Typhoon HIL602+.

The HIL legend reborn. Heavily upgraded and more powerful, with a faster processor, improved I/O and enhanced connectivity.

www.typhoon-hil.com

A HIL perfected for Power Electronics Engineers.

The 6-series flagship product HIL602 has been in constant production for over five years, which is an unprecedented run for a HIL emulator. During these five years, it has been firmly established as a go-to solution for R&D, testing and pre-commissioning, and has won universal praise from engineers, enterprises and market research agencies around the world.

In short, the original HIL602 is a tough HIL emulator to improve upon. Yet, that is exactly what HIL602+ offers you: every feature of the original HIL602 that you have grown to love and rely on, only improved and heavily upgraded, together with some new features.

Typhoon HIL

Typhoon HIL602+.

Ultimate versatility in prototyping, testing and precertification.
Upgraded and refined.

Applications

Typhoon HIL602+ is an ideal all-around tool for development, automated testing, optimization, and automated standardized pre-certification of grid connected converters, automotive converters, electric propulsion drives for terrestrial and marine vehicles, and smaller microgrids.

Why upgrade?

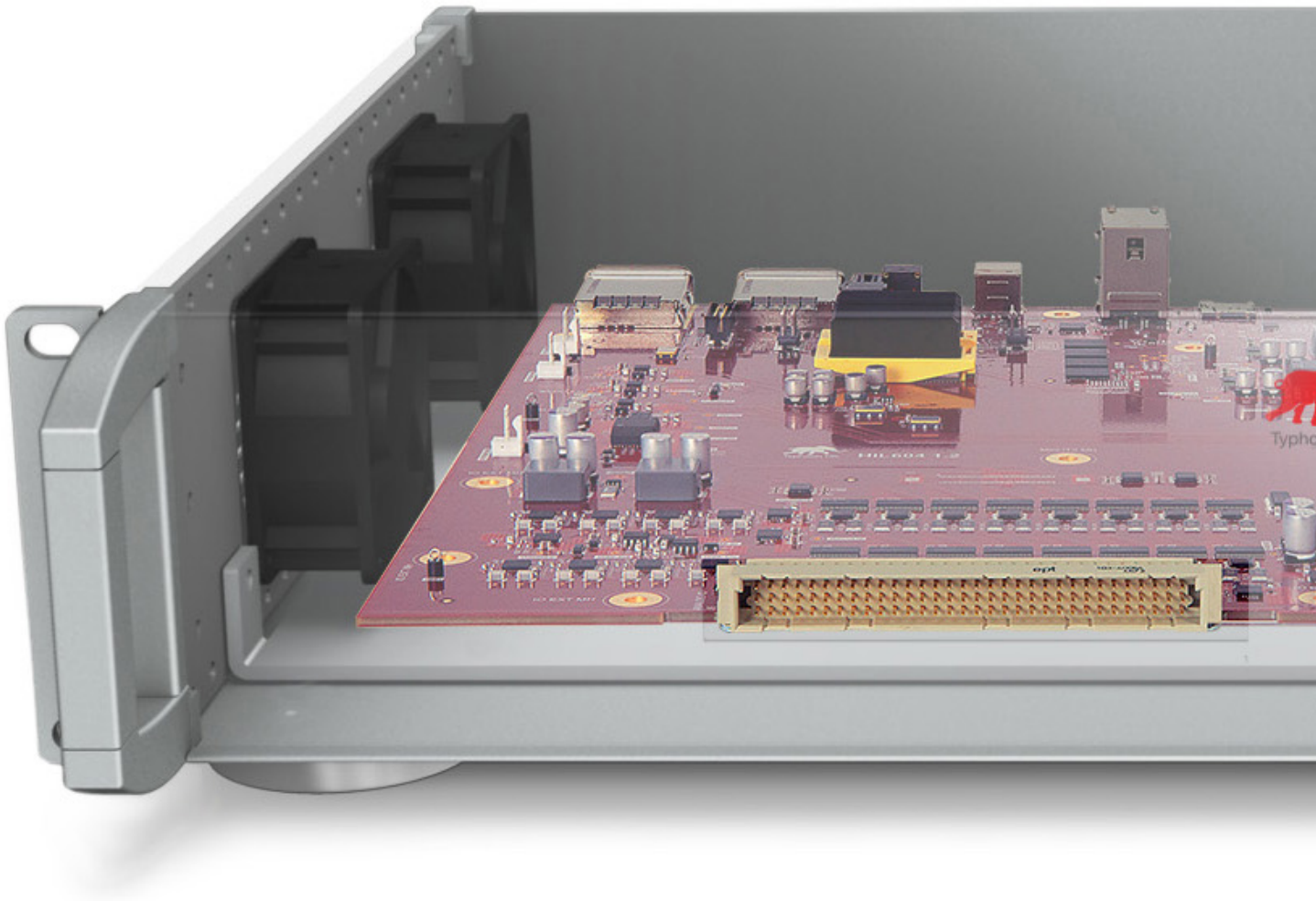
Although the HIL602+ looks similar to its predecessor, it boasts significant upgrades under the hood which allow even easier interfacing with controllers under test and high-fidelity real-time emulation of more complex models.

