

Real Time Simulators Options - OP4512 or OP4610XG - including PHIL to test 1 relay
* Budgetary Quote Only, details must be confirmed with customer *

Quote #
OPPQ6552
8/8/2022

Instituto Federal do Parana - IFPR
Carlos Araujo

Prepared By:
Marcela Trindade
Account Manager
+55 21 99369 6178

marcela.trindade@opal-rt.com

OPAL-RT TECHNOLOGIES

OPAL-RT Corporation
2532 Harte Dr.
Brighton, MI
USA, 48114

Quotation No. OPPQ6552

Date: 2022-08-08
Valid until: 2022-09-29

To:

Instituto Federal do Parana - IFPR
Carlos Araujo
Avenida José Felipe Tequinha 1400
Paranavaí, Paraná 87703-536
Brazil

Phone: 41999106284

Prepared By:

Marcela Trindade
Account Manager
marcela.trindade@opal-rt.com
+55 21 99369 6178

Here is the quote requested

OP4512 Based Real Time Simulator

ITEM #	QTY	DESCRIPTION	UNIT PRICE	DISC.	LINE TOTAL* US$
1	1	[BDL45-100] HILBOX RCP/HIL SIMULATOR based on RT-LAB OP4512 RCP/HIL Kintex®-7 410T FPGA-based Real-Time Simulator - 4 cores Intel® Xeon® E3-1240 v6 Processor 4 cores, 3.7 GHz Xilinx Kintex®-7 410T FPGA Includes the following: --- H a r d w a r e RS422 Expansion Board * 6 RX = 6 Digital IN * 6 TX = 6 Digital OUT --- S o f t w a r e * OPAL-RTLinux 3.x OS (64 bits) with Real-Time Kernel * Recommended Compiler GCC * RT-LAB Host/Workstation License * RT-LAB Real-Time Target License - B Series (3x RT CORES ACTIVATED) * Allow to run SimPowerSystem models P/N: OP4512-HILBOX  	9,894.50 US$	20 %	7,915.60 US$
2	1	32 Channels High Range DIO - Static IO * Digital out 50ma per channel 5-24V push-pull FET * Digital in 0-30 V * DIO selectable per group of 8 channels * 32 static digital P/N: OP5369K1	1,900.80	20 %	1,520.64 US$

[Continued on next page...]

ITEM #	QTY	DESCRIPTION	UNIT PRICE	DISC.	LINE TOTAL* US$
3	1	Analog output card (16 channels, 1 MS/s, 16 bits, 15mA, ±16 V or 8 channels at 2 MS/s) P/N: OP5330-3K1	3,025.00	20 %	2,420.00 US$
4	1	Analog input card (16 channels, 2MS/s, 16bits, 500ns, ±20 V) P/N: OP5342K1	3,509.00	20 %	2,807.20 US$
5	1	Dual-port PCI-E X1 Gigabit Ethernet Kit for OP451x P/N: OP3821	358.60		358.60 US$
6	1	FPGA IP License, selectable 32 DIN and 32 DOUT (PWM/TSD/STATIC) for OP45xx, OP4610XG P/N: S18-0008	1,222.10	50 %	611.05 US$
7	1	eHSx32 - Power electronics simulation toolbox for OP451x simulators Generic and reprogrammable FPGA-based electrical solver * Development license * SimPowerSystem or PSIM or PLECS licenses are optional but not included View the latest official firmware here: https://wiki.opal-rt.com/?pageId=76022271 P/N: OP2211	3,806.00	30 %	2,664.20 US$
			SubTotal OP4512 with IOs and eHS32		**18,297.29 US$**
		- - - O P T I O N A L S S O F T W A R E - - - Prices not included in the final cost, just as a reference			
8	1	eHSx64 - Power electronics simulation toolbox for OP451x, OP57xx simulators Generic and reprogrammable FPGA-based electrical solver * Development license * SpecializedPowerSystem or PSIM or PLECS licenses are optional but not included View the latest official firmware here: https://wiki.opal-rt.com/?pageId=76022271 (Optional) P/N: OP2212	15,015.00	30 %	10,510.50 US$
9	1	LIMITED VERSION ARTEMIS LICENSE [NOT TO SELL WITH XG SERIES] ARTEMiS CPU-based Electrical real-time target license - FX75 series * One target license required per activated core * Limited to 75 states (sum of energy storage device such as capacitor and inductor. 1/3 capacity (Optional) P/N: 000-0130-0157	16,247.00	30 %	11,372.90 US$
10	1	UNLIMITED VERSION ARTEMIS LICENSE [NOT TO SELL WITH XG SERIES] ARTEMiS CPU-based Electrical real-time target license - FX series (one target license required per activated core) (Optional) P/N: 000-0130-0011	27,841.00	30 %	19,488.70 US$
			SubTotal Optional items		**0.00 US$**

[Continued on next page...]

ITEM #	QTY	DESCRIPTION	UNIT PRICE	DISC.	LINE TOTAL* US$

OP4610XG Based Real Time Simulator

		[BDL46-100] HILBOX RCP/HIL SIMULATOR based on RT-LAB			
11	1	OP4610XG - RCP/HIL Kintex®-7 410T FPGA-based Real-Time Simulator - 6 cores AMD® RYZEN® 5 Processor 6 cores, 3.8 GHz Xilinx Kintex®-7 410T FPGA Includes the following: --- H a r d w a r e RS422 Expansion Board * 6 RX = 6 Digital IN * 6 TX = 6 Digital OUT --- S o f t w a r e * OPAL-RTLinux 3.x OS (64 bits) with Real-Time Kernel * Recommended Compiler GCC * RT-LAB Host/Workstation License * RT-LAB Real-Time Target License - B Series (3x RT CORES ACTIVATED) * Allow to run SimPowerSystem models P/N: OP4610XG-HILBOX  	14,294.50 US$		14,294.50 US$
12	1	32 Channels High Range DIO - Static IO * Digital out 50ma per channel 5-24V push-pull FET * Digital in 0-30 V * DIO selectable per group of 8 channels * 32 static digital P/N: OP5369K1	1,900.80	20 %	1,520.64 US$
13	1	Analog input card (16 channels, 2MS/s, 16bits, 500ns, ±20 V) P/N: OP5342K1	3,509.00	20 %	2,807.20 US$
14	1	Analog output card (16 channels, 1 MS/s, 16 bits, 15mA, ±16 V or 8 channels at 2 MS/s) P/N: OP5330-3K1	3,025.00	20 %	2,420.00 US$
15	1	Dual-port PCI-E X1 Gigabit Ethernet Kit for OP451x P/N: OP3821	358.60		358.60 US$
16	1	FPGA IP License, selectable 32 DIN and 32 DOUT (PWM/TSD/STATIC) for OP45xx, OP4610XG P/N: S18-0008	1,222.10	50 %	611.05 US$
17	1	eHSx32 - Power electronics simulation toolbox for OP451x simulators Generic and reprogrammable FPGA-based electrical solver * Development license * SimPowerSystem or PSIM or PLECS licenses are optional but not included View the latest official firmware here: https://wiki.opal-rt.com/?pageId=76022271 P/N: OP2211	3,806.00	30 %	2,664.20 US$

[Continued on next page...]

ITEM #	QTY	DESCRIPTION	UNIT PRICE	DISC.	LINE TOTAL* US$
		SubTotal OP4610XG with IOs and eHS32			**24,676.19 US$**
		- - - O P T I O N A L S S O F T W A R E - - - Prices not included in the final cost, just as a reference			
18	1	eHSx64 - Power electronics simulation toolbox for OP451x, OP57xx simulators Generic and reprogrammable FPGA-based electrical solver * Development license * SpecializedPowerSystem or PSIM or PLECS licenses are optional but not included View the latest official firmware here: https://wiki.opal-rt.com/?pageId=76022271 (Optional) P/N: OP2212	15,015.00	30 %	10,510.50 US$
19	1	LIMITED VERSION ARTEMIS LICENSE ARTEMiS - Target simulation - FXG Basic node-locked license - Allows offline and real-time simulation on the target, max 1 core activated per simulator - Limited to 50 states (sum of energy storage devices such as capacitors and inductors) (Optional) P/N: OP2310-FXGB	16,610.00	30 %	11,627.00 US$
20	1	LIMITED VERSION ARTEMIS LICENSE ARTEMiS - Target simulation - FXG Plus node-locked license - Includes VBR machine and Protection relay libraries for 1 user - Allows offline and real-time simulation on the target, max 1 core activated per simulator - Limited to 125 states (sum of energy storage devices such as capacitors and inductors) (Optional) P/N: OP2310-FXGP	26,510.00	30 %	18,557.00 US$
21	1	UNLIMITED VERSION ARTEMIS LICENSE ARTEMiS - Target simulation - FXG Max node-locked first license - First target core activated with this license - Includes VBR machine and Protection relay libraries for 1 user - Allows offline and real-time simulation on the target - Number of states is only limited by core performance (in average 200 states per core at Ts = 50 µs) (Optional) P/N: OP2310-FXG	39,490.00	30 %	27,643.00 US$
22	1	UNLIMITED VERSION ARTEMIS LICENSE - Extra cores ARTEMiS - Target simulation - FXG Max node-locked additional license - One target core activated per license - Allows parallel offline and real-time simulation on the target - Number of states is only limited by core performance (in average 200 states per core at Ts = 50 µs) (Optional) P/N: OP2310-FXGA	26,510.00	30 %	18,557.00 US$
		SubTotal Optional software			**0.00 US$**
		Communication Protocols Options - Drivers for Slave and Master Modes Selected			

[Continued on next page...]

