

# Three-way evolution suits different needs

**T**he last year has been a busy time for checkweigher designers around the world, with no fewer than 12 manufacturers launching new machines.

On the face of it, this large number of new designs simply demonstrates how competitive the checkweigher market has become. But, looking at the new machines in more detail, it is now evident that there are at least three quite distinct market sectors for checkweighers and if manufacturers wish to compete in all three, they must have separate, appropriately specified and priced machines for each sector.

So what are these market sectors and why are users choosing one type of checkweigher rather than another?

The traditional concept of a checkweigher has been a standalone machine that can weigh, reject high or low weight packs, store weights and display and print out all the statistical information necessary to demonstrate compliance with weights and measures legislation. This first group can be termed full function checkweighers.

However, the philosophy behind the second group of machines is that the best place for processing and storing weight data is an office, and not within an on-line checkweigher. So this group of machines display only the basic weight information that a line operator needs. They can be termed economy checkweighers.

The third group of machines is designed specifically for use in high risk food or pharmaceutical environments. High risk food plants such as meat packing factories require machines that are hygienically designed, with no crevices, ledges or spaces where food or liquids can accumulate. Machines in these environments must also be able to withstand washing with water, detergents and disinfectants. They can be termed high risk environment checkweighers.

Full function checkweighers have for many years had the capacity to store information on several products, as well as weight information,

*Checkweighers are evolving into three distinct groups of machines, each with a specification and price to suit the varying demands of different market sectors. Report by Martin Keay.*

and accept or reject packs to either average or minimum weight legislation. However the recent addition of industrial PCs to full function checkweighers has brought greatly enhanced capabilities, in particular the ability to drive touch screen control panels and to run standard computer software.

Control of the weighing functions on most PC checkweighers is still carried out using a dedicated microprocessor, but the PC has been added to give additional processing power and memory.

#### Information required on the line

Inevitably, full function checkweighers with PCs and touch screens are more expensive than economy checkweighers, but can be justified where the production environment is suitable for sophisticated equipment and where all the weights and measures information is required on the production line.

The addition of PCs and full colour touch screen display panels gives this group of machines most of the display and calculation capabilities of a desktop computer. Touch screen control panels can operate using Windows compatible software and data can be stored, manipulated, displayed and uploaded using standard software packages such as Microsoft Excel. This avoids the need for data to be transferred from the checkweigher for processing on separate off-line equipment.



**High risk environment:** Isbida's new DACS-H-012 can be bosed down. Tubular support legs help inhibit product build-up

The addition of a PC to a checkweigher also allows it to carry out line control functions. Indeed, one of the problems of product changeovers is that there are now so many pieces of line equipment to be changed. Even if pack size remains the same, the checkweigher, metal detector, pack coder and case coder will all have to be set to the new product code. This takes time and it is not uncommon for one or another piece of equipment to be overlooked.

To overcome this problem, Cintex's new Eclipse CS4000 checkweigher has the facility not only to store product settings for the check-



**Full function checkweigher:** *Cintex Eclipse CS4000 (right) can be set up by scanning in the product bar code. It can then set up other line equipment such as ink jet printers (left) and metal detectors*



**Economy model:** *Loma AS has waist height display to minimise the effects of vibration*

weighing function but also, using the new Cintex Linesetter software, to control the product settings for a metal detector and several coding devices, such as ink jet printers and print-apply labellers.

This means that for a changeover, the operator simply identifies the new product to the checkweigher by scanning its bar code, allowing the machine to set new parameters for itself. Then, via a serial interface, it automatically instructs other machines on the line also to make the change, using the pre-programmed product data each holds in its memory.

### Single entry sets up the line

“A single entry, via a bar code, now ensures that the metal detector or X-ray machine has been set up to the appropriate sensitivity, that the checkweigher is working to the right nominal weight and that codes and product descriptions are exact,” points out Cintex. “In this way, coding security and inspection validity is maintained.”

