Ultimaker guide

Buyer's guide: How to choose the right 3D printer

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1. Introduction

As desktop 3D printing technology continues to develop, the quality of what can be achieved on a desktop printer now rivals much more expensive industrial machines, while the range of materials available is growing all the time.

More and more companies are considering purchasing a fused filament fabrication (FFF) 3D printer as an important addition to the production process. The technology is ideal for applications such as visual and functional prototyping, producing customized molds, manufacturing aids, and end-use parts.

How do I choose the right 3D printer?

If you are new to the 3D printer market, the choice on offer can seem overwhelming at first. Different manufacturers offer a variety of printer sizes, service agreements, material compatibility, and software – across a wide price range.

Maybe you already have some experience with 3D printers or have one at home. Even so, a 3D printer for a work environment should meet more serious requirements, such as noise level and safety compliance, as well as the technical specifications and production parameters you need.

For your business, the bottom line is that a 3D printer must be able to safely, reliably, and affordably produce usable parts within your required time frame.

This guide covers everything you need to know before buying an FFF 3D printer. Learn the most important features to consider so that you can make the right choice – with minimal hassle.

At the end, you will find an overview of the questions you need to ask when determining which 3D printer fits your requirements. You can download this as a blank template to send to suppliers.

2. Analyzing your 3D printing requirements

Before you start the process of choosing hardware, you should work out how much of what you produce can be printed on your new 3D printer.

Are you going to be printing prototypes or models? Should the model be visually attractive or does it need to be functional? Do you need to print production volumes? If you have this information available, you can decide on the following requirements.

Build volume

What is the maximum size of a print that you will need? Each 3D printer has a maximum area that it can print within – you will see this referred to as the build volume (or build envelope).

A bigger build volume is ideal for small-batch production or printing large parts

The build volume determines the biggest part dimensions that a printer can produce. For example, the Ultimaker S5 has a build surface of 330 x 240 mm (13 x 9.4 inches) and can print parts up to 300 mm (11.8 inches) tall.

3D printers capable of producing large prints with high standards of accuracy and reliability usually need a bigger investment. But they will save you money in the long run compared to outsourcing large parts.

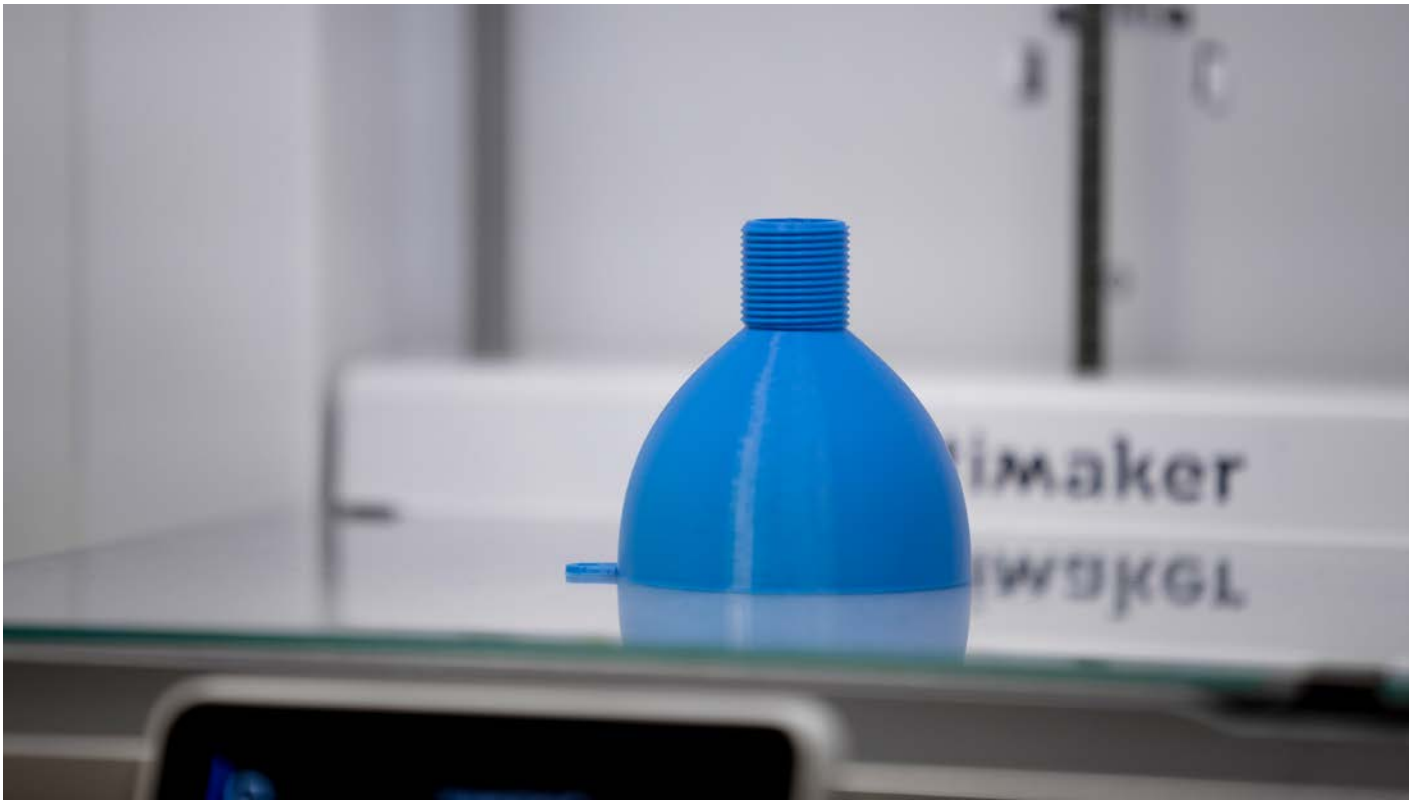
When choosing what 3D printer build volume you need, go with the largest part size that you plan to print most frequently. For the occasional larger object, you can either design it in multiple parts for assembly or outsource it.

