

## Wheel hub motors

FOR AUTOMATED GUIDED VEHICLES

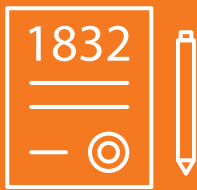


# WE GET IDEAS MOVING

The spirit of innovation and a sense of ideas beyond the familiar has made us into a pioneering company over more than 185 years.

For a quarter of a century, we have been offering customized drive solutions for office and workplace workstations, as well as for shading systems and building technology.

Through our tradition of innovation, we have succeeded in establishing ourselves as a specialist and problem-solver in numerous areas.



Over 185 years'  
experience



More than 60 standard  
solutions for four different  
market segments



100%  
Made in Black Forest

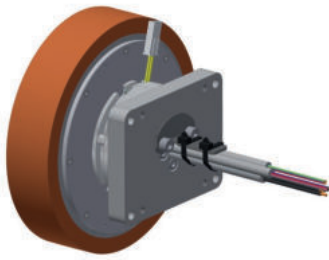


# THE RIGHT PRODUCT FOR EACH APPLICATION

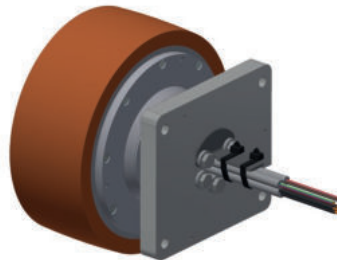
## Lifting Units

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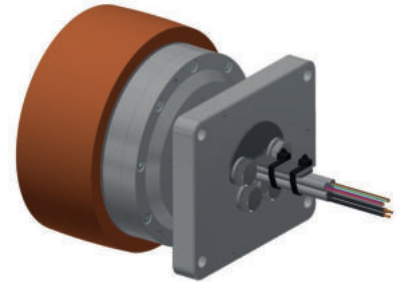
# Wheel hub motors i-Wheel 3213



3213.00-1XXX



3213.00-2XXX



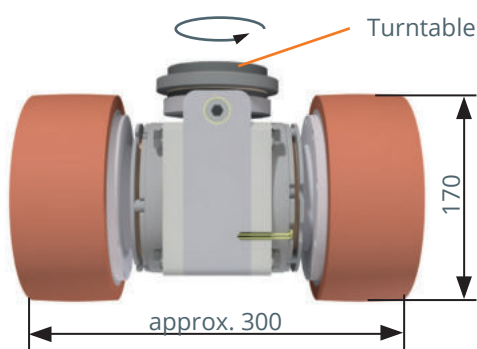
3213.00-3XXX

## An optimal drive solution for every transport task

The Ketterer i-Wheel 3213 wheel hub drives have been specially developed for use in Automated Guided Vehicles (AGV). They are designed as direct drives that are completely integrated in the wheel and therefore need neither an additional gearbox nor an extra motor.

An extremely flat design combined with a high power density allows an application with very tight installation spaces. The compact all-in-one solution not only impresses due to its benefits in terms of space requirements but also thanks to the fact it is maintenance-free and has a service life many times longer than systems equipped with a gearbox.

The i-Wheel 3213 series consists of three high-performance wheel hub drives, which can reach torques up to 34 Nm and speeds up to 27 km/h.



The ultra-compact design enables a simple arrangement of two drives on one rotary disk. This means that maneuvering the vehicle with a zero turning radius is no longer a challenge.

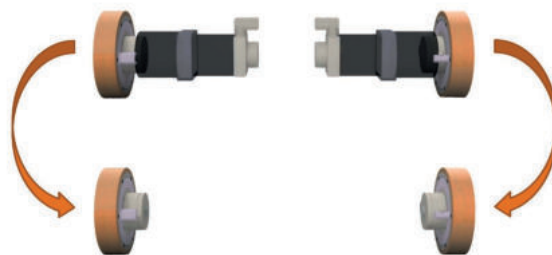
In terms of its efficiency and individual scalability, the family of drives offers an optimal modular solution for electric transportation vehicles.

We would be pleased to develop a solution for you that is specially tailored to your drive task!

Motor layout, flange geometry, the type of brake and the encoder can be implemented in line with your requirements.

## Our technology - Your benefit

- Neither a gearbox nor an extra motor is needed
- Ultra-compact for tight installation spaces
- High power density in the smallest installation space
- Much longer service life compared to conventional drive technology with a gear stage
- No gear – no wear
- Easy to replace the wheel coating
- Very good running properties with minimal noise level



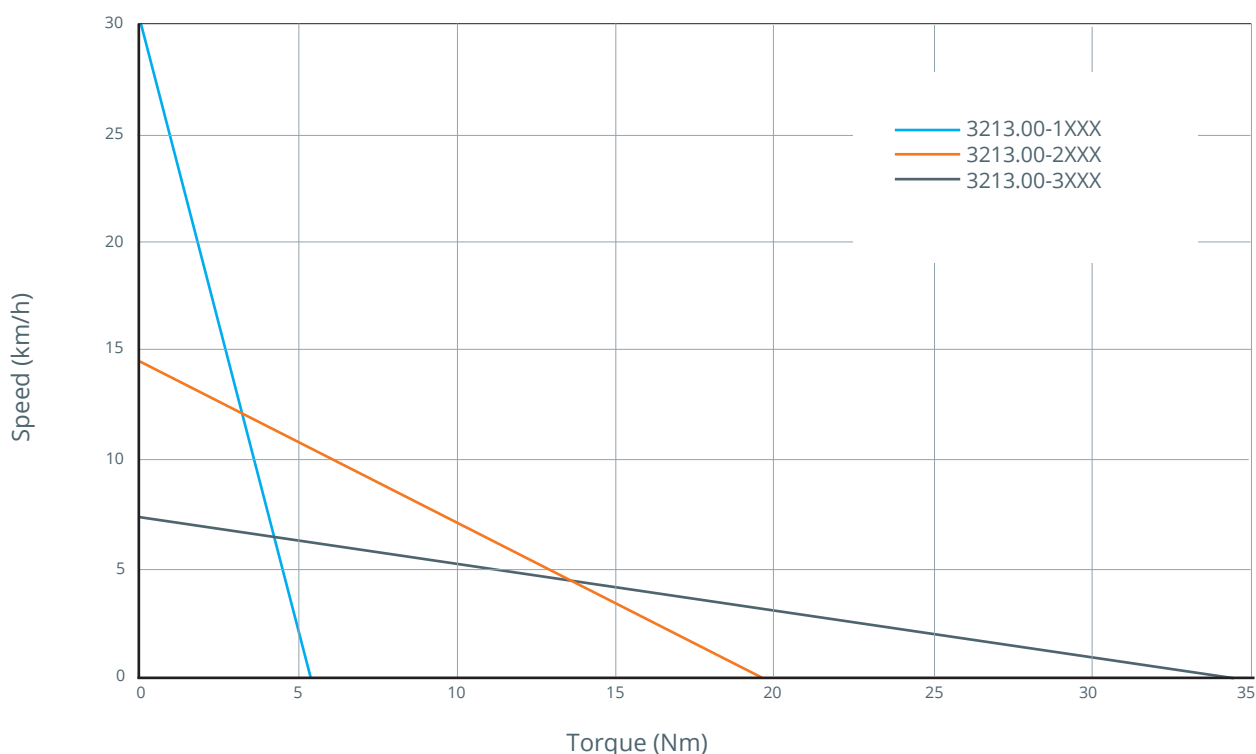
## Safety first

- Safety architecture of the rotational control system using diverse redundancy, or two-channel design
- In combination with a suitable controller, a safety level of **PL-d** in accordance with EN ISO 13849-1 can be achieved
- Safe production processes, as there are no risks of contamination from gear oils and greases (no gearbox)

## Flexibility and customer orientation are our strengths: The choice is yours - we implement it!

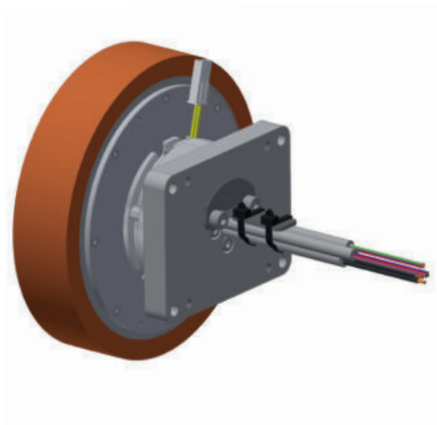
- Flexible voltage range from 24 V to 48 V
- Encoder: BiSS, SSI, TTL incremental in different resolutions
- Brake: Permanent magnetic brake or spring-operated brake with low energy consumption
- Can be combined with various controllers
- Adaptations for mechanical integration and system connection

