


Container terminal automation - The step by step approach


VAHLE System & Project Business | Xiaowei Jiang | Key Account Manager



2018
The world largest ferris wheel in Dubai (UAE) is electrified and automated by VAHLE




2015
The largest container port in the United Kingdom is electrified and automated by VAHLE



2012
One hundred year anniversary

2001
The Shanghai 'Transrapid', equipped with VAHLE conductors, starts its high-speed service



1966
VAHLE becomes Paul VAHLE GmbH & Co. KG


Josef Hötte joins VAHLE and will be a member of company management for almost 30 years

1956
Property is acquired at Westicker Strasse, Kamen


1932
Son Paul Werner Vahle takes over his father's business

1912
Paul Vahle applies the first copperhead for a patent

Foundation of the VAHLE OHG



2017
Opening of the headquarters of VAHLE Automation GmbH in Schwoich, Austria

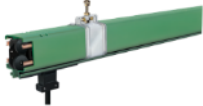


2013
Foundation of the VAHLE DETO GmbH and expansion of the product portfolio by mobile controllers


2007
FABA product line conductor systems acquired

1998
Contactless Power Supply (CPS®) is developed

1962
Production start of KSL, enclosed conductor system



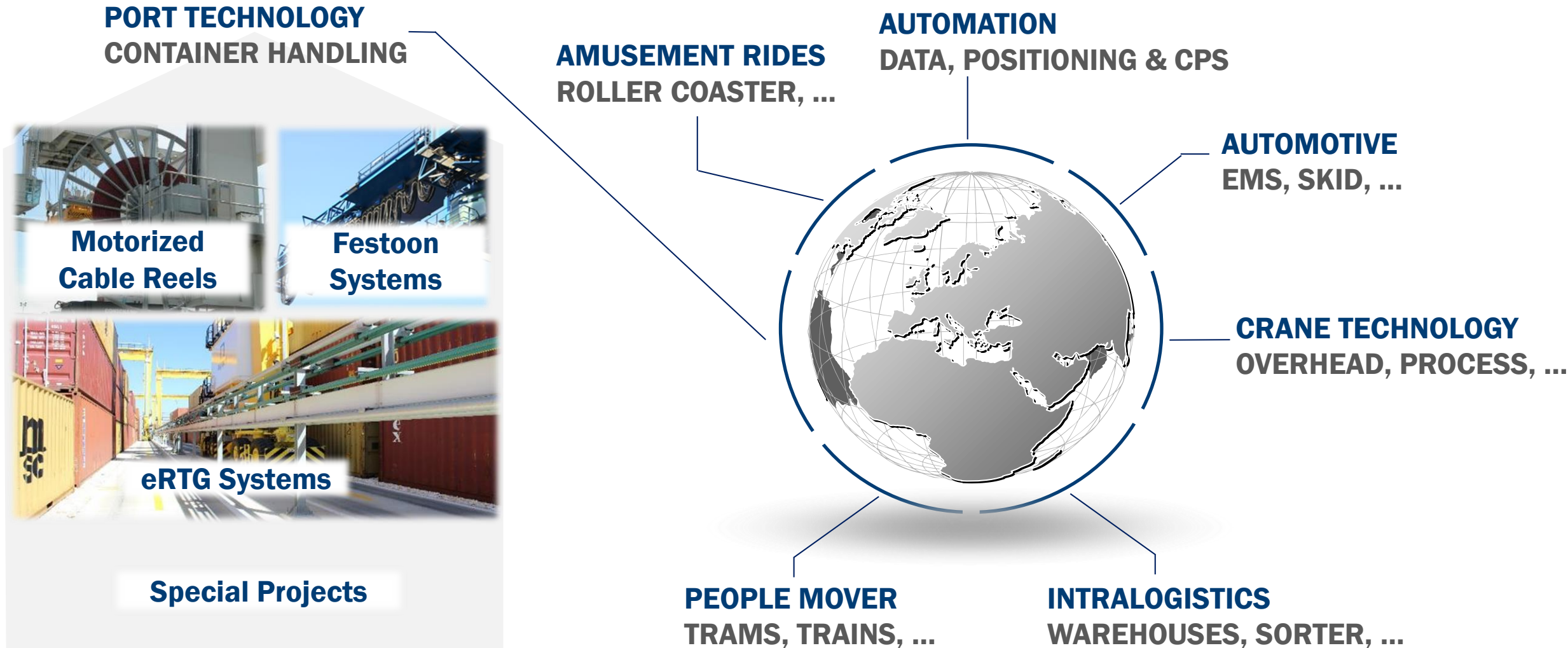
1936
VAHLE has 30 employees



1926
Paul Vahle dies and his wife Helene manages the company

WHAT VAHLE DOES | VAHLE SYSTEMS

OVERVIEW MARKET SEGMENTS



STEPS TO AUTOMATION

1.0 Electrification

Insulated conductor rails 1000 V, 1000 A with aluminum/stainless steel

2.0 Positioning

precise position feedback with a contactless reading head

3.0 Data Communication

interference-free and safe for data & video up to 350 Mbit/s

4.0 - Automation

Combination of electrification, positioning and data



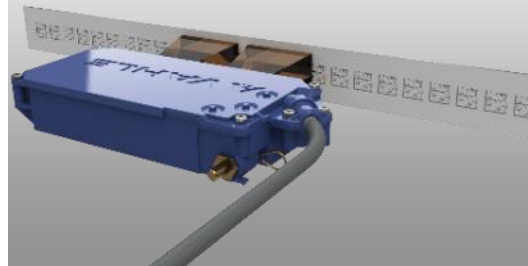
Electrification: flexible

- Electrification by Conductor Rails
- Automated Power Connection for block changes
- Automated seamless switching



Positioning: accurate

- Absolute Positioning System independent from external influences
- Position accuracy up to ± 1 mm
- PN / PB / Ethernet Interfaces for Plug and Play Integration



Data Communication: safe

- Highly shielded data communication
- Up to **350 Mbit/s** gross rate
- Low latency times
- Interfaces Ready for Automation - Ethernet, Profinet & Profinet Safe



Control systems: smart

- Autosteering
- Power measurement
- Remote Maintenance
- Energy optimization



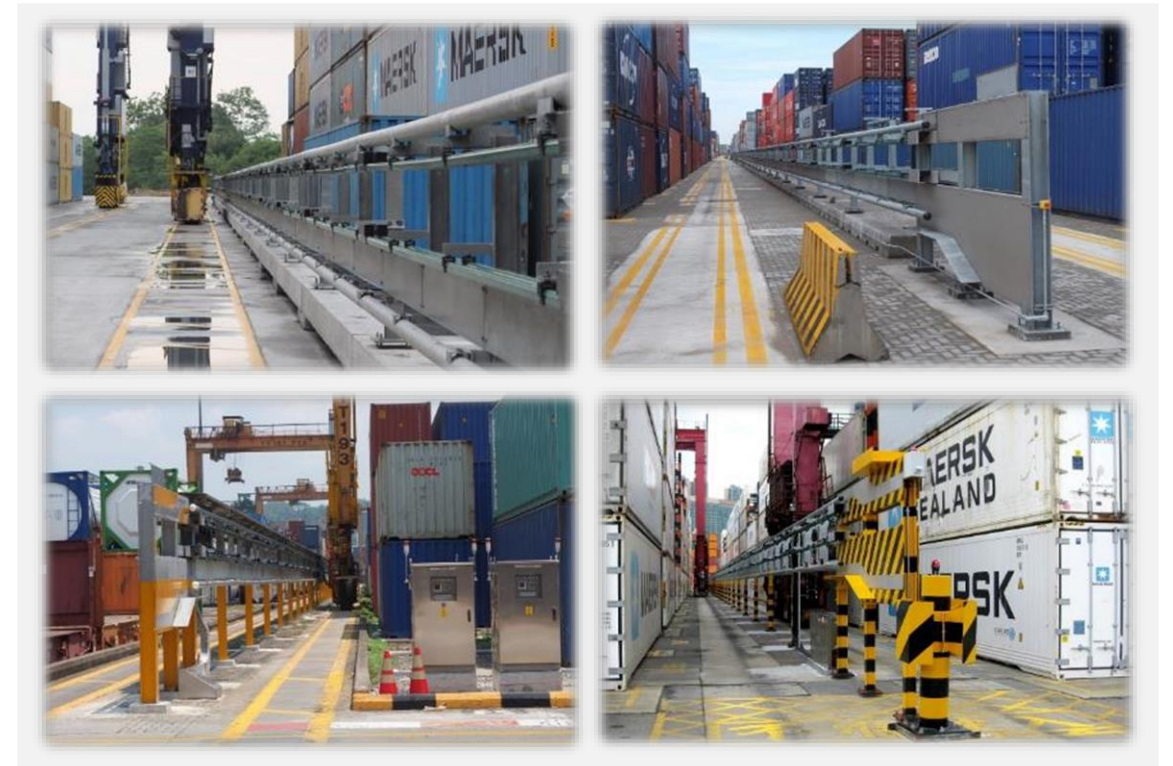
ARTG Solution– Electrification & Automation

