

PCB76503

27.1 Introduction

This PCB is one of the three interconnected PCBs which comprise the active electronics of the MD404B oscillator. It contains two independent oscillators, one providing very low distortion sinusoidal output at any frequency between 10 Hz and 300 KHz, and a second oscillator providing a sinusoidal output at a number of fixed frequencies. The low distortion oscillator frequency can be set directly from the MD404B front panel controls, whilst the second oscillator frequencies are pre-programmed.

The frequency of both oscillators is independently set by strobing across data from the MD404B microcomputer board. An additional fine frequency control can be used to provide $\pm 1\%$ of adjustment of the frequency of the low distortion oscillator. The fine frequency control can be disabled under microcomputer control.

The A1 board is isolated from MJS401D and chassis ground, except for the drive to relay coils. Therefore it is important to use the correct 0 V reference when making measurements of the A1 board.

27.1.1 Low Distortion Oscillator

The low distortion oscillator is based on a "state variable" circuit. Apart from low distortion, the state variable circuit offers the advantages of easy tuning, and quadrature outputs, which are utilised for fast amplitude control. Frequency selection is by means of analogue switches selecting binary weighted resistor networks together with capacitors selected by relays. Calibration data pertaining to an individual A1/A2 board set is stored in the EPROM on the matching microcomputer board. The microcomputer thus provides the correct data to the switched resistor/capacitor networks for a specified frequency, taking into account the particular tolerance variations of the frequency determining components. Fast acting amplitude control is by means of a specially developed vector resolver circuit, which produces a d.c. voltage equal to the peak amplitude of the oscillator output sine wave, with very little filtering. This d.c. voltage responds almost instantaneously to the oscillator output amplitude, and is used to control V.C.A.s via an amplitude control loop which maintains the amplitude at approximately 5 V peak.

27.1.2 Second Oscillator

The second oscillator provides a sinusoidal output at a number of accurate frequencies, derived from a crystal timebase. The output is generated by a function generator IC, which forms part of a phase-locked loop. The output frequency is controlled by data lines from the microcomputer. The amplitude of the output is kept at a constant level by means of an amplitude control loop.

This oscillator is brought into operation when very accurate (± 10 ppm) single frequency tones are required, e.g. for drift measurements on tape machines, or in addition to the low distortion oscillator for twin tone measurements, such as intermodulation distortion.

The number and range of frequencies are limited in comparison to the low distortion oscillator, but provision is made to generate all the required second tones for current international audio measurement standards. The harmonic distortion is approximately 0.5 %, adequate for the intended purpose, since low harmonic distortion is not required for twin tone distortion or wow and flutter measurements.

When not in operation, both the function generator and the crystal timebase are inhibited, in order to ensure completely effective muting.

27.2 Circuit Description

27.2.1 Low Distortion Oscillator

A simplified circuit diagram for this low distortion oscillator is shown in Figure 27.2.1. The design is based on a state variable circuit, with amplitude control by means of a voltage controlled amplifier. Frequency control is by means of two sets of switched integrator capacitors, and two binary weighted resistor networks.

