



Integrated system for feeding metal 3D printers with reactive and non-reactive metal powders

Safeguarding machine operators with closed systems

Protecting products with fail-safe materials handling

Protecting products with inertisation

ATEX design provides security

Conserves resources as products are re-used

The Requirements

Supplying metal powder to metal 3D printers covers the areas of storage, providing, conditioning, conveying and recovering. In particular, the following special requirements must be taken into consideration:

Product quality

- A continuous, reliable supply of powder to the printer must be assured. A drop-off or break in production causes a deterioration in quality and must therefore be avoided.
- New metal powder for feeding has to be screened using specific mesh sizes as

stipulated for an incoming goods inspection.

- Any powder present in the circuit needs to be screened prior to re-use.

Operator safety

- Machine operators must be protected from respirable, toxic fractions of the fine metal powder.

Explosion protection

- Fine fractions of metal powder are explosive. Appropriate explosion protection measures are to be taken.

Product safety

- Metal powders must be protected from atmospheric humidity and oxygen in order to prevent gradual deterioration in quality. These metal powders need to be processed in an inert atmosphere.
- If there is a change in the ambient conditions, the metal powder may adsorb water. This must be eliminated in the powder circuit.

THE SOLUTION



How it all started

In 2016, the Fives and Michelin companies created the AddUp business with the goal of manufacturing and marketing metal 3D printers worldwide. In February 2018, AddUp first approached AZO France. Their enquiry concerned handling of inert metal powder for feeding a 3D printer. Technical requirements and possible concepts were discussed during a visit to AZO Germany. In cooperation with experts from AddUp, AZO developed a bespoke solution, that was specifically designed for

an AddUp printer. The first trials were conducted at the customer's in October 2018 using a prototype system. The results were incorporated into further development with the result that we were already able to supply a plant ready for industrial production for one size of printer by early 2019. The systems have been expanded to cover several sizes of printers thanks to a process of ongoing development and special adjustments.

"For the metal powder handling to feed our 3D printers, we were looking for a partner with whom we could develop the solutions perfectly tailored to our needs. AZO, an expert in raw material automation, supplied us with a system that is perfectly adapted to our printers and various metal powders"

Ludovic Viossat, Supply Chain Manager, and the Technical AddUp Team

AZO.[®]

AZO's integrated solution for reliable, safe feeding of 3D printers with metal powder

The glovebox

- Safe feeding of powder into the production circuit
- Insertion of metal powder containers
- Pneumatic conveying of powder to **one or more printers**
- Inerting for safe handling of highly reactive powders



The screening module

- Integrated into the 3D printer
- Ultrasonic screener for conditioning of the powder before printing
- Inerting for screening under inert gas atmosphere
- Pneumatic conveying of the screened powder to the printing module
- Receiver for recirculation of non-melted powder from the 3D printer



The printer module

- Receiver for conveying the powder
- Valve locks for atmospheric separation between the conveying process and the printer chamber
- Distribution screw for up to two machine inlets
- Recycling of non-melted metal powder

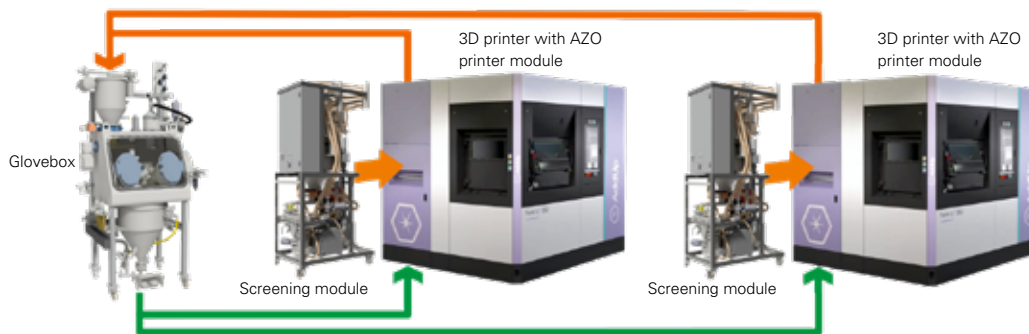


Control system

- Control of the plant via a Codesys-based soft PLC with integrated safety PLC and external 10" touch operating panel
- Ethernet-connection for communication between printer and glovebox
- Defined interface for data communication between printer and glovebox
- Different modes: remote mode, test mode and manual mode

Wiring

- Distributed wiring with cables that are cut to length and terminated in advance
- Plug-in and easy to replace
- IO-Link sensors and IO-Link master with Ethernet interface in IP67 version
- Valve terminals with IO-Link interface
- Distributed module with IP67 rating (digital and analogue IO-s, IO-Link)
- All connection lines are plug in using coded industrial connectors.



Safety concept

- The risk from escaping inert gases is eliminated by using sensor technology and reliable evaluation of results.
- The risk from explosive dust is eliminated by using a secure inertisation concept.
- The risk to machine operators from respirable materials and/or toxic metals is eliminated by using filter technology.

Unique selling points

- Completely inert handling of metal powders (feeding, processing, recovering and extracting)
- Safe handling even of poorly flowing, fine-grained metal powders
- Ultrasonic screener with extraction of coarse material
- Glovebox with possibility for refilling during the printing process
- Central plant: one glovebox serves several printers
- Option for using additional tools for evaluating and analysing machine and process data

