Mobile Inverters and Motors
For Hydraulic Implements, Vehicle Traction and Auxiliary Vehicle Applications
Parker Hannifin
The Global Leader in Motion and Control Technologies and Systems

A Winning Combination

Parker has decades of experience in the development of products and systems for OEMs and users of mobile hydraulic equipment. Parker is now bringing its experience in electric motor and drive technology to the efficient control of mobile hydraulic systems.

With systems engineering and manufacturing teams in Europe, North America and Asia, Parker can provide the expertise to help its customers reduce fuel consumption, reduce noise generation and expand control functionality.

<table>
<thead>
<tr>
<th>Industry-Leading Motor Design</th>
<th>Manufacturing to Meet Our Customers' Needs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parker designs and manufactures permanent magnet AC motors in three global locations, not only for hydraulic system control, but also for vehicle traction and auxiliary vehicle systems, such as fans, pumps and compressors. Designed for optimum performance at a variety of input voltages, Parker PMAC motors can be customized to maximize performance and minimize footprint.</td>
<td>Parker is committed to meeting the increasing service demands that our customers require to succeed in the global mobile market. Parker’s manufacturing teams seek continuous improvement through the implementation of lean manufacturing methods throughout the process. We measure ourselves on meeting our customers’ expectations of quality, not just our own. In order to meet these expectations, Parker continues to invest in our manufacturing facilities in Europe, the Americas and Asia.</td>
</tr>
</tbody>
</table>

About Parker Hannifin Corporation

With annual sales exceeding $12 billion, Parker Hannifin is the world's leading diversified manufacturer of motion and control technologies and systems, providing precision-engineered solutions for a wide variety of mobile, industrial and aerospace markets. The company employs approximately 58,000 people in 47 countries around the world. Parker has increased its annual dividends paid to shareholders for 55 consecutive years, among the top five longest-running dividend-increase records in the S&P 500 index. For more information, visit the company’s web site at www.parker.com, or its investor information website at www.phstock.com
Mobile Applications

Overview

Electro-hydraulic actuation
Frequency-controlled ePump systems for hydraulic implement control

Parker mobile inverters and motors provide frequency control of mobile hydraulic pump systems, particularly in the control of on-vehicle hydraulic implements.

Typical vehicle systems include:
- Construction machinery
- Aerial lift trucks
- Truck-mounted cranes
- Intermodal handling Equipment
- Mining equipment

Electric motor-inverter systems used in conjunction with hydraulic pumps and an onboard battery system offer a number of benefits; significant fuels savings can be achieved, equipment can be operated with the IC engine off and the kinematics of the hydraulic implements can be used to recharge the battery system.

Electric and hybrid-electric vehicle traction
Permanent magnet motors and inverters for drivetrain applications

In vehicle systems, power density is a key design factor. The torque density and speed capabilities of Parker permanent magnet AC (PMAC) motors, combined with a voltage-matched inverter, provide the speed and torque required to achieve breakthrough performance in a variety of vehicle platforms:
- Large Goods Vehicles
- Motorcycles and scooters
- Light commercial vehicles
- Watercraft
- Personal recreational vehicles

With design teams on multiple continents, Parker has the expertise to provide the optimal motor for the required power.

Where overall size and weight are not significant design factors, Parker can also provide high efficiency AC induction motors in combination with our inverter systems.

Auxiliary vehicle systems
Motors and inverters for onboard pumps, fans, compressors

In addition to vehicle propulsion, there are numerous systems that are traditionally reliant on the internal combustion engine for power, such as:
- Power steering
- Compressors for climate control
- Air compressors for braking
- Cooling fans

By decoupling these systems from the engine, and implementing battery-fed electric motor systems, the vehicle operator can achieve efficiency improvements in the engine, or be able to reduce the size of the engine.

Parker can assist with the development of motor-inverter systems to operate auxiliary vehicle systems across a range of battery voltages and control systems.
System Examples
Drivetrain / Traction

Description

Parker offers complete solutions or sub-systems for a wide range of drivetrain and traction applications. High performance IGBT-based inverters provide maximum versatility, offering compatibility with PMAC or induction motor designs. Parker’s inverter/motor combinations are pre-engineered for the highest efficiency and performance, minimizing losses both during motoring and power regeneration, providing maximum vehicle range. Whether applied to series- or parallel-hybrid, or all-electric designs, you can rest assured that Parker has a reliable solution.

