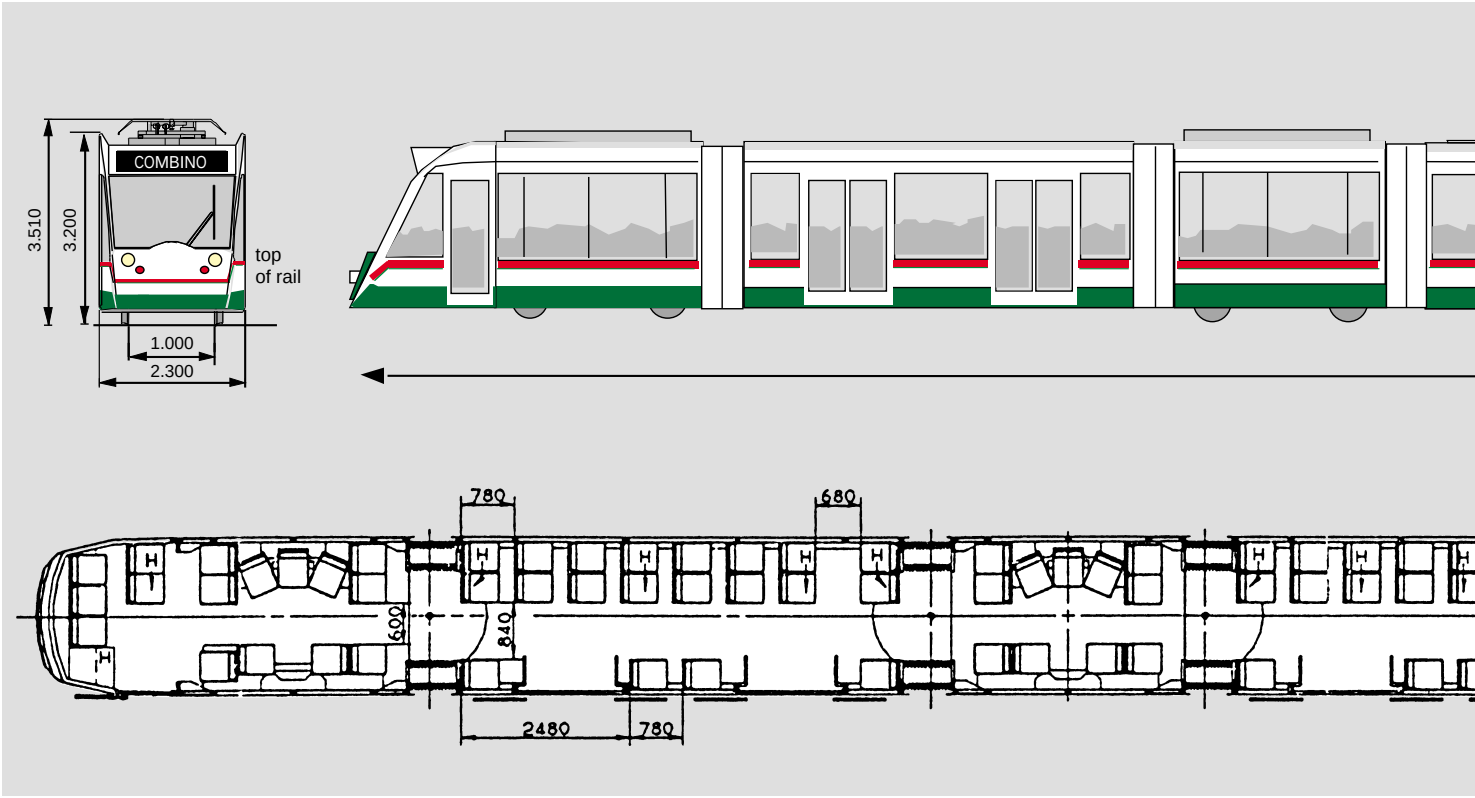
SIEMENS

Seven-Section Articulated Low-Floor Tramcar, Type COMBINO for Stadtwerke Augsburg Verkehrsbetriebe (StwA)

Technical Information

Development of the Combino family of vehicles: Siemens AG, Transportation Systems Group, Erlangen, Mass Transit Rolling Stock division in cooperation with the subsidiary, DUEWAG AG, Düsseldorf Works

