AGV Guidance Technologies

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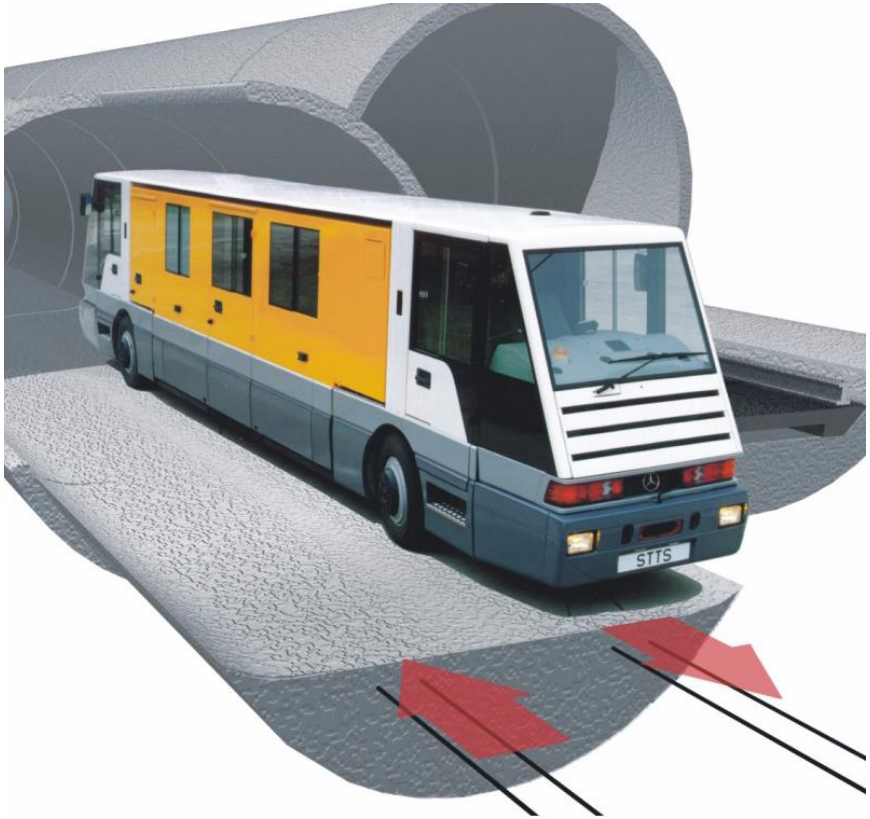
Germany

We are located near Hannover in the green heart of northern Germany

The old part is a farmhouse over 300 years old – with a new extention to host the state of the art technology designed today

Götting KG

- Founded 1965 / approx. 50 professionals (development, manufacturing, etc.)
- Started with the development of amateur radio transceivers
- Changed to industrial applications in the early 1980, ever since involved in guidance sensors for indoor AGVs + RF data transceivers



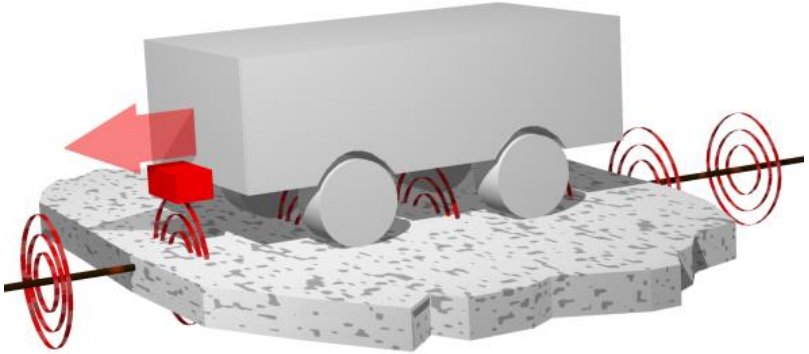
Götting KG

Current Projects

- Automation of trucks in industrial applications for internal transportation
- Full automation of excavators in salt mines
- Automation of outdoor AGVs
  - Airbus wing carrier
  - Sludge turners for water treatment plants
  - Front loaders in organic waste management
  - and many more

