



## Why Temperature Measurement is Important for Glass Industry?

Temperature control is an important factor in glass industry due to high energy process involved in manufacturing of glass. Temperature measurement helps in improving the efficiency of glass plants by maintaining homogeneous quality and reduce scrap of the glass products. For efficient process control, temperature measurement is done during the various production stages in the manufacturing of float glass, technical glass and fiber glass variants.

## What are the Advantages of using Infrared Pyrometers?

- ✓ Remote Temperature measurement without physical contact
- ✓ Infrared pyrometers are available for different spectral ranges and are made particularly by keeping the application in mind.
- ✓ Digital and Robust feature with compact electronic components
- ✓ Minimum or No maintenance of infrared pyrometers as they do not undergo wear and tear due to harsh environment and high temperatures
- ✓ Very fast response time within milliseconds
- ✓ Easy to operate and handle
- ✓ Economic and delivers more than the cost
- ✓ Measurement of wide variety and high temperature ranges
- ✓ High accuracy
- ✓ Remote mounting possible from the hot target
- ✓ Temperature of moving targets can be easily determined
- ✓ Useful in hazardous or inaccessible area
- ✓ No effect of electromagnetic fields on the infrared pyrometer
- ✓ Don't contaminate, damage or interfere with the process

## Role of Wavelength or Spectral Range in Pyrometer Selection

The right wavelength selection is very important for all glass application. The behavior of glass changes with change in wavelength.

- ✓ Glass is transparent in the visible and near wavelengths of infrared region. In spectral range of 5...5.14  $\mu\text{m}$  emissions are very high with almost zero reflections which is very useful as temperature of the glass surface can be measured reliably and accurately. The infrared pyrometer AST AL514 works in this spectral range and is used particularly for the float glass temperature measurement.
- ✓ At 8-14  $\mu\text{m}$  glass is completely opaque and there is no light penetration at all, but reflection is around 20% so we may use 8-14  $\mu\text{m}$  range with emissivity settings as  $e=0.8(1.0-0.2)$ . when the reflectivity is 0.2. This spectral range is useful for temperature measurement of bottles and thin glass sheets. But if the surrounding contains flames and hot objects it can interfere the reading of the pyrometer in this spectral range.
- ✓ Spectral range 1  $\mu\text{m}$ ...is recommended for the molten glass temperature measurement as the light penetrates certain centimeter below and this helps to measure the glass temperature slightly beneath the surface in the Melting Tank, Forehearth and Feeder.

The following table summarizes the glass application and our recommended products for the same.

Glass Application	Installation Points	Products Recommended
Float Glass	Working Tank	AST 450G2
	Canal	AST 450G2
	Tin Bath	AST AL390
Container Glass	Annealing Lehr	AST AL514
	Working Tank	AST 450G2
	Feeder/Fore hearth	AST 450G2
	Glass Gob	AST A450C
Technical Glass	Glass mould	AST A250
	Measuring bulb surface	AST AL514
	Glass Dishes	AST AL514
	Rotary Blow Moulding Machines	AST AL514
Fibre Wool	Forehearth	AST 450G2
	Spinner Bushings	AST A450+

# Float Glass Application

The raw materials are fed into the furnace where its is melted at a temperature of around 1500°C. The molten glass is then transported to the Tin bath through a canal. The glass floats on the tin surface like a ribbon. As the glass flows through the Tin bath its temperature drops from 1100°C till 600°C. Once the glass passes out of the Tin bath it passes into the Annealing Lehr where it is subjected to cooling so that glass becomes resistant to strain, doesn't crack and most importantly cut ability of the glass will be good. Once the glass is properly annealed it exits the Lehr and then the glass is cut by machines and transported.

The regions within the float glass manufacturing process where temperature measurement is crucial are Working tank, Canal, Tin bath and Annealing Lehr.

**1. Application : Working Tank**

Process temperature : 1500°C

Recommended Pyrometer : AST 450 G2

**2. Application : Canal**

Process Temperature: The temperature must be minimum 1100°C before entering the Bath.

