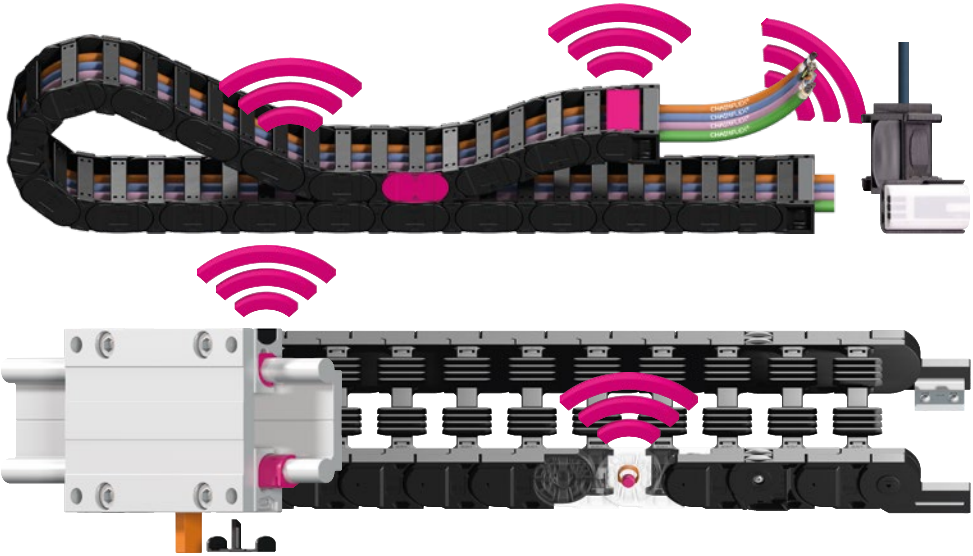


... smart plastics ... smart plastics ... smart plastics ... smart plastics ... smart plastics ... smart plastics ... smart plastics ... smart plastics ... smart plas

smart...

... Industry 4.0 ... Industry 4.0 ... Industry 4.0 ... Industry 4.0 ... Industry 4.0 ... Industry 4.0

plastics...

igus®.eu...

move smart ...
with igus® smart plastics

Energy crisis, skilled worker shortage, Corona pandemic: it is more important than ever for companies to work failure-free, productively and cost-effectively. Automation and the Industrial Internet of Things (IIoT) are powerful tools that can help. And our smart plastics are a cost-effective, time-saving gateway to the Industry 4.0 era. We equip plain bearings, energy chains, and cables with monitoring sensors. They communicate with IT modules wirelessly. This digitalisation allows machines to tell operators how their components are doing in real time. The resulting transparency opens up a world of new possibilities. For instance, components can be replaced at an early stage, preventing expensive system failures. This is called "condition monitoring". Operators can also get the maximum service life out of their components and plan maintenance optimally. This is called "predictive maintenance", and is a great help in times of skilled worker shortages and limited human resources more broadly. The goal is always increased productivity, reduced costs, and enhanced competitiveness.

motion plastics® - products for moving applications made from low-wear, high-performance polymers
smart plastics - smart plastics are intelligent plastic components, including energy chains, plain bearings, and cables, that are equipped with sensor systems. In combination with evaluation modules and AI software, they detect unexpected operating states (condition monitoring) and act by either triggering an alarm or using the machine control system to shut down the system completely - before expensive damage occurs. At the same time, the modules determine remaining component service life and the best time for servicing work (predictive maintenance). Since 2016, when igus® entered the area of condition monitoring and predictive maintenance, we have implemented over 2,500 applications in a wide variety of industrial sectors around the world.

IoT, networked machines that communicate independently with each other without the influence of humans are described by the term "Internet of Things". In contrast to the normal Internet, in which a user operates an input at the terminal, the systems act independently here, machine-to-machine (M2M).

"Just nice to have?"

"Do you know how much an hour of plant downtime costs industrial companies? Between $39,000 and $2 million, according to a study by Senseye, a UK-based analytics software manufacturer. These costs add up. The top 500 sales-volume companies in the world lose nearly $1.5 trillion a year to equipment failures. This massive drain on profits can't be ignored. Not even in small and medium-sized companies. So it is not surprising that more and more companies are implementing forward-looking concepts such as condition monitoring and predictive maintenance. Here is an example: according to the same study, 60 percent of companies in the fast-moving consumer goods (FMCG) industry now see predictive maintenance as a strategic priority. And 70 percent already perform some form of condition-based maintenance. This is an important step in minimising downtime and making maintenance work more economical."

Richard Habering
Head of Business Unit
igus® smart plastics
Phone +49-2203 9649-9806
e-mail rhabering@igus.net

We will be happy to advise you.

If you don't feel like searching, we will work together to find a smart solution that makes your machine safe, and you happy. We are happy to advise you on all questions concerning smart plastics.

We look forward to your message!

move smart ...
... condition monitoring?
... predictive maintenance?

Industry 4.0 means networking the real with the virtual world. Manufacturing processes merge with information technology. Disciplines such as mechanical engineering, logistics, and services communicate with each other in a new, intelligent way.

Source: DIN (www.din.de/de/forschung-und-innovation/themen/industrie4-0/was-ist-industrie-4-0--73174)

"Please, not more **software** *..."*

From page 8

"If only there were a **switch-off function** *for my energy supply system to prevent the next crash ..."*

From page 8

"My plant must **never** *stop."*

From page 24

"My **machine data** *is nobody else's business."*

From page 24

"My energy supply system and plain bearing technology should finally be ready for **Industry 4.0.**"

From page 24

"To see the **remaining service life** *... that would be science fiction."*

From page 24

"When is it time for **maintenance***?"*

From page 24

"I would prefer a **status report** *directly on the machine..."*

From page 8

... what is possible?
The following pages give you an overview ...

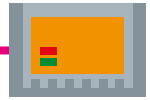
move smart ...

... condition monitoring
... i.Sense

i.Sense:
[cf. "to sense"]
Describes the area of condition monitoring from igus®

i.Cee:
[Cee, cf. "to see"]
Describes the area of predictive maintenance from igus®