For example, the bit-depth of analog inputs has jumped from 12 to 16 bits and their voltage ranges has doubled from ± 5 V to ± 10 V. Connectivity has also been expanded with RS-232, CAN and two Ethernet connectors on the back. Combine this with a new CPU and what you get is a fast, high-fidelity, versatile HIL simulator whose capabilities fit the model-based methodology for virtually any power electronics applications, ranging from grid-tied converters to mid-sized microgrids.

Features and Benefits

- Emulate of up to 6 converters with the new 6-core processor at a timestep of 500 ns.
- Emulate your power stage with up to 2 MHz update rate
- Give your controller an ultra-high-fidelity testing with 20 ns PWM resolution.
- Parallel up to 4 HIL602+ units for testing of smaller microgrids
- Interface to any controller by means of 32 analog outputs, 16 analog inputs, 32 digital inputs, and 32 digital outputs, all featuring over-voltage and short-circuit protection.
- Build your power-stage models with a constantly expanding library of power electronics components and prepackaged examples.
- Automate testing with Typhoon HIL API and Python scripts
- Integrate HIL into your existing test scenarios with support for language agnostic RCP API based on JSON-RCP 2.0
- Let your emulation communicate with external units and systems with standardized protocols, such as IEC 61850, Modbus, DNP3 and OPC UA
- Connect to host PC via USB2.0 .

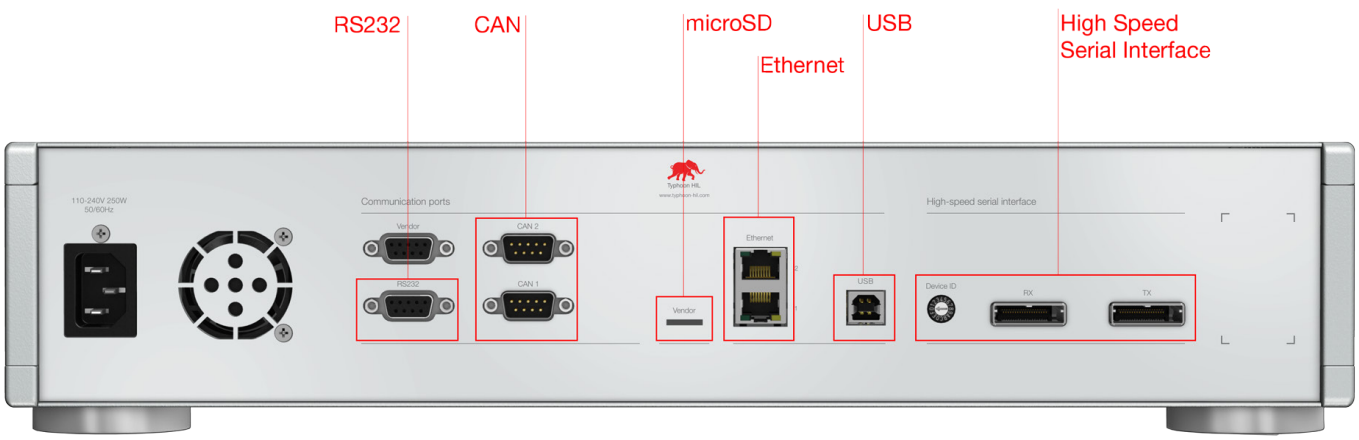
Enhanced I/O for true black box testing of controllers



