RELIABLE SOLUTIONS in POWER ELECTRONICS

PMI

INV SERIES

Power Management Instruments

ON-GRID INVERTER

PMI / GESS / KARMET GROUP COMPANIES

Going Green: Solar Power

Solar power generation has emerged as one of the most rapidly growing renewable sources of electricity following continuous rise in environmental and economic concerns over fossil fuels that is currently the world's major electricity source. Among the other forms of electricity generation sources, solar energy has vast advantages: it has reduced dependence on fossil fuels; it matches peak time output with peak time demand especially in summer; it is modular and scalable as the size and generating capacity is directly linked with the number of installed solar modules; it can be used in remote areas which significantly brings down the cost of transportation and production infrastructure; it is supported by many countries with various forms of incentive programs in place such as the laws allowing investors sell electricity back to the grid, directly subsidizing users to compensate the initial investment and offering tax incentives for the establishment of photovoltaic plants. These grid-tie systems, containing photovoltaic panels and inverters, are connected in parallel to the network grid generates mono-phase or tri-phase electricity and feeds abundant energy back to the grid after supplying the load(s). Then, the net metering calculates and deducts the total sum of energy input to the grid from what the users consumed.

ULTIMATE POWER GAIN WITH MPPT

With an estimated 30 years life time, photovoltaic panels or generators are main source of producing direct current which is transformed to alternating current via inverters that form the heart of the system as their robust design should ensure the continuity of the supplied energy by also leveling up the output voltage to the electricity network voltage of the grid, staying synchronized with the mains frequency. The inverter must as well optimize the energy production with respect to the solar radiation by tracking the Maximum Power Point (MPP). Maximum Power Point Tracking, frequently referred to as MPPT, is a system that operates the Photovoltaic (PV) modules in a way that allows the modules to produce all the power they are capable of.

The sizing of photovoltaic panel power is generally more than the maximum power supplied by the inverter in order to offset the loss of power of the PV modules due to high operating temperature, dirt, cables and ageing. To obtain the desired power it is possible to connect more inverters in parallel to the Grid. Utilizing more inverters means placing more MPPTs with the result of being able to run each unit separately, optimizing the configuration and consequently the performance of the entire plant. Furthermore in the event of inverter malfunction, only the part involved in the malfunction is affected and not the entire production as in the case of the single inverter.

