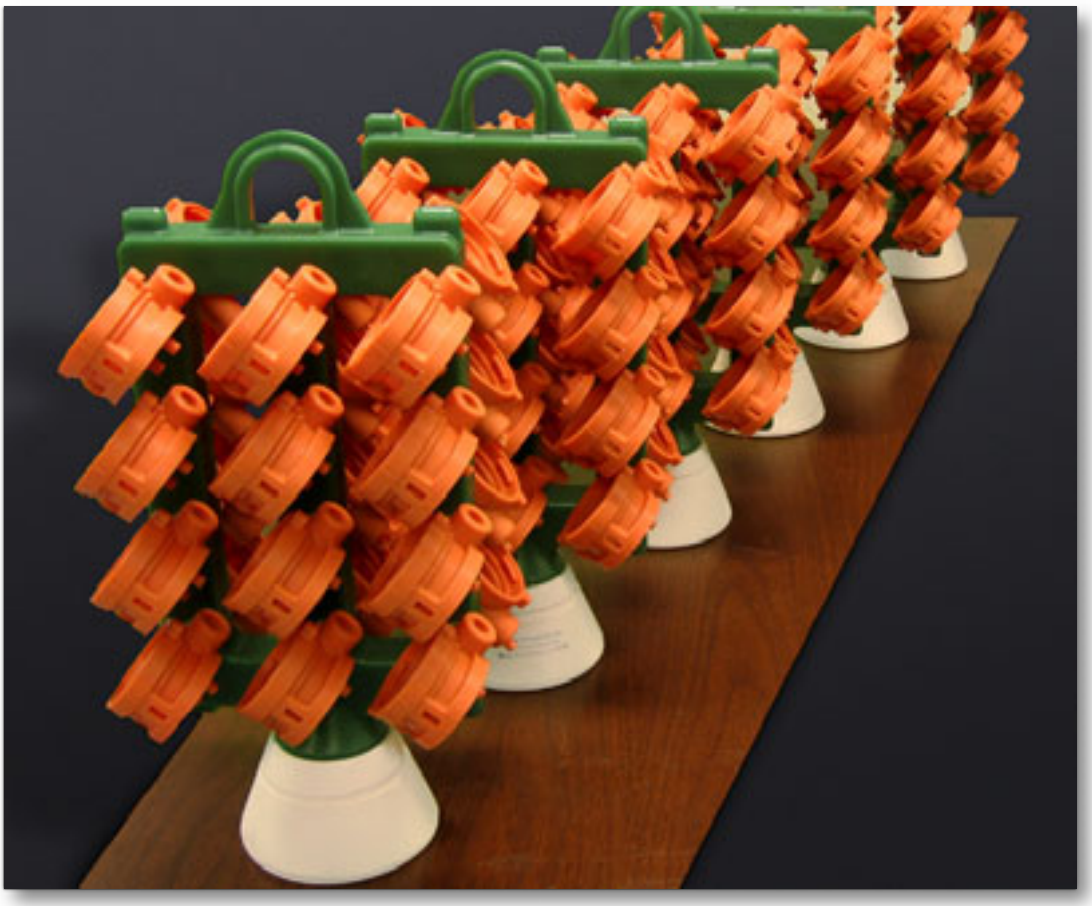
MPI, Inc.

Manufacturer of Automated Waxroom Machinery for Lost Wax Investment Casting Uses InduSoft Web Studio to Build Embedded Operator Interfaces



When creating embedded operator interfaces for a new generation of automated wax processing and pattern assembly machinery, the use of InduSoft Web Studio enabled MPI, Inc. to meet critical design objectives for functionality, operating environment, cost targets, graphical trending, recipe creation and management, and scalability.

- Because InduSoft operator interface runs on Windows CE, MPI machines can use an HMI that can withstand rugged industrial environment while meeting cost targets.
- Entire OI solution could be designed and integrated in-house by OEM engineers with only minimal assistance.
- Powerful trending feature allows detailed analysis of process results.
- InduSoft solution supports recipe creation and file management by operators. Setup time is reduced because recipes built on one machine can be transferred over network to other machines.
- Productivity reporting can be done over LAN, so that efficiency can be tracked remotely.