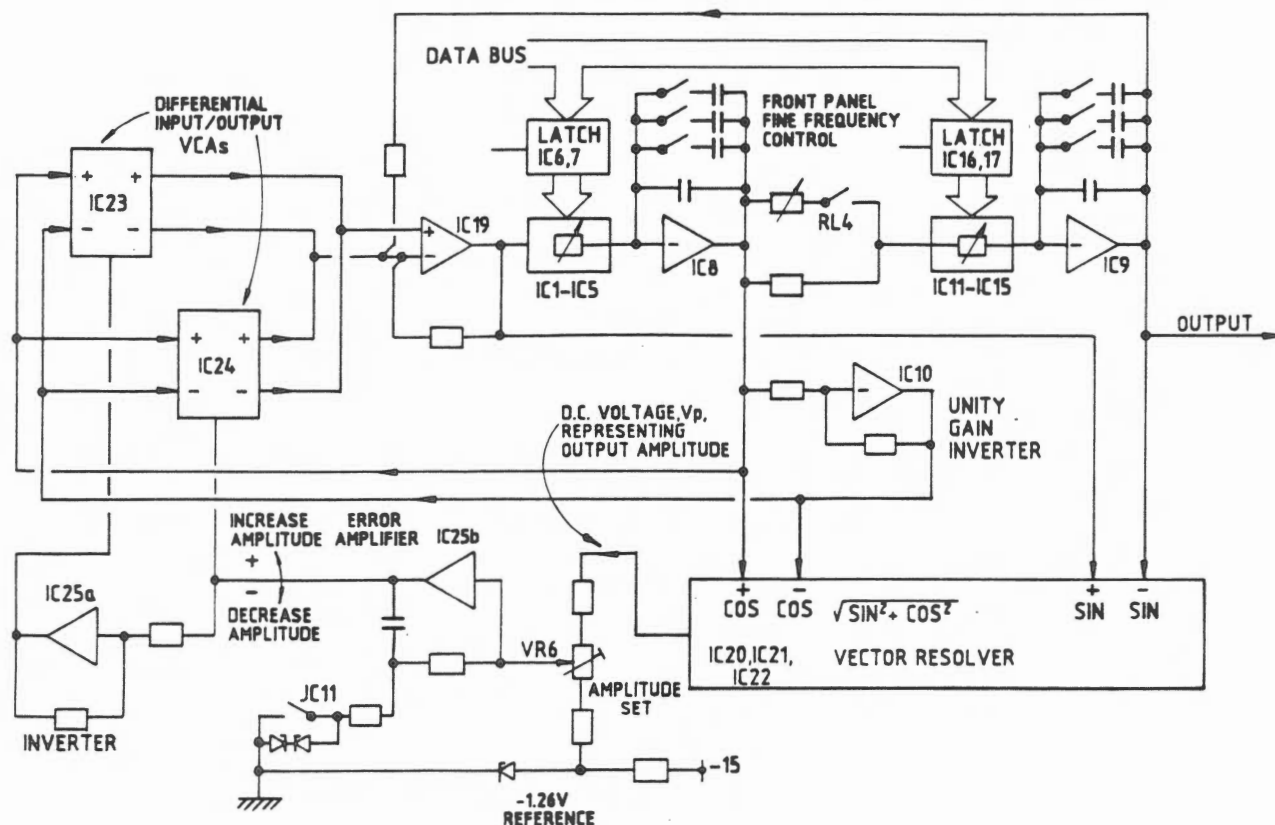


Figure 27.2.1 Low Distortion Oscillator - Simplified Circuit

The oscillator loop comprises IC19, IC18 and IC9. The output is taken from the second integrator, IC9. Each integrator has four capacitors, one permanently in circuit, and the others switched in parallel with it to set a frequency range. Each capacitor accounts for a frequency range of approximately 13:1. The four frequency ranges are as follows:

Frequency Range	Capacitors In Circuit	Relays Closed
10 Hz - 138 Hz	C7+C5	C8+C6
138 Hz - 1.83 KHz	C7+C3	C8+C4
1.83 KHz - 23.8 KHz	C7+C1	C8+C2
23.8 KHz - 300 KHz	C7	C8

The frequency ranges shown are nominal only. The exact frequencies at which ranges change depends upon the tolerance of the capacitors and resistor networks, and the calibration data for the particular A1 board stored in the matching EPROM on the microcomputer board.

Frequencies within a range are set by analogue switches within IC1-IC5 connected to integrator IC8, and IC11 - IC15 connected to integrator IC9. Resistors R102 and R103, and resistor networks RN1 - RN7, together with IC1-IC5, form a 13 bit multiplying digital to analogue converter which provides a binary weighted resistor whose value can be set by the data latched into IC6 and IC7. The resistor network R100, RN15-23, analogue switch ICs IC11 and IC15, and latches IC16 and IC17 form an identical function for the signal into integrator IC9, RN21A, RN22A, B and C, and RN23B supply a contribution to IC9 signal current from the front panel frequency trim control, in order to provide $\pm 1\%$ frequency trimming.

For lowest distortion the amplitude of the signal at the outputs of IC8 and IC9 must be identical and must not vary with frequency. For this reason the bit patterns supplied to the latches programming the resistor networks preceding IC8 and IC9 may not be identical. The factory calibration procedure varies the effective resistance values to ensure that IC8 and IC9 output amplitudes are kept equal at all frequencies.

The networks D1, D2, D3, D4, RN10A and RN10E prevent IC8 saturating and thereby help IC8's internal circuitry from being driven well out of its normal operating conditions. This in turn prevents amplitude control loop instability ("squegging") which would otherwise result from the IC going into and recovering from saturation. The same function is served by an identical network around IC9, D5, D6, D7, D8, RN13A and RN13E.

