SUPERVISORY

SUPERVISORY

SHELL MANAGEMENT SOFTWARE

The Shell-O-Matic shell management software is designed to be intuitive to use, easing operatory navigation.

The following functions are accessible from the main screen:

- System on/off control
- System pause/resume
- Access to maintenance screen (to see I/O status and preventive maintenance)
- Log-in as a different user
- Access to the software configuration screen
- Ability to run the system for a limited number of cycles, then pause
- Unload a part (or batch, if upper button pressed)
- Load a part (or batch, if upper button pressed)
- Unload a work-in-progress part for rework and tag for future re-entry to resume dip sequence
- Load a reworked tagged part and resume dip sequence where it was left
- Make a new program (dip sequence)
- Edit a program
- View hanger list
- Edit hanger (can change recipe or dry time)
- View dip record history

HMI screens

SHELL-O-MATIC 2.1
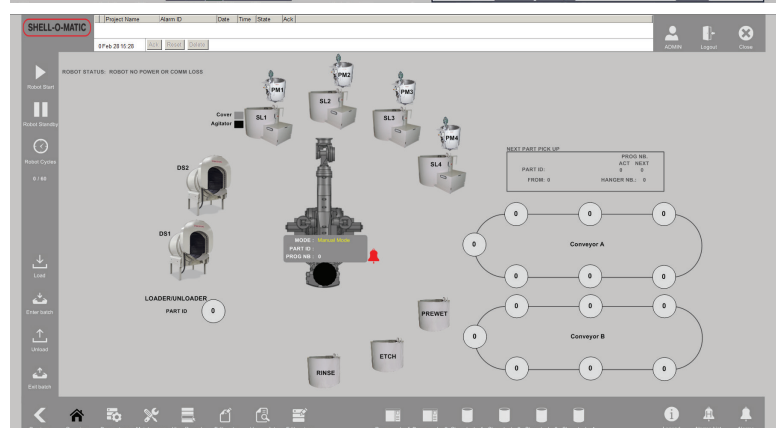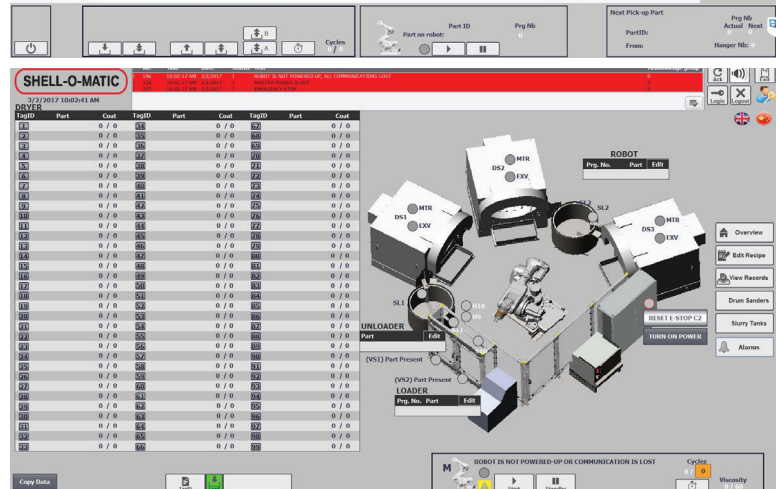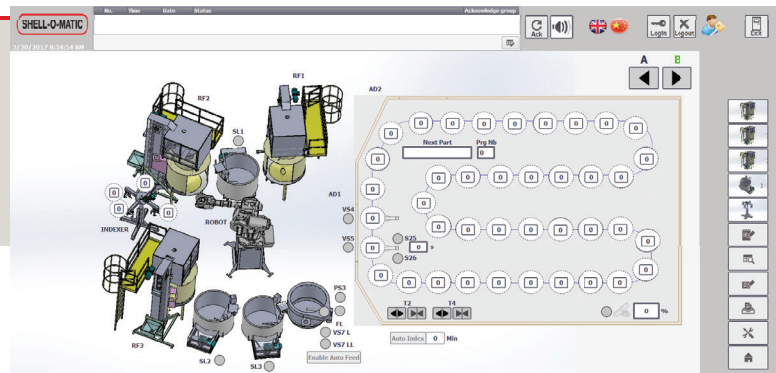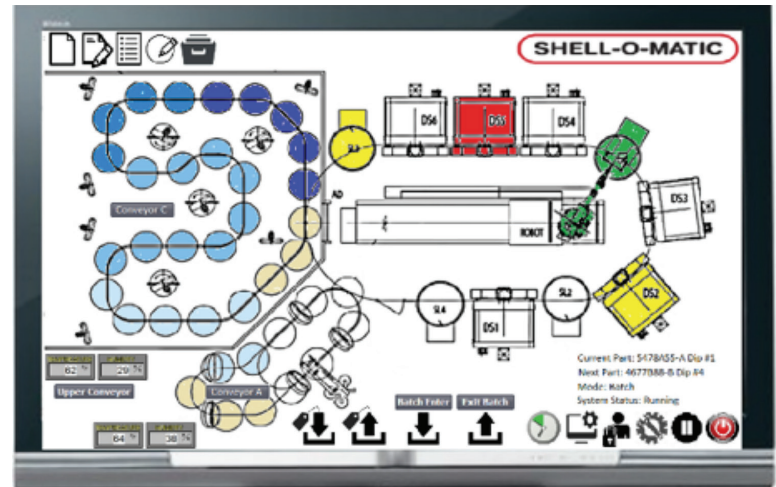
PART TRACEABILITY

