

# Modern energy and data transmission systems for terminal cranes

**Conductix-Wampfler Group**

## Introduction

The international crane business had to critically review its long-standing development strategies in light of the 2009 worldwide recession. This particularly impacted worldwide transport of cargo by containers. Based on an important extension of globally operated sea terminals, national networked domestic ports and goods distribution hubs, the focus is currently on the modernization of technology already in operation. There is also an increasingly strong orientation towards consolidating total terminal costs, and for reducing environmental pollution as a result of container terminal operations.

On account of these new challenges, the crane operators and crane manufacturers have intensified the installation of optimized and custom-made technical solutions. This also means a special challenge for the supplying industry. On one hand, optimization processes must be found for the modernization of the existing technologies. However, on the other hand, a critical review of the technical solutions that have been the standard so far is required. The objective is minimizing the capital expenses and operational costs in order that they are adjusted to the new international environmental standards. Due to the particular impact of energy and data transmission systems on the functional reliability and cost efficiency of container cranes, their modernization and optimization will be important for safeguarding the future of container terminals operating advanced technology.

## Solutions for flexible energy and data transmission

The Conductix-Wampfler group accompanies this process of technical and organizational modernization in the terminals



Figure 1. Cable guidance pendulum on high-speed motorized cable reels for RMG-Yard-CC.

through early and determined development of new techniques and technologies in the field of energy and data transmission systems for container cranes. Depending on the position of the interface to the crane and on the crane itself, there could be new concepts for modernization of existing crane techniques and manufacture of new container cranes.

Especially in the field of crane feeding for STS container cranes and for RMG, advanced and novel Conductix-Wampfler solutions of the electronic controls for motorized cable reels

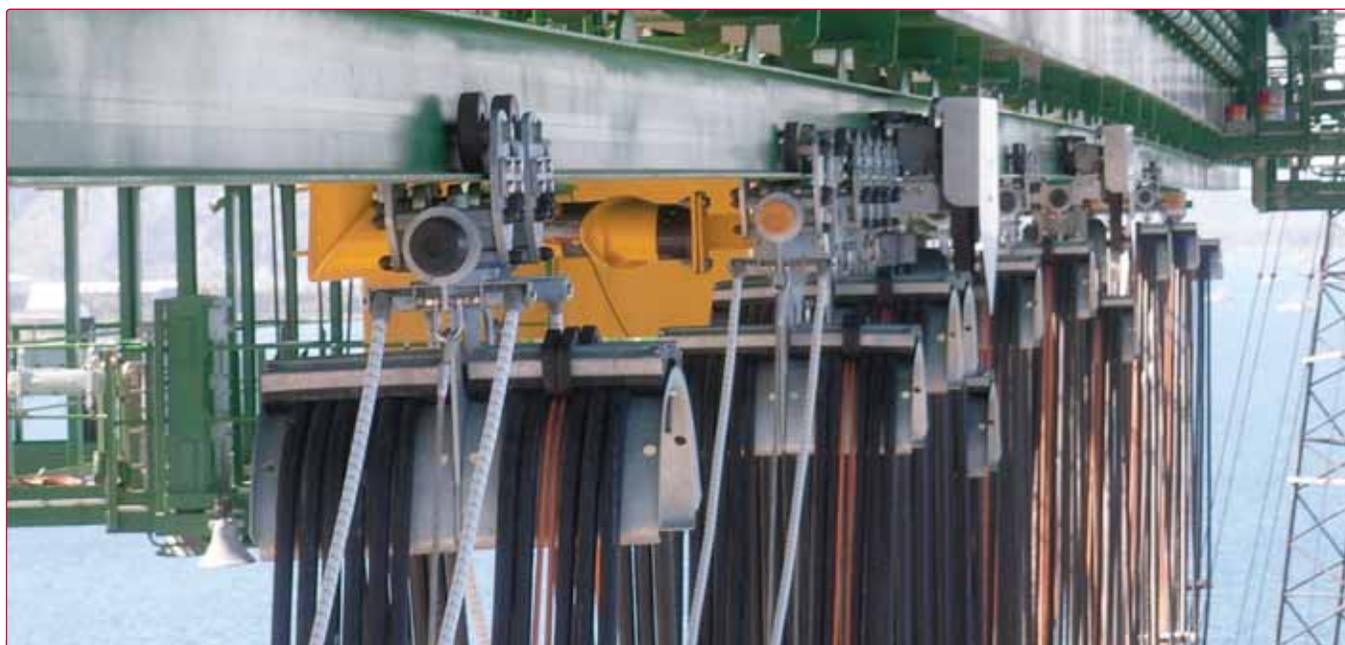


Figure 2. Combination of electromotive and mechanical additional drives for heavy duty cable trolley system on STS-CC.



