

# Yellow Dots of Mystery: Is Your Printer Spying on You?

by **EFForg** on October 15, 2008

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Author:EFForg [author's website](#)

We are an international non-profit advocacy and legal organization dedicated to preserving the right to freedom of speech in the context of today's digital age.

We are your best friends on the Web!

## Intro: Yellow Dots of Mystery: Is Your Printer Spying on You?



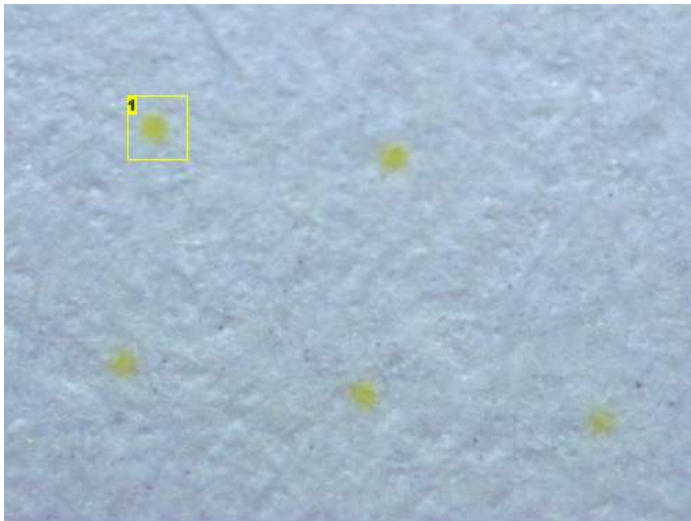
Imagine that every time you print a document, it automatically includes a **secret code that could be used to identify the printer** -- and, potentially, the person who used it. Sounds like something from a spy movie, right?

**Unfortunately, the scenario isn't fictional.** Most color laser printers and color copiers are designed to print invisible tracking codes across every single printed page of their output. These codes reveal which machine produced a document and, in some cases, when the document was printed or copied.

In this instructable, we'll describe **three different ways to see the tracking dots your printer produces**: with a blue light, with a microscope, or with a scanner. If you don't have the necessary equipment for a particular step, go on to the next one.

For further information, or to share your findings, please visit us at <http://www.eff.org/issues/printers>.

Want to help? Download test sheets at <http://www.eff.org/wp/investigating-machine-identification-code-technology-color-laser-printers#help>



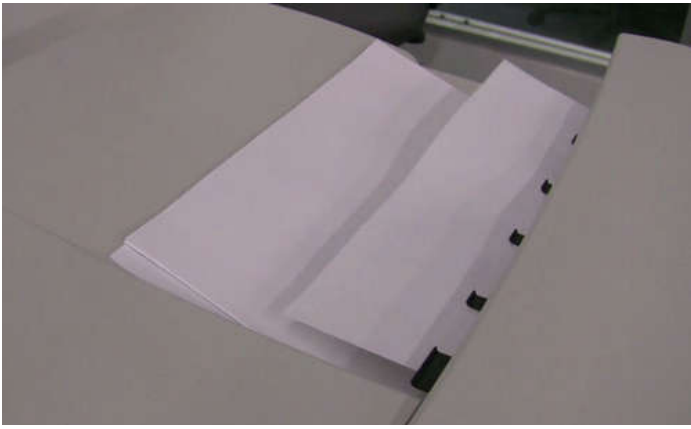
### Image Notes

1. these yellow dots are part of a larger array that can be decoded to reveal the printer's serial number

## Step 1: Print a page with text/graphics

Print out a page from a color laser printer. The page should use color and have some text or graphics on it. You can find a list of printers that we know print tracking dots at our [website](#) .

As you're looking for the dots, keep in mind that they're printed in a regularly repeating pattern across the entire page (not just in the corner of the page), and will be intermixed with other printed data.



## Step 2: Blue light (w/ unaided eye) method

You'll need a blue light for this method. EFF has [blue LED lights](#) available, or you can get a blue LED flashlight or any other strong blue light from any other source. An ordinary battery-powered blue LED will work.

