

Mitsubishi Electric Trendy v robotizaci a automatizaci 28.1.2016, Brno



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- **Popis univerzální robotické buňky jako nového konceptu automatizace/robotizace výroby**
- **Popis komponent použitých v buňce**
- **Video s robotickou buňkou na výrobu teplotních relé**
- **Video ukázky s dalším použitím robotického příslušenství**
 - **Melfa Safe Plus (pro práci s robotem bez nutnosti oplocení)**
 - **3D Vision sensor**
 - **Force sensor**



Before- Human production line

Mass Production



Now -Automated production line

Wide-Vriety low-volume production



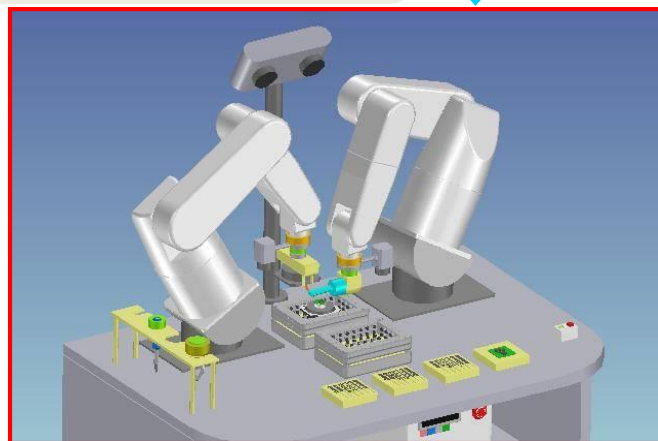
Cell manufacturing

Productivity & Reliability

Flexibility & Simplicity

Productivity & Reliability

Flexibility & Simplicity



Robotic Cell Production system for next generation must have the productivity and the reliability of the automation system and the simplicity of human cell system

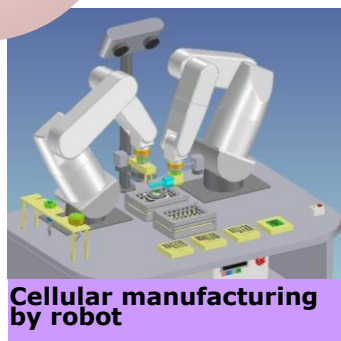
Issues to Encounter in Robotic Cell Production