Overview Subsections



MOBILE PARTS

Existing or new RTG crane

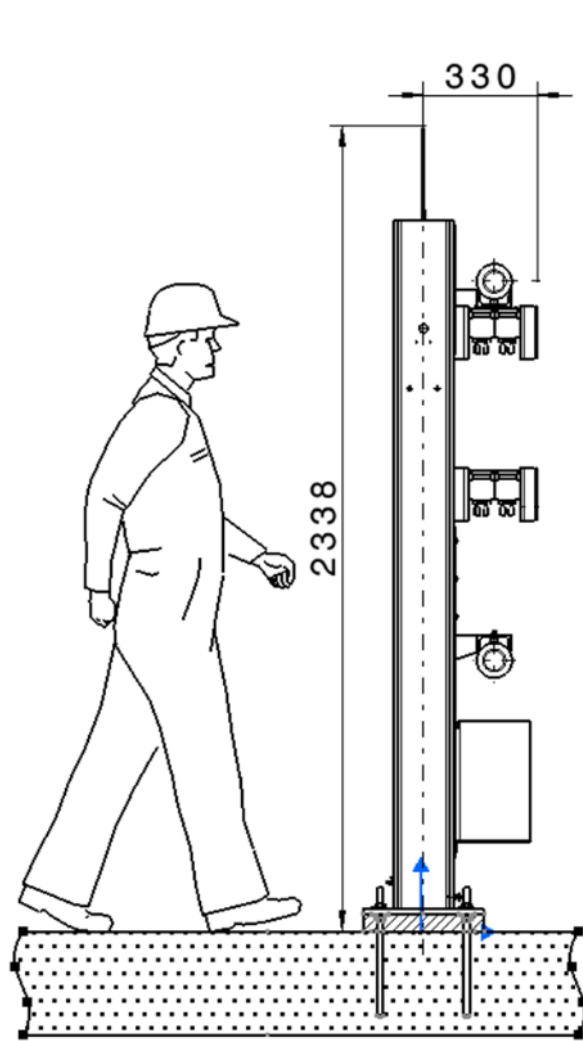


STATIONARY PARTS

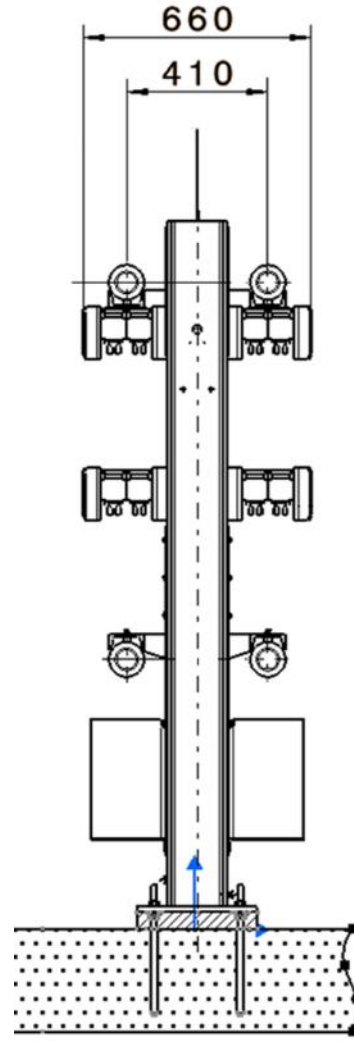
Container Yard

ARTG Solution– Electrification & Automation

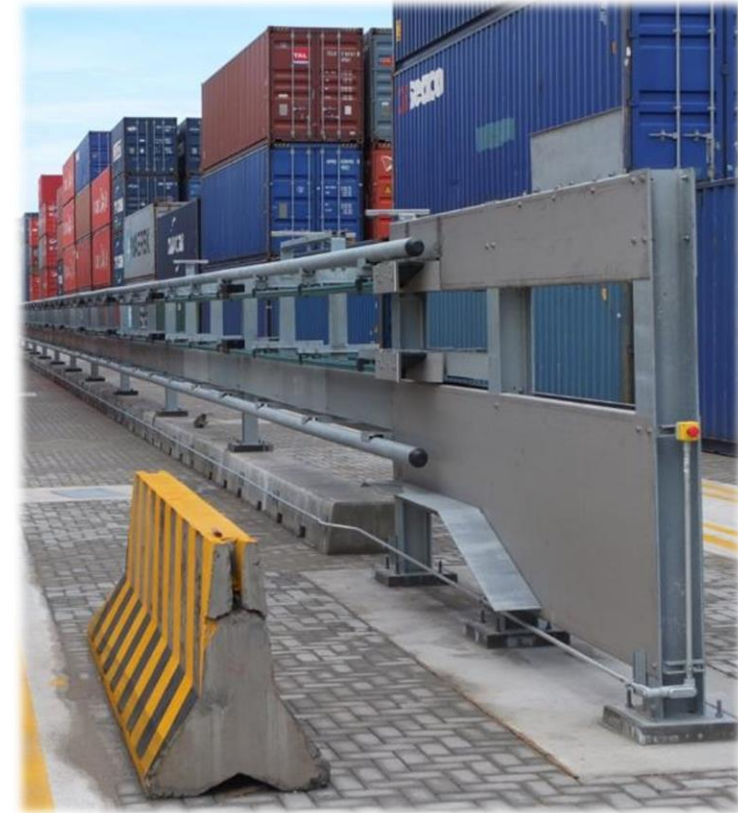
ARTG Solution– stationary side – steel support structure 2+2-System



