

When X-ray systems first entered the commercial marketplace, discussions centred on the technology's contamination detection capabilities, and whether X-rays would ultimately usurp metal detectors in production and packing lines.

Several years on, the spotlight has shifted onto X-rays as checkweighers, with some of the major players in inspection technology introducing X-ray machines that run checkweighing software. This means X-ray systems can be used not only to guard against foreign body contamination but also to verify pack weight.

The way in which the two systems carry out this function is, of course, very different. Alan Johnson, group product marketing manager at Spectrum Inspection (Loma-Cintex), explains the basics:

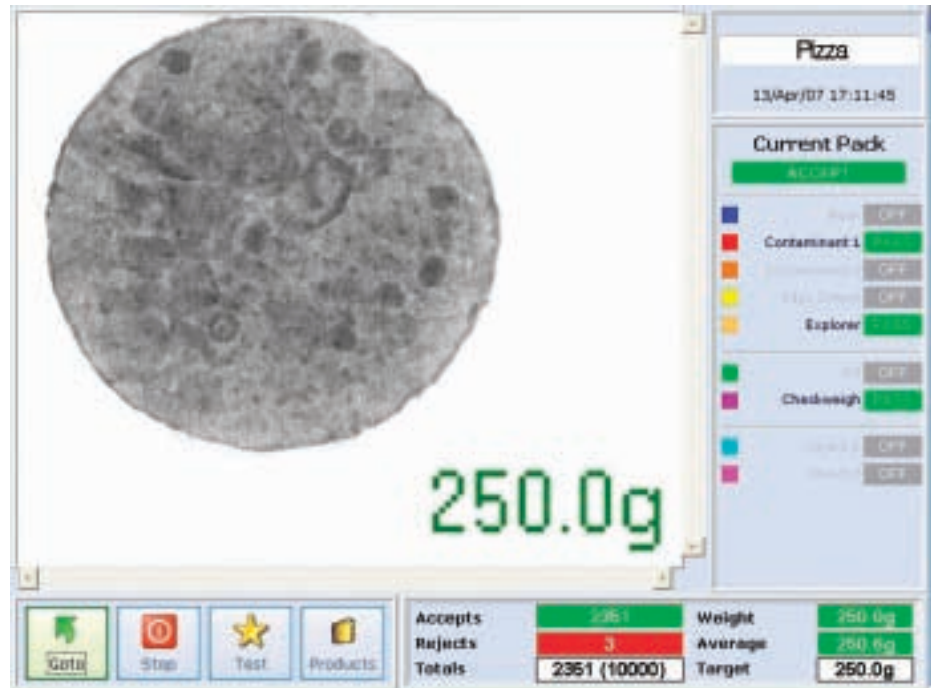
"Checkweighers rely on the force of gravity exerted by an object on a weighing platform. Checkweighers weigh dynamically and the scale is in the form of a conveyor that transports the product from one end of the machine to the other. This conveyor is typically mounted on a loadcell; the loadcell deflects or moves in proportion to the 'weight' of the object. Heavier weights cause more of a deflection than lighter weights and this deflection is converted into an electrical signal which an on-board computer processes. The weight is then displayed."

"X-ray weighing is achieved by inspecting the density of the product – a by-product of contaminant inspection. The simple equation of density equals mass over volume becomes the starting point for evaluating the mass (weight) of the object. Sophisticated software algorithms are then applied to the product being inspected to produce a weight reading as well as production statistics."

So does this mean that one day in the not too distant future, X-rays will render the checkweigher-metal detection combo obsolete?

According to Loma-Cintex, which launched the X-weigh – an X-ray system with checkweighing software – at the Total exhibition earlier this year, there are some compelling arguments for trading in a checkweigher-metal detector for an X-ray machine.

"Most checkweigher-metal detector applications can be replaced by X-ray machines with a checkweighing function," says Alan Johnson. "A major advantage is that they occupy no additional space in the production line and can perform the checkweighing function to a high degree of accuracy – comparable to that of traditional checkweighers."



One stop quality control: Loma X4 X-ray machine now has checkweighing software

X-weigh or checkweigh?

X-RAY INSPECTION MACHINES CAN NOW ALSO PERFORM CHECKWEIGHING FUNCTIONS, PROVIDING A COMPLETE QUALITY CONTROL SYSTEM IN A SINGLE UNIT. EVEN SO, FEW OBSERVERS PREDICT THE DEMISE OF THE CONVENTIONAL CHECKWEIGHER.

