FlexiBowl

A Single Feeding Solution for Many Different Parts

ars

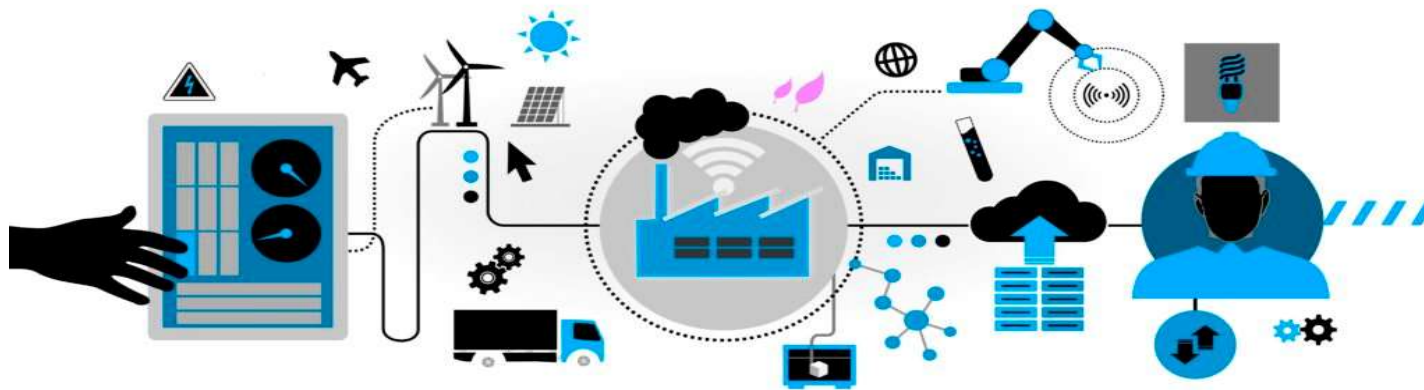# Summary

FlexFeeding: A Growing Market

Growing demand for **flexibility** in the assembly & machine tending applications, due to **shorter product lifecycle & faster time to market**.
Dedicated part feeding solutions aren't always the correct answer.

Cobots: In recent years cobot technology has opened new market opportunities. New opportunities for flexible part feeding.

Some negative comments we hear quite often:

- Flex Feeding is **too expensive** ➡️ Have you considered the **TCO**?

- Flex Feeding is **too slow** ➡️ Is **80 ppm** really slow?
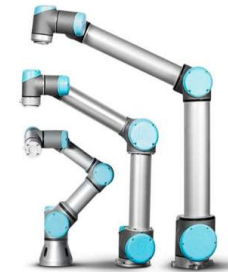
FlexFeeding: A Growing Market

The right comparison between traditional part feeding and flexible part feeding must be based on **TCO (Total Cost of Ownership)**:

Capex: Includes Engineering and Development Costs, in addition to investment costs (purchasing, manufacturing, installation, etc.)

Availability × Performance × Quality Rate

≡ **OEE**

Opex: Includes maintenance, operating costs, dismissal at the end of product cycle. OEE on Flexfeeders significantly higher.

In presence of:
- **Multiple Parts**
- **Variation** of Geometry and Dimension
- **Silicon** and **Rubber**
- **Burrs** and **Flashes**
- **Complex** Geometry
- **Delicate** Surface

FlexFeeders have higher **OEE** (Overall Equipment Efficiency). Less jams, forgive size variations (burrs on plastic parts, accept wider tolerances, etc.) Productivity: significantly improved (up to **80 ppm**), considering developments on robot & vision technology and FF systems
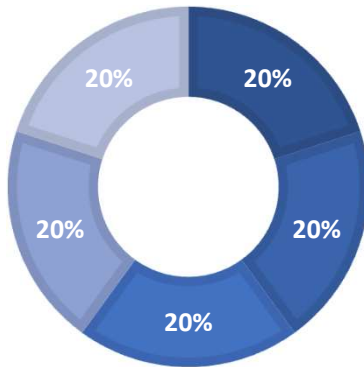
FlexiBowl®

FlexFeeding: A Growing Market

General Industry
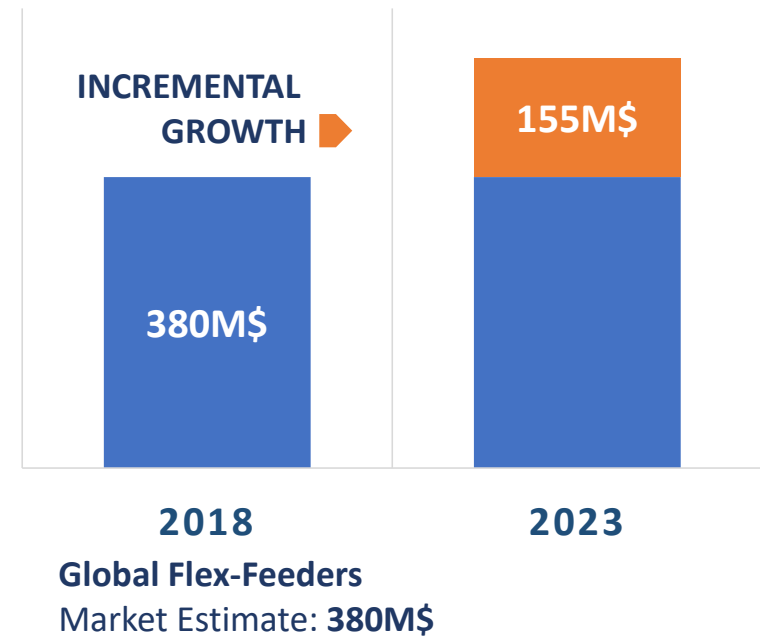**Automotive**
Cosmetic
Electrical Products
Medical

20% 20% 20% 20% 20%

The market is **HIGHLY FRAGMENTED** with many players occupying the market share

One of the **KEY DRIVERS** for this market will be the **TECHNOLOGICAL INNOVATIONS FUELING DEMAND**

The market will be **ACCELERATING** growing at a **CARG** of almost **8%**

INCREMENTAL GROWTH

380M$

155M$

2018

2023

Global Flex-Feeders
Market Estimate: **380M$**

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Summary

FlexiBowl®: How it Works
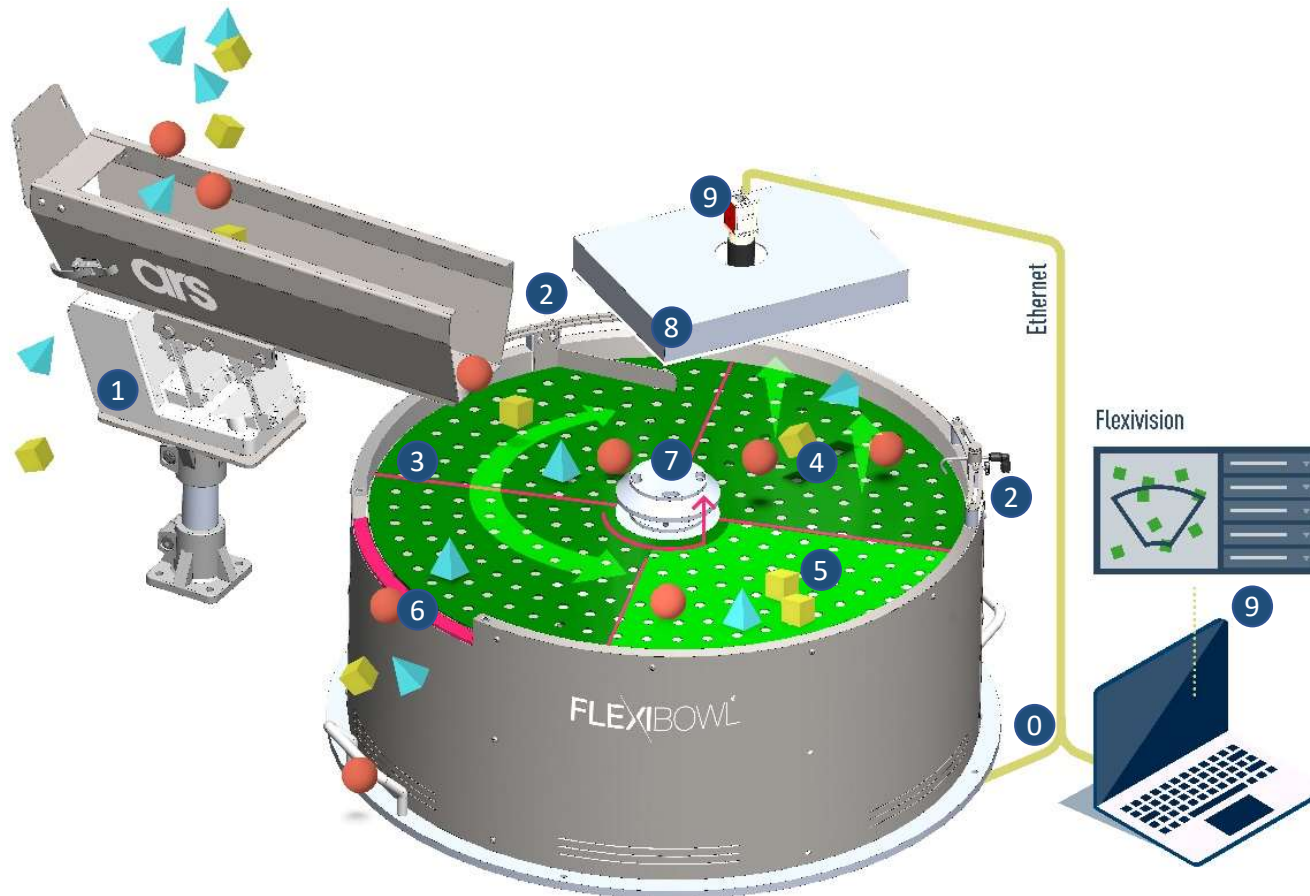
0 Network Connections
Ethernet TCP/IP, Ethernet/IP or Digital I/O connections