Guidance Technologies

Wire Guidance

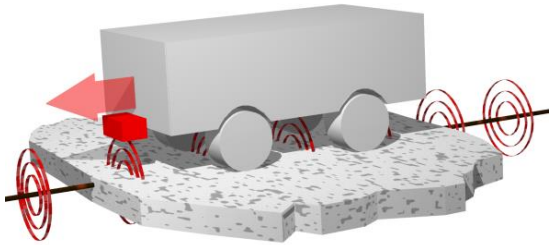


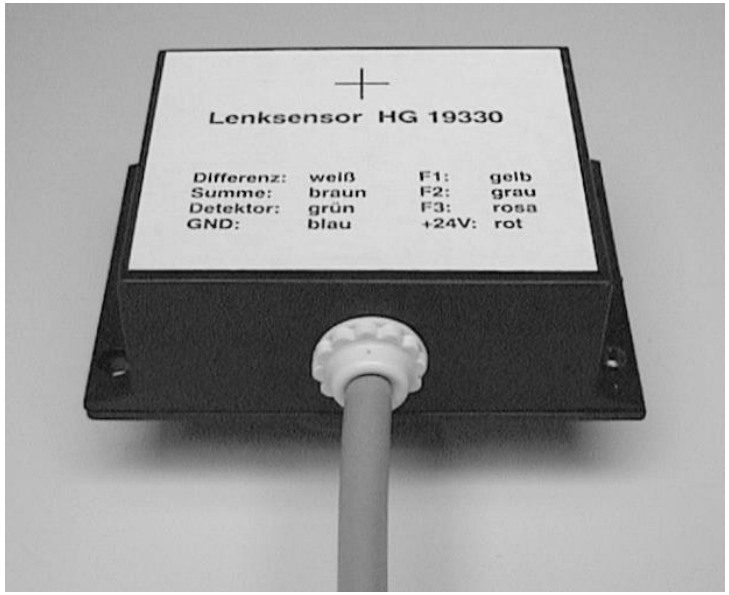
- A current carrying wire in the ground generates a rotational-symmetric alternating magnetic field
- The guidance antenna receives the horizontal and vertical components and extracts the sum (Usum) and difference voltage (Udif)
- Height or current strength deviations may be compensated in an external computer unit
- For each direction of travel at least 1 guidance antenna is necessary

Wire Guidance

Components

- Guidance Antennas, examples
- Frequency Generator, example





Wire Guidance Application Examples

Wire Guidance
Application Examples

Guidance Technologies

Wire Guidance

Advantages

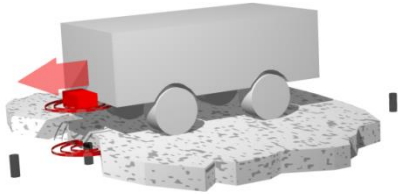
- high reliability
- high accuracy
- not influenced by snow, ice, dirt, etc.
- low costs

Disadvantages

- metal in the ground may influence the operation
- additional sensors are necessary for longitudinal information
- guide wire must be installed permanently =>
  changing the course is costly

Guidance Technologies

Transponder



- Passive, inductive transponders (or Tags) are installed along the intended course in the ground

- The transponders are supplied with energy each time a positioning antenna on the vehicle crosses over. This generates the return signal of the transponder code to the positioning antenna

- The position of the transponder underneath the antenna is immediately recognized and output as x-y-deviation from the antenna origin (center of the antenna)

Automatic Guidance of Vehicles

Features

- Recognition of the absolute lateral position
- High accuracy ±10 mm
- 1-dimensional / 2-dimensional Systems available
- 2-dimensional Systems additionally recognize the sideways deviation
- Used on RMG, STS, AGV
- For noise reduction different frequencies are available: 128 kHz / 13,56 MHz

Positioning and identification systems using transponders (or tags; as they are often referred to) are ideally suitable for the use on any railmounted cranes or vehicles. 2-dimensional Systems are used for AGV.

