Additional information to TILIKUM

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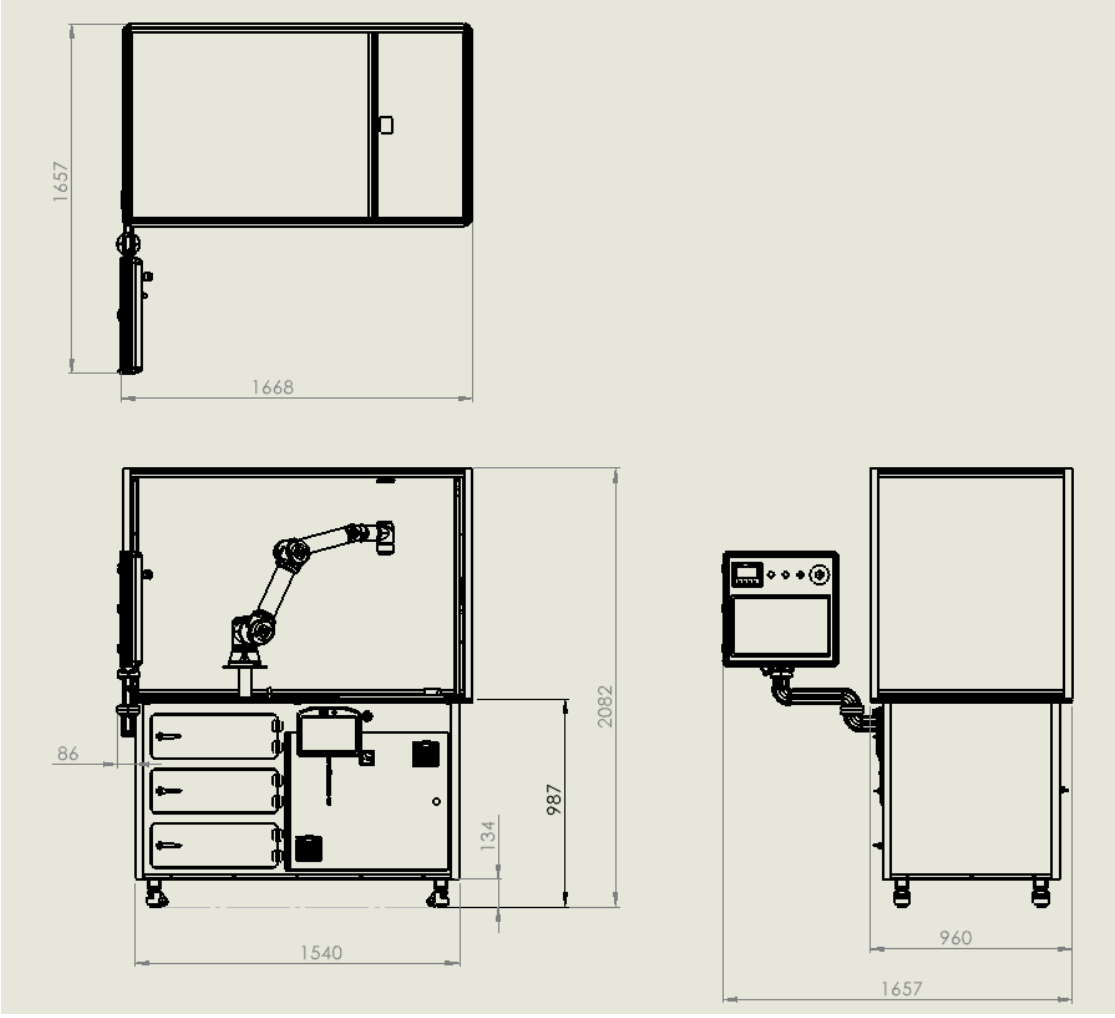
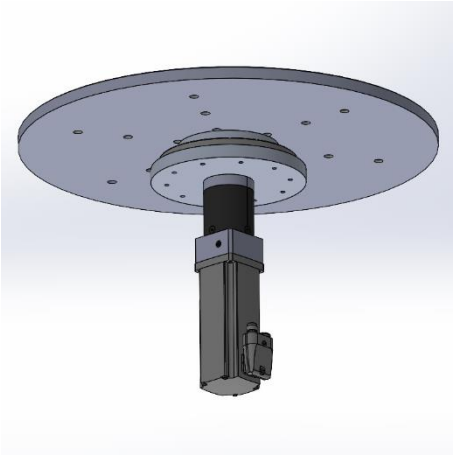
1. TECHNICAL SPECIFICATIONS

