

Compact

- > Compact inverter for air conditioning applications
- > Available for various input voltages
- > Fixed or variable frequency operation possible
- > Integrated into air conditioning system or with separate enclosure for roof or under-floor mounting

Flexible

- > Easily mechanically and electrically adjustable
- > Based on proven platform
- > High overload capability for starting motors
- > Selectable output filter for optimum adjustment to loads



SMART COOLER

Air Conditioning Integrated Inverter

SMA delivers three-phase inverters that are integrated into the air conditioning system and based on the MEE-NT platform to power the air conditioning for the passenger compartments of the Combino Plus tram. At the beginning of 2008, all 40 Combinos of the Budapest public transportation authority (BKV) were retrofitted with air conditioning systems including SMA inverters.



Source: Akos Varga



Combino Budapest

SMART COOLER

Power Supply for Air Conditioning Systems

The three-phase inverter for the air conditioning systems of the Combino trams in Budapest is part of the SMA air conditioning inverter product family. Thus, SMA has innovative, modern, flexible and reliable three-phase inverters for air conditioning applications that have been proven in daily use.

Combino Plus for Budapest

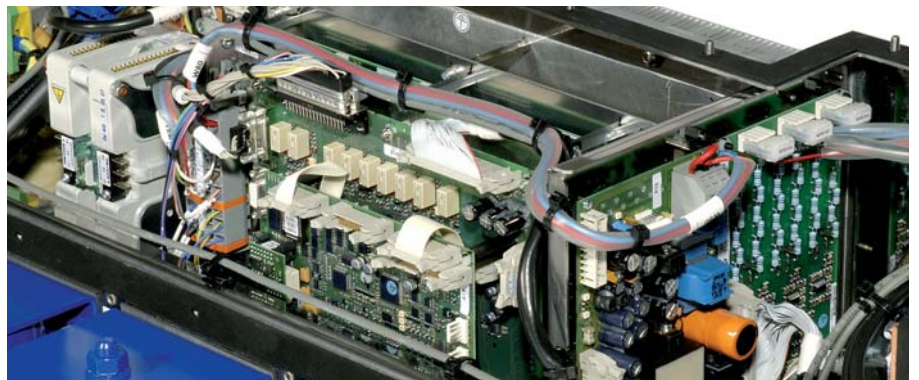
For Budapest, Siemens has developed a new vehicle with its Combino Plus, whose appearance is a strong reminder of the previous Combinos. But in its technical design, there are significant differences. For example, the Combino Plus is made of stainless steel instead of aluminum, and now all modules have a chassis.

At 54 meters long, the Combino Budapest is currently the longest tram in the world. A total of 40 trams were delivered between March 2006 and May 2007.

Now with Air Conditioning

Originally, the Combino was delivered to Budapest with a heating and

ventilation system. However, Budapest is characterized by a continental climate; cool winters are followed by hot summers. In the very first summer in which the Combinos were operational, the comfort of passengers in the trains was reduced due to inside temperatures.



Detailed view of the air conditioning inverter



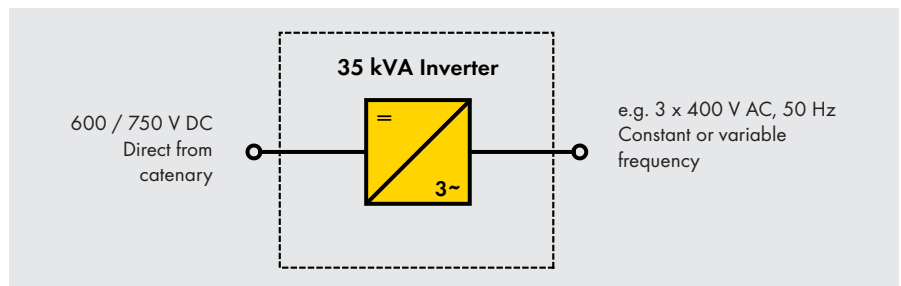
Budapest Parliament with the famous Széchenyi Chain Bridge spanning the Danube



Container of the HVAC system

In late summer of 2007, the BKV decided to retrofit the newly delivered trams with air conditioning. The air conditioning systems were provided by Thermo King and are equipped with integrated SMA inverters. This is the second time Thermo King and SMA have joined forces; they collaborated previously in retrofitting ISAP trains in Athens with air conditioning.

The Combinos were retrofitted in just 4 months. All trams were equipped with air conditioning systems by summer 2008. This was a major challenge for all companies involved, since the systems had to be developed, tested, built, installed and commissioned in only a few weeks.



Simplified block circuit diagram of the air conditioning inverter

Design

The air conditioning inverter for the Combino Budapest consists of an input filter, an input contactor, the actual power unit and an integrated sine wave filter. The air conditioning inverter provides controlled, three-phase AC voltage to operate motorized loads in the air conditioning system.

The standard air conditioning inverters are available with an output power of up to 35 kVA. The output voltage and frequency are adjustable. Essentially, a fixed or variable frequency operation is possible. The air conditioning inverters can be very easily adjusted to the respective voltage and frequency requirements. The output filter is available as a du/dt filter or sine wave filter.

The air conditioning inverter in the Budapest application is connected directly to the 600 V DC catenary. Of course, the devices are also suitable for connection to a 750 V DC overhead cable. Alternatively, they can also be connected to a traction circuit. The device is equipped with a passive input filter that limits the harmonics and electromagnetic interference emissions to permissible values.

The power unit itself is extremely compact. This enables the device to be designed to be small and light-weight so that it can be easily integrated into the air conditioning system. Naturally, other housing designs can also be implemented. The control and system management is implemented in

a completely digital manner in a modern DSP (digital signal processor). This allows the control and system management to be easily adjusted to the project-specific requirements at all times. The air conditioning inverter is equipped with sophisticated integrated diagnostic tools as standard.

Summary

SMA has a proven, cost-effective and powerful product family for applications in new as well as modernized rolling stock in the three-phase inverters for air conditioning applications that are based on the MEE-NT technology platform. The exceptional flexibility and durability has allowed SMA to achieve a high market share of inverters for air conditioning systems in just a short period of time.



View of the air conditioning inverter's heat sink for the Combino Budapest

Technical Data SMART COOLER

for Combino Budapest

Input Voltage:	600 V DC (750 V DC)
Output (AC):	3 x 400 V, 50 Hz, 30 kVA
Dimensions:	1,100 x 450 x 350 (mm)
Weight:	108 kg

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