Recommended Pyrometer : AST 450 G2

**3. Application : Tin Bath**

Process Temperature : starting at 1,100°C and leaving the float bath as a solid ribbon at 600°C. As the glass flows down the tin bath temperature reduces down to 600°C

Installation of the Infrared Pyrometer : AST Infrared sensors should be mounted above the Tin bath

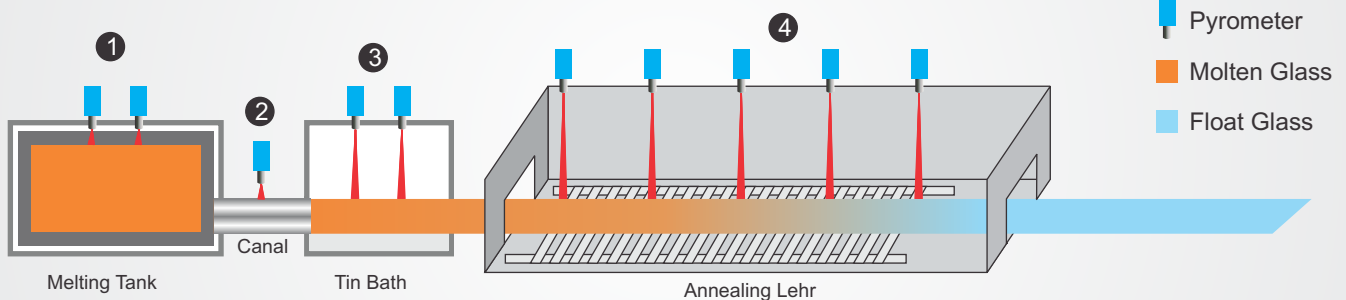
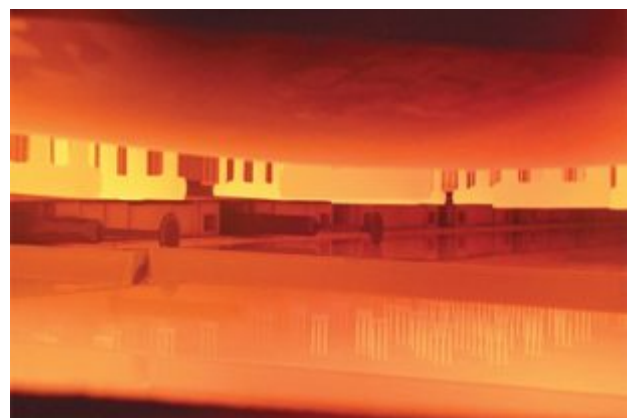
Recommended Infrared Pyrometer : ASTAL390

**4. Application : Annealing Lehr**

Process Temperature : 100°C-800°C

Installation of the Infrared Pyrometer: AST Infrared sensors will be mounted at the top across the Lehr at equal locations.

Recommended Infrared Pyrometer : ASTAL514



We measure temperature accurately even in extreme conditions

# Container Glass Application

The glass containers such as bottles, jars and bowls etc are the various products manufactured in this process. It involves the transfer of molten metal from the working tank to one or more for hearths/feeders. The molten glass then flows into the gob from where it is dropped into the various moulds where the glass forming is done.

The most important and critical region is the Fore hearth/Feeder. Proper temperature is to be maintained in the Fore hearth. By doing so it can be ensured that the molten glass reaching the gob is in homogeneous state. As we know change in temperature is critical to glass viscosity. A slight change leads to changes in viscosity as well.

**1. Application : Working Tank**

Recommended Product : AST 450G2

Temperature measurement is crucial for maintaining homogeneous condition of the molten glass exiting the tank.

**2. Application : Feeder/Forehearth**

Recommended Product : AST 450G2

The AST 450G2 is the right solution for the monitoring of temperature in the Fore hearth. The fast response time is useful in monitoring changes in temperature range. Pyrometer contains small optical head which makes it easier to reach the harsh locations and the Fibre Optic Cable can withstand ambient temperature up to 250°C very easily. The accessory such as air purge unit helps in purging and keeps the optical lens clean and the mounting system provides proper support to the pyrometer.

