EMONA
INSTRUMENTS PTY LTD

3D PRINTERS & ADDITIVE MANUFACTURING

2024 SHORT FORM

FFF Thermoplastics
Carbon Fibre (Continuous Fibre)
Kevlar (Continuous Fibre)
Fibreglass (Continuous Fibre)
SLA Stereolithography
SLS Laser Sintering
Electronics Printers (Aerosol Jet)
Biologics Printers (Aerosol Jet)
Multi-Layer PCB Printers
ADAM Metal 3D Printer
LENS Metal 3D Printers
LENS Hybrid Machine Tools

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Bambu Lab X1E

For Professionals and Engineering Applications

Advanced Network Security Solutions, Protecting Your Business Integrity

The X1E provides WPA2-Enterprise Wi-Fi Authentication (EAP-PEAP/EAP-TLS/TAP-TTLS) and individual physical kill switches for both Wi-Fi and Ethernet (newly added), meeting stringent network security requirements.
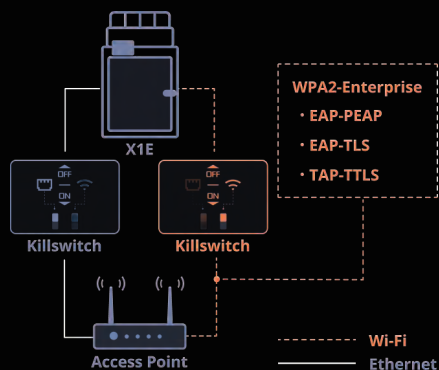
320°C /608°F Nozzle Temperature, Unlocking Greater Heat for High-Temperature Materials

Higher nozzle temperature makes it possible to print higher performance materials with improved dimensional stability, heat resistance and mechanical performance, such as PPA-CF /GF, PPS and PPS-CF.


Active Heating and Controlled Chamber Temp, Reducing Prints Warping

The active heated chamber, reaching temperatures of up to 60°C /140°F, ensures improved print quality, particularly for filaments that are prone to warping, such as ABS and PC.

Effectively Filter Particulates and VOCs, Protecting Yourself in Less Ventilated Environments

A G3 pre-filter, an H12 HEPA filter, and a high-quality coconut shell activated carbon filter are combined to provide optimal air filtration.
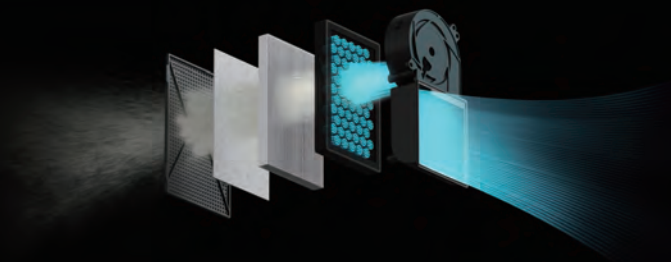
Tech Specs

Supported Filament

PLA, PETG, TPU, PVA, BVOH:	Optimal
ABS, ASA, PC, PA, PET:	Superior
Carbon/Glass Fiber Reinforced PLA, PETG, PA, PET, PC, ABS, ASA:	Superior
PPA-CF/GF, PPS, PPS-CF/GF:	Ideal

Heating

Active Chamber Heating:	Yes
Maximum Chamber Control Temperature:	60 °C

Ethernet

Socket:	RJ45
Speed:	100 Mbps / Full Duplex

Network Control

Ethernet:	Yes
Wireless Network:	Wi-Fi
Network Kill Switch:	Wi-Fi & Ethernet
Removable Network Module:	Yes

Wi-Fi

Frequency Range:	2412 MHz - 2472 MHz (CE) 2412 Mhz - 2462 MHz (FCC) 2400 MHz - 2483.5 MHz (SRRC)
Transmitter Power (EIRP):	≤ 21.5 dBm (FCC) ≤ 20 dBm (CE/SRRC)
Protocol:	IEEE 802.11 b/g/n

Air Purification

Pre-filter grade:	G3
HEPA filter grade:	H12
Activated Carbon Filter type:	Coconut Shell Granulated
VOC Filtration:	Optimal
Particulate Matter Filtration:	Yes

Laser (CLASS 1)

Wavelength:	850 nm, 850 nm
Maximum Output of Laser Radiation	< 0.778 mW

Markforged

Mark Two (Gen 2)

Replace machined aluminum tooling—jigs, jaws, and fixtures—with stronger parts for a fraction of the price. The Mark Two combines our unique continuous carbon fiber reinforcement with workhorse reliability for versatile parts with 26x the strength of ABS, ready same-day for use straight off the printer.

Printer Properties	**Process**	Fused filament fabrication, Continuous Filament Fabrication
	Build Volume	320 x 132 x 154 mm (12.6 x 5.2 x 6 in)
	Weight	16 kg (35 lbs)
	Machine Footprint	584 x 330 x 355 mm (23 x 13 x 14 in)
	Print Bed	Kinematic coupling — flat to within 160 µm
	Extrusion System	Second-generation extruder, out-of-plastic detection
	Power	100–240 VAC, 150 W (2 A peak)
	RF Module	Operating Band 2.4 GHz Wi-Fi Standards 802.11 b/g/n
Materials	**Plastics Available**	Onyx, Nylon White, Precise PLA, Smooth TPU
	Fibers Available	Carbon Fiber, Fiberglass, Aramid Fiber (Kevlar®), HSHT Fiberglass
	Tensile Strength	800 MPa (25.8x ABS, 2.6x 6061-T6 Aluminum) *
	Tensile Modulus	60 GPa (26.9x ABS, 0.87x 6061-T6 Aluminum) *
Part Properties	**Layer Height**	100 µm default, 200 µm maximum
	Infill	Closed cell infill: multiple geometries available
Software	**Supplied Software**	Eiger Cloud (Other options available at cost)
	Security	Two-factor authentication, org admin access, single sign-on

FRONT VIEW
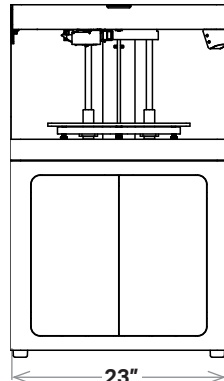
SIDE VIEW

23"

14"

13"

* Continuous carbon fiber data. **Note:** All specifications are approximate and subject to change without notice.
Dupont™ and Kevlar® are trademarks and registered trademarks of E.I. du Pont de Nemours and Company.

Markforged
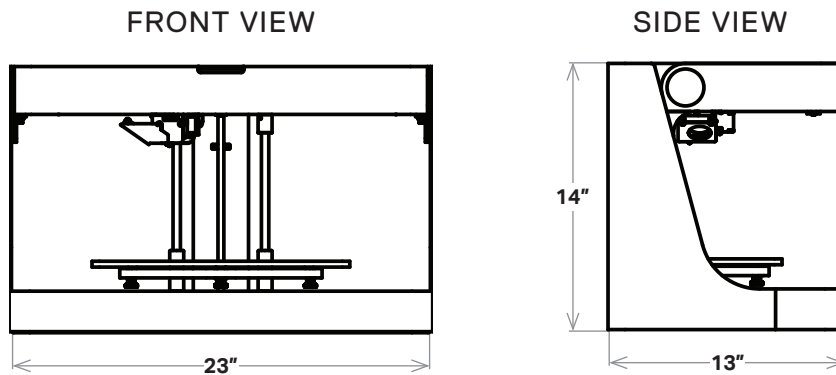
X7 (Gen 2)

The X7 prints industrial-grade manufacturing jigs, jaws, tools, fixtures, and end-use parts. Designed from the ground up to survive the production floor environment and capable of printing parts stronger than machined aluminum for a fraction of the cost, the X7 delivers unparalleled surface finish, build size, and reliability. Accelerate part production with Turbo Print, our fastest print mode, and verify dimensional accuracy with Blacksmith adaptive manufacturing technology — only available on the X7.

|		
Printer Properties	**Process**	Fused Filament Fabrication, Continuous Filament Fabrication
	Build Volume	330 x 270 x 200 mm (13 x 10.6 x 7.9 in)
	Weight	48 kg (106 lbs)
	Machine Footprint	584 x 483 x 914 mm (23 x 19 x 36 in)
	Print Bed	Kinematic coupling — flat to within 80 µm
	Laser	In-process inspection, active print calibration, bed leveling
	Extrusion System	Second-generation extruder, out-of-plastic and out-of-fiber detection
	Power	100–240 VAC, 150 W (2 A peak)
	RF Module	Operating Band 2.4 GHz Wi-Fi Standards 802.11 b/g/n
Materials	**Plastics Available**	Onyx, Onyx FR, Onyx ESD, Nylon White, P-PLA, S-TPU
	Fibers Available	Carbon Fiber, Carbon Fiber FR, Fiberglass, Aramid Fiber (Kevlar®), HSHT Fiberglass
	Tensile Strength	800 MPa (25.8x ABS, 2.6x 6061-T6 Aluminum) *
	Tensile Modulus	60 GPa (26.9x ABS, 0.87x 6061-T6 Aluminum) *
Part Properties	**Layer Height**	100 µm default, 50 µm minimum, 250 µm maximum
	Infill	Closed cell infill: multiple geometries available
Software	**Eiger Cloud**	Slicer, part / build management (other options available at cost)
	Security	Two-factor authentication, org admin access, single sign-on
	Blacksmith	Adaptive manufacturing platform (additional purchase required)

FRONT VIEW

SIDE VIEW
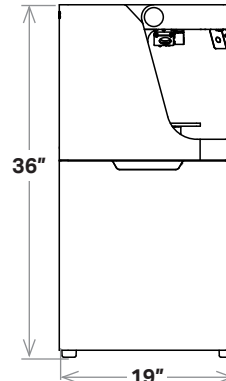
23"

36"

19"

* Continuous carbon fiber data. **Note:** All specifications are approximate and subject to change without notice.
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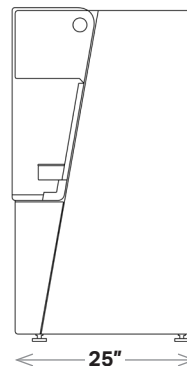
FX10

FX10 matches the part strength, surface finish, and reliability of our Industrial machines with a next-generation sensor package and flexible modular system design. Our fifth-generation extrusion system delivers precise repeatable results at twice the speed of an X7. The heated print chamber and automated spool changeover let you print large, high-quality parts, while its laser micrometer and onboard vision module capture detailed part images for precise calibration, inspection, and verification.

