

# A3 Color LED Printer with Addition of Fifth Spot Color: MICROLINE VINCI C941dn

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Starting with Japan in mid-October 2013, OKI Data began a worldwide launch of its flagship five-color A3 LED printer, the MICROLINE VINCI™ C941dn (C941dn hereinafter, **Photo 1**). Developed for the graphic arts market, the C941dn has a LED head that produces sharp high-quality prints, a simply designed flat paper path for high-speed printing, and for the first time, the intermediate transfer method has been adopted to enhance the printer's paper handling capability. This newly developed C941dn is introduced below.



Photo 1 MICROLINE VINCI C941dn

## Targeted Market and Product Concepts

### (1) 5-color Printing Market and Applications

C941dn is OKI Data's first printer to use five toner colors. It adds fifth toner, either "white" or "clear (gloss)", called a spot color to the usual CMYK combination. Printing with the addition of white or clear to the full color results in rich color reproduction and makes various design expressions possible.

Traditionally, white and clear printings are done primarily with a large expensive production printer or large-format inkjet printer used in commercial printing. However, introductory price, equipment placement and difficulty of operation are problems associated with these printers.

C941dn offers five-color printing in a price range affordable to the customer. Its color LCD control panel and improved operational guidance reduce load on operation. The printer easily overcomes challenges of the printing/design field that uses white and clear spot colors.

Moreover, on-demand printing is now possible in a wide range of applications such as a prototype and design verification for a food or beverage package, printing with white on colored paper, effective use of clear on photos and in backgrounds for catalog production, and POP production using heavy or long paper.

### (2) Product Concepts

The four concepts behind the development of the C941dn were "new expressions with spot colors", "stable print quality", "high productivity" and "usability improvement".

The "new expression with spot colors" concept did not end with the mere achievement of white and clear spot color printing, but went further to a printer design capable of handling both colors on a single unit allowing customers to utilize the printer in a wide range of applications.

Under the "stable print quality" concept, improvements were made to stabilize print quality beginning with extending the life of the drum unit while maintaining the sharp high-quality prints produced with LED heads of previous models.

For "high productivity", a new fuser unit was adopted enabling the printing of both color and black & white at a fast 50 pages/minute.

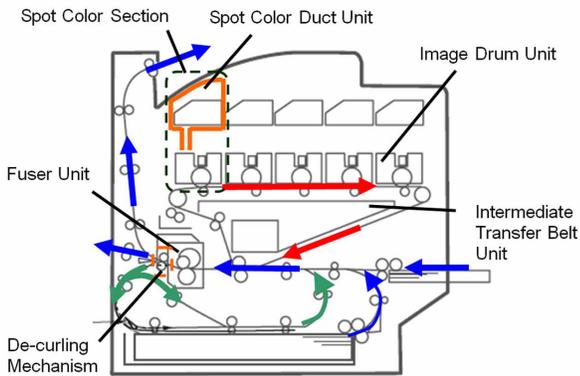
"Usability improvement" enhanced the guidance function of the control panel to ensure operations such as replacing consumables and fixing paper jams can be resolved without a manual.

## Exchanging Spot Color in Five-color Printing

For the five-color printing feature of the C941dn, each color's image drum unit and toner cartridge were made replaceable from the front side of the printer. The printer is equipped with ducts that supply toner from each toner

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cartridge to their respective image drum unit, but the spot color has a detachable duct unit, which the customer can replace with another spot color (**Figure 1**).



**Figure 1 Printer Schematic**

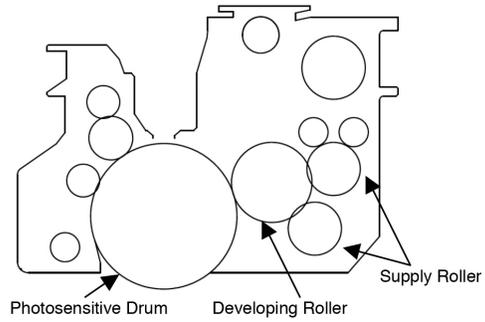
Furthermore, the exclusionary design of the image drum unit/toner cartridge combination prevents the white and clear spot colors from being mixed together.

As for the overall configuration, the previous direct transfer method was replaced with the intermediate transfer belt and combined with the advantageous flat paper path method. This configuration stabilizes the color shift that occurs with heavy papers. Additionally, a de-curling mechanism was employed to reduce curling when printing on heavy papers or envelopes.

