glass WORLDWIDE

Speaking the same language is the key

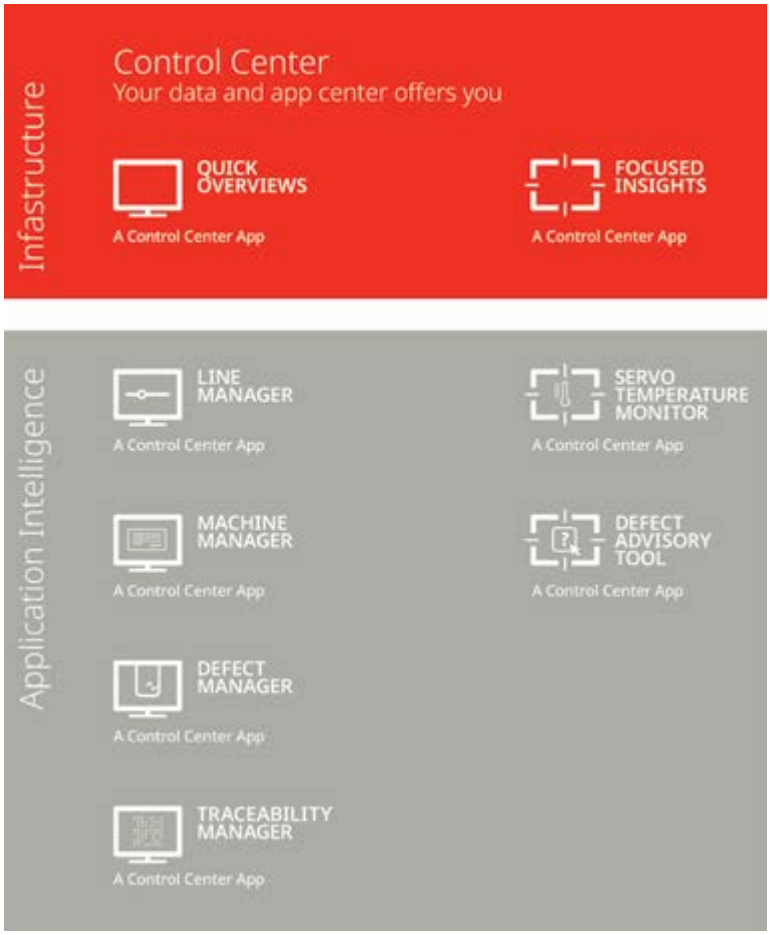
Hollow glass production lines are equipped with increasingly sophisticated sensor systems. This opens the door to thorough process understanding. Before applying any data analysis tool or closed loop, however, a much more basic functionality has to be ensured: The different systems that collect data have to speak the same language or the different data has to be translated so the systems understand each other. Although this sounds simple and straightforward on paper, in practice it is not. In the first of a series of articles, Thomas Bewer sheds light on the importance of data and language for process automation and stabilisation.

One major benefit of the sensor systems is that control system parameters can be automatically adjusted based on measurement results. These so-called closed loop systems help to stabilise the process and speed up job change times.

In a closed loop system, a measurement value has to 'talk' to an actuator. Within Emhart, all the elements are able to communicate with each other – in the case of a closed loop, the interpreter is the FlexTernal software on the FlexIS. The FlexTernal furthermore makes sure that the data is cleaned from outliers and misreadings. Figure 1 summarises the available closed loops from Emhart and the involved systems.

Communication between the different systems becomes even more important when multiple sensors are involved to run a closed loop. This will be the case with the second generation of closed loops currently under development. One of these next closed loops is the smart feeder, where information about the gob falling into the blank is combined with information about the cut gob. Another example is the Vertical Glass distribution closed loop that uses the parison temperature reading with the intensity distribution of the bottle to stabilise glass distribution.

Also, swabbing robots like the Emhart Flex Robot have to communicate with the sensor and the control systems to avoid collisions and to take over further tasks besides process adjustments in the future. For example, information about the gob falling into the blank will indicate a need for deflector swabbing, exchange or adjustment and will trigger an action by the robot.



