Non Contact Infrared Thermometers for the Glass Industry
Glass manufacturing was one of the first industries to use non-contact temperature measurement. Many of today’s non-contact infrared sensor designs evolved directly from the needs and demands of the diverse, and many times harsh processes entailed in the making of glass products in their various forms.

Mikron Infrared Inc. has been closely engaged in the creation and design evolution of non-contact temperature sensors for the Glass Industry for over 35 years. Mikron’s sensor specifications and protective housing designs are in direct response to the special needs of the Industry, and have progressively taken advantage of the dramatic strides in optics, electronics and detector technology.

Today, Mikron infrared thermometers are to be found globally, in all segments of both primary and secondary glass manufacturing:

- Automotive and Architectural
- Decorative and Tableware
- Container and Fiber
- Optical Waveguide Production
- Lamp and Lighting
- Tempering, Laminating and Forming

The company now offers the world’s most comprehensive, single-source array of fixed mounted and portable non-contact infrared thermometers, along with hand held and fixed thermal imaging systems. In support of its sensors, Mikron also has a range of calibration standards and services that provide traceability, referenced to national standards.

The following pages will provide you with an overview of Mikron products for the Glass industry, and of applications that have been successfully engineered. More detailed product information, or the location of your Mikron representative, can be found on our website at www.mikroninfrared.com.
Float Glass Process Applications

**Melting & Refining**
The melt tank (1) and refiner area temperature measurement applications are common to many segments of the Industry. The measurement locations are: The furnace crown, the bridgewall, the burner port block, and the molten glass in the regenerator melt tank furnace. Sensors in the region of 1µ (micron) with and without fiber optics are used in this area. Due to the extreme environmental temperatures, water cooling is necessary for non-fiber optic models. Fiber optic models are used when water cooling is not desirable. Single wavelength (1 color) pyrometers are used throughout the Float Glass Process.

**Float Glass**
After the melt tank (1), the first points of measurement on Float Glass lines are in the Canal Area (2) followed by the Tin Bath (3), which requires multiple measurements to profile the glass. The Canal Area uses a pyrometer with a 1µ spectral response. Generally a fiber optic sensor is preferred. Sensors in the 5µ spectral response region are used here to sense the glass surface temperature.

In the Annealing Lehr (4), again sensors in the 5µ region are installed to sense near the edge and the center of the glass ribbon in each of the annealing zones. In the Cooling Zones near the end of the Lehr, and to determine the correct ribbon temperature in the glass cutting location (5), more economical sensors with 8-14µ spectral response can be used.

**Bending, Tempering and Sagging**
In the bending, tempering and sagging applications associated with the secondary processing of flat glass, sensors in the region of 5µ are used to measure glass surface temperature.

Other spectral responses have been used to measure temperatures just below the glass surface as a means of preventing “skin effect” stress patterns.
Container and fiber glass lines have common features in that they both have a melt tank refiner area and a Distributor with several Forehearths. Normally, fiber glass forehearths are longer and therefore have more zones than the container line equivalent. In the Distribution Area (2) IR sensors in the region of 1µ wavelength are used to measure just below the surface of the glass at one or more points. Due to extremely hot environmental conditions, fiber optic models are preferred.

In the Forehearth (3), again fiber optic sensors with 1µ spectral response are used to sense each zone temperature, and measure approximately 25mm (1”) into the glass. On some forehearths, zone temperature is combined with an additional IR thermometer, sighted into a molybdenum tube through the bottom of the forehearth, just before the orifice, to detect temperature gradients in the glass.

At the end of the glass conditioning phase in the forehearth, the container and fiber glass processes differ.

