Industry 4.0 Fundamentals

FOUR-COURSE-ROTATION AND HANDS-ON EQUIPMENT

Course Syllabus

Overall Concept: The course consists of these elements:

- Group Blocks, total 10 hours
- Pod Rotations, 8 groups, 6 hours each, total 48 hours
- Mini Projects, total approximately 3-6 hours
- Field Trips, total approximately 4-6 hours

The approximate time to complete the activities in this course is 65 hours.

Topic	Lesson Title	Lesson Hours	Hands-on Hours
Introduction to Industry 4.0	1. Introduction to Advanced Manufacturing	1	0
	2. Technology and Advanced Manufacturing	1	0
	3. Industrial Internet of Things	1	0
Safety	4. Safety Responsibilities	1	0
	5. Machine Safety	1	0
	6. Practicing Safety in the Workplace	1	0
	12. Types of PPE	1	0
Print Reading	18. Introduction to Print Reading	1	0
	19. Multiview Drawings	1	0
Mechanical Drives	25. Mechanical Power	1	0

Introduction to Mechatronics Systems	
Topics	**Lesson Titles**
Introduction to Industry 4.0	1. Introduction to Advanced Manufacturing
	2. Technology and Advanced Manufacturing
	3. industrial Internet of things
Safety	4. Safety Responsibilities
	5. Machine Safety
	6. Practicing Safety in the Workplace
	7. Emergency and Accident Response
	8. Hazard Materials Standards
	9. Hazardous Material Handling and Storage
	10. Fire and Electrical Safety
	11. Work Area Safety
	12. Types of PPE
	13. Equipment Safety
	14. Material Handling Safety
Hand Tools	15. Hand Tools 1
Measurement	16. Dimensional Measurement
	17. Measurement Conversion
Print Reading	18. Introduction to Print Reading
	19. Multiview Drawings
	20. Blueprint Dimensions and Notes
	21. Tolerancing
	22. Manufacturing Drawings and Scales
Precision Measurement	23. Caliper Measurement
	24. Micrometer Measurement
Mechanical Drives	25. Mechanical Power
Fluid Power	26. Introduction to Fluid Power
	27. Pneumatic Power
	28. Basic Cylinder Circuits
AC/DC Electricity	29. Basic Electrical Circuits
	30. Electrical Current and Voltage Measurements
	31. Electrical Resistance Measurements
	32. Power in Electrical Circuits
Electrical Relay Control	33. Control Logic Circuits
	34. Electrical Control Diagrams
	35. Relay Control Circuits
Robotics Programming	36. Basic Robot Operation
	37. Basic Robot Programming
Electronic Sensors	38. Introduction to Electrical Sensors

Pod Rotation Groups	Topic	Lesson Title	Lesson Hours	Hands-on Hours	Equipment
A	Hand Tools Measurement	15. Hand Tools 1	1	1	95-MSB2AB
	Safety	13. Equipment Safety	1	1	
		14. Material Handling Safety	1	0.5	
B	Precision Measurement	23. Caliper Measurement	1	0.5	990-MES1
		24. Micrometer Measurement	1	0.5	
	Print Reading	20. Blueprint Dimensions and Notes	1	0	
		21. Tolerancing	1	0	
		22. Manufacturing Drawings and Scales	1	0	
C/D	AC/DC Electricity	29. Basic Electrical Circuits	1	1	990-ACDC1
		30. Electrical Current and Voltage Measurements	1	1	
		31. Electrical Resistance Measurements	1	1	
		32. Power in Electrical Circuits	1	1	
	Safety	10. Fire and Electrical Safety	2	0	
	Electronic Sensors	38. Introduction to Electrical Sensors	1	1	990-SN1
E	Fluid Power	26. Introduction to Fluid Power	1	1	990-PN1
		27. Pneumatic Power	1	1	
		28. Basic Cylinder Circuits	1	1	
F	Electrical Relay Control	33. Control Logic Circuits	1	1	990-EC1
		34. Electrical Control Diagrams	1	1	
		35. Relay Control Circuits	1	1	

G	Robotics Programming	36. Basic Robot Operation	1	1	14551-HS
		37. Basic Robot Programming	1	1	
	Safety	11. Work Area Safety	1	0	
		7. Emergency and Accident Response	1	0	
H	Measurement	16. Dimensional Measurement	1	1	990-MES1
		17. Measurement Conversion	1	1	
	Safety	8. Hazard Materials Standards	1	0	
		9. Hazardous Material Handling and Storage	1	0	