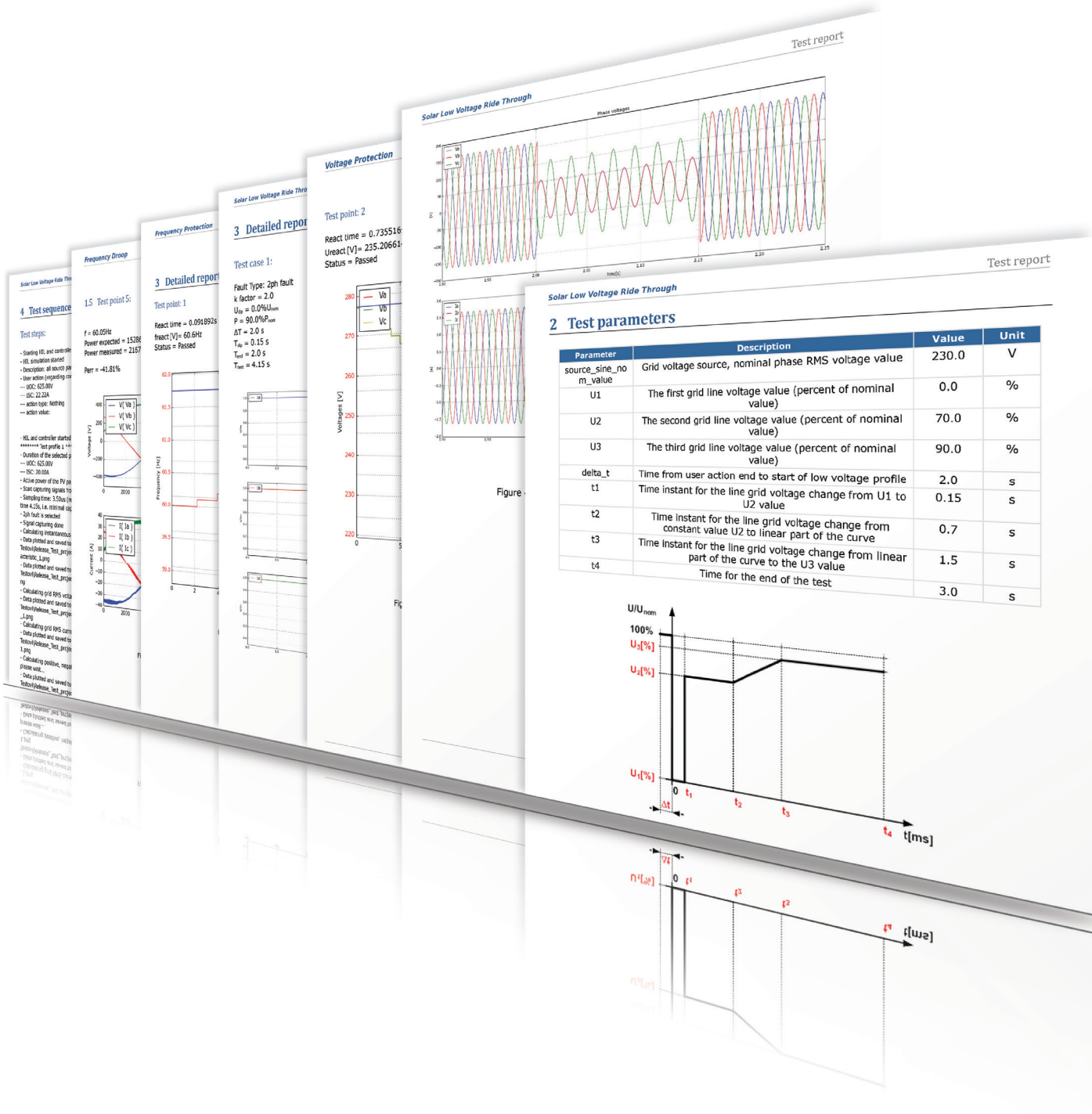
Enhanced I/O for true black box testing of controllers

With the bit-depth of all I/O ports increased to 16, and with the acceptable voltage range doubled in comparison with its predecessor, the HIL602+ can be interfaced to virtually any controller without a need for any kind of signal conditioning. This way you can embrace the true black box approach to HIL testing your controllers, because you can interface them directly to the real-time high-fidelity emulation of the power stage.