Drivetrain/Traction Benefits:

- Optimised system design with PMAC or AC induction motors
- Improved speed performance through flexible motor control-resolver, encoder, sensorless
- Integration into vehicle control system via CAN communications
- Maximum performance and power density through flexible liquid and air cooling

This illustration shows a typical series-hybrid traction system. The internal combustion engine (ICE), which may be a traditional petrol or diesel design, or a gas turbine, drives the Parker PMAC generator, which produces alternating current. The generator output is then converted to DC, used to keep the batteries charged. The battery bank can allow operation with the ICE offline, and also absorbs regenerative energy during braking. A Parker battery management system coordinates charging and discharging while monitoring crucial battery parameters. The traction inverter produces variable frequency alternating current which is used to power the traction motor, which in turn drives the wheels of the vehicle. The system is coordinated by a central controller over Parker IQAN or other means of communication.
System Examples

ePump / Electo-Hydraulic Actuator (EHA)

Description

The combination of Parker’s experience and expertise in hydraulics with high efficiency electric motors and inverters results in a comprehensive offering of “ePump” systems- hydraulic pumps driven by speed-controlled electric motors. Especially suited to utility trucks and commercial vehicles, the ePump concept allows implements to be driven electrically, reducing load on the vehicle’s main engine. In cases where the vehicle is stationary during operation, idling can be eliminated, resulting in reduced fuel consumption and emissions. Vehicles using implements while in motion can benefit from less load on the engine possibly allowing a smaller, more efficient engine to be used.

ePump Benefits:

- Fuel savings from reduced idling
- Reduced emissions
- Quiet operation
- Reduced load on ICE

This illustration shows a typical ePump system that is used to power a hydraulic implement. The AC motor driving the pump is powered by the battery bank through an efficient Parker mobile inverter. In this particular system, the batteries may be charged from the mains supply while the truck is out of service, or by running a small combustion engine or turbine if recharge is not available. The advantages of the ePump based system include fuel savings and reduced emissions, as an oversized combustion engine does not need to run continuously while the hydraulics are in use. When used in new applications, since the combustion engine is not relied upon to power the hydraulics, a smaller and more fuel efficient engine can be used. For a retrofit application, periods of engine idling can be reduced or even eliminated, reducing fuel consumption.
MC Series
Low Voltage Mobile Inverters

Description
Parker’s MC Series Mobile Inverter range provides high performance and functionality in a compact package for mobile motor control applications from 24 to 80 VDC. Compatible with multiple asynchronous motor manufacturers, the MC series settings can be optimized with supplied configuration software. Each inverter provides system control capabilities such as analogue and digital inputs and outputs, contactor coil drivers and proportional valve drivers.

Product Capabilities
- Advanced field oriented vector control
- Auto-configuration of typical induction motors
- High efficiency cold plate heat sink design
- IP 65 protection class
- Motor temp sensor input
- Encoder supply output (5V)
- AB encoder input
- Dual, configurable throttle inputs
- Configurable CAN communication
- Parker IQAN compatible
- Ability to control vehicle control tasks separately from motor control
- 5 configurable coil drive outputs
- 2 configurable digital outputs
- 2 Analogue inputs
- 6 Digital inputs
- Powerful MC configuration utility for system design and diagnostics