Another benefit of a printer with a large build plate surface is that you can produce prints in higher quantity. This enables you to print parts in batches which will save a lot of time compared to setting up and removing each print separately.

Print quality and speed

The print quality has a great influence on the print speed. Printing an object with detailed 100-micron accuracy will take much longer than only 300 micron.

Because of the additive nature of FFF 3D printing, which prints layer on layer, the layer height determines surface smoothness. A bit like the resolution of a screen: the more pixels on a screen – or layers in a print – the more detail you see.



Printing this part with 100-micron layer height produces a smooth curved surface

A higher layer height can result in small but visible 'steps' on a print's curved surfaces. To ensure your chosen 3D printer can create smooth surfaces, check the 'layer resolution' or 'minimum layer height' in its specifications. The smaller this is, the more detail it is capable of producing.

The typical layer thickness capability of an FFF 3D printer is between 20 and 600 micron. A lower minimum thickness of 20 micron means your printer can be used for more niche applications, such as creating molds for parts.

Keep in mind that not all parts need the best quality. For a simple prototype to check fit or dimensions, a faster print is preferable. When setting up your print in software such as Ultimaker Cura, you can choose the layer thickness and speed.

Printing multiple materials

Not all FFF 3D printers have the same capabilities when it comes to printing multiple materials or creating complex geometries. This is because not all FFF printers have the same number of nozzles.

Most printers have only one nozzle and can print only one material (or color) at a time. This is called 'single extrusion'. However, if you want to use two colors or two materials simultaneously, 'dual extrusion' or 'multiple extrusion' (i.e. more than one nozzle) is necessary.

A dual extrusion printer has the great advantage of enabling you to use a separate 'support' material. A 3D printer cannot print features in mid-air, so if your print has any overhangs or cavities, support is required. Printing supports with PVA (polyvinyl alcohol) makes it possible to create very complex parts, and is easy to remove as it dissolves in water and can be safely disposed of down a conventional drain.

Printing PVA effectively and reliably requires a separate nozzle to the one used for 'build' materials, so make sure the printer you choose comes with this. Ultimaker 3D printers use a quick-swap 'print cores' system allowing you to change nozzles in seconds if you want to set up for a print with PVA.

A PLA and PVA dual extrusion print. The white PVA material supports the part during printing, then can be dissolved away in water

Chapter summary

Important questions to consider:

- What is the required minimum build volume for your part size?
- What is your required printing quality?
  400 - 600 micron layer thickness = less detail, high speed
  200 - 400 micron layer thickness = medium detail, medium speed
  20 - 200 micron layer thickness = high detail, low speed
- Do I need a printer capable of dual extrusion?
- Can the printer reliably print PVA support material?

3. Choosing the right materials

Although FFF 3D printing material (often referred to as 'filament') only costs a few cents per gram, it is important to know which material will work best for the parts you intend to produce.

The material an object is made of largely determines its characteristics. So before you choose a 3D printer, you need to make sure it is compatible with the materials you plan to print with.