**3. Application : Glass Gob**

Recommended Product : AST A450C

Efficient temperature control helps in achieving the desired container wall thickness. With the use of infrared pyrometer the correct gob temperature is achieved before entering the next stage. This application demand fast acting infrared pyrometers. The two color pyrometer provides a response time of 20msec. Pyrometer with water cooling jacket is recommended for this application.

**4. Application : Glass Mould**

Recommended Product : AST A250 single wave infrared non contact on-line digital pyrometer with peak picker and software for continuous data storage and available Small spot sizes.



AST 450G-2  
AST 450G2 Mounting systems



Airpurge unit with Sighting Tube



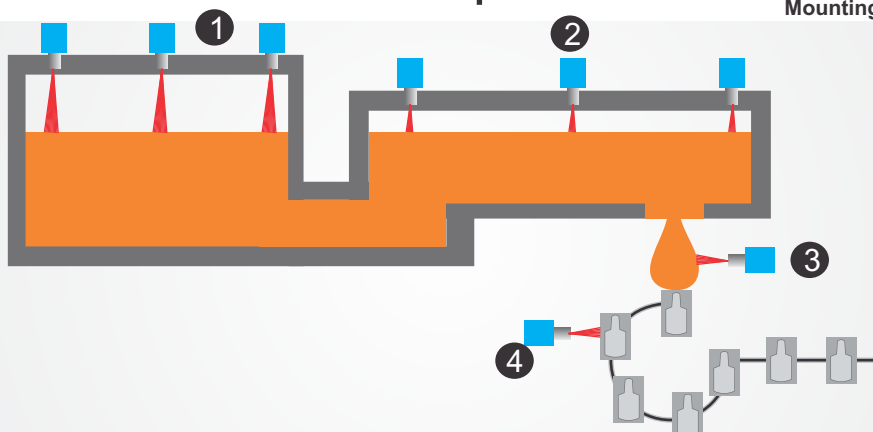
Airpurge unit with Ceramic Tube



AST A450C



Water Cooling Jacket with in-Built Air purge and Mounting Stand



Pyrometer  
Molten Glass

We measure temperature accurately even in extreme conditions

# Products Recommended for Glass

## AST 450G2

- ✓ AST 450 G-2 is specially designed 2 wire digital pyrometer with digital and analog output that allows remote communication and helps in simple installation.
- ✓ Fiber Optic Cable can withstand ambient temperature up to 250°C very easily so no water cooling required.
- ✓ Supplied with software which helps in remote communication. Emissivity, sub range or response time and peak picker can be preset ex-works or adjusted through software.
- ✓ The pyrometer has stainless solid steel body which provides high operation safety even in rough industrial environment
- ✓ The fast response time of 250msec is useful in monitoring changes in temperature range.
- ✓ Pyrometer contains small optical head which makes it easier to reach the harsh locations
- ✓ The accessory such as air purge unit helps in purging and keeps the optical lens clean and the mounting system provides proper support to the pyrometer



## AST A450C



- ✓ Two colour, single colour switchable
- ✓ Temperature measurement is unaffected by dust, water vapour and high ambient conditions due to two color technology.
- ✓ Sighting can be laser targeting light or through the lens
- ✓ Wide temperature range from 600...2500°C
- ✓ Analog output 4-20 mA or 0-20mA or 0-10 V User selectable
- ✓ RS-232 or RS-485 serial communication available
- ✓ USB Output is available
- ✓ Built in lens contamination control system
- ✓ Small spot sizes
- ✓ Fast response time of 20msec adjustable upto 10 sec
- ✓ Very good stability
- ✓ Rugged stainless steel housing
- ✓ User friendly software for setting emissivity ,response time, peak picker

## AST AL514

- ✓ Pyrometer working in spectral range 5.14  $\mu\text{m}$  most suitable for glass surface temperature measurement.
- ✓ Four wire form with analog output 4 to 20mA or 0 to 20mA or 0 to 10V
- ✓ Fast response time of 60ms
- ✓ Very good stability
- ✓ Comes with USB 2.0 connector with cable
- ✓ Pyrometer is used for wide temperature ranging from 400°C to 2500°C.
- ✓ RS 232&RS485 interface is also available for remote communication and data logging.
- ✓ The products recommended for the application is supplied with other necessary accessories like water cooling jackets, Air purge Units and Mounting tubes as a complete system needed for the installation at the plant.
- ✓ The electronic assembly is protected by IP65 rugged stainless steel housing.
- ✓ Highly Accurate due to digital linearization of the output.

