

ABB University Switzerland

Course Program 2009 Part 5 Technology and Solutions

- Power Electronics and Medium Voltage Drives
- Motors and Machines



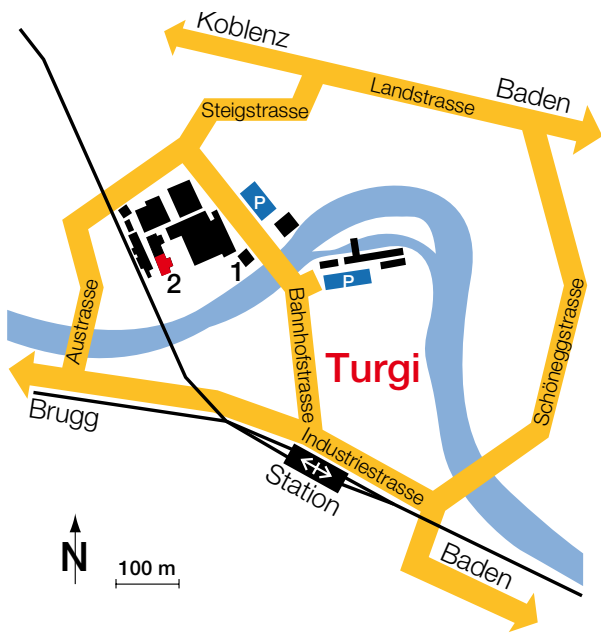
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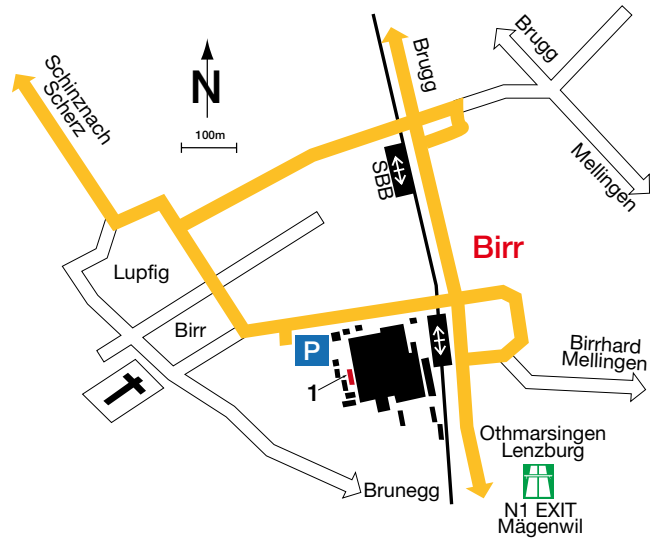


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- Turgi
 1 Portier
 2 LC Power Electronics and Medium Voltage Drives



- Birm
 1 LC Motors and Machines

Course Selection Table



"Take the right train"

Title see page Course No.

Power Electronics and Medium Voltage Drives

Basic Courses

Excitation Systems and Synchronous Machine Fundamentals 3 J990

Product Courses

High Power Rectifier Systems 4 J200

FOCS Level 1 4 J251

FOCS Level 2 5 J252

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ACS 1000 Medium Voltage Drive Service and Commissioning 17 G710

ACS 5000 Medium Voltage Drive Operation and Maintenance AIR COOLED 21 G731

ACS 5000 Medium Voltage Drive Operation and Maintenance WATER COOLED 22 G732

ACS 5000 Medium Voltage Drive Service and Commissioning 22 G740

ACS 6000 Medium Voltage Drive Operation and Maintenance 18 G750

ACS 6000 Medium Voltage Drive Service and Commissioning 19 G760

ACS 6000 Medium Voltage Drive Hands-on 20 G769

AC 800M for MV AC Drives 23 G758

MV Drives Fundamentals (eLearning) 20 G790

MV Drives Product Overview (eLearning) 20 G791

DriveMonitor 23 G795

MEGADRIVE LCI Operation and Maintenance 24 G800

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MEGADRIVE LCI Hands-on 26 G839

AC 800PEC Hardware and Tools 27 J400

AC 800PEC Control Builder 27 J410

AC 800PEC Matlab/Simulink 28 J450

Electrical Machines Operation and Maintenance 29 G911

	Clients, Consultants and others						ABB personnel							
	Executives	Planning personnel	System Engineers	Commissioning personnel	Maintenance personnel	Operators	Consultants and others	Managers	Sales personnel	Project Managers	Engineering personnel	Testing personnel	Commissioning personnel	Service personnel
Excitation Systems and Synchronous Machine Fundamentals														
High Power Rectifier Systems														
FOCS Level 1														
FOCS Level 2														
PSR2/FUPLA2 Programming														
UNITROL P Operation and Maintenance														
UNITROL P Service and Commissioning														
UNITROL P Hands-on														
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ACS 5000 Medium Voltage Drive Service and Commissioning														
ACS 6000 Medium Voltage Drive Operation and Maintenance														
ACS 6000 Medium Voltage Drive Service and Commissioning														
ACS 6000 Medium Voltage Drive Hands-on														
AC 800M for MV AC Drives														
MV Drives Fundamentals (eLearning)														
MV Drives Product Overview (eLearning)														
DriveMonitor														
MEGADRIVE LCI Operation and Maintenance														
MEGADRIVE LCI Service and Commissioning														
MEGADRIVE LCI with AC 800PEC Operation and Maintenance														
MEGADRIVE LCI with AC 800PEC Service and Commissioning														
MEGADRIVE LCI Hands-on														
AC 800PEC Hardware and Tools														
AC 800PEC Control Builder														
AC 800PEC Matlab/Simulink														
Electrical Machines Operation and Maintenance														

Further Training (tailor-made Seminars, Special Courses, Project Courses, ABB internal Courses and Lectures) on all above and other topics, products and systems can be arranged on request.

High Power Rectifier Systems	PSR2/FUPLA2
Excitation Systems	Synchronizing Equipment
Medium Voltage Drive	Electrical Machines
Large Drive LCI	AC 800PEC

Previous course is recommended
 Previous course is required

Excitation Systems and Synchronous Machines Fundamentals

Description

UNITROL[®] is the name of ABB excitation systems for synchronous machines. This basic course introduces the fundamentals of excitation and the UNITROL family.

Objectives

The course goal is to teach students the basics of an excitation system, including the effects on the synchronous machine, regulator functions, converter configurations, field suppression, start-up, the effect of limiters, redundancy and type of control.

Upon completion of this course, the students:

- Know the behavior of the synchronous machine
- Understand the importance of the excitation
- Know the principle design of excitation systems
- Know the influence of excitation to the synchronous machine relating to the generator
- voltage, reactive power and stability

Contents

Introduction to the synchronous machine

- Substitution diagram and its characteristic data
- Steady-state behavior of the synchronous machine
 - No-load operation*
 - Island operation*
 - Parallel operation*
- The transient behavior of the synchronous machine
 - Load rejection*
 - Line disturbances*

Excitation systems for synchronous machines

- Requirements of excitation systems
- Design of excitation systems
- The major components of excitation systems
 - Automatic voltage and reactive power control of the synchronous machine*
- Channel configuration
- Regulator, limiters
- Superimposed regulators (reactive power, power factor)
- Power system stabilizer (PSS)
 - Static converters*
- Mode of operation
- Redundancy
 - De-excitation, field suppression, Crowbar*
 - Start-up sequence*
 - Introduction to the UNITROL[®] family*

Methods

Lectures
 Demonstration of the synchronous machine's behavior using computer calculation program
 Real time demonstration on a generator simulator

Participants

Project design, commissioning, instrumentation and control engineers
 Operating, testing and maintenance personnel
 Sales personnel who wish to gain a basic knowledge as well as a system overview

Prerequisites

Basic knowledge in electronics and electrical machines

Duration

2 days
 Number of Participants: max. 15

J200**Power Electronics****High Power Rectifier Systems****Description**

ABB high power rectifier systems are employed in ABB high power rectifier systems are employed in electro-chemical electrolysis processes, graphite electrolysis plants, and DC-arc furnaces. Typically, such plants consist of at least a rectifier-transformer, rectifier power part, rectifier cooling unit and control system. The current is in the range of 10 - 350 kA.

Objectives

Upon completion of this course, the participants know:

- Basic theory of power electronics and rectifier technology
- Basics of rectifier system design
- The typical design and configuration of rectifier systems
- The major components and main sections of rectifier systems
- Basics of the rectifier control system
- How to perform maintenance work on the rectifier system

Contents

Basics of rectifier theory

Rectifier connections

- 3-phase rectifier bridge
- Star-star surge reactor configuration

Regulator function

- Phase control for thyristor applications
- Tap changer and transductor control for diode rectifier systems

Commutation process

System design

- Design and calculation of the main components
- Principle of harmonics / wave forms
- Consideration of power factor

System arrangement

- On-load tap changer transformer
- Parallel operation of rectifier groups
- Reactive power compensator and harmonic filters

Typical arrangement

- Rectifier transformer

- Rectifier part

- Cooling unit

- System Control

Control, regulator and protection features of the rectifier system

- Local control system

- Master control concept

- Man Machine communication

- The AC 800PEC Control system

Maintenance and troubleshooting

- How to read the electrical drawings

- How to perform maintenance work including cooling system

- Troubleshooting aspects

- How to replace defective components

Methods

Lectures and demonstrations

Factory visit tour

Participants

People who deal with high power rectifier systems

Prerequisites

Basic understanding of electrical systems and power electronics

Duration

4 days

Max. 8 participants

J251**Power Electronics****FOCS Level 1****Description**

The Fiber-Optic Current Sensor is a revolutionary current measurement device based on optical components. The outstanding accuracy under various ambient conditions implies that the Sensor has to be installed with care.

Objectives

The course leads to Level 1 certification on FOCS which allows the participant to install and start-up the sensor on our behalf.

Contents

Lectures

- Theoretical product introduction
- Overview of product documents and user's manual
- Handling hints for sensor

Exercises

- Unpacking of equipment
- Inspection of equipment
- Installation of sensor head
- Laying of optical cable
- Installation of sensor electronics
- Putting into operation
- Testing of sensor
- Installation and test report

Methods

Lectures, Presentations

Demonstrations

Exercises

Participants

Application

Test

Service and Commissioning Engineers

Prerequisites

Basic knowledge of electronics
Personal computer knowledge

Duration

Two days

J252

Power Electronics

FOCS Level 2

Objectives

The Fiber-Optic Current Sensor is a revolutionary current measurement device based on optical components. The outstanding accuracy under various ambient conditions implies that the Sensor has to be installed with care.

