The Tellun Corporation

DB-120 Daughterboard for MOTM-120

User Guide, Rev. 1.0

Circuit design by Richard Brewster

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Introduction

The DB-120 is a daughterboard for the MOTM-120 Sub-Octave Multiplexer. The DB-120 is intended to be used with the Stooge Enterprises 120R panel. The DB-120 adds individual outputs for the four sub-octaves, a staircase wave that is the binary weighted sum of the four sub-octaves, and a switch for selecting either AC or DC coupling for the staircase wave and the signal appearing at the MOTM-120 OUTPUT jack. The four sub-octave outputs are DC coupled square waves that swing between +5 volts and –5 volts.

Circuit Description

The four sub-octave signals from the MOTM-120 are brought into the DB-120 via JP2. Four identical comparators are built around quad op-amp U2. R10 and R9 set the trip point for the comparators at approximately +1.4 volts. When the signal at the positive input of any comparator goes above the trip point, that comparator output goes high (approximately +13.5 volts). When the signal at the positive input of any comparator goes below the trip point, that comparator output goes low (approximately –13.5 volts). R11 and R12 scale the comparator output for the SUB1 signal to +/– 5 volts while providing an output impedance fairly close to 1000 ohms. R13-R18 provide similar scaling for the other three sub-octave outputs.

The four sub-octave signals from the MOTM-120 also feed a binary weighted summer built around U1. R1-R4 set the gain for the sub-octaves such that SUB2 is twice the level of SUB1, SUB3 is twice the level of SUB2, and SUB4 is twice the level of SUB3. This weighting produces a staircase wave as the four sub-octaves cycle through all 16 possible output combinations. R5 sets the amplitude of the staircase wave to 5.6 Vpp. C7 on the DB-120 daughterboard blocks the DC component of the staircase wave so that it is centered about ground. Switch SW1 shorts C7 out of the circuit so that the staircase wave is DC-coupled (going from 0 volts to +5.6 volts). Switch SW1 is also hooked up to C7 on the MOTM-120 motherboard so that the OUTPUT signal from the MOTM-120 can also be DC-coupled.

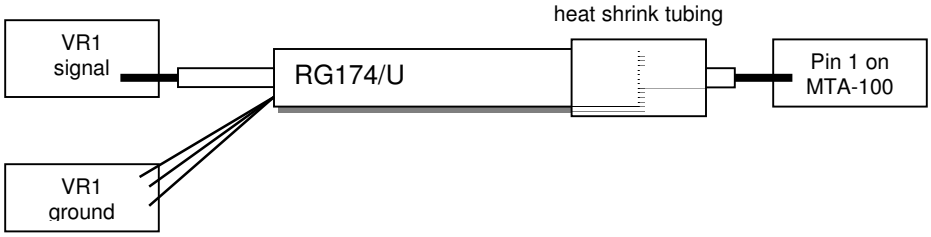
Construction Tips

The DB-120 should be installed on top of the MOTM-120 using 3/4” standoffs. A standard MTA-156 power connector is supplied on the DB-120. An MTA-100 connector is provided for connecting the four sub-octave signals to the DB-120.

Use coax cable to feed the four sub-octaves from the MOTM-120 to the DB-120. The best place to tap the four sub-octaves off the MOTM-120 is directly under the four PCB mounted pots VR1-VR4. There are three pins on each pot. The pin closest to the bottom of the module (i.e. closest to the jacks) is the ground connection. The pin closest to the top of the module is where the sub-octave signal is found. Connect the coax shield

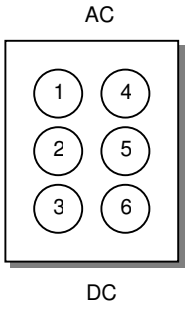
(outside conductor) to the ground connection and the coax core (inside conductor) to the sub-octave signal.

The other ends of these four coax wires connect to the DB-120 via an MTA-100 connector. Clip the coax shield from these ends and cover them with a piece of heat shrink tubing to prevent any stray strands from coming into contact with anything. At this clipped end, connect the coax core (inside conductor) to the MTA-100 connector. You should be able to get all four coax wires to fit comfortably into the MTA-100 connector and still get the dust cover on. Use a cable tie to bundle the four coax wires together near the MTA-100 connector.



The MODE switch (SW1) that connects to the MOTM-120 motherboard needs longer wires when using the Stooge Enterprises 120R panel. Remove the existing wires and replace with a 5” twisted pair. Make sure you reconnect the wires to the bottom two lugs of the MODE switch.

The AC/DC switch on the 120R panel needs to be connected to both the MOTM-120 motherboard and the DB-120 daughterboard. Connect a 4” twisted pair of wires to both pins of C7 on the underside of the MOTM-120 motherboard. Connect the other ends of these wires to pins 4 and 5 of the AC/DC switch as shown below. Use another 4” twisted pair of wires to connect pins 1 and 2 of the AC/DC switch to JP3 on the DB-120. JP3 is erroneously labeled SW1 on the DB-120 (drat).