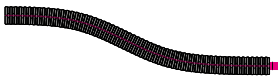
Control cabinet



SPS / PLC

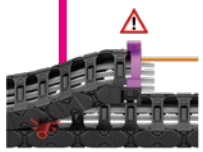
i.Sense:module II

EC.W



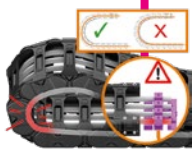
TR.B

Sensor units without module



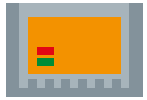
EC.P

EC.B



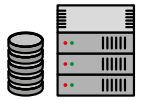
CF.P

Sensor units

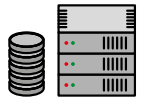


SPS / PLC

Local
HTTP dashboard

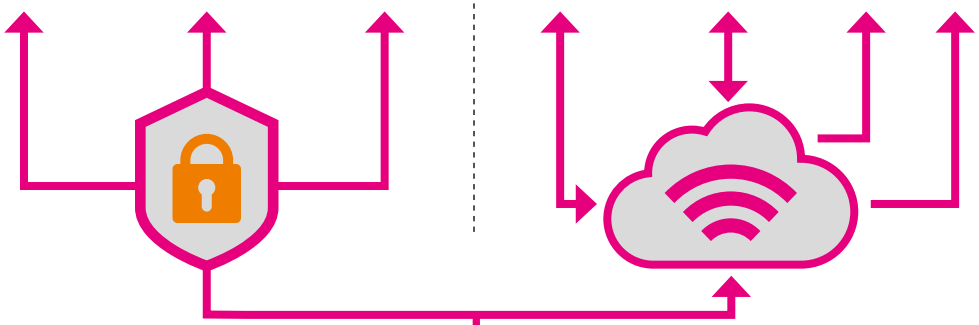


Internal
network
environment



IoT - cloud
services

IoT
remote dashboard



i.Cee: plus II module

Abrasion and motion sensors

move smart ...
... superwise

... the smart, all-encompassing service from igus®

igus® takes care of your application! If you give us your application data or allow us to use the project data, igus® offers a whole range of advantages with superwise. For example, we try to actively share with you price, delivery time, and possible product improvements before an impending replacement.

The igus® superwise service protects you from unexpected e-chain® application failures. An igus® employee will call you when your e-chain system® is nearing the end of its service cycle or when an unforeseeable event threatens your production.

Should something unforeseen happen, smart plastics components protect your e-chain® application and prevent total failure by switching off at lightning speed.

Free access to the superwise online portal gives you an overview of all your igus® e-chain systems® and their current status. You can plan and carry out maintenance and retrofit work in combination with other business processes to ensure that your production runs smoothly.

... in three service packages

... superwise Basic

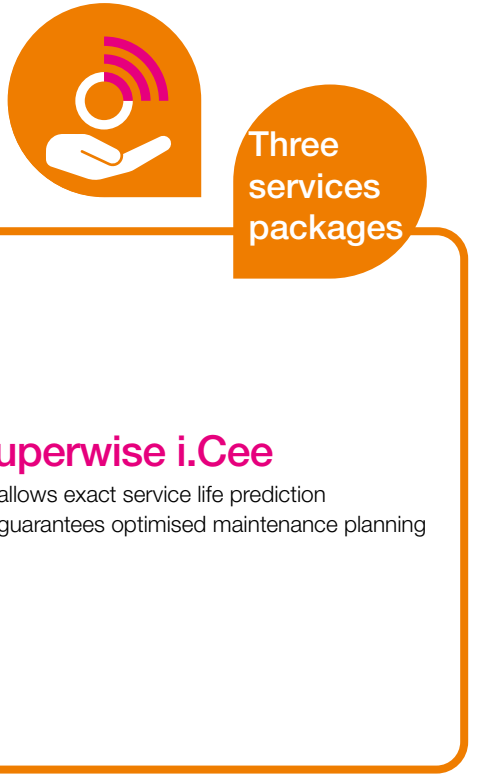
All system data is displayed and a service life forecast created based on your information and the proven online service life calculator's well-understood algorithms. Well before the end of the igus® e-chain® system's safe operating time, the igus® sales department will make you an offer to replace the system!
The aim is to inform you in advance about the upcoming replacement and to make you a corresponding offer!

... superwise i.Sense

smart plastics condition monitoring components reliably prevent total failures caused by broken chains, blockage, or cable damage. In the event of a shutdown, you will be informed immediately by e-mail or SMS, and the igus® sales department will also be notified so that fast deliveries can be arranged if necessary. All reports are saved with measured values in the portal and can be evaluated later for diagnostic purposes. In addition to the basic chain care service, the system records a movement profile (optional), allowing for a more precise service life calculation or service planning

... superwise i.Cee

Additional sensors are installed in your system to determine the actual wear of e-chain systems® or cables. This status information is available to you 24/7 on the chain care portal and enables you to plan long-term maintenance and retrofitting. Depending on the i.Cee hardware in use, sensor data can be saved for later evaluation. The i.Cee systems are designed to detect unusual operating conditions at an early stage and generate preventive information in good time!



Features	superwise Basic	superwise i.Sense	superwise i.Cee
Free online portal	●	●	●
Component overview	●	●	●
Installation history	●	●	●
Static service life indicator	●	●	●
Next service reminder	●	●	●
Real-time status display		●	●
Dynamic (sensor-based) service indicator		●	●
Sensor remote setup		●	●
Dynamic service life prediction			●
... optimised maintenance planning			●

i.Sense

... igus® products for condition monitoring
... records machine status regularly or permanently
... early warning if failures occurs
... www.igus.eu/condition-monitoring

... machine data acquisition for product and process optimisation
... no more unplanned downtime

If smart plastics are used for condition monitoring, they immediately report any unexpected operating states, switch off the system, or emit an alarm. Industrial manufacturers use this function to minimise system failures and downtime.

Control cabinet

... simple module installation on top-hat (DIN) rail
... integration into the existing plant control system via NC contacts
... 24V DC voltage supply

Module

... evaluate all sensor data based on igus® algorithms
... inform the plant controls in real time of any mechanical faults that occur

Sensor units

... assembled directly into igus® e-chain® systems and chainflex® cables
... connected to the i.Sense module via cable
... integrated component of the igus® superwise i.Sense service

i.Sense:module II

IS.EC.P

IS.EC.B

IS.CF.P

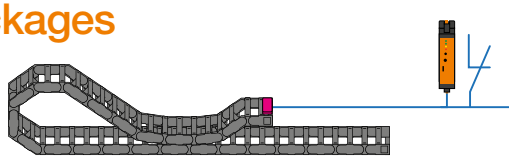
Condition Monitoring - the concept of condition monitoring is based on a regular or constant recording of the machine condition by measuring and analysing physical parameters, e.g. vibration, temperature, position/proximity. Condition monitoring pursues two goals: safety and machine efficiency.
(Source: Wikipedia)

i.Sense systems

... for e-chains®
... avoid unplanned downtime

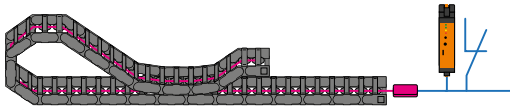
EC.P
... prevents major damage or total failure caused by problems such as blockages

... measures the push/pull forces acting on the e-chain®
... recommends shutdown of the equipment if a force limit is exceeded


EC.P push/pull detection

EC.B
... prevents a total loss if the chain breaks

... detects chain breakage in the early stages
... prevents overloading and subsequent system failure


EC.B breakage detection

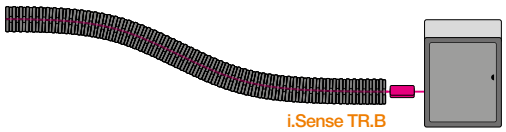
EC.W
... provides system status information at all times

... condition monitoring of the chain in real time
... directly connected to the machine control system via cable