1 Vibrating Bulk Feeder
Drops parts accurately

2 Blow Unit/Wiper - Diverts parts from the external edge, back under picking area

3 Rotary disc
NEW Custom Disc. Quick-release, different Colours, Textures and Materials.

4 Flip unit
turns and spreads parts

5 Backlight
Red, White and Infrared

6 NEW Quick Emptying

7 NEW Quick Disc Releasing

8 Toplight
Red, White and Infrared colours

9 FlexiVision
Fully integrated vision system

Flexivision

Ethernet

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FlexiBowl®: How it Works

Many application videos available on
«**ARS Automation**»
YouTube channel

Link:
https://www.youtube.com/channel/UCdX8E36fHu_IYGWurmc5cpw?view_as=subscriber

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Summary

- FlexFeeding: A Growing Market

- FlexiBowl®: How it Works

- The Benefits of the Circular System

- FlexiBowl® : Product Range & Options

- Bulk Storage: Linear & Motorized Hoppers

- System Architecture & Software

- FlexiBowl® Parameters

- Market & Sales

- FlexiBowl®: New Generation

- Conclusions

The Benefits of the Circular System

LINEAR SYSTEM

A common area for *dropping, separating and picking* parts.

Robot waits until dropping & separating tasks are completed!

Limited robot reach next to the walls.
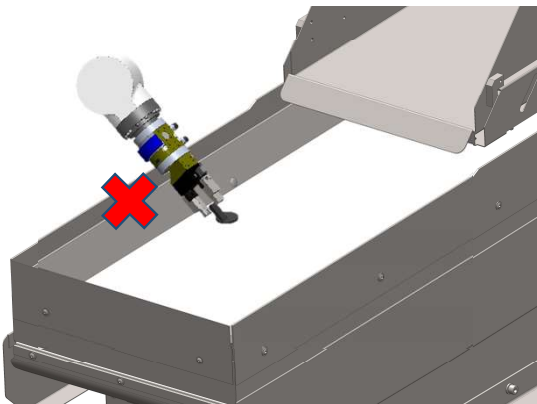
There are two categories of flexible feeders in the market:

1. **LINEAR SYSTEM (either with belt or shaking plate)**
2. **CIRCULAR SYSTEM**

CIRCULAR SYSTEM

Dropping, separating and picking parallel and are carried out on specific sectors of the disc.
Robot waits only during disc movement.

Faster parallel sequence!

A wide open area for picking.

(a) *Dropping Sector*

(b) *Separating Sector*

(c) *Picking Sector*

(d) *Recirculating Sector*
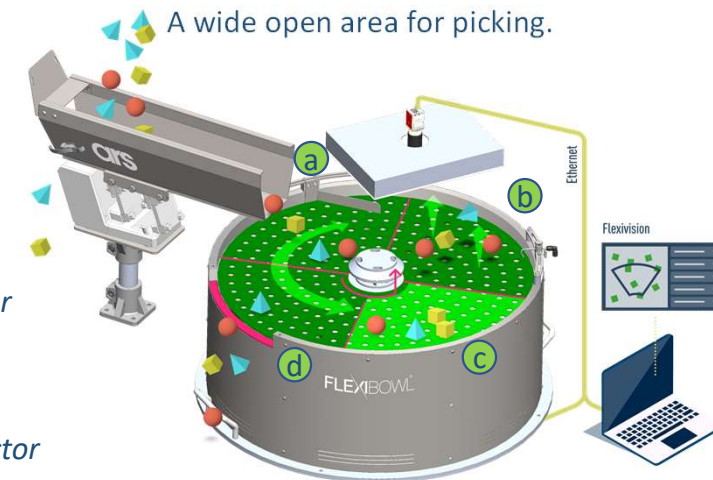
The Benefits of the Circular System

(a) Dropping Sector   (c) Picking Sector

(b) Separating Sector   (d) Recirculating Sector
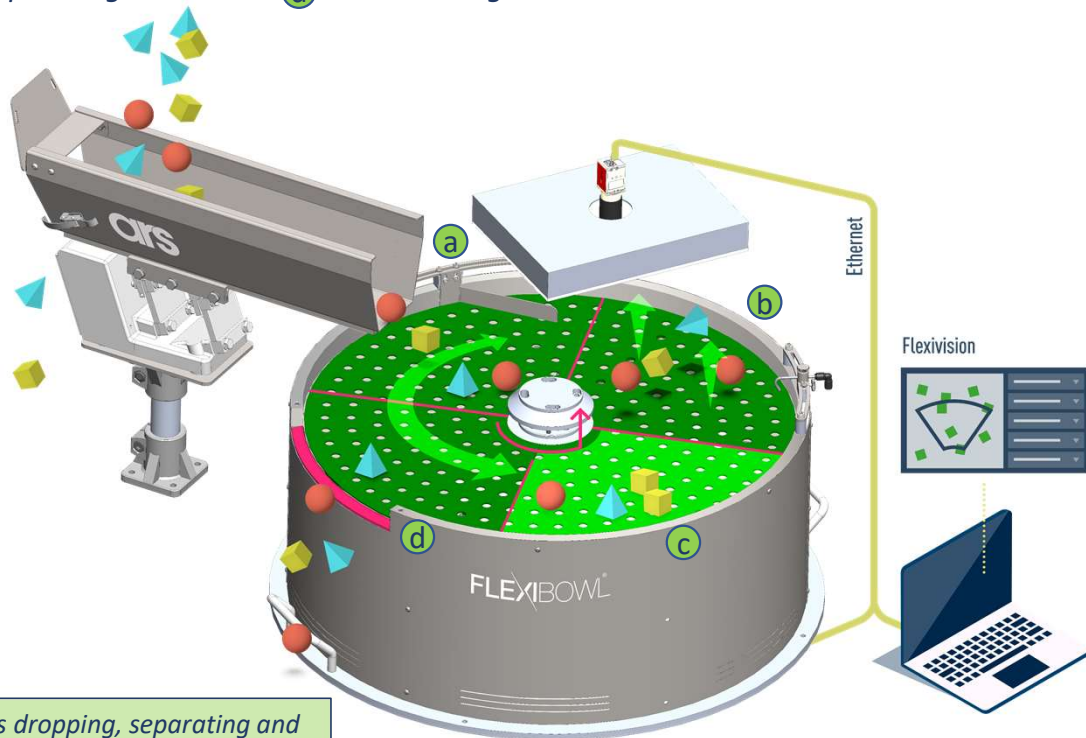
Parts dropping, separating and picking takes on average **0,5 s**

✓ It is compatible with multiple parts feeding and circular tracking (high performance)

✓ Paralleling picking, separating and dropping increases the feed rate

➜ Feed rate over 30% higher than average flexible feeder

✓ Large and heavy products are handled (up to 7 kg, max payload)

✓ Durable design let it work in harsh and dirty environments

✓ Silicon, oily, tangly and cylindrical products are handled

✓ A wide open area for picking (reduced limitation for the robot)

✓ FlexiBowl® parameters are easy to set

✓ The lean design reduces downtime and maintainance costs

➜ Total Cost of Ownership over 40% lower than average flexible feeder

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Advantages against Vibrating Bowl

FlexiBowl® System

Vibrating Bowl

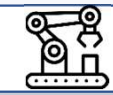| FLEXIBLE	EFFICIENT	SAFE	SMART	CONNECTED	ATO
Families of parts can be fed with a single system	No parts jam, reduced system stops. Higher MTTF	Lower project risk: trials can be carried out upfront and performance predicted reliably	Product changeovers carried out instantly. No mechanical but software tuning	Remote support. Programming and Maintance web-training available	Assembly to order. Spare parts in stock. Maximum 4 weeks delivery time.

DEDICATED	IDLE	RISKY	DUMB	MECHANICAL	DTO
Designed on specific product/s	The system may not work reliably in presence of burrs, size variation, rubber or sticky materials and oil	No trials can be done untill the equipment is ready	Mechanical adjustments and tuning are needed. Equipments retooling is highly costly	On site support only, shorter components lifetime, higher maintainance cost	Design to order. Long delivery time.

