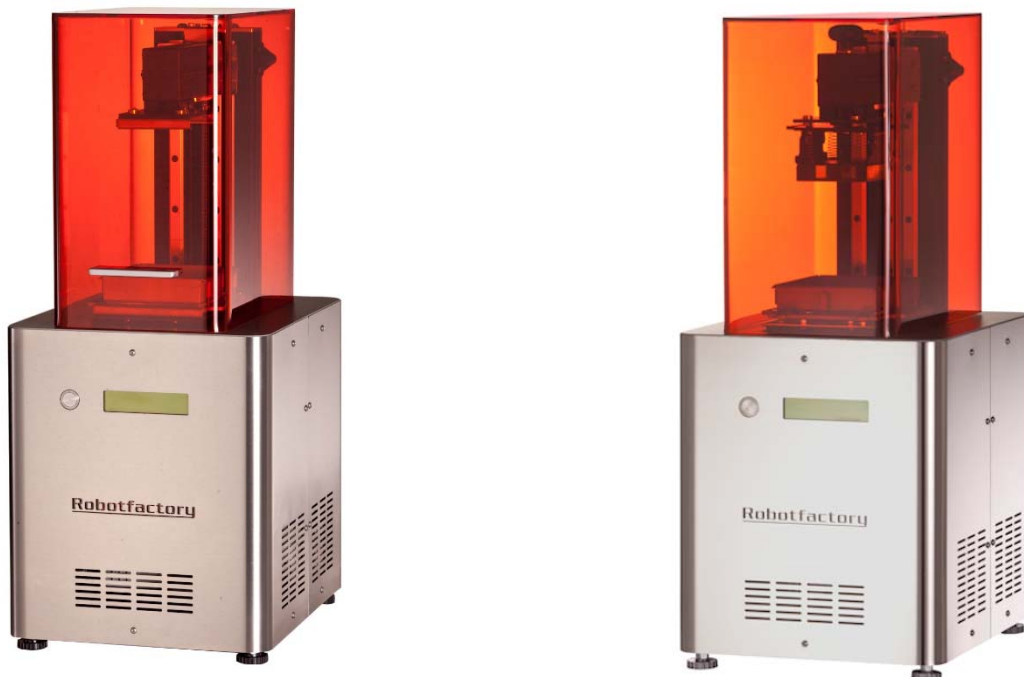


## **3DLPrinter-HD** **3DLPrinter-HD 2.0** **3DLPrinter-HD 2.0+**



## **Technical Note 09/16** **Mask function**

## Introduction

The DLP projector used in 3D Printers, due to the near of lens to the printing area, it presents the drawback of lack of homogeneity of luminous intensity, because it has different zones of illumination inside the printing area.

For this reason, in the projected layer (in the printing step) some parts have different light intensities depending on their location, with the consequent lack of dimensional homogeneity of printed pieces or, in more serious cases, in some areas you can not print if not dramatically increasing the exposure time.

After a long series of tests, we concluded that the better solution is to use, as it isn't possible to increase the luminous intensity in the deficient points, a '**mask**' made of **shades of grey** that can overshadow the most light points, producing for them a more low light.

In this manner we can obtain a balancing of exposure light for every point into printing area and, consequently, a dimensional homogeneity for all objects printed in the different zones of printing area. This solution resolve the issue of lack of homogeneity, requiring only a slight increase in exposure time and assuring a difference in the entire printing area of not more than  $\pm 0.05$  mm.

## Some warnings

Remember to save your jobs before you use the Mask, as we explain in chapter "Save your Jobs" into Appendix of "Printer3DLP - Setup and use of the program" manual.

Remember also (see Technical\_Note\_07-15) that is very important, for obtain a good printing result, the focusing of projector as we explain in chapter "16.3 ADJUSTING THE FOCUS" of "3DLPri-ter-HD - Instructions for installation, use and maintenance" manual.

With the new function Mask, it is added on **C:\Printer3DLP\Resources** a subfolder with name **Mask** containing the picture **Gray\_00.png** that is needed as '**mask**' (mask of shades of grey used for balancing the exposure of light).