## i-Wheel 3213 family: Torque & achievable speeds & 48 V DC





# i-Wheel 3213.00-1XXX



## Direct drive - Benefits in a nutshell

- No gearbox – no wear
- Much longer service life compared to conventional drive technology with a gear stage
- Excellent running properties with barely perceptible noise level
- Safe operation due to permanent temperature monitoring
- Ultra-compact with extremely high power density
- Easy replacement of the the wheel coating on site possible thanks to the patented Ketterer solution



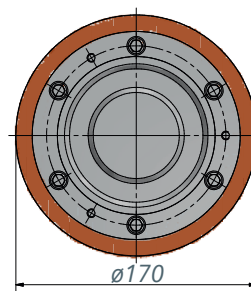
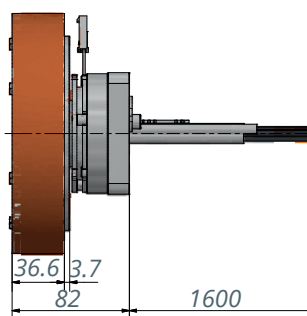
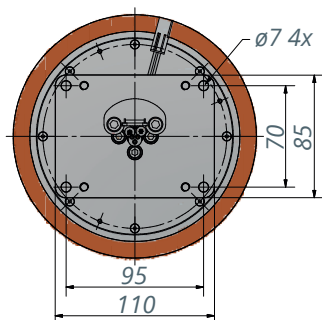
## Safety first

- Rotational control system using diverse redundancy
- **PL-d** safety level achievable with suitable controller
- Safe production processes, as there are no risks of contamination from gear oils and greases (no gearbox)

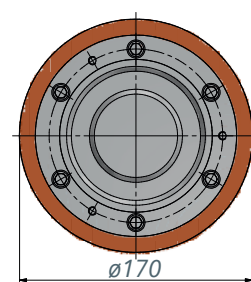
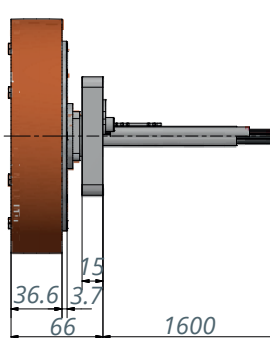
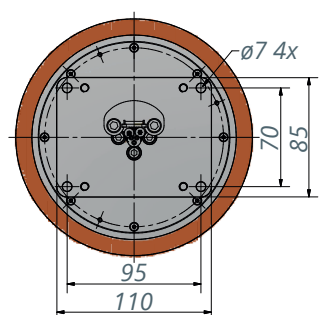
## The choice is yours - we implement it

- Encoder optional: BiSS, SSI, TTL incremental (various resolutions)
- Brake optional: Permanent magnetic brake or spring-operated brake
- Can be combined with various controllers
- Customer-specific mechanical integration and system connection

### 3213.00-1XX1 with brake



### 3213.00-1XX2 without brake



# 3213.00-1XXX i-Wheel-A-170

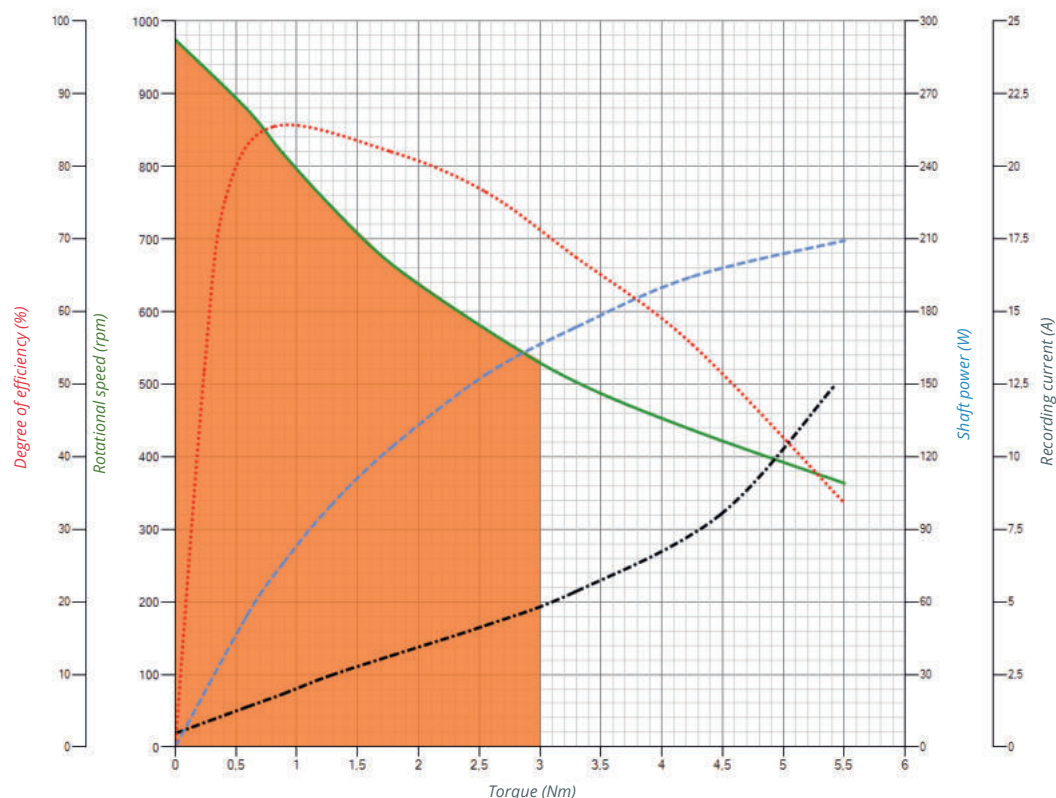
<b>Rated voltage</b>	48 VDC
<b>Rated current<sup>1)</sup></b>	5 A
<b>Rated torque<sup>1)</sup></b>	3 Nm
<b>Rated speed<sup>1)</sup></b>	530 rpm
<b>Max. speed at rated torque<sup>1)</sup></b>	17 km/h
<b>Shaft power (output)<sup>1)</sup></b>	165 W
<b>Idle running speed<sup>2)</sup></b>	975 rpm
<b>No-load current<sup>2)</sup></b>	0.5 A
<b>Achievable max. speed<sup>2)</sup></b>	up to 31 km/h
<b>Max. efficiency<sup>2)</sup></b>	88,6 %
<b>Standstill torque<sup>2)</sup></b>	5.4 Nm
<b>Starting current at idle speed<sup>2)</sup></b>	12,4 A
<b>Torque constant<sup>2)</sup></b>	0.6 Nm/A
<b>Speed constant<sup>2)</sup></b>	11 rpm/V
<b>Terminal resistance (phase to phase)</b>	0.65 Ohm
<b>Terminal inductance</b>	3.7 mH

- 1) Max. ambient temperature = 40 °C, controller-specific  
2) At the nominal point (TU = 20°C), controller-specific  
3) Radial and axial forces apply to the nominal service life  
L10h = 20,000h according to DIN ISO 281

# 3213.00-1XXX i-Wheel-A-170

<b>Rotor inertia</b>	2,900 kg*mm <sup>2</sup>
<b>Max. radial axle load F<sup>3)</sup></b>	800 N
<b>Max. axial axle load F<sup>3)</sup></b>	200 N
<b>Number of magnets poles</b>	32
<b>Interconnection of the motor</b>	L63S4
<b>Encoder type in standard</b>	Digital Halls + TTL magnetic incremental ABZ
<b>Encoder resolution</b>	4.096 cpr
<b>Material of the coating</b>	Blickle Besthane 92 ±3 Shore A

<b>Braking torque</b>	5 Nm
<b>Power supply brake</b>	24 VDC / 17,6 W
<b>Power consumption brake</b>	7 W through PWM Power reduction
<b>Weight incl. brake</b>	4,5 kg



<b>Brake:</b>	
1	+24 V PIN 1
2	GND PIN 2

**Motor phases:**  
Alphawire 6716 AWG16  
U = red  
V = black  
W = yellow

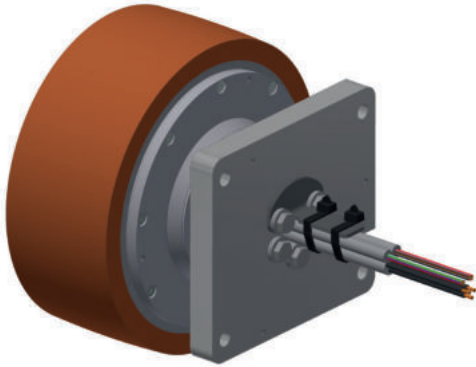
**Hall sensors:**  
igus CF240.PUR.01.08 (8x0,14)C  
1 +5 V red  
2 GND blue  
3 H1 white  
4 H2 brown  
5 H3 green  
6 PT1000 gray  
7 PT1000 pink  
Hall output signal: 3 square-wave signals  
The hall signals have a phase shift of 120° to each other.  
Power supply: 5V ± 5%  
Input current: typ. 40 mA

**Encoder:**  
igus CF240.PUR.01.08 (8x0,14)C  
1 +5 V red  
2 GND blue  
3 A gray  
4 A- pink  
5 B green  
6 B- yellow  
7 Z white  
8 Z- brown