ITEM #	QTY	DESCRIPTION	UNIT PRICE	DISC.	LINE TOTAL* US$
23	1	Driver - IEC 61850-9-2 Sampled Value communication protocol (Publisher and Subscriber) for protection relay interface - 50 data points included P/N: OP3252	3,300.00	30 %	2,310.00 US$
24	1	Driver - IEC 61850-8-1 GOOSE communication protocol (Publisher and Subscriber) for protection relay interface - 50 data points included P/N: OP3251	3,300.00	30 %	2,310.00 US$
25	1	Driver - Modbus Master communication protocol using TCP-IP, RTU or ASCII interfaces - 50 data points included P/N: OP3262	2,981.00	30 %	2,086.70 US$
26	1	Driver - Modbus Slave communication protocol using TCP-IP, RTU or ASCII interfaces - 50 data points included P/N: OP3261	2,981.00	30 %	2,086.70 US$
			SubTotal Communication Protocols		**8,793.40 US$**
		Power Stage - OMICRON Amplifier to connect simulator to 1 Relay			
27	1	**- - - POWER STAGE FOR RELAY TESTING + Cabinet and Accessories - - - Dimensioned for 1 relay**	39,003.80 US$	0.35 %	38,865.53 US$
28	1	Cabinet 40U - 120V - 36" - Black - for international shipping * Dimension (WxDxH): 23"x36"x78", 19" Rack Mount * Includes - Ethernet switch and power bar - Crate for international shipping P/N: SR1302268 Unit Price: US$4,125.00			
29	1	OMICRON Amplifier CMS 356 Rackmount Kit Includes: 1) CMS 356: Voltage and Current amplifier, user manual, carry bag, power lead, Ethernet patch cable, connection cable CMC CMS 356, generator combination cable, 12 leads with 4 mm safety plugs, 12 flexible test lead adapters with retractable sleeves, 12 flexible terminal adapters, 4 flexible jumpers 2) Connection cable to connect CMS 356 to DB9: Length: 2 meters 3) 19" adapter kit for CMC356/CMC256plus complete with screws for mounting P/N: OM_CMS356_RACK Unit Price: US$33,957.00			
30	1	Assembling P/N: TTECDAYINT Unit Price: US$783.53			
			SubTotal Power Stage		**38,865.53 US$**
		Recommended Training			
31	1	[On demand virtual classroom] RT-LAB - Training - Real-time simulation systems fundamentals - Maximum of 10 participants from same company/university - Fixed schedule available on OPAL-RT website: https://www.opal-rt.com/training-programs-overview/ Includes: - Online training - Duration: 4 sessions of 2 hours/day (8 hours total) P/N: OP101_RT	2,915.00	15 %	2,477.75 US$

[Continued on next page...]

ITEM #	QTY	DESCRIPTION	UNIT PRICE	DISC.	LINE TOTAL* US$
32	1	[On demand virtual classroom] eHS - Training - Power electronics real-time simulation - Maximum of 10 participants from same company/university - Fixed schedule available on OPAL-RT website: https://www.opal-rt.com/training-programs-overview/ Includes: - Online training - Duration: 3 sessions of 2 hours/day (6 hours total) P/N: OP205_RT	2,365.00	15 %	2,010.25 US$
33	1	[On demand virtual classroom] ARTEMiS - Training - Introduction to real-time simulation of power systems - Maximum of 10 participants from same company/university - Fixed schedule available on OPAL-RT website: https://www.opal-rt.com/training-programs-overview/ Includes: - Online training - Duration: 4 sessions of 2 hours/day (8 hours total) P/N: OP203_RT	2,915.00	15 %	2,477.75 US$
				SubTotal Training	**6,965.75 US$**

		- - - OPAL-RT MAINTENANCE PLAN - - -			
34	1	ESSENTIAL MAINTENANCE PLAN EXTENSION ESSENTIAL MAINTENANCE PLAN ACADEMIC (5 YEARS) * OPAL-RT's Maintenance Plan provides software updates, maintenance releases, patches, and technical assistance. * Please refer to OPAL-RT's Maintenance Plan Policies: www.opal-rt.com/maintenance P/N: OP1920-ACA5	0.00	100 %	0.00 US$
				SUB-TOTAL MAINTENANCE PLAN	**0.00 US$**

		Incoterms EXW Montréal, Canadá			

Closing Notes

System starts to be manufactured after PO is received and approved.

Delivery time: 14 weeks.

PAYMENT TERMS: 100% in advance (30 days after invoice is issued).

INCOTERMS EXW. Montreal, Canada

BANK DETAILS:
Wire Transfer Information for Opal-RT Technologies Inc
Beneficiairy's information:
Opal-RT Technologies Inc.
1751 Richardson Suite 2525
Montreal, Qc, H3K 1G6
Destination Bank:
HSBC Bank Canada
2001, McGill College, Suite 200
Montréal, Québec, H3A 1G1
SWIFT Code : HKBCCATT
Account number : 489062070

Sub-Total:	97,598.16 US$
Shipping & Handling*:	0.00 US$
Total*:	**97,598.16 US$**

*** TAXES not included**

Terms & Conditions

When placing an order please refer to the following quotation number # OPPQ6552

Delivery :

- Delivery delay : otherwise noticed (see closing notes above) and on standard products, 8 weeks on receipt of purchase order
- Shipping term(*) : Unless otherwise specified (see closing notes), EXW Montreal, Canada. If shipping fees(*) are added in quote : CPT customer premises

Prices :

- Payment Term:
  Unless otherwise specified (see closing notes): 50% at order, 50% upon the delivery within 30 days.
- Quoted prices may vary after the quotation validity date.
- Remark : Quoted product prices do not include taxes, shipping charges or transit insurance.

Warranty, Technical Support :

-For twelve (12) months from date of shipment, we will supply upgrades on OPAL-RT software products and support service, free of charge, provided new major releases become available within that period. Neither above mentioned free software upgrades nor ordered ones entitle to subsequent free upgrades.
- Placing an order indicates acceptance of the Maintenance, Software Updates, Warranty, Return of Merchandise, Limitation of Warranty and Support Services Terms for Opal-RT software and hardware products, that can be dowloaded at the following website :
  https://www.opal-rt.com/warranty-policy/
- Please note that English is the main language of our product documentation (references, guides, HelpDesk, etc.)

* Contact us: http://www.opal-rt.com/technical-support

OPAL-RT Technologies
1751 Richardson
Montreal QC
Canada
H3K 1G6

Required third-party products :

- RT-LAB Host license requires MATLAB™, Simulink™, MATLAB Coder™, Simulink Coder™, edited by The MathWorks. Other toolboxes such as SimScape™ and SimPowerSystems™ are supported.

- RT-LAB XSG Host development license requires XILINX tools.
* Xilinx Vivado suite and Xilinx Vivado System Generator for DSP for Kintex-7 and Virtex-7 FPGA
* Xilinx ISE suite (System or DSP edition) and Xilinx System Generator for DSP for Spartan-3 and Virtex-6 FPGA.

- RT-LAB TestDrive Development license requires LabVIEW™ 8.5 edited by National Instruments.

TERMS AND CONDITIONS OF SALES

V13

As stated herein, 'Seller'' is OPAL-RT Technologies Inc. and the ''Buyer'' is the recipient of the quotation and issuer of the purchase order. The following Terms and Conditions of sales (the ''Contract'') apply to the Seller's quotations and any sales that results.

1. GENERAL

1.1. Quotations are offered for acceptance within thirty (30) days unless a longer time is specified on the face of the quotation, and if not so accepted within the designated period shall be deemed withdrawn.

1.2. All purchase orders are subject to this Contract.

1.3. In this Contract, the expression "Goods" relates to the goods and services, which the Seller proposes to sell or has sold to the Buyer, being the Goods described in the Seller's Quotation and a reference to Goods includes services and electronic products of any kind.

2. ACCEPTANCE OF QUOTATION AND PURCHASE ORDERS

2.1. The quotation must be accepted by the Buyer in writing by counter-signature of the quotation for any quotation above $100,000 US and by electronic confirmation to the Seller for the others.

