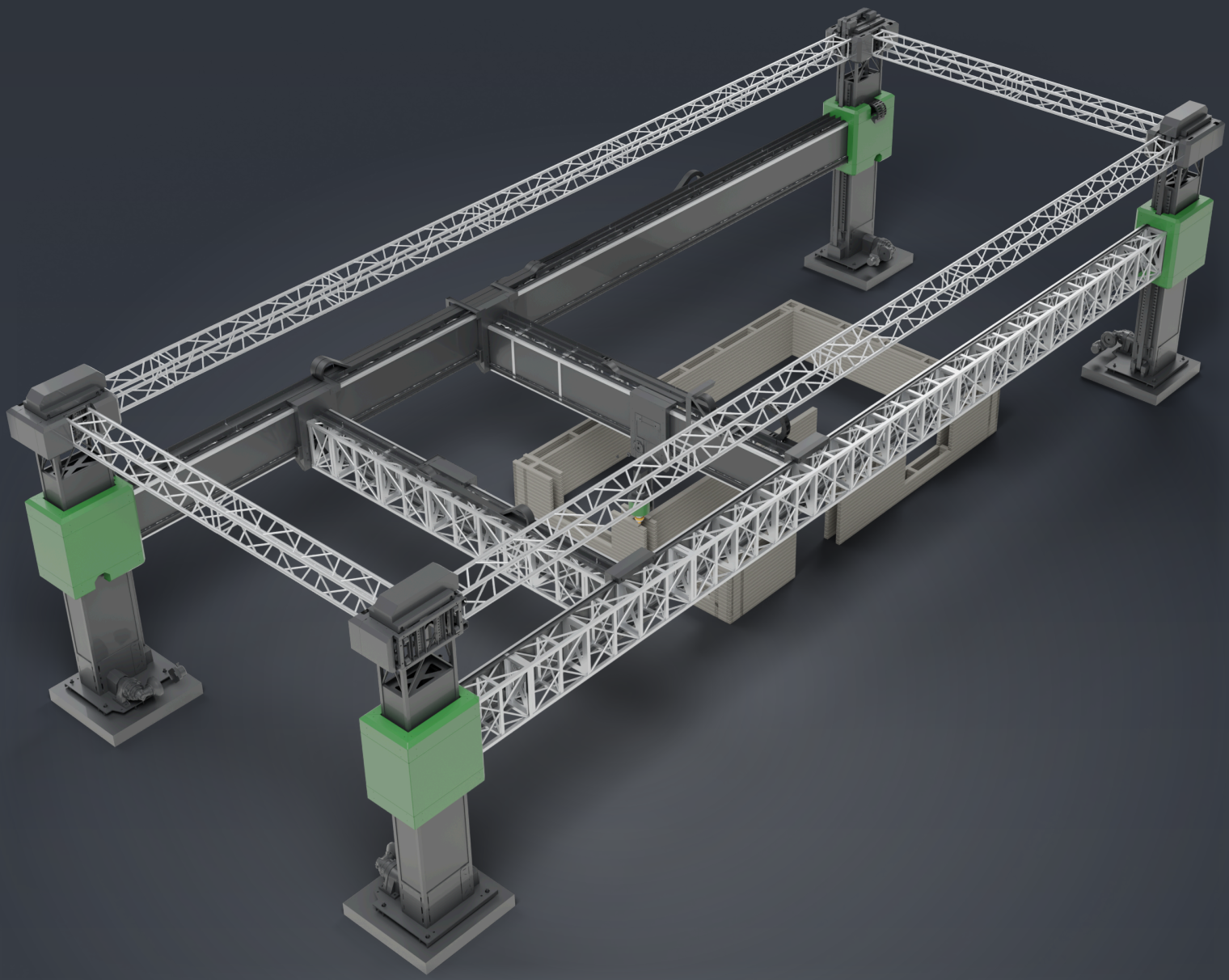
EXTRONE
3D PRINTING TECHNOLOGY

Product catalogue 2027

Large-scale 3D printing

Machines, working tools and software – from the construction site to the production hall.



Catalogue prepared in cooperation with the Łukasiewicz Research Network – Industrial Research Institute for Automation and Measurements PIAP

3D printing on a large scale

Extrone supplies large-scale 3D printers for concrete and plastics, together with working tools and software. We developed the machines and tools in cooperation with the Łukasiewicz Research Network – Industrial Research Institute for Automation and Measurements PIAP.

Every machine is built to order – sized to your projects and your site: on the construction site or in a production hall. A single machine can print with concrete and plastics, and can also mill.

We support you at every stage: from needs analysis, through installation and operator training, to technical support once production has started.

The Extrone team



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Key advantages of 3DCP technology

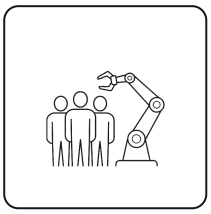
Why 3D concrete printing

3D concrete printing changes the way concrete elements are made: less labour and material, shorter lead times and freedom of form. Below are the key advantages of the technology – and on the following pages, figures from selected projects.



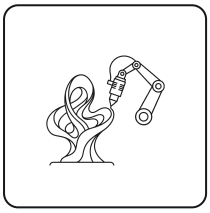
Automation

By eliminating formwork and reducing labour, large-scale 3D printing can shorten the production of concrete elements by up to 75%.



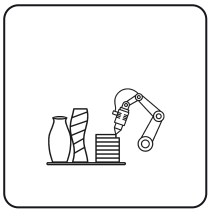
Reduced labour intensity

The machine requires only three operators, who perform mainly technical tasks. Less manual labour and less dependence on workforce availability.



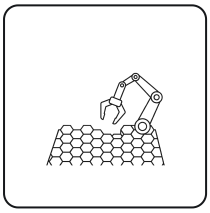
Design freedom

Variable arcs, radii and curved forms are printed with no additional cost for custom moulds – unique architecture is produced at the price of a straight wall.



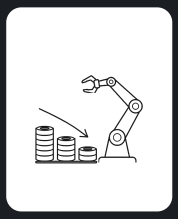
Mass customisation

Unique series of elements without reconfiguring the production line – all modifications are made solely in the digital file.



Topology optimisation

Concrete is placed only where it is structurally needed. This makes fuller use of its properties and reduces material consumption by up to 75%.



Lower costs, higher return on investment

Eliminating formwork and the work associated with it, automating the construction site, finishing projects sooner and earning higher margins on uniquely designed elements make the technology highly profitable.

2 years possible payback of the technology at a printed volume of 2,420 m³

Case studies in numbers

Parkour park

- 17-fold reduction in formwork labour
- element production costs reduced by 47%
- element production time reduced threefold

Printed houses

- construction time reduced from 6 to 3 months
- site crew reduced from 8 to 5 workers
- distinctive exterior design

Embankment stairs

- precast elements with free dimensions for each step
- 50% less labour to install each element
- steps cannot shift relative to one another – lower risk of defects
- 24% less material

Street furniture

- planters, fence posts and benches with distinctive designs
- simple customisation and complete geometric freedom for each element

Foundation footings

- 70% less material thanks to topology optimisation
- automated production – up to one element per hour

Project examples

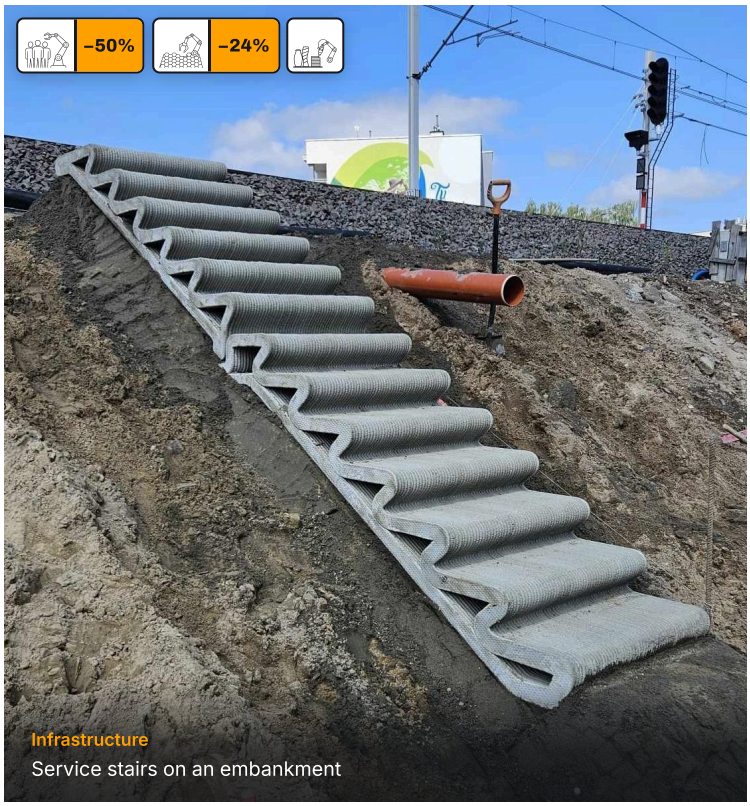
3D printing with concrete and plastics works in many applications – from buildings printed on site and serial precast elements to street furniture and lightweight moulds. Below are examples of elements made with this technology.