LSS1250 Single



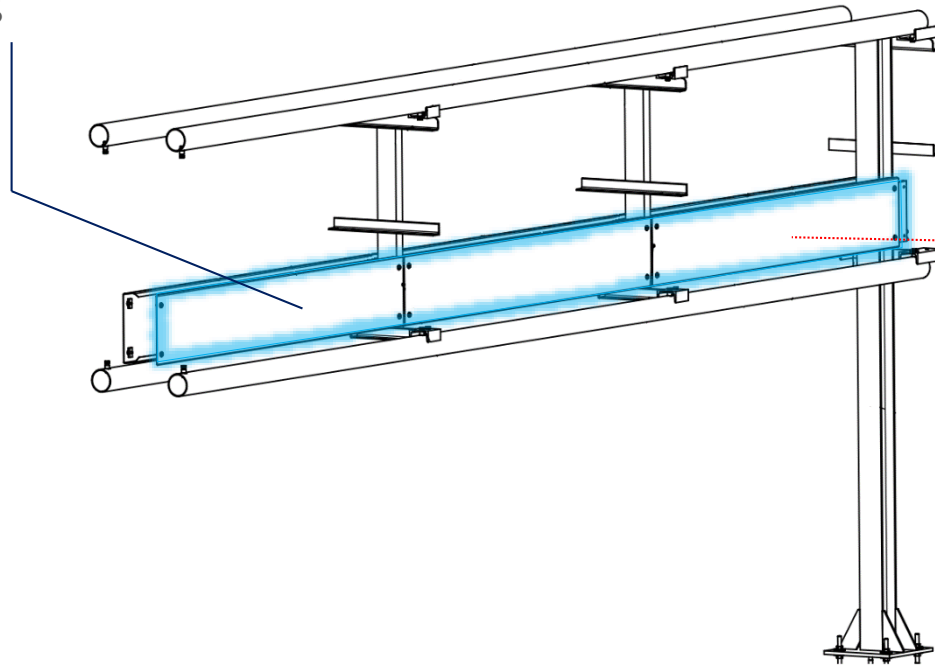
LSS1250 Double



**LSS1250 Back to Back Installation
@ HPH Lazaro Cardenas, Mexico**

REFLECTION PLATE

Reference for steering



1D LASERSCANNER

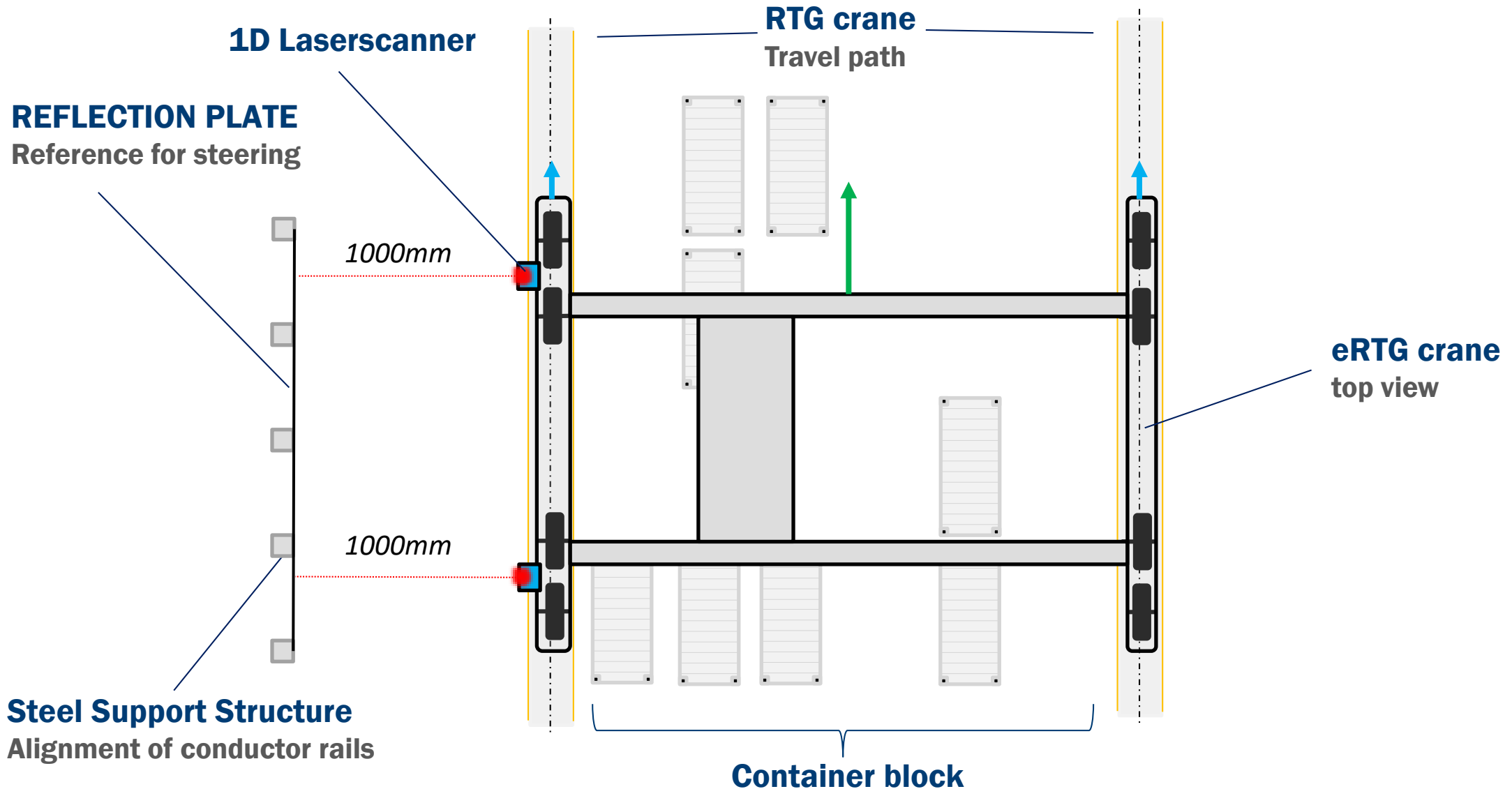
Installed at the RTG crane



Measurement Value: 839 mm

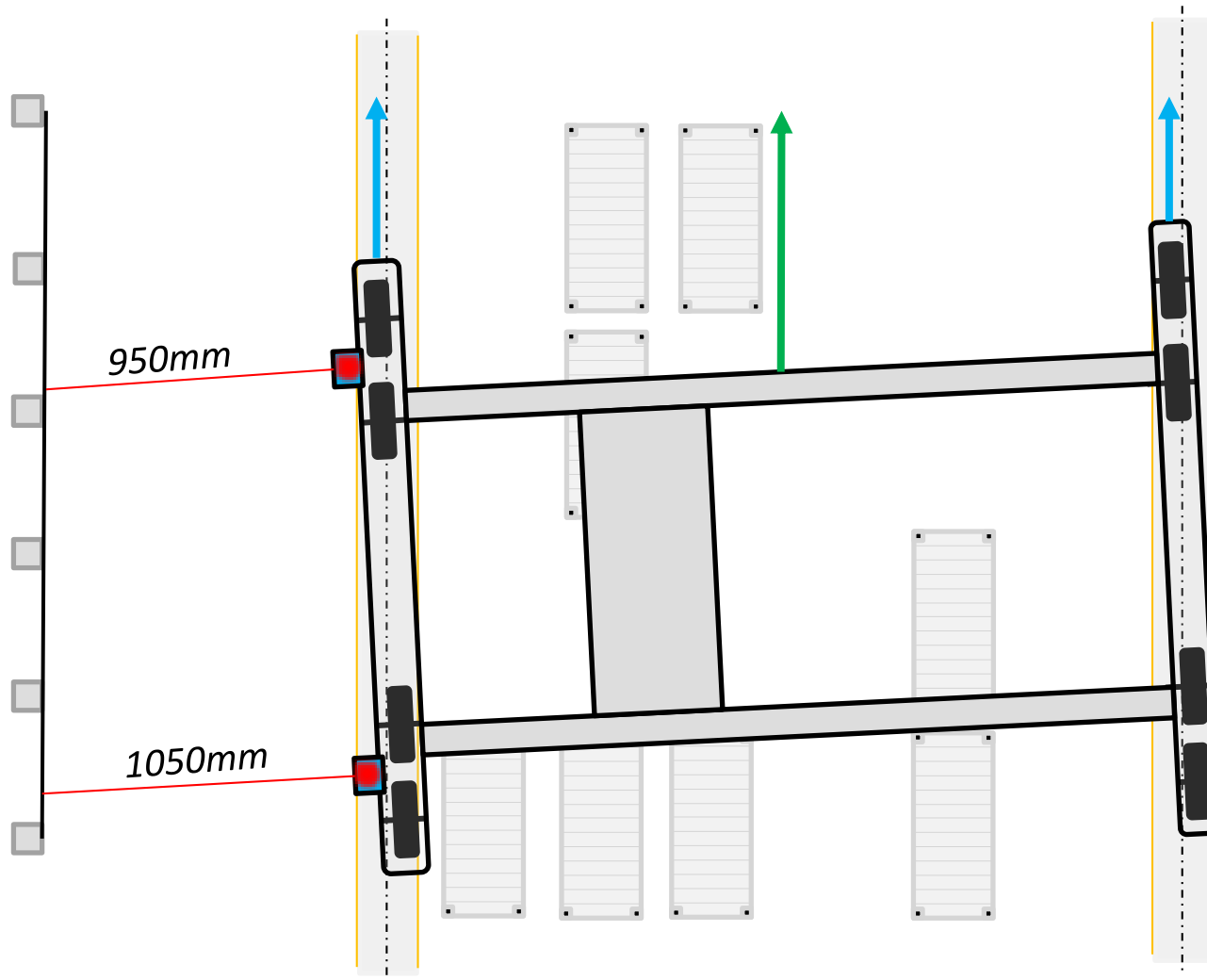
ARTG Solution– Electrification & Automation

