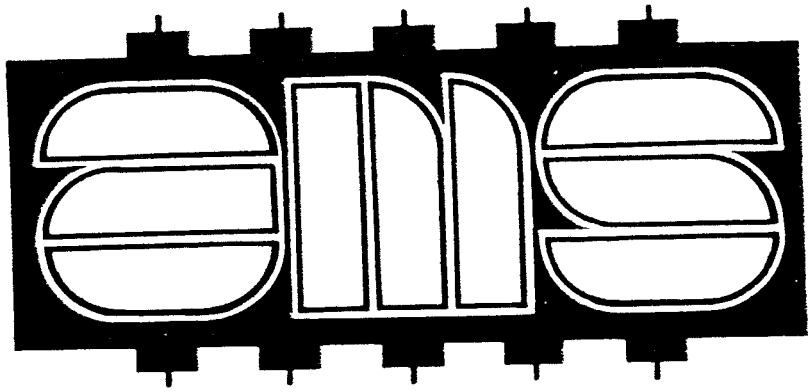

advanced music systems

model dm2·20

# Users Manual

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# 1 INTRODUCTION AND SPECIFICATIONS

## 1.1 INTRODUCTION

1.1.1 The dm2-20 tape phase simulator is the result of long and extensive research into the requirements and needs of the recording industry, for accurate simulation of tape phasing in real time.

1.1.2 Unlike other units of this kind, which solely mix the delayed signal with the original, the dm2-20 uses two independent delay lines to allow true 'over the top' tape phase simulation. This can be either manually or automatically swept, coloured LEDs indicating phase position. Additional phase switching allows cancellation rather than addition of the delayed signals, giving the 'tunnelling or cardboard tube' effect with total cancellation at the equal delay point. 'Flanging' is also possible in the single modulation mode if the 'manual phase' control is set such that one delay is always longer than the other, and modulation is applied to the longer delay. This is achieved by rotating the 'manual phase' control knob to the 2 o'clock position and applying modulation.

1.1.3 The dm2-20 also incorporates an extremely effective method of simulating rotating speakers thus eliminating the need for these large units in the studio and also avoiding the necessity of taking these, not only bulky, but also very heavy speakers on the road. Included in the unit (as standard) is a stereo output that gives a solid spatial sound and a ramp generator to simulate the mechanical characteristics of tone cabinets.

1.1.4 The dm2-20 can also be very effectively used in it's stereo mode for psyco-acoustic image shifting, or auto-panning.

1.1.5 The good signal to noise ratio of the dm2-20 is achieved by careful design and not by the use of compression/expansion techniques employed by many similar products; the resulting sound is, therefore, exceptionally clean.

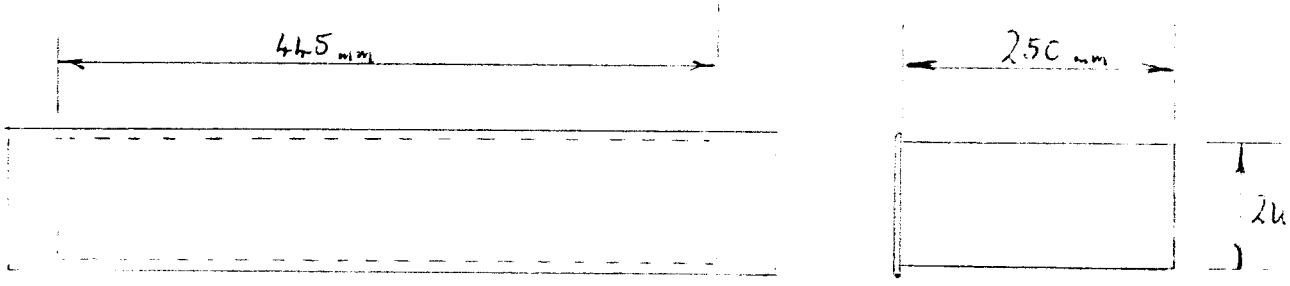
## 1.2 SPECIFICATIONS

### 1.2.1 ELECTRICAL

| | |
|---|---|
| INPUT IMPEDANCE (Zin): | 10Kohm : UNBALANCED |
| INPUT SENSITIVITY: | -4dBm MAXIMUM |
| OUTPUT IMPEDANCE: | 150ohm : UNBALANCED |
| OUTPUTS: | TWO CHANNELS |
| OUTPUT LEVEL: | +18dBm MAXIMUM |
| BANDWIDTH: | 20Hz to 15KHz |
| S/N RATIO: | 75dB AT MANUAL PHASE CONTROL MID-POSITION |
| MAXIMUM PHASING FREQUENCY: | INFINITY |
| PHASING RANGE: | 8 OCTAVES WITHIN THE AUDIO BANDWIDTH WITH CONTINUOUS SWEEP. NO RANGE SWITCHING. |
| MODULATION: | 0.05 TO 20Hz SINUSOIDAL VARIABLE ON ONE OR BOTH CHANNELS. |

### 1.2.2 PHYSICAL DIMENSIONS

The unit is designed for 19" rack mounting:




CASE DIMENSIONS

| | |
|---|---|
| Height: | 2U (3.5 inch) |
| Width (behind F.P.): | 445mm |
| Depth (behind F.P.): | 250mm |
| Weight: | 3.5Kg |

# 2 OPERATING INSTRUCTIONS

## 2.1 INTRODUCTION

This section of the manual contains information regarding installation and operation of the model dm2-20 tape phase simulator. It is recommended that the contents of this section be read and understood before attempting to operate the unit. Should any difficulties arise during operation contact your nearest A.M.S. representative or contact:

ADVANCED MUSIC SYSTEMS.
WALLSTREAMS LANE,
WORSTHORNE VILLAGE,
BURNLEY,
LANCASHIRE,
ENGLAND.

OR TELEPHONE: 0282 36943

## 2.2 SHIPPING INFORMATION

2.2.1 The dm2-20 is packaged in a specially designed container for the best possible protection. Upon receipt of the unit a thorough inspection should be made to reveal any possible shipping damage. If damage is found a claim should be made against the shipping company immediately or at least on the following working day.

2.2.2 If the unit is returned for service or modifications etc., the original container should be used. If the original container is not available, a new container can be obtained from Advanced Music Systems. Please specify the model number when requesting the new container.

## 2.3 INSTALLATION

2.3.1 The model dm2-20 can be operated with a line input voltage of 120 or 240 Volts, adjustable internally. Before connecting the unit to the primary power supply ensure that the line voltage setting is correct. All dm2-20 tape phase simulators leave the factory set to operate on a line voltage of 240 Volts and therefore if it is intended to operate the unit from a 120 Volt supply the following procedure must be followed:

[a] Disconnect the line power cord from the unit.

[b] Remove the top cover plate.

