



PM250 Propulsion Inverters

PRODUCT SUMMARY

The PM Family of Propulsion Inverters are designed for on- and off-road Electric (EV) or Hybrid Electric (HEV) applications. These motor controllers convert the DC power from the vehicle ESS (Energy Storage System / Battery) to the 3-phase AC required by the motor.

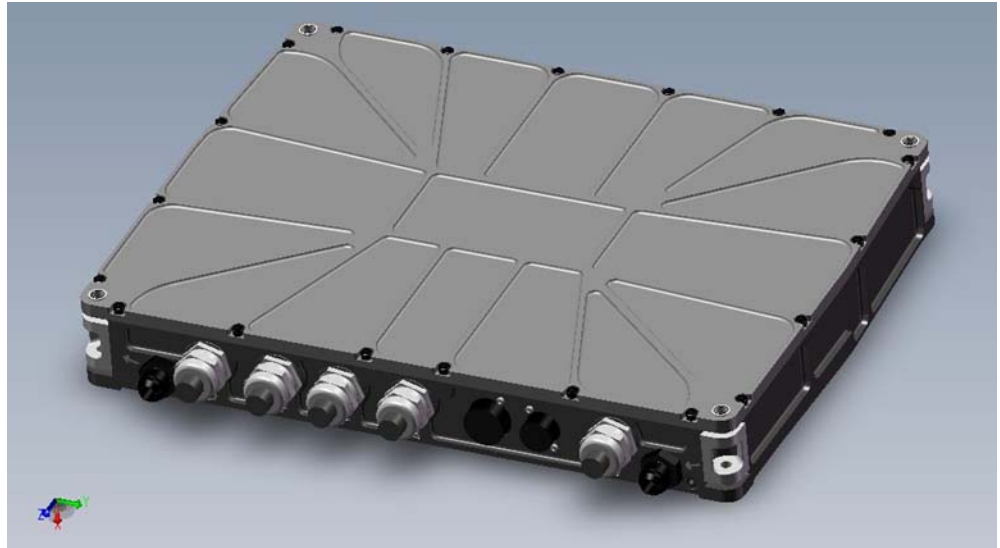
FEATURE SUMMARY

- 6 (0-5V) Analog Inputs
- 2 selectable PT100 / PT1000 RTD Inputs
- 8 Digital Inputs STB/STG
- 4 High Side Driver Outputs
- 2 Low Side Driver Outputs
- 1 Resolver Interface
- 1 Quadrature Encoder Intf
- 1 Sin-Cos Encoder Intf
- 1 3-ph Hall Position Sensor Intf
- 2 CAN 2.0A/B Ports 1MB
- RS232 Programming Port

SYSTEM INTEGRATION

Rinehart has extensive experience in automotive, motor-sports, and military vehicle propulsion and power electronics applications.

- consultation in propulsion system design,
- propulsion system integration
- vehicle development
- Multi-wheel propulsion



A Family of compact, robust, reliable, easy to integrate, and cost effective propulsion inverters for 300—500Hp class OEM and specialty heavy equipment builders. Applications include high-performance road cars, professional motor-sports, heavy vehicle hybrid propulsion, static energy conversion, hybrid range extender or ISG controller, and many more. Suitable for military COTS usage.

Controller Model	PM250DX	PM250DZ	
DC Voltage – operating	50—400	50—800	V _{DC}
DC Overvoltage Trip	420	840	V _{DC}
Maximum DC Voltage – non-operating	500	900	V _{DC}
Motor Current Continuous	Limited by conductor size*	450	A
Motor Current Peak **	900	600	A _{rms}
Output Power Peak (electrical) **	350	460	kVA
DC Bus Capacitance	1500	645	μF
Size and Volume	523 x 391 x 75 15.4		mm L
Weight	20	20	kg
Cable Gland Size	M32	M32	
Minimum Conductor Size	2	2	AWG
Maximum Conductor Size	3/0	3/0	AWG
Minimum Cable O.D.***	11	11	mm
Maximum Cable O.D.	21	21	mm

Ratings subject to change without notice—consult factory

* The maximum conductor size rated in a 32mm cable gland is 3/0 AWG or 95mm². Motor continuous current is limited by the size of the conductor. ** Peak current is defined as a maximum of 30 seconds. *** Depending on cable type, an additional sleeve may be needed to seal the Cable O.D. to the cable gland.

