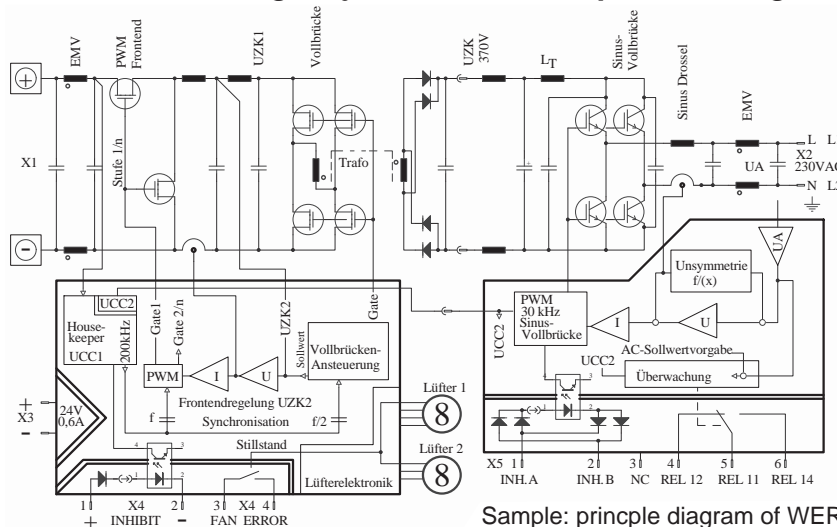


Topology-Mix brings functionality!

- **Patented topology with functionality**
- **for low voltage and high voltage batteries, for Traction line, for intermediate voltages**
- **24V / 36V / 72 / 110V - Battery networks**
- **220V / 450V_{DC} - Fuel cell**
- **600V / 750V_{DC} - Traction line voltages**
- **450V / 670V / 800V_{DC} - intermediate voltages**
- **3Ph-400/480V_{AC} - on-board networks**
- **1Ph-supply of instrumentation, computers, control systems, measurement equipment, tools**
- **3Ph-motor's supply with dynamical run-up of compressors, fans for climatic applications**
rooling stock ventilation, emergency ventilation, compressed air generation and so on

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Sample: principle diagram of WER.H4 series

| Model number | Isolation | AC-out | P _{out} | U _{in} | Use on |
|---------------------------|---------------|---------|------------------|---|--|
| | | | kVA | V _{nom} | |
| WER 50 | low frequent | 1Ph | 0,5 - 1,4 | 72/110/220V _{DC} | Battery networks |
| WER 01 | low frequent | 1Ph | 0,75 - 2,2 | 72/110/220V _{DC} | Battery networks |
| WER 02 | low frequent | 1Ph | 1,0 - 3,0 | 72/110/220V _{DC} | Battery networks |
| DRR 50 | low frequent | 3Ph | 0,55 - 1,5 | 72/110/220V _{DC} | Battery networks |
| DRR 01 | low frequent | 3Ph | 2,0 - 6,0 | 72/110/220V _{DC} | Battery networks |
| DWR / RWR | high frequent | 1Ph | 0,25 - 0,35 | 24-110 _{DC} | Battery networks (special technology) |
| WER.H1 | high frequent | 1Ph | 0,35 - 0,55 | 24-110 _{DC} | Battery networks |
| WER.H2 | high frequent | 1Ph | 0,7 - 1,1 | 24-110 _{DC} | Battery networks |
| WER.H4 | high frequent | 1Ph | 1,4 - 2,1 | 24-110 _{DC} | Battery networks |
| WER.H6 | high frequent | 1Ph | 2,1 - 3,1 | 24-110 _{DC} | Battery networks |
| DRR.H4 | high frequent | 3Ph | 1,4 - 2,1 | 24-110 _{DC} | Battery networks |
| DRR.H6 | high frequent | 3Ph | 2,1 - 3,1 | 24-110 _{DC} | Battery networks |
| DRR 100.U | without | 3Ph | 1,8 - 3,1 | 220-750 _{DC} | Fuel cell, High voltage battery, interm. level |
| DRR 100.B | without | 2 x 3Ph | 1,8 - 3,1 | 220-750 _{DC} | Fuel cell, High voltage battery, interm. level |
| DRR 100.T | without | 3 x 3Ph | 1,8 - 3,1 | 220-750 _{DC} | Fuel cell, High voltage battery, interm. level |
| DRR 02.U | without | 3Ph | 2,0 - 8,0 | 220-750 _{DC} | Fuel cell, High voltage battery, Traction line |
| DRR 02.T | without | 3 x 3Ph | 2,0 - 8,0 | 220-750 _{DC} | Fuel cell, High voltage battery, Traction line |
| WER.H750 | high frequent | 1Ph | 3,0 - 6,0 | 300-750 _{DC} | Fuel cell, High voltage battery, Traction line |
| DRR.H750 | high frequent | 3Ph | 3,0 - 6,0 | 300-750 _{DC} | Fuel cell, High voltage battery, Traction line |
| DRR.UIC | high frequent | 3Ph | 5,0 - 7,0 | 1,0kV _{AC} /1,5kV _{AC/DC} | UIC-high voltage bus |
| FUR 02 Frequency inverter | without | 3Ph | 2,0 - 6,0 | 400V _{AC} 3Ph | 3Ph-on-board network, 3Ph-Generator |
| FUR 03 Frequency inverter | without | 3Ph | 2,2 - 7,7 | 400V _{AC} 3Ph | 3Ph-on-board network, 3Ph-Generator |