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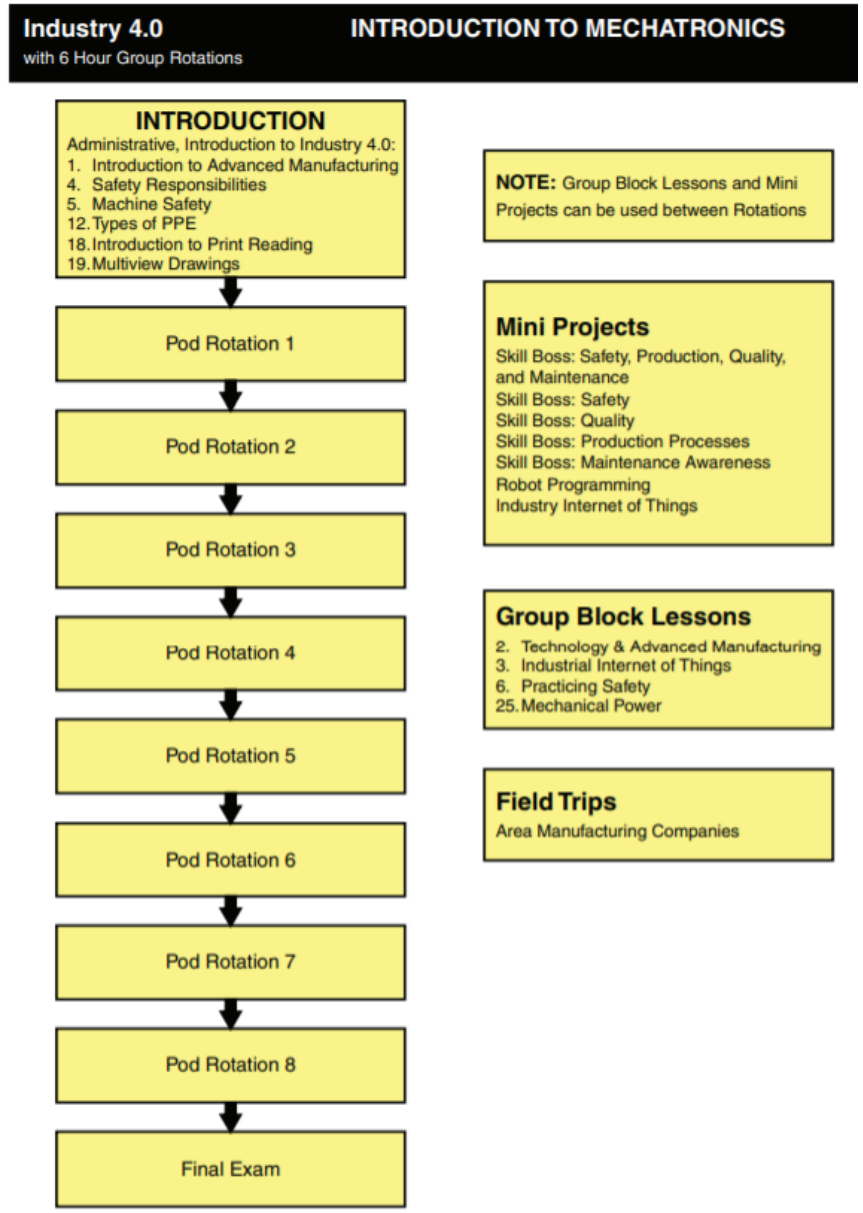


Give the student point scores for each skill on the following basis:

4..... Mastered Skill - with no assistance on first try
3..... Mastered Skill - with no assistance on second or more tries
2..... Can Perform Skill - with no assistance, given enough time
1..... Can Perform Skill - with assistance
0..... Cannot Perform Skill