(4) Variation in parts, frequent short interruptions

Continuous operation

(3) Productivity

Shorter working hours



New model adaptability

(2) Complicated adjustment and startup

Shorter startup time

(1) Parts supply

(4) Variation in parts, frequent short interruptions

Solution

High-speed force control

Compliance function

Error detection, automatic restart

Continuous operation

Improved reliability

Improved operability

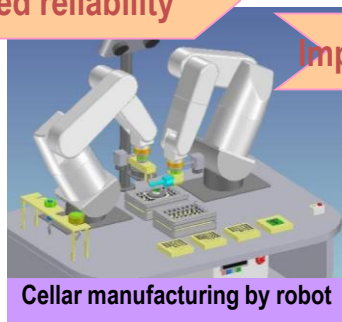
New model adaptability

(1) Parts supply

Solution

3D measurement, detection technology

No positioning jig



Shorter working hours

Improved productivity

(3) Productivity

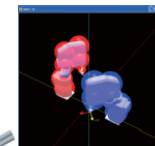
Solution

Self-learning operation

Multi-robot operation

Multi-function hand

Speed-up



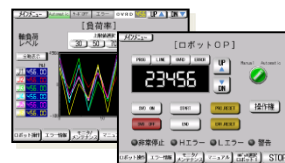
(2) Complicated adjustment and startup

Solution

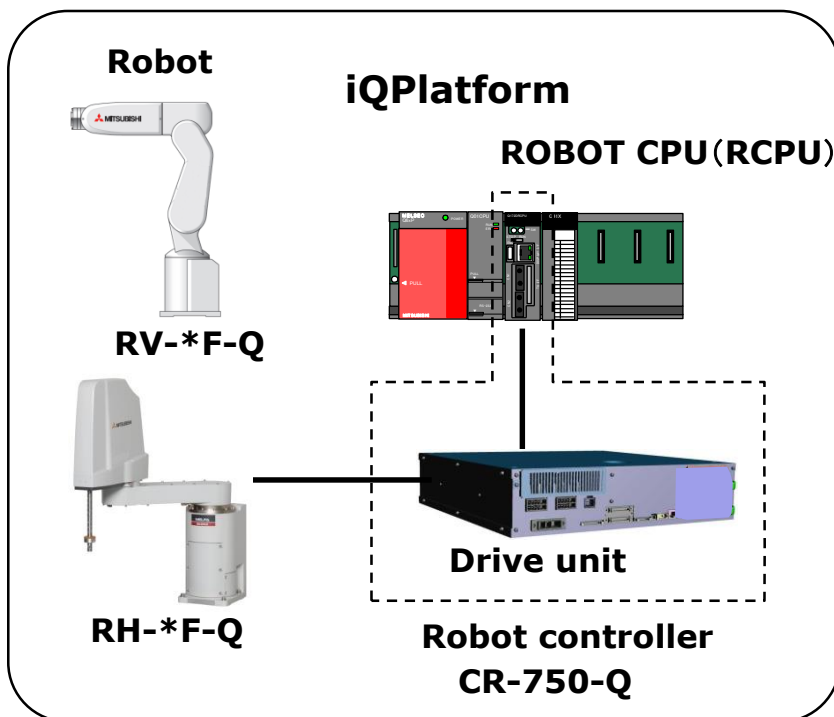
Programming by iQ Platform

Teaching with multi-info GUI

Simplified teaching

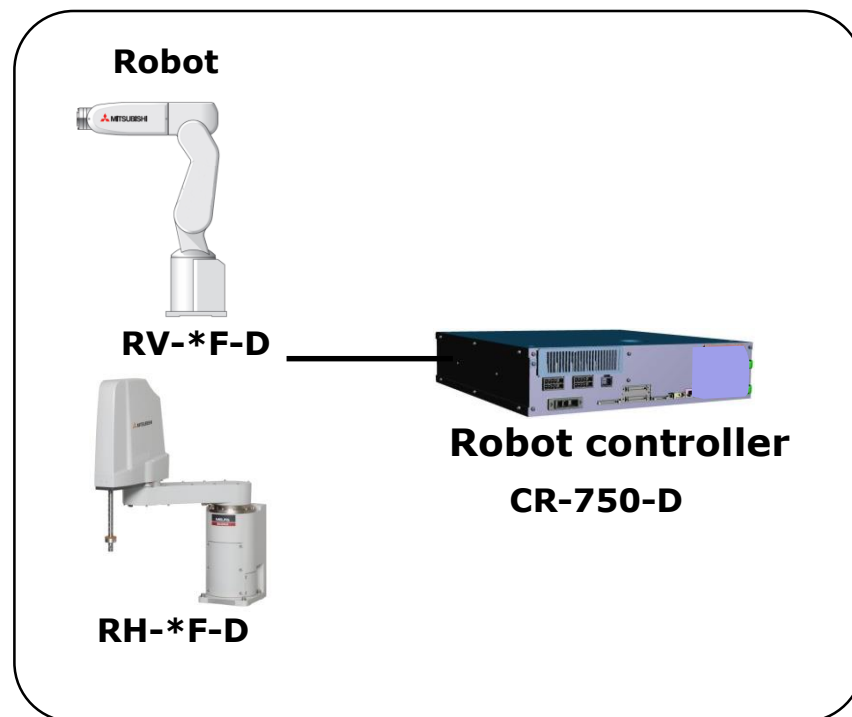


iQ-Platform

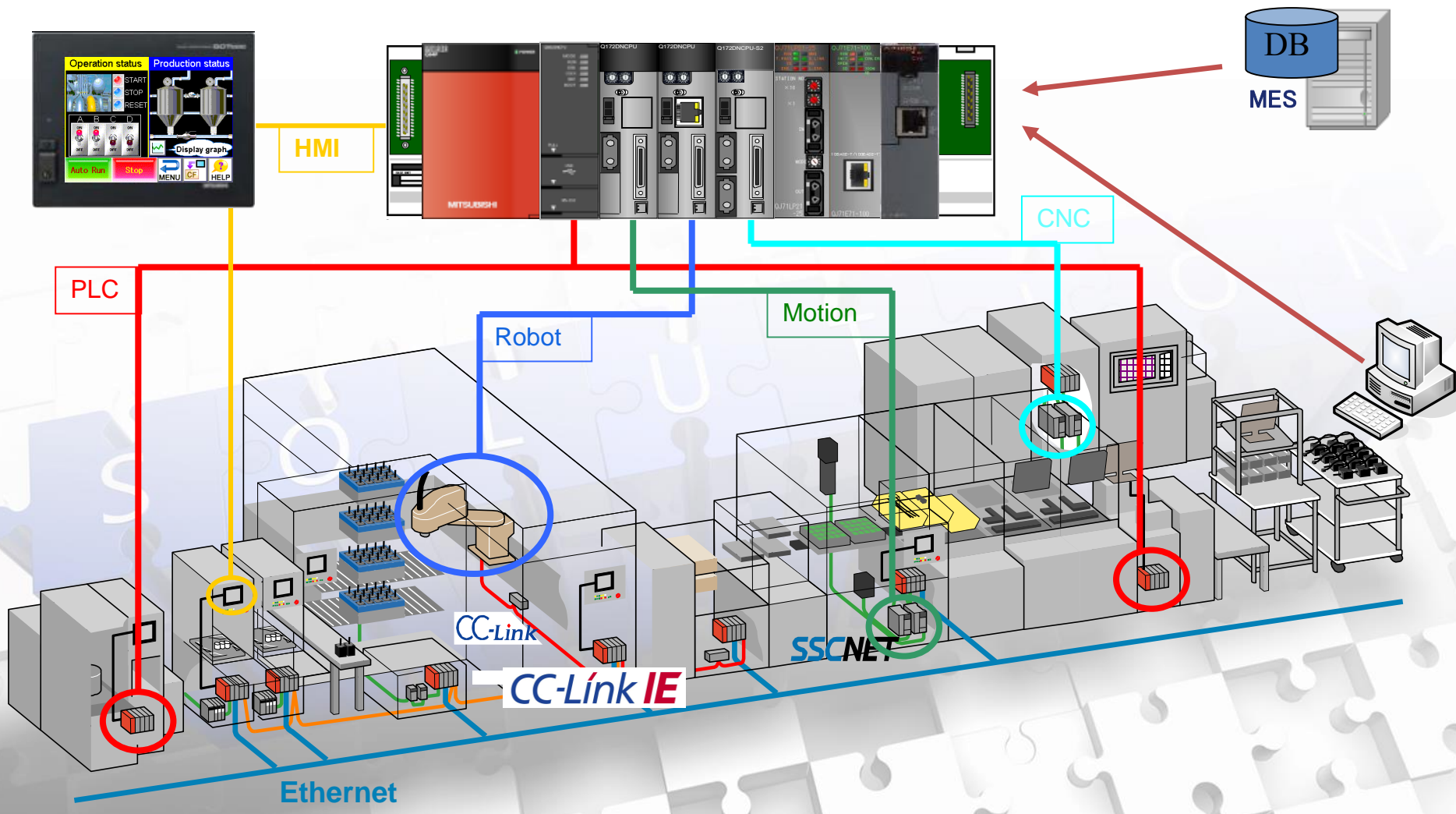


- Capable of building large cell
- Fine system control is possible by high-speed communication with common memory and various PLC units

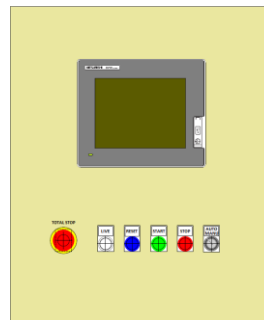
Stand alone type



- Capable of building simple cell
- Variety interfaces are available as standard
- Additional axis, Ethernet, CC-Link, Encoder input



Introduction to intelligent solutions

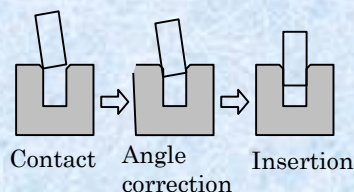


"MELFA SafePlus"

Intelligent solutions

① Force sensor

Detect fitting error
Reduce teaching burden
Stable quality



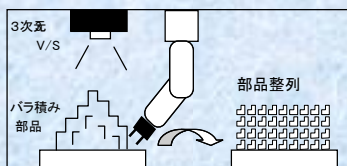
④ Multi-arm Cooperative Control

Handling of long work / heavy weight work
Assembling without jigs



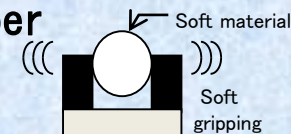
② 2D・3D vision sensor

Jig-less assembling
Parts kitting
Parts picking



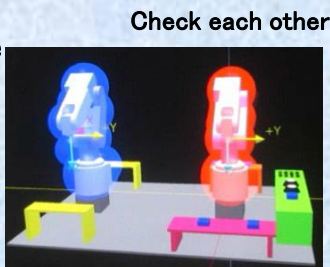
⑤ Multi-functional gripper - electric gripper,

