The Konatic Tin Reader to rapidly check hot end coating levels

Fig 1. The Konatic Tin Reader device.

A new device is designed to check hot-end coating levels on glass containers quickly, conveniently, and accurate enough for container hot-end coating set-up and optimisation. By Peter J Firth*

Tin oxide is applied at the hot-end of the glass container-making process to provide a base upon which the cold-end coating can bond to. Without a good level of hot-end coating, the cold-end coating (most commonly a polyethelene coating) will not bond to the container which leads to unacceptable scratching of the glass during subsequent container handling.

The tin oxide is applied from a vapourised liquid substance such as mono butyl tin chloride, or MBTC for short, and is released from vapour deposits onto the glass container. This is all done at high temperatures that are typical of hot bottles straight after being formed. The coating process is carried out inside the hot-end coating hood, located on the hot-end conveyor of the glass container production machine.

The layer of tin oxide applied has to be with a certain range of thickness on the body of the glass containers. That level is indicated by a minimum and maximum amount typical for most containers.

Technically speaking, any thickness should be measured in standard units of measure. In this case, the coating to be measured would be in the low numbers of nanometres region (a nanometre is defined as one billionth of a metre). If you think that the largest blood cell is about half a nanometre wide, that might give you an idea of what we are trying to measure here!

However, it has been common for many years in the glass industry to use an industry defacto measurement, which was introduced by AGR International many years ago. The measurement AGR introduced to the glass industry is their Coating Thickness Unit (CTU).

Although the Tin Reader is accurate enough to measure in nanometres, there is a conversion carried out in the device to give the thickness in what Konatic call UTCs, which is equivalent to the more familiar CTU number.

For glass coating thickness ranges then each plant will set these, but typically a minimum of 20 UCTs and a maximum of 45 UCTs would be something I have been used to. If you have less than 20 UCTs then the cold-end coating may not bond to the glass. If you have more than 40 UCTs then you are wasting the coating material as 25 UCTs is a safe level to operate at and is ample for its task.

Going much higher in UCTs, say above 80 or 90 UCTs, means that the glass will start to express an iridescence in appearance which is not desirable and can lead to the rejection of the glass containers for quality control purposes.

The Tin Reader is a mature product that is currently available to help the glass container industry to read these very small tin coating thickness ranges.

Together with the new name are technical upgrades from the original device. These upgrades include new and better light-emitting diodes (LED) for better light beam reflection from the surface of the tin coating and the substrate for more reliable and steady readings. The reading no longer varies very much anymore with the slight change in the angle of the device as it is held against the glass container. It has a much steadier reading.

The principle of operation is quite simple. Just a measurement of the light reflections at a fixed wavelength. There will be two reflections, one at the surface of the tin and one at the surface of the glass upon where the tin is deposited. The 'distance' between these two reflections gives the tin coating thickness (although mathematical computing has to be applied to standardise the data to the thickness; this is part of the calibration procedure) ***Fig 2***.

Now, on to the glass business side of things. This is the first portable device I am aware of and it takes sufficiently accurate hot-end coating readings to compare with a laboratory-only device. This will allow the readings of hot-end coating to be taken away from the laboratory and onto

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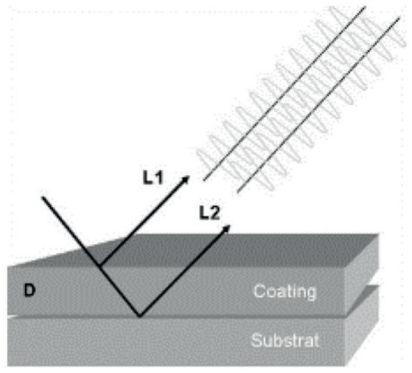
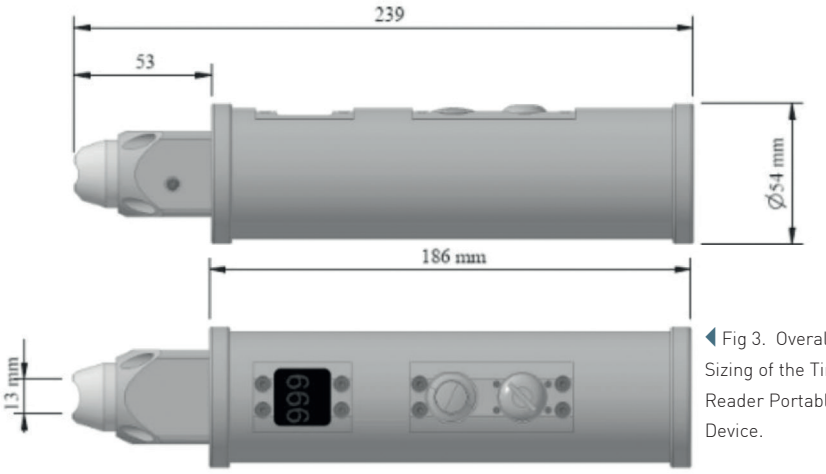


▲ Fig 2. Light Reflection Principle at a Fixed Wavelength.



◀ Fig 3. Overall Sizing of the Tin Reader Portable Device.

the shop floor, where the response times can be quicker.