For make the calibration, moreover, it is added the file **Ring\_Test\_Mask.stl**, on folder **C:\Printer3DLP\Lavori**, with relative **Test\_Mask.job** on **C:\Printer3DLP\Resources\Jobs**.



Name Job : Test\_Mask  
File STL : Ring\_Test\_Mask.stl + Square Base.stl

Num Obj	Thick.Slicer	Expo.Base	Num_Layer Attach_Obj	Exp_Layer Attach_Obj	Expo.Obj	Thick.Base
13	0.05 mm	6 Sec.	0	0 Sec.	2.7 Sec.	0.15 mm

Attention, the times given are for reference only, the correct time must be set depending on the characteristics of the printer and the type of resin used.

The times used in the Job are for printing with Mask **ENABLED**, it recommends, **WITHOUT** Mask, starting with 1.9 - 2.1 **Expo.Obj** time, leaving unchanged the time to **Expo.Base**.

## Description of new feature

The **Printer3DLP** program, when start, reads the parameters by the **Printer\_Setup.ini** file, these parameters allow it the correct configuration for use of new feature.

Remember that for editing of this file you have to use an ASCII editor, like that we put in DVD supplied with printer, in the \Programmi\Editor Notepad++ folder, and remember that the Printer3DLP program must **NOT** be launched **DURING** editing of this file.

In particular, in the Mask section, we find the following settings (after [Mask] label):

[Mask]

**Mask\_On\_Off=ON**

Mask ON = enable the Mask feature (ON uppercase)

Mask OFF = disable the Mask feature (OFF uppercase)

**Gray\_Type=Gray\_00**

Gray\_00 = Name of picture saved in 'png' format (dimensions: 1920 x 1080) that are used as '**mask**' for balancing the projected layers

**Threshold\_Mask=210**

The value represents the threshold of the conversion work in shades of gray, can take values from 0 (Black) to 255 (White)

**Save\_Sliders=0**

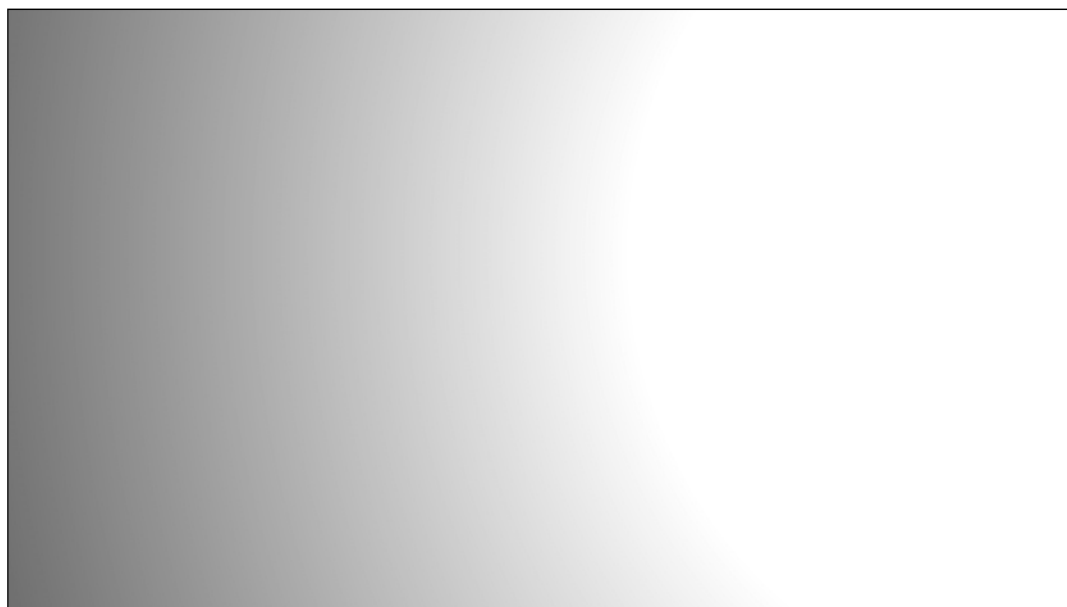
Save\_Slider=0, the projected layers **not saved on hard disk**

Save\_Slider=1, the projected layers **saved on hard disk**

*This parameter can be useful in the calibration phase*

In this case, the program (with Mask\_On\_Off=ON) is initialized with the **Mask** feature 'enabled', it will use the **Gray\_00.png** read from C:\Printer3DLP\resources\Mask folder, with **Threshold\_Mask** put on 210 and it will not save the projected layers on hard disk (**Save\_Sliders=0**).

