

KELLER

*infrared
temperature
solutions*

ITS

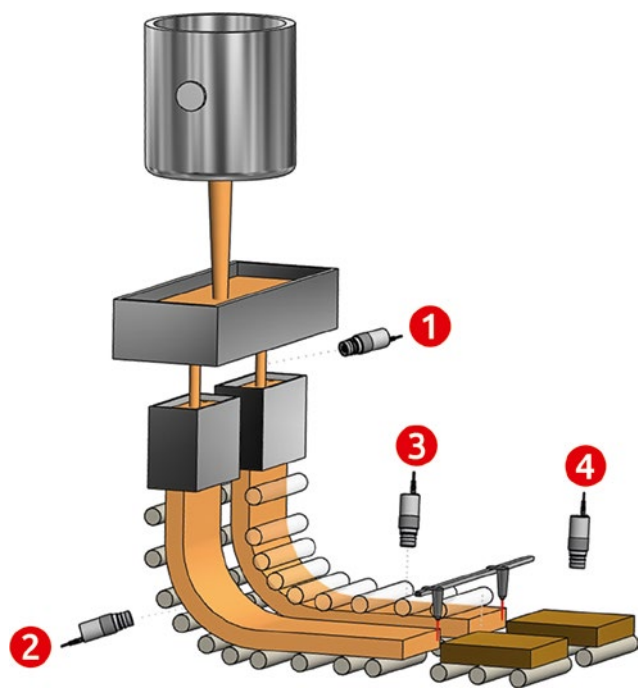
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in terms of
ACCURACY
RELIABILITY
INNOVATION



Application Continuous casting

Optical temperature measurement
on the continuous casting plant



Temperature measuring points on the continuous casting machine

Optical temperature measurement on the continuous casting machine

The increasing requirements for the material properties become ever more demanding for producers in terms of the production process and production parameters. For this purpose, very tight tolerances are specified by the quality control. In order to be able to meet these high requirements, modern measuring methods and measuring systems adapted to the respective measuring points are absolutely necessary. A temperature-controlled production is the prerequisite for achieving the desired material properties while maximizing energy efficiency.

Pyrometers have proven their worth for measuring the temperature when casting the melt and when cooling the slabs or billets on the continuous casting machine. They measure the infrared radiation of the objects and calculate the temperature according to the Planck's law of radiation. The radiation is measured contactless from a safe distance and without destroying the workpiece. The temperature is recorded in a few milliseconds and serves as a monitoring and control variable.

Measuring point pouring stream ¹

The immersion lance normally used can only be used for measuring in the casting ladle or in the tundish, but not during the actual casting process. The measuring accuracy and reproducibility of manual immersion measurement depends on the operator, and thus on the measuring point and immersion depth.

The CellaCast system is an optical method for non-contact temperature measurement. It operates wear-free and maintenance-free and detects automatically the temperature of the pouring stream from a safe distance.

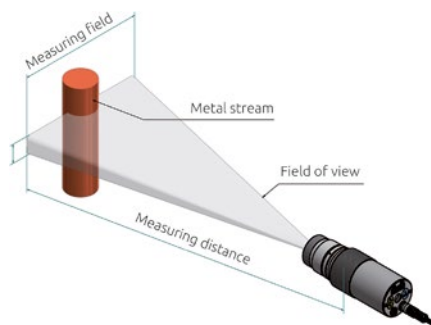
The special feature of optical temperature measurement for liquid metal is that oxides and slag form very quickly on the surface of metals. For a correct measurement, it is imperative that the pyrometer only evaluates the radiation of the bare metal surface. The CellaCast measuring system has a special CSD function (Clean Surface Detection) for this purpose. This filters out the temperature of the pouring melt at the slag-free and oxide-free areas of the metal.

Thanks to the two-colour measuring method, the pyrometer delivers reliable measured values even under the harshest industrial conditions despite dust and steam.

Since the pyrometer works without contact and without wearing parts, there are no ongoing consumption costs for the measuring probes, contrary to immersion measurement.

For optical temperature measurement on the cast, the pyrometer is aligned with the free-falling pouring stream. The pyrometer always detects the temperature of the melt at the same point immediately when the mould is filled.