Street furniture
Parkour park made of printed concrete elements

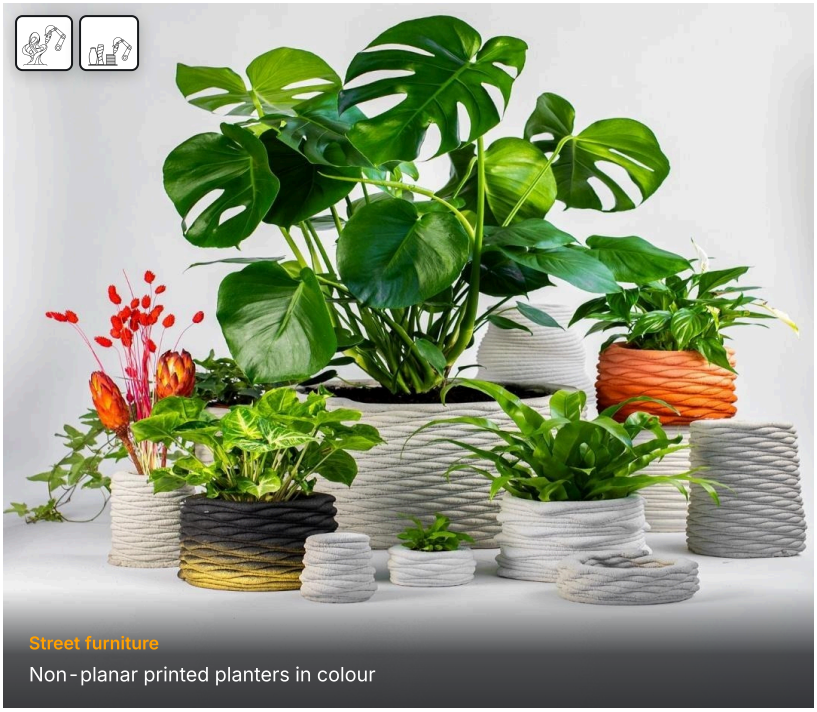


Construction
Wall section with a window opening and a wave texture



Infrastructure
Service stairs on an embankment

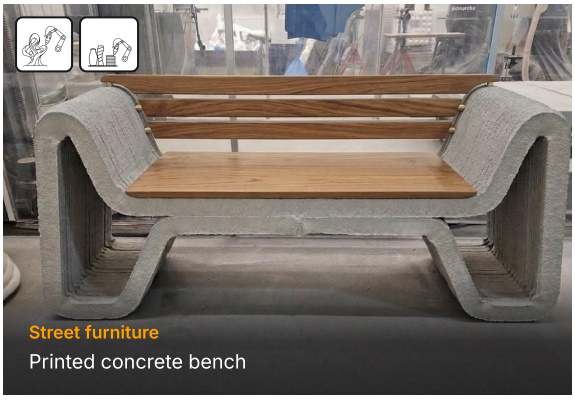
Concrete printing p. 14



Street furniture
Non-planar printed planters in colour



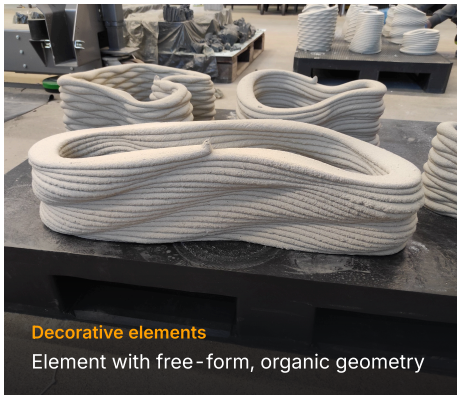
Precast
Columns with a twisted cross-section



Street furniture
Printed concrete bench

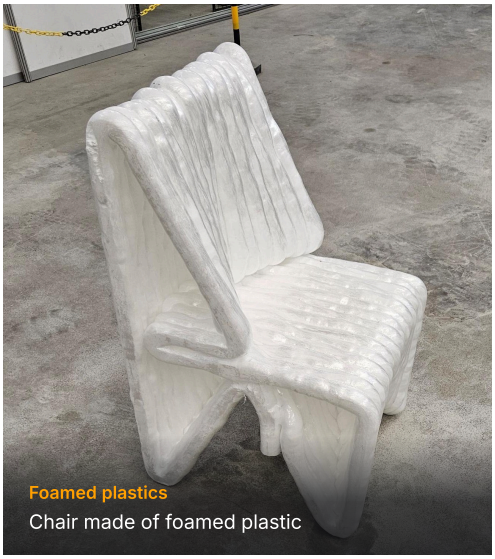


Infrastructure
Foundation footing with an optimised shape

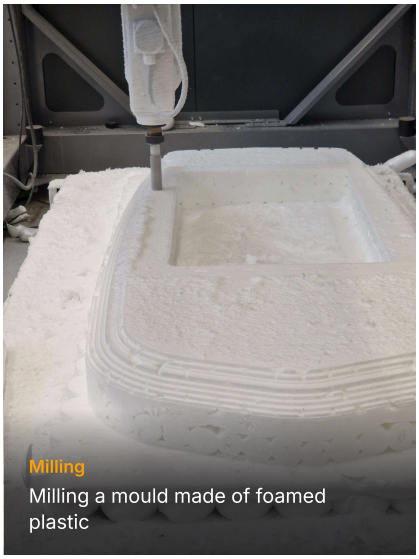


Decorative elements
Element with free-form, organic geometry

Plastics printing and milling p. 16



Foamed plastics
Chair made of foamed plastic



Milling
Milling a mould made of foamed plastic



Solid plastics
PLA stool with a colour gradient

How to choose a configuration

The selection takes three steps: first the machine series, then the working tools, and finally the software.

1 STEP

Size and place of work

How large are the elements and where will they be printed? This determines the machine series and the dimensions of the working area.

Site

BEST SUITED FOR

Buildings and large structures on the construction site

p. 8

Line

BEST SUITED FOR

Continuous, high-output production of concrete and plastic precast elements – printing as a production line in a hall

p. 10

Cell

BEST SUITED FOR

Precast elements, street furniture and plastic moulds – periodic printing, e.g. several times a week

p. 12

2 STEP

Technology and tools

What will the elements be made of? Each working tool can be ordered separately and added later.

Concrete p. 15



Concrete extruder

interchangeable nozzles and nozzle rotation as standard – cross-section shape and wall texture

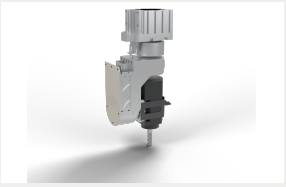
Plastics p. 17



Plastics extruder

lightweight elements that are easy to machine; solid plastics: PLA, PPGF30, PET-G and others – in development

Milling p. 18



5-axis milling head

machining to final dimensions – of prints or of elements made of other materials

Each tool can be ordered with the machine or added later. An optional additional X axis allows a second tool to be mounted on a separate beam.

3 STEP

Software

Software training is part of commissioning.

Control and production preparation

as standard

p. 19

Print data acquisition system

extension – option

continuous process monitoring, parameter logging and quality control – data stored separately for each model

p. 20

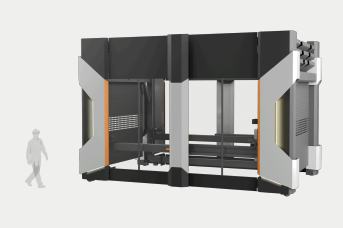
We select the configuration together

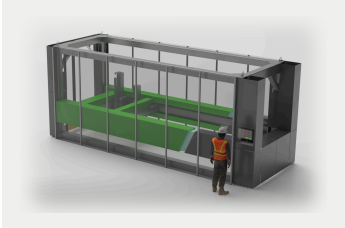
From needs analysis to machine start-up and training – p. 21

Three series – the key differences

All series use the same working tools and the same software. They differ in scale and production mode.