Turn off all the lights, and eliminate as much ambient light as possible. Shine a blue LED light on the blank part of the printed page. As examining a printer page under blue light improves the contrast, the yellow dots should appear black.

If you have good close-range vision, you should then be able to see them easily. They might initially look like small flecks of dirt or dust. If you can't see the dots this way, check to be sure that your printer is known to produce them, and try asking a friend to have a look.



## Step 3: Scanner method

Scan your printed page on a color flatbed scanner at 600 dpi; this makes the dots visible in the scanned image. Modifying the scanner isn't necessary, since it already has a blue light.

The dots can be seen easily by enlarging the scanned image, or by performing a color separation in software and examining the blue channel. A wide variety of image-processing software can perform color separations.

Here are two ways of examining the blue channel with free/open source software:

1. In GIMP, go to Layers, then Channels, then Paths. In the channels tab, deselect the Red and Green channels.
2. With ImageMagick, run the following command at a command line (represented here by the \$ prompt):

```
$ convert -channel RG -fx 0 scan.tiff blue.png
```

This creates a new image blue.png containing only the blue channel.

You can also try converting to greyscale, by mapping the blue channel's value to intensity: with ImageMagick, run the following command:

```
$ convert --fx b scan.tiff grey.png
```

You can also do this interactively in Python if you have the Python Imaging Library (PIL) installed. From a Python prompt, run

```
>>> import Image >>> Image.open(scan.tiff).split()[2].show()
```

to see a greyscale image formed from the blue channel's intensity.

PIL can also help enhance the contrast. For instance, you can try the following to sharpen the color contrast between the dots and the page:

```
>>> import Image >>> blue = Image.open(scan.tiff).split()[2] >>> blue.point(lambda x: (256-x)**2).show()
```



#### Step 4: Magnifying glass or microscope method

Place the printed page under a microscope or look at it through a magnifying glass (ideally with a magnification of 10x or more). Even under normal ambient light, the dots are easy to see. We tried two USB computer microscopes (DigitalBlue and Dino-Lite), but any kind of microscope should work.



#### Step 5: Now what?

Now that you've seen the dots, what can you do?

- **Learn more.** Visit us online at <http://www.eff.org/issues/printers/>.
- **Show your friends.** Despite repeated media interest -- and limited acknowledgments by printer companies -- the existence of yellow tracking dots and similar digital fingerprints is still a complete surprise to almost everyone. Some people even express skepticism that these tracking techniques really exist. You can help spread the word just by showing your friends that the dots are there.
- **Send EFF your print samples** EFF is continuing to collect sample output from color laser printers to help our research. You can download a PDF file from our web site, print test sheets on your color laser printer, and send them to us in the mail.
- **Contact manufacturers via the Seeing Yellow site.** It's outrageous that manufacturers make secret deals to compromise our privacy. What's worse, some printer companies have assumed that people who object must be counterfeiters. The Seeing Yellow project from the MIT Media Lab is helping individuals get in touch with printer companies to express privacy concerns and ask the companies to turn off the tracking and stop building surveillance features into communication technology. You can find contact information for your printer manufacturer -- or manufacturers of devices you're considering purchasing. <http://www.seeingyellow.com>
- **Join EFF** to support our work on privacy, anonymity, and free speech issues at the intersection of law and technology. <http://www.eff.org/support>

Special thanks to the California Consumer Protection Foundation for funding the project.



## Related Instructables



**Making a typewriter with an old keyboard and a dot matrix printer** (Photos) by furri



**How to encrypt your email with Thunderbird** by M4v3r1cK



**I needed a stand to hold the camcorder in the classroom** by eta-beta



**Circuit bend the DS-1** by lp\_man



**How to Enter the Craftsman Workshop of the Future Contest** by Contest Robot



**Homemade arduino printer** by talesgurjao

## Comments

50 comments

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**Grimmiger** says:

Nov 21, 2010. 12:59 AM [REPLY](#)

I just love how so many people are getting paranoid about the government watching everything we do and print! It is not for that. It is mostly used with services such as law enforcement to be able to identify if a certain note or letter was printed from a certain suspects printer. Also it allows other agencies to determine if it is actually from where the letter says it is from. Think of it as more of a personalized watermark. Please do not reply to this comment if all you have to say is the government are out to get us.