[c] With the front panel facing, the mains transformer will be found to the right, fastened to the rear panel. Remove the transformer fixing screws and manoeuvre into a

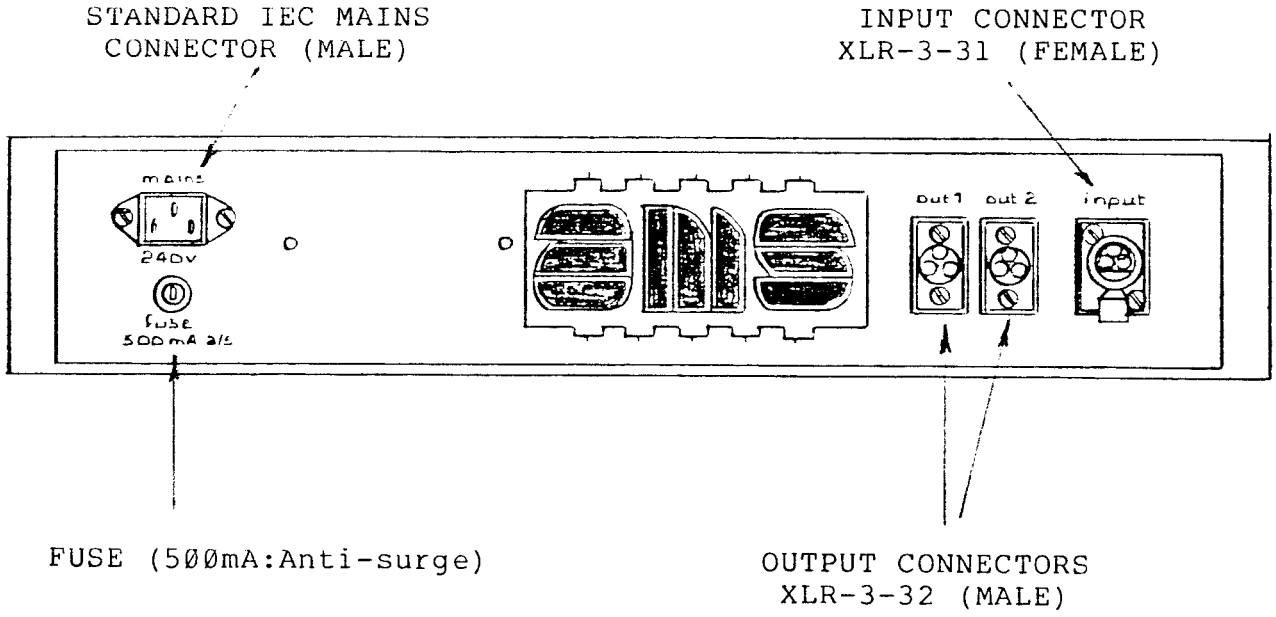
workable position pins 1, 2, 3 and 4 should now be clearly visible.

[d] Remove the link between pin 2 and pin 3 and link pin 1 to pin 3 and pin 2 to pin 4. Now return the transformer to its original position and fix firmly to the rear plate.

DO NOT FORGET TO REPLACE THE MAINS EARTH TAG WHEN FIXING THE TRANSFORMER ONTO THE REAR PANEL.

[e] Replace the top cover plate and the line power cord. The unit is now ready for installation.

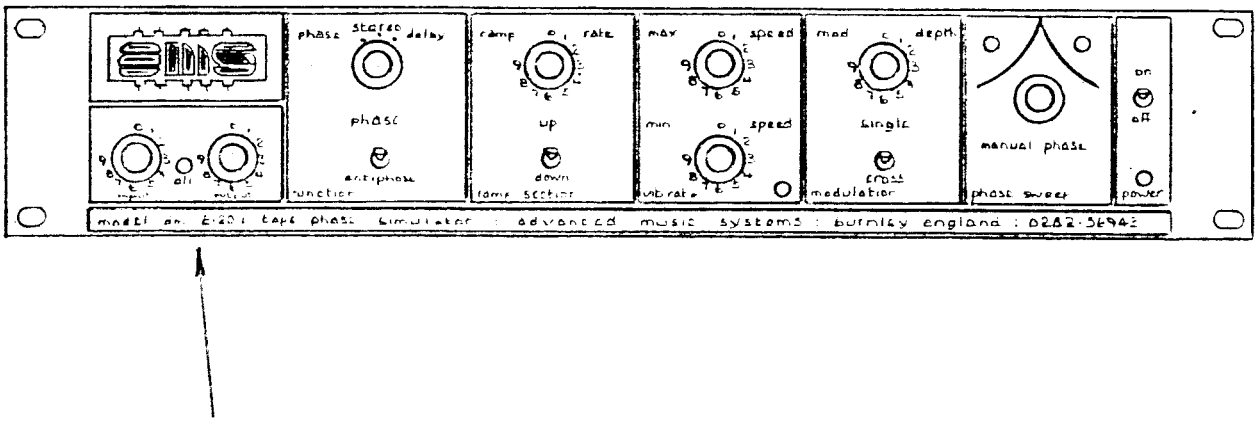
2.3.2 The connections to the rear of the unit are as follows:



## 2.4 OPERATION

### 2.4.1 GENERAL INTRODUCTION

Looking at the front panel it can be seen that it is divided into various sections. Probably the most effective way of learning how to operate the unit is to first become familiar with the front panel controls.

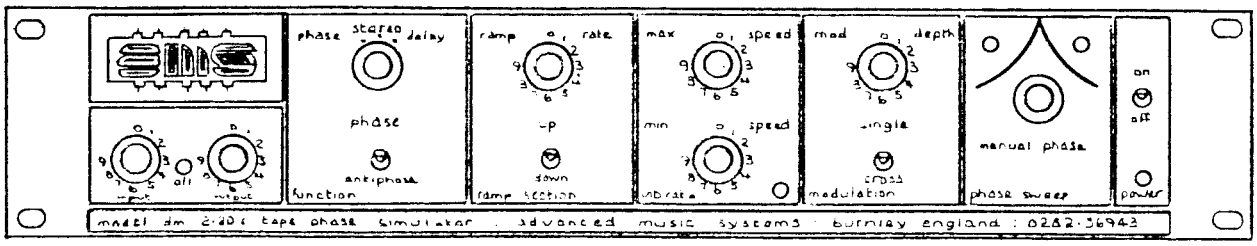



input/output
controls

### 2.4.2 INPUT/OUTPUT SECTION

The signal level at the input can be varied using the input level control knob, a red overload indicater LED is provided. The unit is best operated with the input signal level adjusted so that this LED just fails to illuminate on peak programme material.

The output level control is a ganged control which governs the output of both channel 1 and channel 2. After the input level has been set up for the optimum working level this control should be adjusted to give a good level match on the mixing desk.




function switching

## 2.4.3 FUNCTION SWITCHING SECTION

The three way function switch determines the operating mode of the dm2-20 tape phase simulator; the following modes are available:

[a] PHASE:

This is the basic operating mode in which the dm2-20 creates all the normal phasing effects associated with such devices. The dm2-20 however offers additional phasing possibilities because:

(i) Since the dm2-20 tape phase simulator has two independent delay lines true 'over the top' tape phase simulation is possible.