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Lost Wax Investment Casting

Lost wax investment casting has been used for millennia to produce intricate metal objects that can not be created any other way. While this process has always made it possible for anything that can be modeled in wax to be precisely transmuted into metal, today's sophisticated technology has moved beyond traditional uses such as fine jewelry and sculpture into the manufacture of specialized industrial parts.

In the investment process an original pattern is created by injected hot wax into flexible molds. Multiple wax patterns are then assembled on trees and used to create investment molds by coating the wax with slurry that hardens to form the investment mold. The wax is melted and baked out of the mold, the metal is poured into the cavity and then is allowed to cool. Then the mold is broken away, revealing the metal part, which faithfully reproduces each detail of the original wax (plus the gates and vents of the tree, which are cut away). Silver, gold, aluminum,

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brass, bronze, or even stainless steel may be cast.

Injection of the original wax has evolved to become a highly specialized process in its own right. Maintaining the right temperature, pressure and flow rate of the wax during the injection phase of pattern production is critical to ensuring quality and maintaining production speed. Assembly of the patterns on the trees also requires highly specialized automation tools--the objective is continuous production of fully assembled trees with precise pattern positioning and uniform welds.

MPI, Inc. is a technically advanced supplier of wax room automation equipment in the casting industry, located in the Hudson River town of Poughkeepsie, NY. Its primary market consists of manufacturers who make high precision commercial parts for aerospace applications in jet engines and turbines, and engine parts for the automotive and truck industry.

The Challenge

MPI is committed to using advanced technology and a systems approach to re-inventing operations in the wax room. The company recently designed and introduced two high-end machines for automating wax injection and pattern assembly, plus a portable unit for data analysis, using this approach.

The MPI design team identified six related challenges in designing their operator interfaces.

- *Operating Environment*

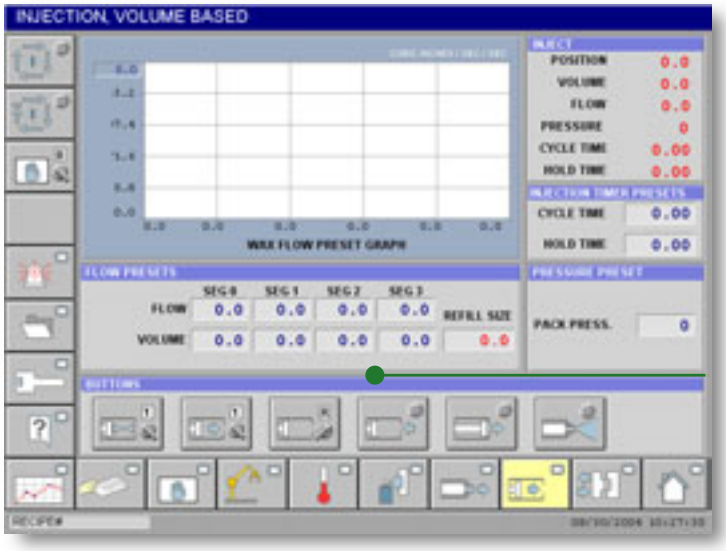
  The rugged industrial environment in the wax rooms where these machines operate imposed certain limitations. In order to reduce the chance of system failure, spinning media such as hard drives were ruled out, which left only the option of a flash-based operating system. In addition, operating conditions required the ability to reboot immediately in case of a power interruption or inadvertent operator shutdown.

- *Cost*

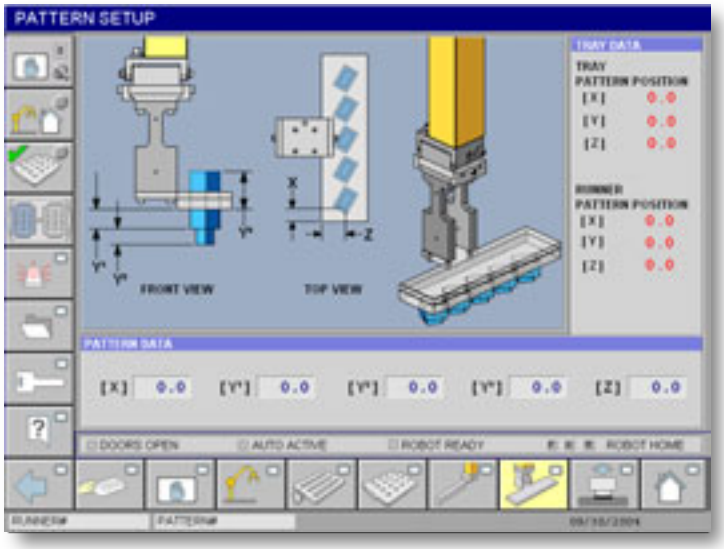
  Industrial PCs would have driven costs above target. This combined with the operating environment virtually mandated the choice of Windows CE 4.1 as their operating system.