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Summary

Product Range

	FlexiBowl® 200	FlexiBowl® 350	FlexiBowl® 500	FlexiBowl® 650	FlexiBowl® 800
Recommended part size	1<x<10 mm	1<x<20 mm	5<x<50 mm	20<x<110 mm	60<x<250 mm
Recommended part weight	<20 gr	<40 gr	<100 gr	<170 gr	<250 gr
Recom. Linear Hopper	1÷5 dm³	5÷10 dm³	10÷20 dm³	20÷40 dm³	20÷40 dm³
Backlight Area (Dim.)	180x52,5 mm	230x78,5 mm	334x167 mm	404x250 mm	404x325 mm
Backlight Area	90 cm²	166 cm²	513 cm²	922 cm²	1125cm²
Max Payload	1 kg	3 kg	7 kg	7 kg	7 kg
Pick Height	270 mm	270 mm	270 mm	270 mm	270 mm
Weight	18 kg	25 kg	42 kg	54 kg	71 kg

NEW

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Product Range

	FlexiBowl® 200	FlexiBowl® 350	FlexiBowl® 500	FlexiBowl® 650	FlexiBowl® 800
Recommended part size	0,04<x<0,4 in	0,04<x<0,8 in	0,2<x<2 in	0,8<x<4,3 in	2,3<x<10 in
Recommended part weight	< 0,71 oz	< 1,4 oz	< 3,5 oz	< 6 oz	< 8,8 oz
Recom. Linear Hopper	61÷305 in³	305÷610 in³	610÷1220 in³	1220÷2440 in³	1220÷2440 in³
Backlight Area (Dim.)	7x2 in	9x3 in	13x7,4 in	16x9,8 in	16x12,7 in
Backlight Area	14 in²	25,7 in²	79,5 in²	143 in²	174,3 in²
Max Payload	2,20 lb	6,6 lb	15,4 lb	15,4 lb	15,4 lb
Pick Height	10,6 in	10,6 in	10,6 in	10,6 in	10,6 in
Weight	39,6 lb	55 lb	92 lb	119 lb	156 lb

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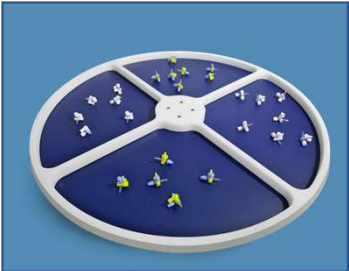
Options

Rotary Discs Rotary discs are available in various colours, textures and degrees of adhesion on all sizes. Discs are compatible with FDA and antistatic requirements. Easy to clean up. Customized discs upon request.
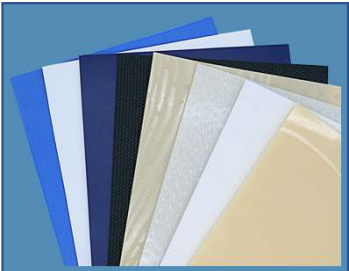
NEW Custom Made

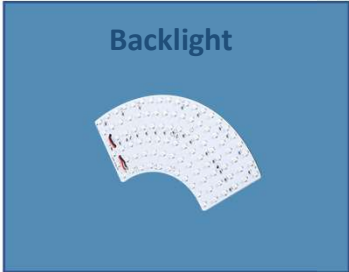**NEW** Custom Made

NEW For Multiple Parts Feeding

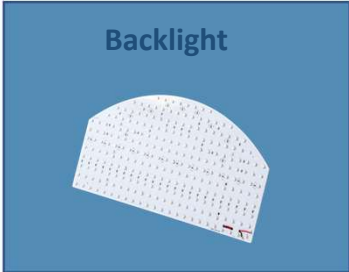A wide range of choice for backlight/ toplight applications

Spike Disc is suitable on **cylindrical** parts
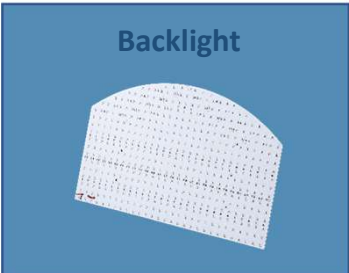
Backlight and Toplight Infrared, red and white colours in different sizes.

Backlight

Backlight

Backlight

Toplight

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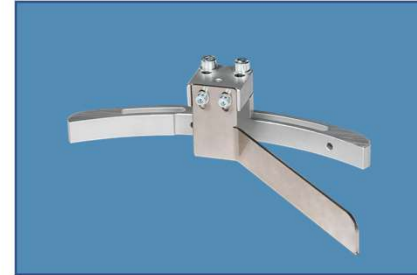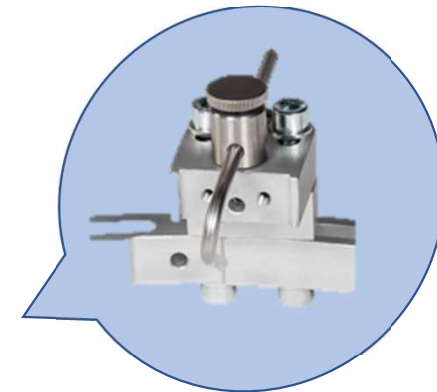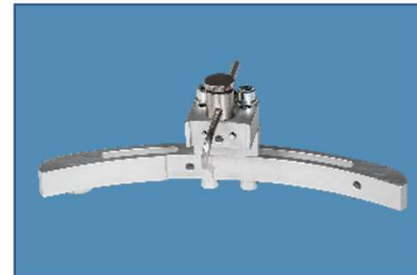
Options

Standard Diverter

Brush Diverter (replaces standard diverter with Special Rotary Discs)

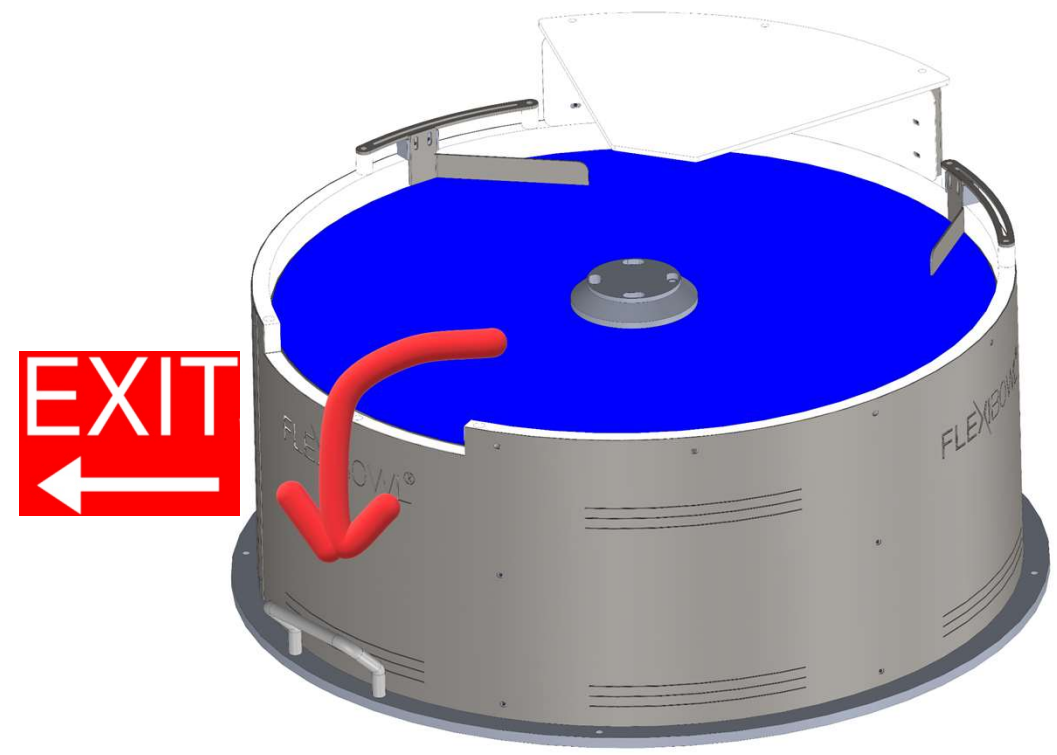**Blow Unit (replaces standard diverter for tiny and lightweight parts)**

Options

Quick Emptying is available for FB500, FB650 and FB800.

Fast & Automatic product changeover

EXIT

Summary

Linear Hopper: Product Range

Accurate and continuous parts flow
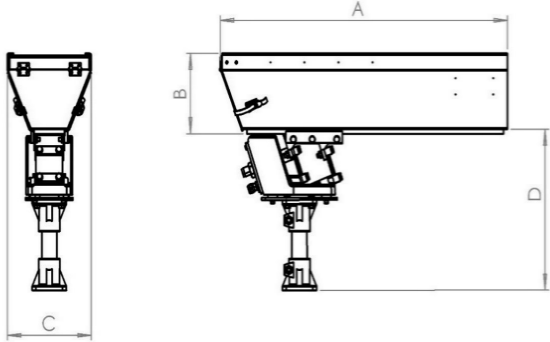
	HOPPER 1,5LT	HOPPER 5LT	HOPPER 10LT	HOPPER 20LT	HOPPER 40LT
A	350 mm	530 mm	630 mm	760 mm	780 mm
B	65 mm	135 mm	135 mm	180 mm	260 mm
C	90 mm	140 mm	140 mm	220 mm	280 mm
D	320 mm	350 mm	350 mm	350 mm	375 mm

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Options

Rear door (quick purge)   STANDARD

Safety guards (hand protecion)   OPTION

Dooser (steady flow)   OPTION

Dual controller (frequency-amplitude)   STANDARD

Bulk feeder covered by **polyurethane**   OPTION

110Vac/230Vac power supply   OPTION

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Motorized Hopper

Availability upon request. Up to 250 liters for higher storage capacity.

