BROSA

Force Measurement & Systems

Know your Loads, Weights and Forces for a Safe and Secure Operation

Facts & Figures

About BROSA

Headquarters

BROSA GmbH, Tettnang, Germany
- Production and R&D Sensors

Subsidiaries

BROSAtronic AG, Switzerland
- Production and R&D Electronics, SW

BROSA B.V., Oss, Netherlands
- Sales Office

BROSA Pte Ltd,Singapore
- Sales Office

BROSA (Nanjing) Co., Ltd., China
- Sales Office

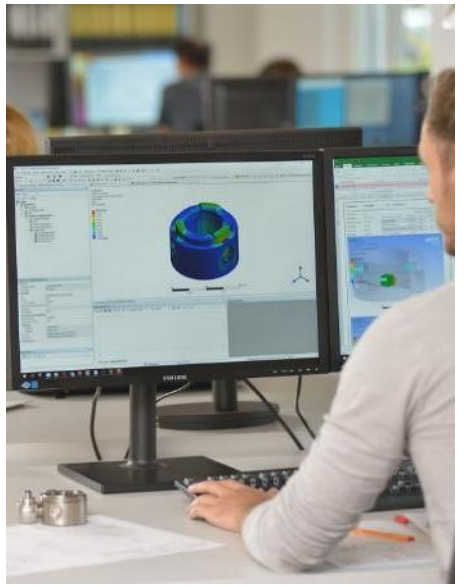
Key Figures

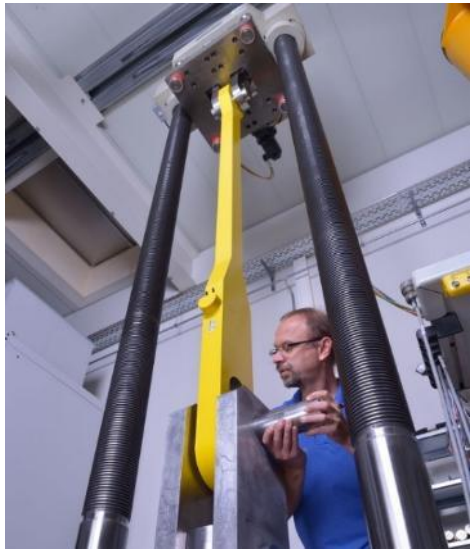
- Founded in 1935
- ISO 9001 and ISO 14001 certified

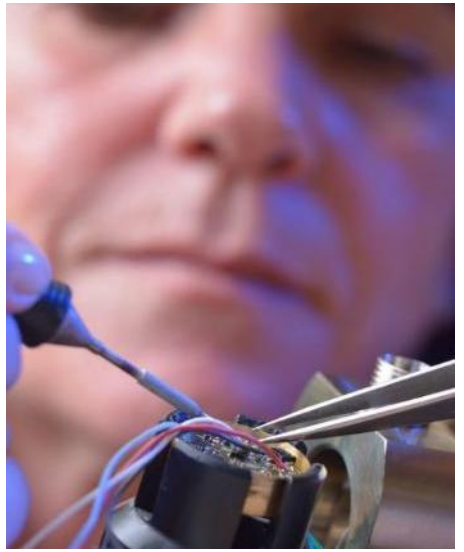
Facts & Figures

About BROSA

- Products are developed in close collaboration with our customers
- Understanding the Trends & Industries
- Compliance with worldwide safety standards
- “Made in Germany”
- More than 90% in house manufacturing
- Full scope of product engineering and manufacturing
  - Specification
  - Technical proposals
  - Production: mechanical, electrical, assembly
  - Calibration
  - Certification, Type Approvals,
  - Customer Acceptance Tests







Product

Portfolio

						
Force measuring pin	Tension load cell	Force sensor washer	Tubular load cell	Compression load cell	Shear force sensor	Rod end load cell
						
Measuring block	Support jack load cell	Bearing force sensor	Angle sensor MEMS	Pressure transducer	BROSA Electronic	Sensor for Ex area

