NEW GENERATION OF DIGITAL QUALITY CONTROL TOOLS FOR WORKFLOW WITH PDF

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Abstract: The growing use of PDF format in the workflow of the graphic arts indu-stry, especially in the fields of pre-press, pre-media, data exchange and digital output sy-stems, cause an increased need for controlling mechanisms. These will monitor the quality of the digital data itself and the quality status of their repro-duction from a digital output system like digital printers, digital image setters, com-puter-to-plate systems and compu-ter-to-press engines. On the market there are some products known today, which control the PDF documents. Nevertheless, the controllability of the PDF digital output is still missing. The Ugra has therefore developed a new generation of quality control tools in PDF format. This paper pres-ents the function of these quality control tools and describes their use in the future PDF workflow.

Quality Control in Production Process

Professional production in the graphic arts industry requires a control of all involved process steps. Each step of the production process can be understood as a black box processing the input to the output. For production each of the process steps has to be under control. For this reason quality control products have to mon-itor process parameters during production. By using controlled processes it is a suf-ficient method of monitoring the set-up of the production process.

The process starts with the input of the image, line-art, text and design. First the ele-ments have to be processed into data files by scanning, illustrating and typing. The image data will be finished to proper data files by image editing. This creates the input data for the next step, the page layout of the document. At this state one has to take care of the format of the data.

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┌─────────────────┐   ┌─────────────────┐   ┌─────────────────┐
│  Original Image │   │     Line Art    │   │      Text       │
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         ▼                     ▼                     ▼
┌─────────────────┐   ┌─────────────────┐   ┌─────────────────┐
│    Scanning     │   │   Illustration  │   │     Typing      │
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│ Imagesetter │ │  Assembly/  │ │ Digital Proofing│
│    (RIP)    │ │ Imposition  │ │                 │
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│ Film Pages  │ │Imposed Print│
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│Film         │ ┌──────────┐ ┌──────────┐ ┌──────────────┐
│Imposition   │ │CTFilm    │ │CTPlate   │ │Digital       │
└──────┬──────┘ │(RIP)     │ │(RIP)     │ │Printing (RIP)│
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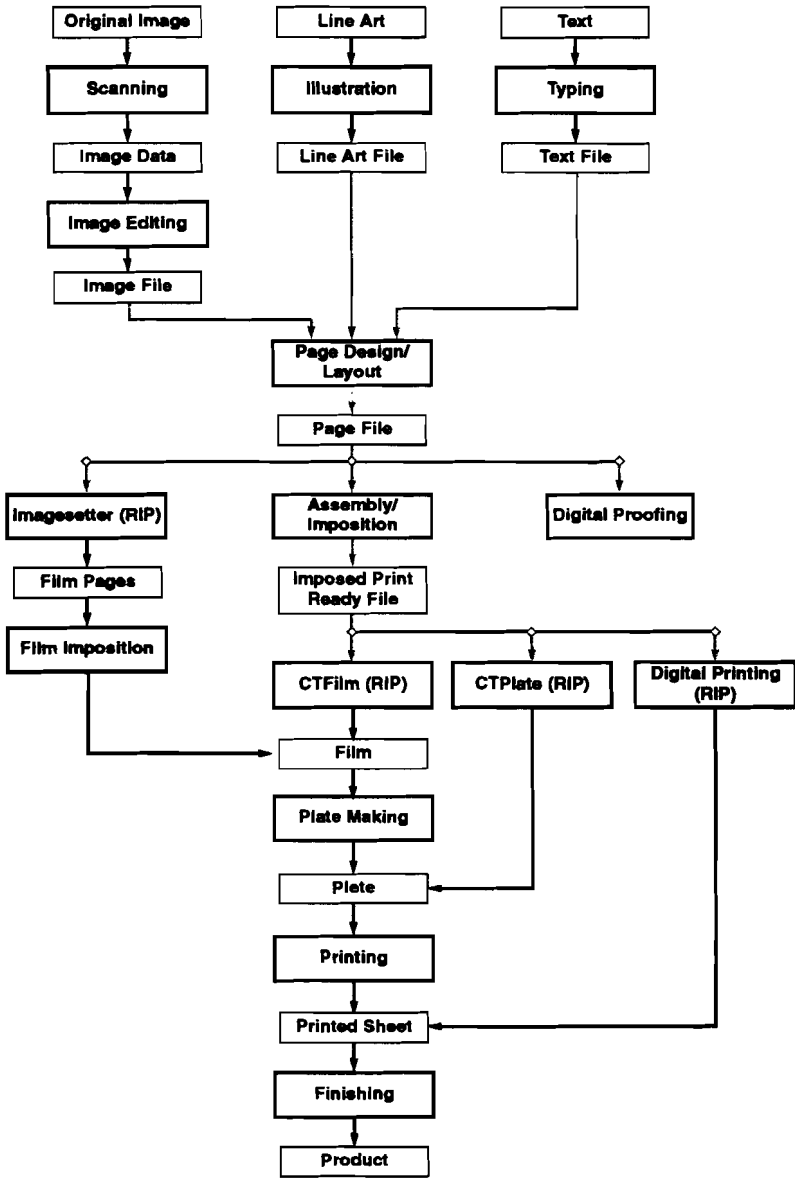
Figure 1   Workflow from original to printed product