2.2. Seller's acceptance of any purchase order is contingent upon Seller's approval of Buyer's credit.

2.3. Acceptance of the Buyer's purchase orders by the Seller does not constitute acceptance of the Buyers' terms and conditions of sale quoted therein, unless specifically authorized with the written consent by the Seller. In the event of the lack of enforcement of the Seller's terms and conditions of sale by the Seller or by the agent of the Seller or by the Seller's subsidiary, neither waiver of the Seller's terms and condition of sales, nor the Seller's acceptance of Buyer's conditions of purchase is to be deemed or implied. In any event, if the Buyer fails to notify the Seller in writing within ten (10) days of the Seller's order acknowledgement that any terms or conditions of that order are unacceptable to the Buyer, the Buyer shall be deemed to have accepted the Contract as set forth in the acknowledgement. Upon acceptance in this manner, the Contract cannot be canceled, revoked, or modified in any particular without the specific written consent of the Seller, after appropriate provision for payment by the Buyer for any additional costs and expenses resulting from such changes.

3. CERTIFICATION STANDARDS, GOODS MARKINGS

3.1. Seller represents and warrants that all Goods purchased by the Buyer shall be conform with all applicable laws related to product safety, electromagnetic compatibility, low voltage equipment, radio equipment and wireless, and restriction of hazardous substances. Seller, or Seller's agent, will affix the applicable regulatory mark on Goods as required.

3.2. Unless otherwise agreed to in a SOW or a Quotation, when required by local regulation, Buyer shall have the responsibility for assisting Seller or Seller's agent in all on site testing or action required to respect certification standards or Goods marking, notably permitting access to the Goods and Buyer's premises and by fully collaborating in obtaining and maintaining applicable certifications and markings for the Goods.

4. DELIVERY

4.1. All delivery dates quoted are estimated, are not guaranteed and do not form a term of this Contract. The Seller undertakes to make every endeavor to adhere to the delivery schedule but will not accept cancellation of Contract for, or liability for, any direct or indirect losses which may arise from late delivery .

4.2. Unless otherwise agreed in writing by the Seller, all costs of delivery will be for the Buyer's account.

4.3. The Seller is not and will not be liable for any loss or damage however it arises because of any failure to deliver or delay in delivery for any reason including, without limitation:

4.3.1. Acts of God, fire, lightning ,explosion, or flood; lock-out, strike or other labor difficulty;

4.3.2. shortage or unavailability of raw materials, labor, power supplies or transport facilities; or failure or inability to obtain licenses or the effect of any applicable laws, orders, rules or regulations of any government or competent authority

4.3.3. Breakage, accident or other damage to or failure of machinery or equipment.

5. DAMAGE OR LOSS IN TRANSIT

5.1. All Goods are delivered EXW Montreal except if shipping fees are added into the quote then the incoterm CPT Buyer's premises will apply. Seller accepts no responsibility past the Buyer's facility for damage or loss of Goods in transit. Any such damage should be noted on the carriers paperwork and notified to the Seller within four days of receipt and the Goods held for inspection to enable a claim to be made on the carrier. If the Goods are lost or not received by the Buyer within six days of invoice, the Seller should be immediately notified.

5.2. In particular, at the time of delivery, the Buyer should verify the condition of the tape used for packaging of goods shipped, and notify the Seller of any issue at https://www.opal-rt.com/contact-technical-support/
Failure to report any damage to the sealing tape of the shipped Goods will result in the Buyer being held responsible for all cost of damages.

5.3. The Buyer shall familiarize himself with best practices for user and machine safety, as well as important notes and warnings specific to OPAL-RT installations. These are in addition to, and do not replace, all other generic and specific safety information provided, and can be found at:
General safety warnings https://wiki.opal-rt.com/pages/viewpage.action?pageId=28508726
Uncrating a large hardware platform instructions https://wiki.opal-rt.com/display/HDGD/Uncrating+a+Large+OPAL-RT+Hardware+Product

6. PRICE AND QUOTATION

6.1. Unless otherwise agreed to in writing by the Seller, all quotations expire 30 days from the date of the quotation. Prices are thereafter subject to change without notice and Goods will be invoiced at the price ruling at the date of dispatch.

6.2. All Goods will be charged at the prices ruling at the date of order plus any applicable Goods and Services Tax (GST) which must be paid to the Seller by the Buyer when payment for the Goods is due.

6.3. Prices will be rounded to the nearest whole cent in the Seller's invoices.

6.4. When preparing a quote, the Seller uses its best knowledge to estimate the necessary time for training, commissioning or giving expert services. If it happens that more time is necessary to complete the work, then the Seller will charge the Buyer all overtime hours at 1,25 X the regular rate.

6.5. The Buyer will have one (1) year from the delivery date to request and use such Seller's commissioning, training or expert services. After this delay, the Seller shall not be obligated to perform such commissioning, training or expert services and will be entitled to execute payment, as per the quotation.

7. TERMS OF PAYMENT

7.1. For orders including software only, payment must be made in cash without deduction within 30 days of the date of invoice or by letter of credit approved by the Seller, unless otherwise provided in the Seller's Quotation or agreed in writing by the Seller or specified by the Seller at the time an order is received.

7.2. For orders including Seller's hardware or third party software or hardware, Seller will invoice Buyer immediately after reception of the purchase order and payment is due no later than 30 days after purchase order date through bank wire transfer. The Buyer understands that the Seller will not be able to deliver any systems unless the hardware and third party software have been fully paid.

7.3. For Seller's distributors, payment must be made according to distributorship agreement.

7.4. The Seller reserves the right to vary the terms of payment and to require payment in cash in full prior to delivery if, at any time, the credit worthiness of the Buyer is, in the Seller's opinion, unsatisfactory. If the Buyer has not paid the Seller in full within 30 days of the payment being due, the Seller may, at its option, rescind the Contract and resell or dispose of the Goods without prejudice to any claims for damages against the Buyer.

7.5. Payment of invoices must be received not later than 30 days from the date of invoice, thereafter the Seller reserves the right to charge interest at the rate of 1% per month or part thereof for outstanding amounts owing by the Buyer.

7.6. Where payment is not received by the Seller within 30 days from the date of invoice, the Seller may in its absolute discretion:

a) Withhold further supply, activate software time locks and dispose of stock held for the order.

b) Institute legal action for recovery of outstanding balance plus interest and costs incurred, including legal costs; and

c) Require the Buyer to pay cash on delivery for any further Goods, and

d) The Seller shall not be liable to the Buyer for any loss or damage resulting directly or indirectly from such action.

8. CHANGES AND CANCELLATION

8.1. If the Buyer makes a change to an order causing a delivery delay or cancels an order less than thirty (30) days prior to scheduled shipment, Buyer shall pay to the Seller a fee equal to 5% of the list price of any Goods affected.

8.2. In addition, where any such change causes a delay in delivery of any Goods affected of greater than one (1) month from the proposed date of delivery for the Buyer's original order, the Buyer will be charged an extra 1% per month of the purchase order until final delivery.

8.3. If the Buyer cancels an order for any Goods not included in the Seller's current price list, any time after the order is received by the Seller then the Buyer will be subject to that additional charge.

8.4. If the Buyer cancels any order or refuses to accept all or any of the Goods in an order other than in circumstances permitted in these Conditions, the Buyer will be liable for any resulting damage or loss suffered by the Seller. If the Goods have been or are in the process of being manufactured or produced specifically for the Buyer, the Buyer will pay to the Seller as liquidated damages the full Contract price of the Goods and any costs incurred by the Seller (including, but without limitation, any GST) less the current scrap value of the Goods as determined by the Seller.

9. LIABILITY

9.1. **LIMITED LIABILITY : UNLESS OTHERWISE PROVIDED FOR IN THIS CONTACT, UNDER NO CIRCUMSTANCES WILL THE SELLER OR ITS SUB-CONTRACTORS OR SUPPLIERS BE LIABLE TOWARDS THE BUYER OR ANY THIRD PARTY FOR ANY, INDIRECT, SPECIAL, INCIDENTAL, PUNITIVE OR EXEMPLARY DAMAGES, OR CLAIMS OR COSTS OF ANY KIND INCLUDING, WITHOUT LIMITATION, ANY LOSS OF PROFITS OR OTHER ECONOMIC LOSS (RESULTING FROM A CONTRACTUAL OR EXTRA-CONTRACTUAL FAULT OR FROM NEGLIGENCE), ARISING OUT OF RELATED TO THE GOODS, EVEN IF THE SELLER HAS BEEN NOTIFIED OF THE POSSIBILITY OF SUCH DAMAGES. CERTAIN JURISDICTIONS PROHIBIT THE EXCLUSION OR LIMITATION OF LIABILITY FOR INDIRECT OR CONSEQUENTIAL DAMAGES, AND IT IS POSSIBLE THAT ONE OR MORE OF THE AFOREMENTIONED EXCLUSIONS OR LIMITATIONS WILL NOT APPLY TO THE BUYER. IT IS ALSO POSSIBLE THAT THE BUYER MAY HAVE OTHER RIGHTS, WHICH RIGHTS MAY VARY FROM ONE PLACE TO ANOTHER. UNDER NO CIRCUMSTANCES WILL THE SELLER TOTAL LIABILITY TOWARDS THE BUYER EXCEED THE VALUE OF THE GOODS TO THE BUYER OR THE VALUE OF THE PRODUCT IN DEFECT SUPPLIED BY THE SELLER AND PAID FOR BY THE BUYER**

9.2. BUYER INDEMNIFICATION: Except where the damages results from Buyer's or Buyer's employees, agents or contractors fault, negligence or willful misconduct, the Seller shall indemnify, defend and hold harmless the Buyer and its affiliates, and their respective directors, officers, employees, insurers, successors and assigns (collectively, the "Buyer's Indemnified Parties"), from and against any and all liabilities, damages and expenses (including, without limitation, attorneys' fees and legal costs) that they, or any of them, may sustain or incur as a result of (a) any breach of any representation, warranty or covenant made by Seller in the Contract, (b) any actual or alleged injury to or death of any person, or any actual or alleged damage to or loss of any property, arising out of (i) the manufacturing or the defect of Seller's Goods, (ii) any Services performed by OPAL-RT or any of its employees, agents, suppliers or contractors, or (iii) the negligent acts or omissions or intentional misconduct of Seller or any of its employees, agents, suppliers or contractors, (c) or otherwise and generally arising out of or having its origin in any act or omission of Seller, its agents, representatives, affiliates or employees in connection with this Contract.

