

The Variables of Calculating Ink Consumption

■ How much ink does your business use for each job? How about consumption per week for all printers combined? What about ink used on a monthly basis? Hopefully the answer is a lot, as that would translate to high volumes of billable printing, with the majority of the ink going on to media, and directly billed to a client. Tracking ink use is a slippery topic compared to tracking square feet or meters printed, and the amount of material waste generated. But tracking ink usage has become a little easier these days, thanks to drop counters and job accounting software. But why is tracking ink use so difficult?

Ink use numbers have a tendency to evade collection for a number of reasons. When you purchase ink, is the shipping cost distributed or added to the cost per milliliter for each ink container shipped? When performing print testing for color or design for a client, is the ink use tracked? How about ink use for media and ICC profiling, cleaning cycles, head purges and ink used during non-use overnight or machine idle time? Let's look at each of these in a little more detail.

Old School

First, there is the topic of ink calculation in, either, dollars (your currency) per

milliliter, or in milliliters used. The raw cost of the ink is just your price (plus shipping) divided by the container's volume. For example, if I buy a cyan cart containing 775 milliliters of ink for \$219 plus eight dollars shipping, the total cost for the cart is \$227, which should then be divided by 775. The result is \$0.293, which just rounds down to 29 cents per milliliter. But we still don't know how many milliliters are used per square foot, or square meter. In this past, this has been a long term tracking project. How many square feet/meter did we print this month, versus how much ink did we run through the printer. You would need to record ink container changes for each printer, per month, diligently. Also required is the total area printed by each printer. After some persistence and a few months, you will get a basic number. Keeping track this way also averages out the type of image printed, heavy versus light coverage jobs, and will only give you an overarching rate for the cost per area.

This method also assumes that the ink from the container goes directly to printing, which may or may not be the case. Some equipment may simply load ink from the cartridge/pouch/box into an onboard secondary ink reservoir for future

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Jeff Burton, Digital Printing Analyst, SGIA

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use. In systems that have this secondary ink storage, keeping ink use statistics becomes really frustrating. You can still count ink containers and total square feet printed, though it may take longer to get to some usage numbers.

Print, Clean, Repeat

For inkjet heads to remain at the ready, they need to be cycled to ensure that there are no clogged nozzles when you want to print. For the case of cleaning or purge cycles, manufacturers know what the volume of ink used is for these procedures, one just needs to ask what that volume is. If you have your print operators keep track of these cycles in a log, you can start accounting for this ink use. You also have to account for ink used during sleep or overnight maintenance cycles. Many printers are kept on standby during the overnight hours and have their sleep interrupted for a brief cleaning cycle. The period between cycles can sometimes be lengthened, depending on the printer, to minimize ink use during standby or sleep times. Again, you can ask the manufacturer about resetting these cycles.

Counting Drops

I would recommend that you start by using the ink consumption calculators that are built into RIP software. I hear you already, “But are they accurate?” Yes, they are approximate, but it will get you closer than counting print jobs and ink inventory. Nevertheless, you should do both. One distinct advantage to RIP drop counters is that ink use is broken down by color, which is extremely helpful when calculating more expensive white or metallic ink costs versus the other common color costs.

I ran a comparison between three commonly used RIP software packages to gain a better understanding of ink consumption numbers generated. For all of the RIP software, the first order of business is to enter the picoliter drop size or sizes (variable drops) that your printer is using. In some circumstances, this number changes whether you are running the printer in variable droplet or in a fixed droplet mode. In other cases, the RIP software has prepopulated this number. The drop size usually is supplied to RIP software manufacturers in a software developers’ kit (SDK) from the inkjet printer manufacturer. After entering all of the drop size numbers, you will then enter the cost of the ink, usually in dollars per milliliter (\$/ml), or in weight measurement. To figure this, just divide the cost of your ink container (plus shipping) by your total ink volume, very simple. In-RIP drop counting has a few distinct advantages.

Ink use for the print can be calculated without actually printing the job, as the RIP calculates the cost either as it RIPs the job or in a subsequent pass. Paper costs are usually added to this calculation, with actual square feet printed, or print area plus waste generated at the same time. The cost of paper can also be introduced, so that you can have a projected/actual cost log for media plus ink costs per image printed. Back to my comparison...

I printed to an HP Z6100 PS printer using two different standalone RIP packages and printed direct using the HP print driver from Photoshop on a Mac. With the HP, cost accounting software is built into the device driver utility, with all processed jobs listed and results that can be exported to Excel.

The print size for this test was only 15 by 20 inches, but for the print made directly via the Mac HP print driver, the ink usage was the highest, at 2.82 milliliters. This was due to the fact that there are no ink restriction modifiers in a print driver aside from the choice of paper, which is the ink limit setting in an OS print driver (no RIP used). Print drivers also have no GCR/UCR settings with which to optimize ink use, so direct print drivers would be expected to have the largest ink use versus software RIP packages.