The course leads to Level 2 certification on FOCS, which allows the participant to change configurations, backup and restore the FOCS Firmware and to service the sensor electronics.

Contents

Lectures

- Parameters and configuration
- Digital interfaces
- Integration of digital interfaces
- Calibration

Exercises

- Functional tests
- Change of configuration parameters
- Servicing and replacing of sensor electronics
- Backup and restoration of FOCS firmware
- Integration of Profibus and PowerLink

Methods

Lectures

Presentations

Demonstrations
Exercises

Participants

Service and Commissioning Engineers, who have completed FOCS course level 1

Prerequisites

FOCS course level 1 completed

Duration

2 days

J320

Power Electronics

UNITROL® P

Operation and Maintenance

Description

UNITROL® P is the name of ABB static excitation systems for synchronous machines. The controller runs with the Programmable High Speed Controller technology (PHSC) in order to achieve excellent controller performance.

Objectives

The course goal is to teach students to operate, maintain and perform simple troubleshooting of the excitation system or automatic voltage regulator (AVR).

Upon completion of the course students will be able to operate the system, perform standard maintenance, and trace and correct simple faults.

Contents

Basics of the synchronous machine

Duties of excitation system

Major components of the UNITROL® P excitation system

The main software function of UNITROL® P

- Voltage regulator
- Limiters
- Power System stabilizer PSS
- Superimposed regulators (Power factor and Var control)

■ Monitoring and protection

Operating aspects

- Local operating panel
- Start/Stop sequence
- Commands and Indications

Maintenance aspects

- Reading the hardware drawing and tracing signals
- Maintenance schedule
- Alarm and fault indication
- How to use the debugger using the FUPLA tool
- What to do in case of troubles
- How to replace hardware devices

Methods

Lectures

Hands on training using demo equipment with generator simulator

Participants

Operator and maintenance staff in power plants and industrial sites with UNITROL® P excitation system

Prerequisites

Basic knowledge of electronics and power generation

Duration

3 days

Number of Participants: max. 8

J340**Power Electronics****UNITROL® P
Service and Commissioning****Description**

UNITROL® P is the name of ABB static excitation systems for synchronous machines. The controller runs with the Programmable High Speed Controller technology (PHSC) in order to achieve excellent controller performance.

Objectives

The course goal is to teach students to use the function programming language FUPLA 2 for re-programming of the UNITROL® P processing unit (PSR2) and to implement the modifications. Students will learn to use the documentation, install and use FUPLA to program and troubleshoot UNITROL® P automatic voltage regulators and excitation systems.

Upon completion of this course, the students:

- Know the design aspects of UNITROL® P
- Know the principle mode of operation of the devices
- Know the UNITROL® P user software and can read the FUPLA
- Are able to modify parameters and the logic control software
- Are able to put a UNITROL® P system into service

Contents

PSR2 Processing Unit

- Operation principles
- Settings
- Memory organization, data formats
- Program control
- I/O device knowledge
- ARCnet coupler

Operating Program Language FUPLA2

- Installation
- PTS Shell (Programming tools)
 - Editor (Fup and state chart)
 - Configuration manager and code generator
 - Documenting
 - Debugger
- Program structure
 - Function blocks, function block library
 - Project design

UNITROL® P

Channel configuration, design aspects
Hardware, interfaces, ARCnet devices, converter electronics

AVR software of UNITROL® P

- Voltage regulator, limiters, PSS, superimposed regulators
 - Channel and follow-up control
 - Monitoring and protection
- Troubleshooting and commissioning aspects

Methods

Lectures
Practical exercises with FUPLA using a PC and the table module
Practical exercises using the UNITROL® P demo unit

Participants

Project design engineers
Commissioning engineers
Testing and maintenance personnel

Prerequisites

Basic knowledge in electronics and digital technique
Basic personal computer knowledge

Duration

8 days
Max. 8 participants

J390**Power Electronics****UNITROL® P Hands-on****Description**

Consecutively to the J340 Service and Commissioning course the participants can deepen their knowledge on UNITROL P by completing the J390 hands-on course. Based on practical exercises the students get familiar with the handling of the tools and application software of the UNITROL P excitation system using simulators. The simulation of the synchronous machine with the grid system allow to carry out realistic commissioning work. Most of the time the participants work on his one supported by an instructor.

Objectives

- After completion of the course the participants are able to:
- Carry out functional test of the various software functions such as voltage and field current regulators, limiters, power system stabilizer, monitoring and protection etc.
 - Trouble shoot the UNITROL P system

Contents

- Calibration of actual values
- Optimization of the various regulators
- Functional tests of the limiters
- Test of channel and mode transfer.
- Functional test of the follow up control system
- Test of reactive power and power factor controller
- Commissioning and test of the power system stabilizer
- Test of the monitoring and protection function
- Programming of additional signals
- Trouble shooting procedures

Methods

Practical hands-on training using simulators and demo units based on well-chosen exercises.
Periodically discussion of problems/questions with the instructor

Participants

Application, Test, Service and Commissioning Engineers

Prerequisites

Completion of the J340 Service and Commissioning course

Duration

3 days

J520 Power Electronics

**UNITROL® F
Operation and Maintenance**

Description

UNITROL® F provides a comprehensive range of Automatic Voltage Regulators and Static Excitation Systems for high performance control of all kind of synchronous machines.

Objectives

The course goal is to teach students to operate, maintain and perform simple troubleshooting of the excitation system or automatic voltage regulator (AVR).
Upon completion of the course students will be able to operate the system, perform standard maintenance, and trace and correct simple faults.

Contents

- Basics of the synchronous machine
- Duties of excitation system
- Major components of the UNITROL® F excitation system
- The main software function of UNITROL® F
 - Voltage regulator
 - Limiters
 - Power System stabilizer PSS
 - Superimposed regulators (Power factor and Var control)
 - Monitoring and protection
- Operating aspects
 - Local service panel
 - Start/Stop sequence
 - Commands and Indications
- Maintenance aspects
 - Reading the hardware drawing and tracing signals
 - Maintenance schedule
 - Alarm and fault indication
 - How to use the commissioning and maintenance tool CMT
 - What to do in case of troubles
 - How to replace hardware devices

Methods

Lectures
Hands on training using demo equipment with generator simulator

Participants

Operator and maintenance personnel in power plants and industrial sites

Prerequisites

Basic knowledge of electronics and power generation
Basic personal computer knowledge

Duration

3 days
Number of Participants: max. 8
Tailor made on-site courses on request

J540 Power Electronics

**UNITROL® F
Service and Commissioning**

Description

UNITROL® F provides a comprehensive range of Automatic Voltage Regulators and Static Excitation Systems for high performance control of all kind of synchronous machines.

Objectives

The course goal is to teach students to start-up, adjust, operate, maintain and troubleshoot the static excitation system (SES) or automatic voltage regulator (AVR).
Upon completion of this course, the students:

- Know the design aspects of UNITROL® F and its possible configuration
- Know the principle mode of operation of the electronic devices
- Can operate the voltage regulator
- Are able to localize and replace defective components
- Are able to apply the Commissioning and Maintenance Tool
- Are able to put a UNITROL® F system into operation

Contents

Configuration for various applications

- Single channel and double channel configuration

Principle operation of the hardware

- Measuring units, I/O interfaces
- UNITROL® F excitation module
- Optional devices (Diode failure relay, Power system stabilizer, Extended I/O board)
- Converter types (Thyristor, Chopper)

Software Functions

- Voltage regulator with limiters and power system stabilizer
- Channel and follow-up control
- Monitoring and protection
- Superimposed controllers (Power factor and Var control)
- Data exchange on double channel systems
- Setting of configuration and parameters using local control panel and CMT tool
- Logic control
- Communication to superior data buses (MODBUS / Profibus)
- The most important parameters

How to use the Commissioning and Maintenance Tool (CMT)

- How to change parameters
- How to display signals using data logger and trending
- How to program application function blocks

Service and Commissioning aspects

- Commissioning procedures and settings
- Alarm Indications
- Troubleshooting
- Preventive Maintenance

Methods

Lectures

Hands on training using demo equipment with generator simulator

Participants

Operator and maintenance personnel in power plants and industrial sites

Prerequisites

Basic knowledge of electronics and power generation

Basic personal computer knowledge

Duration

5 days

J590

Power Electronics

UNITROL® F Hands-on

Description

Consecutively to the J540 Service and Commissioning course the participants can deepen their knowledge on UNITROL® F by completing the J590 hands-on course. Based on practical exercises the students get familiar with the handling of the tools and application software of the UNITROL® F excitation system using simulators. The simulation of the synchronous machine with the grid system allows carrying out realistic commissioning work. Most of the time the participants work on his one supported by an instructor.

Objectives

After completion of the course the participants are able to:

- Carry out functional test of the various software functions such as voltage and field current regulators, limiters, power system stabilizer, monitoring and protection etc.
- Program of additional functions and signals
- Troubleshoot the UNITROL® F system

Contents

- Calibration of actual values
- Optimization of the various regulators
- Functional tests of the limiters
- Test of channel and mode transfer
- Functional test of the follow up control system
- Test of reactive power and power factor controller
- Commissioning and test of the power system stabilizer
- Test of the monitoring and protection function
- Programming of additional functions and signals
- Troubleshooting procedures

Methods

Practical hands-on training using simulators and demo units based on well-chosen exercises.

Periodically discussion of problems/questions with the instructor

Participants

Application, Test, Service and Commissioning engineers

Maximum of 4 participants

Prerequisites

Completion of the J540 Service and Commissioning course

Duration

3 days

J130

Power Electronics

UNITROL® 1000 Service and Commissioning

Description

UNITROL® 1000 provides a comprehensive range of Automatic Voltage Regulators and is intended for small generators and industrial synchronous machines. The maximum output current for continuous operation is 15 ADC. The most advanced microprocessor technology together with IGBT semiconductor technology allows it to be used in all conceivable areas of application.