In the next step the document will be converted to a printable form. The pages have to be arranged either by using software for imposing or by using film following the conventional plate making process.

In this state quality control products can be imported for controling the quality of the following process steps. Five different procedures for output has to be taken into account:

- Conventional plate making process
- CTF, computer-to-film
- CTP, computer-to-plate
- Digital printing-system
- Digital films based on manual assembly

The workflow with conventional plate making process needs five additional process steps: separation and creating film pages, film imposition, plate making and printing.

The computer to film workflow CTF deals with the process steps: separation and image setting of the imposed document, then plate making from the digital forme and next printing.

The computer-to-plate workflow, CTP, deals with the process steps: separation and digital plate setting of the imposed document and printing.

The digital printing workflow needs the only one process step digital printing.

The workflow for digital films is used for exchange of print ready data.

By using any workflow, except conventional plate making, all the pre-media work has to be done digitally. In each output workflow the first step does the rendering, that means the digital information will be changed to an image on material through a raster image processor RIP such as a film-setter.

To control all steps of the listed production process several tools for quality control have to be developed.

Use of PDF in Production Process

For a period of time PDF formats have been used to process image, line-art, text and layout information. The image-editing program PhotoShop 5.5 and the line-art program Illustrator 8.0 import and generate PDF data. The text-processing program MS-Word 8.0 in connection with the print driver PDFWriter makes PDF data. Import of PDF files in MS-Word is not possible.

Concerning the design and layout of a digital document, PDF data can be generated from programs like PageMaker 8.0, InDesign and QuarkXPress 4.0. They generate it either by exporting a PDF or by printing a PostScript file that afterwards will be distilled. Importing PDF data is also possible, when the right import filters are implemented. Using a page file or an imposed print-ready file for output and

data exchange, we recommend using the PDF file format. Five different image data formats were relevant using the PDF file format:

- PDF file with CMYK preseparated image data,
- PDF file with CMYK composite image data,
- PDF file with CIELAB image data,
- PDF file with RGB image data and tagged ICC input profile or
- PDF file with sRGB image data.

Outputting these different PDF files to a RIP or to the Internet will each result in a different treatment (see figure 2). To control each of the process steps and to monitor the quality changes on the document, quality control tools in PDF format would do the best job.
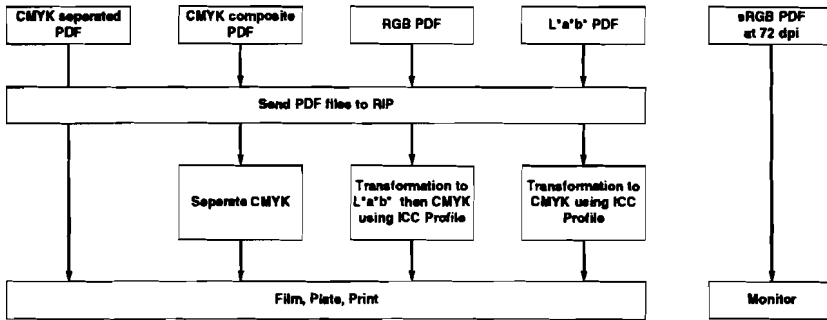
Figure 2   **Output formats using PDF. There are four relevant types of PDF formats for the graphic arts.**

