

Drive successes in Chinese port cranes

Michael Nakulski, Business development of AC and DC drives, Control techniques Ltd, Powys, UK

At a time when we are seeing the world's biggest expansion in port capacity, where else, but in China, one British company, Control Techniques, is enjoying major successes in providing large AC variable speed drives for port cranes in several Chinese ports. The latest of these is a huge project for around 160 drives in Xiamen Haicang Port in Fujian Province in the south of the country.

The port is now owned by Hutchisons Ports Holding (Hong Kong), the world's largest port operator, who is acquiring many of China's busiest ports. Xiamen is ranked number seven in China with a throughput of 3.34m TEU in 2005, an increase of 16.4 per cent on the previous year.

Control Techniques, part of Emerson Industrial Automation, with a well-established Drive Centre in Shanghai and a further Applications Centre in Beijing, has been working closely with a number of the major port crane OEMs in China. These include ZPMC in Shanghai, the world's leader in AC cranes, SPMP in Shanghai, Changzhou GT, GangDi in Wuhan and NOELL in Zhangzhou, proving AC drives for both new cranes and retrofits and DC drives primarily for retrofits in ship-to-shore (STS) and rubber-tire-gantry (RTG) port cranes.

"Our business in China started mainly with DC retrofits," says Control Techniques' Crane and Hoist Business Development Manager, Michael Nakulski. "Over the last few years, we've supplied many DC drives for cranes from 10-40 tonnes in many Chinese ports. In these instances, generally the hoist and gantry shared one DC drive, the boom and trolley sharing another, with the Mentor II digital drives being fitted with a field current controller, a fieldbus adapter and running constant power hoisting control software for smooth anti-sway operation.

A typical example is the DC retrofit of an STS crane at Qingdao Port, with a 450-kW Mentor controlling the hoist and boom and a 125-kW Mentor for the trolley and boom.

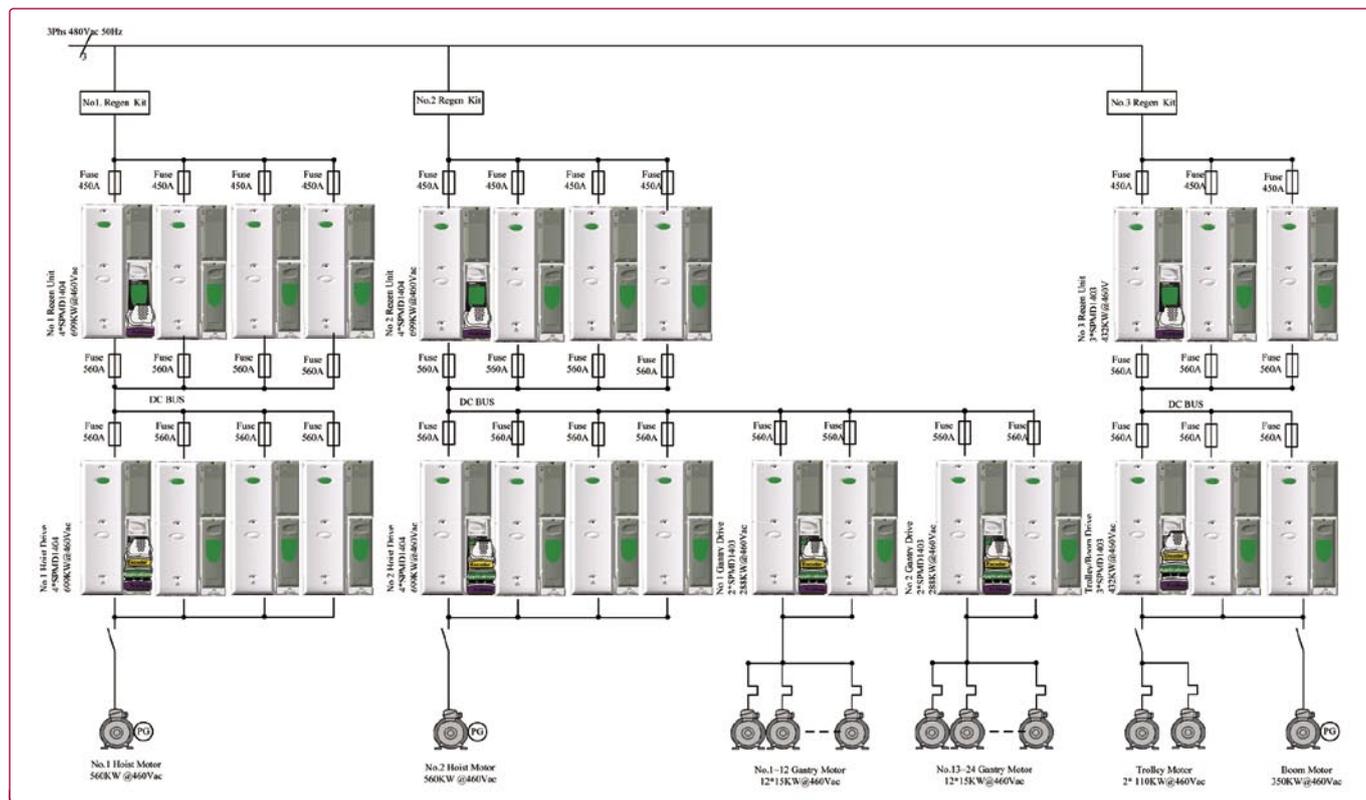
It was eight years ago that Control Techniques achieved its first success in the AC drives arena with an STC crane, with active front end, supplied by ZPMC for Shanghai Longwu Port. Using a common DC Bus supply and full sine-wave four-quadrature energy-saving operation, the configuration was for hoist and gantry to share one drive – in this instance a 150-kW Unidrive – with a second 150-kW hoist motor drive synchronised in 'digital lock'. A second size five Unidrive controlled the trolley (112-kW) and boom (45kW) motion.