**christzilla** says:

Jan 30, 2011. 4:18 PM [REPLY](#)

the government are out to get us



**mudslinger777** says:

Sep 4, 2010. 12:59 PM [REPLY](#)

Why is that one guy wearing a lab coat and safty goggles? Is printing really that dangorous? What a joke!!



**atombomb1945** says:

Oct 22, 2008. 7:02 AM [REPLY](#)

"It's outrageous that manufacturers make secret deals to compromise our privacy." What privacy? How many times do you send a letter to some one and you **do not** want them to know who sent it? This is not any different than your IP address being included in an email or saved at a website.



**daltonjcw** says:

Sep 2, 2010. 7:27 PM [REPLY](#)

So, invading your privacy is ok, since you've go nothing to hide, right? I'll be sure to hack instructables to get every thing I need to know about you to eliminate your intellectual life, get you locked illegally in a government facility, And have your family and friends searched and bugged. Still Sound like a good Idea?



**austinfavero** says:

Jun 11, 2010. 1:26 PM [REPLY](#)

It's very different actually. Just because we are all spied on while surfing the Internet in the name of security, does not mean that should spread to any other area's of our lives. It is outrageous.



**11010010110** says:

Oct 22, 2008. 1:19 PM [REPLY](#)

when you print something you expect it to be anonymous unless you intentionally signed it for love letter (do you really want it to be anonymous ?) you probably just print and its anonymous. for some other stuff you may want to use a generic font / shred the text with babelfish / handle the page with gloves. you sure dont want the dots there



**Cereleste** says:

Oct 22, 2008. 5:42 PM [REPLY](#)

The dot's don't identify the person, right? Just the printer. Then this has nothing to do with privacy. The dots will only tell someone that a XXXprinter printed it, not Bob Smith printed it.



**daltonjcw** says:

Sep 2, 2010. 7:29 PM [REPLY](#)

Yes, So smash your printer with a hammer, and print at the library. Except it's still an invasion of your privacy.



**static** says:

Oct 25, 2008. 12:15 AM [REPLY](#)

However if you send in your warranty card, your privacy would be compromised. Your choices. Rick that the product you buy isn't a lemon, and don't send in the card. Protect you pocket book, by risking your security. Today merchandise can be trace from factory to retailer. Not a stretch to imagine the trace from retailer to purchaser. I fail to trust that every bar coded item I purchase is not link to my checking and/or CC accounts. Paranoia? Perhaps, how can we know for sure?



**11010010110** says:

Oct 25, 2008. 2:03 AM [REPLY](#)

bar codes are not an issue - they are the same on all stuff of the same type you'd better go google on RFID :) many new printers come now with online registration feature in the setup wizard. im sure this registration includes serial # of the printer and some data from the computer we have one such printer / scanner combo from HP and the thing is quite annoying (with options only 'now' and 'later' and cannot be disabled. it gets back to startup when you use the scanner)



**grubbyjeans** says:

Oct 24, 2008. 9:44 AM [REPLY](#)

I know of at one count of the operator being identified and convicted by comparing the operator log with the time stamp in the code. I serviced one particular color printer that included firmware to recognize currency. We were warned, sternly, during training that we should NOT attempt it. The instructors stated that they did not know how the firmware worked or how it affected the printer. Since it was a network printer it had the capability of reporting such attempts.



**papalevies** says:

Oct 26, 2008. 6:36 PM [REPLY](#)

Not only that, even my scanner (canonscan lide 90) can't scan currency (tried it Euro). What is the logic in that??? So I can't send pictures of money? I should return it to the shop.



**11010010110** says:

Oct 24, 2008. 5:36 PM [REPLY](#)

wow ! this story with firmware just shows how the \_government\_ is paranoid what make and model is that printer ?



