

igus® the-chain ... moving energy made easy  
...e-chainsystems®...e-chain®...readychain®...chainflex®-cables



light & quick  
for heavy-weights...

14<sup>th</sup> TRANS Middle East  
TEHRAN 2017



**igus® the-chain ... moving energy made easy**  
**More than 2,950 employees worldwide**



# igus® - Headquarter, Cologne Germany

- **36 igus® subsidiaries worldwide (and more to come)**
- **More than 52 certified igus® distributors around the world**



**igus® the-chain ... moving energy made easy**  
**Local igus® representative**



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# e-chainsystem® benefits



igus® the-chain ... moving energy made easy  
igus® - e-chainsystem® benefits



- ▶ Space saving design
- ▶ No cable loop station & no loop station

additional steel structure for

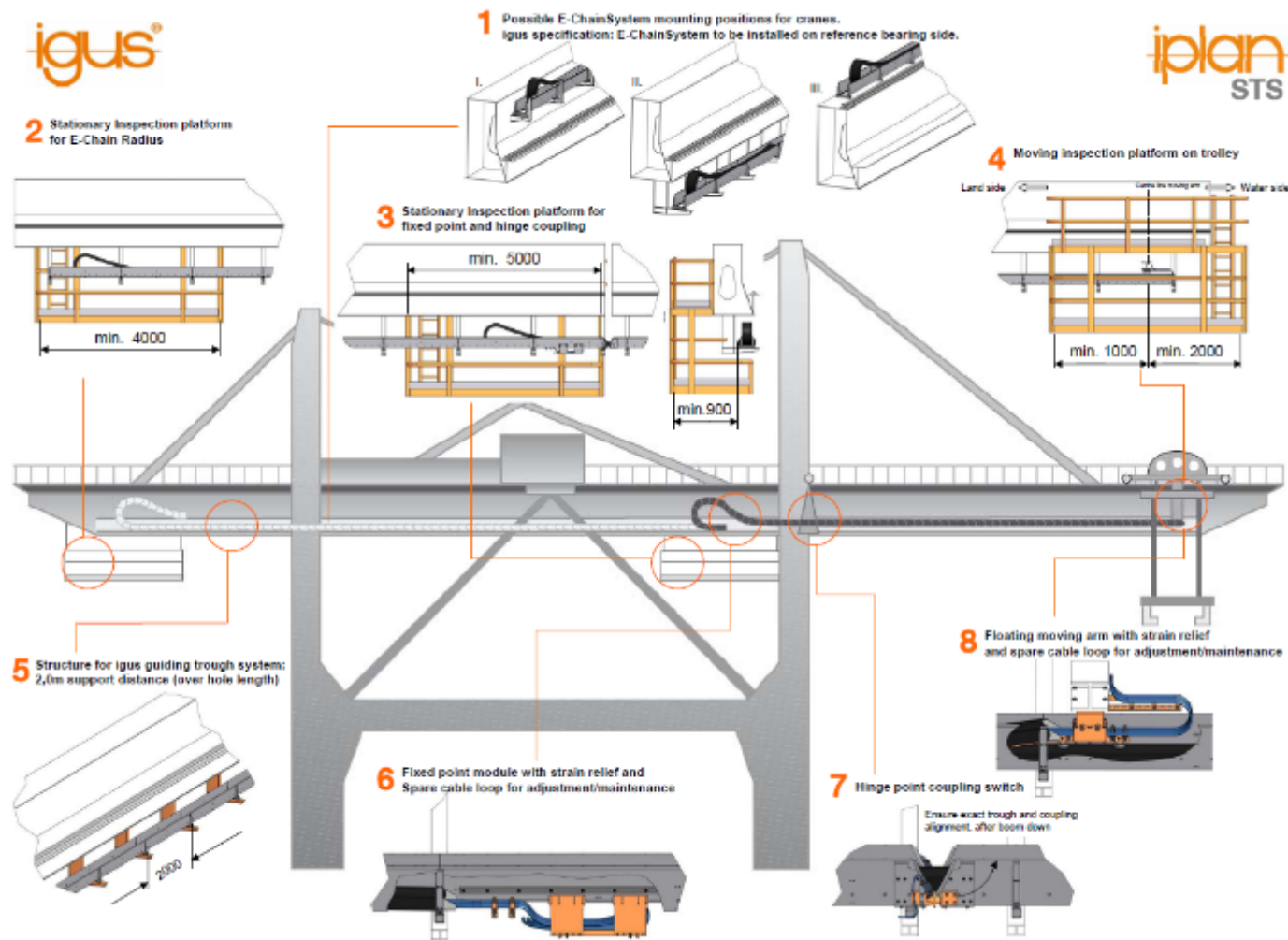
e-chainsystem®



- ▶ No additional drives or control system necessary to move the chain system
- ▶ Synchronous run of trolley and e-chainsystem®
- ▶ All kind of media (power, data, fiber optics, hydraulics, pneumatics, ...) can be conveyed in one system
- ▶ Quick and easy installation of additional cables and hoses
- ▶ igus® field service (inspection, installation, supervisor service)



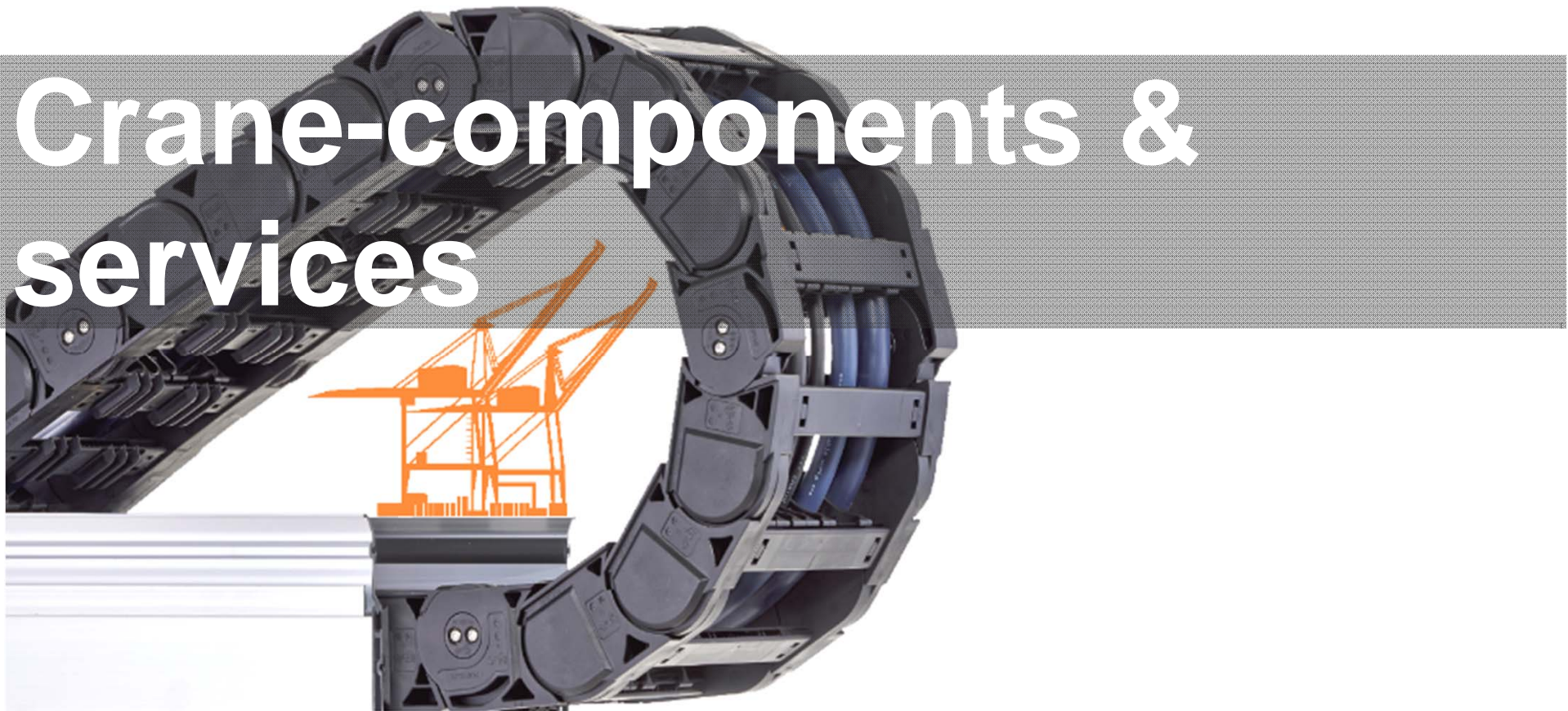
- ▶ Low maintenance extravagance – less downtime of the crane
- ▶ Wind and weather resistant system
- ▶ Spare part guarantee for 10 years and more