Car Unit	Seven-section articulated low-floor tramcar for unidirectional operation
Traction adhesion	76 %
Wheel arrangement	Bo'2'Bo'
Track gauge	1000 mm
Vehicle length over buffers	41960 mm
Vehicle width	2300 mm
Vehicle height	3510 mm above top of rail (pantograph lowered)
Empty weight	approx. 43.7 metric tons
Weight when full (max.)	approx. 70.2 metric tons
Maximum axle load	10 metric tons
Capacity	252 passengers places, incl. 101 seats
Maximum speed	70 kph
Power system	600 V DC + 20 % – 30 % via contact wire
Traction motors (nominal operating point)	6 x 100 kW
Gear ratio	5.4444
Wheel diameter, new	600 mm
Traction motor inverters	3 IGBT PWM inverters
Auxiliary voltages	400 V 3-phase AC / 24 V DC
Low floor component	100 %
Floor height	300 mm
Useful life	min. 30 years
Year of delivery	1999



Overview of the vehicle

In November 1997 Stadtwerke Augsburg Verkehrsbetriebe (StwA) ordered 16 articulated low-floor tramcars of the COMBINO family from the Transportation Systems Group of Siemens AG.

The type of vehicle ordered is a 42-meter-long, seven-section tramcar for unidirectional operation from the modular COMBINO family.

Its configuration calls for a front module with powered running gear, an intermediate module, a module with non-powered running gear, an intermediate module, a module with powered running gear, an intermediate module, and, finally, an end module with powered running gear.

The tramcar design is based on a welded aluminum underframe with a body framework of bolted aluminum sections. Aluminum sandwich panels are used for the roof. In running gear modules, the equipment container forms the roof of the tramcar.

The powered running gear with two outboard drives is characterized by its low center of gravity, minimized unsprung masses and better running performance than conventional 100 % low-floor running gear. This is achieved by means of mechanical, longitudinal coupling of the wheels. Since the opposite pairs of wheels are mechanically decoupled, there is no longer any longitudinal slip which causes wear when the vehicle negotiates curves.

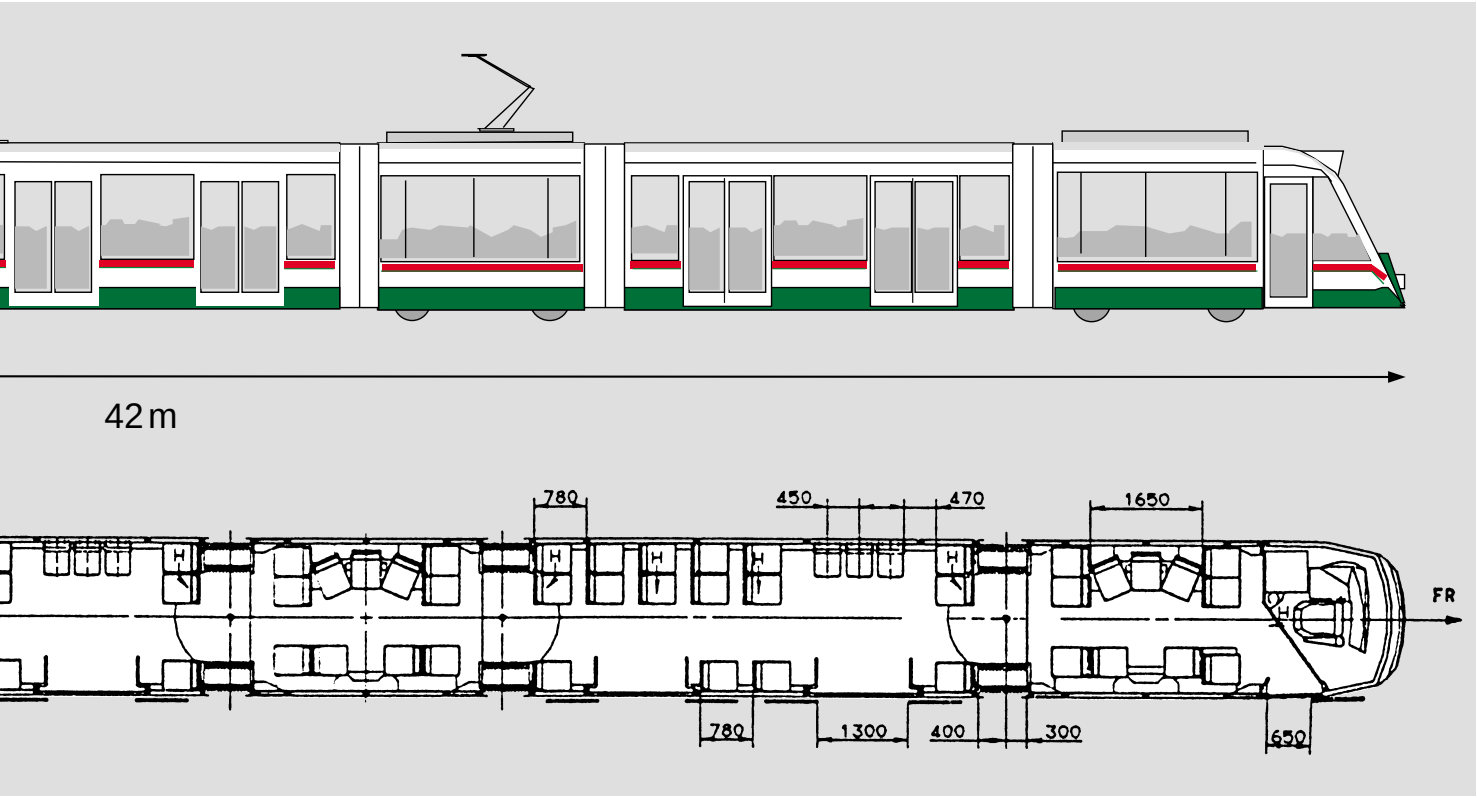
The traction equipment consists of 3 modern IGBT pulse-width modulated inverters, low-wear three-phase induction motors and a 32-bit traction control unit (SIBAS® 32). The drive is fully capable of returning surplus energy to the overhead supply.