The genealogy of raw material and recipe used for old fabrication is critical to master the shell-building process. Our HMI software can offer:

» Dip record showing the recipe & real drying parameters of the mold

» Genealogy of slurries and ingredients used to build specific shells

» Genealogy of sands used in the mold production

» Periodically recorded slurry parameters

» Equipment maintenance status as it was building the shells.

EQUIPMENT STATUS

From the main screen, the user can click on any piece of equipment to display its status, including maintenance, and allow for more detailed control.

The equipment screen offers the following information:

Equipment trends

Motor status (Icon is green when motor is running and black-and-white if motor is stopped. If equipped with intelligent drive, the system can display drive parameters [speed, load, etc.] using a bar graph)

Shows whether vibrator is running or not

Indicates the status of the cylinders

Shows whether the dust collector is running or not

Indicates the blower status

Indicates if maintenance is required

Slurry or sand levels
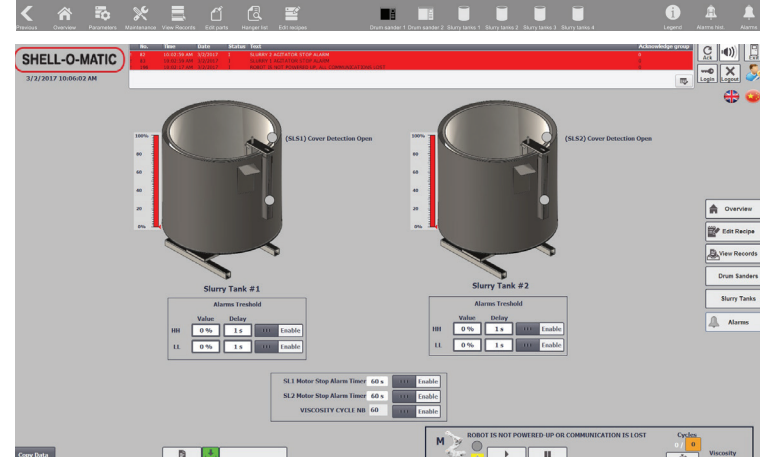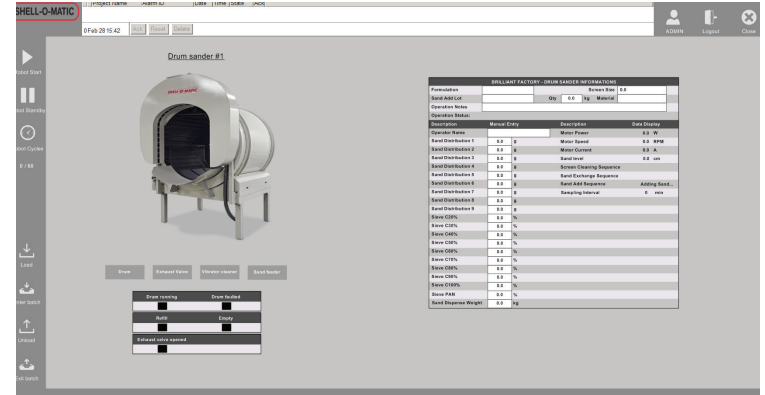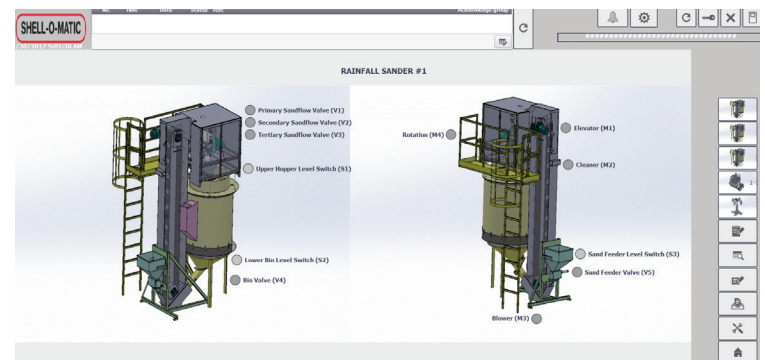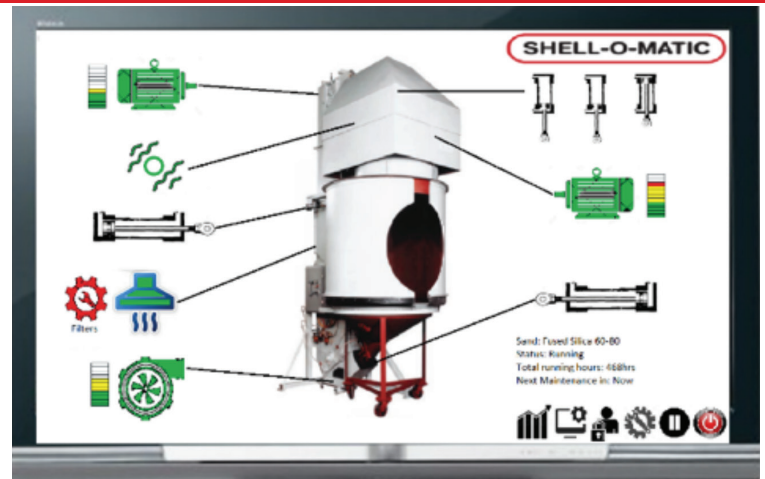
Equipment screen

SHELL-O-MATIC   2.2

SUPERVISORS FOR INDUSTRY 4.0
FROM THE SHELL-MAKING PROCESS
TO THE 'ZERO-TOUCH' FACTORY

IIoT
INDUSTRY 4.0

SHELL-O-MATIC OFFERS A RANGE OF SUPERVISORY SYSTEMS THAT ARE COMPATIBLE WITH THE INDUSTRIAL INTERNET OF THINGS (IIOT OR INDUSTRY 4.0), GIVING OUR CUSTOMERS THE LEVEL OF FACTORY AUTOMATION BEST SUITED TO THEIR NEEDS.

These systems take advantage of the new Manufacturing Execution System (MES) trend to connect the machine automation level to the company Enterprise Resource Planning (ERP) system.