Printer Properties	Process	Fused Filament Fabrication, Continuous Fiber Reinforcement
	Build Volume	375 x 300 x 300 mm (14.8 x 11.8 x 11.8 in)
	Weight	109 kg (240 lbs)
	Machine Footprint	760 x 640 x 1200 mm (30 x 25 x 46 in)
	Temperature Control	Up to 60°C steady-state
	Print System	Direct-drive print head with two nozzles (one plastic, one fiber), automatic material changeover
	Power	100-120 VAC 12A /15A 200-240 VAC 6A / 8A
	Safety	UL 2011/CSA C22.2#301 certified, CE Marked, EU Machinery Directive compliant
Materials	**Plastics**	Onyx®
	Continuous Fibers	Carbon Fiber
Part Properties	**Layer Height**	125 µm minimum, 250 µm maximum
Software	**Eiger™**	Secure digital library, powerful slicer, and printer management (premium options available at cost)
	Security	Two-factor authentication, org admin access, single sign-on, MFP print files encrypted by default and tamper resistant
	Connectivity	Eiger connection and over-the-air updates via wi-fi and Ethernet

FRONT VIEW

46"

30"

SIDE VIEW

25"
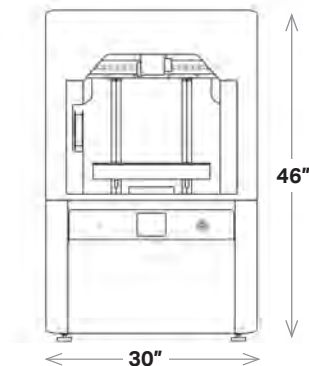
* All specifications are approximate and subject to change without notice. Support for print materials and layer heights will be added over time, though not in every combination. Vision Module will not ship with the first FX10 units but will be included as an upgrade.
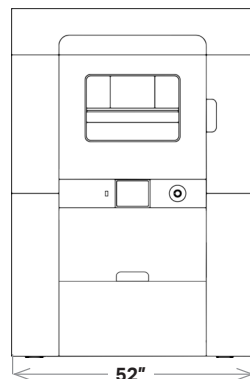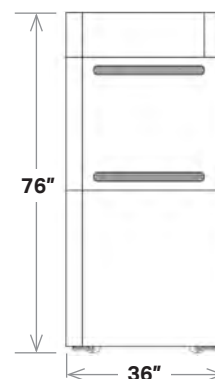
![Markforged]

FX20

FX20 is the biggest, fastest, smartest printer in the Markforged lineup. Engineered to deliver maximum strength, accuracy, and consistency, FX20 produces mission-critical parts for the most demanding applications, from the factory floor to the skies and beyond. Replace long lead-time metals with high-temperature thermoplastics and continuous fiber reinforced composites—with FX20 and the cloud-connected, continuously learning Digital Forge platform, globally distributed production at the click of a button is now a reality.

Printer Properties	**Process**	Fused Filament Fabrication, Continuous Fiber Reinforcement
	Build Volume	Single-nozzle builds: 525 x 400 x 400 mm (20.6 x 15.7 x 15.7 in) Multi-nozzle builds: 500 x 400 x 400 mm (19.7 x 15.7 x 15.7 in)
	Weight	530 kg (1170 lbs)
	Machine Footprint	1325 x 900 x 1925 mm (52.2 x 35.5 x 75.75 in)
	Temperature Control	Up to 200°C steady-state
	Print System	Direct-drive print head with three nozzles (two plastic, one fiber)
	Power	200-240 VAC 2W+PE 40A // 200-240 VAC 3Ø+PE 24A // 347-415 VAC 3Ø+N+PE 14A; 50-60 Hz
	Safety	IEC/UL/CSA 62368-1 certified, CE Marked, EU Machinery Directive compliant
Materials	**Plastics**	Vega, ULTEM™ 9085 filament, Onyx, Onyx FR
	Continuous Fibers	Carbon Fiber, Fiberglass, Aramid Fiber (Kevlar®), High Temperature Carbon Fiber, Carbon Fiber FR
Part Properties	**Layer Height**	50 μm minimum, 250 μm maximum
	Accuracy	+/- 125 μm or +/- 0.0015 mm per mm (whichever is greater)
Software	**Eiger**	Secure digital library, powerful slicer, and printer management (premium options available at cost)
	Security	Two-factor authentication, org admin access, single sign-on, MFP print files encrypted by default and tamper resistant
	Connectivity	Eiger connection and over-the-air updates via Ethernet

### FRONT VIEW

52"

SIDE VIEW

76"

36"

Composites

Markforged

Markforged composite printers use a base plastic matrix reinforced with continuous fibers. Combining the materials during printing yields composite parts far stronger, stiffer, and more robust than conventional 3D printed plastics.

Plastic Matrix

In Fused Filament Fabrication (FFF), a printer heats thermoplastic filament to near melting point and extrudes it through its nozzle, building a plastic matrix layer by layer. Plastics can be reinforced by any one type of fiber.
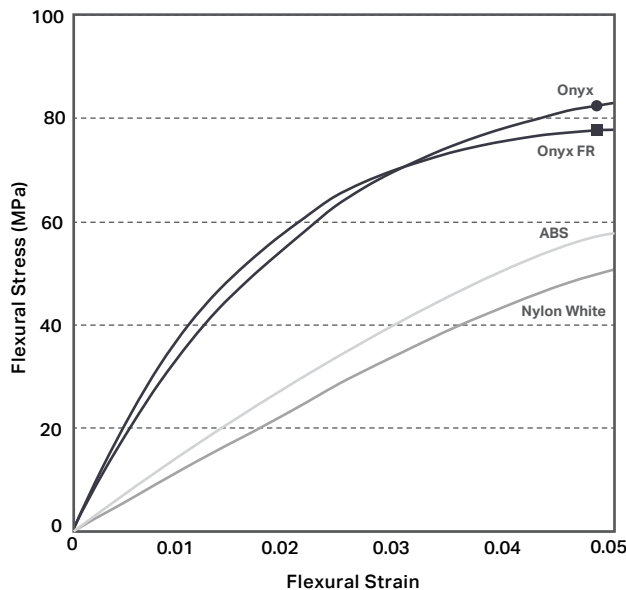
● **Onyx**   Flexural Strength: 81 MPa

Onyx is a chopped carbon fiber reinforced nylon. It's 1.4 times stronger and stiffer than ABS and can be reinforced with any continuous fiber. Onyx sets the bar for surface finish, chemical resistivity, and heat tolerance.
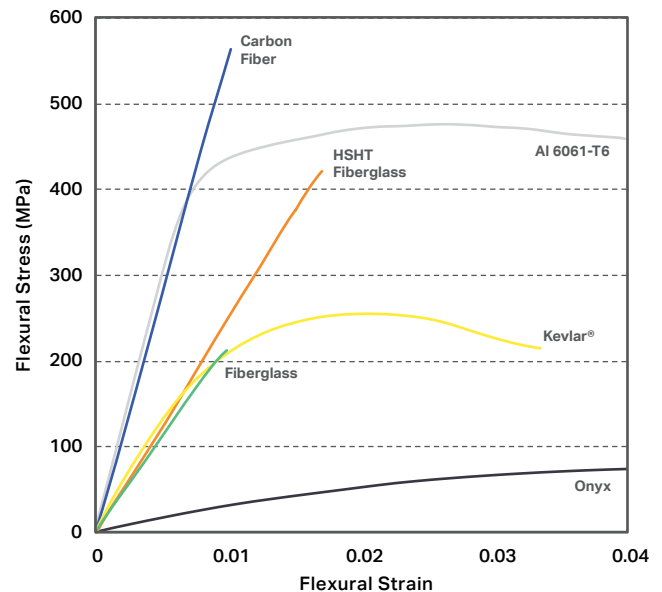
■ **Onyx FR**   Flexural Strength: 79 MPa

Onyx FR achieves V-0 rating on the UL94 flammability test while possessing similar mechanical properties to Onyx. It's best for applications in which flame retardancy, light weight, and strength are required.

● **Nylon White**   Flexural Strength: 50 MPa

Nylon White parts are smooth, non-abrasive, and easily painted. They can be reinforced with any continuous fiber and work best for non-marring work holding, repeated handling, and cosmetic parts.

Fiber Reinforcement

Continuous Filament Fabrication (CFF) is proprietary technology that reinforces plastic printed parts with continuous fibers on each layer of a part. Users can control the layers reinforced, amount, orientation, and type of reinforcing fiber.

● **Carbon Fiber**   Flexural Strength: 540 MPa

Carbon Fiber has the highest strength-to-weight ratio of our reinforcing fibers. Six times stronger and eighteen times stiffer than Onyx, Carbon Fiber reinforcement is commonly used for parts that replace machined aluminum.

● **Fiberglass**   Flexural Strength: 200 MPa

Fiberglass is our entry level continuous fiber, providing high strength at an accessible price. 2.5 times stronger and eight times stiffer than Onyx, Fiberglass reinforcement results in strong, robust tools.

● **Kevlar®**   Flexural Strength: 240 MPa

Kevlar® possesses excellent durability, making it optimal for parts that experience repeated and sudden loading. As stiff as fiberglass and much more ductile, it can be used for a wide variety of applications.

● **HSHT Fiberglass**   Flexural Strength: 420 MPa

High Strength High Temperature (HSHT) Fiberglass exhibits aluminum strength and high heat tolerance. Five times as strong and seven times as stiff as Onyx, it's best used for parts loaded in high operating temperatures.

Markforged

FFF Printer Comparison

markforged.com
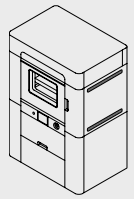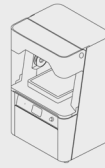
Desktop
Reliable entry-level machines. Accurate parts with good surface finish. Prints with standard materials.

Industrial
Industrial-grade machines with large build envelope and in-chamber sensors for optimized performance. Superior accuracy, resolution, and speed. Full industrial material portfolio.

