microFMS
Flexible Manufacturing System
Welcome to the Learning System for Automation and Technology

microFMS

Your entry-level system for the world of automated flexible manufacturing.

Training concept _________________ 3
Modularity and compatibility _______ 4
Main components ________________ 5
Workpiece spectrum______________ 6
Process and example steps ________ 7
Control concept__________________ 8
Training software and media _______ 9
Configuration examples of production cells _____________ 10

System description version 5.01

All technical data applies at the time of going to print. All texts, representations, illustrations and drawings included in this document are the intellectual property of Festo Didactic GmbH & Co. KG, and are protected by copyright law. All rights reserved, including translation rights. No part of this publication may be reproduced or transmitted in any form or by any means, electronic, mechanical, photocopying or otherwise, without the prior written permission of Festo Didactic GmbH & Co. KG.

All technical data subject to change according to technical updates.

Festo Didactic GmbH & Co. KG
Solution Center
Rechbergstraße 3
73770 Denkendorf/Germany
microFMS

Training concept

microFMS –
Your entry-level system for the world of automated flexible manufacturing

The cost-effective entry-level system for the world of flexible manufacturing and integrated systems. All key sequences of a fully automated flexible manufacturing system – FMS can be covered:

- Buffer for unprocessed parts
- Separation
- CNC machine loading with robot
- CNC machining processes
- Workpiece removal from machine with robot
- Finished parts buffer
- SCADA option
- DNC option

The CNC machines used are a PC-controlled bench lathe and/or bench milling machine, which correspond to the industrial standard in structure and function. The loading robot is a 5-axis industrial robot with a powerful controller (multitasking and contour control).

The modularity of the equipment and the clearly defined interfaces means that the MicroFMS systems can be combined with each other and with MPS® stations or integrated into CIM systems.

A Mechatronics training system

The concept offers a training environment with typical technologies of Mechatronics systems of a modern sophisticated industrial standard.

All of the three technical skills for a successful Mechatronics engineer can be achieved or improved with this training concept. Further, the relation and devices between these technologies can be easily demonstrated and clarified by this concept.

(i) Mechanics
- Handling processed and unprocessed metal workpieces
- Power transmission to convey workpieces
- Milling or lathing process on metal or plastic materials
- Valves, cylinders and grippers as mechanical actors
- Clamping workpieces and integrated parts of a dynamic system with a high performance
- Using of fluids (air) for transactions of mechanical components

(ii) Electrics
- Getting familiar with DC and AC drives
- Understanding the importance of clear and logic wiring
- Understanding communication devices between different electrical components
- Understanding of soft- and hardware devices as well as signal processing
- Electric in the Human-machine interfaces
- Getting familiar with power supply and electrical capacity of industrial systems

(iii) Informatics
- Understanding of NC codes
- Programming with an industrial CNC controller
- Simulation of CNC machining process
- Programming of robot workcells and their simulation
- Using CAD/CAM systems for optimizing production
- Understanding of soft- and hardware devices
- Understanding of signal processing
- Data management

Mechatronics

(i) Mechanics
(ii) Electrics
(iii) Informatics
Modular compatible design allows wide range of combinations and upgrading possibilities

**Expandable system – combination with MPS®**

All production cells e.g. MR5, TR5 and MT2R5 can be expanded to production lines with selected MPS® stations.

Various configurations are possible. Please contact us for an individual offer.

**Integrated stations:**
1. Distribution Station
2. Testing Station
3. Five axis Robot
4. CNC Milling machine
5. Buffering conveyors
6. Programming & Simulation
7. Software packages

**Expandable system – combinations with FMS 50**

All production cells can be combined with FMS 50 to build a comprehensive training system for advanced Mechatronics. The combination of the three learning systems from Festo Didactic: FMS 50, which includes MPS® and microFMS, offers a perfect training environment with a very wide range of technologies from a sensor up to CNC productions using Fieldbus and supervisory systems.

All stations and sub-systems can be use as standalone, in groups or integrated into the total system.

**Integrated stations:**
1. Conveyor system
2. Distribution Station
3. Testing Station
4. Six axis Robot slide
5. CNC Milling machine
6. CNC Lathing machine
7. Assembly with 5 axis Robot
8. AS/RS20 Station
9. Handling Station
10. Sorting Station
11. Vision camera system
12. Buffering conveyors
13. Programming & Simulation
14. Supervisory SCADA system
15. Software packages
16. E-Learning packages

**Expandable system – combinations with iCIM**

All production cells e.g. MR10, TR11 and MTLR16 can be expanded to build a high level CIM system or can be integrated into an existing system.

