




# POWER ELECTRONICS

A stylized globe graphic composed of several overlapping circles in various shades of blue, positioned to the right of the main title.

Serving Defense  
and Aviation for  
Four Decades

**MAK CONTROLS & SYSTEMS PVT. LTD.  
AIR+MAK INDUSTRIES INC.**

# LOAD BANK AC

40kW-144kW 400Hz AC



50Hz-60Hz  
RACK MOUNTED LOAD BANK



400Hz GPU LOAD BANK

## TECHNICAL SPECIFICATIONS

|                       |  |                         |   |
|-----------------------|--|-------------------------|---|
| VOLTAGE (AC)          | : 115V/200V±10%                                    | FREQUENCY (Hz)          | : 400Hz±10% (50Hz model also available)                   |
| LOAD                  | : 48 / 80 / 104 / 120 / 144 kW ±5% (CosØ=1)        | DISPLAY                 | : Digital metering with LED/LCD display for V / A / Power |
| LOAD STEPS (GPU Test) | : 0-100% load in steps of 10% with fine adjustment |                         |   |
| COOLING               | : Forced air cooling                               | INTERFACE               | : USB   |
| OPERATING TEMP.       | : -20 °C to +55 °C                                 | NOISE LEVEL             | : <70 dB  |
| RELATIVE HUMIDITY     | : 0% to 85% without condensation                   | AIRCRAFT INTERLOCK TEST | : PROVIDED  |
| ALTITUDE              | : Upto 1000m without derating, maximum 2000m       | DEGREE OF PROTECTION    | : IP21  |

# LOAD BANK DC

300A-2500A 28.5V DC



28.5V DC LOAD BANK

## TECHNICAL SPECIFICATIONS

|                     |   |                      |                                  |         |   |
|---------------------|---|----------------------|----------------------------------|---------|---|
| Voltage (DC)        | : 28.5V±30%   | Load (A)             | : 300A/1500A/2000A/2500A±10%     | Display | : Red LED high brightness for V / A / Power |
| LOAD STEPS :        | : 300A (or) 600A for 20 Minutes   6 steps 1500A/ 2000A in 35second aircraft starting load simulator |                      |                                  |         |   |
| LOAD TEST PROCEDURE | : ESS-Engine start simulation   | COOLING              | : Forced air cooling             |         |   |
| INTERFACE           | : USB   | OPERATING TEMP.      | : -20°C to +55 °C                |         |   |
| ALTITUDE            | : Upto 1000m without derating, maximum 2000m  | RELATIVE HUMIDITY    | : 0% to 85% without condensation |         |   |
| NOISE LEVEL         | : <70 dB  | DEGREE OF PROTECTION | : IP21                           |         |   |

\* Due to continuous development, the Dimensions, Layout, Configuration and Specifications are subject to change without notice.



# LITHIUM BATTERY ( LFP & LTO ) WITH BMS



LTO BATTERY BANK

MAK has the Integration and control capability of using Lithium batteries in power systems. Lithium battery has the characteristics of safety, environmental protection, long life, high charge/discharge rates and wide operating temperature range (-30 °C to +60 °C). It is widely used in military, marine transportation, aerospace and other fields.



LFP BATTERY BANK

LTO Battery energy storage system is Lithium-ion battery system using the Lithium Titanium Oxide. It is capable of 10C discharge current rating.

LFP Battery energy storage system is lithium-ion battery system using the Lithium Ion-Phosphate. It is capable of 3C discharge current rating.

## DEFENSE GRADE UPS ( RACK MOUNTED / MODULAR )



SINGLE PHASE ONLINE UPS



THREE PHASE ONLINE UPS

The standard 19" modular, scalable, hot-swappable, online double conversion UPS ranging from 10-100kVA, with its flexible configuration of 3/3, 3/1 and 1/1, compact structure, is the ideal choice for various applications.

### SINGLE PHASE UPS

|                    |                   |
|--------------------|-------------------|
| Input voltage      | 180V AC - 275V AC |
| Frequency range    | 40 - 70Hz         |
| Output Voltage     | 210/230/240       |
| Power Rating       | 10kVA - 100kVA    |
| Interface Standard | Rs232             |
| Operating Temp.    | -20 °C to +55 °C  |
| Crest Ratio        | 3:1               |
| Efficiency         | >90%              |

### THREE PHASE UPS

|                     |                           |
|---------------------|---------------------------|
| Input Phase         | 3P+ N + G (380/400/415V)  |
| Input Voltage Range | 304 - 478V AC (line-line) |
| Frequency Range     | 40Hz - 70Hz               |
| Output Voltage      | 3 phase:380/400/415V      |
| Crest Ratio         | 3:1                       |
| Interface Standard  | Rs232                     |
| Optional            | Rs485                     |
| Operating Temp.     | -20 °C to +55 °C          |

# CONVERTERS AND INVERTERS



AC-DC CONVERTER

|                 |                        |
|-----------------|------------------------|
| Input Voltage   | 3ph AC (305 - 520V AC) |
| Output Voltage  | 200 - 450V DC          |
| Output Power    | 10kW Modular           |
| Output Current  | 0 - 23A                |
| Efficiency      | >90%                   |
| Operating Temp. | -25°C to +55 °C        |
| Storage Temp.   | -40 °C to +70 °C       |
| Communication   | Rs485                  |