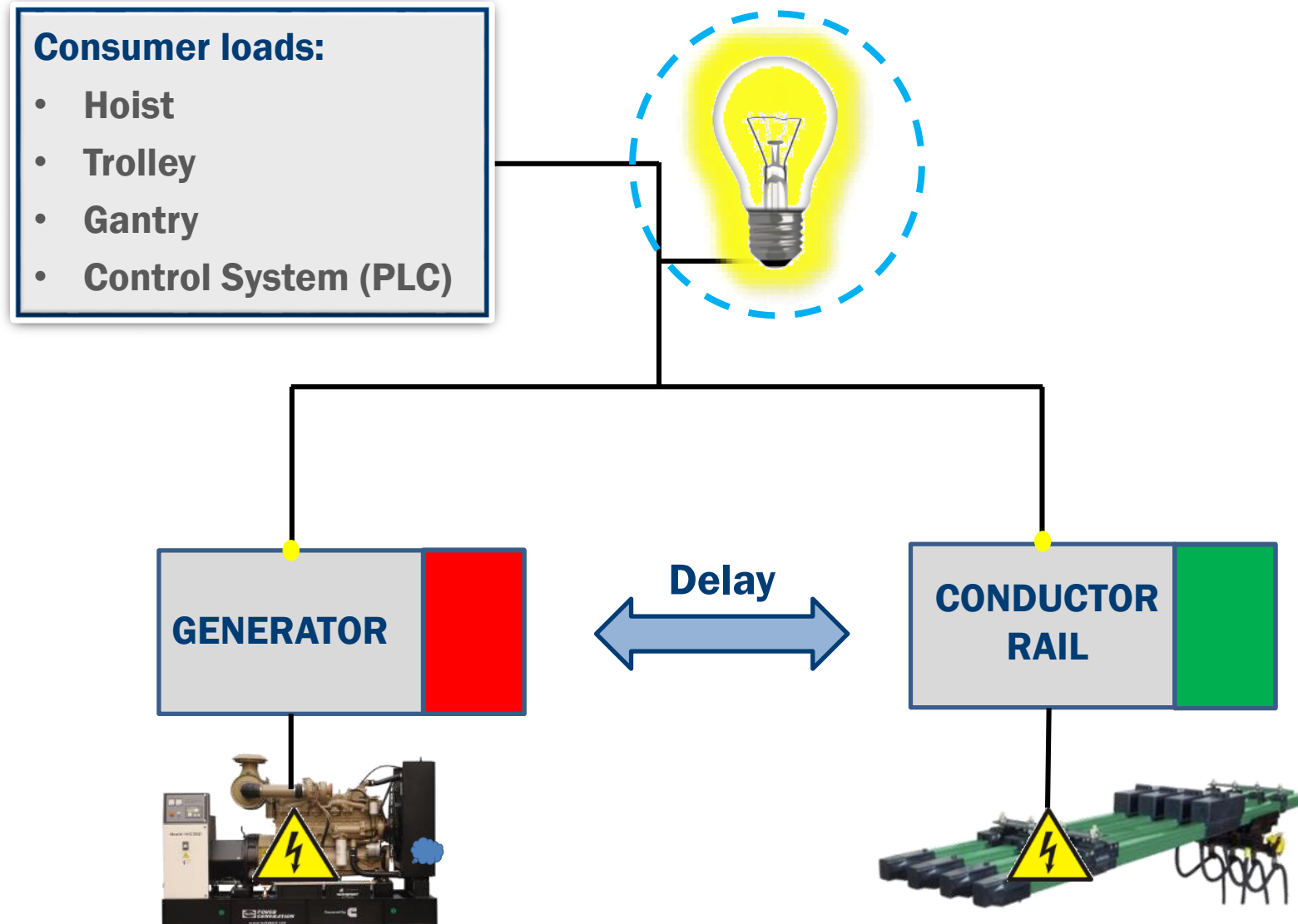
eRTG Crane – Autosteering

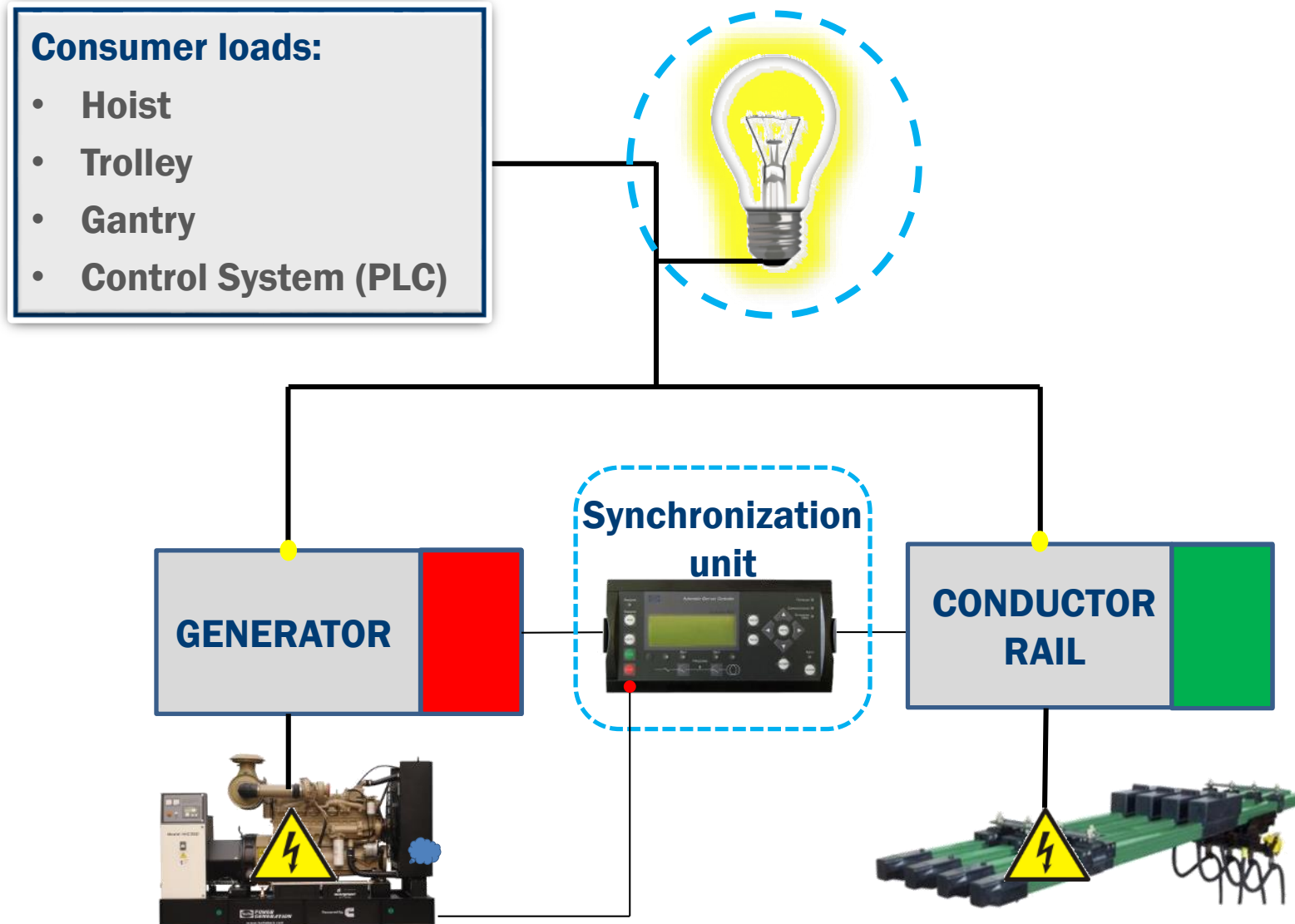


ARTG Solution– Electrification & Automation

eRTG Crane – Autosteering





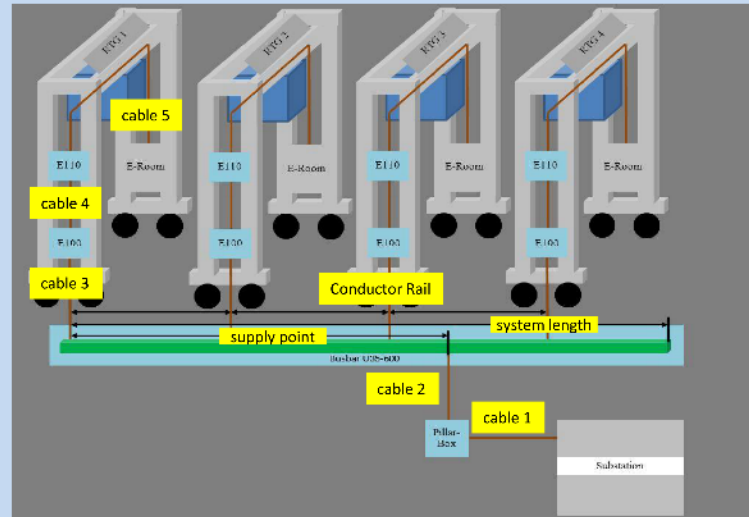


ARTG Solution– Electrification & Automation

eRTG Crane – System Voltage Drop Calculation



**3 RTG cranes are hoisting
1 RTG crane drives gantry**



ProjectNo	-	Date	14.01.2016
Customer	MSC Valencia		
Port	MSC Valencia		
Country	Spain		
voltage sub.	24 kV	Frequency	50 Hz
system voltage	500 V		
system length	325 m		
supply point	163 m		
cosφ	0,95		

adjusted circuit breaker:	System fuse	1000 A	crane fuse (NH)	500 A
---------------------------	-------------	--------	-----------------	-------

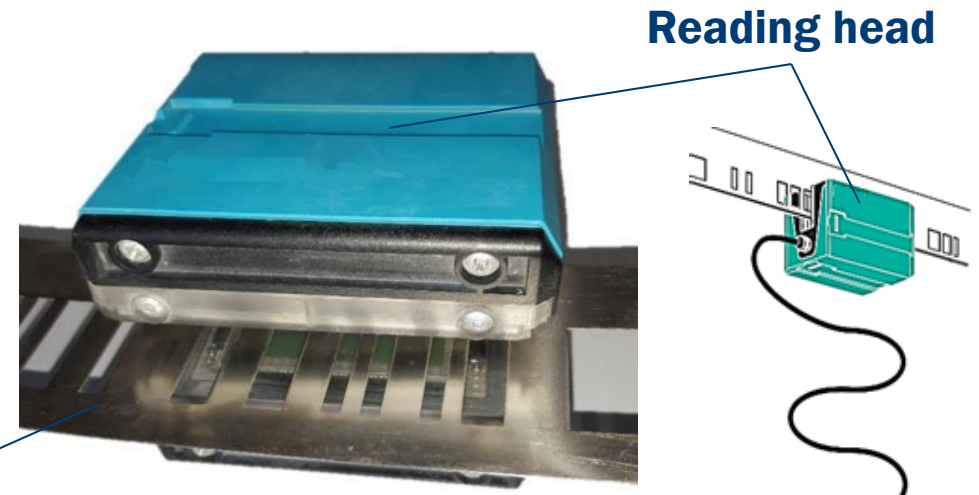
	Hoist	Trolley	Gantry	base load	RTG	Total current
RTG 1	236,22 A	17,53 A		40,41 A	294,17 A	996,57 A
RTG 2	236,22 A			40,41 A	276,64 A	
RTG 3	236,22 A			40,41 A	276,64 A	
RTG 4		17,53 A	91,18 A	40,41 A	149,13 A	

	cable 1	cable 2	cable 3 arm	cable 4	cable 5	Conductor Rail
Cores per Phase	4 x 240 mm ² per Phase	4 x 150 mm ² per Phase	4 x 50 mm ² per Phase	1 x 185 mm ² per Phase	2 x 150 mm ² per Phase	600 mm ²
cabletype	4 x 240 mm ² NYY 0,6/1kV	1 x 150 mm ² H07RN-F 400/750V	2 x 50 mm ² Druseidt 1,8/3kV	1 x 185 mm ² NSGAFÖU 1,8/3kV	1 x 150 mm ² NSGAFÖU 1,8/3kV	600 mm ² Busbar U35-600AE
cable is fused with	1000,00 A	1000,00 A	500,00 A	500,00 A	500,00 A	1000,00 A