The second print was made the same size and printed in the same mode — 1200 x 1200, eight-pass bi-directional — as the HP print. I used a popular RIP software package profiled for that paper and those same particular printer settings. This software stated that the ink used for the same print was down to 1.7 milliliters, a 39 percent ink savings for popular RIP versus no RIP. The percent savings get smaller when you compare RIP to RIP because the majority of RIPs have profiling features and varying manufacturer methodologies for ink restriction, GCR/UCR and light/dark ink start points.

The last print to test ink consumption was with another popular RIP software that was profiled to use the same printer resolution, media and passes as the other two tests. This software reported a very close 1.66 milliliters of ink used for the test image. For this RIP, the savings was in the neighborhood of two percent, although differences between RIP ink usages for the same print could range from 10 to 30 percent.

This was just a cursory test, as ink limits and other RIP variables are difficult to set and assess when trying to create an “equivalent print” across multiple software packages without aim points (using visual assessment only). Some RIPs now have an export or cost accounting function or module that allows job-costing functionality. I think this is the right direction to move for RIP

manufacturers, as digital printers need this information quickly and seamlessly. But what affects ink consumption in the RIP?

Controlling Ink Use in the RIP

The quick answer is everything in the RIP that is a variable, has a direct effect on ink use. Let's start at the beginning of the process of building a media profile, with the ink limiting. In this stage, you will output a test file that shows increasing densities of the major ink channels, CMYK. Reading in these chart values examines where in the patch set adding more of a color ceases to increase the color's chroma. Usually this step is quantified with spectrophotometers, but the patch/number should be corroborated by a visual check. Errors in this stage will be directly related to ink consumption. The linearization stage offers no ink modification adjustments, but the step that allows for per channel ink limiting with overprints is another overlooked area for ink savings. If this visually adjusted step is miscalculated, then over- or under-inking conditions may occur. Another often-overlooked area in the RIP is light ink crossover or transition settings. Check with your manufacturer to help you define proper settings for your media and image type. This is only for printers that have light cyan and light magenta inks.

At the stage of media profiling, right before actually building the profile, there is an area in the software that will let the operator change how the profile treats grey component replacement (GCR) and/or under color removal (UCR). GCR and UCR, when used correctly, will enable users to get the best print using optimized ink levels for greatest ink savings. But dialing in these particular controls takes a little patience and testing, depending on the types of images you print. GCR and UCR are often misunderstood and confused with each other, because they originate in the offset print domain.

GCR uses the simple principle that black should be used to replace neutral (CMY gray component) areas in the original image. The two controls are often used in combination with each other, GCR defining how much black to use, and UCR to control how much CMY to remove. Settings for GCR and UCR at the RIP level are global and affect all files processed by the RIP. One could make various profiles using different degrees of GCR/UCR and save those profiles as separate printing environments, but this is too time consuming and cumbersome.

Ink Optimization Software

Remember that GCR and UCR modifications were originally inceptioned for color separation work and offset presses. Designed with the intention of saving expensive colored inks and avoiding unduly high ink weights — which cause unwanted transfer of ink between sheets and drying or peeling ink issues — these were migrated to inkjet, but could only be used in a global manner for each image processed. The latest concept for inkjet ink optimization is to apply GCR/UCR dynamically, versus the standard global preset approach, throughout the image. Doing it this way provides for the potential of maximum ink savings for images that allow it. Optimization software can either be a module that works inside an existing RIP application, or, in some cases, a standalone application or server configuration. Each manufacturer does have its own methodology for doing this, but there are significant ink savings to be had with this type of addition to one's workflow.

Conclusion

It is not difficult to track ink usage, once you know your printers' ink use behavior when you are not looking. Be aware of the ink savings potential in the basic steps of building a media profile; do not be afraid to test new settings for savings potential. When in doubt, ask your manufacturer about recommended settings, for both software and printer, to aid in ink use optimization settings. Use the on-board drop counters that RIP software provide, being aware that the usage numbers are approximate, varying by +/- 10 to 15 percent. You can always corroborate RIP generated numbers with old school pencil and paper tracking methods.

Jeff Burton is SGIA's Digital Printing Analyst, and provides solutions to digital printing production, color management and application issues, as well as digital equipment and vendor recommendations. In his more than 20 years in the industry, he has worked as production manager, member consultant, trainer, author of numerous technical articles, and presented at a variety of industry events. His extensive background in digital inkjet printing, digital photography, graphics applications, and production methods, serves members by supplying customized solutions to their daily imaging problems. Jeff currently instructs the Color Management Boot Camp, at SGIA's headquarters in Fairfax, Virginia.



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