

Design Note

OPTOCOUPLER FEEDBACK DRIVE TECHNIQUES USING THE UC 3901 AND UC3903

Numerous techniques and devices are available to the designers of optocoupler feedback circuits. The more traditional approaches utilize either an adjustable shunt regulator like the TL431 device or an op-amp and voltage reference as the optocoupler driver. While these approaches do satisfy the basic requirements in many applications, quite often they lack the performance that is achievable from a more sophisticated circuit. Too often, these low cost solutions necessitate additional protection circuitry elsewhere in the control circuit to overcome the deficiencies in the feedback path.

A variety of low cost supervisory ICs contain the required building blocks for the more demanding optocoupler feedback drive applications. Initially developed to address other specific power supply tasks, several control ICs excel in the role as precision optocoupler control and drivers.

The basic building blocks necessary for optocoupler feedback control are a precision reference, an error

amplifier and a drive stage capable of approximately 20 milliamps. In a typical application, the power supply output voltage is monitored and compared to a reference voltage to the error amplifier inputs. Loop compensation and gain are programmed around the amplifier, and the resultant error voltage (V_e) modulates the optocoupler drive current, hence feedback.

In addition to the simple regulation of output voltage, several other housekeeping functions can be performed on the secondary side of the power supply - all with a single integrated controller. Fault protection, for example, from an over voltage or an over current condition can be detected and used to override the normal optocoupler drive. An undervoltage lockout feature could prevent false feedback information during power-up and power down sequences of the power supply. Also, a POWER-OK indicator could separately communicate with the primary side controller, or used to gate the optocoupler drive at the secondary side.

Basic Optocoupler Driver Circuit

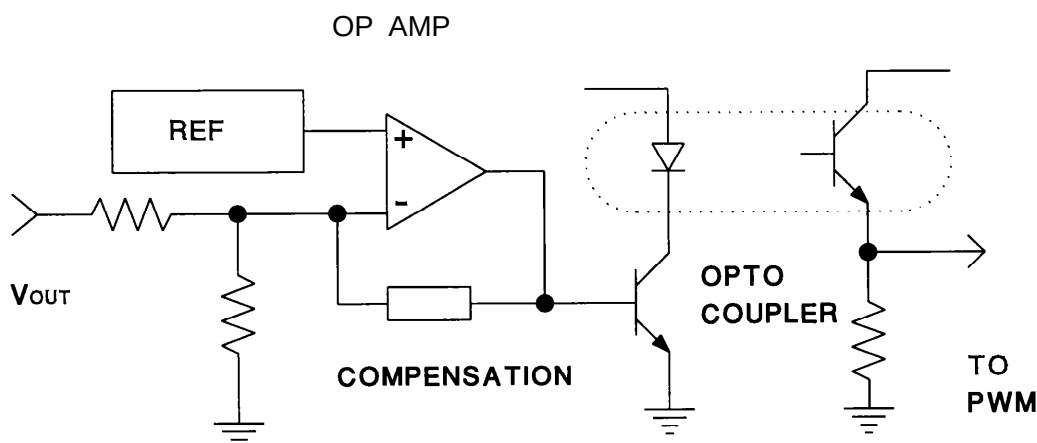


Figure 1.

Many isolated feedback applications required higher performance than can be obtained from an optocoupler feedback technique. Generally, these fall into one of two categories; high frequency switchers (above 250kHz) and those with very high voltage isolation requirements (greater than 5kV). The UC 3901 was developed to amplitude modulate a high frequency carrier applied to a transformer in place of the optocoupler. A peak detection circuit is used to reconstruct the error voltage waveform across the isolation boundary.

By disabling the internal oscillator, no chopping occurs and the outputs operate as linear drivers. When placed across an optocoupler this

configuration yields similar results to other drive techniques - with two advantages. First, a closed loop startup of the power supply can be obtained since both inputs to the error amplifier are made available. Rather than using the traditional approach of soft-starting the error amplifier output, the noninverting, or reference input is gradually ramped up. This technique prevents a large overshoot from occurring as the output approaches regulation. In contrast to the prior method, the amplifiers loop compensation network is not abnormally biased during startup - causing the output excursions. Additionally, an over and under voltage detection is available at the UC3901 "Status output" pin. This open collector output can drive a separate fault indication optocoupler for communication to the PWM controller.

Optocoupler Drive Circuit Features Additional Protection

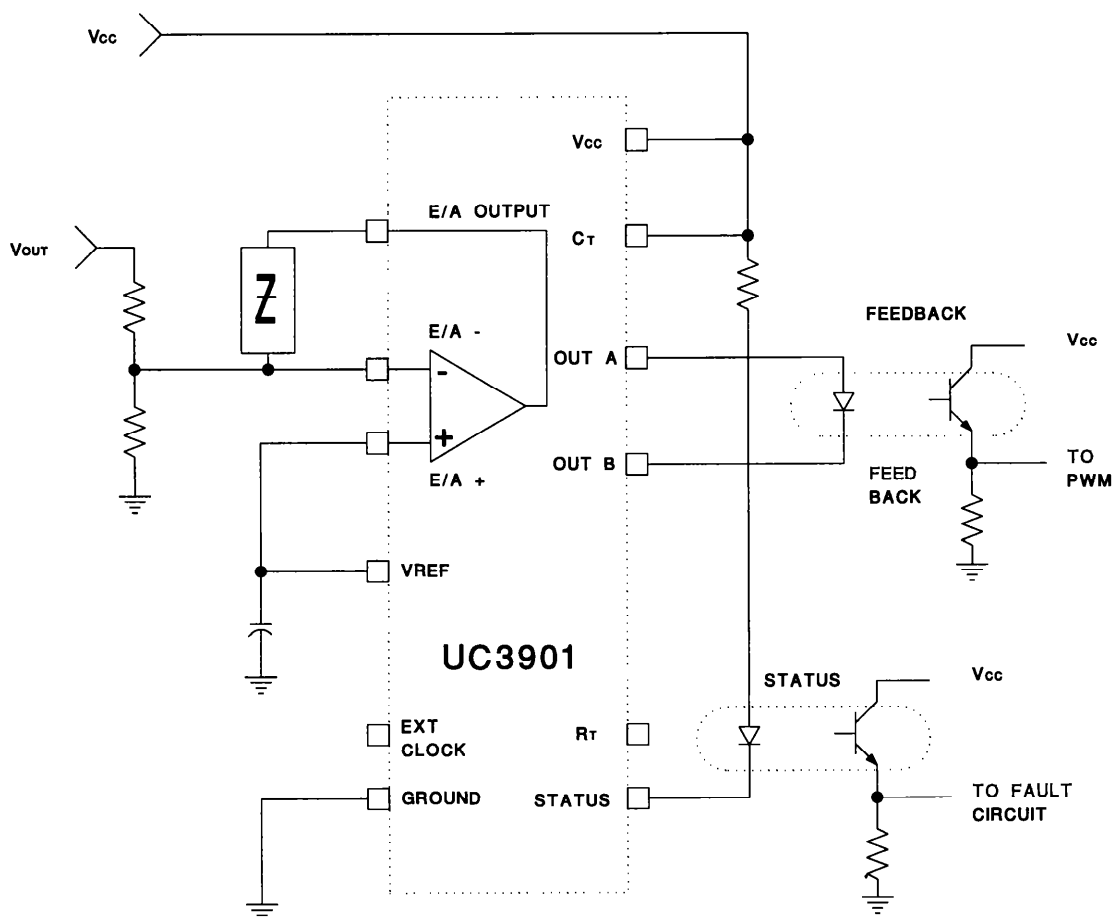


Figure 2.