



# Compact UV-LED Flatbeds Take Inkjet Printing to New Heights



*Smaller UV-LED flatbed printers bring short-run 3-D printing capabilities to pad printing specialists and digital graphics producers.*

Not long ago, the only way to print two-dimensional images onto a three-dimensional surface was to use pad-printing equipment. But a new breed of UV-LED devices can make a big difference in the range of products and services you can offer. A compact flatbed UV-LED printer can be used to produce literally thousands of different type of products, including promotional items, photo gifts, awards, packaging components, and industrial parts. Almost any item you choose can be decorated with your clients' logos or favorite images. These compact flatbed printers are specifically designed to be able to print small quantities of three-dimensional items, such as smartphone covers, lucite gift boxes, casino chips, and pens. Some can even print images directly on cylindrical objects, such as water bottles and golf balls.

“Personalization of promotional items is a growing market,” notes Hiroshi Ono, group product manager of Roland DGA. “And although there are many well-established players in this market, very few of them are equipped to offer short runs or one-offs. And when they do, their lead-time or pricing may not meet the needs of their customers.”

There are several different models breaking ground in this growing market. To illustrate, we’re highlighting seven distinctively different models of compact flatbed UV-LED inkjet printers from Roland, Mimaki, Graphics One, Inkscups Now and Pad Print Machinery of Vermont.

While all of the compact UV-LED flatbeds described can handle promotional items and ad specialties, the two industrial flatbeds described here (the Xjet from Inkscups and the fJET-24 from Pad Print Machinery) are built to operate at much faster speeds than the less expensive models from Roland, Mimaki and Graphics One. Equipped with wider, more rugged, and more expensive printheads, bulk ink systems, and more advanced materials-handling systems, the Xjet and fJET-24 are built to deliver the fast turnaround of larger quantities of printed products that existing buyers of pad-printed manufacturing parts, medical kits, or packaging components might expect.

### Background: Inkjet & Pad Printing

Pad printing is widely used in manufacturing everything from medical test kits, automotive parts, and appliance panels to keyboards, sports equipment, toys, and tag-free apparel. Pad printing is a contact method of printing

that uses silicone “pads” that conform to the topography of the object being printed. Thin layers of ink are transferred from a specialized type of metal plate called a cliché. Pad printing inks are applied one color at a time and the inksets are specifically formulated to adhere to each substrate being decorated. Because the pads come in contact with the print surface, special fixtures are needed to keep the object in place.

Inkjet printing is a non-contact form of printing, in which variable-size droplets of ink are jetted from arrays of nozzles without ever touching the surface being printed.

To make inkjet printing more practical for applications that were formerly the exclusive domain of pad printing, a number of technologies had to be developed. For example, inkjet engineers had to devise ways to accurately deposit inks onto uneven or slightly curved surfaces. The artwork can lose resolution if the distance from the printhead to the print surface is greater than two millimeters. The new compact flatbed printers use laser-alignment systems to automatically capture the set-up information required to ensure the correct distance between the printhead and substrate.



Eileen Fritsch, Freelance Writer

A key challenge of inkjet printing is that one set of inks must adhere to multiple types of substrates.

The development of UV-LED curing systems was also critical because the low heat of the LED curing lamps enables the inkjet flatbed printers to print on heat-sensitive substrates that would warp or shrink when exposed to conventional UV metal halide lamps.

A key challenge of inkjet printing is that one set of inks must adhere to multiple types of substrates. This is different from pad printing or screen printing, in which different formulations of inks are used with each different substrate. With inkjet, you are typically limited to the ink your printer manufacturer offers.

“It is difficult to change over inks, because of the flushing, filters, and cleaning that is necessary,” explains Paul McGovern of Mimaki. “It can be done, but takes at least three to four hours and some additional supplies.”

So, to enable UV-LED inkjet printers to print on the wide range of products that are decorated with screen printing or pad printing, chemists had to develop inkjet-compatible primers, white inks, and clear top coatings.

The development of UV-LED ink-curing technology has made compact flatbeds safe enough for use in a wider variety of printing environments. The UV-LED curing process doesn't release harmful VOCs into the air. Plus, UV-LED lamps don't generate excessive heat, so the curing process doesn't warp heat-sensitive materials.