Gripping force → Soft gripping



③ Interference Avoidance

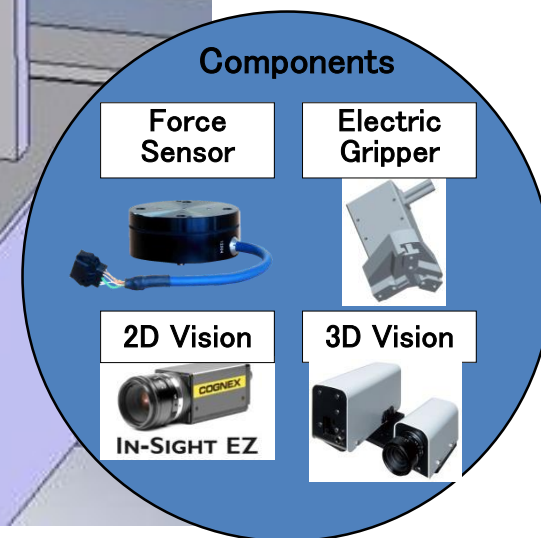
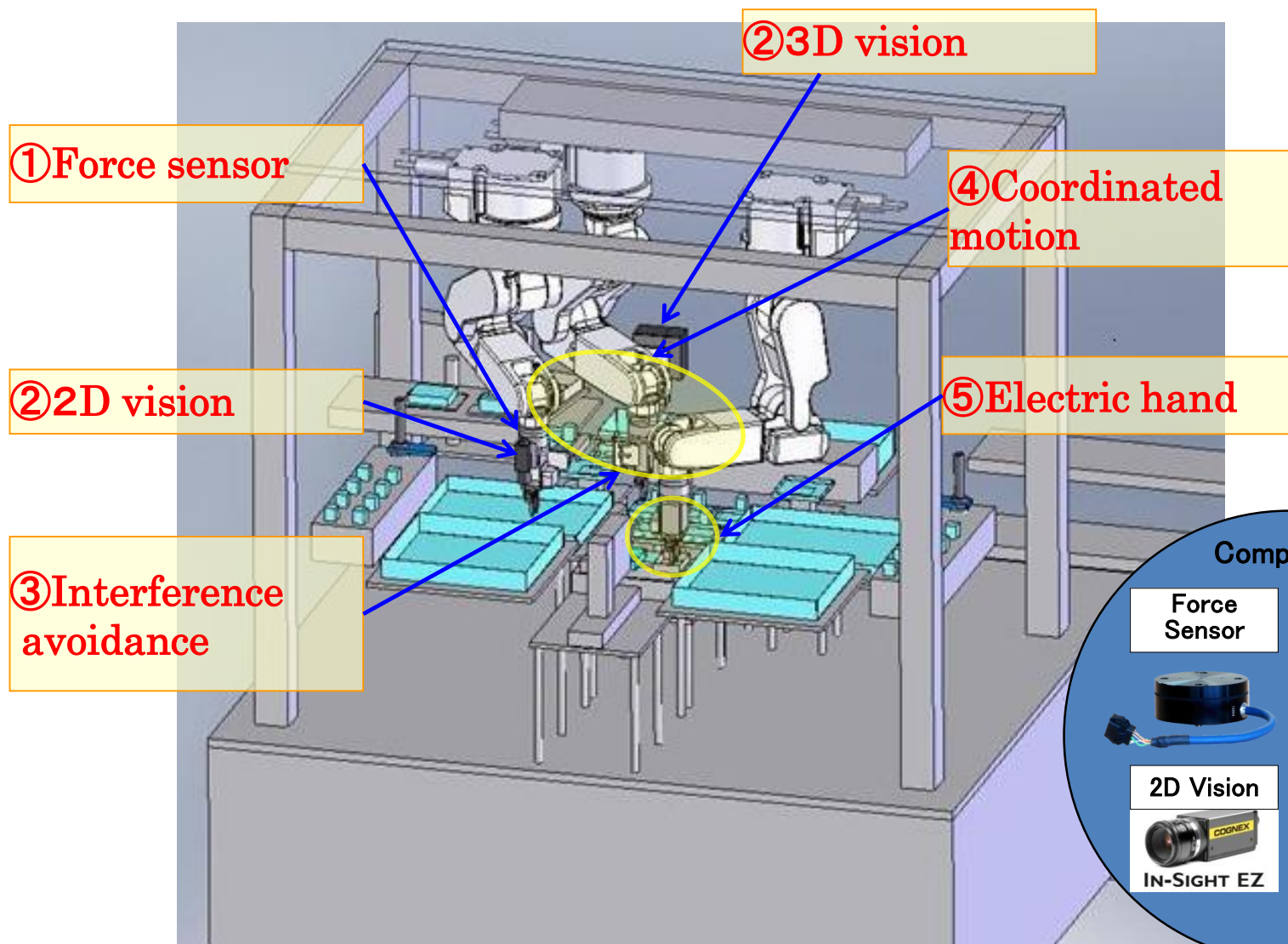
Avoid crashing between robots during setting up
Fail safe for forgetting interlock