<table>
<thead>
<tr>
<th>Model</th>
<th>MC-C</th>
<th>MC-D</th>
<th>MC-E</th>
<th>MC-F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal Voltage</td>
<td>24 VDC</td>
<td>24/48 VDC</td>
<td>48/80 VDC</td>
<td>48/80 VDC</td>
</tr>
<tr>
<td>Max 2 min current</td>
<td>250 Arms</td>
<td>350 Arms</td>
<td>450/350 Arms</td>
<td>650/650 Arms</td>
</tr>
<tr>
<td>Max 2 min Power</td>
<td>7.1 kVA</td>
<td>19.6 kVA</td>
<td>33.2 kVA</td>
<td>61.7 kVA</td>
</tr>
<tr>
<td>Switching Freq (Induction)</td>
<td>2.0 - 4.0 kHz</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weight</td>
<td>3.8 lbs/1.7 kg</td>
<td>6.3 lbs/2.8 kg</td>
<td>9.1 lbs/4.1 kg</td>
<td>15 lbs/6.8 kg</td>
</tr>
<tr>
<td>Operating Temperature</td>
<td>-40 °C to 50 °C</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Storage Temperature</td>
<td>-40 °C to 95 °C</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Protection</td>
<td>IP65</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control Type</td>
<td>Induction (consult factory for PMAC)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Feedback</td>
<td>Quadrature encoder</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Communication Protocol</td>
<td>CANopen, serial</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cooling Options</td>
<td>Air</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Certifications</td>
<td>UL recognized component per UL583, EMC: designed to EN12895, Safety: designed to EN1175, CE marked to EN 61800-5-1 (Safety, Low Voltage Directive) - MC-E and MC-F only.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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MC Series
Accessories and Dimensions

**MC Configuration Manager**
- PC-based programming
- System monitoring
- System diagnostics
- Adjust system variables and programmable parameters
- Online or offline use
- Windows XP/Vista/7 compatible
- Includes USB adaptor

**Dimensions (mm)**

**MC-C**

**MC-D**

**MC-E**

**MC-F**

**Additional Accessories**
Please consult your Parker representative for information on additional accessories required for the integration of MC Series inverters into vehicle systems. Accessories include contactors, feedback devices and connection cables and mounting hardware.
MA3 Series
High Voltage Mobile Inverters

Description
Parker’s MA3 Series inverter combines high performance and motor control with intelligence control functionality. Suitable for either PMAC or AC induction motors, it also offers the flexibility of several feedback options. Speed and torque points can be adjusted instantaneously and performance algorithms optimized to the vehicles needs. On-board digital communications with multiple protocols comes standard, along with a USB programming port. Parker’s rugged cast aluminum housing integrates a proprietary cooling configuration and necessary environmental protection for the toughest mobile applications.

Product Features:
- Environmentally sealed cast housing
- Regenerative braking
- Electronically controlled sinusoidal commutation
- Full programmability
- Compatible with choice of feedback devices
- 4 analogue and 6 digital inputs/outputs
- CAN communications
- Mini USB programming port
- Beaded hose barb coolant connections