	Site The largest structures, printed on site p. 8	Line Continuous production in an enclosed chamber p. 10	Cell Periodic production in an enclosed chamber p. 12
Best for	contractors and developers	precast plants with large, steady volumes	precast plants and street furniture manufacturers
Production mode	a single structure printed at its final location	continuous – the machine moves on to the next station while the print sets	periodic – e.g. several times a week, with breaks for the concrete to set
Typical products	buildings, free-form structures, retaining walls, infrastructure	precast elements, infrastructure, street furniture, plastic moulds	
Max. working area	up to 15 × 13 × 6 m	up to 5 × 5 × 3.5 m	
Structure	modular truss structure, adapted to the project	rigid steel frame with aluminium working axes – high printing precision	
Working area enclosure	open gantry	enclosed working chamber – greater work safety; top cover (option) supports plastics printing	
Place of work	construction site – machine assembled on site	production hall – travel between stations	production hall; container-size option

Common to all series

Custom dimensions
Working area selected for the project within the series range; maximum dimensions can be modified on request.

Quick tool change
Working tools are mounted on a common interface – tools can be changed quickly.

Additional X working axis
Optional second beam for an additional working tool.

Mitsubishi CNC control
5-axis controller – printing and milling under one control system.

Common software
The same toolpath preparation tools for every machine.

Commissioning and training
Installation, start-up and operator training included in delivery.

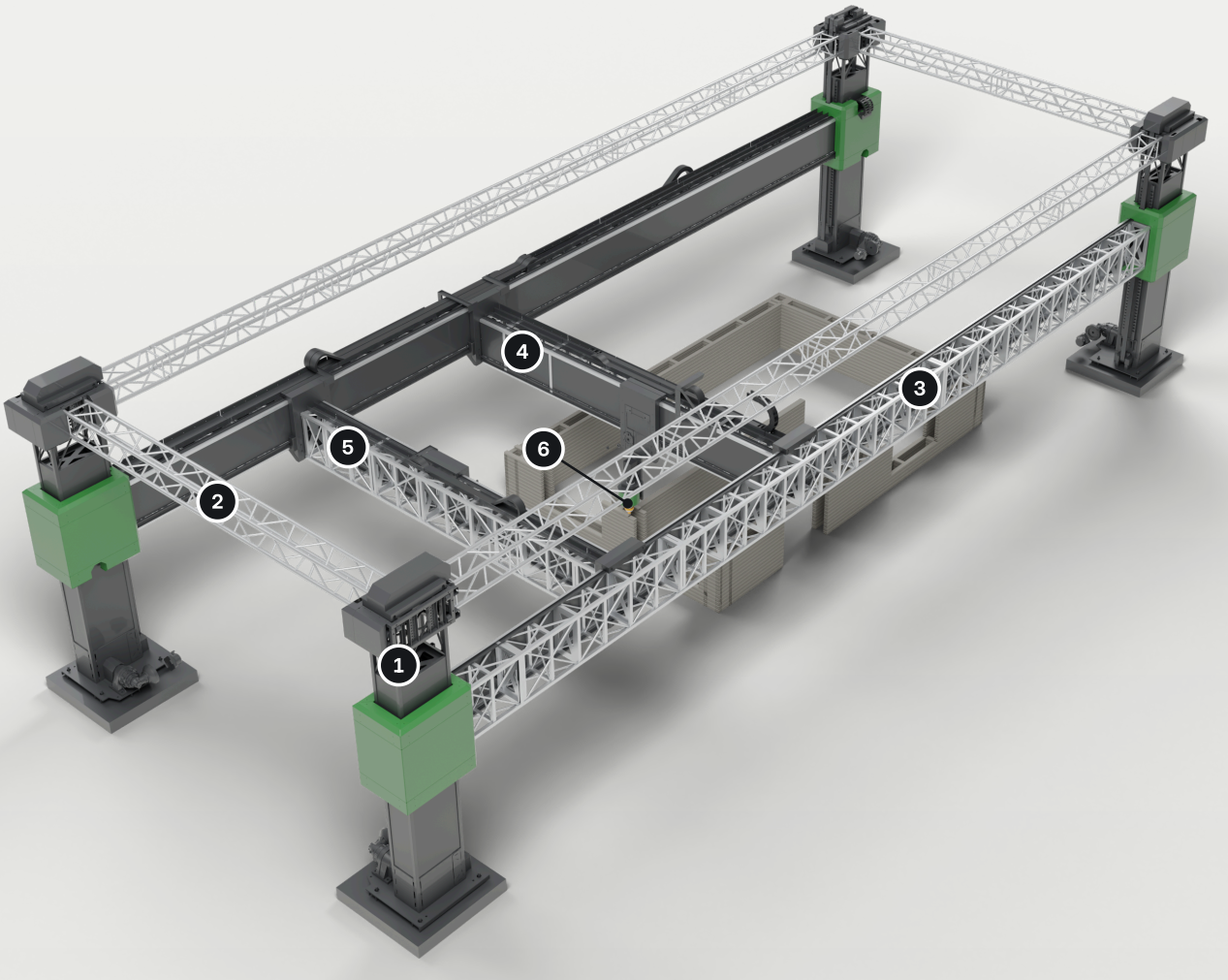
Łukasiewicz
Przemysłowy Instytut Automatyki i Pomiarów PIAP

We developed the machines and working tools in cooperation with the Łukasiewicz Research Network – Industrial Research Institute for Automation and Measurements PIAP.

Machine series

Site

On-site printing – buildings and large structures



1. Z-axis column – lifting the working frame
2. Modular truss frame
3. Y-axis beam
4. X-axis beam
5. Additional X-axis beam (option)
6. Working tool

Modular structure

The truss frame allows the working area to be matched to the project requirements.

Printing at the final location

The structure is built on the construction site – no transport of finished elements.

Easy transport and assembly

Simple design – assembly and disassembly within a few hours, using a crane.

Mitsubishi CNC control

5-axis controller – printing and milling under one control system.

Compatible technologies Concrete printing p. 14 Plastics printing and milling p. 16 Print data acquisition system p. 20

Gantry printer for large structures

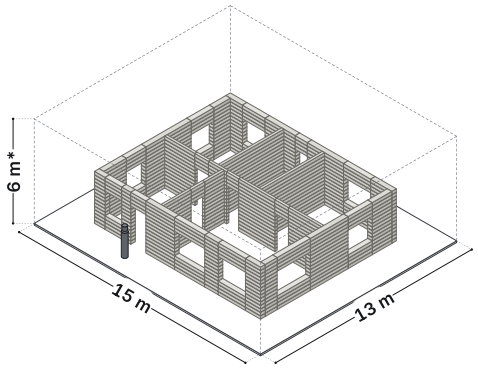
A printer designed for large-scale projects: it prints functional buildings and large concrete elements directly at their final location. The modular structure allows the machine size to be matched to a specific project and the machine to be set up even on uneven ground.

Machine specifications

Structure	**aluminium trusses optimised for load capacity, in 1, 2, 3 and 6 m modules**
Working area enclosure	**open gantry**
Axis guides	**Winkel**
Axis drives	**X and Y – helical-tooth racks; Z – chain**
Printing speed	**up to 300 mm/s**
Rapid traverse speed	**up to 600 mm/s**
Control	**Mitsubishi – 5-axis CNC controller**
Machine setup	**adjustable foundation feet – also on uneven ground; calibration after setup**
Assembly and disassembly	**within a few hours, using a crane**
Transport	**in sections, on a semi-trailer**

Maximum working area

The dimensions given are the maximum working area. We also configure the machine in smaller sizes – matched to your production.

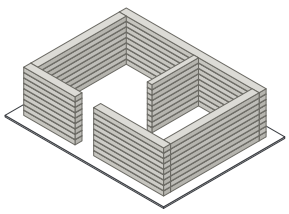


* Larger working area dimensions – on request.

Machine equipment

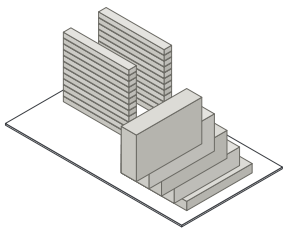
- Automatic lubrication
- Beam deflection compensation performed by the CNC controller
- Quick working tool change system
- Two cameras monitoring the working area
- **Option:** table measurement sensor
- **Option:** additional X working axis – second beam for an additional working tool

Machine capabilities



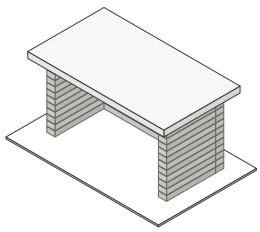
A building in a single setup

The 15 × 13 m area accommodates the footprint of a single-storey house with a footprint of approx. 100 m² – external and partition walls printed at the final location.



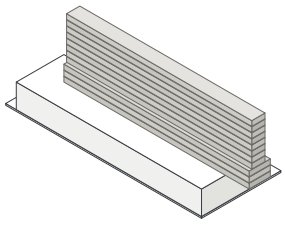
Large precast elements

Precasting of larger concrete elements – walls, foundations and stairs – close to the construction site.



Shelters, gazebos and pergolas

Larger street furniture structures – bus shelters, gazebos and pergolas – printed at their final location.