Why PDF Quality Control Tools?

Concerning the PDF format, it is a format for portable documents. PDF works with interpreted data. The PDF its designed to take all the graphic, text and image data as objects with their characters using a display-list. It is still possible to edit the objects - but the relation is lost between objects. The objects are defined in such ways that they will show the same at different displays.

Concerning the workflow from original to the printed product, the input for the most process steps before rendering PDF data format can be used (see gray line in figure 1). And the usage of PDF format will become more and more common.

Thinking on a PDF document, which will be treated through production process

steps, it is of interest and sometimes urgent to know what changes and alteration have been done on the data of the document.

To control each of the process steps - even that one whose input data, was in the PDF format - quality control tools in PDF format are highly recommended.

The above four arguments are enough to look for PDF quality control tools. There, one has to find a way to make PDFs as a carrier of active program catering information by being processed in the workflow.

Quality Control Tools

There exist tools controlling the quality of the several production steps. Depending on the step they exist as hardware eg, films or as software using PostScript. PostScript has the ability to generate test patterns depending from the resolution of the output device such as image-setter. From the view of programming there exist two kinds of quality control tools namely
a) Tools generating fixed pattern and
b) Tools generating interactive pattern.
Tools generating fixed pattern will be licensed to a certain output device considering device-specific data like resolution and screening. The quality control tool generates the correct pattern only during output on the specific device.
Tools generating interactive pattern are programs asking the RIP about device-specific data like resolution or screening. This quality control tools generate on every output device the device-specific pattern and they gather output information about the output device. All of the digital quality control tools from Ugra/FOGRA are active tools asking the RIP while outputting about device-specific data. This interaction stands for generating on every device the desired pattern.

Using the PDF format for a quality control tool, at first glance, interactive patterns can not be generated. Using the most common program generating PDF documents Acrobat Distiller, the interactive PostScript tool will change to a PDF document with fixed patterns concerning the settings of the Distiller. These tools would generate fixed patterns by outputting on any devices.

We found a way to implement interactive program sequences into the distilled PDF tools. This tools act as a PDF document and as a program generating interactive patterns.

How PDF Quality Control Tools work

The PDF quality control tool is a PDF document containing a program generating interactive patterns. We call this PDF quality control tool a PDF Sandwich. It looks like a re-gular PDF from the outside, but being processed it works as an interactive PostScript program. Using the PDF Sandwich in Acrobat the PDF part will be displayed on the mo-nitor. Sending the PDF Sandwich to a PostScript output device, the PDF Sandwich generates the device specific pattern and gathers information about the output device.
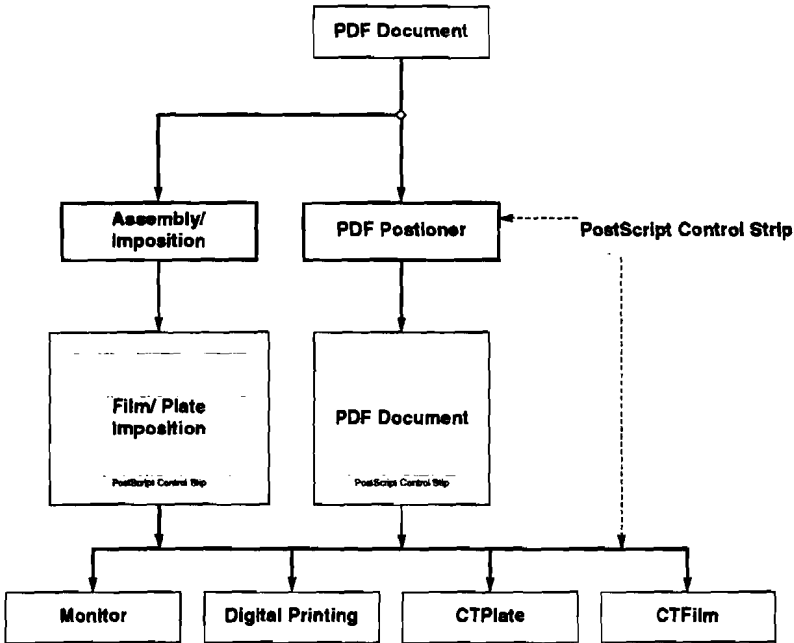
Figure 3   Three ways to use PDF quality control tools.
a) Implement them as a mark in imposition programs
b) Position them directly into a PDF document
c) Sending them direct to the output device