This is possible because of the modular design and the upgradeable robot controller with Ethernet communication device which is necessary for communication with the MES (Management Executing System) of the iCIM.

**Integrated stations:**
1. AS/RS40
2. Assembly with 6 axis robot
3. Assembly with SCARA robot
4. CNC Lathing machine
5. CNC feeding with 5 axis robot
6. Conveyor system
7. MES SCADA system
8. MRP/PPS system
The CNC machines

A wide spectrum of CNC machines that covers different levels of complexity can be selected for integration into the microFMS systems. This opens the possibility to configure the optimal training facilities following the customer specific needs and requested features.

The machines are especially designed for training purposes with a high quality standard to be used in industrial production as well.

All machines are equipped with a PC based interchangeable controller that allows easily the upgrade of the machine with the newest industrial standards e.g. Fanuc or Sinumerik.

The following Milling centers can be integrated into the system:
– Mill 55 top-table machine
– Mill 105 with an automatic tool changer
– Mill 155 with an option of a C-axis
– Mill 300 with up to 11 KW power

The Lathing centers:
– Turn 55 as a top-table with an automatic tool changer
– Turn 105 with a rapid traverse of 5 m/sec
– Turn 155 with an option of a C-axis and driven tools
– Turn 345 with 6.7 KW

The robots

A variety of articulated-arm robots of five or six degrees of freedom and different capacities can be selected and integrated into the microFMS systems to carry out the most important automated processes in the system.

The Mitsubishi robots are of a high quality meeting industrial standards.

Modern multitasking controllers, flexible grippers and a high performance software tools brings the robot cells into a high level of flexibility in their usage.

The Mitsubishi robot family:
The compact five axis articulated-arm robot RV-2AJ with a loading capacity of 2 Kg.
More than two different sizes of 6 axis robots are available for increased geometrical capability can be integrated as well. The RV-1A or the RV-2A.
The usage of a linear slide unit with servo drives makes it possible to move the robot to several working positions. This allows the serving of 2 machines with the same robot.
Chess pieces

The system can handle and process a big variety of work-pieces due to the flexible robot gripper, which can grip rough and processed parts with diameters between 30 and 40 mm.

The illustrated turned and milled parts can be made from rough parts with a diameter of 30 or 40 mm.

Options FMS50/MPS® – MPS® workpiece, pneumatic cylinder

If the system should be integrated with FMS50 or MPS® stations, then the workpiece will be – of course – the one of MPS®, which is the pneumatic cylinder.

On request, it is also possible to operate the system with 2 different workpieces, the cylinder in integrated usage and the chess pieces in standalone usage.

Further option is to integrate a simple assembly process using the same robot to press a thermometer, a hygrometer or a clock into the cylinder housing.

Option iCIM – Parts of a table set

If the system should be expanded to a large FMS or CIM system, then the workpiece will be the table set of the iCIM concept. The table set could include for example a base palette, a pin holder, a clock, a hygrometer, a thermometer or a magnet for paper clips.

Note: depending on the configuration of the system and the selection of type and number of machines either all workpieces or only a part is possible to handle and produce with.
The following example steps gives an idea about possible manufacturing process of the system:

1. Rough materials are buffered and fed on the conveyor. A pneumatically operated stopper is used to distribute the incoming parts – one by one to the robot picking position. An optical sensor is installed to assure that only one part is released to this position and to give the signal to the stopper: “ready for next workpiece”.

2. As demonstrated, the robot grips the rough workpiece after receiving the information from the optical sensor: “new workpiece is available”.

3. The workpiece is fed into the CNC machine by the robot. It is placed onto the clamping unit, after releasing the workpiece, the robot gives the information to the CNC controller: “WP ready to be clamped”.

4. The automatic clamping takes place, the robot moves out of the CNC machining area, the machine door closes automatically and the CNC processing starts. It could be CNC lathing or CNC milling or a combination of both. This depends on the system configuration.

5. Now it is time to pick the processed part out of the CNC machine – after a signal communication between CNC controller and robot controller, the robot gets the task: “pick and place on outgoing conveyor”.