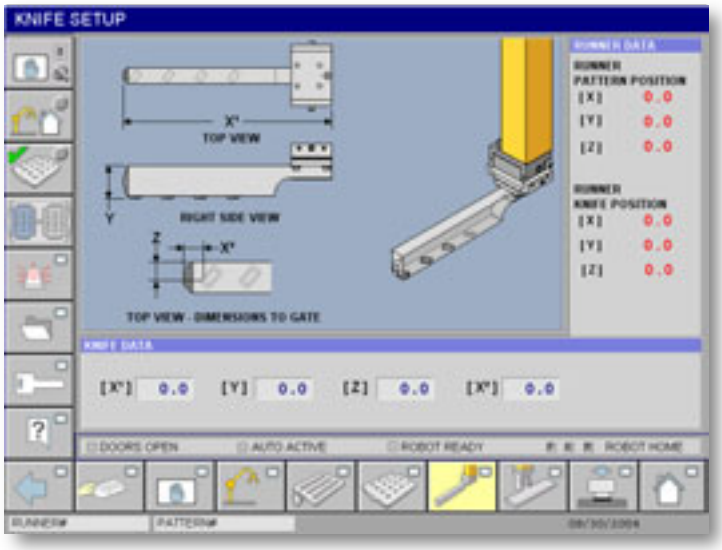
- *Trending*

  Graphical representation of the temperature, pressure and flow rate of wax during the injection process had to be made available at the operator station on a trending display that would compare realtime data with predetermined parameters.



Top right: MPI model 45-12 data monitor display
Middle right: 45-12 injection control display
Bottom right: 45-12 data monitor display





- *Recipe Creation*
  The new machines had to allow operators to create their own recipes by inputting and storing operating parameters for the creation of different patterns.

- *Recipe Management*
  Setup time is a gating factor in determining productivity. The ability to move proven recipes from one machine to another was needed in order to expedite setup and ensure consistent quality.

- *Scalability*
  For remote production monitoring, the same application used on the CE-based machines had to be able to run on a Windows 2000 PC.

The Indusoft Solution

Based on a recommendation from their hardware supplier, the MPI development team chose the InduSoft Web Studio as the tool to create embedded operator interfaces for three MPI products:

Model 4512 horizontal automatic wax injector

This is a high-volume wax injector that gives the user the ability to increase wax pattern quality, quantity and throughput. The MPI 45-12 integrates all controls into a single built-in operator interface that stores up to 400 recipes. Its integrated robotic system automates pattern processing from tool to tray, trimming and optical inspection. An intuitive, touch-screen activated interface monitors and controls injection and operational parameters. The result is an increase in the throughput of quality patterns. The operator can fully adjust and program a horizontal die lubrication system for consistent pattern ejection with no sticking. The operator controls spray on/off position, number of nozzles, spray frequency, and core lubrication in both extended and retracted position. From its quick change die clamping to instant uploading of pattern recipes the MPI 45-12 is engineered to minimize transition times and maximize the throughput of quality patterns. InduSoft made possible automated pattern processing from tool to tray. Patterns are carefully removed from the tool by MPI Robotics quick change end-of-arm tooling, then runners are automatically trimmed and patterns accurately placed on conveyors, trays, or

Top left: MPI model 20-10 data monitor overview display
Middle left: 20-10 pattern setup display
Bottom left: 20-10 knife setup display
Right: MPI model 45-12 horizontal automatic wax injector

jigs for final pattern assembly. Real time graphical representation of pattern cycles compares wax flow and pressure data to predetermined baselines. Adjustments are intelligently introduced if needed. This significantly reduces set up time.

