Fast Laser Printing in Digital Minilabs

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Introduction

Digital Printing on color-negative paper can be achieved by several exposure techniques (e.g. Flying spot laser recorder, CRT, LCD, LED, DMD, PLZT....). All digital Minilabs which are on the market so far make use of one of the above mentioned techniques.

Requiring a high image quality in combination with a high printing speed and a large picture format the flying spot laser recorder technology has proven to be superior compared to competing solutions.

Specification

The exposure unit of the digital Afga Minilab is a preobjective RGB flat line laser recorder with the following main specification: The maximum print width is 8 1/4" with 400 dpi resolution. The paper speed is 100 mm/s resulting in 1700 prints/h of format 4"x 6". All common laser color-negative papers can be exposed.

Components and Applied Technologies:

Laser Sources

The illumination source in the red channel is a laser diode with a feedback electronic to control the laser power in the image plane.

Regarding the green and blue channel a single air cooled Argon Ion laser was chosen, since the availability of high quality and reliable solid state lasers is not yet given and the cost of these laser systems is still inadequate high. The argon ion laser technology is not proprietary and proven since about 25 years resulting in a reliable and compared to other laser technologies cost-effective laser source.

The output of the two line Argon laser is divided by a dicroic beamsplitter and can be modulated separately in each color channel.

To isolate the heat and the vibration of the argon laser from the baseplate of the recorder the laser radiation is coupled to the prescan via a fiber. This fiber connection allows in addition to exchange the laser head very easily by service personnel without touching the recorder module itself.

Modulation

The modulation of each laser beam is performed in two steps: For the (slow) adjustment of the maximum power needed for maximum density an attenuator using polarizing optics is added in each color channel.

For the (fast) modulation due to the image data an acousto- optic modulator is used for the green and blue laser beam. The red laser diode is modulated directly via the diode current.

Scan Element

The line scanning is provided by a polygon mirror. The speed of the polygon motor can be adjusted to the desired line frequency by an external clock.

The vibration level, the pyramidal error and the reflectivity variation of each mirror facet has to be specified properly for a high image quality.

Post Scan

The post scan optics consists of spherical, cylindrical and toroidal lenses to provide the necessary spot size over the whole scan length as well as a correction scheme for the displacement error due to the remaining pyramidal error of the polygon mirror (optical cross scan correction).

Achromatic design of the whole post scan optics guaranties absence of any color separation artifacts.

Baseplate

The aluminum baseplate is ribbed and optimized by a finite element analysis to bring up the resonant frequency to a sufficient level which is well above the highest frequencies of all disturbing vibrations.

Corrections

Beside the (passive) cross-scan and vibration corrections two (active) electronic correction schemes are needed to obtain homogeneous exposures.

To reduce a possible laser power noise the intensity fluctuation is measured by a photodiode and a correction signal is 'added' to the image data.

A similar scheme is used for a possible remaining reflectivity variation of the polygon.

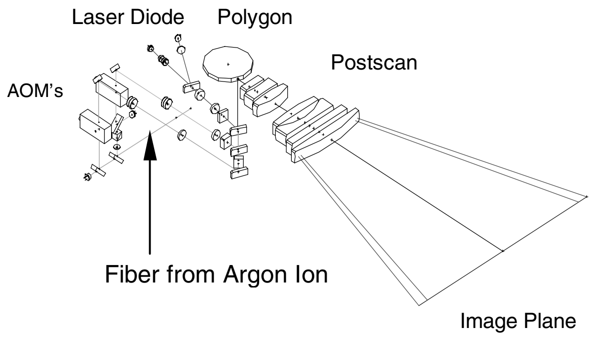

Figure 1. Laser Recorder Unit of Agfa Digital Minilab

Conclusion

The well proven flying spot laser recorder technology was chosen for the print engine of the Agfa digital Minilab to obtain the highest possible image quality in combination with a high print capacity.

Biography

Edgar Kopp received his PhD in physics 1993 from the University Hannover. 1994 he joined the R&D department of the Optics Center from Agfa Munich.

Since 1997 he is responsible for the product line laser within the Optics Center.