	Onyx Pro™	Mark Two™	X7™	FX10™	FX20™
Process					
Fused Filament Fabrication			Thermoplastic-based filaments are heated and extruded through a nozzle in discrete layers		
Continuous Fiber Reinforcement			Continuous fibers laid down in-layer, reinforcing FFF infill to aluminum-strength		
Engineering Thermoplastics[3]					
Onyx™ (Micro carbon fiber filled nylon)	x	x	x	x	x
Onyx ESD™			x		x
Onyx FR™[2]			x		x
Nylon		x	x		
Precise PLA	x	x	x		
Smooth TPU 95A	x	x	x		
ULTEM™ 9085 Filament[1]					x
Vega™ (Micro carbon fiber filled PEKK)					x
Continuous Fibers[3]					
Continuous Fiberglass	x	x	x		x
Continuous Carbon Fiber		x	x	x	x
Continuous Carbon Fiber FR[2]			x		x
High Temperature Carbon Fiber[1]					x
Continuous HSHT Fiberglass		x	x		
Continuous Aramid Fiber (Kevlar®)[4]		x	x		x
Advanced Features					
Out-of-Plastic Detection	x	x	x	x	x
Out-of-Fiber Detection			x	x	x
Fiber Jam Detection	x	x	x	x	x
Adaptive Bed Leveling			x	x	x
Automated Bed Leveling				x	x
Micron Precision Linear Encoders					x
Max Speed	1x	1x	2x	4x	4x
Inspection (compatible)			x	x	
Hardware					
Build Volume	320 x 132 x 154 mm, 6.5 L (12.6 x 5.2 x 6.0 in)		330 x 270 x 200 mm, 17.8 L (13.0 x 10.6 x 7.9 in)	375 x 300 x 300, 33.8 L (14.8 x 11.8 x 11.8 in)	525 x 400 x 400 mm, 84 L (20.7 x 15.7 x 15.7 in)
Print Bed	Flat to within 160 µm; Kinematic coupling Manual shim leveling		Flat to within 80 µm; Kinematic coupling Manual laser-assisted leveling	Heated, Precision-ground aluminum vacuum bed, Auto leveling	Precision ground aluminum vacuum bed Auto leveling
Z Resolution Range	100 - 200 µm		50 - 250 µm	125-250 µm	50 - 250 µm
Build Chamber	Not heated			Heated up to 60ºC	Heated up to 200ºC
Material Storage	Outboard dry box	Inboard dry box		Humidity controlled material drawer, 4 spool bays	
	800cc spool	800cc spool		800cc spools	800cc or 3200cc spools
Supports	Same material breakaway supports				Same material breakaway supports (Onyx) Dedicated breakaway support (Ultem™ Filament and Vega)
Infill	Closed-cell infill; Multiple geometries available				
Specifications					
Storage	Cloud included; Offline available				
Power	100-240 VAC, 150W (2A peak)			100-120 VAC, 12A or 200-240 VAC, 6A	200-240VAC 3P+E, 24A or 347-416VAC 3P+N+E, 14A; 8 kW
Weight	16 kg (35 lb)		48 kg (106 lb)	109 kg (240 lb)	530 kg (1170 lb)
Footprint	584 x 330 x 355 mm (23 x 13 x 14 in)		584 x 483 x 914 mm (23 x 19 x 36 in)	760 x 640 x 1200 mm (30in x 25in x 46in)	1325 x 900 x 1925 mm (52 x 36 x 76 in)

[1]ULTEM™ and 9085 trademarks are used under license from SABIC, its affiliates or subsidiaries.
[2]Available in -A version with traceability.
[3]Support for all Markforged plastic and fiber materials on the FX20 and FX10 will be added over time, although not every combination.
[4]Dupont™ and Kevlar® are trademarks and registered trademarks of E. I. du Pont de Nemours and Company.

REV 6 -11/07/23 - en-US

Metal X System

Join the growing list of universities adding Metal 3D printing capabilities to their fabrication spaces.

PURDUE UNIVERSITY   **RIT**   OKLAHOMA STATE UNIVERSITY   SASKATCHEWAN POLYTECHNIC   UTS

Why choose the Metal X?

Safe and Easy to Use

The Metal X system can be installed in any shop or lab. There are no lasers or loose powders to manage, and system fail-safes insure that students and faculty can safely operate the machine.

Many Materials

Print with stainless steels, tool steels, titanium, and inconel on the Metal X system. Material changeover is as easy as conventional FFF machines and each material has a custom sintering profile.

Affordable to Buy and Maintain

The Metal X system costs up to 10 times less than traditional metal 3D printers and can be effectively maintained for a fraction of the cost. No dedicated machine is operator required.

Visit **markforged.com/education** to learn how you can bring metal 3D printing to your university.

WASH-1

SINTER-1

≋ **Markforged**
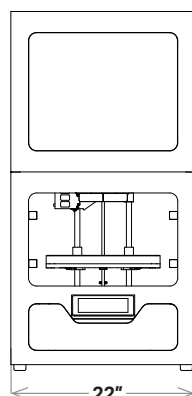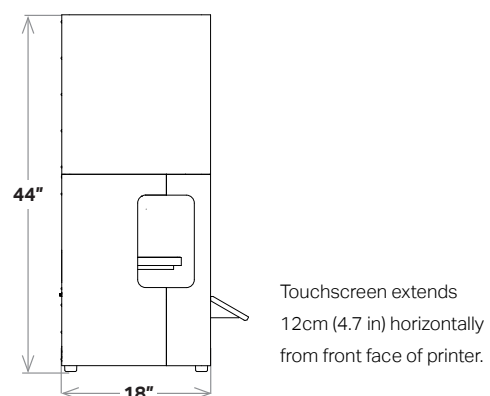
Metal X (Gen 2)

The Metal X is a revolutionary 3D printer that prints metal powder bound in a plastic matrix to eliminate safety risks associated with traditional metal 3D printing methods while enabling new features like close-cell infill for reduced part weight and cost. It's up to 10x less expensive than alternative metal additive manufacturing technologies — and up to 100x less than traditional fabrication technologies like machining or casting. Affordable, reliable, and easy to use, the Metal X print system gives you everything you need to go from design to fully functional metal parts faster than ever before.

| Printer Properties	Process	Metal fused filament fabrication
	Build Volume	300 x 220 x 180 mm (11.8 x 8.7 x 7.1 in)
	Machine Size	575 x 467 x 1,120 mm (22.7 x 18.4 x 44.1 in), 75 kg (160 lbs) Touchscreen: 12 cm (4.7 in) horizontal extension
	Print Chamber	Heated
	Print Bed	Heated, vacuum-sealed print sheet, auto bed leveling
	Print System	Two nozzles — Metal material and release material
	Power Requirements	100–120 / 200-240 VAC (12A / 6A), IEC 60320 type C20
	RF Module	Operating Band 2.4 GHz Wi-Fi Standards 802.11 b/g/n
Materials	Metal Material	Stainless steel (17-4 PH), Tool steel (H13, A2, D2), Inconel 625, Copper
	Release Material	Ceramic (consumed at 1:10 ratio to metal spools, on average)
	Media (Spools)	Filament fed, bound powder
Part Properties	Max Part Size	250 x 183 x 150 mm (9.8 x 7.2 x 5.9 in), 10kg
	Supports	Metal material with ceramic release layer
	Layer Height	50µm and 125µm post-sinter
Software	Supplied Software	Eiger Cloud (Other options available at cost)
	Security	Two-factor authentication, org admin access, single sign-on

FRONT VIEW

22"

SIDE VIEW

44"

18"

Touchscreen extends 12cm (4.7 in) horizontally from front face of printer.

Note: All specifications are approximate and subject to change without notice.

Markforged

Sinter-1

The Markforged Sinter-1 is a high-performing, high-value furnace that is ideal for small batch production. Built on 30 years of Metal Injection Molding (MIM) technology, it's affordable and reliable. Featuring 4,760 cm^3 of active hot zone, the Sinter-1 effortlessly converts washed parts into their high-quality dense final metallic form in as few as 26 hours.

Furnace Properties		
	Materials Supported	Chemically debound Metal X-printed parts
	Heating Element	Kanthal
	Controller	Pre-programmed automatic cycling
	Sinter Run Time	26 hours*
	Peak Internal Temp.	1,300° C / 2,372° F
	Sintering Capacity	Rectangle w/radius top — 141 mm ID x 305 mm L (5.55 in ID x 12 in L)
	Sintering Workload	3,020 cm^3 (184 in^3)
	Sinter Surface Area	348 cm^2 (53.9 in^2) for single ceramic setter plate
	Setter Plate Dimensions	11.4cm W x 30.4cm D, (4.5in W x 12.0in D)
	Gas Types	Argon, argon / hydrogen mix
	Retort	High purity refractory retort (carbon-free)
	RF Module	Operating Band 2.4 GHz Wi-Fi Standards 802.11 b/g/n
Safety & Installation	Environmental Req.	External exhaust (100–150 CFM)
	Power	200–240 V single phase 30A, recommend wiring 50A
Physical Dimensions	External Dimensions	1,270 x 510 x 720 mm (50 x 20 x 28 in)
	Weight	136 kg (300 lbs)

FRONT VIEW

42"

SIDE VIEW

28"

20"
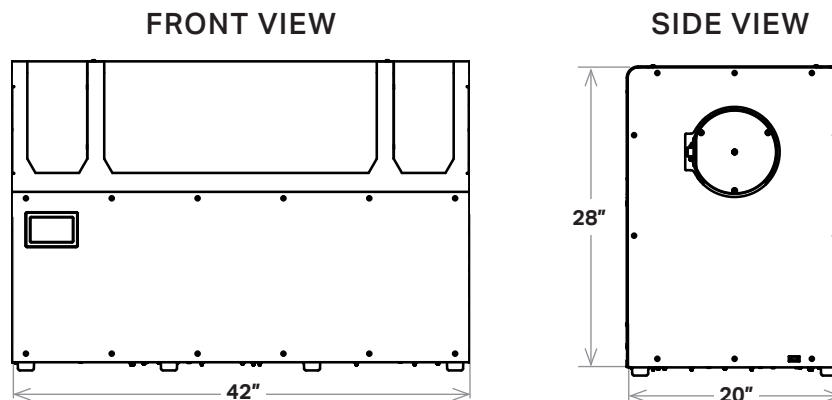
* May vary by material. **Note:** All specifications are approximate and subject to change without notice.

Markforged
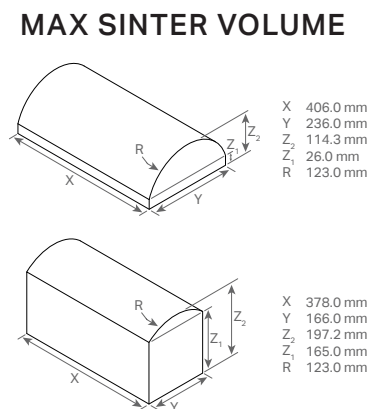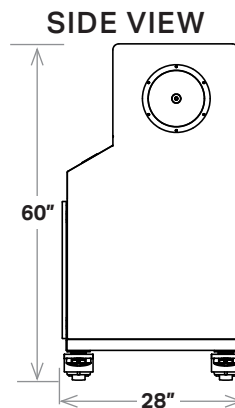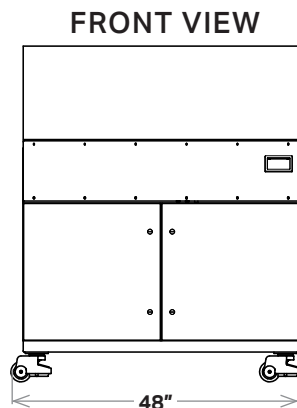
Sinter-2

With an expansive active hot zone (19,644 cm^3 / 1,199 in^3), the Sinter-2 is the perfect solution for mid-volume batch production and for larger parts. Create high-purity metal parts by using sintering technology built with a carbon-free retort. This workhorse furnace is enabled with rapid cooling technology and can process the full range of commercial-grade metals from their washed state into dense metal parts in as few as 30 hours.