27.2.2 Vector Resolver

IC20, 21, 22 and associated circuitry form a vector resolver circuit which provides a continuous d.c. output at a voltage equal to the peak a.c. signal voltage at the outputs of IC19, IC18, IC10 and IC9. The vector resolver circuit has a transfer function of $J((V_p \sin \omega t)^2 + (V_p \cos \omega t)^2)$ where V_p is the peak amplitude of the a.c. signal voltage. Since $(\sin \omega t)^2 + (\cos \omega t)^2 = 1$ the terms under the square root sign reduce to V_p . IC20 and IC21 are accurate analogue divider/multiplier ICs having current input and output, and IC22 adds the $(V_p \sin \omega t)^2$ and $(V_p \cos \omega t)^2$ currents together to produce the d.c. output, V_p , at IC22B's output (TP5). The ' V_p ' d.c. output gives a near instantaneous representation of the a.c. signal amplitude, allowing a fast settling time. It is important to ensure that the ' V_p ' d.c. output has the minimum of a.c. present on it, since the a.c. will add up to the V.C.A. control voltage and increase the residual distortion. VR4, VR5, VR1, VR10 and VC2 are used to minimise the control voltage a.c. components. VR4 sets IC20 balance and minimises ' V_p ' a.c. components from the "sine" inputs at the oscillator frequency. VR5 sets IC21 balance and minimises ' V_p ' a.c. components at the oscillator frequency. VR1 is used to minimise a.c. components at twice the oscillator frequency. VR10 and VR2 are set to minimise a.c. components on V_p at high frequencies. VR3 zeros the vector resolver output with the oscillator stopped.

27.2.3 Voltage Reference, Error Amplifier, and Inverter

The d.c. output of the vector resolver circuit, V_p , is compared with a reference voltage provided by D14 and R50, via the divider network comprising R42, VR6, and R43, by the error amplifier IC25.

The output voltage of the oscillator circuit is therefore set by VR6. The output of IC25 is constrained to +0.5 V to -16 V by D22. C42 provides

attenuation of any a.c. breakthrough on the d.c. control voltage fed to the voltage controlled amplifiers (VCAs). D17, D18 and R77 reduce the time constant of the control loop to decrease oscillator settling time for large oscillator output amplitude changes. At frequencies above 20 KHz, IC11 shorts out D16 and D17 to reduce the settling time at high frequencies.

The V.C.A control input range is from 0 V to 10 V, and at normal operation the outputs of IC25b (TP6) and IC25a (TP7) are both at approximately -5.5 V. IC25a provides an inverted version of the voltage at IC25b output. IC25a also level shifts the d.c. voltage at IC25a and b outputs to be within the 0 V to 10 V range required by the V.C.A. control inputs. This is accomplished by R69 and the connection of IC25a non-inverting input to the -1.26 V reference (D14 anode).

27.2.4 Voltage Controlled Amplifiers (V.C.A.s)

IC23 and IC24 are differential input and output voltage controlled amplifiers whose function is either to set the oscillator output increasing (IC24) or decreasing (IC23). If IC23 is fully "on" (IC25a output at 0 V), IC23 lets through approximately 3/4 of the signal present on IC8 output, and in phase with it. This has the effect of rapidly diminishing the oscillator output voltage, i.e. "damping" oscillation. The other V.C.A. (IC24) control voltage (IC25b output) is at approximately -11 V, effectively shutting it off.

The opposite extreme occurs when IC24 is fully on, and IC23 is fully off. This also lets through 3/4 of the signal originating from IC8 output through to IC19 as before, but this time out of phase. This has the effect of making the oscillator output rapidly increase.

When the oscillator output has stabilised to its correct level, both V.C.A. control voltages are the same at approximately -5.5 V (IC25a and b outputs). Under these conditions, both V.C.A.s attenuate the IC8 output to IC19 by approximately 40 dB, and since the signals are opposite in phase, the net contribution to IC19 output from IC8 via the V.C.A.s is zero.

In practise, IC25a and IC25b outputs are rarely at the same voltage because of tolerance variations of V.C.A.s and associated components.

27.2.5 Second Oscillator

A simplified circuit diagram for this oscillator is shown in Figure 27.2.2.