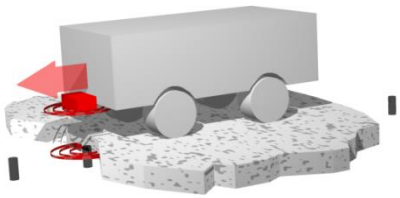
Components

Examples of Transponder reader designs

- Transponder Reader (mounted onto the vehicle/crane)
- Transponders (e.g. mounted into the railway)

- Available interfaces:
  - CAN
  - RS422/RS232
  - Profibus

Transponders (RF ID) for Positioning



- identfication of the Transponder code
- passive maintenance free Transponders
- only 1 Transponder code can be identified at the same time
- differenciation between the following signals:
  - Transponder in field
  - Transponder at center of antenna (mid-point crossing pulse)

How can these systems solve your problem

Applications

Positioning of guided systems

- Conveyors and automated assembley platforms

How can these systems solve your problem

Applications

Positioning of guided systems

- Rail-mounted Container Cranes
- Ship-to-Shore Cranes

Transponders for Guidance and Navigation

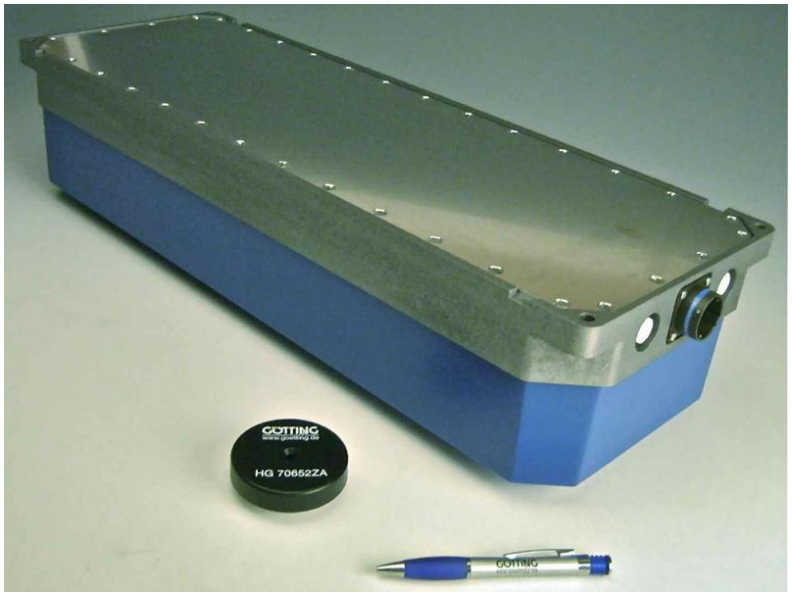
- identfication of the Transponder code
- passive maintenance free Transponders
- only 1 Transponder code can be identified at the same time
- differenciation between the following signals:
  - Transponder in field
  - Transponder at center of antenna (mid-point crossing pulse)
  - Determination of sideways deviation at mid-point crossing pulse

How can these systems solve your problem

Applications

Transponders for Navigation

- Automated trucks
- Coil Transporters
- Feeding robot



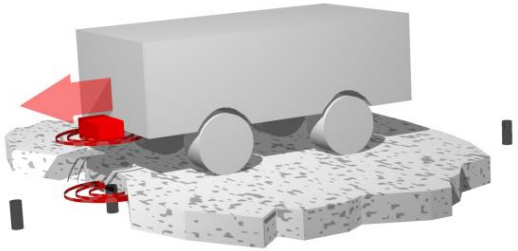
Applications

Transponders for Navigation

- Automated trucks
- Coil Transporters
- Feeding robot

Guidance Technologies

Transponder



Advantages

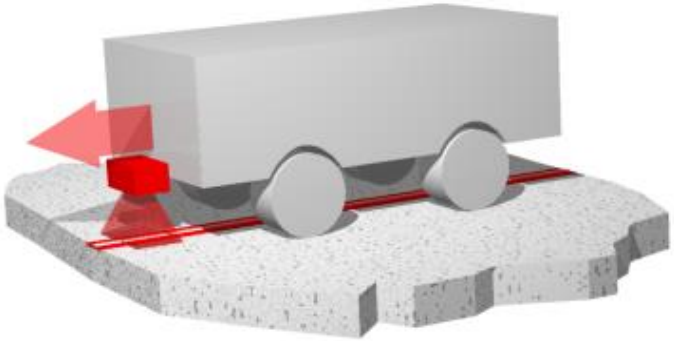
- high accuracy
- independent system
- not influenced by snow, ice, dirt, etc.