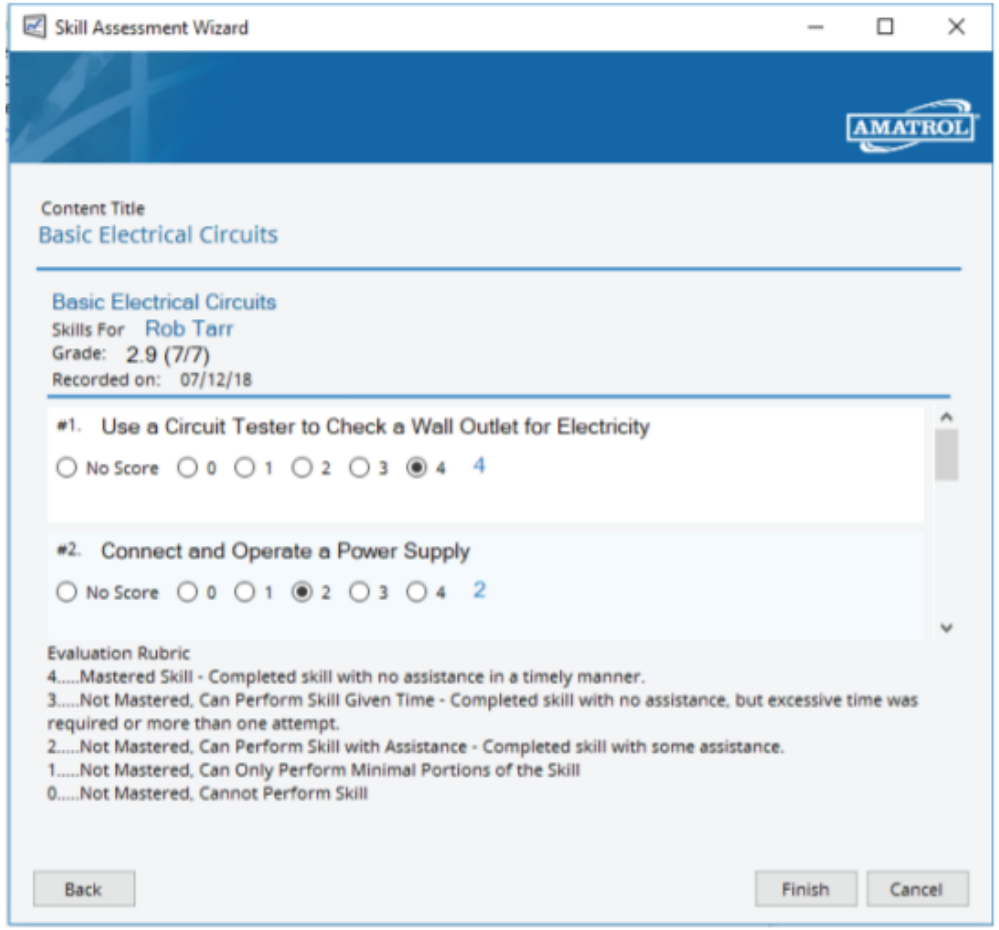
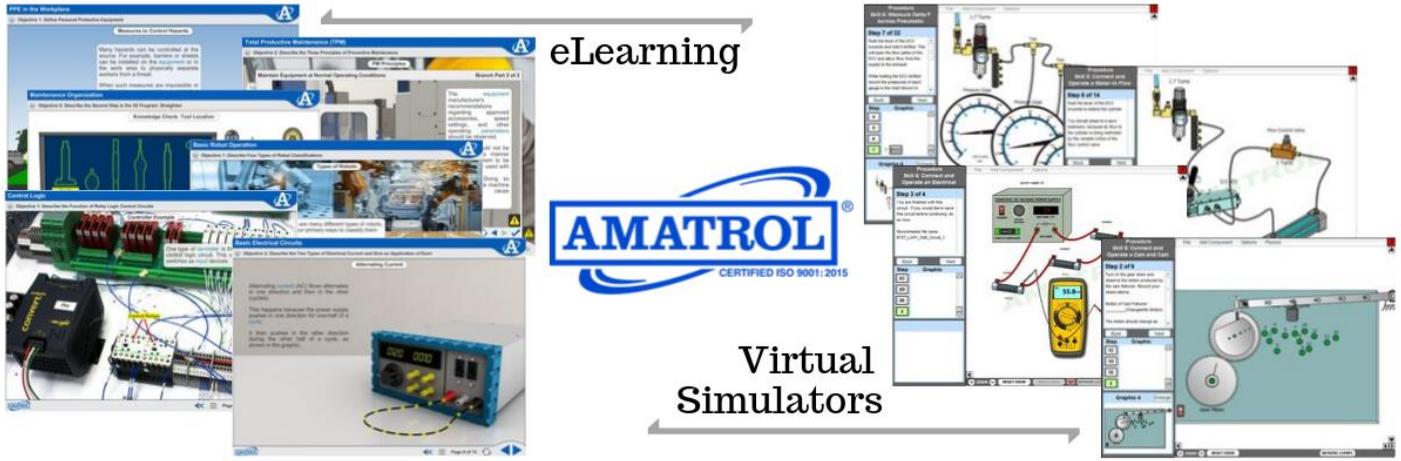


Figure 12. Skill Assessment within the LMS

Course 1: Intro to Mechatronics

95-MSB2AB	Skill Boss Allen-Bradley
33934	Hand Tool Kit Package-Skill Boss



PART NUMBER	DESCRIPTION OR PHOTO
990-ACDC1	Portable AC/DC Electrical Learning System
990-EC1	Portable Electrical Control Systems Learning System