Furnace Properties		
	Materials Supported	Chemically debound Metal X-printed parts
	Heating Element	Kanthal
	Controller	Pre-programmed automatic cycling
	Sinter Run Time	30 hours,* 17 hours (Small Parts Express Run)**
	Peak Internal Temp.	1,300° C / 2,372° F
	Sintering Capacity	Rectangle w/radius top — 248 mm ID x 406 mm L (9.8 in ID x 16 in L)
	Sintering Workload	12,135 cm^3 (741 in^3)
	Sintering Surface Area	1,644 cm^2 (254.8 in^2) for stackable ceramic setter plate
	Setter Plate Dimensions	Top plate: 24.0cm W x 41.0cm D, (9.4in W x 16.1in D) Bottom plate: 17.0cm W x 41.0cm D, (6.7in W x 16.1in D)
	Gas Types	Argon, argon / hydrogen mix
	Retort	High purity refractory retort (carbon-free)
	RF Module	Operating Band 2.4 GHz Wi-Fi Standards 802.11 b/g/n
Safety & Installation	**Environmental Req.**	External exhaust (100–150 CFM)
	Power	200–240 V, 3 phase (3 wire), 30 A 346–416 V, 3 phase (4 wire), 30 A
Physical Dimensions	**External Dimensions**	1,370 x 810 x 1,520 mm (54 x 32 x 60 in)
	Weight	350 kg (772 lbs)

FRONT VIEW

48"

SIDE VIEW

60"

28"

MAX SINTER VOLUME

X	406.0 mm
Y	236.0 mm
Z$_2$	114.3 mm
Z$_1$	26.0 mm
R	123.0 mm

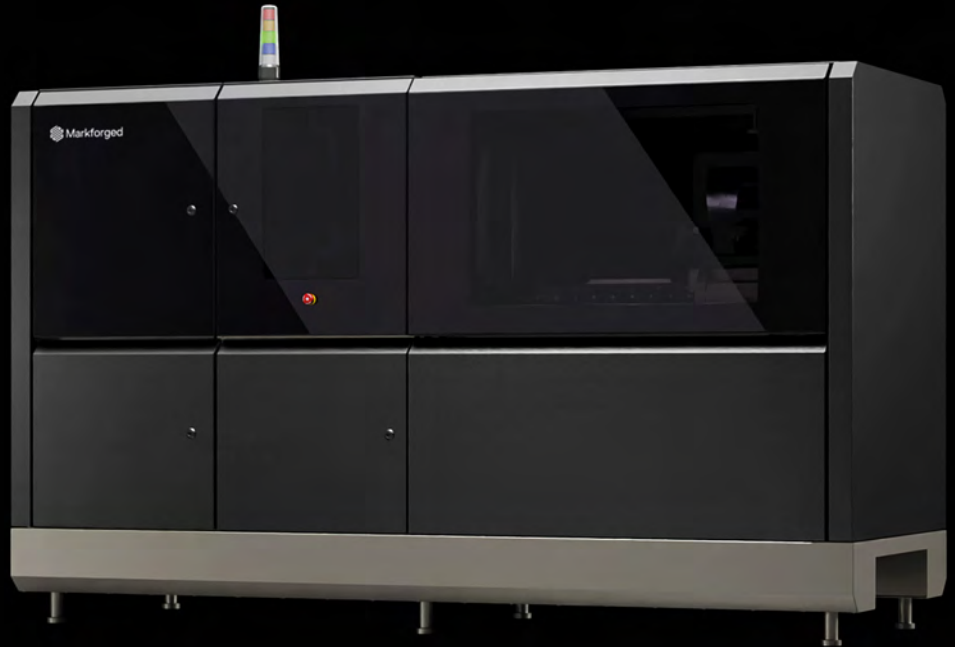|	
X	378.0 mm
Y	166.0 mm
Z$_2$	197.2 mm
Z$_1$	165.0 mm
R	123.0 mm

* May vary by material, operating environment, run mass, electrical frequency, etc. **Note:** All specifications are approximate and subject to change without notice.

** Express Run enabled for 17-4 PH parts where brown (washed and dried) mass totals 250 grams or less

PX100

Additive Metal Production at Unmatched Precision.

The PX100 Binder Jetting system brings a new capability to the Digital Forge: a production system capable of fabricating thousands of complex end-use metal parts. It unlocks high-volume metal production at the point of need, enabling companies to exercise more control over their production process.

New Products, New Markets

Metal Binder Jetting enables manufacturers to become industry leaders by designing and fabricating previously un-makeable parts and unlocking part customization at scale.

Take Control of Your Supply Chain

Eliminate the risks and costs that come with 3rd party suppliers by insourcing critical production runs. Swap dependence for control.

Low-Waste Direct Manufacturing

Fabricate parts without tooling and fixtures and with minimal material waste, bringing products to market faster and cheaper.

Production Applications

The PX100 offers a cost competitive alternative to conventional manufacturing for small and complex designs in a variety of industries, including:

→ Luxury goods
→ Dental and medical
→ Hardware manufacturing
→ Academia
→ Personal electronics
→ Contract manufacturing

System Details

The PX100 is a precise, reliable Binder Jetting machine built on nearly two decades of proven excellence, combining production speed additive fabrication with industry leading part resolution. It comprises one part of the PX100 system, which includes powder handling machines and furnaces to deliver end to end production capabilities. The system is highly configurable and has a wide range of available materials.

Outstanding productivity

→ Capable of print speeds up to 1,000 cm³ per hour

→ Printhead with 70,400 nozzles delivering 2pL droplets at 15.5 kHz

→ Easily exchangeable powder magazine for fast material & build changeover

Detailed precision and quality

→ Static accuracy better than 1μm

→ 1600 dpi resolution with industry leading accuracy and repeatability

→ Robust machine design minimizes downtime and unscheduled stops

Built for your needs

→ Fully customizable, open system

→ Equipped for future updates, such as inertization and automation modules

→ Optimized powder utilization: close to 100% of excess powder is recycled

PX100 Machine Specifications

Printing System	Page-wide print system with 70,400 ink nozzles
Machine Footprint	2700 x 1000 x1700 mm (L x W x H)
Build Volume	250 × 217 × 70 mm or 250 × 217 × 186 mm (L x W x H)
Weight	2000 kg
Typical Productivity	500 – 1,000 cm3 /h
Accuracy	Static accuracy better than 1μm
Power Consumption	3.5 kW (average)
Material Deposition	Recoating with powder applicator
Material Recirculation	Yes, with no degradation

Available Materials

17-4PH Stainless Steel

316L Stainless Steel

4140 Steel

H13 Tool Steel

D2 Tool Steel

Alloy 247

Alloy 625

Alloy 718

Copper

Ti6Al4V

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Form 4

Industrial Parts at Blazing Speed

Fast	**Versatile**	**Intuitive**	**Reliable**	**Accurate**
Most prints in less than 2 hours	Advanced materials for any application	Learn in 15 minutes	Unmatched print success rate	Rivals injection molded parts

Get more done with most prints in under 2 hours.[1]

1. Prepare

Go from CAD to printing in minutes with just a few clicks using our free PreForm software.

2. Print

Monitor your prints and manage your printers from anywhere with an integrated camera, printer diagnostic tools, and our free Dashboard software.

3. Post-Process

Easy, effective post-processing in just fifteen minutes with quick-release Build Platform Flex, Form Wash, and Form Cure.

4. Finish

Use finished parts as they are or opt to sand, paint, coat, or electroplate them.

[1] Typical print time using 80th percentile print height (53mm), 100 µm layer height, and any material

Tackle any problem with our industry-leading materials, or explore more possibilities with Open Platform.

Produce stunning parts that always fit with a surface finish that rivals injection molding.

Leverage materials optimized for impact resistance, rigidity, flame retardancy, flexibility, and more.

Non-acrylate chemistries like true silicone, ceramic, and polyurethane materials.

Certified third-party materials and open license available.

Sharpest features with 50 µm minimum feature size for razor-sharp detail.

Smoothest surfaces with 50 µm pixel size and advanced pixel smoothing for sub pixel resolution.

Accurate assemblies with tight tolerances so your parts always fit.

Form 4 Tech Specs

Technology	Low Force Display™ (LFD)
Build volume (W x D x H)	20.0 × 12.5 × 21.0 cm | 7.9 × 4.9 × 8.3 in
Layer thickness (Z resolution)	25 - 300 microns
XY resolution	50 microns
Average print speed (100 µm layer height)	40 mm/h
Maximum print speed	100 mm/h
Resin Tank lifetime	75,000+ layers with any Formlabs material
Printer weight	18.3 kg | 40.4 lb
Printer dimensions	39.8 × 36.7 × 55.4 cm | 15.7 × 14.5 × 21.9 in
Warranty and service	One-year warranty included Paid service and extended warranty options available
Software compatibility	Windows 7 and up Mac OS X 10.12 and up
File types accepted	STL, OBJ, 3MF

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Form 3L
Big Parts,
Big Throughput

A large format 3D printer compact enough for the office and robust enough for the factory floor. Take control of large-format prototyping and bring your biggest ideas to life with the Form 3L, a cost-effective 3D printer that doesn't compromise on the details.

STOP OUTSOURCING LARGE-SCALE PRINTS

Work faster with a large format 3D printer that's versatile enough to bring large scale fabrication in-house.

TAKE CONTROL OF YOUR PRODUCTION

With its large build volume, high-performance material library, and ability to print any unvalidated 405 nm photopolymer resin (optional, paid license), the Form 3L allows you to produce life-sized high-quality prototypes for a wide variety of applications.

PERFECTIONISM THAT SCALES

Two precision Light Processing Units inside the printer achieve consistent accuracy and detail across the entire build platform.

POST-PROCESSING, SIMPLIFIED

Streamline your workflow and consistently produce clean, high-quality, accurate parts with our automated, large format post-processing machines, Form Wash L and Form Cure L.

Powered by Low Force Stereolithography (LFS)™

LFS technology uses linear illumination and a flexible tank to turn liquid resin into flawless prints. This advanced form of stereolithography drastically reduces peel forces to provide groundbreaking print quality and printer reliability.

Tech Specs

	Form 3+	Form 3L
TECHNOLOGY	**Low Force Stereolithography (LFS)**™	
BUILD VOLUME (W x D x H)	14.5 × 14.5 × 18.5 cm 5.7 × 5.7 × 7.3 in	33.5 × 20 × 30 cm 13.2 × 7.9 × 11.8 in
LAYER THICKNESS	25 - 300 microns (0.001 - 0.012 in)	
LASER POWER	1x 250 mW laser	2x 250 mW laser
XY RESOLUTION	25 microns (0.001 in)	
WEIGHT	17.5 kg ǀ 38.5 lbs	54.4 kg ǀ 120 lb
PRINTER DIMENSIONS	40.5 × 37.5 × 53 cm 15.9 × 14.8 × 20.9 in	77 × 52 × 74 cm 30.3 × 20.5 × 29.1 in
WARRANTY AND SERVICE	One Year Warranty included. Extended Warranty, Pro Service, and Enterprise Plan available.	
SOFTWARE COMPATIBILITY	Windows 7 and up // Mac OSX 10.6.8 and up	
FILE TYPE	STL or OBJ	

A complete ecosystem

Get more done and work more efficiently with an end-to-end 3D printing workflow. From printing to post-processing, each step of the process was designed with efficiency in mind.

