Levels of Process Automation in a Offset Press

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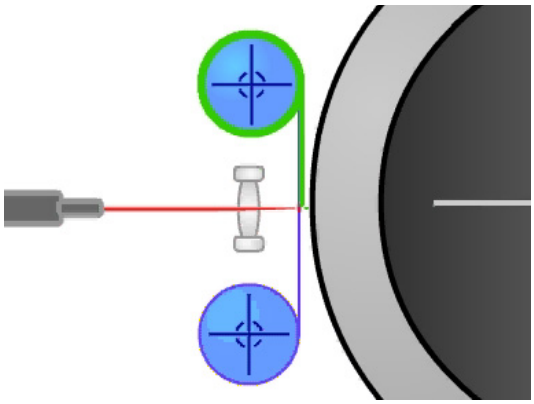
It's an honour for me to make a speech in midst the digital world. The world I come from is Offset. Offset is an analogue printing process with – in the earlier days - analogue form production (film-plate-cylinder). Form means a master we print off – so it's an IOPM-process.

Over the last years digital technologies entered the forms production. Data are now sent digitally direct to a plate or – in our case - direct to the cylinder.



DICOweb™ - direct inpress imaging thermal transfer process

Many interfaces disappeared, many conversions on the data path disappeared. But we still use an analogue print process.

Reason for this is, that the print reproduction using Offset is faster in an order of magnitude than any digital printer. A highly productive Offset printing system prints up to 3 million Letter size pages/hour. The necessary consumables are less expensive; therefore cost per copy is dramatically lower than with any other print process.

And this is a well-accepted technology – 80% of the print market is fed through Offset.

The print process itself is a very complex one. We run a mainly 3media combination, ink water and paper, causing a certain complexity and lots of trial and error approaches to find the right combination for good quality. So inks have to be specified.

The ink is dosed by ink keys or ink pumps, each responsible for a printing width of about 1½". Up to 15rollers per inking unit are producing an even ink film fed to the form, transferred to the blanket and from there to the print. The ink film on the paper is about 1 to 2microns in thickness.

Talking about controls I'd like to start with the inker itself, the heart of an Offset printing press. In order to understand the necessary controls I have to tell you some specifics of these inking units. *(Inking Unit)*

During start up an inking unit causes a certain amount of waste. This results due to an unbalanced ink flow during start-up. We have installed a function called Quick Start (patents pending), which compensates the typical inertia of an inker. Waste can be reduced. (*Quick start).*

Temperature in the production site and in the press itself influences the result during the print run. The more productive a printing system is, the more heat is transferred into the rollers. Viscosity of an Offset ink changes with a factor of 2, having an increase of temperature of 10degrees centigrade. So, we usually install a tempering of the ink train, which controls compensation of temperature drift. During the print run the resulting density can be held constant in a range of +/-0,08D using that function.

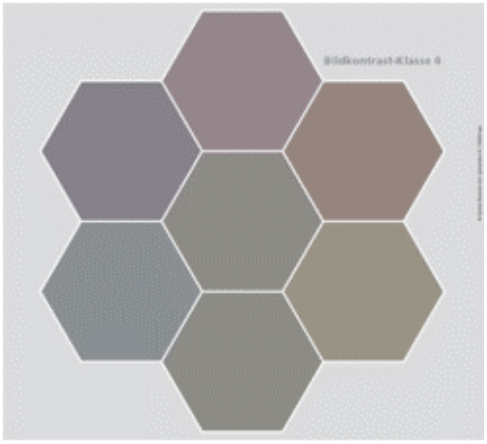
Low coverage is another challenge to handle. As long as there's an even consumption of ink and water everything's fine. In case we have low ink consumption the emulsification of ink and water, which takes place in the inker is critical. For low coverage – let's say a 2% screening or only a very tiny spot on a white page - you'll get much less ink consumption than water consumption. The ink is in danger of getting over emulsified. The ink film is in danger of tearing. In order to print such images we there control the ink flow in a very special way. We only open every second ink key. This is called low coverage stabilisation LCS (patents pending).