EC.W wear detection

TR.B
... monitors the condition of multi-axis chains

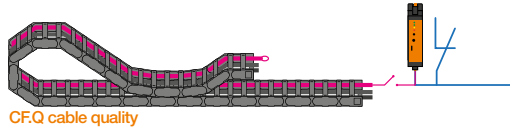
... real-time condition data acquisition for the energy supply system of the robot
... prevents unplanned downtime


i.Sense TR.B

... for chainflex® cables
... extends service life

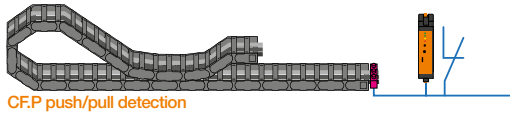
CF.Q
... detects core rupture

... indicates changes in the electrical properties
... provides information and uses an NO contact to notify the operator when there is a malfunction
... detects core rupture


CF.Q cable quality

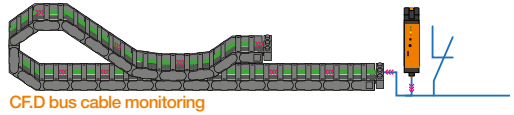
CF.P
... prevents cable failures caused by jacket abrasion

... measures the forces directly at the strain relief element
... triggers a shutdown by means of the NC contact if forces are excessive


CF.P push/pull detection

CF.D
... detects data transmission problems in Ethernet cables at an early stage

... integrated into the cable, no extra measuring cable necessary
... detects packet losses in good time
... alarm via LED, NC contact or the network


CF.D bus cable monitoring

chainflex® - cables designed specifically for use in energy chains. A wide range of cable types with different jacket materials ensures a high reliability in energy chains. igus® chainflex® cables withstand various applications with high speed and acceleration, long travels and tough environmental conditions.

i.Sense
... masters a STS crane

Challenge

Container ships were tiny 40 years ago. They held an average of 1,000 containers. Today? There are Triple E-class giants such as the Ever Ace, the largest ship of its kind, which carries almost 24,000 containers. And ships are getting even bigger. This presents a challenge to ports all over the world, including large ports such as the one in Rotterdam. They must continuously expand their infrastructure - including ship-to-shore (STS) cranes. And that infrastructure must continuously operate without failure seven days a week, 24 hours a day. In all weathers, with high UV exposure, fluctuating temperatures, and salty air. At higher and higher speeds. These demands can push such classic cable guidance systems as cable drums and festoons to their limits.

The solution with smart plastics

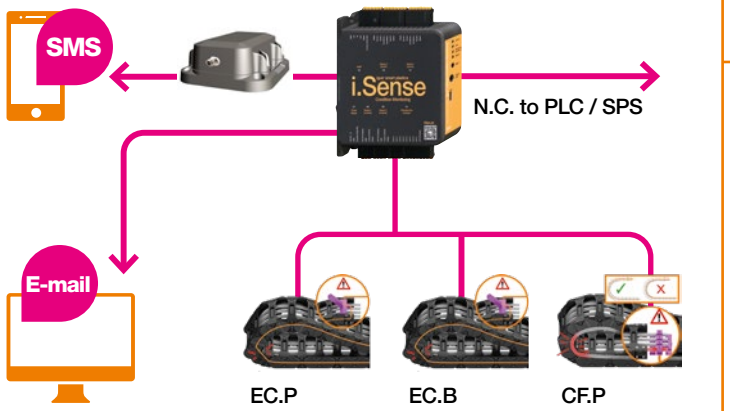
Smart P4.1 rol e-chains® from igus®. These energy chains are so robust and reliable that they run for years with minimal maintenance. They are made of a high-performance plastic that is resistant to salt water, UV radiation, chemicals, and fluctuating temperatures between -40°C and +120°C. Unlike festoon systems and cable drums, they are not affected by adverse environmental conditions and rust. Three different sensor types are installed to monitor the condition of the energy chains and cables. The EC.P force sensor is mounted on the floating moving end of the e-chain® and measures tensile forces. Another CF.P sensor also measures tensile forces, but at a different point: at the fixed end of the e-chain®. A polymer wire is also integrated into the energy chain to function as an EC.B breakage sensor. All three sensors send their data wirelessly and by cable to another important system component: the i.Sense module, a small box not much bigger than a packet of cigarettes, mounted near the e-chain.

... with i.Sense EC.P, EC.B, and CF.P on a P4.1 rol e-chain®

System components

No.	Picture	Product description	No.	Picture	Product description
1		EC.P sensors	4		Connecting cables
2		EC.B sensor	5		i.Sense universal module 4 sensor
3		CF.P sensor	6		SMS module

System description



System result

400% ROI with three-month amortisation period:

- €10,000
(smart plastics investment)
+ €50,000/year
(savings due to fewer plant downtimes)

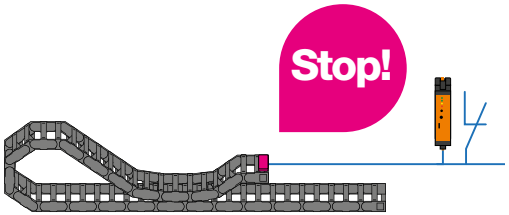
€40,000
annual savings

The EC.P system has been the standard in container cranes for many years.

i.Sense
... masters a sewage treatment plant

Challenge
As the plant runs around the clock, and some of the time without any human presence, faults sometimes remain undetected for hours.
Although the plant runs at a very slow speed, in the event of a breakdown it can even lead to total system failure. This total failure of the energy supply system leads to significantly higher costs than a standstill for several hours, where the system can be put back into operation after a short maintenance period.

The solution with smart plastics
In this case the solution is the push/pull force monitoring system EC.P. This sensor continuously measures the force which the plant requires to move the energy supply system. If these forces change due to external influences such as ice, an animal or a tool left behind during maintenance, the sensor detects this change and switches the system off immediately. This prevents expensive total damage to the sewage treatment plant.



EC.P push/pull detection

EC.P
Push/pull force detection for e-chains®

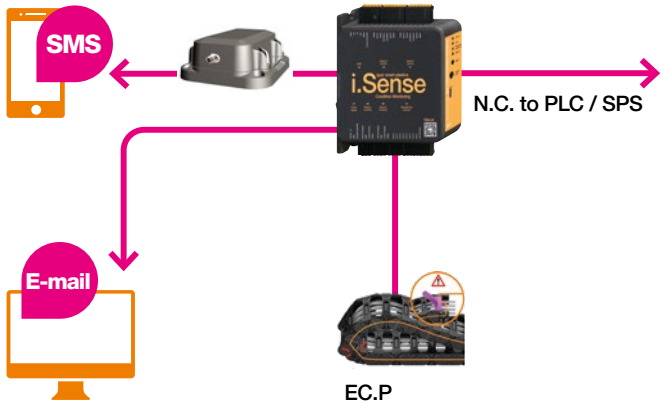
- Measures the push/pull forces acting on the e-chain®
- Recommends shutdown of the equipment if a force limit is exceeded
- Prevents failure