material of the wire	copper	copper	copper	copper	copper	Aluminium/Stainless-Steel
cable length	65,00 m	10,00 m	11,00 m	15,00 m	20,00 m	163,00 m
laying procedure	in earth	side by side in pierced cable tray	side by side in cable ladder	with distance in pierced cable tray	side by side in pierced cable tray	with distance
temperature	25 °C	35 °C	35 °C	35 °C	35 °C	35 °C
Max current-carrying capacity	1073,57 A	1124,36 A	1064,00 A	550,62 A	851,72 A	1000,00 A
current-carrying capacity is	tight limited	ok	ok	tight limited	ok	tight limited
short-circuit current	27600,00 A	17250,00 A	5750,00 A	21275,00 A	17250,00 A	-
Max Temp. isolator	70 °C	60 °C	80 °C	80 °C	80 °C	-
line voltage drop in V	3,49 V	0,80 V	0,72 V	1,18 V	0,94 V	35,20 V
line voltage drop in %	0,70 %	0,16 %	0,14 %	0,24 %	0,19 %	7,04 %

42,33 V	total voltage drop	8,47 %
----------------	---------------------------	---------------

ARTG Solution– Electrification & Automation

eRTG Crane – Absolute Positioning

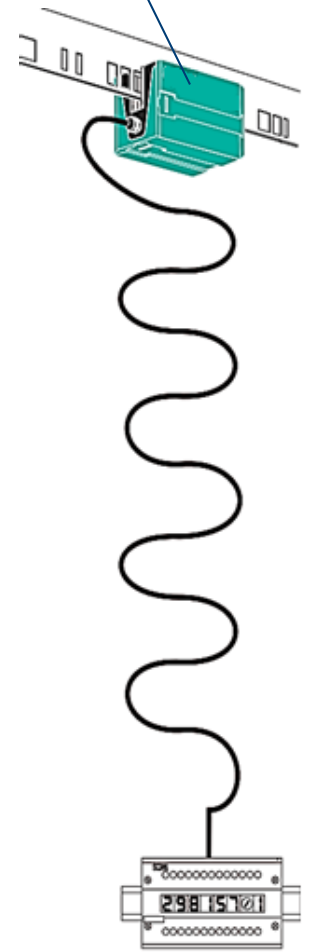


Reading head

Stainless steel code rail

Vahle WCS Positioning System

- Positioning System inside each block
- Stainless steel code rail not glued
- RTG Crane absolute position $\pm 0,8\text{mm}$ w/o use of GPS
- Interface to TOS system / Crane PLC with Profibus/Profinet
- Unsusceptible to external interference (GPS jamming)
- Reading head mounted on Current Collector Trolley
- Port application proven technology (e.g. Port of Oslo – Semi-Automation, Felixstowe, ...)



