

Ensuring productivity and safety in busy ports

Control technology is essential to many modern industries, as it is the only practical way to ensure smooth operation and high efficiency. *Control Engineering Europe* looks at some pioneering solutions in one of the toughest materials handling environments.

Handling goods and cargo efficiently through a busy seaport involves making sure that ships are unloaded and reloaded quickly, and guaranteeing that all the different consignments go into the correct storage location, or straight onto the right trucks for onward transfer. This requires a control system that can handle huge amounts of data in real time; can safely operate heavy-duty machinery; and can withstand extremes of climate and potentially corrosive sea air.

Commercial ports usually run 24/7 and are always busy. Unloading and reloading have to be done with speed and accuracy. Crane operators have to be guided to load the shipping containers straight onto the correct vehicle – a port-owned transporter for transfer to a holding area, or a haulier's lorry. Keeping track of all this activity and of the various cargoes is demanding, and automation is really the only practical option.

The containers are typically identified by barcode and the drive shafts of the various machines and mobile plant can be used to generate real-time information about their position within the harbour complex. It is important that safety is maintained at all times – sea container movements need to be controlled with millimetre precision.

The driveshafts of the various cranes and other machinery can be used to collect weight and movement data on each cargo. Each turn of the shaft will progress the equipment's operation forward or backward a small but

consistent amount, and if you can measure the torque (rotational strain) in the shaft you can calculate the weight of cargo being transferred.

This data can be used to calculate information such as the amount of cargo moved, the time to completion of each operation, and the number of receiving vehicles required. It is also possible to collect commercial data. Safety data including cumulative operating hours and total load lifted are also available.

Taking measurements from driveshafts is difficult in such a harsh and frantic environment, but TorqSense from Sensor Technology can offer a solution. It uses radio waves to measure the instantaneous torque in a rotating shaft and plots this against a time base.

TorqSense is wireless, so is simple to install and robust in use. It is largely unaffected by the salty atmosphere and constant motion. A variation on the concept is used for measuring load – a straight line equivalent to torque. Called LoadSense, it uses a wireless radio frequency pickup to collect data signals from the sensing head.

Sway control

As portside activities become more intense, safety systems have to develop to address increasing risks while allowing greater productivity. Gerhard Ruppel Hydraulik has developed an electro-hydraulic anti-sway system, which allows exact adjustment for container weight.

On ship-to-shore cranes with crane bridges up to 50m high and on rubber-tired gantry cranes with an installed



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height of 30m, a container may sway from over a distance of up to 8.5m, requiring up to eight seconds to complete one amplitude. The degree of amplitude is in direct proportion to the weight of the container.

The sway of the container can delay the loading process, as the load cannot be lowered into position until the swinging has settled. The Ruppel system allows the amplitude, and therefore the oscillation period of the container, to be reduced.

The latest generation of systems uses the same basic principle as its original system – where four attenuation cables are strung diagonally to the direction of sway. During the loading process, the slack in the cables was taken up by a hydraulic unit, complete with integrated control block – the new solution includes integrated electronics which offers greater accuracy when setting the system pressure so that it is proportional to the weight of the container. It also allows for constant pressure monitoring.