Improve your business performance in today’s challenging economic environment - Honeywell’s MetalsMaster non-contacting thickness sensors for on-line aluminum sheet and foil rolling help aluminum producers achieve faster rolling speeds, tighter gauge quality control and reduced mill downtime.

### Product Brief

Honeywell’s non-contacting thickness sensors perform on-line aluminum sheet and foil thickness measurements, helping rolled aluminum producers achieve faster rolling speeds, tighter gauge quality control and reduced mill downtime.

The high-speed, high-flux X-Ray sensor technology ensures 0.1% or better typical accuracy, while rejecting on-line sources of error such as changing sheet position, pass-angle, oil or coolant oxides buildup and mill-ambient air temperature. The sensors handle wide measurement ranges and for most applications, a single sensor provides optimal entry or exit readings.

Mounted on a rigid, welded-box-beam steel C-Frame, the compact sensor head construction meets rigorous rolling-mill requirements for endurance and reliability, installs easily and fits in tight mill locations.

### Features and Benefits

- Unique alloy-insensitive-measurement mode ensures thickness accuracy for critical finishing passes. The single-sensor / dual-mode configuration also offers extended range to handle a wide range of foil thickness.
- The Intelligent Signal Processor (ISP) combines high-speed data acquisition and a real-time processor to perform continuous-response signal processing (CRSP) - fully calibrated and corrected analog thickness signal, updated at 1 ms intervals. CRSP functionality means that your mill subsystems such as Hydraulic Gap Control (HGC), Roll Eccentricity Compensation, AGC and Mass Flow Control take full advantage of the x-ray sensor’s fast response time.
- Wide sensor gaps, up to 200 mm (8 inches) promote easier threading, accommodate varying mill setup changes, and reduce the effects of sheet breaks. Wider gaps are available.
- Optional horizontal C-Frame retract mechanism provides a simple, effective way to maximize mill access for maintenance, threading and during sheet breaks.
- Liquid-cooled sensor heads ensure stable, reliable operation.
- High stability X-Ray source utilizes controlled high-voltage power supply to ensure short- and long-term measurement reproducibility and voltage spike rejection.
- Integral drip-trays in the upper sensor head direct mill coolant accumulation off-sheet to protect aluminum surface finish.
- Highly collimated X-Ray beam and large diameter detector minimize measurement sensitivity when the sheet position changes due to work roll placements and varying rolling mill setups.
- Integral high-velocity air wipes clear sensor windows of excess mill coolant accumulation.
- Continuous pass-angle compensation corrects for changes in sensor beam-to-sheet angular-intersection as coil diameters change.
• High-speed impulse-induction air gap temperature sensors combined with continuous software correction ensure accurate measurements during mill temperature changes.
• Automatic 3-point standardization corrects for buildup of metallic oxide residues and other contaminants on sensor windows.
• UniCal™ universal calibration dramatically expand the thickness range covered by a single calibration - improving precision while reducing calibration maintenance.
• Continuous sensor performance monitoring with diagnostic signals from sensor components for easy diagnostics and maintenance.

Description

X-Ray Advantages
Honeywell sensors take advantage of the numerous benefits of X-Ray sensors, which generate vastly more particles (photons) per unit time than do isotopic emitters. This dramatic flux advantage translates into significantly lower "noise" for smaller digital-sampling times and faster measurement speeds. Thus, feedback control loops can operate much faster, and with less lag and dampening from signal filtering. Faster entry gauge measurements provide thickness information sooner for better mass flow control and feedforward control.

Honeywell’s alloy-insensitive technology for light gauge finishing passes provides low susceptibility to errors caused by composition variations, without the need for spectral analysis of the material.

X-ray beams remain highly collimated even as they interact with air and the aluminum sheet which means the sensor gap can be increased up to 200 mm (8 in) without sacrificing performance.

Wide Measurement Ranges
Honeywell sensors provide the wide measurement ranges needed for today’s “Universal” rolling requirements.

The model 3-2249-1, 10 kV dual-mode sensor focuses on critical light-gauge finishing passes. The alloy-insensitive mode provides excellent accuracy even as alloy chemistry varies for foil and light sheet from 5 microns (0.2 mil) to 330 microns (13 mil). The extended range mode provides measurements up to 625 microns (25 mil) for intermediate rolling passes.

The model 2249-3, 30 kV sensor's 50 micron (2 mil) to 10 millimeter (0.4 inch) range satisfies breakdown, sheet and intermediate rolling applications.

Flexible Applications
Honeywell sensors are ideal for exit measurements of single-stand rolling-mills. The wide measurement ranges, reliability, accuracy, and flexibility are also well suited for entry and interstand-measurements deployed for tandem rolling applications.