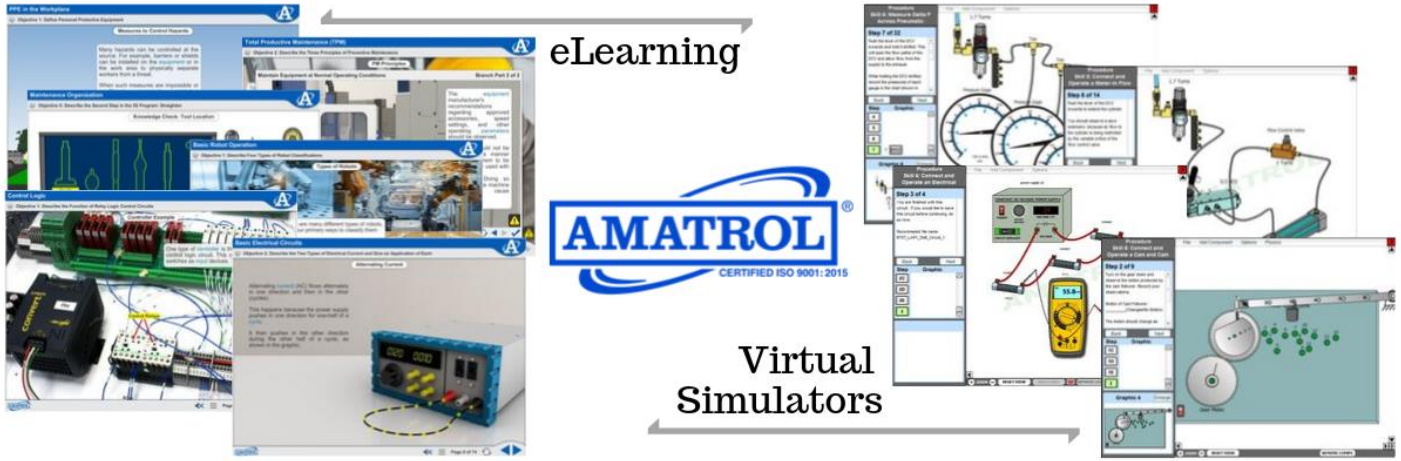
990-PN1	Portable Pneumatics Learning System
990-MES1	Portable Measurement Tools Learning System

990-SN1	Portable Electronic Sensor Learning System
87-TVCAB	Tabletop Smart Factory Visual Communications Learning System - Allen-Bradley Functional software used as standalone software used for web-based data acquisition, production monitoring, and maintenance management.

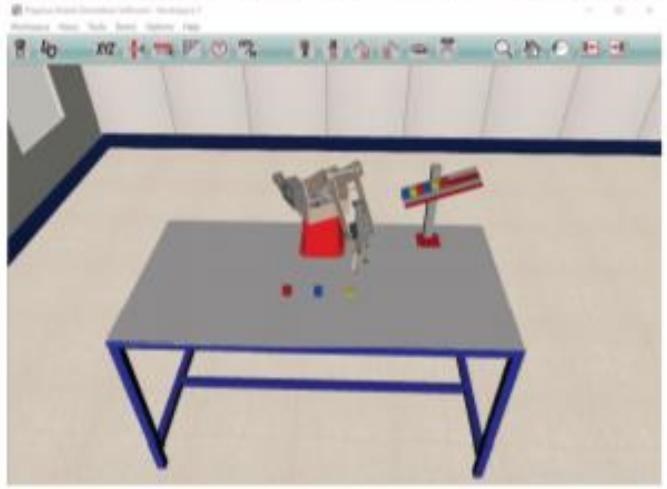
87-TENAB82	Tabletop Mechatronics Smart Factory Ethernet Learning System – AB Micro820
Optional Equipment for this course	
96-ROB1	Robotics 1 Learning System

Course 2: Intro to Industrial Controls

95-MSB2AB	Skill Boss Allen-Bradley
33934	Hand Tool Kit Package-Skill Boss

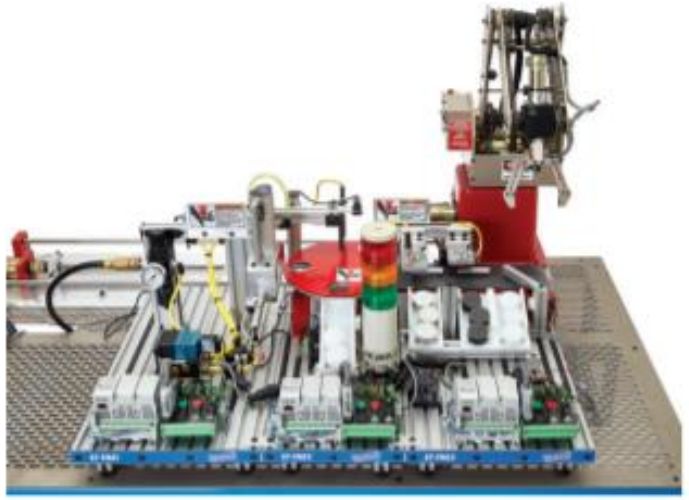
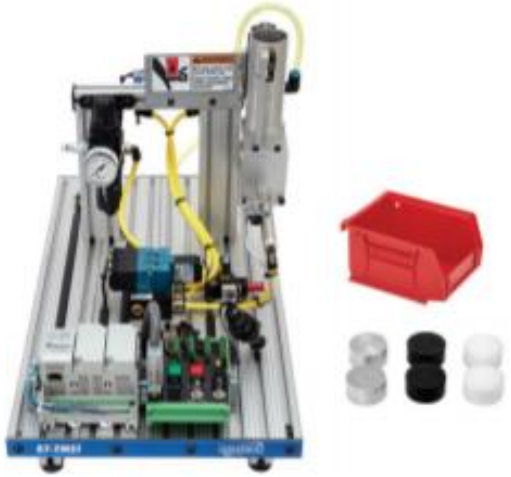