6. The robot is placing the processed workpieces onto the second conveyor for “material output”. These could be lathed or milled workpieces. The conveyor feeds the workpiece to the next stopper. Depending on the configuration, this could be the last process step, or the workpiece could be forwarded to the next station.

7. This process steps concern system configurations that contain more than one machine. After the lathing process, the workpieces are transported to the next station either by the robot with its linear slide unit (e.g. model MTLR5) or by an additional conveyor belt connecting both production cells (e.g. model MT2R5). The steps 2-5 are repeated with the second machine.

© Festo Didactic GmbH & Co. KG, Solution Center, System description version 5.01
The microFMS system is available with the following communication levels. The first is I/O based and the second includes a SCADA system and TCP/IP based communication.

On request, an upgrade from level 1 to level 2 is possible.

**Level 1:**
Automated buffer operation via I/O communication between robot and CNC machine

Software for robot programming

**Level 2:**
Flexible buffer operation with SCADA system and DNC

Scada software

---

**The robot controller:**
A modern robot controller allows multi-tasking functions and it includes external I/O cards, Ethernet communication and a large memory capacity for complex programs.

**The CNC controller:**
Each CNC machine in microFMS has its own PC controller. This allows various industrial controllers to be installed on the PC, such as Siemens 810/820, 810D/840D, Heidenhain TNC 355 or the WinCAM CAD/CAM system. An optional control panel allows the user interface of the desired controller to be simulated.

Central control of automated buffer operation is undertaken by the robot controller. Buffer operation start and stop is via the MPS® control panel at the robot.

Level 1 allows automated processing of an unprocessed parts buffer. If different workpieces are to be manufactured, the appropriate program is selected at the CNC machine. Communication between the robot and the CNC machine – such as start and stop of CNC machining, task complete message, opening and closing of the door – is undertaken by setting and reading the I/Os of the CNC machine’s robotics interface by the robot controller.

Robot, CNC and cell PC and an optional CAD/CAM laboratory are interconected via Ethernet. The DNC commands are passed from the cell PC to the CNC machine via the available DNC interface (RS232 or TCP/IP).

Level 2 corresponds to the full functionality of the Flexible Manufacturing System (FMS). Each unprocessed workpiece in the buffer is assigned a specific process plan. This allows various workpieces to be machined on the system. The cell PC loads the appropriate CNC programs for the workpiece into the machines via DNC. The system can optionally be networked with a CAD/CAM laboratory.
A series of software packages on robot, CNC, work cell and SCADA is available to meet every customer specific needs.

**COSIROP** is a software for programming of Mitsubishi robot systems.

**COSIMIR® Professional** is the industrial PC-based software package for 3D modeling, programming and simulation of industrial robot systems and entire production systems. Users not only have an extensive model library available, but can also use various robot-programming languages.

**COSIMIR® Industrial** is a version restricted to the Mitsubishi robot. Mitsubishi uses it worldwide as an industrial offline robot programming system.

**COSIMIR® Educational** combines an interactive learning program on robot technology and the functionality of **COSIMIR® Professional** for programming and simulation of robots (on the basis of numerous ready-to-use industry-type applications – from a simple handling task to the stations of microFMS). You can import models created with **COSIMIR® Professional** and continue processing them. A download to real robot controllers is only possible with **COSIMIR® Professional** or **COSIMIR® Industrial**.

**COSIMIR® Control** is a powerful SCADA workcell controller software.

**COSIMIR® Factory** is a complete factory simulation package.

**CNC related software packages**

Our partners EMCO and MTS offers a various software packages as online or offline CNC programming and simulation in 2D or 3D as well as CAD/CAM systems.

**WinNC** online or offline licenses with an emulation of the following industrial controllers:

- Siemens Sinumerik 840D
- Siemens Sinumerik 810D
- Siemens 820
- Siemens810
- GE Fanuc Series 21
- GE Fanuc Series 0
- Heidenhain TNC 355
- Emcotronic TM02

A combination of several controllers to operate with the same machine is possible.

**WinCAM** is the CAD/CAM programming system for turning and milling with integrated 3D graphic simulation. It combines the functionality of a professional CAD/CAM system with the advantages of a specific training program.

**Win3D-View** is a 3D-simulation for turning and milling included in WinCAM and offered as an option to WinNC. Graphic simulations of CNC controls are designed primarily for industrial practice.