Linesetter software operates with any further machines in a line on which product data can be selected from their memory by an external signal.

The Cintex Eclipse CS4000 itself incorporates a touchscreen colour graphic display and is equipped with the company’s Intelligent Dynamic Filtering loadcell technology, said to give weighing accuracy to better than  $\pm 0.2g$ . Speed is up to 300 pieces a minute while look ahead control of period mean weight and percentage T1-T2 accepted packs automatically prevents period production statistics falling outside legal limits.

Early last year, German manufacturer Collischan launched its new TC 841 series of full function checkweighers, offering speeds up to 400 items a minute depending on the configuration and accuracy levels required. During operation the actual weight, average value and standard deviation are all displayed simultaneously on a large touch screen control panel.

UK agent Ultracpac points out that belts can be exchanged without tools and machines are available to give weighing ranges up to 1.5kg.

Digi Europe’s latest machine is the CW 3600, offering speeds up to 100 a minute in either average or minimum weight mode for both food and non-food applications. Up to 32 individual systems can be linked together, using Digi’s IFIS software, to accept setting data from a central computer and also to allow production data to be collected for central analysis.

Ancillary equipment includes newly designed

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lockable reject bins and covers to ensure that non-conforming products cannot be removed from the product flow between the point of monitoring and the point of rejection.

Yamato Scale's CSG series checkweigher range includes two high speed models, one of them to IP66 specification, giving throughput up to 330 packs a minute in the range 6-600g, and two medium speed machines for throughput up to 220 a minute in the range 20-2000g. Again there is an IP66 version. Higher weights, up to 6kg, are handled by the CMG range, which gives speeds up to 100 a minute.

For hygiene, the machines are built on a tubular frame to minimise flat surfaces while high temperature wash down is available for the conveyor belts. Controls, based on a 10in colour touch screen, provide self diagnostics and the capacity for remote control and maintenance via a network. Comprehensive troubleshooting pages are also optionally available via e-mail exchange with Yamato.

### Economy checkweighers

However the fastest growing sector of the checkweigher market, in the UK at least, is for economy checkweighers. The term economy correctly implies that these machines are cheaper than full function checkweighers, but it would be wrong to think that their weighing performance is necessarily inferior to the full function machines.

The essential difference between the two is that the economy checkweigher has the minimum of onboard display and calculation capability. The argument for using economy machines is that many production lines are quite hostile environments for complex electronic equipment and so the best place to collect and process weight data is in an office, not on the production line itself.

This reduces the on-line task to recording weights accurately, rejecting out of specification packs, and displaying basic weight information so that the line operator can run the line effectively. Weight data is all uploaded to a central system for processing and long term storage.

Typical of these economy checkweighers is the new Loma AS series.

The classic design for a checkweigher is to have an eye level control panel. However this raises the machine's centre of gravity and accentuates vibration in the checkweigher's frame, which in turn has an adverse effect on weighing accuracy. To minimise this effect, the trend in recent years has been to reduce the size of eye

level control panels. But on the Loma AS the eye level panel has been removed completely and replaced by a waist level display, which has improved weighing accuracy significantly.

However, there is another important benefit, says Loma product manager Alan Johnson. "The design also means that the operator does not have to lean across the conveyor at any time, so not only does this make ergonomic sense, but is also a lot safer for the operator."

The AS is available with a choice of conveyor options to handle items up to 45kg and employs variable speed AC motors to allow conveyor speed to be adjusted to suit application and product flow. Tool-less tracking is also a feature of the transport mechanism, making it easy to re-adjust while the line is running.

Eliminating vibration was also the reason behind the design of Ward Bekker's Apex machine. "Vibration is at the minimum at the apex of a pyramid structure," points out managing director Steve Wainwright. "That was why we used a pyramid frame for the Apex checkweigher and why the weighing platform is mounted directly to the apex of the pyramid."