Whereas pad printing inks require degassing and curing time, UV inkjet inks cured with LED lamps are completely dry the moment the job is complete.

### Compact Flatbeds Designed by Digital Graphic Experts

Let's start by looking at the compact UV-LED flatbed printers offered by Roland,

Mimaki and Graphics One. These printers (in the \$40,000 to \$65,000 range) allow photo labs, awards and promotion companies, commercial printing firms, and graphics producers to diversify without sacrificing a lot of precious floor space. Artists and entrepreneurs are using these printers to build new businesses around specialized products such as custom-decorated gun grips or decorated glass art.

### Roland VersaUV LEF-12 Benchtop Flatbed Printer

The LEF-12 is a fully enclosed system that can print 1440 dpi images on items up to 11 x 12 inches and up to 3.94 inches thick. It enables print-service providers to tap into the fast-growing market for personalized products.

“The LEF-12 enables businesses to print in full color directly on a wide range of consumer products without the complex set-up and workflows involved in analog processes,” explains Hiroshi Ono of Roland DGA Corp.

The device uses Roland's advanced ECO-UV inks in combination with long-lasting UV-LED lamps to adhere to treated and untreated substrates including PVC, PET, ABS, acrylic, wood, boards, and more. The inks cure instantly and offer the flexibility required to avoid cracks in printed images.

The printer comes with Roland's VersaWorks software and is configured with six inks: CMYK plus white and a clear coat.

“With clear ECO-UV ink, users can simulate varnishing and add tactile effects to their designs,” says Ono. Users can create and apply custom textures, or choose from more than 70 ready-to-apply textures in the Roland Texture Library, which is included in Roland's VersaWorks' software.



Roland iPhone cases



Roland LEF

“Everything from gloss highlights to faux leather, and even Braille, can be produced with ECO-UV clear ink.”

Roland designed the LEF-12 with novice users in mind, so the unit requires very little maintenance. The system is fully enclosed to cut the risk of UV light exposure to the skin and eyes, reduce dust and debris, and minimize ink odor. For example, an advanced ink-circulation system automatically circulates the white ink to keep it from settling in the ink lines.

“To ensure outstanding print quality around the curvature of objects, two mist filters are incorporated in the LEF-12 — one on the back of the unit, and the other between the printhead and UV lamp,” explains Ono. “These mist filters catch residual ink that may mist when printing off the edge or curvature of a product. This cuts down on overspray, and keeps the ink from settling on the printer’s internal components.”

To avoid costly damage caused by head strikes and lost production, the printer can adjust the table height on the fly, even if the object is lifted slightly or the height of the object varies from batch to batch.

According to Ono, the LEF-12 can be a complementary device for companies that specialize in pad printing: “But for businesses that are focused on smaller production runs, high levels of personalization, versatility, and premium-quality printing, the LEF can be their sole production unit.” He says, “The LEF-12 is large enough to handle most of the products commonly imprinted in the personalization market.” The base price of the Roland VersaUV LEF-12 is \$29,995.

**Mimaki UJF Series**

Mimaki offers three models of compact UV-LED flatbed printers in its UJF series.

The models differ in print resolutions, flatbed sizes, and the thickness of the materials they can handle, but all come with user-friendly RasterLink 6 RIP software.

The Mimaki UJF-3042 FX enables short-run, variable-data 1200 x 1200 dpi printing on almost any substrate up to 300 mm x 420 mm and 50 mm thick (about 11.8 x 16.5 inches up to two inches thick). The Mimaki UJF-3042 HG has these same capabilities but can decorate objects (including cylindrical items) up to 150 mm (5.9 inches) thick.

Last fall, Mimaki announced the Mimaki UJF-6042. This printer can produce near photo-quality resolutions of 1800 x 1800 dpi on items up to 610 mm x 44 mm and 150 mm thick (about 25 inches x 16.5 inches and 5.9 inches thick). Expected to be available early in 2013, this model will be able to print images directly on products such as photo album covers, softballs, and the acrylic panels used for award plaques. The higher resolution imaging of the UJF-6042 is partly due to the increased dot-placement accuracy of its “ball/screw” type bed transport system.