The frequency of most laboratory checks is much lower than the line-operative checks made out on the production line. That is mostly because the laboratory typically serves the whole factory and the line quality controller is focused on just one production line (or two lines, as the case may be).

Before the Tin Reader, there wasn't any option to take hot-end coating readings out on the shop floor so it was common for quality controllers simply to do a 'rub test'. This rub test is simply rubbing the bodies of two containers against each other (after the cold-end coating has been applied). This is done with a good amount of force applied to try to break the coatings and create a scratch mark on the container.

If you managed to create a scratch on the containers this way, it was clear that there was a problem with the coating. When you do the rub test, you will feel a reasonable amount of lubricity at the first contact of the containers together (if any cold-end coating has been applied), but then later the lubricity breaks down during the rub test and creates scratch marks on the container. This would indicate inadequate application of either hot-end or cold-end coating.

For excessive hot-end coating detection out on the production line, that relied upon a visual assessment of the container where you can see slight multi-colours (termed 'blooming' or 'iridescence'). It would take an excessive amount to create this effect and normally only happens with some form of malfunction or unintended settings change on the hot-end coating equipment.

With the Tin Reader device readings might not be quite as accurate as the ones taken using the Konatic NANO device, which is their laboratory version for hot-end coating measurement, but the Tin Reader data is more than sufficient to set up and optimise the hot-end coating out on the shop floor.

▲ Fig 4. Tin Reader Storage Flight Case with Accessories.

Now don't get the impression this is a small pocket-sized device, which could easily go missing. The overall sizes are given in ***Fig 3***.

It is small enough to be carried by hand but large enough so as not to be hard to find.

The accurate measurements taken by the Tin Reader can be used to save money by reducing the usage of hot-end coating. This is to ensure the coatings are held at the lower end of the operating window for coating thickness. By using the device this way, the glass plant can run at lower-than-normal tin oxide operating limits. In this way, there will be a payback on this investment due to improved control over the hot-end coating application.

The amount of payback will of course depend on where you are operating now on hot-end coating usage compared to where you could be if you could control tighter using more regular checks for feedback and coating hood adjustment. This will make a nice internal project for someone to do a small study and look into the investment into the Tin Reader device as a cost-saving project.

Other features and benefits to be aware of are as follows:

- The readings are taken instantly. Just hold the head square to the surface to be read and press the 'read' button. While the button is pressed, move the head around slightly to get a maximum figure which then represents the real coating thickness at that point. Because of this, you can check anywhere on the container, very quickly.
- Although the device cannot read on

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the container finish (unlike the Konatic NANO lab-only device), it can measure just under the finish. It is normal to look for less than 10 UCTs on the finish to avoid 'rusting' effect of crown finishes and problems with hight torques on metal twist-off caps. Any reading detected under the finish which approaches 10 UCTs will be something to act upon and correct, ideally it should read zero.

- There is no special 'oil' that is required to be used. You can always use the device and it can be used as a replacement if you run out of oil on a machine that uses oil.
- It can measure bottles while still hot and up to 100°C, meaning almost immediate checks can be taken straight after coating hood adjustment, after letting sample containers cool until able to be handled.
- It can operate in up to 55°C of ambient air temperature, meaning usage in the hot-end environment is not a problem.
- There is an alarm on the device if it does get too hot. In that case, you can simply put it somewhere to cool down and reuse again when cool.
- It can be used on Decorating lines to check to see if there are any problems with hot-end coating levels causing problems with label of print adhesion.
- There are alarms giving different readout colours to indicate the status of the reading compared to reference levels. By default, this is red (alarm) for less than 20 UCTs, Green (OK) for 20 – 80 UCTs, and Blue (alarm) for greater than 80 UCTs. This is a programmable setting each device can be adjusted for.
- The total UCT it can read is 120, which is more than enough for normal tin oxide coating levels applied to glass containers. Hence there is no problem with the reading range of the Tin Reader.
- The device has already been validated for accuracy and repeatability by several of the major glass container companies in the world including the largest one. You can do your own testing if you like, but with the confidence that is should give satisfactory results.
- In addition to the readout UCT figures, the device can be simply set to give Red, Green or Blue indication for simplicity of line operation checks. This is a 'Mode 2' use of the device which is just there as an option.
- The Tin Reader device can be used as a back-up to the laboratory hot-end coating meter, in case of its malfunction. The results are accurate enough for maintaining laboratory quality records.
- The cost is low enough for having more than one device per plant. Ultimately, each production line could have one if there is to be a very close focus on minimising hot-end coating material usage costs.

Konatic sells the device directly to its customers and offers calibration servicing as well as any repairs required after the warranty period expires. For day-to-day calibration checks, the use of a reference container with a known UCT reference value at a particular point on the container can be used.

The same sample container can be used repeatedly, since tin oxide levels on a container should easily last for up to two years if the glass is not scratched.

The cost of the Tin Reader makes it easy to justify financially. Coming complete with flight case, charger, and a USB with all the technical documentation loaded on it. Keys are also supplied to lock the safe-storage flight-case for security reasons (***Fig 4***). ■

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