For hygiene, the design avoids any external nuts, bolts and clips in the assembly of the system, so eliminating bug traps and ensuring efficient washdown. In addition, use of CNC folded stainless steel components in the structure keeps welded joints to a minimum, while the gradient of the pyramid base also prevents product debris from lodging.

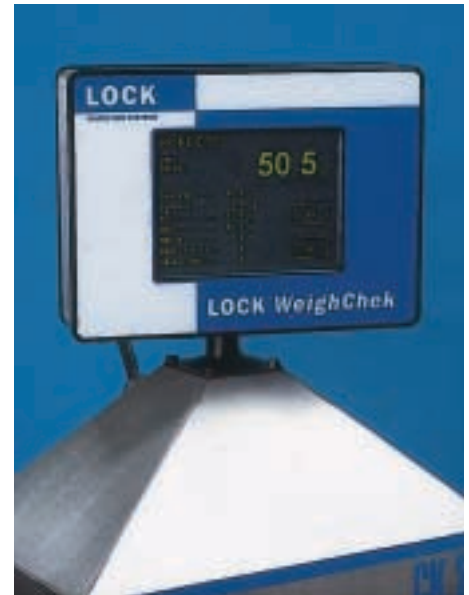
For cleaning, the conveyors can be disassembled without tools, with rollers and skid plates simply lifting off, while there is a choice of flat belts or tapes to suit the particular application. Drive is via brushless AC motors, which are IP65 rated, as original equipment, against water ingress during washdown.

### Much longer working life

Choice of AC motors, rather than the more traditional DC drives, has been made to ensure a much longer working life, says Ward Bekker. On the control side, the Apex employs an extra-bright, high contrast LCD screen that can be rotated through 300deg for the display to be aimed at the operator position, either up or down line.

Apex models are available in a number of weight ranges, able to cater for items of 10g, up to cases and other large packs weighing 40kg. Speeds of 300 a minute are typically achieved on weights of 500g.

Meanwhile, Mettler-Toledo has recently



**Swivelling display:** Lock WeighCheck can be viewed from anywhere on the line

recognised the importance of the economy checkweigher market and has just launched the Garvens E series checkweigher specifically for this market. Maximum weights handled extend from 600g to 100kg.

On the Garvens E series, the weighing platform, pre-feed and reject conveyors are clamped to the central rectangular column that supports the control panel. This allows the working height of the checkweigher to be varied between 550 and 1100mm, in contrast to most machines that will typically only have a 50mm range of adjustment.

Another feature of Garvens checkweighers is the PrintCard, which allows information to be transferred from the checkweigher to a central data storage and processing computer, with no need for expensive interconnecting wiring.

The checkweigher stores the weight data and when the quality controller wants to collect this data for analysis or storage off line, he or she inserts the PrintCard into the checkweigher. The appropriate information is then loaded onto the card so that it can be taken to an office. Once inserted into a card reader, the information on the PrintCard can be printed off, stored in a computer or analysed to produce statistical data.

Sparc Inspection Systems has focused particularly on hygiene and ease of cleaning for its new Midi checkweigher, using a tubular stainless steel frame rather than box section to avoid dirt traps or ledges, while the conveyors are readily detachable. In fact, the three conveyors for infeed, weighing and outfeed are identical, each with its own servo drive motor, and locate simply via pegs.



**Pyramid design:** Ward Bekker's Apex checkweigher shown linked up with a metal detector

This means that not only can each be removed in a matter of 15-20 seconds for cleaning, but that a fourth 'spare' conveyor can be employed, allowing the machine to continue in operation while the three operating conveyors are removed, in turn, for cleaning. Conveyor belts themselves simply slide off the conveyor frame, once tension is released.

#### **All-round visibility**

The Midi also features an operator panel that swivels, for all-round visibility, and can operate at speeds up to 300 a minute, depending on pack size. Maximum capacity is 10kg and accuracy to  $\pm 0.05$  per cent.