In any case, notwithstanding what precedes, except in the event of willful misconduct or gross negligence on the part of Seller, Seller's liability toward the Buyer shall

not be higher than the value of the Goods sold that lead to the claimed damages.

9.3. SELLER INDEMNIFICATION: The Buyer agrees to indemnify, hold harmless and defend the Seller and its affiliates, and their respective directors, officers, employees, clients, agents, insurers, successors and assigns (collectively, the "Seller's Indemnified Parties"), from and against any and all liabilities, damages and expenses (including, without limitation, attorneys' fees and legal costs) that they, or any of them, may sustain or incur as a result of:

a) the negligent acts or omissions or intentional misconduct of Buyer or any of its employees, agents, suppliers or contractors;
b) the migration of the Seller's Goods to a different hardware or software environment;
c) unlawful or unauthorized third-party hacking into the Buyer's computer equipment;
d) any infringement of Seller's Intellectual Property;
e) any breach of any representation, warranty or covenant made by Buyer in the Contract.

10. FORCE MAJEURE EVENTS

10.1. Neither Party shall be liable for any delay in the performance of its obligations hereunder due to an adverse event caused by a superior force as awarded by a competent authority or court of law (hereinafter referred to as "Force Majeure

10.2. Seller undertakes to (i) notify Buyer immediately of any event of Force Majeure and (ii) resume its performance forthwith after the Force Majeure event ceases. If any Force Majeure event continues for an unbroken period exceeding thirty (30) days, Buyer is entitled by notice in writing to the Seller to terminate this Contract and any order associated with it. In the event of such notice being given, all Services completed and accepted hereunder before the giving of such notice, and all Services completed and accepted thereafter in accordance with and to the extent specified in such notice, shall be paid for by Buyer subject to acceptance by Buyer. In no case under such termination shall Seller be entitled to any amount which taken together with any amounts paid or due to Seller under the terminated order, would exceed the total amount payable for the Services to be supplied under the terminated order.

11. INTELLECTUAL PROPERTY

11.1. For the purpose of this Contract, the term "Intellectual Property" means (a) all inventions (whether or not patentable or reduced to practice), all improvements thereto, and all patents and industrial designs (including utility model rights, design rights and industrial property rights), patent and industrial design applications, and patent disclosures; (b) all trademarks, service marks, designs, trade dress, logos, slogans, and all other indicia of origin, and all goodwill associated with any of the foregoing; (c) all works of authorship (whether or not copyrightable), copyrights (including "look-and-feel"), mask works, database rights and moral rights; (d) all trade secrets, know-how, technologies, processes, techniques, protocols, methods, formulae, recipes, product specifications, data, scents, initials, algorithms, compositions, industrial models, architectures, layouts, designs, drawings, plans, Specifications, methodologies, ideas, research and development, and confidential information (including technical data, customer and supplier lists, pricing and cost information, and business and marketing plans and proposals); (e) all software; and (f) all other proprietary and intellectual property rights worldwide.

11.2. Trademarks, know-how, computer programs, software and other Intellectual Property rights belong to Seller and shall remain Seller´s sole property and Seller shall as far as reasonably protect such rights. Nothing contained in this Contract shall be construed to give the Buyer any proprietary interest in or rights to Seller´s Intellectual Property, and all use by the Buyer of Seller's trademarks and symbols shall be to the benefit of Seller.

11.3. The sale and purchase of the Goods does not confer on the Buyer any of Seller's Intellectual Property rights. Nothing in this Contract is intended, nor shall anything in this Contract be construed to grant or convey any Intellectual Property rights of Seller to Buyer.

11.4. The Buyer agrees to inform Seller of any known infringement or known alleged infringement of industrial, commercial or Intellectual Property rights, belonging to Seller, or any legal action taken against the Buyer in respect of the breach of such rights. The Buyer shall safeguard Seller´s interests by making information on such infringement to Seller immediately available.

11.5. Seller grants to the Buyer a limited, non-exclusive, non-transferable, royalty-free, worldwide right and license to Seller's Intellectual Property necessary for Seller's unrestricted use and support of the Goods provided under the Contract. This license does not confer to Buyer any right to copy and reproduce, alter or otherwise moditfy Seller's Intellectual Property.

12. RETURN POLICY

12.1. The Seller warrants to the original Buyer and/or ultimate Buyer of the Seller's Goods that if any part thereof proves to be defective in material or workmanship within one (1) year after the delivery of the invoice, such defective part will be repaired or replaced, free of charge, at the Seller's discretion, if shipped prepaid to Opal-RT Technologies Inc. at 1751 Richardson, suite 2525, Montreal, Quebec, Canada, H3K 3G6, in a package equal to or in the original container. The Goods will be returned freight prepaid and repaired or replaced if it is determined by the Seller that the part failed due to defective materials or workmanship. Otherwise, the fees will be charged to the Buyer (see Warranty Policy and Liability on Opal-RT's web site at www.opal-rt.com , under Support, Return Merchandise, click on "Please read about our RMA procedure and warranty policy"). The repair or replacement of any such defective part shall be the Seller's sole and exclusive responsibility and liability under this limited warranty.

13. PREVAILING CONTRACT

13.1. These terms and conditions supersede all previous or different instruments, namely Buyer's purchase order's terms if any, unless otherwise provided by law, and no change or modification of these terms and conditions shall be of any force unless such change or modification shall be executed by an authorized officer of Seller. The terms and conditions of this instrument shall supersede any terms and conditions on any confirmation purchase orders or other documents Buyer may present, the terms and conditions herein being binding. Acceptance of any quotation is limited to the terms and conditions herein.

14. GOVERNING LAWS

14.1. This Contract created by Seller's quotation, Buyer's purchase order and Seller's acknowledgement shall be governed by and construed in accordance with the laws of the province of Québec and the laws of Canada applicable herein.

15. LANGUAGE

15.1. The parties hereto confirm that it is their express wish that this Agreement be drawn up in English only. Les parties aux présentes confirment leur volonté expresse que la présente convention soit rédigée en anglais seulement.

OPAL-RT TECHNOLOGIES Software & Hardware Maintenance Plans

OPAL-RT's Service Promise

Each year, OPAL-RT invests more than 50% of its allocated R&D resources towards ensuring our customers that the platforms and software continuously increase in their quality, in their responsiveness with regards to issue resolution, and in their inclusion of new features that always push the real-time simulation envelope forward.

We also invest considerably in our Technical Support: a qualified, responsive and attentive Support team that is either located in or dispatched to strategic areas around the world, as required, in order to assure they're able to listen, dialog, and diagnose online with our end users at times appropriate and convenient for them—during their working hours, wherever they may be.

All support engineers are top-of-the-line application engineers dedicated to assisting our users towards issue resolution by providing courteous, personalized, and high-caliber professional customer service.

OPAL-RT TECHNOLOGIES' Software & Hardware Maintenance/Service Plan

- Each purchase of one or more OPAL-RT real-time simulators includes by default a one-year software Essential Maintenance plan and two years of hardware maintenance service.
- Options for extended software and hardware maintenance[1] and service periods or upgrades of maintenance levels may be chosen optionally as required.
- Academic customers benefit from an Essential Maintenance program of five years, included by default in the real-time simulator offer.

Maintenance/Service Plan Extension

When the maintenance period is three months from its expiry date, users will receive a request to select between the following Maintenance/Service Plans going forward: either the Essential or Premium Maintenance/Service plan.

The Essential Maintenance Plan

The **Essential Maintenance Plan** is recommended for all users who want to ensure that they receive full access to the latest versions of OPAL-RT software as they are released, and that they are able to log issues with OPAL-RT's Support team—without necessarily using their real-time simulator in the context of a critical development path.

- It includes full access to OPAL-RT software updates in order to synchronize with the latest MATLAB™ releases, and to receive access to all major new feature releases and incremental bug fix versions.

[1] Hardware warranty may not be renewed for more than 5 years from the date of purchase. Hardware warranty is valid if customer has renewed the maintenance contract continuously--otherwise a reinstatement fee will apply.