Advantages of connecting these systems include:

» Ability to create "zero touch" factories by connecting machines to automate business/manufacturing processes

» Records of process variability with complete traceability

» Enhanced troubleshooting tools

» Better process standardization with more complete recipe and customer requirement flow at the machine and control level

» Better production flow control over the factory

» Real-time feedback on the parts and lots status

» More accurate scheduling

» Improved, easy-to-create and more precise KPI (key performance indicator)

» Better tracking of machine usage

» Enhanced preventive maintenance tools

» More data available for the quality system and better product traceability

ERP

MES

PLC AND SCADA

MACHINES
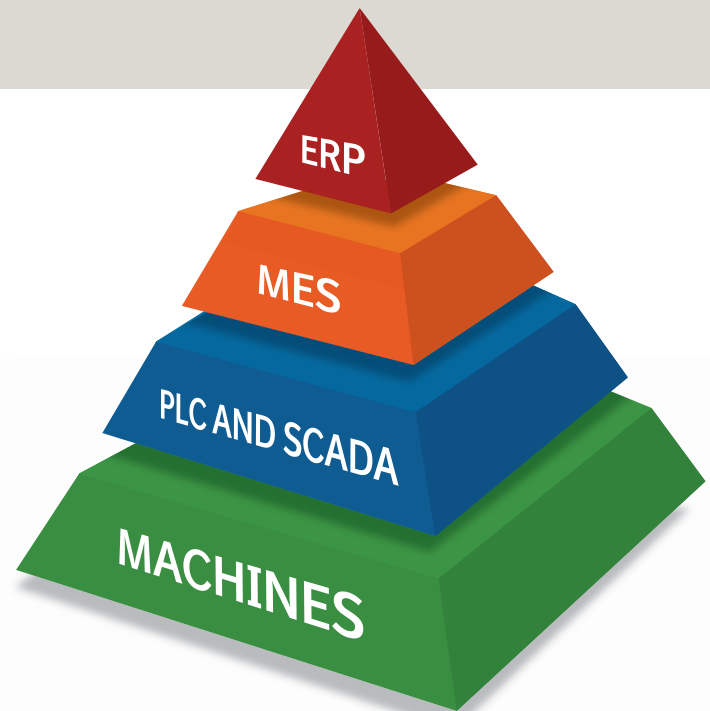
CONTROL ARCHITECTURE
A STATE-OF-THE-ART SYSTEM

FOR A TYPICAL SHELL-MAKING ROBOTIC CELL, A POWERFUL PLC SYSTEM ENABLES ALL THE CONNECTIVITY, CPU POWER AND MEMORY CAPACITY NEEDED TO MAKE A STATE-OF-THE-ART SYSTEM.

We use state-of-the-art high end PLC of reputable brands and, while most robotic cell manufacturers would provide a human-machine interface (HMI) panel with limited CPU and expansion capacity, at Shell-O-Matic we recommend an industrial PC with the use of Scada software to perform the HMI.

In a Shell-O-Matic-powered robotic cell, the PLC takes control of all the inputs and outputs (I/Os), broadcasting their status over an easy-to-configure network connected by a robust, machine-level ethernet platform.

» Reliable communication

» Easy to expand if future automation is added

» Can be connected to surrounding automated systems or higher-level IT systems

» PLC brand can be selected to match existing customer factory automation standard.