... with i.Sense EC.P on an e-chain® 2500 in basic flizz®

System components

No.	Picture	Product description	No.	Picture	Product description
1		EC.P sensors	3		i.Sense universal module 4 sensor
2		Connecting cables	4		SMS module

System description



System result

900% ROI with two-month amortisation period:

- €2,000
(smart plastics investment)
+ €20,000/year
(savings due to fewer plant downtimes)

- €18,000
annual savings

... masters a modern packaging machine

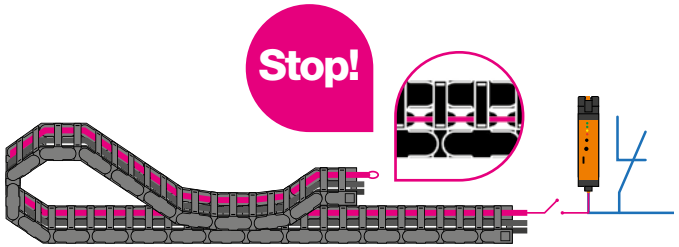
... with i.Sense CF.Q on chainflex® measuring system cables

Challenge

Sliced and wrapped bread is an everyday product for many households. But the technology behind it is very complex. The bread must be sliced gently and packed and sealed securely. GHD Georg Hartmann Maschinenbau is among the world's leading manufacturers of systems for slicing and packaging foodstuffs. Besides precision, speed is also important.

Cutting-edge machines such as the GBK 440 pack up to 80 sliced breads per minute - more than one per second. So it has a high stroke in a relatively small installation space. The fast movements greatly tax the energy chains carrying the energy, control, and measuring cables. So all cables must be optimised for a minimum bend radius of just 63 millimetres. This places high demands on cable quality. Unfortunately, core rupture cannot be entirely avoided. It leads to cost-intensive breakdown, since high throughput means large production backlogs can develop very quickly.

So GHD wanted a warning system that would detect failures in advance and thus avoid them. It commissioned igus® GmbH, a manufacturer of lubrication-free high-performance plastics and fail-safe energy supply systems, to implement the solution.



CF.Q cable quality

CF.Q

Cable quality monitoring

- Indicates changes in the electrical properties
- provides information and uses an NO contact to notify the operator when there is a malfunction

The solution

For energy chains, cables, and plain bearing products, igus® has developed a product family in which sensors make the plastic components intelligent. The generic term is smart plastics. The principle is easy to understand: smart sensors detect component status and report it to the i.Cee module, which forwards the data - to the cloud, for example. The igus® CF.Q module monitors the cable to avoid breakage in such applications as the GHD Hartmann bread packaging machine.

The monitoring system principle is based on the assumption that two cables from a single production batch behave in the same way under load and are therefore susceptible to core rupture at the same time. So the measuring system cable is supplemented with a second identical one. The system continuously monitors the two additional cores. By measuring the push/pull forces and electrical characteristics, the device recognises the beginning of a core rupture at a very early stage.

To this end, igus® has collected a large amount of data from load tests and uses historical data from different application scenarios to serve as a reference value for the forecast. The software can therefore predict exactly how many work cycles a chain can handle without failure. The process data determined at the same time can be used to predict the remaining number of days of reliable chain use, enabling companies to plan maintenance and replacement precisely.

The result

The igus® CF.Q system is an integral part of the GBK 440 packaging machine. It allows the intervals between maintenance operations to be greatly extended. All data is evaluated in the customer control system and output via notifications on the Human Machine Interface (HMI).

This concept makes it possible to operate the cables far beyond the end of the guarantee. The company using it saves several thousand euros in maintenance costs per year. i.Sense CF.Q's modern technology detects core rupture before it occurs. The system thus saves the user high downtime costs.

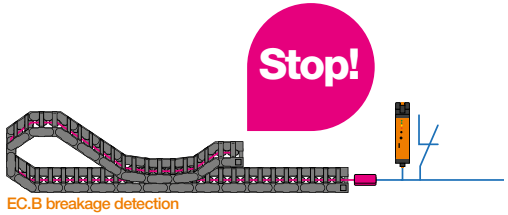
i.Sense
... masters an engine factory

"A high price can be avoided."

Challenge
At the engine plant in Austria, the largest and most important engine plant of a major German car manufacturer, an engine comes off the assembly lines every 14 seconds on average - in peak periods, more than 6,000 engines are produced every working day. This output can only be achieved with reliable components and a high degree of automation.

The solution with smart plastics
EC.B modules monitor the condition of the chain. If a chain breaks, the machine is stopped automatically to prevent subsequent damage. Additional EC.W modules signal advanced wear of the chain. The measurement of wear data means that a chain's remaining service life can be predicted and replacement can be planned at an early stage.

Read more about this application at www.igus.eu/smartplastics



EC.W
Service life monitoring for e-chains®

- Condition monitoring of the chain in real time
- directly connected to machine control via cable

EC.B
e-chains® breakage detection

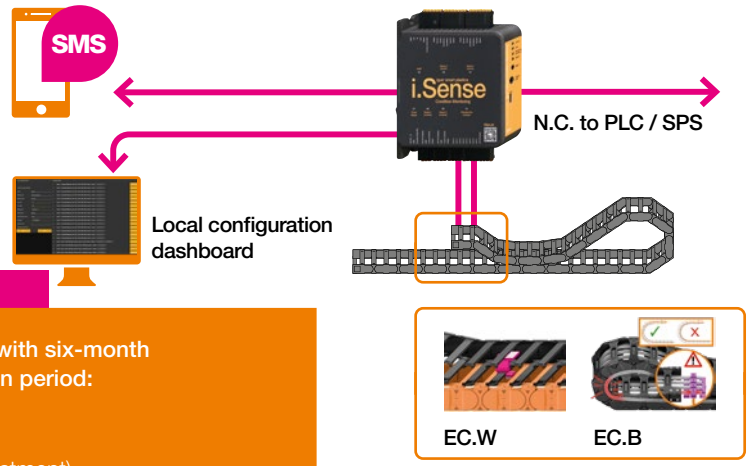
- Detects chain breakage in the early stages
- Prevents overloading and subsequent system failure

... with i.Sense EC.B and EC.W on various E4.1 e-chains®

System components

No.	Picture	Product description	No.	Picture	Product description
1		EC.W sensor	3		i.Sense universal module 4 sensor
2		EC.B sensor type A	4		Connecting cables

System description



System result

300% ROI with six-month amortisation period:

- €5,000
(smart plastics investment)
+ €20,000/year
(savings by avoiding contractual penalties)

€15,000
annual savings

You can always ask us for our many other references from the automotive industry or conveyor technology.

smart bearing technology

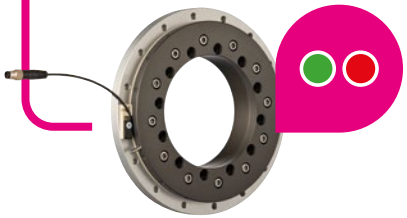
... monitors the wear of various plain and slewing ring bearings
... can be integrated into i.Cee
... www.igus.eu/info/smart-bearings