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# Crane-components & services





## e-chain® series E4.1



- ▶ High lateral stability
- ▶ Suitable for large unsupported lengths
- ▶ Dirt repellent, with smooth, wear-resistant surface
- ▶ Wide, cable friendly plastic crossbars
- ▶ Large interior separation kit



Successfully used on various Reachstacker applications around the world



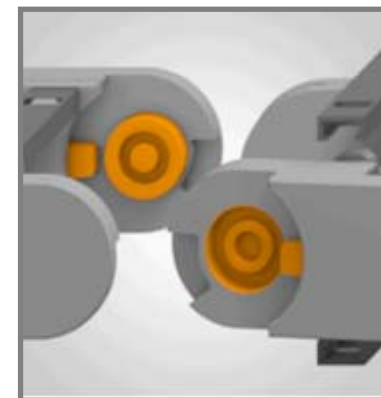
## Heavy Duty (rol) e-chain® series



**17 years experience -  
chains with integrated rollers!**

- ▶ Heavy Duty energy chain® for high cable loads
- ▶ Large pin / bore connection surface
- ▶ Enlarged gliding surface, less wear
- ▶ High tensile stability
- ▶ Robust steel mounting brackets

Successfully used in various port applications since 2004!

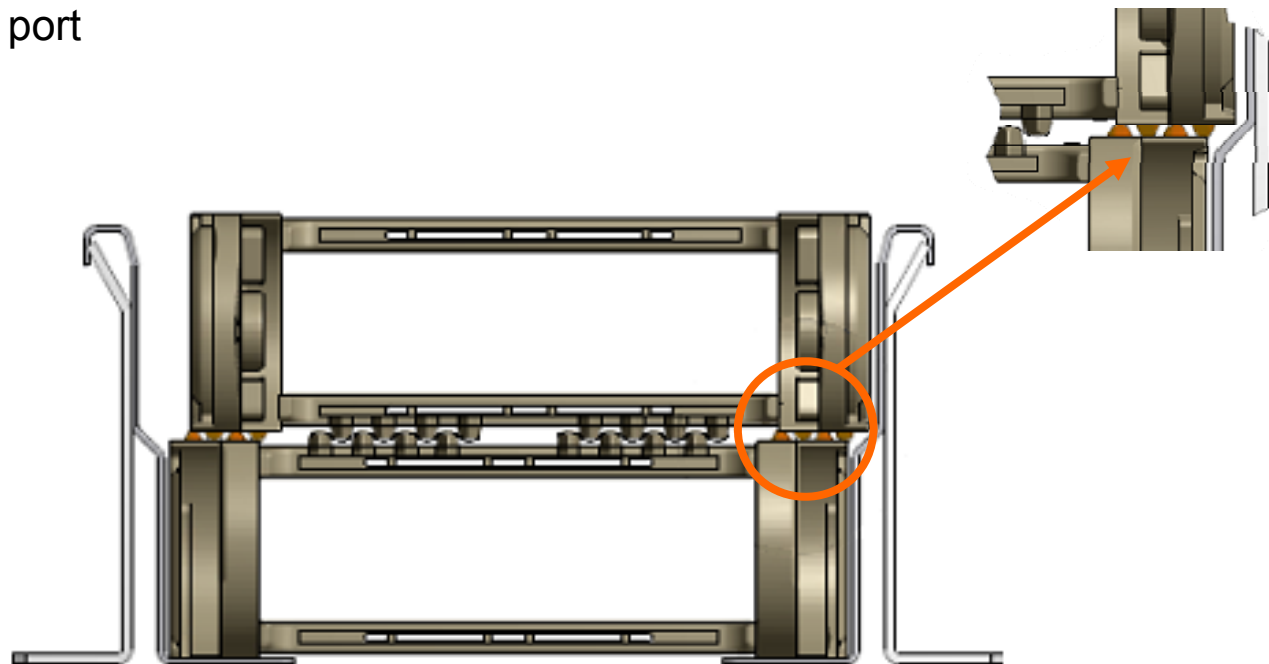


## e-chain® series P4



- ▶ Smooth & low noise operation
- ▶ Integrated grooved roller, running on a large, even & plain surface
- ▶ Designed for high fill weights & fast travel speeds

Successfully used in various port applications since 2008!



## Guide trough systems for cranes (Steel or Aluminum)



Heavy Duty installation sets, with reinforced brackets / special installation profiles

## chainflex®-cables



More than 25 years experience in the development of cables for e-chains®

### Bus Cables



chainflex® bus cables are available for all continuous bus systems within e-chains®

### Fiber Optic / Coaxial Cables



Plastic (980/1000) or glass fibers (62.5/125 or 50/125), 1, 2, 6 or 12 fibers  
(all tested for several million life cycles inside e-chains®)

### Control Cables



PVC, PUR, TPE – A wide selection of materials for all applications – shielded and unshielded control cables with various combinations of cores and cross sections

## chainflex®-cables



More than 25 years experience in the development of cables for e-chains®

### Motor & Servo Cables

Shielded servo cables for inverter operation 600/1000 V, with one or two shielded signal pairs. Shielded & unshielded motor cables (1,5 to 95mm<sup>2</sup>)

### Single Core Motor Cables

Shielded and unshielded single core motor cables for most demanding requirements as copper or special CCA material conductors

### Single Core CF Crane

Shielded, highly flexible single core for up to 6/10kV.  
Medium voltage cable for most demanding requirements in crane applications

## Test lab

- ▶ 2750 m<sup>2</sup> test area
- ▶ More than 80 e-chain® & chainflex® tests running at a time
- ▶ Function & life time testing
- ▶ Simulating real conditions (travels up to 300 m and speeds up to 300 m/min)



Climatic tests for all e-chain® & chainflex®-cables.  
Material tests from - 40°C up to +199°C.

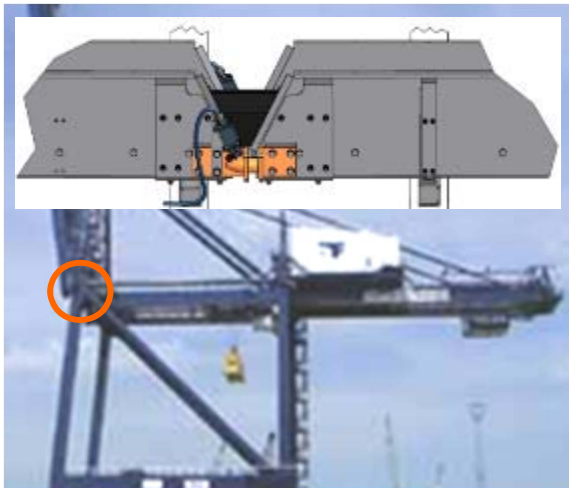


chainflex®-cables in life span test. Millions of cycles  
guarantee: chainflex® lasts or money back!



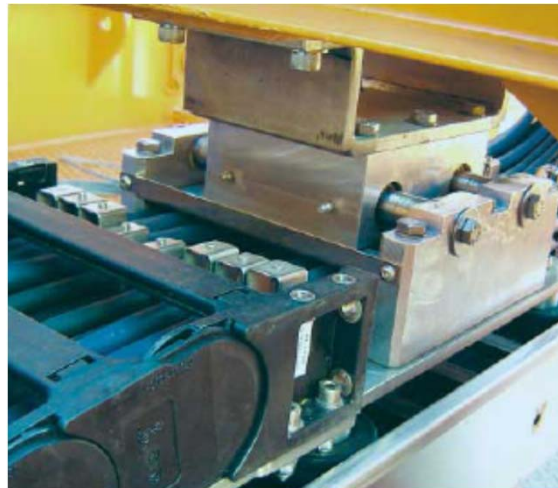
## igus® Special parts

### Hinge clutch



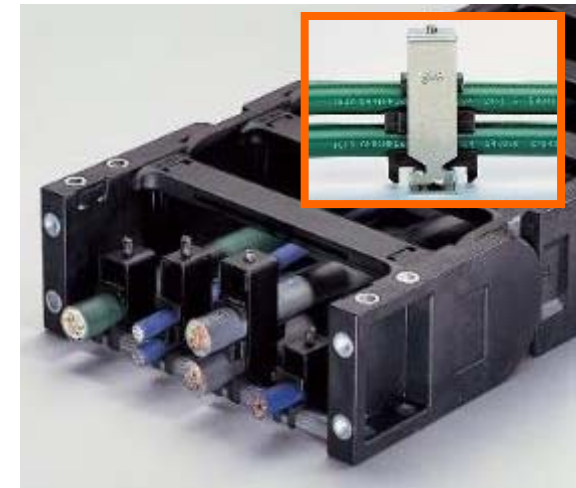
Hinge clutch at the hinge point, with bolts and holes to get a safe adjustment of the trough system after bringing down the boom.