Applications on the Emhart Control Center.

Data translation

When combining different time series of different systems, the next challenge arises: The correct data for the right time frame needs to be picked and correlated. This task is fulfilled by the Control Center, which stores the data of measurement systems and the change log of the timing system. Based on this data, the Control Center translates the data for the user into tailored data analysis and aggregated views. The different applications on the Control Center offer information for different needs of all the hierarchy levels and advise what actions the users should take to successfully fulfil their tasks.

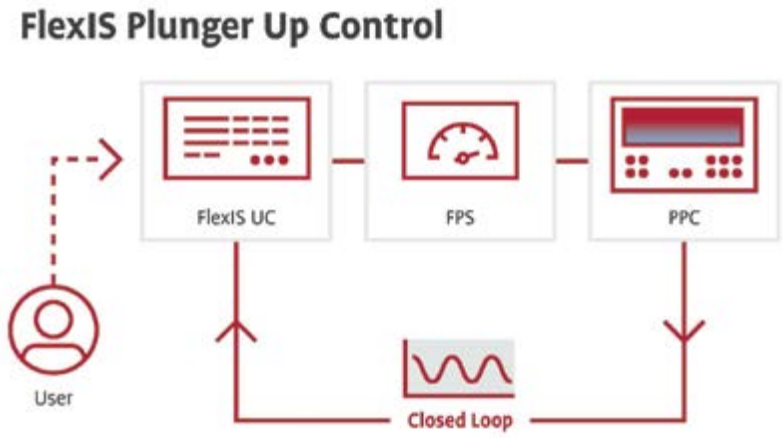
One very good example for such an application is the defect advisory tool, which displays the aggregated view of the currently detected defects to the hot end operator. But it is not just statistics - they get translated into the operator's

	System 1	System 2	Interpreter
Plunger up closed loop	Plunger process control measurements	FPS pressures in the FlexIS control system	FlexTernal
Mould temperature closed loop	Mould temperature measurement by TCS or Blank Radar	Mould cooling timing in the FlexIS control system	FlexTernal
Plunger temperature closed loop	Plunger temperature measurement by TCS or Blank Radar	Plunger cooling timing in the FlexIS control system	FlexTernal
Bottle spacing closed loop	FlexRadar measurements	Pushout timing in the FlexIS control system	FlexTernal
Smart feeder	Gob weight and shape measured by the Gob Radar. Gob length at section level measured by the BlankRadar	Feeder multi gob timing in the FlexIS control system	FlexTernal

Figure 1: Summary of the currently available closed loops from Emhart and the involved systems.

language. The hot end operator is empowered to identify the defect and its cause as pictures of the inspection machines are displayed and he receives advice how to remedy the defect. This is achieved by matching the classification in the inspection machine with the defect language at the hot end.

For the correlation of the inspection results to the forming setting and measurement results on the hot end, a further 'interpreter' is needed – the data matrix code. This code is laser marked by the Emhart ID Mark on the conveyor at the hot end. This code includes a unique number for each individual bottle. In the Control Center, all gathered forming information is related to this number. This code is then read in the inspection machine and all inspection results are attached to the number as well. Now, forming settings and measurements can be correlated to occurring defects.



Plunger Up Control closed loop schematic.

A vital role

For artificial intelligence or machine learning projects, the data cleaning and translation into a consistent data model is vital. According to data science companies, data cleaning and data modelling take about 80% of the time (and cost) of data science-related projects. Therefore, Emhart offers data access via an 'advanced data interface' to allow the access of measurements and machine settings via one single interface.

This short overview shows how important the communication of all different subsystems is to guarantee optimised production and seamless integration. Bucher Emhart Glass offers all the necessary components out of one hand and with this, ensures that all partners speak the same language: The FlexIS control system, the involved Radar family measurement systems, the FlexRobot, the FleXinspect and the Symplex B or C inspection machines.

More details on the above described aspects will be given in future articles to be published in *Glass Worldwide*.

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