### New Image Drum Unit for Stable Print Quality

Effort was made to reduce the wear on the photosensitive drum and supply rollers, which govern the life of the image drum unit. Adopting a spring-action configuration for the developing roller nip enabled the photosensitive drum to absorb thermal expansion of rubber rollers caused by temperature changes and roller run-outs, thus reducing nip pressure to 60% of the previous drum. As a result, wear is 1/4 of the previous drum, and print quality has been stabilized as well.

The supply roller was increased from one roller in the previous unit to two, and while maintaining supply performance of the toner, the amount of nip on the developing roller from each supply roller was reduced. The result was a 50% drop in wear. These improvements extended the life of the image drum unit from the approximately 20,000 sheets with the previous unit to approximately 40,000 sheets (**Figure 2**).



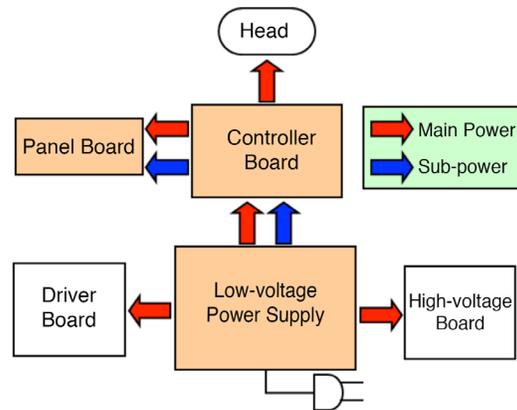
**Figure 2 Image Drum Unit Schematic**

## High Productivity

### (1) High-speed Printing and Power-saving Control

In order to combine high-resolution/multi-gradation/high-speed printing with ecology, circuit configuration and power control system were renewed. The bus interface connecting the dedicated ASIC with the CPU utilizes PCI Express, and the image data transfer path to the LED employs impedance controlled FFC.

While achieving high-resolution/multi-gradation/high-speed printing with the above, standby power consumption was substantially reduced by shutting off power to the CPU or dedicated ASIC depending on power-save or sleep power modes and switching between high-load, high-efficient power supply and low-load, high-efficient power supply (**Figure 3**).

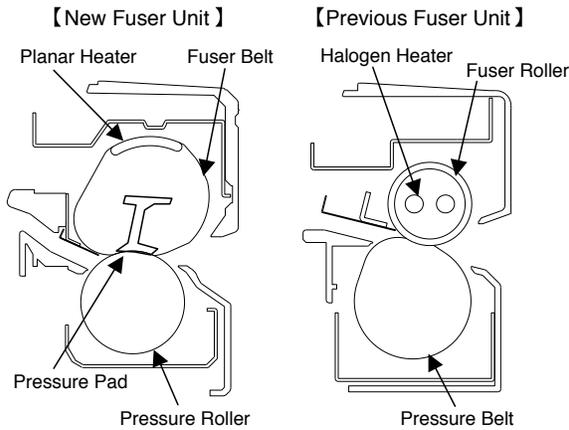


**Figure 3 Block Diagram of Power Supply System**

**(2) New Fuser Unit**

To achieve high-speed printing and fast warm-up, the planar heating method developed for the C841dn/C811d<sup>1)</sup> line of printers was adopted. Directly heating the fuser belt with the planar heater improves thermal conductivity, and to minimize heat loss further, the pressure roller is a sponge roller, which has excellent heat insulating property. As a result, warm-up time was reduced 55% compared with the previous model (**Figure 4**).

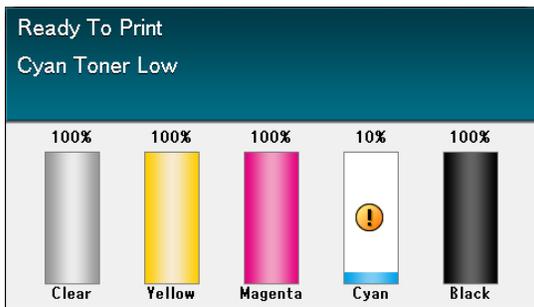
Additionally, the width of the pressure pad located inside the fuser belt was stretched to widen the fusing nip for a 25% increase in speed.