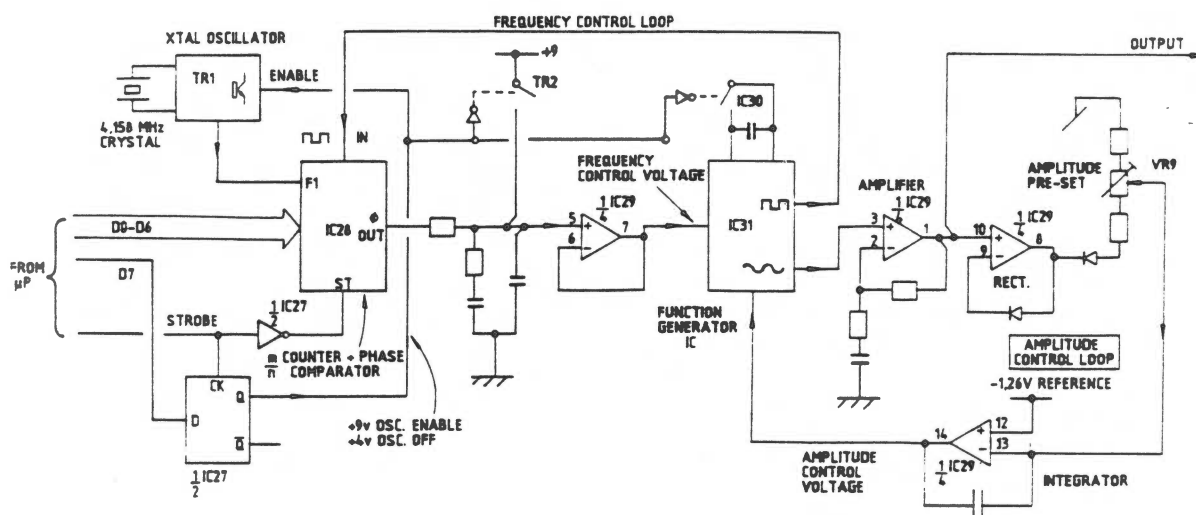


Figure 27.2.2 Second Oscillator - Simplified Circuit

The second oscillator derives its sinusoidal output from an integrated circuit function generator, IC31, a programmable divider and phase detector IC28, and frequency control filter, IC29. A reference frequency is supplied to IC28 by a crystal oscillator, TR1 and associated components.

The function generator IC31 also has an amplitude control loop, to send the output voltage to the reference voltage and provide frequency independent and stable output voltage. The amplitude control loop comprises IC31 and three of the four amplifiers within IC29. The first of the three amplifiers takes the sine output from IC31 up to 10 V peak, the second amplifier serves as a half-wave rectifier, and the third is configured as an integrator, whose output is connected to the output amplitude control pin of IC31.

27.2.6 Timebase

The frequency reference is a single transistor Clapp type oscillator running at 4.158 MHz. VC1 is used to tune the oscillator to exactly 4.158 MHz. The oscillator is enabled when pin 5 of IC27 (Q output) goes high, and establishes a voltage on the base of TR1 allowing oscillation to start.

27.2.7 Oscillator Enable Latch

The second oscillator is enabled by a high logic level on data line 7, and a strobe pulse on data strobe F. The high logic level appears at IC27 pin 5 (Q output) at the strobe pulse. This enables the 4.158 MHz oscillator in the manner already described. The high logic level also turns off TR2 and the opto-coupled F.E.T. IC30, thus allowing IC31 to function. (See function generator description.)

27.2.8 Programmable Divider, Phase Comparator and Buffer

IC28 contains two programmable dividers and a phase comparator circuit. One divider is connected to the 4.158 MHz input (pin 3), and the other to the square wave output of the function generator IC31. The dividers are each programmed by the microcomputer system via data bits D0-D6 and strobe line F inverted by IC27. If the divider driven from the 4.158 MHz input is

programmed to divide by N, and the divider driven from IC31 square wave output is programmed by M, IC31's output frequency is $M/N \times 4.158 \text{ MHz}$.

When IC31 is operating at the correct frequency, the phase comparator output settles at the exact voltage required by IC31 to produce the correct output frequency. This voltage is smoothed by R90, R95, C48 and C47, buffered by an amplifier within IC29 configured as a voltage follower, level shifted by R94 and R99, and applied to the frequency control voltage input, pin7 of IC31.

If IC31 is operating above the correct frequency, the voltage at the phase comparator output (pin 12) of IC28 rises, causing the function generator frequency to decrease. Conversely, the phase comparator output voltage falls to increase IC31 output frequency if it is too low.

27.2.9 Function Generator

IC31 contains all the active circuitry required to produce simultaneous sine and square wave outputs. The output frequency is controlled by the voltage on pin 7, and the output amplitude controlled by the voltage on pin 1. C55 determines the useable frequency range. Bias is provided via divider R88 and R87, decoupled by C53 and supplied to pin 3 via R89. VR8 sets the mark/space ratio of the square wave output and also the time symmetry of the sinusoidal output. VR7 and VR8 are set to minimise the sine distortion.

27.2.10 Amplitude Control Loop

This comprises two of the amplifiers within IC29, and the amplitude control section of IC31. The first amplifier is configured as a half-wave signal rectifier, together with R96, D20, and D21. The rectified half wave output is reduced in amplitude by the potential divider R97, VR9 and R108 to feed the inverting input of another amplifier within IC29, which acts as an integrator/error amplifier, comparing the half-wave rectified signal on VR9 slider to the -1.26 V reference present on the amplifier non-inverting input. The output of the error amplifier is level-shifted and attenuated by R84, R85 and R86, and fed to the amplitude control input of IC31 via pin 1. If the output voltage is higher than the nominal set by VR9 (approximately 10 V peak), the error amplifier will raise the voltage at IC31 pin 1 to reduce the output amplitude. The converse applies if the output voltage falls below the nominal value.