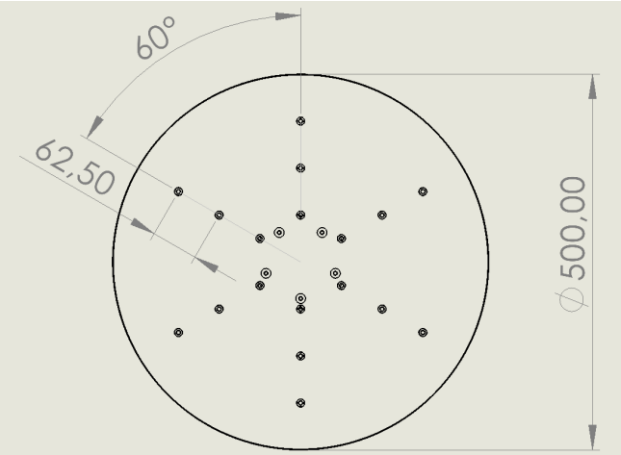
Dimensions:	1660 x 960 x 990 mm
Weight:	500 kg
3D scanner:	HandySCAN 3D BLACK
Inspection software:	PolyWorks Inspector
Robot:	Universal Robots 5
Turntable:	YES (simulated load 15 kg)
Automatic calibration:	YES (adjustable time, nomber of cycles)
Control system:	PLC Siemens
Power voltage:	230 V
Option to extend with OPCE:	YES (workspace cover, camera for positioning parts, barcode / QR code reader)

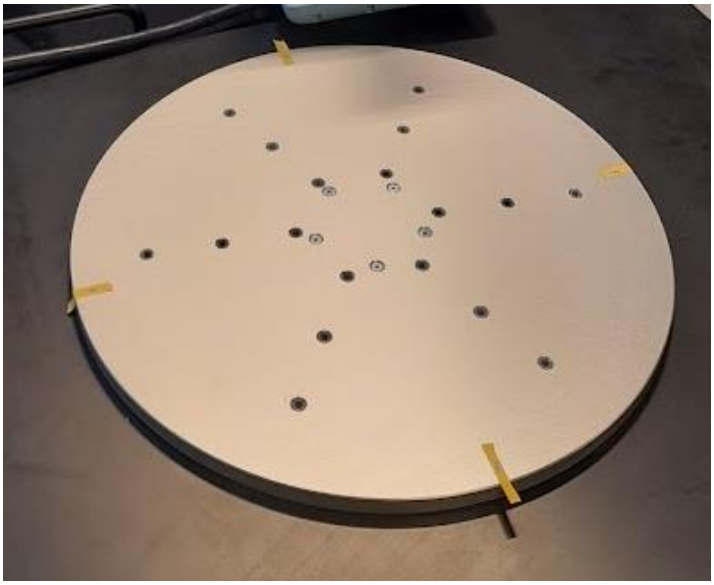


2. TURNTABLE – DIMENSIONS, LOAD AND CONTROL

Turntable is optimized for load of up to 15 KG. It can mechanically support parts up to 30 KG. With a planned load of up to 30 kg, the circuit breaker can be replaced to take advantage of the higher capacity of the turntable.







These two rotation modes can be used in one scanning project:

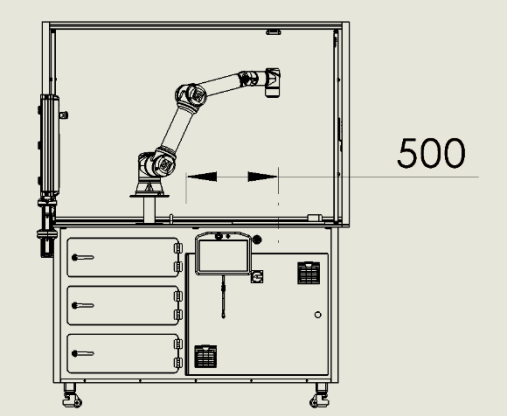
a) **Continuous rotation** until stopped
b) **Rotate by given increment** (Only one increment value can be set for one scan project, another value can be set for another project.)