### Floating moving arm



igus® floating moving arm for compensation of the lateral mismatch. Floating moving arms are successfully used by igus® on STS / RMG / RTG / ASC cranes and other applications for more than 15 years.

### Strain relief



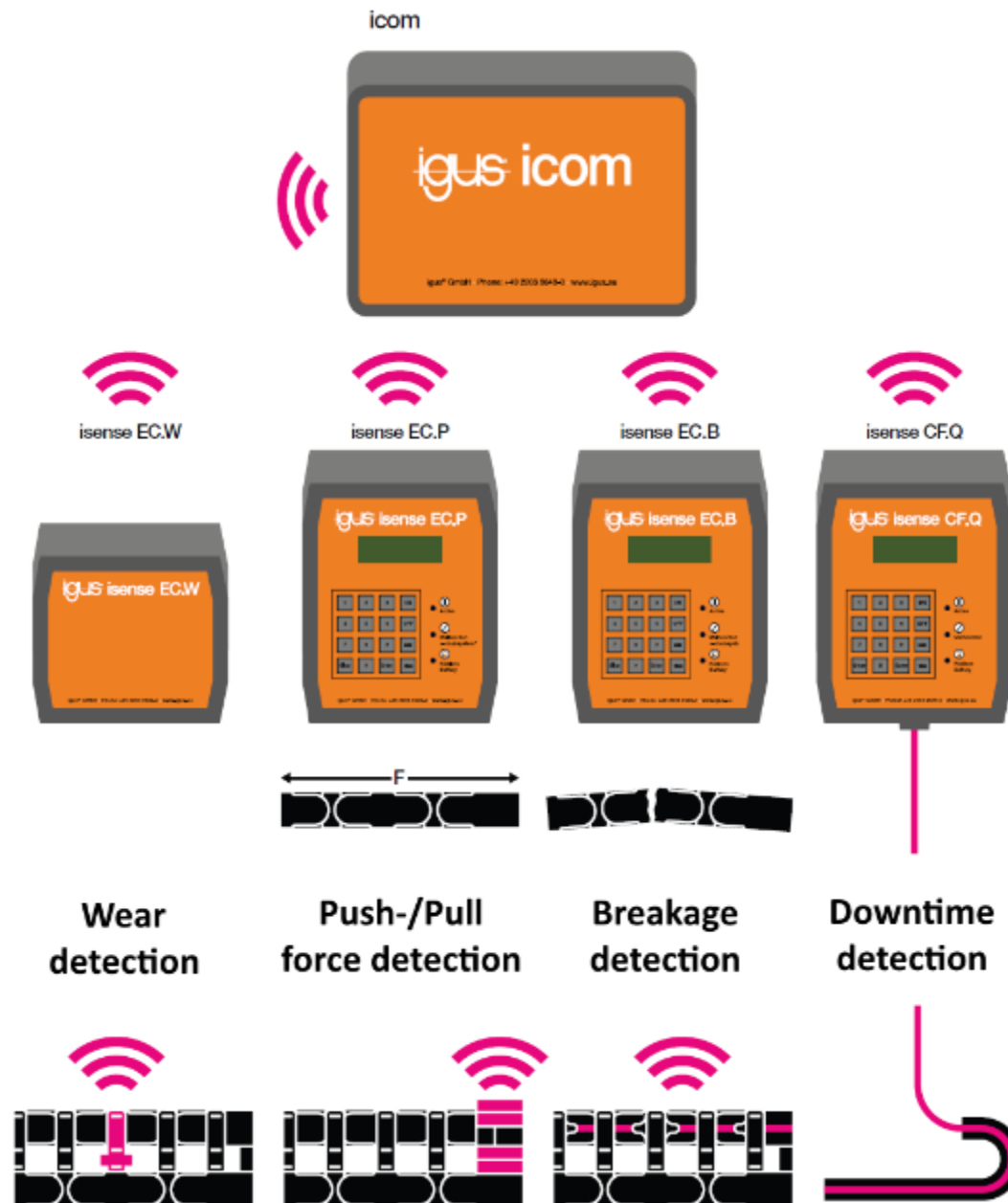
Clamps for safe cable strain relief. All strain relief elements are an igus® own development.



## igus® smart plastics

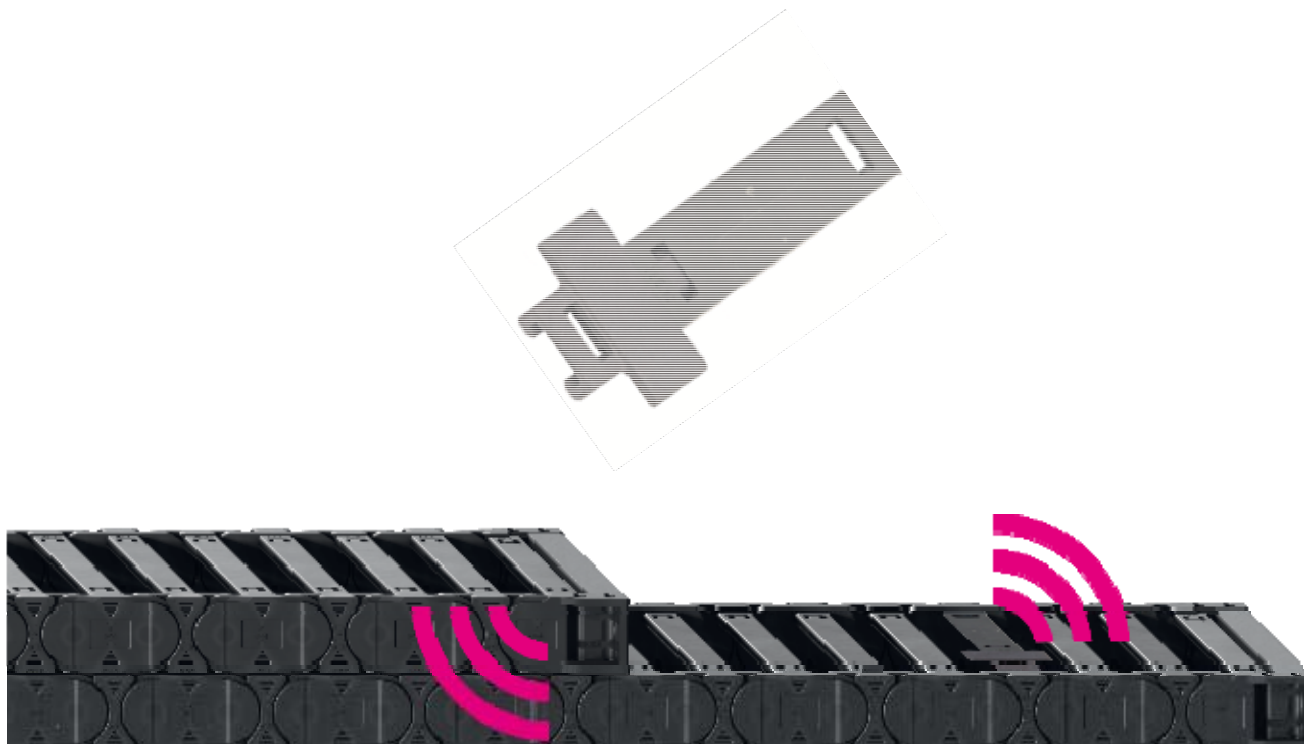
### icom – igus® communication module

Receives data from isense sensors & sends the data – according to configuration – to desired terminals.