ZPMC followed this up with an order for Control Techniques AC drives for a 1600 tonne float crane. Unidrives were supplied for the main hoist (2x480-kW), the 210 and 110-kW auxiliary hoists and the boom (2x480-kW). The crane operated with the main hoists in load sharing mode and communicated throughout using Profibus DP.

Control Techniques drives for port cranes

Control Techniques, is a global leader in the design and manufacturing of AC and DC variable speed drive technology with an installed base of over three million drives worldwide. With experience in applying drives to cranes and hoists for more than 30 years, Control Techniques has developed this specialist technology to maximise port crane productivity.

"Our design philosophy gives us major benefits in the port crane market," explains Michael Nakulski. "Our Unidrive SP range has a modular design with standard power modules that



SPMP- XICT 65T/63M Quayside Crane Scheme.



Control Techniques is about to commission over 160 modular Unidrive SP drives across two projects at XICT and one project at the Xiamen Hairun Container Terminal.

are produced in quantity to extremely exacting quality standards. There is no variation in build, with thousands being made every year, so the field reliability is the best in the market.

From the customer's point of view, this means that modules are interchangeable. Few spares need to be carried (keeping costs down) and, in the rare event of a failure, the crane can continue at a reduced capacity to complete the task in hand, until a convenient moment when the module can be interchanged in a matter of minutes, with no programming required. Should the module be a 'master', setting up of parameters is as quick and easy as inserting a SmartCard. Everything is designed to minimise downtime and maximise port productivity."

The Unidrive SP range is packed with features to meet the variation in crane design and operation needs. Wireless Ethernet gives connectivity to terminal management systems, internal load measurement helps determine optimum hoisting and travelling speeds to maximise throughput and Secure Disable (to EN954-1 category 3 or 4) gives absolute safety when undertaking maintenance. An RFI filter is a standard fitment and connectivity to all major fieldbus protocols such as Profibus and DeviceNet and 48-96 Vdc battery back-up facility to return all equipment to safe and secure positions in the event of a supply failure are options.

Crane control has been refined over many years to meet the specific duties called for in different applications; anti-sway control, differential GPS control for RTG automated steering systems, grab/hoist co-ordinated control and slew control to give operators greater 'feel.' Operators comment on the smooth constant power hoisting and rapid travelling, regardless of load. Operator control consoles and screens are designed for clear information and operator comfort and energy-saving functionality is a major benefit, particularly for cranes using diesel generator supplies.

The Control Techniques cranes drives range encompasses global voltages up to 690 V and ratings up to 1.5 MW. Harmonic reduction through sine-wave AC line regeneration produces significant energy-saving.

Many thousands of drives have been supplied for container cranes – ship-to-shore, rubber-tire-gantry, rail-mounted-gantry and

straddle carriers – for bulk handling – ship loaders and unloaders, grab unloaders, slewing grabs and barge-mounted grabs – and Cargo systems – single and double booms and Goliath overheads.

Xiamen International Container Terminal (XICT)

XICT, a joint venture with Hutchisons Port Holdings, is seen as one of the most important port developments in China and is poised for major growth. Control Techniques' Drive Centre in Shanghai has a close working relationship with the port operators and can point to many major successes over the years, with upgrades of quayside cranes, both DC and AC, a sinewave regeneration on an STS crane, high-voltage cable reelers and upgrading of RTG cranes being just a few examples.