**grubbyjeans** says:

Oct 24, 2008. 7:09 PM [REPLY](#)

Xerox - I worked for them 33 years. The technology is used in mostly color and all models have something similar. The quality was so good that copies would be accepted by scanners. Something had to be done to prevent counterfeit.



**11010010110** says:

Oct 22, 2008. 6:29 PM [REPLY](#)

scenario 1 your boss asked you to print some stuff for him with deadline. deadline passed and you did not do that. boss calls and asks whyits not ready. you tell him you sent and thats the mail service fault (and not yours). you sit to print it and remember to write there the date of 2 days ago (to make the show perfect) boss recieves the mail. he is freaked off how late the docs arrived and shares his rage with a friend. his friend suggests him to check the true date encoded in the dots and decode that using the calculator in the EFF site scenario 2 you are a journalist who uses the computer for his professional stuff as well as his personal stuff. he prints a document that he wants to make confidential so that no one can get on him if the document falls in the wrong hands. the document does a month ago his daughter married an he printed the invitation letters on the same printer. one of those letters is enough to link him to the confidential doc via the printer serial number the dots contain information that you did not intend to include in the document you print and you are likely to be unaware of its existence. this is a privacy issue. no need in your name it may be very complicated to find by incident a titled document printed on the same printer - so it does not look that severe. possibilities become huge when dots meet other info that can be esily crossed with them - like where was batch of printers of model X and manufacture date Y sold - probably available from the manufacturer lets wait for the EFF guy to explain more



**atombomb1945** says:

Oct 23, 2008. 7:13 AM [REPLY](#)

Cereleste, you are correct, the information is just Lexmark - serial number xxxx-xxxx-xxxxxx and perhaps the date and time. This is not printing out your name, address, and contact information. 11010010110: Both Scenarios are possible, but not really probable. Unless that Boss makes it a policy to look at the dots on each page, then he probably would not even think about it. If someone is using a printer for both "questionable" business practices and personal use, he deserves to be caught. Base line point is this: If you are printing something out that you do not want to be linked to in any way what so ever, make sure you have an older printer that does not support the dot printing.



**atombomb1945** says:

Oct 23, 2008. 7:16 AM [REPLY](#)

Post Script: This is nothing new. Forensic Detectives used to be able to tell what typewriter was used to create a letter based on the pits in the letters as they stamped into the ribbon and paper. Some companies would even put these pits into their letters on purpose so that it was a form of signature that their typewriter was used.



**static** says:

Oct 25, 2008. 12:28 AM [REPLY](#)

Comparing apples to oranges. The detectives have to have both the document and typewriter in hand to connect the document to a typewriter, and the typewriter to an user. Same goes for using old school methods used to match a document to a printer. Now only the document is the only thing needed to connect it to a specific printer.



**technodude92** says:

Oct 23, 2008. 8:58 PM [REPLY](#)

You do realize there are other ways to tell where a document came from... Forensic scientists and the FBI don't need fancy dots to tell them where a document came from. And if every model has a different method of placing dots, it would take more money and time to develop a database of different methods and then cross check the dots with the database. I don't believe it's worth it. And i guarantee I'll get a scathing reply about "the man" and how "big-brother" is watching, but i still believe that this is the printer manufacturers decision and not the government violating your freedom of speech.



**neorazz** says:

Dec 12, 2009. 9:24 PM [REPLY](#)

not true the fbi created the method... i fix copiers. no color copier is allowed to be sold in the usa without this dot pattern encoded in the image it is created in the print engine not from the image process even when the machine is internally calibrating itself these dots are formed and visible on the transfer belt the only information encoded in the dots is model numbers and time and date that way if a fraudulent document is found it can be traced back to the source ...one day the fbi showed up and took an entire machine as evidence when some funny money showed up...BTW most high end color copiers can detect money being printed on them and will actually code to the point where your local rep cant fix it and a rep from the manufacturer has to come in and reset it ...that how deep the rabbit hole goes my friend for the manufacture i represent there are only 4 people in the usa that can reset that code



**static** says:

Nov 5, 2008. 11:48 PM [REPLY](#)

But such a database would connect a document to a model of printer, not to an individual printer, as the coded dots do. Nothing to do with big brother watching or free speech. The USA darn nearly descended into McCarthyism, with no respect for the bill of rights, post 9/11. No need to give the government more tools to harass anyone that doesn't tow the nationalists line.