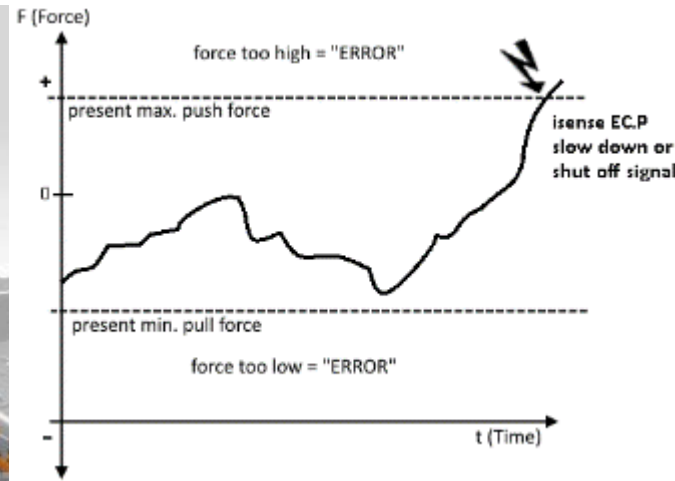
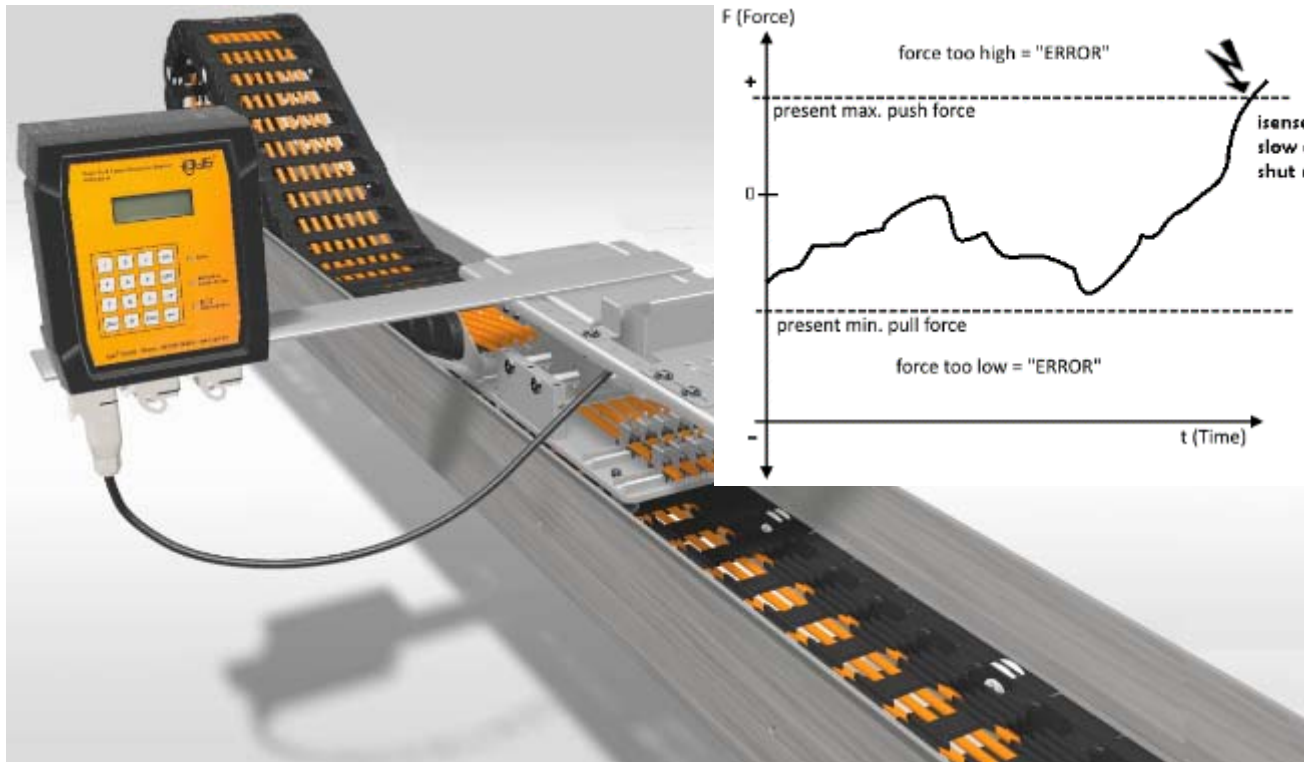
## igus® smart plastics – isense EC.W(ear)

- ▶ Diagnostic tool to measure the wear on the e-chain®
- ▶ Receiver unit/antenna of the wear sensor in crossbar
- ▶ Equipment downtime for replacement can be scheduled



## igus® smart plastics – isense EC.P(ush/Pull)

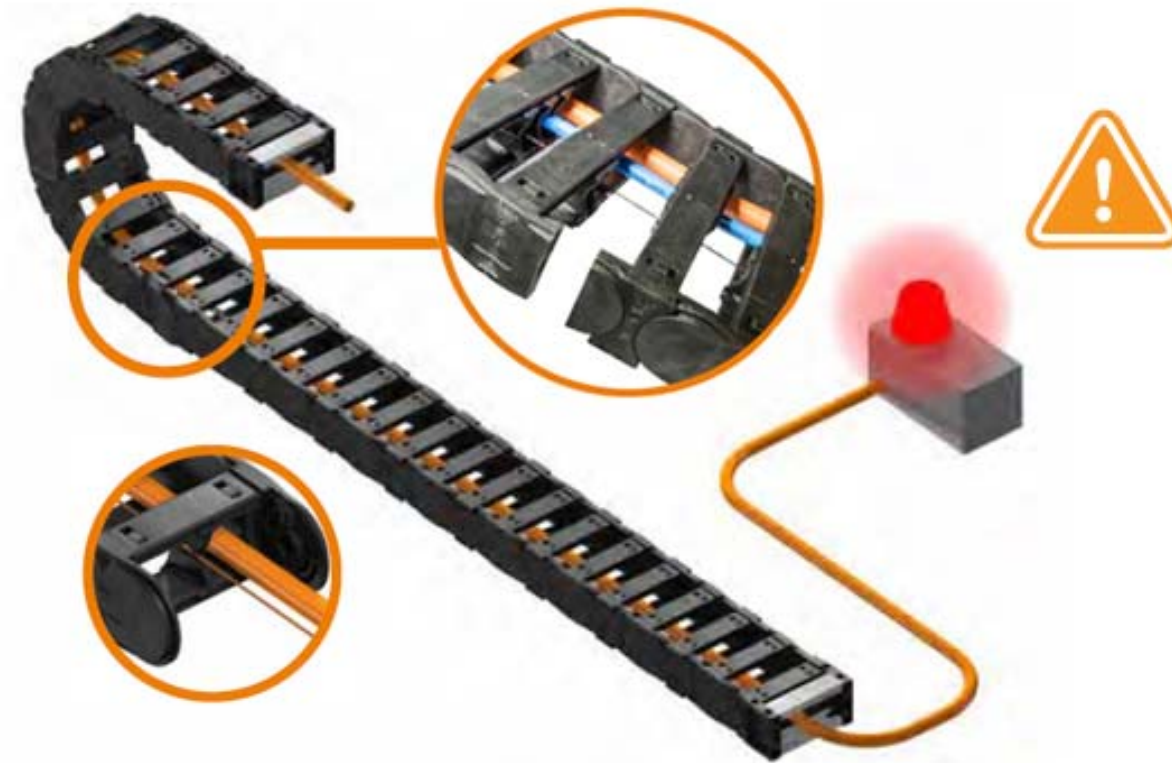
- ▶ Diagnostic tool to monitor the push/pull forces of igus® e-chains®
- ▶ Combination of a load cell (force monitoring) & evaluation unit
- ▶ Prevents damage to e-chainsystem®