Disadvantages

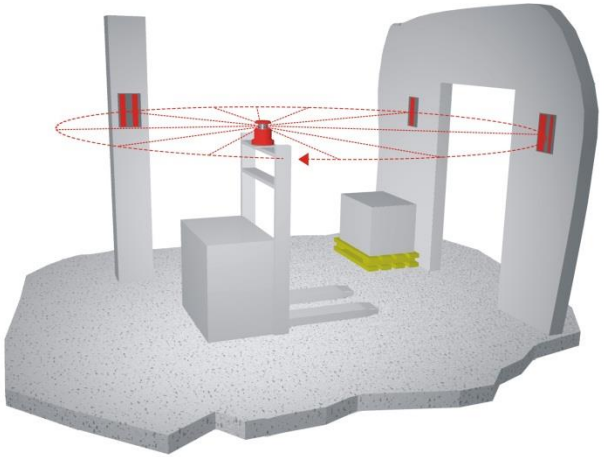
- structure of the antennas may not be suitable for every vehicle
- metal in the ground may influence the system reading range

Guidance Technologies

Optical/Laser



- Camera/interpreter assembleys enable guiding vehicles along a taped or painted line on the ground
- A 360° Laser Scanner Sensor is used for vehicle positioning and guidance
- Obstacle recognition with the aid of Laser Scanners as additional feature for automated guided vehicles (AGV)
- Laser Scanners enable environment detection and allow orientation along changing environments



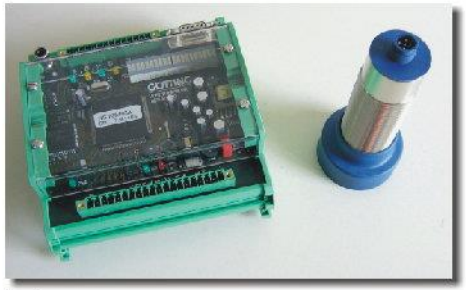
Optical Systems for AGV Guidance

Optical Guidance

Simple & flexible guidance for indoor and outdoor vehicles

- ➜ Simple installation of guidance lines as painted or taped band
- ➜ Low cost environment
- ➜ High flexibility
- ➜ Very reliable operation
- ➜ Special equipment for indoor and outdoor applications available

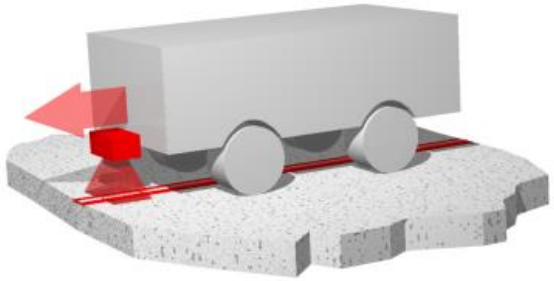
Application Examples



Indoor:
Controller HG 73840 and
Rod Camera HG 73841

Outdoor:
Controller HG 73830 for
2 Cameras and Ball Camera

Optical Line Guidance



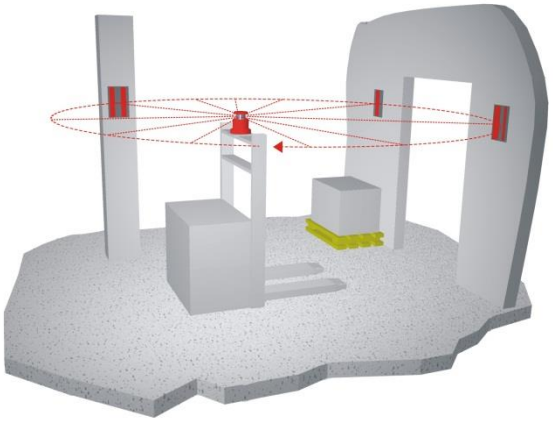
- A painted or taped line on the ground is used as guidance line
- A contrast between guidance line and floor is required:
  - Dark on light ground

    or
  - Light on dark ground
- For position information along this guidance line an additional system, e.g. small transponder system is required