SOFTWARE

Prepare your files and your print queue in PreForm and manage printers and teams through your online Dashboard.

40+ MATERIALS

Bring any project to life, from functional prototypes to end-use parts. Seamlessly switch between a library of 40+ advanced materials with a cross-compatible cartridge system, or experiment with any third-party resin.

PREMIUM SUPPORT

Our Formlabs support team is staffed with 3D printing experts who will help you get the most out of your printer so you can stay focused on growing your business.

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Formlabs Automation Ecosystem

Produce Thousands of Parts Easily, Quickly, and Efficiently

Reach new levels of productivity with an automated 3D printer fleet that you can operate from anywhere. Skyrocket your ability to produce high-quality, affordable parts through 24/7 back-to-back production without any operator interaction. Automatically operate your fleet to eliminate idle printer time with easy-to-implement solutions including Form Auto, Fleet Control, and the Resin Pumping System.

Labor savings up to

80%

Lower cost per part by

40%

Reduce packaging waste by

96%*

Increase productivity by

3x

Increase resin capacity by

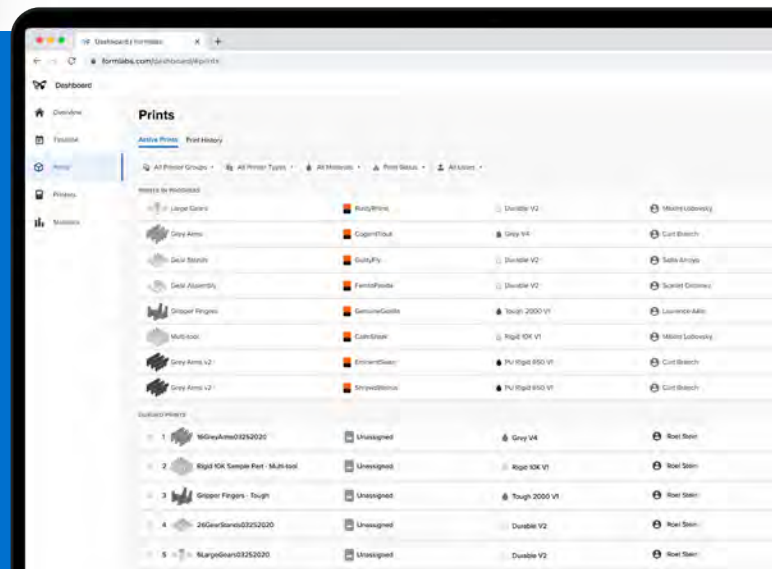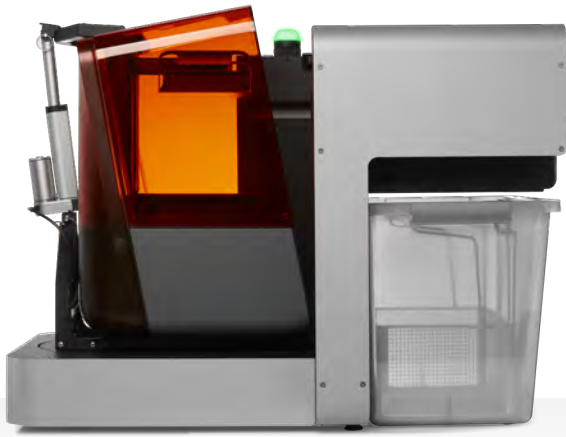# 5x

Values will vary based on part geometry, material, layout and orientation.

* Value shared is not final and subject to change.

Save Money and Time

With automated queue management, printing, and part removal, production doesn't have to stop when you leave work. When you're ready, post-process a bin full of parts at once in minutes while Form Auto keeps working.

Form Auto

Form Auto is an automated hardware extension for your new or existing Form 3/3+ 3D printers that seamlessly removes finished parts from the Build Platform 2 and starts the next print without the need for operator interaction, enabling 24/7 printing without downtime.

Fleet Control

Fleet Control activates new, advanced features within our Dashboard and PreForm software that leverage automation and workflow optimization for advanced fleet management including centralized queue management and automatic printer assignment.

Resin Pumping System

Resin Pumping System is an accessory for the Form 3 and 3L printers that seamlessly delivers 5L of resin through a pumping system directly to the printer's resin tank. Improve efficiency and reduce waste with less frequent cartridge changes and unlock bulk pricing on Formlabs SLA resin.

Realize the Benefits of High-Throughput Automated 3D Printing

Scale capacity with demand and produce parts more quickly and affordably than ever with the Automation Ecosystem. Redefine throughput and realize money savings.

Rotating Arms
Grey Resin

36
Parts Produced Per Day
With Automation Ecosystem

2,62 €
Cost Per Part
Without Automation Ecosystem

1,87 €
Cost Per Part
With Automation Ecosystem

Gear Assemblies
Durable Resin

42
Parts Produced Per Day
With Automation Ecosystem

4,07 €
Cost Per Part
Without Automation Ecosystem

2,42 €
Cost Per Part
With Automation Ecosystem

Orthodontic Models
Draft Resin

176
Parts Produced Per Day
With Automation Ecosystem

3,11 €
Cost Per Part
Without Automation Ecosystem

1,89 €
Cost Per Part
With Automation Ecosystem

Get Started Now.

The Formlabs Automation Ecosystem is waiting for you.

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The Fuse 1+ 30W SLS Ecosystem

High Performance Selective Laser Sintering Within Reach

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Fuse 1+ 30W

Designed for maximum output and minimum waste, Fuse 1+ 30W is a compact SLS 3D printer that packs an industrial punch.

SAME-DAY PARTS
Unlock rapid in-house 3D printing and deliver high-precision parts within a day thanks to a powerful 30W laser.

SLS 3D PRINTING MADE EASY
Easy-to-use hardware and software are designed to get you up and running quickly and maximize your efficiency at every step of the process.

INDUSTRIAL-GRADE MATERIALS
Produce durable parts that can withstand heavy use with industry-standard materials that benefit from fine-tuned settings and inert gas printing capabilities.

COMPACT AND SCALABLE
A compact footprint and modular ecosystem make the Fuse 1+ 30W suitable for any environment.

Materials

Unlock high-performance SLS 3D printing with our library of industrial-grade materials, including nylons, stiff composites, and elastomeric powders.

Post-processing

An automated ecosystem that reinvents SLS post-processing
to deliver ready-to-use parts with a professional finish in as little as 15 minutes.

Fuse Sift

Extract parts in just 5 minutes using this all-in-one powder management station for
Fuse Series SLS 3D printers.

COMPACT, ENCLOSED SYSTEM

A negative air pressure system contains powder while enabling ergonomic part extraction from the unsintered powder.

AUTOMATIC POWDER REFRESHING

Fuse Sift automatically doses used and fresh powder with precision to help you minimize your cost per part and eliminate unnecessary waste.

NONSTOP PRINTING

Reduce downtime by transferring modular build chambers and powder cartridges between the Fuse 1+ 30W and Fuse Sift for a nonstop, cyclical workflow.

Fuse Blast

Reinventing SLS Post-Processing with a fully automated cleaning and polishing solution in minutes.

10 MINUTE HANDS-FREE PART CLEANING

Pre-programmed cleaning routines automatically process an entire build chamber in as little as 10 minutes, while media filtering reduces post-processing time on Fuse Sift by 80%.

CONSUMER-GRADE PARTS

The ionization system prevents dust and media from re-settling on your prints, for clean-to-the-touch parts, while the polishing function allows you to go the extra mile and deliver parts with a smooth, semi-gloss, scuff-resistant, dye-ready surface finish.

EXTENDED MEDIA LIFE

Minimize overhead costs thanks to the passive filtering system that reduces media saturation and extends media life by four to eight times.

From Design to Finished Part

An Innovative Ecosystem For A Streamlined And Intuitive Workflow

1 → **2** → **3** → **4** → **5**

| **PreForm** | **Fuse 1+ 30W** 6-24 hours | **Dashboard** | **Fuse Sift** 5-10 minutes | **Fuse Blast** 10-15 minutes |

Efficient Print Packing for Optimal Part Density

Use our free print preparation software, PreForm, to import STL, OBJ, or 3MF files, orient models, estimate print times, and pack parts for optimized density, reducing print time and limiting waste.

Fast and Reliable Printing

Easily set up your printer and achieve fast printing thanks to the 30W laser. Print same-day prototypes and enable small series manufacturing of durable end-use parts in under 24 hours.

Remote Monitoring for Peace of Mind

Take control of your production across multiple locations and machines. View printer availability, manage materials, track jobs, and receive notifications all in one cloud-based Dashboard to minimize downtime and maximize output.

Convenient, Compact Powder Management

Our all-in-one powder management station combines part extraction, powder recovery, storage, and mixing in a single device. Fuse Sift will dispense and mix used and new powder automatically so you can reduce waste and control your powder supply.

Fully Automated Part Cleaning and Polishing

Fuse Blast is an advanced automated finishing solution for SLS parts that quickly removes powder and consistently delivers professional parts that are clean to the touch. Deliver a smooth, semi-gloss, and dye-ready surface finish with the polishing option.