However, not everyone in the industry necessarily agrees with this.

Far from the two technologies being comparable in accuracy, Bob Ries, Thermo Fisher Scientific's contaminant inspection product manager, says that generally a checkweigher is in the order of ten times more accurate than an X-ray machine.

Inherent accuracy

Indeed, Mettler Toledo's X-ray marketing manager Nicola Vosloo believes the checkweigher's inherent accuracy is one selling point that will assure its long term survival.

"We don't believe checkweighers will become obsolete because there is still a need in the market for accurate weighing measurements – you

can get much greater accuracy on a checkweigher than you can on an X-ray," she says.

Ishida Europe claims that its IX-GA X-ray can achieve more accurate results than some of its competitors because of the way it calculates the weight parameters.

"After passing a product ten times through the X-ray unit, the IX-GA creates a reference table from which each gray scale of the image is converted into weight parameters. The system then optimises the formulae depending on the level of gray scale, whereas many of our competitors only use one fixed formula to get weight parameters from the gray scale," explains Ishida marketing manager Torsten Giese.

Of course, the degree of accuracy that can be achieved by an X-ray or a checkweigher depends

on the product in question, as Nicola Vosloo explains.

"X-ray will only really be accurate if the product is uniform and homogenous throughout because the mass measurement is taken off the gray scale image. If you've got loose powder in a pouch that can move around, for example, it won't be ideal for taking a mass measurement – you'd be better off with a checkweigher. A cake bar or cereal bar would work well with X-ray."

This theory is being put into practice at a factory in Germany where cake bars individually wrapped in aluminium foil are passed through an X-ray system supplied by Mettler Toledo. The X-ray not only checks for contaminants, such as metal and stones in the raisins, but also measures the mass of each product.

Weighing in zones

Where X-ray does offer a major advantage over a gravimetric checkweigher is in 'zonal weighing'. If a pack contains several compartments or components, the mass of each part as well as the whole pack can be calculated by the X-ray. In contrast, users of gravimetric checkweighers have to assume that if the gross weight is correct the individual contents are also present and correct.

"Imagine a TV dinner with various different compartments," says Thermo Fisher's Bob Ries. "A checkweigher can tell you very accurately whether the weight is correct, but it can't tell you whether you're light on peas or heavy on potatoes. That's where X-ray offers a clear advantage; it can look at each zone and even if the total weight is correct, it will be able to tell you whether there are too few potatoes or too many peas. That's an example of where X-ray, although less accurate, delivers greater value."

Ishida has found this principle to be particularly beneficial when applied to 'chain bags'.

"Products packed in a series, such as chain bagged powdered soups and liquid soups for instant noodles, cannot be weighed individually on a checkweigher," points out Torsten Giese. "However, our X-ray technology uses a weight estimation function which estimates product weight from the X-ray image. Specifically, the system calculates the volume of the product from the brightness of the image. This makes it possible to check the weights of such products."

According to Mettler Toledo, beverages are another product that may benefit from X-ray.

"Conventional checkweighers can do a good job of weighing beverage containers, however, to some companies it's just as important to ensure the fill line of the container is always at the same

height. Consumers looking at the product on-shelf will have a natural reaction to buy the bottle with the highest fill line. X-ray, while checking for mass, can also check for fill height," says Nicola Vosloo.

Companies packing pharmaceuticals into blister packs may also get value from an X-ray, as the weight variability of the packaging materials is often greater than the accept-reject tolerances of the package contents.

"Take a 12-pack of tablets, for example," says Ms Vosloo. "Each tablet only weighs 100mg, however the variability of the packaging materials is greater than 100mg. A traditional gravimetric checkweigher could not guarantee that all packages would contain 12 tablets although, using X-ray, the position of each tablet can be verified, plus a check performed for broken, deformed or partial tablets."

X-ray also allows for multi-line checkweighing, so one X-ray machine can replace several checkweighers, with considerable cost savings.

For example, Loma-Cintex says that with its X-weigh system a number of lines can be run through one machine, with each pack inspected according to its own target weight parameters.

Another plus point with the X-weigh, adds Alan Johnson, is that unlike a traditional checkweigher, it is unaffected by pack rate, speed, vibration, air turbulence, pack orientation or stability and requires little maintenance.

