

Testing real-time power electronics control implementations next to spinning machinery or a grid-connected converter is a challenging experience. The higher the power level the more challenging the experience.

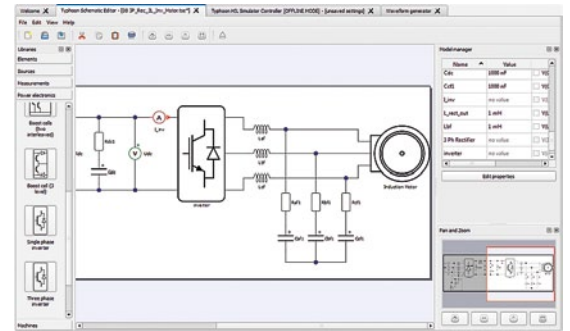
Because it is prohibitively expensive to emulate the ultra-low latency response of a power electronics systems in digital technology there is an countless hardware test benches still in use in power electronics industry and academia. Those test benches are in the range from only a few hundred watts to few hundred kilowatts.

Typhoon HIL⁴⁰⁰ with its 1 μ s calculation step and latency brings real system performance in a Box that is as intuitive, flexible, and easy to use as any state of the art non-real-time simulation software suite.

HIL⁴⁰⁰ is a powerful desktop Hardware-in-the-Loop (HIL) system with 1 μ s time step and latency which:

- is as easy to use as any state of the art non-real time simulators,
- requires no third party licenses or complex setup procedures,
- has a fully configurable hardware interface.

All software and hardware components of **HIL⁴⁰⁰** are built by *Typhoon HIL* therefore there are no limitations with respect to development of custom functionality.



HIL⁴⁰⁰ is ideal for organizations that want to accelerate their power electronics development, enhance product reliability and reduce time-to-market.

With 1 μ s time step and latency **HIL⁴⁰⁰** offers an unprecedented insight into the inner workings of power electronics hardware, including the fast switching waveforms

HIL⁴⁰⁰ replaces laboratory test benches, and enables automated, hardware-in-the-loop testing of power electronics control systems, including fault injection.

Application Fields for **HIL⁴⁰⁰**

- **Transportation**
 - Hybrid and electric vehicles, hybrid and electric busses and heavy duty mining trucks
 - Electric locomotives, tramways and trolley busses
 - Ships with electric propulsion systems
- **Energy**
 - Wind power generation
 - Solar power generation
- **Industrial**
 - Industrial drives
 - Power quality applications
 - AC and DC power supplies
- **Research and Education**

Typhoon HIL⁴⁰⁰

digital technology — analog performance

Typhoon HIL control center

Schematic editor: New model, Open model

Waveform generator: Open waveform generator

HIL control panel: Preview with time step: 1 (5 periods plotted)

Control panel: Channel 1-12, Input signal generator

Hardware schematic: Motor, Inverter, and various electronic components.

Typhoon HIL software tools provide an intuitive way to configure and operate your “high power laboratory”:

- draw the schematic of the hardware circuit,
- define component names and values,
- define measurements,
- select grid voltage and motor loading,
- connect internal signals to IO pins and set the gains and offsets,
- compile and download the configuration to **HIL⁴⁰⁰** with a click of a button, and
- change grid voltages and load profile during run time.

Typhoon HIL, Inc.
 1010 Massachusetts Av.
 Cambridge
 02138 Massachusetts, USA
 www.typhoon-hil.ch
 Phone: +1 617 909 0087
 e-mail: info@typhoon-hil.ch



For maximum flexibility **HIL⁴⁰⁰** digital and analog IO pins can be connected to the internal signal of their kind. Analog IOs also have programmable gains and offsets.

HIL ⁴⁰⁰ Built in IO system													
64 PIN AIO Connector								96PIN DIO Connector					
A1	AO1			C1	AGND			A1	DI1	B1	DO1	C1	3V3
A2	AO2			C2	AGND			A2	DI2	B2	DO2	C2	3V3
A3	AO3			C3	AGND			A3	DI3	B3	DO3	C3	3V3
A4	AO4			C4	AGND			A4	DI4	B4	DO4	C4	3V3
A5	AO5			C5	AGND			A5	DI5	B5	DO5	C5	3V3
A6	AO6			C6	AGND			A6	DI6	B6	DO6	C6	DGND
A7	AO7			C7	AGND			A7	DI7	B7	DO7	C7	DGND
A8	AO8			C8	AGND			A8	DI8	B8	DO8	C8	DGND
A9	AO9			C9	AGND			A9	DI9	B9	DO9	C9	DGND
A10	AO10			C10	AGND			A10	DI10	B10	DO10	C10	DGND
A11	AO11			C11	AGND			A11	DI11	B11	DO11	C11	DGND
A12	AO12			C12	AGND			A12	DI12	B12	DO12	C12	DGND
A13	AO13			C13	AGND			A13	DI13	B13	DO13	C13	DGND
A14	AO14			C14	AGND			A14	DI14	B14	DO14	C14	DGND
A15	AO15			C15	AGND			A15	DI15	B15	DO15	C15	DGND
A16	AO16			C16	AGND			A16	DI16	B16	DO16	C16	DGND
A17	+12V			C17	AGND			A17	DI17	B17	DO17	C17	DGND
A18	+12V			C18	AGND			A18	DI18	B18	DO18	C18	DGND
A19	-12V			C19	AGND			A19	DI19	B19	DO19	C19	DGND
A20	-12V			C20	AGND			A20	DI20	B20	DO20	C20	DGND
A21	+5V			C21	AGND			A21	DI21	B21	DO21	C21	DGND
A22	+5V			C22	AGND			A22	DI22	B22	DO22	C22	DGND
A23	-5V			C23	AGND			A23	DI23	B23	DO23	C23	DGND
A24	-5V			C24	AGND			A24	DI24	B24	DO24	C24	DGND
A25	AI1			C25	AGND			A25	DI25	B25	DO25	C25	DGND
A26	AI2			C26	AGND			A26	DI26	B26	DO26	C26	DGND
A27	AI3			C27	AGND			A27	DI27	B27	DO27	C27	DGND
A28	AI4			C28	AGND			A28	DI28	B28	DO28	C28	5V
A29	AI5			C29	AGND			A29	DI29	B29	DO29	C29	5V
A30	AI6			C30	AGND			A30	DI30	B30	DO30	C30	5V
A31	AI7			C31	AGND			A31	DI31	B31	DO31	C31	5V
A32	AI8			C32	AGND			A32	DI32	B32	DO32	C32	5V

HIL⁴⁰⁰ has a

- 96 pin digital connector with
 - 32 digital inputs, and
 - 32 digital outputs, as well as
- 64 pin analog connector with
 - 16 analog output, and
 - 8 analog inputs.

Typhoon HIL uses standard DIN 41612, type C connectors for all its products. All **Typhoon HIL** products have the same software configurable pin layout.

In order to simplify external signal conditioning electronics the **HIL⁴⁰⁰** output provides on its AIO and DIO connectors

- +/-5V, +/-12V analog power, and
- +3.3V and +5V digital power.

It's about real time