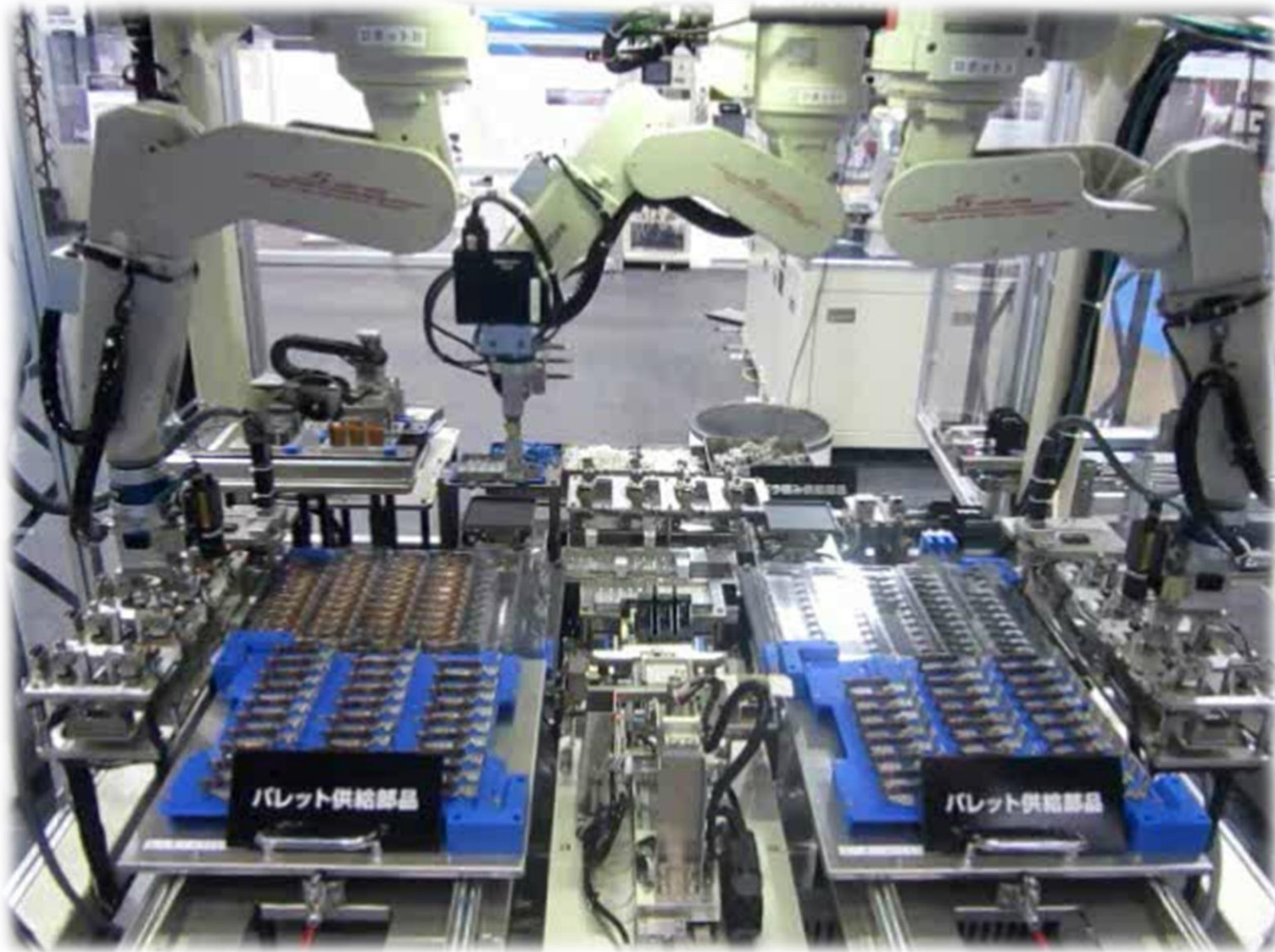


⑥ iQ Platform

Supply total system solution

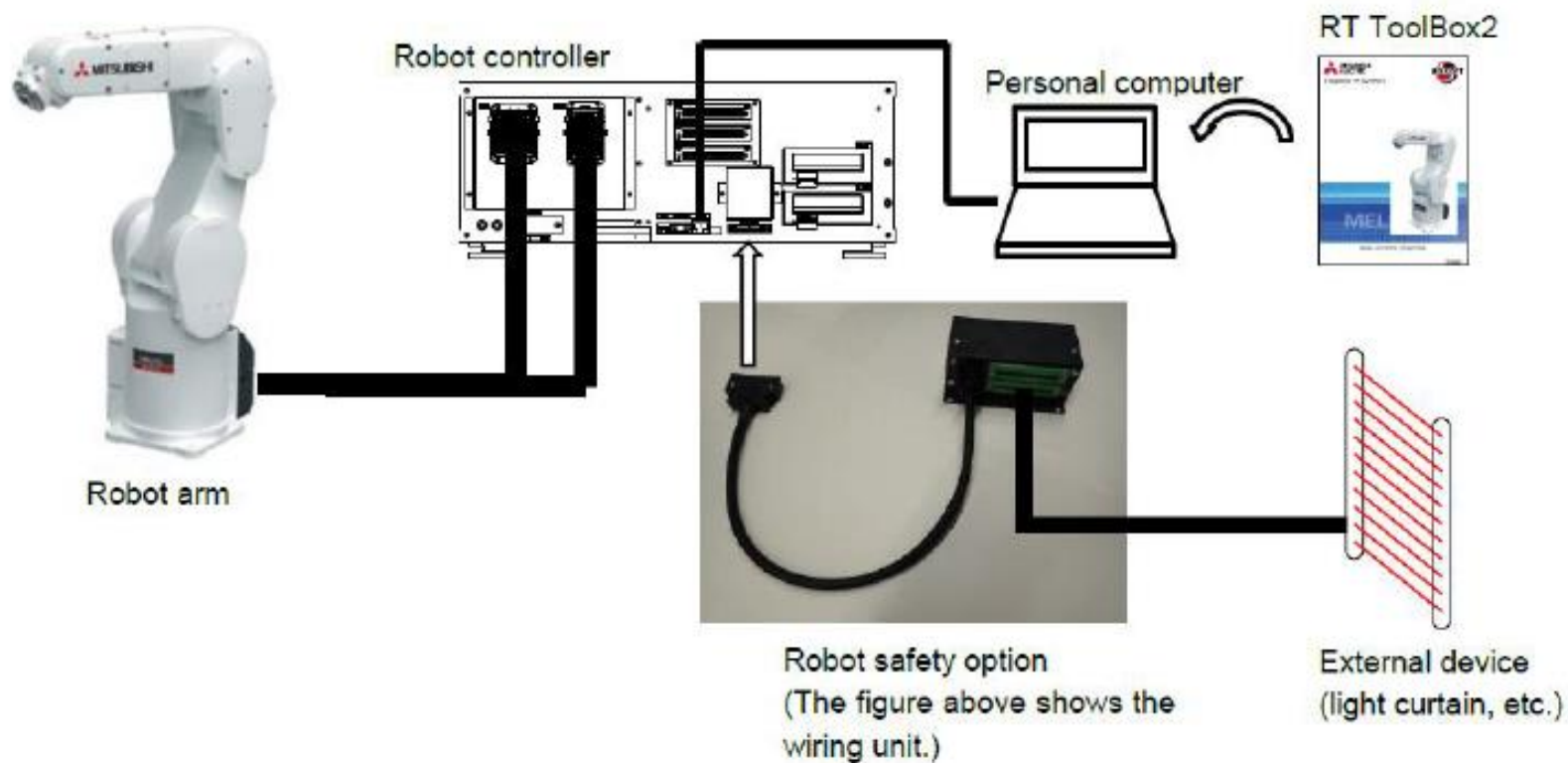






Movie Example ~Assembly of thermal relay~

■ System configuration

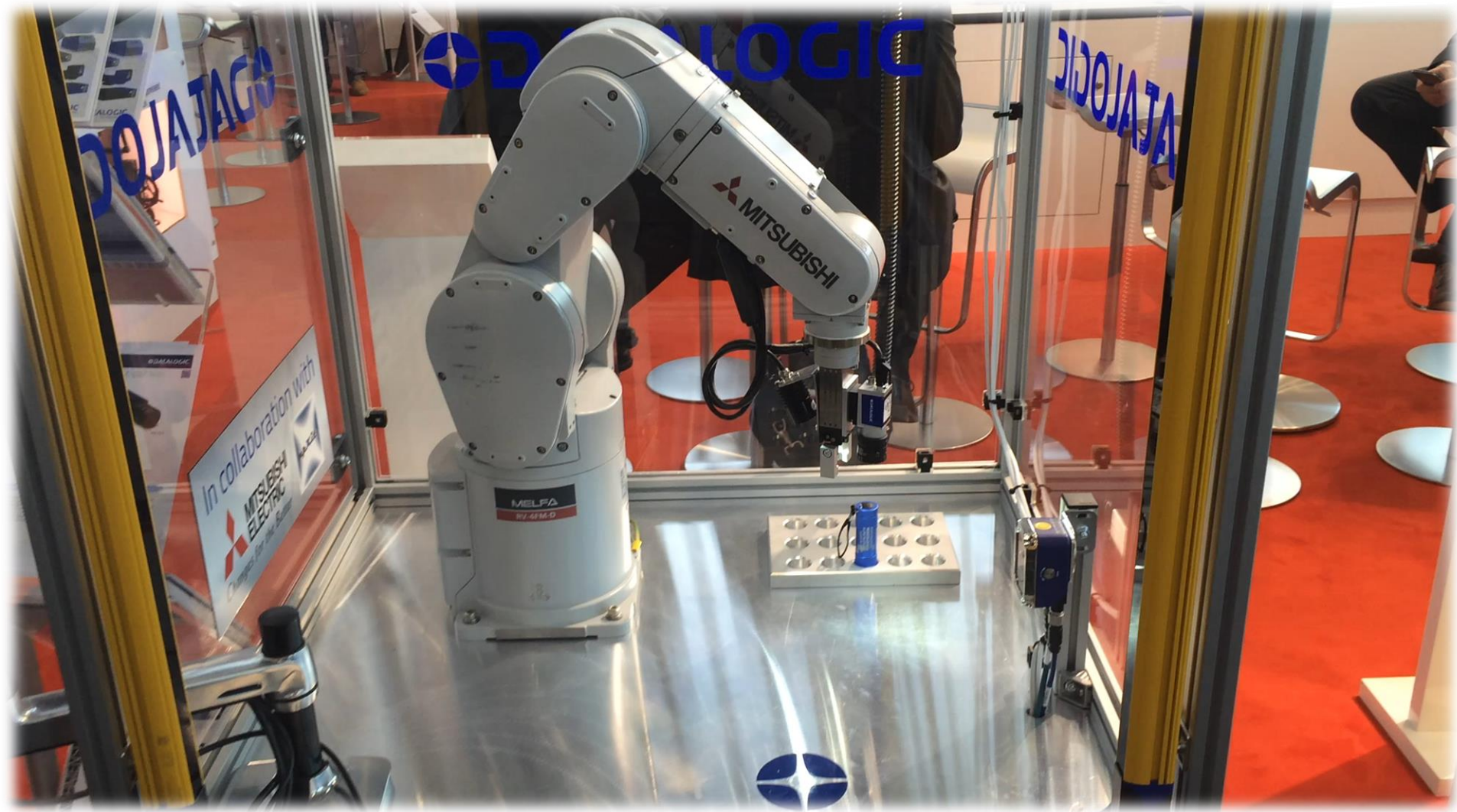


"MELFA SafePlus"