The initial image that comes with the program is as follows:

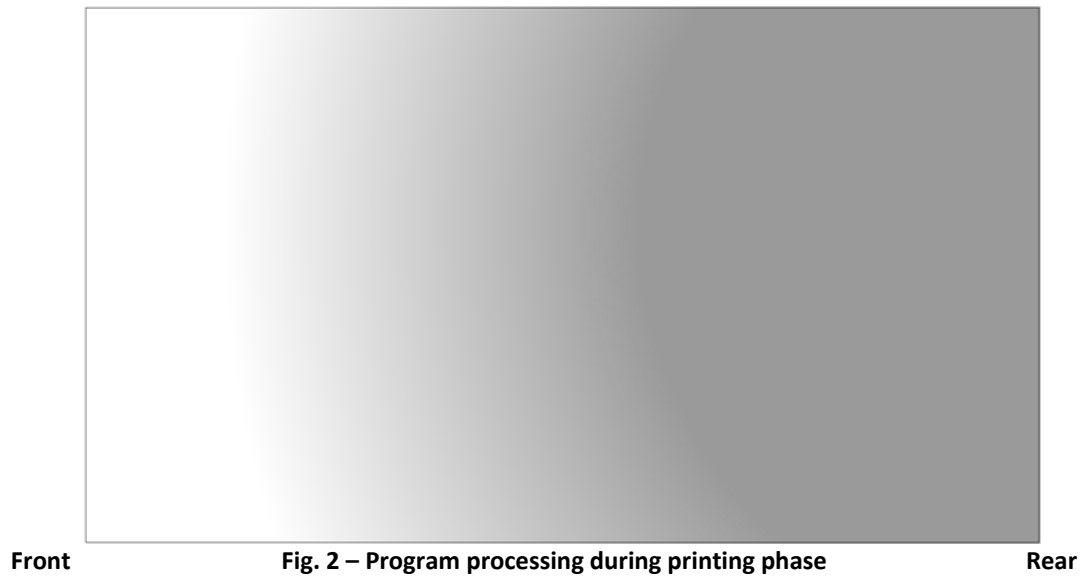


Front

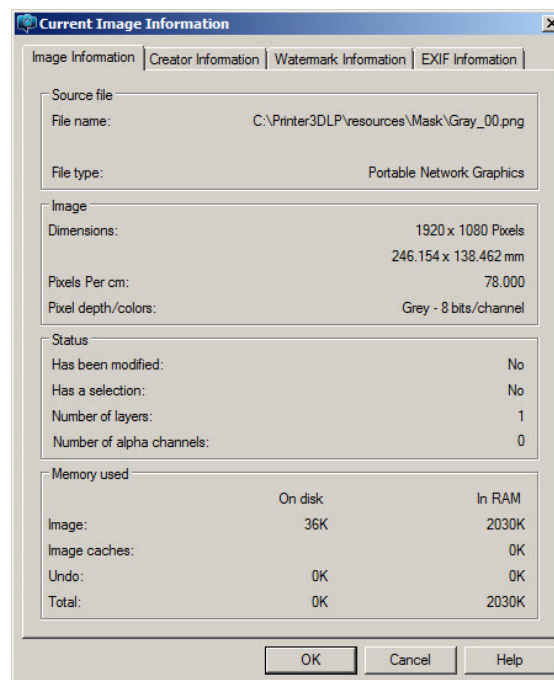
Fig. 1 – Gray\_00.png image of balancing

Rear

As the program projecting the printing layers, analyzes the image 'Mask', pixel by pixel, computes the **negative** (in the photographic sense) and generates, with these values, the image (layer) to be projected, during the printing process, will produce this projection:



The picture of **Fig. 1**, it is what we evaluated more useful to fit the function of balancing at almost the 80% of the 3DLPrinter-HD and 3DLPrinter-HD 2.0+ machines.