<table>
<thead>
<tr>
<th>Description</th>
<th>MA3-40</th>
<th>MA3-60</th>
<th>MA3-80</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage Operating Range</td>
<td>205 - 400 VDC</td>
<td>310 - 600 VDC</td>
<td>410 - 800 VDC</td>
</tr>
<tr>
<td>Nominal Voltage</td>
<td>320 VDC</td>
<td>480 VDC</td>
<td>640 VDC</td>
</tr>
<tr>
<td>Peak Current Output</td>
<td>225 A</td>
<td>325 A</td>
<td>400 A</td>
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<tr>
<td>Continuous Current Output (A rms)</td>
<td>130 A</td>
<td>185 A</td>
<td>225 A</td>
</tr>
<tr>
<td>Peak Power</td>
<td>93.5 kW</td>
<td>135 kW</td>
<td>160 kW</td>
</tr>
<tr>
<td>Continuous Power</td>
<td>54 kW</td>
<td>77 kW</td>
<td>93.5 kW</td>
</tr>
<tr>
<td>Switching Freq (PMAC)</td>
<td>4.0 kHz</td>
<td>4.0 kHz</td>
<td>4.0 kHz</td>
</tr>
<tr>
<td>Switching Freq (Induction)</td>
<td>2.0 - 4.0 kHz</td>
<td>2.0 - 4.0 kHz</td>
<td>2.0 - 4.0 kHz</td>
</tr>
<tr>
<td>Efficiency</td>
<td>97%</td>
<td>97%</td>
<td>97%</td>
</tr>
<tr>
<td>Control Voltage Range</td>
<td>7 to 32 VDC</td>
<td>7 to 32 VDC</td>
<td>7 to 32 VDC</td>
</tr>
<tr>
<td>Max Control Current @ 7 V</td>
<td>0.7 ADC</td>
<td>0.7 ADC</td>
<td>0.7 ADC</td>
</tr>
<tr>
<td>Min Control Current @ 32 V</td>
<td>8 ADC</td>
<td>8 ADC</td>
<td>8 ADC</td>
</tr>
<tr>
<td>Max Inrush Current</td>
<td>18.9 ADC</td>
<td>18.9 ADC</td>
<td>18.9 ADC</td>
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<tr>
<td>Weight</td>
<td>35 lbs/15.9 kg</td>
<td>35 lbs/15.9 kg</td>
<td>35 lbs/15.9 kg</td>
</tr>
<tr>
<td>Operating Temperature</td>
<td>-40 °C to 55 °C</td>
<td>-40 °C to 55 °C</td>
<td>-40 °C to 55 °C</td>
</tr>
<tr>
<td>Storage Temperature</td>
<td>-40 °C to 85 °C</td>
<td>-40 °C to 85 °C</td>
<td>-40 °C to 85 °C</td>
</tr>
<tr>
<td>Protection</td>
<td>IP65</td>
<td>IP65</td>
<td>IP65</td>
</tr>
<tr>
<td>Control Type</td>
<td>Speed/Torque</td>
<td>Speed/Torque</td>
<td>Speed/Torque</td>
</tr>
<tr>
<td>Feedback</td>
<td>Resolver</td>
<td>Resolver</td>
<td>Resolver</td>
</tr>
<tr>
<td>Communication Protocol</td>
<td>CANopen</td>
<td>CANopen</td>
<td>CANopen</td>
</tr>
<tr>
<td>Cooling Options</td>
<td>Water/Glycol or Hydraulic Oil</td>
<td>(Alternate cooling configurations available. Contact your local sales office)</td>
<td></td>
</tr>
<tr>
<td>Flow Rate max (min)</td>
<td>2 gpm/7.6 lpm (1 gpm/3.8 lpm)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max Pressure</td>
<td>30 psi/2.07 bar</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max Inlet Temperature</td>
<td>55 °C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Certifications</td>
<td>CE and UL pending (consult factory)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
MA3 Series
Accessories and Dimensions

DSE Lite Software
For inverter setup and tuning, DSE Lite is an easy-to-use software tool with straightforward function block programming and an intuitive user interface. In addition to supporting user-defined configurations, it offers real-time monitoring and performance charting. An on-line help function is available for the various drive function blocks. DSE Lite is compatible with Windows XP™ and Windows Vista™ operating systems. DSE Lite is available for download free of charge from www.parker.com/ssl

Cables - Resolver Feedback

<table>
<thead>
<tr>
<th>Assembly P/N</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>175-00726-03</td>
<td>0.92 m (3 ft) cable</td>
</tr>
<tr>
<td>175-00726-05</td>
<td>1.52 m (5 ft) cable</td>
</tr>
<tr>
<td>175-00726-10</td>
<td>3.05 m (10 ft) cable</td>
</tr>
<tr>
<td>175-00726-15</td>
<td>4.57 m (15 ft) cable</td>
</tr>
<tr>
<td>175-00726-25</td>
<td>7.62 m (25 ft) cable</td>
</tr>
</tbody>
</table>

Dimensions (mm)
Motors and Generators
Permanent Magnet (PMAC)

Breakthrough Performance
Parker's family of PMAC motors and generators have been designed to meet the challenging requirements of vehicle duty performance. The design has focused on reducing magnetic material content, optimising stator lamination design, and cooling configuration that yields a compact motor with very high output power.

- Specific Power (peak) >14 kW/L
- Specific Power (cont) >10 kW/L
- Power Density (peak) >3.9 kW/kg
- Power Density (cont) >2.6 kW/kg

Parker's vehicle motors include patent-pending cooling, constant torque/constant power regions, low-cost electrical connections, full environmental protection and more.

