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ISO/IEC 17025 Accredited

Choosing the Right Counting Scale

Counting scales come in a variety of shapes, sizes and prices and can include small pocket balances, full-sized floor scales or high-precision balances with counting features. Each of these options can range in price from $25 to $7,000, so, what makes a quality counting scale and how do you help your end-customers choose what's right for their application?

High-Quality counting scales require high internal resolution combined w/ good linearity, repeatability and stability. Failing in any one of these areas can drastically affect the accuracy of counting scales.

High Internal Resolution

Piece weights are determined by the internal resolution of the scale, not the displayed resolution which is significantly lower than the internal resolution. The internal resolution determines the smallest weight change a scale can see. So, the higher the internal counts, the more accurate the piece weight will be especially, when working with smaller pieces. With an accurate piece weight, you and your customer can be confident that piece counts are accurate.

Linearity

Linearity refers to the error seen at different weight points between zero and full capacity. If the displayed reading is closer to the known weight that is placed on the scale, linearity and accuracy are greatly improved. Scales w/ poor linearity will have more error any time the count is taken near where the scale is not linear. Counting scales with better linearity are less prone to these errors, resulting in more accurate counts.

Repeatability

Repeatability is the scales ability to display the same weight each time the same weight is applied to the scale. If the same weight is placed on a scale multiple times and the displayed weight varies each time, the scale has a problem w/ repeatability. A variety of factors can contribute to poor repeatability including cornering or setting Auto Zero Tracking (AZT) improperly. On scales with lower accuracy, AZT is sometimes set wider to overcome poor return to zero. Scales with poor repeatability struggle to accurately count lighter pieces accurately.

Stability

To calculate an accurate piece weight, the scale must first be able to determine a truly accurate sample point relative to true zero. With high resolution, stability is a must. Higher end counting scales build in tolerance to allow only stable weight reading when calculating piece weights. Lower end counting scales often capture the weight at the time the sample is taken without factoring in the piece weights, and ultimately piece counts, that are less accurate.

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Pros and Cons of Current Counting Scale Technology

Today there are a variety of different technologies in use within counting scales. However, the most common technologies being used today are:

- Analog Load Cell Technology
- Capacitance Cell Technology
- Force Motor Cell Technology
- Avery Weigh-Tronix Second Generation Quartzell Technology

Each of these has their merits as well as drawbacks as shown in the table below.

Technology	Pros	Cons
Analog Cells	• Affordable • Reasonably accurate, especially for larger pieces	• Low internal resolution • Less stable • Not ideal for weighing lighter components on a larger capacity scale
Capacitance Cells	• Provide very linear readings • Good general counting scale • Used in counting and balance applications	• May have reduced internal resolution relative to other digital cells • May struggle to accurately count lighter components • Can easily be damaged if mishandled
Force Motor	• High Accuracy • High internal resolution • Common in balances and counting scales	• Can be easily damaged if mishandled • Higher cost
Quartzell	• Specifically designed for counting • Can deliver accurate sample count of 99.75% across a wide range of components from very light to much heavier parts • A very robust design with overt 1100% overload protection	• Higher cost than most traditional analog cells scales

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Addressing Customer Concerns

Customers today generally want to know the following:

- What is the smallest item this scale can count?
- Is this scale appropriate for my environment?
- How can I make the most of my investment?

Determining the Smallest Item the Scale Can Count

The smallest item a scale can count is dependent on the minimum piece weight. Calculating the minimum piece weight can be done in different ways and can be quite complicated, but a very simple and effective way to estimate this is to multiply the manufacturer's recommended readability/stability by five. This will give you a close estimate of the average piece weight the scale should weigh within. As an example, to estimate the average minimum piece weight of a typical 60 pound capacity counting scale with an analog cell, displayed resolution of 30,000 divisions and stable readability of 60,000 divisions (0.001lb.), you would use the following: 0.001 x 5 = 0.005 lb. On a 70 lb. capacity ZK scale from Avery Weigh-Tronix with displayed resolution of 100,000 divisions and stable readability of 3,500,000 divisions (0.00002lb.) the estimated average minimum piece weight is 0.00002 x 5 = 0.0001lb. This is the smallest recommend item each of these scales can count within the accuracy bounds selected.

While calculating the average minimum piece weight is useful to customers, on highly accurate counting scales with high internal resolution such as the ZK830 and ZK840, the piece weight can be calculated using the minimum sample size that will always guarantee the accuracy the customers has set within the scale.

On the ZK Counting Scales, the minimum sample weight can be easily calculated by using 0.01% of the scale's full base capacity for dribble counting or 0.02% of the scale's full base capacity for bulk sampling. This means that a on a 70lb scale, the scale can accurately calculate a piece weigh with 99.75% accuracy by using a minimum sample weight over 0.007lb. This minimum sample weight could come from a sample size of 5, 10, 50 or more pieces.

Scale Environment

Outside influences, including busy walkways, open doors, heating and air conditioning outlets, blowers and vibrating machinery, can all affect the count accurately of the scale. Ideally, counting scales should be located away from these disturbances but the reality is that many real-world applications require scales to work accurately within these environments. In these cases, scales that can filter out the effects of these influences are necessary. The ZK Series of counting scales from Avery Weigh-Tronix relies on three different digital harmonizer filters along with software algorithms to accurately operate within these noisy environments.

Draft shields or windbreaks can be used to reduce the effects of unwanted airflow over the scale. These can be as simple as a three-sided wooden windbreak around the scale of semi-permanent option can greatly increase the scale's accuracy when counting lighter items, especially in areas where airflow is a problem.

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Maximize Counting Scale's Ability

While a quality counting scale can significantly improve count accuracy, count inaccuracy is not always determined by the scale being used. Variations in the manufacturing process of the parts being counting often negatively influence count accuracy. There are a number of simple differences in component piece weights.

Always use an accurate counting scale. The more accurate the counting scale, the better the chance is of maintaining stable count readings and getting more accurate piece weights. An accurate counting scale will have high internal resolution, excellent linearity and repeatability and always show a stable weight reading.

Take regular count samples. Because different batch builds can result in minor weight variances, taking regular samples can help reduce count error and provide more accurate piece weights based on the latest batch produced.

Use larger sample size. Using a larger sample size will help average out any component piece weight variance between parts and provide a more accurate overall piece weight. When using larger sample sizes, be aware that the sampling process will take longer and may increase the risk of operator error during sampling.

For more information on how the range of counting scales from Avery Weigh-Tronix addresses each of these issues to provide unprecedented counting accuracy across a wider capacity range than any other scale of the market, please visit….
www.automatedscale.com/counting-scales

or email info@automatedscale.com