PART NUMBER	DESCRIPTION OR PHOTO
990-SN1	Portable Electronic Sensor Learning System
990-PN1	Portable Pneumatics 1 Learning System

990-EC1	Portable Electrical Control Systems 1 Learning System
14554-HS	Pegasus Robot Simulation Software Functional software used as standalone simulation software 

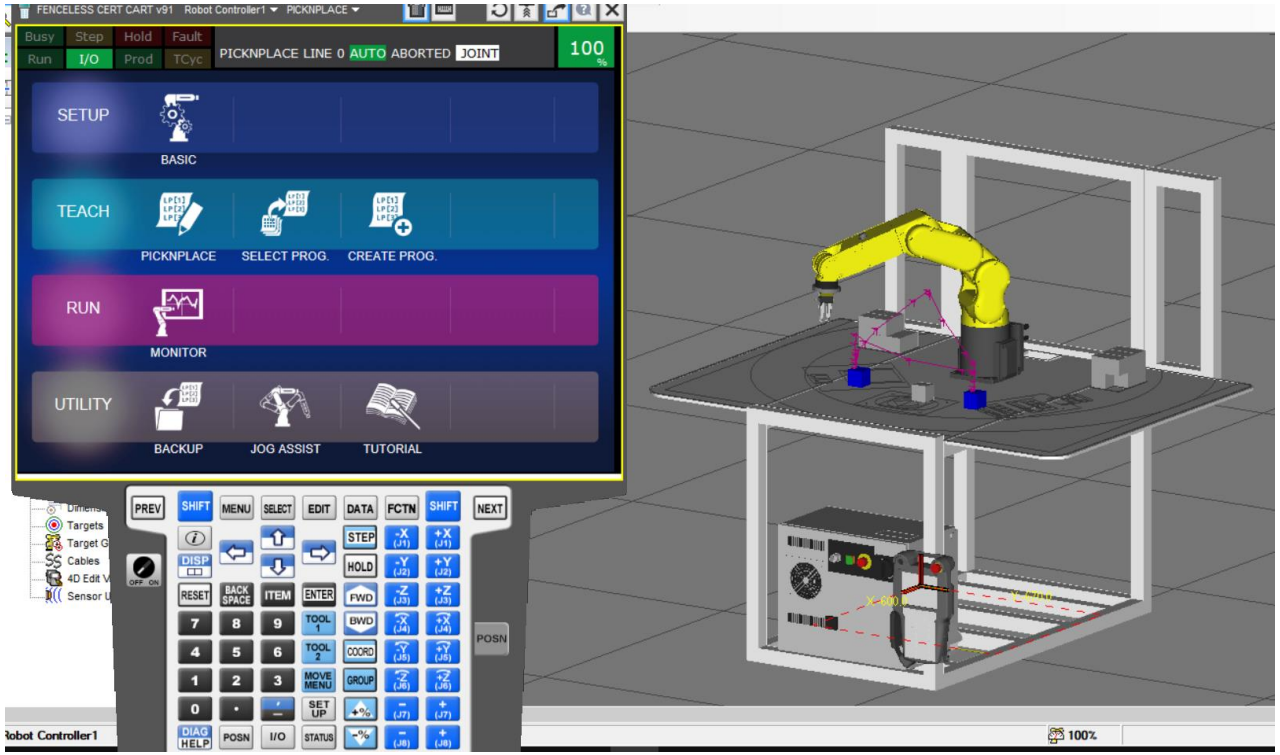
96-ROB1	Robotics 1 Learning System
96-ROB2A	Robotics 2 Learning System

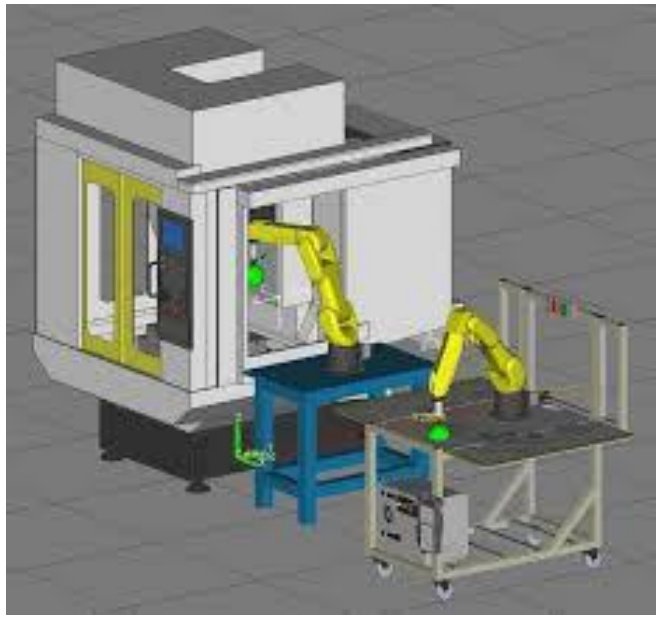
990-BH1 BASIC HYDRAULICS
Basic Hydraulics
Student Reference