PPDS – continuous real push-/pull-force measurement and limit comparison

## igus® smart plastics – isense EC.B(reakage)

- ▶ Electronic diagnostic tool for partial e-chain® defect detection
- ▶ Prevents unexpected down time



isense EC.B



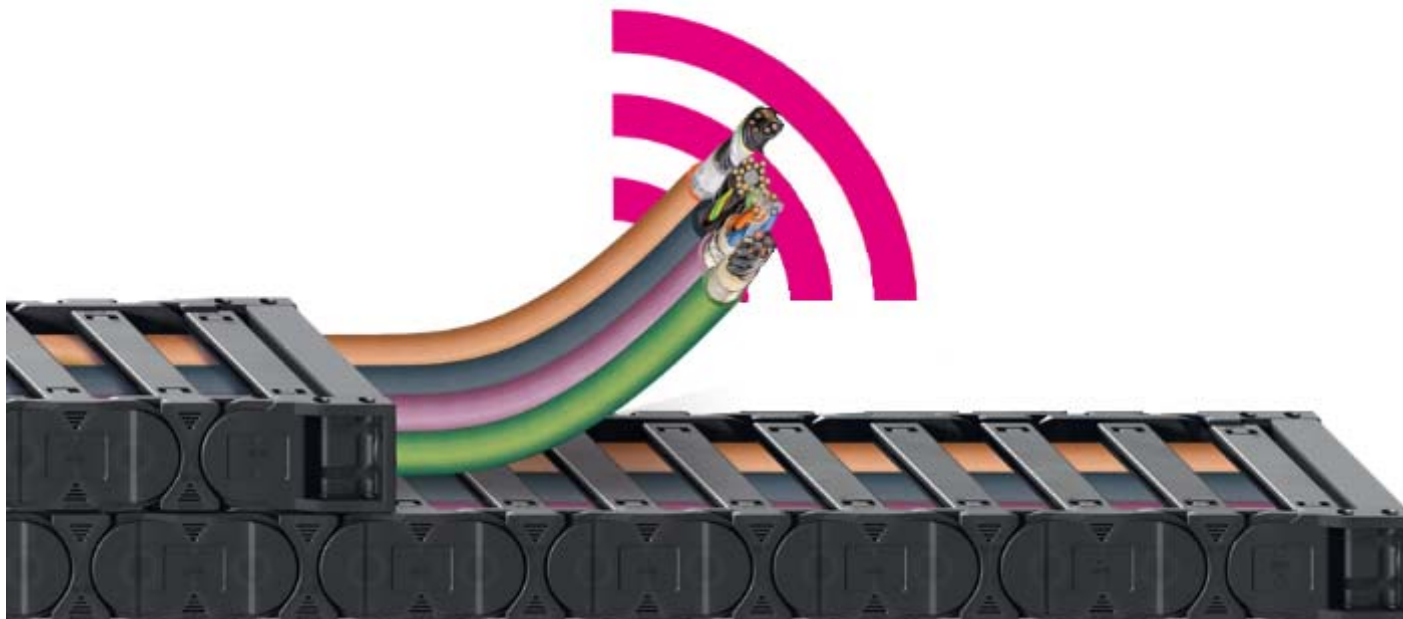
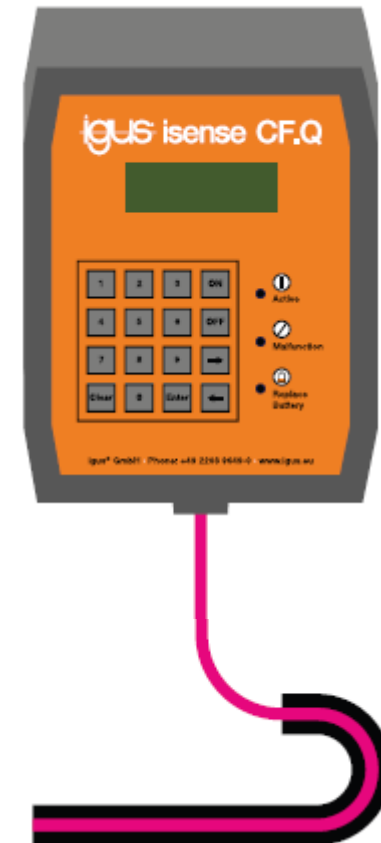
Alarm through autonomous detection of a defect/partial defect of the e-chain®

## igus® smart plastics – isense CF.Q (Electronic Conductor Quality)

- ▶ Electronic diagnostic tool measuring various cable parameters
- ▶ Continuous comparison of real time data to preset values
- ▶ Prevents unexpected down time

