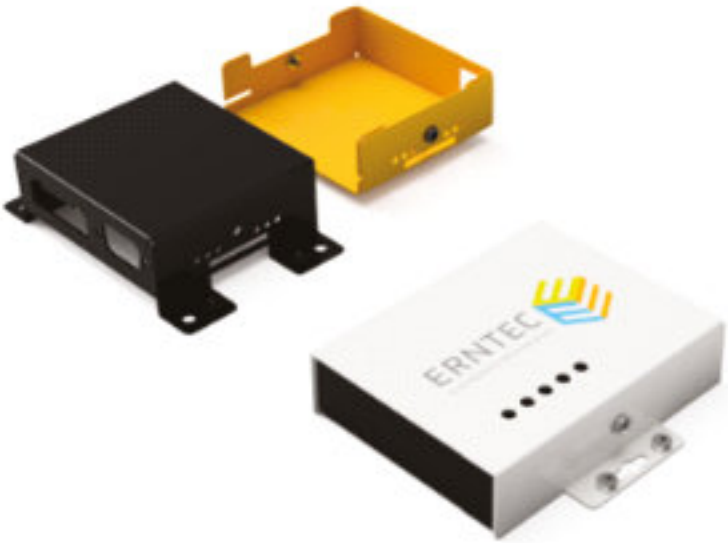
ARTICLE

Digital Printed Parts



Example of Digital Printing on Sheet Metal Parts

Exploring Digital Printing for Electronic Enclosures and Front Panels

When designing an electronic enclosure or a panel to match your enclosure the ability to create a visually appealing and highly customised look is important. Digital printing on metal and plastic surfaces offers designers a flexible tool to achieve a desired look.

This article delves into the world of digital printing for electronic enclosures and front panels, highlighting the advantages, suitable artwork types, constraints, and when to choose digital printing over other popular techniques.

Overview of Digital Printing Technology

Digital printing utilises specialised printers designed to transfer digital images onto various surfaces such as metal and plastic. There are a host of different printers that directly transfer digital images onto metal and plastic surfaces, eliminating the need for the traditional printing plates or screens.

One common type of digital printer is the UV printer. UV printers use UV-curable inks that are formulated to dry instantly when exposed to UV light. This allows for fast and efficient printing on metal and plastic surfaces. UV printers often feature a flatbed design, allowing direct printing onto flat or slightly curved panels. Some UV printers also can print multiple layers, enabling the creation of textured or embossed effects on the printed surfaces.

Another type of digital printer is the solvent-based ink-jet printer. These printers use solvent-based inks that are designed to adhere effectively to metal and plastic substrates. Solvent-based ink-jet printers typically offer a wider colour gamut and excellent colour vibrancy.
They are often used for high-quality, large-format printing on materials such as signage, banners, and displays. However, they can also be employed for printing on metal and plastic surfaces.

Typical Workflow

It is important to note that different printers have specific operational features and capabilities. A service provider will have their own set of guidelines and recommendations on the optimal use, including constraints and best practices for achieving high-quality prints.

The steps below outline a general workflow and considerations

Example of a front panel printed for colour management testing

1 Image Preparation

A digital image or design is required or created using graphic design software. This involves ensuring the image meets the desired specifications, such as resolution, colour mode, and file format.

2 Print Constraints

Once a suitable file is available due consideration must be given to any constraints. For example, the maximum printable area, how flat is the print surface, can proper ink adhesion and accurate results be achieved.

3 Colour Management

Colours should be adjusted and calibrated to ensure accurate and consistent reproduction during printing. This includes calibrating the printer, inks, and colour profiles to match the desired colour output.

4 Print File Preparation

The colour adjusted image is now processed into a print-ready format compatible with the printer. Additional adjustments, such as resizing, cropping, or adding bleed areas may be required to ensure the image fits the desired print size and maintains proper proportions.

5 Printing Process

Once a print file is ready, in theory it can be sent to the printer.
The process from here can vary depending on the technology utilised by the printer. (UV or solvent-based inks) and the surface being printed. Different consideration must be given to printing on plastic or metal surfaces to ensure that the ink adheres to the surface. The operator may need to specially prepare /clean or add an extra layer (e.g. A "white" layer or primer layer) to get optimal adhesion.

6 Finish & Post-Process

Once the printing process is complete, the printed panels may undergo additional finishing processes, such as UV curing or lamination, to enhance durability, protect the print, or add specific desired effects. These finishing processes contribute to the final appearance and longevity of the printed designs

Advantages for Electronic Enclosures and Front Panels

Digital printing offers several advantages specifically for designers of electronic enclosures and front panels:

Customisation and Branding:

Digital printing enables customise designs to match branding requirements or incorporate unique visual elements. Logos, product names, icons, or graphics can be seamlessly integrated into an enclosure or front panel, enhancing the brand identity.

High-Resolution prints:

Digital printing technology ensures excellent print quality with sharp details and precise reproduction of intricate patterns, labels, or symbols. This level of detail allows for clear legibility and enhances the overall aesthetic appeal.

Multi colour and Gradient designs:

Digital printing excels in reproducing vibrant multi-colour designs and smooth gradients, allowing for visually striking front panels or enclosures. This versatility in colour reproduction enables designers to create eye-catching products that stand out in the market.

Short Production Runs and Rapid Prototyping:

The flexibility of digital printing allows for quick turnaround times, making it ideal for short production runs or rapid prototyping. Designers can easily produce small batches or even individual prototypes without incurring high setup costs.