Features

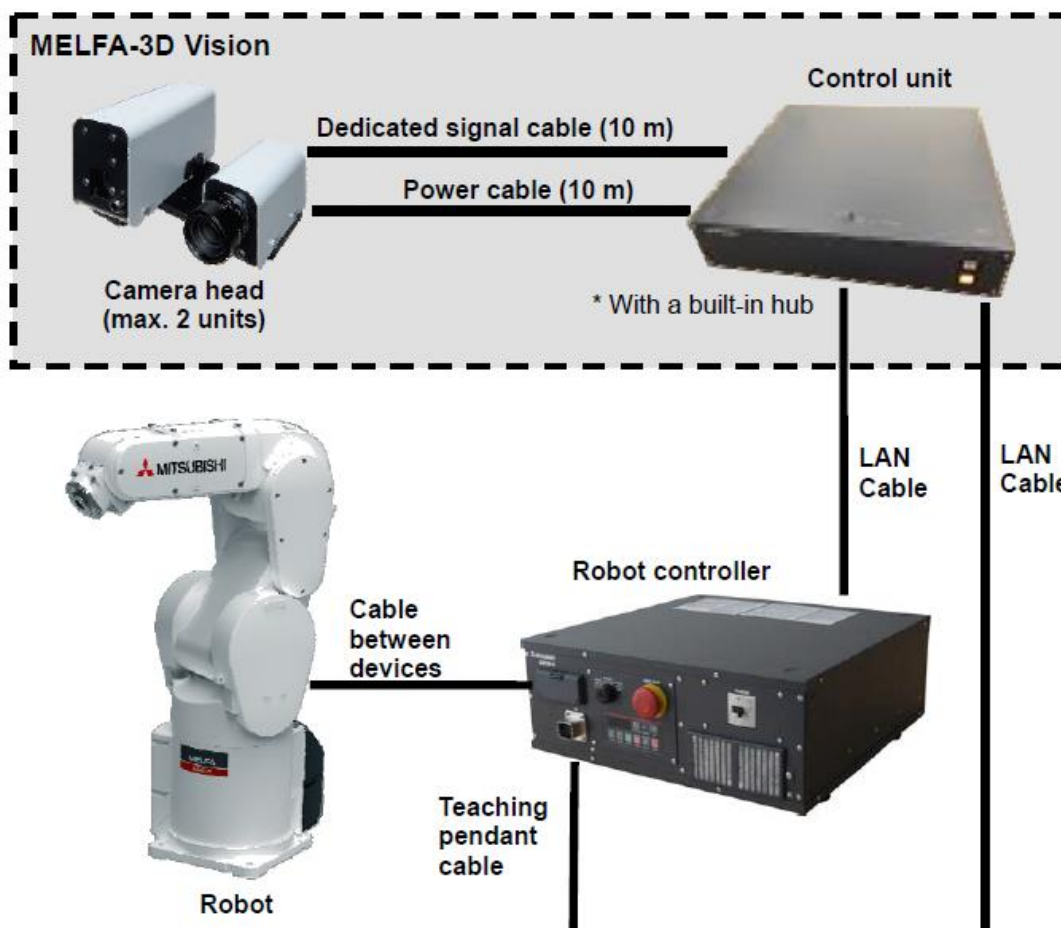
Safety Function	Description	Related Standard
Reduced Speed Control	Function to control the robot speed with less than 250mm/s when signaled via safety input signals. Two different zones with different limited speed can be activated. Operator can be interactive while the robot is running in automatic mode, but with safe low speed.	SLS
Limited Range Control (Free plane limit function)	Function to control the robot movement range and to ensure that the robot does not exceed the set limit activated by the safety input signal. This function monitors four particular points of the robot arm. If one of them exceeds any set plane, the robot will stop immediately.	SLP
Torque Monitoring (Collision detection function)	The allowable torque range is set by parameter and the estimated torque is calculated with the robot movement. Actual torque (feedback) is monitored and if that value exceeds the allowable torque range, the robot immediately stops as STR error. This function is necessary for the detection of collision between humans and the robot/equipment.	STR
Safety Inputs (Dual channel)	Safety input function for activating the three different safety modes. Also an easy and safe connection to a Safety PLC is possible.	ISO13849-1
Safe Torque Off Safe Stop 1	Function that shuts off the motor power and stops the robot when some error occurs.	STO SS1

"MELFA SafePlus"





MELFA-3D Vision



3.2. Measurement Principal

This product measures distance using a camera head comprised of a projector and a camera. The measurement principal is briefly described below.



Fig. 3-1 Camera head

Patterns such as those shown in

Fig. 3-2 are irradiated from the projector, and these are captured by the camera. By processing these images, the pattern irradiation range can be split into several hundred divisions, each of which can be identified by assigning a number.



Fig. 3-2 Pattern irradiation example

5.2.1. Hand eye merits and demerits

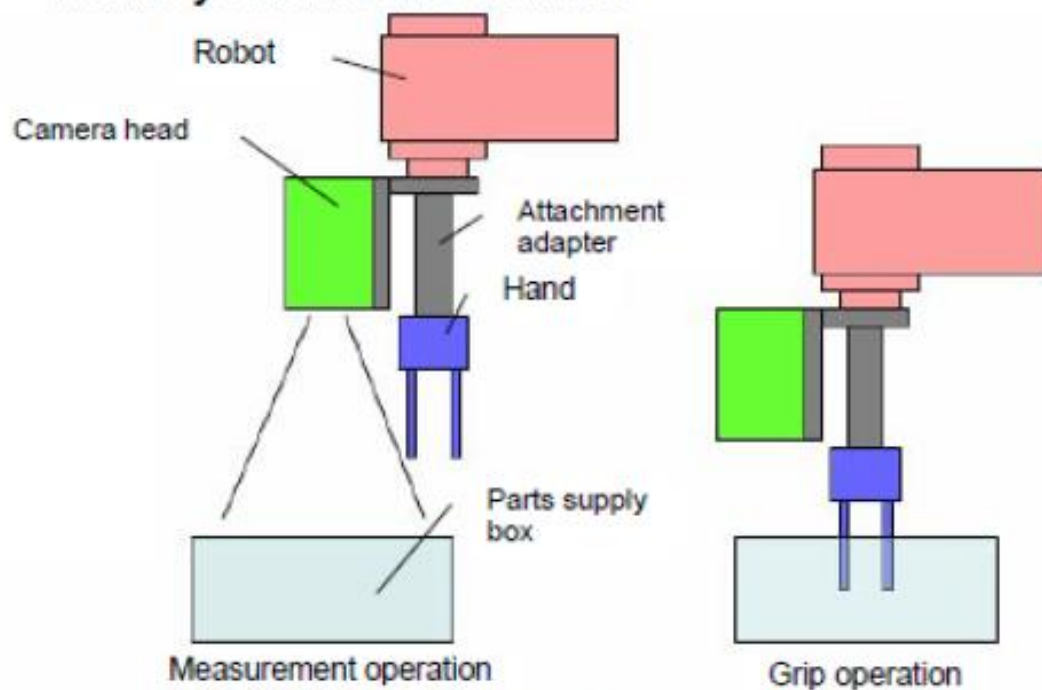
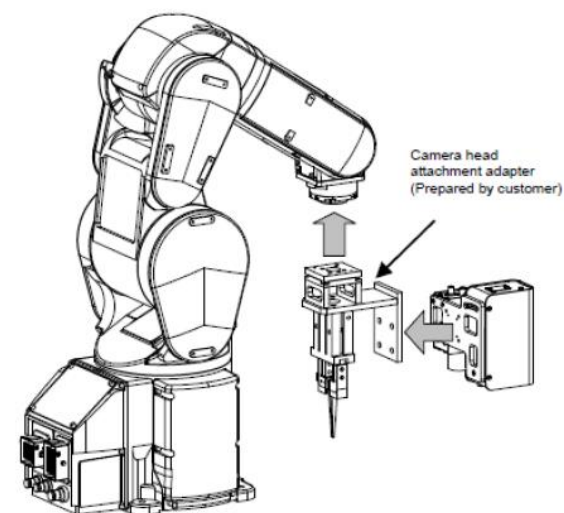


