Technical Overview for Interstand Centerline Deviation System

Hot Strip Mill Measurement System

Global Gauge Corporation

Global Gauge Mission

We will consistently deliver the most advanced, accurate and reliable measurement systems to flat product producers throughout the world. We will continue to succeed because of our hard work, our innovative solutions and our intense commitment to solving our customers' problems.

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Revision History

Date	*Remarks*	*Revision*
February 1, 2024	Author: D. Kober	A_00
September 26, 2024	Additional diagrams, updated information as projects progress	A_01

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1.0 Application Information

1.1 Application Information

Application

Mill Type: HSM Finishing Stands
Measurement Location: Mounted above centerline
Material: Flat Rolled Metals
Width Range: to be determined
Thickness Range: to be determined

Utilities

Power: 120V, 60HZ
2 psi filtered, dry air for pressurized assembly

This proposed solution covers the furnishing of all services, labour, and material required with the design, fabrication, and delivery of an MCA-based Interstand Centerline Deviation System.

The system will be engineered, designed, and manufactured to meet the requirements as defined by the customer.

The MCA-based Interstand Centerline Deviation System manufactured by Global Gauge is a non-contact measurement system using state of the art digital GigE camera operating at high speed to measure the centerline deviation of the material as it passes through each stand of the HSM.

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2.0 Global Gauge Recommended System

Global Gauge Corporation (GGC) is a manufacturer of industrial measurement and control systems for steel mill applications throughout the world. We have been successful providing solutions to rolling mill customers for 20+ years. Many of our staff members have 30 - 40 years of experience in this industry.

Precision alignment is crucial for ensuring product quality and minimizing material waste. Global Gauge Corporation's Interstand Centerline Deviation System (ICDS) is designed to deliver real-time, high-precision measurements of strip deviation between finishing mill stands.

This system leverages advanced image processing technology to measure the exact position of the metal strip, ensuring it stays centered throughout the rolling process. With easy integration into existing setups, the Interstand Centerline Deviation System (ICDS) improves overall mill performance by:

- **Prevention of Cobble Formation:** Poor steering can lead to cobbles, disrupting production and increasing downtime.
- **Mitigation of Tail Whip:** Bad steering can cause tail whip between the final two mill stands, potentially resulting in a violent enough tail whip to create a 'bruise' on the rolls.
- **Reduced Downtime:** Cobbles and bruised rolls require changing, which can lead to significant downtime. If the roll shop is behind on production, the unavailability of rolls exacerbates this issue.
- **Long-Term Insights:** By analyzing data from the ICDS, manufacturers can uncover root causes of steering issues and predict maintenance needs for wearing or failing components, ultimately enhancing operational reliability.

With robust construction and reliable performance in harsh industrial environments, the Interstand Centerline Deviation System (ICDS) is a trusted tool for automated strip steering systems. Our systems deliver the precision and accuracy needed to meet the highest production standards.

For more information, or to schedule a demo, contact us to see how the Interstand Centerline Deviation System can elevate your production process.

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2.1 Overview of Proposed Solution

The primary purpose and objective of installing a Centerline Deviation System at this location is to measure the deviation of the Strip as it's being rolled through each finishing mill stand of the HSM and feed this information back to the customer control system.

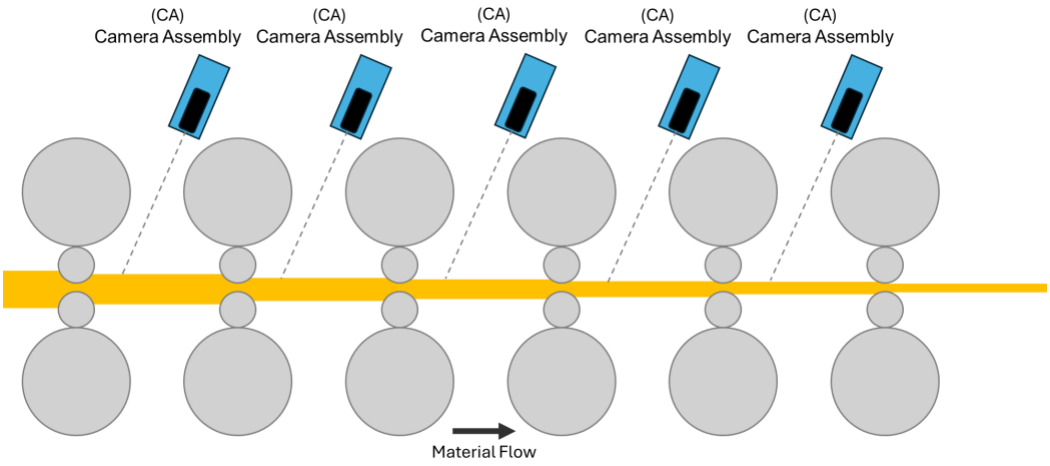

Figure: General Overview of Proposed System

Based on the experience of installing multiple steel mill width gauging systems around the world and understanding the usage of different sensors technologies at different steel mills, GGC employs a solution that has been proven to provide extremely accurate results even in the most difficult mill environments.