Sparc also offers a checkweigher that can be installed under an existing conveyor to check that cases contain the correct number of primary packs, and which is also sufficiently accurate to give simultaneous feedback control to the filler.

Installed after the case packer, the Pakweigh machine is able to handle weights up to 50kg

and requires no modification to a standard roller conveyor. Instead, lifting fingers rise between the rollers to weigh the case or tray to an accuracy of  $\pm 1g$  at speeds up to 35 a minute. This, points out Sparc, avoids the usual need to cut into existing conveyor systems and also allows the machine to be readily transferred from one line to another.

If required, the results of the weighing can be fed back to the filler, for target weight adjustment to meet average weights requirements. Pre-programmed limits are employed to calculate a trend factor.

The machine incorporates a 100 product memory and can provide full batch and sample statistics, downloaded if required to a remote printer or PC for management information and record-keeping. It is built to IP65 for use in all food applications, including wet environments.

The conventional wisdom with display screens on checkweighers has been that they are fixed and will be read by an operator or

quality control inspector standing in front of the machine. However Lock Inspection Systems, Ward Bekker and Sparc Inspection have realised that this arrangement has the disadvantage in most line layouts that the operator has deliberately to approach the checkweigher to get an idea of the range of pack weights being produced on the line.

The Ward Bekker Apex and the Lock WeighChek checkweighers both have the facility to display weights in large type and to swivel the display panel so that it can be viewed by a line operator from up or down the line. This allows the operator to make adjustments to filling equipment and observe the effect on pack weight without having to walk to the checkweigher.

#### **Used by line operators**

But do line operators actually make use of such a facility? Apparently very much so. "Every time I have seen one of our Apex checkweighers on site, the display panel has been adjusted so that operators can see it from up or down the line" says Steve Wainwright at Ward Bekker.

The Lock WeighChek series of checkweighers, launched at last year's PPMA Show, have been designed in particular for ease of use, with a self-learn set-up routine and a full networking capability. For example, product characteristics at a given speed are taught simply by passing through eight packs.

East-to-read graphics display the weigh-pulse for each product passage: a powerful tool, says Lock, for trouble-shooting, training and rapidly optimising any new pack/speed combination.

The screen will also display any background 'mechanical' noise experienced by the weigh-cell, allowing corrective action to be readily identified if optimum weighing accuracy is not being achieved. Typical accuracy is 0.2g on a 200g pack at a speed of 80 a minute.

There are also RS485 ports on all machines for networking with up to 40 Lock checkweighers or metal detectors and RS 232 ports for external printer connections and so forth.

Driver Southall's latest range is the P2000 series, equipped with front-facing digital touch screen control panels at eye level, for easy programming. The machines join the existing P1000 range of checkweighers for handling smaller packs such as those used in pharmaceuticals, as well as medium and larger sized cartons.

Against the cost saving of purchasing an economy checkweigher, rather than a full function checkweigher must be set the cost of some form of data gathering system. Most check-

weighers can be equipped with the facility to upload data. However, different manufacturers use different protocols and even when this problem is solved, collecting data in a form that suits a data processing system and collecting data in a form that satisfies Trading Standards Officers are two quite different things.

Most checkweigher manufacturers offer dedicated systems to collect data from their own checkweighers that are acceptable to TSOs but, on the whole, these systems are specific to checkweighers made by those manufacturers. However Ward Bekker is now offering the 'In-Line QCpro' weight data management system that can collect data from almost any checkweigher and present it in a manner acceptable to Trading Standards Officers.

The software runs on a standard PC with a Windows 9x/NT operating system and the connection to the checkweighers is through a robust serial multiplexor system. The serial connection between the checkweigher and multiplexor can be either RS232 (up to 24 metres cable length) or RS422 (up to 1km cable length). Output is always RS232 allowing a standard PC COM port to be used.