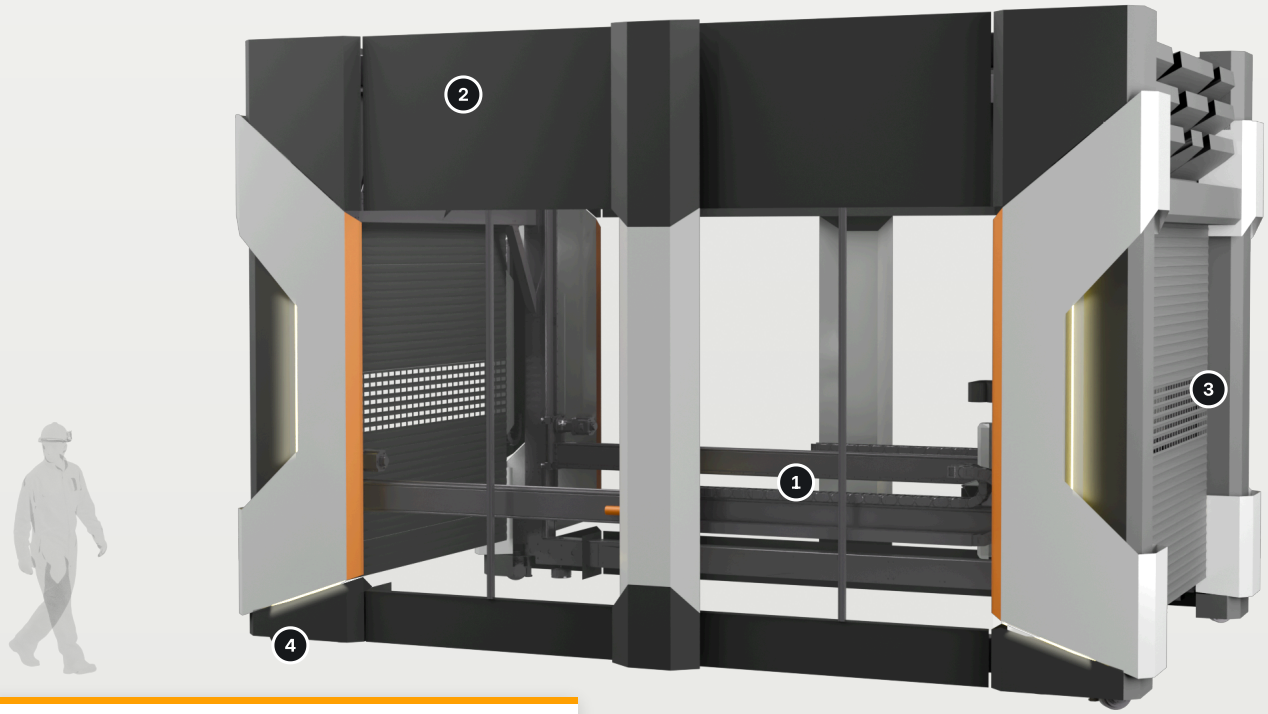
Infrastructure

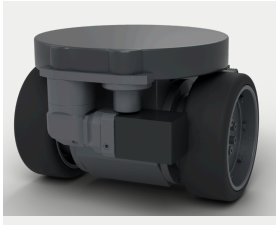
Retaining walls, fences and infrastructure elements printed directly on site.

Machine series

Line

Continuous production in a hall – the machine moves on to the next station while the print sets





Travel module

Operator-controlled travel – no crane, no disassembly.

1. Lightweight aluminium working axes
2. Enclosed chamber with access control
3. Travelling printer structure
4. Driven travel wheels

Mitsubishi CNC control

5-axis controller – printing and milling under one control system.

Interchangeable working tools

Concrete and plastics printing plus 5-axis milling – after a quick tool change.

Continuous production

One machine serves several stations in the hall – higher series output.

Precision and dynamics

Rigid steel frame, aluminium axes and helical-tooth racks.

Compatible technologies Concrete printing p. 14 Plastics printing and milling p. 16 Print data acquisition system p. 20

Compact printer on travel wheels

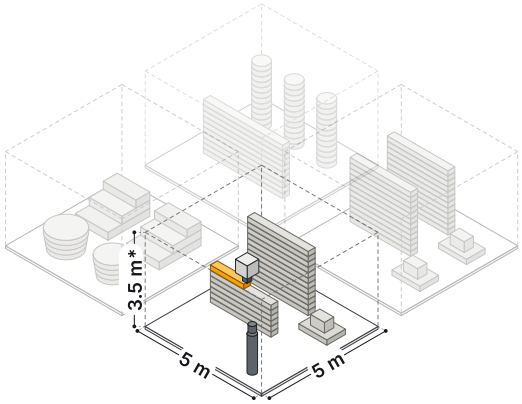
A compact printer for steady, high-output series production. While a printed element sets, the machine moves on to the next station and keeps printing – no breaks for the concrete to set or for removing prints. With the plastics extruder and the milling head, the machine also prints with solid and foamed plastics and machines the prints by milling.

Machine specifications

Structure	**rigid steel frame with aluminium working axes – high printing precision and high motion dynamics**
Working area enclosure	**enclosed working chamber – protects the operator, contains chips and dust; top cover – option**
Axis guides	**Nadella Heavy Line GU**
Axis drives	**helical-tooth racks on all axes; gantry – two motors**
Printing speed	**up to 500 mm/s**
Rapid traverse speed	**up to 900 mm/s**
Vertical speed (Z axis)	**up to 150 mm/s**
Control	**Mitsubishi – 5-axis CNC controller**
Machine setup	**driven travel wheels – operator-controlled travel**

Maximum working area

The dimensions given are the maximum working area. We also configure the machine in smaller sizes – matched to your production.

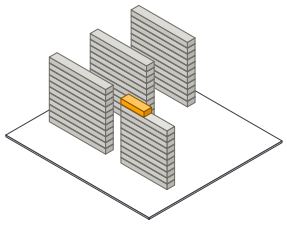


* Larger working area dimensions – on request.

Machine equipment

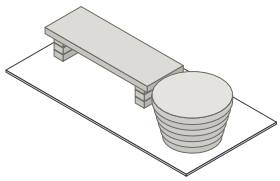
- Quick working tool change system
- Two cameras monitoring the working area
- Central lubrication system
- **Option:** table measurement sensor
- **Option:** additional X working axis
- **Option:** chamber top cover with extraction connection – recommended for plastics printing

Machine capabilities



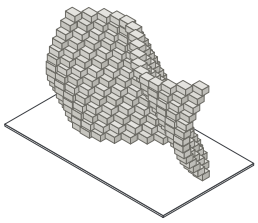
Series production of precast elements

Repetitive elements – walls, foundations and stairs – printed batch by batch at successive stations in the hall.



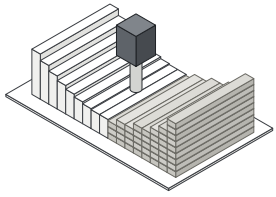
Street furniture

Benches, planters, bins and safety barriers for urban spaces.



Solid and foamed plastics

Laminating moulds and models made of foamed polystyrene, and elements made of PLA, PPGF30, PET-G and others (solid plastics – in development).



