



# Flexible & Integrated Manufacturing Training

Integration of all components in a manufacturing process is the cornerstone of Industry 4.0

By connecting individual systems and sharing results of each process, industrial plants can be optimized to run more efficiently, monitored to be better maintained and deliver more uptime, and be flexibly customized to be more efficient and productive.

Intelitek offer training and curriculum for a broad range of interdisciplinary skills that prepare students for jobs in 21st century industry. This Industry 4.0 Training system is a capstone project approach for schools to offer a comprehensive platform where students can implement and practice the variety of skills they learn.

The Industry 4.0 Manufacturing Cell (I4MC-1000) is a configuration where systems integration, maintenance, design, and operation can be implemented, learned and tested.



# Comprehensive Industry 4.0 Integrated Solution

## 1 Electrical Systems

Electrical circuits, control systems and motors are a core building block of any manufacturing process. Students learn to understand, troubleshoot, build and maintain electrical systems.

## 2 Mechanical Systems

Machines for manufacturing, movement and operation of products rely on mechanical systems. Students learn about conveyors, pulleys, belts, shafts, bearings, and gears, and how to service and maintain them.

## 3 Sensors and Machine Vision

Visual sensors and many other sensors are used in manufacturing processes to enable the system and to ensure safety. Students need to be able to understand the operation of sensors and how they are integrated into the system control and automation.

## 4 Pneumatics & Fluid Power

Pneumatics and in larger systems, hydraulics are an efficient way to actuate mechanical systems. Understanding the fundamentals of pneumatics operation and how to use, build, operate and maintain them is a valuable part of understanding how industrial processes work.

## 5 Maintenance and Troubleshooting

Stuff breaks! Designing for reliability, performing predictive maintenance, troubleshooting skills and servicing are important parts of industry systems. Students should learn to put maintenance and troubleshooting high in the list of priorities

## 6 Automation with PLCs

Using a PLC (Programmable Logic Controller), students learn to control and monitor the flow of workcells and systems. Integrating the machines, robots, accessories and sensors is what makes a factory floor environment Industry 4.0 compliant.

## 7 Robotics & Parts Manipulation

Robots enable repeatable, accurate, and reliable parts, and product handling. Students in modern manufacturing must understand how robots work, how to operate and program them, and what can be done with robotics.

## 8 Integration, Networking IIOT & Cloud

Industry 4.0 pivots around information flow and sharing. Using advanced connectivity of systems and devices, and by sharing data from every part of the process across the system, technicians, operators, supervisors, specialists, designers, integrators, and managers can monitor, adjust, maintain and improve their systems.

## 9 Data Collection and Analysis

Graduates of programs can obtain industry certifications from leading vendors that are testaments to their job readiness and recognized by employers worldwide.

## Interdisciplinary Training for Industry 4.0

- Manufacturing Fundamentals
  - Safety
  - Tools
  - Measurement and QC
  - Maintenance
  - Manufacturing Processes and Definitions
- Electrical for Industry
  - Basic Power Electricity
  - Electrical Control Systems
  - Industrial Power Electronics
- Mechanical Systems
- Sensors
- Machine Vision and Quality Control
- Pneumatics
- Hydraulics
- Automation and PLCs
- Robotics and Materials Handling
- Networking and Cybersecurity
- Data Collection and Analysis
- Simulation and Planning
- Process Management

# Industry 4.0 for Education

TECH LEARNING  
CREATIVE THINKING  
CAREER SKILLS

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# Industry 4.0 Areas of Focus

## Core Skills

**Fundamentals of Manufacturing:** courses and curriculum to build basic skills and understanding of the components in manufacturing environments.

- Electrical Systems
- Mechanical Systems
- Hydraulics
- Pneumatics
- Motors
- Robotics
- Machining
- Machine Vision
- Employment Skills

## Maintenance and Operation

**Industrial Maintenance and Basics of Automation:** Learn the nuances of manufacturing and complexities of advanced systems that are used in manufacturing and how to control and manage those systems.