Digital I/O
C
B
A
32
1


RS232
CAN
microSD
Ethernet
USB
High Speed
Serial Interface
110-240V 250W
50/60Hz
Communication ports
Vendor
RS232
CAN 2
CAN 1
Vendor
Ethernet
USB
High-speed serial interface
Device ID
RX
TX

Automated testing with Python.

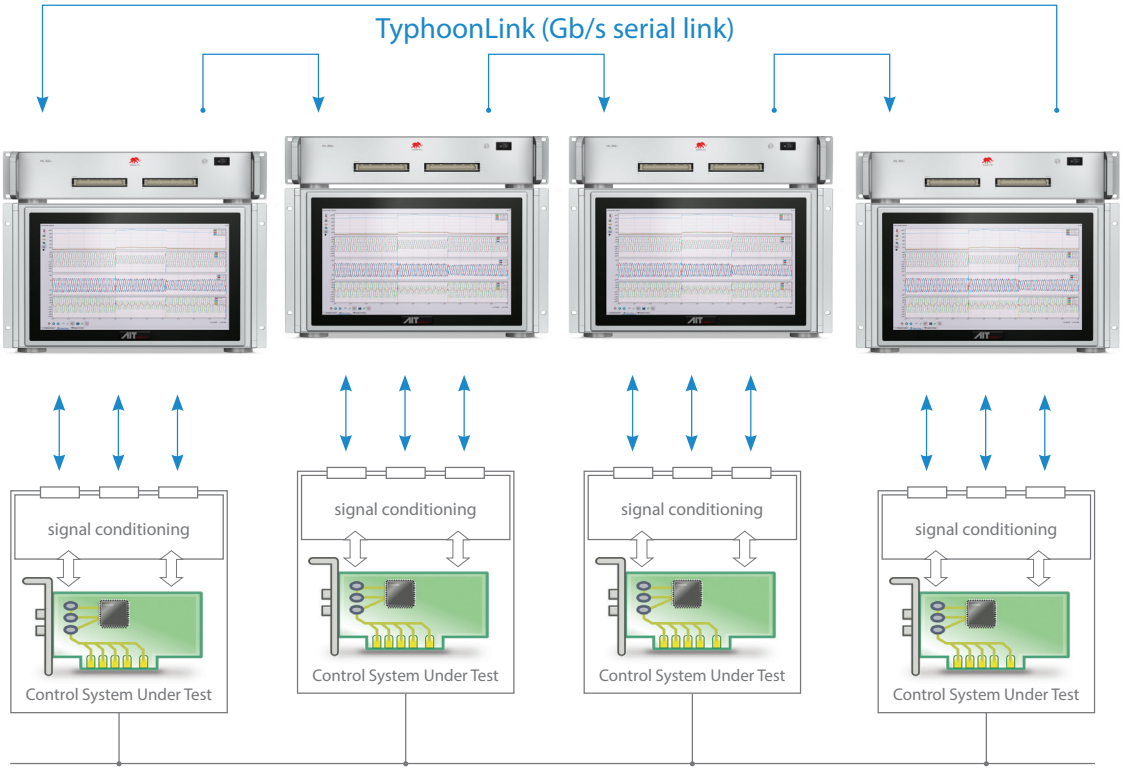


Automated testing with Python.

With support for Python scripts and with a well-documented and constantly expanded Typhoon HIL API, automate collection of thousands of data point and assess the behavior of their controller in every operational scenario imaginable. Unparalleled numerical stability and reliability means that even the most complex test scenarios can be completely unattended. Integrate your HIL602+ into your earlier test scenarios thanks to Typhoon HIL's support for the language agnostic RCP API based on JSON-RCP 2.0.

Develop a control system for a small- or medium-scale microgrid.

A cluster of paralleled HIL602+ allows you to develop, test and pre-certify a microgrid control system, or to streamline integration of multi-vendor microgrid components.