Fig. 5-4 Hand eye



5.3. Fixed Camera

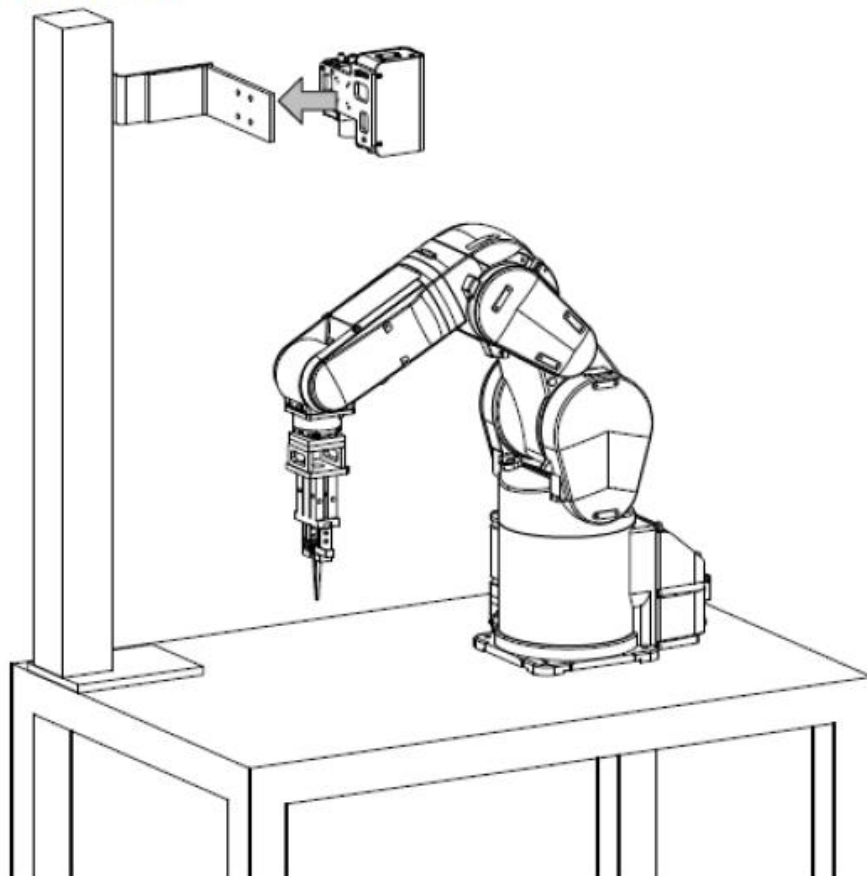
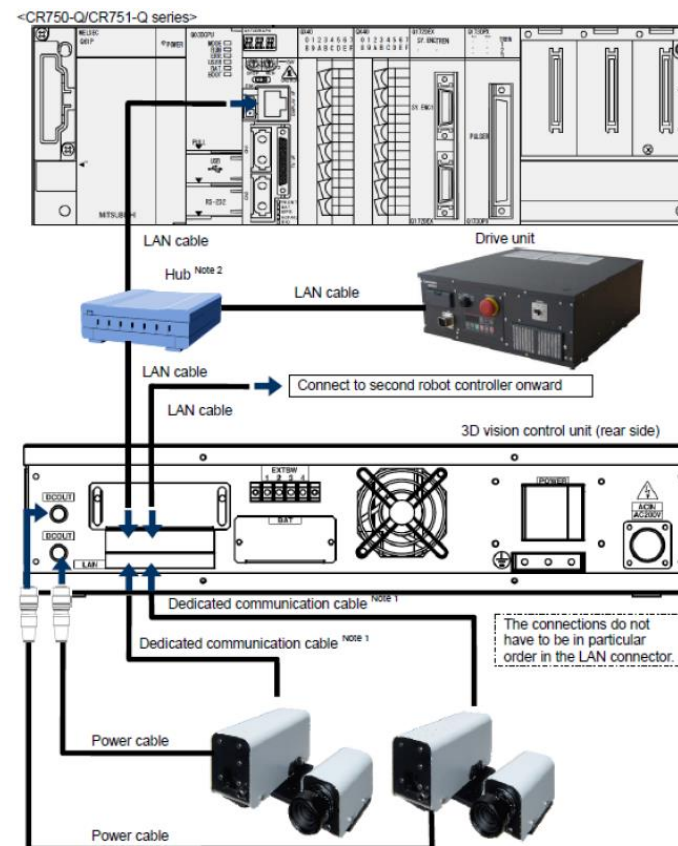