**Fig. 3 – Image information Gray\_00.png**

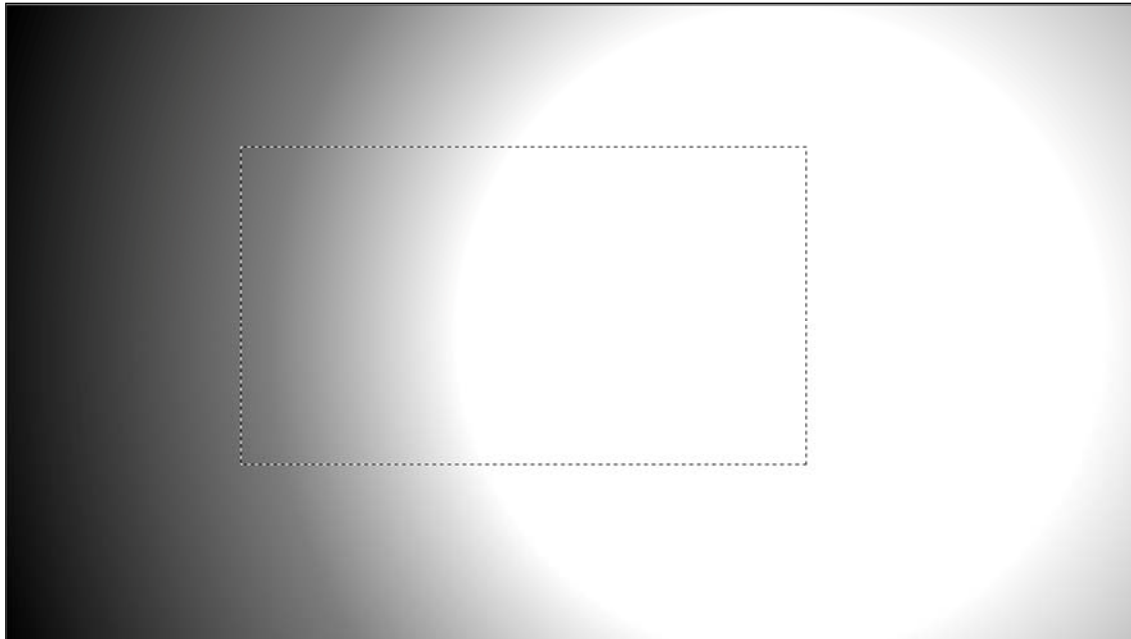
Note, in **Fig. 3**, the information concerning the format of the file **Gray\_00.png**. Please note that you must follow to this information if you decide to prepare your file, otherwise the program will crash.

In case that you should prepare your own image (.png), because you feel it is best suited to balance the exposure of your printer, you have to use a program such as **Corel PaintShop Pro** or **Photoshop** using the '**Gradient**' feature (see the related manuals of the program for specific procedure).

We recommend to follow these steps:

- Create a raster image (Grey-8bit) of this dimensions: 3840 x 2160 (twice as necessary) with 78.000 pixel cm
- Generate, in gray shades, the more suited gradient
- Select the relevant section (dimensions 1920 x 1080)
- Save, using a different name, to use it as a mask, for example: **Gray\_01.png**
- Finally, change the setting to '**Gray\_Type =**' in the file **Printer\_Setup.ini**, with the name of the new image (in our example **Gray\_01.png**).

In the DVD, on folder **3DLPrinter-HD\TechnicalNote\_NoteTecniche\File\_09-16** are preset many images made with **Corel PaintShop Pro** that can be used to generate new Mask.



**Fig. 4 – Gradient 3840 x 2160**

**Fig. 4** is an example of what we have describe above, it shows the original image from which we started to build the 'mask' **Gray\_00.png**, then used in the file **Printer\_Setup.ini** of the program. The dotted line, size: 1920 x 1080, it is exactly the part of the image that was saved with the name **Gray\_00.png**.