“The UJF series printers are ideally suited for the promotional products industry,” says Paul McGovern, national sales manager of Mimaki USA. UJF printers can also be used for industrial applications such as printing gauges and dials, graphic overlay panels for membrane switches, and decorating music accessories such as drumsticks and guitar picks.

For the UJF series of printers, you can choose from one of three Mimaki ink formulations, depending on whether most of the products you plan to print will be rigid, flexible, or photographic.



Mimaki UJF-6042

## Graphics One

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Cubix 308 UV

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Pad printing will continue to do a better job on products that have deep recesses, or variations in their surface topography, such as keyboards and stepped switches.



Graphics One Go Cubix 308 UV



Xjet industrial inkjet printer UV LED

The LH-100 ink is recommended for rigid substrates that require a high level of resistance to chemicals and scratching but won't be bent or folded during post-processing. It runs in a CMYK configuration along with white inks, clear coats, and primers.

The LF-200 ink is designed for projects in which the cured image might be subjected to stretching during post-processing. This ink enables the ink to be stretched up to 200 percent during post-processing without causing visible cracks in the cured ink used to create an image. This ink runs in a CMYK configuration with two channels of white ink.

The LF-140 ink is for six-color (CMYK plus LcLm) photorealistic projects in which clients expect to see smoother gradations and less granularity. This ink is more flexible than the LH-100 ink, making it less likely to crack during post-processing. The LF-140 inkset doesn't include clear ink, but can be configured to run a combination with LH-100 ink.

If you will be printing on a high surface-tension product such as a smooth metal, a Mimaki UJF-series printer can automatically apply the primer only to the area to be printed.

"The advantage of a 'jettable' primer is that you don't need to overcoat the entire product surface," explains McGovern. "For example, if you printed a snake image on a lighter, only the actual snake image will have the primer applied underneath."

Some of the materials that Mimaki has tested with its PR-100 inkjet primer include PET, acrylic, glass, aluminum, brass and copper.

The base price for the UJF-3042FX is \$36,995. The base price of the UJF-3042HG is \$43,995. Pricing for the UJF-6042FX hasn't yet been announced.

#### *Graphics One Go Cubix 308 UV LED*

This 30-inch "three-in-one" printer allows you to print on rolled, rigid, and 3D or cylindrical objects, such as bottles. Powered by an industry-standard Wasatch SoftRIP, it can be set up to run two sets of CMYK ink (for throughput of up to 120 square feet per hour) or a combination of CMYK inks, white inks, and clear varnish. The five-inch adjustable gantry height lets you print on materials up to five inches thick. The printer can support high-definition, high-resolution variable drop printing in resolutions up to 1440 dpi.

Users who will be reproducing photos on promotional items can opt for an upgrade that enables you to print six or eight colors. The six-color configuration can be run with

two white inks. If you choose the eight-color mode, you can run four white inks plus a clear coating.

According to Dan Barefoot of Graphics One, the unique design of the Cubix 308 will appeal to screen printers, sign shops, and dye-sub service bureaus who want to expand the range of on-demand products they can offer. He notes that a "smaller" UV flatbed printer such as the Cubix 308 can handle larger promotional items that might be difficult to image through a dye sublimation or toner transfer process. While the Cubix 308 can be used for industrial parts, the main focus is promotional and small signage.

"Our UV ink offers excellent adhesion to most substrates," says Barefoot. "If there is a concern about the resistance, we offer a clear coat for further protection. We have printed on substrates such as wood, metal, leather, award plaques, glass, and bottles without the need for precoating." The base price of the Cubix 308 UV LED is \$29,995.

### Compact Flatbeds Designed by Pad-Printing Experts

In the pad-printing world, equipment engineers focused first on building high-speed industrial inkjet printers for inline decoration of manufacturing parts. Those machines offer incredibly fast speeds with medium print quality.