Fig. 5-5 Fixed camera attachment example

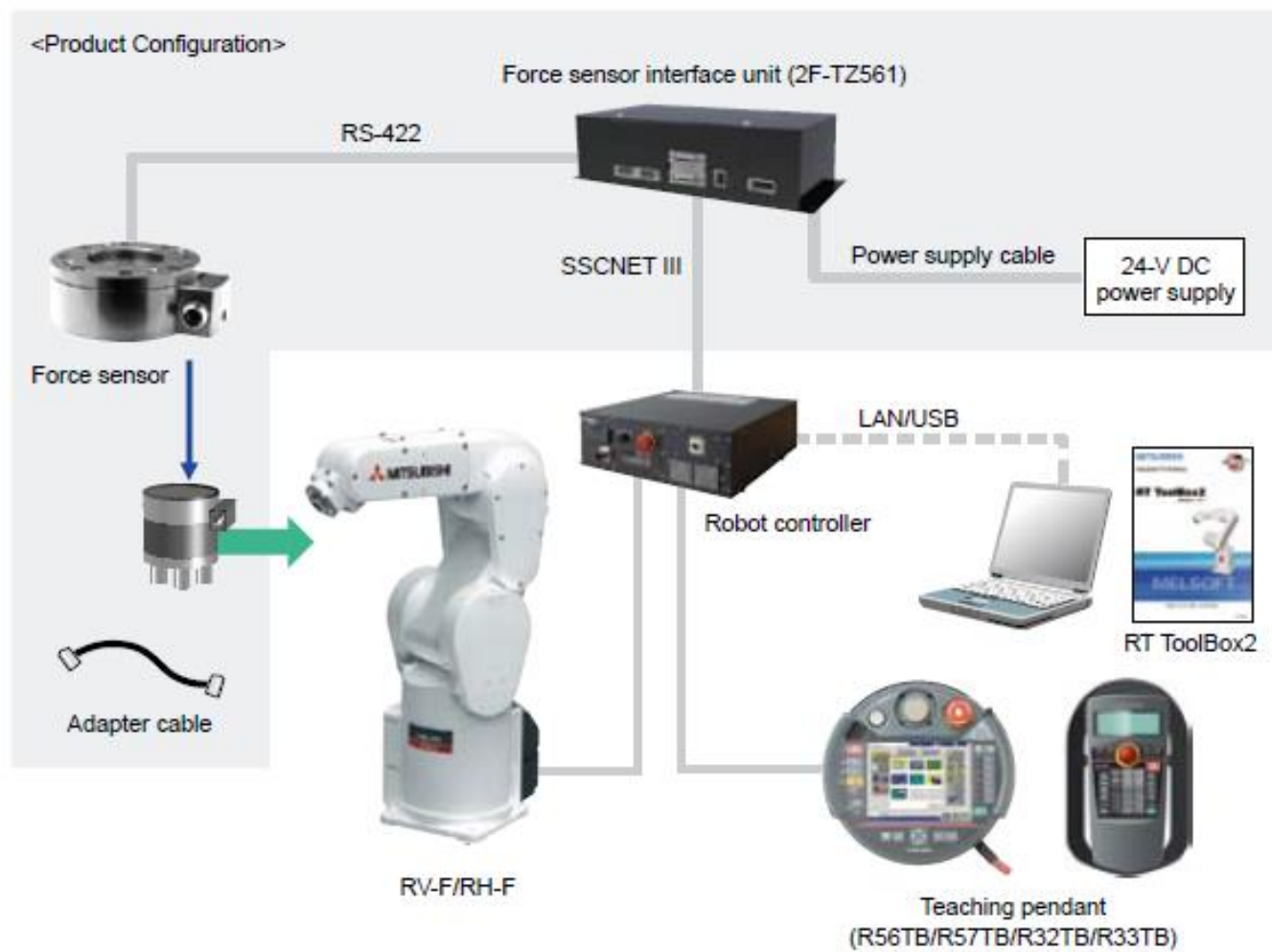


MELFA-3D Vision



Force sensor

System Configuration



✓ Stiffness control



Position compensation



Fixed position control

✓ Pressing force control



Copying surface

✓ Force detection



Pressing force control

基板への コネクタ挿入作業 (リカバリー動作の開発)

Connector Insertion (Error detection → Recovery motion)

Force sensor – movie example (2)