## **Use of Mask feature**

After making the adjustment, which will be explained later (this must be done by the user, because it is different from printer to printer), **the program projecting the printing layers, analyzes the image 'Mask', pixel by pixel, computes the negative (in the photographic sense) and generates, with these values, the image (layer) to be projected.**

During calibration and use must take into account some parameters that affect the final result:

- ❖ The brightness (if different from the factory setting to 65)
- ❖ The contrast (if different from the factory setting to 55)
- ❖ The focusing of the projector
- ❖ The cleaning of projector lens
- ❖ The cleaning of glass (Siligel support)
- ❖ The limpidity of Siligel (we recommend using a Siligel in excellent condition)

- ❖ The life (hours) of projector lamp (more you use the lamp, more this one diminishes its brightness)
- ❖ Quality of Resin (please refer to the remarks made in many documents and technical notes already released)

## Calibration

To optimize the use of this feature, you need for the first thing the calibration (one off) of **Threshold\_Mask** and of the image used as 'mask'.



Fig.5 - Printing with **Threshold\_Mask = 160**



Fig.6 - Printing with **Threshold\_Mask = 180**



Fig.7 - Printing with **Threshold\_Mask = 210**

For calibration you have to follow these steps:

- Switch **on** and **enable** the printer
- Launch **Printer3DLP** program
- From **Jobs** folder, push the "**Load Job**" button and select the "**Test\_Mask**" job (these are 12 rings that fill completely the usable size of the print area), for loading is required about 1 minute
- From **Slicer** folder, by pushing the "**Slicing**" button, run the slicing
- Proceed to clean the lens
- Insert a new Siligel in the Vat
- Adjust perfectly the focus of the projector (**this step is one of the most important**)

- Perform the "**Zero Setting**"
- Put the resin into the Vat
- From the Printing folder, push "**Start Printing**", starting the printing (**the times used in the Job are for printing with Mask enabled**)
- After about 6/7 layer, by pushing the "**Stop Printing**" button, stop printing
- Remove the object from construction base
- Clean the construction base and exit from program
- Ensure that all supports are present (they are 36 supports)

In the case there are less supports (of 36), normally it can happen on the **front** of print area, you need to obscure a bit the **rear** part of print area, keeping a constant exposure time.

So, changing the Printer **Setup.ini** with **Notepad++** editor, decrease the **Threshold\_Mask** value (we advise to operate for little steps) setting the **Threshold\_Mask** value near the darkest shade (approaching it to zero value). Remember that the value of the **Threshold\_Mask** can be from 0 (black) and 255 (white).

- Launch **Printer3DLP** program
- From **Jobs** folder, push the "**Load Job**" button and select the "**Test\_Mask**" job (these are 12 rings that fill completely the usable size of the print area)
- From **Slicer** folder, by pushing the "**Slicing**" button, run the slicing
- From the **Printing** folder, push "**Start Printing**", starting the printing with updated values
- After about 6/7 layer, by pushing the "**Stop Printing**" button, stop printing
- Remove the object from construction base
- Clean the construction base and exit from program
- Ensure that all supports are present (they are 36 supports)

In the case, still there are less supports (of 36), repeat the previous procedure editing the **Printer Setup.ini** file with **Notepad++** editor for a further 'decrease' of the **Threshold\_Mask** value, remember in this case to increase the exposure times.

If all the supports are built, but there is diversity dimensional between them, you must adjust the value of **Threshold Mask**, accordingly and possibly change the exposure times of the layer in the folder **Printing** of the program (into **Object Exp. Time**).



**Fig. 8 – All of the support present with the correct size**

If the issue is on a different part, not on front part of printing area, you have to prepare a new Mask, as explained previously, starting from image **Gradient** of dimension 3840 x 2160 and trying



to 'move' the rectangle of dimension: 1920 x 1080 (see the hatched part in in Fig. 4), in order to adapt it to your needs.

In this phase, in order to find the optimal settings for own printer, you need, if necessary, make some tests, changing the settings and evaluating each time, how the result changes depending on different parameters. The parameters that affect the result, are essentially three:

- 1) The image adopted as a mask - the mask of gray shades setted in **Gray\_Type**
- 2) The value **Threshold** – threshold of conversion of gray tones setted in **Threshold\_Mask**
- 3) The **Exposure** times of layers – setted in Printing folder of program into **Object Exp. Time**.

