

## Matrix93

### Matrix converter 3-phase AC to 9-phase AC, P=10 kW

#### > Customer:

Texas A&M

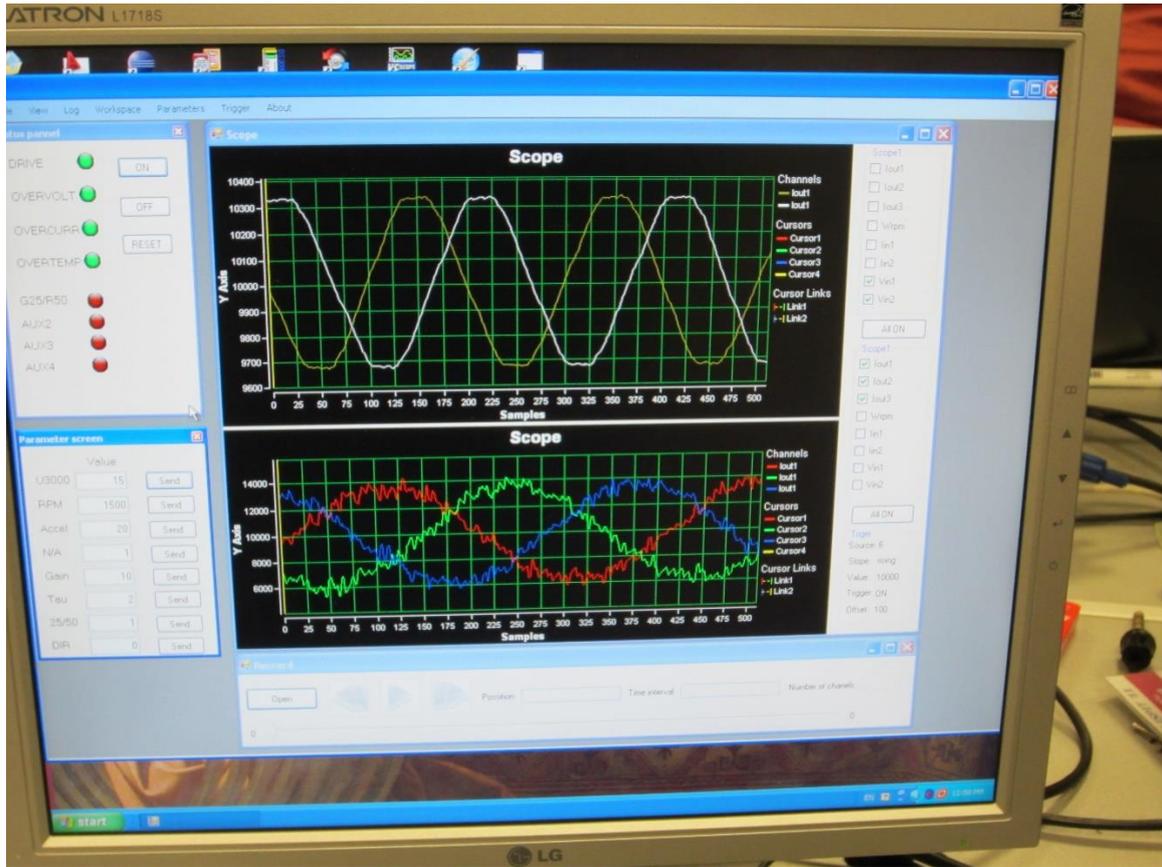
#### > Product description:

Matrix93 converter provides the interface between the 3-phase mains up to 3 x 540Vac and the ac loads or sources having any number of phases from 3 up to 9. Thus, it is possible to connect and supply a 6-phase or 7-phase AC motor. It is also possible to connect a small wind-power unit with 5-phase or 9-phase ac generator. The unit Matrix93 is designed primarily for the experimental work. Therefore, all the key parts are easily accessible.