27.2.11 Second Oscillator Inhibiting Circuitry

The oscillator is only enabled when pin 5 of IC27 (Q output) goes high. When the "enable" line originating from IC27 pin 5 is low, TR2 turns on and forces IC31 control voltage to its highest extreme, setting IC31 to its lowest frequency. This corresponds to the lowest current through C55, which is effectively shorted out by opto-coupled F.E.T in IC30, also turned on when the enable line is low. This completely stops any spurious signal from the second oscillator when not enabled.

NOTE The 5 V logic ICs IC27, 28 and reference oscillator circuit is connected between the +9 V and +4 V rails, thus logic "low" is +4 V, "high" is +9 V. In turn, these voltages are measured with respect to the analogue "0 V" test point, not chassis earth.

27.3 Removal/Replacement

Removal and replacement of the A1 board are dealt with in section 25 of this manual. It is important that these details are closely followed in order to avoid damage to, or malfunctioning of, the MD404B oscillator.

27.3.1 Accessing the A1 Board While Live

After following the removal instructions in section 25 as far as removal of the A1 board, the A1 board can be pushed back onto the pins of the "comb" connector of the digital board the "wrong way up", i.e. with the A1 board above the digital board, and the "comb" pins entering the A1 board connectors from the wrong side. This operation must be performed **very carefully** because it is very easy to fail to mate one (or more) pins of the comb and bend them.

The A1 board may now be accessed from both sides, while all boards are connected up and able to fully work.

Insert one of the long screws into the middle pillar set to strengthen the board set and remove the mechanical stress from the "comb" connector.

27.4 Fault Finding

27.4.1 No Output From Main Oscillator

Re-position A1 board for checking by re-positioning the board as described in the assembly/disassembly section.

Check that all the supply voltages are correct. If they differ by more than 20%, it indicates a faulty supply regulator, or excessive current drawn from the supply rail.

If the supply rails are correct, check the voltage at TP8. It should be between -1.2 V and -1.32 V. If the voltage is incorrect, check C39 or D14.

If TP8 voltage is correct, check the voltage at TP5. It should be between +50 mV and -50 mV. If it is not, check the outputs of IC19, IC18, IC9, IC10. If they are between +20 mV and -20 mV, check IC20 to IC22. If there are large d.c. voltages on IC19, IC8, IC9 and IC10 outputs, it indicates either a faulty IC or a break in the d.c. feedback path which centres IC8 and IC9 outputs. Measure the output voltage and polarity at IC19 output. Next measure the voltage at IC8 output. If the voltage is at opposite polarity to that of IC19 output, measure the output voltage and polarity at IC9. This should be opposite in polarity to the voltage at IC8 output. If the voltage at any two succeeding stages in the state variable loop comprising IC19, IC8, IC9 are the same polarity, it indicates a break between stages. If the abnormal d.c. voltage polarity is the same at IC8 and IC9 outputs, for example it indicates a fault which breaks the d.c. path between IC8 and IC9. Check that at least one control pin is at +9V on IC14 or IC15. If not, there is a fault in the data lines into IC17 or IC17 itself.

A similar argument applies to IC19, IC18 d.c. path. Check IC4, IC5 control voltages and IC7.

If no large d.c. offsets occur at IC19, IC8, IC9 or IC10 outputs, or at TP5, measure the voltages at TP6 and TP7. TP6 should read 0 V, and TP7 should be at approx -10 V. If this is not the case, check IC25b and associated components. If the TP6 and TP7 voltages are correct as indicated, suspect IC24 or IC23.

27.4.2 Main Oscillator Output High And Clipping

The main oscillator output should be 10 V pk-pk. If it is at approximately 10 V pk-pk and clipping it indicates a fault in the V.C.A.s (IC23 and IC24), the control loop IC20 to IC25, or a large difference in the two CR time constants due to a fault condition. To isolate the fault, first determine whether the fault persists over the entire frequency range, then check the output voltages at the outputs of IC8 and IC9. If they are markedly different in amplitude or the fault appears only over a range of frequencies, check that the relays RL1, RL2, RL3 selecting the frequency determining capacitors are functioning correctly. If the relays are correct, rotate the frequency control and check all the control inputs of IC1-IC5 and IC11-IC15 with an oscilloscope, for the logic level changes between +4 V and +9 V.

This is by no means an exhaustive check of the frequency determining resistor networks and analogue switches, but it will give an indication of any major faults in this area.