Figure 3. Conductor rail type 0813 with inductive data transmission IDAT 2.

provide a technically sophisticated application of the reel technique. With the application of mobile (oscillating) cable guides (see Figure 1), the tensile forces will be determined by their position and always be held contemporarily by the custom-made drive control (Sinamics/AC800M) in the area of the permissible cable tensile force. So it will be possible, even with the feeding point in the center, to pass it smoothly at high speed without any reduction.

At the interface of the STS container crane, between crane control and main trolley supply, advanced components for the heavy duty cable festoon systems can be applied. The increased use of modern STS container cranes, with rope-driven technology for travel, and hoist movement of the main trolley, has produced a rigorous reduction of transfer demands on energy and control signals between crane and main trolley.

There are currently high speed festoon systems available for speeds up to 250 meters per minute, with standardized drive versions. Depending on the operation conditions and length of travel, the distance of the main trolley is up to 180 meters. The

inclusion of a second mechanical drive section, by means of the catenary towing trolley, or alternative, and the installation of partially arranged additional electromotive drives, will significantly harmonize the dynamic course of motion in the cable loops. These additional drives (see Figure 2), together with advanced frequency inverter drive control by Conductix-Wampfler, will produce a very gentle and low-wear operation and movement of the high cost cable packages. With these special motorized cable trolley systems, average operating lifetimes of more than 12 years can be achieved, even during extreme crane operation.

In order to be able compensate the differing qualities in the accuracy of the assembly on the cable trolley track, special chassis with asymmetric arrangement of the rollers can be installed, if required. This technique has proved particularly valuable on highly loaded, high speed cranes, with a technically insufficient layout of track. Generously dimensioned rollers, in combination with the inherent travel characteristics, will make the required drive forces for the festoon system much more favorable than on a comparable installation on energy guiding chains.

The most favorable option for a rope driven container crane is the installation of modern conductor rail systems. This technically mature system solution allows for the complete economy of the station area for the heavy duty cable trolleys and of the track extension for the energy guiding chains in the final positions. This can lead to a radical reduction in the size and number of maintenance platforms in crane construction. The minimization of the components in number and weight allows shifting of the load center on the seaward side, leading to an increased lifting capacity and improved structural statics of the crane. The focus on worldwide development works is a continuous improvement of the operational performance of the current collectors, but also the further development of a powerful data transmission technique.

The new System IDAT 2 developed by Conductix-Wampfler, differs from alternative solutions due to a complete abandonment of autonomous, flexible guiding elements and a sufficiently

