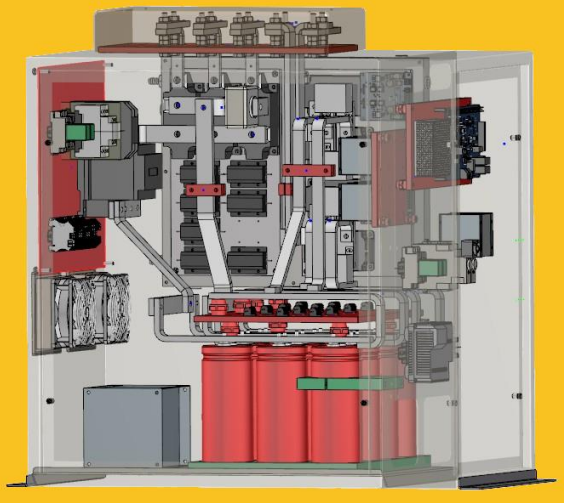
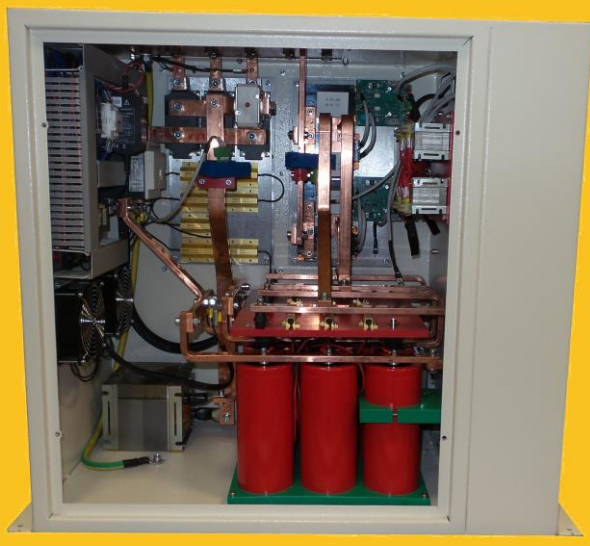
Digital Power Ver. 3.0

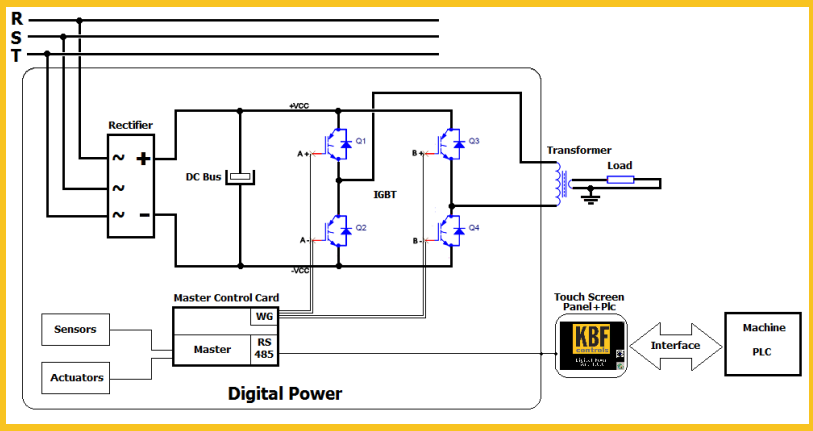
The Digital Power project was developed by KBF srl to provide an innovative and reliable solution in the management of the power of sintering machines for metal products that can replace the traditional solutions which provide, depending on the sizes, single-phase controls or rectified current. We've created a completely digital control managed by microprocessors that, optimizing the use of IGBT technology, increase the energy efficiency of machinery by reducing their cost of use. The possibility to choose the form of square or sinusoidal wave and the 30 to 100 Hz output frequency increase the flexibility of the digital power and make it more easily adaptable to different loads or work situations. To interface the analog and digital signals with external control electronics and to display and insert the working parameters, we chose to use a Touch-Plc for its high versatility and the possibility to connect it with a remote management .