Durability and Resistance:

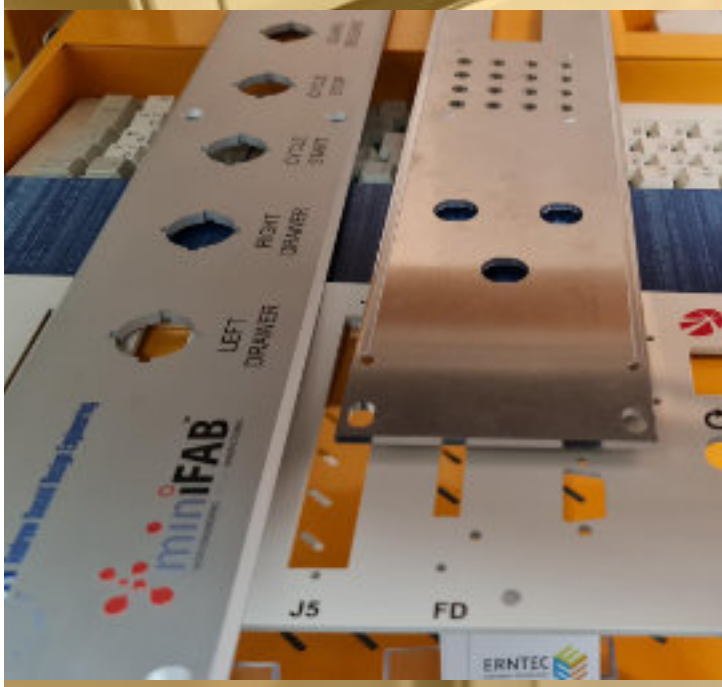
Digital printing utilises inks that are specially formulated to withstand environmental factors, ensuring the prints remain durable and resistant to fading, even in demanding electronic enclosure applications.

Precision and Accuracy:

Digital printing technology ensures precise alignment and registration, enabling designers to create clean and professional-looking front panels or enclosures. Fine text, intricate patterns, and small components can be accurately reproduced, providing a high-quality finish.

Design Flexibility:

With digital printing, designers can experiment with various artwork designs and adjust quickly. This flexibility allows for easy iteration and refinement of designs, ensuring the final



Constraints for Digital Printing on Enclosures & Front Panels

Surface texture and finish

The texture and finish of a material can impact the quality of digital prints. Certain textures may require additional surface preparation or specific printing techniques to achieve the desired results.

Colour accuracy and consistency:

While digital printing offers excellent colour reproduction, it is essential to manage colour calibration to ensure consistency across different batches or production runs.
Variations in colour can occur due to factors such as ink, substrate, or printer settings. Designers should work with the service provider to see what can be produced consistently.

Environmental factors and durability:

Although digital prints are generally durable, exposure to extreme temperatures, moisture, or harsh environments can impact their longevity. Designers should consider the specific environmental conditions in which their product will operate and work with their service provider to ensure optimal durability. Regular maintenance and cleaning routines can further contribute to the longevity of digital prints on electronic enclosures and front panels. Providing end-users with proper care instructions and guidelines can ensure that the prints remain vibrant and durable over an extended period. Ultimately, by being proactive and attentive to the potential effects of environmental factors on digital prints, designers can guarantee that the print maintains its visual appeal and brand identity throughout their entire life-cycle.

Size and resolution limitations:

Digital printing technology has its limitations regarding print size and resolution. Large-scale prints may require specialised equipment, and extremely high-resolution graphics may result in longer printing times or file size limitations.

Cost considerations:

While digital printing offers cost advantages for short print runs and rapid prototyping, it may not be as cost-effective as other methods for large-scale production runs. Designers should assess their specific budgetary requirements and production volume when choosing digital printing as a printing solution.

There are various tests that can be performed to evaluate the durability of digital prints, such as accelerated ageing tests, humidity resistance tests, and temperature cycling tests. Conducting these tests can help identify potential weaknesses and allow for adjustments to be made before the final product is manufactured and deployed. Implementing protective measures, such as applying UV-resistant coatings or using weather-resistant substrates, can significantly extend the lifespan of digital prints in challenging conditions.

When to Choose Digital Printing over other Methods

Digital printing vs. screen printing

• **Complex designs:** Digital printing excels in reproducing intricate designs, making it suitable for complex front panel artwork or enclosures with detailed graphics.

• **Multi-colour designs:** Digital printing allows for the reproduction of vibrant, multi-colour designs without the need for separate screens or colour separations.

Digital printing vs. engraving:

• **Customisation and personalisation:** Digital printing offers easy customisation options, making it ideal for incorporating personalised elements or unique designs into electronic enclosures and front panels.

• **Detailed designs:** Digital printing can accurately reproduce minute details or small text that may be challenging to achieve with engraving techniques.

Digital printing vs. laser engraving:

• **Full-colour designs:** Digital printing excels in producing full-colour designs, including photo-realistic images, which may not be achievable through laser engraving.

• **Text and minute details:** Digital printing provides greater flexibility and precision when it comes to reproducing text and intricate details on electronic enclosures and front panels.

SUMMARY

Digital printing on metal and plastic surfaces offers designers using electronic enclosures and front panels a wide range of benefits including customisation, high-resolution prints, vibrant multi-colour designs, and short production runs.

While considerations such as surface texture, colour consistency, and cost must be kept in mind, digital printing provides a versatile and efficient solution for bringing visually appealing and personalised designs to life.

By harnessing the advantages of digital printing, designers can create electronic enclosures and front panels that not only protect and house electronics but also reflect their brand identity and captivate end-users.