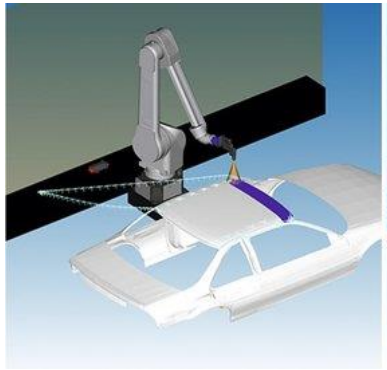
870-PTAB82	Table Top Mechatronics Learning System – AB Micro820 
87-TMS1	Inventory Station - Tabletop Mechatronics 

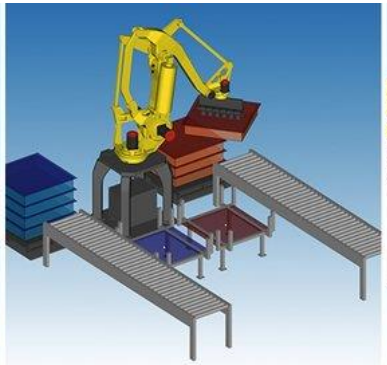
Optional Equipment for this course	
96-CNC1	CNC Machines 1 Learning System (Optional)

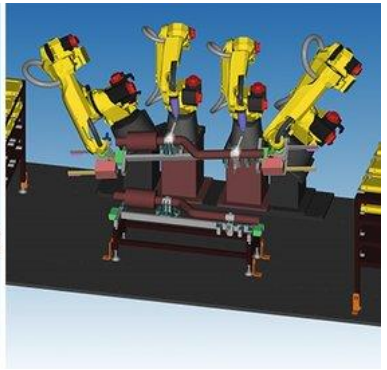
Course 3: Intro to Industrial Robotics

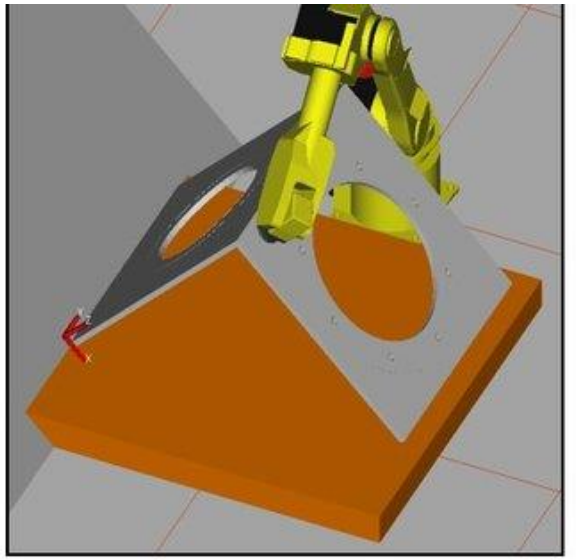


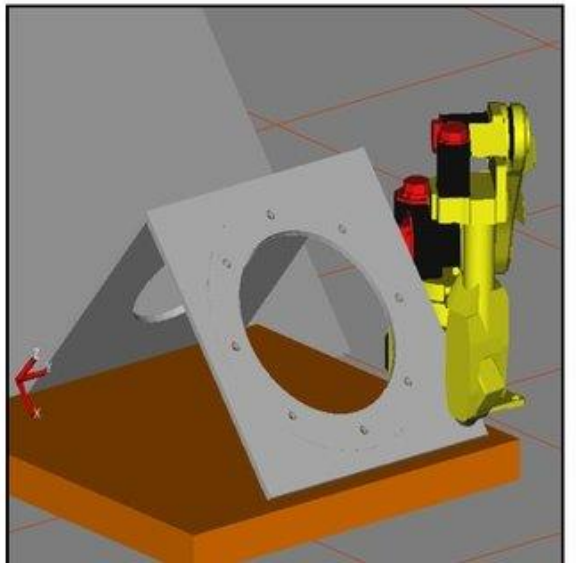












An Integrated Method for the Geometric Inspection of Wind Turbine Hubs with Industrial Robot

