

# Hot Runner Monitoring in Injection Molding Improves Product Quality

## Introduction

Injection molding of plastic products is a large and complicated process involving dynamic temperatures and flow controls. Typically, thermoplastic molding material is melted in a heating cylinder and injected into molds via a hot runner system. Machine control programs orchestrate a symphony of valve openings and closings, modified according to carefully monitored runner temperatures. Different target products require different materials, with varying melting and cooling temperatures, injection pressures, speeds, volumes, and curing times. Careful monitoring and control of these parameters decides product quality and yield rate.

This customer is a Korea-based supplier of hot runner systems for injection molding equipment, and they wished to leverage Internet of Things (IoT) technology to enhance their monitoring and control over molding processes. They used Advantech's Edge Intelligence Server(EIS) to render an IoT solution that adds both equipment and environment sensors in order to implement well-rounded monitoring and more intelligent control over molding temperatures, speeds and times, in order to help their customers improve manufacturing outcomes.

In the past, hot runner control systems could only monitor and control parameters within the molding equipment itself. Environmental changes in temperature or humidity tended to result in quality deviations, with skilled machine operators struggling through repeated iterations to make compensating adjustments. Now with the IoT solution, the Korean company is able to tout their hot runner systems' well-rounded monitoring and precision controls, as well as preconfigured cloud services, setting themselves distinctly ahead of their competitors.

This solution helps the users of their hot runner systems lay the foundations for implementing Industry 4.0 manufacturing. Advantech EIS is a hard-and-software integrated IoT platform with a preconfigured cloud connection. With Advantech EIS in place, end users can easily expand and upgrade their systems as needed, choosing whether and when to implement cloud-based big data analysis to transform and improve their businesses.

## Application Requirements

As the injection molding process is often large and complicated, with any given machine taking multiple molds for making different products, dynamic control was required over heating temperatures, viscosity, flow pressures and speeds, as well as valve and nozzle timings. As such, the deployment of a monitoring system required support for a large volume of I/O points and high computing power to deal with the processing load.

Secondly, the application required a powerful logic flow control platform to enable data processing and feedback. HMI support was needed to present the operating status of equipment and implement supervisory management. IoT connectivity and cloud connectivity were also required in order to implement remote monitoring control and cloud applications.

## System Solution

For this application, Advantech provided EIS-D150 for device monitoring and data manageability, which is equipped with the Intel® Core™ i5 processing power needed to support large-volume I/O applications.

The Advantech EIS series comprises solution-ready platforms preconfigured with the software resources needed for IoT connectivity,

data manageability, and cloud services. The EIS solution includes many of Advantech's powerful software tools, including WISE-PaaS/RMM, an open-standard IoT device remote monitoring and management platform. The WISE-PaaS/RMM can be interlinked with Advantech's SCADA software, WebAccess/SCADA, which provides high volume I/O support for large-scale sensor data collection and I/O controls, as well as intuitive graphical user interfaces for supervisory management.

The WebAccess/SCADA is a powerful platform for easy data acquisition and integration, providing over 200 drivers for connecting with sensors and equipment using different industrial communication protocols. For example, the customer in this case uses OPC UA industrial standard for its injection devices; with WebAccess/SCADA, the user can connect the injection devices to the monitoring control system without needing to do protocol conversion.

With WebAccess/SCADA, a single EIS-D150 is able to connect with and control over 5,000 I/O points, delivering great system extensibility and compatibility for system expansion in the future. WebAccess/HMI software can be used to visualize data and flow.

The hot runner monitoring system continuously checks whether all tasks are being completed to spec as required, and if not, it makes automatic adjustments according to environmental and operational parameters. This requires edge intelligence computing and logic flow control. Also contained in the Advantech solution package is Node-RED, a powerful logic-flow editing tool with an intuitive graphical interface, which helps greatly to visualize the process.

Meanwhile, the Advantech EIS solution also has WISE-Agent built-in. WISE-Agent contains a conversion tool for transforming data into MQTT, IoT-standard language, for upload to a backend server or to the cloud. A Microsoft Azure package is also pre-configured here to provide optional access to big data analysis or other cloud services.

## Benefits

- Supports massive I/O counts with a single edge intelligence server
- Provides IoT connectivity and manageability for data acquisition, transmission and applications, with seamless cloud integration
- Helps customers add value to their products that distinguish them from competing products and improve market competitiveness
- Helps end-users build Industry 4.0 infrastructure for implementing intelligent manufacturing