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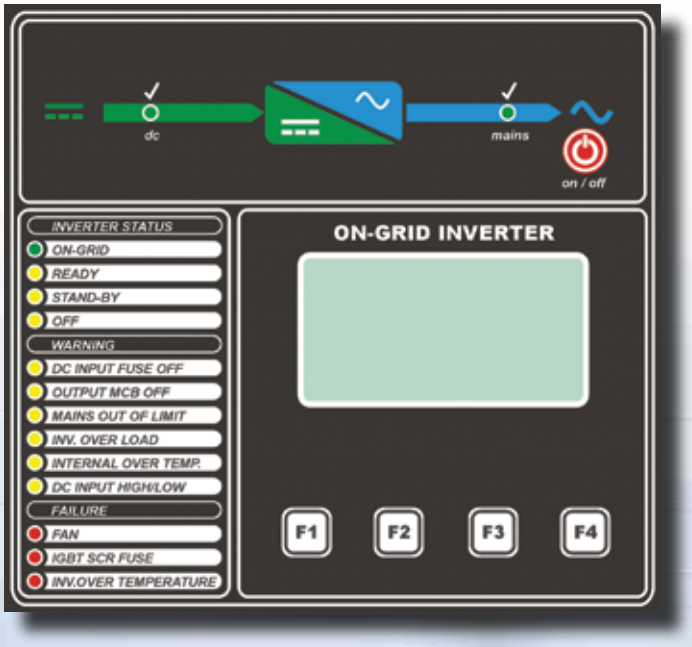
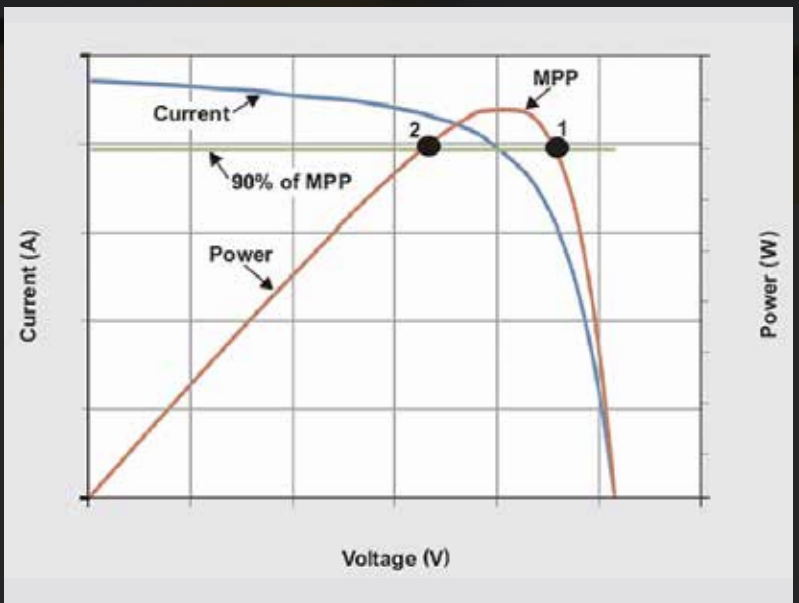
FEATURES AT A GLANCE

- Optimum power distribution independent of each phase voltage
- 6 pulse IGBT module topology
- Low filter loss thanks to 20 kHz switching frequency
- High conversion efficiency
- High accuracy MPPT technology
- High yield at low irradiance levels
- Automatic reactive current and power factor control
- Sinusoidal inverter output with < 3 % total harmonic current distortion (ITHD)
- Display advanced parameter graphical display
- Short Circuit, Over Current, Over Voltage Protections at Output
- Thermic Over Current Fuse with Indicator, DC Over Voltage and EMI-RFI Filter at Input
- More than 200.000 hrs MTBF with More than 20 years life time
- Industrial grade front access cabins, easy maintenance
- Customized output isolation transformer design to suit different voltage levels and frequency
- Advanced communications via Modbus TCPIP or Modbus RTU with local or remote configuration and monitoring
- Power ratings from 10 kW up to 200 kW with N+1 configuration
- Full nominal power up to 45 °C Smart fan controlling system to optimize the efficiency