... monitors the wear of drylin® DLW.W linear carriages
... looks ahead and makes maintenance predictable
... www.igus.eu/info/smart-bearings

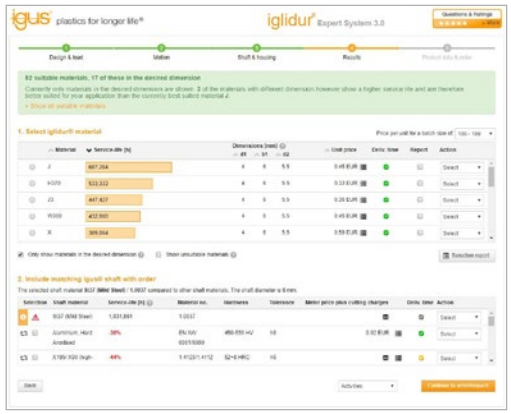
Sensors

... **iglidur® plain bearings**
from stock or in desired dimensions with integrated condition monitoring

... **iglidur® 3D printing**
Custom design with condition monitoring, no minimum order quantity



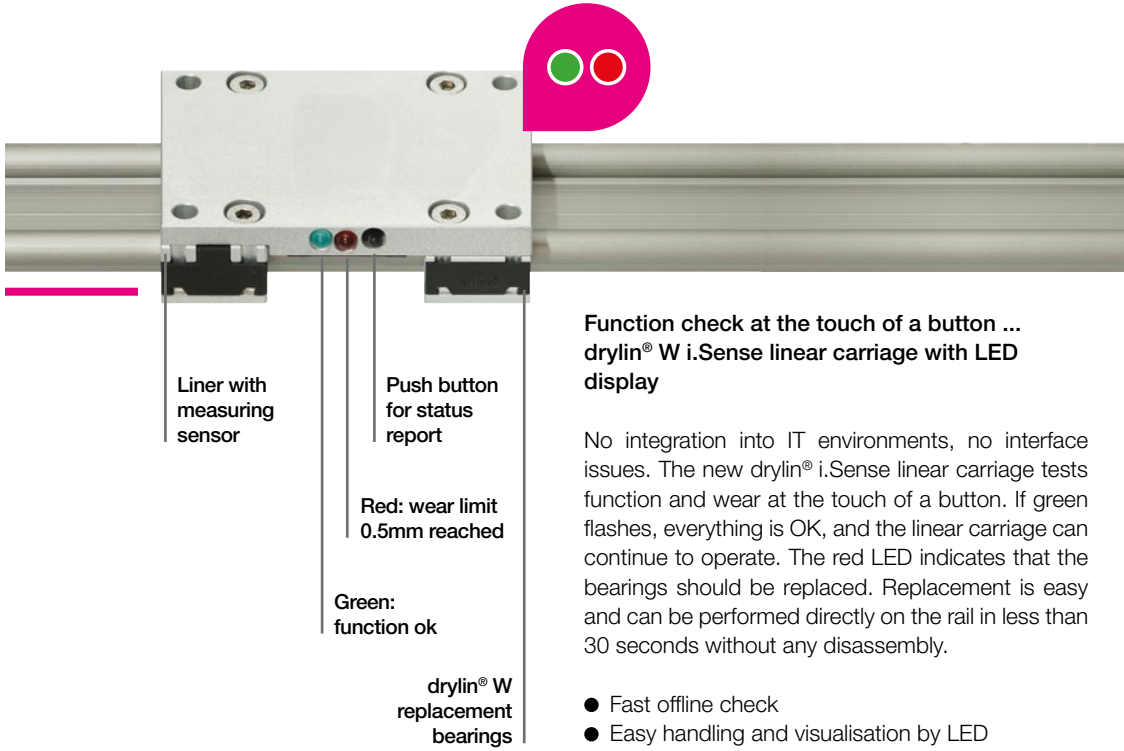
... **Slewing ring bearing iglidur® PRT**
Condition monitoring of the lubrication-free and maintenance-free iglidur® sliding elements



Calculating and monitoring
iglidur® materials are developed by igus® from high-performance polymers that feature special properties: Their special composition makes them extremely wear-resistant and resilient, and they are self-lubricating. The wear behaviour of the various materials - optimised for each area of application - has been analysed in thousands of tests, so their service life in customer applications can be calculated in advance.

... **ReBeL® lightweight robots**
For the latest generation, igus® has applied its motion plastics expertise to power electronics and, using conductive plastic tracks, developed an encoder with which the exact axis position is developed.

i.Sense LED linear carriages

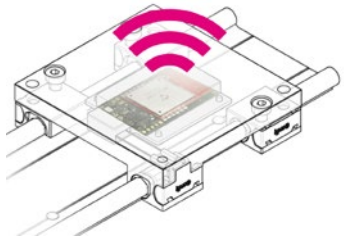


Function check at the touch of a button ... drylin® W i.Sense linear carriage with LED display

No integration into IT environments, no interface issues. The new drylin® i.Sense linear carriage tests function and wear at the touch of a button. If green flashes, everything is OK, and the linear carriage can continue to operate. The red LED indicates that the bearings should be replaced. Replacement is easy and can be performed directly on the rail in less than 30 seconds without any disassembly.

- Fast offline check
- Easy handling and visualisation by LED
- For drylin® W profile guides and linear modules
- Spare liners available from stock

... can be integrated into i.Cee



- Service life monitoring through "smart wear measurement"
- Change of drylin® W liners in seconds
- Reduce downtime

smart plastics ...
... not just nice to have
... quotes from the Internet

"Predictive maintenance can reduce maintenance costs by up to 30% and machine downtime by up to 70%."[2)]

"[...] unplanned repair costs and the loss of income due to machine downtime are usually higher than the costs of a Condition Monitoring System[...]"[5)]

It is statistically proven that a fire-fighting strategy is three to five times more expensive than a preventive maintenance strategy.[6)]

Maintenance and repair of machinery and industrial plant account for between 15% and 40% of indirect costs in industrial enterprises.[4)]

Avoid unplanned repair cost of €40,000[1)] and more for a replacement!

"From the perspective of a single machine, digitisation allows us to look into the future."[3)]

1) Source: igus® - e.g. at a stacker reclaimer. igus® application at Tata Steel in Haldia, India with a travel of 480m and a chain length of 240m was able to avoid a replacement worth about €40,000
2) Source: Elisabetta Castiglioni, A1 Digital - https://www.produktion.de/trendsinnovationen/id-6-beispielewie-man-mit-industrie-4-0-geld-sparen-kann-295.html
3) Source: Christian Liedtke, KUKA - https://www.produktion.de/trendsinnovationen/id-6-beispielewie-man-mit-industrie-4-0-geld-sparen-kann-295.html
4) Source: https://www.industrystock.de/de/news/detail/2387
5) Source: https://www.instandhaltung.de/maintenance-in-derindustrie/so-klapptcondition-monitoring-beispritzgiessmaschinen-311.
6) Source: https://www.instandheld.de/ungeplanter-maschinenstillstand-5-tipps-fuer-erste-hilfe-und-langfristigen-schutz/

i.Cee

... precisely predicts maintenance
... prevents downtime or loss of quality
... www.igus.eu/predictive-maintenance

Both the above-mentioned sensors for service life calculation and the i.Sense sensor units for condition information provide data from which indicators for premature wear of the product or the risk of product failure can be determined at a very early stage. Based on the experience gained in the 3,800m² test laboratory for plain bearings and energy transmission solutions, in combination with self-developed algorithms, the system alerts and informs the user at an early stage about possible failure risks and/or the next maintenance date.