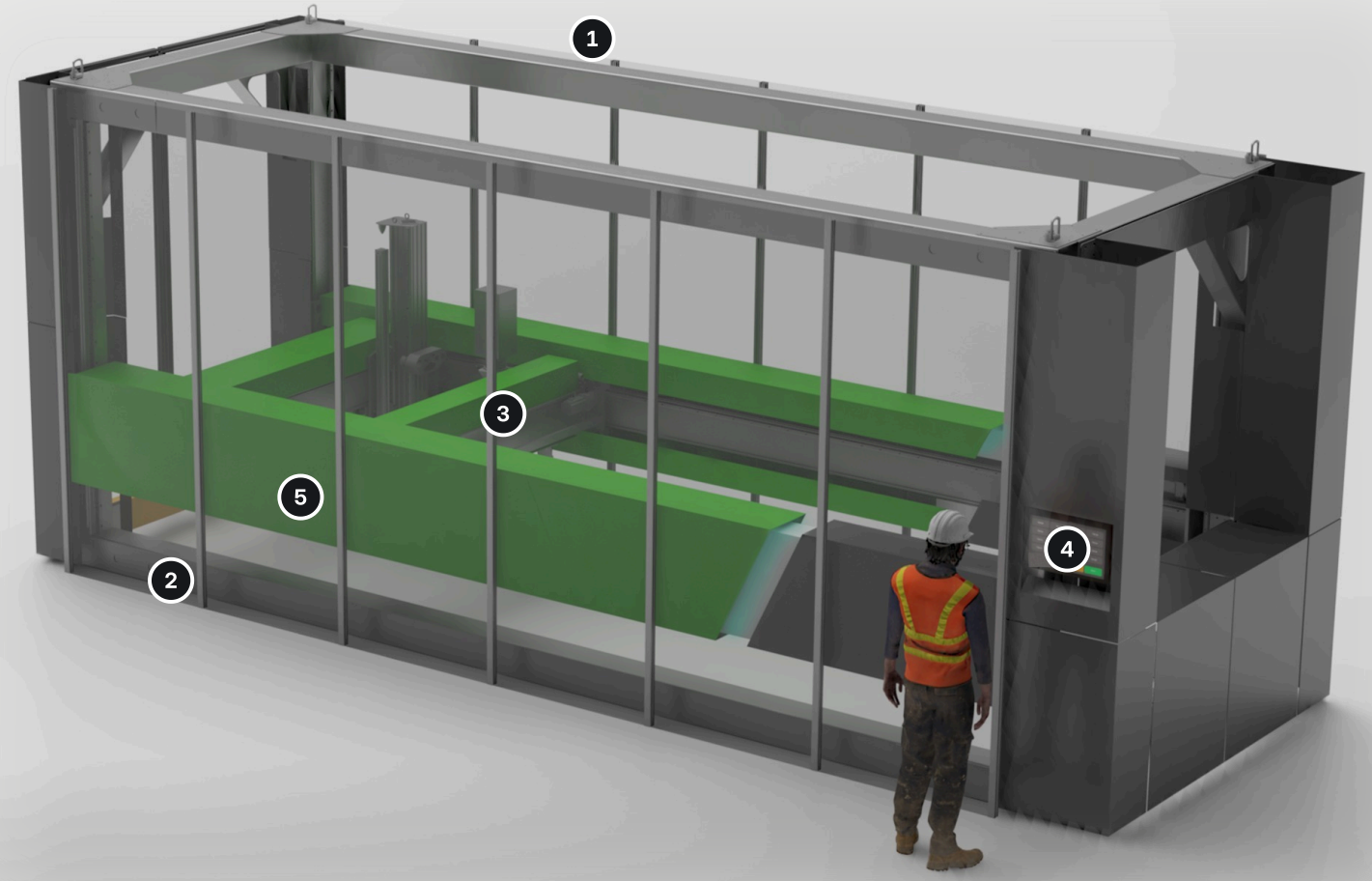
Milling

The 5-axis milling head machines prints or elements made of other materials to final dimensions.

Machine series

Cell

Precast station – concrete elements, street furniture and moulds



1. Rigid steel frame
2. Enclosed chamber – plastic walls
3. Additional X-axis beam (option)
4. Operator panel
5. Lightweight aluminium working axes

Mitsubishi CNC control

5-axis controller – printing and milling under one control system.

Interchangeable working tools

Concrete and plastics printing plus 5-axis milling – after a quick tool change.

Precision and dynamics

Rigid steel frame, aluminium axes and helical-tooth racks.

Frame open on one side

Access to the working area from the open side – convenient removal of prints.

Compatible technologies
Concrete printing p. 14
Plastics printing and milling p. 16
Print data acquisition system p. 20

Printer for small and medium-sized projects

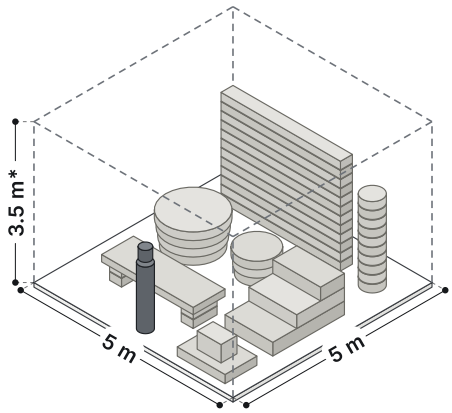
A compact printer for precasting – concrete elements, garden and landscape elements and street furniture. It works in cycles: the element sets in the working area, and once the print has been removed, the machine is ready for the next job. With the plastics extruder and the 5-axis milling head, it also prints with solid and foamed plastics and machines prints to final dimensions.

Machine specifications

Structure	**rigid steel frame with aluminium working axes – high printing precision and high motion dynamics**
Working area enclosure	**enclosed working chamber – protects the operator, contains chips and dust; top cover – option**
Axis guides	**Nadella Heavy Line GU**
Axis drives	**helical-tooth racks on all axes; gantry – two motors**
Printing speed	**up to 500 mm/s**
Rapid traverse speed	**up to 900 mm/s**
Vertical speed (Z axis)	**up to 150 mm/s**
Control	**Mitsubishi – 5-axis CNC controller**
Machine setup	**stationary, frame open on one side**

Maximum working area

The dimensions given are the maximum working area. We also configure the machine in smaller sizes – matched to your production.

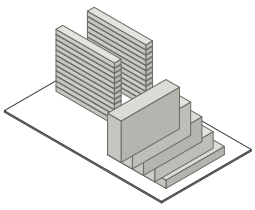


* Larger working area dimensions – on request.

Machine equipment

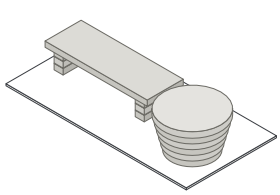
- Quick working tool change system
- Two cameras monitoring the working area
- **Option:** table measurement sensor
- **Option:** additional X working axis
- **Option:** central lubrication system
- **Option:** chamber top cover with extraction connection – recommended for plastics printing
- **Option:** container size with lifting points – the machine can be relocated in one piece

Machine capabilities



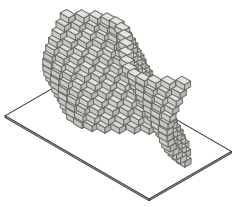
Precast elements to order

Walls, foundations and stairs printed in cycles – with breaks for the concrete to set and for removing prints.



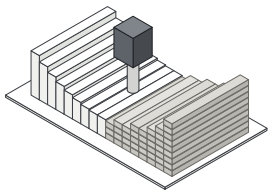
Garden and landscape elements

Benches, planters and decorative elements – including unusual, organic shapes.



Solid and foamed plastics

Laminating moulds and models made of foamed polystyrene, and elements made of PLA, PPGF30, PET-G and others (solid plastics – in development).



Milling

The 5-axis milling head machines prints or elements made of other materials to final dimensions.

3D concrete printing

3D concrete printing combines digital design with the reliability of a traditional building material. The machine lays the mix bead by bead, layer upon layer – without formwork, straight from the digital model. The same process is used to build structures at their final location and to precast elements in a hall.

How a print is made

1 **Mix preparation**
A mixer or a pump with a continuous mixer, also with a silo – selected to suit your production.

2 **Pumping system**
We select the pump from several models; it delivers the mix to the extruder's buffer tank.

3 **Concrete extruder**
The extruder lays a bead with the specified cross-section; the flow rate can be changed during printing.

4 **Machine**
The machine guides the extruder along the toolpath stored in the program (G-code).

Why 3D concrete printing

- less manual work on the construction site and in the plant
- greater work safety
- design freedom
- shorter construction and production time
- precision and repeatability of elements
- continuous operation possible, 24/7

What can be printed

Construction	residential and commercial buildings, precast elements (walls, foundations, stairs), load-bearing structures
Outdoor furniture and landscaping	benches, planters, bins, decorative walls, playgrounds with unusual shapes
Urban space	bus shelters, urban stairs, safety barriers, gazebos and pergolas
Industry and art	tanks and technical housings, sculptures and spatial installations

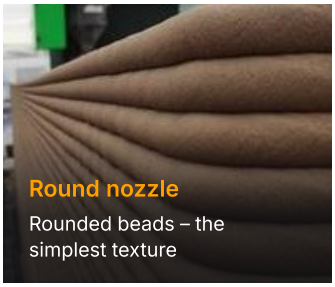
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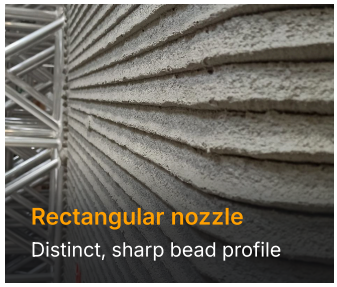
Surface finishes

Bead width
set by the nozzle size (Ø 20–70 mm, bead 25–90 mm); with nozzle rotation – up to 250 mm

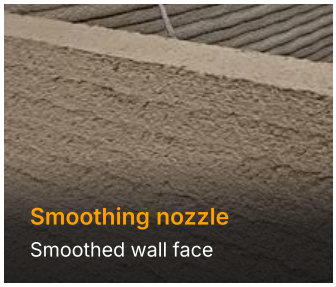
Bead height
defined in the program (G-code) – also variable during printing