TYPICAL MACHINE-LEVEL AUTOMATION NETWORK

Switch Profinet
or Ethernet IP

PLC	I/Os

Industrial PC
with HMI
screen

Robot

I/O replicated toward a data
table to isolate machine
network from factory

Read write I/Os
to the PLC via
a control word
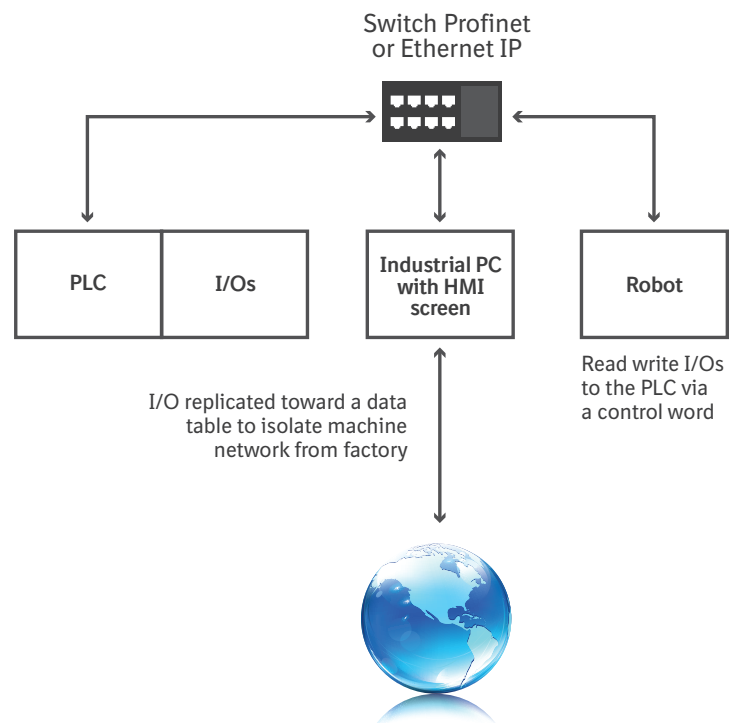
KEY CELL COMPONENTS

There are three key elements to the overall architecture: the PLC, an industrial PC displaying Scada-HMI, and an articulated robot (which connects to the rest of the system through the Ethernet communication protocol).

SCADA-HMI

» Configurable and scalable system

» Functions equally well as a small or large supervisory system:
  • Can be delivered as a basic single-station HMI
  • In a bigger system, can be turned into a distributed multi-user supervisory system

» Can be set up in multiple ways
  • In a redundant-servers fashion
  • Deploying a full factory status display

» Enables Internet-based connectivity for remote system status display

» Extensive connectivity package
  • Any vendor automation products
  • All vendor communication protocols
  • Higher-level systems and databases

ARTICULATED ROBOT

Ethernet allows the PLC to connect to any robot brand, allowing the PLC to know the real-time status of the robot, and control its functions:

» Dictate robot routine to run as a function of the part recipe

» Allow robot programs to access all I/Os and process variables

» Enhance safety and human-robot collaboration

ETHERNET COMMUNICATION BETWEEN THE PLC AND ANY ROBOT
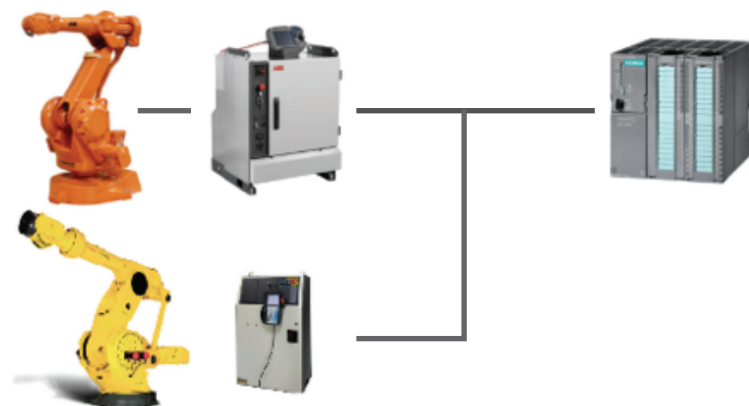
MES AND ZERO-TOUCH FACTORY
THE FUTURE IS HERE

To build Manufacturing Execution Systems (MES) in foundries, Shell-O-Matic uses the Proficy suite of software from GE Digital.