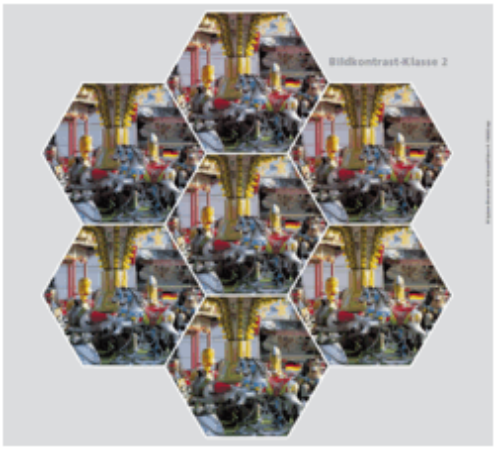
Now, you heard about some internal controls in the inker, we heard we have to stabilize the start-up, the continuous run, a low ink consumption, but you have to be aware that anyway 8 inkers (double sided, CMYK-printing) have different properties, different settings, so in order to get an even output they have to be calibrated before.

A 4colour test form has to be printed (FOGRA IT8.7/3) and measured colormetrically in the test fields. Roller and cylinder settings are adapted accordingly.

Based on that calibration, the presetting specific for the individual image can now be done.

Offset can reproduce a 1% coverage as well as a 100%. It is used for the most difficult to print products like the ones for the cosmetic industry. The human eye is characterising skin tones in a very sensitive way. Color deviations are identified quickly. That's why the industry has developed tools to control this very sensitive issue. System Brunner – a Swiss based company – offers a grey scale control.





www.systembrunner.ch

Talking about quality, most of the plates/forms for nowadays use are imaged in 2400dpi, the thermal transfer imaging of the DICOweb™ does 3200dpi – sufficient to fulfil highest quality needs. Taken as given that an imaged pixel is correct in size and shape, the print process itself making it worse due to the ink- and water-emulsion which is squeezed between form and transfer cylinder and between transfer cylinder and substrate *(Printing Unit)*. This is causing dot gain. Dot gain is the deviation of the target dot size causing color deviations at the end. It can be corrected if the deviation is well known for the used inks and related to each single printing couple.

So each new job, each imaging of a new form offers the opportunity to adapt dot gain in the imaged master. Direct inpress imaging helps for short reacting closed loop cycles. And despite of having a highly automated process the printer can control the resulting quality and interfere manually according a proof. Anyway the 2400dpi result in 256grey levels at 150lpi.

The resolution is perfect for high quality printing, but at the end we have 4 colour separations to match to each other. A register control is necessary to control this. The printing cylinders carrying the image can be adjusted in side lay as well as in circumferential direction. A camera analyses the printed marks on the running web. It corrects the deviation online. We reach a preciseness of +/-0,05mm=1/500" for all 4colours.

In order to get modular solutions for control and automation – depending on the special needs of print products - we have defined different automation levels A^1 till A^4.

Level A^1 and A^2 are state of the art, level A^3 is getting standard, and A^4 – we believe – is the future.

A^1 is the lowest level: the presetting of a set value for average ink consumption in a certain area of the printed image.

As an example for that level out of the analogue world, plates are scanned and an ink key presetting is generated related to the coverage in an appropriate area of the image. Going to digital, there's a prepress link, which transfers the ink key presetting extracted directly from the image data without any intermediate step.

A^2 is a level where the process is controlled by closed loop systems for density/color and register. We there use medium to highly automated algorithm.

The image data are used as target value, and a matching is been done with a very fast reacting density control system. That density control *("IDS")* controls the ink keys accordingly.

A^3 is a level, where process individualisation takes place. You have to be aware that in a printing press there are different printing couples – each having different transfer characteristics. Due to the master based Offset process these characteristics are compensated individually after every print job. This allowing for a current calibration of every single separation. The compensation values are fed into the next plate/ form imaging.