The vehicle's control system is laid out in the form of a serial bus system with a lower-level, permanently-wired fallback level for the most important train control functions.

Low-wear and low-maintenance components are used throughout for the auxiliary and ancilliary equipment. An improved energy balance is achieved as the result of the low vehicle weight, the recovery of braking energy and the exclusive use of braking current for operating the storage heaters up to an outdoor temperature of approximately 0 °C.

The vehicle comes with the following features:

- Air conditioner for the driver's cabs
- Low-height electronics cabinets for clear view through the entire tramcar
- Swing plug sliding doors (6 double-leaf doors in long modules, 2 single-leaf doors in end modules)
- Ticket vending machine prepared, ticket validator
- "Black box" for recording accident data
- Halogen-free vehicle cabling
- Energy measurement program
- ZUB automatic train control system
- 2 outside mirrors on the front module



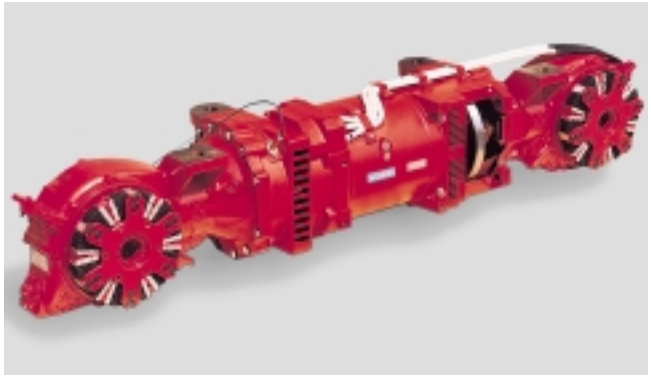
COMBINO drive unit, type 1TB1422-0GA03

consisting of: motor, brake disc, motor-gear coupling, bevel gearing, quill shaft, wheel-gear coupling.

Voltage	380 V
Current	221 A
Rated power output	100 kW
Rated speed	1580 rpm
cos w	0.74
Max. voltage	702 V
Max. current	259 A
Max. speed	4000 rpm
Gear ratio	5.4444

Bodyshell of the powered module with FRP end section

- Optimum field of vision for the driver
- Easy-to-replace outer paneling sections which are most likely to be damaged in accidents
- Crumple zone due to recessed underframe. Most of the damage caused by an accident only has a local effect
- Freestanding dashboard console
- High-strength FRP sandwich construction