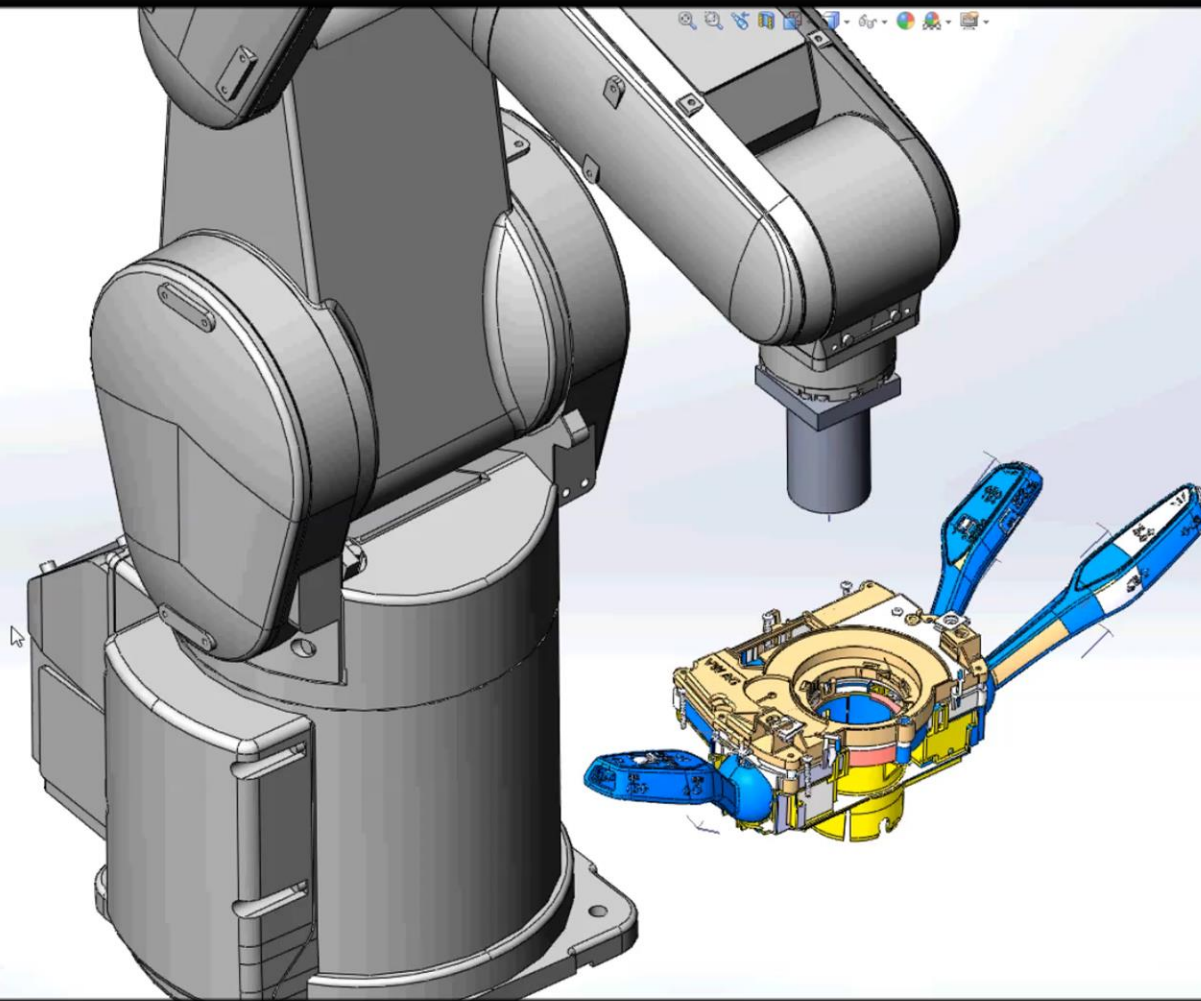


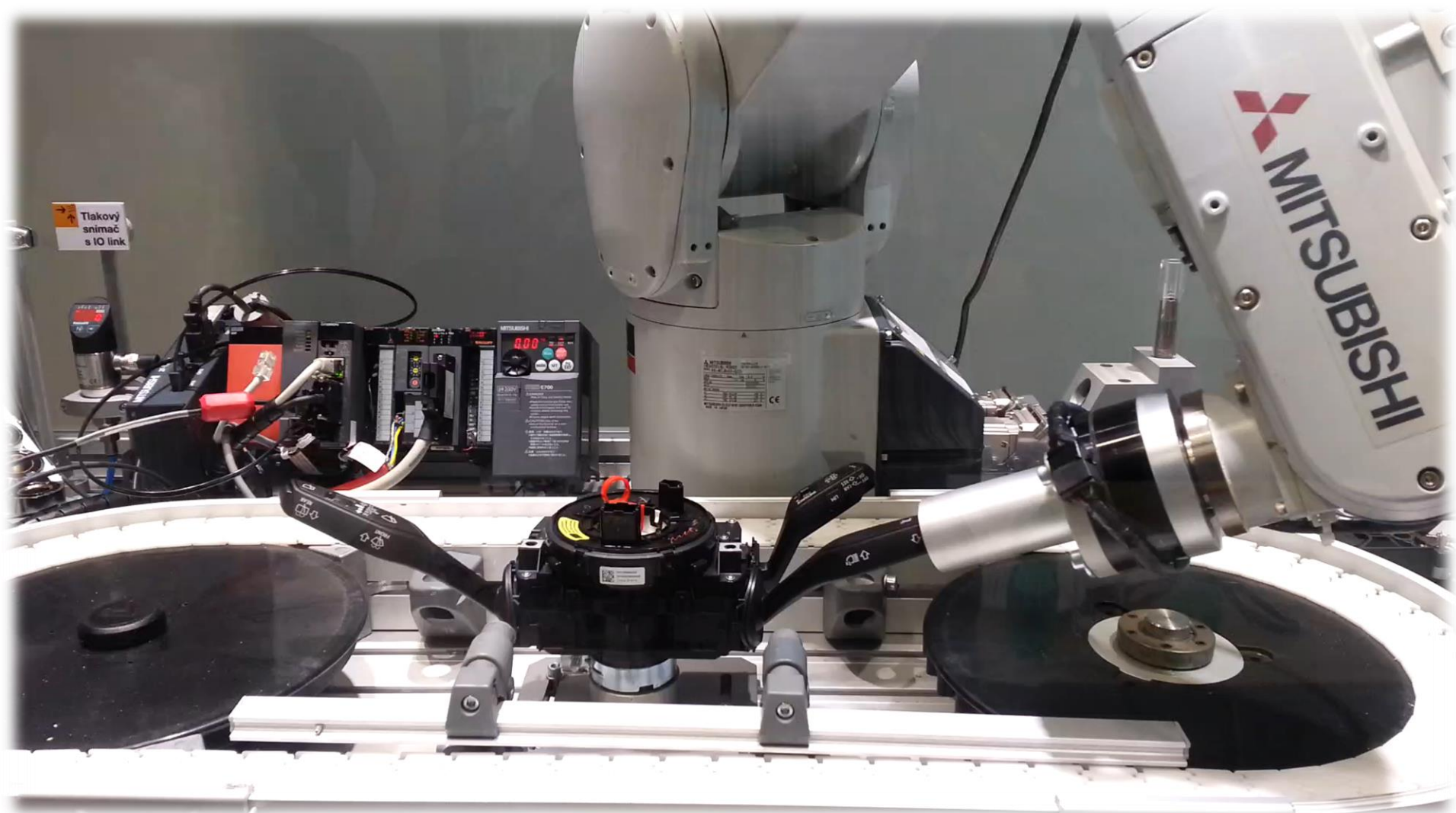
Install Bearing

- **Konzultace řešení (výběr robota, umístění, atd.)**
- **3D Simulace**
- **Simulace pracovního cyklu**
- **Reálné simulace**
- **Studie**
- **Školení**
- **Aplikační podpora**
- **Servis**

Připravujeme:

- **Hot-line support**
- **Projekt management**





2015-09-22

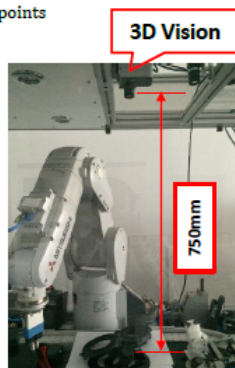
MELFA-3D Vision Camera test report

1. Camera Head Specifications





- Model name 2F-3DVS2-HEAD
- Measurement method Triangulation method (Pattern irradiation type)
- Active light source LED projector
- Lens Mounting method C mount
Focal length 12.5mm
- No. of measurement points About 300,000 to 600,000 points

2. Testing environment

- Working distance 750mm
- Field of view 210mm × 280mm
- Light environment General lighting
- Camera fixation method Fixing

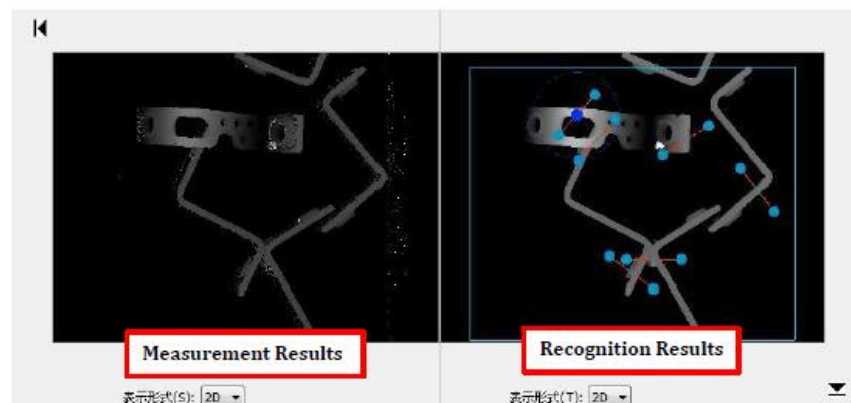


3. Test results

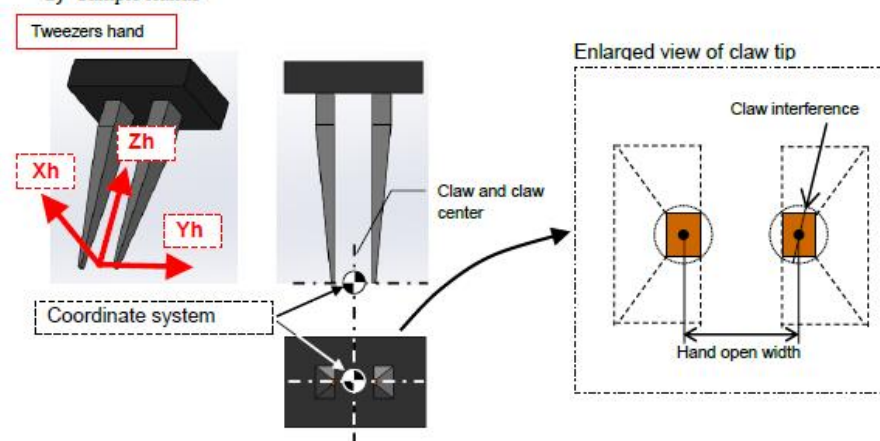
Work NO.	Work type	Measurement Results	Recognition Results	Suction hand	Parallel /Tweezers hand	Conveyance probability
1		×	×	×	×	Not tested
2		△	△	△	×	Not tested
3		○	○	△	○	Not tested
4		○	○	△	○	Not tested

5. Notes

- 1) Reference screen (Image monitor)



2) Sample Hands





for a greater tomorrow



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Leak tester

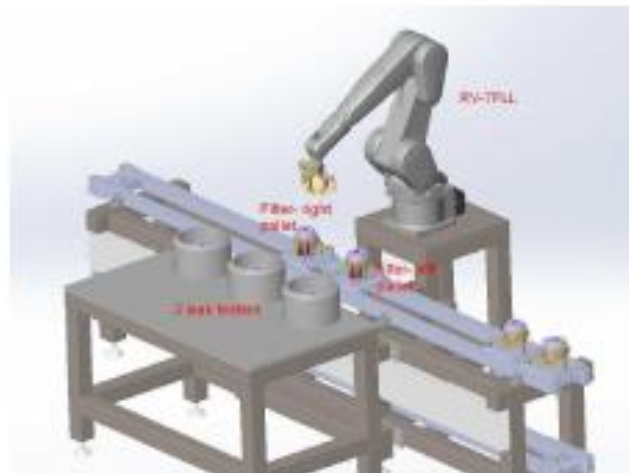
1. Robot

Robot KV-7711-D

2. Assumptions

The robot takes a filter from pallet from left side and place to one of three leak tester and after the leak test a filter will be place to right pallet.¹

Simulation's goal was to check robot's reachability for all elements.



Drawing 1. Comp draft

3. Simulation Result

All elements are in robot's reach



for a greener tomorrow



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Drawing 2. Example movement

4. Robot's program

```
Servo On
Wait M_Servo=1
Loadset 0,0
Ovrd 80
GdL On
Dim Peak(3)
Now Pstart
For m1=1 To 3
Now Pstart,-200
Mus Pstart
HOpen 1
Qty 0.1
Mus Pstart,-200
Now Peak(m1)-200
```

A white Mitsubishi industrial robot arm is shown in the background, positioned vertically. The arm has the Mitsubishi logo and 'MITSUBISHI' text on its upper section. The base of the arm is labeled 'MELFA RV-4FL-D'. The background is a solid blue color with faint, stylized white lines and circular patterns, suggesting a technical or industrial theme.

Thank you for your attention