(ii) Flanging is also possible by turning the 'manual phase' control knob anticlockwise to the 2 o'clock position and applying 'single' modulation.

(iii) On the dm2-20 you have the ability to switch the output channels 'in' or 'out' of phase and therefore the ability to choose between phasing, flanging or tunnelling effects.

(iv) On the dm2-20 you are able to perform manual phase sweeps giving accurate controlled phasing.

(v) On the dm2-20 you are able to ramp between various frequencies at various rates, all adjustable using front panel control knobs, giving a variety of vibrato and automatic phasing effects.

(vi) Finaly you have the ability to select 'single' or 'cross' modulation again enabling a larger variety of phasing efects to be achieved.

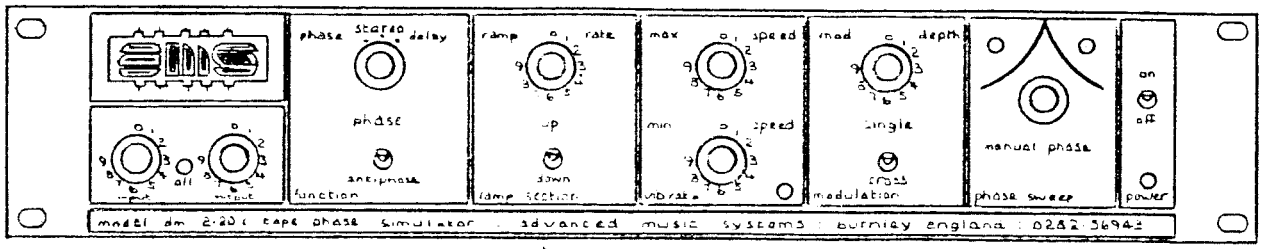
[b] STEREO:

In this mode the output signals of the delay lines are not summed but are independent; thus if the 'manual phase' control knob is rotated either side of the 12 o'clock position, the image will shift from side to side. This phsyco-acoustic image shifting can also be accomplished automatically; auto-panning is accomplished by using the modulation controls on the front panel. Auto-panning is best accomplished with only slight modulation either side of the 12 o'clock position. Broader sweeps giving no further improvement and possibly changing the signal by introducing frequency shift.

This frequency shifting (doppler effect - see section 2.5.4) if used in conjunction with 'cross' modulation can produce an extremely realistic rotating speaker effect.

[c] DELAY:

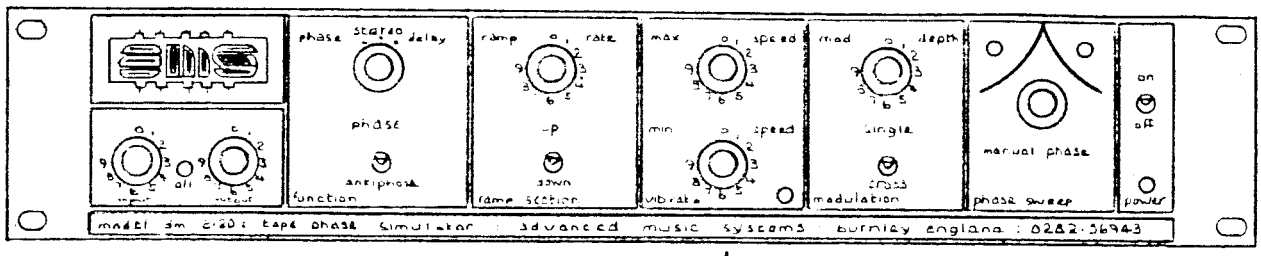
In this mode channel 1's output is fed into the input of channel 2 and both channels run in phase and at the same rate, therefore the delays attainable on channel 2 are twice as long as those attainable on channel 1. Coupled with slight modulation this increases the effectiveness of the unit for automatic double tracking (ADT).




ramp section

## 2.4.4 RAMP SECTION

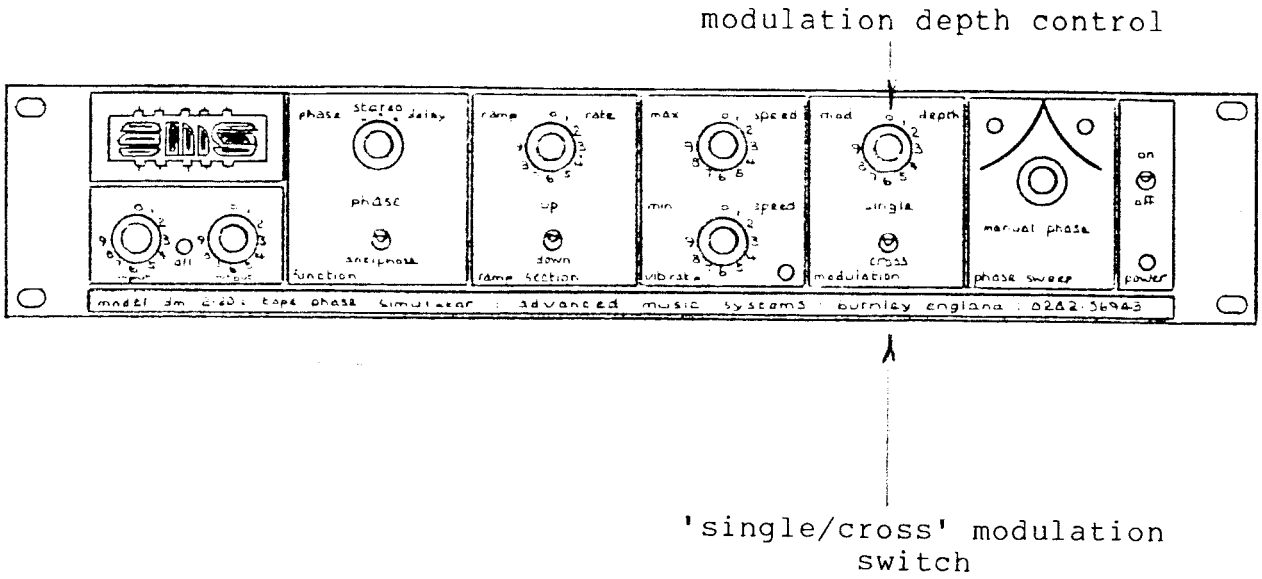
The ramp rate is the rate of change in frequency which occurs when ramping between the two extremes available (the two extremes being set by the vibrato maximum and minimum speed control knobs - next section), and can be varied using the ramp rate control knob. The 'up/down' control switch determines the starting frequency and therefore the direction of the ramp. Setting the 'up/down' control switch to 'up', for example, the frequency will initially start at the set minimum and rise to the set maximum.




maximum and minimum vibrato
speed control section

## 2.4.5 VIBRATO SECTION

These control knobs set the maximum and minimum vibrato speeds (see above). The flashing yellow LED giving an indication of the present speed.