There exist the following three ways to apply the PDF quality control tools to the workflow (see also figure 3):
- Sending the PDF Sandwich direct to the output device (RIP)
- Position the PDF Sandwich on a print ready PDF document
- Position the PDF Sandwich as a mark in a PDF imposition program

Sending the PDF quality control tool direct to the output device will test the quality of the output device. The raster image processor RIP will then process the interactive program sequences. The output will consist of the device-specific patterns and information (see figure 4b). Viewing the same PDF quality control tool on the visual display, only the PDF part with distilled information will be seen (see figure 4a). The PDF quality control tool can be sent using Acrobat Reader.

Positioning the PDF quality control tool on a print ready PDF document gives the possibility of control the quality of the output device and documenting the output conditions (see figure 4b). Viewing the PDF document on the visual display, only the PDF part with distilled information will be seen (see figure 4a). The PDF quality control tool can be positioned using the Ugra/FOGRA-PDF-Positioner, which is a plug-in to Acrobat. The PDF document containing the PDF quality control tool can be sent using Acrobat Reader.

Positioning the PDF quality control tool, as a mark in a PDF imposition program will be a future option for imposition programs that accept marks in PDF format.
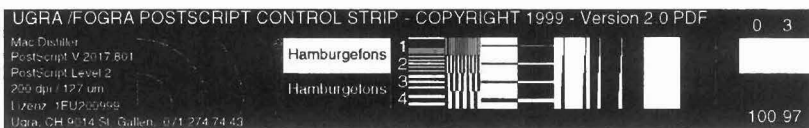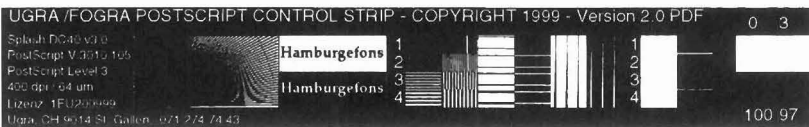

Figure 4a

Figure 4b

Figure 4a and 4b **Parts from the Ugra/FOGRA PostScript Control Strip Version 2.0 seen on the visual display (figure 4a) and output on an image-setter and offset printed (figure 4b).**

Specific quality control tools for each production step

For each step in the production process the parameters that influence product quality have to be under control. Table 1 shows the main quality characteristics that belong to the different process steps.

Process Step	Quality Characteristics
Scanning	resolution color information white/ black point
Image Editing	highlight/ shadow placement midtone placement masking editorial color changes color space transformation
Digital Proofing	press simulation color information tone & color reproduction resolution, aliasing
Imagestter/ CTFilm/ CTPlate	linearization dot shape screening- dot shape, screen angle, screen ruling exposure developing tone reproduction resolution, aliasing
Digital Printing	color information tone & color reproduction resolution, aliasing
Plate Making	proper contact exposure developing
Printing	ink/ paper conditions registration dot gain slurring, doubling trapping no moire gray balance color density