**WinTrain CNC** is a computer based training software on general CNC technology.

**WinTutorials** is training software to assist the trainer (for machine series 155).
microFMS
Configuration examples of production cells

**TR5: Turning with robot automation** (example picture)

**Function:**
TURN 55 is an industry-compatible inclined-bed lathe that allows all machining possibilities of a modern CNC lathe: facing, longitudinal turning and contour turning, plunge cut, crop, threading and drilling.
The 5-axis RV-2AJ industrial robot undertakes the automatic control and loading/unloading of the CNC machine. In the parts buffer station cylindrical unprocessed parts are buffered and fed separated to a robot for removal. After CNC machining, the robot removes the finished part and places it on the station’s other conveyor belt, where it is either buffered or separated for further transport.

**Optional:**
– Upgrade to TR6 with 6-axis robot RV-1A instead of 5-axis (recommended).
– Upgrade COSIMIR® package to 1 x Industrial and 10 x Educational.

**Scope of delivery**

<table>
<thead>
<tr>
<th>Item</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Industrial Robot Mitsubishi RV-2AJ incl. drive unit and teach pendant</td>
<td>1</td>
</tr>
<tr>
<td>Robot interface adapter, pneumatic gripper</td>
<td>1</td>
</tr>
<tr>
<td>EMCO concept Turn 55 incl. Keyboard, automation- and tool kits</td>
<td>1</td>
</tr>
<tr>
<td>Festo machine base with aluminum profiles</td>
<td>1</td>
</tr>
<tr>
<td>Control Personal Computer, Pentium incl. 15” monitor</td>
<td>1</td>
</tr>
<tr>
<td>700 mm Festo conveyor belt with 24 V DC motor incl. stoppers</td>
<td>2</td>
</tr>
<tr>
<td>Trolley MPS® type incl. profile plate 700 x 350</td>
<td>2</td>
</tr>
<tr>
<td>Control panel. MPS® type mounted on the robot trolley</td>
<td>1</td>
</tr>
<tr>
<td>COSIMIR® Educational 4.1 software license</td>
<td>1</td>
</tr>
<tr>
<td>COSIROP software license</td>
<td>1</td>
</tr>
<tr>
<td>WinNC, CNC programming software, machine license</td>
<td>1</td>
</tr>
</tbody>
</table>

**MR5: Milling with robot automation** (example picture with PC Mill 55)

**Function:**
MILL 55 is a 3-axis milling machine of industry-compatible design that allows all machining possibilities of a modern CNC milling machine: contour milling, thread milling and cutting, and drilling/boring.
The 5-axis RV-2AJ industrial robot undertakes the automatic control and loading/unloading of the CNC machine. In the parts buffer station cylindrical unprocessed parts are buffered and fed separated to a robot for removal. After CNC machining, the robot removes the finished part and places it on the station’s other conveyor belt, where it is either buffered or separated for further transport.

**Optional:**
– Upgrade to MR6 with 6-axis robot RV-1A instead of 5-axis.
– Option for concept Mill 55: 8 x automatic tool changer.
– Upgrade COSIMIR® package to 1 x Industrial and 10 x Educational.

**Scope of delivery**

<table>
<thead>
<tr>
<th>Item</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Industrial Robot Mitsubishi RV-2AJ incl. drive unit and teach pendant</td>
<td>1</td>
</tr>
<tr>
<td>Robot interface adapter, pneumatic gripper</td>
<td>1</td>
</tr>
<tr>
<td>EMCO concept Mill 55 incl. Keyboard, automation- and tool kits</td>
<td>1</td>
</tr>
<tr>
<td>Festo machine base with aluminum profiles</td>
<td>1</td>
</tr>
<tr>
<td>Control Personal Computer, Pentium incl. 15” monitor</td>
<td>1</td>
</tr>
<tr>
<td>700 mm Festo conveyor belt with 24 V DC motor incl. stoppers</td>
<td>2</td>
</tr>
<tr>
<td>Trolley MPS® type incl. profile plate 700 x 350</td>
<td>2</td>
</tr>
<tr>
<td>Control panel. MPS® type mounted on the robot trolley</td>
<td>1</td>
</tr>
<tr>
<td>COSIMIR® Educational 4.1 software license</td>
<td>1</td>
</tr>
<tr>
<td>COSIROP software license</td>
<td>1</td>
</tr>
<tr>
<td>WinNC, CNC programming software, machine license</td>
<td>1</td>
</tr>
</tbody>
</table>
**MT2R5:** Turning and Milling with robot automation (example picture)

**Function:**
The combination of TURN 55 and MILL 55 allows you to create a process with both turning and milling operations. Each CNC machine has its own control PC and its own feed and order compilation device, allowing the system to be separated and rejoined very easily.