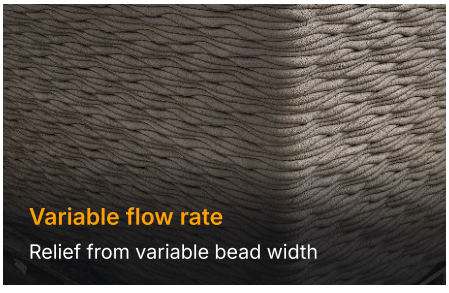
Flow rate
changed during printing – varies the bead width and creates a relief

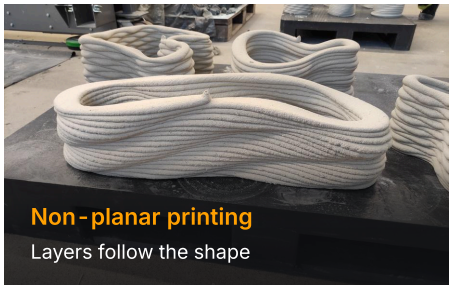


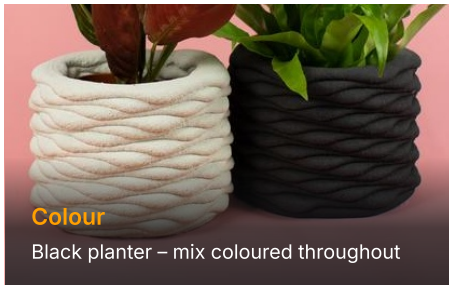












Mix – typical parameters

Strength (28 days)	Vertical build rate	Mix working time	Colour	Reinforcement
15–90 MPa	**up to 0.5 m/h**	**up to 40 min**	**integral colouring**	**bars placed during printing**

Typical values – depending on the mix used. Choosing the mix allows the parameters to be matched to the application, e.g. to achieve a faster vertical build rate.



1. Stainless steel buffer tank
2. Geared drive
3. Mounting plate with quick coupling
4. Nozzle rotation system
5. Interchangeable nozzle

Printing tool

Concrete extruder

The extruder lays the mix bead by bead and gives it the specified cross-section. We offer two series models and a made-to-order version.

- stainless steel buffer tank
- surface-hardened parts of the extrusion system
- flow-rate adjustment during printing
- quick nozzle change system – 10 nozzles in the set
- nozzle rotation system – required for non-round nozzles
- concrete level sensor – integration with the pump control

	CPE35	CPE50
Application	precast elements, street furniture	walls and larger structures
Motor power	3 kW	5 kW
Buffer tank	35 l	50 l
Max. flow rate	1.5 m³/h	3 m³/h
Pump connection	DN35	DN80
Round nozzle diameter	20–55 mm	40–70 mm
Bead width	25–70 mm	50–90 mm
Bead width with nozzle rotation	up to 200 mm	up to 250 mm
Max. aggregate size	8 mm	10 mm

We can tailor the extruder parameters to your needs.

Nozzles – bead cross-section



round
bead with rounded sides – the simplest texture



rectangular
flat bead sides – an even wall face



trapezoidal
bead tapering towards the top



smoothing
smooths the side surface during printing



nozzle rotation
as standard – required for non-round nozzles

Coming soon

- Automatic composite reinforcement of the print
- Pigment dosing into the extruder
- Extruder for multi-component materials
- Bead width measurement
- Twin-nozzle version – higher printing output

Solutions at the final stage of development and production preparation. Availability, timing and parameters are confirmed individually.

3D printing with plastics

The plastics extruder prints from granulate, layer by layer. Foamed polystyrene produces large, lightweight bodies – above all moulds and models, which we mill on the same machine to final dimensions and surface finish. Solid plastics – PLA, PPGF30, PET-G and others – produce compact, thin-walled elements with a smooth surface.

How a print is made

1 Granulate
Foamed polystyrene or a solid plastic.

2 Feeding
Pneumatic conveying delivers the granulate to the extruder.

3 Extruder
Plasticises the granulate and lays a bead with the specified cross-section.

4 Machining
5-axis milling to final dimensions.

Foamed plastics

Modified polystyrene printed at 150 °C. The print has closed cells – it is lightweight, does not absorb water, insulates well and withstands compression well for its weight. We set the density in the range of 100–500 kg/m³; one tonne of granulate yields approx. 6.7 m³ of print (at approx. 150 kg/m³).

Features

- print volume approx. 5 times greater than that of the granulate
- large overhangs can be printed
- no warping or interlayer cracking
- easy to machine, little waste
- after milling: smooth surface and accuracy to any required tolerance
- fully automated production of moulds and models

Applications

- **Laminating moulds** – working surface milled to size
- **Tooling** – fixtures and moulds for room-temperature use
- **Models and prototypes** – fast production of form models and prototypes
- **Lightweight structures** – large elements with high compressive strength for their weight
- **Stage design** – lightweight stage set elements and props
- **Thermal insulation** – elements with low thermal conductivity



Foamed plastic
Openwork body – large overhangs

Foamed polystyrene vs. insulation boards

	FPE PrintE	XPS	EPS
Density	**170 kg/m³**	**33 kg/m³**	**20 kg/m³**
Young's modulus in compression	**45 MPa**	**10 MPa**	**5 MPa**
Tensile strength	**0.9 MPa**	**0.3 MPa**	**0.1 MPa**
Compressive stress at 10% strain	**1.5 MPa**	**0.3 MPa**	**0.1 MPa**

Print properties depend on the density at which we print (100–500 kg/m³). The values in the table refer to a density of approx. 170 kg/m³.



Solid plastic – PLA
Thin-walled shapes

Solid plastics In development

Solid plastics are printed with the same extruder after changing a set of parts.

Features

- PLA, PET-G and other granulates
- glass-fibre reinforced plastics – PPGF30
- bead width from 5 mm – thin-walled elements
- compact, smooth prints with regular layers

Applications

- composite laminating moulds and tooling
- assembly and positioning fixtures
- furniture and interior fittings
- large decorative elements and lamps
- thin-walled elements with free-form geometry



1. Granulate feed hose
2. Screw servo drive
3. Heating zone housing
4. Nozzle

Printing tool, granulate

Plastics extruder

The extruder plasticises the granulate in heating zones and lays a bead with the specified cross-section. We offer two models – FPE20 and FPE50.

- foamed plastics; solid plastics – with an additional set of parts
- pneumatic granulate conveying – as standard
- servo drives for the screw and the granulate feeder
- heating zones and print bead post-heating
- active print cooling
- communication with the machine – Modbus TCP

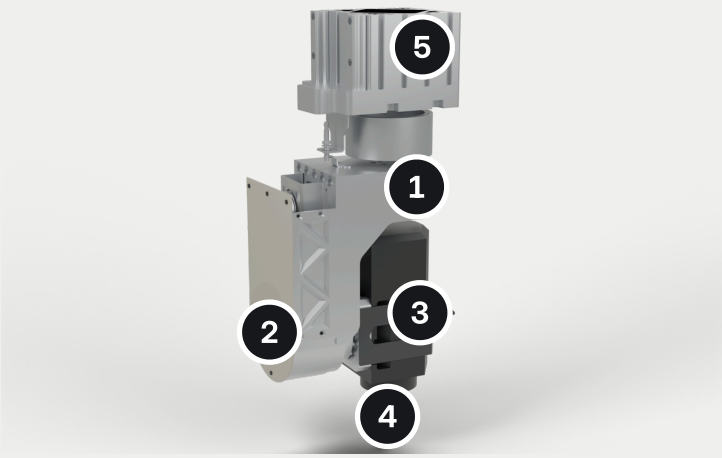
	FPE20	In development FPE50
Maximum throughput	20 kg/h	50 kg/h (estimated)
Print density	adjustable, 100–500 kg/m³	adjustable, 100–500 kg/m³
Heater power	6.7 kW	12 kW
Print bead post-heating	6.8 kW	6.8 kW
Main drive	servo drive 4 kW	servo drive 7.5 kW
Granulate feeder drive	400 W	400 W
Communication with the machine	Modbus TCP	Modbus TCP

We can tailor the extruder parameters to your needs.

Coming soon

Solid plastics kit – PLA, PPGF30, PET-G and others

Solutions at the final stage of development and production preparation. Availability, timing and parameters are confirmed individually.