Typical System Layout
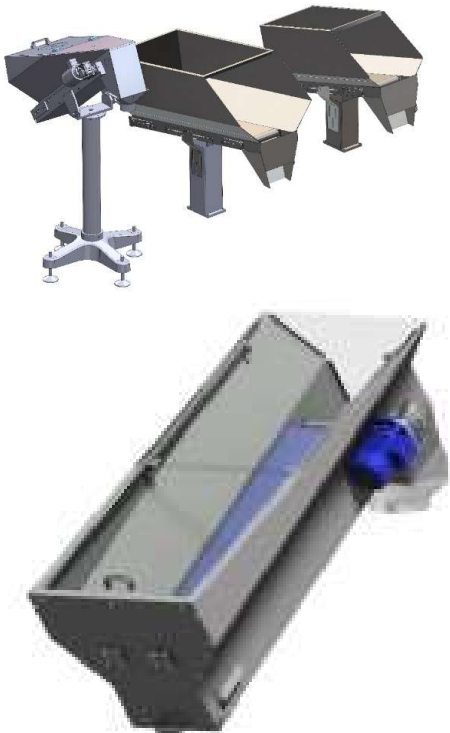
Linear hopper are always recommended as a buffer.
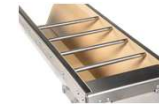Motorized hoppers include sensors to syncronize with Flexibowl and linear hopper.
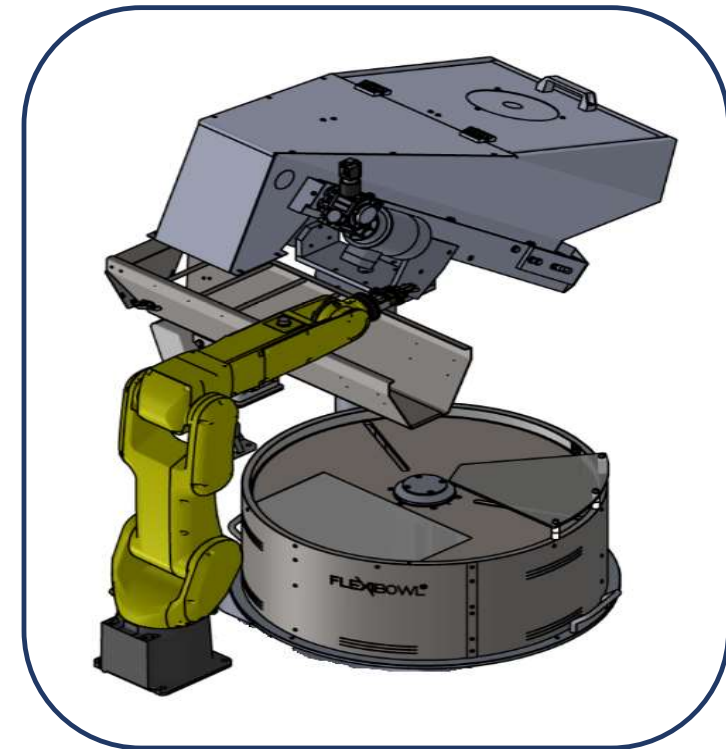
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- System Architecture & Software

- FlexiBowl® Parameters

- Market & Sales

- FlexiBowl®: New Generation

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System Architecture & Software

Flexibowl system includes: robot, vision system, parts storage devices (linear hopper, motorized hopper and other accessories, i.e. end effector, external camera & flip, etc.).
Flexibowl connectivity: TCP/IP; Ethernet/IP, digital I/O

Typical sw architectures:

1.**Robot Master** (slaves: FlexiBowl, smart cameras/integrated vision, hopper, etc.).

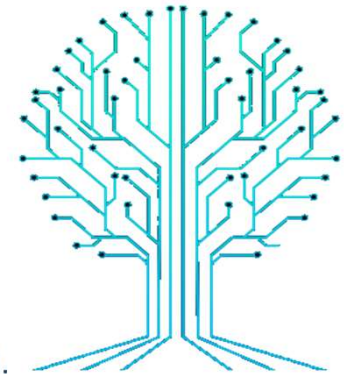   ARS available solutions: sw Plug-ins / software packages (Fanuc, UR, etc.)

2.**PC based vision master** (slaves: robot, hopper, etc.).

    Quick & easy solution. No need to know in depth every robot language.

    Ars available solutions: FlexiVision (very easy to use, ideal for beginners, medium/low level applications).
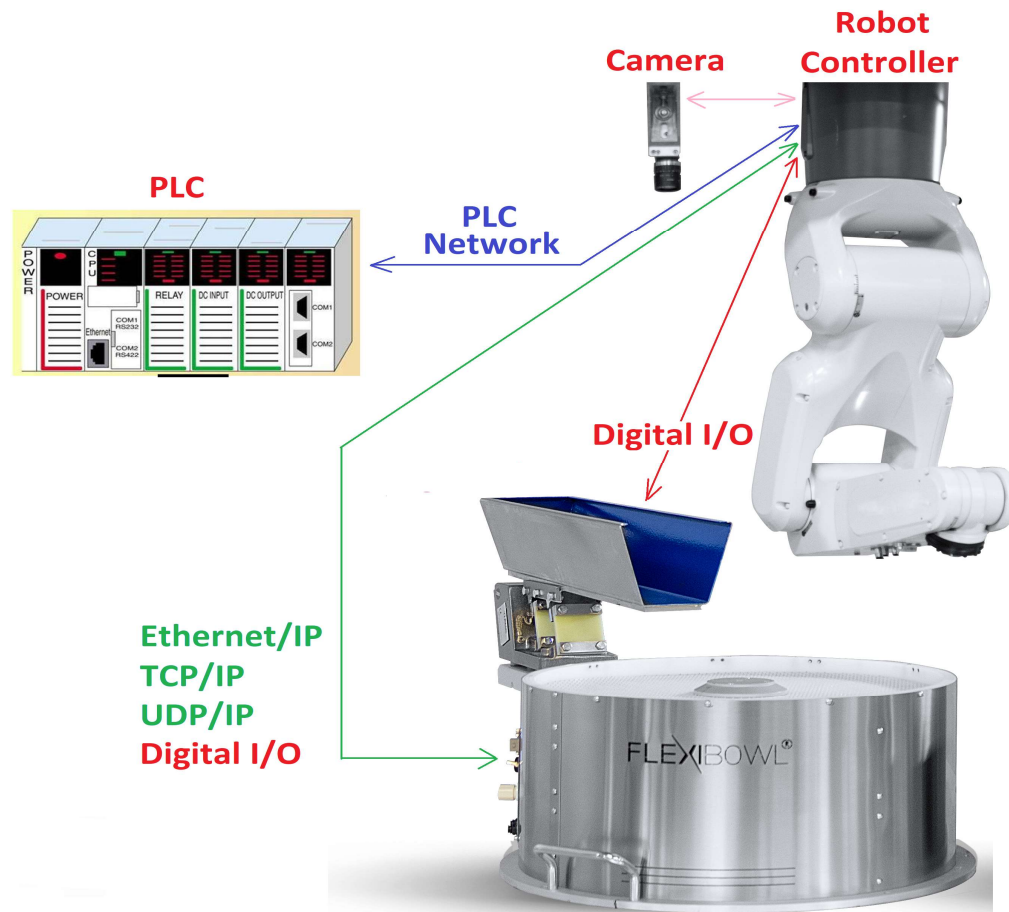
3.**PLC Master** (robot, smart cameras, hopper, etc.).
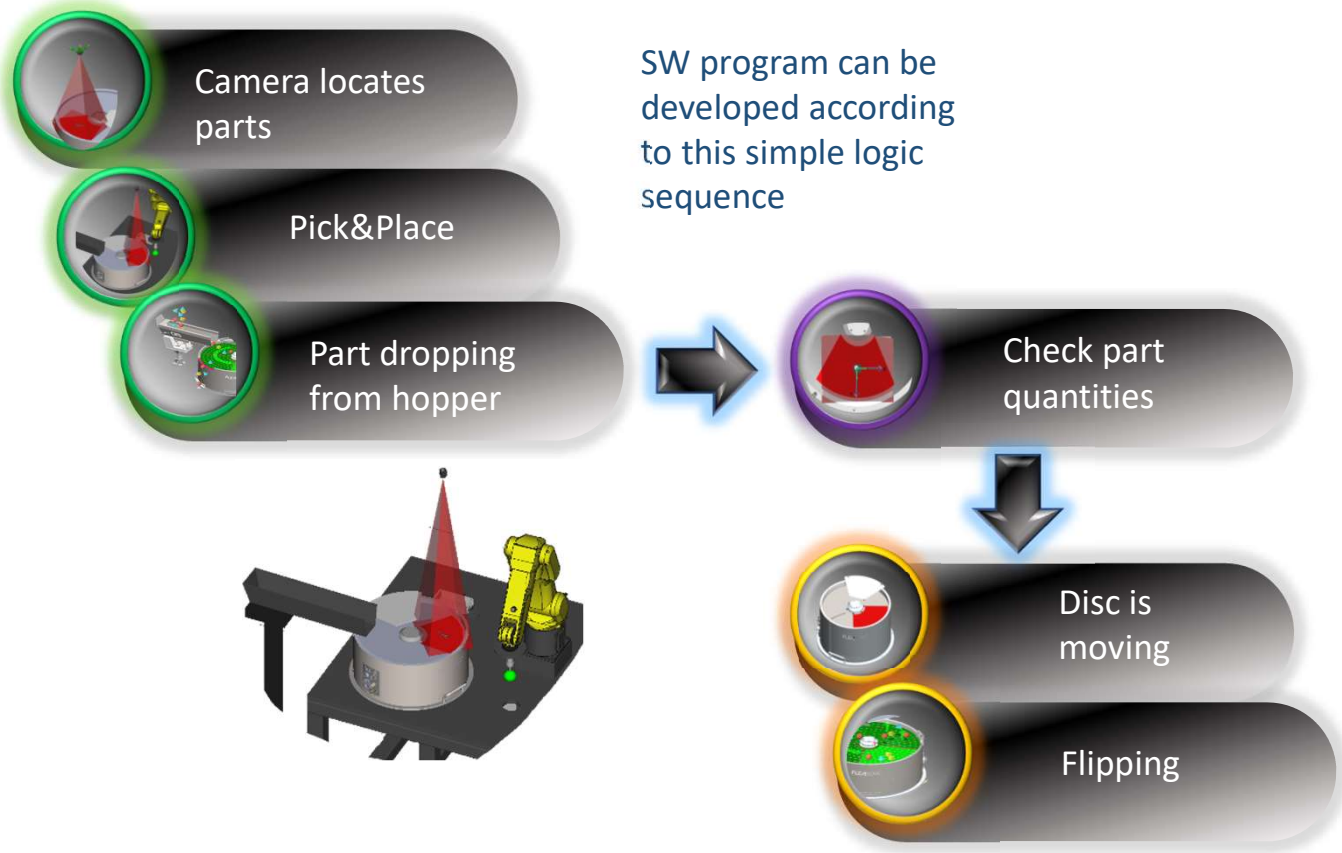
    ARS available solution: Open communication protocol.