- Safety
- Intro to Advanced Manufacturing
- Lean Manufacturing
- Soft skills
- Tools and Planning
- Measurement and Blueprint Reading
- Quality Control

## Integration and Automation

**Manufacturing cell setup** Study the pieces that tie advanced manufacturing components together to create a smart factory.

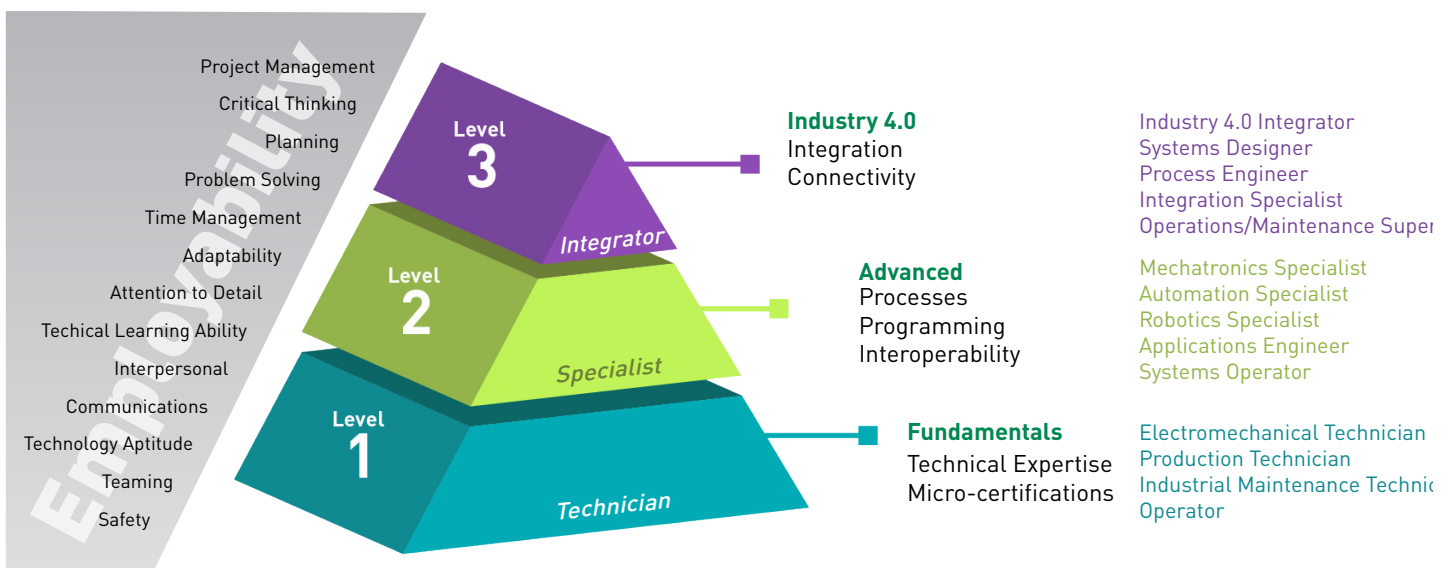
- Automation and PLCs
- Networking and Communications
- Data collection and analysis
- Flexible manufacturing Systems
- Computer Integrated Manufacturing

## Design and Optimization

**Advanced integration and multi-cell integration** Here, advanced students will practice the design and integration of actual industry 4.0 processes and create a multi-stage manufacturing process.

- Simulation
- Process Design
- Advanced Networking for integration
- IIoT and Cloud Integration
- Cybersecurity Awareness
- Preventative Analysis and Maintenance
- Optimization and Efficiency

# Building Expertise in Industry 4.0 Technologies



# Industry 4.0 Training - Student Benefits

Advanced Manufacturing Systems help businesses to create better products, become more efficient, and increase revenue as time goes on. Teaching these skillsets to students early on will serve to prepare them for their transition into industry.

## Complete Training Solution

Intelitek training systems provide students hands-on experience with industrial level equipment and applications within a lab environment. The modularity and flexibility of the training allows it to be configured into an educational program that best suits a school's needs and budget. Training solutions from Intelitek are supplied as turnkey solutions, together with professional development, installation.