Differential encoder output signal:  
3 square-wave signals (RS422)  
Channel A, B (90° phase shift) and  
Index Z  
Accuracy: ± 0.5°  
Power supply: 5V ± 5%  
Input current: typ. 35 mA

# i-Wheel 3213.00-2XXX

## Direct drive - Benefits in a nutshell



- No gearbox – no wear
- Much longer service life compared to conventional drive technology with a gear stage
- Excellent running properties with barely perceptible noise level
- Safe operation due to permanent temperature monitoring
- Ultra-compact with extremely high power density
- Easy replacement of the the wheel coating on site possible thanks to the patented Ketterer solution



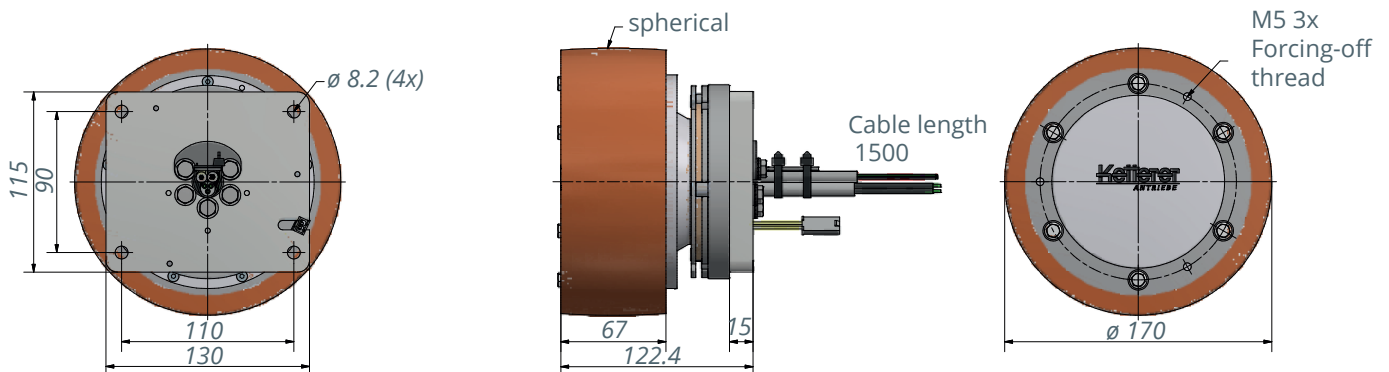
## Safety first

- Rotational control system using diverse redundancy
- **PL-d** safety level achievable with suitable controller
- Safe production processes, as there are no risks of contamination from gear oils and greases (no gearbox)

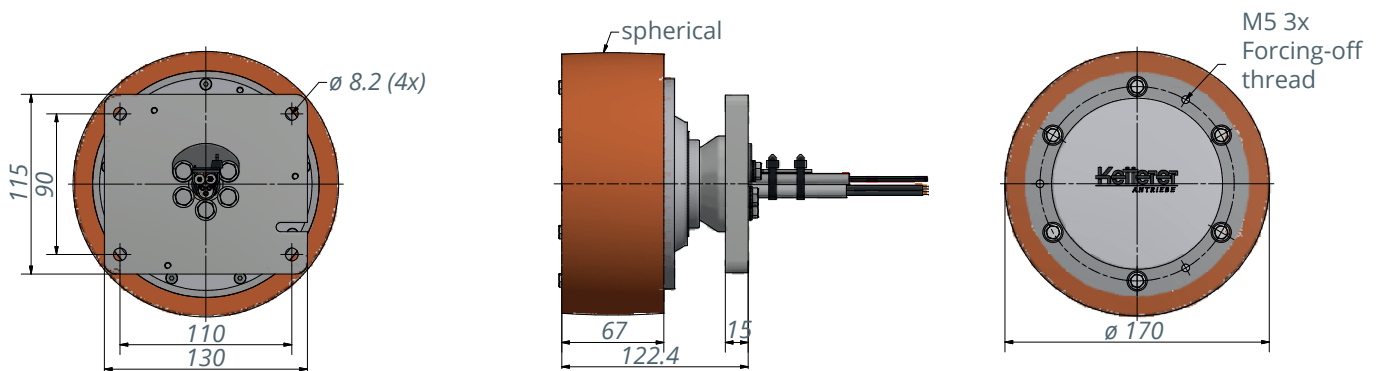
## The choice is yours - we implement it

- Encoder optional: BiSS, SSI, TTL incremental (various resolutions)
- Brake optional: Spring-operated brake
- Can be combined with various controllers
- Customer-specific mechanical integration and system connection

### 3213.00-2XX1 with brake



### 3213.00-2XX2 without brake

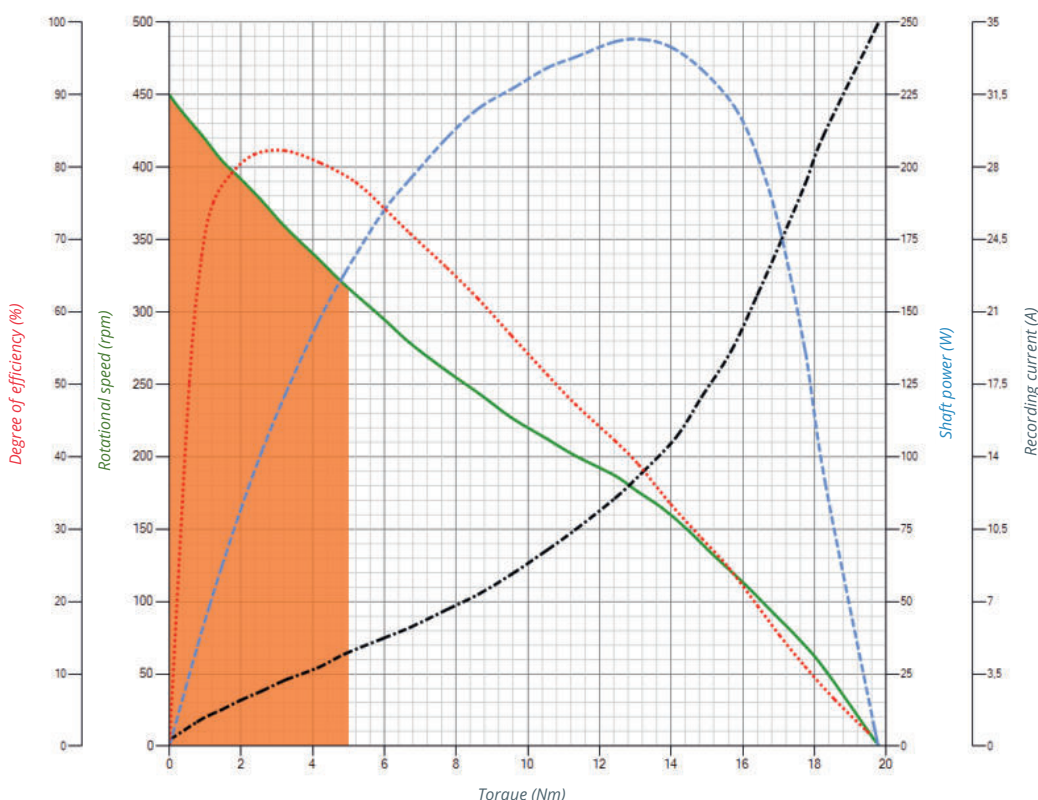




# 3213.00-2XXX i-Wheel-A-170-123

<b>Rated voltage</b>	48 VDC
<b>Rated current<sup>1)</sup></b>	4.5 A
<b>Rated torque<sup>1)</sup></b>	5 Nm
<b>Rated speed<sup>1)</sup></b>	316 rpm
<b>Max. speed at rated torque<sup>1)</sup></b>	10 km/h
<b>Shaft power (output)<sup>1)</sup></b>	165 W
<b>Idle running speed<sup>2)</sup></b>	450 rpm
<b>No-load current<sup>2)</sup></b>	0.3 A
<b>Achievable max. speed<sup>2)</sup></b>	up to 14 km/h
<b>Max. efficiency<sup>2)</sup></b>	82 %
<b>Standstill torque<sup>2)</sup></b>	20 Nm
<b>Starting current at idle speed<sup>2)</sup></b>	32 A
<b>Torque constant<sup>2)</sup></b>	1.25 Nm/A
<b>Speed constant<sup>2)</sup></b>	9.4 rpm/V
<b>Terminal resistance (phase to phase)</b>	1.05 Ohm
<b>Terminal inductance</b>	7 mH

- 1) Max. ambient temperature = 40 °C, controller-specific  
2) At the nominal point (TU = 20°C), controller-specific  
3) Radial and axial forces apply to the nominal service life  
L10h = 20,000h according to DIN ISO 281



