Sources				
	Paper Manual	**Hafler.com Manual**	**Blue Shadow's Manual**	**Hafler.com DH-220 Manual**
Year	1979	1980	7/1980	1984
Document #	929201	929204	929203	LM128
Serial #	3952043	N/A	3102021	N/A
DH-200 Differences				
Component	**1979 Manual (929201)**	**1980 Manual (929204)**	**7/1980 Manual (929204)**	
R28	47Ω 1/2W	47Ω Carbon Comp		
R34	47Ω 1/2W	47Ω Carbon Comp		
R39	2.2Ω 1/2W	.5Ω 1/2W	.5Ω 1/2W	
C2	390pF 500 Disc	390pF 500V Mica		
C3	.001µF 100V Disc	.001µF 100V Film		
C4	.001µF 100V Disc	.001µF 100V Film		
C6	270pF 500V Disc	270pF 500V Mica		
C7	.1µF 100V Disc	100µF 80V Electrolytic		
C8	.1µF 25V Disc	.1µF 100V Film		
C9	560pF 500V Disc	680pF 500V Mica	680pF 500V Mica	
C10	.1µF 100V Disc	100µF 80V Electrolytic		
C11	.01µF 100V Disc	.01µF 100V Film		
C12	.1µF 100V Disc	.1µF 100V Film		
C13	390pF 500V Disc	390pF 500V Mica		
C18	47pF 500V Disc	680pF 100V Mica	47pf 500V Mica	
C19	.005µF 1000V Disc	.0047µF 100V Film	.0047µF 100V Film	
C20	.01µF 100V Disc	.01µF 100V Film		
C21	.01µF 100V Disc	.01µF 100V Film		

Q1	BC546B	2N5550	2N5550	
Q2	BC546B	2N5550	2N5550	
Q3	BC546B	2N5550	2N5550	
Q4	BC556B	2N5401	2N5401	
Q5	BC556B	2N5401	2N5401	
Q6	BC556B	2N5401	2N5401	
Q9	BC546B	NP2222	NP2222	
Q12	1A09	2N3440	2N3440	
Q13	1A10	2N5415	2N5415	
DH-200 Oddities				
While working on my two DH-200 I've located a few inconsistencies which I can't yet attribute to design revisions. I've cataloged them here.				
1. On my amplifiers C18 was connected between ground and the gate of Q14 instead of between ground and the drains of Q14 & Q15. The pictures of the amplifiers within the manual also appear to have this connection. So is the schematic wrong? Or did someone in the assembly make a mistake for a few years? In the DH-220 manual this inconsistency is resolved and the pictures appear to show C18 connected as shown in the schematic.				
DH-200 vs.DH-220				
The DH-220 appears to be an evolved version of the DH-200. Here I did my best to analyze the topology changes between the two amplifiers. It is by no means a definitive comparison, often I am making speculative oberservations and I do my best to make it clear when I am mostly guessing.				
1. The DH-220 adds an additional potentiometer to adjust the DC offset of the amplifier. This resulted in a redesign of the input network and tails of the two input differential pairs. I believe the offset adjustment works by balancing the tail currents between the two sets of input pairs. By turning the potentiometer one decreases/increases the current in one pair and increases/decreases an equal amount in the second. This adjusts the output voltage of the differential pairs, and thus the entire amplifier.				

2. In the DH-200 the VAS was composed of what I believed to be two unusual arrangements of a darlington pair. Upon inspecting the schematic of the DH-220, I now believe the VAS is composed of a common-collector buffer stage, followed by a common-emitter gain stage. In the DH-220 this stage has been modified so the buffer transistors (Q7, Q10) draw current from the ground rail instead of the VAS output. This may have been to eliminate a form of local negative feedback. I am unsure of the purpose of D9 & D10, perhaps biasing?	
3. The VAS is loaded by a modified version of the Vbe multiplier found in the DH-200. In both amplifiers, the bias current of the amplifier is controlled by adjusting the potentiometer that is part of the Vbe multiplier. This potentiometer adjusts the voltage that is formed across Q9, thus altering the bias of the driver and output stages. In addition the DH-220 adds an emitter resistor to Q9, and an additional resistor to ground. I suspect the additional resistor (R38) sets the overall impedance of the node and thus sets the gain of the VAS stage. This was most likely done to make the gain of the VAS stage less dependent on the device parameters of Q8 & Q11, which may have let to greater reliability or better manufacturing yield.	
5. There are numerous changes to component values between the two amplifiers. As the DH-220 is a higher power amplifier, the gain of the forward amplifier, and the feedback network must have been changed which would explain the numerous changes in component values.	
6. The DH-220 also benefits from extensive bypassing. A number of capacitor were added to the design simply to bypass capacitors already present in the DH-200. C7, C11, C13, C21 & C22 exist definitively as bypass for existing capacitors. Also, at least C17 and C408 were added as additional bypassing.	
7. I've heard the DH-220 had a completely reworked grounding systems. This is difficult to tell from the schematic, except for the replacement of R39 with C23. The original purpose of R39 baffles me. My best guess is the purpose of R39 (and C23) was to create a impedance between the input and output grounds. This would help force the input currents to flow through the chassis and the output currents to flow into the power supply. This is beneficial as the ground noise of the output stage wouldnt interfere with the input stage. The ultimate question this raises for me is why even bother connecting the grounds on the PCB if the goal is to seperate them. The DH-220 effectively does disconnect these stages at ground through the use of C23 which is VERY high impedance at LF.	