Tech Specs: **Fuse 1+ 30W**

Technology	Selective laser sintering (SLS) Class 1 Laser Product	**Printer Dimensions** (W × D × H)	64.5 × 68.5 × 107 cm (165.5 cm with stand) 25.4 × 27.0 × 42.0 in (65.0 in with optional stand)
Build Volume	165 x 165 x 300 mm 6.5 x 6.5 x 11.8 in	**Weight**	114 kg (without build chamber or powder) 251.3 lb (without build chamber or powder)
Layer Thickness	110 microns 0.004 in	**Power Requirements**	EU: 230 VAC, 7.5 A (dedicated circuit) US: 120 VAC, 15 A (dedicated circuit)
Laser Type	Ytterbium Fiber 30W	**Warranty and Service**	One Year Warranty included. Extended Warranty, Standard Service Plan and Premium Service Plan available.
Laser Spot Size	200 microns (0.0079 in)		
Material Refresh Rate	20% – 50%		
Build Chamber	Modular, compatible with Fuse 1+ 30W, Fuse 1 and Fuse Sift	**Software Compatibility**	Windows 7 and up // Mac OSX 10.6.8 and up
Print Support Structures	No supports necessary	**File Type**	STL, OBJ, or 3MF files

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300,000,000+ Parts Printed With Formlabs Technology

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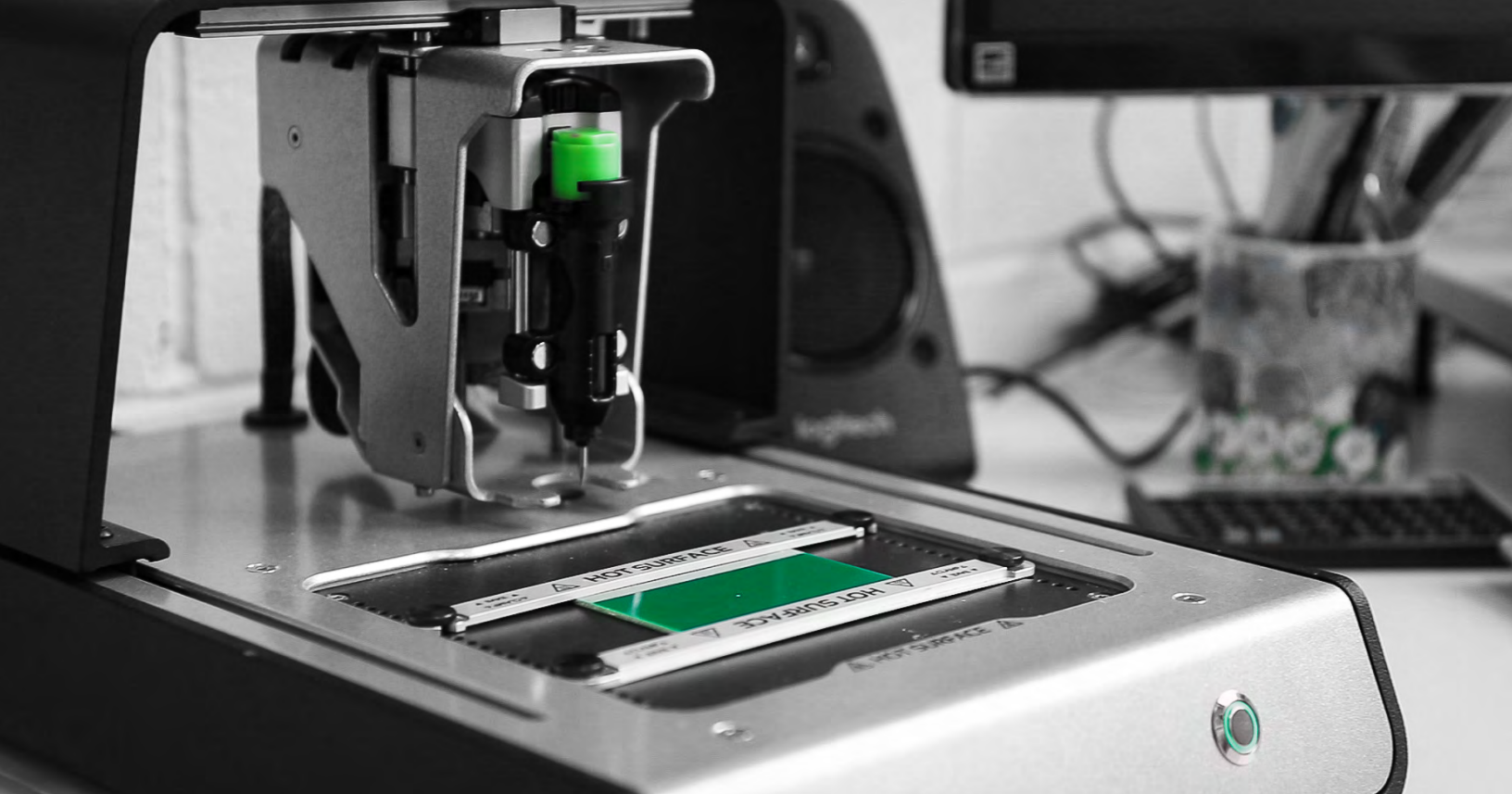
# The V-One is a desktop, multi-functional circuit board printer.

Save time and money with desktop PCB manufacturing.

If you had access to your own PCB factory — 24 hours a day, seven days a week — that sat on your desktop and printed custom circuits on a variety of substrates with a zero-day lead time, what could you make? How fast could you make it?

Those are the questions that inspired us to create the V-One Desktop PCB Printer.

The V-One can print traces of conductive ink, drill through-holes and vias, precisely dispense solder paste and reflow components with a built-in heater.

The Voltera V-One is an all-in-one solution for board fabrication that keeps your development cycle tight and your IP completely in-house.
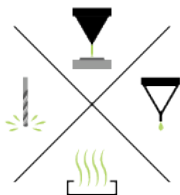
All-in-one circuit design

Print conductive traces, drill through-holes, dispense solder paste and reflow components on your desktop; at home, the lab or the office.

Easy experience

Using the V-One is a breeze. From simple software with in-app video instructions to magnetic attachments, it's as easy to use as an iPad app.
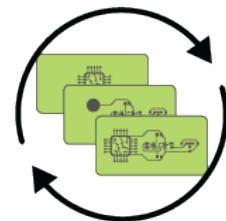
Rapid iteration

Save money and shave weeks off your product development. Test your prototype board the same day you finish the design and export the Gerber file.

Design. Print. Test. Repeat.

The Voltera V-One is a "compile" button for hardware designers and engineers.

Align

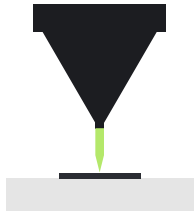Align quickly using Voltera's smart height probe and existing board features as fiducials for XY alignment.

Drill

Designed to be compact, the V-One drills through-holes and vias at 13,000 RPM with a 3 mil runout.
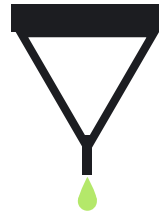
Dispense

Deposit ink and solder paste on printed or facto-ry-fabbed boards with a 0.65mm pin-to-pin pitch.

Reflow

Cure ink and reflow with one click using pre-reg-istered heating profiles on the 550W heater.

Teams at leading companies like Apple, Intel, Seimens, Bosch, NVIDIA, GM, HP, Raytheon, Procter & Gamble and more use the V-One to rapidly design hardware.
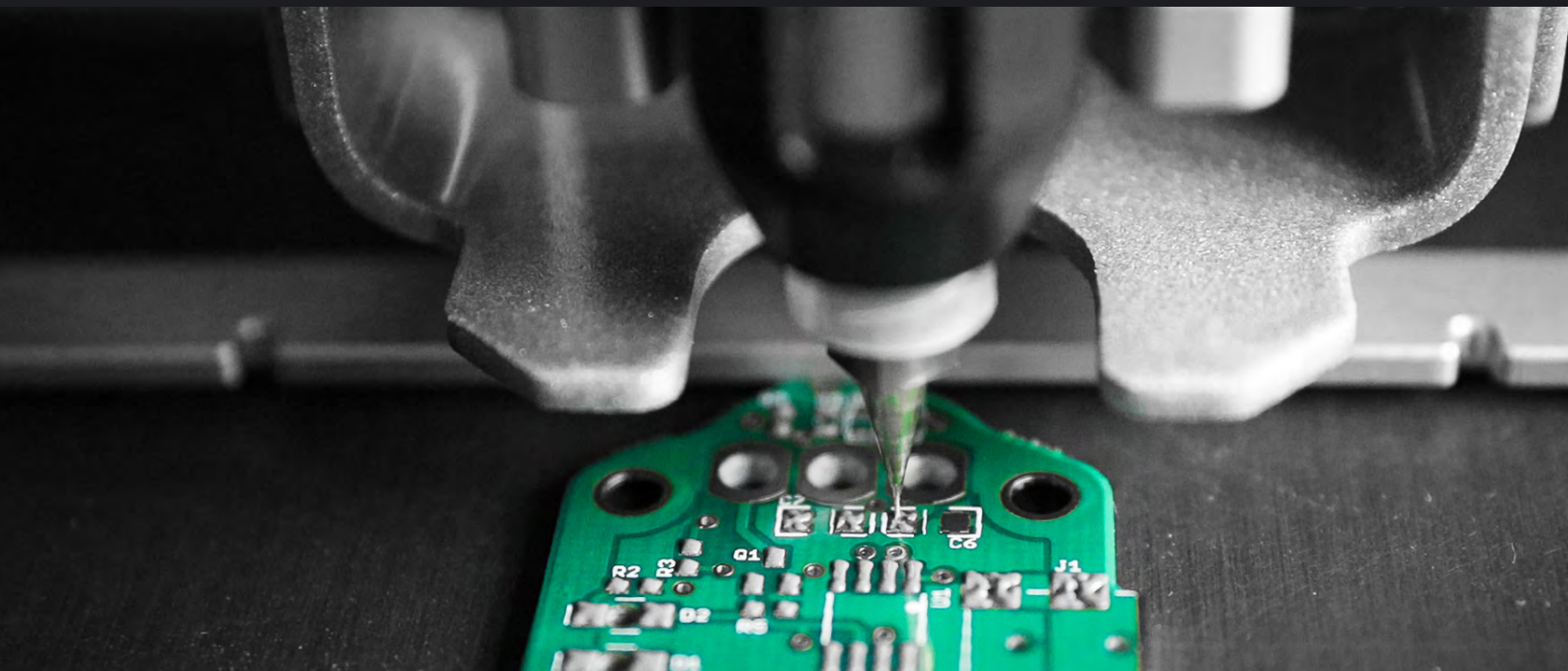
Along with printing custom circuit traces, the Voltera V-One can precisely dispense solder paste onto printed or factory-fabbed boards for rapid population of surface-mount components.