# 3213.00-2XXX i-Wheel-A-170-123

<b>Rotor inertia</b>	14,500 kg*mm <sup>2</sup>
<b>Max. radial axle load F<sup>3)</sup></b>	2,500 N
<b>Max. axial axle load F<sup>3)</sup></b>	1,250 N
<b>Number of magnets poles</b>	32
<b>Interconnection of the motor</b>	L63S4
<b>Encoder type in standard</b>	Digital Halls + TTL magnetic incremental ABZ
<b>Encoder resolution</b>	4,096 cpr
<b>Material of the coating</b>	Blickle Besthane 92 ±3 Shore A

<b>Braking torque</b>	16 Nm
<b>Power supply brake</b>	24 VDC / 19.4 W
<b>Power consumption brake</b>	7 W through PWM Power reduction
<b>Weight incl. brake</b>	10,3 kg

<b>Brake:</b>		
1	+24 V	PIN1
2	GND	PIN2

**Motor phases:**  
igus CF77.UL.25.04.D (4G2.5)

U = 1  
V = 2  
W = 3

The PE conductor is not connected

**Hall sensors:**  
igus CF240.PUR.01.08 (8x0.14)C

1	+5 V	red
2	GND	blue
3	H1	white
4	H2	brown
5	H3	green

Output signal: 3 square-wave signals  
The hall signals have a phase shift of 120° to each other.  
Power supply: 5V ± 5%  
Input current: typ. 40 mA

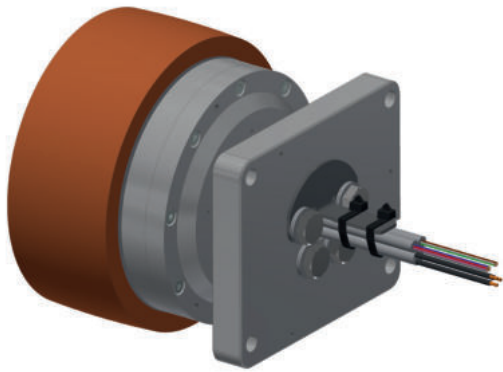
**Encoder:**  
igus CF240.PUR.01.08 (8x0.14)C

1	+5 V	red
2	GND	blue
3	A	gray
4	A-	pink
5	B	green
6	B-	yellow
7	Z	white
8	Z-	brown

Differential output signal:  
3 square-wave signals (RS422)  
Channel A, B (90° phase shift) and  
Index Z  
Accuracy: ± 0.5°  
Power supply: 5V ± 5%  
Input current: typ. 35 mA

# i-Wheel 3213.00-3XXX

## Direct drive - Benefits in a nutshell



- No gearbox – no wear
- Much longer service life compared to conventional drive technology with a gear stage
- Excellent running properties with barely perceptible noise level
- Safe operation due to permanent temperature monitoring
- Ultra-compact with extremely high power density
- Easy replacement of the the wheel coating on site possible thanks to the patented Ketterer solution



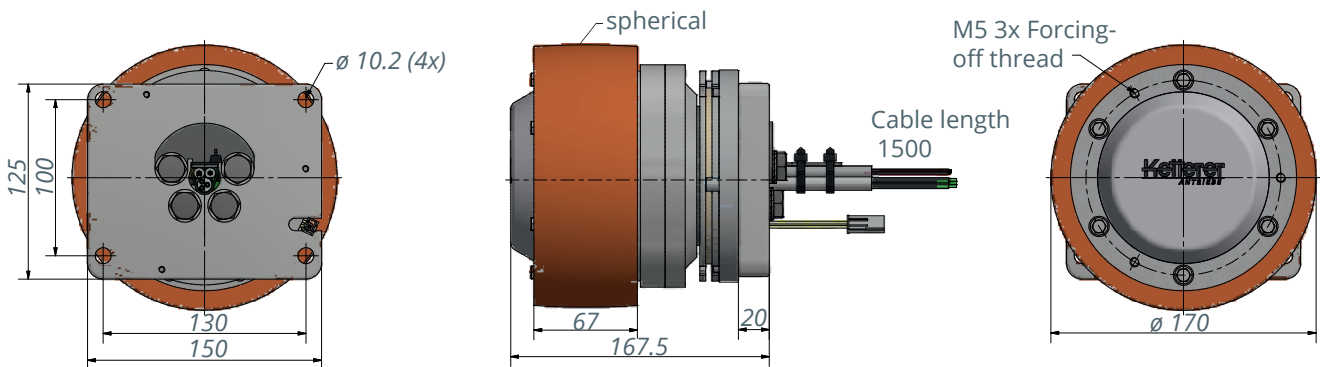
## Safety first

- Rotational control system using diverse redundancy
- **PL-d** safety level achievable with suitable controller
- Safe production processes, as there are no risks of contamination from gear oils and greases (no gearbox)

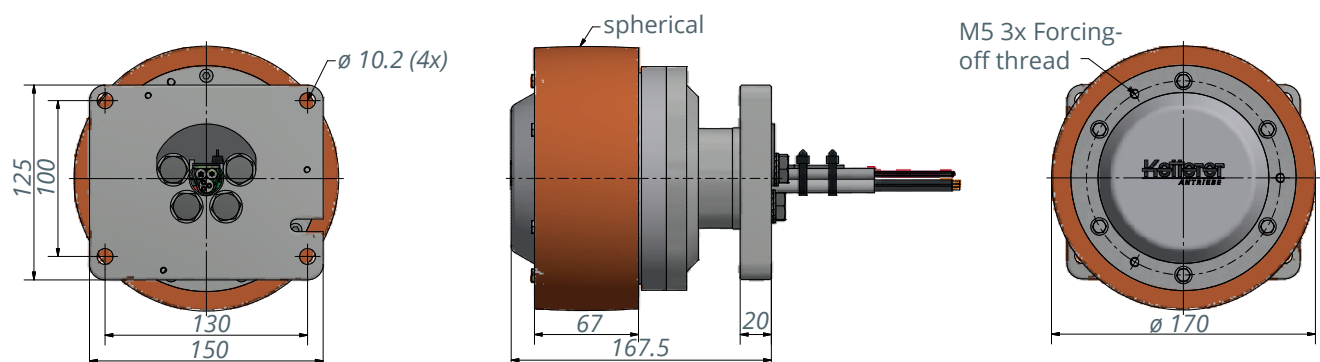
## The choice is yours - we implement it

- Encoder optional: BiSS, SSI, TTL incremental (various resolutions)
- Brake optional: Spring-operated brake
- Can be combined with various controllers
- Customer-specific mechanical integration and system connection

### 3213.00-3XX1 with brake



### 3213.00-3XX2 without brake



# 3213.00-3XXX i-Wheel-A-170-168

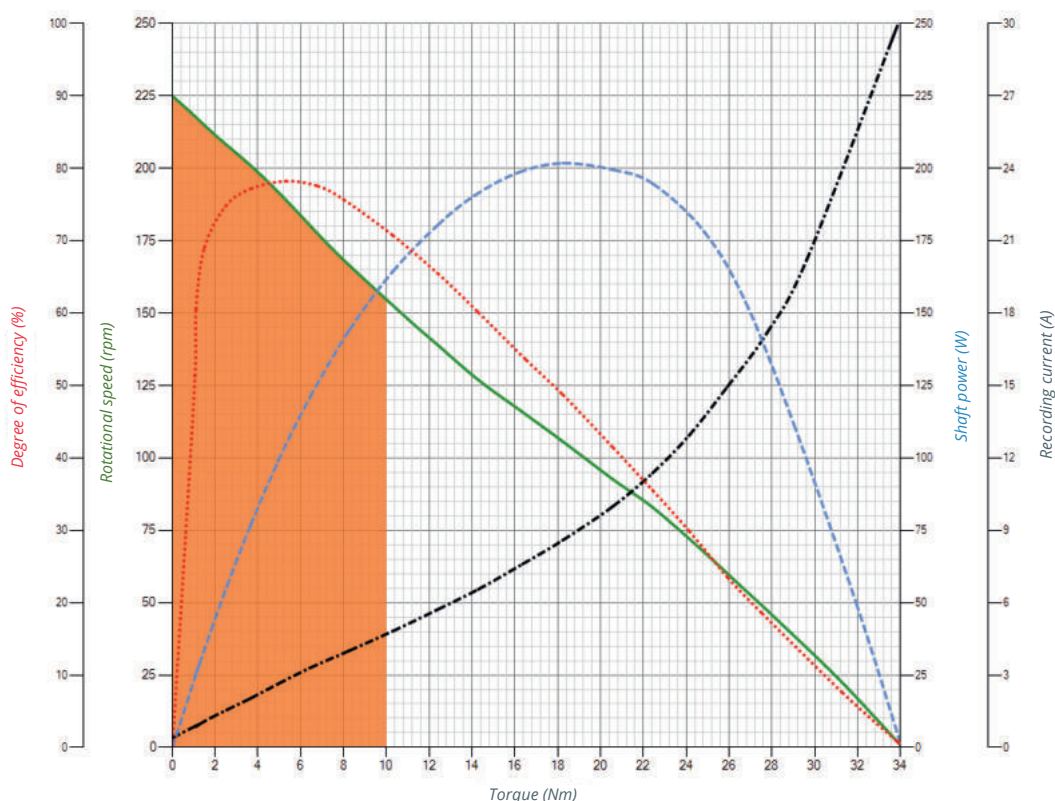
<b>Rated voltage</b>	48 VDC
<b>Rated current<sup>1)</sup></b>	4.7 A
<b>Rated torque<sup>1)</sup></b>	10 Nm
<b>Rated speed<sup>1)</sup></b>	154 rpm
<b>Max. speed at rated torque<sup>1)</sup></b>	5 km/h
<b>Shaft power (output)<sup>1)</sup></b>	161 W
<b>Idle running speed<sup>2)</sup></b>	225 rpm
<b>No-load current<sup>2)</sup></b>	0.4 A
<b>Achievable max. speed<sup>2)</sup></b>	up to 7 km/h
<b>Max. efficiency<sup>2)</sup></b>	78 %
<b>Standstill torque<sup>2)</sup></b>	34 Nm
<b>Starting current at idle speed<sup>2)</sup></b>	29 A
<b>Torque constant<sup>2)</sup></b>	2.1 Nm/A
<b>Speed constant<sup>2)</sup></b>	4.7 rpm/V
<b>Terminal resistance (phase to phase)</b>	1.75 Ohm
<b>Terminal inductance</b>	15 mH

