Early-career power engineer training resources

This document provides links to educational resources and training tools targeted toward early-career power engineers. Leveraging this guide navigates you directly to tools, calculators, videos, design guides and other resources to help increase your power distribution knowledge and understanding as well as get you up to date on emerging technologies such as microgrids and electrical vehicle charging infrastructure.

Power system design basics

One of the most highly respected and most often referenced documents in the power system design industry. Formerly Tab 1 of the Westinghouse / Cutler-Hammer / Eaton Consulting Application Guide, this document is a must have for both new and experienced power system engineers. This resource includes overviews of power system design as well as detailed system analysis, grounding, protection, power quality, and other application information and reference data.

DER and microgrid design guide

This guide can be leveraged as a starting point for consulting engineers and developers to help them **navigate the complexity of DER and microgrid electrical system design**. The design guide covers the benefits and use cases for a DER system or microgrid, DER technologies, process and planning, design principles, code and regulatory considerations, technical control sequences as well as a few project examples.

Eaton consultant portal (Eaton.com/Consultant)

Eaton's consultant portal is a curated collection of design, specification, educational content and tools for consultants and power system design engineers.

Design Resources

- Design guides – Product-specific design and application data
- Guide specifications – Editable product specification guides in industry standard CSI format
- National Electrical Code (NEC) 2023 changes
- **Tools**
  - Harmonics calculator
  - Variable frequency drive energy savings estimator
  - Fault current calculator – Bussmann

Quarterly Consultant Newsletter

- Sign-up **for Eaton's quarterly Consultant Newsletter** to stay up to date on the latest industry trends, training opportunities and new product releases

Powering Business Worldwide

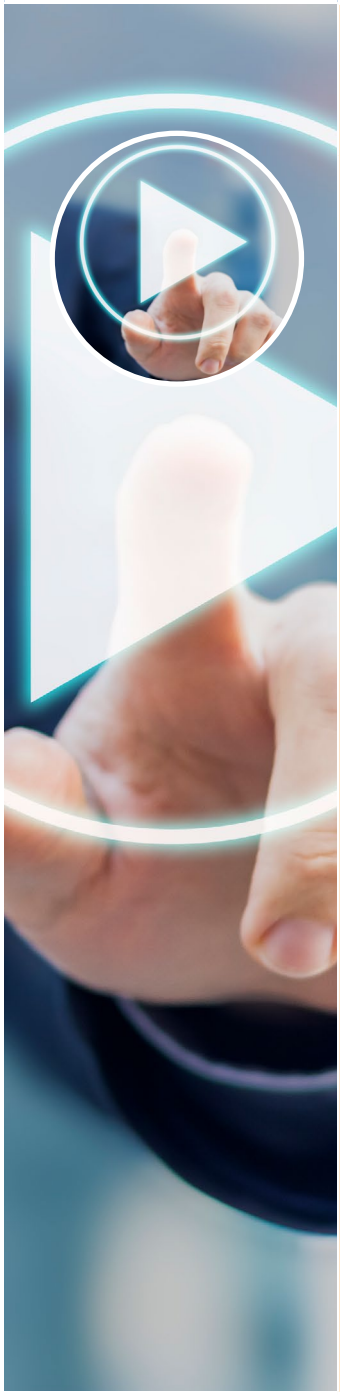
Eaton ExL series—in-person, hands-on experiential learning

Eaton's Experiential Learning (ExL) series classes are held at one of Eaton's Experience Centers, manufacturing facilities or enterprise data centers. Courses are designed to further professionals' understanding and knowledge of power systems at any stage of their career. Below are ExL courses specifically tailored for early-career engineers:

- **PowerUP**—(1.5 Day)—Power system design fundamentals and calculations, connect theory to real-world applications, collaborate with peers and industry experts
- **PowerBOOST**—(1.5 Day)—Breaker, transformer, switching device types and applications, switchboard/switchgear differences, key codes and standards, communication protocols and networking

Contact your local Eaton Application Engineer for more information about Eaton's ExL series courses and availability.

Educational videos from Eaton Experience Centers

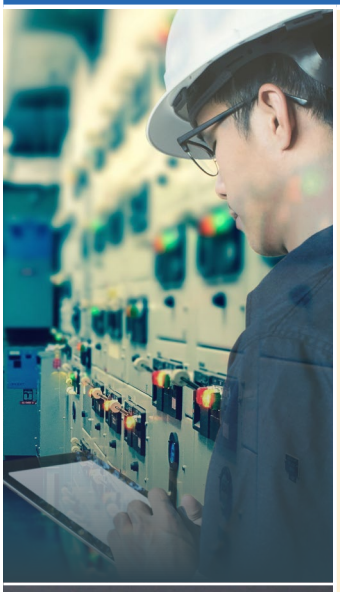


Eaton Experience Centers offer first-of-their-kind, hands-on classroom training and demonstration environments that allow you to experience complete power management solutions. Additionally, Experience Center engineers have created a vast library of educational video content on a wide variety of power system engineering topics.