AC/DC switch viewed from behind (pins facing toward you). With switch in the up position (AC) pins 2 and 3 are connected, and pins 5 and 6 are also connected.

Use coax cable to hook up the five outputs from the DB-120 to the SUB1, SUB2, SUB3, SUB4, and STAIR output jacks. Holes are provided on the DB-120 for using cable ties with these five coax connections (just like on the MOTM-120).

A simple way to provide power to the DB-120 is to use a pass-thru MTA-156 connector. This connector can be installed on an existing MOTM power cable to provide two outlets from one cable.

The PCB uses 0.4” spacing for the resistor pads, 0.4” spacing for the ferrite bead pads, and 0.2” spacing for most of the capacitor pads. The electrolytic capacitors have a 0.1” pad spacing.

Wiring Guide

From	*To*	*Wire Length (inches)*	*Wire Type*
VR1 on MOTM-120	JP2 pin 1 on DB-120	9	coax
VR2 on MOTM-120	JP2 pin 2 on DB-120	8	coax
VR3 on MOTM-120	JP2 pin 3 on DB-120	7	coax
VR4 on MOTM-120	JP2 pin 4 on DB-120	7	coax
SW1 on MOTM-120	MODE switch	5	twisted
C7 on MOTM-120	AC/DC switch pins 4 - 5	4	twisted
JP3 on DB-120	AC/DC switch pins 1 - 2	4	twisted
SUB1 on DB-120	SUB1 jack	4	coax
SUB2 on DB-120	SUB2 jack	4	coax
SUB3 on DB-120	SUB3 jack	4	coax
SUB4 on DB-120	SUB4 jack	4	coax
STAIR on DB-120	STAIR jack	4	coax

Modifications

R5 sets the amplitude of the staircase waveform. As designed, the output signal is 5.6 Vpp. Increase R5 to increase the amplitude. Lower R5 to lower the amplitude.

DB-120 Parts List

Resistors (18)

Quantity	*Description*	*Part No.*	*Notes*
1	1 K	R8	5% or better, Mouser #291-1K
4	2.2 K	R12, R14, R16, R18	5% or better, Mouser #291-2.2K
4	3.9 K	R11, R13, R15, R17	5% or better, Mouser #291-3.9K
1	10 K	R9	5% or better, Mouser #291-10K
1	15 K	R5	5% or better, Mouser #291-15K
3	100 K	R6, R7, R10	5% or better, Mouser #291-100K
1	24.9K	R4	1%, Mouser #271-24.9K
1	49.9 K	R3	1%, Mouser #271-49.9K
1	100 K	R2	1%, Mouser #271-100K
1	200 K	R1	1%, Mouser #271-200K

Capacitors (9)

Quantity	*Description*	*Part No.*	*Notes*
1	100 pF ceramic	C8	Mouser #140-50N5-101J Mouser #147-75-101
1	470 nF polyester	C7	Mouser #581-470NJ63
5	0.1 uF ceramic	C3 – C6, C9	Mouser #147-72-104 Mouser #581-SA105E104M
2	22 uF 35V electrolytic	C1, C2	Mouser #140-XRL35V22

Semiconductors (2)

Quantity	*Description*	*Part No.*	*Notes*
1	TL074 quad op amp	U2	Mouser #595-TL074CN
1	TL072 dual op amp	U1	Mouser #595-TL072CP

