

HyPM[®] Fuel Cell Power Modules



HyPM[®] HD Fuel Cell Power Module
for mobility applications

HyPM[®] XR Fuel Cell Power Module
for backup power applications

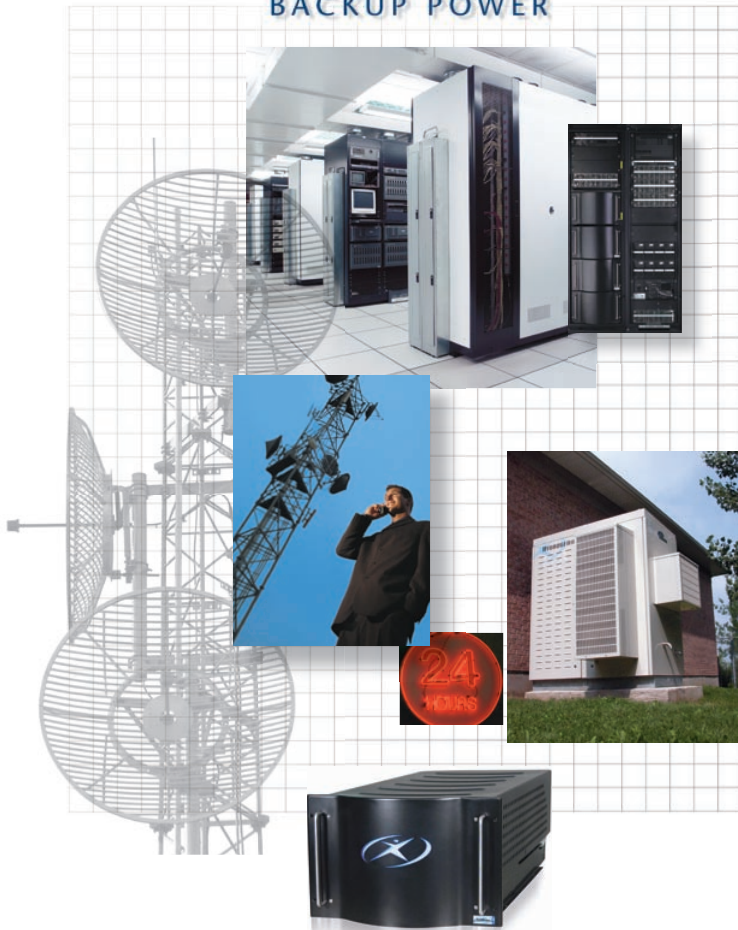
Powered with Purpose

Purpose-built to deliver the best in performance for specific applications, yet sharing the strengths of a common platform, Hydrogenics' family of HyPM[®] Fuel Cell Power Modules are today's product of choice for Original Equipment Manufacturers (OEMs) and system integrators.

...Powered with Purpose!

Designed and built on a proven common platform, Hydrogenics' HyPM® HD and HyPM® XR Fuel Cell Power Modules are 'tailored to purpose' for a range of mobility and backup power applications. Our customer-driven design differentiations ensure a cost-effective HyPM product that meets the demanding criteria for your application.

BACKUP POWER



Hydrogenics HyPM XR Fuel Cell Power Modules deliver the reliability that backup power markets demand

When business relies on critical networks, such as database centers or telecom infrastructure, we know that customers demand the utmost in reliability. Reliability that ensures that there is always high quality power when needed, the very moment it is needed, and at the right cost.

Powered for purpose ...the rack-mountable **HyPM XR**, suited for both AC and DC backup power applications, is built around Hydrogenics' unhumidified PEM (proton exchange membrane) fuel cell stack technology. This innovative architecture makes it a simpler system with fewer parts, meaning fewer failure modes and lower life-cycle costs for extended run backup power applications.

HyPM XR is available in power outputs of 4 kW, 8 kW and 12 kW.

MOBILITY



Hydrogenics HyPM HD Fuel Cell Power Modules deliver the durability and power density that mobility markets demand

When putting power on board a vehicle, a prime requirement is having a robust system that can log the hours in rugged conditions, within tight space and weight tolerances. Adding to the challenge, efficiency is paramount in order to manage fuel costs and maximize vehicle range.

Powered for purpose... the **HyPM HD** is built around Hydrogenics' proprietary PEM stack technology using high durability components designed for demanding dynamic conditions. This low profile module delivers world-leading efficiency from a low pressure design, all within a compact package. And integrating a fuel cell system with other powertrain components does not come any easier than it does with a HyPM product.