GE Digital tracks all aspects of the manufacturing process. The software comes in modules, and Shell-O-Matic designs each customer's system using just the modules required.

The Shell-O-Matic MES takes care of all automatic and manual manufacturing requirements for the plant of the future. The Shell-O-Matic MES can be used to manage the whole investment casting foundry from raw material management to casted part delivery.

The Shell-O-Matic team connects with customer engineering and management teams to tailor the MES system to the individual foundry's needs.

Enterprise Systems

ERP

Maintenace, ...

Proficy Plant Applications

Efficiency

Quality

WMS

Production

Batch

Recipe MGR

Proficy Workflow

Reporting

Historian

Control System / Production PC/HMI SCADA
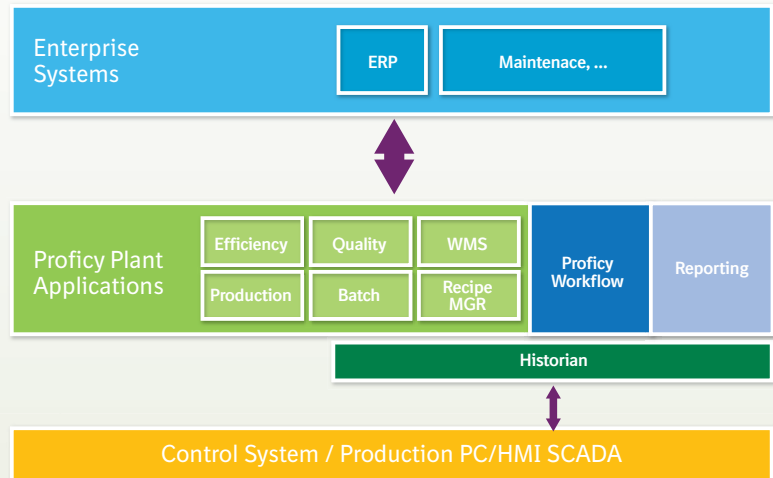
GE PROFICY SOFTWARE ARCHITECTURE

THE GE PROFICY SOFTWARE ARCHITECTURE CAN WORK WITH ANY PLC PLATFORM TO BUILD A COMPREHENSIVE MES SYSTEM.

What sets this solution apart is the GE Cimplicity software – the HMI and Scada system implemented by the industrial PC.

Not only can the GE Cimplicity software take control of a shell-making robot cell, but it can also be deployed with other GE Digital products to take control of an entire factory through an Industry 4.0 system, or the Industrial Internet of Things (IIOT).

GE Cimplicity software

GE CIMPLICITY TOOLS

The power of the GE Cimplicity software comes from its suite of tools.

PREDIX

The operating system for the Industrial Internet, Predix powers the industrial app economy. With broad ecosystem support, Predix-based apps are unleashing new levels of performance for industrial assets.

BRILLIANT MANUFACTURING

Connecting streams of machine data to powerful analytics and people, GE Cimplicity tools provide industrial companies with a Brilliant Factory approach.

» Valuable insights to manage assets and operations more efficiently

» World-class talent and software capabilities

» Big gains in productivity, availability and longevity

HISTORIAN

The heart of the system is the Historian software, which records the status of all probes and variables in the system. That data is then used by the other proficy modules to create all the functions of a MES system.

Don't be fooled by its small footprint – Historian can scale to support hundreds of users and millions of individual machine data points.