LIQUID COOLED  
AC-DC CONVERTER & DC-AC INVERTER

|                               |   |
|-------------------------------|---|
| Nominal Working Input Voltage | 128V - 700V AC                              |
| Output Voltage                | 28V / 48 V / 110 V DC                       |
| Output Continues Current      | 200A (Can Be Increased With Add on Modules) |
| Efficiency                    | >90%  |
| Operating Temp.               | -20 °C to +60 °C                            |
| Communication                 | CAN   |
| Cooling Method                | Liquid Cooling System                       |

## MODULAR RECTIFIER



MODULAR RECTIFIER

|                 |                  |
|-----------------|------------------|
| Input Voltage   | 85V - 290V AC    |
| Output Voltage  | 28V DC/48V DC    |
| Output Current  | 0 - 70A/0 - 35A  |
| Efficiency      | >90%             |
| Operating Temp. | -25 °C to +65 °C |
| Storage Temp.   | -30 °C to +70 °C |

## 50kW LIQUID COOLED RECTIFIER



A Rectifier Unit, 50KW, 28V DC is designed & developed for use in pulsed radar application which delivers output with high efficiency and with Very high Power Factor at input due to Active Power Factor Correction technology. It is Liquid cooled type & Designed for EMI/EMC as per MIL-461E.

|                 |   |
|-----------------|---|
| Input Supply    | 415V ±10% L-L AC (Sine Wave), 50 Hz, 3 Phase, 3 wire. |
| Output Voltage  | 28V DC (Adjustable voltage between 26 V to 30V)       |
| Output Power    | Max 50 kW with 5 numbers of Independent 10kW Modules  |
| Efficiency      | ≥ 85 %  |
| Operating Temp. | -20°C to 55°C   |



# DC POWER SUPPLY



- High Efficiency
- APFC Front End
- Small Size
- Light Weight
- Low Noise

|                        |                  |
|------------------------|------------------|
| Input Voltage          | 85V - 290V AC    |
| Output Voltage         | 21V - 28.5V DC   |
| Efficiency             | 85%              |
| Charging Current Limit | 210A             |
| Operating Temp.        | -25 °C to +65 °C |
| Storage Temp.          | -30 °C to +70 °C |

# SPECIALISED AUTOMATIC VOLTAGE REGULATOR

28V/200A RECTIFIER



|               |          |
|---------------|----------|
| Field Current | 10A      |
| Field Voltage | 75V DC   |
| Frequency     | 50/400Hz |

## POWER CONDITIONING UNITS



40kVA 50Hz & 400Hz Dual Output PCU

### TYPICAL APPLICATIONS

|                 |                       |
|-----------------|-----------------------|
| Input Voltage   | 3ph 350V AC $\pm$ 20% |
| Input Frequency | 50Hz to 400Hz         |
| Efficiency      | 90%                   |
| Operating Temp. | -20 °C to +55 °C      |
| Storage Temp.   | -30 °C to +70 °C      |

- This PCU had dual outputs of capacity 40kVA (32kW)
- 415V 3ph 50Hz      • 200V 3ph 400Hz
- It will consist of converter & two inverter in the form of independent modules

## PMA BASED POWER SYSTEM

MAK developed various PMA based power systems with variable speed engine, compact coupled to a PMG for defense applications from 2.5kVA to 140kVA (customizable).

|                 |                                 |
|-----------------|---------------------------------|
| Rated Power     | 2x70kVA                         |
| Output Voltage  | 3ph 415V $\pm$ 2% 50Hz $\pm$ 1% |
| Operating Temp. | -20° C to +55° C                |
| Storage Temp.   | -30° C to +70° C                |
| EMI / EMC       | MIL STD 461E                    |



2x70 kVA SYNCHRONISED POWER SYSTEM WITH LTO BATTERY BACKUP

# STATIC FREQUENCY CONVERTER

FROM 2kVA TO 200kVA 50Hz TO 60Hz / 400Hz FREQUENCY CONVERTERS



SOLID STATE GROUND POWER UNIT



JET BRIDGE MOUNTED SFC



24kVA WHEEL MOUNTED SFC



DEFENSE GRADE 15kVA SFC

## INPUT\*

|           |                                |
|-----------|--------------------------------|
| Voltage   | 3 phase 400V/415V AC $\pm$ 15% |
| Frequency | 45Hz upto 65Hz $\pm$ 5%        |

## OUTPUT\*

|                    |                                  |
|--------------------|----------------------------------|
| Voltage            | 3 phase 200V AC - 400Hz $\pm$ 1% |
| Overall Efficiency | Upto 95%                         |
| Max. Crest Factor  | 1.4:1                            |

## ENVIRONMENTAL CONDITIONS

|                   |                              |
|-------------------|------------------------------|
| Operating Temp.   | -20 °C to +55 °C             |
| Relative Humidity | 10% - 100%                   |
| Noise Level       | <65 dBA@1 meter              |
| Altitude          | Upto 2500m without de-rating |

\* Other Voltage and Frequencies available on request. For Detailed technical specification or any other queries please contact us.

ONE STOP DESIGN AND SYSTEM INTEGRATION HOUSE FOR ALL YOUR ENGINEERING NEEDS

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