At the 2012 SGIA Expo, Inkcups Now and Pad Print Machinery of Vermont introduced less-expensive industrial-strength UV-LED flatbeds that can produce high-quality images. In addition to printing ad specialty items, these machines can help contract decorators and other industrial printers meet the rising demand for faster turnaround of shorter runs of more customized products. The ability to print variable data (such as serial numbers on a limited-edition collectible or bar codes on medical test kits) is a big plus.

### Inkcups Xjet Industrial Inkjet Printer

The Xjet is a conveyORIZED flatbed printer designed for both short-run inkjet printing and long-run industrial printing of three-dimensional parts up to 5.75 inches high. It prints single or multi-color images on light or dark products with variable quality settings up to 1200 x 1200 dpi. The print area measures 500 x 600 mm (19.7 x 23.6 inches). An industrial PC preloaded with RIP software is included.

"The Xjet printer supports quick turnaround for a wide assortment of products with minimal job set-up and extremely low cost," said Mike Bissel, vice president of for Inkcups Now. "The

## A Few Tips

Before adding a compact flatbed UV-LED printer to your digital-graphics or pad-printing operation, here are a few words of advice.

"Understand that UV-curing inks can't print on every material that screen printing allows today," says McGovern. "Even though a cured image might look beautiful printed on metal, it might be easy to peel off with a fingernail if the print surface hasn't been pretreated and/or coated."

Once you have an idea for product, do some research and testing to come up with the right combination of primer, inks, materials, protective coatings, and decorative finishes that will give you the right look and durability for its intended use. To get started, find out what your printer manufacturer recommends. Pad printing equipment manufacturers routinely sign non-disclosure agreements when they test unique new applications.

If you will be printing on materials commonly used for awards, trophies, and promotional materials, you may be able to buy pre-treated or coated materials that allow for greater ink adhesion. Once again, consult your printer manufacturer for advice.

If your shop will be routinely printing on materials with a high surface tension, McGovern recommends buying a plasma treatment system that will modify the surface of your materials to improve ink adhesion.

If 80 percent of your jobs will be on rigid substrates, it might be wise to choose a device with an ink system that will provide the greatest durability on materials that won't be flexed or folded, says McGovern. Then, buy a less expensive unit to print the remaining 20 percent of your projects with inks that offer the flexibility for use on softer materials.

Ask about maintenance requirements. Find out what's involved in keeping the equipment in peak operating condition. Some printers use advanced ink-circulation systems and other automated features to minimize equipment downtime.

Find a company who will be there to support you. "Don't let analysis paralysis prevent you from jumping in," says Mike Bissel of Inkcups Now. "Find a great company that will provide the support and dedication necessary to your success. This is perhaps just as important as the quality of equipment."

Julian Joffe of Pad Print Machinery of Vermont agrees that good support is essential if you don't want to waste money on a printer that ends up unused: "We work with our customers to ensure they know their equipment and best practices for printing their product(s)." Now that clients expect super-fast turnaround, you can't afford to waste time waiting for service technicians every time little things go out of adjustment. Plus, Joffe says, "If you know the machine well enough to be able to repair it, you will be able to make it perform at optimal levels throughout the life of the machine."

Ask what type of return on investment you can expect to generate. "There is a strong business case for adding a device to an existing personalization business and also for starting a new business focused around UV applications," said Ono. "In fact, the right UV-LED printer generally pays for itself within the first three months, and offers profit margins per print ranging from 40-90 percent."

One of the keys to achieving these returns, of course, is marketing your services by showing high-quality samples. Make it easy for your customers to immediately see that the possibilities with these devices are endless.



Specialty Graphic  
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Pad Print Machinery of Vermont fJET-24



Pad Print Machinery of Vermont

machine not only supports the decoration of flat items, it is also capable of printing on cylinders.”

If the parts to be decorated won't sit flat on the conveyor bed, the Xjet can be equipped with traditional tooling fixtures.

The Xjet's six heads deliver CMYK plus two white inks and can be operated for either uni- or bi-directional mode. In its fastest mode, it takes just 90 seconds to print the items loaded on the printedbed. It uses a staggered printhead for simultaneous white and color printing.