1. C axis – rotation
2. A axis – tilt
3. HSK-63F spindle
4. Milling tool
5. Local Z axis

Machining tool

5-axis milling head

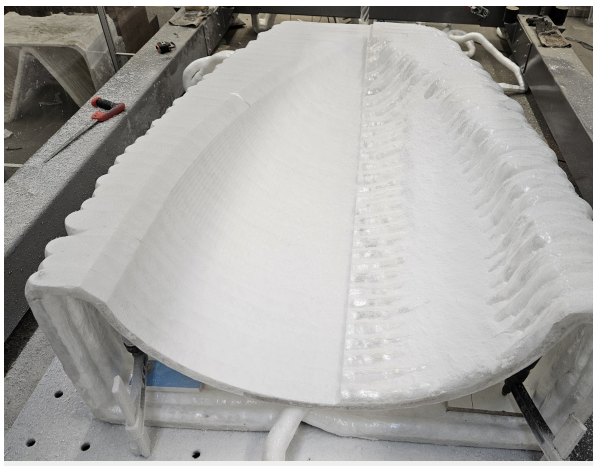
The milling head machines prints and elements made of other materials to final dimensions – on the same machine, after a quick working tool change. A typical application is finishing moulds and models made of foamed polystyrene: printing gives a shape close to the target, and milling gives a smooth surface and accurate dimensions.

- two rotary axes A and C – machining of undercuts and radii
- automatic tool clamping
- ceramic bearings, lubricated for life
- spindle cooling with compressed air
- tool clamping and spindle speed sensors

	Standard
Local Z axis	vertical axis, 1 m travel
Local Z-axis speed	up to 200 mm/s
Spindle power S1 / S6	5 / 7 kW
Torque S1 / S6	4 / 5.6 Nm
Spindle speed	up to 24,000 rpm
Tool holder	HSK-63F
A / C axis range	±130° / ±180°
Tool change	manual

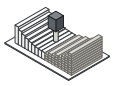


Milling
Machining a pocket in a foamed polystyrene print

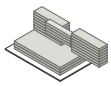


Surface
Left: milled smooth; right: layers as printed

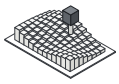
Tool capabilities



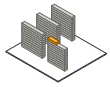
Final dimensions
Machining a print with allowance to final dimensions and tolerances.



Smooth surface
Mould working surface ready for laminating.



Other materials
Machining elements made of other materials – also without prior printing.



Printing and machining in one
Printing and milling on one machine – after a quick tool change.

From model to print

Every print starts from a digital model. The program is prepared in well-known toolpath design software, and the machine executes it under the control of an advanced, high-precision **Mitsubishi** M800 series CNC controller.

1 **3D model**
Design of the element in CAD software.

2 **STL file**
Model saved as a triangle mesh.

3 **Print toolpath**
Slicing into layers or parametric design of the nozzle path.

4 **Parameters**
Flow rate, layer height, bead width and texture.

5 **G-code**
Program with motion and output commands for the machine.

6 **Print**
The **Mitsubishi** CNC control executes the program; the flow rate can be corrected during printing.

7 **Monitoring**
Camera view; parameter logging with the data acquisition system (option, p. 20).

Two ways to prepare the toolpath

Slicing the model into layers

Typical elements – the fast route

The 3D model is sliced into layers automatically, and the software determines the nozzle path in each of them. Ready-made settings for your machine allow G-code for walls, precast elements and moulds to be prepared quickly.

Parametric toolpath design

Full control

The toolpath is designed parametrically: full control of the bead cross-section, variable layer height, tilt and manual path correction. This is how concrete textures, non-planar prints, organic forms and plastics toolpaths are created.

Machine control

- **Mitsubishi** – 5-axis CNC controller, M800 series
- printing and milling under one control system
- 15″ operator panel at the machine
- additional handheld control pendant
- two cameras monitoring the working area
- table measurement sensor – option
- access control to the machine's working area – depending on the series

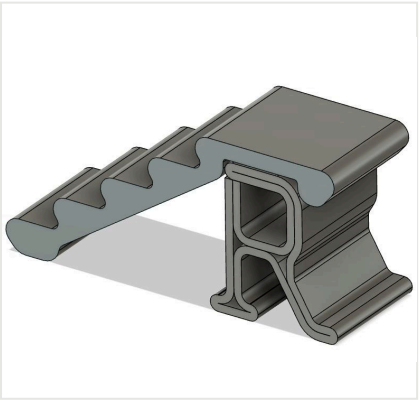
Training

Training takes place during machine start-up. We teach machine operation and control, and how to prepare the first G-code programs for your elements.

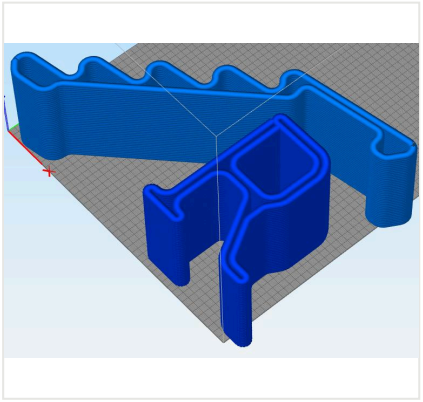
Extension: data acquisition system (p. 20)

- print parameters recorded separately for each element
- live camera view and layer progress
- 3D reconstruction of the printed element

One element – from model to print



1 **3D model**
Digital model of the precast element.



2 **Toolpaths**
Toolpaths generated in the software, layer by layer.



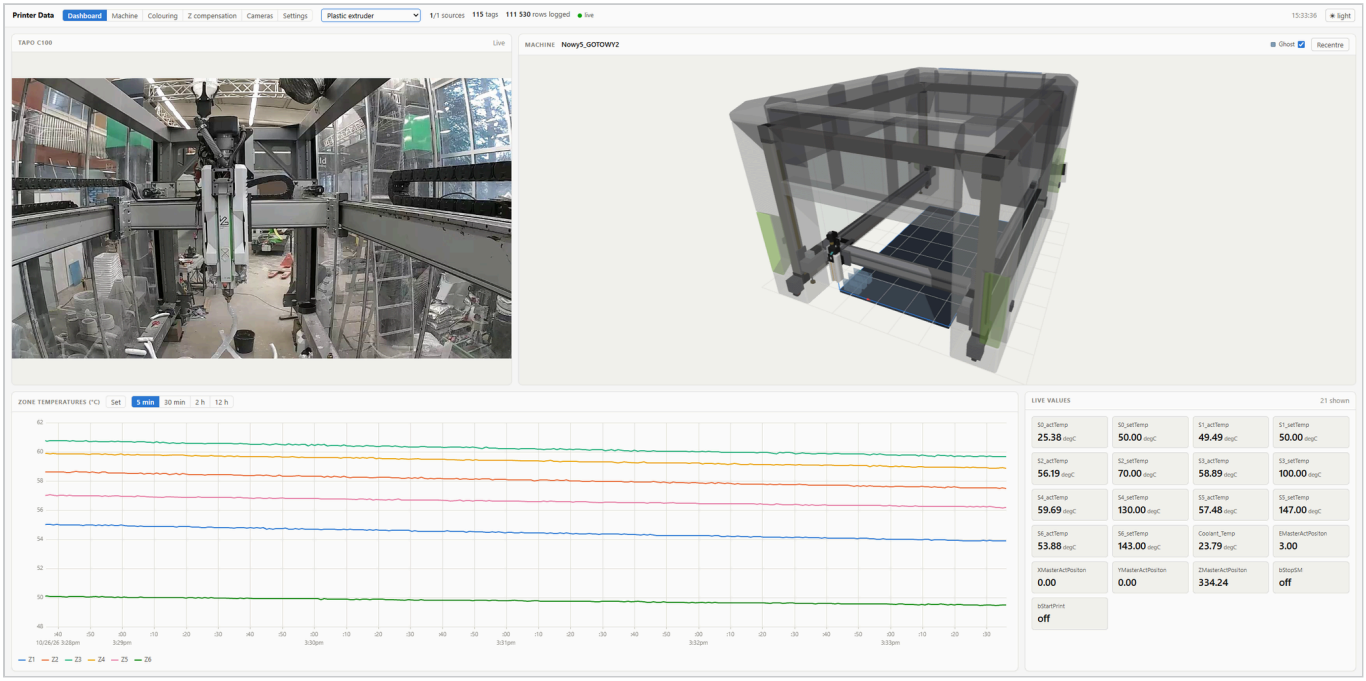
3 **Print**
Elements printed directly from the program.

Print data acquisition system

In development

The system enables continuous monitoring of the printing process: it records machine and tool parameters, camera images and the program run – separately for each printed model. It therefore also serves for quality control and production documentation. The system monitors and documents – it does not interfere with machine control.

Availability software extension (option) for every machine series – concrete and plastics printing; selected milling data. Solution in development – availability and timing confirmed individually.



Data acquisition panel – view during plastics printing: camera image, 3D machine model, zone temperatures and live values.