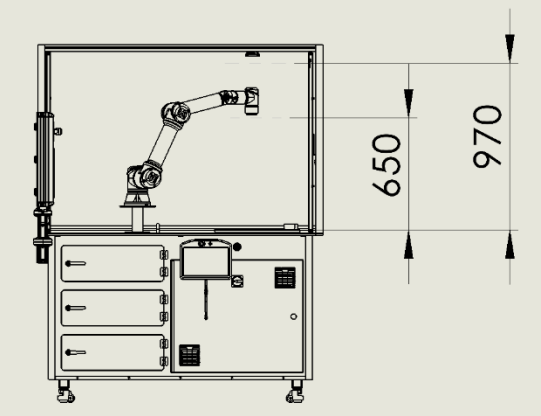
It is also possible set the turntable rotation speed for each scan project. The rotation function can be started from the robot program using URCAPS.

3. MAXIMUM PART SIZE

For safety reasons, the part must not extend beyond the edge of the turntable. The maximum diameter of the part is therefore 500 mm. In specific applications, where the customer obtains the certification for the given use with a larger part, it is possible to place the part on the turntable up to a maximum diameter of 1000 mm without the use of a protective cover. However, it is necessary to simulate in advance whether the robot can reach all the necessary measuring points.

The maximum height of the inserted part is 970 mm. This is the distance from the plane of the turntable to the safe distance of the top cover. We recommend a maximum part height of 650 mm for optimal reach of the robot to the scanning points. The ideal part height is up to 500 mm.

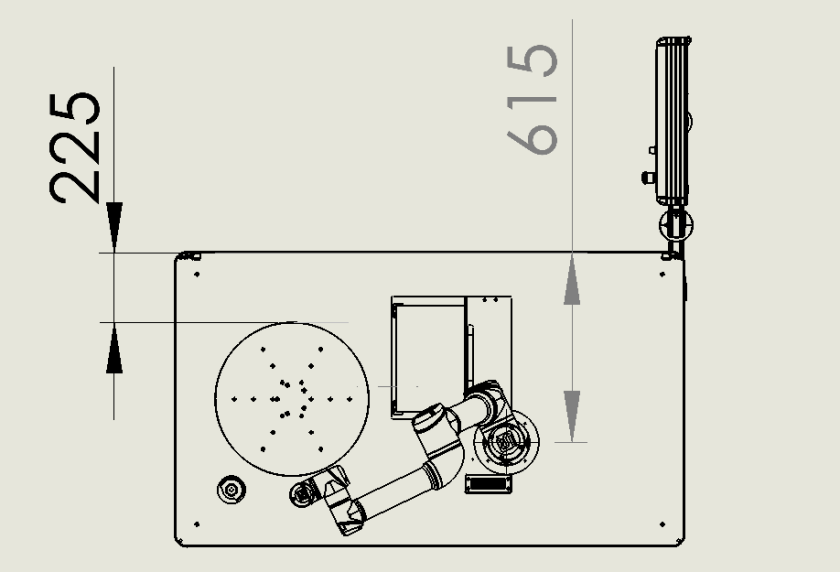




4. WORKSPACE SECURITY

Workspace is secured by installation of plexiglass from 3 sides and:

a) **Manual door with sensors**
b) **Laser barriers** - safety of catching movement on the finger. The location of the barriers is 225 mm from the edge of the turntable and 615 mm to the centre of the robot. The location is calculated according to the safety regulations of the Czech Republic.



5. PLC MANAGEMENT

PLC system SIEMENS version S7-1511 PN is used in TILIKUM. The PLC communicates with the scanner using the Creaform I / O module.