If the foregoing tests indicate that IC8 and IC9 are approximately the same, short TP11 and TP12 together. The output should rapidly diminish to zero. Check the resolver output with an oscilloscope while shorting TP11 and TP12. The d.c. voltage should diminish to zero as the output sine wave diminishes, and rise with the output sinewave as the TP11, TP12 short is removed. The d.c. voltage should be approximately the same value as the peak sine wave output, with some a.c ripple superimposed. If this is not the case, check IC8, IC20-IC22, and associated components. If IC20-IC22 are operating correctly, check the reference voltage at TP8. It should be between -1.2 V and -1.32 V. If it is not, check D14 or C39. If TP8 voltage is correct, check that VR6 has not become open circuit due to mechanical damage. If the fault condition persists, check that the voltage at TP7 is at 0 V and the voltage at TP6 is at -10 V without TP11 shorted to TP12, and that TP6 is at 0 V and TP7 at -10 V with TP11 and TP12 shorted. At no time should TP6 or TP7 be above +0.7 V. If the voltages measured during the foregoing checks are different from those specified, suspect IC25 and associated components.

If shorting TP11 and TP12 fails to make the oscillator output diminish to zero, check the TP6 and TP7 voltages as before. If these are correct, suspect IC23, IC24 and associated circuitry.

27.4.3 Main Oscillator Frequency Incorrect

If the frequency seems to be in error over a particular block of frequencies only, check the operation of RL1, RL2, and RL3 as follows :

<u>Suspect Range</u>	<u>Check Operation Of:</u>
10Hz - 138Hz	RL3
138Hz - 1.83KHz	RL2
1.83KHz - 23.8KHz	RL1

Note The frequency ranges above are approximate - the exact change over frequencies depend upon the calibration data stored in EPROM for the individual board.

Smaller frequency errors occur if the analogue switch ICs, IC1 to IC5, IC11 to IC15 are faulty. Rotate the frequency control, and monitor each of the control inputs on IC1 to IC5 and IC11 to IC15 with an oscilloscope. Transitions between +4 V and +9 V indicate that the frequency control logic signals are arriving at the analogue switch control inputs. If any of the control inputs on the analogue switches appears static when the frequency control is rotated, particularly on IC4, IC5, IC14 and IC15, then suspect a fault in the appropriate latches IC6, IC7, IC16 and IC17. If the latches are functioning, suspect the microcomputer board or the connections between it and the A1 board.

If the frequency error seems to be the same percentage error from that expected in one range, it could indicate the occurrence of drift in value in the integrator capacitors. If this appears to be the case, return the complete MD404 to the factory for software calibration.

27.4.4 No Output From Second Oscillator

The second oscillator is muted until required for any twin-tone measurement, or Wow and Flutter measurement. If it fails to operate, check the following,

after selecting Wow and Flutter or IMD on the MJS401D front panel.

If the IMD or W & F LED (as appropriate) is not lit, this indicates either a fault in the communications port on the microcomputer board, or a software bug. Versions of software before 4.2 and 4.3 in the MJS401D, and 1.5 in the MD404B, sometimes show this problem, depending on the exact timing of the Reset signals of the two microcomputers. If your software is of an earlier version, contact your agent or dealer.

Check that VR7 and VR8 are not at one extreme of their travel.

Monitor TP9 with an oscilloscope via a low capacitance (<10 pF) probe. There should be 4.158 MHz present at approximately 5 V peak-peak. If there is no 4.158 MHz signal at TP9, check the logic level at IC27 pin 5. This should be at +9V. If not, check IC27.

If the 4.158 MHz signal is present, check the voltage at IC31 pin 2. This should be a sine wave of approximately 1.7 V pk-pk, at the expected output frequency. If there is no output at pin 2 of IC31, remove IC30. If the output is restored, suspect IC30. If not suspect IC31.

If the signal is present at IC31 pin 2, check the signal at TP10. This should be 10 V pk-pk sine wave at the expected frequency. If no signal is present, suspect IC29.

27.4.5 Second Oscillator Output Level Incorrect

Check that a half-wave rectified signal of 10 V peak is present at D21 anode. If not, check IC29 and associated components. Check VR9 for mechanical damage. If the slider becomes detached from the track the control loop cannot function and the output voltage will be too high.

Check that VR7 and VR8 are not near one extreme of their travel.

Further causes of incorrect output level could be IC29 or IC31.

27.4.6 Output Frequency Incorrect

Check reference oscillator frequency at TP9, using a recently calibrated frequency counter. The frequency should be at 4 158 000 Hz ± 40 Hz. If this is correct, check the voltage at IC29 pin 7. It should be at +6.5 V. If it is not, check IC28 and TR2.

If the foregoing tests are to no avail, check IC31 and associated components.

Another possible cause of frequency errors could be the data strobe signal not present at IC28 pin 11, due to a fault in IC27, or the microcomputer board.

27.5 Calibration

27.5.1 Equipment Required

MJS401D with 80 kHz low pass filter and IEEE-488 remote control interface and any IEEE-488 controller.

If the IEEE-488 interface is not available, a separate distortion meter capable of measurements at 3.15 kHz may be used.

Digital multimeter with recently calibrated a.c measurement capability of $\pm 0.05\%$ accuracy at 1 kHz. If the MJS401D has been calibrated recently (within 6 months), the MJS401D may be used instead of the digital multimeter.