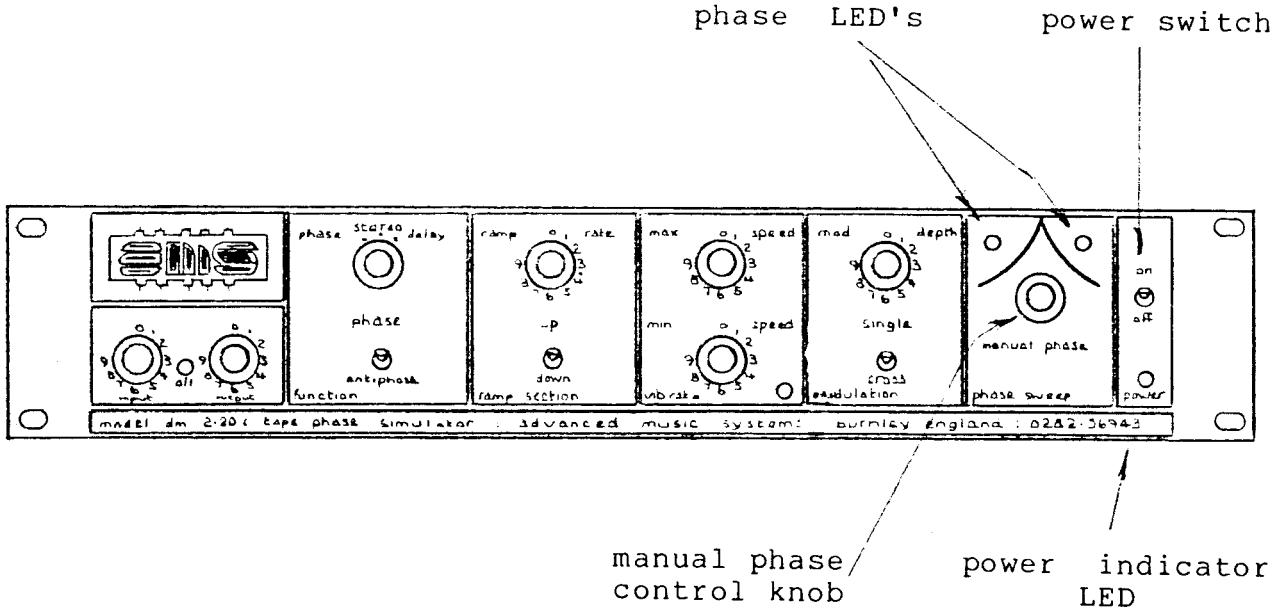



## 2.4.6 MODULATION SECTION

The 'modulation depth' control knob controls the depth of sweep, whilst the 'single/cross' modulation switch determines how this sweep is applied. In the 'single' modulation mode only channel 1 can be both modulated manually and automatically, whilst channel 2 can only be modulated manually. If 'cross' modulation is selected then both channels 1 and 2 are modulated automatically (channel 1 being in antiphase with channel 2) both channels still capable of being modulated manually.

## 2.4.7 MANUAL PHASE SWEEP SECTION

The 'manual phase' control knob effects the unit in three different ways dependent upon the position of the function control knob. If 'phase' is selected then phasing, flanging and tunnelling can be controlled manually, the phase LED's indicating the relative phasing position. If 'stereo' is selected then altering the position of the 'manual phase' control knob will shift the image, in this case the phase LED's will indicate the relative position of the image. Lastly, if 'delay' is selected alteration of the 'manual phase' control knob will alter the delay length, the two phase LED's will both be continuously illuminated indicating that 'phase changing' in this mode is not possible.




## 2.4.8 POWER SECTION

The red indicator LED will illuminate when power is applied to the unit, and the unit is switched on.

## 2.5 A USER'S GUIDE TO THE dm2-20 FLANGER

### 2.5.1 INTRODUCTION

This section of the manual describes in more detail how the dm2-20 tape phase simulator can be used to create various effects.

IMPORTANT NOTE:

In this section, and throughout the manual, where 'phasing' is used to describe an effect it implies the effect obtained by using multiple tape machines rather than 'flanging' which is the (sloshing) effect obtained by mixing a short delayed signal with the original. 'Phasing' in this manual does NOT mean the effect obtained by foot pedals using banks of tuned filters.

### 2.5.2 ORIGINAL SETTINGS

With power on and a signal present ensure that the input level control is set so that the red overload indicator LED just illuminates on the programme peaks. Now reduce the input level slightly, again by using the input level control knob, so that the level LED is just prevented from being illuminated. The output level control knob should now be adjusted to give a good level match on the mixing desk. The following should be set as indicated:

'function switch' set to 'phase'.
'phase/antiphase' switch set to 'phase'.
'ramp rate' control knob set to maximum.
'up/down' switch set to 'down'.
Vibrato 'max' and 'min' speed controls set to zero.
'modulation depth' control knob set to zero.
'single/cross' modulation switch set to 'single'.
'manual phase' control knob set to the central position.

### 2.5.2 MANUAL PHASING

If the 'manual phase' control knob is rotated back and forth with the rest of the controls set as above, controlled phasing will be obtained on both channels 1 and 2. The phasing rate will depend entirely upon how quickly the 'manual phase' control knob is rotated.

If the 'phase/antiphase' switch is set to 'antiphase' and the 'manual phase' control knob is rotated back and forth, phase cancellation on both output channels 1 and 2 will occur. This 'phase cancellation' creates the 'tunnelling' or 'cardboard tube' effect that you can now hear. This 'cancellation' effect is amply demonstrated by placing the 'manual phase' control knob exactly at the cross-over point (central position) where virtually no output will be obtained on either channel; if now the 'phase/antiphase' switch is returned to the 'phase' position

both outputs will be restored.

## 2.5.3 AUTOMATIC PHASING

### [a] MAXIMUM AND MINIMUM AUTOMATIC PHASING SPEEDS:

First ensure that the front panel controls are set as in 2.5.2 above.

For automatic phasing the 'modulation depth' control knob must be off the zero setting; to start with set it to about '2'. The maximum and minimum phasing speeds are set as follows:

(i) minimum:

The minimum phasing speed is now set by adjusting the 'min speed' vibrato control knob to the setting required (say '2').

(ii) maximum:

With the 'ramp rate' control knob still on maximum. Set the 'up/down' control switch to the 'up' position. The maximum phasing speed is now set by adjusting the 'max speed' vibrato control knob to the setting required (say '6').

### [b] RAMPING BETWEEN MAX AND MIN PHASING SPEEDS:

Now the 'ramp rate' may be set to the required speed (say '1'). If 'down' is now selected the phasing frequency will slowly decrease to the set minimum, if 'up' is selected the phasing frequency will increase to the set maximum. The rate at which the phasing frequency changes being purely a function of the 'ramp rate' selected.

Not only are you able to here this rate of change, but you are also able to see it, by watching the yellow speed LED you can monitor the phasing frequency.