Two 5-axis industrial robots RV-2AJ undertake automatic control and loading/unloading of the CNC machines. Following the first machining operation, the semi-finished work piece is separated on the first order compilation conveyor, passed via the MPS® Conveyor to the feed conveyor of the second station, where it is buffered. A further machining operation can then be automatically started.

**Optional:**
- Industrial 6-axis robot RV-1A instead of 5-axis for Turning (recommend).
- Option for concept Mill 55: 8 x automatic tool changer.
- Upgrade COSIMIR® package to 2 x Industrial and 10 x Educational.

---

**MTRL5:** Turning and Milling with robot automation and linear axis (example picture)

**Function:**
This combination of TURN 55 and MILL 55 allows very efficient implementation of a CNC machine production line for turning and milling operations.

A Mitsubishi RV-2AJ 5-axis industrial robot that travels on a linear axis undertakes automatic control and loading/unloading of the CNC machines. Unprocessed parts are fed to the first production process via conveyor 1. The machined work pieces are then buffered on the second conveyor and separated for the next manufacturing process. The finished parts are then placed in an additional box.

In order to ensure smooth transportation, after machining the work pieces must still have a cylindrical shape with a diameter of 30 or 40 mm.

**Optional:**
- Upgrade to MTRL6 with 6-axis robot RV-1A instead of 5-axis.
- Option for concept Mill 55: 8 x automatic tool changer.
- Upgrade COSIMIR package to 1 x Industrial and 10 x Educational.
TR11: Turning with robot automation (example picture)

Function:
Our EMCO PC Turn 105 is a PC-controlled 2-axis CNC table-top lathe complying in structure and function to the industrial standard. It easily fulfills all the basic demands in technical training and advanced training. All essential sequences in the modern production sequence can not only be explained but also followed true-to-life. Practical simplification, a well designed machine concept and easy operability quickly lead to successful learning.

The 6-axis industrial robot RV-1A undertakes the automatic control and loading/unloading of the CNC machine. In the Parts buffer station cylindrical unprocessed parts are buffered and fed separated to a robot for removal. After CNC machining, the robot removes the finished part and places it on the station’s other conveyor belt, where it is either buffered or separated for further transport.

Optional:
– Upgrade to TR12 with 6-axis robot RV-2A instead of RV-1A.
– Upgrade COSIMIR® package to 1 x Industrial and 10 x Educational.

Note:
The Turn 105 machine is not available with 5-axis robot due to technical limitation.

MR10: Milling with robot automation (example picture)

Function:
Our EMCO PC Mill 105 is a fully developed PC-controlled, 3-axis CNC milling machine. It complies in structure and function to the industrial standard. All essential functions in the modern production sequences can be explained and followed true-to-life. An important prerequisite for fast learning success is the well-designed machine concept, simplification and easy operability.

The 5-axis RV-2AJ industrial robot undertakes the automatic control and loading/unloading of the CNC machine. In the Parts buffer station cylindrical unprocessed parts are buffered and fed separated to a robot for removal. After CNC machining, the robot removes the finished part and places it on the station’s other conveyor belt, where it is either buffered or separated for further transport.

Optional:
– Upgrade to MR11 with 6-axis robot RV-1A instead of 5-axis.
– Upgrade to MR12 with Large 6-axis robot RV-2A instead of 5-axis.
– Upgrade COSIMIR® package to 1 x Industrial and 10 x Educational.
**MTRL10: Turning and Milling with robot automation and linear axis**

**Function:**

This combination of TURN 105 and MILL 105 allows very efficient implementation of a CNC machine production line for turning and milling operations. A Mitsubishi RV-2AJ 5-axis industrial robot that travels on a linear axis undertakes automatic control and loading/unloading of the CNC machines. Unprocessed parts are fed to the first production process via conveyor 1. The machined work pieces are then buffered on the second conveyor and separated for the next manufacturing process. The finished parts are then placed in an additional box.

In order to ensure smooth transportation, after machining the work pieces must still have a cylindrical shape with a diameter of 30 or 40 mm.