## AST AL390

- ✓ Highly accurate infrared pyrometer working in spectral range of 3.9 $\mu\text{m}$
- ✓ Analog output 4 to 20mA or 0 to 20mA or 0 to 10V
- ✓ Serial communication RS-232 or RS-485
- ✓ Response time 60 ms
- ✓ Very good stability
- ✓ USB output



# Technical Specifications of products

Features	AST AL514	AST 450 G2	AST A450C	AST AL390
Temperature Range (Analog sub range adjustable)	300°C to 1400°C 400°C to 2500°C	600°C to 1800C	600° - 1600°C 800° - 2500°C	300°C to 1400°C
Emissivity Range	0.2 ..... 1 adjustable	0.05.....1 adjustable	0.1....1 adjustable (for single color mode) 0.75....1.25 slop adjustable (for two color mode)	0.1....1 adjustable
Spectral Range, $\mu\text{m}$	5.14 $\mu\text{m}$	1 $\mu\text{m}$	0.7....1.15 $\mu\text{m}$	3.9 $\mu\text{m}$
Photodetector Type	Thermopile	Silicon	Silicon/Silicon	Thermopile
Response Time	60msec	250 msec adjustable upto 10 sec.	20msec. Adjustable upto 10 sec	60msec. Adjustable upto 10 sec
Accuracy	< 500°C accuracy is 1.5% of temperature reading	+/-0.3 % of the measured value or 3°C whichever is greater	$\pm 0.5\%$ +1°C of measured value	1.5 % of temperature reading
Repeatability	0.3 % of reading in °C +1°C (whichever value is greater.	0.2% of reading in °C +1°C	0.1% of reading in °C +1°C	0.3 % of reading in °C +1°C
Distance to Spot size Ratio	50 : 1	100:1 min spot size 16mm	100:1(600 to 1600°C) 200:1(800 to 2500°C)	50:1
Digital output	USB 2.0, RS-232 or RS-485 (Isolated)(User Selectable)	USB 2.0	USB 2.0	USB 2.0
Analog output	4-20 mA or 0-20 mA or 0-10 V User selectable	4-20 mA	4-20 mA or 0-20mA or 0-10 V User selectable	4-20 mA or 0-20mA or 0-10 V User selectable
Power	24V DC	24 V DC	24 V DC	24 V DC
Sighting	Laser pilot Light	-	Laser pilot light (PL) or through the lens sighting (TL)	Laser pilot light
Protection class	IP65	IP65	IP65	IP65
Operating temperature range	0°C to 70°C, 0°C to 200°C (with cooling jacket)	Max.250°C (Optical Head & Fibre Optic) 0°C +70°C at pyrometer end	0°C.....+70°C, 0°C.....+200°C(with cooling jacket)	0°C.....+70°C, 0°C.....+200°C(with cooling jacket)
Storage Temp.	-20°to 70°C	-20°to 70°C	-20°to 70°C	-20°to 70°C
Dimensions/Weight	Dia.= Ø49.5mm; Length= 118mm / Weight= 0.6 kg	115 mm * 65 mm * 55 mm / 0.5 Kg	Dia. = Ø49.5 mm; Length = 118 mm / Weight = 0.6 kg	Dia.= Ø49.5mm; Length= 118mm / Weight= 0.6 kg
Adjustable Parameters via software	Emissivity, Analog output, Address, Response time, Peak picker, Analog Output sub range	Response time, Temperature sub range, emissivity	Emissivity, Emissivity Slope, Analog output, Address, Switch off limit, Response time, Peak picker, Analog output sub range, switches b/w 2-color or single color	Emissivity, Analog output, Address, Response time, Peak picker, Analog Output sub range