1Ph/3Ph-inverters / Frequency inverters

One-phase and three-phase sine wave inverters generate synthetic sine wave voltages out of DC-network voltages. These 1ph/3ph inverters and frequency inverters are used in mobile applications on 24V up to 110V railway on-board networks, on 220/450V high voltage batteries or 450V up to 800V intermediate voltages, 750V-traction line voltage or UIC-voltages. This documents can just give general explanations, because the system specific requirements and combination can be very extensive.

Functional description

1Ph-inverter

1-ph inverters regulate the amplitude and the sine-wave form to a distortion factor of better 1% and a quartz-stable frequency with a complex U/I-control loop. In low voltage applications the WER-family regulates the DC-input voltage to a sine wave voltage of $(U_{in} \text{ min } -5V) \times 0,7$. This intermediate sine voltage is connected to a isolating low-frequency transformer with integral symmetry regulation (Patent pending).

3Ph-inverters

3-ph inverters work with a low-frequent intermediate circuit of $(U_{in} \text{ min } -5 V) \times 0,65$. The 3-ph voltages is generated by putting the intermediate voltage on a transformer with a pre-connected sine-choke. That leads to a isolated synthetic sine wave output voltage.

In general

Input sided works an active (Transistor) or passive (Relay) soft start. This input is reverse polarity protected. The customer is responsible for a input sided fuse. An additional auxiliary voltage is normally not necessary. The primary supply network is burdened with a alternating current of the double output frequency and the full current amplitude. The input current ripples can be smoothed down with a pre-connected choke (ask for application) based on the high internal capacitors. (With this solution also long supply cables can be used and the battery is less burdened)

Inverters with low-frequency transformer are short circuit proof statically and dynamically. They re equipped with an internal temperature protection and the output runs up with f/U- or U-Control respectively. These very robust power bocks are offered as components for chassis mounting or integrated 19"-racks as complete solution. In the case of a component order SYKO supports the customer for the integration (logistic advance on the customer side).

At 3-ph-inverters in general the wave form and amplitudes for motors are mathematically given. In special cases SYKO regulates the amplitude and wave form (long distance supply).

The shown and described devices are part of high power systems and developed for special applications. They are designed and tested in accordance to the state of the art technology and adapted in analogy to existing components. In general those electrical devices can cause heavy health and material damage by improper use, mistakes in operating, insufficient service or improper changes.

Isolation

At DC-input voltages, which generate output voltages $U_{\text{out rms}}$ (e.g. 3-ph 115/230/400 V_{rms}) with a buck-topology the system works without input-output isolation because of weight and functional reasons as long the motor keeps the required isolation voltage.

In system applications (e.g. in 750V traction line applications for compressors, cold air dryers, fans for incoming/outgoing/circulating air) a stable intermediate voltage is needed for the supply of several inverters (e.g. Triplex system) or to process an isolated on-board voltage / or battery charging. SYKO works with the Double-Regenerator principle (patent pending) as front end solution. If no output sided transformer is used, the motor must be designed to handle the isolation test voltage.

A high voltage (UIC-voltages) supplied 3-ph inverter needs an isolated intermediate voltage, which is generated with the patented, voltage cascaded Regenerator-topology.

3-ph inverters are equipped with an f/U control system for the run-up and over load, a I²t-control and a very fast actual value-current limitation. (pulse for pulse). With an isolated 0V to 5V signal the f/U can be adjusted from 0 to max.(100/120 %). Signalling out of / to the converter is possible.

Frequency inverters

Frequency inverters process a DC-intermediate circuit without isolation on the 3 Ph/50 – 60 Hz 400/480V-network. From there the frequency inverters work with the upper explained inverter concept.

Please inquire your project. SYKO will work out a solution with you.