---

<table>
<thead>
<tr>
<th>Scope of delivery</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Industrial Robot Mitsubishi RV-2AJ incl. drive unit and teach pendant</td>
<td>1</td>
</tr>
<tr>
<td>Robot interface adapter, pneumatic gripper</td>
<td>1</td>
</tr>
<tr>
<td>Linear slide unit Festo DGL type, length between 2 – 3 meter</td>
<td>1</td>
</tr>
<tr>
<td>EMCO concept Mill/Turn 105 incl. Keyboard, automation- and tool kits</td>
<td>2</td>
</tr>
<tr>
<td>Festo machine base with aluminum profiles</td>
<td>2</td>
</tr>
<tr>
<td>Control Personal Computer, Pentium incl. 15” monitor</td>
<td>2</td>
</tr>
<tr>
<td>700 mm Festo conveyor belt with 24 V DC motor incl. stoppers</td>
<td>2</td>
</tr>
<tr>
<td>Working table incl. profile plate 700 x 700</td>
<td>1</td>
</tr>
<tr>
<td>Mobile control panel with cable 1,5 meter</td>
<td>1</td>
</tr>
<tr>
<td>COSIMIR® Educational software license*</td>
<td>1</td>
</tr>
<tr>
<td>COSIROP software license</td>
<td>1</td>
</tr>
<tr>
<td>WinNC, CNC programming software, machine license</td>
<td>2</td>
</tr>
</tbody>
</table>

**Optional:**

– Upgrade to MTRL11 with 6-axis robot RV-1A instead of 5-axis: *(recommended).*

– Upgrade to MR12 with large 6-axis robot RV-2A instead of 5-axis.

– Upgrade COSIMIR® package to 1 x Industrial and 10 x Educational.
TR16: Turning with robot automation (example picture of TR17 with RV-2A)

**Function:**
The EMCO PC Turn 155 is a PC-controlled CNC lathe (optional with C axis and driven tools) complying in structure and function to the industrial standard. It easily fulfills all the basic demands in technical training and advanced training. All essential sequences in the modern production sequence can not only be explained but also followed true-to-life. Practical simplification, a well designed machine concept and easy operability quickly lead to successful learning.

The 6-axis industrial robot RV-1A undertakes the automatic control and loading/unloading of the CNC machine. In the Parts buffer station cylindrical unprocessed parts are buffered and fed separated to a robot for removal. After CNC machining, the robot removes the finished part and places it on the station’s other conveyor belt, where it is either buffered or separated for further transport.

<table>
<thead>
<tr>
<th><strong>Scope of delivery</strong></th>
<th><strong>Quantity</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Industrial Robot Mitsubishi RV-1A incl. drive unit and teach pendant</td>
<td>1</td>
</tr>
<tr>
<td>Robot interface adapter, pneumatic gripper</td>
<td>1</td>
</tr>
<tr>
<td>EMCO concept Turn 155 TC8 incl. automation- and tool kits</td>
<td>1</td>
</tr>
<tr>
<td>700 mm Festo conveyor belt with 24 V DC motor incl. stoppers</td>
<td>2</td>
</tr>
<tr>
<td>Trolley MPS® type incl. profile plate 700 x 350</td>
<td>2</td>
</tr>
<tr>
<td>Control panel. MPS® type mounted on the robot trolley</td>
<td>1</td>
</tr>
<tr>
<td>COSIMIR® Educational 4.1 software license</td>
<td>1</td>
</tr>
<tr>
<td>COSIROP software license</td>
<td>1</td>
</tr>
<tr>
<td>WinNC, CNC programming software, machine license</td>
<td>1</td>
</tr>
</tbody>
</table>

**Optional:**
- Upgrade to **MR17** with large 6-axis robot RV-2A instead of RV-1A.
- Upgrade COSIMIR® package to 1 x Industrial and 10 x Educational.

**Note:**
The Turn 155 machine is not available with 5-axis robot due to technical limitation.

MR16: Milling with robot automation (example picture of MR17 with RV-2A)

**Function:**
The EMCO PC MILL 155 is a PC-controlled CNC milling station with C axis and driven tools complying in structure and function to the industrial standard. It easily fulfills all the basic demands in technical training and advanced training. All essential sequences in the modern production sequence can not only be explained but also followed true-to-life. Practical simplification, a well designed machine concept and easy operability quickly lead to successful learning.