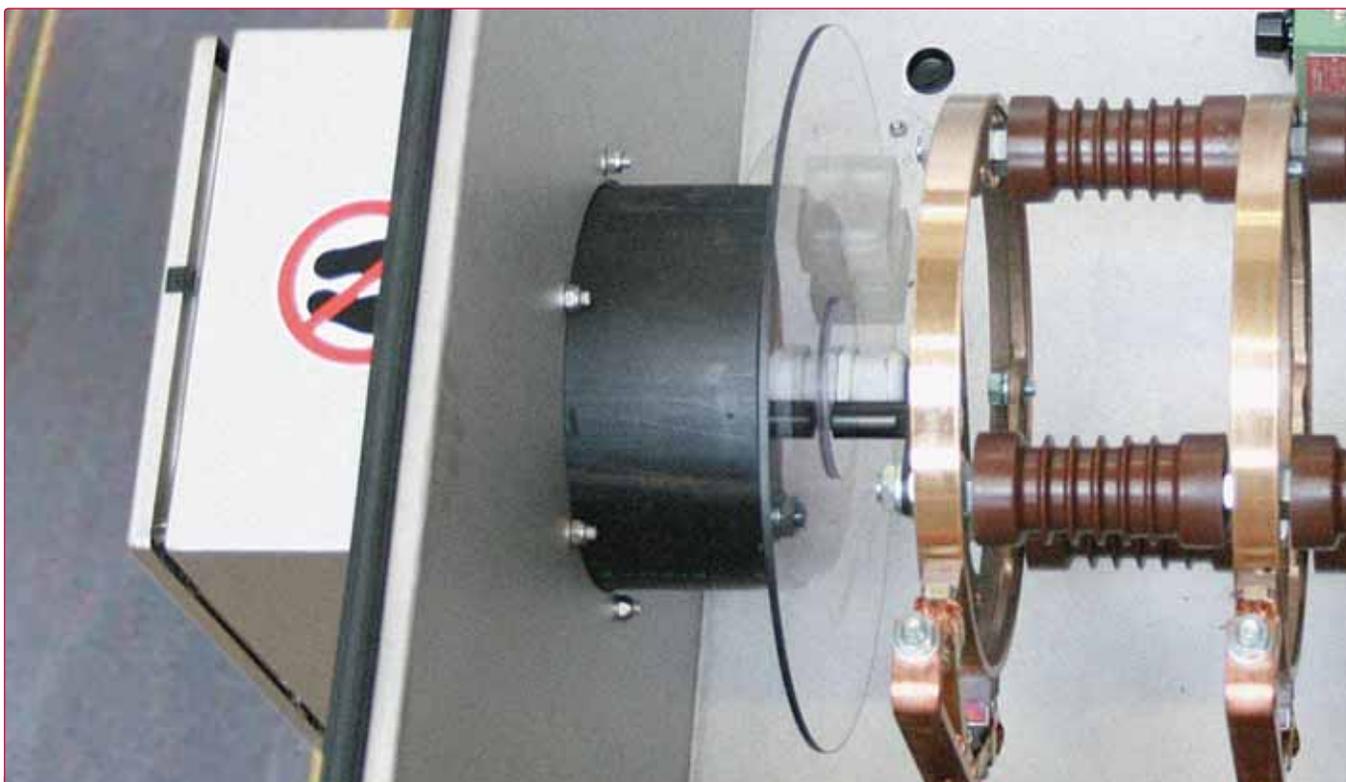


Figure 4. Motorized cable reel with optical fiber rotary joint.

dimensioned data transmission performance that meets market requirements. The IDAT-2 system, based on purely inductive communication, allows a steady exchange of data and signals, regardless of the speed, up to a data rate of 100 megabytes per second, via Profinet-/Ethernet couplings, even with intensive crane operation and erratic climatic conditions. A particularly favorable aspect of this development is the fact that a completely wear-free data transmission system exists, which is resistant to changes in weather. Mutual interactions and electromagnetic feedback, as they might occur on the market in radio data transmission systems, have been completely eliminated. This will allow an important contribution to better security, as well as improved reliability for the fast and steady data communication between crane and main trolley control at an extremely high level.

The installation of high speed rotating, frequency-controlled motorized cable reels has been created for the interface of the spreader. With the help of the ultra-modern stand-alone electronic drive control, modified by Conductix-Wampfler it has been possible, in spite of an increased hoist/lowering speed of a maximum of 240 meters per minute, to considerably increase the lifetime of the special spreader cables supplied by Conductix-Wampfler. Additional damping and relief components at the motorized cable reel and at the spreader secure an over average lifetime of the special cable. The further development of the two company internal optical rotary joints for a maximum lifting height of up to 70 meters allows the trouble-free transmission of redundant electrical signals, as well as audio and video signals (see Figure 4) for an automatic operation.

A heavy cost explosion and the systematic extension of environmental protection, especially in connection with the worldwide depression, had an influence on the development of the market and have lead to a determined optimization of the drive solution used for the RTG cranes in operation. With this technical conversion of the crane-internal diesel-driven energy production to an electrical long distance central supply, a combination of cost savings and environmental compatibility has been achieved.

There are considerable savings on costs (of 70 to 80 percent) and a significant reduction of noise, dirt and exhaust emissions (of up to 60 percent) which can be achieved with these E-RTG.

The system solutions for energy supply and data transmission developed by Conductix-Wampfler, are not only the basis for a stepwise conversion of the worldwide 8,000 strong RTG fleet, but increasingly also provide technical solutions, even for new crane investments. As alternative solutions, they have been established on the market as electrical power supply for the RTG container cranes by means of motorized cable reels or conductor rails. 850 RTG container cranes have currently been converted, and are currently the preferred products to be used, due to their better automation and higher flexibility conductor rail systems, or horizontally shifted conductor rail installations and current collector trolleys.

