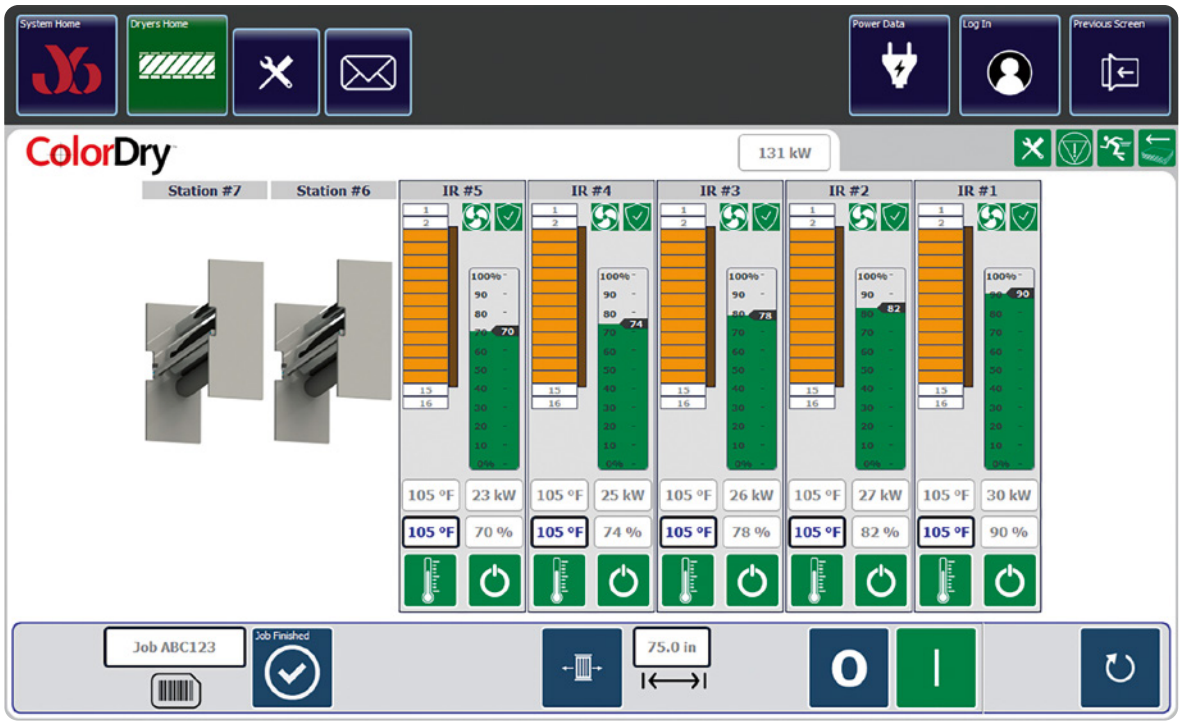


JB AutoDry™ user interface

THE ADVANTAGES OF A DRYING CONTROL

IN THE FOLLOWING ARTICLE, WILBERT STREEFLAND OF TECHNOLOGY COACHING BV REVIEWS THE LATEST SYSTEM FROM JB MACHINERY.

In the process of making a box there is always room for improvement, such as the use of dryers when printing. JB Machinery developed the ADC which stands for AutoDryer Control.

The Problem

When we print water-based ink on the surface of a substrate, the water in that ink needs evaporating. To accelerate that process we use dryers; this can be hot air or IR. It is common that the operator sets the dryer power level based on experience, therefore the feedback loop is via the observations of the operator. The results is that in most cases the thought is 'more is better' and dryers are set on maximum power.

Is this really needed? The water film applied with the ink ranges between 1 to 3 Qm (millionths of a metre) at most. When you apply a water film of that thickness on your kitchen table it disappears before you finished applying it. The amount of water in the substrate is roughly 30x higher. It is therefore likely that using dryers at 100% results in also removing moisture from the substrate, which of course is a waste of energy.

Why would we use a dryer if a 1Qm water film disappears that easily from the ink printed on the substrate? Well, evaporation takes energy from the substrate. A simple test can be done using a non-contact thermometer such as a Fluke 62 MAX IR (as pictured here).

With this device you can measure non-contact board temperature inside the machine. You start running sheets through your machine and measure the un-printed board temperature just after the print station you plan to use and record the value. Next, you start printing a full tone area and you measure, in the same position, the printed board temperature. Depending on the printed ink film thickness, the board temperature will drop. When I did the test, I recorded a drop in temperature of about 3-5 °C. Thus, after every layer ink you print, the board temperature drops. The colder the board gets the more difficult it is to get the next ink layer dried. We need to apply energy to the board with a dryer when we print on multiple print stations after each other, in order to maintain board temperature at a constant level. But we only need to apply the amount of energy that was removed from the substrate due to the evaporation of the water in the ink. At the same time, you want the same conditions in all print nips. That means that also the temperature of the board that enters the first print station needs to be controlled. Call it pre-conditioning of the board/ substrate temperature.