In fiber glass production, the last point of measurement of the forehearth, is at the Platinum Bushing (4). A variety of techniques have been used in this final production stage to ensure that correct temperature and temperature distribution across the bushing is maintained. This insures that the holes in the bottom of the Platinum Bushing remain open and unobstructed, allowing the molten glass to flow. For this measurement, portable or fixed systems with narrow-band, short wavelength spectral response or two color thermometers are used. All non-contact infrared thermometers avoid the errors attributable to electrical or electro-magnetic interference that complicate thermocouple measurements.
Lamp & Lighting Process Applications

Like Container and Fiber Glass production, Lamp and Lighting only differs in the forming and secondary manufacturing stages. Depending on the glass materials under process such as soda lime, lead glass or borosilicate (quartz) temperatures vary, ranging from approximately 500°C to 2200°C respectively. Mikron’s Line of IR Sensors at 5 micron spectral response are used to measure glass/quartz surface temperature, whether it is viewed directly or through clean flames. In the case where the glass is luminous, (molten glass), an IR Sensor with a 1 micron spectral response should be used.

Mikron’s non-contact infrared temperature sensors are ideal for monitoring and control of critical processes in the manufacture of incandescent bulbs, fluorescent tubes (mercury/sodium vapor) metal halide and high intensity discharge lamps. Mikron has a variety of products available for lamp/bulb flame sealing, bending, annealing and forming applications including the models M67S with through lens sighting, MI-N5/5+, with laser sighting and the M67SV which has video monitoring capability. For checking filament temperature choose from the M770S a fast, highly accurate Digital 2-color sensor with variable focussing optics or M770SV which incorporates video capability. The fiber optic model M780 is used in harsh and confined areas. In addition single color fiber optic sensors can be used to measure pinch die temperature, to reduce breakage in automotive lamp glass applications. In addition, the IR Sensor’s speed of response should be considered due to the very high speed nature of the Lamp/Lighting Glass Process.
Mikron IR Products for Glass Industry Applications

**Materials**
- Molten Glass or Refractory
- Non-Molten Glass Surface
- Metal Surface
- Tungsten Surface

**Measurement Points**
- Melt Temp.
- Canal Area
- Distribution Area
- Forehearth
- GOB
- Tin Bath
- Lehr
- Lamps
- Bulbs
- Blanks
- Molds
- Plungers
- Pinch Die

**Mikron Models**

<table>
<thead>
<tr>
<th>Materials</th>
<th>Measurement Points</th>
<th>Mikron Models</th>
</tr>
</thead>
<tbody>
<tr>
<td>Molten Glass or Refractory</td>
<td>Melt Temp. Canal Area Distribution Area Forehearth GOB</td>
<td>M67S(H) MI-N200/5 MI-N300/5 MI-N200/5 MI-N300/5</td>
</tr>
<tr>
<td>Non-Molten Glass Surface</td>
<td>Tin Bath Lehr Lamps Bulbs</td>
<td>M67S(E) MI-N5/5 MI-N5/5 MI-N5/5 MI-N5/5</td>
</tr>
<tr>
<td>Metal Surface</td>
<td>Blanks Molds Plungers Pinch Die</td>
<td>M67S(H),(Q),(D) MI-GA10 MI-S5 MI-S140 MI-S140</td>
</tr>
<tr>
<td>Tungsten Surface</td>
<td>Filament</td>
<td>MI-S5 MI-S5-TV MI-SA5 MI-SA5-TV</td>
</tr>
<tr>
<td>Metal Surface</td>
<td>Filament</td>
<td>MI-S10 MI-S10 MI-S200 MI-S200</td>
</tr>
<tr>
<td>Tungsten Surface</td>
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<td>MI-GA10 MI-GA10 MI-GA300 MI-GA300</td>
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</tbody>
</table>

Portable Models
- M67S(E), MI-N5/5, MI-N5/5, MI-S10, MI-S10

Fiber Optic Models
- M67S(H), MI-N200/5, MI-N300/5, MI-N200/5, MI-N300/5

Portable Models
- M67S(H),(Q),(D), MI-GA10, MI-GA10, MI-GA10, MI-GA10

Fiber Optic Models
- M67S(H), MI-N200/5, MI-N300/5, MI-N200/5, MI-N300/5

Portable Models
- M67S(H),(Q),(D), MI-GA10, MI-GA10, MI-GA10, MI-GA10
Mikron Products for Glass Industry Applications

**MI-N300/5**
Glass surface measurement, 2-wire design, 5.14µm spectral response and 100ms speed of response.

**MI-N200/5**
Glass surface measurement, (2-wire loop powered design) with service interface. Programmable measuring range, 5.14µm spectral response and 120ms speed of response.

