BILLET CONTINUOUS CASTER CUT TO LENGTH

APPLICATION

Logika Technologies Inc.
Canada.
Billet Continuous caster

Continuous casting, also called strand casting, is the process whereby molten metal is solidified into a “semi-finished” billet, bloom, or slab for subsequent rolling in the finishing mills. Prior to the introduction of continuous casting in the 1950s, steel was poured into stationary molds to form ingots. Since then, “continuous casting” has evolved to achieve improved yield, quality, productivity and cost efficiency. It allows lower-cost production of metal sections with better quality, due to the inherently lower costs of continuous, standardized production of a product, as well as providing increased control over the process through automation. This process is used most frequently to cast steel.

Problems in Continuous Caster Cut to Length (Contact Based).

Existing contact length measurement methods such as encoder wheels, touches on drive rolls or touches for motor speed are the typical techniques employed in controlling cut length tolerances. Each of these methods is susceptible to the typical issues associated with contact devices like slippage, changing roll or wheel diameter and wear & tear, resulting in long term, unpredictable drift of the length measurement. These issues are particularly challenging when trying to measure on a billet or slab at 900°C to 1000°C. In short, contact devices measure their own rotational motion, which is not necessarily the motion of the strand, while LOGIKA’S CCD CAMERA BASED directly measure the motion of the strand, providing a more accurate and repeatable measurement to the control system for cut length control and tracking. In practice, contact length measurement techniques on continuous casters deliver cut length tolerances in the range of +/- 30mm to 50 mm. Moreover, to achieve these results requires frequent service and time by maintenance personnel, as well as, continuous, online process calibration by operations personnel. Without this constant attention, cut length tolerances can quickly drift beyond the 50 mm range resulting in significant weight variation and thus loss in yield at both the caster and roll mills. In fact, due to the variation in length, many mills will add an additional “safety factor” of 50 mm or more to compensate for this long term, unpredictable variation to be sure the roll mill does not receive less than the length or weight specified. Since length is the only dimension that can be controlled in real time at the caster, optimizing length measurements and cut length tolerances over the long term optimizes long term weight tolerances, providing greater process control and tolerances for the roll mill. In addition to cut length, cast speed serves as an important input for process and quality control. Documenting & tracking of events such as changes in chemistry, ladle changes, changes in spray practice or other quality and process events is often required to guarantee specified
mechanical properties and offers significant insight into understanding the cause and effect of process events.

Errors in speed and length measurements caused by slippage between the strand and roll, introduces errors in tracking these events. The ability to precisely locate these process and quality events is vital to quality control and provides a greater understanding of the unique characteristics of a particular process for continued efficiency, quality and process improvement.

LOGIKA’S CCD CAMERA BASED CUT TO LENGTH Features and Function

**Working principle:** The equipment uses dynamic image recognition technology to detect and display the status of the billet online. Infrared cameras installed beside the rollers accumulate field images which are stored in the computer. An Image recognition module converts the analog video signal into a digital signal which is identified by computer software. The software calculates the actual billet length and speed, and displays the billets position on the screen simultaneously. At the same time it controls the flame cutting equipment when the setup cutting lengths are reached. Real time and high efficiency make the system fit various complex field applications.

![Fig1: System illustration](image-url)
System function:

1) The system can identify the length of hot billet and control the flame cutter to cut hot billet. Moreover, it can detect the billet status and speed on the roller.

2) Easy to store and modify billets length cutting parameters, the monitor automatically displays and switches multi-pictures taken by cameras.

3) The monitor can display the real-time running state of hot billet and related parameters, such as: each strand billet average casting speed, cut number of each strand, all strands total cut number and total yield etc.

4) Operator can use keyboard and mouse to change various parameters, fine adjust cutting length of each strand online separately.

5) The cut to length software has product management functions, like counting the number of cut billet etc.

6) In normal circumstances (the flame cutter can automatically return to original position and clamp rapidly and accurately without dragging and sliding), system identification error is within ± 5mm, final cut error is less than ± 10mm. The system can be adjusted to reduce the error down to a minimum requirement. If the cutter cannot automatically return to the original position after each cut, due to dragging or sliding caused by loose clamps, accuracy can be improved by adding a positioning device to compensate and improve cutting accuracy.

7) System can provide communication interface per customer needs.

Signal output: Two relay outputs for each strand, one for each Pre-cut signal and the other is for each Cut signal.
Working environment

(1) System and the camera normal working temperature: ≤ 70°C.

(2) Power supply: AC 220V

(3) Camera installation requirement: No obstruction between target and cameras’ field of view

Hardware installation

The system layout and work flow chart are as follows:
Operation description

For Example, A casters of 3 Strands are used in the field, system is configured with single LCD monitor and 3 strands display. Before the system runs, high resolution infrared cameras transfer the standard image information (including the correct cutting length information) into the central control system and store them. In the actual product line, four cameras are setup to detect different cut length ranges of the 3 strands. See the system layout for more details.

- Camera1 detects range from 3m to 5.5m
- Camera2 detects range from 5m to 7.5m
- Camera3 detects range from 7m to 9.5m
- Camera4 detects range from 9m to 12.5m

Note: The no of camera depends upon the minimum and maximum cut length. For example: if the minimum cut length is 3meter and maximum cut length is 5 meter then only one camera required.

After calibrating each camera, the billet cutting length can be easily adjusted on screen. The high resolution infrared cameras capture the image remotely; transmit the video signal to an image acquisition unit (which converts image analog signal to digital signal). The computer compares this information with the original standard stored information. Finally digital control signals are sent out by an output unit and converted to an ON/OFF signal which the PLC can detect and then execute the action. After measuring the actual cutting length of billet, and comparing it to the setup value, the operator can fine tune to improve the cutting accuracy.
Hardware installation position selection

Industrial control personal computer and length cutting controller

The control equipment’s should be installed inside the operator control room, as shown in the following illustration.

Monitors in above figure show two sets of length cutting systems

Use the following pictures as the reference for installation infrared cameras locations
OTHER SYSTEM

LOGIKA provides complete turnkey systems including hardware, software and installation. These include:

Blast Furnace

- Torpedo Car Positioning
- Temperature Measurement at Tap Hole
- Stove Dome temperature measurement

Continuous Casting

- Tundish Metal temperature
- Slab / Billet / Bloom temperature
- Cut to Length for Slab and Billet
- Casting temperature
- Casting Velocity in Real Time
- Slab Width, Thickness and Length measurement
- Skew/Centering Control

BOF

- Positioning of Ladle
- Temperature measurement at Ladle Pre-Heater
- Temperature measurement at Spray Chamber

Hot Rolling Mill

- Slab Alignment on entry to Reheat Furnace
- Width measurement on exit from Reheat Furnace
- Slab video monitoring inside the reheat furnace
- Slab Detection inside the reheat furnace
- Edge Positioning and Coil Centering

Cold Rolling Mill

- Width Measurement
- Coil Diameter measurement
- Coil weighing system
- Strip Centering
- Weld Seam/Hole Detection
- Laser Loop Scanner/control

We also provide Real Time Location System using RFID which can be implemented in all the departments, like yard management, dispatch management, inventory management etc.
## CONTACTS

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