## Supports Your Curriculum

Intelitek Training integrates with stand-alone disciplines like Mechanical Engineering, Electrical Engineering, and Manufacturing Engineering as well as cross-disciplinary programs like mechatronics, informatics and industrial engineering. Industrial level hardware combined with configuration and simulation software and interactive E-learning content makes Intelitek training unique.

## Industry Aligned Training

Intelitek delivers a complete training package optimized for education and aligned with industry 4.0. The program is based on decades of collaboration with industry and education partners and the self-guided or instructor led curriculum align with industry defined competency requirements.

## HOW TO BUILD YOUR INDUSTRY 4.0 TRAINING PROGRAM:

### 1 Deliver skills training for core topics

- Electrical
- Mechanical
- Pneumatics
- Hydraulics
- PLCs
- Automation
- Networking
- Machine vision
- Mechatronics

### 2 Configure the Industry 4.0 Manufacturing Cell

Use the I4MC-1000 cell to implement an Industry 4.0 Capstone project where students will use their interdisciplinary training to learn systems integration, troubleshooting, maintenance and automation. Students, build, interconnect, configure, troubleshoot and operate the cell.

### 3 Expand the system to enhance the scope of Industry 4.0 learning

Integrate advance training and skills specific to Industry 4.0

- Robotics
- Machine Vision
- Sensors
- Machining
- ERP/MES



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# Industry 4.0 Manufacturing Cell (I4MC-1000)

The I4MC-1000 cell is a fully configured emulation of an industrial plant with a comprehensive range of mechanical, electrical, pneumatic and automation components for students to construct, operate and troubleshoot. The cell is a learning environment for a school, where students can become practiced in manufacturing processes and expand their skill-set to advanced Industry 4.0 operations.

The cell can be expanded to integrate additional components like machining, robotics, sensors, advanced networking, and can be interfaced with data collection and analysis applications, IIoT components, control and analysis software (ERP and MES) and remote cloud applications to fully integrate Industry 4.0 into the learning experience.

Once operational, faults analysis, skills exercises and integration projects can be introduced by the instructor to expand the knowledge of the students.



## Documentation and Operating Instructions

- Supplied for each task in standard industry format
- Work orders and operating procedures
- Electrical schematics and mechanical drawings
- Observable and measurable performance standards
- Maintenance supervisor signoff /assessment

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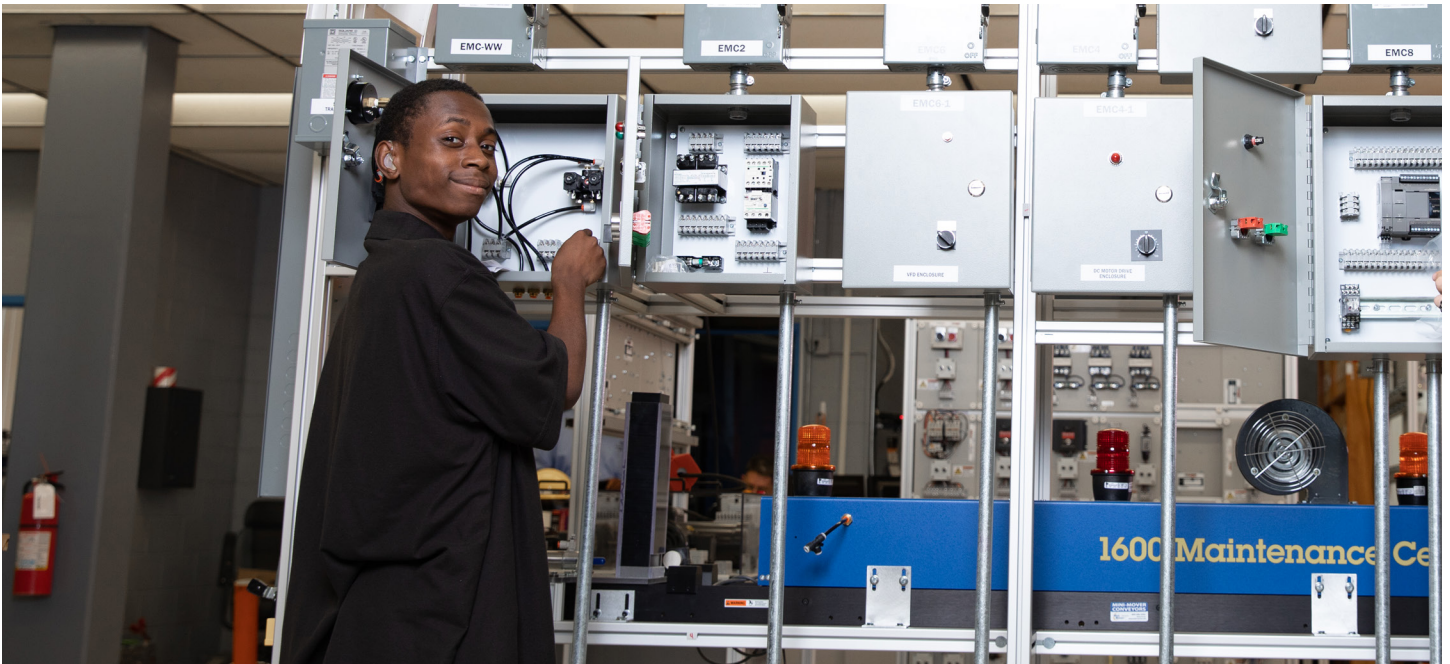