Journal of Intelligent Computing Vol. 7

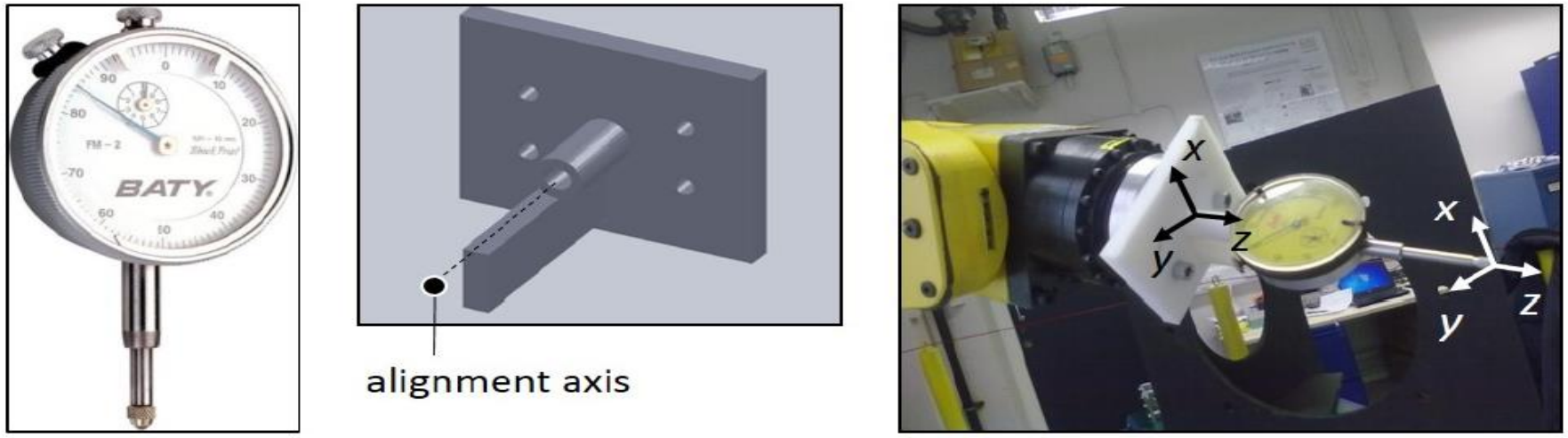
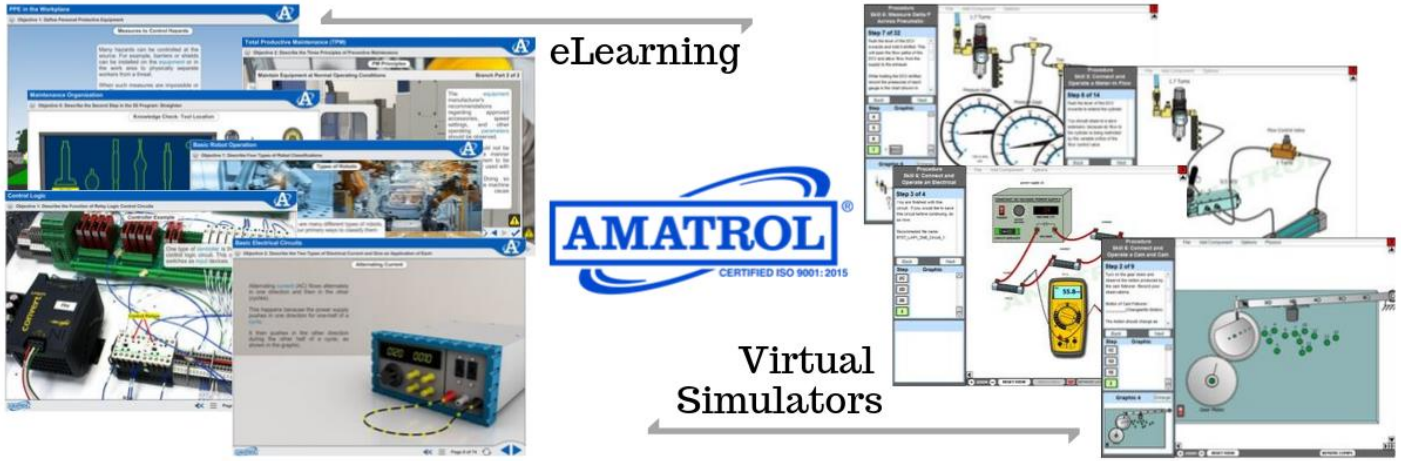


Figure 5. The robot-HLC registration set-up: a Baty CL1 dial test indicator (left panel) is mounted on the end-effector flange of Fanuc M6-iB Robot Arm (right panel) by means of an ABS customized support (central panel)

Secco, Emanuele & Deters, C. & Wurdemann, Helge & Lam, Hak-Keung & Althoefer, Kaspar. (2016).