The V-One Spec

PRINTING	METRIC	IMPERIAL
Minimum Trace Width	0.2mm	8mil
Minimum Passive Size	1005	0402
Minimum Pin-to-Pin Pitch	0.65mm	26mil
Resistivity	12mΩ/Sq @ 70um Height	12mΩ/Sq @ 3mil Height
Supplied Substrate Material	FR4	FR4
Maximum Board Thickness	3mm	0.125"

SOLDERING	METRIC	IMPERIAL
Minimum Passive Size	1005	0402
Minimum Pin-to-Pin Pitch	0.5mm	20mil
Solder Paste Alloy	Sn42/Bi57.6/Ag0.4	Sn42/Bi57.6/Ag0.4
Solder Wire Alloy	SnBiAg1	SnBiAg1
Soldering Iron Temperature	180-200°C	355-390°F

FOOTPRINT AND PRINT BED	METRIC	IMPERIAL
Dimensions (L × W × H)	390mm × 257mm × 207mm	15.4" × 10.1" × 8.2"
Weight	7kg	15.4lbs
Print Area	128mm × 116mm	5" × 4.5"
Max. Heated Bed Temperature	240°C	464°F

DRILLING	METRIC	IMPERIAL
Spindle Speed (Max.)	13,000 RPM	13,000 RPM
Power	12V, 25W	12V, 25W
Runout (TIR)	0.076mm	0.003"
Shank Diameter	3.175mm	1/8"
Supplied Substrate Material	FR1	FR1
Bit Diameter (Max.)	2mm	0.078"
Bit Length (Max.)	38.1mm	1.5"

SOLDER COMPATIBILITY	Sn42/Bi57.6/Ag0.4 Solder	Sn63/Pb37 Solder
Standard Ink	✓	✗
Flexible Ink	✓	✗
Copper PCBs	✓	✓
HASL PCBs	✗	✓

SOFTWARE REQUIREMENTS		
Operating Systems	Windows 7, 8, 10 (64bit), OSX 10.11+	
Compatible File Format	Gerber	
Connection Type	Wired USB 2.0	
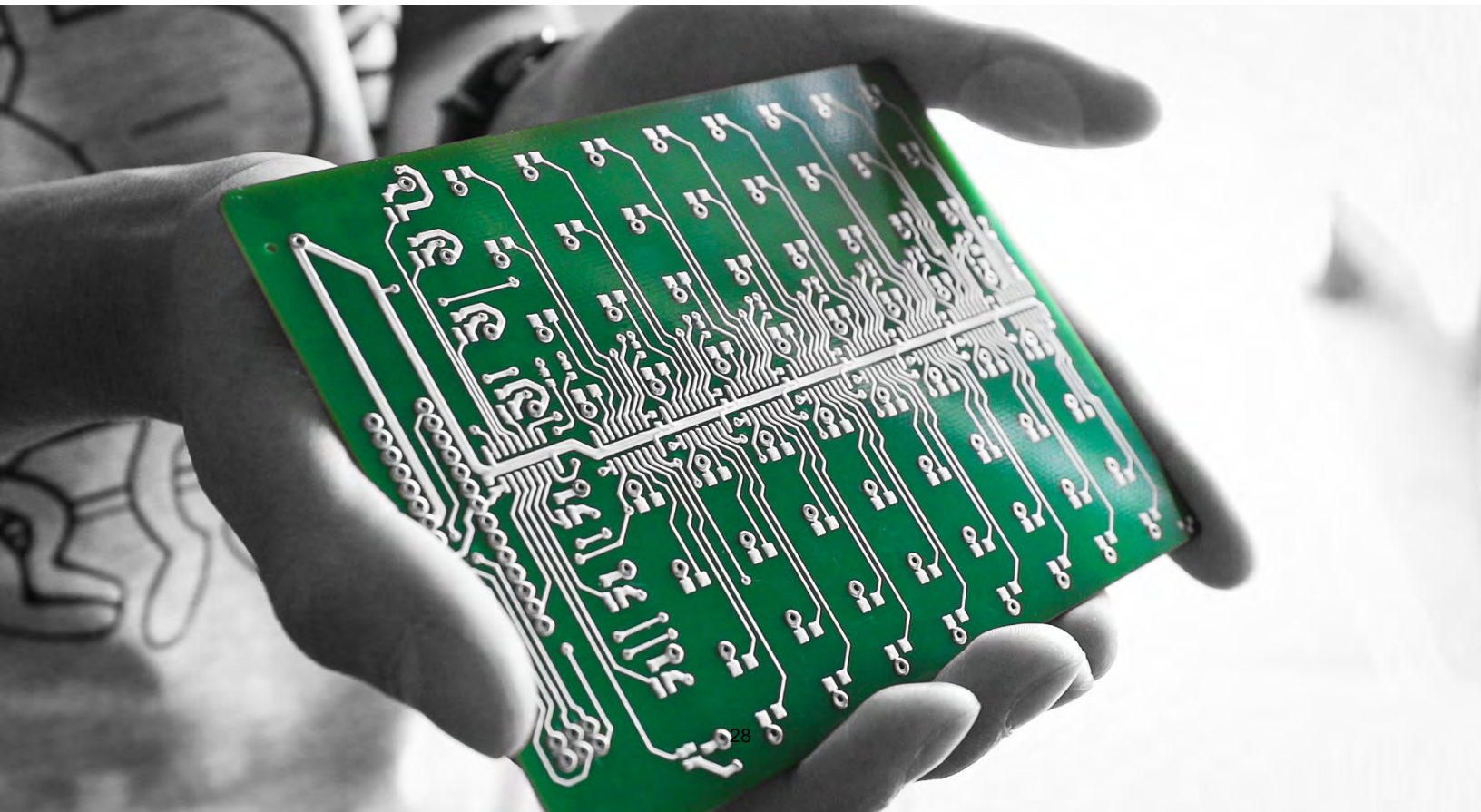
OPTOMEC®

Production Grade 3D Printers... with a Material Difference

LENS® Metal
Additive Manufacturing
Product Family

Making Production Grade Metal Additive Manufacturing More Affordable and Accessible

Optomec Inc. offers a full range of additive manufacturing solutions for creating, enhancing and repairing metal components with its Laser Engineered Net Shaping (LENS) systems. LENS systems use high-powered lasers to build structures layer by layer directly from powdered metals, alloys, ceramics or composites, which result in a range of benefits:

▶ Reduced manufacturing and materials costs
▶ Reduced process and lead times
▶ Reduced environmental impact
▶ Improved product performance
▶ Rapid design changes

LENS® 500 HYBRID CONTROLLED ATMOSPHERE SYSTEM

Affordable Hybrid Machine for the Fabrication and Restoration of High Value Metal Components.

LENS 500 HY CA System. An additive only controlled atmosphere model, LENS 500 AM CA, is also available.

The LENS 500 Hybrid Controlled Atmosphere System sets a new standard in affordability and performance for titanium and aluminum metal additive manufacturing applications. The system incorporates an Optomec proprietary hermetically sealed Class 1 enclosure and an integrated gas purification system that maintains oxygen and moisture levels to below 40 ppm.

Built on a rugged cast iron CNC platform, the system features high precision ball screws, spindle, and ATC for precision machining operations. Additive functionality is enabled with integrated Optomec LENS Print Engine technology including Steadyflow™ powder feeders, water-cooled LENS processing head, and SmartAM™ closed loop controls. A high power fiber laser and advanced Siemens controls complete the system. Powerful Optomec software enables multi-axis build strategies that combine additive and subtractive operations in a single tool path. Optional material starter recipes and unparalleled customer service and support round out the LENS 500 Hybrid Controlled Atmosphere System.

LENS 500 HY CA FEATURES

▶ Full Atmosphere Control – superior metal quality
▶ Cast Iron CNC Platform – affordable rugged base
▶ Full CNC Machining Capability – finished parts in one set-up
▶ Full LENS Additive Capability – industry proven technology
▶ Up to 5 Axis Motion – for complex parts/repairs
▶ Fiber Laser – high performance/reliability
▶ Closed Loop Controls – part to part consistency
▶ Common materials: Inconel Alloys, Stainless Steels, Titanium alloys

LENS APPLICATIONS

▶ Hybrid Manufacturing
▶ Finished Functional Prototypes
▶ Repair damaged/worn parts
▶ Restore mis-machined components
▶ Remanufacturing of legacy parts

LENS®860 HYBRID CONTROLLED ATMOSPHERE SYSTEM

Larger Work Envelope & Higher Power Bring More Capabilities for Affordable, High Quality Metal Hybrid Manufacturing.

LENS 860 HY CA System. An additive only controlled atmosphere model. LENS 860 AM CA is also available.

The LENS 860 is the newest model in the affordable Optomec Hybrid system line-up. With an 860x600x610 mm work envelope the system enables additive and subtractive manufacturing of mid-size and large parts. The LENS 860 comes standard with a hermetically sealed build chamber and closed loop atmosphere controls for producing parts with superior metal quality. The LENS 860 can be configured with a high power 3 kW fiber laser reducing manufacturing time for building, repairing or coating parts.

Built on a rugged CNC platform, the system features a 16 tool ATC and an 8,000 or optional 10,000 RPM spindle for machining operations. The base LENS 860 system is equipped with a 3-linear axis motion system, but optionally can be delivered with a user interchangeable rotary table and/or tilt-rotate trunnion for 4 and 5 axis for additive and subtractive metal processing. Additive manufacturing is enabled with the industry proven LENS Print Engine technology including integrated Steadyflow™ powder feeders, water-cooled LENS deposition head, and SmartAM™ closed loop process controls.

A Siemens controller manages the system's additive and subtractive functions through an easy to use HMI. Powerful Optomec software enables multi-axis build strategies that combine additive and subtractive operations in a single tool path program. Optional material starter recipes and unparalleled customer service and support round out the LENS 860 Hybrid Controlled Atmosphere System.

LENS 860 HY CA FEATURES

▶ Full Atmosphere Control – superior metal quality
▶ Large Build Volume – process larger parts
▶ Rugged CNC Base – affordable system platform
▶ Full CNC Machining Capability – finished parts in one set-up
▶ Full LENS Additive Capability – industry proven technology
▶ Up to 5 Axis Motion – for complex parts/repairs
▶ High Power Laser – faster processing
▶ Closed Loop Controls – part to part consistency
▶ Common materials: Inconel Alloys, Stainless Steels, Titanium alloys

LENS APPLICATIONS

▶ Hybrid Manufacturing
▶ Finished Functional Prototypes
▶ Repair damaged/worn parts
▶ Restore mis-machined components
▶ Remanufacturing of legacy parts

Laser Engineered Net Shaping

Argon Atmosphere — DriTrain removes O₂ and humidity while recirculating atmosphere

LENS Optics and Deposition Head — Tool Motion

Titanium porosity depends on O₂ level of Chamber

- Gas-driven powder delivery
- Powder flowrate increases with laser power

Cooling rate is a function of substrate conduction path

Melt Pool 0.3mm to 5.0mm Diameter
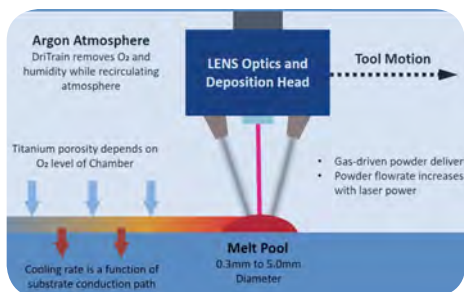
How the LENS Process works:

The LENS process is housed in a chamber which is purged with argon such that oxygen and moisture levels stay below 40 parts per million for LENS Hybrid CA Systems and 10 parts per million for LENS Additive CA Systems. This ensures there is no impurity pickup during deposition.

The LENS Deposition head delivers the laser and powder to the deposition zone. Metal powder is conveyed through nozzles to the focal point of the laser creating a melt pool. Argon gas is used to deliver the powder and protect the melt pool from contamination.

Toolpaths are generated from a CAD model and instruct the LENS system to build or machine the part using standard G & M commands. Material starter recipes provide pre-qualified LENS processing parameters to print a variety of commonly used powders including Titanium, Inconel, and Steels.The part is built layer by layer under the control of software that monitors a variety of parameters to ensure geometric and mechanical integrity. When complete, the part is removed and can be heat-treated, Hot-Isostatic Pressed, machined or finished in any other manner.