Talking about process control and process automation more deeply, the question arises which are the demands. Is it only just to reach a good enough quality at reasonable cost? Is it a standardization of the color perception in order to compare print quality coming out of different lots, out of different sites, out of different printing presses and processes?

And a further question arises, if it's only the printing process we want to control and automate. Are there any other processes influencing the quality. Or is the print process the one where all bugs happen and have to be compensated.

Frankly speaking: our approach is, that process controls is not only necessary in the printing press. It starts at the very beginning of a print products life:

The advertiser pays the bill. Somebody is starting a print products life. Somebody wants to earn money with an advertisement. He/she needs the print product to highlight different advantages. He/she wants to address feelings. The content has to convince, has to promote a sales process. At the end the overall effectivity is defined as a relation between expenses and profit.

The process we see is by far an overall view. It starts with the birth of the print product. It starts with an idea, being transferred to an advertisers agency, long before the print process starts.

A^4 is the level, where image content is the determining factor of the process control.

Level A^4 is the level, where the creator enters the process control, where the creator defines the most important areas of an image, where he defines color for example (a special red to promote sales of meat), where he defines colors for target groups to address. This is called generic coding.

Defining important areas in a printed image, controls have to be concentrated to these predefined areas. There are no more control strips triggering the quality, there are only characterising areas in the image doing so. These characterising areas are defined in coverage, in contrast, in colour, in……. Control devices measure directly in these characterising areas, directly in predefined areas of the image.

Definition of these areas has to be undertaken as one part of the complete idea. Measuring directly in the image generate the necessary compensation.

So, level A^4 is the level, where we address the complete process queue.

Level A^4 is the level, where we there start to separate the image into the pure content, a description and a logical structure. That's XML and that's the necessary structure to address content orientation and a cross media world.

As an example I'd like to show you 4 different images with completely different ideas, having different requests on the output result. The most requesting duty would be, if these totally different pictures have to be printed on the same page.

As a further example I'd like to show you the resulting structure in the media world. Every different printing process and even paperless reproduction on screens is linked together in the content orientation. If it's RGB or CMYK or 7color reproduction, every press, analogue or digital, every screen has it own different color gamut. Transfer algorithms have to be defined in advance for every single output device in order to carry the same idea to the addressee in a comparable way.

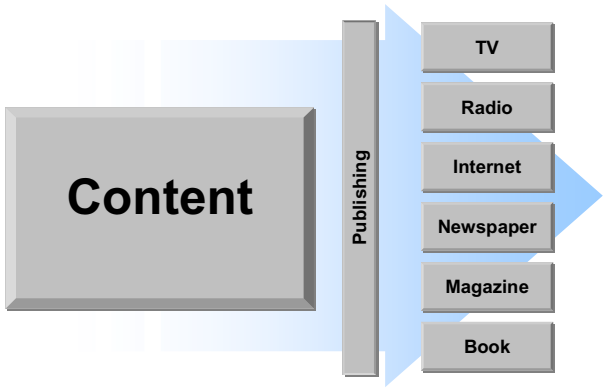
What does that mean for the media world? Up to now process control and process automation was seen as a standardisation for only print quality for one single press. Looking to a complete process queue we now get access to the digital media world – we align together with other digital media like the Internet, using latest XML-technology. Digital inpress imaging allows for direct addressibility as a networking printer.

As long as paper is the preferred carrier for information, Offset printed products will be competitive in the media world.

Content orientation is the possibility for the advertiser to even raise the efficiency of invested money. Inline digital communication between advertising agency and printer is essential to meet a print products intention. What's the target I'm heading to, what are the capabilities I get in print, and there has to be an interfacing link, which does the conversion. The JDF's (Job Definition Format) intention is to communicate between the parties.

We live in a world of publishing. Content is delivered using different medias, having different output devices, with different characteristics.

Content Transfer



Talking about the Internet or the TV or Ink jets or Offset press s - the Content is the driving force.

Biography

Peer A. Dilling, age 48, Mechanical Engineer, Technical University of Munich, Germany. He has been with MAN Roland since 1982 as the Product Manager for "Digital Printing Systems".