

Meltio Engine Blue

# Robot Installation and Integration Requirements

Applies to Meltio Engine Blue CNC / Q4 2024 / V1



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# 1. Robot Requirements

Meltio has an open platform strategy for the hardware and slicing software. The Meltio Engine Robot Integration is compatible with any robot if it is compliant with the following requirements:

## 1.1. Robot Payload

Actual weight of the Meltio Engine Deposition Head dry weight is 23 kg, including hoses and liquids it can get up to 27.5 kg. Meltio recommends at least a 45-60kg robot payload. This is very important to ensure that the robot is able to follow the additive toolpath. While printing, the welding wire is being pushed against the print, which generates a normal force on the robot arm. Because of that, it is important that the robot arm is stiff enough and can maintain the trajectory. Meltio technology allows depositing a layer height between 0.4 and 1.2 mm, so a minimal deviation is compromising the quality of the part.

There is no downside in choosing a robot with a larger payload. Even the cost for larger payload robots can be less as it is more common in the industry.

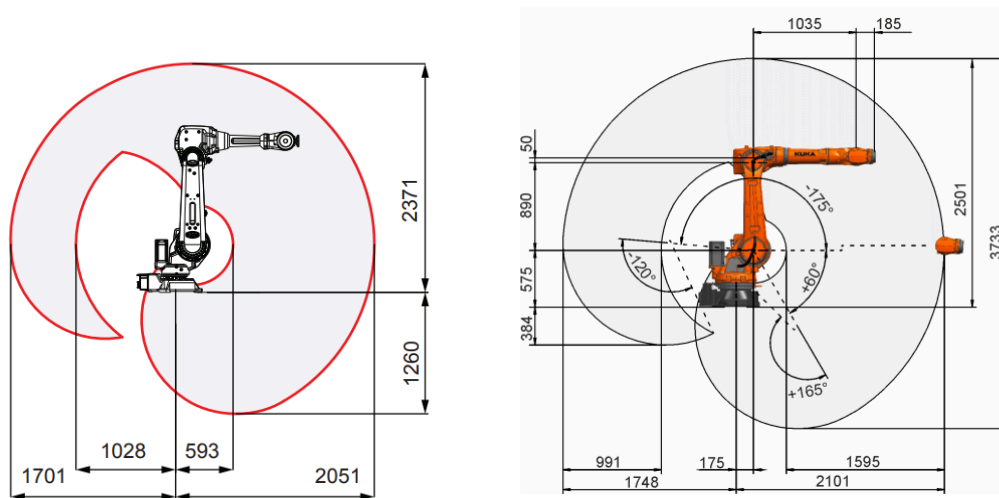
## 1.2. Robot Accuracy/Repeatability

Meltio recommends a robot position repeatability of  $\pm 0.06$  mm according to ISO 9283. This will define the toolpath quality: the smaller this value is would offer the better results.

## 1.3. Robot Reach

The robot reach will define the spherical building volume of the 3D printing solution (Robot Arm + Meltio Engine). The recommended reach will be 2000mm, but this will depend on the user application.

The following figure illustrates the workspace of an ABB IRB4600 2050mm reach and a Kuka KR 2100mm reach.



In order to get the most out of the workspace of the robot arm, it is possible to mount the robot on a plinth, which can be provided by robot manufacturers.

## 1.4. Installation of the Meltio Engine Robot

- The Robot must be installed before starting the Meltio Engine Integration. This includes that the Robot has a power supply, and the data cables are installed within the Robot controller.
- The Robot must be attached to the floor according to the manufacturer's indications.
- The Robot must be installed/configured so it could not create a dangerous situation while installing the Meltio Engine.
- The Robot must be calibrated as defined in the Robot manual. Meltio is not responsible for the quality of the prints in terms related to calibration or robot configuration.

All of this needs to be in order for the Meltio Technical Support team to help on the integration.

