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Four-point characterization using capacitive and ohmic contacts WANG ZHOU, BRIAN KIM, YASH SHAH, CHUANLE ZHOU, MATTHEW GRAYSON, Dept. of Electrical Engineering and Computer Science, Northwestern University, NEBILE IŞIK, Walter Schottky Institut, Technische Universität München — A four-point characterization method is developed for semiconductor samples that have either capacitive or ohmic contacts. When capacitive contacts are used, capacitive current- and voltage-dividers result in a capacitive scaling factor which is not present in four-point measurements with only ohmic contacts. Both lock-in amplifier and pre-amplifier are used to measure low-noise response over a wide frequency range from 1 Hz – 100 kHz. From a circuit equivalent of the complete measurement system after carefully being modeled, both the measurement frequency band and capacitive scaling factor can be determined for various four-point characterization configurations. This technique is first demonstrated with a discrete element four-point test device and then with a capacitively and ohmically contacted Hall bar sample using lock-in measurement techniques. In all cases, data fit well to a circuit simulation of the entire measurement system over the whole frequency range of interest, and best results are achieved with large area capacitive contacts and a high input-impedance preamplifier stage. Results of samples (substrates grown by Max Bichler Dieter Schuh, and Frank Fischer of the WSI) measured in the QHE regime in magnetic fields up to 15 T at temperatures down to 1.5 K will also be shown.

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