

PRINTER TECH ARTICLE

HP LaserJet Toner Level Detection

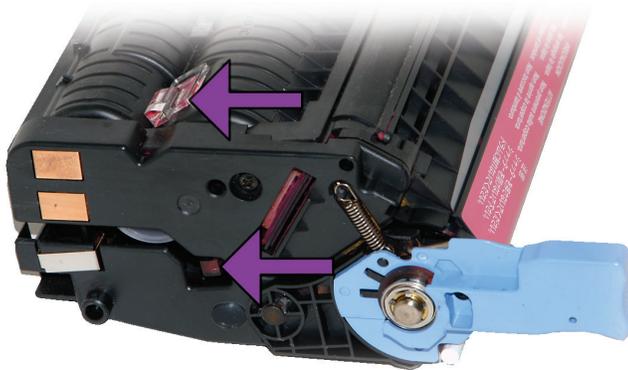
Because an adequate supply of toner is essential for proper operation of a laser printer, all printers contain mechanisms for monitoring toner usage. In this article, we will describe the monitoring methods used by HP.

There are three methods of tracking toner usage in LaserJets. Most use some combination of the three. The methods are:

1. Electromagnetic toner sensing. The AC bias voltage applied to the developing cylinder produces an electromagnetic field in the toner particles. The strength of this field is proportional to the amount of toner inside the cartridge. The cartridge has an internal antenna that detects the field, and the printer monitors the signal from the antenna. When it gets below a certain level, the printer knows that the toner is getting low. This method is quite accurate, but it only works with magnetic toner, and since many color toners are wax-based, electromagnetic toner sensing is used primarily on monochrome printers.

2. Optical toner sensing. The printer directs a light beam into the toner hopper through a window (light guide). If unblocked by toner, the light exits through an opposite window and is detected by a receiver. When the optical receiver detects light a high percentage of the time, the printer concludes that toner is low. When it is unblocked all the time, the printer concludes that the toner is out.

An upside-down 4600 toner cartridge with light guides indicated



This method works equally well for magnetic and non-magnetic toner and is used in many color printers.

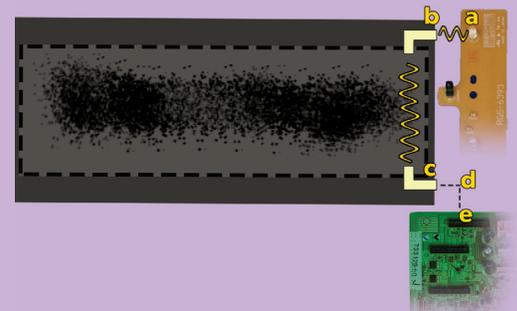
3. Page counts. Toner cartridges are rated to print a certain number of pages at a nominal coverage of 5 percent (meaning that the page is 5 percent toner and 95 percent white space). This takes into account the amount of toner in the cartridge as well as wear and tear on the mechanical components. So the printer can also estimate the remaining life of the cartridge by keeping track of how many pages have been printed with it (this will be more or less accurate, depending on how far the print jobs stray from the nominal 5 percent coverage). Color printers usually also keep track of the number of developer and/or drum rotations, as this can differ from the number of pages printed. As with method 2, this works on all types of cartridges. However, because it is an estimate, it tends to be less accurate than methods 1 and 2, both of which more directly measure the actual amount of toner remaining.

LPT

TONER DETECTION METHODS



ELECTROMAGNETIC TONER SENSING: an antenna detects the electromagnetic field of the remaining toner.



OPTICAL TONER SENSING: Light from the toner sensor PCA (A) shines through a light guide (B) into the toner hopper of the cartridge. If unblocked by toner, the light reaches another light guide (C) and reaches a receiver (D). The DC controller (E) determines the toner level based the signals received.

Black Print Cartridge
HP Part Number: C9720A

Estimated Pages Remaining:

(Based on historical black page coverage of 5%)

Low Reached:

Page Counts: a toner level estimate is made based on page counts at 5% toner coverage