HIL602+ cluster for microgrid control developers

The HIL602+ has significantly improved paralleling capabilities. A cluster of paralleled HIL602+ units is a comprehensive environment that you can also use to design, test and pre-certify small and medium-size microgrid control systems. In a cluster of up to four HIL602+ units, you can emulate 16 or more converters. Different part of the model can run at different timesteps, e.g. 500 ns and 10 µs.
Cluster works and behaves as a single unit, only with the capability to emulate much bigger and more complex models. All functions, such as modeling in Schematic Editor, controlling and interacting with the emulation in HIL SCADA, acquiring data with scope and capture, and automating testing through Typhoon API and Python scripts, work exactly as if you were using a single HIL.

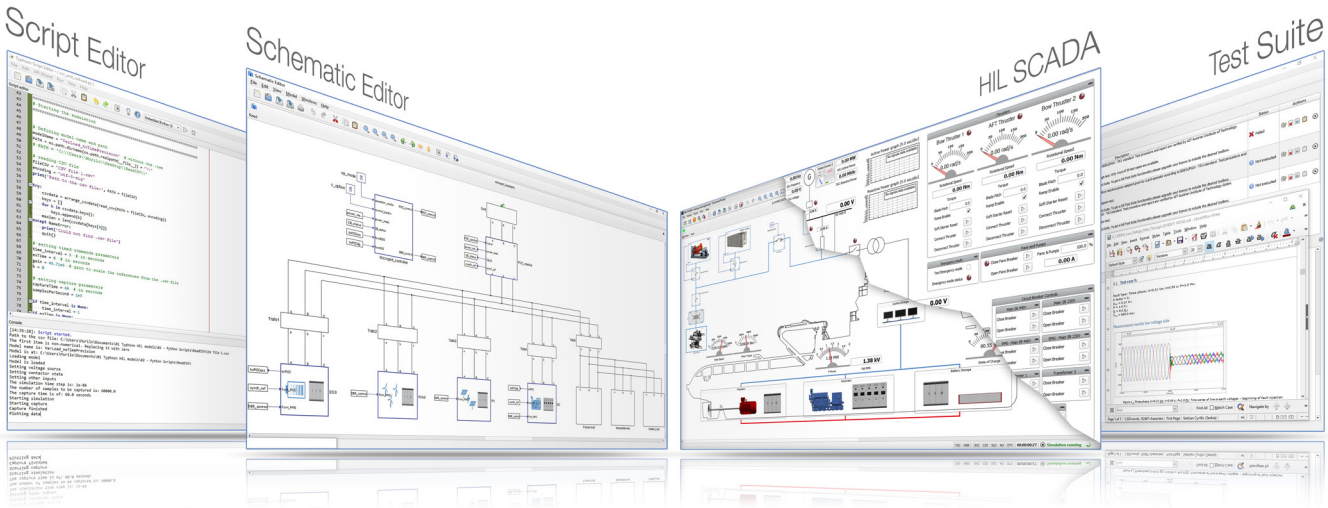
HIL602+ cluster for system integrators

System integrators can interface multiple controllers from multiple vendors to the high-fidelity microgrid emulation and troubleshoot and optimize their integration before the microgrid construction and installation has even begun.

This methodology works for both centralized and decentralized microgrid control configurations and allows you to test both low-level and application-/microgrid-level control layers. You can use automated testing and pre-certifying by means of Python scripts and Typhoon API. Additionally, you can also make your emulation communicate with external devices (e.g. protection relays) and software environments (e.g. SCADA) by means of IEC 61850, Modbus, DNP3, OPC UA or other industry standard communication protocols

Unified and integrated hardware-and-software HIL environment.

Intuitive and easy to master, Typhoon HIL's software allows a one-click direct interaction with your HIL602+, creating a unified environment for power electronics design, test automation and quality assurance.



Unified experience.

HIL602+'s raw emulation power would mean little without software to control it and interact with it. Typhoon HIL's Control Center software is your single point of interaction with the entire HIL602+ setup. It comes packed with examples to get you started. Typhoon HIL's software is designed to simplify and streamline your everyday work with the HIL602+. It is devised to minimize the time it takes to create models and automate testing, giving you more time to focus on actual testing.