The Premium Maintenance Plan

The **Premium Maintenance Plan** includes all features of the **Essential Maintenance Plan**, as well as bundled Premium Services required in the context of critical applications. Real-time applications are frequently core elements of a mission-critical path toward product development: down time or troubleshooting efforts may potentially become costly in this context for OPAL-RT customers—and this plan has been specifically designed in order for OPAL-RT Support engineers to be an integral part of your team!

- The **Premium Maintenance Plan** includes a dedicated engineer, assigned to your projects. This focused, dedicated engineer is ultimately responsible for your successful operations, and can assist you any time you may require support help with mission-critical real-time applications.
- Because OPAL-RT simulators are fully scalable, the **Premium Maintenance Plan** entitles users to claim the benefit of a substantial discount**—a full 25%**[2]**—**on any hardware update for your project purchased during the eligible maintenance period.
- The **Premium Maintenance Plan** also includes a hardware warranty[1] on all OPAL-RT simulators for the duration of the contract.

	ESSENTIAL Essential Maintenance Plan	PREMIUM Premium Maintenance Plan
Support requests via email	✓	✓
Knowledgebase access	✓	✓
Support request via phone	✓	✓
Guaranteed 48h support response	✓	✓
Engineers assigned to project	✗	✓
Access to the latest software	✓	✓
Inclusion of 2 user models for new release test and validation	✗	✓
Extended hardware warranty	✗	✓
Free firmware migration to new hardware platform	✓	✓
25% discount on project update hardware[2]	✗	✓
Project software upgrade allowed	✓	✓
Free firmware upgrade	✓	✓

[1] Hardware warranty may not be renewed for more than 5 years from the date of purchase. Hardware warranty is valid if customer has renewed the maintenance contract continuously--otherwise a reinstatement fee will apply.

[2] Discount may be applied after one year.

Maintenance/Service Plan Pricing[3]

The **Maintenance/Service Plan** pricing is based on the value of each project, including OPAL-RT software and hardware.

- All one-time or non-recurring engineering costs, such as engineering services, integration, training, third party hardware and commissioning are not included in the calculation of the maintenance/service offer.
- OPAL-RT greatly values their customers' loyalty and encourages the selection of a 3- to 5-year maintenance contract, as this commitment allows us to pass along significant discounts on the number of projects and the years of maintenance offered and signed for.

	Essential Maintenance Plan	**Premium Maintenance Plan**
Maintenance value	7% of simulator price (SW & HW)	10% of simulator price (SW & HW)
Reduction on simulator quantity	5% reduction per simulator (to a maximum reduction of 50% for 2 or more simulators)	
Special discount on 3 years	20% on maintenance value	
Special discount on 5 years	30% on maintenance value	
Special discount on 10 years	40% on maintenance value	

[3] The Maintenance/Service Plan does not apply to simulators including more than 100k USD in Research and Development costs, or to products not included in OPAL-RT's current portfolio.

eFPGASIM

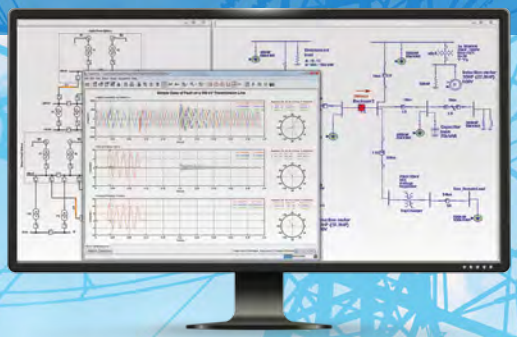
REAL-TIME SIMULATION
FOR POWER ELECTRONICS ON FPGA



OPAL-RT TECHNOLOGIES

WWW.OPAL-RT.COM

Choose eFPGASIM for your next power electronics project







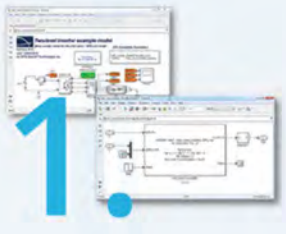
- Microgrids
- Electrical Motors and Drives
- Hybrid & Electric Vehicles
- Electrical Ships
- Electrical Aircrafts
- Energy Conversion Controls
- Wind Turbine Converters
- Photo Voltaic Inverters
- Distributed Energy Resources
- Modular Multi-Level Converters (MMC)

Hardware-in-the-Loop (HIL) Testing with eFPGASIM

Real-time simulation of power electronics remains one of the greatest challenges to HIL simulation. I/O capability for capturing PWM frequency, overall latency of the closed-loop simulation, mathematical solving of coupled switches and fault injection on power electronics schematics are just some of the complexities of this evolving industry.

After two decades of real-time simulation research and development, coupled with hands-on experience with power electronics, OPAL-RT has delivered eFPGASIM, the industry's most powerful and intuitive FPGA-based real-time solution. eFPGASIM is optimal for development, testing and validation of control systems or feasibility studies requiring sub-microsecond time step capacity.

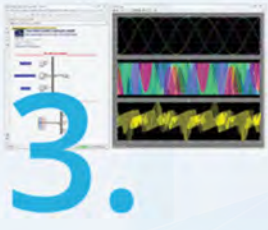
From Modelling to FPGA Execution in 3 Steps



Develop your power electronic diagram with your favorite circuit editor



Then, compile your model, let eHS automate your system equations and configure your I/O parameters.



Finally, execute the real-time simulation and perform manual and automated tests and enjoy sub microsecond FPGA-based simulation time step.

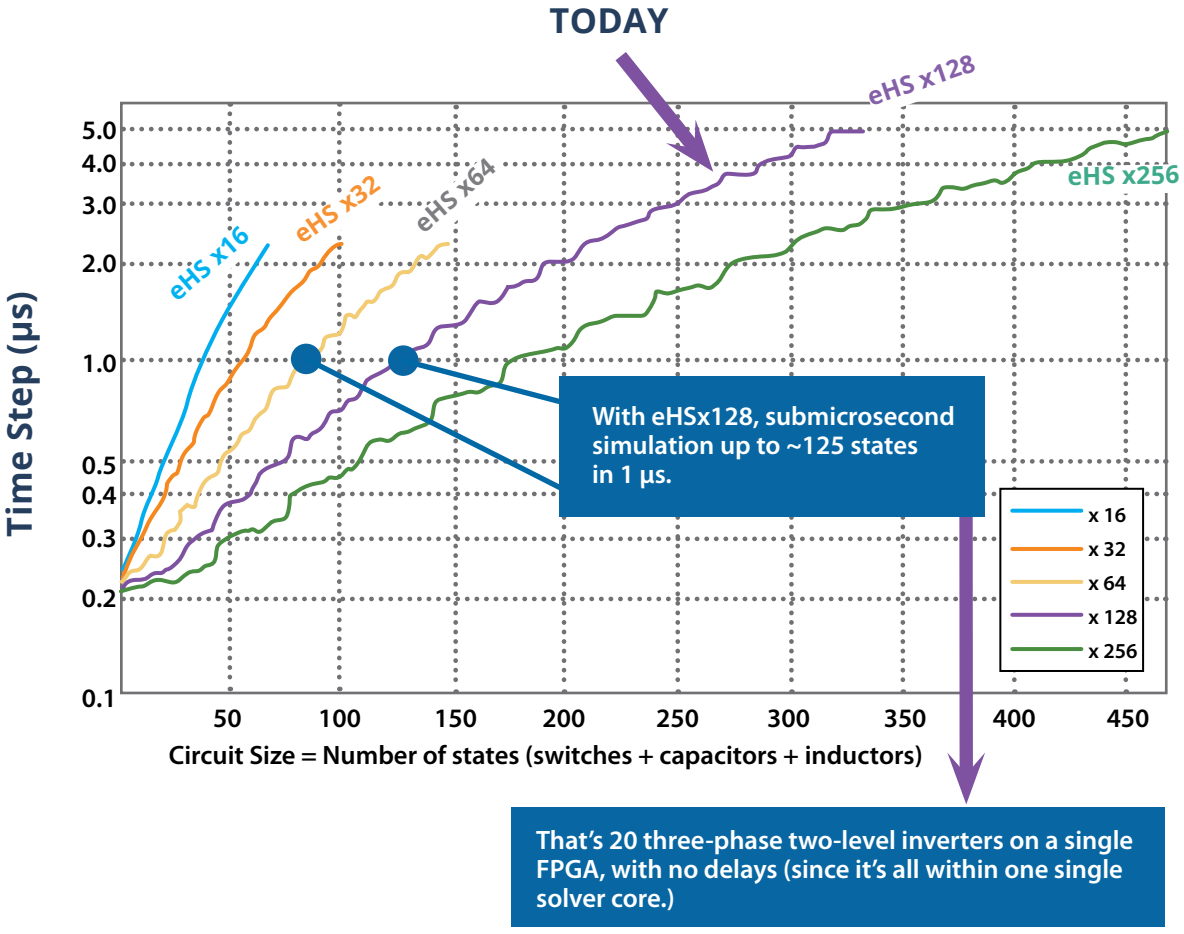
eHS allows to easily run test sequences and make on-the-fly changes to simulation parameters by using the eHS Test scenario feature. It allows the test engineer to jump from one set of values to the next without stopping the simulation.