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Robot Master

PLC

PLC Network

Camera

Robot Controller

Digital I/O

Ethernet/IP
TCP/IP
UDP/IP
Digital I/O

FLEXIBOWL®

Robot Master

Camera locates parts

Pick&Place

Part dropping from hopper

SW program can be developed according to this simple logic sequence

Check part quantities

Disc is moving

Flipping

Two **Parallel Tasks** are recommended: one to handle robot movements, the second one to handle vision, hopper and Flexibowl®.

How to Manage the Hopper

Here is what we recommend to manage the part-flow from hopper:

Example: let's assume a 60 degree forward movement for the disc, and 3 steps necessary to shift from picking area to the hopper.

A FIFO register (shift register) stores the histogram result acquired from the camera above the picking area. The status of the last register turns the hopper on / off.
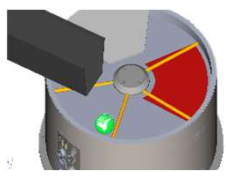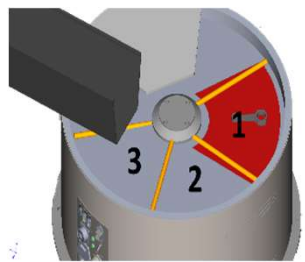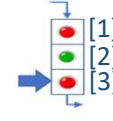

At time T0, no parts are left in the pick area Fifo array [3] is false, the hopper is activated. Fifo array [1] is false.
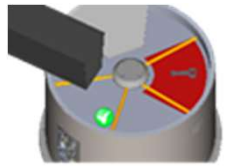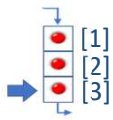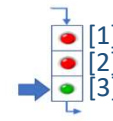
At time T1, there are parts left in the pick area, Fifo array [3] is false, the hopper is activated. **Fifo array [1] is true.**
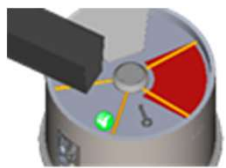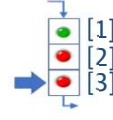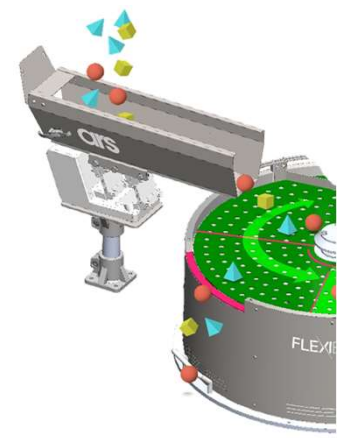
At time T2, no parts left in the pick area, . Fifo array [3] is false, the hopper is activated. Fifo array [1] is false.

At time T3, no parts left in the pick area, . Fifo array [3] is true, the hopper isn't activated. Fifo array [1] is false.

Note: A timer define how long the hopper is activated

Robot Master - FlexiBowl® commands

List of FlexiBowl commands

Standard communication can be established using socket messages via UDP - TCP/IP - Ethernet/IP – digital I/O.

FlexiBowl® is compatible with all programming languages that support socket message communication.

Action	Description
MOVE	Moves the feeder the current parameters.
MOVE-FLIP	Moves the feeder and activates Flip simultaneously
MOVE-BLOW-FLIP	Moves the feeder and activates Flip and blow simultaneously
MOVE-BLOW	Moves the feeder and activates blow simultaneously
SHAKE	Shakes the feeder with the current parameters
LIGHT ON	Light on
LIGHT OFF	Light off
FLIP	Flip
BLOW	Blow
QUICK_EMPTING	Quick Emptying Option
RESET_ALARM	Reset Alarm and enable motor

Command	Description
QX2	Move
QX3	Move - Flip
QX4	Move - Blow - Flip
QX5	Move - Blow
QX5	Shake
QX7	Light on
QX8	Light off
QX9	Flip
QX10	Blow
QX11	Quick Emptying Option
QX12	Reset Alarm

Example: TCP/IP Python program

```python
import socket

def move_flb():

    #Define the address
    TCP_IP = 192.168.1.10
    TCP_PORT = 7776
    BUFFER_SIZE = 1024

    #Create the message
    MESSAGE = chr(0)+chr(7)+"QX2"+chr(13)

    #Create the socket
    s = socket.socket(socket.AF_INET, socket.SOCK_STREAM)
    try:
        #Connect to socket
        s.connect((TCP_IP, TCP_PORT))

        #Send the message
        s.send(MESSAGE)

        #Recive the echo command
        data = s.recv(BUFFER_SIZE)

        #Print the message
        print("Message send: " + MESSAGE)
        print("Message recive: " + data)

        #Close the server
        s.close()

    except :
        print("Not Connected")
        return False
```

Robot Master - Plug-in

Flexibowl sw plug-in includes all functionalities required to control FlexiBowl. They can be easily and quickly embedded into customer application sw. Fully documented for a wide robot choice.

Example: Omron ACE plug-in

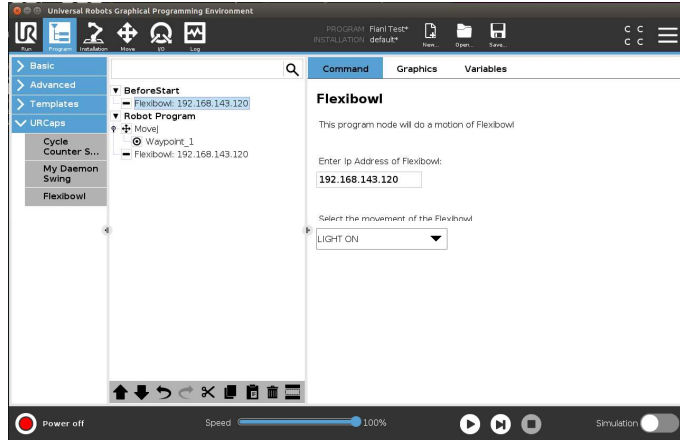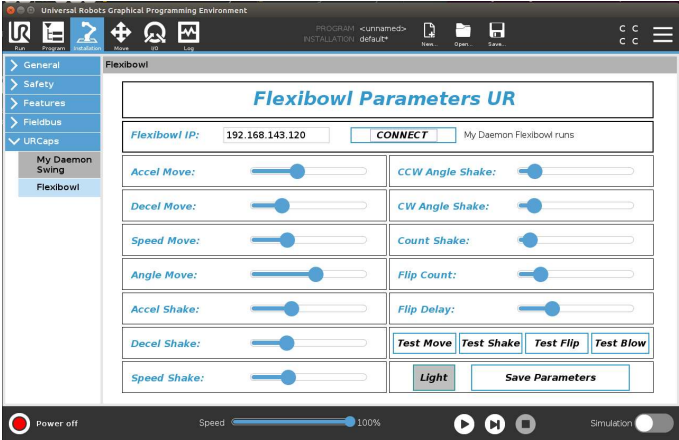Compatible with any integrated/third party vision product

Robot Master - UrCap

FLEXI-EASY

e-Series

- **Connect** the feeder to an UR controller directly

- Enable applications with UR Robot and FlexiBowl **without writing lines of code**

- Control **multiple FlexiBowls** at the same time

- Completely integrated UrCap sw. **Fully documented**.

