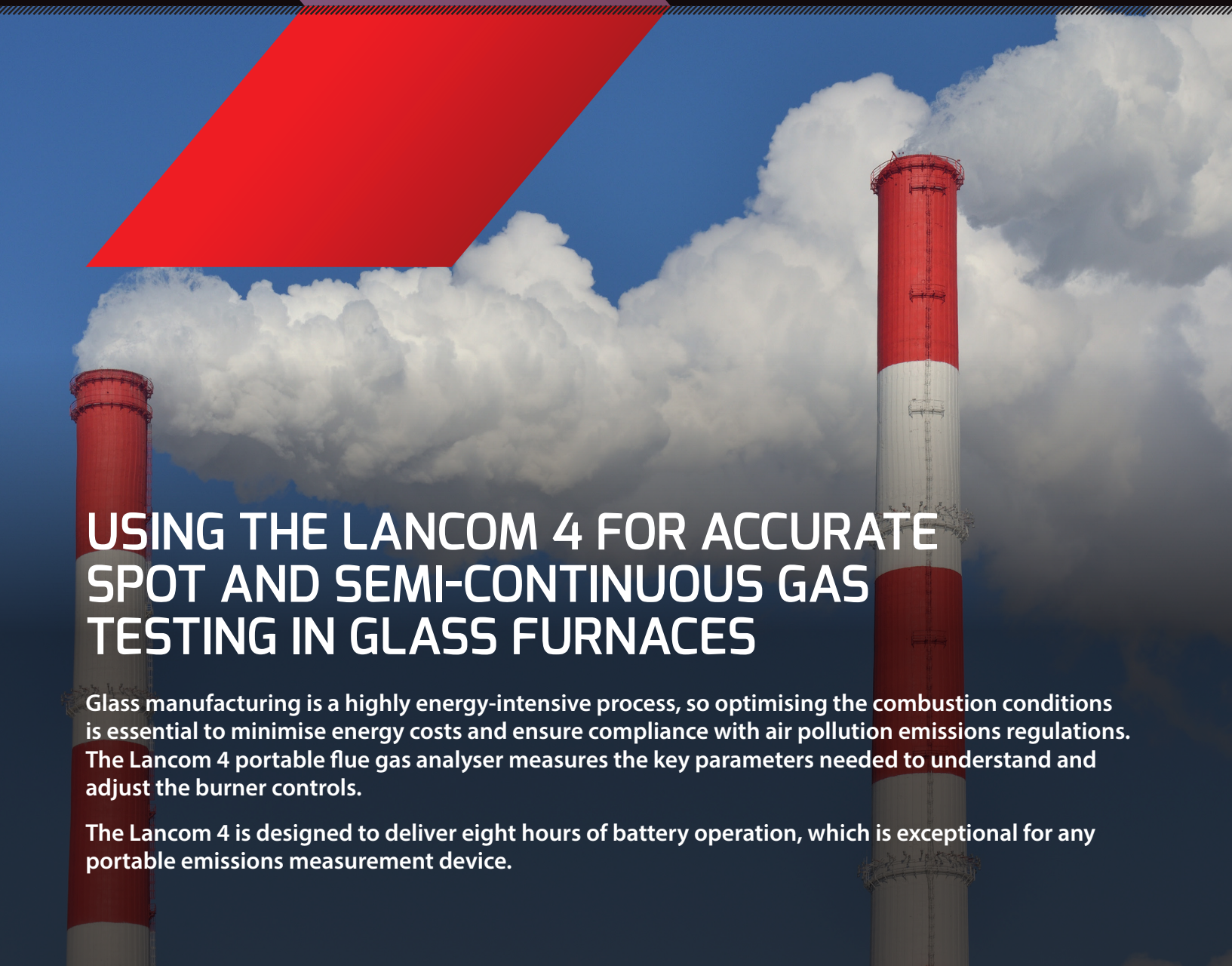
LAND

AMETEK®

*OPTIMISING COMBUSTION CONDITIONS IN GLASS MANUFACTURING*

APPLICATION NOTE



# USING THE LANCOM 4 FOR ACCURATE SPOT AND SEMI-CONTINUOUS GAS TESTING IN GLASS FURNACES

**Glass manufacturing is a highly energy-intensive process, so optimising the combustion conditions is essential to minimise energy costs and ensure compliance with air pollution emissions regulations. The Lancom 4 portable flue gas analyser measures the key parameters needed to understand and adjust the burner controls.**