### **Additional Installation Requirements:**

- The Meltio Engine requires a clearance of 0.5 m on each side to facilitate maintenance and 30 cm of clearance at the rear to connect Meltio Engine ports.
- A shielding gas connection is necessary to prevent oxidation during printing and to protect the sensitive optical system from dust and smoke. Either Argon or Nitrogen may be used. A connection (Meltio recommends using a pressure regulator and not a flow regulator) must be installed between the printer and the gas bottle. The Meltio Engine controls the gas mass flow internally and requires a constant pressure connection of 4–6 bars.
- The chiller requires 30 cm of clearance on both the left and right sides for airflow intake and 20 cm at the rear for connections.

## **1.5. Additional Axis - Tracks or Positioners/ 2-axis Rotary-Tilting table**

Installing additional axes can offer more printing strategies as well as increase the building volume of the solution. Any track or positioner is compatible with the Meltio Engine Integration if it is fully controlled by the Robot controller.

The installation, configuration, and calibration of the additional axes must be ready before the Meltio Engine Integration can start. The Meltio Technical Support Team cannot help or work on the configuration of these additional axes.

While Meltio's Open Platform supports additional axes, the final results depend on the software chosen by the integrator. For specialized configurations, software modifications may be necessary. Please contact your integrator or software provider to verify compatibility.

## 1.6. Robot Communication Protocol

The robot must have installed and configured an industrial network device with at least eight (8) digital inputs and eight (8) digital outputs free to use. **The signals need to be defined using the following same naming in the robot controller. This is part of the Meltio Standardized Integration process and also ensures software compatibility.**

ROBOT DIGITAL INPUTS	ROBOT DIGITAL OUTPUTS
DI_ENGINE_01	DO_ENGINE_01
DI_ENGINE_02	DO_ENGINE_02
DI_ENGINE_03	DO_ENGINE_03
DI_ENGINE_04	DO_ENGINE_04
DI_ENGINE_05	DO_ENGINE_05
DI_ENGINE_06	DO_ENGINE_06
DI_ENGINE_07	DO_ENGINE_07
DI_ENGINE_08	DO_ENGINE_08

### 1.6.1. Advanced communication protocols

Both the Robot Controller and the Meltio Engine should be connected to the Local Network with static IP addresses. The user must know these IP addresses to connect to the Meltio Engine using OPC DA (OPC Data Access) or Socket TCP/IP communication protocols.

The Robot must be connected to the Local Network using the WAN connector in the robot controller. If it is connected using the controller LAN connection, it will create a DHCP Server, assigning an IP to every device on the network, which will create conflict with the local network.

Apart from this, Socket or OPC communication protocols require two extra digital outputs from the robot that will generate an emergency stop in case of connection loss. To fulfill this requirement the recommended solution would be to use a 16 Digital I/O module.

## 1.7. Robot Cell

A laser-safe cell has to be built. The recommended measure is at least 3x3x3m (2m reach robot). It must include light, walls, doors, and laser-safe windows (or cameras in case there are no windows).

## 1.8. Security Circuit

The emergency security circuit must be pre-installed. The security circuit must include the robot cell door interlock with the robot security circuit. Therefore, in case the door opens, it will generate an emergency stop. The circuit should be prepared so that the Engine signals for security can be connected in series, in the same way the door interlock is installed. Meltio can provide basic documentation guidance.

## 1.9. Software Compatibility

Every robot configuration needs to be reflected in the slicing software. The robot operator must gather any configuration and calibration data from the robot controller to be updated in the software. Also, every robot brand has its own programming language, so the most common robot brands will maximize the compatibility with the most softwares. Meltio recommends ABB, Kuka, Fanuc and Yaskawa to maximize compatibility.

## 1.10. Robot Operator

End-users must have a robot operator able to control, configure and jog the robot, as well as being able to calibrate the tool, positioner or any working plane. This person will be in charge of assisting the Meltio technical support team through the integration process in any robot-related aspect.



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