Safety Sensor Concept

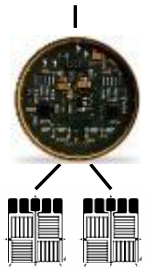
Single output

PL c / SIL 1

1 measuring system
1 amplifier
1 output

4-20 mA
CANopen
PROFINET

PL d / SIL 2

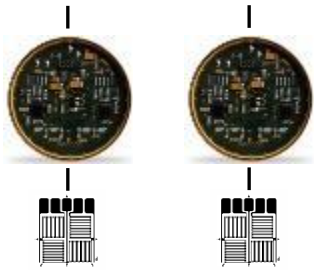


2 measuring systems
1 amplifier
1 output

4-20 mA
CANopen
CANopen safety
PROFINET
PROFINET PROFIsafe

Redundant (double output)

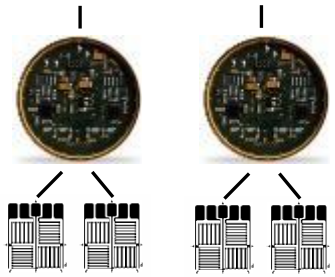
2x PL c / SIL 1 *



2 measuring systems
2 amplifiers
2 outputs

4-20 mA
CANopen
PROFINET

2x PL d / SIL 2 *

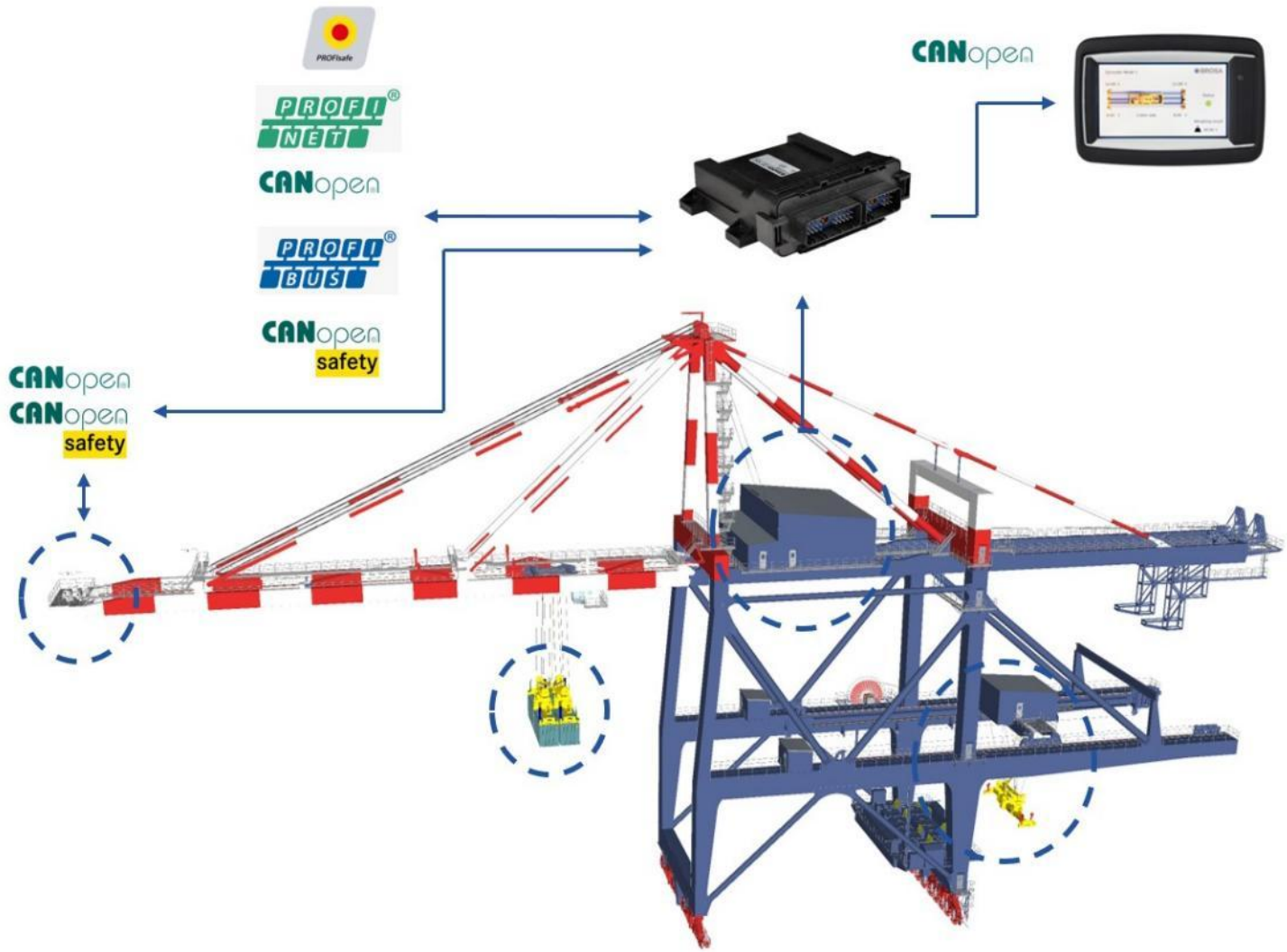


4 measuring systems
2 amplifier
2 output

4-20 mA
CANopen
CANopen safety
PROFINET
PROFINET PROFIsafe

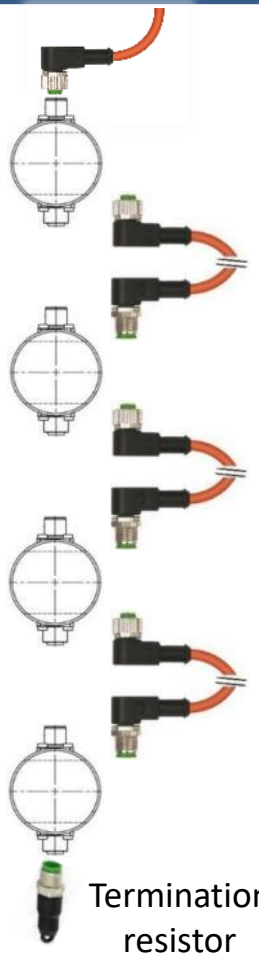
* PL e / SIL 3 is possible if used in parent systems DIN EN ISO 13849-1