The most commonly used material in FFF 3D printing is a vegetable-based plastic called PLA. This is a great go-to material, especially for visual prototyping. But sometimes you may need more mechanical properties from your material like flexibility, toughness, or heat resistance.

Because different materials require different capabilities from a printer to print successfully – such as nozzle temperature, build plate temperature, or extra-strong components – not all printers are compatible with all materials.

In the table below we have summarized the properties of some of the most common 3D printing materials, all of which will print on an Ultimaker 3D printer. You can see our full materials range on our website.

Material	**Properties**
PLA (polylactic acid)	Excellent surface quality and detail. Mechanical properties not suitable for some functional applications
ABS (acrylonitrile butadiene styrene)	Strong, ductile material with wear resistance and heat tolerance
Nylon (polyamide)	Strong yet flexible, with good chemical, impact, and abrasion resistance
CPE (copolyester)	A durable and flexible 3D printing material with a glossy finish and good impact and heat resistance
PC (polycarbonate)	Strong and tough material with heat resistance up to 110 °C
TPU (thermoplastic polyurethane)	Flexible material for creating parts with rubber-like properties. Offers high impact and wear resistance
PP (polypropylene)	Durable material with high toughness and fatigue resistance, so it retains shape after torsion, bending, or flexing
PVA (polyvinyl alcohol)	A water-soluble material used to create 'supports' for overhangs and cavities which then dissolve away

Open filament system

One thing to be aware of when choosing a 3D printer is that not all printers are compatible with all materials. Some brands of printer limit you to using only their own materials. Or some printers are only capable of printing one or two material types.

Ultimaker's materials are all tested and optimized to work well with Ultimaker printers. But Ultimaker printers also have an 'open filament system', so if you already have a preferred material supplier or you want to experiment with another filament, you are free to do so.

Some 3D printer brands will leave you locked in to only using their materials, so be sure to check with your seller.

Chapter summary

Important questions to consider:

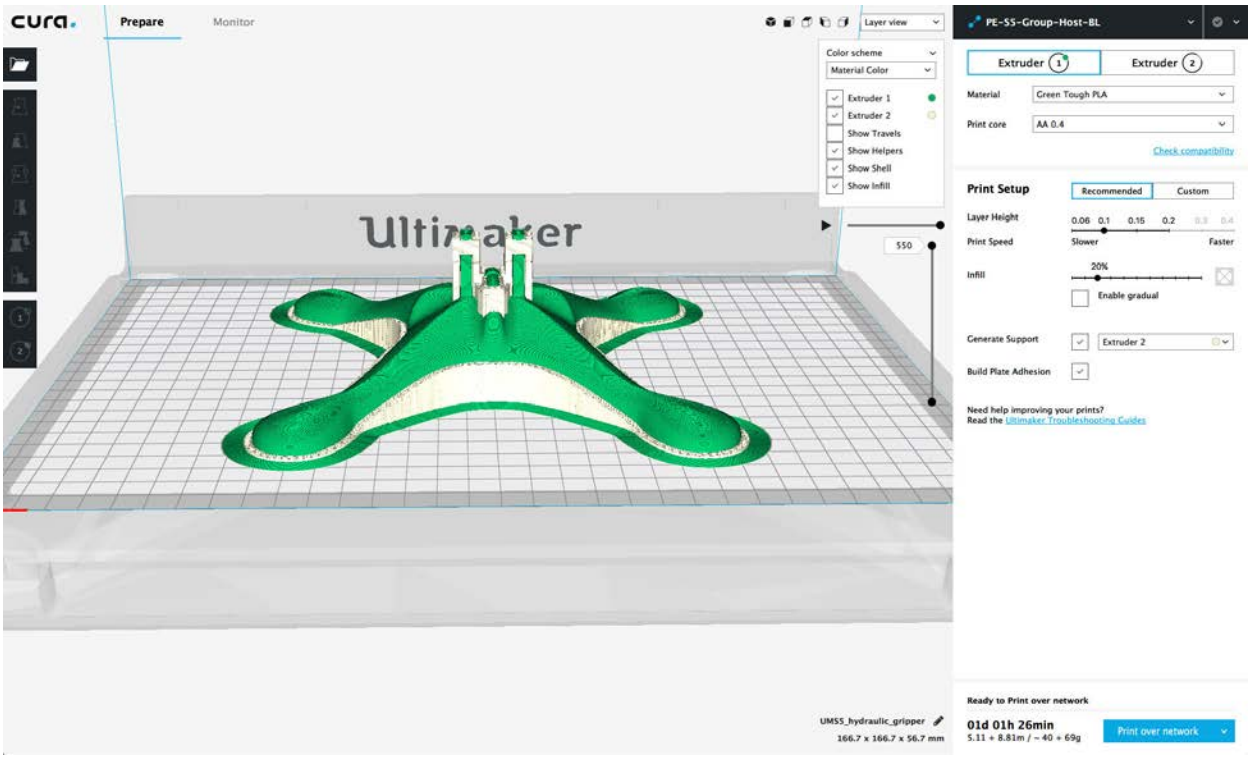
- What properties do my 3D printed parts need?
- What material is required for my project?
- Will my prints need support material?
- Which colors do I need to print with?
- Which 3D printers are compatible with these materials?