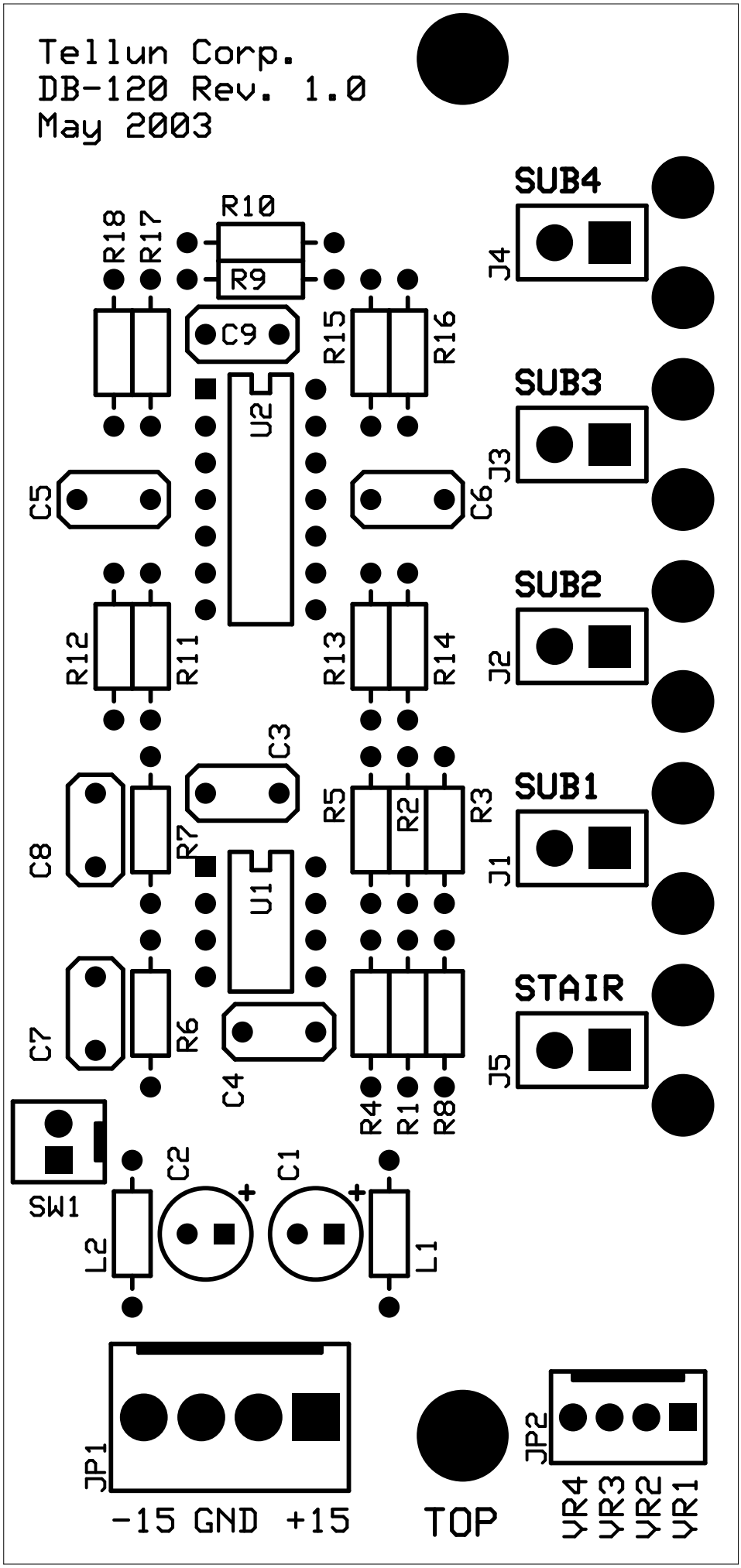
Miscellaneous

Quantity	*Description*	*Part No.*	*Notes*
5	phone jack	J1 – J5	Switchcraft 112A, Allied #932-9391
1	8 pin DIP socket		for U1 (optional)
1	14 pin DIP socket		for U2 (optional)
2	axial ferrite beads	L1, L2	Active #MURJP2141, or Mouser #623-2743002112
1	MTA-156 4 pin	JP1	Mouser #571-6404454 (header)
1	MTA-100 2 pin	JP3	Mouser #571-6404562 (header) Mouser #571-6404402 (connector) Mouser #571-6405502 (dust cover)
1	MTA-100 4 pin	JP2	Mouser #571-6404564 (header) Mouser #571-6404404 (connector) Mouser #571-6405504 (dust cover)
1	MTA-156 4 pin pass-thru		Mouser #571-6405994 (connector) Mouser #571-6406434 (dust cover) (optional, for supplying power to DB-120 using existing MOTM-120 power cable)

1	DPDT switch, NKK M2022ES1W01	SW1	Allied #870-8652

Hardware

Quantity	*Description*	*Notes*
1	DB-120 PCB	printed circuit board
2	3/4” standoff (6-32 thread)	Mouser #534-2211 (for mounting board DB-120 above MOTM-120)
1	power cable	with MTA-156 connectors (if not using MTA-156 pass-thru)
1	120R panel	Stooge panel
1	4 pot short Stooge bracket	Stooge bracket
2	#6-32 screw	for mounting DB-120 to standoff
	coax cable (RG174/U)	Mouser #566-8216-100 (100 foot spool)
	heat shrink cable	
	hookup wire	
	solder	both organic and no clean


Tellun Corp.
DB-120 Rev. 1.0
May 2003
R10
R9
R18
R17
C9
R15
R16
U2
C5
C6
R12
R11
R13
R14
C3
C8
R7
R5
R2
R3
U1
C7
R6
C4
R4
R1
R8
SW1
C2
C1
L2
L1
JP1
-15 GND +15
TOP
JP2
VR4 VR3 VR2 VR1
SUB4
J4
SUB3
J3
SUB2
J2
SUB1
J1
STAIR
J5