Safety System Concept



Safety System Concept

Load sensors with CAN in / CAN out



Connection cables 5 pin male / female connectors

Termination resistor

Electronic System 0656
with connectors and accessories

Profinet

RS232, Profibus

Operator's Display

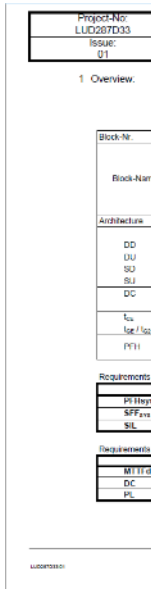
Crane PLC

Certificates

Weighing & Safety, FMEA, OIML Certificate

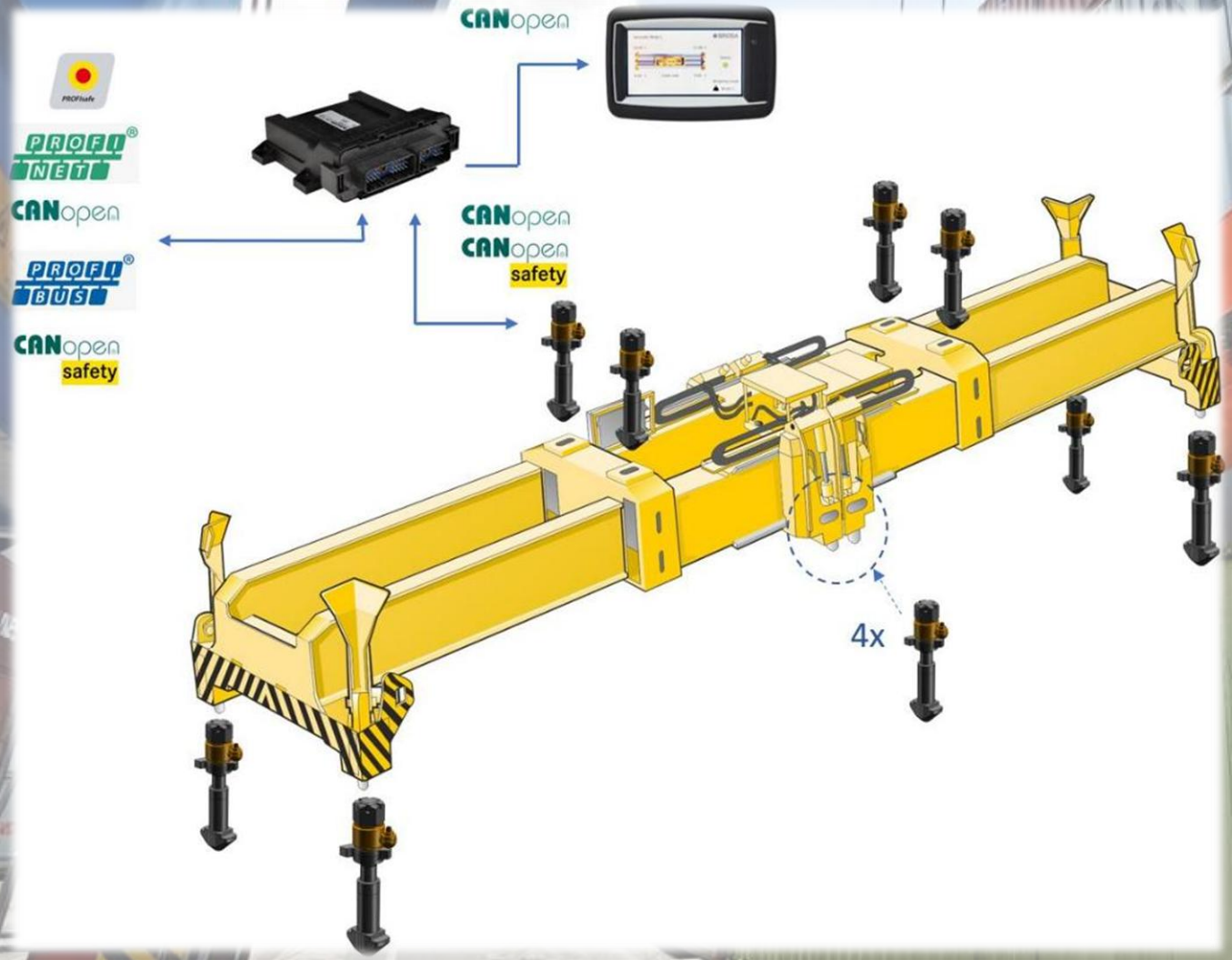
Key Data from RP & FMEA

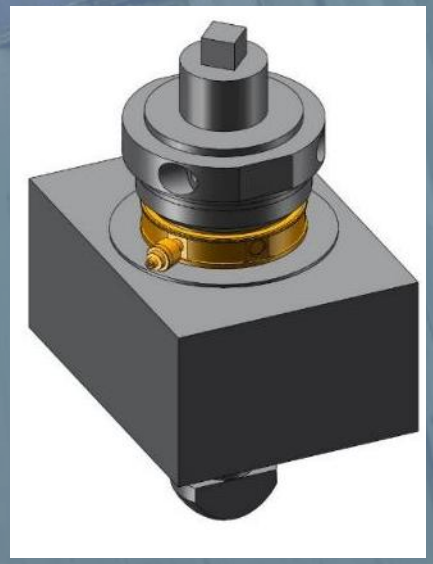
- Standard: IEC 61508 / EN 13849
- Architecture-Category
- Probability of a dangerous failure (PFH)
- Mean Time to a dangerous Failure (MTTFd)