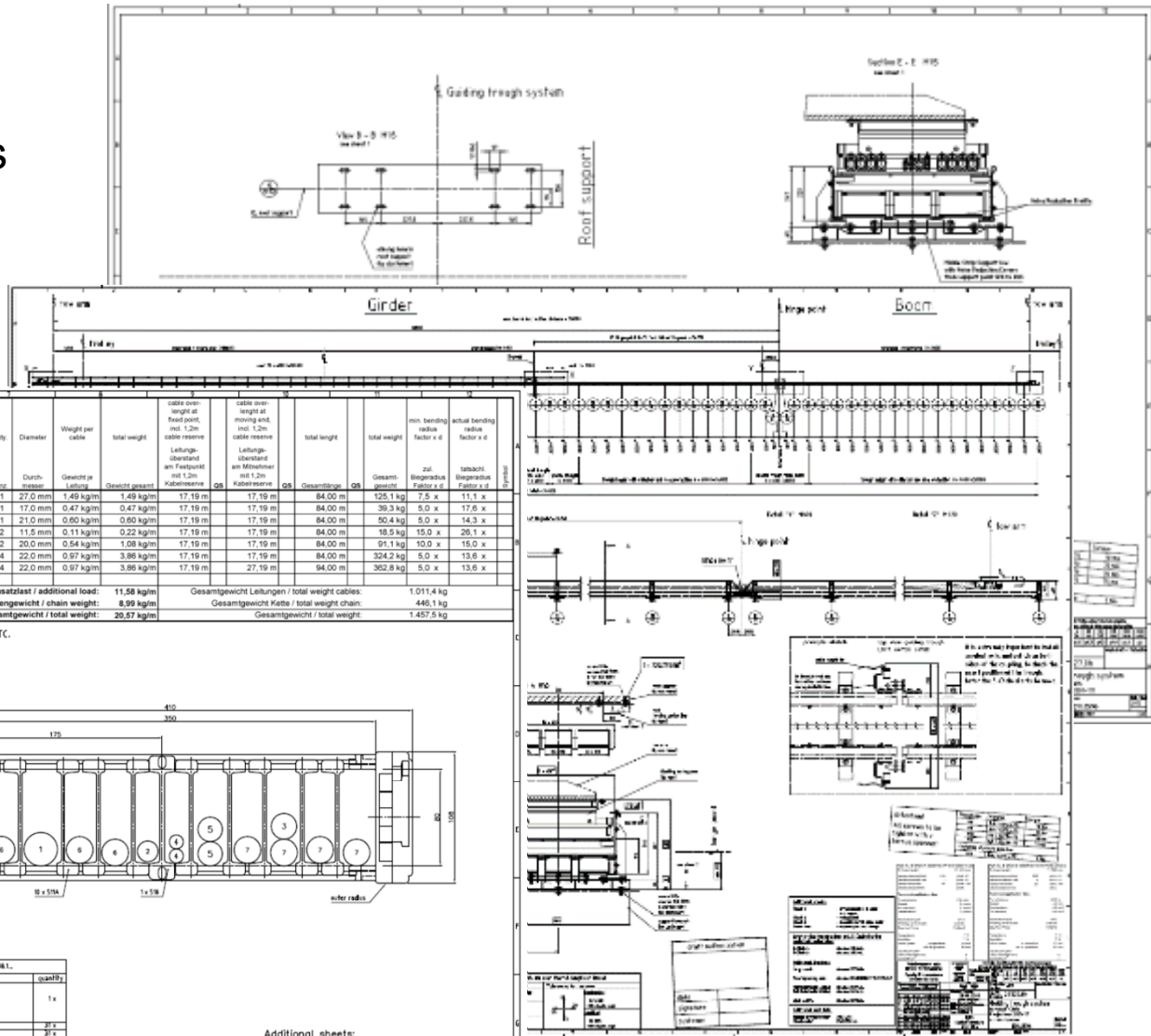


isense CF.Q



# Project engineering

- ▶ Detailed project drawings
- ▶ igus® documentation



Part. no. / Description	MAT no.	No. of cores & conductor cross-section	Qty	Diameter	Weight per cable	total weight	cable over-length at fixed point, incl. 1.2m cable reserve	cable over-length at moving end, incl. 1.2m cable reserve	total length	total weight	min. bending radius factor x d	actual bending radius factor x d
1 CF38 250.04		(4 G 25.0/C)	1	27.0 mm	1.49 kg/m	1.49 kg/m	17.19 m	17.19 m	84.00 m	125.1 kg	7.5 x	11.1 x
2 CF9 25.12		12 G 2.5	1	17.0 mm	0.47 kg/m	0.47 kg/m	17.19 m	17.19 m	84.00 m	39.3 kg	5.0 x	17.6 x
3 CF9 25.18		16 G 2.5	1	21.0 mm	0.60 kg/m	0.60 kg/m	17.19 m	17.19 m	84.00 m	50.4 kg	5.0 x	14.3 x
4 CFL3.62.82.5/125.TC		8x 0.62.5/125µm	2	11.5 mm	0.11 kg/m	0.22 kg/m	17.19 m	17.19 m	84.00 m	19.5 kg	15.0 x	20.1 x
5 CF12.10.06.02		(6 x 2 x 1.0/C)	2	20.0 mm	0.54 kg/m	1.08 kg/m	17.19 m	17.19 m	84.00 m	91.1 kg	10.0 x	15.0 x
6 CF38 160.04		(4 G 16.0/C)	4	22.0 mm	0.97 kg/m	3.86 kg/m	17.19 m	17.19 m	84.00 m	324.2 kg	5.0 x	13.6 x
7 CF38 160.04		(4 G 16.0/C)	4	22.0 mm	0.97 kg/m	3.86 kg/m	17.19 m	27.19 m	94.00 m	362.8 kg	5.0 x	13.6 x

Zusatzlast / additional load: 11.58 kg/m  
 Gesamtgewicht / total weight: 8.99 kg/m  
 Gesamtgewicht / total weight: 20.57 kg/m

Gesamtgewicht / total weight: 1.011.4 kg  
 Gesamtgewicht Kette / total weight chain: 446.1 kg  
 Gesamtgewicht / total weight: 1.457.5 kg

Pos. 4, Belieferung - AB 1766608, ersetzt durch CFL6.12G.62.5/125.TC.  
 Delivery, AB 1766608, replaced by CFL6.12G.62.5/125.TC.

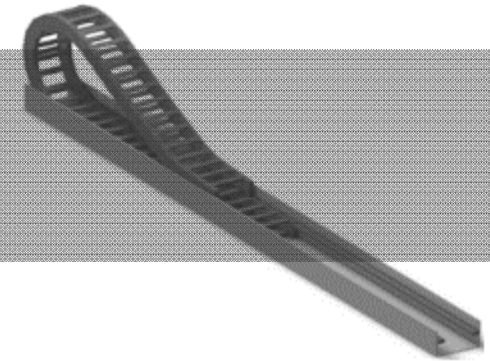
**Drum typ II**

**Technical Data of the Drum:**  
 chain fixed on centre of drum with stainless steel on the bracket.  
 middle bracket, 160mm

Part	Description	quantity
1	1x HG - to BKG	1 x
2	2x HG - to BKG	2 x
3	2x HG - to BKG	2 x
4	1x HG - to BKG	1 x
5	1x HG - to BKG	1 x

**Additional sheets:**  
 sheet 1/2 - interior shelving  
 sheet 2/2 - coil arrangement

View: from fixed point into the chain  
 Production mark in accordance with DIN 34  
 Version: 02.11.2009  
 Scale: 1:1  
 Drawing: 75279.1d  
 Project: HI Area 4.025  
 Project-no.: 2005-227  
 Fig. no.: see drawing  
 Date: 01.11.2009  
 Scale: 1:1  
 Material: 177



# Technical details

▶ **Speed up to 600 m/min**

The fastest crane with igus® e-chain® is running at 300m/min

▶ **Acceleration up to 10 m/s<sup>2</sup>**

▶ **Travel length up to 900 m**

The longest crane application running with igus® e-chain® is 500 m long  
(STS, Port of Singapore, since 2002)

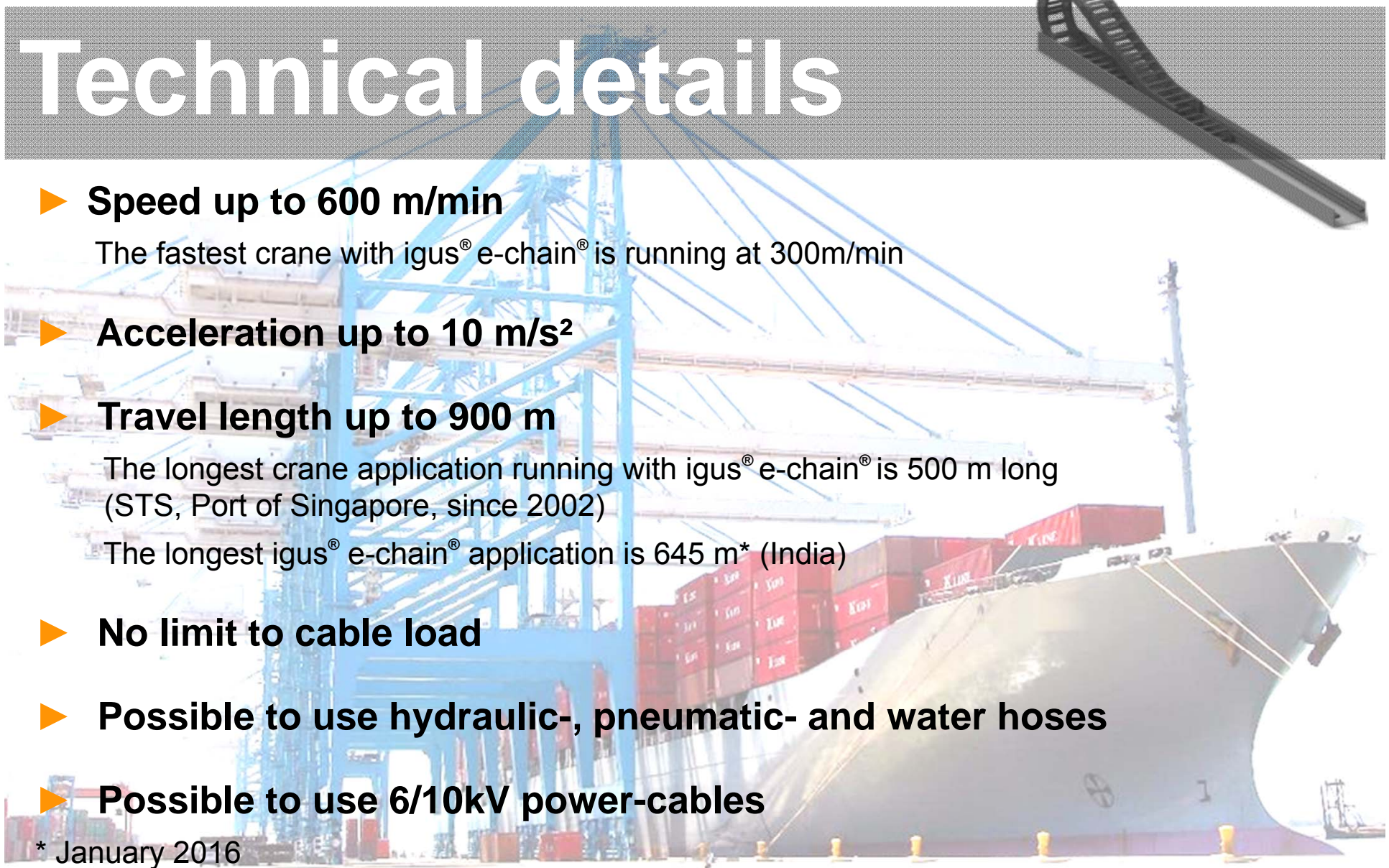
The longest igus® e-chain® application is 645 m\* (India)