Offline: i.Cee:local / i.Cee:cloud

... keeps all i.Cee module application data ready to be called up at any time

... can be accessed either via a display at the plant, via a cloud solution or an IoT dashboard, as JSON/MQTT protocol, on the intranet, via the REST API interface or also directly via SMS or email.

... is part of the igus® superwise i.Cee service

i.Cee Hardware

... **i.Cee:plus II Module**

- Installation on top-hat (DIN) rail in control cabinet
- Storage and processing of sensor data
- Real-time calculation of the maximum product service life
- multi-connectivity for the desired customer connection

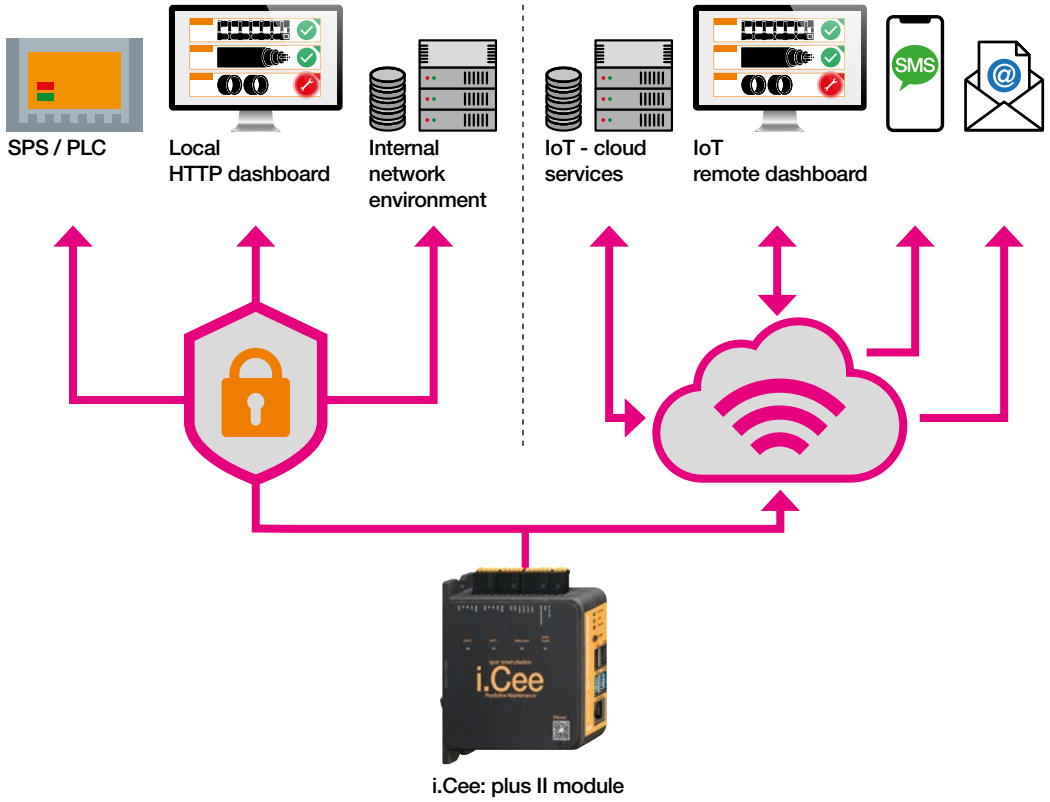
... **i.Cee:box**

- Installation on or in the control cabinet for wireless communication with the sensor modules via LoRa technology
- Supply of several assets possible

Sensors

... provide up-to-date wear, condition and movement data

... two options for data transmission
... according to customer request
... i.Cee:local
... local network
... i.Cee:cloud
... works online (IoT)



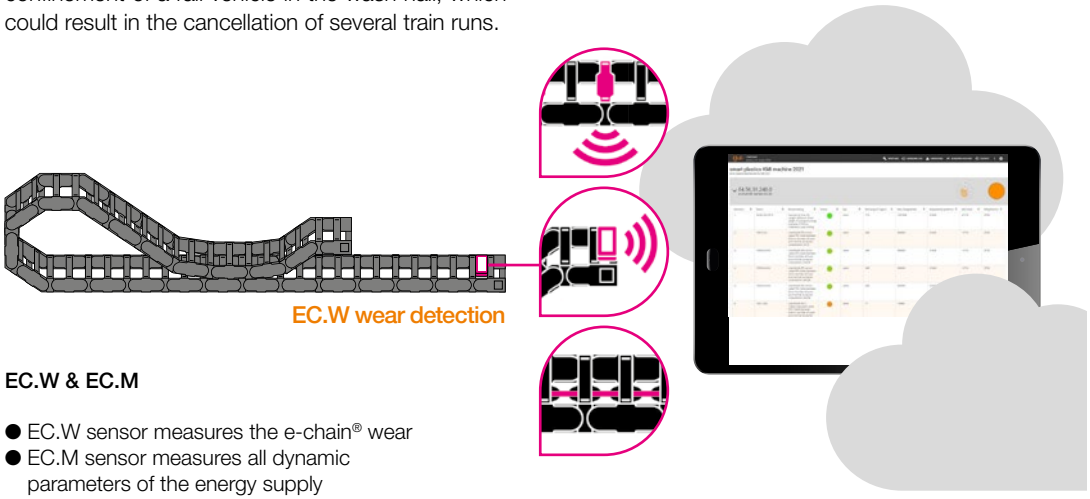
i.Cee
... in use at train washing station in Luxembourg

Challenge

The previous energy chain systems of a competitor caused disruptions in the operation of the plant, as they were partially rising or otherwise falling off. This was particularly problematic because the washing plant is operated autonomously and a failure of an energy chain system could bring the entire washing process to a halt. The necessary repair measures were therefore time-consuming and partly necessary at night and on weekends. Failure would mean the confinement of a rail vehicle in the wash hall, which could result in the cancellation of several train runs.

The solution with smart plastics

The aim was to find a product that not only safely supplies the washing trolleys with data, voltage, compressed air, water and cleaning agents, but also fulfils CFL's requirement to operate Europe's most modern train washing plant. For this purpose, a system was required that allows the operator to monitor each individual energy chain and to avoid a breakdown of the plant. Besides an igus® energy chain designed for long travels, igus® smart plastics components were installed. Sensors monitor the status of every igus® energy chain during operation with regard to the application of force but also with regard to wear and tear, and inform in good time as soon as a repair or replacement is required. In the course of the modernisation of the energy chain systems, the entire cleaning system was also renewed, so that in addition to particularly environmentally friendly cleaning agents, the used washing water was also reused again and again through reprocessing.