- 1) Max. ambient temperature = 40 °C, controller-specific  
2) At the nominal point (TU = 20°C), controller-specific  
3) Radial and axial forces apply to the nominal service life  
L10h = 20,000h according to DIN ISO 281

# 3213.00-3XXX i-Wheel-A-170-168

<b>Rotor inertia</b>	26,850 kg*mm <sup>2</sup>
<b>Max. radial axle load F<sup>3)</sup></b>	7,500 N
<b>Max. axial axle load F<sup>3)</sup></b>	2,500 N
<b>Number of magnets poles</b>	32
<b>Interconnection of the motor</b>	L62S4
<b>Encoder type in standard</b>	Digital Halls + TTL magnetic incremental ABZ
<b>Encoder resolution</b>	4,096 crp
<b>Material of the coating</b>	Blickle Bestha- ne 92 ±3 Shore A

<b>Braking torque</b>	30 Nm
<b>Power supply brake</b>	24 VDC / 21.5 W
<b>Power consumption brake</b>	7 W through PWM Power reduction
<b>Weight incl. brake</b>	17.6 kg



## Brake:

1	+24 V	PIN1
2	GND	PIN2

## Motor phases:

igus CF77.UL.25.04.D (4G2.5)

U = 1  
V = 2  
W = 3

The PE conductor is not connected

## Hall sensors:

igus CF240.PUR.01.08 (8x0.14)C

1	+5 V	red
2	GND	blue
3	H1	white
4	H2	brown
5	H3	green

Output signal: 3 square-wave signals  
The hall signals have a phase shift of 120° to each other.  
Power supply: 5V ± 5%  
Input current: typ. 40 mA

## Encoder:

igus CF240.PUR.01.08 (8x0.14)C

1	+5 V	red
2	GND	blue
3	A	gray
4	A-	pink
5	B	green
6	B-	yellow
7	Z	white
8	Z-	brown

Differential output signal:  
3 square-wave signals (RS422)  
Channel A, B (90° phase shift) and  
Index Z  
Accuracy: ± 0.5°  
Power supply: 5V ± 5%  
Input current: typ. 35 mA

# i-Wheel Clever 3213.00-21XX

Wheel hub drive with fully integrated Circulo 9 Motion Controller from Synapticon - a compact, intelligent drive system with minimal integration expenses.



**synapticon**  
INTEGRATED MOTION



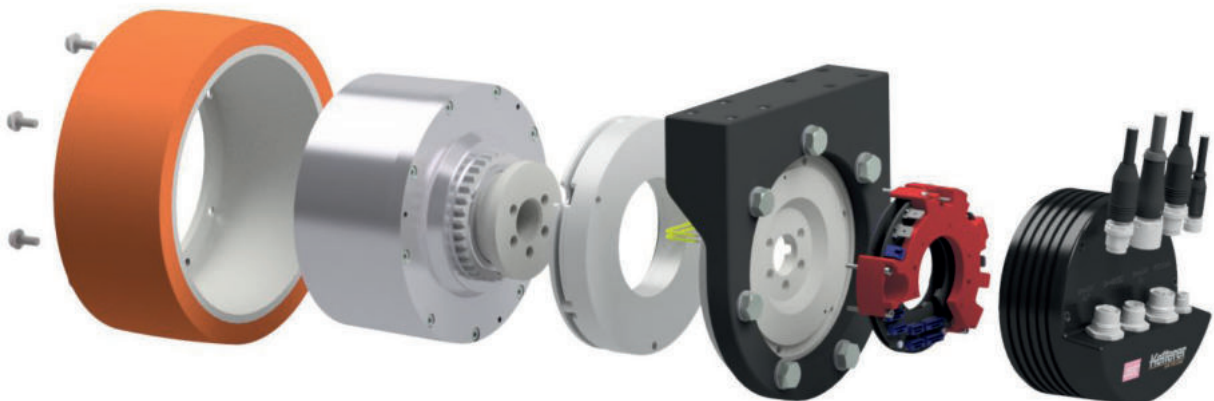
## Direct drive: Advantages in a nutshell

- No gearbox – no wear
- Much longer service life compared to conventional drive technology with a gear stage
- Excellent running properties with barely perceptible noise level
- Safer operation through permanent temperature monitoring
- Ultra-compact with extremely high power density
- Easy replacement of wheel coating on site possible thanks to patented Ketterer solution



## Overall System: Intelligent - Safe - Ultracompact

- Optimum Performance Scaling: Available in all three Ketterer standard performance classes of the i-Wheel family
- Highest performance in drive control in the smallest installation space
- Easy to Use: Seamless Integration in a few easy steps
- Plug & Play: Standard plug & standard cable can be used
- High speed EtherCAT interface, low latency, negligible jitter
- Over 10 certified safety functions (SIL2, PL-d)
- High Resolution Absolute Encoder
- User-friendly Synapticon parameterization and tuning software
- Model predictive field-oriented control for high efficiency, maximum bandwidth
- Optional emergency stop brake with energy saving mode
- Available in the near future: Circulo 9 with Safe Motion Module





3213.00-21XX i-WheelC-A-170-185	
<b>Rated voltage</b>	48 VDC
<b>Rated current<sup>1)</sup></b>	4.5 A
<b>Rated torque<sup>1)</sup></b>	5 Nm
<b>Rated speed<sup>1)</sup></b>	316 rpm
<b>Max. speed at rated torque<sup>1)</sup></b>	10 km/h
<b>Shaft power (output)<sup>1)</sup></b>	165 W
<b>Idle running speed<sup>2)</sup></b>	450 rpm
<b>No-load current<sup>2)</sup></b>	0.3 A
<b>Max. efficiency<sup>2)</sup></b>	82 %
<b>Standstill torque<sup>2)</sup></b>	19.7 Nm
<b>Starting current at idle speed<sup>2)</sup></b>	35 A
<b>Max. radial axle load F<sup>3)</sup></b>	2,500 N
<b>Max. axial axle load F<sup>3)</sup></b>	1,250 N
<b>Encoder resolution</b>	262,144 cpr
<b>Material of the coating</b>	PU-Rad: 92° ±3° Shore A
<b>Braking torque of the emergency stop brake</b>	16 Nm

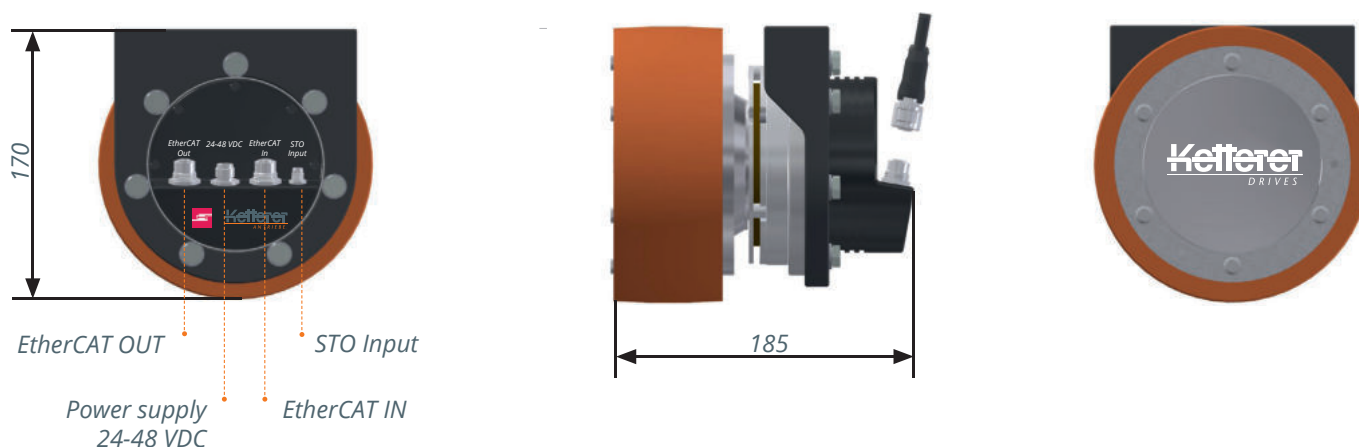
1) Max. ambient temperature = 40 °C, controller-specific