Powered by Performance

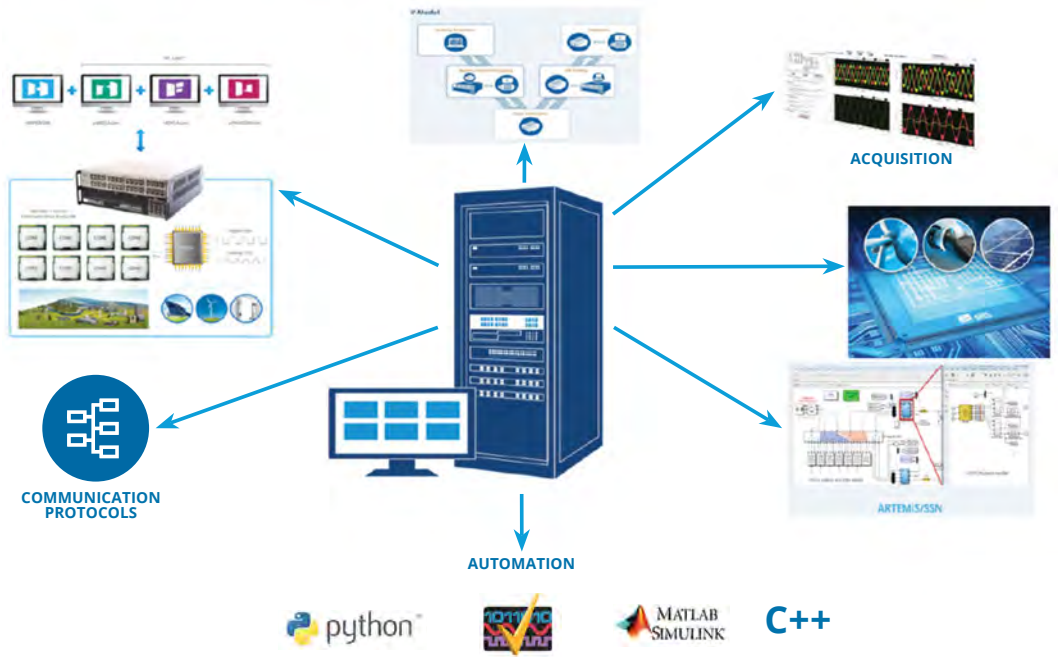
Witness what makes eFPGASIM the industry's most powerful and intuitive FPGA-based real-time solution

With its latest version of eFPGASIM, OPAL-RT has made it possible to simulate highly complex electrical circuits in real-time with unsurpassed precision and performance. Its new solver has been optimized to simulate much larger circuits, with 50% more states, switches and measurements.

This breakthrough means that it is now possible to solve much more complex circuits without needing to break down equations by adding artificial delays that can have a major impact on accuracy. It can also run simulations with a significantly smaller sampling rate, which makes it easier to develop and test equipment that requires shorter loop times and that has faster inputs and outputs, like the ones used to capture PWM and send analog signals.



Full Ecosystem Testing



eFPGASIM offers the most extensive solution for power electronic HIL testing. Not only does it offer the most advanced hardware and software solvers, it also allows power electronic engineers to test their controller at its best in a complete and in their normal environment. The eFPGASIM system interacts with the range of the OPAL-RT products, such as:

- eMEGASIM system, allowing users to connect their power electronics device from a microgrid to a very large power grid.
- ePHASORSIM system, to interact with integration of renewables and the progressively overloaded transmission network, cybersecurity concerns, and the complexity of operation, monitoring, and control and protection on power grids.
- Communication protocols such as Modbus, IEC 61850, DNP3, CAN, ARINC 429, MIL-STD-1553 and many others, for a complete interaction with power electronic controllers or other environments.
- A complete suite of API, allowing users to interact with other applications, such as Python, TestStand, LabVIEW, C++, Java and any other programming language that can manage ".dll" calls.

The eFPGASIM suite

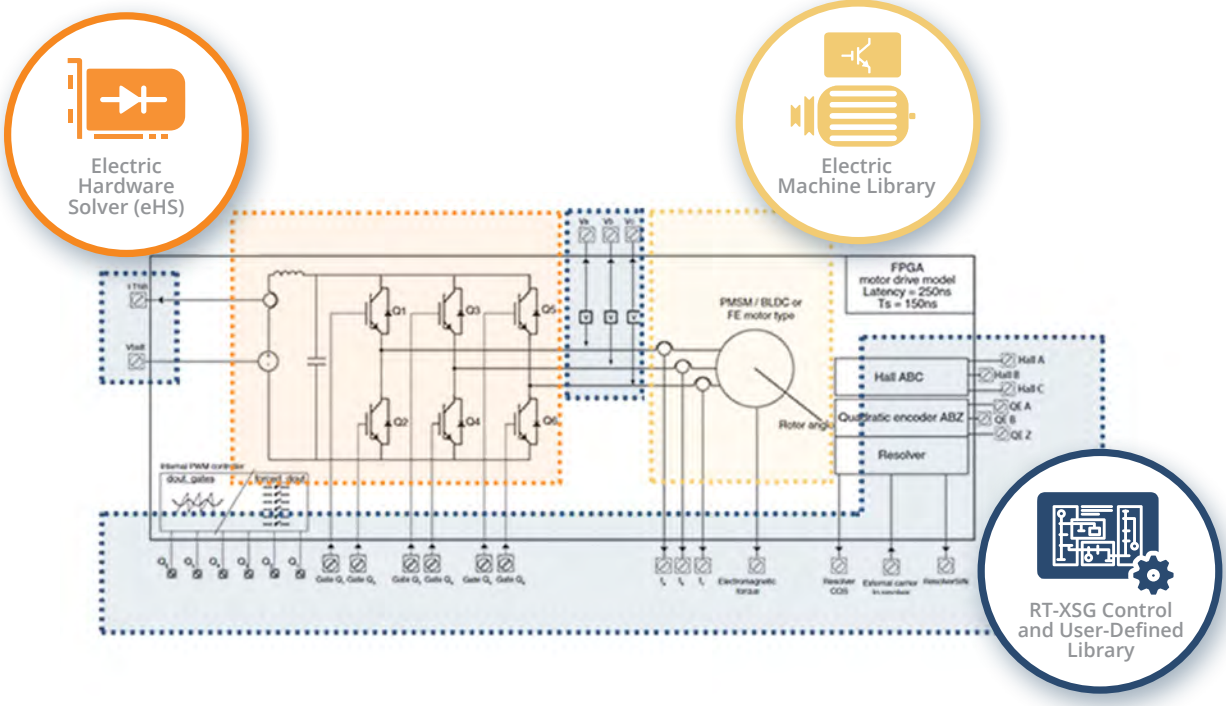
eFPGAsim is comprised of three key software technologies:

eHS: At the heart of eFPGASIM suites, eHS provides a convenient user interface that enables users to import real-time models, created using the simulation tool of your choice, with unprecendented speed and accuracy.

FPGA electric motor library: Offers a broad spectrum of the most common electrical machine. These machines are widely parametrables to fit with most of the common industry configurations.

RT-XSG: Used to edit custom FPGA configurations, and to transfer high-bandwidth data between the simulation models and the user-defined code running on eFPGASIM.

This platform for testing and validation of power electronics systems covers a wide range of applications, from renewable energy conversion to highly complex multi-modular converters. The eFPGASIM library also contains optimized power electronics models for widely used 2 level inverters, DC/DC converters and H-bridge drives. These models embed fault capability and are capable of time steps.



Compatible Hardware

Simulator Platform Comparison Chart





	OP4200	OP4510	OP5707
CPU	ARM7	INTEL XEON E3	INTEL XEON E5
Number of cores	2	4	4, 8, 16, or 32
XILINX FPGA (Standard configuration)	Zync7030 (125T)	Kintex 7 (325T)	Virtex 7 (485T)
SFP optical interferance (GTX 5 Gbits/s)	2	4	16
I/O modules with 16 analog or 32 digital signals	4	4	8
Maximum number of I/O channels	128	128	256

NATIONAL INSTRUMENTS™

Perfect Partnership for Power Electronics and Power System HIL

OPAL-RT has partnered with NI, a global leader in Test, Measurement, and Control Solutions, to expand its real-time simulation offering its customers with even more accessible, cutting-edge, real-time simulation technology.

These eFPGASIM software and eHS solver are compatible with NI hardwares.



NI CRIO

CompactRIO is a real-time embedded industrial controller made by National Instruments for industrial control systems.



PXI

PXI is a rugged PC-based platform for measurement and automation systems. PXI combines PCI electrical-bus features with the modular, Eurocard packaging of CompactPCI and then adds specialized synchronization buses and key software features.

