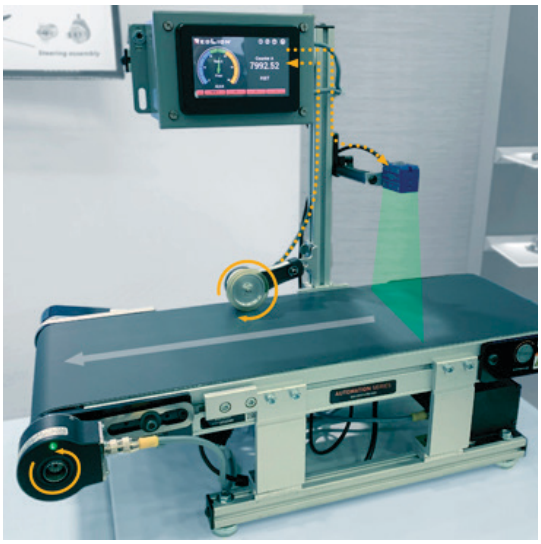
Conveying Applications

Conveyors offer an efficient means of transporting large quantities of materials and items at a regulated rate. Often conveyors are driven by simple constant speed motors with minimal feedback requirements. Sensors and motion control devices come in to play when conveyors are integrated with companion equipment, such as palletizers or labelers. Encoder feedback can be used to monitor belt speed and direction, as well as the position of objects on the conveyor.

Integrating conveyors with vision systems

For many conveyor applications, incremental encoders are used in tandem with vision sensors to aid with operations such as product marking, inspection, and pick and place. The function of the encoder is to indicate belt speed, with the rate of encoder pulses generally equivalent to the resolution requirements of the receiving device. For example, an inkjet printer may rely on a vision sensor to detect the edge of the target object, with the print area starting 20 mm past the edge. If the encoder supplies 20 pulses per mm of belt travel, the printer will count 400 pulses after detecting the object edge and then begin printing. Typically, the encoder will supply pulses to the printer equivalent to the lines per inch of print resolution, so that each measured increment of travel is equivalent to a line of print. This helps ensure the printed image is in the correct location on the target, and not stretched or compressed.



An encoder provides belt position information to a camera (center-right), and can be surface-mounted (center) or mounted to the roller shaft (lower left).

Surface-mounted conveyor feedback

An effective means of obtaining conveyor feedback is to read directly from the belt itself, using a precision measuring wheel attached to a rotary incremental encoder. Traditionally, this setup would entail a shaft encoder, a torsion arm, a pivot point, a tension spring, and a measuring wheel. All-in-one solutions integrate these components into a single cost-effective device that is simple to install. Spring tension is recommended to avoid wheel slippage caused by belt motion, changes in speed or direction, belt seams, and belt contaminants. Spring tension also allows for mounting the encoder underneath the belt when there isn't adequate clearance on the upper surface. For thinner belts, it's recommended that the belt be supported by a roller where the measuring wheel meets the belt.

For conveyor feedback, the measuring wheel surface material should offer the combined attributes of grip and durability. For most continuous belt materials, a polyurethane wheel surface with 65-85 durometer meets the criteria. Measuring wheel size can be selected with an eye toward convenience and accuracy when calculating encoder resolution. Designers should also ensure that the frequency of the encoder signal does not exceed the input frequency limit of the receiving device. If the conveyor belt can rock side-to-side along the axis of linear travel, then a dual wheel solution should be considered. This setup keeps the wheel aligned with belt travel for accurate belt tracking.

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Programmable encoders offer flexibility

Often, newly acquired end-of-line production equipment is installed alongside an existing conveyor. For the installer or integrator tasked with this project, calculating the correct encoder resolution may not be possible until an on-site visit, and even then, it may take some trial and error. In such situations, a programmable encoder allows the installer to test and adjust encoder counts on site. Likewise, programmable encoder resolution can help end-users when relocating labelers, printers, or inspection systems from one production line to another.

Roller shaft- and motor-mounted encoders

Surface mounted measuring wheel feedback may not be a practical option in some applications. Examples are when using segmented conveyor belts with large gaps, when heavy dust, liquids or solvents are on the belt, in extreme temperatures, or when surface mount locations are limited. In such applications, encoders can be applied to a roller shaft or to the drive motor itself, with thru-bore encoders offering a simple installation method. In some cases, the best solution is offset mounting of the encoder via a belt and sprocket or a gear and chain. With offset mounting options, it's recommended to minimize radial bearing loads on the encoder with proper tensioning. A sturdy shaft encoder with robust bearings and use of a flexible shaft coupling will also help extend encoder operating life.

Drive roll diameter, pulley or gear ratios, and belt speed should be determined prior to encoder specification. With this information, the installer can calculate the length of belt travel per encoder revolution and specify the desired number of encoder pulses per rotation.

Overhead conveyors

While belt conveyors support top loads, overhead conveyors move suspended loads and may use chains, cables, or a rail system as a transport mechanism. Thus, in many cases, direct surface mount feedback may not be suitable and shaft mount options are employed. Since overhead conveyors often transport heavy, suspended loads in proximity to workers, absolute encoders may be the preferred choice to ensure position information is retained in the event of power loss. Also, an overhead conveyor may transport an item that reaches multiple workstations along the path of travel. Absolute encoder feedback enables the system designer to confirm each workpiece is properly positioned in relation to automated or human workstations.

Baggage handling

Baggage handling systems usually feature multiple high-speed conveyors, sorting mechanisms and mobile platforms all working in concert to ensure bags arrive on time at the appropriate destination. In addition to meeting the traveler's expectations, these systems also need to enable operators to comply with security requirements for traceability of items during transport. Incremental encoders on drive motors can provide speed control feedback for belt conveyors, while absolute encoder feedback can be used to help report position information of scanned tags.

Conclusion

A properly configured rotary encoder is a key component in many conveying systems. Both end user and OEM system designers benefit from encoders that have configuration options to meet a wide range of application requirements, as well as attributes such as accuracy and reliability. Contact the EPC Sales Team or your EPC Distributor Partner for assistance in selecting and specifying encoders for your conveying application.

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