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Robot Master- SW Package
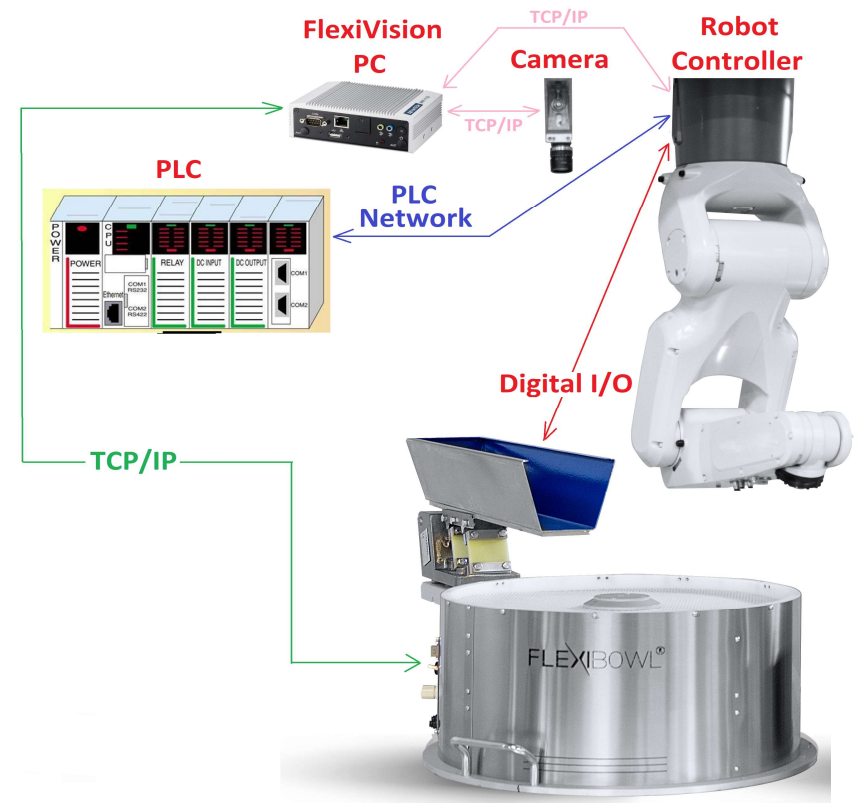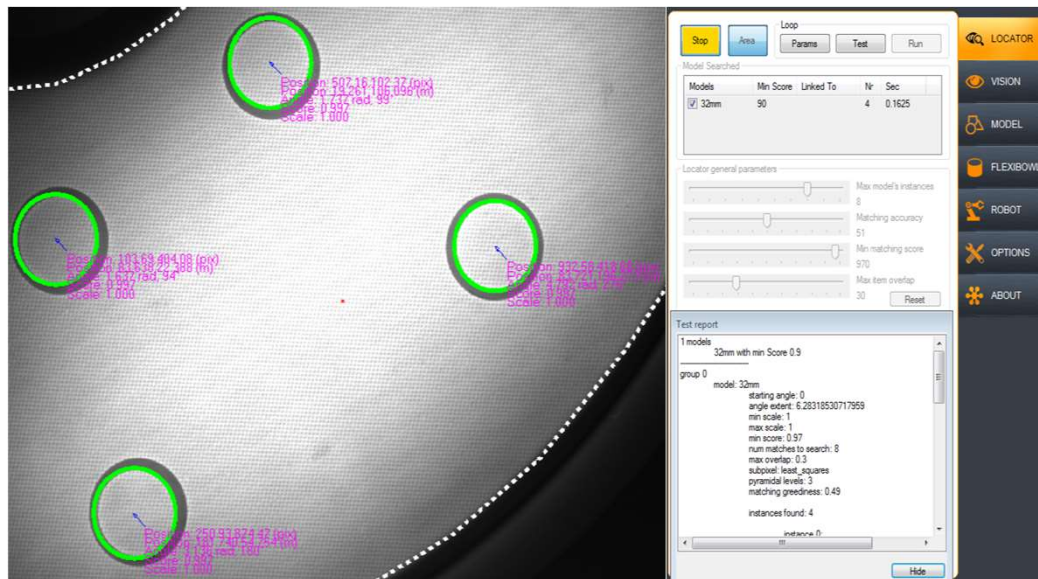
FLEXI-EXPERT

- A **complete sw package**, available for Fanuc robots, iRvision & Flexibowl

- **No need to write** any line of custom sw

- Possibility to **create recipes** and manage them with menu **driven operator interface**, **integrated into robot pendant**

- Ability to manage **multiple FlexiBowls**

- Possibility to define **special pick** and **place trajectory** path.

- FlexiBowl and hopper management has never been so **intuitive** and **simple**

FANUC
FlexiBowl®
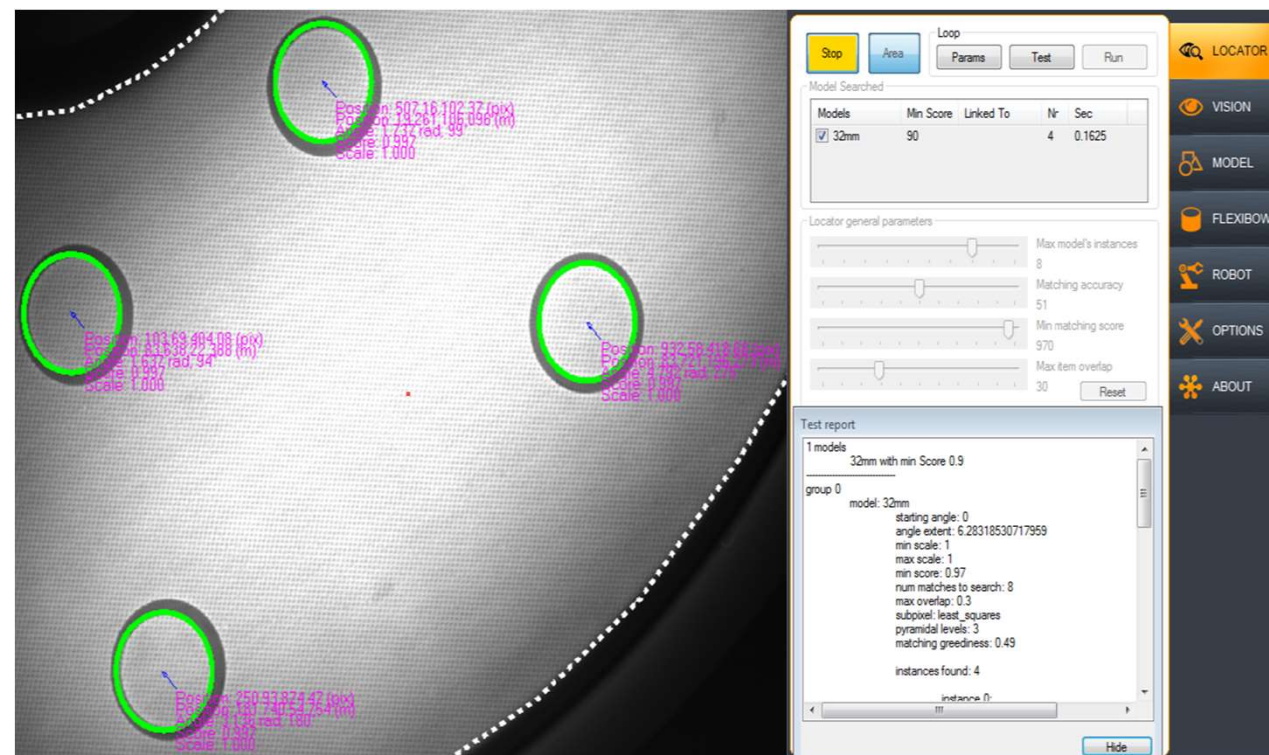

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Vision Master - FlexiVision
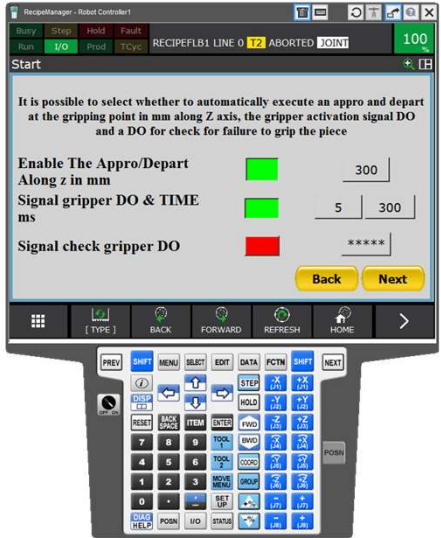
Vision Master - FlexiVision

FlexiVision is an **integrated PC-based vision** software for robot guidance, developed on **HALCON** libraries. Designed for **fast setup** and deployment. Compatible with **every robot**. No need to develop custom robot sw.