### [c] SINGLE AND CROSS MODULATION:

The phasing effect you have been listening to is accomplished by modulating a single channel only and then summing both channels at their respective outputs; hence the term 'single' modulation. If the 'single/cross' modulation switch is set to 'cross' modulation, a quite different (and very distinctive) effect will be produced. This is accomplished by modulating both channels, the modulation on channel 1 being in antiphase with the modulation on channel 2, hence the term 'cross' modulation. It has the effect of mixing two signals, one higher and one lower in frequency than the input signal. Mixing this signal with the original signal externally using the mixing desk creates an even more distinctive sound.

By using one stereo output channel only, a very nice modulation effect can be obtained by ensuring there is slight cyclic frequency shifting of the signal. This sound is especially pleasing on guitar and will enhance most musical instruments.

[d] PHASE SWEEP:

The 'modulation depth' control knob determines the length of sweep to each side of the 'in phase' position.

[e] FLANGING:

In discussing the above we have left the 'manual phase' control knob in it's 12 o'clock position. If however the 'manual phase' control knob is rotated 'anticlockwise' to the 2 o'clock position and 'single' modulation is applied conventional 'flanging' will be obtained. In this position the phase position indicator LED's will not change.

[f] ANTIPHASE:

Of course all of the above comments equally apply to the 'antiphase' position. Various additional flanging effects can be obtained by combining these automatic sweeps whilst using the 'manual phase' control knob.

2.5.4 STEREO MODE

Set the dm2-20 to the original settings as described in 2.5.2 above, with one exception, the function switch should be set to 'stereo'.

With the dm2-20 tape phase simulator in the stereo mode both channel outputs become independent and therefore phasing does not take place. In this mode, as the 'manual phase' control knob is rotated either side of the null position the signal will move within the stereo image from one side to the other. This psycho-acoustic image shifting can be controlled manually, as above, or automatically by use of the 'modulation' controls. If the 'manual phase' control knob is set to it's mid-position and the modulation depth control knob is set to about the '2' setting the signal's image will continuously move from one side to the other within the stereo image.

If too much modulation depth is chosen you may notice a slight frequency shift as the image moves from side to side. If 'up' is now selected on the 'up/down' switch this frequency shift will become more apparent. This is because the shift in frequency of the original signal is caused by the rate of change of clock frequency (a form of doppler effect) and this rate of change increases as the speed and depth increase. By reducing either the speed or the depth the frequency shift is reduced.

If the speed and depth controls are increased too far the original signal will become unrecognisable and both outputs will be completely 'out of tune' with the original. However if used in moderation this effect, espescially in the 'cross' modulation mode, can give a very realistic rotating speaker sound.

By use of the mixing desk a mixture of phasing and image shifting, or frequency shifting, can be accomplished.

### 2.5.5 DELAY MODE

Set the dm2-20 to the original settings as described in 2.5.2 above, this time the 'function switch' should be set to 'delay'.

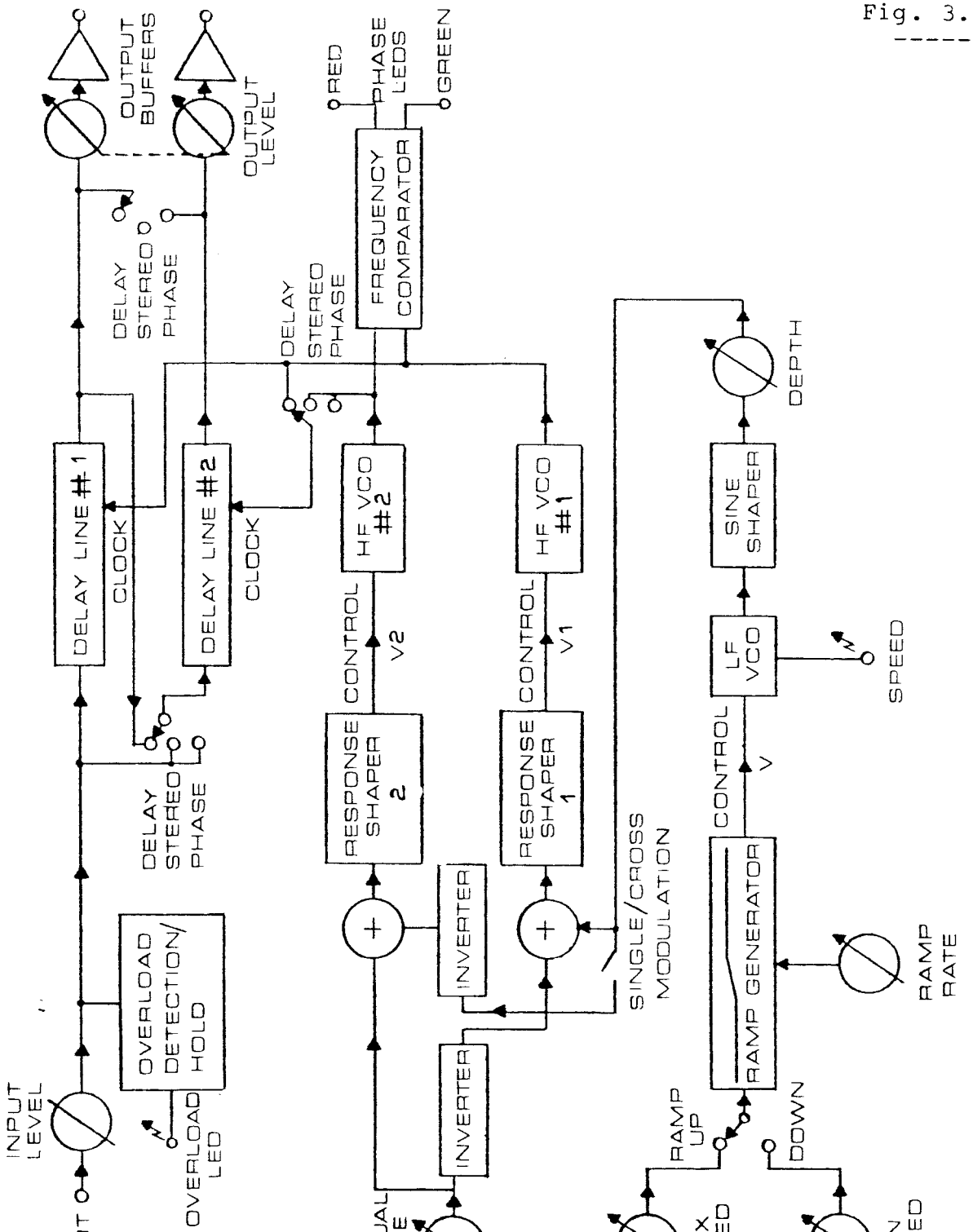
With the dm2-20 tape phase simulator in the delay mode channel 2 is delayed by exactly twice the amount of channel 1. Thus the dm2-20 can be used in this mode to give the automatic double tracking (ADT) effect. Slight pitch shifting using the 'modulation' controls and mixing both outputs with the original also adds to this effect. For applications requiring greater delays, the dm2-28 (offering 80mS of delay) should be used. As with all Bucket Brigade or Charge Coupled Device based units, the larger the delay, the less the signal to noise ratio, so this effect should be used with care.