Rinehart Motion Systems LLC

Hybrid vehicles, power hybrid packaging, power electronics and propulsion controls

For more information: info@quantumworks.com
619-438-0018





PM250 Propulsion Inverters

Automotive quality design and manufacturing

- Automotive qualified or temp range components, IPC Class 3 PCB fab
- TS16949-compliant formal product development processes
- Automotive design verification and product validation with full DVPnR

Full set of flexible integrated I/O

- 5V analog power for external transducers and
- 5V digital power for external encoder operation
- All external inputs can be used by the system controller as distributed I/O

On the fly mode switching and parameter update over CAN

- speed or torque mode on command at Start
- Torque limits can be changed every 6msec
- Active DC Link discharge on command

Configurable as vehicle master or slave

- CAN network and throttle pot interface options
- Multi-controller coordination, BMS and DC-DC Interface, custom options

Simplest setup and operation

- 1 motor type parameter selects 90% of required settings
- Simple file download to clone a working setup

MOTOR FEEDBACK

Souriau 8STA61626SN size 16 with 26 #20AWG pins

MAIN LV I/O CONNECTOR

Souriau 8STA62041SN size 20 with 41 #20AWG

FEATURES

Easy to use CAN-based network node

Custom .dbc messaging

Standard J1939 on request

Extensive feedback broadcast messaging for datalogging

Calibration with production tools

PC-based setup and programming tools available for free

FUNCTIONAL SAFETY

Compatible with ISO26262 vehicle safety certification (not standalone compliant)

ISO6469 High Voltage Safety

Command Safety Watchdog

ENVIRONMENTAL

Designed to ISO16750 heavy vehicle climatic, mechanical, and environmental requirements

ISO20653 washdown / high pressure wash rated

Built-in shock mounts for easy installation

Low-Cost cable gland interface for shielded power cable without expensive connectors

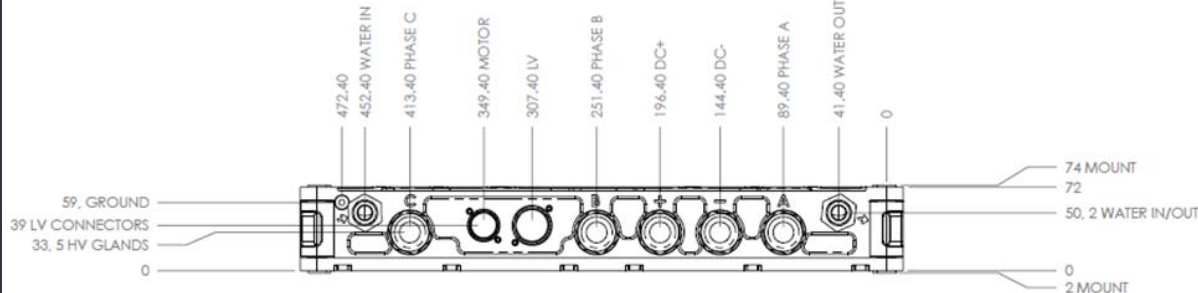
ORB Coolant ports—can be adapted to any standard hose fitting, any angle

Robust, fault-tolerant IGBT power stage

Description	Value
Short Circuit Protection	Yes
Hardware Over-current, Over-voltage Protection	Yes
Vehicle System Power	9 .. 16V _{DC} (12V Systems)
Isolation – High-Voltage to Low-Voltage or to Case	2500V _{rms}
Isolation – Low-Voltage to Case	50V
Operating Temperature Range – coolant water – no derating	-40 .. +80°C
Derated Coolant Temperature Range – derate 100% -> 0%	+80° .. +105°C
Non-Operating Temperature Storage Temperature	-40 .. +115°C -55 .. +105°C
Coolant Type	50/50 EGW
Coolant Flow Rate	20 – 30 LPM (5 – 6 GPM)
Coolant Pressure Drop (60°C coolant at 25 LPM)	1.3 bar (132kPa / 18psi)
Maximum Coolant Pressure (absolute)	2.75 bar (275kPa / 40psia)
Operating Shock (ISO 16750-3, Test 4.2.2.2)	500 m/s ² (50g), pending
Operating Vibration (ISO 16750-3, 4.1.2.4 Test IV)	27.8 m/s ² (3g _{rms}), pending
Environmental Protection Class (see ISO 20653)	IP6K9K, IP67
EMC compatibility	IEC61000 / FCC Part 15 Class B, pending