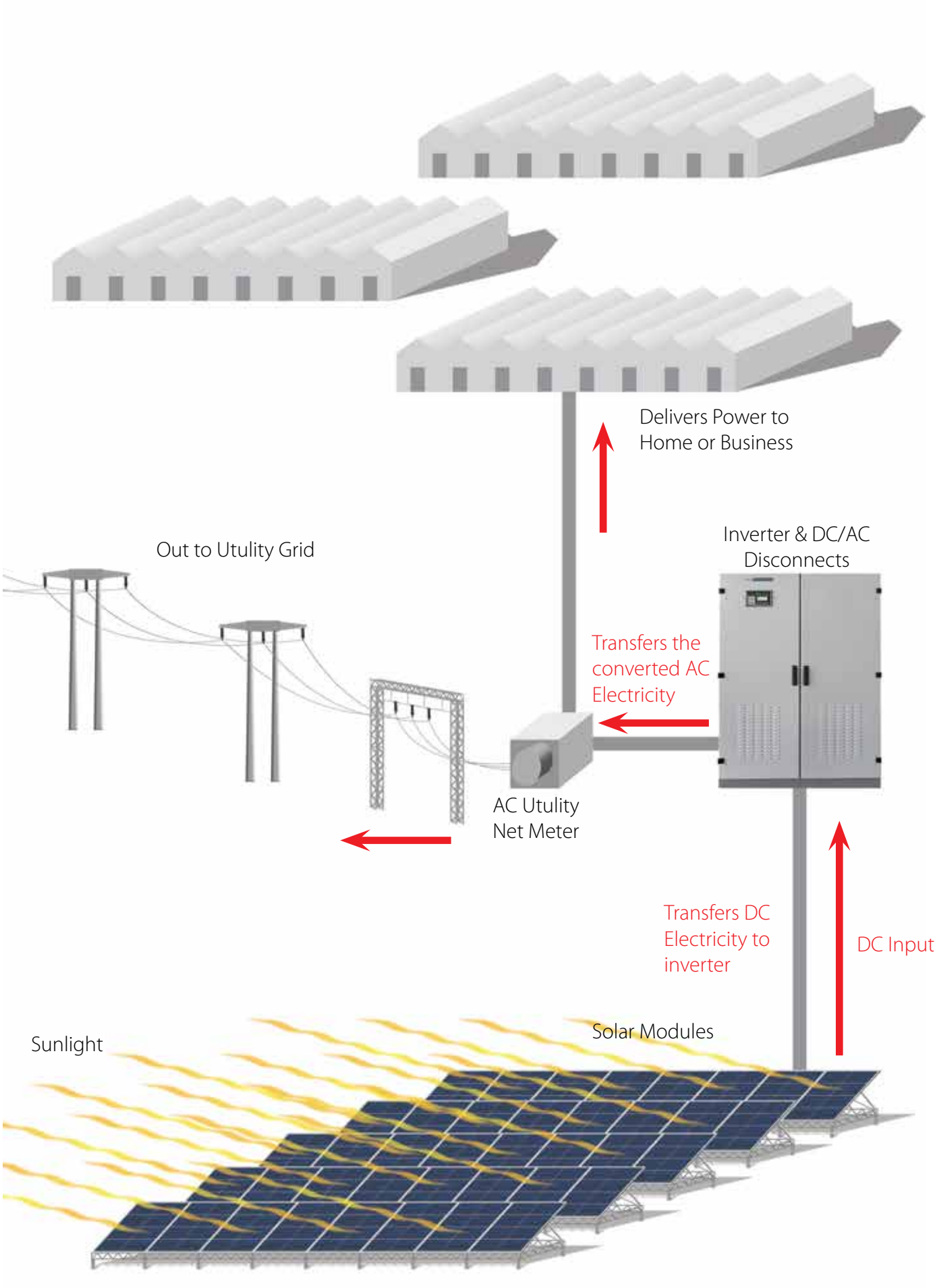
GRAPHICAL DISPLAY PANEL



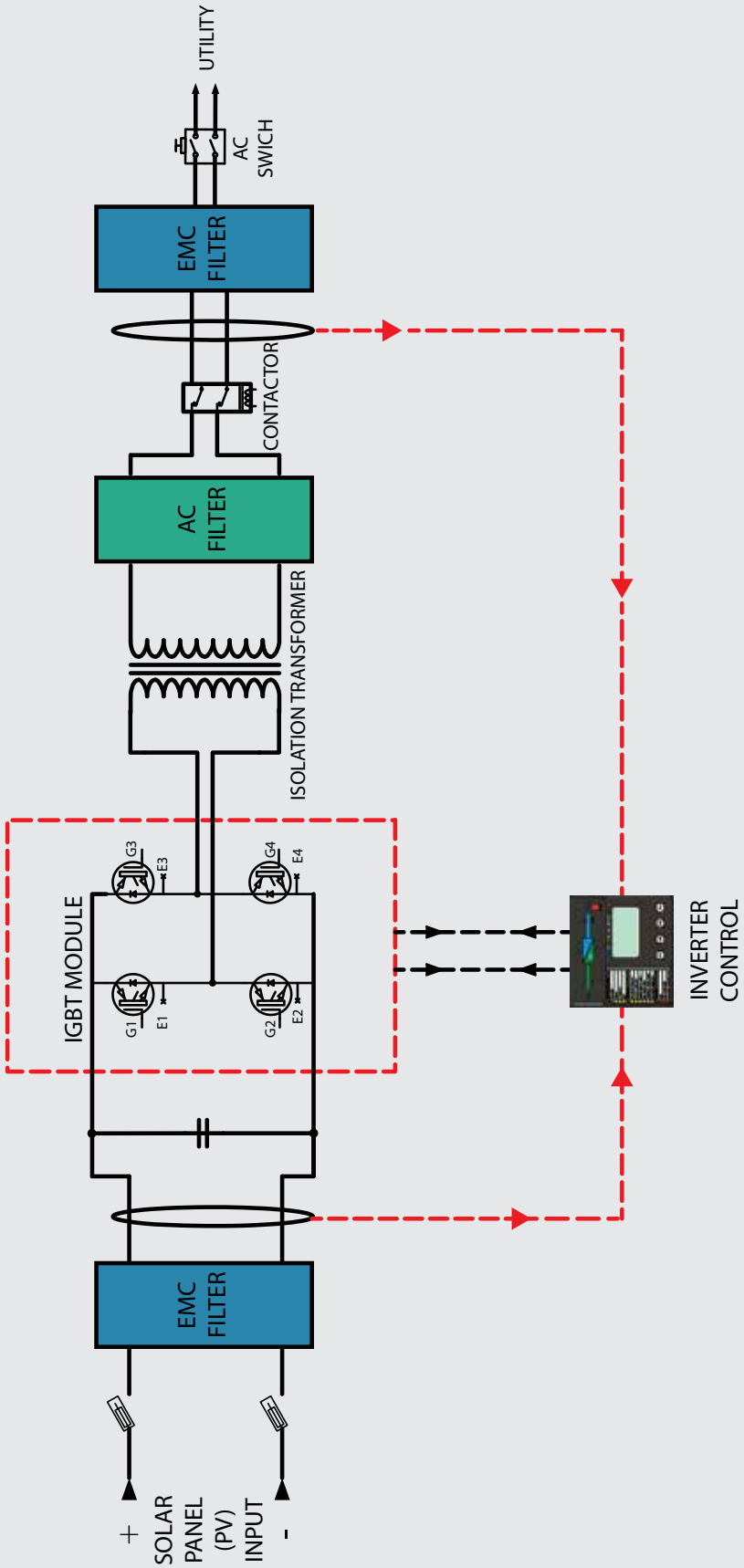


With its 30 year design and manufacturing experience in industrial AC & DC power conversion systems, PMI – GESS has developed its new grid-tie inverters for photovoltaic plants that are connected to the grid network. PMI grid-tie inverters use an algorithm to identify instant by instant maximum power point (MPPT) that continually changes throughout the day depending on latitude, orientation of the solar panels, the season and hour of the day that in turn directly affects the temperature and irradiation hitting each photovoltaic cell. Smart Software powered system calculates the voltage at which the module is able to produce maximum power and operates at this voltage to extract maximum power from the panels. In other words, the smart controller adjusts the voltage by a small amount from the array and measures power; if the power increases, further adjustments in that direction are tried until power no longer increases. Typical Ipv x Upv graph is shown on the left.