- Diagnostic Coverage of dangerous failures (DC)
- Mission time
- Resulting in Safety Integrity Level
  - SIL2 = PLd



BROSA 3P Sensor Washer

Integration of the Sensor in a Twistlock

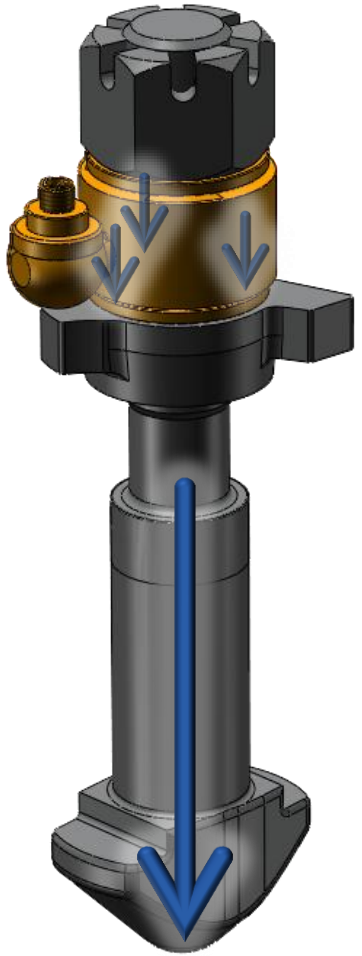




BROSA 3P Sensor Washer

Integration of the Sensor in a Twistlock

- No effect on twistlock cross-section
- Direct force measurement by integrating the sensor into the twistlock assembly
- Tension of the twistlock is transformed into a compression force
- Detachable mechanical assembly
- Can be re-used during twistlock inspection
- Can be re-used after twistlock exchange
- Designed and tested for > 2 Mio. load cycles