The illustrates a sample HMI Screen for an existing GGC Width and Centerline Deviation measurement system. The customer application designed for this project will closely resemble this HMI, but can be customized with customer input:

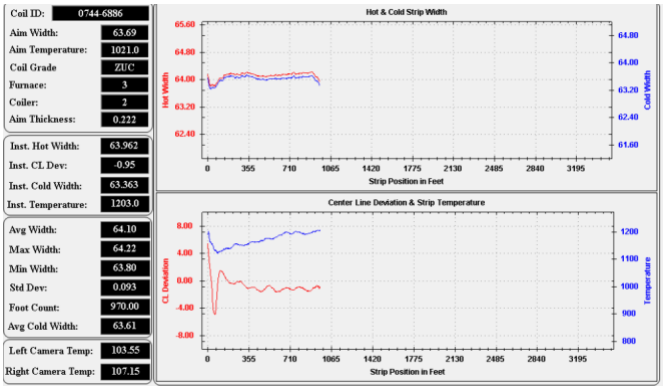

Figure: GGC Width/CL Deviation Measurement System HMI

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A certified calibration light box will be provided for calibrating and verifying the camera calibration. The primary purpose of this light box is to align and calibrate the camera. The light box can also be used for verifying the camera alignment and calibration periodically.

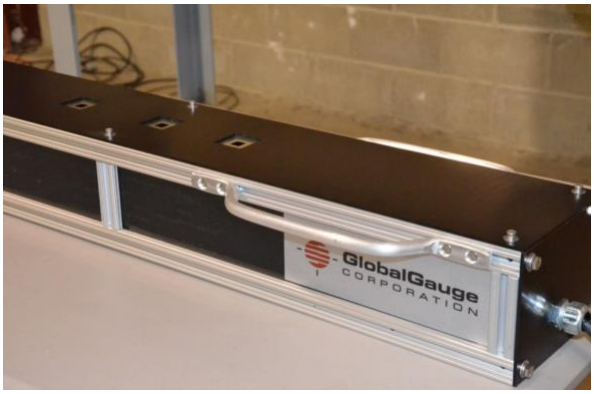

Figure: Calibration Light Box

2.2 System Block Diagram

The primary system components of the Interstand Centerline Deviation System are the Electronics Power Console (EPC) and Mono-Camera Assembly (MCA). The EPC houses the Gauge PC and associated components. The Figure below illustrates the block diagram of the system.

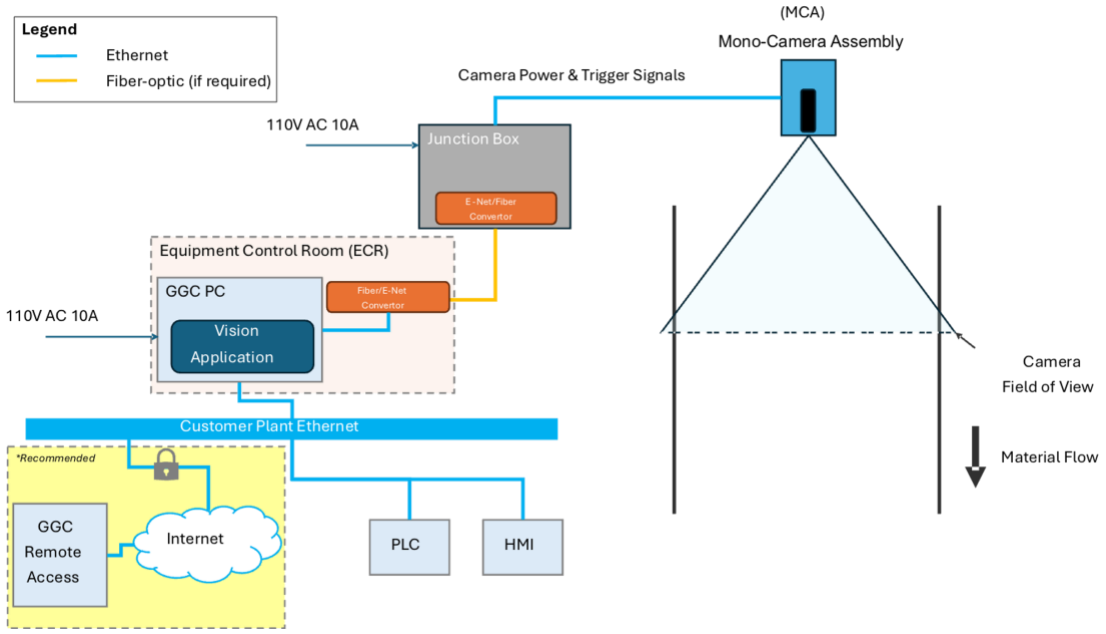

Figure: Centerline Deviation System Basic Block Diagram

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The Figures below shows one of the existing MCA housings currently installed interstand at a Cleveland-Cliffs Hot Mill and how this arrangement is mounted between the stands at this location.