GRID-TIE SOLAR APPLICATION: OPERATION OF THE SYSTEM

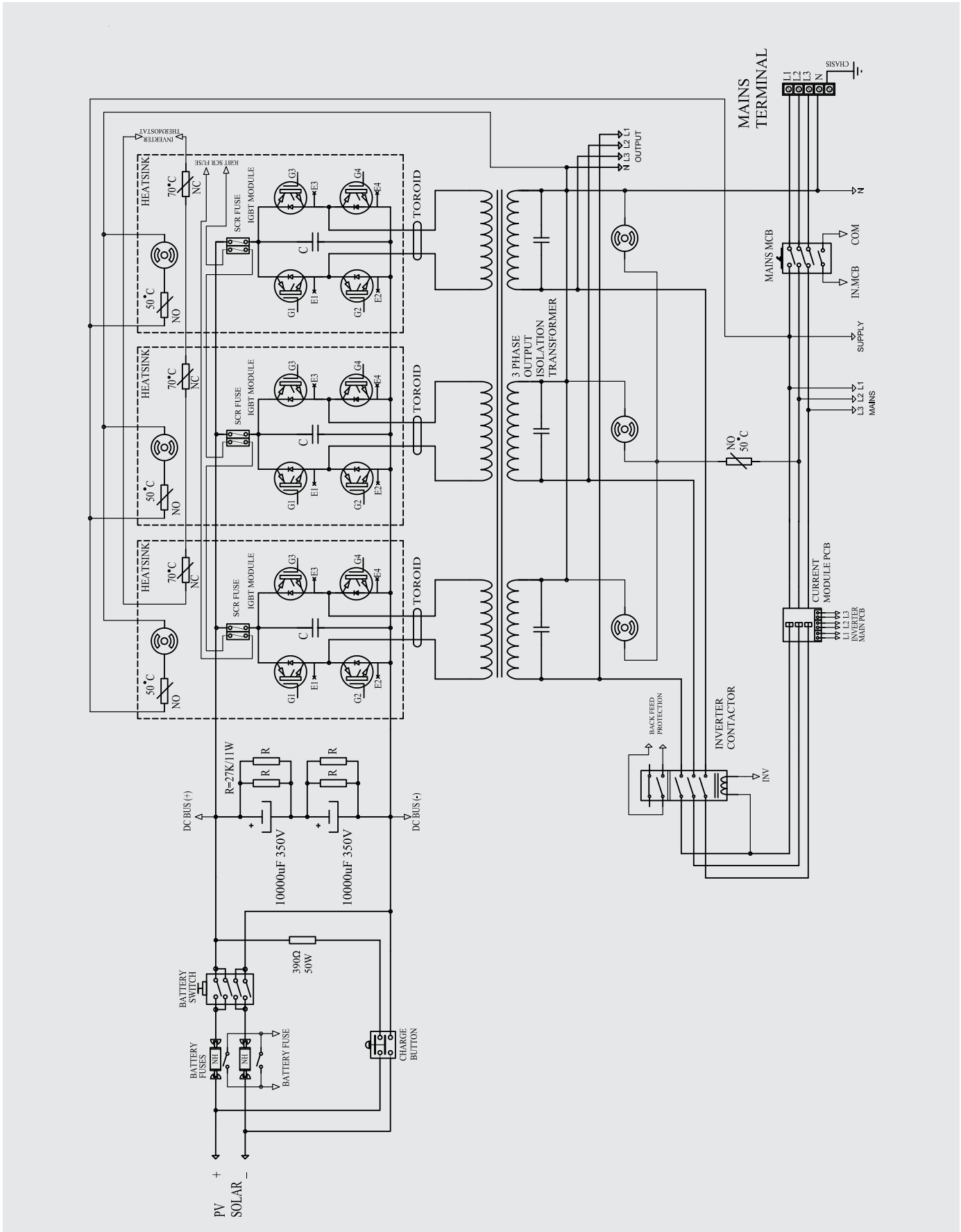


OPERATING LOGIC OF THE INVERTER



PMI On-Grid Inverter topology is based on 1 Full Bridge 2 High Frequency IGBT Inverter Modules (3 full-bridge 6 high frequency IGBT modules for 3 Phase output) using PWM (pulse width modulation) and control logic based on DSP. Monitoring of electrical values and parameter adjustments can be done through Graphical Display and Mimic diagram of the PMI On-Grid Inverter system. EMC filters decrease the radio frequency emissions on the AC network and photovoltaic modules while Full Bridge High Frequency IGBT Inverter Modules convert direct current to alternating current. Isolation of DC input and AC output is ensured by galvanic Isolation Transformer at the output of the inverter. No load losses of the transformer is avoided by separating the inverter from AC output by contactor while inverter is in "OFF" position. All operations are controlled through Control PCBs and Graphical Display monitors the whole system.