Technical Characteristics

<table>
<thead>
<tr>
<th>Motor Dimensions</th>
<th>Units</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length</td>
<td>mm</td>
<td>200/250/300/350/550</td>
</tr>
<tr>
<td>Diameter</td>
<td>mm</td>
<td>142/210/310</td>
</tr>
<tr>
<td>Shaft</td>
<td>mm</td>
<td>Spline</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>System Performance</th>
<th>Units</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peak Power</td>
<td>kW</td>
<td>13 - 400</td>
</tr>
<tr>
<td>Rated Power</td>
<td>kW</td>
<td>9 - 250</td>
</tr>
<tr>
<td>Peak Torque</td>
<td>Nm</td>
<td>22 - 1400</td>
</tr>
<tr>
<td>Rated Torque</td>
<td>Nm</td>
<td>15 - 980</td>
</tr>
<tr>
<td>Peak Efficiency</td>
<td>%</td>
<td>96</td>
</tr>
<tr>
<td>Max Speed</td>
<td>RPM</td>
<td>8000</td>
</tr>
<tr>
<td>Base Speed</td>
<td>RPM</td>
<td>2000 - 4000</td>
</tr>
<tr>
<td>Input Voltage</td>
<td>VDC</td>
<td>24 - 750</td>
</tr>
<tr>
<td>Max Current</td>
<td>Arms</td>
<td>up to 1250</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Cooling</th>
<th>Units</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td>NA</td>
<td>Internal</td>
</tr>
<tr>
<td>Coolant</td>
<td>NA</td>
<td>Water or Oil</td>
</tr>
<tr>
<td>Inlet Temp</td>
<td>Degrees Celsius</td>
<td>50 - 70</td>
</tr>
<tr>
<td>Pressure</td>
<td>mm Hg</td>
<td>51 - 510</td>
</tr>
</tbody>
</table>

Custom Solutions
Parker’s family of PMAC motors and generators share breakthrough standard magnetic and thermal designs, but can easily be customised to fit the mechanical constraints of our customers' vehicle programs. With no minimum volume requirement, Parker can assist in the development of both prototype and serial production motors and generators.

Customisation Specialists
As a designer and manufacturer of PMAC motors and generators, Parker is well positioned to quickly and cost effectively design and produce custom solutions to our customers' specifications, including mechanical solutions, such as connectors, shafts, mounting and motor kits. Additionally, Parker can customise motor magnetic designs and cooling systems to produce desired performance under specific conditions, such as voltage, duty cycle, ambient temperature or operating environment.
Motors and Generators
Permanent Magnet (PMAC)

Highest Efficiency
The right selection and design of the best component technology with the optimal performance characteristics ensures that PMAC motors and generators will perform at very high efficiencies.

Parker’s PMAC stators and rotors have been very carefully designed to minimise losses over a large operational region.

Not only does this utilise each battery charge more effectively, but it also increases reliability by limiting thermal buildup and cycling that lead to material fatigue and failure. Together, this provides the lowest total cost of ownership.

Broadest Scalability
From electric power steering motors to Category O4 electric traction motors, the same cutting edge design ensures predictable performance and reliability

- Three diameters: 142mm, 210mm and 310mm
- Extrusion-based housing, internal rotor and stator construction, patent-pending cooling configuration create a motor package with unmatched flexibility to scale torque/power levels up or down as application requirements change.
- 12 standard sizes. Custom lengths made with 95% production parts.
- Voltage from 24VDC to 750VDC
- Flexible base speed
- 8000 RPM max speed
- Peak power to 300kW+
Motors and Generators

Asynchronous Motors
Asynchronous induction motors designed for mobile application are available as part of a complete Parker mobile inverter system.

Asynchronous motors are available for inverter systems from 24 VDC to 650 VDC and are delivered with a pre-configured and tested Parker mobile inverter.

Please consult your local Parker sales office to discuss your specific application requirements.

Battery Management Systems
Hybrid vehicle systems require substantial energy storage facilities and Parker can assist with battery system design, including:

- Local battery management modules
- Real-time battery status communications to supervisory system
- Charging and cell-to-cell balancing
- Loading and temperature management
- System packaging

We work with multiple battery chemistries, including traditional lead-acid and advanced lithium-ion technologies.