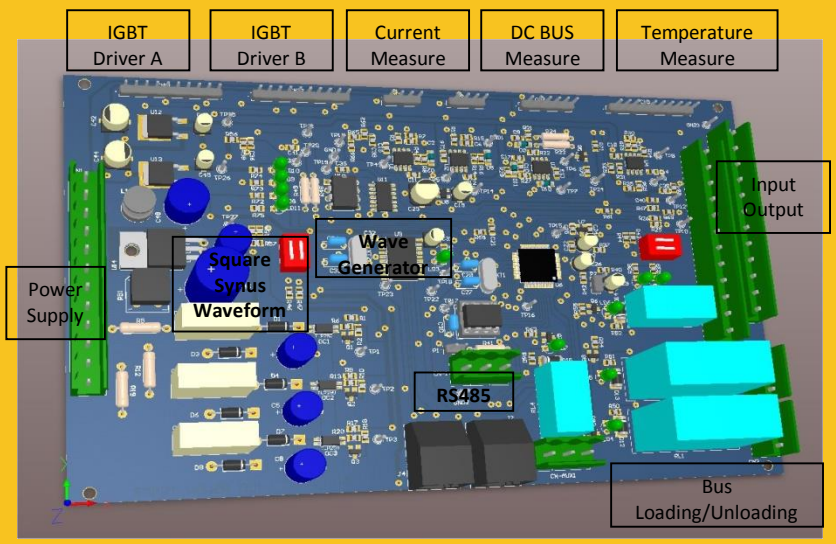


Technical Concepts

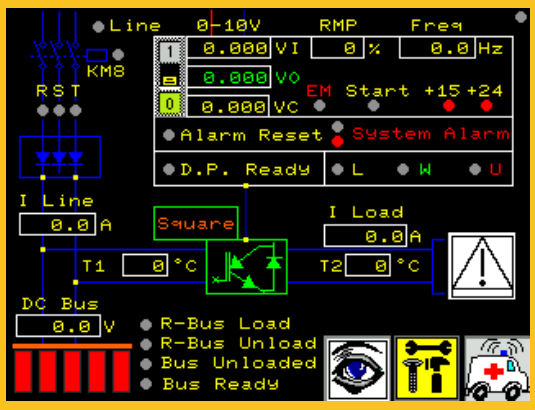
Wiring Diagram:
The simplified diagram in the picture by side shows the basic principle of operation of the system. The three-phase line that supplies the Digital Power is rectified by a diode bridge and a capacitor bus. An H bridge circuit with IGBT converts the DC-BUS voltage into AC voltage driving the primary of a single phase transformer with the waveform selected at the selected frequency.

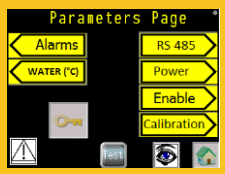


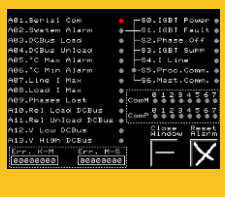
Main Board:
The heart of the system is the Main Board that processes the variables and the logic states of the system and manages the communication with the control panel via the master microprocessor. The data are exchanged with the secondary microprocessor that create the pulses for driving the four sides of the IGBT bridge in two different ways:
ISPP Mode: the shape of the output wave is a square wave programmable by the operator panel: frequency and the duty cycle (rpm).
MSPWM Mode: the shape of the output wave is sine wave, the frequency is programmable from the operator panel.



Touch-Plc:
The choice of the Touch-Plc meets the need to have a single object that is simultaneously interfaced with the machinery on which the Digital Power is installed, with the operator who has to decide and observe the operation and with the network in order to allow the remote control. The PLC functionality included allows the management of the internal and external logic and analogic status and makes the interfacing with the outside virtually universal.







Using the System

The Digital Power was initially designed to be used on board sintering machines for metal tools with high output power because they use a straightening system on the secondary of the transformer via diodes whose cooling is due to a large loss of energy quantifiable, if compared to the Digital Power consumption in 30-35%. The lower cost and lower complication of the transformer, the lower cooling of water and the high value of the cosφ have made the Digital Power the best choice not only technically but also economically. In a second step the Digital Power was also applied in the production and in the power conversion of machine with lower power with single-phase energy management, because the energy consumption is in any case less, the value of the power factor is always greater than 0.85, the system is balanced because connected to the three phases and the current required for each phase is lower leaving space to the use of other machinery in the company.

Following a series of real value readed during sintering cycles that compare the value of the used energy and changes in a cosφ values using the three systems Digital Power, Single-phase and Three-phase rectifier, used in full power and power partialisation conditions.

Measure	Digital Power	Single-phase	Three-phase rectifier
Energy	7,95 kW/h	8,80 kW/h	11,30 kW/h
cosφ	0,88-0,99	0,60-0,75	0,47-0,87
Saving %		10,69%	29,64%

Full power

Measure	Digital Power	Single-phase	Three-phase
Energy	1,32 kW/h	1,84 kW/h	2,52 kW/h
cosφ	0,82-0,94	0,35-0,60	0,35-0,80
Saving %		28,26%	47,60%

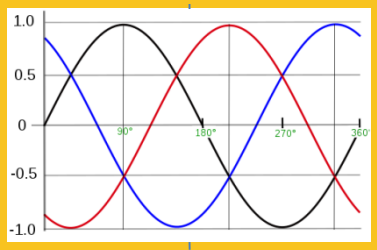
Power partialisation

Technical Data

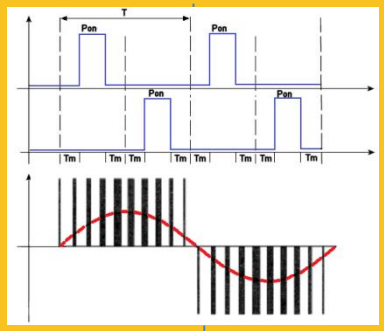
Parameters	**Digital Power 100 kW**	**Digital Power 150 kW**
Mechanical dimensions h x w x d	750x790x430 mm	750xx790x430 mm
Voltage supply	400 VAC	400 VAC
Voltage supply auxiliary	230 VAC	230 VAC
Output Power	100 kW - 560VAC	180 kW - 560VAC
Power reference signal	Analog Signal 0-10V / 0-20mA / 4-20 mA	Analog Signal 0-10V / 0-20mA / 4-20 mA
Output waveform	Square or sinus	Square or sinus
Frequency range	30Hz - 100Hz	30Hz-100Hz
Duty cycle range (rmp)	10%-95%	10%-95%
Cooling circuit	Water 60 l/h - Press.3 bar	Water 70 l/h - Press.3 bar

Conclusions

Digital Power



•The energy is drawn from the three-phase network in a balanced way.
•The power factor values are consistently high (> 0.80> <0.99).
•Less noise created towards the net.



- Digital control of the waveforms, of their frequency and the duty cycle (rmp).
- Best performances of the system related to the possibility of generating waveforms parameterized and optimized depending on the applied load.

•High efficiency, low heat dissipation.
•Significant energy savings value.
•Simple cooling system.

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