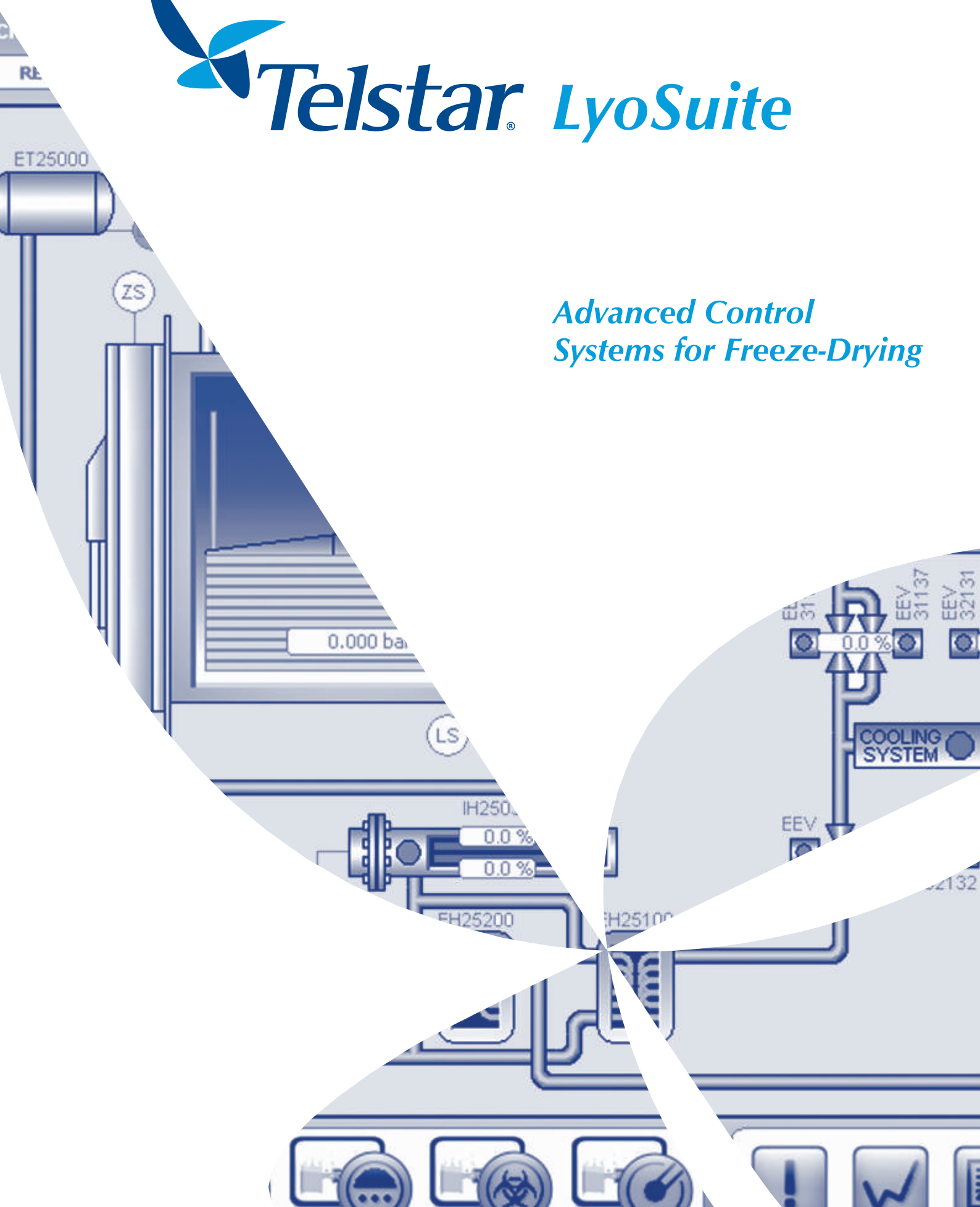




Telstar LyoSuite

*Advanced Control
Systems for Freeze-Drying*



Combined Control Technologies

Telstar has extended the concept in control systems for freeze drying with LyoSuite™, a combination of technologies which provides robustness and **advanced parametric monitoring** within a user-friendly framework.

LyoSuite™ combines the proven robustness of industrial PLC control with the security of a widely available SCADA package and integrates a suite of tools for advanced process monitoring. At the heart of the system is the patented Lyometrics.