Control FlexiBowl® parameters
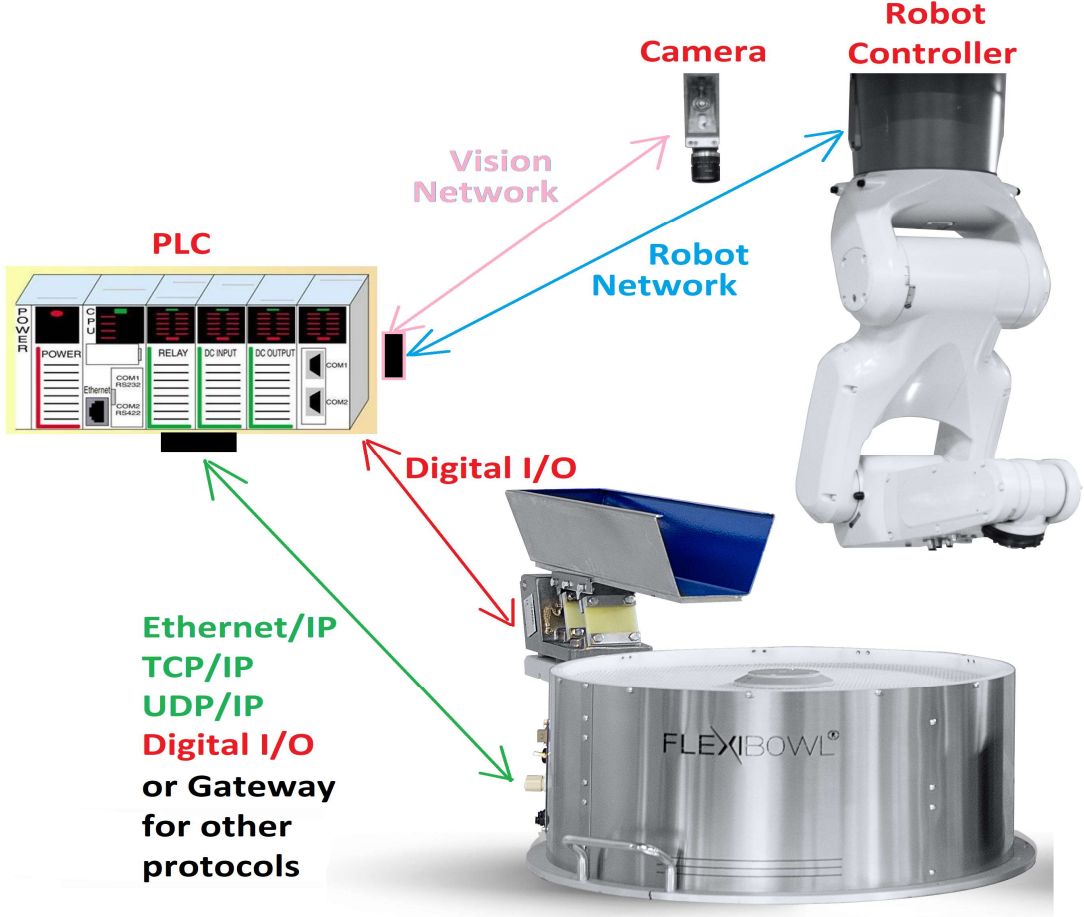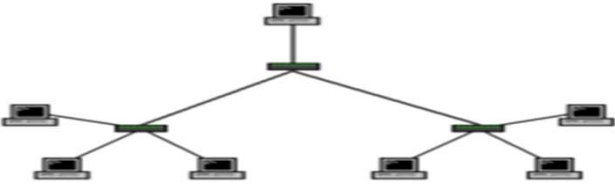
Calibrate the camera and the robot

Design and manage your recipes

Geometry and pattern matching

Hundreds of industrial GigE cameras supported

Connect up to 3 cameras and 2 robot with a single dongle key

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PLC Master

TCP/IP

EtherNet/IP™

DIGITAL I/O

Camera

Robot Controller

Vision Network

Robot Network

PLC

Digital I/O

Ethernet/IP
TCP/IP
UDP/IP
Digital I/O
or Gateway
for other
protocols

FLEXIBOWL®

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- FlexiBowl® : Product Range & Options

- Bulk Storage: Linear & Motorized Hoppers

- System Architecture & Software

- FlexiBowl® Parameters

- Market & Sales

- FlexiBowl®: New Generation

- Conclusions

FlexiBowl PC Interface

FlexiBowl Parameters Program can be used to **pre-set FlexiBowl parameters** when using **digital I/O** connection.
Parameters can be modified through **ethernet connection**.

Easy to set up

You can easily :

- **Change** the IP address.
- **Set-up** the **parameters** for each type of movement.
- **Configure** and **test** different motion sequences.
- **Save/Upload** different parameters configurations.

Summary

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Applications

ELECTRONIC ASSEMBLY

MECHANICAL ASSEMBLY

MACHINE TENDING

MATERIAL HANDLING

TRAY LOADING

PACKING

KITTING

End Users

ARS leads all the way through

Preliminary analysis

Viability tests

Feed rate optimization

Equipment design

Software

System ramp up

Training

Remote support

After-sale service
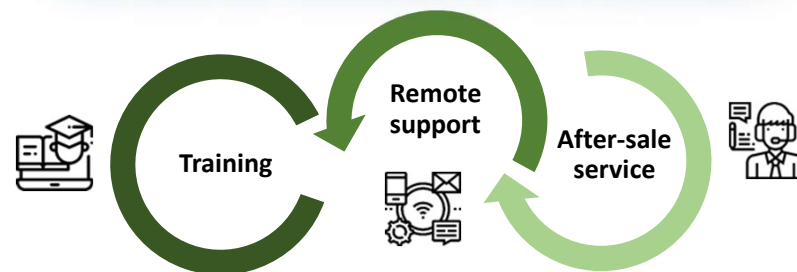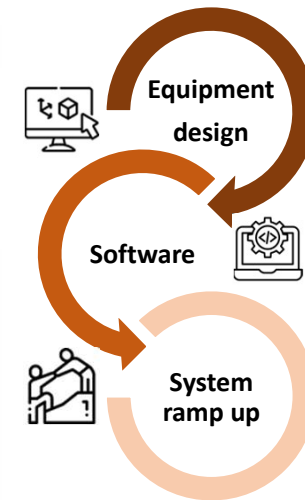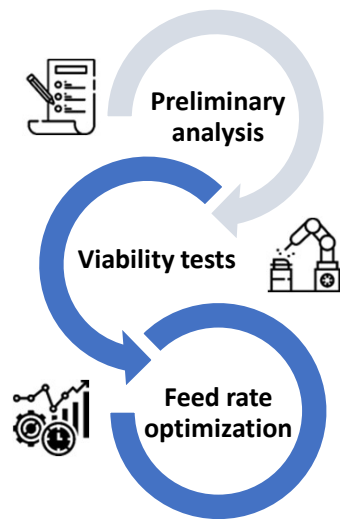
Global Network
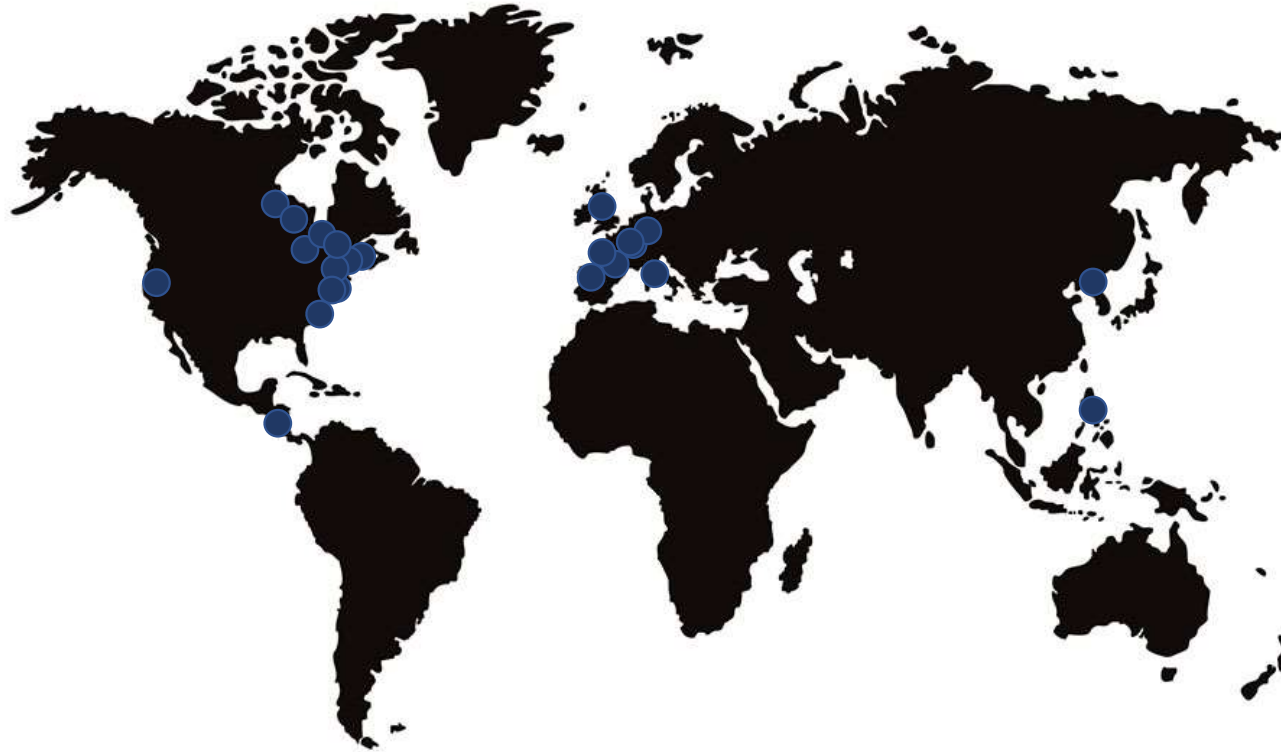
20+ **Distributors worldwide**