▶ **No limit to cable load**

▶ **Possible to use hydraulic-, pneumatic- and water hoses**

▶ **Possible to use 6/10kV power-cables**

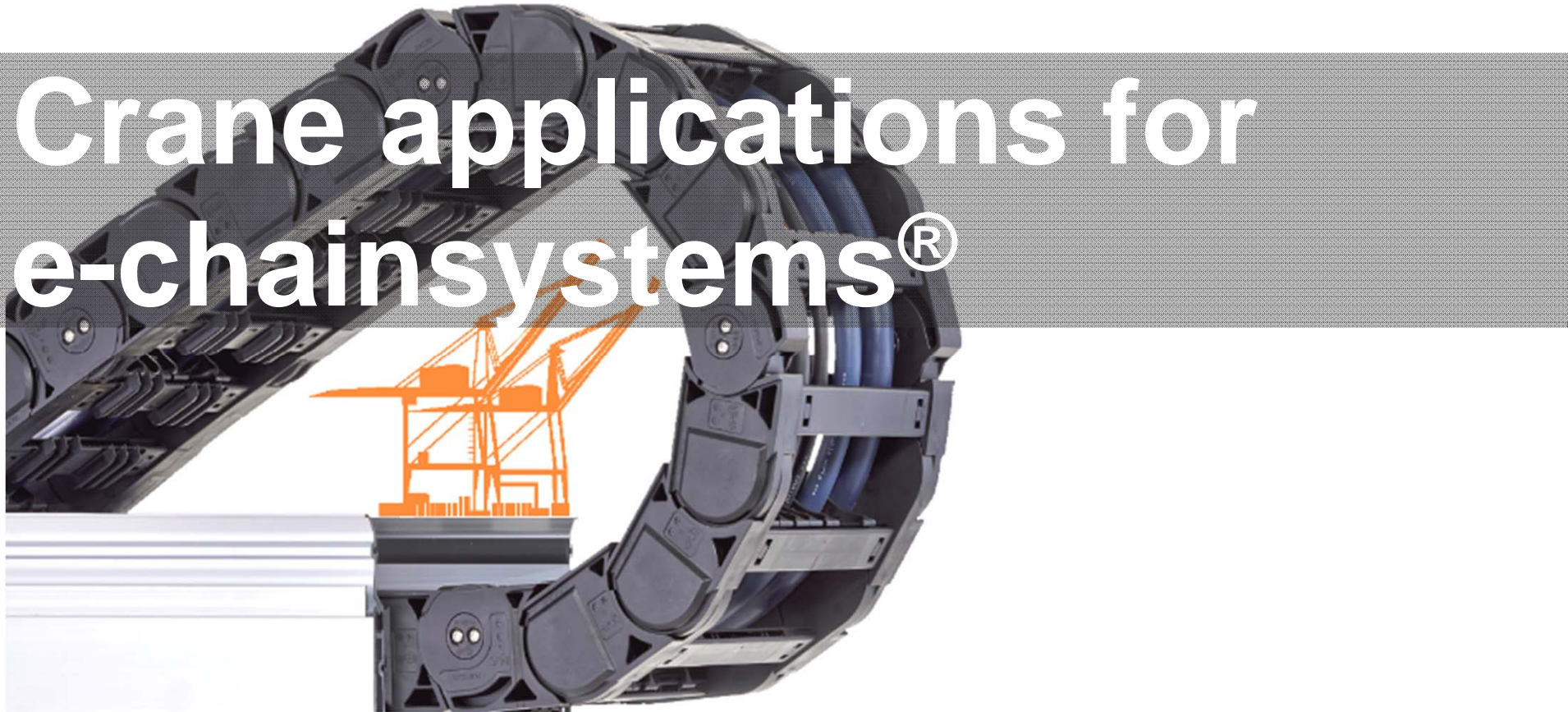
\* January 2016



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# Crane applications for e-chainsystems®





# ... STS trolley travel with e-chainsystem® & stainless steel guide trough ...



Travel length: 118,5 m  
Speed: 4,0 m/s  
Acceleration: 0,8 m/s<sup>2</sup>

e-chain®: P4.56R.20.250.S40.0.AG  
chainflex®: CF330, CF9, CFLG  
Guide trough: stainless steel HD trough

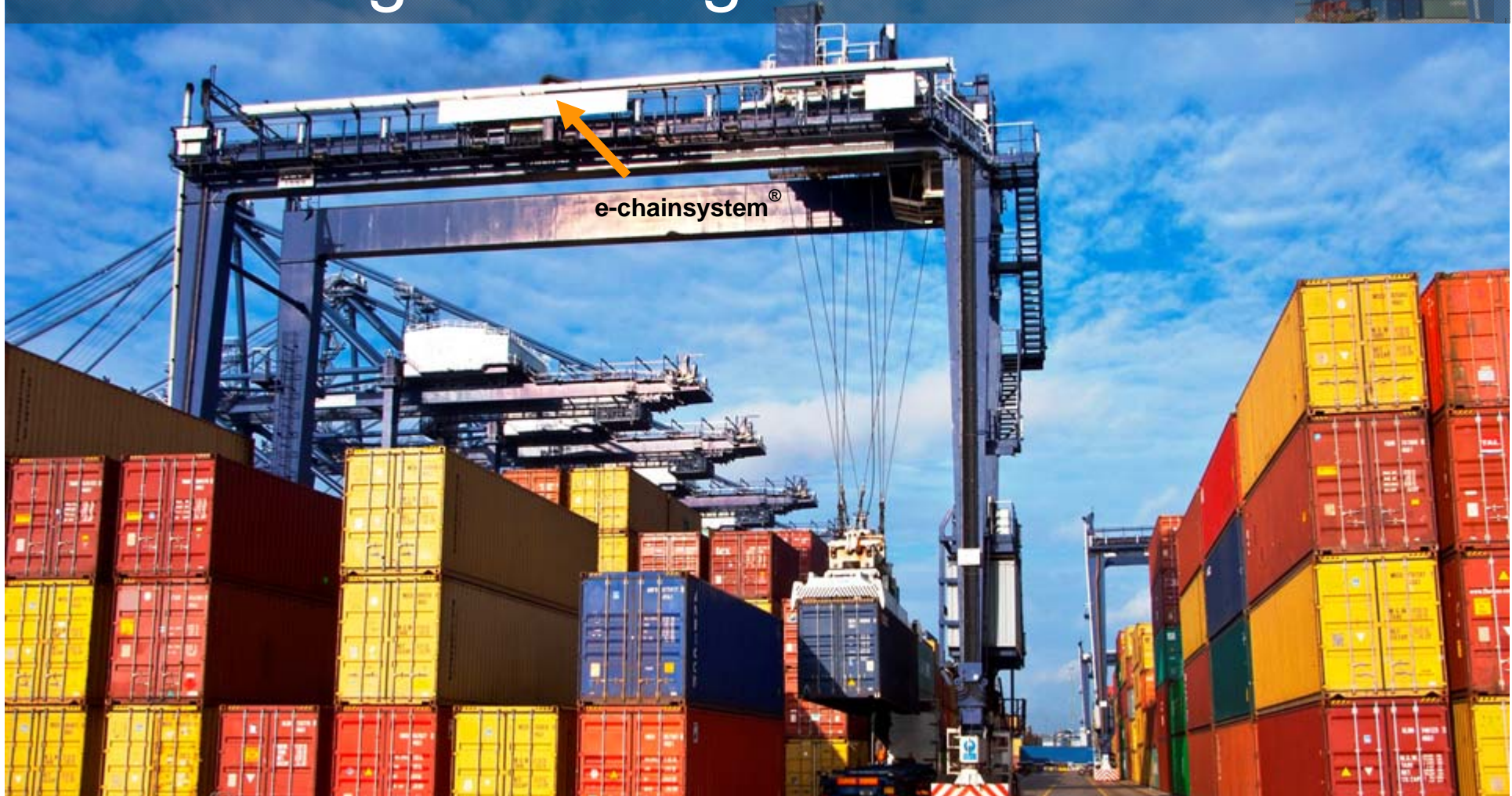
# ...RMG/ASC trolley travel with e-chain-system® & stainless steel guide trough ...