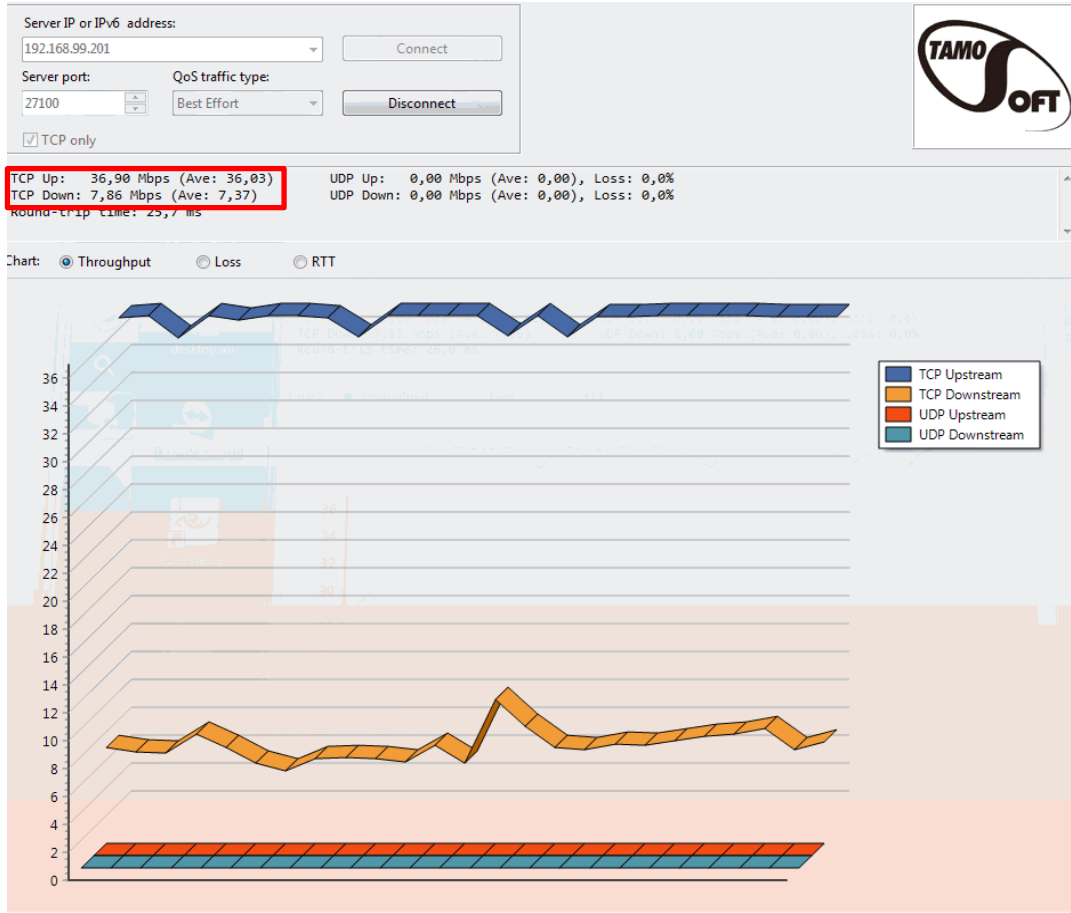
ARTG Solution- Electrification & Automation

eRTG Crane – SMGX Data Communication - Test setup @ PFL



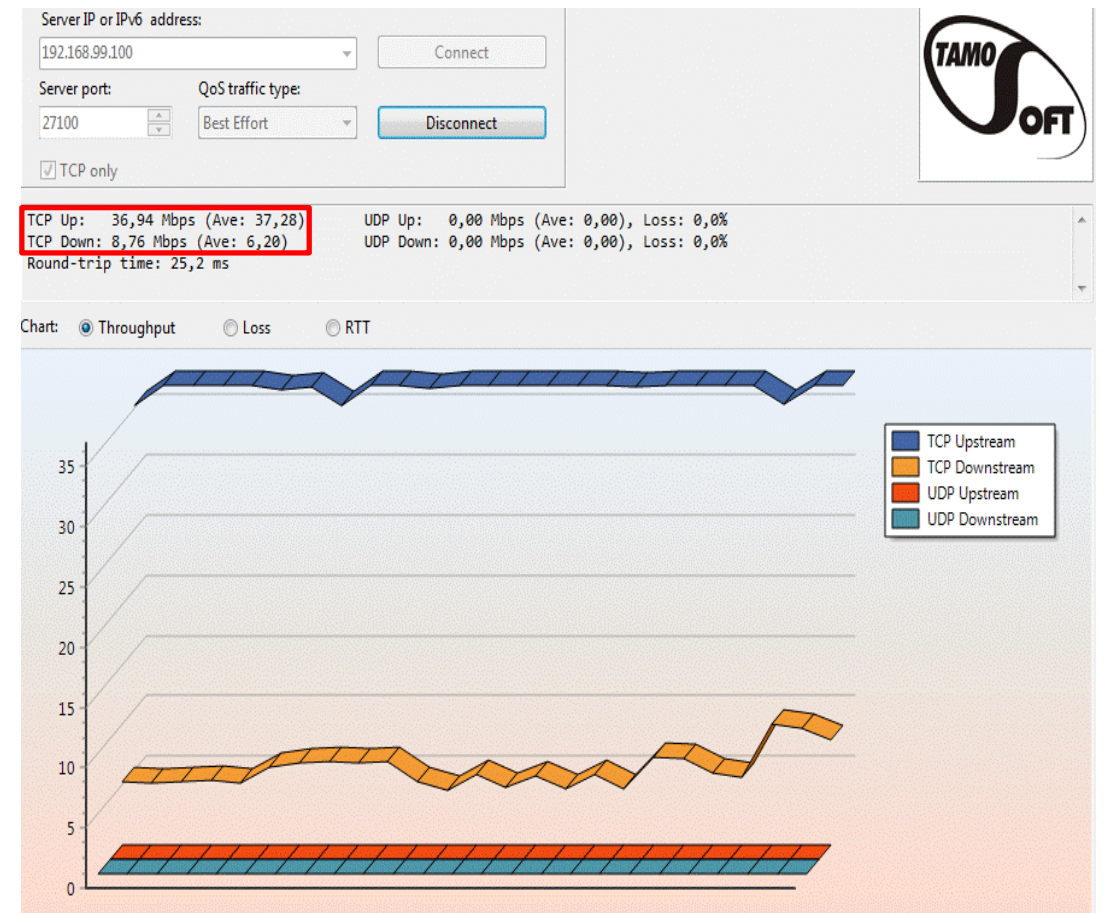
ARTG Solution– Electrification & Automation

