

# Protection and Substation Automation

## Training Programmes



**ABB**

# Protection and Substation Automation Training Programme

## Overview

The objective of the Training Program is to provide education and training to make application of Protection and Substation Automation leading to more and secure power. We have developed a training program to help you to meet the technical challenges and complexities of integrating modern Protection and Substation Automation into your expanding power system infrastructure.

The Training Program offers a structured program, designed to improve the technical competency of your engineers and optimize the value of your power system investment.

We offer standard courses listed below. All the course are prescheduled. For details of course enrolment application refer separate leaflet. They can also be obtained from the training coordinator.

Special training to suit specific needs can be arranged on request.

For field training programs at the customer location please contact the training coordinator. The contact details of the training center are given on the back page.

## Course Details

The following full courses are available. Each course consists of number of modules. The details of these modules are given in the subsequent sections.

### Course INPS-SA1: Transmission Line Protection

#### Objectives

To impart knowledge on the basics of Transmission Line Protection and products normally used in these applications. The product training covers information on basics and product operation & maintenance and configuration & engineering aspects.

#### List of Modules

INPS-SA101	The Electrical Power System - Fundamentals
INPS-SA102	Protection for Electrical Power Systems -Fundamentals
INPS-SA104	Protection for Transmission Lines & Autoreclosing -Application & Design
INPS-SA301	IED670 Protection and Control device with PCM600 Toolbox - Operation & Maintenance
INPS-SA304	RED670 for Line Differential Protection Solutions - Configuration & Engineering
INPS-SA314	REX521 Protection IED - Operation & Maintenance
INPS-SA302	REL670 for transmission Protection solutions-Configuration & Engineering
INPS-SA312	REF54x Feeder Protection and Control IED - Operation & Maintenance
INPS-SA313	REF54x for Control and Protection Solutions - Configuration & Engineering

#### Methods

Lectures, demonstrations, application and calculation exercises.

#### Participants

Personnel from Power Utilities, Power Generation companies & industries and Consultants responsible for engineering, relay setting, testing, commissioning, operation, and maintenance of substations.

#### Pre-requisites

Degree or diploma in engineering, basic knowledge of Protection & Substation Automation and PC operations

## Course INPS-SA2: Station Protection

### Objectives

To impart knowledge on the basics of Station Protection and products normally used in these applications. The product training covers information on basics and product operation & maintenance and configuration & engineering aspects.

### List of Modules

INPS-SA101	The Electrical Power System - Fundamentals
INPS-SA102	Protection for Electrical Power Systems - Fundamentals
INPS-SA105	Protection for Busbars, circuit breakers, power transformers and reactors Application & Design
INPS-SA301	IED670 Protection and Control device with PCM600 Toolbox - Operation & Maintenance
INPS-SA303	RET670 for Transformer Protection Solutions - Configuration & Engineering
INPS-SA307	REB500 Busbar and Station Protection System - Operation & Maintenance
INPS-SA308	REB500 for Busbar and Station Protection System - Configuration & Engineering
INPS-SA106	Engineering of Protection System.

### Methods

Lectures, demonstrations, application and calculation exercises

### Participants

Personnel from Power Utilities, Power Generation companies, & industries and Consultants responsible for engineering, relay setting, testing, commissioning, operation, and maintenance of substations.

### Pre-requisites

Degree or diploma in engineering, basic knowledge of Protection & Substation Automation and PC operations



## Course INPS-SA3: IEC 61850 and Station Automation

### Objectives

To impart knowledge on basics of IEC 61850-communication standard and station automation and to give knowledge of the systems normally used in these applications. The training covers information on the basics and on system operation & maintenance and configuration & engineering aspects.

### List of Modules

INPS-SA201	Substation Automation in Transmission and Distribution Networks - Fundamentals
INPS-SA202	Data Communication for Power Utilities - Fundamentals
INPS-SA203	Functions of Substation Automation Systems - Application & Design
INPS-SA204	Communication Protocols for Power Utilities - Application & Design
INPS-SA205	IEC 61850 for Substation Automation - Application & Design
INPS-SA206	System Architecture Design for Substation Automation - System Design
INPS-SA301	IED670 Protection and Control device with PCM600 Toolbox - Operation & Maintenance
INPS-SA306	REC670 for Control Solutions- Configurations and Engineering
INPS-SA315	COM581 for communication solution in utilities - Configuration & Engineering
INPS-SA401	MicroSCADA Pro for Substation Automation - Operation & Maintenance
INPS-SA402	Maintenance for Substation Automation Systems - Operation & Maintenance
INPS-SA403	MicroSCADA Pro for Substation Automation Solutions
INPS-SA404	Configuration for Substation Automation System - System Integration

### Methods

Lectures, demonstrations and exercises

### Participants

Personnel from Power Utilities, Power Generation companies, Industries and Consultants responsible for engineering, relay setting, testing, commissioning, operation, and maintenance of substations.

### Pre-requisites

Degree or diploma in engineering, basic knowledge of Protection & Substation Automation and PC operations. Knowledge of data communication will be an added advantage.

## Course INPS-SA4: Generator System Protection

### Objectives

To impart knowledge on the basics of Generator Protection and products normally used in these applications. The product training covers needs of operation & maintenance and configuration & engineering.