Objectives

The course goal is to teach students to operate, maintain and perform simple troubleshooting of the automatic voltage regulator (AVR). Upon completion of the course students will be able to operate the system either using the front panel or the PC tool, perform standard maintenance.

Contents

- Basics of the synchronous machine
- Duties of excitation system
- Major components of the UNITROL® 1000
- The Hardware configurations and parts
 - Control elements
 - Device connections
 - Inputs/outputs
- The main software function of UNITROL® 1000
 - Voltage regulator
 - Limiters
 - Power factor and Var control
 - Droop compensation control
 - Boost output
 - Synchronisation
 - Monitoring and protection
- Operating aspects
 - How to use the front plate panel
 - Start/Stop sequence
 - Commands and Indications
 - Exercises using the demo equipment
- How to use the PC-tool
 - How to install the PC-tool
 - How to display signals
 - How to change parameter
 - How to operate the voltage regulator using the PC-tool
 - Exercises using the demo equipment and PC-Tool
- Servicing and Faults
 - Trouble shooting
 - Maintenance aspects

Methods

Lectures
Hands on training using demo equipment with generator simulator

Participants

Operator and maintenance personnel in power plants and industrial sites

Prerequisites

Basic knowledge of electronics and power generation
Basic personal computer knowledge

Duration

3 days
Number of Participants: max. 6
Tailor made on-site courses on request

J620

Power Electronics

UNITROL® 5000 Operation and Maintenance

Description

UNITROL® 5000 is the newest product of UNITROL® series of excitation systems introduced by ABB Switzerland Ltd.. It is a microprocessor-based system using the state-of-the-art technologies currently available. Its design is based on ABB's over 35 years of experience in solid-state AVRs as well as 10 years in microprocessor-based technology in this field.

Objectives

The course goal is to teach students to start-up, adjust, operate, and maintain the UNITROL® 5000 excitation system

Upon completion of this course, the students:

- Remember the synchronous machine and its operating conditions
- Know the duties of excitation systems
- Know the design aspects of UNITROL® 5000 and standard configuration
- Know the principle mode of operation of the electronic devices
- Can operate the voltage regulator using the local panels
- Can read and interpret the hardware and software drawings
- Can use the commissioning and maintenance tool
- Are able to display signals
- Can explain the most important software functions
- Can identify and interpret alarm indication
- Can read the fault logger
- Are able to localize and replace defective components
- Is able to carry out maintenance work on the excitation system

Contents

- Basic operating condition of the synchronous machine
- Duties of excitation systems
- Configurations of UNITROL® 5000
 - Single channel and double channel configuration
- Principle operation of the hardware
 - Measuring units, I/O interfaces
 - Controller board
 - Fast I/O
 - ARCnet field bus
 - Converter types

- Local service and control panel
- Principle operation of the software
- Voltage regulator with limiters and power system stabilizer
 - Channel and follow-up control
 - Monitoring and protection
 - Superimposed cos phi / VAr control
 - Communication to superior data buses (MODBUS / Profibus)
- Using commissioning and maintenance tool
- How to read signals and the fault logger
 - How to record and display signals with the data logger and trending window
- Maintenance aspects
- How to localize and replace defective components
 - How to interpret alarms
 - What to do in case of troubles

Methods

Lectures for introduction
 Practical exercise using UNITROL® 5000 excitation demo equipment
 Hands-on training using generator simulator

Participants

Operator and maintenance personnel in power plants and industrial sites

Prerequisites

Basic knowledge of electronics and power generation
 Basic knowledge using personal computer

Duration

3 days
 Number of participants: max. 8
 Tailor made on site courses on request

J640 Power Electronics

UNITROL® 5000 Service and Commissioning

Description

UNITROL® 5000 is a microprocessor-based system using the state-of-the-art technologies. Its design is based on ABB's over 35 years of experience in solid-state AVR's as well as 10 years in microprocessor-based technology in this field.

Objectives

The course goal is to teach students to start-up, adjust, operate, maintain and troubleshoot the UNITROL® 5000 excitation system
 Upon completion of this course, the students:

- Remember the synchronous machine and its operating conditions
- Know the duties of excitation systems
- Know the design aspects of UNITROL® 5000 and its possible configuration
- Know the principle mode of operation of the electronic devices

- Can operate the voltage regulator using the local panel
- Can read and interpret the hardware and software drawings
- Can use the commissioning and maintenance tool
- Are able to change parameters and display signals
- Can explain the most important software functions
- Are able to implement new standard function blocks to the software
- Can identify and interpret alarm indication
- Can read the fault logger
- Are able to localize and replace defective components
- Are allowed to start the certification program for commissioning UNITROL® 5000

Contents

- Basic operating condition of the synchronous machine
 Configurations of UNITROL® 5000 for various applications
 Single channel and double channel configuration
 Principle operation of the hardware
- Measuring units, I/O interfaces
 - Controller board
 - Fast I/O
 - ARCnet field bus
 - Converter types
 - Local service and control panel
- Principle operation of the software
- Voltage regulator with limiters and power system stabilizer
 - Channel and follow-up control
 - Monitoring and protection
 - Superimposed cos phi / VAr control
 - Data exchange on dual-channel systems
 - Setting of configuration and parameters using local panel and CMT tool
 - Logic control
 - Communication to superior data buses (MODBUS / Profibus)
 - Most important parameters
 - Using commissioning and maintenance tool
 - How to change parameters, how to record signals using the data logger and trending window
 - How to add application function blocks
 - How to read the fault logger
- Service and Commissioning aspects
- Commissioning procedures and settings
 - Alarm indication
 - Troubleshooting using the help of the users manual
 - Preventive Maintenance

Methods

Lectures for introduction
 Practical exercise using UNITROL® 5000 excitation demo equipment
 Hands-on training using generator simulator

Participants

Project design and commissioning engineers
 Testing and maintenance personnel

Prerequisites

Basic knowledge of electronics and power generation
Personal computer knowledge is required

Duration

5 days
Number of participants: max. 8

J649 Power Electronics

UNITROL® 5000 Hands-on

Description

Consecutively to the J640 Service and Commissioning course the participants can deepen their knowledge on UNITROL® 5000 by completing the J690 hands-on course. Based on practical exercises the students get familiar with the handling of the tools and application software of the UNITROL® 5000 excitation system using simulators. The simulation of the synchronous machine with the grid system allows carrying out realistic commissioning work. Most of the time the participants work on their own, supported by an instructor.

Objectives

After completion of the course the participants are able to:

- carry out functional test of the various software functions such as voltage and field current regulators, limiters, power system stabilizer, monitoring and protection etc.
- program of additional functions and signals
- troubleshoot the UNITROL® 5000 system

Contents

- Calibration of actual values
- Optimization of the various regulators
- Functional tests of the limiters
- Test of channel and mode transfer
- Functional test of the follow up control system
- Test of reactive power and power factor controller
- Commissioning and test of the power system stabilizer
- Test of the monitoring and protection function
- Programming of additional functions and signals
- Troubleshooting procedures

Methods

Practical hands-on training using simulators and demo units based on well-chosen exercises.
Periodically discussions of problems/questions with the instructor.

Participants

Application, Test, Service and Commissioning engineers, maximum 4 participants

Prerequisites

Completion of the J640 UNITROL 5000 Service and Commissioning course.

Duration

3 days

J680 Power Electronics

UNITROL® 6000 Service and Commissioning

Description

UNITROL® 6800 is the newest product of UNITROL series of excitation systems introduced by ABB Switzerland AG. It is a microprocessor-based system using the state-of-the-art technologies currently available. Its design is based on ABB's high performance controller family AC 800PEC.

Objectives

The course goal is to teach students to start-up, adjust, operate, maintain and troubleshoot the UNITROL® 6800 excitation system

Upon completion of this course, the students:

- Remembers the synchronous machine and its operating conditions
- Know the design aspects of UNITROL® 6800 and its possible configuration
- Are familiar with the principle mode of operation of the electronic devices
- Can read and interpret the hardware drawing
- Are able to operate the voltage regulator using the excitation control terminal:
 - *change parameters and display signals*
 - *use the trending and datalogger*
 - *reading the fault logger*
 - *identify and interpret alarm indication*
- Can explain the most important software functions
- Are able to localize and replace defective components
- Are familiar with the test and commissioning procedure of UNITROL 6800
- Are allowed to start the certification program for commissioning UNITROL® 6800.

Contents

- Basic of excitation system and operating condition of the synchronous machine
- Configurations of UNITROL® 6800 for various applications with its redundancy principle
- Setup and principle of operation of the hardware devices
 - *Main Controller*
 - *Measuring and I/O interfaces*
 - *Converter Control Interface*
 - *Local Control Terminal ECT*
 - *Converter types*
- Principle operation of the software

- Voltage regulator with limiters and power system stabilizer
- Superimposed cos phi / VAR control
- Channel and follow-up control
- Monitoring and protection
- Logic control
- Ethernet addressing and communication to upper control systems
- How to use the tools for UNITROL 6800 utilized for Commissioning
 - *PECinstaller and configurator tool*
 - *Excitation Control Terminal*
- How to use the Local Control Panel LCP
- How to use the Local Control Terminal ECT
 - *How to setup up a particular configuration*
 - *How to change parameters, how to record signals using the data logger and trending features*
 - *Software downloads*
 - *Alarm indication and how to read the fault logger*
- How to use the Converter Control Panel CCP
- Commissioning procedures and settings
- Maintenance and troubleshooting procedures

Methods

Lectures for introduction
 Practical exercise using UNITROL® 6800 excitation demo equipment
 Hands-on training using generator simulator

Participants

Project design and commissioning engineers
 Testing and maintenance personnel

Prerequisites

Basic knowledge of electronics and power generation
 Personal computer knowledge is required

Duration

5 days
 Number of Participants: max. 6

J681 Power Electronics

**UNITROL® 6000
 Operation and Maintenance**

Description

Since many years, UNITROL® is a synonym for high UNITROL® 6080 is the newest product of UNITROL series of excitation systems introduced by ABB Switzerland AG. It is a microprocessor-based system using the state-of-the-art technologies currently available. Its design is based on ABB's high performance controller family AC 800PEC.