Frequency counter, 7 digits, accuracy ± 1 part per million, with a $\times 10$ low capacitance (< 10 pF) probe.

27.5.2 Main Oscillator

All the calibration procedures are carried out at the factory, and should not need to be re-adjusted unless components have been replaced. Frequency calibration data is stored in the EPROM on the microcomputer. Adjustment of presets can be carried out with the following procedure.

27.5.3 Vector Resolver Circuit Adjustments

1/ Short TP11 and TP12 together. Set VR3 for minimum d.c. offset at TP5 (between 0 V and +0.5 V).

2/ Remove short circuit between TP11 and TP12. Connect MD404B output to MJS401D input A.

MJS401D Front Panel Setup

Input	Load	Function	Filters	Rectifier	Scale	Dist'n	Coarse	Fine
A	Off	THD+N	30 kHz	RMS	% Dist	0.01 %	---	---

3/ Set MD404B to 1 kHz and +30 dBu.

Set VR1, VR4 and VR5 for minimum distortion reading on MJS401D. These adjustments are interactive and so must be repeated, in order, several times.

4/ MJS401D Front Panel Setup

Input	Load	Function	Filters	Rectifier	Scale	Dist'n	Coarse	Fine
A	Off	THD+N	80 kHz	RMS	% Dist	0.01 %	---	---

Set MD404 frequency to 20KHz.

Set VR10 and VC2 for minimum distortion reading on MJS401D. These adjustments are interactive and so must be repeated, in order, several times.

5/ Set the MD404B to 1 kHz, sine wave, 0 output resistance, and 0 dBu output level (0 dB LED just on; one detent down would extinguish the LED). Set the fine level control halfway.

If you are using the digital voltmeter for level calibration:

Connect the digital voltmeter across the MD404B's output terminals.

Set VR6 for 0.775 V (0 dBu) on the digital multimeter.

Alternatively, if you are using the MJS401D for level calibration:

MJS401D Front Panel Setup

Input	Load	Function	Filters	Rectifier	Scale	Dist'n	Coarse	Fine
A	Off	Level	Off	RMS	dB Exp	---	+30	0

Set VR6 for 0 dBu on the MJS401D.

27.5.4 Second Oscillator Crystal Frequency

Switch off the MJS401D. While holding the "Level" button, switch on again. The display should show "DIAGNOSTIC". Press the "Level" button again; the display should show "GROUP 1". Press the second button of the filters group; the display should show "W&F 1" for a second, then "DIAGNOSTIC" again. The second oscillator is now enabled, and should be generating 3.15 kHz.

Connect the frequency counter between ground and TP9. Use of a low capacitance probe is crucial; the probe capacitance affects the frequency being measured.

Set VC1 for exactly 4.158 MHz at TP9.

27.5.5 Second Oscillator Distortion Presets

If you are using IEEE-488 control of the MJS401D:

Connect MD404 output to the MJS401D "A" input.

Send the following strings over the IEEE-488 bus to the MJS401D (a short pause may be necessary after the "Reset"):

```
Reset
Oscillator reset
Function THD
Filter 30 kHz
Oscillator W&F 3150 Hz
Oscillator level 0 dB
```

Adjust VR7 and VR8 for minimum distortion. This should be less than 1% (typically 0.5%).

Alternatively, if you are using an external distortion meter:

Connect the MD404B output to the distortion meter input.

Switch off the MJS401D. While holding the "Level" button, switch on again. The display should show "DIAGNOSTIC".

Press "Level" again. Display should show "GROUP 1".

Press the second button in the "Filters" group. Display should show "W&F 1" for about a second, then revert to "DIAGNOSTIC". The MD404B should have its "W&F" LED lit, and be generating 3.15 kHz.