POWER WIRING DIAGRAM OF THE INVERTER



ON-GRID INVERTER TECHNICAL SPECIFICATIONS

Power Management Instruments

GENERAL	
Model	INV Series
1Phase Power Options	6 / 10 / 20 / 30 /40 kW
3Phase Power Options	10 / 20 / 30 / 40 / 60 / 80 / 100 kW / 200 kW
Topology	Six Module IGBT High Frequency Switching Inverter With Output Isolation Transformer
Control	DS PIC Controlled
Overall Efficiency	>%90 (1 Phase) / >%93 (3 Phase)
Over Load Capacity	10 min for 110%
Isolation Voltage	2.500 VAC (Input-Output, Input-Chassis, Output-Chassis)
Grid DC Connection	Sequence Rail Terminal (+/- DC)
INPUT	
Input DC Voltage, MPPT	300-350 VDC (1 Phase) ; 500-600 VDC (3 Phase)
Min-Max Input DC Voltage	250-450 (1 Phase); 300-700 (3 Phase)
Input Protection	Thermic Over Current Fuse With Indicator, Over Voltage and EMI-RFI Filter
Instant Voltage and Pulse Protection	IEEE 587 (4500 A, 110 Joules)
OUTPUT	
Output Voltage	120/220/230 /240 VAC (1 Phase) ; 208/380/400/415/480 VAC (3 Phase, independent phase controlled)
Output Voltage Tolerance	±10%
Output Frequency	50 or 60 Hz
Output Frequency Tolerance	±2% Synchronized on Mains
Output Waveform	Fully Sinusoidal, THD <3%
Output Protection	Short Circuit, Over Current, Over Voltage and Over Temperature
Output Transformer	Galvanically Isolated
ON-GRID GROUP	
Grid Number 1 Phase	12 Grid In Series, MPPT Grid Voltage 26-28 VDC, 10 Grid In Series, MPPT Grid Voltage 33-36VDC
Grid Number 3 Phase	20 Grid In Series, MPPT Grid Voltage 26-28 VDC, 16 Grid In Series, MPPT Grid Voltage 33-36VDC
FRONT PANEL	
Indicator and Buttons	Graphic LCD Panel, Menu Select and Menu Set Buttons
Warning Messages	Input Fuse/Operating Mode/Inverter Synchronization/DC Input High- Low/Inverter Over Load/Internal Over Temperetaure /Inverter Over Temperature/IGBT SCR Fuse Fail/Inverter Output High-Low
Viewing Measured Values	Output Voltage/Output Frerquency/Inverter Load Level/DC Bus Voltage/Internal Temperature /Event History
Adjusting Parameters	Date/Time /Alarm Sound Level/Communication Slave Number/Led Test
Sound Alarm	On Warning Messages 2 Short 'beep' per 2 seconds
Communication	RS 485 - Modbus - TCP/IP communication are available to monitor and remote parameter setting (Optional)
Protection devices and environmental conditions	
Access to Cabin	Front Access
Level of protection	IP 21 as Standard; IP42 with Front Access as Option
Permitted temperature range	-10°C - +45°C
Non condensing relative humidity range	<95%
Maximum height above sea level	1000 m ASL

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PMI/OES reserves the right to make alterations on technical specifications.

GROUP COMPANIES

Ortadoğu Elektronik Sanayi Ltd. Şti.
Karmet Makina Elektronik Tasarım A.S.
PMI Elektrik Sistemleri Dis Tic. Ltd. Sti

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MANUFACTURING PLANT AND R&D

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