The special feature of the CellaCast PA 83 is the rectangular measuring field. As long as the pouring stream moves within the measuring field, a reliable measured value is determined.



Panoramic pyrometer with rectangular measuring

The CellaCast has an intelligent ATD function (Automatic Temperature Detection) for detecting the casting temperature. After the start of the casting process, the measured value determination is started automatically. The measured values are transmitted simultaneously via the analog output and the serial interface. The plant operators can see the temperature on a large display. The measured values can be stored on a PC or a central data acquisition system. This ensures continuous control and documentation of the temperature.

Measuring point slab/billet ^{2 3}

Since the pyrometric temperature measurement is an optical measuring method, the reliability of the measurement on the surface and the intermediate media in the visual field can be strongly influenced by dust, steam and smoke. Therefore, two-colour pyrometers are preferably used for measurement. Even if the lens is dirty or the infrared radiation in the field of view is weakened by up to 90 %, the two-colour measuring method still provides reliable measured values.

Scaling and oxidation on the surface of the billet have a major influence on the measuring accuracy of the continuous casting machine. Consequently, the emissivity, i.e. the radiation ability of the billet, changes extremely. However, a scaled surface has a higher emissivity compared to a scale-free surface. Depending on the absolute temperature values, a conventional pyrometer can display a higher measured value than at the scale-free point even at a lower scaling temperature due to the higher emissivity.



Scale and oxide significantly change the radiation properties

In order to minimize the interfering influence of the scale and oxide on the measurement, the so-called CSD function (Clean Surface Detection) was developed. Based on the two-colour measuring method, a high optical resolution and a very short measuring time, the software algorithm of the CSD function in the pyrometer is able to filter out the measured values at the hot spots of the scale- and oxide-free surface in particular. While the billet passes the pyrometer, the true temperature at the clean spots is automatically measured and displayed thanks to the CSD function.

The CellaTemp® PA/PX 40 two-colour pyrometer is used to measure the temperature of the slabs or billets in the cooling section of the continuous casting machine. A CellaTemp® PA / PX 41 pyrometer with fibre optic cable is used for measurements from below. Both devices have a high optical resolution to reliably detect the correct temper-

ature at the scale- and oxide-free points of the passing slab from a distance of several metres in combination with the CSD function. For optical alignment, the devices have a through-the-lens sighting, a laser pilot light or a video camera. With the camera function, the measuring environment and measuring point can be checked at any time on the monitor in the control room. The measuring field marking, the measured temperature and the measuring point designation are displayed in the monitor image via the video signal.

The CellaTemp® PA has a conventional analog output for connection to the plant control system. Alternatively, the identical devices from the CellaTemp® PX series can be used. These also have the modern IO-Link interface standardized in accordance with IEC 61131-9. This offers the option of integrating the pyrometer directly into fieldbus systems such as Profibus, Profinet, EtherCat or EtherNet/IP.



CellaTemp® PX two-colour pyrometer

Measuring point after separation ④

If the temperatures are below 650 °C, a CellaTemp® PA/PX 20 pyrometer is used as an alternative.

Measuring systems

Measuring system	CellaCast PA 83-K012	CellaTemp® PA 41-K001	CellaTemp® PA 40-K013	CellaTemp® PA 20-K005
Pyrometer	PA 83 AF 13/C	PA 41 AF 190	PA 40 AF 21/C	PA 20 AF 9
Design	Stationary			
Measuring range	650 – 1700 °C	900 – 3000 °C	650 – 1700 °C	250 – 2000 °C
Sighting aid	Video camera	Laser pilot light	Video camera	Through-the-lens sighting
Spectral range	0.95/1.05 µm			
Mounting combination	PA 83-011	PA 20-091	PA 83-011	PA 83-010
Scope of delivery	Pyrometer Connection cable VK 02/A AF 1 (5 m) Video cable VK 02/F AF 1 (5 m) Mounting combination PA 83-011	Pyrometer Connection cable VK 02/A AF 1 (5 m) Mounting combination PA 20-091	Pyrometer Connection cable VK 02/A AF 1 (5 m) Video cable VK 02/F AF 1 (5 m) Mounting combination PA 83-011	Pyrometer Connection cable VK 02/A AF 1 (5 m) Mounting combination PA 83-010



- Headquarters
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