If the conditions in all print nips are identical than the ink will likely respond identically in all print nips.

In addition, it is important to realise that overheating the ink during drying results in the ink not having time to stick to the substrate. It is not uncommon that ink is loss on the substrate due to over-drying.

The Solution

How do we get to identical print conditions in each print nip in terms of drying? JB Machinery developed ADC (AutoDryer Control) for this. What the system does is measure the temperature of the board just after passing the dryer. Next, there is a feedback loop that controls the power supply to the dryers depending on the measured temperature and target temperature.

Therefore, if the set board temperature is 35°C and the sensor measures 40°C actual board temperature, the power to the dryer before the sensor is reduced. And if the temperature is lower than the target temperature, the power is increased.

This is done for each print station dryer individually, as the power that needs to be applied is depending on how much ink is printed by the individual print station.

JB IR cassette with AutoDryer sensor

Remember, only IR dryers can be used for this type of control as we need a quick response in changing power based on the temperature sensor reading. The target is to maintain a constant board temperature. That temperature should be high enough to allow a quick evaporation of the water from the ink but it needs to be low enough to avoid evaporation of water from the substrate.

To best explain the problem of unwanted substrate moisture removal, we look at a graph where we measure substrate moisture content, in a moisture analyser, using different temperatures for measuring moisture content. The moisture analyser allows measuring moisture content between 50°C and 200°C – we measure moisture content at different temperatures where every test was done with the same sample weight as we also measure the time needed to do the moisture analysis. The graph below shows the results of the moisture content in function of analysis time and temperature.

What you see is that the test time is significantly shorter at 200°C than at 50°C, but also the highest moisture content is measured at 200°C. This graph explains that if we want to avoid removing moisture from the substrate while drying the water from the ink, we need a low temperature. The recommended temperature is 35°C.

Now what happens when we increase the machine production speed? The hypothesis is that the board is a shorter time in form of the dryer that suggest more power, but the loss of energy between stations is also less. That implies less energy is needed.

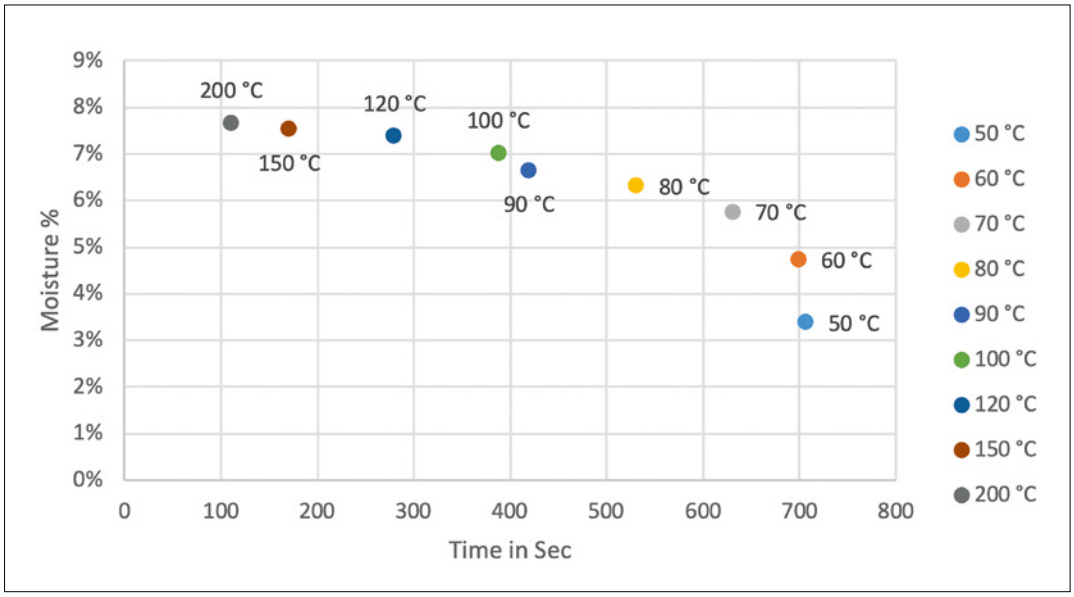
The testing we did showed that, in general, the power consumption of the dryers increased when increasing the machine speed, but the energy consumption used per sheet dropped. Thus, at higher speed we use less energy per sqm of board using the ADC.

Ah yes... and what if the environmental temperature is higher than the set board temperature? Well... the dryers will stay off, although the operators switched them on, as long as the drying of the ink on the surface of the board does not result in a board surface temperature lower than the set board temperature.

The JB Machinery ADC will help to avoid wasting energy while the print conditions are constant in all print nips.

What Does it Deliver?

