

OP1400

4-Quadrant PHIL Amplifier



**High-speed and
low-latency**
closed loop
communication
for real-time
simulation

Go Beyond with OPAL-RT's High-Fidelity 4-Quadrant Power Amplifier

Characterize performance of power equipment before it is in operation and develop safer products with OPAL-RT's OP1400 4-Quadrant PHIL Amplifier. The OPAL-RT OP1400 System allows users to perform Power Hardware in the Loop (PHIL) to optimize testing and validation of power systems and power electronics equipment, in applications such as distribution, microgrids, motor drives and inverter-based resources.

PRODUCT HIGHLIGHTS

- Innovative soft-switching technology using Sic Transistors
- High speed fiber-optic interface with the real-time simulator
- Low output distortion - < 0.75%
- Versatile testbenches, ideal for research labs, both academia and industry
- Integrated with RT-LAB and HYPERSIM software platforms with readily available interfacing blocksets
- Suitable for applications such as grid emulation, DERs, and motor emulation

APPLICATIONS

- Characterization of the dynamics of the electric Device Under Test (DUT)
- Functional testing of DUT under realistic real-world electrical conditions, using PHIL to emulate the grid and interactions with other emulated/virtual equipment
- Create a microgrid topology where you can connect physical equipment. Analyze its interaction with other emulated DER and power grids
- Test variable speed drives using PHIL to emulate the electric motor
- Build your own flexible, modular and adaptable electric lab for research purposes

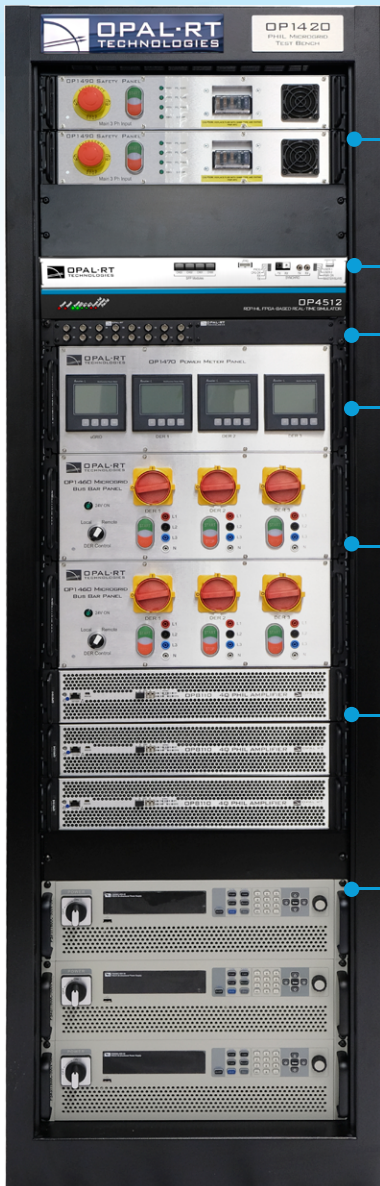
Key Features

- ✓ High-fidelity 4-Quadrant PHIL Amplifier with 100% non-dissipative regeneration
- ✓ Available with up to 6 amplification units each accommodating the following standard operation modes:
 - Maximum output current 20 Apeak
 - Voltage and current control modes
 - Nominal 5 kW, AC 3-phase, 120 VL-N (208 VL-L)
OR
 - Nominal 5 kW, DC, 400 VDC
(other configurations available upon request)
- ✓ Large Signal Bandwidth: DC to 10kHz (-3dB), 0.75% THD
- ✓ Integrated coupling inductors
- ✓ Integrated voltage and current measurements transferred to the real-time simulator via optic fiber communication

OP1400 Series Hardware Platform

OP1400-60 Example

40U Standard Cabinet (1U = 1.75 inch)



Safety Panels | OP1490-3 and 1490-4

Real-time simulator (optional) |
OP4512 (recommended)

DB37 to 16 BNC connectors (optional) | OP8211

Power Meter Panel | OP1470

2 x Microgrid Busbar | OP1480

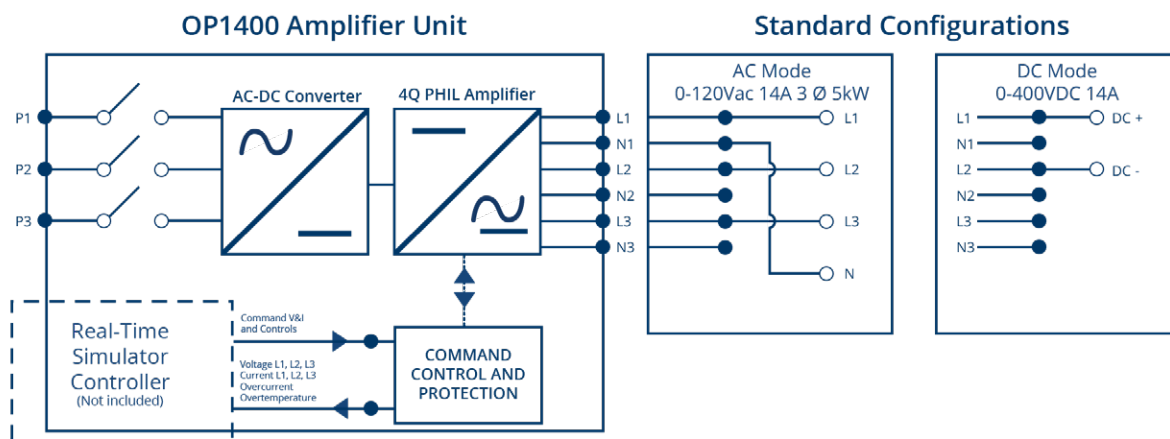
3 x 4Q PHIL Amplifier | OP8110-6

3 x 12 kW, 500 V DC Power Supplies
(IT60012C-500-60)

It also includes:

- RT-LAB or HYPERSIM platform related licenses
- Integration and FAT with standard configurations
- Accessories

Schematic Diagram of Amplification Unit



Standard Configurations and Specifications

The OP1420 is offered in 3 standard configurations with a set number of 5 kW amplification units supporting either AC or DC.

Standard Configurations*					
Configuration Number	OP1400-10	OP1400-20	OP1400-30	OP1400-40	OP1400-60
Amplification units (5 kW)	1	2	3	4	6
Available Rated Power	1 x 5 kW	2 x 5 kW	3 x 5 kW	4 x 5 kW	6 x 5 kW

Amplification Unit Electrical Specifications	
AC Mode Rated Voltage	3-phase, 120 V _{L-N} (208 V _{L-L})
DC Mode rated Voltage	- 400 V _{DC} to + 400 V _{DC}
Maximum transient current	20 A _{peak}
Sourcing / sinking capability	100% source and sink, no dissipation

PHIL Performance	
Mode of operation	Voltage and Current control
Closed-Loop Bandwidth	DC to 10 kHz (-3dB)
THD	< 0.75%
Time Delay Input to Output	5.5us to 8.3us
High Speed Communication Link	6.6 Gbps SFP Link, compatible with OPAL-RT Simulators

Other Technical Data of the Amplifier Unit	
Cooling	Air forced
Protection	Overload, short circuit and over temperature protections
Measurements	Integrated Voltage and current measurements

* Other configurations available upon request. Have questions or require additional help? Please contact us at opal-rt.com/contact/ for answers and more options. You can also consult the [online user manual](#).



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 manufacturer, 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 electronics systems and electrical grid. RT-LAB and OPAL-RT solvers and models are integrated with advanced field programmable gate array (FPGA) I/O and processing boards to create complete solutions for RCP and HIL Testing.



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