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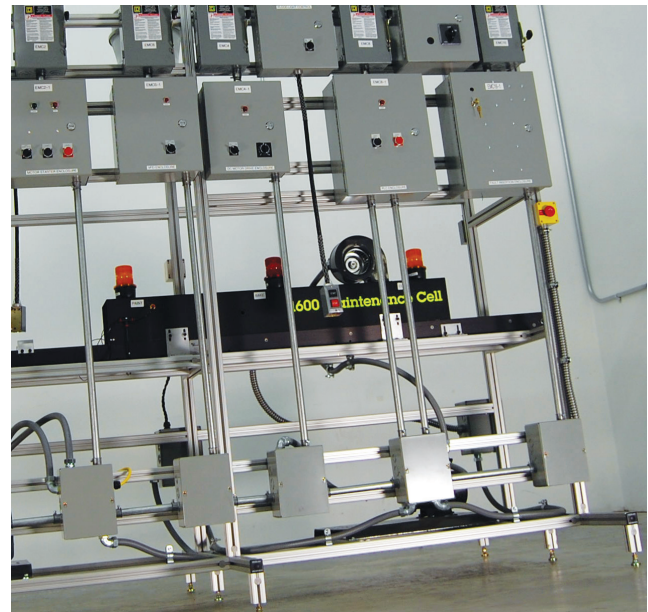


## I4MC-1000 Cell Description

In a footprint of 5.6 square meters (60 square feet), the JobMaster® 1000 Industry 4.0 Manufacturing Cell simulates an automated manufacturing operation of an industrial plant. This platform, often used as a capstone project for a study program, delivers relevant skills in the installation, operation, troubleshooting and maintenance of industrial equipment.

The base cell includes electrical power distribution and controls, wiring, conduit and equipment housings, motors, a simulated industrial process and automation through a PLC system. The cell is enhanced with industry 4.0 communications using IP networking. Students gain an understanding of industrial processes by installing, operating and troubleshooting sub-systems onto the cell including::

- Electrical Systems
- Conveyor Drive and Control
- Parts Manipulator and Controls
- Simulated Paint, Bake and Cool Process Tunnel
- Motors, Motor Controls and Drives
- PLC Control with HMI
- Networking
- Maintenance Components
- Pneumatic System and Controls
- Instructor Fault Insertion System



The construction of the cell can be performed entirely by the trainees. Using industry-standard work orders, standard operating procedures, schematic diagrams and technical manuals as resources, students assemble the components and install the electrical wiring and controls for the cell and add-on components.

