

# PROTECTION RELAY TESTING

This table provides a comparison and visual summary of core features between several entry-level protection relay testing bundles.

	 	 	 
	<b>eMEGASIM   OP4510</b> <b>Comprehensive protection system for research &amp; education</b>	<b>HYPERMIM®   OP4510</b> <b>Closed loop protection relay testing</b>	<b>HYPERMIM®   OP5707</b> <b>Flagship Real-Time Digital Simulator</b>
Part Number	OP45BDL-PT-FX75	OP45BDL-PT-HX30	-
<b>APPLICATIONS</b>			
Protection function testing	✓	✓	✓
Protection scheme testing (including virtual relay library)	✓	✓	✓
Events analysis	✓	✓	✓
COMTRADE play back	-	✓	✓
Traveling wave testing	-	-	✓
<b>HIGHLIGHTS</b>			
Maximum entry-level network size	75 states (~ 30 single-phase nodes on one core)	30 single-phase nodes on one core	Up to 20,000 single-phase nodes
Control loop minimum delay	7 μs	5 μs	5 μs
Model minimum time step	3 μs	3 μs	3 μs
Run offline simulation	✓	✓	✓
Play back COMTRADE files	-	✓	✓
Split models automatically for parallel computation	-	✓	✓
Maximum number of IED connections using standard communication protocols (IEC 61850, DNP3, Modbus, C37.118, ...)	Unlimited ***	Unlimited ***	Unlimited ***

\*\*\* Optional

SOFTWARE			
RT-LAB   Real-time Simulation Software	✓	-	-
HYPERSIM® license	-	1 user	1 user
Supports the Simscape Power Systems & SimPowerSystems® Library	✓	✓	✓
Real-time power electronics/power system core license	3 Cores	1 Core HYPERSIM HX30	UP to 40 Cores
ARTEMiS: power electronics/power system solver license	eMEGASIM 1 Core – Fx75	N/A	HYPERSIM up to 40 Cores
TECHNICAL SPECIFICATIONS			
Chassis	OP4510	OP4510	OP5030 or OP5700
CPU	4 cores XEON E5 @ 3.5Ghz	4 cores XEON E5 @ 3.5Ghz	Up to 96 cores XEON E5 or E7
Maximum I/O cards per chassis	Up to 4 cards	Up to 4 cards	Up to 8 cards
Remote I/O expansion capabilities (HSL)	✓	✓	✓
Analog Output   16 channels, 16bits, 1 MS/s, +/-16V	***	***	***
Analog Input   16 channels, 16 bits, 2MS/s, +/-20V	***	***	***
Analog Input   16 channels, 16 bits, 500 kS/s, +/-20V	***	***	***
Digital Input   32 channels, 4.5V to 50V, 40 ns	***	***	***
Digital Output   32 channels, 5V to 30V, 65 ns	***	***	***
Default RJ45 Ethernet ports	2	2	2
Additional RJ45 Ethernet ports (for IEC 61850 and other Ethernet-based protocols)	2 ports ***	2 ports ***	4 ports ***
Time synchronization kit (for time-stamped communication protocols)	***	***	***
COMMUNICATIONS PROTOCOLS			
IEC 61850-8-1 GOOSE/Sampled Values/SV data integrity manipulation C37.118 slave/master DNP3 slave/master Modbus slave/master	***	***	***
One-line diagram schematic editor	-	✓	✓
Requires third-party software	MATLAB®, Simulink® and Simscape Power Systems™	-	-

\*\*\* Optional

Specialized Power System software	-	✓	✓
Specialized power system solver to optimize real-time performance of Simscape Power Systems  - Includes the fastest, most accurate solver for eMEGASIM applications. ARTEMiS solvers and algorithms eliminate artificial delays, while using advanced decoupling techniques for added speed and efficiency.	✓	-	-
Closed-loop testing (Observe effect of the relay on the grid)	✓	✓	✓
Specialized test automation tool for protection	-	✓	✓
Application Programming Interface (API) for tests	Python, C	Python, C	Python, C
IEC 60255 protection relay testing sequence	-	***	***

\*\*\* Optional