# 3 THEORY OF OPERATION

## 3.1 INTRODUCTION

This section of the manual contains a complete description of how the dm2-20 works together with a functional block diagram of the unit (Fig 3.1). It will be helpful if reference is made to the detailed circuit drawings whilst reading through this section.

Fig. 3.1



## 3.2 OVERALL FUNCTIONAL DESCRIPTION

The dm2-20 is a dual CCD (Charge Coupled Device) delay line unit, phasing being obtained by varying the delay times with respect to each other. The two delays can be operated in series or in parallel to give a spectrum of phasing/flanging/tunnelling and delay effects.

A common input buffer (IC1) supplies both the overload detection circuit (IC2, D1, D2 and TR3) and one or both delay lines (IC14 and IC15). PR1 is preset so that the overload detection LED (LD1) illuminates at the onset of clipping. One delay line (IC14's) is permanently connected to the input buffer, the other is only connected to the input buffer when the 'phase/stereo/delay' switch (S4) is in either the phase or stereo positions. With S4 in the delay position the output of the CCD delay circuit of IC14 is connected to the input of the CCD delay circuit of IC15 (ie. the output of IC34 is connected to the positive end of C18, via PR10 and S4). Switching S4 to the delay position also causes both delay lines to be fed from the same clock (channel 1's) and therefore the delay on channel 2 becomes exactly twice that of channel 1; both phase LED's illuminate simultaneously since input gating to the frequency comparator locks out channel 2's clock frequency and channel 1's clock is fed to both inputs. Anti-aliasing filters are used on the inputs of the CCD delay circuits (IC12 and IC13), DC bias required by the delay lines also being provided by these filters, and set by PR4 and PR5.

The SAD 1024 is a dual 512 stage bucket-brigade charge coupled device, the two sections being independent as to input, output and clock. The parallel-multiplex configuration used here enables full use of the clock cycle giving the best sampling rate and therefore the best performance. The outputs are summed and buffered by IC21, IC24 and the DC bias is removed by C32, R52 and C33, R60. The sampling steps are then smoothed using filter circuits (IC22 and IC25) to reconstitute the original signal.

The two outputs can be independent (with the function switch in the stereo position); mixed in or out of phase using the output of IC25 or IC31 (with the function switch in the phase position), or the output of IC34 via PR10 (the output of IC14's delay circuit) can be fed back to the positive end of C18 (the input of IC15's delay circuit) thus connecting the CCD's in series, creating longer delay times (with the function switch in the delay position). PR10 is adjusted so as to give the same output level whether in phase, stereo or delay mode. Line output buffering is accomplished by IC39 and IC40.

The SAD 1024's require two phase clocks (15Vp-p). Each two phase clock comprises two waveforms 180 degrees out of phase. These clocks are controlled and generated as follows:

A low frequency voltage controlled oscillator (vco), generated by a triangular wave oscillator formed around IC7, 44 and TR4 feeds a diode shaper (IC11) which generates a sine wave. The frequency of this sine wave can be ramped (up or down), the maximum and minimum frequencies being determined by the vibrato maximum and minimum speed controls on the front panel, the speed and direction of this ramp is controlled by the 'ramp section' front panel controls. The amplitude of this sine wave being fed to IC17 is controlled by the modulation depth control knob on the front panel. With the 'single/cross' modulation switch in the 'single' position the low frequency sine wave is fed to only clock 1's input buffer and is summed with the output from the 'manual phase' control on the front panel. In this position clock 2's input is the inverse of the output from the 'manual phase' potentiometer only, and the low frequency sine wave does not modulate this channel. When the 'single/cross' modulation switch is in the 'cross' modulation position, both clock input buffers are a summation of the output from the 'manual phase' potentiometer and the low frequency sine wave; with clock 2's input an inversion of clock 1's input. These input buffers (IC19 and IC20) also limit the input level to the multipliers from 0V to +10V. The output from each multiplier (used simply for response shaping) is then fed to an optical isolator whose output impedance varies according to the signal across the internal light emitting diode. This variation in impedance is used to control the output of the high frequency vco which determines the sampling rate of the 'two phase' clock.

# 4 MAINTENANCE

## 4.1 INTRODUCTION

This section contains maintenance information for the dm2-20 and includes general maintenance procedures, performance testing and trouble shooting information.

## 4.2 SERVICE INFORMATION AND WARRANTY

4.2.1 Each dm2-20 tape phase simulator is warranted for a period of one year upon delivery to the original purchaser. Details of the warranty are given in Section 5 of this manual.

4.2.2 A factory service is available for the dm2-20 on request. Shipping information is given in Section 2 of this manual. If required an estimate can be provided to the customer prior to work being carried out.

## 4.3 GENERAL MAINTENANCE

### 4.3.1 ACCESS

Access can be gained to both sides of the printed circuit board by removing the top and bottom cover plates, four M3 x 6mm pan head Posidriv screws hold each plate in position. For cleaning purposes it will be helpful if the two side panels are also removed, each side panel is also held on by four M3 x 6mm pan head Posidriv screws. The transformer is fastened to the rear panel using two M5 x 12mm pan head Posidriv screws, shake proof washers and M5 nuts. This should also be removed together with the secondary protection boots covering the mains wiring.

### 4.3.2 CLEANING

The dm2-20 should be cleaned periodically to remove dust, grease and other contaminants. The surface of the printed circuit board should be cleaned using dry air at low pressure (less than 20 psi). If grease is to be removed use Freon T.F. or Arklone F and remove grime with clean dry air at low pressure. Clean the front panel with a soft cloth dampened with a mild solution of detergent and water.

### 4.3.3 FUSE REPLACEMENT

The power fuse is located on the rear panel just below the I.E.C. mains socket. If replacement is necessary, use a 500mA Anti-surge for operation at 240V and a 1A Anti-surge for operation at 120V.

## 4.4 TEST DATA AND SETTING UP PROCEDURES

### 4.4.1 INTRODUCTION

The test data and procedures detailed below are a comprehensive guide for the engineer who needs to maintain and calibrate the dm2-20. Advanced Music Systems will be happy to help with any problems that may be encountered; please contact:

THE ENGINEERING DEPARTMENT.
ADVANCED MUSIC SYSTEMS.
WALLSTREAMS LANE,
WORSTHORNE VILLAGE,
BURNLEY,
LANCASHIRE,
ENGLAND.

OR TELEPHONE 0282 36943

### 4.4.2 GENERAL

To gain access for setting up the unit the top cover plate must be removed; ensure that all three secondary protection boots and the sleeving for the mains transformer terminals are in situ before commencing the tests.