Model 20-10 Automated Pattern Assembly System

The MPI 20-10 is the world's first fully automated pattern assembly system (APAS). It produces wax pattern assemblies with either short or long runs and is designed to optimize rapid tool changeovers and improve quality in the wax room. The MPI 20-10 utilizes stored rec

ipes and quick change tooling. It is available in semi-automatic or automatic configurations.

Model 20-20 Process Vision

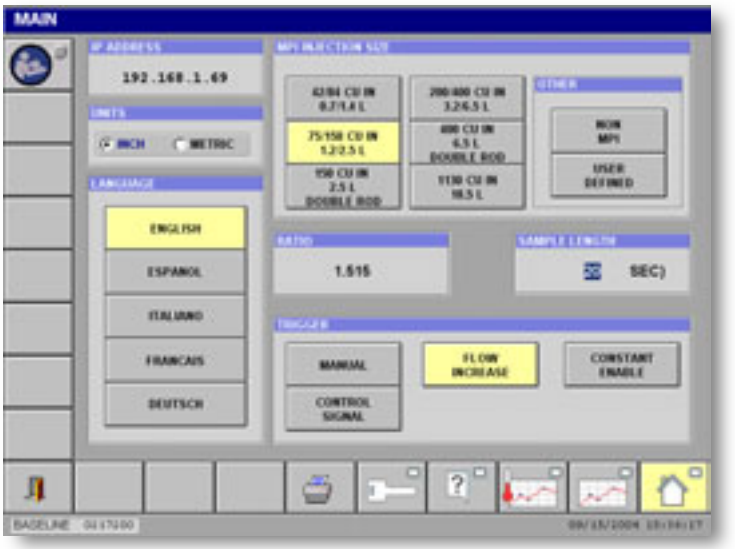
The MPI 20-20 is a data collection device in a lunchbox-size enclosure that can be taken into field to collect data and graph it; it is used extensively as part of the MPI customer support, training and process optimization program. Data from hydraulic sensors on the machine is collected via a micro PLC and uploaded to the InduSoft application running on the 20-20 and used there for process analysis.

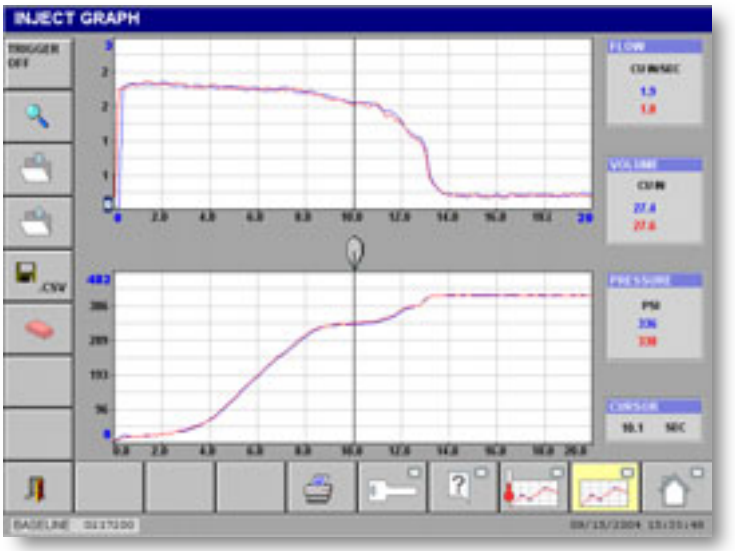
Results

MPI personnel did the majority of the programming of the operator interfaces, requiring only three days of assistance from an InduSoft engineer.

The resulting applications involved between 25 and 40 displays per machine, and utilized the recipe management function built into the InduSoft Web Studio. The OI's enable operators to use a touch-screen to create their own recipes, monitor production from a single workstation, transfer recipes between machines via a LAN, and send productivity reports for central monitoring.

Not only did the trending feature allow the necessary comparison to baseline parameters, it also had two features that improve functionality: simplified zooming for detail inspection of data, and a vertical cursor that allows the operator to read precise values at any point on the trend.





Top Left: MPI model 20-10 automated panel assembly system

Top Right: 20-20 Process Vision main set up screen. Allows operator to switch to their native language.

Bottom: 20-20 Process Vision trending page shows flow, volume and pressure of wax and supports data export to .csv file. This supports detailed production analysis.

Web-Ready InduSoft Tools for Automation

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