4. Determining software requirements

To operate a 3D printer, additional software is required. Once you have a 3D model that has either been designed in CAD software or created from 3D scan data, you will need to prepare it for 3D printing.

This is done using print preparation, or 'slicing', software. This software converts your 3D model into layers, then sends the output to the printer in a file format it understands. Some software packages are proprietary while others, such as Ultimaker Cura, can be used with multiple brands of 3D printer.

This software should be intuitive and simple to use. Software that includes default profiles for materials and your 3D printer will make it easy to get started. This means you won't have to calibrate the printer or manually enter lots of data (for example, how hot the nozzle and build plate need to be). As you get more familiar with your printer, you may also find it important that the software lets you fine-tune your print settings.



Ultimaker Cura software interface

Managing the printing process

Your chosen software should give you insight into the printing process at all times. Some printers only provide information on the built-in display, which means you have to go to the printer to check its status.

It is important that any errors are detected as soon as possible in order to make the production process run as smoothly as possible. Information about the progress of the printing process should be able to be accessed remotely via the software or a mobile app. Some printers are even equipped with a camera, so you can check on your print even if you are far away from the printer.

Chapter summary

Important questions to consider:

- What software is included?
- Are more software licenses needed for additional users?
- What 3D model file formats are supported?
- Does it offer preconfigured material and printer profiles?
- Can custom printing profiles be created?
- What (advanced) settings can be changed?
- Can the printing process be monitored remotely?

5. Additional hardware requirements

At the start of this guide, we looked at the printer specifications required to print certain types of parts. But there are other choices to make which will affect the quality of your printed parts and how you operate the printer.

Open or semi-closed printer

In an FFF 3D printer, plastic filament is melted and applied in thin layers on top of each other. This technique is temperature-sensitive and when the temperature inside the printer cools rapidly, deformation called 'warping' can occur on the print. To limit this, choose a closed or semi-closed printer with side walls. This will reduce heat loss and temperature changes. Printers with no side walls are more likely to result in deformations to your print.

Type of build plate

You should also consider your printer's build plate – the surface onto which the first layer is printed. Not all materials adhere sufficiently to all surface types, so it is preferable to choose a printer with the option to replace the build plate or to apply sheets to the surface to aid adhesion for certain materials. Check a printer's material compatibility information to determine this. Removable build plates are much easier to keep clean, which is important for good adhesion.

Ultimaker S5 in an office environment

Printer location

Where do you plan to install the printer? FFF is a clean and safe technology that requires no protective clothing or other precautions beyond levels of ventilation achievable in an office or workshop. Check the safety data sheets of materials that you plan to use for precise instructions on ventilation.

However, the operating sound and design of the printer may make the machine less suitable for an office environment. An operating sound level above 60 decibels is not recommended in an office environment.

Unattended use

When you want to produce larger prints, or if you simply want to maximize the availability of your 3D printer, you will need to leave it running outside of working hours.

That's why it is very important to check that a printer comes with a safety declaration. This document should outline the safety standards and testing done on the printer. Ultimaker provides a 'Declaration of safe unattended professional use' for Ultimaker S5, Ultimaker 3, and Ultimaker 2+ printers.

Connectivity

3D printers support a variety of connections to send designs to the printer, operate the printer, and monitor progress. As well as Ethernet and USB, the latest generation of printers offers support for Wi-Fi, making printing from different workstations easy.

Chapter summary

Important questions to consider:

- Is the printer open or semi-closed?
- What type of build plate does the printer come with?
- Is the printer suitable for an office environment?
- What is the noise level of the printer?
- Which methods for data transfer are supported (Wi-Fi, Ethernet, USB)?

