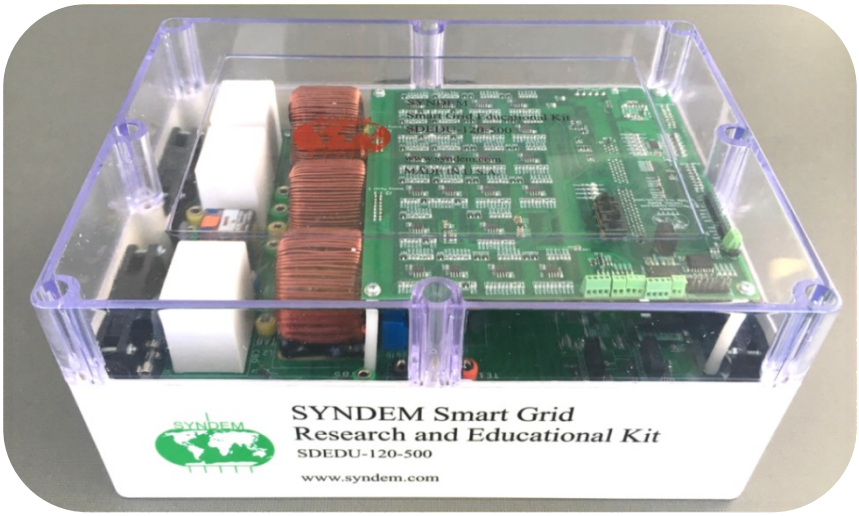
MAKING POWER SYSTEMS WORLDWIDE STABLE, RELIABLE, SECURE, AND SUSTAINABLE

MathWorks Partner

SYNDEM Smart Grid Research and Education Kit

SDEDU-120-500



The SYNDEM Smart Grid Research and Education Kit is for startups, university professors, researchers, and students to explore and learn different topologies and control algorithms of power electronic converters. It is quickly reconfigurable to obtain 10+ different converter topologies, covering DC/DC converters and single-phase/three-phase DC/AC, AC/DC, and AC/DC/AC converters. It can be used to facilitate research and education in different applications, such as motor drives, grid integration of solar power, wind power, energy storage, and flexible loads. The controller is the widely-used Texas Instrument (TI) C2000 ControlCARD and is equipped with automatic code generation through MATLAB®, Simulink®, and TI Code Composer Studio™ (CCS), making it possible to obtain experimental results suitable for IEEE Transactions papers within hours of simulations. The kit comes with complete interface details and sample implementations, based on which users can easily test their own control algorithms. It is a MathWorks-approved third-party product.

Key Features

- Made in the U.S.A.
- All-in-one reconfigurable power electronic converter to obtain 10+ topologies
- Reprogrammable through auto-code generation in MATLAB/Simulink
- Flexible output voltage up to 120V or 240V and output current up to 5A
- Versatile communication interfaces, such as RS485 and CAN, for SCADA
- 4 DAC channels for easy debugging and monitoring without using differential probes
- Suitable for parallel, grid-tied or islanded operation
- Ideal for research and education in smart grid, microgrid, renewable energy, EV, etc.
- Designed by a globally well recognized professor in control and power engineering

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Top 10 Reasons Why Customers Purchase SYNDEM Smart Grid Research and Educational Kits

1. Designed by Dr. Qing-Chang Zhong, IEEE Fellow, a globally well-recognized professor in control and power engineering who served as a Distinguished Lecture of three IEEE societies (Control Systems, Power Electronics, and Power and Energy) and an Associate Editor of four *IEEE Transactions* (*Automatic Control, Control Systems Technology, Power Electronics and Industrial Electronics*) with profound understanding of research and hands-on education in control, power electronics, and power systems. Adopting the Kits offers you direct access to Dr. Zhong for technical inquiries regarding the Kits, as well as broader discussions on research, education, and career development.
2. Trusted by researchers, professors and students in 10+ countries.
3. All-in-one with three built-in phase legs, reconfigurable for 10+ converter topologies: saving time and efforts of researchers, professors and students to get familiar with different boards; saving equipment investment on different boards.
4. Re-programmable with auto-code generation through MATLAB/Simulink: saving even more time and efforts for researchers, professors and students so that they can focus on developing core skills and activities in control and power electronics.
5. No recurring software subscriptions or paywalls necessary. Once you own it, you own it.
6. Built-in with 4 bipolar digital-to-analogue channels (DAC) with the option to re-route currents, voltages and internal control signals to an oscilloscope without the need of using differential probes: saving ~$4000 on four differential probes for each Kit.
7. Built-in with an independent three-phase 1200V 35A diode bridge, which can be used to generate DC voltage for the DC bus without the need of buying a separate DC power supply: saving another ~$1000.
8. Built-in with safety and protection as users can start with low voltage, such as 24V or 48V, and then increase the voltage after building up their confidence: saving investment further.
9. Built-in with scalability: suitable for basic educational experiments and advanced research for single-Kit systems or multiple-Kit systems in islanded or grid-tied operation.
10. Capable of building your own solar simulators, wind turbine simulators, battery testing systems etc., saving further equipment investment.

