# Use a photoelectric-FET optocoupler as a linear voltage-controlled potentiometer

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You can use a photoelectric FET as a variable resistor or a potentiometer in combination with a fixed resistor. The H11F3M photoelectric FET has an isolation voltage of 7.5 kV, enabling you to safely control high-voltage circuit parameters. The nonlinear-transfer characteristics of these devices are problematic, however (**Figure 1**). To correct the nonlinearity, using a simple feedback mechanism as a potentiometer yields a linear response (**Figure 2**). This circuit uses two photoelectric FETs: one for feedback and the other for applications requiring an isolated potentiometer. You connect the inputs of the two photoelectric FETs in series to ensure the same amount of current for the input LEDs.

Place 50-kΩ resistors at the FET outputs to mimic the response of a potentiometer. The circuit amplifies the difference between the set input voltage, which you adjust using potentiometer $R_7$, and the feedback from photoelectric FET 1. The resulting output controls the current in the

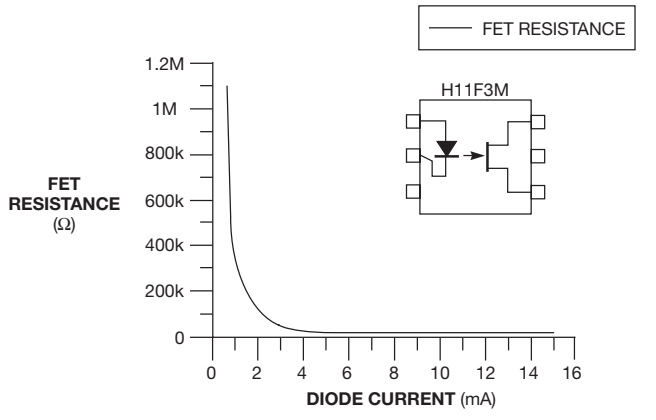


Figure 1 The output resistance of a photoelectric FET is nonlinear with respect to the input-LED current.

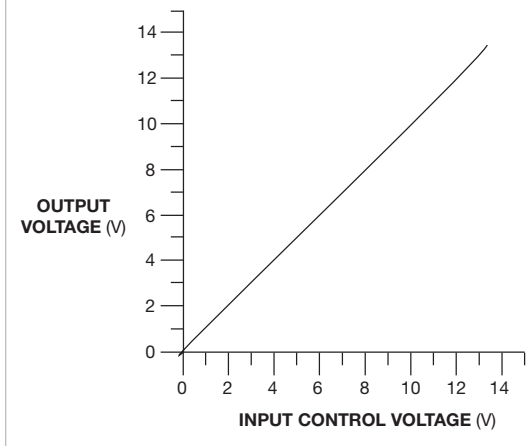


Figure 3 The feedback circuit greatly improves output linearity.

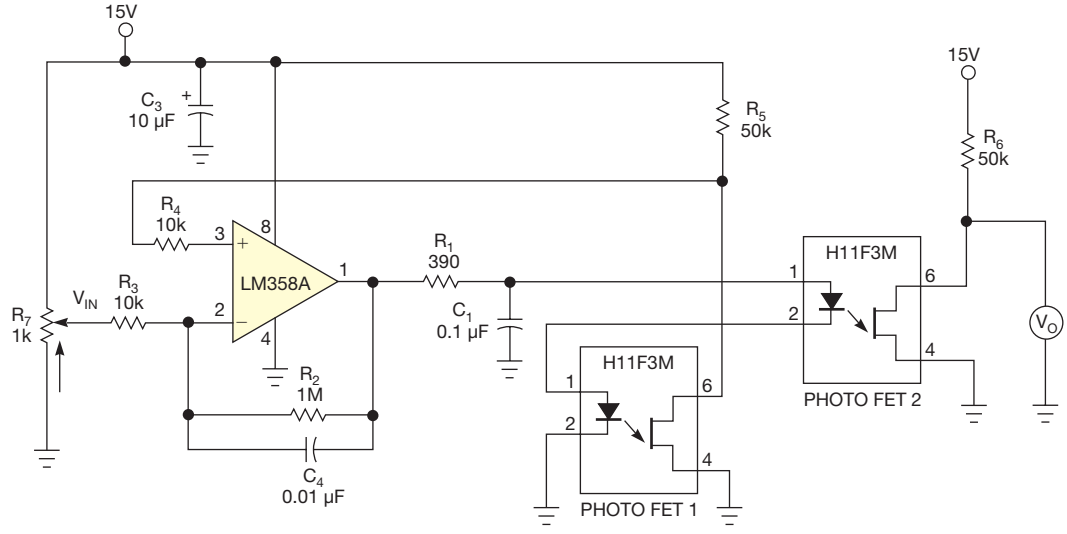


Figure 2 This circuit feeds back the response of an identical photoelectric FET to linearize the response.

photoelectric-FET LEDs until the feedback voltage equals the input voltage. The output voltage follows linearly with the input voltage (**Figure 3**). You might think that photoelectric FETs bearing the same part number are identical, but small manufacturing discrepancies can be present. Five H11F3M parts have offsets within 3%. EDN