Travel length: 113 m  
Speed: 2,5 m/s  
Acceleration: 0,5 m/s<sup>2</sup>

e-chain®: P4.56R.20.300.S40.0.AG  
chainflex®: CF300, CF330, CF34, CF9, CFLG  
Guide trough: stainless steel HD trough

# ... RTG trolley travel with e-chainsystem® & aluminum guide trough ...



# ... Ship unloader crane & trolley travel with e-chainsystem® & stainless steel trough ...



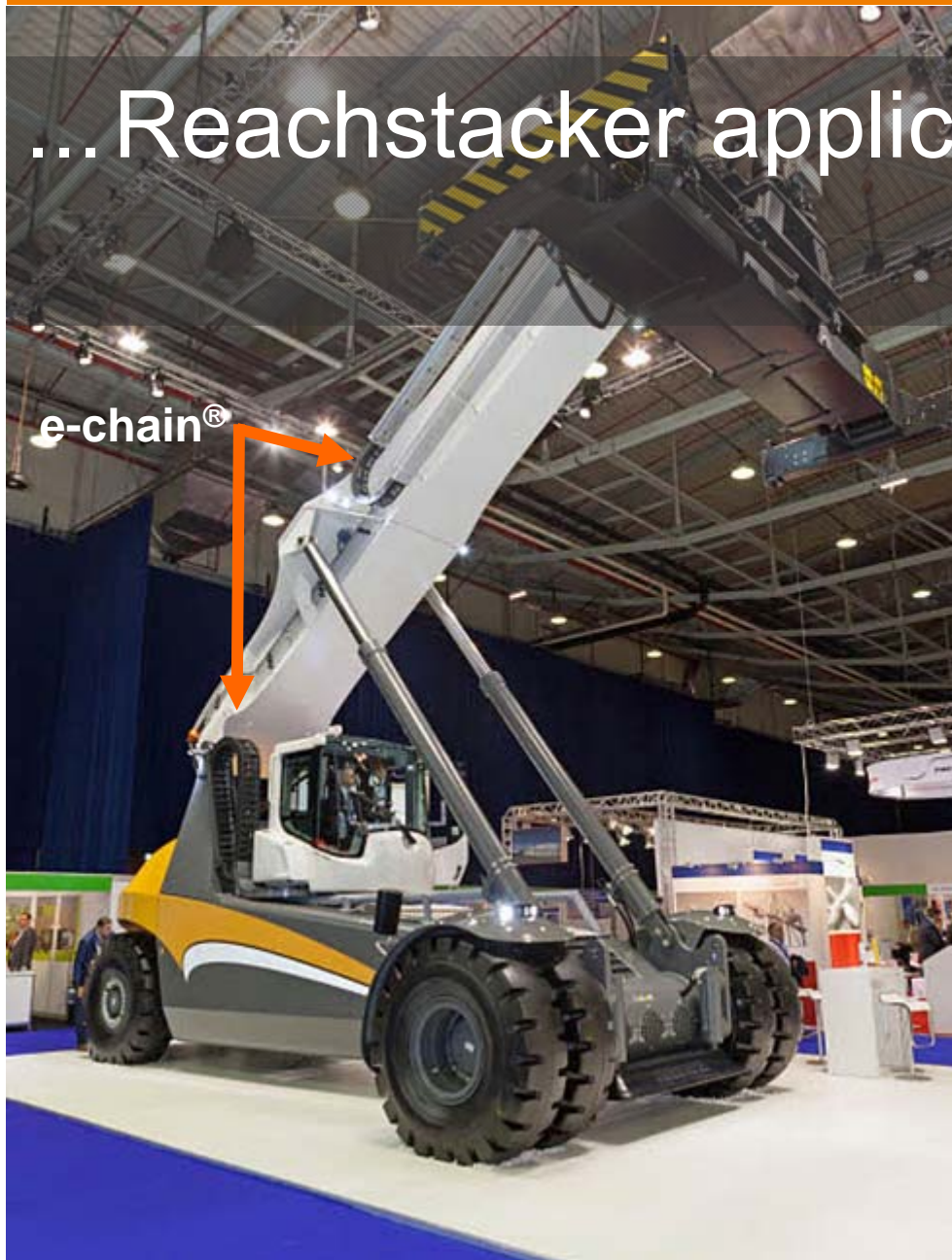
e-chainsystem®

e-chainnsystem®

Travel length, crane / trolley: 441 / 90 m  
Speed, crane / trolley: 0,5 / 3,2 m/s  
Acceleration, crane / trolley: 0,1 / 1,0 m/s<sup>2</sup>

e-chain® crane / trolley: 5050R rol-e-chain®  
chainflex®: CFCRANE, CF330, CF31, CF11, CFLG  
Guide trough: stainless steel HD

# ... Reachstacker applications ...



# ... Retrofit STS crane ...

Before: Festoon System



After: igus® e-chain®



# ... Retrofit RMG crane ...

Before: Festoon System

After: igus® e-chain®



# ... Retrofit RTG crane ...

Before: Cable Tender System

After: igus® e-chain®

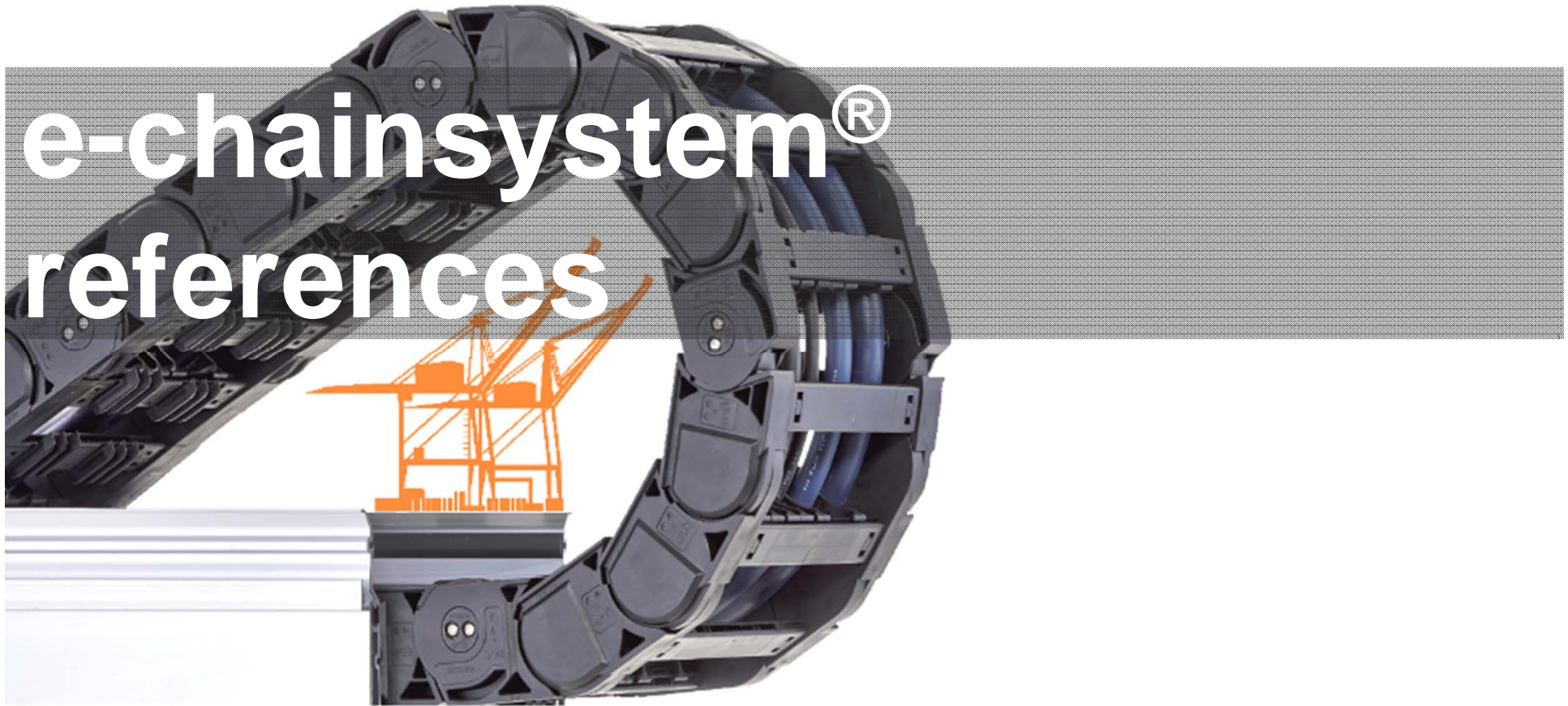




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# e-chainsystem® references





## Worldwide:

- ▶ More than 5.337\* RTG´s / RMG´s (172 with P4 e-chain®)
- ▶ More than 929\* STS (317 with P4 e-chain®)
- ▶ More than 15.500\* Spreader applications
- ▶ More than 30.000\* Indoor-, Gantry-, Bulkhandling-, Shipyard- and Special-cranes

\* November 2016



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igus® - Crane references



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