**The Lancom 4 is designed to deliver eight hours of battery operation, which is exceptional for any portable emissions measurement device.**

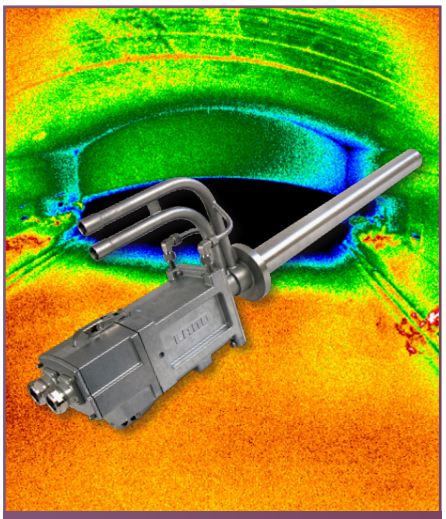
# COMBUSTION OPTIMISATION REQUIREMENTS

The first requirement for combustion optimisation is to set the correct fuel-to-air ratio. In general, the requirement is to minimise the amount of excess air whilst still allowing complete combustion of the fuel. This requires a knowledge of the oxygen ($O_2$) and carbon monoxide (CO) concentrations in the flue gases. A high oxygen concentration is an indication that heat is being wasted by venting hot air through the stack, whereas excess carbon monoxide is an indication of incomplete combustion.

In most cases, the CO concentration is below 100 ppm, but on furnaces with failing regenerators, CO values in excess of 70,000 ppm are possible, so a wide measurement range is essential. The Lancom 4 can accommodate both a low and a high-range CO sensor. Where the CO concentration exceeds the maximum range of the low-range CO sensor, the sensor is automatically purged with ambient air and the instrument switches to the high-range sensor.

The next requirement is to minimise emissions of oxides of nitrogen (NOx). There is a direct correlation between peak flame temperature and the formation of NOx. Based on Zeldovich's theory, any parts of a flame that are above 1600 °C will form thermal NOx.

Generally, the higher the temperature is, the greater the risk of dissociating oxygen and forming thermal NOx, which is dominant in glass melting furnaces. While a flue gas analyser such as AMETEK Land's Lancom 4 can show which exhaust ports have the highest NOx, it may not indicate which of the burners is generating the most NOx. The AMETEK Land NIR-B infrared borescope imager is the ideal tool for this. When the burners are firing, the indicated temperatures are not reliable, since the not emissivity of the flames is not known, but the application of relative isotherms within the image offers the ability to see which flames are typically hotter and give an indication of the flame length.



The AMETEK Land NIR-B infrared borescope imager is the ideal tool for indicating which burner is generating the most NOx.

A borescope thermal imager can be used to determine conditions within the melt tank

# RECOMMENDED PRODUCT:

## LANCOM 4


### FEATURES OF LANCOM 4

Many glass melting furnaces have a water-cooled sampling probe, which is robust and effective but not ideal for portability. The Lancom 4 has a high-temperature probe which includes a mullite ceramic probe and is resistant to the high temperatures found in a glass furnace, but is rather fragile. Depending on the glass type, sample location, and furnace operating conditions, operators should allow for probe breakage and have spare probes available.

The Lancom 4 comes with a water catch pot, external filter, external dehydrator, and an internal micro-filter, which provide a good degree of instrument protection when working on a glass furnace. In some cases, an additional filter system and gas preparation system may be used – such additional protection will only extend the life of the analyser and increase its reliability.

The instrument uses ambient air as a zero gas, and it performs a zero calibration each time it is switched on, with the the oxygen sensor calibrated to a standard concentration of 20.9%. AMETEK Land recommends an annual factory calibration, but on-site calibration is quick and easy if the relevant calibration gases are available. If a stack testing team is on-site, there is normally a chance to use its calibration gases to check your instrument.

One of the features of the Lancom 4 is the ability to use quick-release hose barbs on the measured inlet and exhaust. It is worth keeping a spare hose barb available to let the instrument purge with air between samples. It is also possible to place a finger over the inlet to prove suction on the analyser. In most cases, the instrument exhaust can simply vent to the ambient air. If the Lancom 4 is used in a confined location, it may be necessary to connect a hose to the exhaust and vent to a remote area.