I/O modul Creaform:

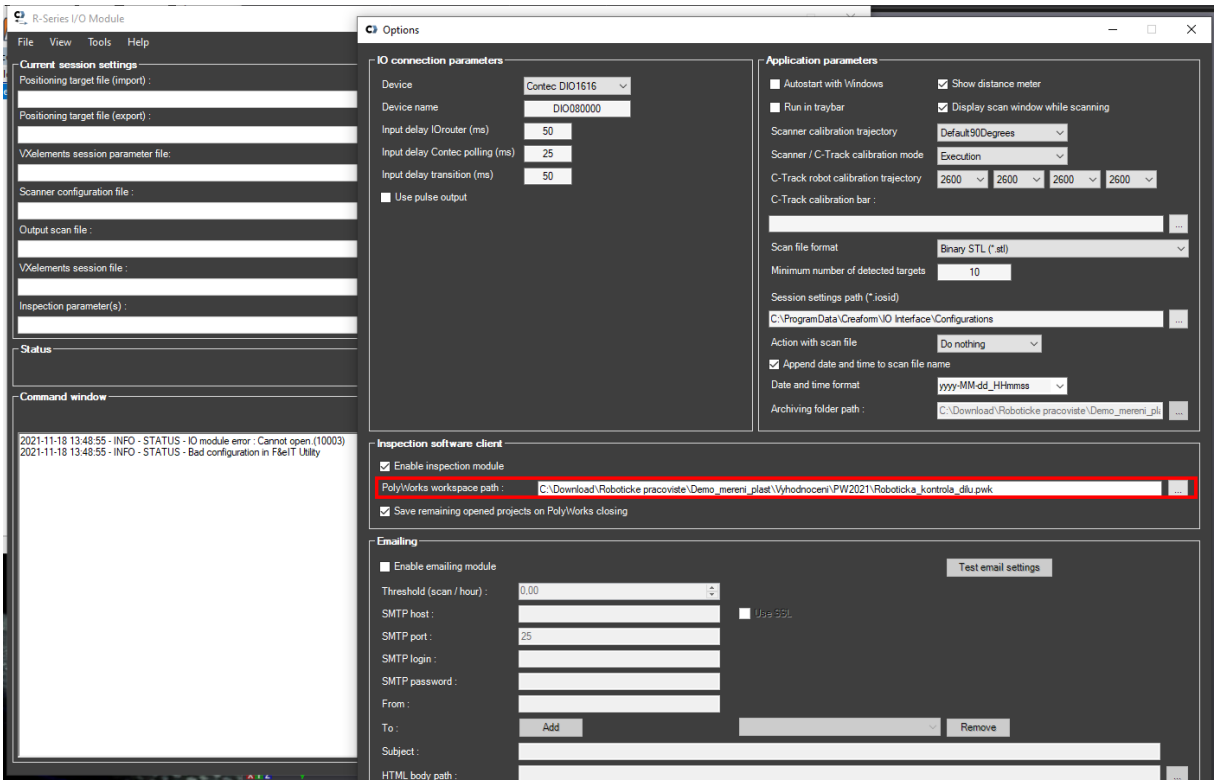
The PLC is controlled via the HMI touch screen on the workplace work panel. There are two modes to access the control: Administrator and Operator. The operator can only run ready-made projects. The interface is currently available in Czech and English. It is not a problem to add other languages.

6. RECOMMENDED MINIMUM SYSTEM REQUIREMENTS

To guarantee the maximum smooth operation of the scanning workplace, we recommend using a desktop workstation according to the requirements of the HandySCAN BLACK 3D scanner. If the HandySCAN BLACK 3D scanner is also expected to be used as a hand-held scanner, we highly recommend to purchase also a laptop that meets the requirements as a second computer.

7. INSPECTION SOFTWARE

Currently, the inspection site is able to communicate strictly with the PolyWorks Inspector software. This is a direct link created by the scanner manufacturer from the R-Series I / O Module.



8. VERSION OF VXELEMENTS AND SYSTEM UPDATE

The workplace runs on version VXelements 9.0.1. In the future, we will update the management for major versions of VXelements.

We planning to replace the form of control from the hardware I / O module to a new way by using OPC libraries. However, we are waiting for this communication to be released and approved by Creaform.