Typhoon HIL's software is intuitive and streamlined by design. Start by modeling power electronics converters in the drag-and-drop Schematic Editor using a library of passive elements, converters, sources and machines. Once your model is done, click a single button to rapidly compile the circuit into machine code that is runs on your HIL602+. Then, with another click, launch the real-time simulation. Monitor and control your emulation in fully-use-configurable HIL SCADA. Select the signals you want to see on the scope, change sources and parameters, and insert faults for a fully interactive experience. Of course, the entire process can be fully automated, which also includes automatic test report generation.

Discover simplicity.

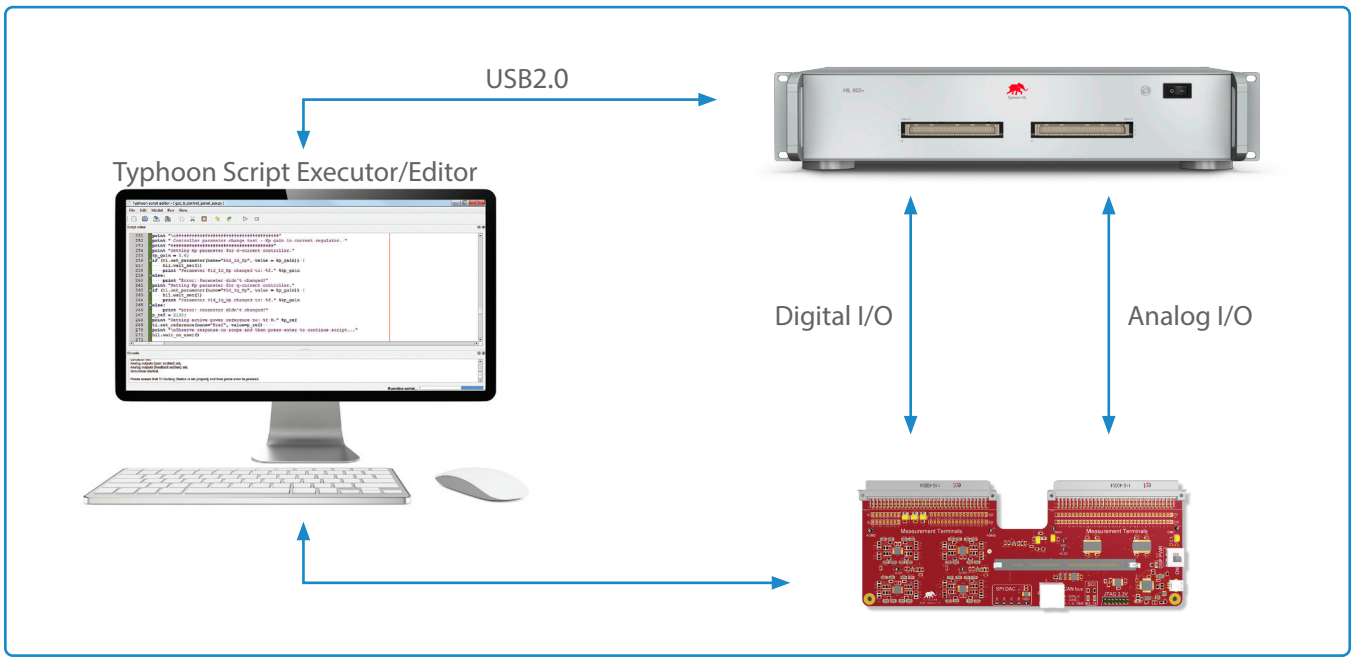
Schematic Editor, a vector-graphics circuit editor, is where you do all your modeling. It is also place to do the rapid control prototyping by means of the constantly expanding Signal Processing Toolbox. In Schematic Editor you also take care of communication functionalities by means of drag-and-drop comunication blocks. Your finished models are compiled for real-time execution with a single click.

HIL SCADA is fully user-configurable environment for monitoring and controlling your real-time emulation, as well as for test automation and data acquisition. It allows you to create a custom user interface by simply dragging-and-dropping various control and monitoring widgets. HIL SCADA also allows you dynamic routing of all signals and comes with a rich library of test scripts for testing grid compliance, protection, etc.