The 6-axis industrial robot RV-1A undertakes the automatic control and loading/unloading of the CNC machine. In the Parts buffer station cylindrical unprocessed parts are buffered and fed separated to a robot for removal. After CNC machining, the robot removes the finished part and places it on the station’s other conveyor belt, where it is either buffered or separated for further transport.

<table>
<thead>
<tr>
<th><strong>Scope of delivery</strong></th>
<th><strong>Quantity</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Industrial Robot Mitsubishi RV-1A incl. drive unit and teach pendant</td>
<td>1</td>
</tr>
<tr>
<td>Robot interface adapter, pneumatic gripper</td>
<td>1</td>
</tr>
<tr>
<td>EMCO concept Mill 155-5000 incl. automation- and tool kits</td>
<td>1</td>
</tr>
<tr>
<td>700 mm Festo conveyor belt with 24 V DC motor incl. stoppers</td>
<td>2</td>
</tr>
<tr>
<td>Trolley MPS® type incl. profile plate 700 x 350</td>
<td>2</td>
</tr>
<tr>
<td>Control panel. MPS® type mounted on the robot trolley</td>
<td>1</td>
</tr>
<tr>
<td>COSIMIR® Educational 4.1 software license</td>
<td>1</td>
</tr>
<tr>
<td>COSIROP software license</td>
<td>1</td>
</tr>
<tr>
<td>WinNC, CNC programming software, machine license</td>
<td>1</td>
</tr>
</tbody>
</table>

**Optional:**
- Upgrade to **MR17** with 6-axis robot RV-2A instead of RV-1A.
- Upgrade COSIMIR® package to 1 x Industrial and 10 x Educational.
**microFMS**

Configuration examples of production cells

**MTRL16:** Turning and Milling with robot automation and linear axis (example picture)

**Function:**
This combination of TURN 155 and MILL 155 allows very efficient implementation of a CNC machine production line for turning and milling operations.

An RV-1A 6-axis industrial robot that travels on a linear axis undertakes automatic control and loading/unloading of the CNC machines. Unprocessed parts are fed to the first production process via conveyor 1. The machined work pieces are then buffered on the second conveyor and separated for the next manufacturing process. The finished parts are then placed in an additional box.

In order to ensure smooth transportation, after machining the work pieces must still have a cylindrical shape with a diameter of 30 or 40 mm.

**Scope of delivery**

<table>
<thead>
<tr>
<th>Item</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Industrial Robot Mitsubishi RV-1A incl. drive unit and teach pendant</td>
<td>1</td>
</tr>
<tr>
<td>Robot interface adapter, pneumatic gripper</td>
<td>1</td>
</tr>
<tr>
<td>Linear slide unit Festo DGL type, length between 2 – 3 meter</td>
<td>1</td>
</tr>
<tr>
<td>EMCO concept Turn 155 TC8 incl. automation- and tool kits</td>
<td>1</td>
</tr>
<tr>
<td>EMCO concept Mill 155-5000 incl. automation- and tool kits</td>
<td>1</td>
</tr>
<tr>
<td>700 mm Festo conveyor belt with 24 V DC motor incl. stoppers</td>
<td>2</td>
</tr>
<tr>
<td>Working table incl. profile plate 700 x 700</td>
<td>1</td>
</tr>
<tr>
<td>Mobile control panel with cable 1,5 meter</td>
<td>1</td>
</tr>
<tr>
<td>COSIMIR® Educational 4.1 software license</td>
<td>1</td>
</tr>
<tr>
<td>COSIROP software license</td>
<td>1</td>
</tr>
<tr>
<td>WinNC, CNC programming software, machine license</td>
<td>2</td>
</tr>
</tbody>
</table>

**Optional:**
– Upgrade to MTRL17 with large 6-axis robot RV-2A instead of RV-1A.
– Upgrade COSIMIR® package to 1 x Industrial and 10 x Educational.
Some references and pictures

- China: MTLR10 with FMS50
- Finland: MTLR16
- Germany: TR5
- Iran: MR5 with Festo 3 axis robot and MPS®
- Mexico: MR5, MR10, MTR11, MTLR16
- Saudi Arabia: MTLR5
- Turkey: MR5, MTLR5, MTLR17, MTLR30 with machine series 300 similar to MTLR17
- Egypt: similar to MTLR17

TR5

MR5 with EMCO PC Mill 55

The new EMCO concept Mill 55

Robot pick and place, feeding CNC Turn 55