2) At the nominal point (TU = 20°C), controller-specific

3) Radial and axial forces apply to the nominal service life  
L10h = 20,000h according to DIN ISO 281

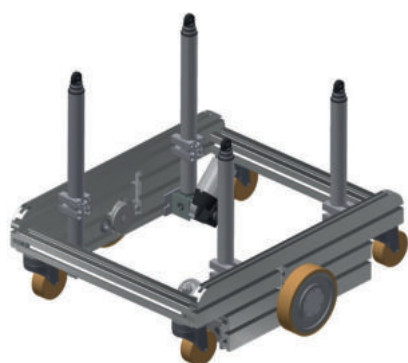
Circulo 9 Motion Controller by Synapticon	
<b>Communications interface</b>	EtherCAT, FSoE (FailSafe over EtherCAT)
<b>Rated voltage range</b>	24 - 48 V DC
<b>Max. voltage</b>	60 V DC
<b>Continuous phase current RMS</b>	20 A
<b>Max. efficiency</b>	99 %
<b>Hardware Protection</b>	Overcurrent, overvoltage, undervoltage, PW deadtime, overtemperature, PWM shoot through
<b>Standard Safety Functions</b>	STO/SBC
<b>Safe Motion Modul</b>	FSoE, STO, SBC, SS1/2, SOS, SMS, 4xSLS, Safe Process Data (position, velocity)
<b>Certified Safety Functions</b>	STO – SAFE TORQUE OFF SBC – SAFE BRAKE CONTROL SBT – SAFE BRAKE TEST* SS1 – SAFE STOP 1 SS2 – SAFE STOP 2 SLS – SAFELY LIMITED SPEED SLP – SAFELY LIMITED POSITION* SLT – SAFELY LIMITED TORQUE* SAFE VELOCITY PROCESS DATA SAFE POSITION PROCESS DATA SAFE TORQUE PROCESS DATA SAFE DIGITAL GPIO AND ANALOG INPUTS
	*The functions must be implemented in the safety controller using secure process data

## i-Wheel Clever 3213 with integrated Circulo 9 Motion Controller by Synapticon





# Ket-Rob - Drive platform for AGV/AGC



## Description

Tailored to the requirements of autonomous robot technology, Ketterer offers a modular drive platform for **Automated Guided Vehicle** systems or - **Carts (AGV/AGC)**.

All components are designed for simple integration.

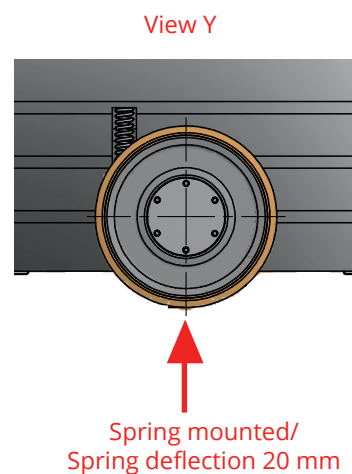
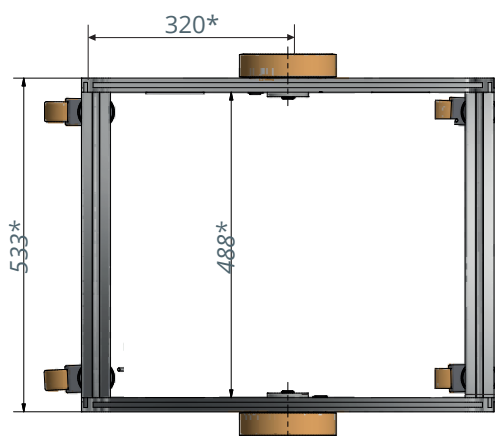
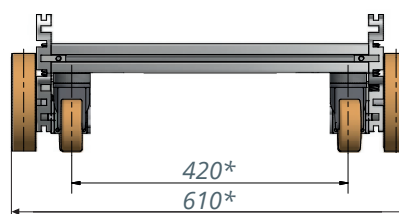
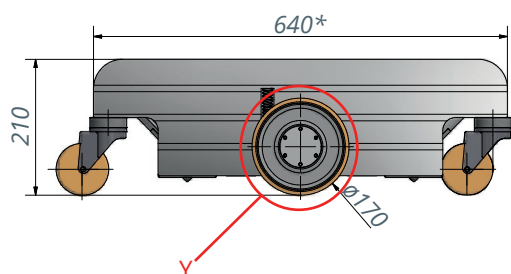
## Your benefits

- Complete basic drive module for **Automated Guided Vehicle** systems or - **Carts (AGV/AGC)**
- Dimensioning of the drive platform according to individual requirements
- Gearless BLDC wheel hub drives with a durable Vulkollan or solid rubber wheel
- Noise-reduced direct drive with spring suspension (spring travel 20 mm). Therefore driving on uneven surfaces is not a problem
- Large design scope of the vehicle structure due to very low installation depth of the wheel hub drives
- Very quiet in operation
- Maintenance-free, therefore no maintenance and service needed
- Load platform height adjustment and load platform in accordance with customer-specific requirements optionally possible
- Customer-specific adaptations of the drives or systems are possible

## Technical data

	<i><b>Ket -Rob</b></i>
<b>Power supply</b>	24 V- 48 V
<b>Utilize speed</b>	7 km/ h
<b>Acceleration</b>	0.5 m/s <sup>2</sup>
<b>Max. Engine power (per drive unit)</b>	210 W
<b>Load capacity</b>	100 kg
<b>Starting torque (per drive unit)</b>	6 Nm
<b>Braking torque (per brake)</b>	9 Nm
<b>Power supply brake (per drive unit)</b>	24 V/ 18 W
<b>Driving direction</b>	forward and backward
<b>Ground clearance</b>	30 mm
<b>Max. incline</b>	4 %
<b>Protection class</b>	IP 20
<b>Operating temperature</b>	5 to 40 °C (Humidity 10-90 % non-condensing)

## Basis: Without height adjustment for transport platform



\* Dimensions can be customized

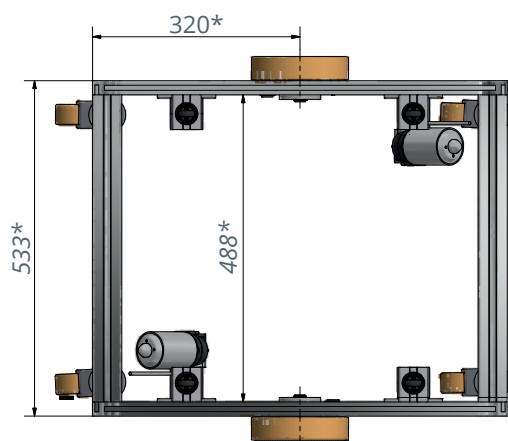
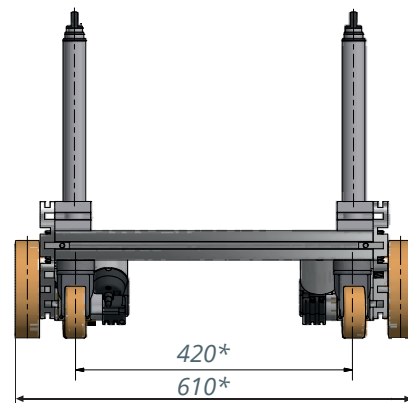
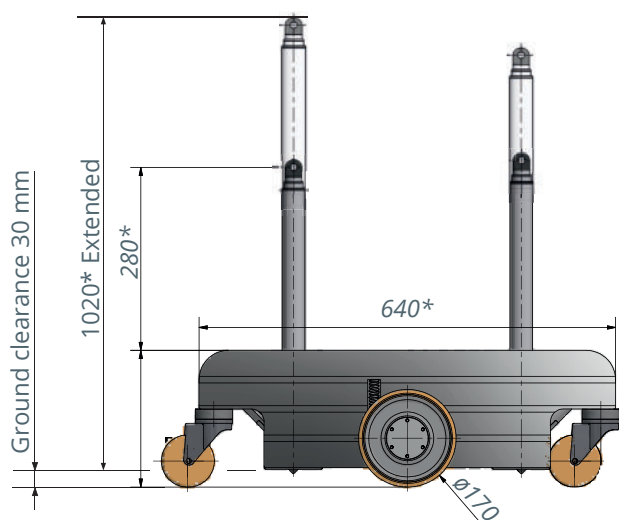
## Ket Rob consists in the standard version of:

- 2 x BLDC wheel hub drives with encoder and brake (without regulation/control)
- 4 x load bearing steering wheels
- Frame

## Additional options:

- Height adjustment for transport platform
- Transport platform

## Additional option: Height adjustment for transport platform



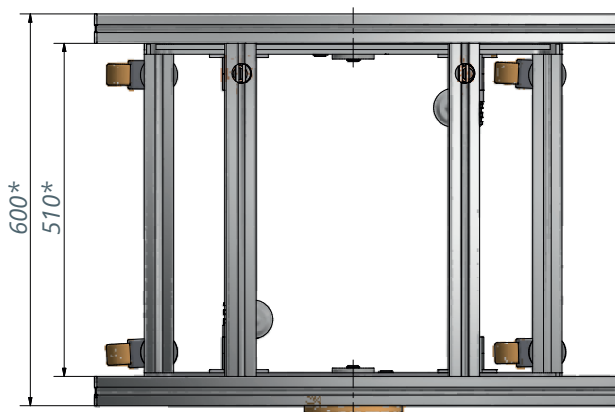
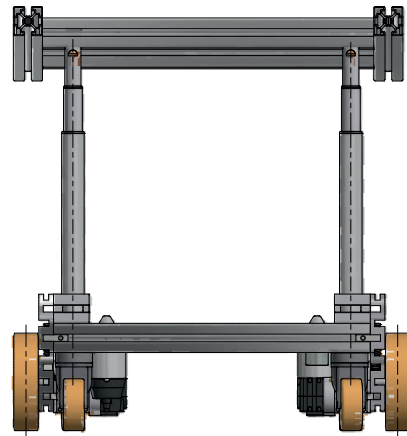
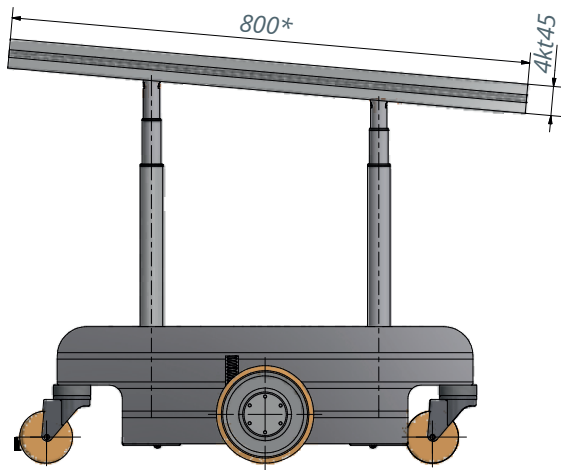
\* Dimensions can be customized

## Technical notes

- For the linear height adjustment many Ketterer standard solutions conceivable: e.g. 3120, 4643, 4114, ..... Information about these products can be found at [www.ketterer-drives.com/products](http://www.ketterer-drives.com/products)
- Customer-specific adaptations are possible



## Additional option: Transport platform



\* Dimensions can be customized

## Orientation aid

In the era of Industry 4.0 and Big Data, it is unimaginable to do without Automated Guided Vehicle Systems (AGVS) and Automated Guided Vehicles (AGV).

They have become a component of modern intralogistics solutions.

### *Automated Guided Vehicle Systems (AGVS)*

*Automated Guided Vehicle Systems are floor-bound systems that are used in-plant, inside and/or outside of buildings. They essentially consist of one or more automatically controlled vehicles, guided without contact, with their own travel drive and, if necessary, of*

- *a master controller,*
- *a device for location determination and position detection*
- *a device for data transmission and*
- *infrastructural and peripheral devices*

*The main task of an AGVS is the automatic transport of materials. In the broader sense, AGVSs also include systems that are used for service tasks such as handling, monitoring, cleaning, mobile information and guidance – including in areas accessible to the general public.*

*VDI guideline 2510*

### *Automated Guided Vehicles (AGVs)*

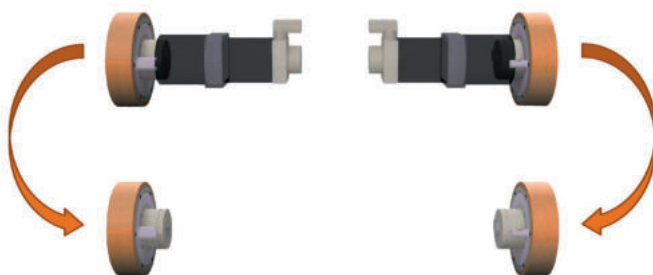
*Automated Guided Vehicles (AGVs) are floor-bound conveyances with their own travel drive, which are automatically controlled and guided without contact.*

*They are used for the transport of materials, i.e. for pulling and/or carrying conveyed goods with active or passive load handling devices. This guideline deals with vehicles with wheel drives. Rail-guided vehicles, air-cushion vehicles and walking machines are excluded.*

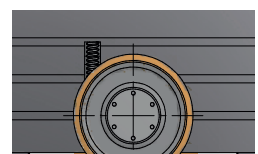
*VDI guideline 2510*



More space due to gearless configuration

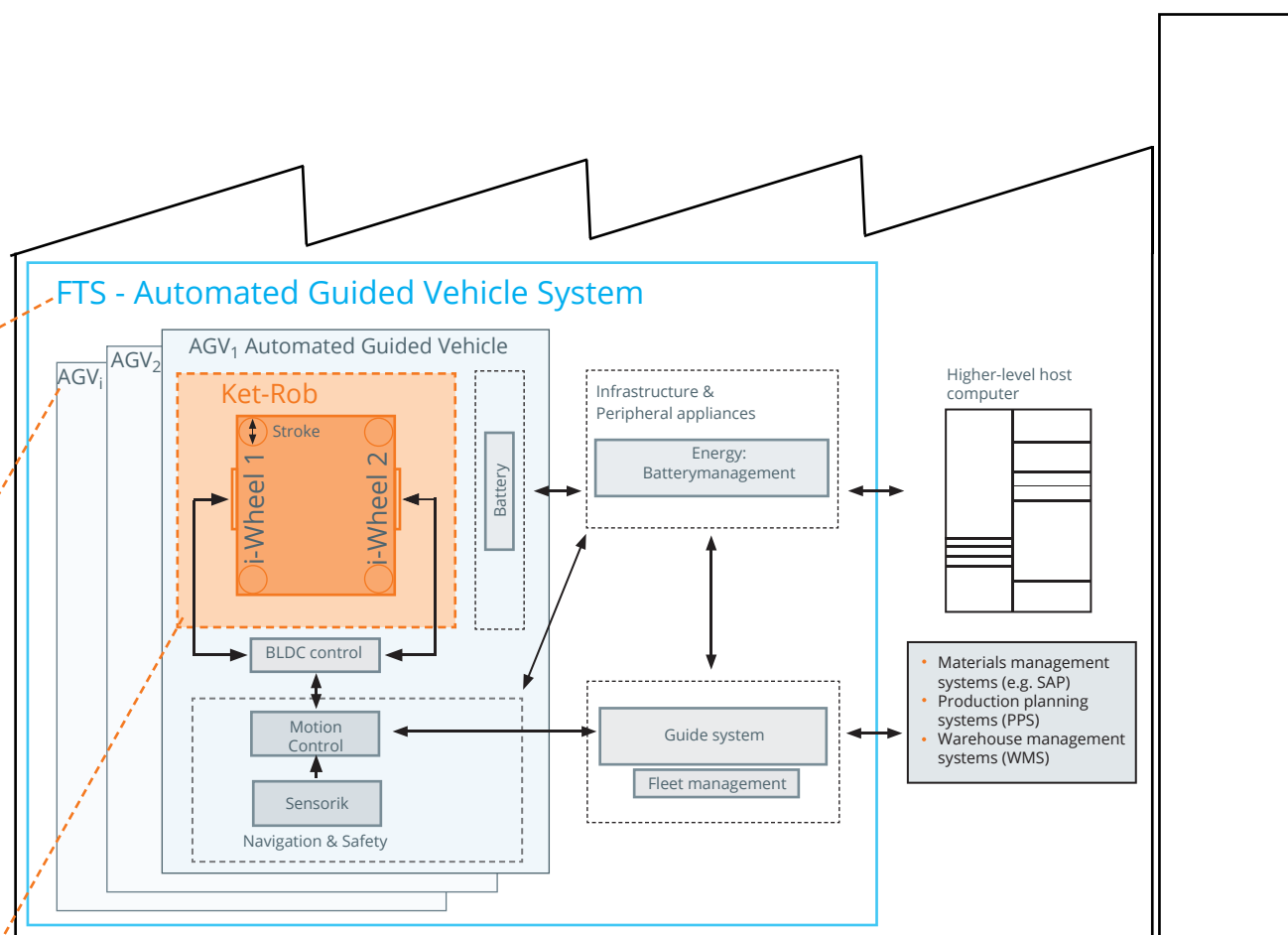


Drives with spring suspension – uneven surfaces are not a problem



Spring-loaded/  
Spring deflection 20 mm





## Ket-Rob – more time for essentials

Ketterer's drive platform „Ket-Rob“ enables the project manager, in the development of an AGV / AGVS, to concentrate on the complex part of the work, i.e. the proprietary application and idea, including the programming and coordination of the necessary control systems.