Optical Line Guidance

- Indoor AGV in process optimization

Laser Scanner Guidance



- Reflecting marks on the walls / structure enable the Laser Scanner to calculate ist position accuractely within a defined area
- Extremely flexible
- Reflecting marks all have to be on the same level
- indoor use (IP65)

Laser Scanner Guidance

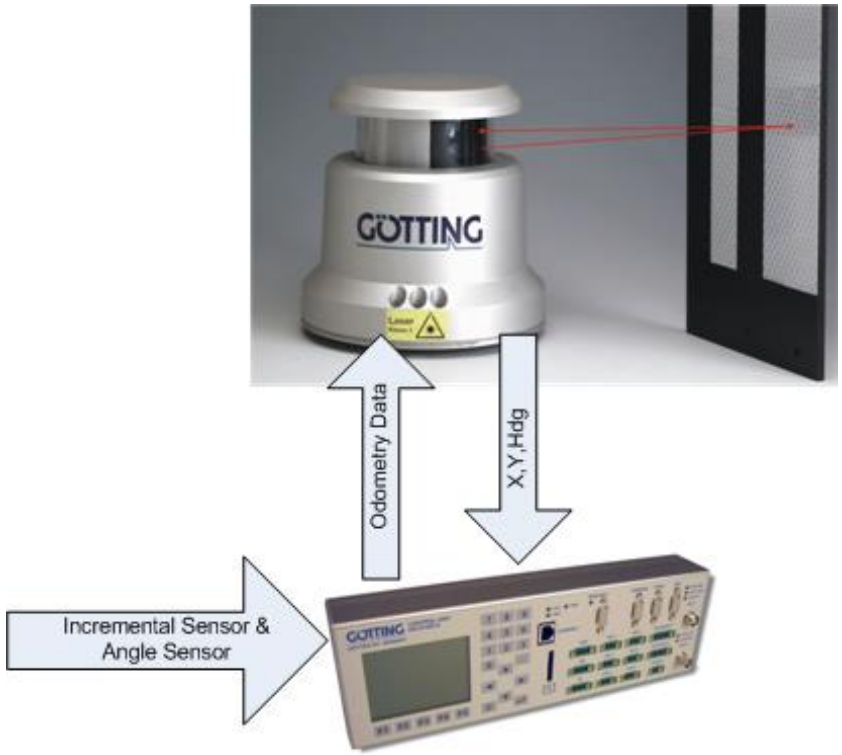
➢ use on indoor AGV in applications that require flexibility or do not allow any installations on the ground

Laser Scanner Guidance

- communication with vehicle controller directly via CAN bus

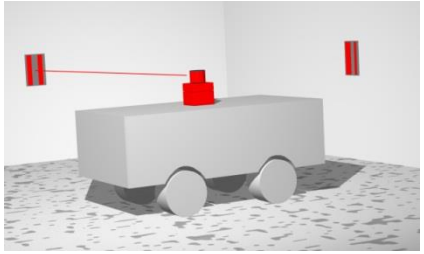
or

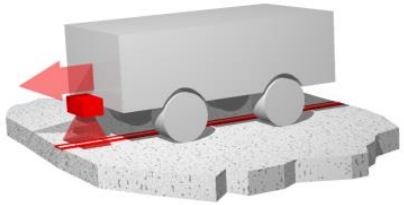
- through Götting Navigation Controller to the Vehicle Controller with the options: CAN, Ethernet, Profibus



Guidance Technologies

Optical/Laser





Advantages

- high reliability
- high accuracy
- low costs
- not influenced by metal in the ground