Testing Capabilities
In addition to comprehensive motor design and manufacturing capabilities, Parker can provide motor performance testing at our motor testing facilities in the U.S. and Europe.

Parker motor testing facilities utilize programmable, Parker-designed and manufactured power conversion systems to simulate real-world motor conditions up to 350 kW continuous power.

Additionally, Parker can couple motor-inverter combinations to hydraulic test rigs to simulate the response of different combinations of hydraulic components.

Typical testing outcomes include:
- Motor continuous and peak torque validation
- Drive cycle simulation and power usage
- Drive cycle efficiency data
- Quantification of time at peak torque

Please consult your local Parker sales office for more information.
ePump Kits
Mobile Inverters, PMAC/Induction Motors, Hydraulic Pump

Subsystem Capabilities

Today, mobile OEMs face tremendous demands to provide machines that cost less to operate and that meet future regulatory standards. To reduce the time to meet these demands, Parker offers pre-engineered and customisable ePump kits to assist in the development of hybrid-electric vehicle platforms. An ePump kit includes:

- Low or high voltage inverter, depending on the battery system and performance requirements
- Matched AC induction or PMAC motor
- Motor-pump mounting
- Mobile hydraulic pump - fixed displacement (vane or gear style) or variable displacement (bent-axis piston style)

To understand the performance capabilities of each unique kit, we have developed a complete ePump test facility that can measure the hydraulic output of an ePump with a given electrical input. In addition, we can customize our test stand variables (temperature, duty cycle, on-board power availability) to develop a unique ePump kit for your application.

Flexible Solutions

- 5 pre-engineered high voltage e-Pump kits are available to meet your application needs
- Induction and PMAC motor flexibility, along with multiple hydraulic pump options creates unique performance capabilities
- Direct coupled pumps for ease of implementation
- High and low voltage mobile inverter options across multiple power ranges
- Optional plug & play CAN interface available with Parker IQAN controllers

<table>
<thead>
<tr>
<th>Description</th>
<th>Kit Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pump type</td>
<td>Vane</td>
</tr>
<tr>
<td>Maximum flow</td>
<td>320 l/min</td>
</tr>
<tr>
<td>RMS pressure (1)</td>
<td>29 bar</td>
</tr>
<tr>
<td>RMS power</td>
<td>13 kW</td>
</tr>
<tr>
<td>RMS bus current</td>
<td>24 Amps DC</td>
</tr>
<tr>
<td>Pressure (2)</td>
<td>50 bar</td>
</tr>
<tr>
<td>Power</td>
<td>27 kW</td>
</tr>
<tr>
<td>Bus current</td>
<td>60 Amps DC</td>
</tr>
<tr>
<td>Rated performance fluid temperature range</td>
<td>10°C - 50°C</td>
</tr>
<tr>
<td>Operating fluid temperature range</td>
<td>-40°C - 80°C</td>
</tr>
<tr>
<td>Filtration</td>
<td>ISO 18 /14</td>
</tr>
</tbody>
</table>

NOTES

(1) RMS pressure and power at 650 VDC and water/glycol cooling.
(2) Operation for 60 seconds. RMS duty cycle not to exceed continuous operation.
ePump Kit Options
Mobile Inverters, PMAC/Induction Motors, Hydraulic Pump

Control and Communication

- Control, operation performance and health monitoring of the ePump Kit subsystem is accomplished through analogue, discrete, and CANopen digital formats.
- SAE J1939 protocol compatibility is available by using a Parker IQAN controller as a gateway.
- For variable speed fixed displacement pump configuration, optimized and responsive pressure/flow can be achieved by using motor current and motor speed feedback.
- The inverter is capable of real-time selectable speed torque commands enabling all traditional pump PQ control architectures.