Objectives

The course goal is to teach students to start-up, adjust, operate, maintain and troubleshoot the UNITROL® 6080 excitation system

Upon completion of this course, the students:

- Remembers the synchronous machine and its operating conditions
- Know the design aspects of UNITROL® 6080 and its possible configuration
- Are familiar with the principle mode of operation of the electronic devices
- Can read and interpret the hardware drawing
- Are able to operate the voltage regulator using the excitation control terminal:
 - *change parameters and display signals*
 - *use the trending and datalogger*
 - *reading the fault logger*
 - *identify and interpret alarm indication*
- Can explain the most important software functions
- Are able to localize and replace defective components
- Are familiar with the test and commissioning procedure of UNITROL 6080
- Are allowed to start the certification program for commissioning UNITROL® 6080.

Contents

- Basic of excitation system and operating condition of the synchronous machine
- Configurations of UNITROL® 6080 for various applications with its redundancy principle
- Setup and principle of operation of the hardware devices
 - *Main Controller*
 - *Measuring and I/O interfaces*
 - *HMI and Communications*
 - *Excitation Control Terminal ECT*
 - *Local Control Panel LCP*
 - *Converter types*
- Principle operation of the software
- Voltage regulator with limiters and power system stabilizer
- Superimposed cos phi / VAR control
- Channel and follow-up control
- Monitoring and protection
- Logic control
- Ethernet addressing and communication to upper control systems
- How to use the tools for UNITROL 6080 utilized for Commissioning
 - *PECinstaller and configurator tool*
 - *Excitation Control Terminal*
- How to use the Local Control Terminal ECT
 - *How to setup up a particular configuration*
 - *How to change parameters, how to record signals using the data logger and trending features*
 - *Software downloads*
 - *Alarm indication and how to read the fault logger*
- Commissioning procedures and settings
- Maintenance and troubleshooting procedures

Methods

Lectures for introduction
 Practical exercise using UNITROL® 6080 excitation demo equipment
 Hands-on training using generator simulator

Participants

Project design and commissioning engineers
 Testing and maintenance personnel

Prerequisites

Basic knowledge of electronics and power generation
 Personal computer knowledge is required

Duration

5 days
 Number of Participants: max. 8

J683 Power Electronics

**UNITROL® 6800
 Operation and Maintenance**

UNITROL® 6800 is the newest product of UNITROL series of excitation systems introduced by ABB Switzerland AG. It is a microprocessor-based system using the state-of-the-art technologies currently available. Its design is based on ABB's high performance controller family AC 800PEC.

Objectives

The course goal is to teach students to operate, maintain and troubleshoot the UNITROL® 6800 excitation system
 Upon completion of this course, the students:

- Remembers the synchronous machine and its operating conditions
- Know the duties of excitation systems
- Can explain the hardware concept and used configuration of the UNITROL® 6800 excitation system
- Are familiar with the principle mode of operation of the electronic devices with its indication and settings
- Can read and interpret the hardware drawing
- Are able to operate the voltage regulator using the excitation control terminal:
- Can explain the most important software functions
- Are able to localize and replace defective components
- Is able to carry out the maintenance work based on the maintenance schedule

Contents

- Basic of excitation system and operating condition of the synchronous machine
- Configurations of UNITROL® 6800 with its redundancy principle
- Setup and principle of operation of the hardware devices
 - *Main Controller*
 - *Measuring and I/O interfaces*
 - *HMI and Communications*
 - *Excitation Control Terminal ECT*
 - *Converter Control Panel CCP*
 - *Power Converter*
- Principle operation of the software
- Voltage regulator with limiters and power system stabilizer
- Superimposed cos phi / VAR control
- Channel and follow-up control
- Monitoring and protection
- Ethernet addressing and communication to upper control systems
- How to use the tools for UNITROL 6800 utilized for maintenance
 - *PECinstaller and configurator tool*
 - *Excitation Control Terminal*
- How to use the Local Control Terminal ECT
 - *operate the excitation system locally*
 - *Verify the operating point of the synchronous machine*
 - *Displaying signals on the panel*
 - *use the trending and transient recorder*
 - *reading the event/alarm logger*
 - *identify and interpret alarm indication*
- How to use the Converter Control Panel
- Maintenance and troubleshooting procedures
- How to replace hardware components
- How to verify proper operation of the excitation system
- How to perform functional tests

Methods

Lectures for introduction
 Practical exercise using UNITROL® 6800 excitation demo equipment
 Hands-on training using generator simulator

Participants

Operation and maintenance personnel

Prerequisites

Basic knowledge of electronics and power generation
 Personal computer knowledge is required

Duration

5 days
 Number of Participants: max. 8

J684**Power Electronics****UNITROL® 6080****Operation and Maintenance**

UNITROL® 6080 is the newest product of UNITROL series of excitation systems introduced by ABB Switzerland AG. It is a microprocessor-based system using the state-of-the-art technologies currently available. Its design is based on ABB's high performance controller family AC 800PEC.

Objectives

The course goal is to teach students to operate, maintain and troubleshoot the UNITROL® 6080 excitation system. Upon completion of this course, the students:

- Remembers the synchronous machine and its operating conditions
- Know the duties of excitation systems
- Can explain the hardware concept and used configuration of the UNITROL® 6080 excitation system
- Are familiar with the principle mode of operation of the electronic devices with its indication and settings
- Can read and interpret the hardware drawing
- Are able to operate the voltage regulator using the excitation control terminal:
- Can explain the most important software functions
- Are able to localize and replace defective components
- Is able to carry out the maintenance work based on the maintenance schedule

Contents

- Basic of excitation system and operating condition of the synchronous machine
- Configurations of UNITROL® 6080 with its redundancy principle
- Setup and principle of operation of the hardware
 - *Main Controller*
 - *Measuring and I/O interfaces*
 - *HMI and Communications*
 - *Excitation Control Terminal ECT*
 - *Service Control Panel SCP*
 - *Power Converter*
- Principle operation of the software
- Voltage regulator with limiters and power system stabilizer
- Superimposed cos phi / VAR control
- Channel and follow-up control
- Monitoring and protection
- Logic control
- Ethernet addressing and communication to upper control systems
- How to use the tools for UNITROL 6080 utilized for maintenance
 - *PECinstaller and configurator tool*
 - *Excitation Control Terminal*

- How to use the Local Control Terminal ECT or the Service Control Panel SCP
 - *operate the excitation system locally*
 - *Verify the operating point of the synchronous machine*
 - *Displaying signals on the panel*
 - *use the trending and transient recorder*
 - *reading the event/alarm logger*
 - *identify and interpret alarm indication*
- Maintenance and troubleshooting procedures
- How to replace hardware components
- How to verify proper operation of the excitation system
- How to perform functional tests

Methods

Lectures for introduction

Practical exercise using UNITROL® 6080 excitation demo equipment

Hands-on training using generator simulator

Participants

Operation and maintenance personnel

Prerequisites

Basic knowledge of electronics and power generation
Personal computer knowledge is required

Duration

5 days

Number of Participants: max. 8

J685**Power Electronics****UNITROL® 6000 Overview****Description**

Since many years, UNITROL® is a synonym for high quality Automatic Voltage Regulators (AVR) and Static Excitation Systems (SES). UNITROL 6000 is the latest technical development, a logical continuation of this tradition. It is a very flexible product range based on reusable modules. With single / double channel control configuration (additional back-up controller on request) and a wide selection of thyristor bridge modules, the system can be configured to meet all field data and availability requirements.

Objectives

Upon completion of this course, the students:

- are able to be partner on system discussion
- are able to explain the benefit of UNITROL® 6000 to former UNITROL® systems.
- Are familiar with the system architecture of UNITROL® 6000 and its hardware configuration
- are able to line up various system configurations based on a system specification

- are able to explain the system connectivity of UNITROL® 6000 (I/O, Fieldbus to upper control systems etc.)
- are familiar with the tool concept of UNITROL® 6000

Contents

- What is UNITROL® 6000
- Application range
- UNITROL® 6000 System Topology
 - Control arrangement
 - Converter topology
 - Operating range
- UNITROL® 6000 Hardware concept
 - Principle of operation of the hardware devices used in UN6800 as well as UN6080
- What is new compared to former UNITROL
- UNITROL® 6000 software concept
 - Software structure (FPGA, MATLAB/Simulink, Control IT)
 - Standard software
 - Customizing the software, Engineering aspects
 - Software features
 - Tools used for UNITROL 6000
 - Software download concepts
- Documentation/Training

Methods

Lectures for introduction
Discussions

Participants

Project Manager, Application and Sales Engineers

Prerequisites

Basic knowledge of electronics

Duration

1 day
Number of Participants: max. 10

J688 Power Electronics

UNITROL® 6000 Hands-on Service and Commissioning

Consecutively to the J680 UNITROL® 6800 or J681 UNITROL® 6080 Service and Commissioning courses the participants can deepen their knowledge on UNITROL® 6800/6080 by completing the J688 hands-on course. Based on practical exercises the students get familiar with the handling of the control hardware and application software using demo units and control boards. The fully functioning UN6800 or UN6080 demo units with the real time generator simulators allows to carry out real commissioning and troubleshooting as well as maintenance works. Most of the time the participants work on their own supported by an instructor.

Objectives

After completion of the course the participants are able to:

- Operate the UNITROL® 6000 Voltage Regulators using the Excitation Control Terminal
- Configure, scale and calibrate the software
- Optimize and tune all closed loop control circuit
- Perform functional tests
- Carry out repairing and preventive maintenance works
- Troubleshoot the excitation system
- Put the UNITROL® 6000 voltage regulator in service

Contents

- Software handling, upload/download using SW tools
- Using the excitation control terminal ECT
- Application parameter settings, configuration, calibration
- Optimization and tuning of the closed loop control circuits
- Troubleshooting procedures: fault finding and repairing

Methods

Practical hands-on training using the demo units, and demo control boards based on well-chosen exercises. Discussion of problems and questions with the instructor.

Participants

Service and Commissioning Engineers

Prerequisites

Completion of the J680 or J681 Service and Commissioning course

Duration

3 days

J950 Power Electronics

PSR2-FUPLA2 Programming

Description

The units of the PSR programmable high-speed The units of the PSR programmable high-speed controller make up a universal control, regulation and monitoring system which has been specially devised for power converters. The system has been optimised to serve as the processing node for the process control level, includes all the functions needed for this purpose and provides an interface for communication with a master process control system

PSR devices have operated successfully for years in complex high speed controlling systems for

- Variable -speed drives
- High power frequency converters
- Static Var-compensator
- Large rectifier plants
- Excitation systems

Objectives

The course goal is to teach students to program the PSR devices.

