5.4.5 Absolute Pickup Sensitivity

The results obtained using the motorized test bench offer conclusive indications about the local sampling of the string; the results are, however, based on a movement which is untypical for a string (rotation rather than transversal wave). In order to obtain supplementary data regarding the absolute pickup sensitivity, the same pickups were investigated again using a **shaker test bench**. An electromagnetic shaker (B&K 4810) served as drive, causing a string of 10 cm length and a diameter of 0,66 mm to vibrate with a sine movement. The string was positioned orthogonally versus the magnetic axis, moving closer to and further away from the magnet, respectively. This can be seen as an excerpt from a very low-frequency, level-polarized transversal wave. An accelerometer served as sensor to capture the measurements; most of the investigations were done in the frequency range between 80 and 95 Hz with a displacement-amplitude of approx. 0,4 mm.

Fig. 5.4.31 shows the dependency of the measured voltage level on the width of the gap between the magnetic pole and the string (the distance d); this gap was varied between 5 mm and 0,5 mm. The results for the single-coil pickups can be divided in three groups: Telecaster and Stratocaster (relatively shallow curvature), SDS-1 and P-90 (stronger curvature), and Jazzmaster (flatter evolution). In this kind of measurement, the SDS-1 proves to be 10 dB more sensitive („louder“) than the Stratocaster Pickup. On the right hand side of Fig. 5.4.31 we find the results for humbuckers. 490R represents the typical Gibson-humbucker; similar dependencies could be found for the 57-classic and ES-335 pickups. The Toni-Iommi-pickup differs from the 490R for small distances – this can be traced to a different construction.

The pickups are most sensitive with their magnetic pole axis pointing in the same direction as the movement of the string. In the guitar this corresponds to a vibration plane perpendicular to the to the fret-board. String-vibrations in parallel to the fretboard induce next to no voltage (chapter 5.10).

Fig. 5.4.31: voltage level dependent o the variable distance *d*. Displacement amplitude = 0,4 mm, frequency =84 Hz. In practice, the distance *d* often 3 – 4 mm, the associated gradient is -2 ... -3 dB/mm.

These figures are reserved for the printed version.

The different sensitivities are predominantly due to the various types of coils and their distance to the string. The distance *d* marks the clearance between string and magnetic pole; large magnet protrusions (such as for the Stratocaster) require the coil to be further away from the string compared e.g. to the Jazzmaster. The following table summarizes the measurement results.

Tonabnehmer	**§)**	
DiMarzio SDS-1		
Gibson P-90		
Rockinger P-90		
"Telecaster"-Fake (Bridge)		
Duncan APTL-1 (Telecaster-Type, Bridge)		
Fender Jazzmaster-62 (Bridge)		
Rockinger Strat-Type (Balkenmagnet)		
Fender Telecaster-52 (Bridge)		
Fender Jazzmaster-62 (Neck)		
Schaller		
Fender Stratocaster (Balkenmagnet)		
Fender Stratocaster (USA Standard, Bridge)		
Ibanez Blazer		
Joe Barden Strat-Type (Bridge)		
Fender Jaguar (Neck)		
Rickenbacker (Toaster-Pickup)		
Fender Telecaster Texas (Bridge, D / A)		
Fender Telecaster-70 (Bridge, mit Platte)		
Fender Stratocaster (USA Standard, Middle)		
Fender Telecaster-70 (Bridge, ohne Platte)		
Fender Noiseless Stratocaster (Neck, G)		
Duncan SSL-1 (Strat-Type)		
Lace-Sensor gold		
Fender Stratocaster-72 (G)		
Gretsch HiLoTron		
"Telecaster"-Fake (Neck)		
DiMarzio DP-172 (Telecaster-Type, Neck)		
Fender Telecaster-73 (Bridge, D / A)		
Duncan APTR-1 (Telecaster-Type, Neck)		
Fender Telecaster-52 (Neck)		
DiMarzio DP-107 Megadrive		
Gibson Burstbucker #2		
Gibson 57 classic		
Gibson 490R		
Squier Humbucker		
Gibson ES 335 (Neck, 1968)		
Gibson Tony Iommi		
Gibson ES 335 (Bridge, 1968)		
DiMarzio DP-184		
Gretsch FilterTron		

Table: low-frequency pickup transmission-coefficient T_{Uv}.
String diameter = 0,70 mm (plain), distance to the magnet pole d = 2mm.

§) The numeric values are reserved for the printed version.