Control Center also includes a waveform editor for source definition and Script Editor for automatic testing via Python Scripts or Typhoon API. Even standardized tests, such as BDEW and UL 1741 SA, and automatic test reports are launched from Control Center, without ever switching to a different piece of software.

Automatic, language-agnostic HIL testing.

Test your power electronics controls until you run out of bugs to fix, not time and money. With Python scripts and Typhoon API write test script libraries to test your designs under all operating conditions, faults, and even in corner cases.



Automate testing with Python scripts

Typhoon Script Editor enables you to build and execute test libraries to exhaustively test all aspects of a controller. Program test sequences under a spectrum of operating conditions, including faults. For grid connected converters, test dynamic grid support, i.e. low voltage ride through, active and reactive power injection, protection etc. Use the library of test scripts to test in accordance with dynamic grid support standards such as German BDEW or American UL 1741 SA. In drives applications, program various drive cycles and test fault responses under both internal and external faults.
For example, inject short and open circuit faults, switch faults, and test against parameter variations. Define performance envelopes and verify the system compliance.

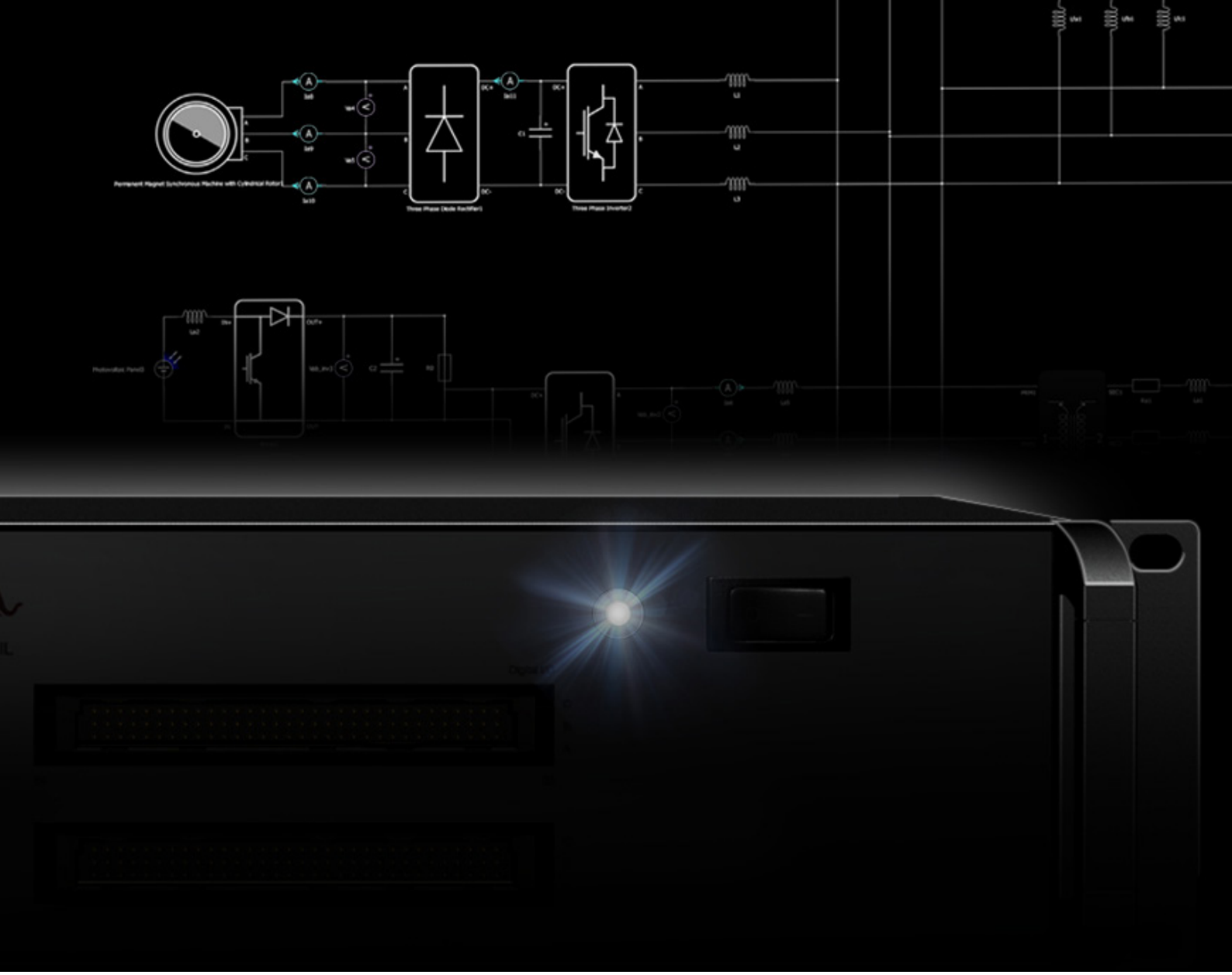
The power of API.