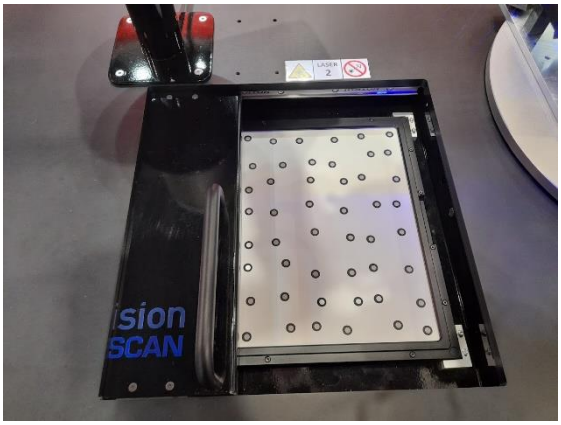
The workplace in the delivered configuration with the delivered software versions will always be fully functional regardless of the newly released versions of the individual software.

9. SYSTEM CALIBRATION

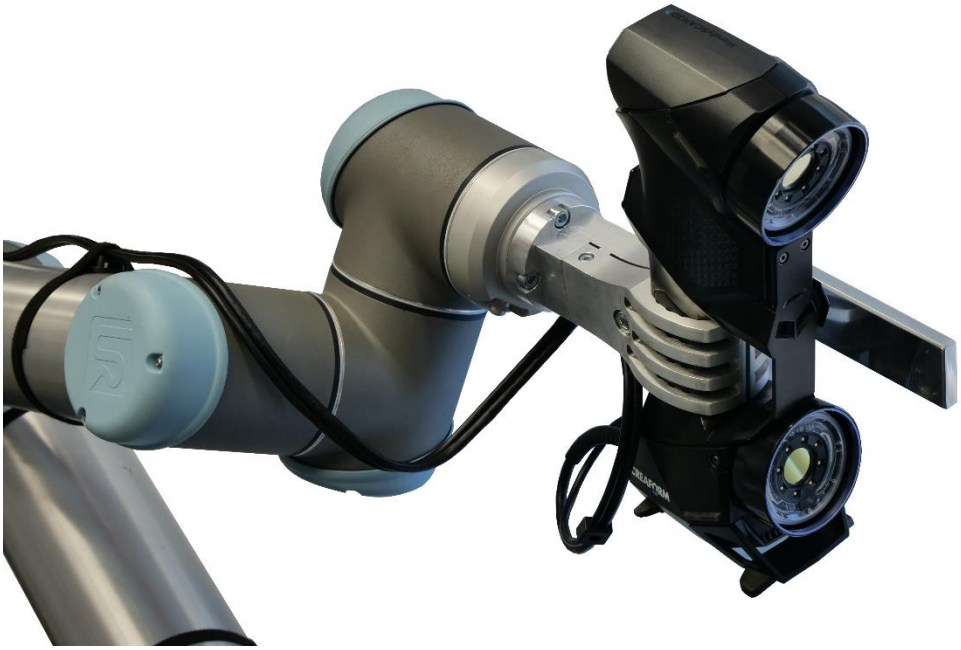
The workplace is equipped with an automatic calibration process. The administrator defines when the automatic calibration should take place with these parameters:

- Auto-calibration will be performed after switching on the workplace to the electrical network (yes / no)
- Auto-calibration will be performed after the workplace operation time has elapsed
- Auto-calibration will be performed after X number of scan cycles

The safety door above the calibration plate is automatically operated by the robot and its position (open / closed) is secured by multiple sensors.



3D scanner holder and extension for opening the calibration plate door:



Calibration of the 3D scanner is performed according to standard practices in the Creaform service centre (France, Canada). User will receive a new certificate for the scanner directly from the manufacturer.

User calibration with a calibration plate is used to validate the scanner to the given environment and verify the functionality of the scanner.

10. WORKPLACE EXPANSION OPTIONS

The workplace allows these types of expansions:

- **Barcode reader**

  According to the customer's request, the correct type of barcode reader is selected for the required application.