Upon completion of this course, the students are able to:

- Address the important device types
- Write application programs with «FUPLA2»
- Use the FUPLA2 Debugger
- Modify existing FUPLA projects

Contents

Introduction to PSR2 technology

Functions and setting of the PSR2 devices, such as

- Processing unit
- I/O modules
- Gate control unit
- ARCnet devices

Operating Program Language FUPLA2

- PTS Shell
- Editor
- Configuration manager
- Code generation
- Debugger, diagnosis
- PSRView application
- Function block library

Programming aspects

- How to set up a project
- Program structure
- Data formats
- Memory mapping
- Macro technique

Methods

Lectures

Exercises using the programming tools on table models

Participants

Project design and commissioning engineers

Testing engineers, who use a standardized PSR system

Prerequisites

Knowledge in electronics and digital technique

Personal Computer knowledge

Duration

5 days

Number of Participants: max. 8

J900

Power Electronics

SYNCHROTECT® 5 Operation and Commissioning

Description

SYNCHROTECT® products from ABB are used for automatic synchronization of generators with power lines and for paralleling of synchronous lines. They are designed for fully-automatic paralleling of monitoring of paralleling (Synchrocheck) by means of dual-channel or single-channel systems

Objectives

The course goal is to teach students to operate the device and set up the appropriate system parameter.

Upon completion of this course, the students:

- Know the basic requirement of a synchronizing equipment
- Understand the meaning of the parameter settings
- Know how to calculate and change parameters
- Can apply SYNCHROTECT® 5 to specific system
- Are able to put the SYNCHROTECT® 5 into operation

Contents

Basic synchronizing theory

- Paralleling conditions
- Principle of paralleling
- Modes to paralleling
- Effects of bad paralleling

Hardware-specific information

Channel configurations

Software and parameter setting

Test and commissioning aspects

Methods

Lectures

Practical exercises using generator simulator and SYNCHROTECT® rack

Participants

Project design, commissioning, instrumentation and control engineers

Operating, testing and maintenance personnel

Sales personnel who wish to gain a basic knowledge as well as a system overview

Prerequisites

Basic knowledge in electronics and electrical machines

Duration

2 day

Number of Participants: max. 6

Tailor made on site courses on request

G700

Medium Voltage Drives

**ACS 1000 Medium Voltage Drive
Operation and Maintenance**

Description

The ACS 1000 is a medium voltage drive for speed and torque control of asynchronous motors. It is based on the latest technologies as DTC control and IGCT power semiconductors. ACS 1000 is rated from 315 kW to 5 MW, for motor voltages of 2.3, 3.3 and 4 - 4.16 kV. The version ACS 1000i has the input transformer and input contactor already integrated in the drive cubicle, allowing a compact design and reduced installation costs, for new or retrofit applications.

Objectives

The course goal is to teach students to operate, maintain and troubleshoot the ACS 1000 drive, air-cooled and water-cooled units.

Upon completion of this course, students will be able to locate the hardware components, to verify and replace drive's parts and to perform preventive maintenance. The use of the available programming and troubleshooting tools is trained by practical operating exercises.

Contents

Generalities

- ACS 1000 family overview, system requirements
 - AC motor and DTC control
 - Medium voltage safety requirements
- Hardware description (Power Electronic & Control)
- Component and PCB functions
 - Hardware schematics and electrical drawings
 - PCB settings and configuration
 - ACS 1000i characteristics

Water-cooled system

- Water circuits description
- Preventive maintenance

Operation

- Energize / de-energize the drive, start-stop sequence
- Local operation with drive control panel and DriveWindow tool
- Remote control

Software introduction

- Software structure, parameter's description
- Application configuration, parameter's setting
- Fault-tracing and troubleshooting
- Alarm and fault indications
- Checking and replacing PCB's and components
- Using DriveWindow SW tool for configuration and troubleshooting
- Getting help from ABB

Methods

Lectures and demonstrations
 Practical exercises with demo equipment
 Factory visit

Participants

Electricians, technicians and engineers who operate, maintain or troubleshoot ACS 1000

Prerequisites

Basic knowledge of AC motors and drives
 Basic knowledge using computers with Windows

Duration

3 days
 Max. 8 participants
 English speaking
 On-site training or special program on request

G710

Medium Voltage Drives

**ACS 1000 Service and
Commissioning**

Description

The ACS 1000 is a medium voltage drive for speed and torque control of asynchronous motors. It is based on the latest technologies as DTC control and IGCT power semiconductors. ACS 1000 is rated from 315 to 5 MW, for motor voltages of 2.3, 3.3 and 4 - 4.16 kV. The version ACS 1000i has the input transformer and input contactor already integrated in the drive cubicle, allowing a compact design and reduced installation costs, for new or retrofit applications.

Objectives

The participants will learn how to commission, operate, maintain and troubleshoot the ACS 1000 drive system. Upon completion of this course, the participants will be able to:

- understand the drive system topology
- verify and modify drive parameters, locate and replace faulty hardware components
- carry out service and maintenance work as well as fault-tracing.
- using MV Drive Portal database to update the knowledge of the drive, get familiar with spare parts and warranty issues handling.
- start the certification program for commissioning, after completion of the certification program the participants are allowed to commissioning the medium voltage drive system.

Contents

Generalities

- ABB Medium voltage family overview
- Three-level inverter topology, DTC control
- Options and typical applications

Hardware description (Power Electronic & Control)

- Component and PCB functions
- Hardware schematics and electrical drawings
- PCB settings and configuration

Water-cooled system

- Water circuits description
- Pre-commissioning procedure
- Preventive maintenance

Drive commissioning

- Drive system technical and environment requirements
- Commissioning procedure, application configuration
- Tests and reports

Software description

- Software structure, parameter's description
- Pass codes, service parameters
- Software download, programming, parameters upload / download, FW back-up and restore
- Fieldbus programming (interfacing with overriding system)

Fault-tracing and troubleshooting

- Alarm and fault indications
- Measuring and replacing PCB's and power components
- Advanced software functions for troubleshooting, using DriveWindow and DriveDebug
- Warranty managing and reporting
- Getting help from ABB

Methods

Lectures and demonstrations
 Practical exercises with demo equipment
 Factory visit

Participants

Commissioning engineers, testing and maintenance personnel

Prerequisites

Good knowledge of AC motor and drive engineering
 Personal computer knowledge

Duration

4 days
 Max. 8 participants
 English speaking

G750

Medium Voltage Drives

ACS 6000 Medium Voltage Drive Operation and Maintenance

Description

The ACS 6000 is a modular type medium voltage AC drive platform for megawatt class asynchronous and synchronous machines in single and multi drive systems. This product platform is based on latest technologies such as IGBT power semiconductors and sophisticated control principles based on DTC.

The ACS 6000 platform is suitable for drive applications like rolling mills, mine hoists and pump storage plants etc. within a power range of 3 to 27 MVA and output frequencies between 0 and 75 Hz.

Objectives

The participants will learn how to operate, maintain and troubleshoot the ACS 6000 drive system.

Upon completion of this course, the participants will be able to understand the drive system topology, to locate and replace faulty hardware components and to carry out preventive maintenance.

Using available programming and troubleshooting tools will be trained by practical exercises.

Contents

General Topics

- Introduction to product
- Different DC bus configurations (single and multi drive)
- Medium voltage safety requirements

Hardware Description (Power Electronics & Control)

- Functions of components and PCB's (printed circuit boards)
- Hardware schematics and electrical drawings
- PCB settings and configurations

Redundant Watercooling System

- Cooling circuit description
- Preventive maintenance

Operation

- Energizing and de-energizing the converter

Start / stop sequence

- Using local control panels and DriveWindows tool

Software Introduction

- Active rectifier, inverter and excitation software concept
- Data exchange between modules

Setting parameters

Fault-tracing and troubleshooting

- Interpretation of alarm and fault messages
- Replacement of PCB's and components
- Getting help from ABB

Methods

Lectures and demonstrations
 Practical exercises with demo equipment
 Visit of the assembly line

Participants

Electricians, technicians and engineers, who will operate, maintain or troubleshoot the ACS 6000 drive system.

Prerequisites

Basic knowledge on asynchronous and synchronous motors and drive engineering
knowledge on use of MS Windows based computers and English

Duration

4 days
Max. 8 participants
On-site training on request

G760 Medium Voltage Drives

ACS 6000 Service and Commissioning

Description

The ACS 6000 is a modular type medium voltage AC drive platform for megawatt class asynchronous and synchronous machines in single and multi drive systems. This product platform is based on latest technologies such as IGCT power semiconductors and sophisticated control principles based on DTC. The ACS 6000 platform is suitable for drive applications like rolling mills, mine hoists and pump storage plants etc. within a power range of 3 to 27 MVA and output frequencies between 0 and 75 Hz.

Objectives

The participants will learn how to commission, operate, maintain and troubleshoot the ACS 6000 drive system. Upon completion of this course, the participants will be able to:

- understand the drive system topology
- locate and replace faulty hardware components
- carry out service and maintenance work as well as fault-tracing but not allowed to commission the medium voltage drive system without certification
- start the certification program for commissioning, after completion of the certification program the participants are allowed to commissioning the medium voltage drive system

Contents

Generalities

- Asynchronous and synchronous motor control
- System description
- Medium voltage safety requirements

Hardware description (Power Electronic & Control)

- Component and Printed Circuit Board functions
- Hardware schematics and electrical drawings
- Printed Circuit Board settings and configuration

Redundant water-cooled system

- Water circuits description
- Pre-commissioning procedure
- Preventive maintenance

Drive commissioning

- Drive and motor environment requirements
- Commissioning procedures
- Tests and report

Operation

- Energize/ de-energize the drive, start-stop sequence
- Using operator control panel and Drive Windows tool
- Standard overriding control

Software description

- Active rectifier, inverter and excitation software parameters
- Parameter setting and programming
- Software download
- Fieldbus programming (overriding system)

Fault-tracing and troubleshooting

- Alarm and fault indications
- Replacing PCBs and components
- Advanced software functions for troubleshoot
- Getting help from ABB, using MV Drive Portal database for updating the knowledge of the drive, handling spare parts and warranty issues

Methods

Lectures and demonstrations
Practical exercises with demo equipment
Manufacture visit

Participants

Commissioning engineers, testing and maintenance personnel
ABB personnel only

Prerequisites

Good knowledge of synchronous and asynchronous motors and drive engineering
Good personal computer and English knowledge

Duration

5 days
Max. 8 participants

G769

Medium Voltage Drives

ACS 6000 Medium Voltage Drive Hands-on

Description

Consecutively to the G760 ACS 6000 Service and Commissioning course the participants can deepen their knowledge on ACS 6000 by completing the G769 hands-on course. Based on practical exercises the students get familiar with the handling and commissioning of the drive and application software using demo units and demo control boards. The fully functioning demo drive allows to carry out real commissioning work. Most of the time the participants work on their own supported by an instructor.