EC.W wear detection

EC.W & EC.M

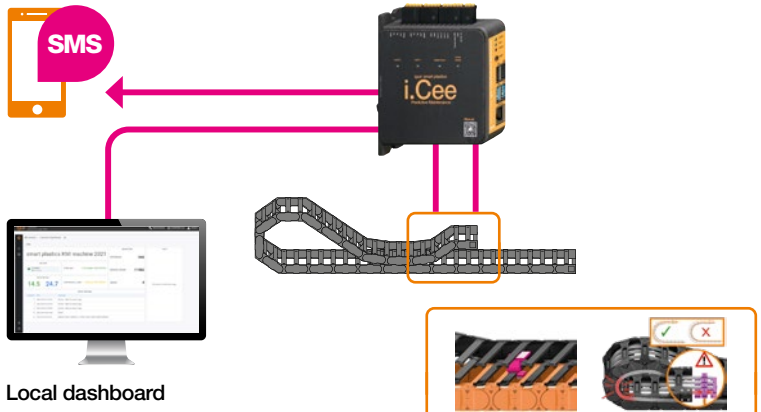
- EC.W sensor measures the e-chain® wear
- EC.M sensor measures all dynamic parameters of the energy supply

... for 200m travel

System components

No.	Picture	Product description
1		EC.W sensor
2		EC.M sensor
3		i.Cee: local DIN top-hat rail module
4		Connecting cables

System description



System result

340% ROI with six-month amortisation period:

- €25,000
(smart plastics investment)
+ €10,000/year
(lower inspection costs)
+ €100,000/year
(no unplanned downtimes)

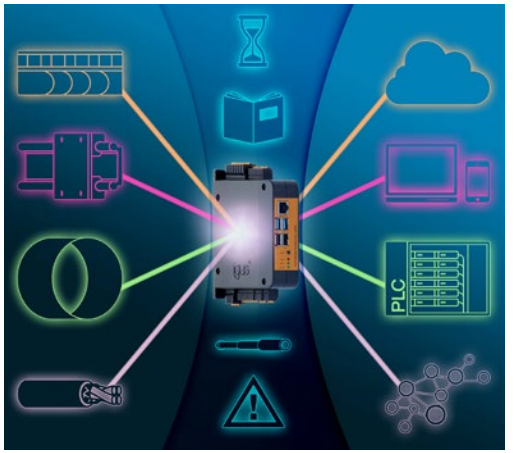
- €85,000
annual savings

... recommends use-based maintenance

Online condition monitoring from anywhere in the world - maintenance recommendations

In addition to the maintenance recommendation alerts, all measured sensor values can be displayed with history on a detailed page. In this way, exceptional operating conditions or creeping mechanical changes can be detected early on and corresponding measures initiated in good time.

... and reduces maintenance costs



Multi-connectivity for easy overview

The possibility of seamless integration into the designated network environments allows the implementation of various Industry 4.0 use cases. The data of the i.Cee:local module can be accessed either via a display on the system, via a cloud solution or an IoT dashboard, as JSON/MQTT protocol, on the intranet, via the REST API interface or directly via SMS or email. Online or offline, the i.Cee module enables maintenance staff to access the data quickly, easily, and according to the customer's needs.

In the new i.Cee:portal, numerous functions and use cases will be made possible in a single central location in the future:

- Secure (VPN), authenticated access to local i.Cee dashboards
- Overview of all customer assets (online and offline)
- Remote configuration and reset for individual assets
- Status report for all assets
- Alarm and message overview
- Configuration management

It doesn't matter what type of terminal device you want to use.

Data flows
... how you define it
... Input options
... Output options

Motion profile

... Siemens SPS connection

... integrated acceleration sensors EC.W/EC.I M

... OPC UA customer application server

... GPS position data

... igus® positioning system EC.PP

... standard positioning systems, e.g. 4-20mA

i.Cee:software

i.Cee Module

i.Sense Module

i.Cee:output

... Siemens S7

... OPC-UA server

... IoT-Cloud dashboard

... HTTP Dashboard via private IP address

... MES / SCADA

... JSON-File via MQTT Broker

... REST via HTTP

... Text or .CSV file

... Text messages via SMS

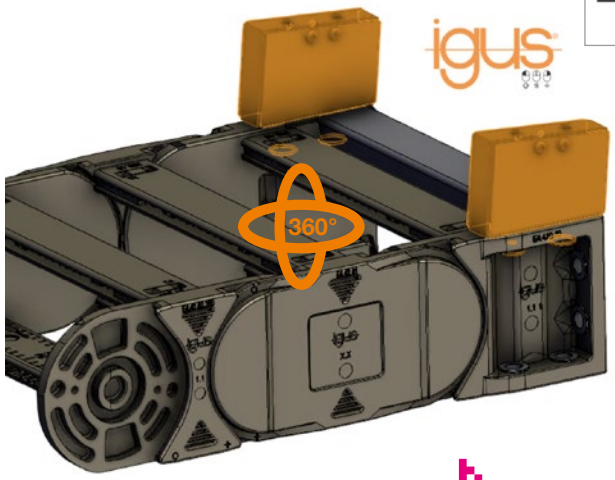
... Sensor raw data management via SMB protocol

... Sensor raw data management via FTP

... FANUC Field System Integration

Online
... all with a single click
... check it out, try it out, and implement it
... www.igus.eu/smartplastics

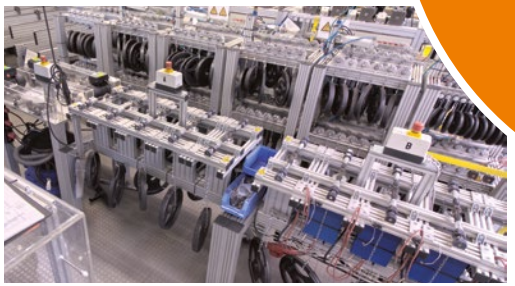
Updated igus® smart plastics website with all products and news, the online selection tool, online seminars, application examples and much, much more.



smart plastics under test
... the largest test laboratory in the industry
... www.igus.eu/test

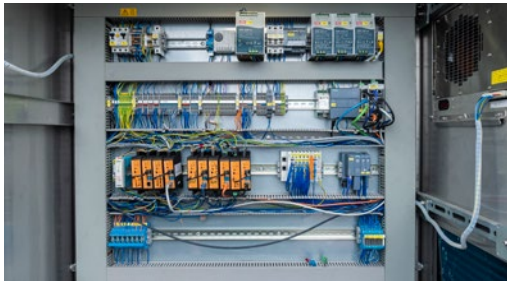
Anyone who can make reliable and useful predictions about maintenance work is one step ahead of the competition. In the age of digitisation, more than Big Data is required for such predictions. In order to be able to use the sensor data to derive the correct recommendations for maintenance to be accurately scheduled, long term empirical values from the igus® test database are used.

