

Basic guidelines and instructions for the use of flexible feeding systems from flexfactory

The following notes are intended as a guide to help you in the planning and design flexible feeding stations. If you have any questions or for further information regarding the integration of our flexible feeding systems, please don't hesitate to contact us.

1. Basics

- 1.1. The flexfactory feeders are based on the random principle, i.e. that parts fall randomly after shaking. The availability of pickable parts on the feeder is therefore not constant and no fixed cycle time can be guaranteed. Hence, the possible feeder performance is always specified in [parts/minute], since the individual cycles [time/part] varies due to the systems principle. However, the variation in availability can be compensated by suitable machine concepts or buffering.
- 1.2. For systems with a fixed cycle time requirement, a suitable buffering strategy or the use of two feeders is recommended in order to compensate the varying availability of products after a feeder movement. When using a buffer, the robot must be able to fill the buffer if more parts than required are provided by the feeder.
- 1.3. If a fixed cycle time must be maintained without the use of a buffering system, we can perform tests to determine how often a required cycle time is actually exceeded and the duration of these exceedances.
- 1.4. Simultaneous feeding of different parts on one feeder is only possible in specific, exceptional cases and is generally not recommended.
- 1.5. The flexfactory vision system cannot be used as a true quality inspection of parts.
- 1.6. The image processing system only searches for the taught-in pattern/part type, i.e. wrong parts (wrong type or defective parts), which differ strongly from the good parts are not recognized by the camera and remain in the picking area. In this case, the system continues to run, but the output can be negatively affected.
- 1.7. The elimination of bad parts by specific recognition and picking with the robot is only possible in exceptional cases and must always be clarified with flexfactory.
- 1.8. Factors to consider when choosing the suitable camera resolution:
 - Detection of the smallest features
 - Accuracy of the position determination
 - Processing time of vision system
 - Price of the vision system
 - System upgradeability (new parts)

- 1.9. A system accuracy of several 1/10mm must be expected, i.e. this tolerance must be considered when picking the parts on the feeder or at placement of the parts. Generally, the higher the parts, the greater the tolerance required, as the effect of distortion increases more towards the outside of the picking area. By using centering grippers or intermediary positioning, the accuracy on the output can be increased significantly.
- 1.10. The maximum load of the integrated part container, according to the data sheet must not be exceeded. The maximum allowed total weight of the parts in the picking area must also be observed.
- 1.11. In toplight applications, the light size should be twice as large as the picking- or image area for homogeneous illumination.
- 1.12. Communication between your (robot-) controller and our vision system is established via Telnet over Ethernet or alternatively via RS232. We provide sample programs for the most popular robot brands. Our camera software is based on the so called native-mode protocol of the Cognex In-Sight cameras (string protocol). Fieldbus protocols are not supported.

2. Construction: feeder

- 2.1. The base frame on which the feeder is mounted should be as rigid as possible to minimize the transmission of vibration to the camera and the rest of the system. In this respect, the highest possible mass of the mounting plate is also desirable.
- 2.2. The feeder must not be mounted on damping elements.
- 2.3. Due to the feeders working principle it can happen that occasionally some parts jump out of the picking area during a feeding process. Depending on the type of parts and the requirements of the application, a raised edge of the feeder in the front area can be necessary.
- 2.4. Sufficient space should be left behind the feeder for changing the feeding plate.

3. Construction: camera

- 3.1. The camera should be mounted at the distance specified by flexfactory so that the entire picking area is visible (centered and vertically above the picking area). The mounting distances for specific camera models can be found on our website.
- 3.2. The camera position should be slightly adjustable in X/Y (approx. +/- 20mm).
- 3.3. The camera tower should be stiff and well braced to prevent transmission of vibration from the machine to the camera.
- 3.4. The camera must be oriented/mounted transversely (90°) to the feeding direction (cable connections to the side). This way, the image area will fit the picking area: i.e., the long side of the image aligns the feeding direction and the short side of the image corresponds with the feeder width.

- 3.5. For toplight applications, the camera and the light must be mounted in a way that the lens is accessible for adjustments. In addition, depending on the lens used, a maximum distance must be maintained between the cameras backside and the top of the toplight:
- For a lens with a focal length of $f=16\text{mm}$, the distance must be $<100\text{mm}$
 - For a lens with a focal length of $f=25\text{mm}$, the distance must be $<150\text{mm}$
 - For a lens with a focal length of $f=35\text{mm}$, the distance must be $<250\text{mm}$
- 3.6. CAD/STEP models of all feeding systems are available on our website:
<https://www.flexfactory.com/en/products>

4. Construction: robot

- 4.1. The robot should be able to pick the parts in the entire pick area of the feeder, at any angle. The following points must be observed:
- Working area of the robot (Caution if the gripper-center doesn't correspond to the rotation center of the robot axis!)
 - No collision of the gripper or robot arm with the feeder or other components.
- 4.2. The entire picking area of the feeder should be accessible to the robot without any obstacles.
- 4.3. If a finger gripper is used, the fingers of the robot gripper must be designed as small as possible so that as little space as possible needs to be reserved as a clear zone when picking.
- 4.4. The robot should move out of the camera image area as quickly as possible after picking up a part in order to take the next image as early as possible.
- 4.5. The robot must not obstruct the camera image area during placing of the parts or during other operations.

5. Construction: work cell

- 5.1. Effects of disturbing ambient light should be minimized. Direct sunlight must be prevented in any case - even when using IR light with bandpass filter. If visible light is used, tinted protective screens and a cell roof (not translucent) is recommended.