**Figure 4 Comparison of Fuser Units**

**Improved Operability of the Control Panel**

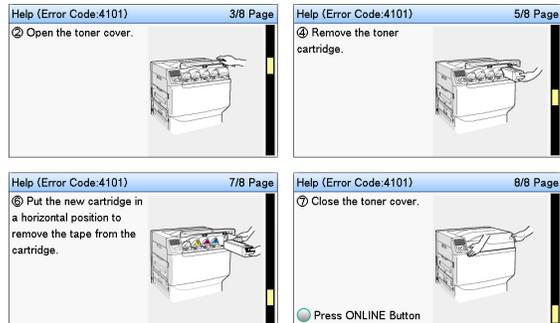
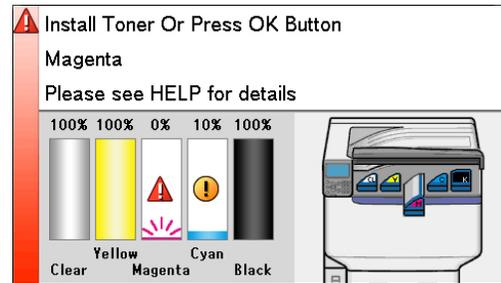
Control panel of the C941dn uses a 4.3-inch high-resolution color LCD display (128dpi, 480 × 272 pixels). Size and line spacing of its bold universal design font is easy to read, and the outlines of icons have been made thicker for better visibility (**Figure 5**).



**Figure 5 Standby Screen (Toner Indicator)**

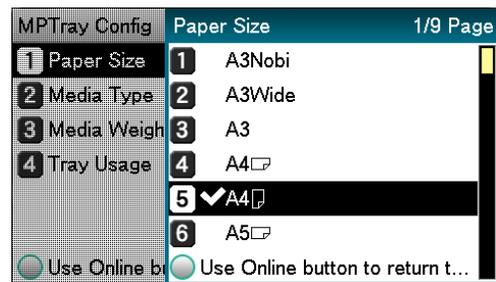
When an error such as a toner replacement request or paper jam occurs, the situation is displayed using easy-to-understand animation. If multiple errors occur simultaneously, sections that can be indicated on the displayed error screen are all shown with icons or are highlighted allowing the errors to be resolved all at once.

If necessary, the lit help button can be pushed to display the resolution procedure on the screen with text and illustration, which can then be followed sequentially much like an operating manual (**Figure 6**).



**Figure 6 Toner Replacement Request and Help Screens**

While inheriting the display and operation from the previous printer, use of the numeric keypad makes it possible to navigate through the menu with fewer steps (**Figure 7**).



**Figure 7 Menu Screen**

Furthermore, the status of printer can be checked from a distance with the flashing light pattern of the lamp located on front side (Photo 2).



Photo 2 Lighting of Front Lamp

## Summary

As presented above, details of the technologies that support the concepts behind the C941dn's five-color printing have been described. Focusing on the printing and design industries of the graphic arts market, OKI Data plans to develop products with unique features, as the five-color printing using white/clear spot color described here, which will see a wide range of printing use by the customers. ◆◆

## References

- 1) Yuji Toyama et al, "The World's Smallest A3 Color Digital LED Printers: C811/C831/C841" OKI Technical Review, April 2012/Issue 219 Vol. 79 No. 1, pp.58-62

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# TIP [ Glossary ]

## On-demand printing

Printing as required even for small number of copies using on-demand printing machines, or digital printers/MFPs.

## Spot color

Special color that cannot be recreated using the four CMYK colors (process colors) or a pre-mixed color/ink. White, fluorescent and metallic colors such as gold and silver are referred to as spot colors.

## Direct transfer method

Method for transferring toner from each color's photosensitive drum to the paper. In this method, the toner is directly transferred from the image drum unit to the paper.

## Intermediate transfer method

Toner from each color's image drum unit is transferred to the intermediate transfer belt. The combined toner is then transferred from the intermediate transfer belt to the paper.

In this method, the toner is transferred from the image drum to the intermediate transfer belt then to the paper.

## Flat paper method

Paper transport path from paper feed to image transfer/fusing to discharge is structured almost in the straight line. It is suitable for transporting heavy papers and envelopes. It also prevents paper curling during transport.

## De-curling mechanism

Mechanism for correcting the paper curling that occurs when fusing the toner to the paper

## Universal design

Design of facilities, products and information that can be used regardless of differences in culture, language, nationality, age, gender or physical abilities.