Recorded data

- axis positions and head path
- G-code program: line, progress of layers and elements
- concrete: tank level, pressure upstream of the nozzle, flow, mixer speed, screw torque, mix temperature
- plastics: extruder heating zone temperatures, feeding, cooling
- camera images and time-lapse photos
- working table height map
- ambient conditions: temperature, humidity, wind speed

What the operator sees

- dashboard with live values and charts
- 3D model of the machine with the printed and remaining toolpath
- camera view and a top view of the table
- tool mode: concrete, plastic, milling

For every element

- separate record for each program run and each element
- 3D reconstruction of the printed element from the record
- export: CSV, PNG/PDF charts, 3D model in an HTML file, time-lapse photos

The system includes

- 27″ industrial touch screen
- industrial computer running the software
- additional cameras monitoring the process
- set of required sensors

Benefits

- continuous monitoring of the printing process – live values and camera images
- comparison of runs – series repeatability
- data for process analysis and improvement – export to files
- quality documentation for every printed element
- faster operator response to changes during printing

From analysis to production

1

Needs analysis

We get to know your product range, production scale and resources, and assess the conditions: place of work, power supply, operation and material logistics.

2

Selection and offer

We propose the series, machine size and working tools, and prepare an offer with a delivery schedule and installation requirements for the configured machine.

3

Commissioning

We start up the machine, train the operators and provide technical support once production has started.

Included in delivery

Installation and start-up

Installation of the machine at your plant or on the construction site and initial start-up.

Training

Assembly, machine operation and preparation of the first G-code programs – 10 working days.

Technical support

Support after start-up and service during the warranty period.

Warranty

12-month warranty from the signing of the final acceptance report.

Software

Control software and a G-code preparation program with machine settings.

Application support

Design optimisation for printing

We analyse your designs for printability: wall shape and cross-section, overhangs, division into parts and print sequence. We propose changes that shorten printing time, reduce material consumption and limit the risk of errors.

Material selection

We help select the mix or plastic for the application and the operating conditions of the element.

Support with first projects

We help prepare your first production elements – from file to finished print.

Tests before purchase

Before you decide to buy, we print sample elements from your material or to your design to check that the technology meets your expectations.





Metal printing – wire arc deposition (WAAM)

WAAM (Wire Arc Additive Manufacturing, also DED-arc) is 3D metal printing on a robotic station with a deposition tool. An electric arc melts the welding wire, and the molten metal is laid layer by layer along a path derived from the CAD model. The result is a near-net-shape element – without moulds or dies – which is then machined to size.

1
Model and paths
The CAD model is divided into layers, and the robot motion is checked in simulation before starting.

2
Layer deposition
The arc melts the wire; the interpass temperature is controlled.

3
Heat treatment
If necessary – stress relief and homogenisation of material properties.

4
Finish machining
Milling the surface to size – the allowance is usually approx. 1 mm.

Materials

- carbon and low-alloy steels
- stainless steel
- nickel alloys
- aluminium alloys
- bronzes, incl. aluminium bronzes

Applications

- large structural parts
- deposition of protective layers – wear and corrosion resistance
- repair and regeneration of worn parts
- prototypes, small series, spare parts on demand
- moulds and tooling
- parts for the aerospace, energy and shipbuilding industries

Advantages of the technology

- deposition rate significantly higher than in powder-based methods
- standard wire and welding power sources
- part size is limited by the robot's reach, not by a chamber
- little waste – especially with expensive nickel alloys
- functionally graded and bimetallic materials possible

One technique – two applications

Printing parts from wire
1–10 kg/h

The part is built from scratch from wire – near-net shape. Best suited to medium and large parts; deposition rate increases with size.

Layer deposition (cladding)
up to 15 mm

The arc fuses the filler material with the substrate and creates a layer permanently bonded to it. The surface gains hardness or corrosion resistance – without replacing the whole part; a cheaper substrate can be coated with a more expensive alloy.

Two arc variants

MIG/MAG
highest deposition rate – large parts, easy implementation and low-cost equipment

CMT
a MIG variant with a lower deposition rate – better process control and fewer thermal defects

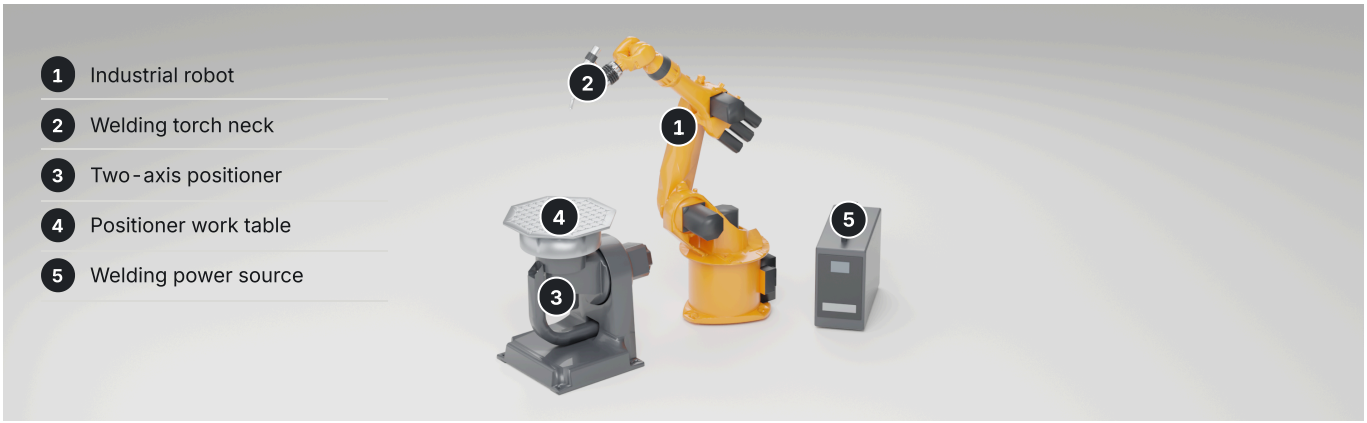
Good to know

The surface after deposition is wavy, so the element usually requires finish machining. The process is not suitable for very fine details (resolution approx. 1 mm). High heat input widens the bead and causes distortion – this is reduced by the CMT arc and laser assistance (p. 23).

Metal printing system

WAAM station

The station combines an industrial robot with a welding torch, a welding power source with CMT function and a built-in wire feeder, a two-axis positioner and, optionally, a laser head that assists wire melting. We mount the deposition system on any industrial robot, so the working space is matched to your needs. Robot programs are prepared from the CAD model in CAM systems.



Industrial robot

any industrial robot guides the welding torch along the programmed path

Welding power source

current up to 500 A, CMT function – less heat and a narrower bead

Laser head – option

2.5 kW laser aimed at the wire at an angle – assists or replaces arc melting

Positioner

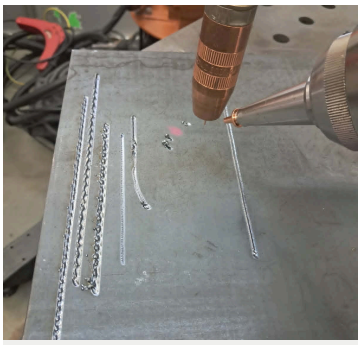
a two-axis positioner orients the part being built

Toolpath software

robot programs from the CAD model – Esprit CAM and Alma

Fume extraction

removes welding fumes; the station operates in a dedicated room



Laser-assisted deposition
Welding torch and laser head above test beads



Metal print
Thin-walled vessel deposited from wire

Deposition bead width

approx. 8 mm
standard MIG/MAG source

approx. 5 mm
CMT arc – more stable, less spatter

approx. 3 mm
with the laser head – little fume, almost silent operation

Technical data

Robot	**any industrial robot – selected to suit your needs**
Working space	**matched to your needs – defined by the robot's reach**
Positioner	**two-axis**
Station shown in the visualisation	**6-axis robot: 16 kg payload, 1610 mm reach, 0.05 mm motion accuracy**

Equipment and options

Welding power source	**3–500 A, CMT function, pulse mode**
Wire feeder	**built-in**
Cooling	**liquid-cooled**
Laser head	**option – 2.5 kW, with chiller**
Fume extraction	**yes**
CAM software	**Esprit CAM, Alma**

EXTRONE

3D PRINTING TECHNOLOGY

Get in touch. Based on a description of your planned production, we will select the machine series and working tools and estimate the achievable output.

Address	Extrone sp. z o.o., ul. Stefana Batorego 107B, 87-100 Toruń, Poland
E-mail	kontakt@extrone.pl
WWW	extrone.pl

TECHNOLOGY PARTNER

Łukasiewicz
Przemysłowy Instytut Automatyki i Pomiarów PIAP

We developed the machines and working tools in cooperation with the Łukasiewicz Research Network – Industrial Research Institute for Automation and Measurements PIAP.

Our equipment is continuously developed, so its technical parameters are subject to change. Drawings are for illustration only.