- **Navigation camera**
  If the customer doesn´t want to create jigs for fixing parts on the turntable, a camera can be placed above it to navigate correct position of the placed part. When creating an inspection cycle, the first image of placing the part on the turntable is captured. When starting the program, the operator is then forced to place the part in this position within the specified tolerance. The price and type of camera depends on the properties of the parts (gloss, size, etc.) that the customer wishes to place on the table.

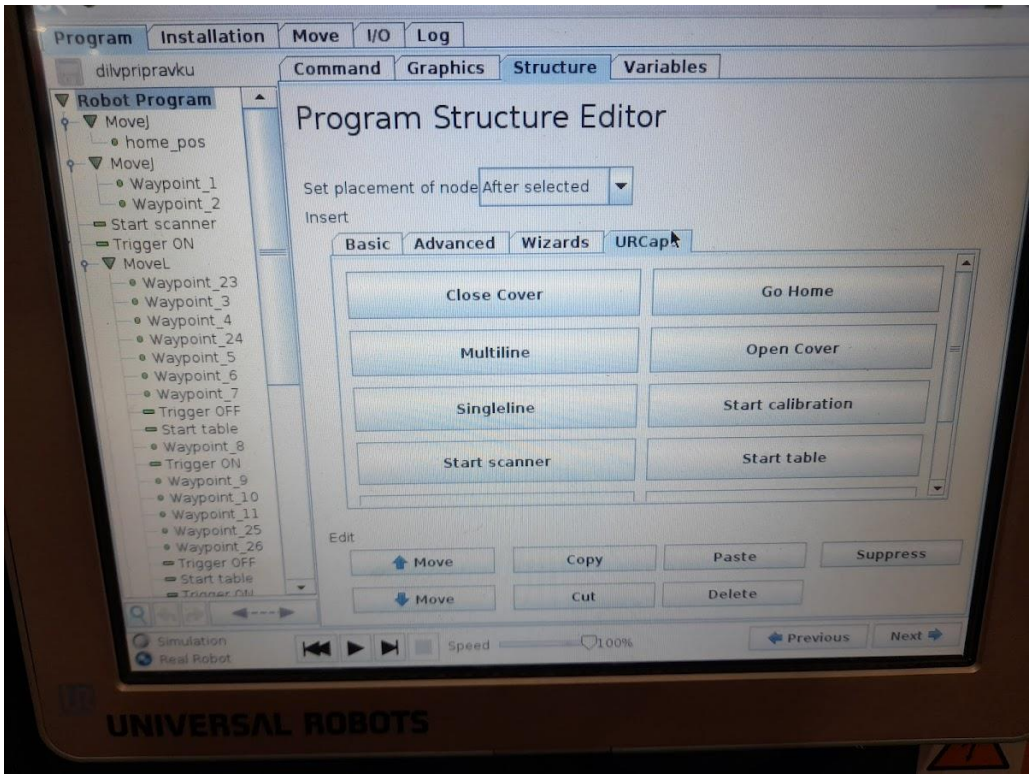
11. INSPECTION PROCESS CREATION

The whole process is programmed inside the Universal Robots console. We store the individual waypoints on which the robot is to move, and we also insert other functions such as scanner control and turntable rotation. Programming UR robot routes is very simple and intuitive. Other functions are called using created URCAPS commands, which pass information to the PLC and the PLC passes this information on to the I / O module.

In the PLC control, a part name is created in the database and following information is assigned to this part:

1) The name of the program in the robot
2) The name/number of the template for VXelements (template *.csp)
3) Turntable rotation speed
4) Increment for incremental turntable rotation