HyPM HD is available in power outputs of 4 kW, 8 kW, 12 kW, 16 kW and 65 kW.

Common Platform

At Hydrogenics we started with leading fuel cell technology and put it on a robust platform in an optimized operating environment. The result – a fusion of strengths and features that HyPM® customers experience across our full product offering of Fuel Cell Power Modules.

DYNAMIC RESPONSE

- Full operating range from idle to full power in 4 seconds
- Rapid response to load changes

EFFICIENCY

- High peak operating efficiency > 50%

EASE OF INTEGRATION

- Simple electrical and mechanical interfaces
- Liquid cooling for efficient heat removal
- Fully compatible with hybrid configurations

HIGH RELIABILITY

- Unlimited start-stop cycles (patented)
- Built-in advanced diagnostics and controls (patent pending)

COMPACT

- Industry leading gravimetric and volumetric power density

ENVIRONMENT FRIENDLY

- Zero emissions
- Quiet operation

SCALABLE

- Scalable power outputs ranging from 4 kW to 65 kW
- Multiple modules configurable in series or parallel

Whatever the application, customers benefit from HyPM's extensive track record in on-bench testing and real-time deployments across a wide range of mobility and stationary power load profiles. Also they benefit from manufacturing cost efficiencies that Hydrogenics passes along to the customer.

NEW! FOR 2007

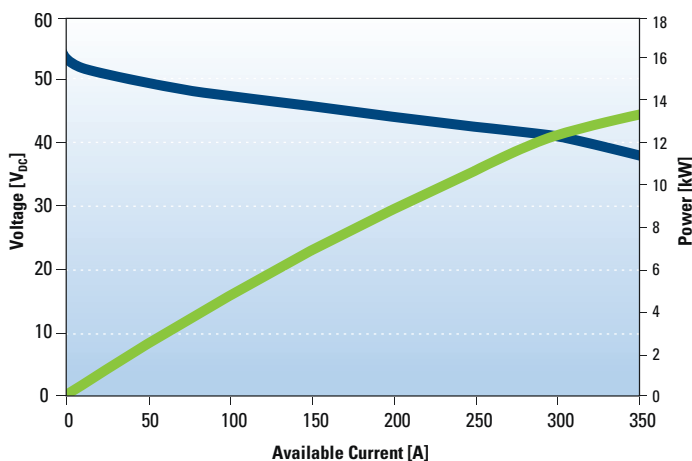
H2X® 204
Fuel Cell Stack



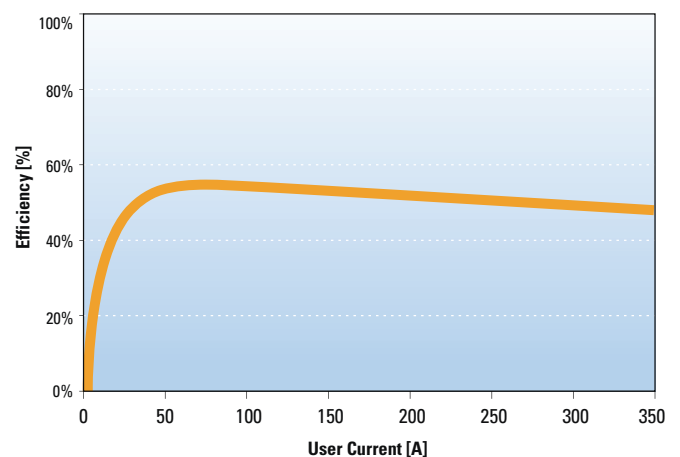
H2X® 506
Fuel Cell Stack

Hydrogenics proven low pressure Proton Exchange Membrane (PEM) fuel cell stack architecture is at the core of HyPM's superior product offering. Our new H2X® 204 stack expands HyPM's product offering to deliver solutions for lower power ranges.

Typical HyPM® Power Curve & Operating Characteristics



Typical HyPM® Efficiency



* based on HyPM® 12 Power Module

HyPM[®] XR Backup Power Module

Built on the common platform of HyPM strengths, our UL compliant HyPM XR is further tailored to deliver...