# Manufacturing Cell Learning Modules

## Project Planning

- Review Manufacturing Cell blueprints
- Create installation plan
- Assign tasks and schedules
- Hold weekly project meetings to review progress

## Basic Manufacturing Cell Frame

- Work Order 1 Assemble the Base
- Work Order 2 Assemble and Install the Conveyor Mount
- Work Order 3 Install Crossbars and Top Members
- Work Order 4 Inspect & Align Completed Frame

## Electrical and Control Enclosures

- Work Order 5 Install Pull Boxes
- Work Order 6 Install Equipment Enclosures
- Work Order 7 Install Fuse Box and Station Transformer

## Conduit & Fittings Installation

- Work Order 8 Cut and Ream Conduit
- Work Order 9 Wire & Connect Main Power Cord
- Work Order 10 Install & Connect Circuit Breakers
- Work Order 11 Install Equipment Grounds
- Work Order 12 Perform Megohmmeter Tests

## Conveyor, Conveyor Drive & Controls

- Work Order 13 Install Conveyor
- Work Order 14 Install Conveyor Drive Components
- Work Order 15 Install and Align Conveyor Drive Chain
- Work Order 16 Install Conveyor Drive Safety Guard
- Work Order 17 Install and Connect Conveyor Drive Work
- Work Order 18 Install Emergency Stop Circuits
- Work Order 19 Perform Circuit Continuity Tests
- Work Order 20 Megger Test Conveyor Drive
- Work Order 21 Test and Troubleshoot Conveyor Drive

## Predictive/Preventive Maintenance

- Work Order 22 Lubricate Conveyor Drive
- Work Order 23 Verify Conveyor Alignment
- Work Order 24 Verify Drive Chain Alignment
- Work Order 25 Obtain Vibration Profiles

## Part Manipulation

- Work Order 26 Install Part Stacker and Feeder Tray
- Work Order 27 Install Part Kicker
- Work Order 28 Install Stacker Part Sensor

## Paint, Bake and Cool Tunnel

- Work Order 29 Install Tunnel
- Work Order 30 Install Paint Nozzles
- Work Order 31 Install Paint Bake Heaters
- Work Order 32 Install Part Count Sensor
- Work Order 33 Install Paint Tunnel Status Indicators

## Programmable Logic Controller (PLC)

- Work Order 34 Install the PLC
- Work Order 35 Rough-In PLC Power
- Work Order 36 Install HMI Panel with PLC
- Work Order 37 Program PLC
- Work Order 38 Program HMI with operation functions
- Work Order 39 Program HMI with results graphs
- Work Order 40 Program HMI with Notifications
- Work Order 41 Connect PLC Input Sensor Circuits
- Work Order 42 Connect PLC Output Sensor Circuits
- Work Order 43 Troubleshoot Paint, Bake & Cool System

## Networking

- Work Order 44 Install network router
- Work Order 45 Install network cabling
- Work Order 46 Configure IP addressing
- Work Order 47 Perform connectivity tests

## Variable Frequency Drive

- Work Order 48 Install Drive
- Work Order 49 Rough-In Drive Wiring
- Work Order 50 Megger Test VFD Wires
- Work Order 51 Program and Test Drive

## Safety Function Operations

- Work Order 52 Interconnect safety cutoffs
- Work Order 53 Test Lock out/tag out
- Work Order 54 Program stack lite

## Fault Insertion System (Optional)

- Work Order 55 Install fault insertion sub panel
- Work Order 56 Rough-in power circuit
- Work Order 57 Rough-in fault insertion wiring
- Work Order 58 Install and configure triggered faults
- Work Order 59 Test triggered fault system

## Fault Insertion/Troubleshooting System

A configurable and programmable fault insertion system is an add on option. Installed as a complete system and integrated with the completed cell, fault initiating is either preset or actuated by wireless remote control. 120 faults and related troubleshooting scenarios including items like:

- shorted/open/miswired components
- intermittent wiring faults
- blown circuit fuses/electrical overloads/imbalance
- mechanical misalignment
- improper component lubrication
- equipment vibration
- improper pneumatic pressure/flow
- Up to 4 faults may run simultaneously