Safe Lifting of Loads

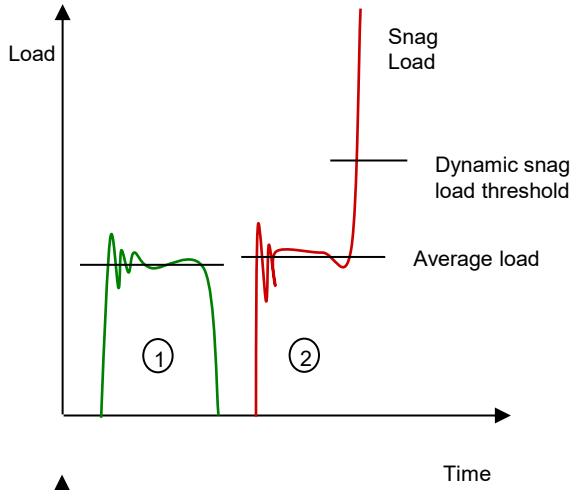
Why Safety Systems

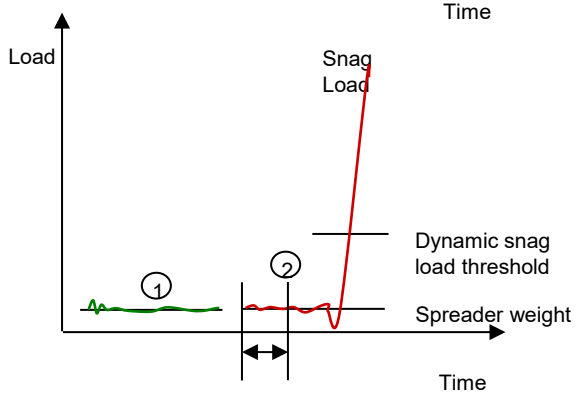
- Nearly 25% of accidents in container ports are load dependant. But not in all cases containers are overloaded.
- Safety systems on lifting equipment are a mandatory requirement when loads are lifted
- Monitoring of Safe Working Limits and Operational Limits at all times
- Safety Systems must comply with Safety Standards
- European and International Safety Standards
- Performance Level d (DIN 13849)
- Safety Integrity Level 2, SIL2 (IEC 61508)

Additional & Special Functions

Snag Load Detection

- Dangerous situations occurs when
- A container gets stuck in the railings of a vessel during the lift
- Parts of the spreader block the lift
- When the head covers are not completely removed and obstruct the lifting area
- ….
- The load sensors are immediately registering a second increase of the load signal
- Once a second increase is detected on any of the load sensors the snag warning can be triggered
- The threshold for the detection is dynamic, dependant on the weight of the container being lifted.





Additional & Special Functions

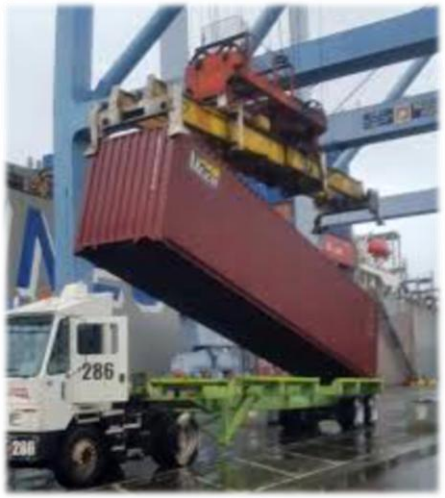
Lock detection for twistlocks

Dangerous situations occurs when

- One of the twistlocks is not correctly locked in corner
- For Twin-Spreaders: the twin detection system does not detect 2 containers, so that inner twistlocks will not lock

Enhancement for better detection and much more safe lifts

- Installation of force sensor washer on each twistlock
- Load measurement and plausible load checks by start lifting



Mobile Port Equipment

Critical Situations

- Driving at high speed
- Taking turns at high speeds
- Load too high at straddle carrier
- Load measurement at the twistlocks can reduce the possibility of dangerous situations (known weight)
- Knowing the centre of gravity and lifting height can also reduce the possibility of dangerous situations (position)