**MI-N5/5**
Glass surface measurement, digital pyrometers with analog and digital outputs, 5.14µm spectral response, 80ms response time, laser aiming.

**MI-N5/5-M+**
Glass surface measurement, high speed version of MI-N5/5+ with 30ms and 10ms response times, laser aiming, spectral range 5.14µm.

**MI-S300 MI-GA300**
Good value, small, fast (10ms), medium/high temperature, 2-wire pyrometers with fixed focus, adjustable emissivity and LED aiming, easy installation.

**MI-S200 MI-GA200**
Fast (20ms), medium/high temperature, digital pyrometers with analog output, 2-wire design, maximum value storage, programmable measuring range, LED aiming.

**MI-S5 MI-GA5**
Very fast (2ms) digital pyrometers with analog output and digital interface. Maximum value storage, adjustable measuring range, laser aiming or through-the-lens sighting or integrated TV camera.

**MI-N5/5/5 MI-N5/5/5+**
Glass surface measurement, digital pyrometers with analog and digital outputs, 5.14µm spectral response and 100ms speed of response.

**MI-N200/5**
Glass surface measurement, (2-wire loop powered design) with service interface. Programmable measuring range, 5.14µm spectral response and 120ms speed of response.

**MI-S5 LO/GL MI-S5 LO/GL**
Fiber optic pyrometers for measurement of molten glass for forehearth, feeder and gobs. Adjustable measuring ranges, 2-wire design, analog output (service interface). Digital with adjustable measuring ranges with 250ms and 2ms respectively.

**M67S E, D, H**
Diversified industrially hardened pyrometer with precision upright through lens sighting, focusable optics, adjustable emissivity and easy 2-wire installation with 4-20 mA analog output. Speed of response 100ms/100ms/10ms.

**M68, M668**
Fiber optic models for non-contact temperature measurement of inaccessible locations where direct sighting is impossible or where exceptionally high ambient temperatures exist or EMI or RF interference is a problem. Speed of response 10ms and 50ms respectively.

**M680 H**
Multi-channel ultra precision fiber optic system. Wide range digital pyrometer with precision optics. Digital output, optional 4-20 mA analog output, long stainless steel sheathed fiber optic cable lengths and 50ms response speed.

**M770S**
Digital 2/color pyrometer with precision focusable optics, adjustable slope, alarm relay and temperature display for temperature range 1112°F to 6332°F. Powerful software for process diagnostics. 4-20mA and RS485 outputs.
Protective Hardware

Accessories

Mikron infrared sensors are inherently rugged and reliable, but for long term accuracy and reliability, the optics must remain clean and the electronics must not be subjected to conditions exceeding ambient temperature specification limits. Mikron’s extensive range of protection and mounting accessories make installation simple, keep maintenance to a minimum and ensure optimum performance in the harsh process environment of glass manufacturing.

Protective Cooling Jacket
with air purge and aiming flange assembly for models M67S and M770S Series

Air Purge & Water Cooling Jacket
for MI-200 or MI-N200/5 Sensors

Stainless Steel Protective cooling jacket with integrated air purge for MI-N5/5+ Sensors

Air Purge & Water Cooling Jacket
for MI-300/5

Air Purge Mini Assembly
for fiber optic models M68 and M668

Air Purge Assembly
for fiber optic models M68 and M668

Air Purge
with mounting bracket and ceramic/ inconel sight tube for MI-S50-LO-GL and MI-S5-LO-GL

Programming Module
Model MI-HT6000 for setting MI-Series sensor parameters

Scanning Mirror Assembly
MI-SCX Series

M300
For calibration of all infrared glass industry sensors ranging from 200º C to 1150ºC.