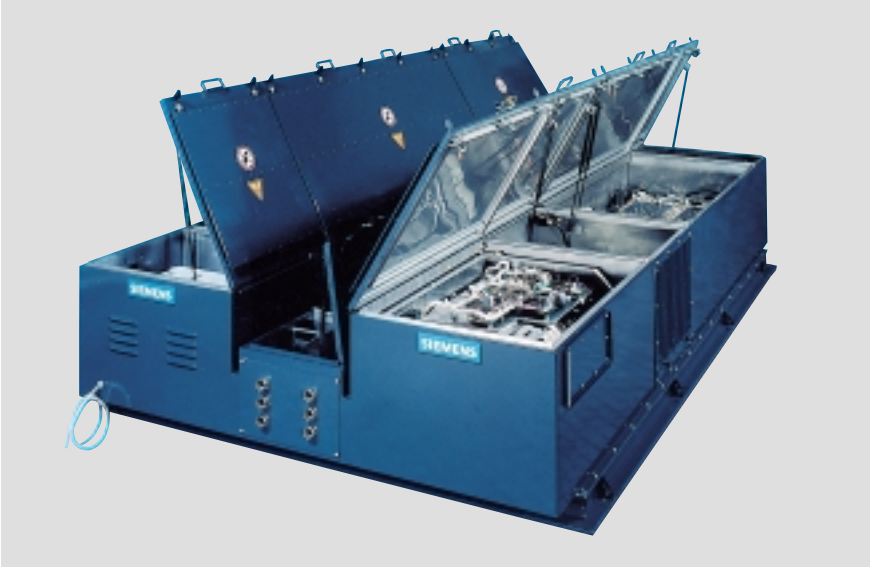
Drive unit

Bodyshell of the powered module with FRP end section

COMBINO central container

integrating the traction equipment which includes power converter, traction control unit, input filter, line reactor and brake resistor, as well as on-board power system with on-board converter, on-board distribution board and battery. This results in shorter cables, less wiring and therefore the highest degree of operating safety.

The container also forms the vehicle roof at the same time. All service work can be done from inside the car.

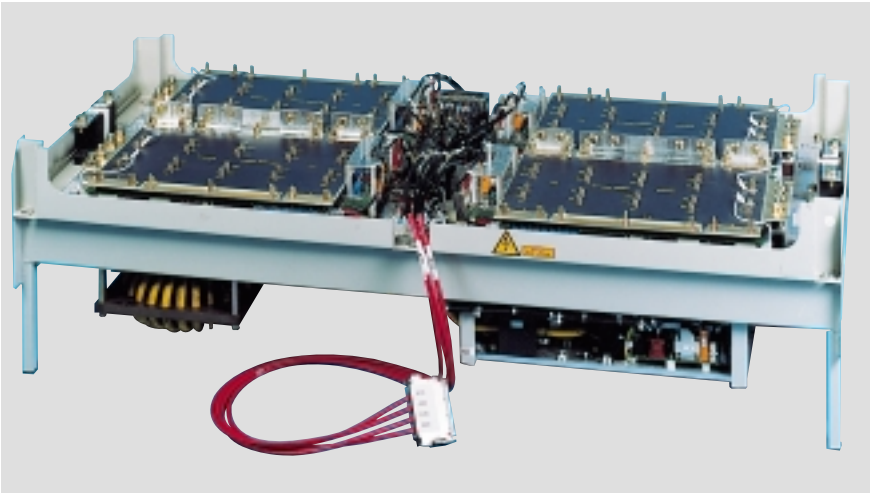


COMBINO central container

COMBINO traction inverter

Air-cooled IGBT pulse-width modulated inverter with integrated IGBT brake chopper and protective thyristor in a two-level circuit controlled via fiber optic cables.

Large numbers of the inverter are already being used in various other rail vehicles. The essential features of the inverter system are its very high efficiency, minimum noise and utmost reliabiliry.

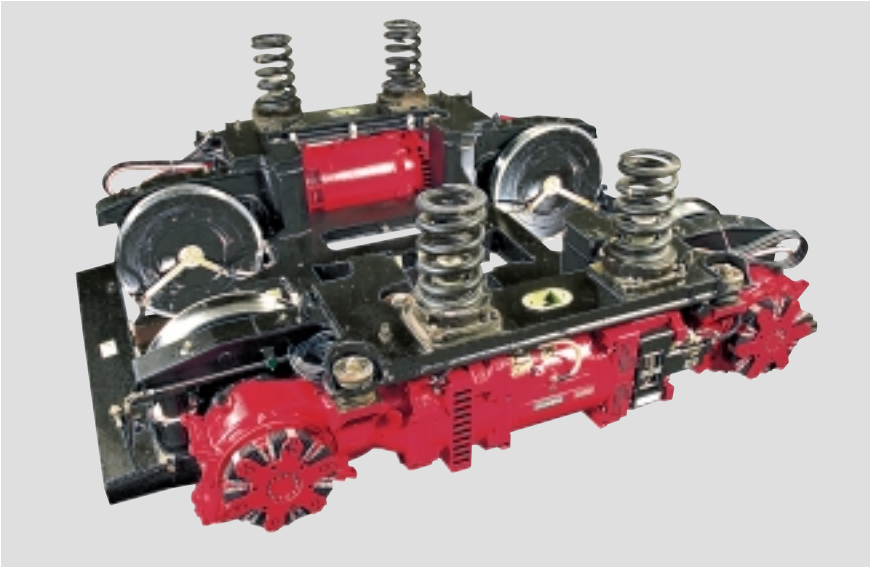


COMBINO traction inverter

COMBINO powered running gear, type SF30 TF

Track gauge	1435 mm
Distance between wheel pairs	1800 mm
Min. track radius	15 m

Equipment: 2 electromagnetic track brakes, sander, wheel flange lubricator, wheel silencer



COMBINO powered running gear

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