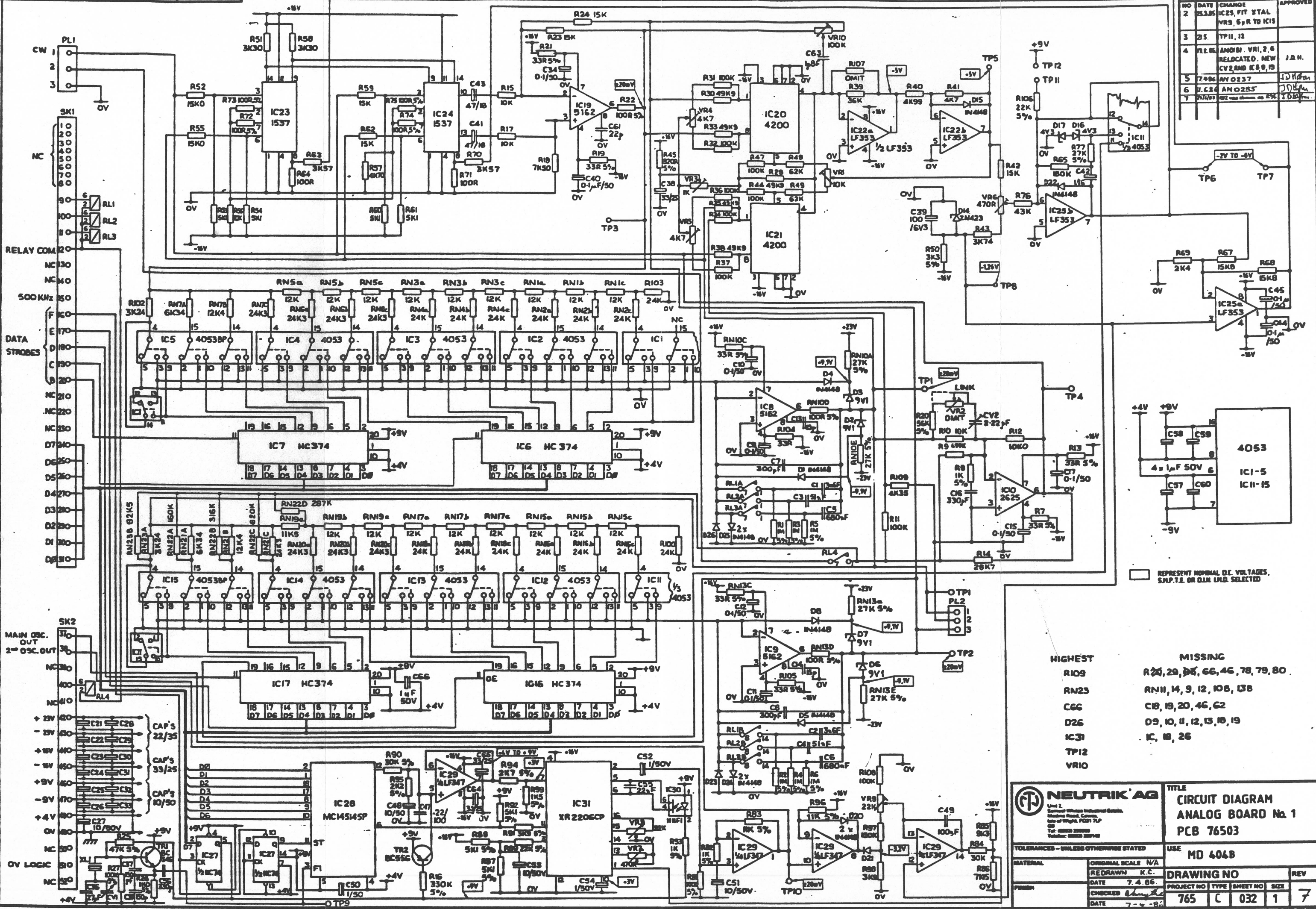
Set the MD404B output to a level suitable for the distortion meter.

Adjust VR7 and VR8 for minimum distortion. This should be less than 1% (typically 0.5%).

27.5.6 Second Oscillator Level

Select "Read Osc" function and "dB Exp" scale on the MJS401D. Set the MD404B to 0 dB level (0 dB LED just on; one detent of the level control would extinguish the LED) and the fine level control halfway. Unplug all cables from the MD404B output.

Set VR9 for exactly 0dB.



REVISION				
NO	DATE	CHANGE	BY	APPROVED
2	25.8.85	IC23, FIT	STAL	
3	25.8.	TP11, 12		
4	21.8.	AND IN. VRI, 2, 8		J.A.H.
5	7.9.86	RELOCATED. NEW		
6	7.1.86	CV2 AND IC9, 13		
7	27.1.87	AN O237		
		AN O255		
		AN O255		

HIGHEST	MISSING
R109	R20, 29, 34, 66, 46, 78, 79, 80
RN23	RN11, 14, 9, 12, 108, 138
C66	C18, 19, 20, 46, 62
D26	D9, 10, 11, 12, 13, 18, 19
IC31	IC, 18, 26
TP12	
VR10	

NEUTRIK AG		TITLE	
Unit 2 General Wholes Industrial Estate Maidenhead Road, Crowthorne Berkshire, RG8 7LP Tel: 0494 25000 Telex: 98020 250148		CIRCUIT DIAGRAM ANALOG BOARD No. 1 PCB 76503	
TOLERANCES - UNLESS OTHERWISE STATED		USE MD 404B	
MATERIAL		DRAWING NO	
ORIGINAL SCALE N/A REDRAWN K.C. DATE 7.4.86		PROJECT NO TYPE SHEET NO SIZE	
CHECKED		765 C 032 1 7	
DATE 7-4-86			