Table 1
**Process steps
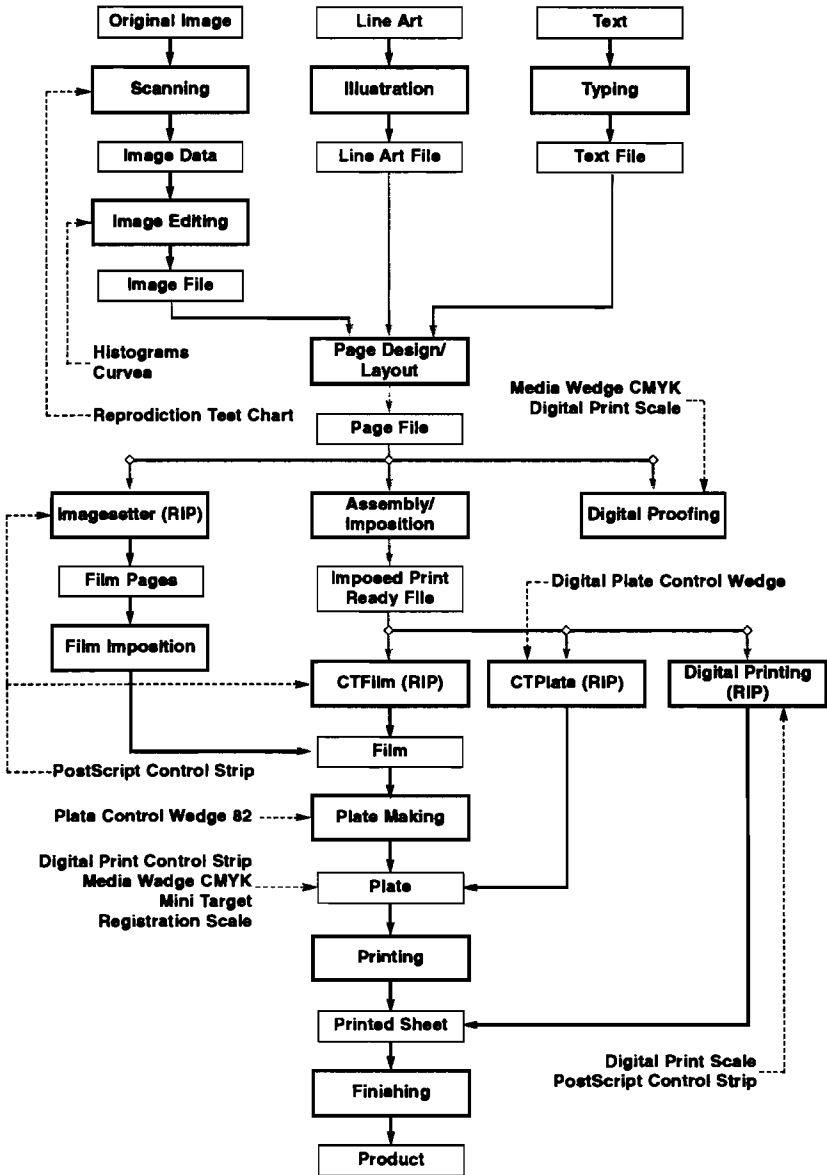and their
quality char-
acteristics.**

Figure 5   Application of quality control tools in graphic arts workflow

Building just one control tool dealing with all of the quality characteristics in Table 1 would be very unpractical. Because of the specific parameters of each production process step, there is a need for specific quality control tools that belong to each step of the production process (see figure 5). For that reason there exist quality control tools for the following production steps:

Production step:	Quality control tool:
Scanning	Reproduction Test Chart
Image Editing	Histograms, Curves
Digital Proofing	Media Wedge CMYK or CIELAB
Imagesetter, CTFilm	PostScript Control Strip
Plate Making	Plate Control Wedge
Computer to Plate	Digital Plate Control Wedge
Offset Printing	Analog or Digital Print Control Strip
Digital Printing	Digital Print Scale

Conclusion

We suggest that quality control tools still be used in production even in the future with the digital PDF workflow.