Objectives

After completion of the course the participants are able to:

- Operate the ACS 6000
- Carry out “cold” commissioning and preventive maintenance works
- Troubleshoot the drive

Contents

- Powering the drive (auxiliary power)
- Insulation test
- Commissioning and maintenance of Water Cooling Unit
- Software download
- Application parameter settings
- Using SW tools (DriveWindow, DriveDebug)
- Torque Controller tuning
- Replacing phase modules
- Replacing diodes and IGCTs
- Troubleshooting procedures: fault finding and repairing

Methods

Practical hands-on training using the demo drive, demo phase module and demo control boards based on well-chosen exercises.

Discussion of problems and questions with the instructor.

Participants

Service and Commissioning Engineers

Prerequisites

Completion of the G760 Service and Commissioning course

Duration

3 days

G790

Medium Voltage Drives

MV Drives Fundamentals (eLearning)

This course provides a basic overview of ABB MV Drives product portfolio and product features. It also covers the design principle, common features and product family pre-selection information.

Objectives

After the successful completion of this course the participants will be able to understand and explain to others:

- ABB MV Drives product family characteristics
- ABB MV Drives common features and customer benefits
- ABB MV Drives applications and product family preselection based on application data

Contents

1. Product Overview
 - ABB MV Drives product portfolio (e.g. power & voltage range, topologies, main characteristics and features)
2. Features & Selection
 - ABB MV Drives design philosophy
 - Common core features
 - Main applications for ABB MV Drives product family
 - Preselection of the right ABB MV Drives product based on customer’s application data
 - ABB’s MV Drives testing and services
3. Examination
 - Repetition questions of most important issues
 - Successful participation required to sign up for other MV Drives courses

Participants

This course is designed for ABB employees and authorized Technical Partners only; independent of work discipline (e.g. marketing, sales, engineering,..).

Prerequisites

- Successful participation of G790e – MV Drives Fundamentals (exam score > 70%)
- Knowledge in electrical engineering is beneficial but not mandatory

G791

Medium Voltage Drives

MV Drives Product Overview (eLearning)

This course provides a basic overview of ABB MV Drives product portfolio and product features. It also covers the design principle, common features and product family pre-selection information.

Objectives

After the successful completion of this course the participants will be able to understand and explain to others:

- ABB MV Drives product family characteristics
- ABB MV Drives common features and customer benefits
- ABB MV Drives applications and product family preselection based on application data

Contents

1. Product Overview
 - ABB MV Drives product portfolio (e.g. power & voltage range, topologies, main characteristics and features)
2. Features & Selection
 - ABB MV Drives design philosophy
 - Common core features
 - Main applications for ABB MV Drives product family
 - Preselection of the right ABB MV Drives product based on customer's application data
 - ABB's MV Drives testing and services
3. Examination
 - Repetition questions of most important issues
 - Successful participation required to sign up for other MV Drives courses

Participants

This course is designed for ABB employees and authorized Technical Partners only; independent of work discipline (e.g. marketing, sales, engineering,..). Prerequisites

- Successful participation of G790e – MV Drives Fundamentals (exam score > 70%)
- Knowledge in electrical engineering is beneficial but not mandatory

G731

Medium Voltage Drives

ACS 5000 Medium Voltage Drive Operation and Maintenance AIR COOLED

The ACS 5000 is a modular type medium voltage AC drive platform for applications driven by megawatt class standard asynchronous or synchronous motors up to 6.9 kV.

This product platform is based on latest technologies such as Voltage Source Inverter Multilevel-Fuseless topology (VSI-MF), IGCT power semiconductors and sophisticated control principles based on DTC.

The ACS 5000 platform is suitable for drive applications like bar and rod mills, conveyors and pump storage plants etc. within a power range of 2 to 7 MVA and output frequencies between 0 and 75 Hz.

Objectives

The participants will learn how to operate, maintain and troubleshoot the ACS 5000 air cooled drive system.

Upon completion of this course, the participants will be able to understand the drive system topology, to locate and replace faulty hardware components and to carry out preventive maintenance.

Using available programs and troubleshooting tools will be trained by practical exercises.

Contents

General Topics

- Introduction to product
- Different configurations
- Medium voltage safety requirements

Hardware Description (Power Electronics & Control)

- Functions of components and PCBs (printed circuit boards)
- Hardware schematics and electrical drawings
- PCB settings and configurations

Air Cooling System

- Cooling circuit description
- Preventive maintenance

Operation

- Energizing and de-energizing the converter

Start / stop sequence

- Using local control panels and DriveWindow tool

Software Introduction

- Inverter software concept
- Data exchange between modules

Setting parameters

Fault-tracing and Troubleshooting

- Interpretation of alarm and fault messages
- Replacement of PCBs and components
- Getting help from ABB

Methods

Lectures and demonstrations

Practical exercises with demonstration material

Visit of the assembly line

Participants

Electricians, technicians and engineers who will operate, maintain or troubleshoot the ACS 5000 air cooled drive system.

Prerequisites

Basic knowledge on asynchronous and synchronous motors and drive engineering

Basic knowledge on use of MS Windows based computers

Training and documents in English.

Duration

3 days

Max. 6 participants

On-site training on request

G732

Medium Voltage Drives

**ACS 5000 Medium Voltage Drive
Operation and Maintenance
WATER COOLED**

The ACS 5000 is a modular type medium voltage AC drive platform for applications driven by megawatt class standard asynchronous or syn-chronous motors up to 6.9 kV.

This product platform is based on latest technologies such as Voltage Source Inverter Multilevel-Fuseless topology (VSI-MF), IGCT power semiconductors and sophisticated control principles based on DTC.

The ACS 5000 platform is suitable for drive applications like bar and rod mills, conveyors and pump storage plants etc. within a power range of 5 to 24 MVA and output frequencies between 0 and 75 Hz.

Objectives

The participants will learn how to operate, maintain and troubleshoot the ACS 5000 water cooled drive system. Upon completion of this course, the participants will be able to understand the drive system topology, to locate and replace faulty hardware components and to carry out preventive maintenance. Using available programs and troubleshooting tools will be trained by practical exercises.

Contents

General Topics

- Introduction to product
- Different configurations
- Medium voltage safety requirements

Hardware Description (Power Electronics & Control)

- Functions of components and PCBs (printed circuit boards)
- Hardware schematics and electrical drawings
- PCB settings and configurations

Redundant Water Cooling System

- Cooling circuit description
- Preventive maintenance

Operation

- Energizing and de-energizing the converter

Start / stop sequence

- Using local control panels and DriveWindow tool

Software Introduction

- Active rectifier, inverter and excitation software concept
- Data exchange between modules

Setting parameters

Fault-tracing and Troubleshooting

- Interpretation of alarm and fault messages
- Replacement of PCBs and components
- Getting help from ABB

Methods

Lectures and demonstrations

Practical exercises with demonstration material

Visit of the assembly line

Participants

Electricians, technicians and engineers who will operate, maintain or troubleshoot the ACS 5000 water cooled drive system.

Prerequisites

Basic knowledge on asynchronous and synchronous motors and drive engineering

Basic knowledge on use of MS Windows based computers

Training and documents in English.

Duration

3.5 days

Max. 6 participants

On-site training on request

G740

Medium Voltage Drives

**ACS 5000 Service and
Commissioning**

Description

The ACS 5000 is medium voltage AC drive platform for applications driven by megawatt class standard asynchronous or synchronous motors up to 6.9kV. This product platform is based on latest technologies such as Voltage Source Inverter Multilevel-Fuseless topology (VSI-MF), IGCT power semiconductors and sophisticated control principles based on DTC. The ACS 5000 platform is suitable for drive applications like bar and rod mills, conveyors and pump storage plants etc. within a power range of 2 to 24 MVA and output frequencies between 0 and 75 Hz.

Objectives

The participants will learn how to commission, operate, maintain and troubleshoot the ACS 5000 drive system. Upon completion of this course, the participants will be able to:

- understand the drive system topology
- locate and replace faulty hardware components
- to carry out service and maintenance work as well as fault-tracing but not allowed to commission the medium voltage drive system without certification
- to start the certification program for commissioning, after completion of the certification program the participants are allowed to commissioning the medium voltage drive system

Using available programming and troubleshooting tools will be trained by practical exercises.

Contents

Generalities

- Synchronous and asynchronous motor control
- System description
- Medium voltage safety requirements

Hardware description (Power Electronic & Control)

- Component and Printed Circuit Board functions
- Hardware schematics and electrical drawings
- Printed Circuit Board settings and configuration

Redundant cooling system

- Water/air circuits description
- Pre-commissioning procedure
- Preventive maintenance

Drive commissioning

- Drive and motor environment requirements
- Commissioning procedures
- Tests and report

Operation

- Energize/ de-energize the drive, start-stop sequence
- Using operator control panel and Drive Windows tool
- Standard overriding control

Software description

- Inverter and excitation software parameters
- Parameter setting and programming
- Software download
- Fieldbus programming (overriding system)

Fault-tracing and troubleshooting

- Alarm and fault indications
- Replacing PCBs and components
- Advanced software functions for troubleshoot
- Getting help from ABB

Methods

Lectures and demonstrations
 Practical exercises with demo equipment
 Manufacture visit

Participants

Commissioning engineers, testing and maintenance personnel, ABB personnel only

Prerequisites

Good knowledge of asynchronous and synchronous motor and drive engineering
 Good personal computer and English knowledge

Duration

5 days
 Max. 8 participants

G758 Medium Voltage Drives

AC 800M for MV AC Drives

Description

This course description will be available online from the second half of the year.
www.abb.com/abbuniversity (click on Switzerland)

G795 Medium Voltage Drives

DriveMonitor

Description

DriveMonitor™ is a diagnostic intelligent tool installed in a MV Drive system and designed to automatically collect and analyse selected drive signals and parameters. It can be installed inside or outside the drive and can monitor up to nine drive units. (ACSx000 and LCI). It consists of an industrial PC with embedded firewall, as well as the software layer continuously monitoring the drive status and collecting relevant data. A touch panel is available as option.