eRTG Crane – SMGX Data Communication - Bandwidth tests



Client #1

Average upstream: 36 Mbps
Average downstream: 7 Mbps

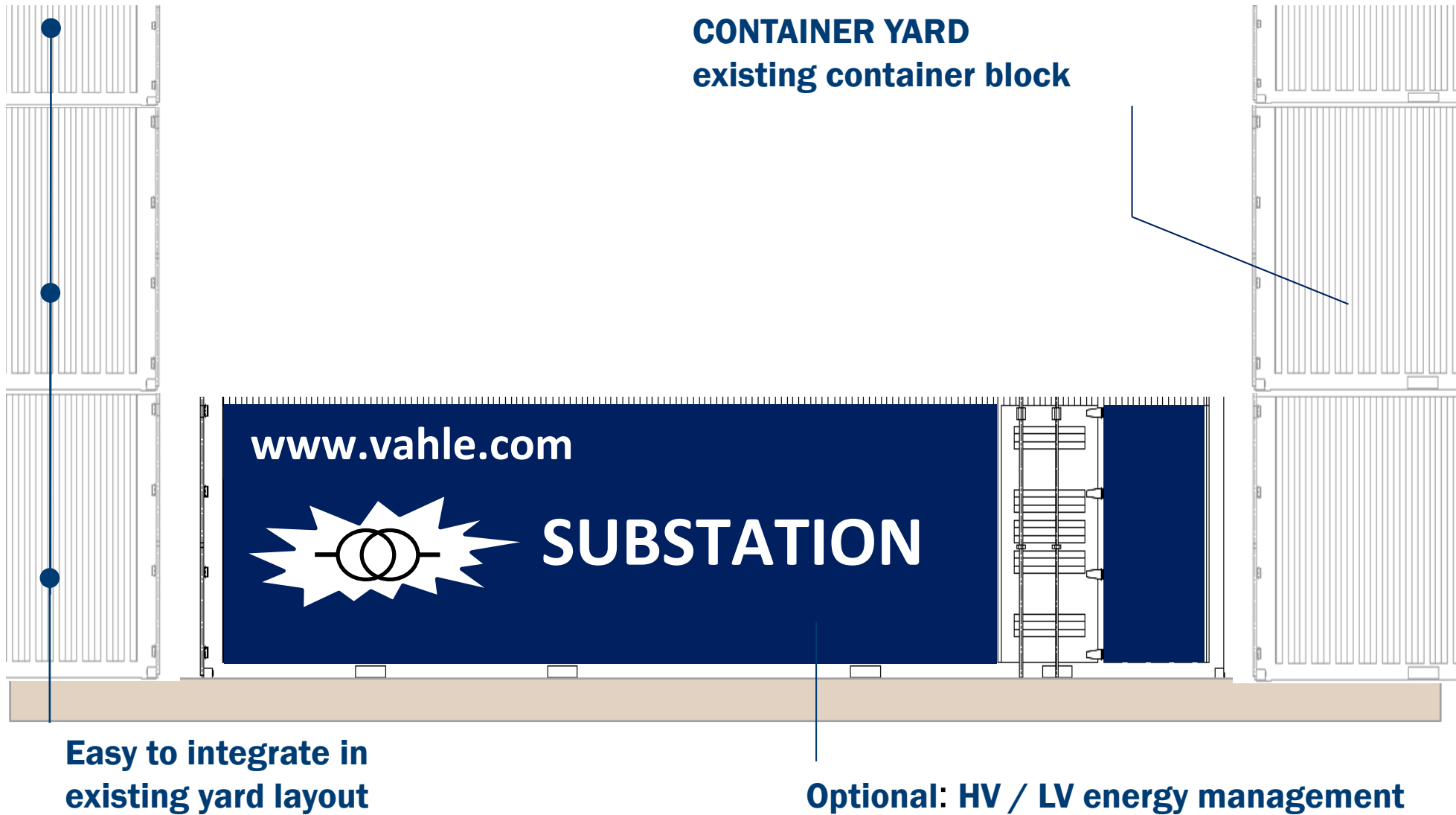


Client #2

Average upstream: 37 Mbps
Average downstream: 6 Mbps

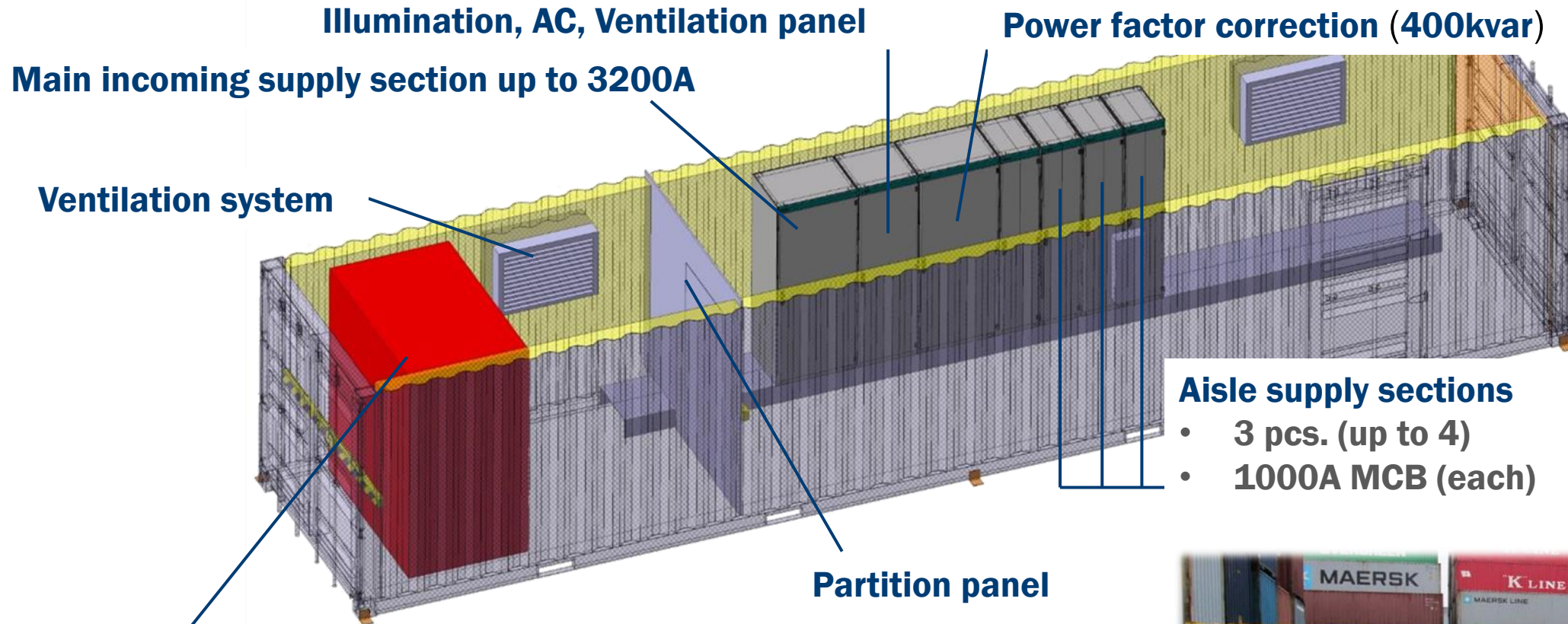
ARTG Solution– Electrification & Automation