Currently, Control Techniques is about to commission over 160 modular Unidrive SP drives across two projects at XICT and one project at the Xiamen Hairun Container Terminal. The crane OEM being Shanghai Port Machinery Plant (SPMP) and local dealer being GangDaxing in Xiamen.

The first of these, at the Xiamen Hairun Container Terminal comprises four sets of 20 Unidrive SPM AC drives for STS cranes. These are Post-Panama ship-to-shore container cranes rated at 65 tonnes with a boom height of 43 metres and a boom length of 63 metres. The hoist has a no-load speed of 180 metres/min and a full load speed of 75 metres. The trolley speed is 210 metres/min, the gantry speed 45 metres/min and the boom duty cycle is seven minutes/single way.

Unidrive SP drives are responsible for all motor control operations; the 560-kW hoist, the 250-kW trolley, the 250-kW boom and the 7.5-kW gantry motors.

The hoist section comprises two motors coupled together to a common gearbox. In normal operation both motors will operate, one in speed loop, the second in torque mode, but, in an emergency either one can be operated individually. The drives for the trolley and boom sections operate in closed loop speed control.

The gantry section comprises 16 motors, operating in parallel in open loop control.

The crane features constant power hoist control, hoist position counter, additional hoist protection and hoist brake control.



Control Techniques' Drive Centre in Shanghai has a close working relationship with XICT port operators, being involved in upgrades of quayside cranes, both DC and AC, a sinewave regeneration on an STS crane, high-voltage cable reelers and upgrading of RTG cranes among others.

The software tools required are included as part of the package, making commissioning straightforward – it is simply a matter of plugging into any of the drives and the whole system can be viewed and set up.

The Control Techniques drive system provides full sinewave PWM rectification, with four-quadrant control to give maximum energy-saving. In the event of any failure, the system can still operate at reduced power. Each power stack can be tested independently before paralleling, additional units can be added later for greater power demand and an extra power stack can be connected to provide system redundancy.

As part of the same project, Control Techniques has also provided a 5.5-kW Unidrive SP running a high voltage cable reeler and a 30-kW Unidrive SP operates two 7.5-kW motors in parallel on the spreader cable reeler. Two further sets of 26 drives

have been supplied for two 65 tonnes ship-to-shore cranes for XICT – boom height 43 metres, boom length 63 metres, hoist speeds 180 metres/min, no load and 75 metres, full load.

Finally, six sets of seven drives have been supplied for Rubber Tire Gantry Container Cranes at XICT Each is rated at 41.5 tonnes, with hoist speed at 55 metres, no load and 23 metres/min, full load.

Summary

The Unidrive SP modular drive is well suited for port crane applications, especially with regeneration. The design meets all of the needs of both the crane builder – standard sizes, ease of programming and energy efficiency – and the user – with its exceptional reliability, flexibility in operation, ease of maintenance, safety, low spares requirement and, again, energy saving operation.

ABOUT THE AUTHOR



Michael Nakulski, BEE (honours), MBA, is a Chartered Engineer and a member of the Institution of Engineering and Technology.

He has previously worked for ABB, Honeywell and Carbone Lorraine as a project manager, Subsequent management roles at Siemens and AOIP involved him in variable speed drive technology and heavy electrical and electronic engineering. Joining Emerson Control Techniques in 2000 he held the position of head of Product Management for several years before moving into his present role undertaking the business development of AC and DC drives for the Crane Industry. Michael has many years of worldwide experience in applying drives to cranes and hoists. His professional interests lie in technology trends and strategies for the drives industry.

ABOUT THE COMPANY

Control Techniques Ltd, a company of the Emerson Group is headquartered in Wales (UK) where it mass produces variable speed drives operating from modern manufacturing premises equipped with automatic assembly lines. The marketing and sale of products and the design, production and servicing of automation systems, on the other hand, is devolved to peripheral units designated Drive Centres. Control Techniques production centres operate in accordance with ISO 9002 standards, and employ fully automated systems in their manufacturing processes.

ENQUIRIES

Michael Nakulski
Business Development Manager
Emerson Industrial Automation
Control techniques Ltd
St Giles Technology Park
Newtown
Powys SY16 3AJ
UK

Tel: +44 1686 612900

Fax: +44 1686 612999

Mob: +44 771 471 4585

Email: michael.nakulski@controltechniques.com

Website: www.controltechniques.com