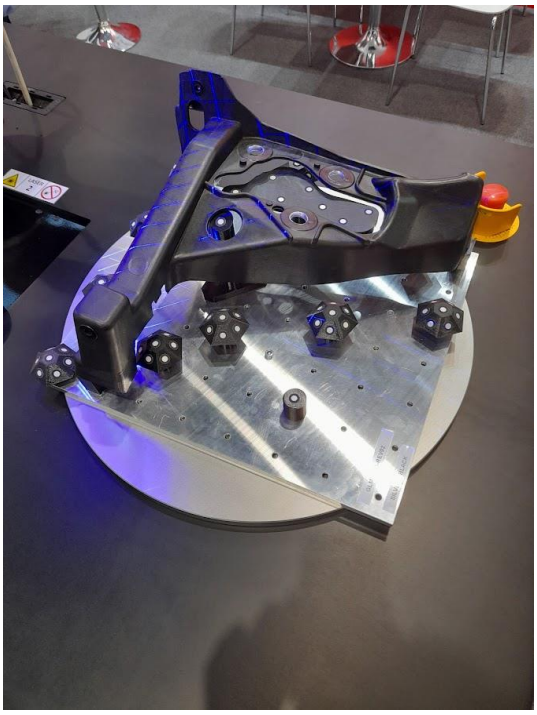
After performing the inspection process, the operator receives a message on the control panel whether the measured part is OK or NOK. The system saves all measurements.

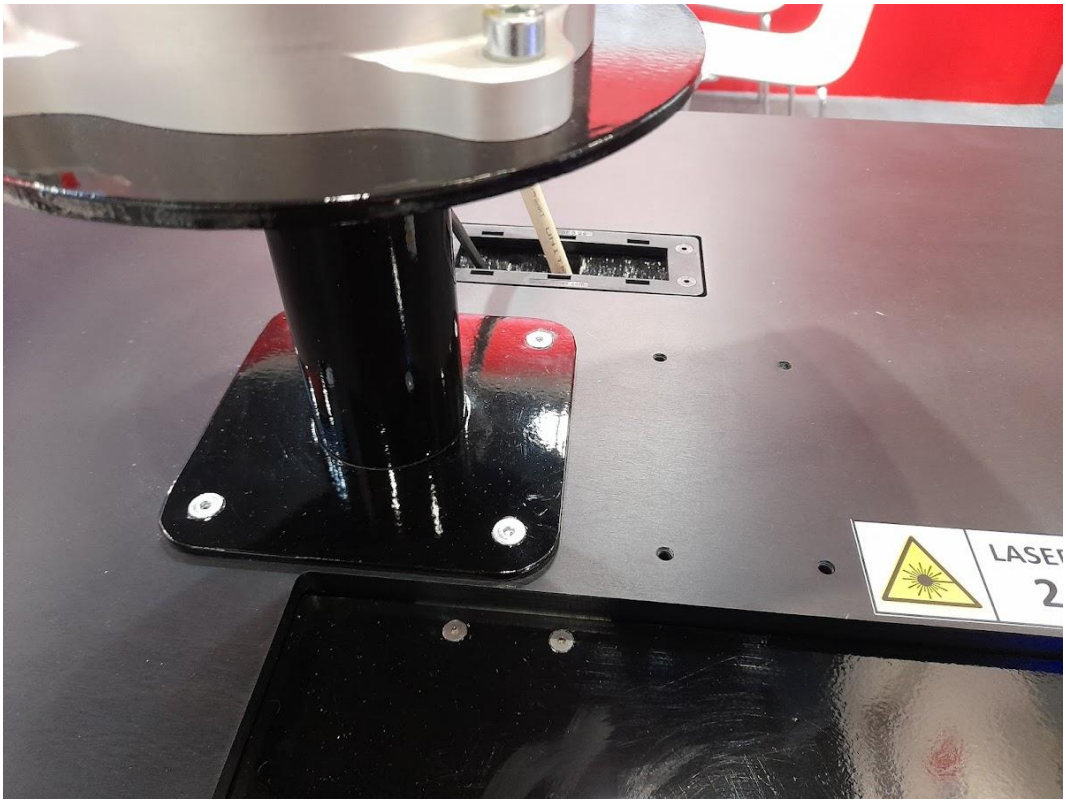


12. CERTIFICATION

The Tilikum inspection workplace has all the necessary documents for operation in the Czech Republic. All technical documentation, parts list and individual drawings for parts are delivered to the workplace. There is also a complete documentation of control and electrical wiring. A declaration of conformity and operating instructions are also included.