» Provides administration and trending capabilities following install and tag configuration

» Supports high availability and data-redundancy needs through out-of-the-box data-mirroring
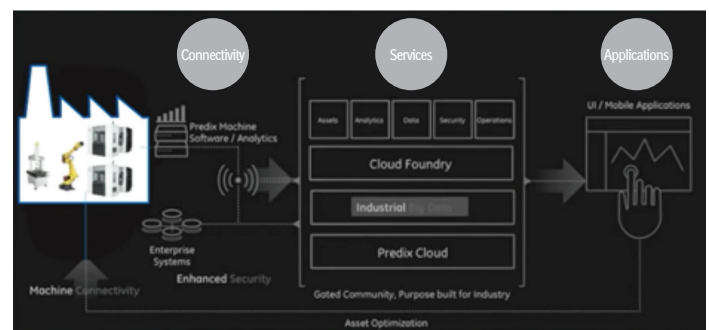
GE Digital IIOT model

SHELL-O-MATIC

MES ELEMENTS

The MES connects the streams of machine data to powerful analytics and people, providing industrial companies with valuable insights to manage assets and operations more efficiently.

The MES is made up of a series of GE Digital modules, including:

» Historian – Central information storage for all data coming from the plant. Everything starts with data, making this the heart of your entire system

» Open Enterprise – Connects the MES to any ERP on the market, showing real-time order status as well as feeding all orders and data to the MES to handle their execution in the automated factory

» Scheduler – Compares customer orders with availability of staff, material and equipment in real time to enable live interactive production planning. Also guides material flow across the factory to ensure manufacturing cells are fed the right materials and recipes to make the right products

» Plant Applications – As the brain of the MES, it performs three core functions: OEE (downtime/efficiency), Quality (SPC), and Production (traceability, mass balance, label-printing, interface to ERP)

» Workflow – Simplifies tasks for operators/technicians by guiding them through required steps of their product processes

» HMI/Scada – Provides various visualization tools throughout the system

» CSense – Pinpoints the causes of production and process variations and executes actions to notify or automatically eliminate production stoppages or quality issues before they happen

» Maintenance Gateway – Allows the MES to connect with any Maintenance system on the market to streamline all equipment maintenance and track equipment status to automatically dispatch tasks to the maintenance crew
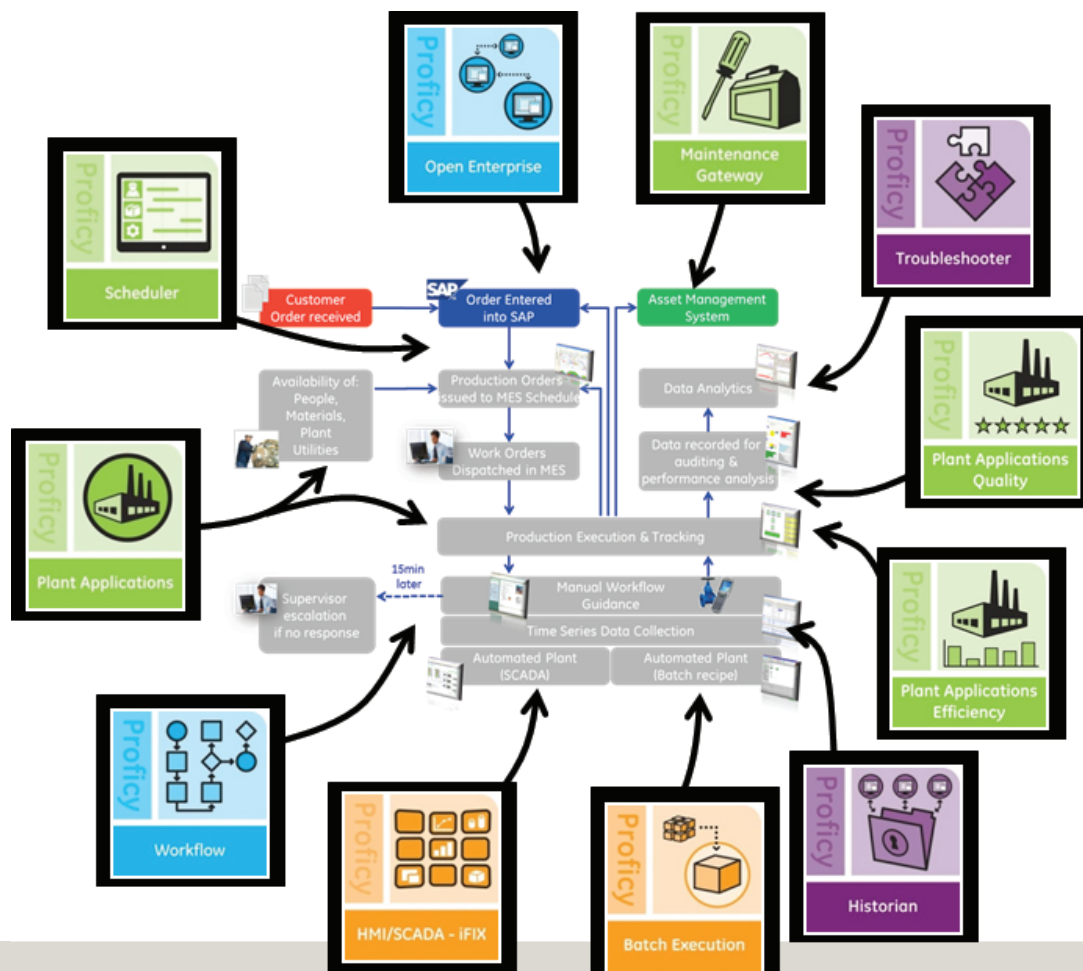
PART TRACEABILITY

