GLASS LEVEL CONTROL

A constant glass level in the melting end is a very important control component in the glass melting process. Glass level variations influence the steady operation of the furnace, and due to hydrostatic pressure, have a significant influence on the gob weight.

The high measuring accuracy of OPTIBEAM amounting to ± 0,10 mm allows for the precise control of the glass level together with all common charging machines. The equipment can be installed as a self-contained unit and can be easily operated via a touch-sensitive display. With the HORN OPTIBEAM all maintenance work, as well as adjustment of the measuring device, may be effected from outside during operation without any difficulty.

MEASURING PROCEDURE

In its molten condition, glass forms a smooth, reflective surface. This physical characteristic is used for contactless glass level measurement via laser beam. The laser beam hits the glass surface at an angle of 10 - 20°. Depending on the glass level, the laser is reflected at different points on the glass surface and, depending on the reflection, reaches different points on the CCD line camera installed at the opposite site. The measuring range of the camera sensor is -8.00mm ± 8.00mm based on a CCD range of 0..5000 pixels => 2500 pixel for the zero point and 312 pixel/mm glass level.

The camera evaluates this raw signal and converts it to a specified norm signal of 4..20mA / 0..10V DC which is then relayed to an evaluation unit.

<table>
<thead>
<tr>
<th>Output scaling</th>
<th>4..20mA</th>
<th>0..10V DC</th>
</tr>
</thead>
<tbody>
<tr>
<td>-8.00</td>
<td>4 mA</td>
<td>0 V</td>
</tr>
<tr>
<td>0.00</td>
<td>12 mA</td>
<td>5 V</td>
</tr>
<tr>
<td>+8.00</td>
<td>20 mA</td>
<td>10 V</td>
</tr>
</tbody>
</table>

RECEIVING THE SIGNAL

In front of the camera an infrared filter and an interference filter are installed to eliminate disturbing signals and to observe the laser beam signal only. The laser beam is shaped to a line, which is read by the CCD line camera. Due to atmospheric influences, the line shaped laser beam is diffused. The camera’s CCD line receiver consists of 5,000 lines each of which are 14 μm high and 35,0 mm wide. The signal received by the camera is evaluated as a gray-scale value and indicated as a raw signal. With the threshold height and deviation filters it is formed into a block signal.
Mounting and adjusting unit

1: Heat protection shield
2: Cooling box for laser / camera module
3: Connector for cooling water outlet
4: Laser / camera module
5: Connector for cooling water inlet
6: Adjuster for vertical angle axis
7: Adjuster for horizontal axis left / right
8: Adjuster for height level
9: Additional basement positioning screws

6  Adjustment for the angle of the cooling unit for the modules
7  Adjustment of the horizontal axis (left / right)
8  Adjustment of the vertical axis (up / right)
9  Adjustment of basement in horizontal axis (left / right)
SOFTWARE

Main frame
- Graphic (short-term recording) as well as numeric indication of glass level
- Display of actual values for analog output glass level and glass level controller
- Alarm and message management with date and time registered. All messages are stored in log files

Password protection dialog
- All user levels are password protected. Authorised operating staff can make the required settings by entering the password „123123“. An additional administrator level can only be accessed by entering an administrator password in order to make changes to programmes, Windows, hardware and verifying function.

Parameter menu
- Indication of the raw signal coming from the CCD line. The signal peak shows the actual glass level height
- Indication of formed block signal which results from the threshold and deviation filtering.
- Selection of different camera types (in case there is an older camera version)
- Adjustment for 0.00 mm point and all necessary parameters for plausibility check of raw signal

Language dialog
- List of all available languages. Text languages change immediately
- All languages with WINDOWS support can be integrated.
  Maximum 20 languages possible

Recorder menu
- Short-term recording with adjustable time axis and resolution axis. Charts can be stored as bitmap by way of double click
- Long-term recording with adjustable time axis and resolution axis. Charts could be stored as bitmap by way of double click
- Adjustment for time axis = sample time for historic data files for glass level

Data transfer dialog – destination path
- Dialog window for selecting the destination path for stored data files
- All data files can be stored on USB stick supplied
The evaluation unit consists of a closed industrial PC with IP65 protection class. All function card inputs and outputs for laser and digital cards are integrated. The PC can be supplied as a self-contained unit or installed in a control cabinet.

**EVALUATION UNIT**

The evaluation unit
- is formed as a closed industrial PC with IP65 protection class
- integrates all function cards and supply for laser and digital cards

**Stand alone version**
- PC stand on mounting frame
- fixing on walls with free angle
- cable connection indirectly onto the PC by clamps on the mounting frame

**Integrated version**
- PC cased in adaption frame
- opening possible at the rear
- cable connection directly onto the PC by SUB-D plugs

**GLASS LEVEL CHARTS**

**Short-term recording**
The down peaks every 20 minutes indicate the glass level at working end during the reversal sequence on a regenerative end fired furnace. The resolution is ±/± 1 mm graphical range. The fluctuations indicate the results of the glass level control.

![Short-term recording chart](image)

**Long-term recording**
The glass level is displayed for a period of 24 hours. The peaks of the reversals are also visible. The resolution is ±/± 1 mm graphical range.

![Long-term recording chart](image)
Cross section laser module
1: Protection glass disc
2: Laser diode with forming optics
3: Teflon cartridge
4: Adjusting screw for focus
5: Adjusting potentiometer for laser beam power
6: Connecting socket for cable kit

Cross section camera module
1: Protection glass disc
2: Interference and infra red filters
3: Steel cartridge
4: CCD-line camera
5: Connecting sockets and calibration potentiometers
6: Connecting socket for cable kit

Features:
- precise measuring of glass level by +/- 0,1 mm
- rare service intervals, only for cleaning openings and protection glasses
- contactless measuring
- integrated glass level controller
- laser and camera protected in water cooled housings
- easy to operate with touch-sensitive display
- based on Windows 2000
- storing of historical data on Microsoft software and transfer via USB stick
- data compensation for external influences from the plant, such as vibration from processing machines
- installation at distributor, forehearth or working tank

Technical Data
<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring accuracy</td>
<td>± 0,10 mm</td>
</tr>
<tr>
<td>Linear measuring range</td>
<td>10 / 16 mm</td>
</tr>
<tr>
<td>Max. measured length</td>
<td>approx. 5 m</td>
</tr>
<tr>
<td>Required opening</td>
<td>Diameter of approx. for laser beam 80 mm or gap of 80 x 50 mm</td>
</tr>
<tr>
<td>Evaluation unit</td>
<td>Industrial PC with menu-driven surface</td>
</tr>
<tr>
<td>Output signal</td>
<td>4 – 20 mA for control or others</td>
</tr>
</tbody>
</table>