DriveMonitor™ also generates application specific alarms and measurements, as well as automatic reports, extremely useful in determining the root cause of an event.

The remote monitoring is performed via an Internet connection; the embedded firewall allows the access only to ABB experts and / or user's personnel nominated by the customer. The access is read - only, the operation of the system from the remote computer is not permitted.

Diagnostics and troubleshooting with remote monitoring is available in a service contract with a local ABB unit or directly with ABB Switzerland Ltd.

Objectives

The participants will learn how to access and use DriveMonitor™, as well as how to install and troubleshoot the system.

Upon completion of this course the participants will be able to remotely connect to DriveMonitor™ computer and perform fault tracing and troubleshooting (provided they already have the specific drive knowledge) or work in conjunction with the ABB expert in the case of a service contract.

Contents

- Overview: general presentation of the system, differences between DriveMonitor™ and other monitoring tools
- Hardware Description: Industrial PC with embedded firewall, Touch panel
- Software Presentation: Events (alarms, faults, signals and family definition, fault handling), Loggers, Monitoring, Reporting
- Installation and start-up: Fiber Optic (FO) and network hardware connections, NDBU95 settings, internet and DriveMonitor™ settings.
- Maintenance and troubleshooting

Methods

Lectures and demonstrations
 Practical exercises with Demo equipment (DriveMonitor™ units connected to drives).

Participants

Technicians and engineers involved in the maintenance and troubleshooting of MV drive systems.

Prerequisites

Basic knowledge of MS Windows based computers
 Basic knowledge of the MV drives installed in the system
 Good English knowledge

Duration

2 days
 Max. 6 participants
 On-site training available on request

G800 Medium Voltage Drives

MEGADRIVE LCI Operation and Maintenance

Description

Load Commutated Inverters (MEGADRIVE LCI) or in other terms Static Frequency Converters (SFC) are used together with large synchronous motors as an adjustable speed drive or to start large gas turbines without high inrush current on the power supply. These systems are available in a power range from 1000kW up to 100MW.

Objectives

The course goal is to teach students to operate, maintain and troubleshoot a MEGADRIVE LCI.

Upon completion of this course, the participants:

- know the function of a MEGADRIVE LCI
- know the different modes of operation
- are able to operate and maintain a MEGADRIVE LCI
- are able to localise faults and replace defective parts

Contents

- Power electronics in general
 - The function of rectifiers and converters
- Static Frequency Converter
 - Principal function
 - Configuration for various applications
 - Regulation circuits
 - Characteristic curves
 - Limitations, monitoring and protection
- Operation
 - Operating modes
 - Annunciation
- Safety in relation to MEGADRIVE LCI
- Documentation
 - Project documentation
 - How to read the Hardware schematics
- Hardware components
 - Functions, settings
 - Interfaces to peripherals
 - Water cooling / Air cooling
 - Maintenance and Trouble shooting
 - Replacement of thyristors
 - Software tool FUPLA (Debugger)
 - Test programs

Methods

- Lectures and demonstrations
- Practical exercises inclusive hands-on training using a LCI-model
- Factory tours

Participants

- Operating personnel
- Maintenance personnel

Prerequisites

- Basic electro technical knowledge
- Basic knowledge of synchronous machines
- Personal computer knowledge is recommended

Duration

4 days
 Number of participants: Max. 8
 On site course on request

G810 Medium Voltage Drives

MEGADRIVE LCI Service and Commissioning

Description

Load Commutated Inverters (MEGADRIVE LCI) or in other terms Static Frequency Converters (SFC) are used together with large synchronous motors as an adjustable speed drive or to start large gas turbines without high inrush current on the power supply. These systems are available in a power range from 1000kW up to 100MW.

Objectives

The course goal is to teach students to operate, commission, maintain and troubleshoot a MEGADRIVE LCI.

Upon completion of this course, the participants:

- know the function of a MEGADRIVE LCI
- know the different modes of operation
- are able to operate and maintain a MEGADRIVE LCI
- know how to perform the test programs
- are able to localise faults and replace defective parts

Contents

- Power electronics in general
 - The function of rectifiers and inverters
- Static Frequency Converter LCI
 - Principal function
 - Configuration for various applications
 - Regulation circuits
 - Characteristic curves
 - Limitations, monitoring and protection
- Operation
 - Operating modes

■ Annunciation

Safety in relation to MEGADRIVE LCI

Documentation

- Project documentation
- How to read the Hardware schematics
- How to read the Software schematics

Hardware components

- Functions, settings
- Interfaces to peripherals
- Water cooling / Air cooling

Maintenance and Trouble shooting

- Replacement of thyristors
- Software tool FUPLA (Debugger)
- Test programs

Methods

Lectures and demonstrations

Practical exercises inclusive hands-on training using a LCI-model

Factory tour

Participants

Commissioning, application and service engineers
Testing and maintenance personnel who need deep knowledge in LCI - systems

Prerequisites

Electrotechnical college qualifications or equivalent

Basic knowledge of synchronous machines

Basic knowledge of personal computers

Duration

5 days

Number of participants: Max. 6

G820 Power Electronics

**MEGADRIVE LCI with AC 800PEC
Operation and Maintenance**

Description

Load Commutated Inverters (MEGADRIVE LCI) or in other terms Static Frequency Converters (SFC) are used together with large synchronous motors as an adjustable speed drive or to start large gas turbines without high inrush current on the power supply. These systems are available in a power range from 1000kW up to 100MW.

Objectives

The course goal is to teach students to operate, maintain and troubleshoot a MEGADRIVE LCI controlled by AC 800PEC

Upon completion of this course, the participants:

- know the function of a MEGADRIVE LCI
- know the different modes of operation
- are able to operate and maintain a MEGADRIVE LCI
- are able to localise faults and replace defective parts

Contents

Power electronics in general

- The function of rectifiers and converters

Static Frequency Converter

- Principal function
- Configuration for various applications
- Regulation circuits
- Characteristic curves
- Limitations, monitoring and protection

Operation

- Operating modes
- Annunciation

Safety in relation to MEGADRIVE LCI

Documentation

- Project documentation
- How to read the Hardware schematics
- Hardware components
- Functions, settings
- Interfaces to peripherals
- Water cooling / Air cooling
- Maintenance and Trouble shooting
- Replacement of Thyristors
- Software tools:
 - LCI Control Terminal
 - (Transient Recorder)
- Test programs

Methods

Lectures and demonstrations

Practical exercises inclusive hands-on training using a LCI-model

Factory tour

Participants

Operating personnel

Maintenance personnel

Prerequisites

Basic electrotechnical knowledge

Basic knowledge of synchronous machines

Personal computers knowledge is recommended

Duration

4 days

Number of participants: Max. 8

On site course on request

G830

Power Electronics

MEGADRIVE LCI with AC 800PEC Service and Commissioning

Description

Load Commutated Inverters (MEGADRIVE LCI) or in other terms Static Frequency Converters (SFC) are used together with large synchronous motors as an adjustable speed drive or to start large gas turbines without high inrush current on the power supply. These systems are available in a power range from 1000kW up to 100MW.

Objectives

The course goal is to teach students to operate, maintain and troubleshoot a MEGADRIVE LCI controlled by AC 800PEC

Upon completion of this course, the participants:

- know the function of a MEGADRIVE LCI
- know the different modes of operation
- are able to operate and maintain a MEGADRIVE LCI
- know how to perform the test programs
- are able to localise faults and replace defective parts

Contents

Power electronics in general

- The function of rectifiers and converters

Static Frequency Converter

- Principal function
- Configuration for various applications
- Regulation circuits
- Characteristic curves
- Limitations, monitoring and protection

Operation

- Operating modes
- Annunciation

Safety in relation to MEGADRIVE LCI

Documentation

- Project documentation
- How to read the Hardware schematics
- Software overview

Hardware components

- Functions, settings
- Interfaces to peripherals
- Water cooling / Air cooling

Maintenance and Trouble shooting

- Replacement of Thyristors
- Software tools:
 - PECInstaller
 - LCI Control Terminal (Operation, Event, Transient Recorder)
- Test programs

Methods

Lectures and demonstrations

Practical exercises inclusive hands-on training using a LCI-model

Factory tour

Participants

Commissioning, application and service engineers
Testing and maintenance personnel who need deep knowledge in LCI - systems

Prerequisites

Electrotechnical college qualifications or equivalent
Basic knowledge of synchronous machines
Basic knowledge of personal computers

Duration

5 days

Adds

Number of participants: Max. 6

On site course on request

G839

Power Electronics

MEGADRIVE LCI Hands-on

Description

Consecutively to the G830 MEGADRIVE LCI Service and Commissioning course the participants can deepen their knowledge on MEGADRIVE LCI by completing the G839 MEGADRIVE-LCI hands-on course. Based on practical exercises the students get familiar with the handling and commissioning of the drive and application software using demo unit and table models. The fully functioning demo drive allows to carry out real commissioning work. Most of the time the participants work on their own, supported by an instructor.

Objectives

After completion of the course the participants are able to:

- Operate the MEGADRIVE LCI
- Carry out “cold” commissioning and preventive maintenance works
- Troubleshoot the drive

Contents

- Setup of the LCI control system
- Using SW tools (PECInstaller, LCI Control Terminal)
- Software handling and download
- Operation of the MEGADRIVE LCI
- Running Test programs
- Control characteristic
- Tuning
- Troubleshooting procedures: fault finding and repairing

Methods

Practical hands-on training using the demo drive and table models based on well-chosen exercises.

Discussion of problems and questions with the instructor.