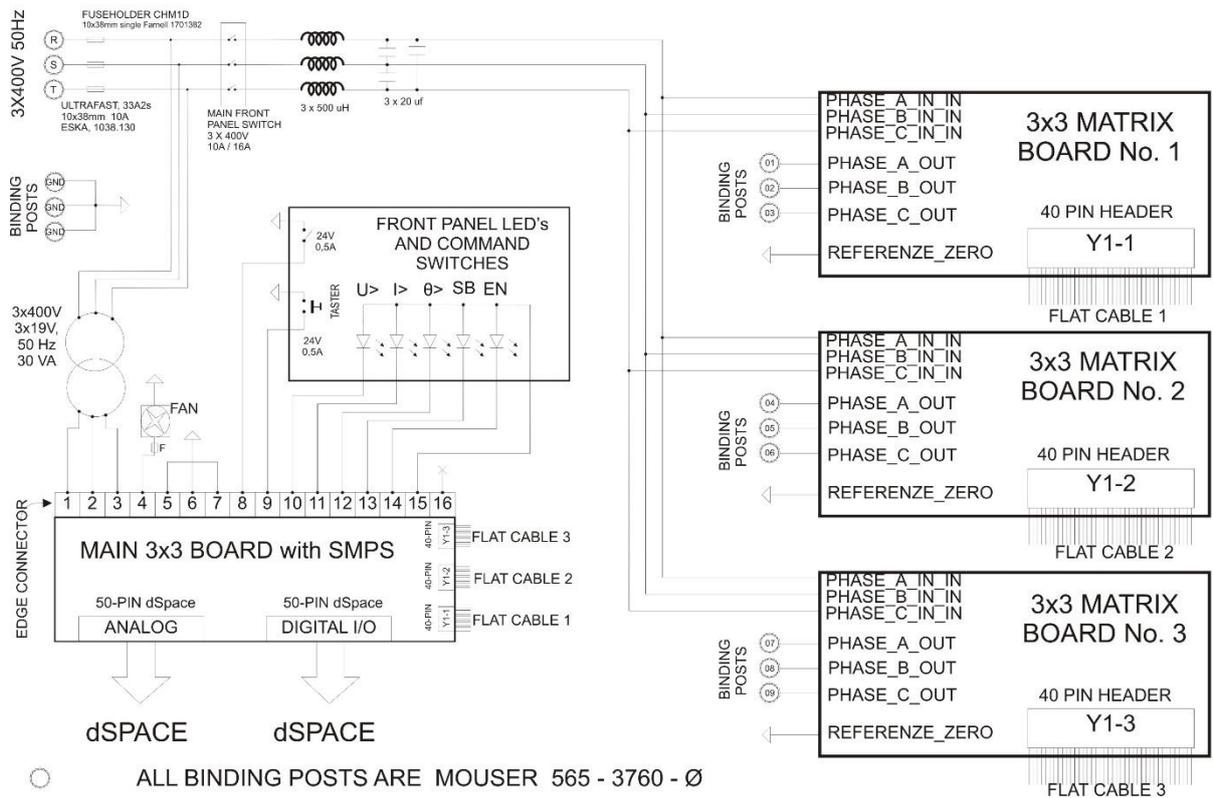
The unit uses three modules, each of them being a compact 3-phase-in / 3-phase-out matrix converter.

Matrix93 has an excellent efficiency due to recirculation of the energy leakage during commutations. Namely, matrix converters use bidirectional power switches to connect the input and output phases. When passing the current from the previous to the next, bidirectional switches have to be operated at the same instant, namely, while the former is being opened, the later has to close. An overlap in conduction of the two switches results in a brief but harmful short circuit. On the other hand, insertion of lockout-time (dead-time) interval, during which both switches are off produces an overvoltage. The usual solution includes insertion of a small lockout time, and addition of necessary snubbers that would curb the overvoltage and dissipate the corresponding energy. In cases where the commutations repeat each 100 us, while the lockout time is 1 us, said design decisions reduce the efficiency by 1%. Solution implemented in Matrix93 includes an auxiliary circuit for harvesting of the excess energy during the commutation and its reuse.

The unit comes in a package with advanced DSP control platform, with the modulation that provides  $U_{out}$  up to  $0.86 U_{in}$ , and with real-time USB-link which turns the laboratory PC computer into the scope capable of inspecting, triggering and storing real-time waveforms.



**INTERNAL CONNECTIONS OF A MATRIX CONVERTER 3 PHASE IN / 9 PHASE OUT**



> **DDC involvement:**

Concept, hardware design, safety and EMC norms, DSPcontrol software design and communication software design, preseries production and customer support.