Other features on this heavy-duty 1500-lb. machine include highly opaque white ink for one-pass printing on dark substrates, a bulk ink system, and a programmable servo controlled loading station.

“The Xjet is a unique machine that was specifically designed to overcome the traditional shortcomings of industrial inkjet systems,” said Bissel. “Designed to be blazingly fast, this machine significantly reduces the typical cost of fixturing and job-changeover time.”

*Pad Print Machinery of Vermont fJET-24*

The fJET-24 is a high-resolution industrial inkjet printer for printing high-quality graphics on industrial and promotional products that have a flat or mostly flat surface up to 75 mm thick (2.95 inches). Recommended for personalized souvenirs, customized gifts, and industrial products, the fJET-24 can print 1200 x 1200-dpi images on areas up to 20 x 24-inches in either CMYK multicolor or spot colors.

“CMYK printing is not that easy to do in the pad-printing world,” explains Julian Joffe, CEO of Pad Print Machinery of Vermont. “The internal ColorPRINT RIP on the fJET-24 allows almost instantaneous creation of a separation file that is sent directly to the printer in seconds.”

Joffe said the fJET-24 can be particularly useful in “small- to mid-sized companies that need to produce high-quality graphics on flattish items in medium-sized production runs with plenty of changeovers in images.” This includes industrial printers and manufacturers as well as ad specialty companies who don't want to deal with long delivery times and high shipping costs of having their products printed in China.

Other specs include 300-ml ink tanks for each color, an automatic ink-supply system with alerts to warn when supplies are running low, and double LED UV lamps with air cooling.

To ensure accurate imaging, a built-in laser pointer detects where the product is placed on the flatbed. A high-performance AC servo motor controls the shuttle

movement, and a precision linear encoder ensures accurate placement of the ink drops. To produce sharp images with smoother gradients, the fJET-24 uses VDS (variable droplet size) print control technology. The fJET-24 comes with six industrial-grade printheads for fast uni-directional or bi-directional printing of CMYK plus two white inks. Options include additional printheads and the ability to print variable data.

Because Pad Print Machinery has been custom building printing equipment for years, the company's engineering experts can customize the fJET-24 to print on larger or taller objects or load items automatically. The base price of the fJET-24 is available upon request.

### Can Inkjet Replace Pad Printing?

"UV-LED printing devices will replace a portion of pad-printing equipment," predicts Inkcups exec Mike Bissel. "However, they will each survive and co-exist as complementary devices. Pad printing will remain the go-to process for certain applications, while inkjet absorbs a portion of the product-decorating business for which it is ideally suited."

Because of the reduction in set-up time and the elimination of analog components such as plates and pads, UV-LED inkjet printing can be a cheaper methodology for certain types of jobs, agrees Joffe. The set-up costs of producing flat or nearly flat parts are particularly low because they don't require the creation and use of special tooling or fixtures.

"With inkjet, very short runs (and even slightly longer runs) of CMYK graphics are now feasible," says Joffe. The cost of setting up repeat multi-color and spot-color jobs is minimal because the RIP can store the print parameters for each job.

Despite these advantages, "There will always be a need for pad printing," says Mimaki's Paul McGovern.

For example, Joffe says pad printing is particularly good for monochrome jobs and high-speed production of parts that have the same text or images: "If I tried printing 3 x 2-inch key chains on the fJET-24, I could produce about 540 per hour. A typical pad printer could easily produce 1,000 key chains in the same amount of time."

Pad printing also will continue to do a better job on products that have deep recesses, or variations in their surface topography, such as keyboards and stepped switches. A video on Pad Print Machinery's website demonstrates why pad printing is necessary for these types of products.

On the other hand, because an inkjet printhead should never come in contact with the item being printed, the objects don't get compressed. Thus, inkjet printers can be used to decorate soft objects, such as wallets, binders, and padfolios.

### New Directions to Reach a Growing Market

Whether you want to build a new business around a compact flatbed, or grow your existing digital printing or pad-printing operation, you can choose from several different models with many options. These new UV-LED devices can significantly add to the range of products and services you can offer and help you to build on your existing brand or to expand into new territories.

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