HARDWARE LIST:

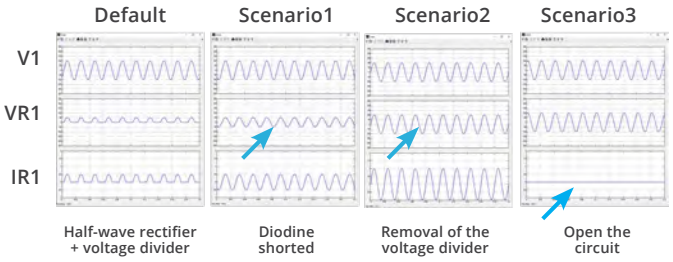
- NI cRIO-9068 / Zynq 7020 - CompactRIO (only for courseware)
- NI-PXI-7971 / K7 325T - FlexRIO
- NI-PXI-7972 / K7 325T - FlexRIO
- NI-PXI-7975 / K7 410T - FlexRIO
- NI-PXI-7976 / K7 410T - FlexRIO
- NI-PXIe-7858R / K7 325T - R Series
- NI-PXIe-7868R / K7 325T - R Series
- NI-PXIe-7822R / K7 325T - R Series
- NI-cRIO 9034 / K7 325T - CompactRIO
- NI-cRIO 9039 / K7 325T - CompactRIO

eFPGASIM Power Electronics Toolbox

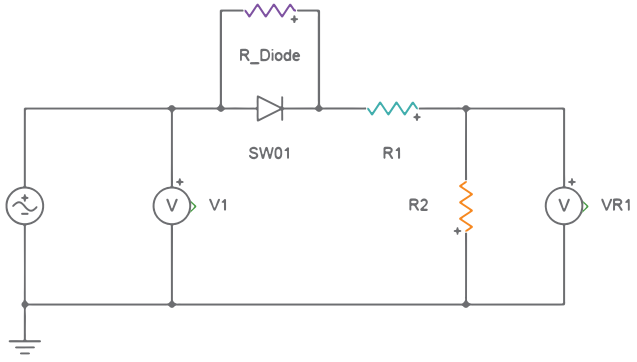
eHS ELECTRICAL SOLVER

A generic and reprogrammable FPGA-based electromagnetic transient (EMT) solver at the heart of the eFPGASIM suite, eHS provides a convenient software environment that enables users to bring models into real-time in a matter of seconds.

- Facilitates the design cycle of complex circuit simulation by allowing a gradual simulation integration from offline simulation into FPGA simulation.
- Increases the simulation accuracy of complex and fast electric circuits and drives by achieving very small model time step updates.
- Compatible with National Instruments' Multisim, as well as other platforms such as Simscape Power System, PLECS Blockset and PSIM.
- Simulate the most advanced and complex power electronic schematics
- Make changes to power electronic parameters, such as the topology of the schematic, without recompilation and while the simulation is running
- Accessible to control without requiring any VHDL or FPGA programming skills.



Create customized test scenarios to generate faults or simulate other events and manoeuvers. Perform on-the-fly parameter changes in your simulated circuit without reloading or recompiling your model.



	A	B	C	D	E	F
1		R1	R2	R_Diode	snubber: SW01	SW01_Ron
2	Default	100	100	1000000	10000	0,001
3	Scenario1	100	100	0,001	10000	0,001
4	Scenario2	0,001	100	0,001	10000	0,001
5	Scenario3	0,001	1000000	0,001	10000	0,001

SimScape Power System

plecs PSIM



RT-XSG LIBRARY

An important part of the eFPGASIM suite is RT-XSG, a Simulink™ library, based on Xilinx System Generator library. It provides a state-of-the-art solution for advanced FPGA-accelerated real-time and HIL system simulation of user-developed models and control systems. It enables engineers to generate custom, application-specific code and algorithm that can be implemented on an FPGA device.

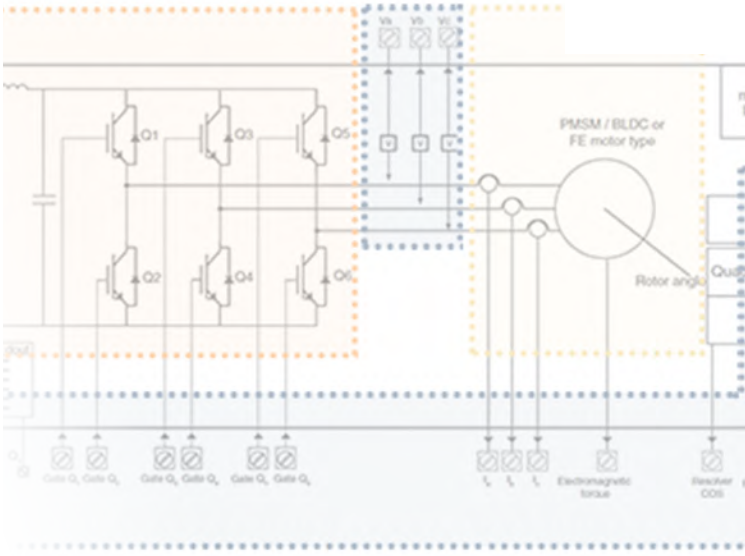
- Offers greater flexibility by allowing users to implement their own calculations on FPGA.
- Allows the use of dedicated FPGA processors for sub-microsecond computation loops.
- Accessible to non-VHDL experts in fixed and floating points.
- Saves time when conducting FPGA-based co-simulation by automatically managing configuration file generation on each supported platform.

WWW.OPAL-RT.COM/RT-XSG

ELECTRICAL MACHINE LIBRARY

The Electric Machine Library fits in the eFPGASIM suite as the ideal platform for designing and testing controllers. It includes detailed mathematical machines of different types of electrical machines, such as permanenent magnet machines, asynchronous machine, induction machine, and switched reluctance machines.

WWW.OPAL-RT.COM/SOFTWARE-SOFTWARE-OVERVIEW/FPGA-ELECTRIC-MACHINE-LIBRARY/




eFPGASIM





ABOUT US

Founded in 1997, OPAL-RT TECHNOLOGIES is the leading developer of open Real-Time Digital Simulators and Hardware-In-the-Loop testing equipment for electrical, electro-mechanical and power electronic systems.

OPAL-RT Simulators are used by engineers and researchers at leading manufacturers, utilities, universities and research centres around the world.

OPAL-RT's unique technological approach integrates parallel, distributed computing with commercial-off-the-shelf technologies.

The company's core software, RT-LAB, enables users to rapidly develop models suitable for Real-Time Simulation, while minimizing initial investment and their cost of ownership. OPAL-RT also develops mathematical solvers and models specialized for accurate simulation of power electronic systems and electrical grids. RT-LAB and OPAL-RT solvers and models are integrated with advanced field programmable gate array (FPGA) I/O and processing boards to form complete solutions for RCP and HIL testing.

OPAL-RT CORPORATE HEADQUARTERS

1751 Richardson, Suite 2525 | Montréal, Québec, Canada | H3K 1G6
Tel: 514-935-2323 | Toll free: 1-877-935-2323 | Fax: 514-935-4994

U.S.A.
OPAL-RT Corporation
26 Summit Street, Brighton
MI 48116, USA
Phone: (734) 418-2961
Fax: (866) 462-5120

EUROPE
OPAL-RT Europe S.A.
196 Houdan Street
92330 Sceaux, France
Tel: +33 1 41 73 40 80

INDIA
OPAL-RT India Pvt Ltd
100 ft road, Binnamangala
Bangalore - 560 038, India
Tel: +91.80.6572.6326
Fax: +91.80.4152.5049

WWW.OPAL-RT.COM/EFPGASIM

© 2018 by OPAL-RT TECHNOLOGIES Inc. All rights reserved.