Once you find the right settings (**Gray\_Type** and **Threshold\_Mask**), you can use the printer like usual, changing the exposure times as required.

Remember that you have to take into account certain parameters that affect the final result, as explained above, then over time you may need to repeat the calibration operation, especially if you change the values of **brightness** and **contrast** of the projector, if the **lamp projector** has accumulated to many hours of work, or if the lamp is **replaced**.

## Conclusion

With a little patience, the result is that we can obtain the uniformity of the total size on the printing area (see Fig. 9), a result that hardly other 3D printers, with DLP technology, are able to reach (especially considering the breadth of our printing area).

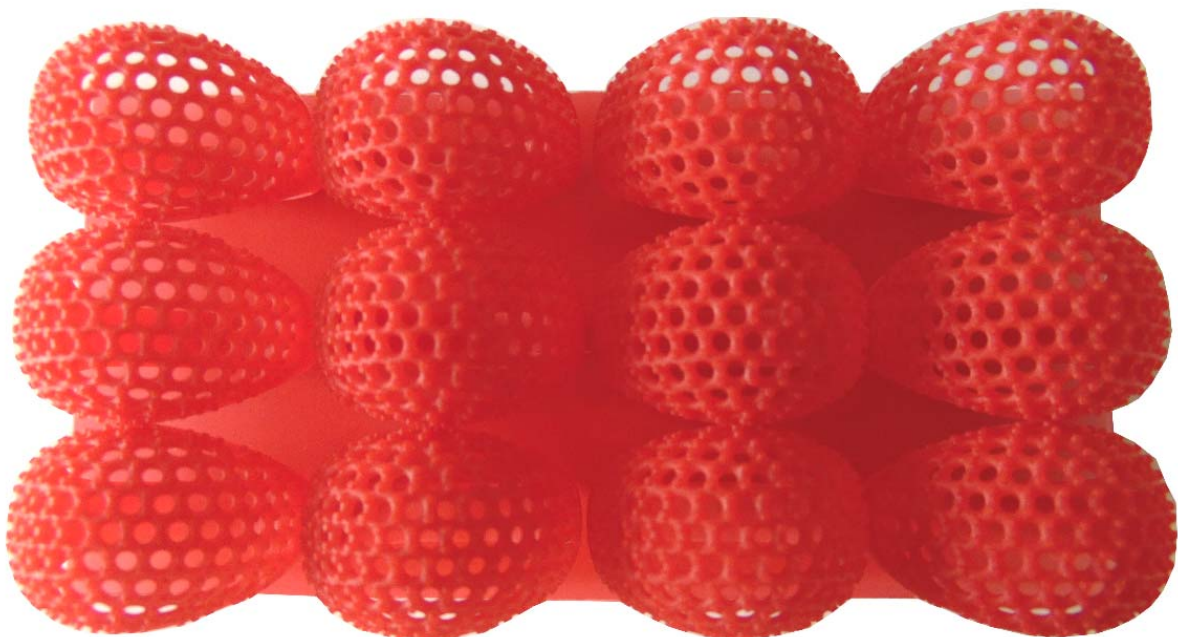


Fig. 9 – Dimensions of printing area: 100 x 56 mm.



## Note

Remember, if you do not feel more to use the '**new feature**', because not necessary for your uses, you can disable it, in any time and continue to use normally the program.

To disable the feature, proceed as follows:

Change the **Printer\_Setup.ini** file, when the Printer3DLP is not running, always using an ASCII editor, like that we put in DVD supplied with printer, in the \Programmi\Editor Notepad++ folder

In the **Mask** section, change the following settings:

[Mask]

**Mask\_On\_Off=OFF**

**Gray\_Type= Gray\_00**

**Threshold\_Mask=210**

**Save\_Sliders=0**

In this case, the program is initialized with the **Mask** feature '**disabled**', so it will not use the **Gray\_00.png** and **Threshold\_Mask**.

*In order to improve and grow the product, we ask that you inform us of any possible malfunction or improvements, sending an email to [robot@robotfactory.it](mailto:robot@robotfactory.it) with the much detail as possible description about the problem when it occurs or the required improvement.*

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