To obtain accurate results the should be allowed to stabilize for two to three minutes each time it is switched on. On switch on verify that the mains input LED is illuminated.

### 4.4.3 SET UP PROCEDURE

[a] STARTING

[i] Inspect board and wiring for obvious physical damage and check for mechanical tightness of all fittings.

[ii] Check continuity exists between earth pin on I.E.C. mains connector and chassis.

[iii] Check that both live and neutral on I.E.C. mains connector are isolated from chassis, with mains switch on and off.

[iv] Check isolation exists between the ground plane on the printed circuit board and the chassis.

[v] Check that the resistance between the live and neutral pin on the I.E.C. mains connector is approximately 100 ohms when the mains switch is set to on and that the pins are isolated from each other when the mains switch is set to off.

[vi] Check that the resistance between the ground plane and all the power rails on the printed circuit board is at least greater than 100 ohms and that no two rails are shorted together.

[vii] Power up the unit and measure the power rails at the test links. Voltages should be +5V +/-0.25V; +15V +/-0.5V and -15V +/-0.5V.

[b] ADJUSTING LOW FREQUENCY OSCILLATOR

[i] Turn the 'ramp rate' control knob and the vibrato 'maximum speed' and 'minimum speed' control knobs to maximum (9). The yellow LED should now flash quickly.

[ii] Attach the oscilloscope probe to TP1 and ensure that potentiometers PR2 and PR3 are adjusted to give the best sine wave; there should be no D.C. level at this point.

[c] ADJUSTING MULTIPLIERS

[i] Attach oscilloscope probe, channel A to TP4 (input).

[ii] Attach oscilloscope probe, channel B to TP5 (output).

[iii] Turn 'modulation depth' control knob to minimum (0) and the 'manual phase' control knob to extremity giving around zero voltage on channel B. With the oscilloscope on maximum sensitivity adjust the offset potentiometer, PR7 to give 0V on channel B.

[iv] With the oscilloscope set on 2V/division adjust the scale potentiometer, PR6 so that adjustment of manual phase control knob to the other extreme gives exactly 10V on channel B.

[v] Repeat steps [iii] and [iv] until no further adjustment is necessary. Multiplier output should give less than 5mV of noise.

[vi] With oscilloscope channel A set to 0.5V/division and oscilloscope channel B set to 50mV/division, turn the 'manual phase' control knob to give 1V increase (from end position) on channel A. (N.B. the base level may not be exactly zero volts)

[vii] Adjust scale potentiometer PR6 to give 0.10V on channel B.

[viii] Turn the 'manual phase' control knob back to base position and with the oscilloscope set to maximum sensitivity adjust the offset potentiometer, PR7 to give zero volts on channel B.

[ix] Repeat steps [vi] to [viii] until no further adjustment is necessary.

[x] Attach oscilloscope probe, channel A to TP2 (input)

[xi] Attach oscilloscope probe, channel B to TP3 (output)

[xii] Turn 'modulation depth' control knob to minimum and the 'manual phase' control knob to extremity giving around zero voltage on channel B (opposite to the position obtained in 3.3 above). With the oscilloscope set at 2V/division adjust scale potentiometer, PR8 so that adjustment of the 'manual phase' control knob to the opposite extreme gives exactly 1ØV on channel B.

[xiii] Return the 'manual phase' control knob to give approximately zero volts on channel B. With the oscilloscope set for maximum sensitivity adjust offset potentiometer, PR9 to give zero volts on channel B.

[xiv] Repeat steps [xii] and [xiii] until no further adjustment is necessary.

[xv] With oscilloscope channel A set to Ø.5V/division and oscilloscope channel B set to 5ØmV/division, turn the 'manual phase' control knob to give 1V increase (from end position) on channel A. (N.B. the base level may not be exactly zero volts)

[xvi] Adjust scale potentiometer PR8 to give Ø.1ØV on channel B.

[xvii] With oscilloscope channel B set for maximum sensitivity, turn the 'manual phase' control knob back to base position and adjust offset potentiometer, PR9 to give zero volts on channel B.

[xviii] Repeat steps [xv] to [xvii] until no further adjustment is necessary.

[d] SETTING UP BASE FREQUENCY

[i] Connect oscilloscope to TP7 (plated through hole) and turn 'manual phase' control knob to give minimum frequency (15Vp-p). Adjust offset potentiometer PR7 to give a frequency of 3ØKHz (approximately 33uS).

[ii] Turn the 'modulation depth' control knob to the '1' setting. By adjusting the vibrato 'maximum speed' control knob choose a slow modulation speed (about Ø.5Hz) and select 'cross-modulation'. Ensure that the frequency does not drop below 3ØKHz (ie. does not swing greater than 33uS). Return the depth control knob to the zero setting.

[iii] Connect oscilloscope to TP6 (plated through hole) and turn 'manual phase' control knob to give minimum frequency (15Vp-p).

[iv] Adjust offset potentiometer PR9 to give a frequency of 30KHz.

[v] Turn the 'modulation depth' control knob to the '1' setting. By adjusting the vibrato 'maximum speed' control knob choose a slow modulation speed and select 'cross-modulation'. Ensure that the frequency does not drop below 30KHz. Return the depth control knob to the zero setting.

[e] SETTING UP DELAY DEVICE OFFSET

[i] With no input to unit and with oscilloscope probe on TP9, adjust PR4 to give +6V.

[ii] With no input to unit and with oscilloscope probe on TP8, adjust PR5 to give +6V.

[iii] Set the function switch to the 'phase' position and inject a 1KHz sine wave into the input at the rear of the unit (approximately 1Vp-p) and with the input control knob varying between approximately '5' and maximum monitor the signal at TP10 and adjust PR4 to give the best sine wave, adjusting the input to give even clipping at top and bottom. Adjust 'manual phase' control knob through entire range and optimise the setting of PR4 to give the best sine wave just below clip point over entire sweep range.

N.B. THE SIGNAL IS UNFILTERED AT THIS POINT AND WILL THEREFORE SHOW SAMPLING STEPS AT ONE EXTREME OF THE 'MANUAL PHASE' CONTROL KNOB.

[iv] Now monitor the signal at TP11 and adjust PR5 to give the best sine wave, optimising the setting through the entire phasing range, as above.

[v] Adjust input level for maximum undistorted output level at TP11 and TP10 over the whole phase sweep range and adjust PR1 to just obtain illumination of overload LED.

[vi] Attach oscilloscope probe to TP11 and adjust PR10 so that the same output level is obtained in both stereo and delay positions of the function switch.

[vii] Attach the oscilloscope probe to both unit outputs in turn. Ensure that 20Vp-p is obtained with the output control set to maximum. Switch the function control switch to 'phase' and set the 'manual phase' control knob to the 12 o'clock position; adjust it finely to obtain the exact turnover point of the two 'phase LED's'. With the 'phase/antiphase' switch in the phase position, maximum output should be obtained. With the 'phase/antiphase' switch in the antiphase position the output should fall to almost zero.