ars Industrial Robotics and X-Ray

Summary

FlexiBowl®: The new generation

NEW

H) New FB200

F) A new set of accessories to better divert parts

E) New quick connect system

B) Full Ethernet connectivity

Ethernet

Flexivision

G) Custom discs

I) Plug-Ins for all main robots

D) Empty Door

C) Improved backlight: more powerful & uniform

A) New servo drive system

FLEXIBOWL

**ars** Industrial Robotics and X-Ray

FlexiBowl®: The new generation

NEW
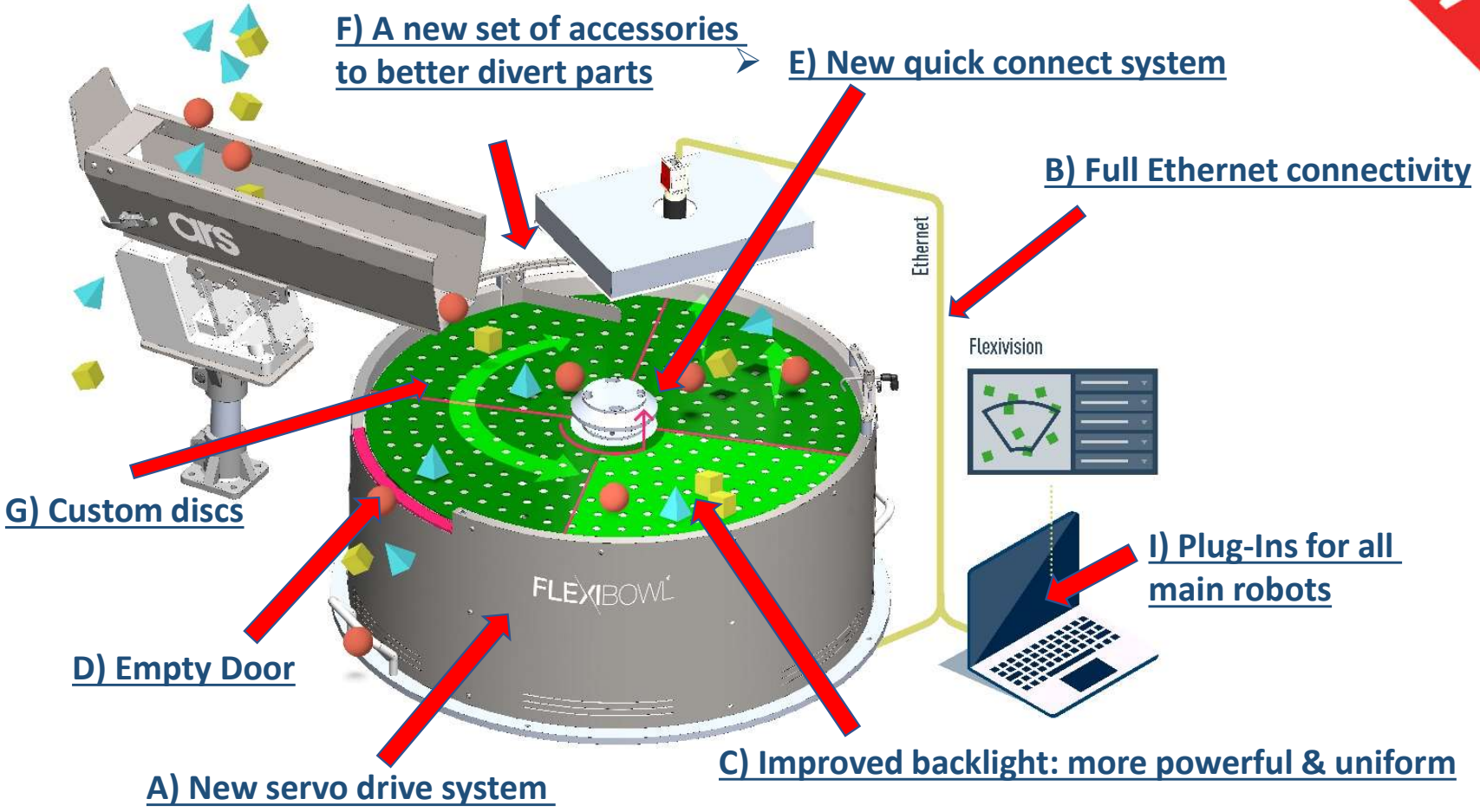
A lot of improvements and changes are introduced with new generation FlexiBowl: **easier to use and integrate**, more **efficient** and more options to increase application range.

In detail:

➢ **A) New servo drive system with higher torque**: the flexible feeder with the higher torque in the market, up to 7Kg max payload. No need for parameter calibration.
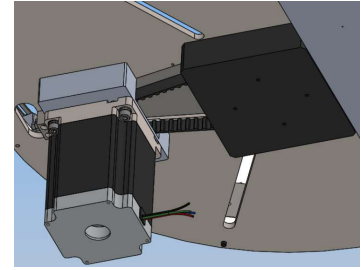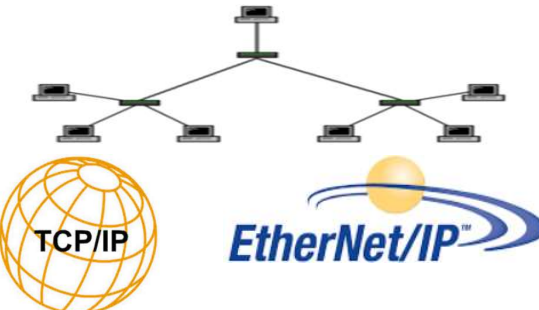
MAXIMUM LOAD CAPACITY

7 Kg

**ars** Industrial Robotics and X-Ray

FlexiBowl®: The new generation

> **B) Full Ethernet connectivity**: "TCP/IP", "UDP/IP" and "Ethernet/IP" are already integrated. Digital I/O control is also available. 110/230Vac power supply. (no 24Vdc).
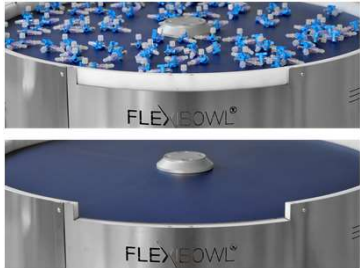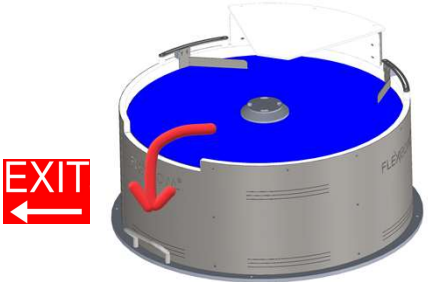
> **C) Powerful and uniform backlight**: a new backlight, with "continuous" or "strobe" function, larger vision area and easier to replace
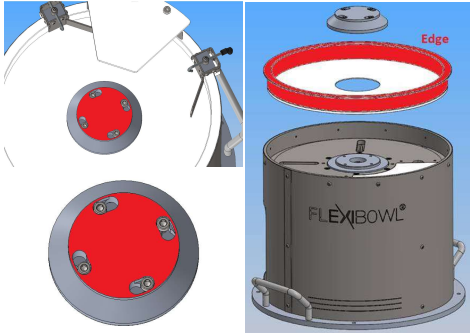

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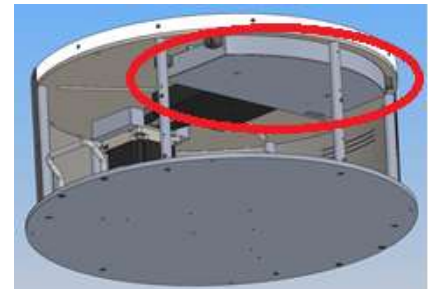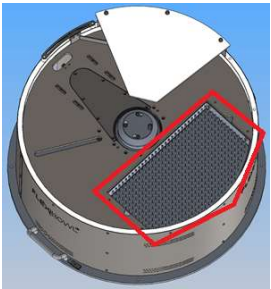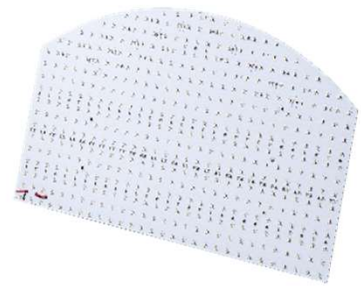
FlexiBowl®: The new generation

➤ **D) New quick emptying**: for fast and easy automatic product changeover

➤ **E) New quick release system**

➤ **F) Additional accessories and options**: new fixing system for diverter, air blow and flip screen. Easily adjustable and removable. New digital control for flip unit.

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THANK YOU

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