**technodude92** says:

Nov 6, 2008. 4:38 PM [REPLY](#)

The government doesn't harass those that don't "tow



**altered\_tome** says:

Oct 27, 2008. 3:06 AM [REPLY](#)

Then why ask the printer companies to institute the yellow dots, if they don't need them? And if they asked them to include this technology, then don't you think they maintain a comprehensive database of what the dots mean? It's not like Xerox/XP/Canon etc. has a vested interest in what you print.



**technodude92** says:

Nov 4, 2008. 7:51 PM [REPLY](#)

i think the effort it would take to maintain a database of yellow dot patterns outweighs the benefit. To answer your question, no i don't think the government maintains a database of yellow dot patterns, and Xerox, HP, Canon, Brother DO have a vested interest in what you print, or rather how you print.



**atombomb1945** says:

Oct 24, 2008. 11:53 AM [REPLY](#)

You are correct, this is not something that the government has in created, it is only a digital signature of the printer. Now if someone were to say print off a threatening letter and send it to someone, then this could be used to **help** track the person in question down. But just by looking at the dots on the page would not be all that it takes.



**technodude92** says:

Oct 24, 2008. 8:27 PM [REPLY](#)

my point exactly.



**NinjaSloth** says:

Oct 22, 2008. 9:12 PM [REPLY](#)

out of curiosity what does your name say in binary?



**11010010110** says:

Oct 23, 2008. 4:39 AM [REPLY](#)

ash



**Plasmama** says:

Oct 23, 2008. 10:14 AM [REPLY](#)

ash? Then why does my binary translator says you are 0 ?



**11010010110** says:

Oct 23, 2008. 10:29 AM [REPLY](#)

11010010110 --> 10100101 --> A5 (hex) --> A5h --> Ash



**papalevies** says:  
Nice! Why do you trim the "1" and "10" though? Signal start/end?

Oct 26, 2008. 6:51 PM [REPLY](#)



**computer\_freak\_8** says:  
Clever!

Oct 26, 2008. 9:53 AM [REPLY](#)



**beehard44** says:  
what if you have black ink?

Aug 29, 2010. 10:27 PM [REPLY](#)



**RN1358** says:  
I have been servicing copiers and printers for over 30 years (unfortunately). The yellow dots you are talking about are there to prevent counterfitting, not so much for currency, but for Stock certificates, Bonds, etc. I have been told by several manufacturer's reps that the yellow dots are required by the government, but I have not been able to verify that as fact. As for the comment that "your printer is spying on you", Canon, Xerox, Minolta, etc. couldn't care less what you copy...they just want to sell more printers, copiers and supplies! Most newer color copiers also will detect if you try to copy currency, and prevent it from printing out. One model I use to service would generate an error code that had to be reset by the tech if you tried to copy currency; another model would display a warning the first 2 times you tried to copy currency, and on the third attempt, the machine would be disabled, and would require the replacement of a very expensive main pcb to fix the machine. And, of course "nobody here tried to copy money" was the first thing the customer would say!

Jan 15, 2010. 9:26 PM [REPLY](#)



**djr6789** says:  
i tried making giant a4 sized £10 notes and my printer stopped working :O and now i know why :O

Feb 12, 2010. 5:23 AM [REPLY](#)



**mortal101** says:  
I have no color ink and I bought my printer at a swap meet 3 years ago. They could never track anything to me if they wanted.