The multiplexors are fitted with a 1Mb buffer, upgradable to 4Mb, that can store data for several days in the event of a PC failure.

Data from each checkweigher is captured and stored in a database. A report browser provides access to the captured reports so that they can be selected by checkweigher and date and time received. Detailed reports can be produced from this basic metrological data by date/time, range, product or line and nominal weight. More advanced reports can also be produced showing giveaway in weight or cost terms while the data itself can be copied and pasted into Microsoft Word or Excel files.

### Hygienic alternatives

Checkweighers designed specifically for use in high risk food or pharmaceutical environments are a relatively new development. Most checkweighers can now be cleaned easily, with no tools required for dismantling and removing conveyors. However, for high risk situations checkweighers need to be able to withstand washing with water, detergents and aggressive disinfectants.

To cope with these conditions it is not sufficient simply to make sure that all enclosures are rated to IP65 or IP66. The design of support structures, the choice of drive motors, the linking of drive motors and the choice of contact



**High Speed:** Anritsu SV series checkweigher with metal detector on a common frame

materials may all have to be altered to produce a hygienic machine that will survive in an aggressive environment.

### Floor supports isolate vibration

The design of frames to support checkweighers is an issue which exercises both checkweigher designers and microbiologists. Checkweigher designers would like as much floor support as possible to isolate vibration from the weighing platform, however this approach can result in a forest of support legs.

Meanwhile the microbiologist or hygiene specialist would like to have as few legs as possible, so that the floor under the machine can be easily cleaned and the points where the machine's feet touch the floor, which are highly favoured by bacteria, are kept to the minimum.

Inevitably a compromise between these two conflicting objectives must be found. The Anritsu SVh, which is designed for small pharmaceutical packs, uses a single support frame for the pre-feed conveyor, weigh platform and reject conveyor, while the Ishida DACS-H-012, which can handle much larger pack sizes particularly in the fresh food industries, uses a separate support frame for the reject conveyor.

The waterproofing of electrical enclosures on checkweighers is a very vexed subject. In many food factories, machinery needs to be hosed down to ensure complete cleanliness, present-

ing particular problems for checkweighers, which contain sensitive electronics. The standard measure for waterproofing of electrical enclosures are the so called IP ratings, which are described in EN 60529: 1992.

In this standard the first digit describes protection from objects, for example: fingers IP2X or dust IP5X. The second digit describes waterproofing, for example: light rain IPX4, heavy rain IPX5 and heavy seas IPX6.

### Ratings assume water

Appropriately the Ishida DACS-H and Anritsu SVh are proofed to IP66, which is generally recognised to be "waterproof". However it is worth noting that the IP ratings assume that the liquid is always water, not mixed with detergent or disinfectant, and that it is at atmospheric pressure rather than high pressure.

The choice of conveyor drive system is also a critical factor for these high-risk environment machines and inevitably also a compromise. On the Ishida DACS-H-012, AC motors have been selected to drive the pre-feed and weighing platform conveyors with quite long, but totally enclosed belt drives. The belt conveyors can be easily detached from the belt drive without tools and without access to the enclosed drive belt.

Built in stainless steel, the Ishida DACS-H-012 is aimed specifically at the hygiene requirements of the fresh meat, poultry, dairy, fish and produce industries. On top of the IP66 and NEMA 4X electrical standards for hosedown and hence hygiene, the support legs are built from tubing to help prevent product build-up and reduce cleaning time. No tools are required to remove the belt conveyor, reject arms and other key parts for cleaning.

The control unit offers simple procedures to store up to 100 pre-set target weights for simplified product changeover, while the panel can also produce graphs and histograms of production activity, with an optional printer to provide hard copies of the data. In fact, the machine can also be specified to interface with a host computer, Ishida multihead weigher and other equipment up and down stream. Weighing range is 12 to 1200g with a top speed of 175 items a minute.