In the laboratory scientists rely on sensors for measurement of critical product parameters, such as thermocouple for monitoring temperature. Under production conditions, however, the use of such sensors is made difficult, since the operator is often isolated from the process for reasons of safety and quality. Within an isolated or contained environment or one in which automated loading and unloading is being performed the placement of sensors becomes a totally impractical proposition.

Furthermore, when the product volume is very small, the presence of a foreign object, whether wired or wireless, can be sufficient to render the sample non-representative of the batch.

These practical problems are overcome through the use of Lyometrics.

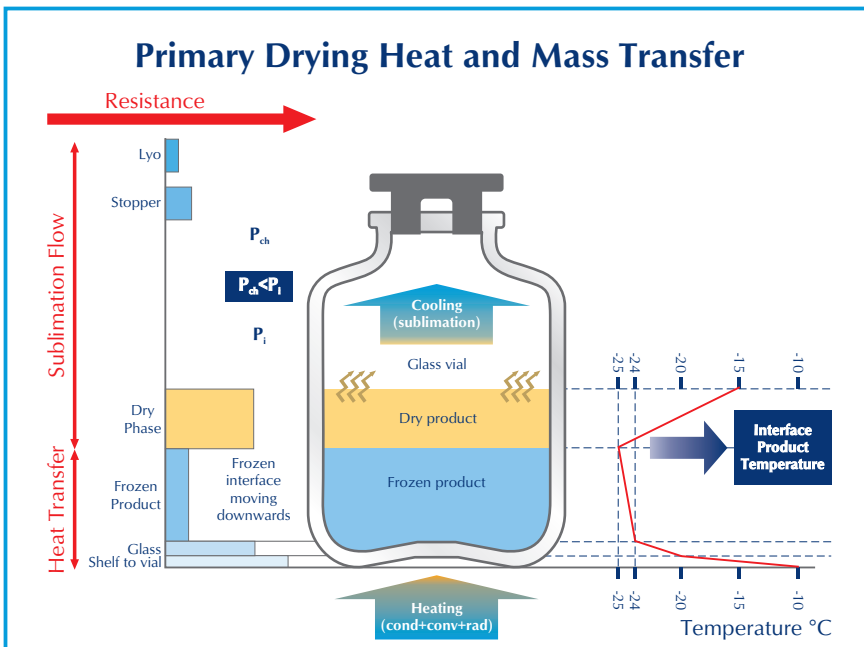
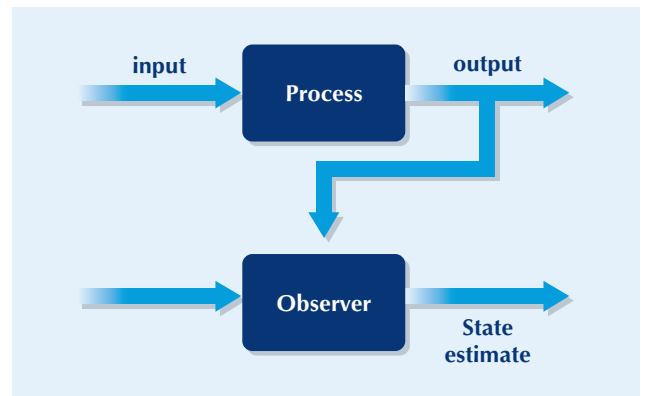
Advantages of Lyometrics

Any freeze-drying cycle can be monitored by Lyometrics and the system has the following advantages:

- No sensors require inserting into the product;
- Average batch parameters are tracked;
- Continuous tracking of the entire primary drying process, including identification of primary drying endpoint;
- Applicable to drying in vials or in bulk;
- Characterization of the freeze drying plant, to support process scale-up;
- Improved process understanding leads to shorter development times.



When automatic loading systems are utilized the activity of placing sensors to monitor product temperature becomes extremely difficult.



Lyometrics is a non-invasive monitoring technique whereby a mathematical model makes predictions from experimental data and prior knowledge of the system. Unlike alternative techniques, **the modeling is performed dynamically**, so that the prediction closely tracks the state of the actual system.

All Telstar freeze-dryers are suitable for integration of Lyometrics and the following parameters can be monitored and recorded without product sensors

- Temperature at the sublimation interface;
- Sublimation mass flow rate;
- Primary drying endpoint;
- Mass transfer coefficient;
- Heat transfer coefficient.



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Telstar reserves the right to improvements and specifications changes without notice.

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