IQAN - ECD Controllers

The highly intelligent IQAN system is an electronic approach to controlling and monitoring hydraulic systems on mobile machines. Parker IQAN master communication modules can be used as a standalone controller, a single bus master, or with other IQAN master modules. The IQAN-MC3 model is designed in accordance with IEC 61508, and can be used to implement safety functions of up to SIL2. There are two CAN interfaces for bus Communication using IQAN CAN Protocol (ICP) and SAE J1939 or Generic CANopen.

- **Rugged Design**
- **32-Bit Technology**
- **TFT color display modules available**
- **User Friendly - No programming experience needed**
- **Software based development**
- **Functions can be easily modified in the field**
- **Safety functionality**
- **Global support**

<table>
<thead>
<tr>
<th>Description</th>
<th>IQAN Master Modules</th>
<th>IQAN Expansion Modules</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAN Interfaces</td>
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<td>MD3</td>
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</tr>
<tr>
<td>Digital Outputs</td>
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<td>1</td>
</tr>
<tr>
<td>Voltage/Digital Inputs</td>
<td>8(12)</td>
<td>7(7)</td>
</tr>
<tr>
<td>Frequency Inputs</td>
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<td>(5)</td>
</tr>
<tr>
<td>USB Ports</td>
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</tr>
<tr>
<td>RS-232 Ports</td>
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<td>1</td>
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</table>
## Ordering Information

**MA and MC Series Inverters**

### Order example

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<th>1</th>
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<th>4</th>
<th>5</th>
<th>6</th>
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<th>9</th>
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<tr>
<td>Order example</td>
<td>M</td>
<td>A</td>
<td>3</td>
<td>-</td>
<td>60</td>
<td>-</td>
<td>0400</td>
<td>-</td>
<td>R0</td>
</tr>
</tbody>
</table>

### Inverter family

- **M** Mobile Inverter
- **A** High Voltage - 400, 600, 800 VDC
- **C** Low Voltage - 24, 48, 80 VDC

### Control module build

- **A** High Voltage - 400, 600, 800 VDC
- **C** Low Voltage - 24, 48, 80 VDC

### Frame size

- **3** MA Series Inverter
- **C** MC Series xx kW
- **D** MC Series xx kW
- **E** MC Series xx kW
- **F** MC Series xx kW

### Maximum operating voltage

**Low Voltage MC Series Inverter**

- **02** 24 VDC
- **04** 48 VDC
- **08** 80 VDC

**High Voltage MA3 Series Inverter**

- **40** 400 VDC
- **60** 600 VDC
- **80** 800 VDC

### Peak current ratings

- **24 VDC Nominal Voltage**
  - **0250** 250A - MC Series Frame C
  - **0350** 350A - MC Series Frame D

- **48 VDC Nominal Voltage**
  - **0350** 350A - MC Series Frame D
  - **0450** 450A - MC Series Frame E
  - **0650** 650A - MC Series Frame F

- **80 VDC Nominal Voltage**
  - **0350** 350A - MC Series Frame E
  - **0650** 650A - MC Series Frame F

- **400 VDC Nominal Voltage**
  - **0225** 225A - MA3-40 Series Inverter
  - **0325** 325A - MA3-40 Series Inverter
  - **0400** 400A - MA3-40 Series Inverter

- **600 VDC Nominal Voltage**
  - **0225** 225A - MA3-60 Series Inverter
  - **0325** 325A - MA3-60 Series Inverter
  - **0400** 400A - MA3-60 Series Inverter

### Peak current ratings (Continued)

- **800 VDC Nominal Voltage**
  - **0225** 225A - MA3-40 Series Inverter
  - **0325** 325A - MA3-40 Series Inverter
  - **0400** 400A - MA3-40 Series Inverter

### Feedback Option

- **00** None
- **R0** Resolver
- **EQ** Incremental quadrature encoder
- **A0** Absolute encoder
- **M1** SinCos absolute encoder
- **LS** Line sync card

### Communication Option

- **0** None
- **1** CANopen communications
- **2** IQAN communications

### Coolant Connections

- **0** None
- **1** Water/Glycol hose
- **2** Hydraulic fitting

### Branding

- **01** Parker branded
- **XX** OEM branding (assigned by factory)

### Special Options

- **00** None
- **XX** Special option (assigned by factory)
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