6. Uptime and support

When you rely on a 3D printer for your business, maximum availability and uptime are very important. Any malfunctions and maintenance mean downtime, which has a negative influence on business operations.

That's why high-quality, quick-response support through a local dealer is important. A local dealer can provide you with onboarding training, periodic maintenance, and a quick solution in case of malfunctions.

There are a lot of different brands and printers on the market. It is important to choose a manufacturer with a support network that covers your location, and with extensive experience in producing 3D printers. This ensures continuity, such as continued software and firmware development, and the availability of spare parts over a long period.

Chapter summary

Important questions to consider:

- What is the reputation of the printer brand?
- In which regions is the manufacturer active?
- Does the manufacturer have a worldwide network with a dealer in my area?
- Does the dealer offer onboarding training? What are the additional costs?
- Does the brand have an active online community?
- Does the dealer offer a maintenance contract? What are the additional costs?
- What is the expected maintenance?
- Can I perform simple maintenance tasks myself, such as cleaning the print head or calibration?
- Is the printer only compatible with the manufacturer's own materials, or is material from third parties usable?
- Are there customer case studies available?

7. Request for information

The questions in this guide are designed to help you research your options and talk to various suppliers. This way you can compare 3D printers and create a shortlist. You can also ask your seller to provide sample prints as part of the selection process.

Once you have a shortlist, you can continue the purchase process by asking the seller to fill out our template request for information form for your shortlisted printers.

We have provided information on Ultimaker products in the example below, but you can also download the blank template from the link above.

Then you can compare the key features of these printers and make your final decision.

Required user specifications

Required minimum build volume (e.g. 150 x 150 x 150 mm):

- Required printing quality (e.g. 50 micron):
- Dual extrusion required? Yes / No
- Additional nozzle for printing PVA required? Yes / No
- Heated build plate required? Yes / No
- The printer must be compatible with the following materials:

Questions to be answered by the seller

Printer	**Ultimaker printers**
Printer brand and type	Ultimaker, FFF 3D printer
Price	Ultimaker 2+: from $2,499 Ultimaker 3: from $3,495 Ultimaker S5: $5,995 *Excluding taxes*
Software	**Ultimaker software**
What software is included? (Supported OS)	Ultimaker Cura (MacOS, Windows, and Linux)
Are additional software licenses required?	No, Ultimaker Cura is free to use
What 3D model file formats are supported?	STL, OBJ, X3D, 3MF
Can printing profiles be created?	Yes, and custom settings can be saved for easy use in future
What printing settings can be set?	Over 300 customizable settings, including material, infill, support, cooling, and more
Hardware	**Ultimaker hardware***
Is the printer an open model or a semi-closed model?	Semi-closed, with the build chamber enclosed on four sides
What type of build plates are available?	Glass build plate
What is the expected maintenance?	Monthly, quarterly, and annual maintenance tasks (see ultimaker.com)
Can I perform simple maintenance tasks myself, such as cleaning the print head or calibration?	Yes
What safety documentation does the manufacturer provide?	Safety information in product manual, plus EC declaration of conformity, VPAT certificate, CB certificate, Declaration of safe unattended use, and material safety data sheets (see ultimaker.com)
Working space	**Ultimaker working space**