Nov 1, 2008. 5:30 AM [REPLY](#)



**lcalasari** says:  
Correction: They could never track you via your printer

Jan 14, 2010. 7:28 PM [REPLY](#)



**mikegraham** says:  
If you were a suspect, they could find your printer.

Nov 4, 2008. 8:34 PM [REPLY](#)



**itsme123** says:  
why could not you just print a blank page many times thru different printers ( or print in white something like a period). running it thru top first , then bottom first then thru other printers, it would be hard to tell which printer made which mark making it hard to tell exactly where each mark came from

Jul 6, 2009. 9:47 AM [REPLY](#)



**zomfibame** says:  
Just a very simple, basic question for you guys; the identification dots printed on home printers..... are they all yellow, in every brand of printer? because if that is the case then... why can't one just adjust the yellow ink 100% down in an expensive printer, and in a cheap one where you can not adjust the percentage of each ink color.... just remove the yellow ink container. If a person wanted to make political publications, I'm thinking that the lack of yellow ink would become a political statement in and of itself; wouldn't it? If the publication had only red, purple, blue, and black, but NO yellow, and as a result, no green.... then that itself would be a political statement. so, like I said, why not just "turn off" the yellow ink? ohhhh, and also, Is there anything at all that I own that the government can't track? hummm, I wonder if they can track my toilet-paper too?

Nov 1, 2008. 9:58 PM [REPLY](#)



**Azayles** says:  
Also no red, as red is made from magenta and, you guessed it, yellow :P

Jun 14, 2009. 1:42 PM [REPLY](#)



**ricardjorg** says:  
i think that if the printer "decides" to add the dots without your order.. even if you set the yellow settings to 0%, it would still print the dots, even with your specific order.. it would be best just to remove the yellow ink container.. in my hp its not possible to do, since the yellow is together with the magenta and cyan..

Dec 9, 2008. 8:47 AM [REPLY](#)



**ac-dc** says:  
A typical color laser printer will not print with one of the cartridges missing. Empty, yes, missing, no.

Feb 12, 2009. 9:30 PM [REPLY](#)



**mettaurlover** says:  
just replace it with a different colored empty cartridge!

Aug 14, 2009. 1:52 AM [REPLY](#)





**ac-dc** says:

Aug 14, 2009. 1:37 PM [REPLY](#)

That would be the same as it being missing, color laser printers can identify whether the cartridge installed is the right color and won't print if the correct color cartridge is not in every slot. Older models might still print, but most color lasers have been able to identify the cartridge for several years/generations. I checked a website to see if mine was known to do the yellow dots and it wasn't listed because it was too new, but the 2 or 3 prior models from years past that it is based upon are on the list.

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**lcalasari** says:

Jan 14, 2010. 7:26 PM [REPLY](#)

Best solution would be to print using a yellow sheet of paper

---



**ac-dc** says:

Jan 15, 2010. 1:36 PM [REPLY](#)

You really think the government scanners set up to detect these dots couldn't see toner on a page that's the same color?

I'd bet I could even see it with naked eyes, because today's typical color toner is glossy (high wax content).

Plus, it occurs at a regular interval (spacing per set of dots), the whole point of them is to provide a way for them to be detected/identified.

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**lcalasari** says:

Jan 15, 2010. 2:28 PM [REPLY](#)

Glossy paper? If you can't get a hold of that, then find out the exact colour that the dots are (may take awhile), and then print all of you paper solid yellow, using that exact shade, before using it

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**ac-dc** says:

Jan 15, 2010. 8:55 PM [REPLY](#)

You seem to be overlooking that the ultimate goal is not to foil the "man", it's just to continue using a printer in a cost effective manner. Who wants yellow paper?

What is the point of a laser printer on yellow paper? You do realize a laser printer depends on a white background as the mix for the colors right? Light blue isn't light blue with yellow paper, it's green. Gray isn't gray, it's yellow-gray. Totally defeats the purpose of having a color laser printer.

Also, same exact shade of yellow, on glossy paper, it wouldn't matter. It still won't have the same reflectivity, toner covers up the paper fiber texture present when it's dyed fibers (to make colored paper), and a simple chemical would react with the paper but not the plasticized and wax toner so no matter what color the paper started, no matter all the other what-ifs, it's still so easy to reveal the dots that any layman with a high school chemistry class under their belt could figure out a way, let alone the government who has full specs on the issues and sophisticated equipment set up for this very thing.

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[view all 155 comments](#)