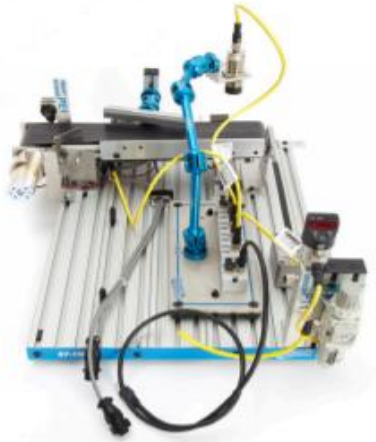
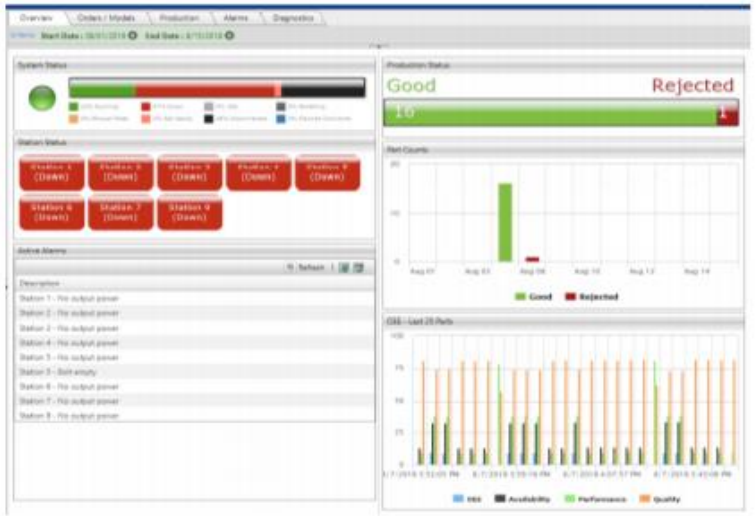
Course 4: Intro to IIoT

95-MSB2AB	Skill Boss Allen-Bradley
33934	Hand Tool Kit Package-Skill Boss



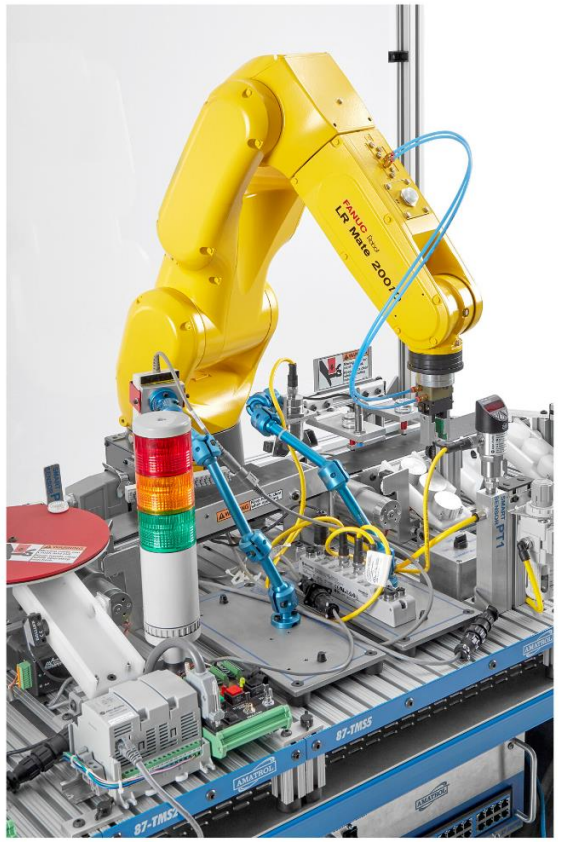
PART NUMBER	DESCRIPTION OR PHOTO
87-TVCAB	Table Top Smart Factory Visual Communications Learning System - Allen-Bradley Functional Software used as standalone software used for web-based data acquisition, production monitoring, and maintenance management.
87-TMS1-4 with 870-PTAB82 at Stations 1-3	Table Top Mechatronics Learning System - AB Micro820

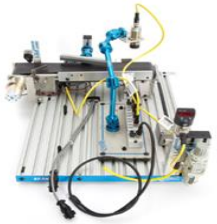
87-TMS2 (with 870-PTAB82)	Inspection Station Table Top Mechatronics
87-TMS3 (with 870-PTAB82)	Distribution Station Table Top Mechatronics

PART NUMBER	DESCRIPTION OR PHOTO
87-TMS5AB1	Tabletop Smart Factory RFID/ Sensors Learning System – AB L16 
87-TMEAB	Tabletop Smart Factory Manufacturing Execution Learning System (IGear Pulse Software) 

PART NUMBER	DESCRIPTION OR PHOTO
82-8RSM RS or 82-800	RS Logix 500 Mini or Studio 5000
990-PABCL1F	Portable PLC Troubleshooting Learning System – AB CompactLogix includes FaultPro

Capstone: Intro to IIoT



PART NUMBER	DESCRIPTION OR PHOTO
87-TMS5AB1	Tabletop Smart Factory RFID/ Sensors Learning System – AB L16 
87-TMEAB	Tabletop Smart Factory Manufacturing Execution Learning System (IGear Pulse Software)
990-PABCL1F	Portable PLC Troubleshooting Learning System – AB CompactLogix includes FaultPro