Automatic coupling and decoupling at the drive-in systems installed by Conductix-Wampfler significantly increases the flexibility and efficiency of the RTG container cranes in the respective storage area (see Figure 5). A combination of inductive

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Converting a conventional RTG into an electrical one (E-RTG™) means to shut down the diesel generator and to power the RTG with electrical power only. This conversion is now possible with the complete RTG electric power solutions developed by Conductix-Wampfler:  
**Plug-In Solution, Drive-In Solution and Motorized Cable Reel Solution.**

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E-RTG™  
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Figure 5. E-RTG with drive-in system as 2 + 2 version.



Figure 6. Racer energy guiding chain with support trolley on Intermodal-CC.

data transmission type IDAT 2 secures the real-time loss-free data exchange with the central processor by means of the installed motorized cable reel technique. A complex system solution is achieved by the simultaneous installation in the respective storage section of an automated drive control for the RTG drive units, joined to the conductor rail geometry.

To permanently secure the strong handling capacity of the RMG, there are today high-speed motorized cable reels available at the interface to the crane supply. The modern drive systems, equipped with magnetic couplings or electronic controls, allow adjustment to the respective crane operating conditions at optimal costs. The newly launched trailing cables, with integrated measuring line for the control of the tensile force, in combination with customized electronic drive controls, will provide additional security for the motorized cable reels.

For the fast and highly frequented crane and main trolley movements typical on RTG, the predominantly used products for a travel distance of up to 100 meters for main trolley tracks at the interface between crane and main trolley are today energy guiding chains as energy and data transmission systems. However, in order to secure a trouble-free automatic operation in the long-run, increased maintenance efforts and special preventive measures are crucial.

At Conductix-Wampfler, studies were undertaken and after much analysis, it was found that to minimize the 'wear and tear' on the installed energy guiding chains and flexible cables, that plastic chains with single links have proven to be successful. (see Figure 6). With the system inherent accompanying support trolley, this results in a significant relief on the chain lines and the electrical cables or hoses installed within. Optimized wear behavior, as well as a longer operational life and an increased functional security, will help reach reduced drive forces with these special energy guiding chain solutions.

Conductix-Wampfler has been directly involved with the container terminal industry in developing and deploying energy and data transmission systems. Often these systems are customized as well as being standardized complex systems. A major factor

in deploying such technologies is that project planning, delivery, installation and maintenance for all interfaces must be considered with experts.

Working in collaboration with crane manufacturers, such as Kalmar, Künz and ZPMC, Conductix-Wampfler is developing a new generation of sophisticated energy and data transmission systems. Furthermore, it is important that the demands from the customers, such as global container terminals operators like APMT, DPW, HPH and PSA are identified to be latter incorporated as system requirements for development. Overall, the importance of maintaining contacts to the industry is vital to ensure a properly designed and engineered system.

## Outlook

In combination with the already available existing data transmission system IDat 2, there will be a completely wearless and cost effective energy and data transmission system available for the crane main trolley interface.

Another trend is becoming apparent for a self-sustaining energy supply of a spreader. If it can be made to decouple the drives and electronic components on the spreader from the energetic supply of the electric energy supply by means of a decentralized energy generation, a minimized motorized cable reel with spiral fiber optics with all associated effects for economies and technical advantages might be possible.

Conductix-Wampfler's inductive energy transmission systems allow continuous energy supply during movement in the terminal area, but also the stationary charging of batteries for the electric drives at and on the vehicle. In order to enable the increased demands on energy performance for transport vehicles, Conductix-Wampfler is currently working on various system solutions and technologies in cooperation with interested parts of the electronics industry.

This underlines the intensive and worldwide cooperation with container crane manufacturers, crane operators and crane service companies that firms such as Conductix-Wampfler are committed to.

## ABOUT THE COMPANY

**Conductix-Wampfler** is the world leader in the design and manufacture of efficient energy and data transmission systems for all types of mobile machinery. Dedicated electrification solutions help to keep customers' operations up and running 24/7 – 365 days per year. Conductix-Wampfler offers all available technologies and products to meet flexible and mobile energy and data transmission requirements, all from one source. Customers benefit from unbiased consulting, engineering, and offering of the most suitable products.

## ENQUIRIES

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