Ratings subject to change without notice—consult factory

These Propulsion Inverter products are designed and manufactured to comply with the following international standards: ISO6469, ISO6493-3, ISO16750, ISO20653, IEC60950, <IEC61000 pending>



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Rinehart Motion Systems LLC—propelling innovation in electric propulsion

PM100 and PM150 Family Propulsion Inverters

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- 2 Low Side Driver Outputs
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- 1 Sin-Cos Encoder Intf
- 2 CAN 2.0A/B Ports
- 1MB RS232 Programming Port

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- vehicle development
- Multi-wheel propulsion



A Family of compact, robust, reliable, easy to integrate, and cost effective propulsion inverters for 60—200Hp class OEM and specialty heavy equipment builders. Applications include high-performance road cars, professional motor-sports, heavy vehicle hybrid propulsion, static energy conversion, hybrid range extender or ISG controller, and many more. Suitable for military COTS usage.

Controller Model	PM100DX	PM100DZ	PM150DX	PM150DZ	
DC Voltage – operating	50—400	100—800	50—400	50—800	V _{DC}
DC Overvoltage Trip	420	840	420	840	V _{DC}
Maximum DC Voltage – non-operating	500	900	500	900	V _{DC}
Motor Current Continuous	300	150	450	225	A
Motor Current Peak *	350	200	450*	300	A _{rms}
Output Power Peak (elect) *	100	100	150	150	kVA
DC Bus Capacitance	440	280	880	560	μF
Size and Volume	200 x 87 x 314 5.5		200 x 87 x 436 7.6		mm L
Weight	7.5	7.5	10.7	10.7	kg
Cable Gland Size	M25	M25	M32	M32	
Minimum Conductor Size	4	4	2	4	AWG
Maximum Conductor Size	1	1	3/0	1	AWG
Minimum Cable O.D.**	9	9	11	11	mm
Maximum Cable O.D.	16.5	16.5	21	21	mm

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* peak is 10seconds, PM150DX is terminal / wire size limited.

** depending on cable type, if diameter is too small it may be necessary to sleeve the cable.

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PM100 PM150 Propulsion Inverters

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Configurable as vehicle master or slave

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- Multi-controller coordination, DC-DC Interface, custom options

Simplest setup and operation

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MOTOR FEEDBACK

AMPSEAL 23p

MAIN LV I/O CONNECTOR

AMPSEAL 35p

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without expensive connectors

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Short Circuit Protection	Yes
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Vehicle System Power	9 .. 16V _{DC} (12V Systems)
Isolation – High-Voltage to Low-Voltage or to Case	2500V _{rms}
Isolation – Low-Voltage to Case	50V
Operating Temperature Range – coolant water – no derating	-40 .. +80°C
Derated Coolant Temperature Range – derate 100% -> 0%	+80°.. +105°C
Non-Operating Temperature	-40 .. +105°C
Storage Temperature	-55 .. +105°C
Coolant Type	50/50 EGW
Coolant Flow Rate	8—10 LPM (2 GPM min)
Coolant Pressure Drop (60°C coolant at 10 LPM)	0.35 bar (35kPa/5psi) PM150
Maximum Coolant Pressure (absolute)	4.5 bar (450kPa / 65psia)
Operating Shock (ISO 16750-3, Test 4.2.2.2)	500 m/s ² (50g), pending
Operating Vibration (ISO 16750-3, 4.1.2.4 Test IV)	27.8 m/s ² (3g _{rms}), pending
Environmental Protection Class (see ISO 20653)	IP6K9K, IP67
EMC compatibility	IEC61000 / FCC Part 15 Class B, pending

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Racing Version are available under special order:

- PM100DXR provides 450Arms peak current in the smallest package for 400V-class applications
 - PM150DZR provides 400Arms peak current for 800V-class applications for 300kW peak output
- These version trade useful operating life for increased peak power handling in transients.

Example applications include:

- Motorcycle racing
- LMP prototype and FormulaE constructors
- Hybrid Supercar makers

Consult factory for more information on suitability of these product variants in your application, and to place orders.

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