

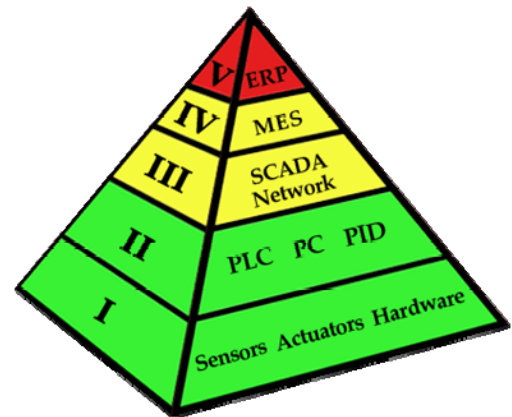
FLATE / HCC - HAS-200 Handout

1. System overview

The HAS 200 offers a realistic, hands-on experience in automated manufacturing for students and working technicians. It does this by simulating an automated manufacturing process by modeling key work-in-progress stages at 11 hands-on stations. The “product” produced by the system is simple in concept and consists of raw material (polyethylene feedstock beads of three different colors) that is sorted, weighed, containerized and uniquely labeled for different customer requirements. This ingenious system allows scenario designers to model situations of lots of varying specifications.

Specifically, the HAS 200 manufactures containerized products consisting of beads of multicolor, yellow, red or blue. Basically, the system fills the container with the product color and quantity required by the order. The container includes a bar code label that makes the product traceable and a color label that identifies the product color. The HAS200 can manufacture 19 different products; each consisting of a container filled with either red, yellow, or blue plastic beads (or any combination of the colors) in total amounts of 15, 30, or 45 grams. The HAS 200 has two modes of operations manual and automatic.

In simulating a modern, highly automated factory the HAS 200 utilizes the first 4 levels of the Automation Pyramid so that: each station knows its requirements, production quantities and communicate effectively with other stations, and the system constantly is aware of work in progress. The red color in the pyramid represents the business part of the system (Level 5). The yellow color represents the production operations of the system (Level 3 & 4). The green color represents the equipment used for production in the system (Level 1 & 2). Below is a detailed explanation of each of the pyramid levels:



Level 1: includes all the hardware in the HAS 200 in this case it is the sensors and actuators which actually perform the operations. The sensors are electronic devices used to sense a part or make measurements. Actuators are mechanisms that activate equipment by use of pneumatic, hydraulic, or electronic signals.

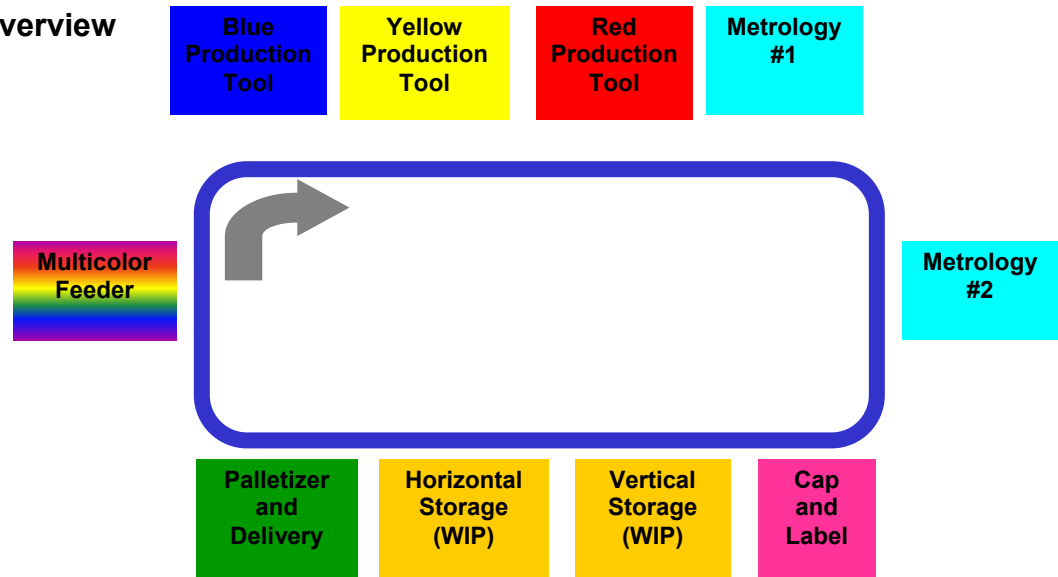
Level 2: includes everything that controls the equipment such as the PC, PID and PLC's. The PC is used for control, data acquisition, storage and database. The PID (Proportional-Integral-Derivative) controller measures an "output" of a process and controls an "input" with a goal of maintaining the output at a target value. The PLC's (programmable logic controllers) control the operation of each station.

Level 3: includes the SCADA (Supervisory Control and Data Acquisition). This tool gathers data in real time, from remote locations, in order to control equipment and conditions. It also provides data for reports and statistical analysis.

Level 4: includes the MES (Manufacturing Execution System). This tool keeps track of production schedules, inventory availability, WIP, material handling and maintains the databases.

Level 5: includes ERP (Enterprise Resource Planning) which integrates all facets of the business, including planning, manufacturing, sales, order fulfillment, billing, supply chain management and marketing.

2. Station Overview



Station 1: Multicolor Feeder - This station supplies empty multicolor-labeled boxes that get filled at production stations 2, 3, and 4.

- A mechanism comprised of a set of actuators and a vacuum, move boxes from the stocker to the conveyor belt, which is part of the Automated Material Handling System (AMHS).
- Photo detectors on the sides of the stocker provide different signals that tell the system when the stocker is running low and when it is empty.
- Up to 40 containers can be stored in the removable stocker.

Station 2, 3 and 4: Color Feeders - These production stations supply single-color boxes to the system, fill boxes with the plastic beads, weigh filled boxes, and place them onto the conveyor belt.

- They can also fill boxes supplied by the Multicolor Box Feeder station.
- These stations have removable stockers identical to those on Station 1.
- In the center of each station, a metal hopper holds the plastic beads used to fill boxes with specified amounts of material (15, 30, or 45 grams).
- After a box is filled, a scale weighs it to make sure the amount is correct; if the amount is incorrect, the box will be rejected.
- A box will also be rejected if its bar code cannot be read by the BCR or if it is not correct for the station.

Station 5 and 6: Metrology - These stations measure the height of the material contained in the boxes.

- The only difference in the stations is that Station 5 uses a digital encoder to determine the height of the content while Station 6 takes measurements with an analog linear potentiometer.
- The height is correlated to the mass. If it doesn't match the specified mass the container will be rejected.

Station 7: Cap and Label - This station puts plastic covers on completed boxes, prints and attaches labels.

- Lids are stored in a stocker similar to those on Stations 1-4.
- A direct thermal printer prints the labels that display such information as lot numbers, production dates, and expiration dates.

Station 8 and 9: Storage - These stations store both completed boxes ready to be dispatched and WIP waiting to be put back into circulation (such as empty or partially filled boxes).

- On the Vertical Stocker, up to 81 boxes can be stored in numbered cells among the two vertical racks. 56 boxes can be stored in the Horizontal Stocker.
- Both stations have a human machine interface –HMI (Allen-Bradley Touch screens) that can be used to control container movement within in the station.

Station 10: Dispatcher - This station removes boxes from the conveyor and loads them onto a two-part platform that then releases the boxes onto a ramp and out of the factory.

- The platform is divided into two bays that can store different lots of boxes simultaneously.
- A pneumatic cylinder positions the platform from side to side so that one of the bays can receive a container depending on the lot.

