4	0V (Priority channel only)
Pin 5	Priority control operate (Priority channel only)

Pins 5 and 1 may be connected together to provide simultaneous triggering and priority operation, when returned to 0V

SPECIFICATION

Dee-Dah tone character	Alternating fixed frequency tones of 1000Hz & 700Hz approximately, at 0.5 second intervals
Warble tone character	Single tone sweeping between 1000Hz & 700Hz approximately, on a 0.25 second continuous cycle
Triggering	External momentary make switch
Tone duration	Duration of trigger
Auxiliary output	1V RMS @ 33k ohm
Adjustments	Tone pitch Speed of Warble/Dee-dah
Tone selection	By Molex type pin header and jumper on PCB: Dee-dah or Warble