SOLAS Container Weighing

- Safety issues for extended functions (e.g. SOLAS)
  - Detection of wrongly declared Container Weights
  - Improvement of Ship Stowage Plans
  - All VGM must be taken by a verified system

New Developments

Terminal Automation

- Automation or Industry 4.0 is making his way with big steps into the container handling industry
- Not the individual speed but rather a repeatable speed is the key factor to increase efficiency
- Results shall be sellable time of the operation
- Key Performance Indexes are (next to many others):
  - High equipment availability
  - Minimum downtime (Repairs, Maintenance)
  - Accident prevention
  - Extended equipment lifetime
- Maintenance
  - Corrective maintenance
  - Preventive maintenance
  - Predictive maintenance
- Load sensors and systems to calculate and record lifetime data

New Developments

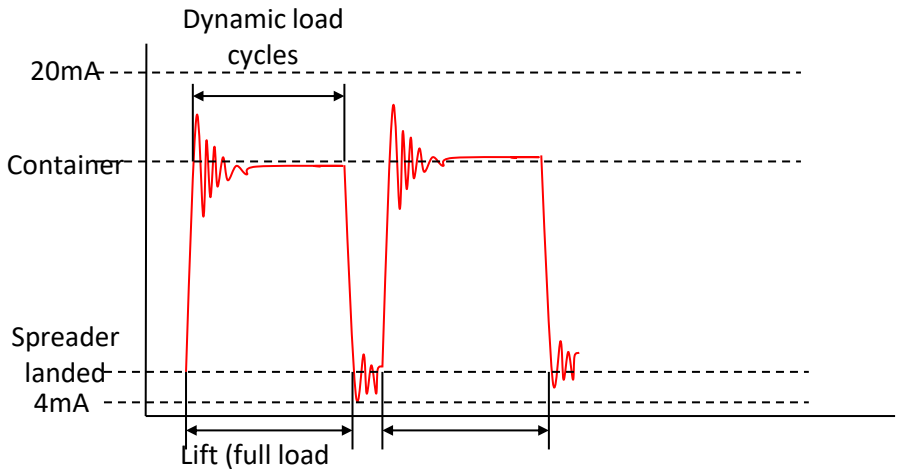
Lift data vs. Lifetime

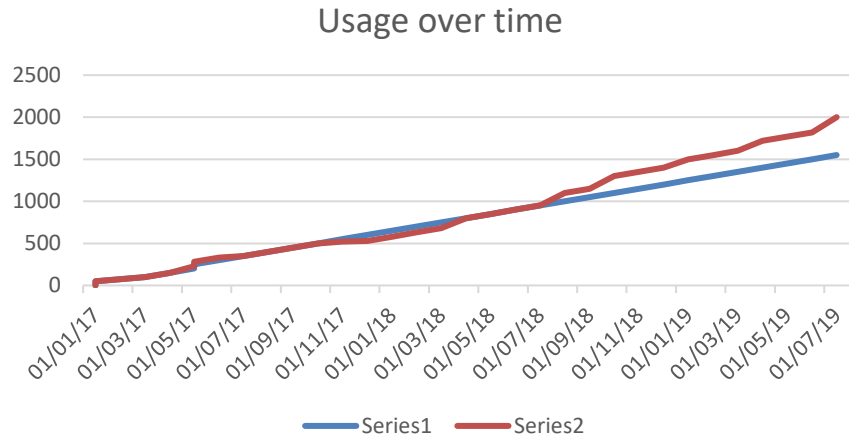
Integrated parameters

Sensor
- Service hour meter
- Load collective
- Load cycles
- Overload counter

System
- Time based parameters

Calculation for
- Maintenance intervals
- Machine fatigue & lifetime
- Etc…..





New Developments

Intelligent Sensors

For sensor installation in the headblock

Acceleration = change in velocity

- Change in speed
- Change in direction
- Change in both

During a lift of a container the hoisting speed accelerates while the trolley movement changes the direction.

This causes unwanted effects into the measurement of the force created by the container

The amplifier inside the sensor needs to calculate the dynamic forces

Result shall be an increase of the overall accuracy of the load measurement by splitting the load signal in a static and a dynamic signal

Users & Customers

Overview

BROSA GmbH

Sensor and System

- A competent partner for load sensing and monitoring
- A leading supplier to the container handling industry
- An innovation driven development partner for future oriented products
- Supplier to all major crane and port equipment manufactures
- Products are used in all major ports around the world.

BROSA GmbH

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