The following are specific videos applicable to early-career power systems engineers

VIDEO: • Electricity 101 – the water analogy
VIDEO: • Motors 101
VIDEO: • Transformers 101
VIDEO: • Generators 101
VIDEO: • Formulas and calculations for transformers and motors
VIDEO: • Grounding and bonding
VIDEO: • Grounding and bonding of generators and transfer switches
VIDEO: • Fuses explained
VIDEO: • Circuit breakers explained
VIDEO: • Overcurrent protective devices: fuses, breakers, and contactors
VIDEO: • Circuit protection
VIDEO: • Medium-voltage air-insulated and gas-insulated switchgear explained
VIDEO: • Low-voltage drawout switchgear explained
VIDEO: • Variable frequency drives – benefits and applications
VIDEO: • Multi-tenant high-rise – design and code considerations
VIDEO: • Residential power systems
VIDEO: • Utility power systems explained
VIDEO: • Understanding codes and standards – NEC
VIDEO: • Short circuit current rating (SCCR)
VIDEO: • Arc flash safety
VIDEO: • Short circuit, coordination, and arc flash study overview
VIDEO: • Load flow, power factor correction, and harmonics study overview
VIDEO: • Motor starting and motor protection
VIDEO: • Transformer application considerations and calculations
VIDEO: • EVCI – basics of EV charging
VIDEO: • Eaton's EnergyAware UPS
VIDEO: • UL certification process explained
VIDEO: • Seismic bracing for mechanical, electrical, and plumbing
VIDEO: • EV level 2 charging infrastructure
VIDEO: • Motor control fundamentals
VIDEO: • Electrical arcs and sparks – why electricity jumps
VIDEO: • DC fast charger overview
VIDEO: • Switchboard basics
VIDEO: • Ohmic voltage sensing
VIDEO: • What is a UPS and how does it work?
VIDEO: • Current transformers (CT)
VIDEO: • VFD basics
VIDEO: • ATS bypass isolation transfer switch basics
VIDEO: • Medium voltage motor controls

Fundamentals, FAQs and technical product explanations



These web-based fundamentals pages are a quick way to learn about typical product attributes, available configurations and application considerations.

Low-voltage power distribution and control systems

- Busway fundamentals
- Safety switch fundamentals
- Automatic transfer switches (ATS) fundamentals
- Switchboard fundamentals
- Panelboard fundamentals
- Low-voltage switchgear fundamentals
- Intelligent motor control center fundamentals
- Ring vs. ringless style metering

Medium-voltage power distribution and control systems

- Medium-voltage switchgear fundamentals
- Medium-voltage motor starters and drives fundamentals
- Unit substation fundamentals
- Prefabricated electrical assembly fundamentals

Electrical circuit protection

- Circuit breaker fundamentals

Utility and grid solutions

- Fundamentals of electric distribution system planning
- Fundamentals of AMI
- Fundamentals of substation automation
- Fundamentals of reclosers
- Fundamentals of power capacitors
- Fundamentals of network protectors
- Fundamentals of utility fuses and fusing equipment
- Fundamentals of surge arresters
- Fundamentals of medium-voltage cable accessories
- Fundamentals of three-phase overhead distribution switches
- Fundamentals of controls
- Fundamentals of power distribution voltage regulators
- Fundamentals of medium-voltage transformers
- Fundamentals of overhead distribution connectors

Retrofits upgrades and modernization

- Circuit breaker and switchgear repair fundamentals

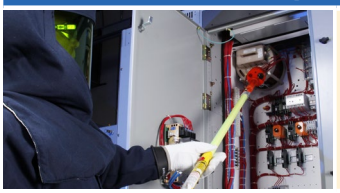
Residential

- Load center fundamentals

GEIS

- Fundamentals of encapsulation
- Fundamentals of emergency lighting

Electrical circuit protection tools

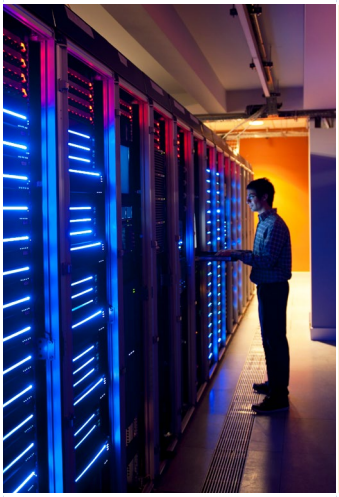


- Selecting protective devices (SPD) handbook
- Selective coordination
- Short-circuit current ratings
- Protective device ratings

Protection, control and solutions tools

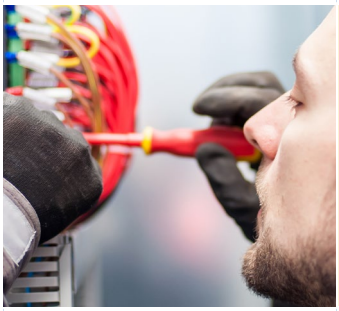
- Variable frequency drives training
- How to select a variable frequency drive. Top 8 considerations
- Harmonics and harmonic frequencies in electrical systems
- Metering accuracy FAQs

Backup power, UPS, surge and IT control power distribution



- Power distribution FAQs
- UPS maintenance bypass installation best practices
- Tips for UPS battery storage life
- EnergyAware UPS technology
- Power conditioners FAQ
- Power factor corrections FAQ
- Surge protection FAQ
- Rackmount PDU FAQ
- Top five UPS components that require preventive maintenance
- High density rack PDU FAQs
- Colocation assessment: key questions for both colocation providers and clients
- Power management FAQ

Conduit, cable and wire management tools



- Cable tray use at high temperatures
- Non-metallic cable trays—performance at elevated temperatures
- Selecting the right materials for cable tray use at low temperatures
- Zinc whiskers
- Sway brace attachment
- Understanding wireway uses and selection
- What are branch line restraints?

Electric vehicle charging infrastructure tools

- Fundamentals of electric vehicles and charging infrastructure
- Consumers guide to EV charging
- EV charging infrastructure solutions

For more information, visit
Eaton.com/consultants

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