Price tag justified

However, for individual lines it is questionable whether an X-ray's premium price tag can be justified. True, X-rays are coming down in cost, but as Bob Ries points out: "I suspect a lot of the lower price X-ray systems don't necessarily support the more sophisticated functions like checkweighing."

There is also the question of whether X-ray satisfies weights and measures legislation, which is still a grey area.

Checkweigher installations may require certification as a legal trade device by local Weights and Measures officials. According to Mettler Toledo, in most jurisdictions only gravimetric checkweighers comply with this requirement.

"A core element to this certification is the calibration and performance verification of the checkweigher using a traceable certified standard, also known as a test weight. Since X-ray measures item density and converts that value into a calculated pseudo weight, there is no ability to trace the derived value to the certified test weight standard," explains Nicola Vosloo.

Chinese enter European market with full range of checkweighers

Chinese manufacturer Saimo Technology has opened a sales and distribution outlet in the UK as part of the pan-European launch of a series of low cost checkweighers developed by the company to meet European needs.

The range includes machines to weigh from 2g to 50kg as well as combined checkweigher/metal detectors, while control displays extend from 5in LCD through to 12in full function touch screens.

Memory for a minimum of 100 products is standard.

The Saimo machines are fully integrated, since the company manufactures both the load-cell and the electronic controller. All versions can be set for multiple weight classification zones while advanced digital filtering is said to ensure weighing accuracy.

All traditional checkweigher features such as feedback control to a filling machine, automatic zero and product tracking are included together with the benefits that come from photocell-independent operation. Multi-product

At present, though, the jury seems to be out on whether or not X-rays satisfy these standards.

On the one hand, Bob Ries says: "Standards for calibration of weight measurement by X-ray have not been approved or accepted by any governing weights and measures legislative body."

On the other hand, Loma-Cintex claims its X-weigh incorporates software that complies with national weights and measures legislation and automatically calculates the correct reject set points for European and Canadian Average Weight legislation and American Minimum or MAV weight control.

It is also important to keep in perspective the number of X-ray systems that are actually being bought for weighing applications, as at present, it is lower than some X-ray companies would perhaps like to think.

Bob Ries at Thermo Fisher says: "Only in a very limited number of applications is this actually happening. In general, because traditional checkweighing is so accurate, easy and widely accepted, it continues to be the first solution."

"What we are seeing is that customers are making the decision to buy X-ray because of the contaminant detection capabilities, and then as an afterthought they will look at the check-



Chinese machines for Europe: Saimo Technology has launched a range of low cost checkweighers

inspection, classification and recording of several products running simultaneously is also possible.

Saimo says that data logging capabilities are particularly comprehensive with the software protected by multi-level passwords to ensure data integrity.

Specific features include the facility to store

data and alarm records to complement quality control procedures in the factory and a comprehensive statistical analysis of the saved data. Support for industry standard networking protocols is available as is the ability to identify and correct fault conditions remotely.

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High speed: Bizerba's new CWE checkweigher can run at 120 metres a minute

weighing option as an add-on. It isn't the other way round – checkweighing isn't driving the purchase of X-ray."

This view is backed up by Chris Keenan of Selo, UK distributor of Anritsu's KD74 X-ray system, who says: "Customers are definitely more interested in X-ray as it is easier for them to justify the expense when the system offers them more solutions. But although a number of companies want to use X-rays as checkweighers, they will only achieve accurate results with uniform products."

Investing in checkweighers

Typical proof that major manufacturers in the processing industries are still investing in checkweighers, comes from United Biscuits UK which has recently added a further checkweigher from Lock Inspection Systems to its inspection armoury for products such as Jacob's Cream Crackers, Jacob's Club and Jacob's Twiglets.

United Biscuits bought the Lock CK1500 checkweigher to replace an old unit and was particularly impressed by the machine's touch-screen display panel, which shows average, actual, over and underweight data and is said to be easy to read and interpret.

Installed at the end of UB's packing line, the system provides the final check before goods are delivered to customers. A pusher reject device transfers under- and overweight products from the line onto a table, where they can be manually inspected.

Equally, Yamato has recently sold ten G series checkweighers to a large UK packing house.

The G series is said to be capable of weighing virtually any product from 10g up to 6000g at rates up to 330 packs a minute in most environments. Accuracy is usually $\pm 0.2g$ and this also applies when detecting a missing item in a pack, such as one biscuit in a pack of five, according to Yamato.