As the molds enter or leave the cell, it is important to record the associated traceability data. Shell-O-Matic can completely adapt the system to customer needs.

For each mold, the system can record:

» Part number

» Number of coats performed on the mold

» Program number used on each coat

» Minimum drying time of each coat

» Date when the part entered the cell

» Dip start time

» Temperature and R.H. in the drying environment for each coat

» Real (actual) drying time

» Slurry tank (and slurry parameters) used for each dip

» Sander (and sand parameters) used for each dip

Plus any other parameters the customer chooses to record.

BAR CODE SCANNER

The system is equipped with a bar code scanner to automatically pick up the part number/job number/work order/etc. (depending on how the customer manufacturing system is set up).

RFID SYSTEM

Tags are placed on each part and the antennas, at various pickup and drop points of the robot in the cell, allowing for real-time tracking of the mold shell-making process, no matter what happens. The RFID system is the best way to avoid all possibility of errors as a part may leave the cell process for manual rework or an unexpected event.
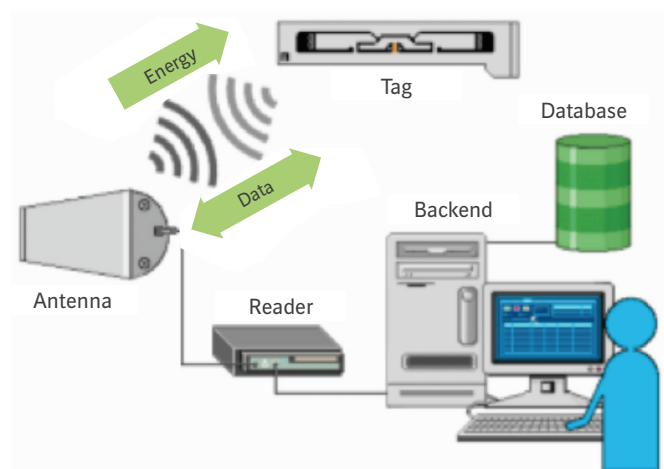
REMOTE ACCESS AND SUPPORT
KEEPING EVERYTHING UP AND RUNNING

Shell-O-Matic knows that if a cell slows down or stops, it is imperative to get it back up and running quickly.

With the PLC-based supervisor, Shell-O-Matic experts can assist either by connecting to the computer remotely or by establishing a VPN connection. This allows our fully equipped diagnostic PCs to virtually become part of a customer's machine network to check the system status and reprogram it if needed.

Client Shell Room

SHELL-O-MATIC

HMI

Internet

VPN

PLC