**Product details for Ultimaker S5. Information on other 3D printers available on ultimaker.com*

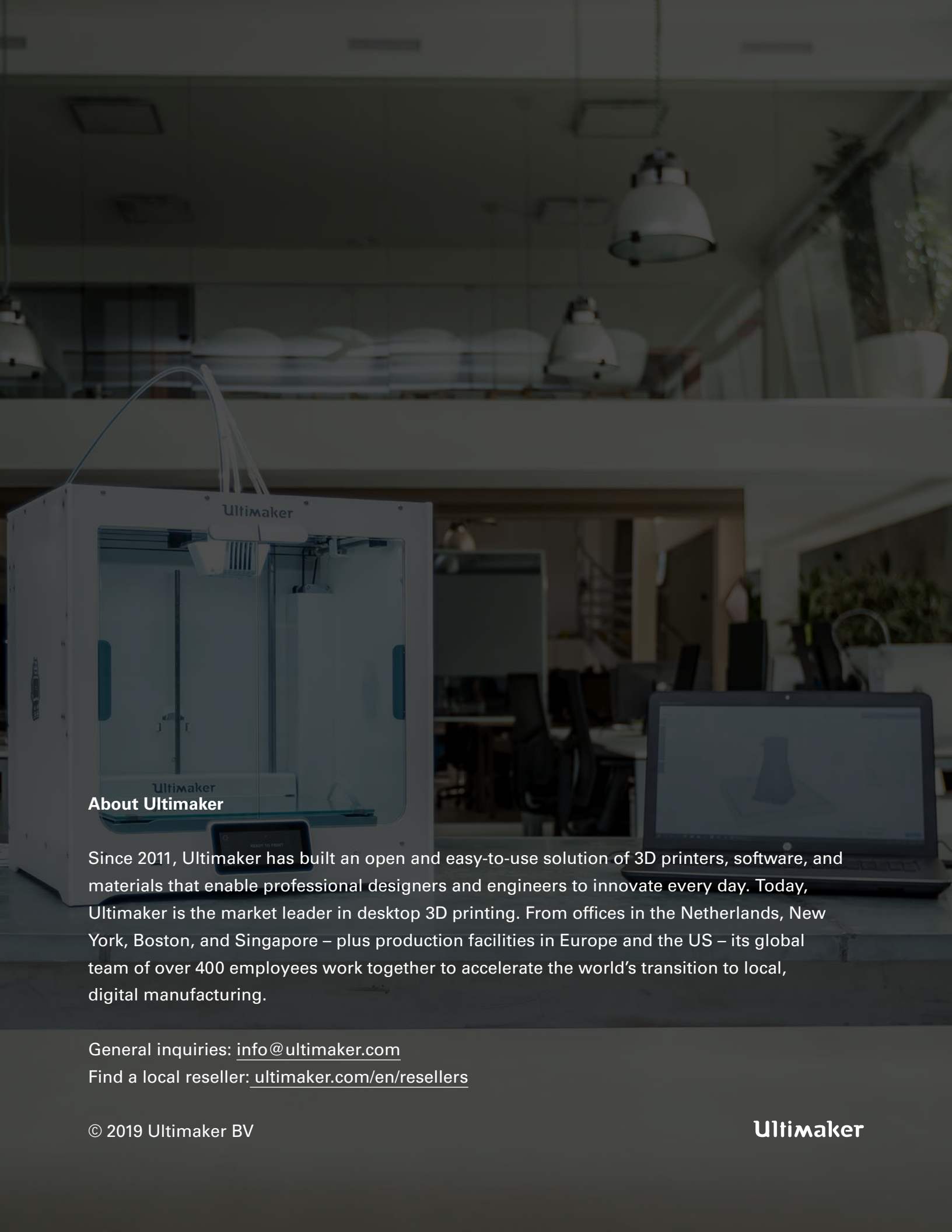
Is the printer suitable for an office environment?	Yes, all Ultimaker printers are suitable for office use
What is the noise level of the printer?	Up to 50 dBA
Which protocols for data transfer (e.g. Wi-Fi, Ethernet, USB) are supported?	Wi-Fi, LAN, USB port for Ultimaker S5 and Ultimaker 3, SD card only for Ultimaker 2+
How can the printing process be monitored? Can it be done remotely?	Network-enabled Ultimaker printers offer remote monitoring via Cura Connect and the Ultimaker app (including live camera feed)
Manufacturer	**Ultimaker**
How long has the manufacturer been in business?	Since 2011
Does the manufacturer have a worldwide network with a service partner in this region?	Ultimaker has a global network of resellers and service partners (see ultimaker.com)
Does the dealer offer onboarding training? What are the additional costs?	Yes, ask your Ultimaker reseller for details
Does the brand have an active online community?	Yes, over 40,000 members ready to share knowledge and best practice
Does the dealer offer a maintenance contract? What are the additional costs?	Maintenance contracts are not required with an Ultimaker printer. Ask your reseller for any options
Is the printer only compatible with the manufacturer's own materials, or also with materials from third parties?	Ultimaker offers a material range optimized for its printers, but other brands' materials can also be used

Find a reseller

Ultimaker's global network of dedicated service partners is ready to help you find a 3D printing solution to give your business the edge.

Find your local Ultimaker reseller

Compare Ultimaker 3D printers



About Ultimaker

Since 2011, Ultimaker has built an open and easy-to-use solution of 3D printers, software, and materials that enable professional designers and engineers to innovate every day. Today, Ultimaker is the market leader in desktop 3D printing. From offices in the Netherlands, New York, Boston, and Singapore – plus production facilities in Europe and the US – its global team of over 400 employees work together to accelerate the world's transition to local, digital manufacturing.

General inquiries: info@ultimaker.com
Find a local reseller: ultimaker.com/en/resellers

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