Disadvantages

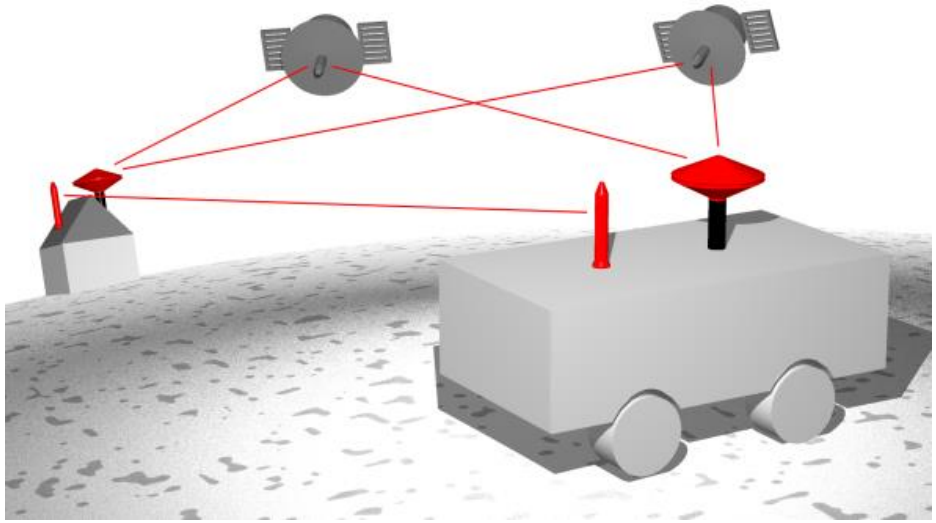
- snow, dirt, light may influence the system performance
- additional sensors are necessary for longitudinal information

Guidance Technologies

DGPS

- Using 24 satellites that rotate swayingly around the equator, the position of a GPS antenna on top of a vehicle is determined

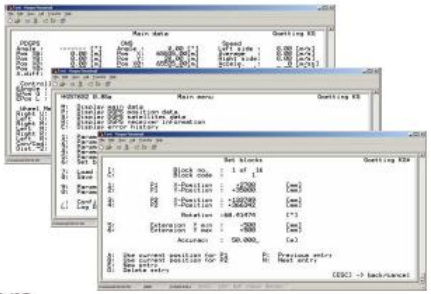
- A correcting fixed reference unit and carrier phase evaluation of the received signal improve the accuracy to cm-level