Enhanced Visibility
Honeywell sensors provide faster measurements to increase the visibility of gauge variations throughout the rolling mill pass schedule. Enhanced visibility enables precise and accurate process improvements, tighter automatic gauge control, and reliable indications of coil quality. The sensors’ high response-bandwidth (up to 1 kHz) accurately tracks the complex gauge variations rolled into each coil.

Each rolling-pass imprints new gauge patterns in the metal. These patterns combine with prior-pass variations to produce increasingly complex, high-frequency patterns. The result is high-frequency gauge variation patterns which are quite detectable by Honeywell sensors, even at faster mill speeds.

Rolled aluminum producers can use this visibility to achieve the competitive gauge tolerances demanded by today's customers.

Enhanced Resolution
Continuous improvement in gauge uniformity requires finer thickness measurement resolution and the ability to resolve gauge variations in the shortest possible strip length. A sensor's resolving power refers to its ability to detect and report small changes in actual on-line thickness. The key sensor specifications which characterize this attribute are response time and sensor repeatability, which depend on measurement integration time and thickness measured.

The Honeywell sensors' low-noise design accurately detects gauge changes below 0.1 percent in the shortest possible strip length.
Enhanced Calibration Accuracy

Extremely precise calibration correlations over wide thickness ranges instill confidence in both operators and management. Lab values are obtained using known density and gravimetric measurements of precision samples of actual production material. Once calibrated on a reference alloy, calibrations for other alloys are set with a single sample and single parameter.

Enhanced On-line Accuracy

Honeywell X-Ray sensors reduce the required gauge-tolerance safety margins needed to finish on-target. Their speed and precision are ideal for rolling within tighter gauge tolerances to minimize rejects and increase yields.

Honeywell X-Ray sensors are effectively immune to oil mist present in the sensor's measurement gap while rolling.

Small variations in the concentration of individual alloying elements within each alloy's composition limits can induce thickness errors for X-Ray sensors. The unique alloy insensitive mode of the Honeywell 10 kV X-Ray Sensor for thicknesses below 330 microns (13 mils) ensures the ultimate in accuracy for finish-pass rolling exactly at the thickness targets required.

Common sources of measurement errors are easily overcome by integrated secondary measurements, which continuously correct the on-line thickness readings.

3-Point Standardization

As oxide residuals build up on the sensor windows, the actual calibration curve shifts in a way that depends on the actual thickness reading. Honeywell sensors are calibrated both clean and with simulated dirt buildup. When standardizing, a third point (the internal standard flag) creates a correctly scaled version of the dirt correction, continuously compensating the on-line readings.

Pass-Angle Compensation

When the angular-intersection of the X-Ray beam with the aluminum is perpendicular, the actual thickness is equal to the "apparent" thickness, as "seen" by the sensor. However, the pass-angle of the aluminum through the sensor can change as the diameter of the coil changes. Honeywell sensors can continuously calculate current coil diameter, pass-angle and actual versus apparent thickness compensation.

Temperature Compensation

Automatic zero, span, and internal flag checks correct the sensor based on the ambient temperature during standardization. When the sensor is standardized at room temperature, 20°C (68°F), but used at running temperature, 100°C (212°F), a thickness error equivalent to 30 percent of the air mass in the sensor gap must be accurately measured and compensated. Honeywell sensors incorporate two high-speed impulse induction air gap temperature sensors to draw representative air samples while standardizing and running. Continuous on-line ideal gas law calculations ensure accurate compensation on-line.

Alloy Compensation

When alloying elements vary in the cast metal, the thickness measurement accuracy can be compromised during downstream processing. In addition to the alloy-insensitive mode for the 10 kV sensor, MetalsMaster also has an off-line tool that converts composition elemental analysis into a corrected calibration factor for the thickness sensor.
Specifications

Max. Ambient Temperatures
150° C (300° F): Sensor and C-Frame
100° C (212° F): Horizontal retract
60° C (140° F): Intelligent Signal Processor (ISP) with liquid cooling

Electrical Power Requirements:
1A at 115-230VAC, 50/60Hz

Liquid Cooling Requirements (water, or mill coolant):
Clean, continuous, reliable flow
Flow per sensor: 4 liters/min (1 gpm)
Flow per ISP: 0.76 liters/min (0.2 gpm)
Liquid temperature max: 25° C (77° F)

Air Requirements Per Sensor
Purge air or nitrogen (recommended):
1.4 - 2.1 bar (20 – 30 psi)
Purge flow: 0.24 liter/sec (0.5 scfm)
Air wipe: 1.4 – 8.6 bar (20 – 125 psi)
Air wipe flow: 0.24 liter/sec (0.5 scfm) max

Product Weight
C-Frame and one sensor: 180 kg (400 lbs)

AGC System Outputs (2):
-10 to +10VDC, Deviation or Absolute
Configurable Scaling
Max. output frequency: 1 kHz

Maximum Humidity:
99% relative humidity

For More Information
Learn more about Honeywell’s products and services, visit our website www.honeywellprocess.com or contact your Honeywell account manager.