RELIABILITY

- Reduced parts count enabled by proprietary unhumidified stack technology
- Patent pending control technology
- > 1000 hour life

COST-EFFECTIVENESS

- Further cost reductions through:
 - low catalyst loading ≤ 0.6 mg Pt/cm²
 - optimized BOP
 - elimination of humidification sub-system
- Designed for manufacturability:
 - low cost single frame platform
 - high volume components



Module Specifications		HyPM [®] XR 4	HyPM [®] XR 8	HyPM [®] XR 12
Maximum Power	(kW)	4.5	8.5	12.5
Voltage Range	(V _{DC})	30 – 38	24 – 38	37 – 57
Maximum Operating Current	(A)	150	350	350
Dimensions (L x W x H)	(cm)	87 x 50 x 32	87 x 50 x 32	96 x 50 x 32
	(in)	34 x 20 x 13	34 x 20 x 13	38 x 20 x 13
Volume	(l)	139	139	154
	(gallons)	37	37	41
Mass	(kgs)	80	80	90
	(lbs)	177	177	198
Peak Efficiency	(%)	55	55	55
Time from Idle to Peak Power	(s)	≤ 4	≤ 4	≤ 4

Power Solutions for Backup Fuel Cell Power Modules

Hydrogenics offers power solutions to provide constant voltages of 24 and 48 V for the following products:

Nominal Voltage	HyPM XR 4	HyPM XR 8	HyPM XR 12
24 V _{DC}	✓	✓	✓
48 V _{DC}	✓	✓	

Please contact us if you have voltage requirements not shown above.

HyPM® HD Mobility Power Module

Built on the common platform of HyPM strengths, HyPM HD is specifically designed to deliver...

DURABILITY AND RELIABILITY

- Longer life components
- Patent pending control technology
- Robust design to withstand the demands of mobility applications
- > 3000 hour life

COMPACT POWER

- High volumetric and gravimetric power density



Integration Interface

- electrical terminals
- coolant inlet
- hydrogen inlet
- hydrogen outlet
- coolant outlet
- air outlet
- communication interface

Integration interface is similar for both modules

Module Specifications		HyPM HD 4	HyPM HD 8	HyPM HD 12	HyPM HD 16	HyPM HD 65
Maximum Power ⁽¹⁾	(kW)	4.5	8.5	12.5	16.5	65.5
Voltage Range	(V _{DC})	58 – 79	48 – 79	36 – 57	48 – 76	218 – 305
Maximum Operating Current	(A)	80	180	350	350	300
Dimensions (L x W x H)	(cm)	85 x 36 x 25 ⁽³⁾	85 x 36 x 25 ⁽³⁾	94 x 45 x 30	96 x 51 x 41	^{(2),(3)}
	(in)	33 x 14 x 10	33 x 14 x 10	37 x 18 x 12	38 x 20 x 16	
Volume	(L)	77 ⁽³⁾	77 ⁽³⁾	127	201	578
	(gallons)	20	20	34	53	153
Mass	(kgs)	75	75	78	115	321
	(lbs)	165	165	172	254	707
Peak Efficiency	(%)	50	50	54	56	55
Time from Idle to Peak Power	(s)	≤ 4	≤ 4	≤ 4	≤ 4	≤ 4

⁽¹⁾ Beginning of life, continuous power

⁽²⁾ 5 Modules including: 2 Stack Modules: 96 x 67 x 33 cm (38 x 27 x 13 in) each; Air Delivery: 63 x 43 x 43 cm (25 x 17 x 17 in); Power Electronics: 46 x 33 x 19 cm (18 x 13 x 8 in); Water Pump: 34 x 18 x 14 cm (13 x 7 x 6 in)

⁽³⁾ Dimensions include covers which can be removed to decrease volume

Power Solutions for Mobility Fuel Cell Power Modules

Hydrogenics offers power solutions to provide constant voltages of 24, 36, 48 and 72/80 V_{DC} for the following products:

Nominal Voltage	HyPM HD 4	HyPM HD 8	HyPM HD 12
24 V _{DC}	✓	✓	✓
36 V _{DC}	✓	✓	✓
48 V _{DC}	✓	✓	✓
72/80 V _{DC}	✓	✓	✓

Please contact us for information on Power Solutions for our HyPM 16, 65 and custom fuel cell products or if you have voltage requirements not shown above.