Climate chamber: dynamic tests of cables in e-chains® at -40°C



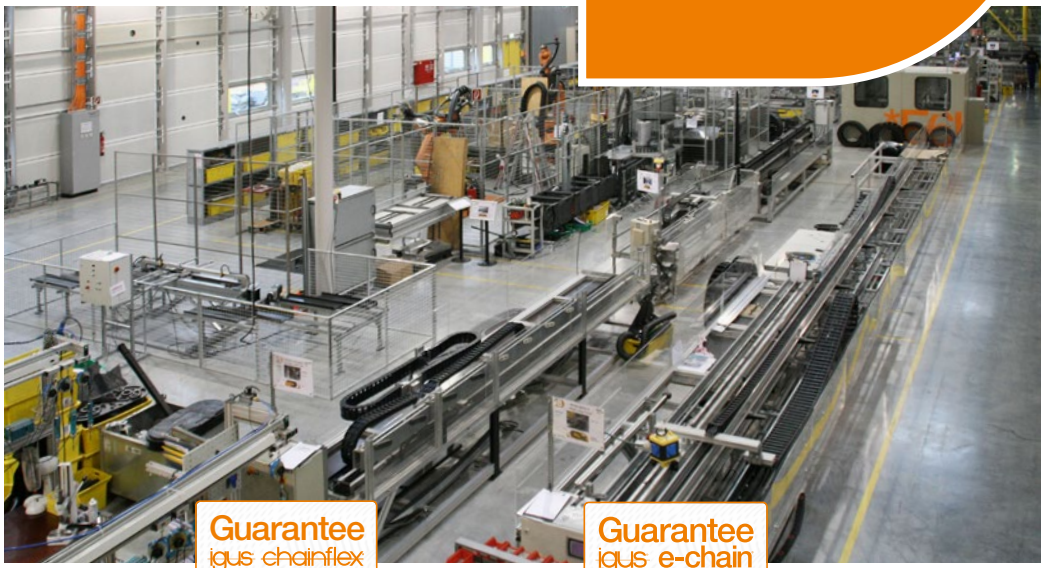
dry-tech® test laboratory

- 3,800 m² test area
- 4,100 energy chain system tests annually at 180 test stations: climate chamber, outdoor tests, noise chamber, travel lengths up to 130m, robot systems etc.
- 2 billion test cycles a year for highly flexible cables
- 1 million electrical measurements recorded annually
- 15,000 tribological tests (friction and wear) in 300 test set-ups
- 140 trillion test movements in the bearings business unit
- Sensors on the test machines provide permanent measurement data, processed in the central database

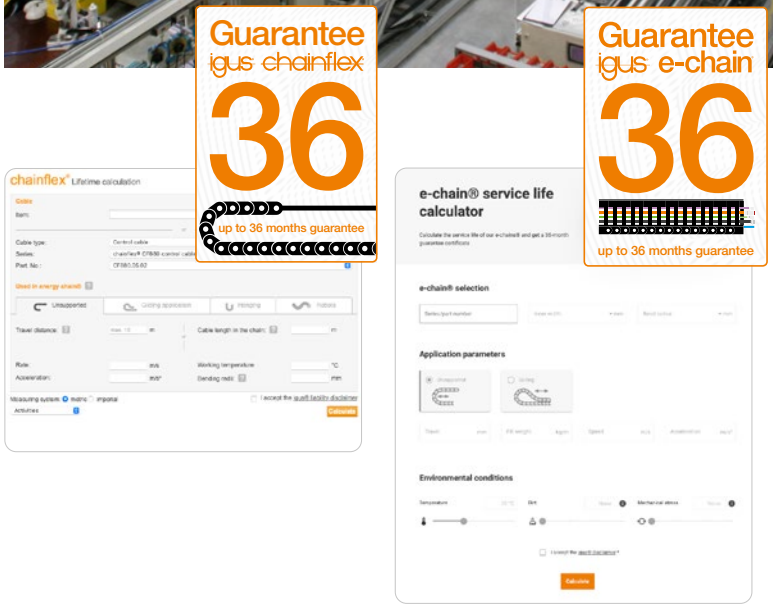


P4.1 e-chain® with EC.PP in the igus® outdoor test (left) and control cabinet with smart plastics modules (right)

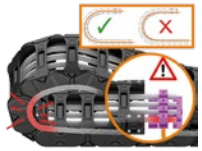
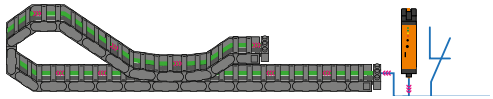
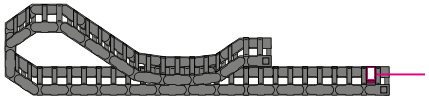
Calculate service life online and get up to 36 months guarantee!



igus® lab, Cologne. A section of the motion plastics® test laboratory spread over 3,800m²



Order smart plastics quickly
... in the online shop
... www.igus.eu/smart-plastics-shop

System	Description	System image	QR code and link to the shop
i.Sense EC.P	... for gliding applications with e-chains® series E4, P4 & E2		
Sensor technology	As a DMS sensor for KMAs or with load cell integrated into the FTA		
Evaluation module	i.Sense EC.P module		
Connecting cables	between sensor and control cabinet		igus.eu/product/20702
i.Sense EC.B	... for gliding unsupported applications		
Sensor technology	Movement sensor with travel measuring system with tension spring or rope hoist sensor starting at 35m		
Evaluation module	i.Sense:module II		
Connecting cables	between sensor and control cabinet		igus.eu/product/20703
i.Sense CF.P	... for e-chains® of the E4 and P4 series on long travels with CF		
Sensor technology	Mounted on the C-rail as a load cell		
Evaluation module	i.Sense:module II		
Connecting cables	between sensor and control cabinet		igus.eu/info/condition-monitoring-cf-p
i.Sense CF.D	... for all systems with CF bus cables		
Sensors & evaluation module	State-of-the-art CF.D module for data acquisition and analysis		igus.eu/info/condition-monitoring-buscables-cfd
i.Sense EC.W	... for all gliding applications		
Sensors & evaluation module & connection cable	EC.W sensor separators incl. 1m connection cable		igus.eu/product/21092
smart plastics iSet	... complete package with i.Sense & i.Cee		
i.Sense components	EC.P, EC.B sensors, i.Sense module		
i.Cee components	i.Cee:plus module, i.Cee dashboard, SMS module		igus.eu/product/20812

Notes

igus®.eu/8pm

Place your orders until late. Ordering and deliveries weekdays from 7.00am to 8.00pm, Saturday from 8.00am to 12.00pm. No minimum order quantity, no surcharges. Quick delivery.

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/9001:2015
/16949:2016
/14001:2015

igus® is certified according to ISO 9001:2015 and IATF 16949:2016 in the field of energy chains, cables, harnessing, and plastic bearings. igus® is also certified according to ISO 14001, a recognised basis for environmental management systems.

/smartplastics

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Subject to technical alterations. MAT0074198.20
Issue 03/2023

smart plastics