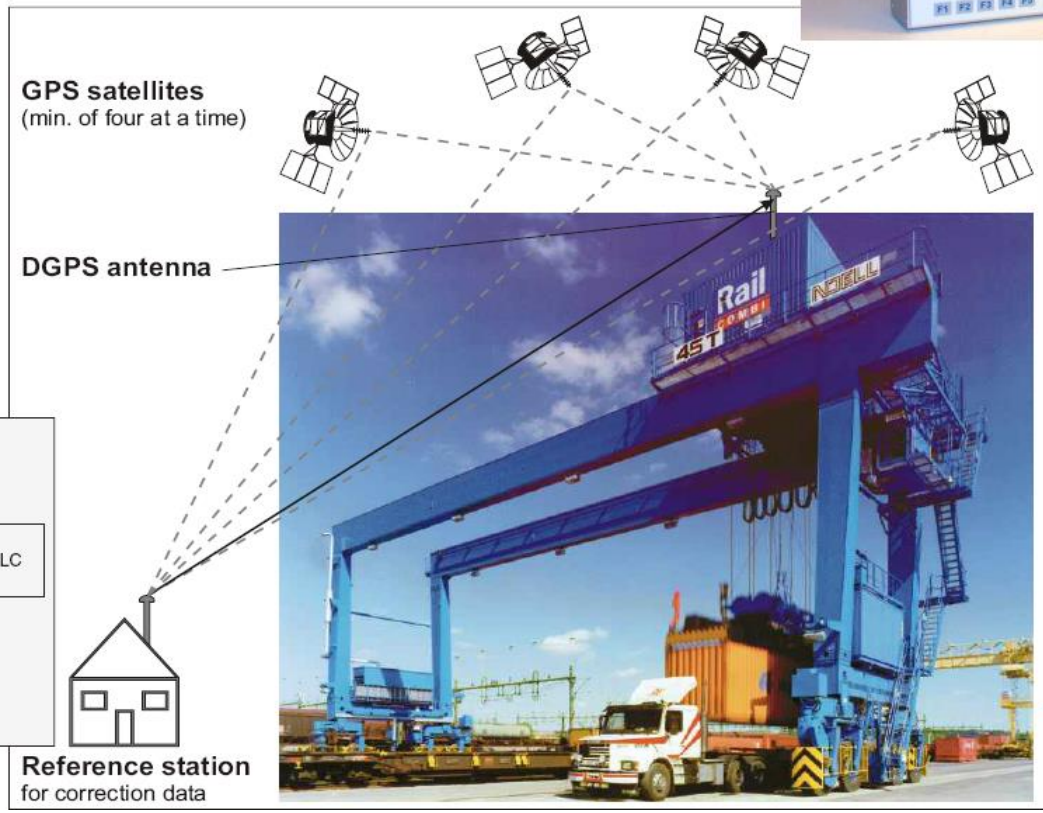
Automatic Guidance of Vehicles

Features

- ➜ Container Tracking
- ➜ Autosteering
- ➜ Steering accuracy better ±10 cm
- ➜ Only incremental encoders for the gantry and a PLC-interface required
- ➜ Service friendly through built-in display and keyboard or PC-Interface

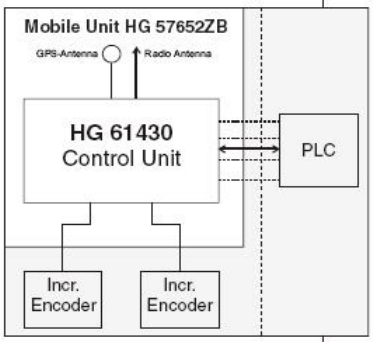


Hardware



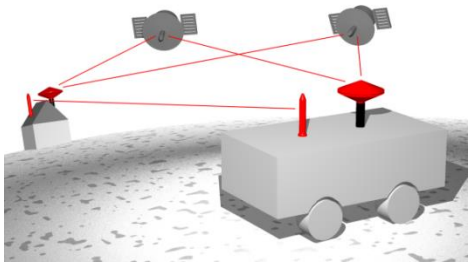
- ➜ Base station HG 57652ZA
  Existing base stations can be integrated
- ➜ Mobile Unit HG 57652ZB
  various interfaces supported
  - Inputs for encoders
  - Serial interfaces RS232
  - CAN
  - Ethernet
  - Profibus