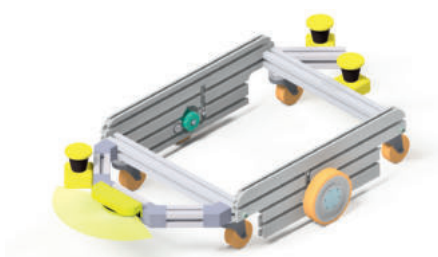
If the controller is to be evaluated, the Ketterer platform enables a prototype for an AGV / AGVS to be created and tested very quickly. The time saved can be used in the development of system variants in order to find the optimum solution for the in-house AGV / AGVS.



Variable  
dimensioning



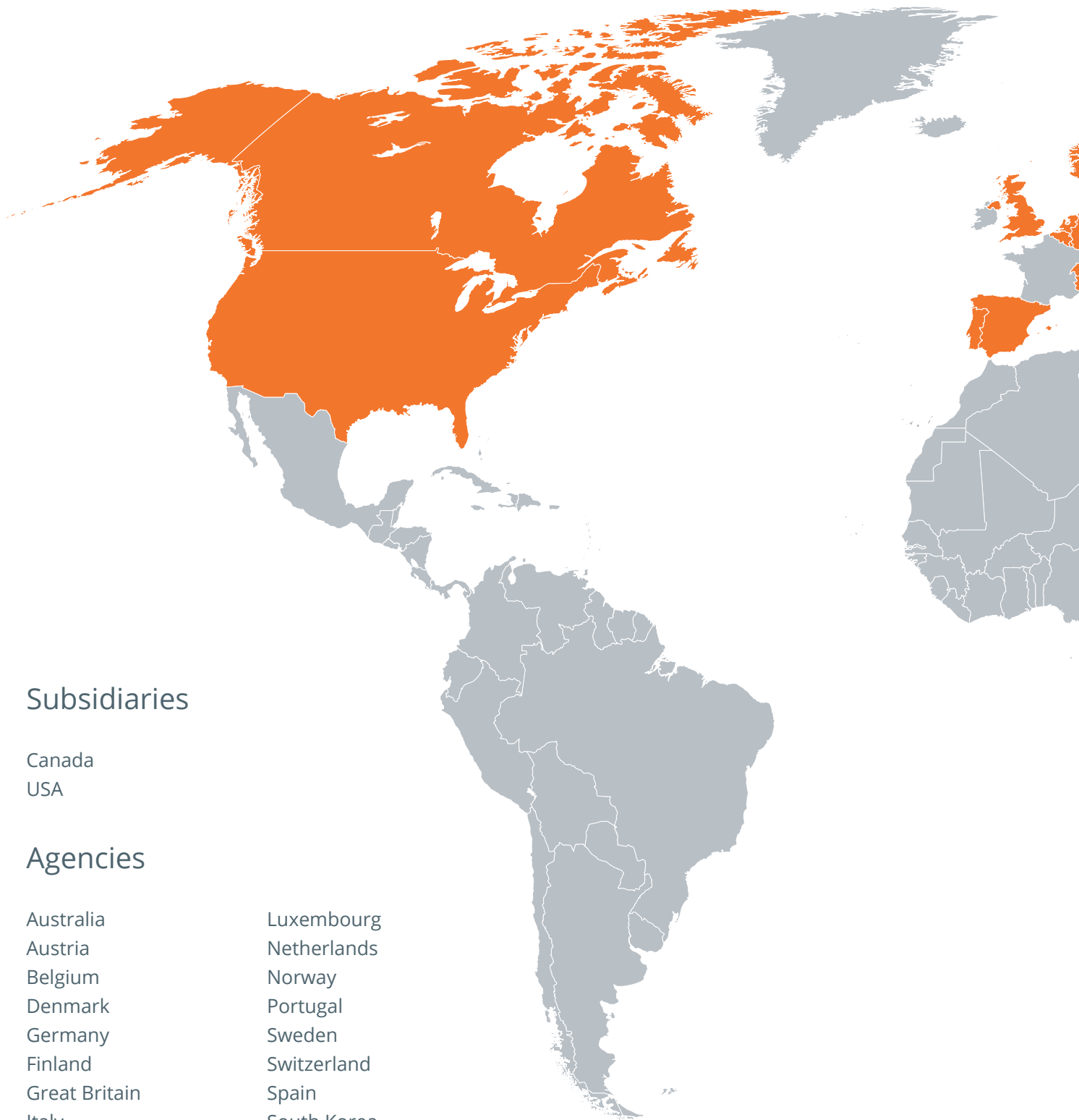
Frame prepared for  
the mounting of sensors



Optionally with lifting  
and/or tilting unit



# USED AROUND THE WORLD



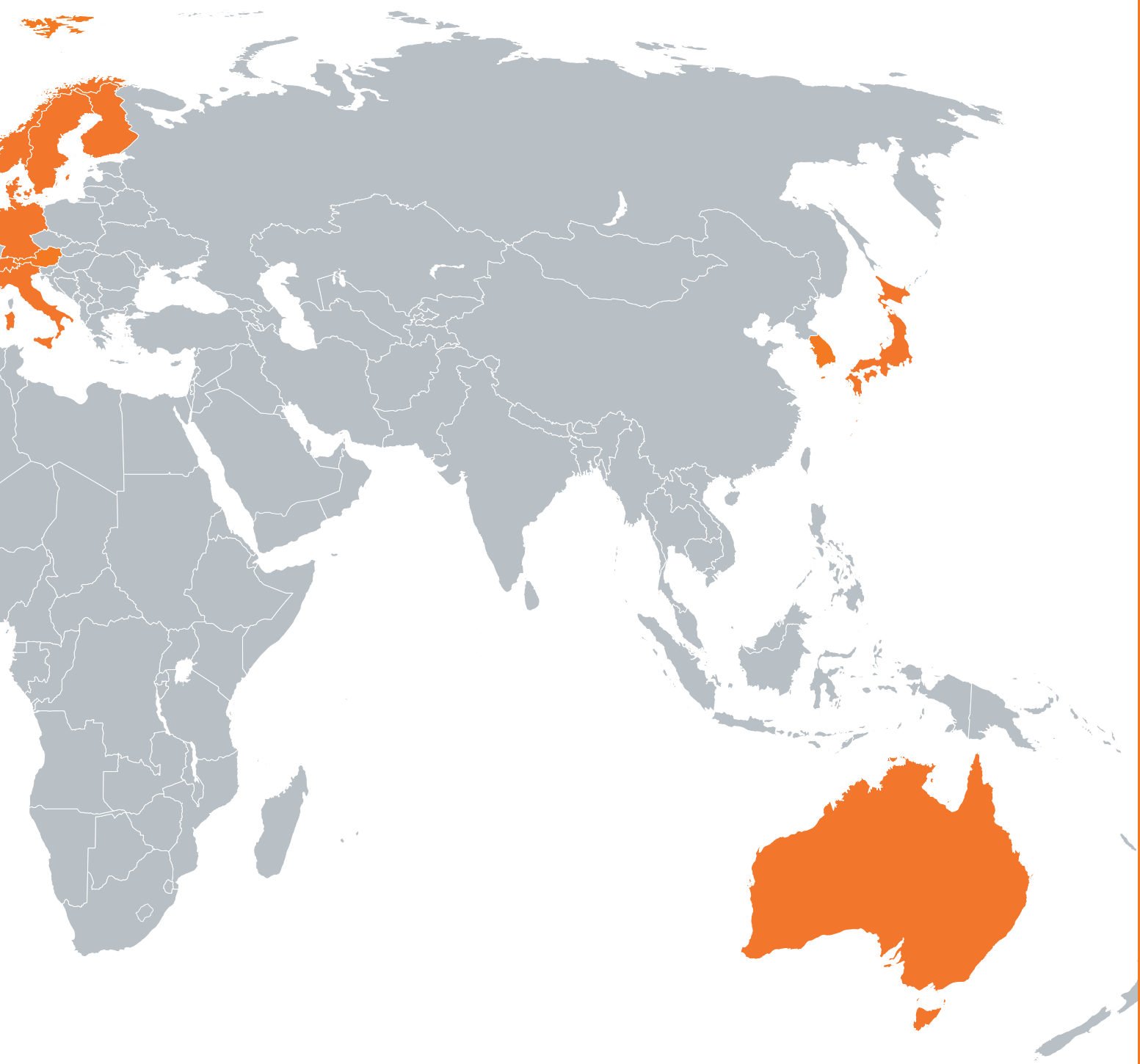
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