Yamato says remote communications, and the ability to download and monitor data, is increasingly a requirement of checkweigher customers who are offered a Data Acquisition Suite package capable of processing data from up to 20 checkweighers and outputting to a remote PC.

Data acquisition

Yamato recently installed and commissioned a full Data Acquisition Suite to take information from five checkweighers using a multiplexer which then transmits the information to a local PC in real time. Data produced includes giveaways, line efficiencies and costed giveaways. This data can also be used for satisfying Weights and Measures legislation as well as yielding cost savings via improved production efficiencies.

Avery Weigh-Tronix, meanwhile, has saved over a metre of floor space at Crepe Cuisine – a supplier of bakery products to UK supermarkets – by installing a combination checkweigher and metal detector unit to weigh packs of pancakes.

Packs weighing up to 1500g are weighed at speeds of 60 a minute to $\pm 0.2g$ accuracy, which is a massive improvement on the previous random checks carried out on some 5 per cent of the output.

A lockable bin receives contaminated packs off the conveyor for quarantine and a pusher reject mechanism sends under or overweight packs to a table.

An integral tally roll printer prints data at the end of each production period, including the number of packs, average pack weight and number of rejects, to assist with due diligence.

Selo says one of the key selling points of the Anritsu equipment is that Anritsu manufactures both the weighcell and the metal detector head, which benefits customers buying combi systems as the equipment is more compact than other



Monitoring biscuits: *United Biscuits has installed a CK1500 checkweigher from Lock Inspection*

available systems and can be operated via the same control panel.

The Anritsu range of checkweighers starts with the economically priced SVf, which is mainly supplied to the produce industry. The SVi range has a high protection rating for harsh operating environments, while the SVh systems are high speed/high accuracy mainly used in the pharmaceutical industry.

Bizerba's newly introduced CWE checkweigher has been designed to 'help optimise the quality assurance of pre-packaged goods', and its modular design promises maximum flexibility, according to Bizerba.

Depending on the pack and the production environment, it can weigh packs ranging from 25 to 6000g at line speeds up to 120 metres a minute. IP65 protection and a quick-action conveyor body and belt changing system are said to enable fast, simple cleaning.

The operator can quickly view data via a monochrome display or a 12.1in colour touchscreen. From a visual display of operating speed, pack weights and production trends, pack giveaway can be monitored and the production process controlled.

The CWE multi display concept permits several operating units to be set up at different points in the production line, for example, as remote displays. Short and long-term statistics can be viewed, saved and memorised.

AEW Delford Systems offers a choice of checkweighing systems for the food industry.

The G1000 is said to be a versatile, cost-effective system for general applications. Operating

at speeds of up to 180 packs per minute, it is ideal for packaged products such as ready meals.

The G2200 is a top-of-range system for demanding food processing applications, sealed to IP66. The unit operates at speeds up to 180 packs a minute with modular software for ease of operation and programmability and a choice of average and minimum weight programmes as standard.

High throughput model

The G2300 Checkweigher is a high throughput system designed for integration into high speed slicing lines. Ideal for cooked meats and bacon, or fresh meats, poultry and fish, the G2300 has a similar specification as the G2200. Up to 200 pre-programmed memories can be accessed via the keyboard, with multi-line networking and RS232/422/485 links for production control.

Ixapack UK supplies a wide range of high-speed single and multi-lane checkweighing systems incorporating touch screen controls that allow up to 200 different programs to be stored and recalled.

For ease of cleaning the machines employ a quick release belt roller system and are available with a particularly broad range of options including reject systems and receptacles, extended infeed and outfeed conveyors, modems for instant trouble shooting diagnostics and optional metal detection combination units.

One popular feature says Ixapack is the on-screen drawings, which can be expanded to show all replacement part numbers. Data retrieval

can be via a simple ticket printer or transfer to a PC using a data storage card or network.

The Dynamic CWS checkweigher/metal detector made by Iman Pack of Italy is now available from UK representative Friedheim International in three versions: HR-600, SR-1600 and HL-3000, all supplied in either plain stainless steel or painted and left or right handed.

Respective weighing ranges are 10-600g, 20-1600g and 50-3000g with speeds up to 350 items a minute depending on model. ■

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For full details of all PPMA members able to supply checkweighing systems, consult the PPMA machinery finder service, tel: 020 8773 8111, or visit www.ppma.co.uk