Here is an estimation on energy saving. The tests done allowed us to calculate that 5 Wh/m² is needed to print at 5,400 sheets/hr and printing 2.7 colours on average. From a reference machine where dryer energy consumption was measured over one year, printing an average 2.7 colours, average speed 4,700 sheets/hour, the energy consumption was 12.1 Wh/m². Using the JB Machinery ADC on the reference machine could have saved 58% on energy. For the reference machine that would have been €32,000/year cost saving in energy.

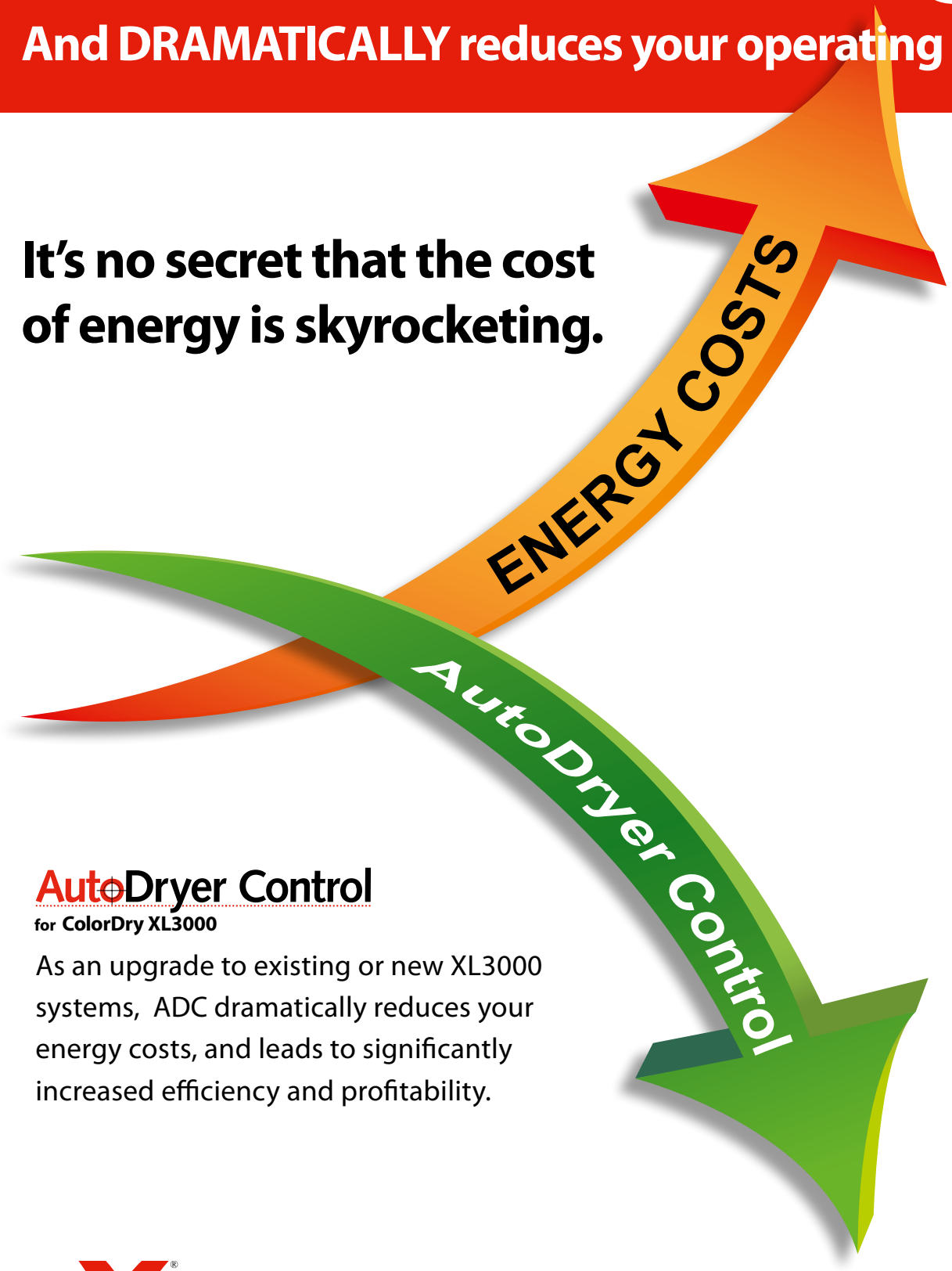


Remember that the energy cost saving is one-thing, but dryer control will also improve the print level as the ink is not overdried and shorten setup time due to zero dryer set time which results in less board waste and customer complaints. ■

This Ad Saves Energy!

And DRAMATICALLY reduces your operating costs!

It's no secret that the cost of energy is skyrocketing.



AutoDryer Control
for ColorDry XL3000

As an upgrade to existing or new XL3000 systems, ADC dramatically reduces your energy costs, and leads to significantly increased efficiency and profitability.

JB MACHINERY

Productivity — Quality — Profitability

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