Typhoon API comprises: HIL Control Panel API, Schematic Editor API, Texas Instruments DSP Control Panel API, and Test Executor. *HIL Control Panel API* provides an interface with the target HIL and enables control of the simulation process and all functions available through Control Panel. *Schematic Editor API* provides programmatic interface to manipulate existing schematic diagrams. It enables changing circuit parameters, compiling a circuit, setting target hardware platform, time step, simulation method etc. *Texas Instruments DSP Control Panel API* provides programmatic interface to control TI docking station and change controller parameters. *Test Executor Test* enables running one or more python scripts and generates html report files with test results.

HIL602+ technical details.

Processor	Processor configurations	up to 6 processing cores; 2x ARM cores
Analog inputs (AI)	Channels	16 channels
	Resolution	16 bit ADC
	Input voltage range	± 10 V
	Sample rate	up to 1MSPS
	Linearity (DNL/INL)	1/2
	Gain error / offset error	0.01% / 1mV
	Input resistance	6.8 kΩ
	Protection	±24 V tolerant, ESD protection
Analog Outputs (AO)	Channels	32 channels
	Resolution	16 bit ADC
	Output voltage range	± 10 V
	Sample rate	up to 1MSPS
	Linearity (DNL/INL)	1/1
	Gain error; offset error	0.01% ; 1mV
	Output resistance	0 Ω
	Protection	±24 V tolerant, ESD protection
Analog IO connector	Connector	DIN 41612, type C 96 pin male connector
Externally available power supply	±5V	up to 2A, ressetable protection
	±12V analog	up to 2A, ressetable protection
	+3.3V digital	up to 2A, ressetable protection
	+5V digital	up to 2A, ressetable protection

Digital inputs (DI)	Channels	32 channels
	Input voltage range Vo	$-15V < V_o < 15V$
	Threshold voltages (low, high)	(V_{IL}(max) = 1.5 V; V_{IH}(min) 2.5 V)
	Input resistance	100 kΩ
	Protection	±24 V tolerant, ESD protection
Digital outputs (DO)	Channels	32 channels
	Output voltage range Vo	$0V < V_o < 5V$
	Threshold voltages (low, high)	(V_{OL}(max) = 0.2 V; V_{OH}(min) 4.8 V)
	Output resistance	430 Ω
	Protection	±24 V tolerant, ESD protection
Digital IO connector	Connector type	DIN 41612, type C 96 pin male connector
Connectivity	Ethernet	2x RJ45 connectors; 10/100/1000 Mbps
	USB2.0	2.0 high speed; 1x B type connector
	CANw	2x DB9 connector
	RS232	1x DB9 receptacle
	High speed serial link	8 lane, 5 GHz; 2x PCIe 4x connector
Housing	Dimensions	19" rack mountable; 2U height
	Weight	up to 10 kg
Power supply	Mains	90-240 V ; 250 W



Typhoon HIL, Inc.
15 Ward Street, 2nd Floor,
Somerville, MA 02143
USA

Phone: +1 800-766-3181

Typhoon HIL GmbH
Technoparkstrasse 1
CH-8005 Zürich
Switzerland

Phone: +1 800-766-3181

Tajfun HIL d.o.o.
Bajči Žilinskog BB
21000 Novi Sad
Republic of Serbia

Sales: +381 21 3010 474
Tech support: +381 21 3010 476

www.typhoon-hil.com
e-mail: info@typhoon-hil.com

Typhoon HIL