Principle Layout



GÖTTING

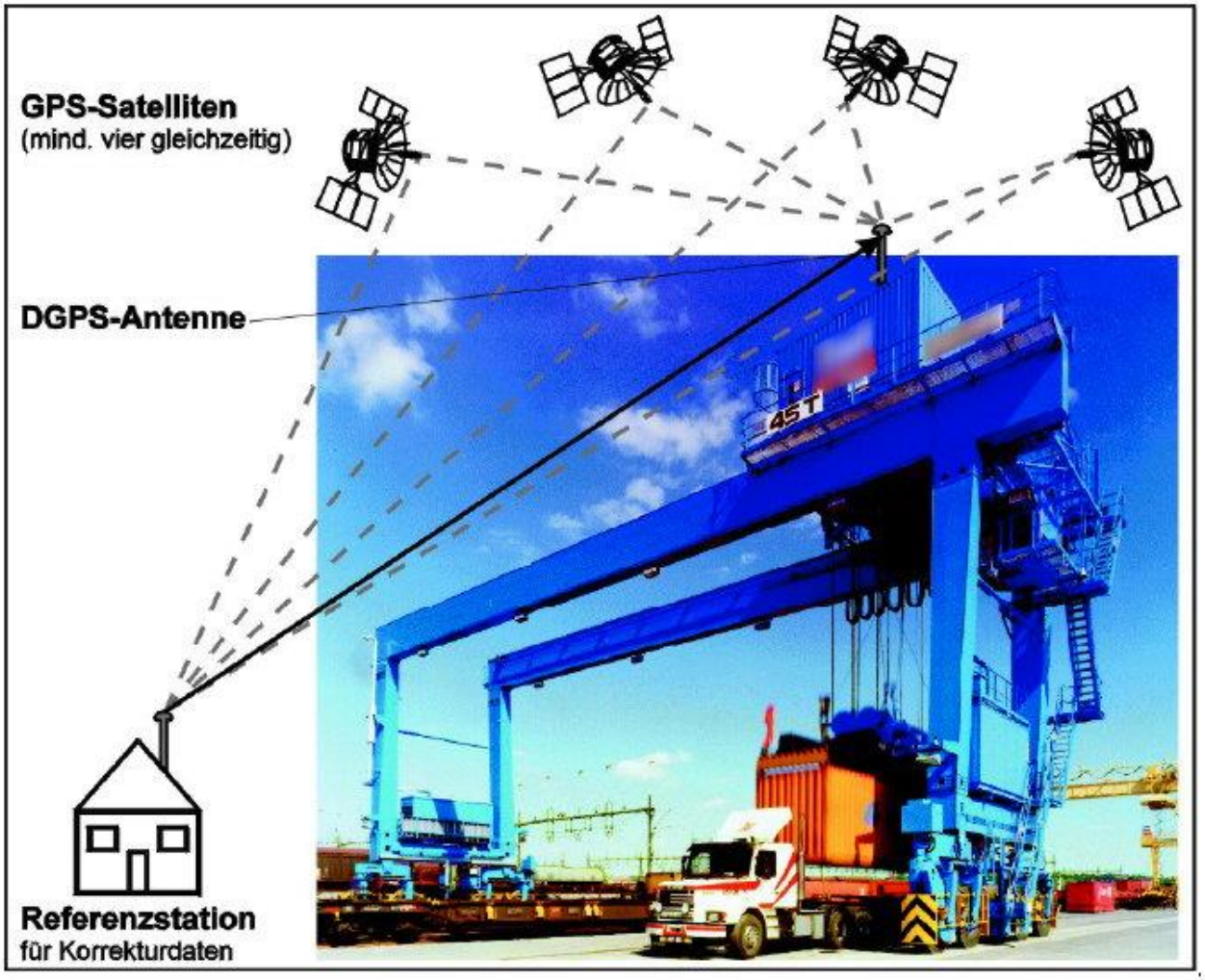
High Precision DGPS



- outdoor use only!
- free sight to the satellites required
- very flexible
- only environmental installation required is the reference unit

High Precision DGPS

- principle

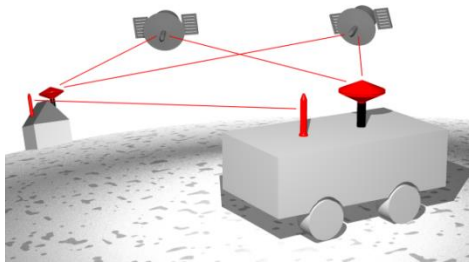


High Precision DGPS

- Container Cranes

Guidance Technologies

DGPS



Advantages

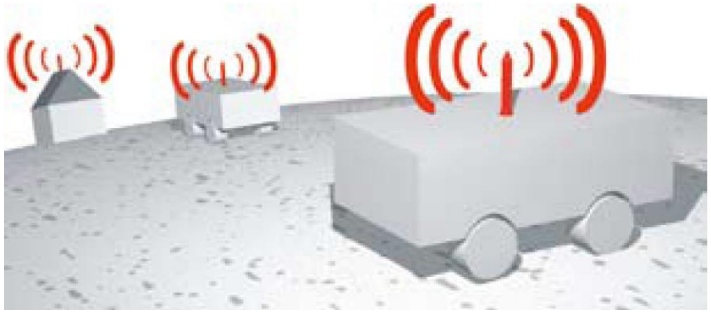
- no environmental installations necessary
- not influenced by snow, ice, dirt, etc.
- track can easily be changed by mere software changes

Disadvantages

- free sight to the satellites must be guaranteed (approx. 170° round sight)
- high costs, especially for applications with few vehicles due to required reference unit

RF Data Communication

- Narrow-band low power devices
- Board band RF data communication modems
- Customized solutions for high-speed data transmission



Semi Automatic Convoi

Principle Structure

- A man-driven front vehicle is followed by a number of unmanned vehicles at a set distance between them

Applied Technologies

- Laser Scanners for verification of distance
- Encoders on both vehicles for synconisation
- RF Data communication between the vehicles

Application Examples

- **Wing carrier (Airbus; wire guidance)**

Thank you for your kind attention !