Participants

Service and Commissioning Engineers

Prerequisites

Completion of the G830 Service and Commissioning course

Duration:

3 days

J400 Power Electronics

**AC 800PEC
Operation and Programming**

Description

The “AC 800PEC” Control Platform is ABB’s high performance process control system and belongs to the ControlIT product line.

The AC 800PEC is the optimum solution for combining:

- the high-speed control requirements of power electronic applications
- low-speed process control tasks usually carried out by separate PLC units

The AC 800PEC controller is configured and programmed using Control Builder M, ABB’s well-established programming tool complying with IEC 61131-3, and MATLAB®/Simulink® with Real-Time Workshop®.

Objectives

The course aims to provide application, development engineers with enough skills to be able to commence developing products using the AC 800 PEC platform.

Contents

Configuration:

- Introduction to AC 800PEC family of hardware components
- Choices of fundamental configurations
- Configuration workshop using table model
- Principle of operation of the hardware devices
- The I/O interfaces of AC 800PEC
- Communication to upper control levels
- IndustrialIT integration

Software Tools:

- How to get started, download, backup and installation procedures
- Overview of MATLAB/Simulink capabilities, enabling application, development engineers to understand what possibilities are available
- Programming workshop, using AC 800PEC (Control Builder M) to create example applications
- Configuration and use of PECView tool
- Creating the Man Machine interface using the process panel PP210/PP245
- Communication via ABB’s Communication Expansion Bus (CEX)

- Anybus-S Interface: Programming aspects using the ANYBUS-S interfaces to communicate with other controllers & remote diagnosis
- Error handling, recovery boot procedures

Methods

Lectures, presentations, demonstrations, exercises using table models

Participants

Application, test, service and commissioning engineers

Prerequisites

Basic knowledge of electronics
Personal computer knowledge

Duration

5 days

J410 Power Electronics

AC 800PEC Control Builder

Description

The “AC 800PEC” Control Platform is ABB’s high performance process control system and belongs to the ControlIT product line.

The AC 800PEC is the optimum solution for combining:

- the high-speed control requirements of power electronic applications
- low-speed process control tasks usually carried out by separate PLC units

The AC 800PEC controller is configured and programmed using Control Builder M, ABB’s well-established programming tool complying with IEC 61131-3, and MATLAB®/Simulink® with Real-Time Workshop®.

Objectives

The goal of this course is to learn the engineering of the Extended Automation System 800xA with AC 800PEC controllers.

Upon completion of this course, students will be able to:

- Explain the System 800xA architecture and the function of the different components
- Create a new project and plan the structure of application programs
- Configure the AC 800PEC hardware and corresponding I/O’s
- Design and configure application programs by using a variety of IEC 61131-3 languages
- Setup the OPC connectivity to AC800PEC
- Develop project specific libraries

Contents

Configuration:

- System 800xA architecture
- Engineering Workplace <-> PLC Control Builder
- Project and application structures
- AC 800PEC Hardware
- OPC connectivity
- Applications with FBD and ST
- Control Modules
- Sequential Function Charts (SFC)
- MATLAB/Simulink Interface
- Communication between controllers

Methods

This is an instructor led course with interactive classroom discussions and associated lab exercises. Approximately 50% of the course is hands-on lab activities.

Participants

This training is targeted to application engineers, programmers and system integrators.

Prerequisites

Students shall know the fundamentals of working with Control Systems and have basic knowledge of Windows XP.

Duration

5 days
 Number of participants: max. 8
 On site course on request

J450

Power Electronics

AC 800PEC Matlab/Simulink

Description

The “AC 800PEC” Control Platform is ABB’s high performance process control system and belongs to the ControlIT product line. The AC 800PEC is the optimum solution for combining:

- the high-speed control requirements of power electronics applications
- low-speed process control tasks usually carried out by separate PLC units.

Objectives

The course shows how to build system simulations and to use the control part of the simulation directly as real-time code.

Contents

- Systematic procedure for building up a system simulation, later use of the control part for real-time code
- Show parallels between real-time code and simulation
- Guidelines (signal- and variable names, program structures)
- Interfaces of the control application:
To the FPGA
PSE-Interface
- Task Handling / Timing / Dead-times / Delays
- State Machine
- Program download, use of installer
- External mode

Methods

Lectures, Presentations, Demonstrations
 Exercises using table model

Participants

Application, Test, Service and Commissioning Engineers

Prerequisites

Basic knowledge of electronics
 Personal computer knowledge
 Basic Matlab / Simulink knowledge

Duration

3 days
 Max. 8 participants

Electrical Machines Operation and Maintenance

Objectives

Common understanding of electrical machines.

To be able to make a competent assessment of the faults most frequently arising on electrical machines and to initiate the necessary corrective measures.

To be able to perform a simple maintenance independently.

Contents

■ Basics

Brief introduction into the theory of electrical machines

■ Electrical Machines Maintenance

Fundamentals and terminology of maintenance

Winding structure, insulation system

Test methods and determination of state particularly with regard to bearing condition, vibration, simple check of the windings, diagnosis of sliprings and commutator, faults on brushes and brush gear and kind of methods for eliminating the most frequently occurring faults

Methods

Lectures, demonstrations, hands-on with state-of-the-art ABB equipment (about 50% of the time), practical exercises, discussions, factory tours.

Participants

Design and planning personnel, engineering and application personnel, maintenance and operating personnel and consultants from the Electricity Supply Industry.

Business managers, sales personnel and technical personnel from ABB companies.

Prerequisites

Technically trained persons

Duration

4 days

Course Enrolment Form

Please write in capital letters

From	To
	ABB University Switzerland
	ATPS-Training
	Austrasse
	CH-5300 Turgi/Switzerland
Fax	Fax: +41 58 589 30 00
	Tel: +41 58 589 38 50
Phone	E-mail: university@ch.abb.com

Course no.	Date	No. of days
Course no.	Date	No. of days
Course no.	Date	No. of days

First name	Surname	
Date of birth*	Marital status*	Sex (m/f)
Nationality*	Passport no.*	Valid until*
Home address*	Company address	Invoice address
Phone	Phone	
E-mail	E-mail	ABACUS-code**

* Only for participants outside Switzerland and the European Union.

** Only for ABB personnel

Accommodation

To be paid by course participant

Hotel required (Y/N)

Flat required (Y/N)

only for stays beyond a month

Hotel Cat (I/II/III)

Single/double room (s/d)

Refer to the hotel categories in our course program

Arrival date

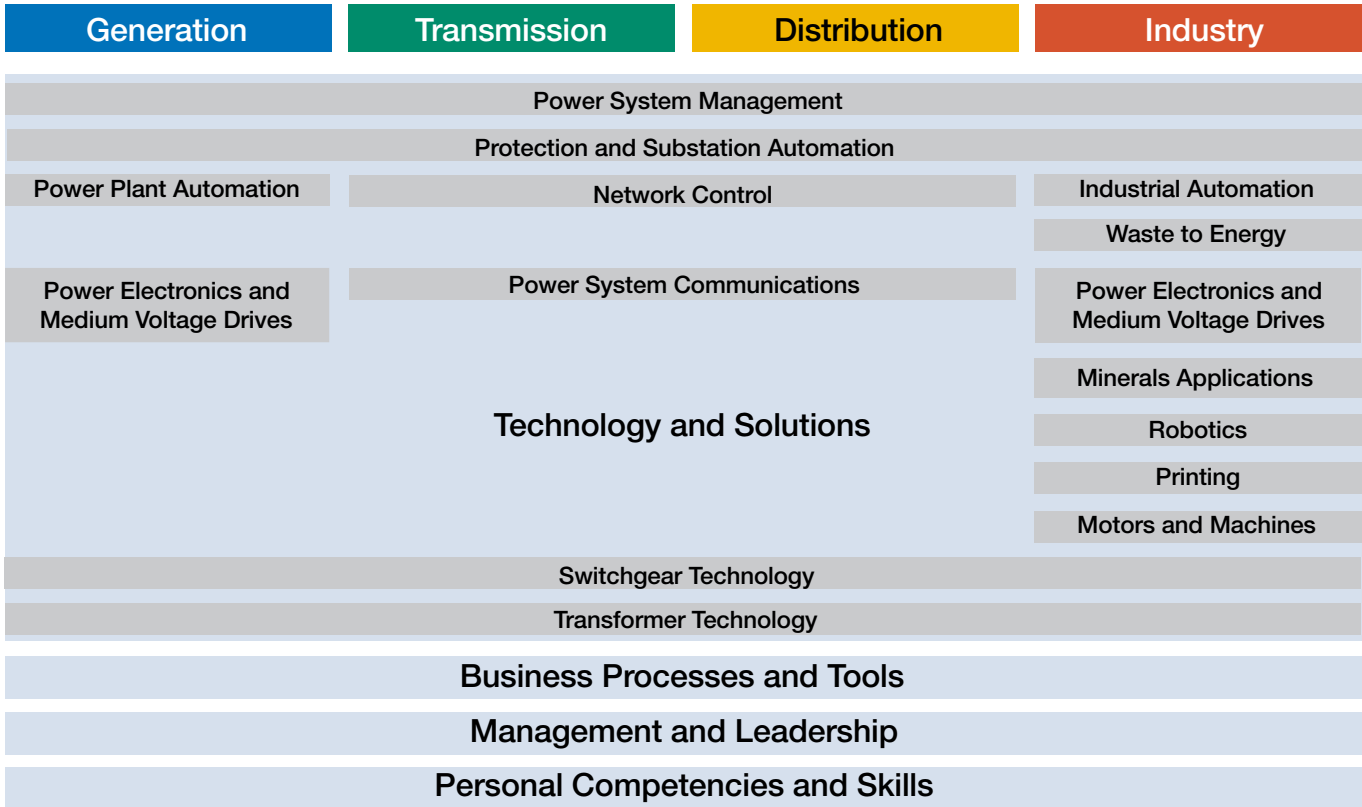
Departure date

Registration

I agree to the general conditions on page 8/9 in part 1 of our course program

Date

Signature



*To create, build up, find, select,
organize, present and exchange Knowledge;
To pass on Knowledge freely
to wherever our customers and employees
currently need it and can independently
utilise, convert, renew and extend it:*

Knowledge management ...

*... this is the mission of
ABB University Switzerland.*



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