13. PHOTO DOCUMENTATION





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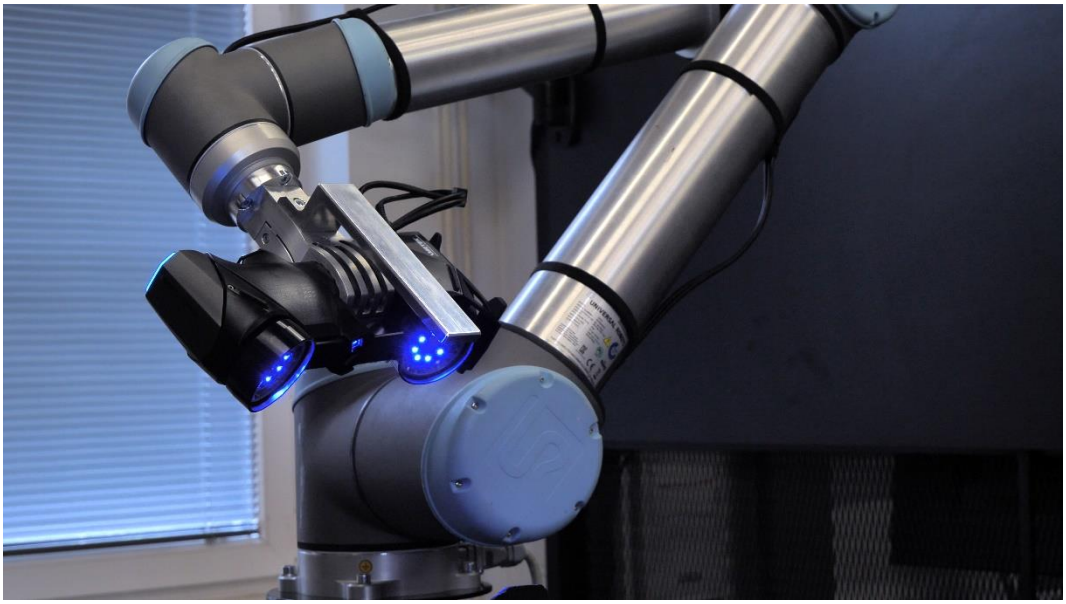

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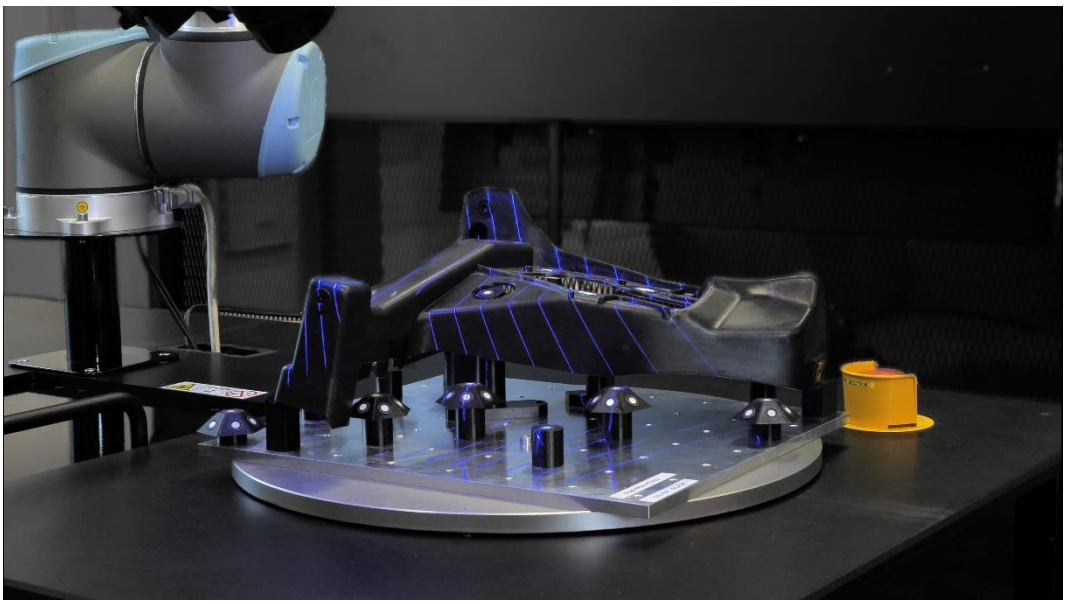
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