M103A VCO Driver

FUNCTION DESCRIPTION

The M103A Oscillator Driver is an enhanced version of the popular Moog 921A module (used in Moog system 55). It features much more precises components with more accurate settings of the parameters. For example the front panel frequency control is made of a 360 deg. span precision potentiometer that gives a +/-2% linearity compared to the original Allen-Bradley carbon type with a linearity of 20%.
The inner IC's & resistors have also been upgraded with a slightly modified schematic. Since the input/output specs are essentially the same as the 921A the following description is mostly the same as the 921A's original specifications.

The M103A Oscillator Driver is a control voltage processor which runs associated with M103B oscillators through internally wired connections (via PCB AMP connectors).
Two voltages are generated:
one for frequency control, and one for rectangular wave duty cycle control. Control inputs to this module change the frequency control and one for rectangular wave duty cycle control. Control inputs to this module change the frequency of its associated oscillators in volt/octave increments. Manual settings of the frequency and width of rectangular wave pots changes the nominal frequency and duty cycle of the connected M103B's in parallel. Two ranges are provided on the frequency potentiometer: semitone (two octaves compass) and
octave (12 octaves compass). These ranges are selected by the white rocker switch below the pot. Control inputs for frequency and rectangular width are summing.

The printed circuit board

The PCB has been designed to fit behind a 1U Moog style front panel. It is a double side board 2.6” X 5.5” and is mounted using 4-40 1.5” hexa standoffs to keep accessibles all the onboard trimmers. All the parts are through hole types. Connectors H2, H3, H4 are positioned to be connected to adjacents 3 X M103B VCO modules for drive purposes. Power is connected by use of a 6 pins 0.156” Molex type connector. The PCB has 4 mounting holes, one on each corner.

The circuit description

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For precision and lasting reliability a voltage reference IC is used for accurate and stable voltage reference for all CV summings. U1 is a high precision voltage reference IC that gives a stable +10.00volts. Front panel potentiometer FREQ uses this precise voltage for its span and then its cursor's voltage is buffered by a precision opamp OPA2277PA (U2A). This buffered voltage is then trimmed by the use of P2 and P3 to be amplified by U2B. The resulting CV voltage is summed with incoming external CV's (through CV input jacks J1,2,3) summed themselves through U3A. U2B output is inverted through U3B with a gain depending on the values of R3 & R5 by the use of rocker switch's S1 position. Ratio between R4-P4 and resistors R3-5 (in parallel) determines CV span of P1 FREQ pot according to rocker switch's S1 position.
Resistors R3, R5 & R11 mix voltages to the summing opamp U3B which gain is finaly adjusted to 1V/oct span by mean of P4 (1V/OCT). Pin#7 of U3B is then fed to 3 buffers U5A-B-C who put a final 100ohm output impedance CV that will drive internaly (behind the front panel) the adjacents M103B VCO's CV ins.
The Pulse Width Modulation is taken care of by means of U4 IC. The Rectangular width front panel pot P6 send a voltage between +/-15VDC through buffer U4B which output goes to one of 3 summing resistors R14, R17, R19 and are summed by U4A. The final PWM voltage gain is adjusted by P5 (PWM SPAN) with respect to M103B VCO's PWM input max span specs +/-5VDC.
The 2 PWM inputs jacks J4, J5 can receive +/-5VDC PWM external voltages.
All the final freq and PWM CV's go to th 3 CV connectors named H2, H3, H4
For driving purpose of the 3 adjacent M103B VCOs.

Adjustments and trimmings:

The following is the adjustment procedure for all PCB trimpots:

-Adjust front panel FREQ knob to get +5.00v on pin#1 of U2. The front knob should points to zero position. If not, unscrew the knob and reposition it to zero position and tighten it back. Make sure +5.00v is still on pin#1 of U2.

-Adjust front panel FREQ knob to get +4.48v on pin#1 of U2.

-Temporary place a jumper between GND and pin#5 of U2.

-Adjust P2 (oct adj) to get -4.00v on pin#7 of U2.

-Remove jumper between GND and pin#5 of U2.

-Adjust front panel FREQ knob to get +5.00v on pin#1 of U2.

-Adjust P3 (offset adj) to get 0.00v on pin#7 of U2.

Adjustments and trimmings (continued):

-With 0.00v still present on pin#7 of U2 apply +10.00v to one of the module's CV jacks (ex: Jack1) by placing a jumper between pin#6 of U1 (+10.00v) and input J1 (Carefull to not short pin#6 of U1 to GND!)

-Adjust P4 (1v/oct) to get +10.00v on pin# 7 of U3 (Pins 1, 7, 8 of U5 should follow the same voltage).

Playing with the rocker switch octave/semitones, values printed around front panel FREQ pot now should 'track' with values going on connectors de H2, H3, H4 (to VCO's).

-Adjust front panel WIDTH OF RECT, WAVE knob to get +0.0v on pin#7 of U4. The front knob should points to 50% position. If not, unscrew the knob and reposition it to 50% position and tighten it back. Make sure +0.0v is still on pin#7 of U4.

-Put WIDTH OF RECT, WAVE knob to 90% and adjust trimpot P5 (PWM span) to get +4.3vdc to pin#1 of U4.

The M103A is now ready to drive a trio of M103B VCO's.

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ELECTRONIC SPECIFICATIONS

POWER CONNECTOR PIN ASSIGNMENTS

1	-15V
2	A GND
3	A GND
4	+15V
5	D GND
6	+5V

Panel Size: Single width 2.125"w x 8.75"h.
Frequency control inputs: 3 summed
Frequency input impedance: 100k +/-1%
Rectangular duty cycle width inputs: 2 summed
Rectangular input impedance: 100k +/-5%

Frequency pot range: semitone: -1oct…..+1oct.
octave: -6oct…..+6oct.
Width of Rect. Wave pot range: 10%….90%.
Span switch: +/-12 semitones
+/-6 octaves
All output impedances: 100ohms +/-5%

Power:
+15V @ 17mA,
-15V @ 15mA,
+5V @ 0mA.