Navigation Controller

The Navigation Controller is used for the track guidance of Automated Guided Vehicles (AGV) along virtual tracks. It has the following tasks:

1. Determination of the current position via transponder, GPS or external systems.

2. Reconstruction of the route to be driven (by means of segment files).

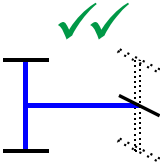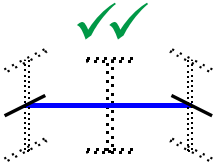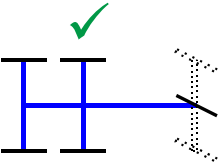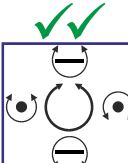3. Track guidance (navigating the vehicle along the track).

Photo: Navigation Controller Hardware HG G-61430ZD

Suitable and Unsuitable Vehicle Types

Particularly suitable are all vehicles that operate predictably and reproducibly. Several non-steered axles, trailers or vehicles with a center pivot steering are not suitable. The wheel slippage has to be low and the wheels should be hard to minimize friction.

One fixed axle	Symmetrical steering	Two fixed axles	coordinate chassis / omnidirectional vehicles
particularly suited	particularly suited	less accuracy and partly rubbing, grinding wheels	particularly suited
e.g. fork-lift truck	e.g. some heavy duty vehicles	e.g. large towing tractors	e.g. special vehicles

Examples of automated vehicles

Interfaces

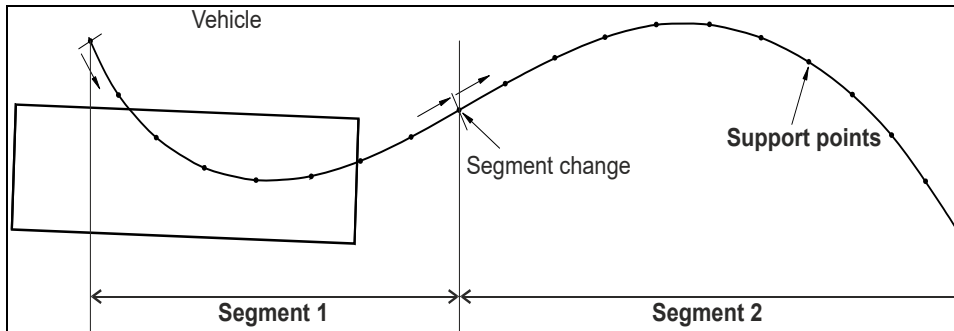| Label	Function	Label	Function
ETH	RJ 45, Ethernet	SIO 3	RS 232, not used
USB	USB 1.1, Type A (logging on a memory stick) & Type B (firmware update) not usable at the same time	IO	3x inputs switching threshold 0 – 24 V, Transponder antennas 1x output 0 – +Ub, emergency stop
SIO 1	RS 232, communication with internal GPS receiver (optional)	ENCODER 1/2	Switching threshold 0 – 24 V, connection for incremental encoders
SIO 2	RS 232, configuration of the Ethernet interface	PROG	Only for Götting internal use
CAN 1	CAN bus 1, CAN spec. V2.0 part B, connection of Götting devices (e.g. gyro)	ANT 1/2	Withption GPS: 2 x TNC for GPS antennas Otherwise dummy plugs
CAN 2	CAN bus 2, CAN spec. V2.0 part B, connection of third party devices	Feldbus	Optional extension module Profinet (HG G-61431ZA) / Profibus (HG G-61431YA)

Table: Interfaces of the Navigation Controller

Position Determination with Sensor Fusion

The position determination is carried out by an internal sensor fusion of transponders and/or GPS and an odometry. Alternatively the position can be provided externally (e.g. Laser Scanner HG G-43600). The odometry can be improved by using the Gyro HG G-84300.

The sensor fusion calculates the position and the heading of the vehicle. It then provides the Navigation Controller a data set with the following content (the so-called **Pose**):

X-Position / Y-Position / Speed / Vehicle direction

GÖTTING

Navigation along Virtual Tracks

Sketch:
Layout of a track with segments and support points

The Navigation Controller needs information regarding the vehicle geometry and a segment file for the track. The segments define sections of a course. Segments do not take real parts of a site into account but are defined virtually in the CAD program *Malz++Kassner* to best match the vehicle abilities and the site conditions. Each segment consists of a minimum of 4 support points. The Navigation Controller uses the support points to calculate a virtual route for the defined vehicle.

For each support point it is possible to define the speed the vehicle is to drive. The Navigation Controller interpolates linearly, so that a smooth speed profile is used. Additionally for each support point attributes can be set. With attributes special actions can be triggered, e.g.:

- Spot turn (turn vehicle on a point)

- Stop distance (possibility to stop the vehicle inside a segment instead of at its end only)

- Offset driving (in order to prevent a driveway to get worn from the highly accurate automatic driving the vehicle can be navigated with offsets to the track)

- Inverted steering (special case for when omnidirectional vehicles need to steer into a particular direction at certain points of a track)

- Switching between the positioning systems at certain parts of a track (e.g. transponder and GPS)

Technical Data Hardware HG G-61430ZD

- Casing	Aluminium
- Dimensions	approx. 210 mm x 105 mm x 69 mm (B x W x T)
	approx. 239 mm x 105 mm x 79 mm with Feldbus module
- Weight	approx. 800 g / approx. 950 g with Feldbus module
- Mounting	To be attached to a 35 mm top hat rail according to EN50022. The mounting place has to be protected against humidity, e.g. inside a control cabinet
- Temperature ranges	Operation -25 to 70° C / Storage -40 to 85° C
- Portection class	IP 20
- Shock / vibration	DIN rail mount: 3.5 mm from 5-9 Hz, 1G from 9-150 Hz
	10 sweeps each axis, 1 octave per minute
- Relative humidity	95 % (not condensing) at 25° C
- Power supply	Nominal 12 – 24 Volt
	(Maximum range 10 – 30 Volt)
- Current consumption	200 mA @ 24 Volt
	approx. 300 mA @ 24 V with Feldbus module

GÖTTING

Date: 02.09.2016
Deutsch, Rev. 03
Author(s): RAD / ML