Figure: MCA Housing containing Gig-E Camera and Lens

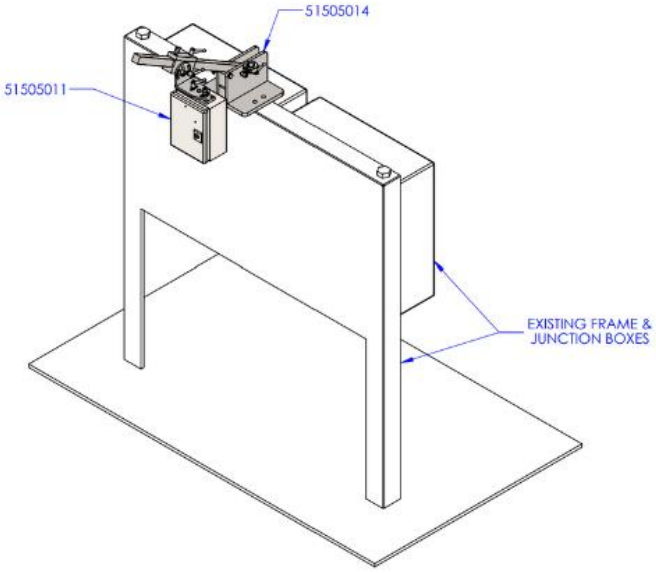

Figure: Mounting example including GGC MCA Housing and Mounting Arm

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2.3 Measurement Philosophy

The measurement philosophy for measuring the centerline deviation of the material using line scan cameras depends on the following factors:

- Using the illumination of the hot metal to identify the center, and each edge, of the material as it's being rolled.
- Ensuring the camera line of sight is in between two rolls or has contrast for determining edges.
- Operating the Line scan camera at high speed.

The following describe the sequence of steps for the required measurements of width:

1. As the material travels under the camera, the camera is continuously imaging the width, and the gauge software processes the acquired images to determine the precise location of the material edges both on the operator and drive side.

2. These parameters are converted into a centerline deviation measurement that can be displayed in real time on a user-friendly supplied HMI screen.

3. The measurements can be communicated to the customer's control system for additional processing.

2.4 Specifications

The Global Gauge Interstand Centerline Deviation System will operate under the following specifications:

S.NO.	SPECIFICATION	SPECIFICATION VALUE
1	Number of cameras	Qty. 1 contained in HSM-duty
2	Type of cameras	Linescan Camera with 4096 pixels
3	Camera mounting height	TBD
4	Camera Interface	GIG E
6	Mill Interface	To be determined with customer input
7	Strip temperature range	Ambient, Hot Mill
8	Software Package	HMI software, diagnostics software and data archiving software

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3.0 System Description

The following equipment would be provided under this project. All components are being provided to result in a fully functional Interstand Centerline Deviation System, including all interconnecting cables.

3.1 Interstand Centerline Deviation System

- Mono Camera Assembly (MCA)
  Including, but not limited to:
  - Camera enclosure, sealed for camera protection
  - High Speed Digital Linescan Camera Assembly (GigE), including Lenses and Focus Bodies.
  - Industrial Mount for Camera Alignment
  - Optical Ports for Camera Imaging, including Optical Filters
  - Warning Lamps as Required
  - Mounting Brackets to mount to customer's take-over-point to be defined in project kick-off meeting

- Electronics Power Cabinet (EPC), Rittal, including:
  1 Unit, including but not limited to:
  - Industrial PC, Win10
    - HD Capable of 3-6 mos. Data Storage
    - Flat Panel Monitor, Keyboard and mouse
  - All necessary Software licenses to run the system
  - GGC Interstand Centerline Deviation Software
  - Mill Interface and I/O Modules as Required (e.g., Ethernet, Profibus, etc.)

- Certified Calibration Sample Light Box
  - Including support rails for positioning on roller table under Camera Assembly

- Lasers for MCA Alignment

3.2 System Cables as Required

- All interconnection cables as needed (up to 100m each)
- Local Power Cables, up to 25 m each

3.3 Documentation

- System drawings, Operator's and Maintenance Manuals, in standard GGC format
- Including drawings/documentation for erection of all equipment supplied by GGC.

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