### FEATURES

- Measure up to eight gases simultaneously
- Uses quick-release hose barbs on the measured inlet
- Customisable to specific gas measurements and process stream conditions

### BENEFITS

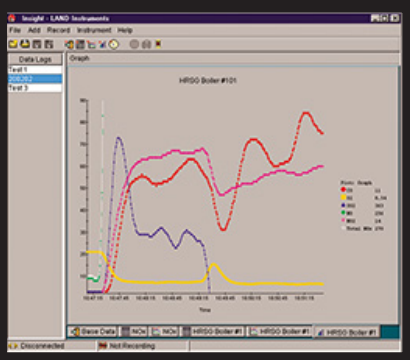
- Simple to set up and easy to use
- Achieve excellent analytical performance through a long-life eight-hour battery charge
- Ideal for converntional and oxy-fueled furnaces

# DIRECT LOGGING SOFTWARE:

## INSIGHT DATA ACQUISITION & ANALYSIS

Insight DAA software is the complimentary data acquisition software for the Lancom 4 portable gas analyser, allowing users to download and log stack emissions data to a Windows PC or laptop.

Used in conjunction with a Lancom 4 Analyser, Insight provides the statistical and graphical tools for the viewing, in-depth analysis and presentation of collected data.



# FURNACE CONDITIONS

When working on an oxy-fuel furnace, it is important to consider that at stoichiometric conditions there is, in theory, 66% water. The reality is that it will be less than this, but it still has significant potential to literally flood the instrument. There may be strange flows in the flue system, specifically when more than one port is used. The benefit of oxy fuel is that conditions are typically steady-state, and there is no need to wait for a full firing cycle on a regenerative furnace. The exhaust port is typically under negative pressure, so the probe should always be sealed with fibre to reduce parasitic air ingress.

On an end-fired furnace, the port neck is the best location from an emissions perspective, but is likely more difficult from a health and safety perspective because of the high ambient temperature. The target wall is often used, as there are almost always access platforms. This point is close to the potential location of a Lambda or oxygen probe sensor. It is important to remember that an in-situ oxygen sensor measures on a wet basis. Because of the sample conditioning, the oxygen in a Lancom 4 is a % dry basis and will indicate a higher $O_2$ concentration.

Cross-fired furnaces typically have 3 to 9 ports to measure, with 20 to 30 minutes per reversal. This creates a chronological dilemma. The reversal period is typically 20 minutes and there are transient variations as the fuel flow and air ratio stabilise the reduction in air preheat temperature. Depending on the furnace and control system, it is advisable to wait five minutes before recording data, or to disregard it during the analysis.

If you were to measure every port for 20 minutes as in an end-fired, a full survey could take up to 6 hours! As a first step, you should attempt to measure every port during one reversal. If you follow this process, it is essential that you test the same ports in the same order, since then you will measure at similar phases of the firing cycle. To minimize the risk of dehydration and heat exhaustion for the person using the Lancom 4, it is best to start the measurement sequence at the last port. This port will typically have the highest excess $O_2$ and so the measurement will stabilise faster. By starting at the furthest point, psychologically you are working "homewards" to the control room. Position the analyser mid-way between the sample points and as soon as the measurement is stable, record and move the probe to the next measurement point. Then move the analyser and, if possible, retire to a lower temperature area as a new sample comes through. The length of the tube is a compromise, since the shorter the tube the faster the response time, but there is more risk of damaging a probe. A longer tube is easier to move but has a slower response. The instrument's insulated carry case can be used as a radiation shield.

Lancom 4 is a portable flue gas analyser that is integrated into a compact battery-powered unit and is able to measure up to eight gases simultaneously with nine separate sensors (including high and low CO). Simple to set up and easy to operate, Lancom 4 enables highly accurate spot and semi-continuous gas testing, adaptable to a wide variety of applications and ensuring a plant maintains full compliance with safety and emissions requirements. Customisable to specific gas measurements and process stream conditions, a resilient stainless-steel probe extracts the gas sample, while advanced real-time processing techniques produce the highly accurate combustion and emissions calculations needed. A ceramic probe is available for high-temperature applications, such as those in the glass industry.