CMC 356

The Universal Relay Test Set and Commissioning Tool

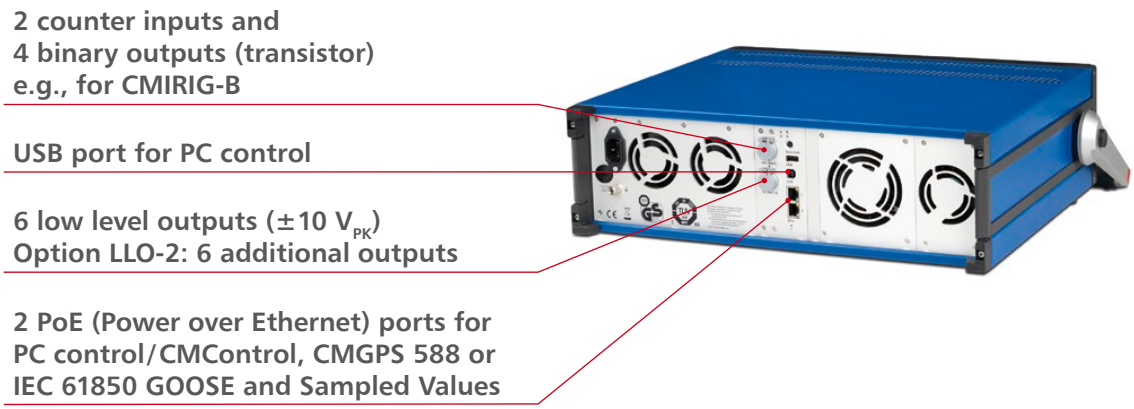


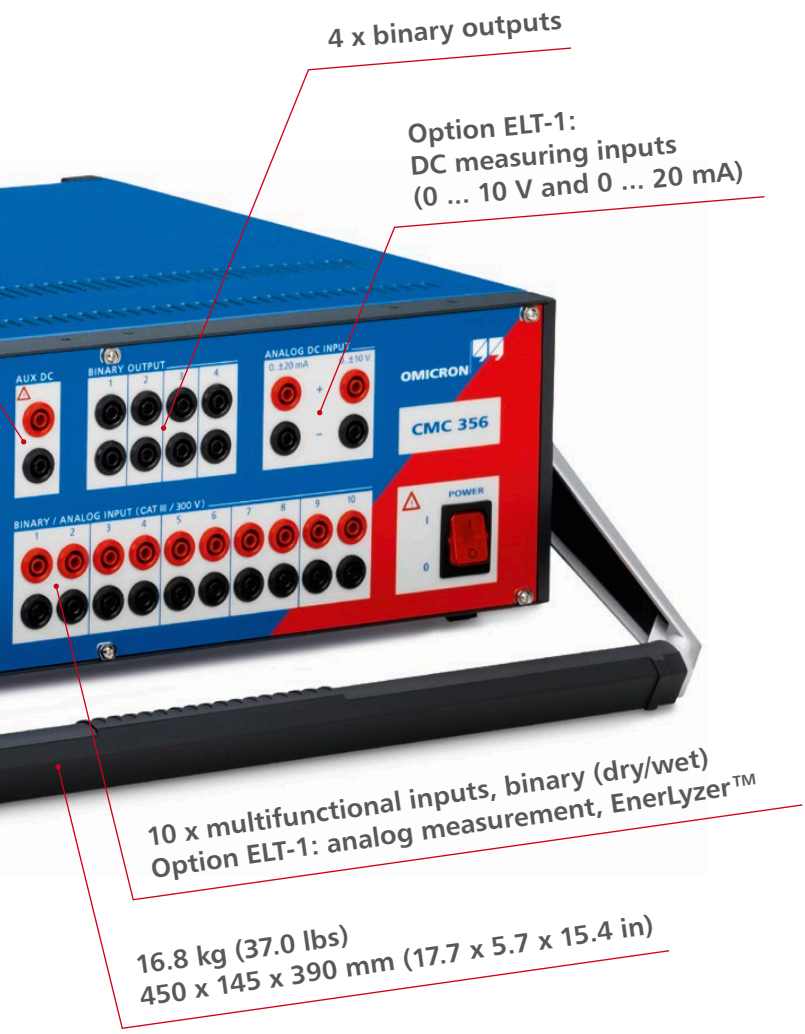
CMC 356 – Universal Relay Testing and Commiss

The CMC 356 is the universal solution for testing all generations and types of protection relays. Its powerful six current sources (three-phase mode: up to 64 A / 860 VA per channel) with a great dynamic range, make the unit capable of testing even high-burden electromechanical relays with very high power demands.

The CMC 356 is the first choice for applications requiring the highest versatility, amplitude and power. Commissioning engineers will particularly appreciate its ability to perform wiring and plausibility checks of current transformers, by using primary injection of high currents from the test set.







The analog test signals are generated digitally using DSP technology. This, in combination with the use of additional error correction algorithms, results in accurate testing signals even at small amplitudes.

The six current and four voltage output channels are continuously and independently adjustable in amplitude, phase and frequency. All outputs are overload and short-circuit proof and are protected against external high-voltage transient signals and over-temperature.

The integrated network interface supports comprehensive testing in the IEC 61850 environments using optional GOOSE simulation and subscription and Sampled Values simulation functionality.
Up to 12 independent channels with low-level signals are available at the back of the test set, which can be used to test relays which have a low-level input facility or to control external amplifier units.

By utilizing the EnerLyzer software option, the ten binary inputs of a CMC 356 equipped with the ELT-1 hardware option alternatively work as analog measurement inputs. The unit then can also be used as a multifunctional multimeter and transient recorder.

Besides its operation with the powerful Test Universe software running on a PC, the CMC 356 can also manually be controlled with the highly flexible CMControl unit and the CMControl App running on an Android Tablet or a Windows PC. For more information please visit our website.



CMControl-6 Front Panel Control (option)

For detailed technical data see product catalog or visit our website.

CMC 356: 6 Phase Current + 4 Phase Voltage Test Set and Commissioning Tool

Protection Relay Test Set

- High-burden electromechanical relays
- Static relays
- Numerical relays
- IEC 61850 IEDs (GOOSE and Sampled Values)
- Relay panels
- End-to-End testing with GPS or IRIG-B
- Busbar protection (up to 22 signal generators)

Power System Simulator

- Transient fault simulation
- Power swing
- CT saturation simulation
- CB simulation
- Rogowski coil simulation
- Compensated network
- Transient playback (COMTRADE, PL4 (EMTP), ...)

Programmable Voltage and Current Source

- Research & development
- Production quality assurance

Universal Tool for Substation Commissioning

- Checking SCADA annunciations
- Burden measurement
- CT/VT polarity checker
- Wiring checker
- Plausibility check for CT/VT with primary injection

Portable 10-Channel Measurement Device[1]

- Transient recording (trigger: binary, PQ, GPS)
- Multimeter for: I, V, f, S, P, Q, cos φ ...
- Trend recording for: I, V, f, S, P, Q
- Harmonics analysis



[1] With ELT-1 hardware option and EnerLyzer™ software option

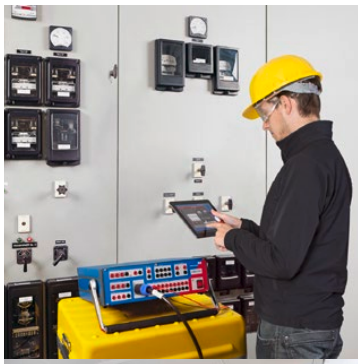
Key Features

- Very powerful current sources for testing high-burden electromechanical relays
- High current amplitudes for 5 A relay testing
- High accuracy and versatility for testing static and numerical relays of all types
- Integrated network for testing IEC 61850 IEDs
- Continuous synchronized outputs with CMIRIG-B (e.g. for PMU or MU testing)
- Primary injection capabilities for commissioning tasks
- Test Universe software with unrivaled manual and automated testing functionality
- Front panel control with the unique CMControl (option)
- 10-channel analog measurement and transient recording functionality (option)
- Reliable and robust

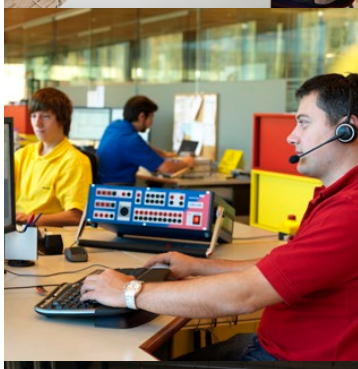
Additional Benefits

OMICRON provides

- Worldwide high quality technical support
- Platforms for an international knowledge exchange
- Training courses designed for electric power system technicians and engineers









CMC 356 Ordering Information

CMC 356 with Test Universe Software	
VE002801	CMC 356 Basic
VE002802	CMC 356 Protection
VE002803	CMC 356 Advanced Protection
VE002825	CMC 356 Recloser

CMC 356 with CMControl (without Test Universe Software)	
VE002820	CMC 356 with CMControl P
VE002824	CMC 356 with CMControl R
VE002826	CMC 356 with CMControl P App activation key
VE002827	CMC 356 with CMControl R App activation key

The CMControl can also be ordered as add-on together with a CMC 356 with Test Universe software or as a later upgrade.

CMC 356 Hardware Options	
VEHO2801	ELT-1 EnerLyzer and Transducer hardware option (if ordered with a new CMC 356)
VEHO2802	ELT-1 EnerLyzer and Transducer hardware factory upgrade (for used CMC 356)
VEHO2803	LLO-2 Additional 6 low level outputs option (if ordered with a new CMC 356
VEHO2804	LLO-2 Additional 6 low level outputs factory upgrade (for used CMC 356)

OMICRON is an international company serving the electrical power industry with innovative testing and diagnostic solutions. The application of OMICRON products allows users to assess the condition of the primary and secondary equipment on their systems with complete confidence. Services offered in the area of consulting, commissioning, testing, diagnosis and training make the product range complete.

Customers in more than 140 countries rely on the company's ability to supply leading-edge technology of excellent quality. Service centers on all continents provide a broad base of knowledge and extraordinary customer support. All of this together with our strong network of sales partners is what has made our company a market leader in the electrical power industry.

The following publications provide detailed information on the products described in this brochure and their applications:



Product catalog (secondary equipment)



CMControl P



Testing Solutions for Protection Systems

For more information, additional literature, and detailed contact information of our worldwide offices please visit our website.

www.omicron.at | www.omicronusa.com

© OMICRON L2447, February 2014
Subject to change without notice