[viii] Switch off and attach the top cover plate.

[f] AUDIO CHECK OUT

[i] Set the controls as follows:

'input' set just prior to clipping.
'output' set for comfortable listening level.
'function switch' set to phase.
'phase/antiphase' switch to phase.
'ramp rate' set to '1'.
'up/down' switch set to down.
'max' speed to '9'.
'min' speed to '2'.
'modulation depth' to '4'.
'single/cross' modulation switch to single.
'manual phase' control to central position.

With the dm2-20 set as above phasing should be audible.

[ii] If the 'phase/antiphase' switch is set to the 'antiphase' position the 'tunneling' or 'cardboard tube' effect should be audible, with the signal momentarily disappearing at 'cross-over'.

[iii] If the 'up/down' switch is set to 'up' the phasing speed should gradually increase to the set maximum and on returning the switch to the 'down' position the phasing speed should ramp to the set minimum.

[iv] If 'cross' modulation is now selected the phasing character should change and become more balanced, 'cross' modulation has a very distinctive sound of it's own.

[v] If the 'modulation depth' control knob is now set to zero, no phasing will ocurr. If the 'manual phase' control knob is now rotated 'manual phasing' should be audible.

[vi] Switching the function switch to stereo, it should be possible to place the signal anywhere within the stereo image by adjustment of the 'manual phase' control knob. If the 'manual phase' control knob is now centralised and the 'modulation depth' control knob is set to '2' the signal will shift from side to side in the stereo image.

[vii] If delay is now selected and the 'manual phase' control knob is rotated quickly the signal will appear to change in pitch. At one extreme of the 'manual phase' control knob the signal will appear central, whilst at the other the signal will appear to be to one side.

[g] THE UNIT IS NOW READY FOR USE.

## 4.5 TROUBLE SHOOTING

The following section has been written as a guide for fault finding in case of malfunction during service. If the dm2-20 malfunctions whilst under warranty, contact the engineering department at A.M.S. or an approved service organisation immediately. If an attempt is made to service the unit whilst it is still under warranty without guidance or permission from one of the above bodies warranty may well be invalidated.

| SYMPTOM | POSSIBLE CAUSE |
|---|---|
| Loss of output on one channel. | [1] Check for output s/c on the respective channel - check both the cable connected to the unit and the internal wiring of the unit.<br><br>[2] Ensure the output from the respective high frequency vco is O.K. (and therefore that the SAD 1024 is being clocked). If the h.f. vco is O.K. check the delay line. If the h.f. vco is not O.K. check back along the modulation circuitry. |
| Loss of output on both channels. | [1] If the input level LED is not functioning correctly check the input connecting lead for s/c; also check the input wiring in the unit. If the input wiring is O.K. check IC1 and IC2.<br><br>[2] If the input level LED is functioning correctly check that S4 is switching correctly. |
| Distortion on both channels. | Check that the input 'overload LED' is illuminating on input overload and that the overload detection circuitry is operating correctly. |
| Distortion on one channel only, in both stereo and phase modes | Check the SAD 1024 and the delay line circuitry of the particular channel involved. |
| Distortion on channel 2 when in delay mode only | Ensure that the output from the first channel has been attenuated enough by PR10 for input to the second channel. |
| Both outputs present but no 'auto-phasing' effect. | If the LF vco speed LED is flashing check sine shaper circuitry, IC16 and IC17. If the LED does not flash check the LF vco circuitry. |

4.5 TROUBLE SHOOTING (CONTINUED)

| SYMPTOM | POSSIBLE CAUSE |
|---|---|
| Both outputs present but no phasing effect when using the manual phase control knob. | Check the 'manual phase' control knob potentiometer and IC18. |
| Both outputs present and pnasing but phase LEDs not operating correctly. | Ensure that both 'phase LEDs' are illuminated when the function switch is in the delay position. If this is not the case then check the frequency comparator circuit. If this circuitry is O.K. replace the faulty LED(s). |

# 5 WARRANTY

## 5.1 LIMITED LIABILITY

ADVANCED MUSIC SYSTEMS GUARANTEES THIS PRODUCT FROM DEFECTS IN MATERIAL AND WORKMANSHIP UNDER NORMAL USE AND SERVICE FOR A PERIOD OF ONE YEAR. THIS GUARANTEE EXTENDS TO THE ORIGINAL PURCHASER ONLY AND DOES NOT APPLY TO FUSES OR ANY PRODUCT OR PARTS SUBJECTED TO MISUSE, NEGLECT, ACCIDENT OR ABNORMAL CONDITIONS OF OPERATION.

IN THE EVENT OF FAILURE OF A PRODUCT COVERED BY THIS GUARANTEE, ADVANCED MUSIC SYSTEMS OR THEIR CERTIFIED REPRESENTATIVES WILL REPAIR AND CALIBRATE EQUIPMENT RETURNED TO AN AUTHORISED SERVICE FACILITY WITHIN ONE YEAR OF THE ORIGINAL PURCHASE; PROVIDED THAT THE GUARANTORS EXAMINATION DISCLOSES TO ITS SATISFACTION THAT THE PRODUCT WAS DEFECTIVE. EQUIPMENT UNDER THIS GUARANTEE WILL BE REPAIRED OR REPLACED WITHOUT CHARGE. IF THE FAULT HAS BEEN CAUSED BY MISUSE, NEGLECT, ACCIDENT OR ABNORMAL CONDITIONS OF OPERATION, AN ESTIMATE OF THE COST OF THE REPAIR WORK WILL BE SUBMITTED BEFORE WORK IS STARTED.

## 5.2 WHAT TO DO IF A FAULT IS FOUND

If a fault developes in the unit, notify Advanced Music Systems or their nearest service facility giving full details of the difficulty. On receipt of this information service or shipping instructions will be forwarded to you.

## 5.3 SHIPPING INFORMATION

All A.M.S. products are packaged in specially designed containers for the best possible protection. If the unit is returned the original container should be used. If this is not possible, a new container can be obtained from Advanced Music Systems; please specify the model number when requesting a new container.

If the specially designed container is not used ensure that a suitable rigid container of adequate size is used, wrap the instrument in paper and surround it with a good thickness of shock absorbing material.

## 5.4 CLAIM FOR DAMAGE DURING TRANSIT

The instrument should be thoroughly inspected immediately upon delivery to the purchaser. If the instrument is damaged in any way a claim should be filed with the carrier immediately. A quotation to repair shipment damage can be obtained from A.M.S or their certified representative. Final claims and negotiations with the carrier must be completed by the customer.

## 7.5 APPLICATIONS PROBLEMS

Advanced Music Systems will be happy to answer all applications questions to enhance your use of this equipment. Please address all correspondence to:

ADVANCED MUSIC SYSTEMS.
WALLSTREAMS LANE,
WORSTHORNE VILLAGE,
BURNLEY,
LANCASHIRE,
ENGLAND.

OR TELEPHONE 0282 36943