LENS 860 HYBRID CONTROLLED ATMOSPHERE SYSTEM

	SPECIFICATIONS	LENS 860 HYBRID CA SYSTEM	LENS 860 AM CA SYSTEM
AUTOMATION PLATFORM	Additive Mode XYZ Travel (mm)	598x600x610	860x600x610
	Subtractive Mode XYZ Travel (mm)	860x600x610	NA
	Table Size XY (mm) / Payload (kg)	1000x600 / 600	1000x600 / 600
	Positional Accuracy (mm)	± 0.005	± 0.005
	Positional Repeatability (mm)	± 0.003	± 0.003
	Rotary Table A Axis (Optional)	**Removable**	**Removable**
	Additive Mode XYZ Travel (mm)	598x600x610	860x600x610
	Subtractive Mode XYZ Travel (mm)	860x600x610	NA
	Table Ø (mm)	170	170
	Trunnion 170 (Optional)	**Removable**	**Removable**
	Additive Mode XYZ Travel (mm)	598x600x350	860x600x460
	Subtractive Mode XYZ Travel (mm)	860x600x350	NA
	Table Size Ø (mm)	170	170
	Maximum Workpiece Size Ø, H (mm)	260 x 350	260 x 460
	Maximum Workpiece Weight Horz/Vert (kg)	100 / 50	100 / 50
	Rotary Axis "C"(degrees)	360	360
	Tilt Range "A" axis (+/- degrees)	-15 / +115	-15 / +115
	Trunnion 250 (Optional)	**Permanent**	**Permanent**
	Additive Mode XYZ Travel (mm)	598x600x360	860x600x480
	Subtractive Mode XYZ Travel (mm)	860x600x360	NA
	Table Size Ø (mm)	250	250
	Maximum Workpiece Size Ø, H (mm)	335x360	335x480
	Maximum Workpiece Weight Horz/Vert (kg)	100 / 75	100 / 75
	Rotary Axis "C"(degrees)	360	360
	Tilt Range "A" axis (degrees)	-30 / +120	-30 / +120
	CNC Controller	Siemens 840D	Siemens 840D
	Touch Probe	Option	Option
	System Approx weight (kg)	5960	5960
	System Dimensions (mm)	4068x2735x2660	4068x2735x2660
LENS DEPOSITION	CDRH Class 1 Airtight Enclosure	Standard	Standard
	Antechamber Ø (mm)	375	375
	Pneuma Seal Door with Glove Access	Standard/3 Glove Ports	Standard/3 Glove Ports
	Oxygen/Moisture Level (ppm)	< 40	< 10
	Standard Powder Feeders	Up to 4	Up to 4
	Laser Power Standard (W)	500 - 3000	500 -3000
	Closed Loop Process control	Option	Option
	2.5D Tool Path Software	Option	Option
	5 Axis Tool Path Software	Option	Option
MACHINING	Tool Changer	16 Tool Carousel	NA
	Tool Taper	CAT 40	NA
	Spindle (rpm)	8,000	NA
	Spindle Center Distance to Column Surface (mm)	700	NA
	Spindle Nose to Table Surface (mm)	120-730	NA
	Spindle Motor Peak (W)	7000	NA
	Spindle Torque (Nm)	95	NA

ABOUT OPTOMEC

Optomec® is a privately-held, rapidly growing supplier of Additive Manufacturing systems. Optomec's patented Aerosol Jet Systems for printed electronics and LENS 3D Printers for metal components are used by industry to reduce product cost and improve performance. Together, these unique printing solutions work with the broadest spectrum of functional materials, ranging from electronic inks to structural metals and even biological matter. Optomec has more than 300 marquee customers around the world, targeting production applications in the Electronics, Energy, Life Sciences and Aerospace industries. For more information about Optomec, visit http://www.optomec.com.

OPTOMEC®
Production Grade 3D Printers... with a Material Difference

AEROSOL JET® FLEX SYSTEM

For Conformal Printed Electronics Applications

The Aerosol Jet FLEX System is a modular, conformal printed electronics solution addressing evolving R&D to production requirements.
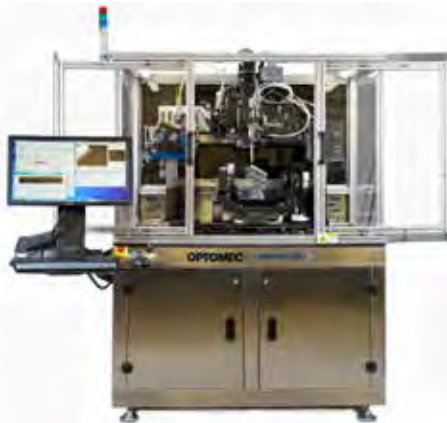
Aerosol Jet FLEX System

Driven by R&D and manufacturing requirements to address evolving product functionality coupled with reduced size, and weight, the system provides maximum scalability starting with planar to multi-axis deposition capabilities, facilitating rapid prototyping through low volume production needs.

The Aerosol Jet FLEX System is a modular, digitally driven print solution equipped with a 350mm X 250mm heated vacuum chuck. It comes standard with closely coupled print modules which include material cassettes and associated print heads. Print cassettes can be loaded with different materials facilitating fast change over from one material to another enabling rapid product R&D and prototyping. The closely coupled print modules provide extended run times of up to four hours without interruption, material dependent. Print modules can be swapped out in a few minutes minimizing down time during long print runs. Optionally, a full 5-axis tilt & rotate trunnion and a wide feature print head can be added to the system.

Aerosol Jet supports a wide variety of functional materials, including conductive inks, dielectrics, polymers, adhesives, etc., which can be-deposited onto planar and non-planar substrates.

The System includes a fine feature print head capable of printing features sizes from 10 to 250 microns. Optional products include a wide feature print head capable of expanding print capabilities to millimeters in a single print pass and an interchangeable full 5-axis tilt & rotate motion solution with a print envelop of 200mm x 300mm x 200mm, (x, y, z).

Aerosol Jet FLEX System

KEY FEATURES

▶ Features sizes ranging from 10 microns to millimeters
▶ Dispensing support for a wide variety of inks / materials
▶ Repeatable recipe driven dispense
▶ Non-planar 3D printing capabilities
▶ Optional 4th and 5th-Axis automation capabilities
▶ R&D to low-volume flexibility

APPLICATIONS

▶ Process Development
▶ Planar and Non-Planar Antenna
▶ Complex Molded Interconnect Devices (MIDs)
▶ Strain, Temperature, and other Sensors
▶ Low Volume Manufacturing

Aerosol Jet Process

How the Aerosol Jet Process Works:

1. An ink, such as a conductor or dielectric, is atomized within the Print Module creating a dense aerosol with a tight distribution of droplet sizing.

2. The aerosol is transported to the Print Head using high purity nitrogen as a carrier gas.

3. The aerosol is focused within the Print Head by an annular sheath of nitrogen focusing and accelerating the material onto the substrate as it travels through the nozzle.

4. The Print Head's in-line shutter facilitates fast feature termination. Interchangeable Print Heads with various nozzle geometries allow for feature size flexibility ranging from 10 microns to millimeters.

Aerosol Jet Flex System Specifications

|	SPECIFICATIONS	AEROSOL JET FLEX SYSTEM
PRINT CAPABILITIES	Minimum Line Width	10μm at 20μm pitch (Materials and Surface Dependent)
	Layer Thickness	100nm > 6μm (single print pass)
	Ink Viscosity	
	Ultrasonic Atomizer	1 to 15cP
	Pneumatic Atomizer	1 to 500cP
	Material Droplet Size	1 to 5μm Ø
	Nozzle Stand-off Height	Up to 5mm (nozzle tip to substrate surface)
AUTOMATION PLATFORM	Printing Area (mm)	350 x 250 x 200 (x,y,z)
	Positional Accuracy (μm)	±10μm (100mm range)
	Positional Repeatability (μm)	±2μm (x,y,z axis)
	System Approx. Weight (kg)	1088
	System Dimensions (mm)	1020 x 1375 x 2240
	Electrical Requirements	110/220V, 50 or 60Hz, 40 Amps (10 amps continuous oper., typical)
	Gas Input to System	345 to 425 kPa (50-60 psi), >99.9% nitrogen gas, at 20 slpm
OPTIONS	Wide Feature Printhead (mm)	0.635 and 1.0 round, 3.0 x ~0.400 slotted
	UV Cure System	365nm
	IR Laser	830nm, 1W
	Trunnion with Tilt & Rotate Stage	200 x 300 x 200mm (x,y,z) work area w/±90° tilt & 360° rotate

Aerosol Jet Printing Examples

Strain Sensor Printed on Steel Beam

Fully Printed Phased Array Antenna Courtesy: Univ. Massachusetts, Lowell
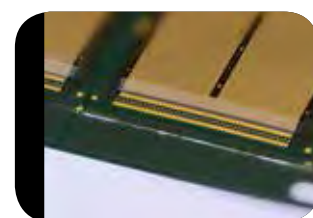
Stacked Die Printed Interconnects

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DragonFly IV

RESHAPING THE ELECTRONICS INDUSTRY WITH ADDITIVELY MANUFACTURED ELECTRONICS

Design flexibility beyond the traditional boundaries
Breakthrough solution for traditional development challenges
One-stop shop for design and manufacturing

RESHAPE
Performance

RESHAPE
Development Cycles

RESHAPE
Form Factor

PRINTER CAPABILITIES

Build Volume	160 mm x 160 mm x 3 mm
Inks	Optimized silver nano particles and dielectric inks
Supported File Formats	All major ECAD and MCAD Software, ODB++, Gerber & Excellon, STLs
Resolution	18 μm (x), 18 μm (y), 10 μm (z)
Min. Line / Space	75 μm traces/ 100 μm spacing
Min. BGA Pitch	350 μm
Min. Via	150 μm
Min. Dielectric Layer Thickness	10.0 μm
Min. Conductive Layer Thickness	1.18 μm
Conductivity (Relative to Copper)	30% +/-5%
Dielectric Constant (Dk) @ 2 GHz/15 GHz	2.77 / 2.78
Tangential Loss (Df) @ 2 GHz/15 GHz	0.015 / 0.018

PRINTER SPECIFICATIONS

Dimensions	1,400 mm x 800 mm x 1,800 mm
Weight	520 kg, (1150 lbs)
Power Supply*	230 VAC, 20 A, 50–60 Hz
Network Connectivity	Ethernet TCP/IP 10/100/1000
Operational Humidity	Above 35% non-condensing
Operational Temperature	18°C (64°F) to 25°C (77°F)
Regulatory Compliance	UL, CE, FCC
Deposition Technology	Piezo drop-on-demand inkjet
Number of Printheads	2, one for each ink: conductive and dielectric
Software	FLIGHT Software Suite (Design, Verification, Pre-Production)

* Must use UPS (Uninterruptible Power Supply)

DragonFly IV

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