Aluminium temperature measurement developments

Richard Gagg* describes new and enhanced methods of temperature measurement for aluminium extruders.

Previously in Aluminium International Today, Richard Gagg discussed the importance of accurate temperature measurements for modern aluminium extrusions. In this article, he discusses parallel developments, which now enable non-contact temperature sensors to automatically and dynamically track and accommodate physical process changes as they occur. Higher quality extrusions and increased production yields can then be achieved.

The first example is temperature measurement of the extruded profile at the press exit as it exits the die. A non-contact pyrometer is physically aligned to target the extrusion at its optimum measurement position. Traditionally, as die changes occur they would require an operator to verify correct pyrometer alignment and then either physically re-position the pyrometer's mounting bracket or manually manipulate it using a motorised actuator via a hand-held, remote-control keypad. To simplify and automate this process AMETEK Land has developed an intelligent, motorised actuator that can function independently of an operator.

In that die exit application, a new SPOT actuator is mounted above the press exit, and a SPOT AL EQS pyrometer is attached directly to it. The actuator and SPOT pyrometer share the same low voltage power supply. Both the pyrometer and actuator communicate directly with each other via an Ethernet connection, coordinating together in harmony. One of the actuator's selectable modes commands it to automatically align the pyrometer to target the optimum hot spot measurement position on the extrusion. No operator intervention is necessary as the actuator/pyrometer combination jointly communicate, calculate and rapidly re-adjust to the correct, optimised target alignment.

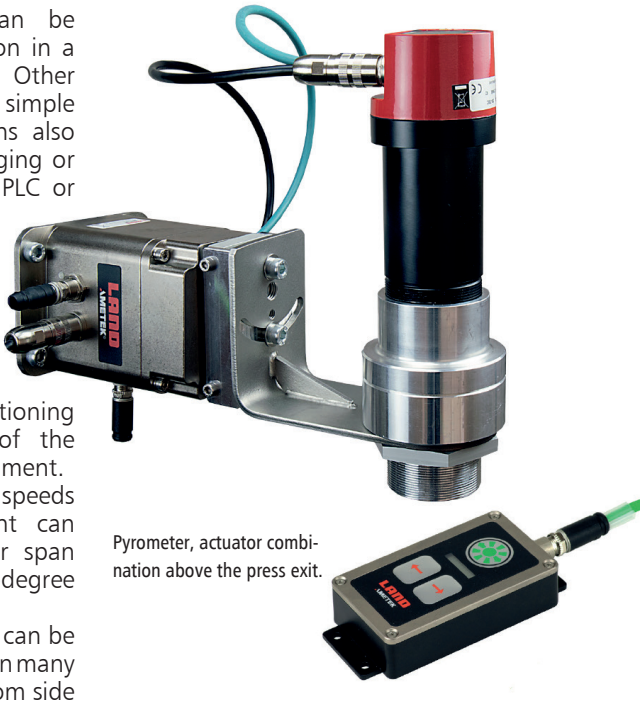
In other operational modes, the alignment actuator function can be configured to acquire the extrusion in a repeating, timed interval action. Other options can initiate a scan by a simple signal from a push button. Scans also can be triggered by digital messaging or switch commands from either a PLC or an integrated digital press control system.

Designed from the outset to work together collectively the SPOT AL EQS pyrometer's tightly focused adjustable optics and rapid 15ms temperature response, combined with the 0.1-degree positioning and fast swivel speed action of the actuator facilitate this precise alignment.

For even faster response speeds the actuator's arc of movement can be selected to a smaller angular span anywhere within the overall 90-degree range of swivel.

This measurement combination can be very useful at the exit of the quench. In many cases, the extrusion will wander from side to side at this location. In this application, the pyrometer/actuator assembly can rapidly and repeatedly locate, target and measure the laterally shifting profile, producing a valid temperature reading. If desired the actuator can be configured to scan at user-defined time intervals to re-acquire and measure the extrusion. After each temperature measurement, the pyrometer reading is held until completion of the next scan, at which time the temperature reading is updated. In this way a valid temperature value is always received without experiencing any false measurement drops if the profile wanders out of the pyrometer's view.

Some extruders who employ sophisticated press controls are interested in the billet temperature profile from its head to the tail immediately after the billet has arrived at the side of the press. This profile data can then be communicated to the control system, where it will be used to modulate the press speed. In this billet scan mode of operation, the pyrometer/actuator combination scans along the length of the billet defining the thermal profile prior to it being loaded into the press.



Pyrometer, actuator combination above the press exit.

In all actuator modes the SPOT pyrometer's high brightness, flashing green targeting LED automatically triggers during the scan. The LED exactly defines where the pyrometer is currently aimed together with the diameter of the measurement spot. This makes it easy for an operator to quickly verify the pyrometer's aim.

Both devices feature integrated digital signal processing, and they communicate directly with each other using Modbus TCP. Each device incorporates a web server, which greatly simplifies configuration. No special tools or cables are required for setup. The user just connects via Ethernet using a standard web browser, enters

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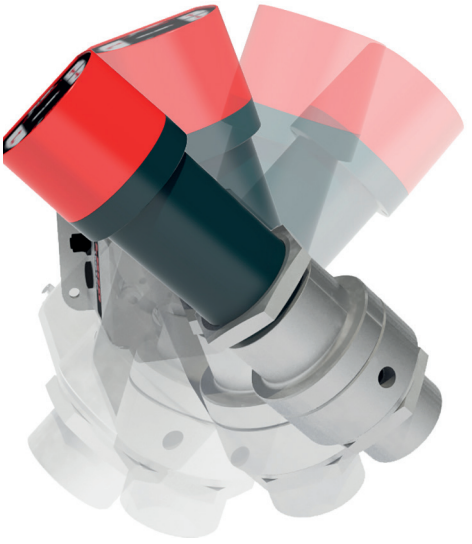
the IP address of the device to select and change the settings required. The actuator features an integrated network switch and features a gateway setting to enable communications with remote Ethernet devices on different IP addressed network segments.

If the end user's press control system includes a menu of frequently used dies and their geometries, a unique targeting angle can be communicated directly to the actuator, which will then position the pyrometer for that die's characteristics. This has the advantage that every time the same production job is run the pyrometer will target the same physical position on the profile. Fewer variables translate to better repeatability and quality.

For some users, the need for a backup or override method of scanning is desirable, and, for this purpose, an optional hand-held remote control is available.

If an optional transmitter is added to the press to measure the speed of the extrusion, then that speed signal can be integrated together with the SPOT AL EQS pyrometer temperature readings coming from both the press and quench exits.

By combining the live temperature readings before and after the quench with the distance between the two pyrometer locations and the current extrusion speed allows quench rates to be continuously and accurately calculated and displayed.



The actuator precisely positions in 0.1 degree increments through a 90-degree swivel movement.

Fully featured and configurable software is available to integrate multiple measurement variables, such as temperature, speed and other parameters. In this way customised interactive combinations of signals can be employed for better process control and understanding.

The advent of this new positioning technology allows for more repeatable and reliable temperature measurements to be taken. The ability to integrate these measurements into press and quench controls can further improve product quality, including surface finish and desired metallurgical properties. By measuring these variables and understanding their effects on the process provides extruders with competitive advantages and attracts customers who are demanding the highest quality extrusions. Shorter setup times and increased production rates also improve profit margins. And, for less demanding extrusions, the ability to reduce die wear and increase production speeds results in improved efficiencies from the same press machinery. ■

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