eRTG Crane – Substations



ARTG Solution- Electrification & Automation

eRTG Crane - Substations - Detail



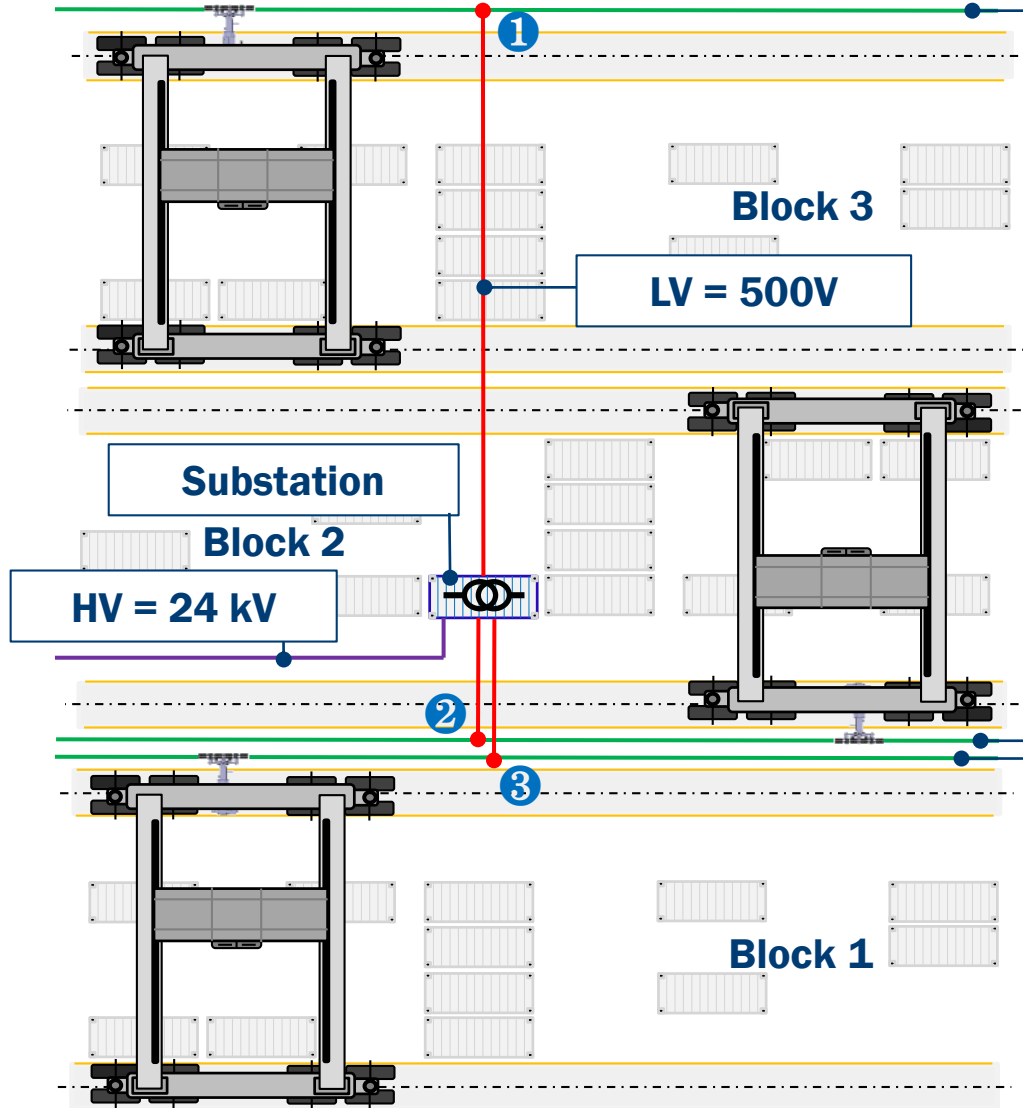
Resin transformer
24kV / 500V
Bi-directional - Eco Design

Complying with standards:
IEC/EN/VDE..100 ; DIN EN 50274
IEC 61641 ; IEC 61439 ; EN 45014



ARTG Solution– Electrification & Automation

eRTG Crane – Substation – LV & HV power link



Conductor rails

Example:

- Center feeding of conductor rails
- Substation position optimized
 - Containerized Substation
 - Input Voltage: 24.000V AC 3phases
 - Short cable routes
 - 1000A MCB inside the substation per block
 - Low voltage release of MCB possible
 - Maximal 4 times 500V block feeding outputs
 - ✓ Used: 3 of 4
- Junction box next to conductor rails installed
- Each block independently disconnectable

Energy Storage Technology (LiFeP04)

- **LiFeP04-batteries are ecological and most parts are recyclable**
- **Every single battery cell is monitored to ensure maximum availability and optimize the charging cycle**
- **Interface for online monitoring via internet**
- **Installation of the energy storage components in container or building**
- **1 MW is equivalent to 40' ISO-Container**



Hong Kong, Modern Terminals Limited

- **Electrification of 15.000 m & 104 RTGs**
- **Realization in 2011-2012**
- **ARTG in 2018**



GB – HPH UK – Port of Felixstowe

- **Stationary: 49 Blocks**
- **Mobile: 48 RTGs**
- **Duration: 2015 - 2018**



Norway – Port of Oslo

- **Electrification of 4 Blocks & 2 RTGs in 2015**
- **Additional new test track (60m) with latest components of data transmission installed**



Thailand – HPH HLTL – Port of Laem Chabang

- **Stationary: 20 Blocks incl. Data transmission system**
- **Mobile: 20 RTGs**
- **Duration: 2017 - ongoing**
- **First Remote controlled RTGs for HPH Group**

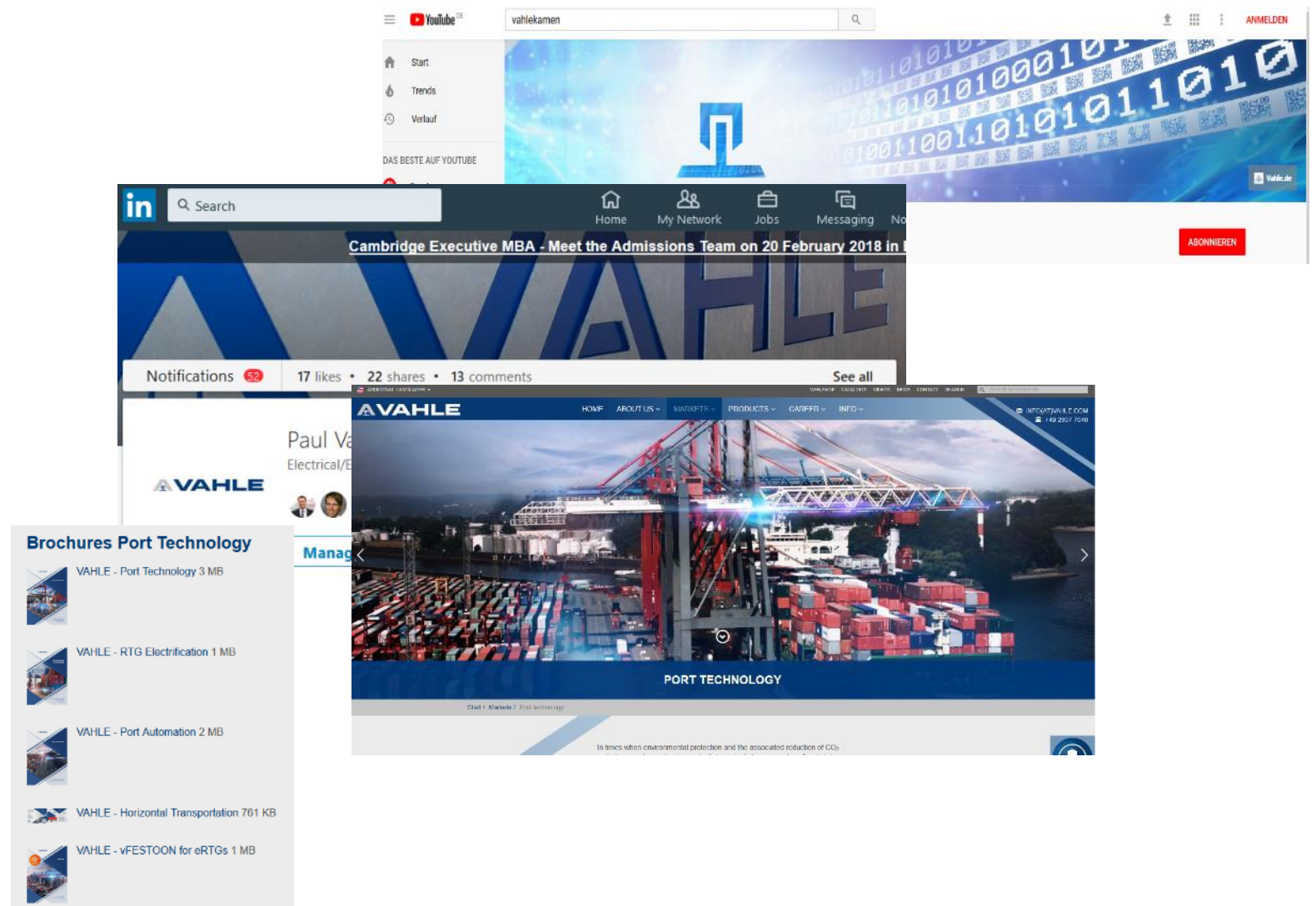


Please follow on

- Youtube
- LinkedIn
- HomeSlide
- Brochures

Please contact us:

Jiang.xiaowei@vahle.com





**THANK YOU FOR
YOUR ATTENTION**