Anritsu's SVh is one of a new range of checkweighers with models offering speeds up to 600 a minute for items such as confectionery and biscuits, as well as pharmaceuticals. There will eventually be some 90 models in the range, says UK agent Skerman Promac, offering a variety of

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options to suit specific applications and user preferences. All are based on a new forced balance weigh cell which, Skerman points out, provides maximum stability for minimum weighing time, and hence higher speeds.

Variations include, for example, a choice of touch screen or push-button control screen, and there is a series of weight ranges extending from 60g for the 600-a-minute machine to 25kg for heavy-duty case-weighing units.

In addition Anritsu is to offer a multi-lane version of the SV checkweigher, with up to four lanes controlled from a single panel.

### A question of accuracy

As discussed in our last issue (*Machinery Update*, March-April 2001, p65), the whole question of accuracy and weighing equipment is fraught with problems, not least because manufacturers express accuracy in different ways. In addition, the accuracy of a particular machine is affected significantly by the weight of the product it is checking, the shape of the product and the speed of operation.

Even so, there are still differences in the weighing accuracy of machines, not only as a result of the design issues discussed already, but also because of the type of weighing device employed.

The most accurate devices available are generally acknowledged to be force balances, such as those used in the Anritsu SV series. Strain gauge based load cells are less expensive alternatives to force balances and so are used on most of the 'economy' checkweighers. However strain gauge load cells have a larger zone of indecision than force balance devices.

But this brings us to the real question, how accurate does a checkweigher need to be?

In the days when all products were sold under minimum weight legislation, it was impossible to avoid some product giveaway. The cost of this product giveaway could be calculated and used as a justification for buying more accurate weighing equipment to reduce the amount of product which, in effect, was never paid for by the consumer.

However the major benefit of average weight legislation is that there may not be any giveaway of product or so little that more accurate instruments are very difficult to justify. The issue then becomes one of how accurate must a checkweigher be to satisfy the law? Currently the answer depends on which country you are in.

In the UK, most checkweighers based on strain gauge load cells are perfectly legal and so

more accurate machines are really only relevant where goods are being sold to minimum weight or for applications, such as in the pharmaceutical industry, where greater accuracy is needed for reasons of process control.

However, in Germany and some other countries of Continental Europe, the weights and measures authorities insist on more accurate checkweighers being used. Consequently, most checkweighers sold in these countries use force balances rather than strain gauge load cells and it is often the case that checkweighers run at slower speeds in Germany than they do in the UK for a similar product.

The irony of this situation is that the average weights legislation, which applies to the pre-packaging of most goods in Europe, is the same in all the countries of the European Union.

It is possible that the Measuring Instruments Directive, which will apply to checkweighers as well as other measuring instruments, could have some influence on this situation when or if it is finally agreed.

However there is now some doubt that the Measuring Instruments Directive will ever find its way onto the Brussels statute book, because the European Commission is not convinced that it is 'necessary'. Indeed, there is also no guarantee that, even if it does become law, it will alter the weights and measures legislation that applies to the use of weighing instruments in the UK and Germany.

What would really help would be a 'Use of weighing instruments Directive', which would harmonise the way in which trading standards officials operate within the different countries of Europe. ■

### FOR FURTHER INFORMATION:

<b>Cintex</b>	<b>enter 119</b>
<b>Digi Europe</b>	<b>enter 120</b>
<b>Driver Southall</b>	<b>enter 121</b>
<b>Ishida Europe</b>	<b>enter 122</b>
<b>Lock Inspection Systems</b>	<b>enter 123</b>
<b>Loma Systems</b>	<b>enter 124</b>
<b>Mettler-Toledo</b>	<b>enter 125</b>
<b>Skerman Promac</b>	<b>enter 126</b>
<b>Sparc Inspection Systems</b>	<b>enter 127</b>
<b>Ultrapac</b>	<b>enter 128</b>
<b>Ward Bekker</b>	<b>enter 129</b>
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