HYDROGENICS: Delivering the Complete Package

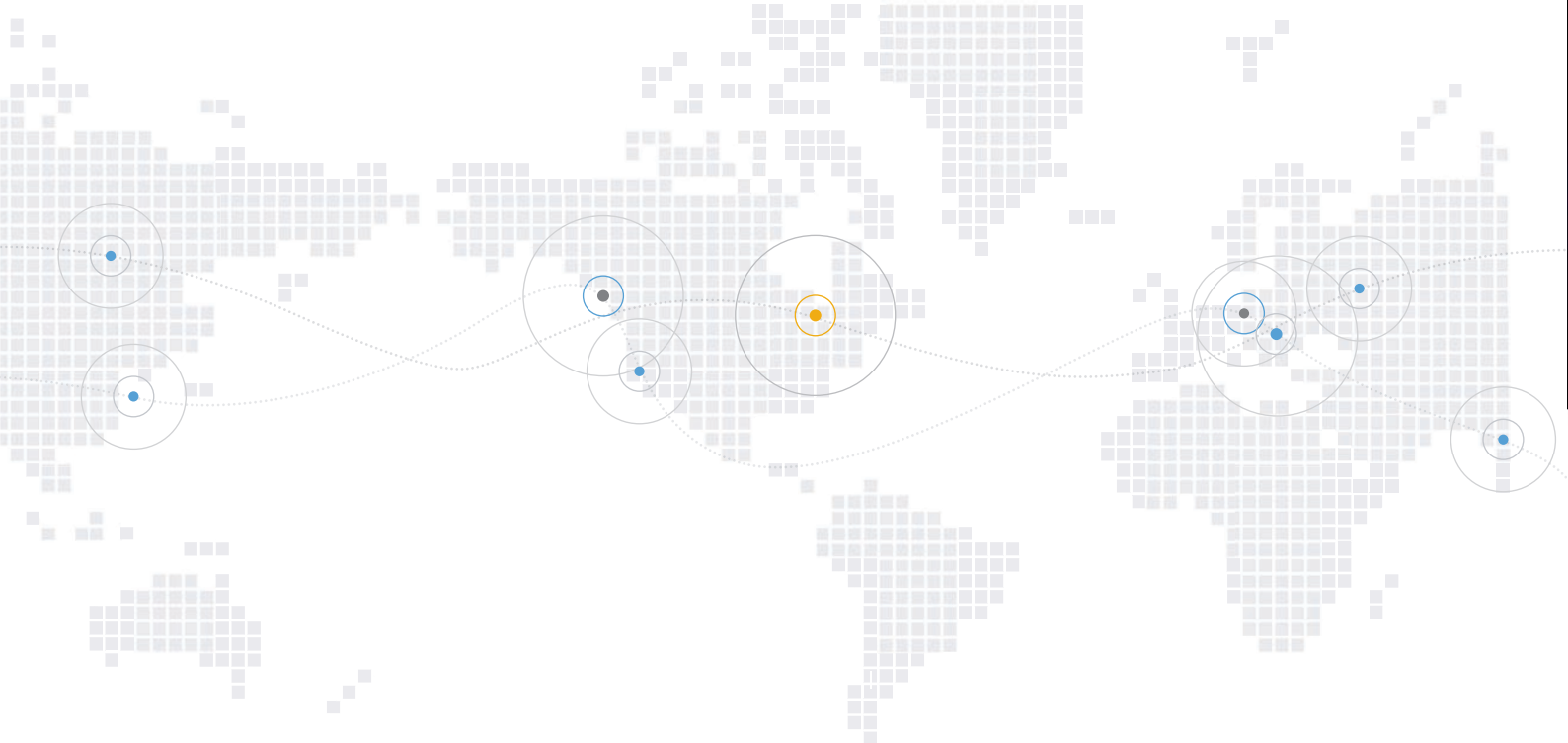
Hydrogenics Corporation is a recognized world leader in the development and manufacturing of hydrogen and fuel cell products for a full range of energy and industrial applications.

Many of our **Power Systems** customers look to us, not only for world-leading fuel cell solutions, but also for innovative hydrogen supply and refueling solutions. One way we can do this is by working together with our **OnSite Generation** business group to propose a suitable hydrogen station to meet the needs of these customers, and then undertake the necessary collaboration to make it happen.

Hydrogenics OnSite Generation offers a full line of HySTAT™ hydrogen stations and turnkey hydrogen generation solutions for a wide range of hydrogen applications including industrial processes, vehicle

refueling and distributed power. Hydrogenics' world-wide leadership in scalable electrolysis-based products and integrated reformer-based systems positions the company to offer a full array of hydrogen generation and refueling options. From a selection of versatile modular components, Hydrogenics can propose the optimum HySTAT™ hydrogen station configuration that precisely meets a customer's specific operational criteria for hydrogen generation, storage, and dispensing.

With its complete suite of hydrogen products and service solutions, Hydrogenics is committed to changing power and powering change.



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