Videos and Publications

- http://www.syndem.com/Products.html
- Go Real: Power Electronics From Simulations to Experiments in Hours: Versatile Experimental Tool for Next Generation Engineers, *IEEE Power Electronics Magazine*, vol. 7, no. 3, pp. 52-61, 2020.
- Learning-by-Doing: Design and Implementation of a Solar Array Simulator With a SYNDEM Smart Grid Research and Educational Kit, *IEEE Power Electronics Magazine*, vol. 11, no. 1, pp. 47-54, 2024.
- Design and Implementation of an All-in-One Solid-State Wind Turbine Simulator, *IEEE Power Electronics Magazine*, vol. 12, no. 3, pp. 84-91, Sept. 2025.

Where to buy: Please email admin@syndem.com.

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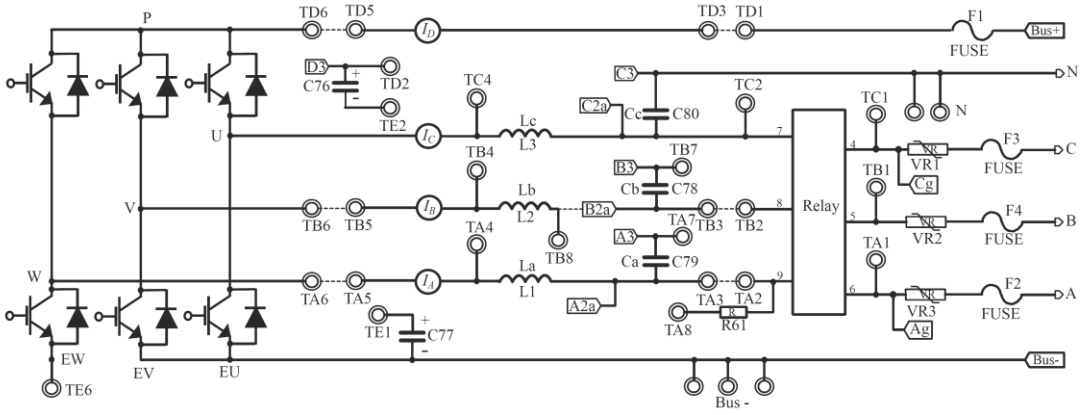
Technical Details

The kit consists of one control board, up to two power boards, Simulink blocksets, Simulink demo models, and one Texas Instrument C2000 ControlCARD TMDSCNCD28335. As illustrated below, each power board contains one three-phase converter, five voltage sensors (three phase voltages, one grid voltage, and one DC-bus voltage), four current sensors (three phase currents and one DC-bus current), one junction temperature sensor, one three-phase relay, and three-phase LC filters. The board also contains an independent 1200V 35A three-phase diode bridge (not shown below). Wires are provided to configure the board into desired circuit.



The kit comes with Simulink blocksets that cover all the hardware interfaces. A sample Simulink model is supplied, which demonstrates a DC-DC-AC converter consisting of a buck/boost converter connected to a PV/DC input and an H-bridge DC/AC converter connected to a load, with both converters sharing a DC bus. A PI controller is adopted to regulate the DC bus voltage, Vdc, and another controller is adopted to regulate the amplitude and the frequency of the AC output voltage. Almost all Simulink blocksets are included in the Simulink model to demonstrate how to use them. Some internal signals, such as PV/DC voltage, PV/DC current, and error codes, are sent out through RS485. A host Simulink model with RS485 interface is also provided.

Key Parameters

Parameter	Value
Control supply	100~240VAC, 50/60Hz, 30W
DC-bus voltage allowed	0~400V (default), 0~800V (to be customized)
DC-bus current allowed	0~5A
DC-bus capacitors	470μF 450V x2 (in parallel or in series)
LC filter inductors (x3)	1.0mH @ 10A
LC filter capacitors (x3)	20μF 250Vrms @50/60Hz or 350Vdc
Phase voltage allowed	0~240Vrms (120Vrms recommended) or 0~320Vdc
Phase current allowed	0~5A
IGBT	STMicroelectronics A1P35S12M3: 1200V 35A
Relay	PT370012: 3 channels, 240Vrms, 10Arms, 12V coil
Independent diode bridge	3SRB3516: three-phase 1600V 35A
Control board analog inputs (12-bit)	-10V~10V (18 channels); 0V~10V (4 channels)
Control board DAC outputs (12-bit)	-5V~5V (4 channels)
Customizable digital inputs (switches)	4
Customizable digital outputs (LEDs)	4
IGBT temperature protection bound	100 °C
Overvoltage/overcurrent protection	Reconfigurable software bounds with preset hardware bounds

Use Case I: Teaching

Use Case II: Research

Use Case III: Field Demonstration with 20 Kits

Use Case IV: Smart Grid Testbed with 108 Kits