#### List of Modules

INPS-SA103	Protection in Power Plants - Application & Design
INPS-SA309	REG216/316*4 Generator Protection IED - Operation & Maintenance
INPS-SA310	REG216/316*4 for Generator Protection Solutions - Configuration & Engineering
INPS-SA301	IED670 Protection and Control device with PCM600 Toolbox - Operation & Maintenance
INPS-SA305	REG670 for Generator Protection Solutions - Configuration & Engineering

### Methods

Lectures, demonstrations, design, application and calculation exercises

### Participants

Personnel from Power Utilities, Power Generation companies & industries and Consultants responsible for engineering, relay setting, testing, commissioning, operation, and maintenance of substations.

### Pre-requisites

Degree or diploma in engineering, basic knowledge of Protection & Substation Automation and PC operations

### Modules on request

In the training courses described above we can also add few additional modules dealing with other numerical products and COMBIFLEX products. These are listed in the section "Modules on request" described at the end of the next section.



# Details of the modules included in the main courses

The lists of various course modules, which form the basic building blocks of any course, are given below. The standard courses are structured using these modules.

## Modules on Basics of Protection

### INPS-SA101: The Electrical Power System - Fundamentals

#### Contents

- Power Systems - General
- Fault Calculation
- Grounding
- Current Transformers
- Voltage Transformers
- Switchgear and other Primary Equipment (in brief)

### INPS-SA102: Protection Principles for Electrical Power Systems - Fundamentals

#### Contents

- Protection - General
- Subdivided Systems
- Earth Fault Protection

### INPS-SA103: Protection in Power plants - Application & Design

#### Contents

- Basics of Generator Protection
- Generator Stator Protection
- Generator Rotor Protection
- Generator Transformer Protection
- Unit Auxiliary Transformer Protection
- Engineering Recommendations
- eBOP (Electrical balance of Plant)
- Generator Protection Settings

### INPS-SA104: Protection for Transmission Lines

#### Contents

- Line Protection - Introduction
- Requirements of Line Protection
- Measuring Principles
- Auto Reclosing
- Auto Reclosing - 1 ½ CB Arrangement
- Synchro-check
- Protection of Series Compensated Lines
- CT Requirements (Typical Line Protection)
- Line Protection Settings.

### INPS-SA105: Protection for Bus bars, Circuit Breakers, Transformers, Reactors - Application and Design.

#### Contents

- Protection of Transformers
- Protection of Reactors
- Protection of Capacitors
- Protection of Busbar
- Protection of Circuit Breaker
- Station Protection settings

### INPS-SA106: Engineering of Protection Systems

#### Contents

- Different Bus Configuration.
- Protection for Different Voltage Levels and Equipment.
- Panel Layout
- PT Selection Logic
- DC Distribution
- GR-A and GR-B Protection
- Trip Logic
- Control System structure and Interlocks.

## Modules on Basics of Substation Automation

### INPS-SA201: Substation Automation in Transmission and Distribution Networks - Fundamentals

#### Contents

- Benefits of Substation Automation
- Substation Automation Solutions - Structure and Architecture
- Control, protection and monitoring concepts
- Graphical User Interface, Single Line Diagram, Event List, Alarm Lst
- Trends, Reports, System Supervision

### INPS-SA202: Data Communication for Power Utilities - Fundamentals

#### Contents

- Introduction to Data Communication and protocols.
- The ISO/OSI 7Layer model - the common basis for all protocols
- Communication gateways and Communication to Network Level
- Communication on Process Bus, Inter Bay Bus and Station Bus
- Local Area Networks (LAN) and Wide Area Networks (WAN)
- Introduction to Substation Communication

### INPS-SA203: Functions of Substation Automation Systems - Application & Design

#### Contents

- Substation automation
- Control on station and bay level, interlocking
- HMI, functions, principles of switchgear control, access control, interfaces
- Automatic operations like switching sequences, autoreclosure, tap changer control etc.
- Process supervision - States, alarms, events, time synchronization
- Station supervision - Basic functionality, data acquisition, fault recording, parameterization
- System supervision - Self-supervision of components, communication supervision, etc.

### INPS-SA204: Communication Protocols for Power Utilities - Application & Design

#### Contents

- Communication inside and outside substations
- Short summary about communication requirements of utilities
- Protocol Converters:
  - General concepts
  - Fundamentals of Power System Communication from dedicated links for protection to WANs
- Short summary about the basics of communication
- Protocols:
  - Overview of protocols use
  - Private ABB protocols LON, SPA,
  - IEC 60870 family for communication in power systems - Structure, implementation and handling of IEC 870-5-101,103, 104,
  - IEC 61850

### PS-SA205: IEC 61850 for Substation Automation - Application & Design

#### Contents

- ISO/OSI model
- Control levels, communication paths of IEC 61850
- The requirements for a communication standard in substations Interoperability, free allocation of functions, future-proof
- The structure of the standard
- The approach of IEC 61850
- The data model
- The Substation Communication description Language (SCL)
- The benefits of IEC 61850
- How to specify an IEC 51850 based SAS

### INPS-SA206: System Architecture Design for Substation Automation - System Design

#### Contents

- Architecture of functions in substations (control, monitoring and evaluation)
- Data model and domain specific services
- Important requirements from the specification for the system architecture of a substation automation solution

## Modules on IEDs

### INPS-SA301: IED670 Protection and Control IED with PCM600 Toolbox - Operation & Maintenance

#### Contents

- Introduction to PCM600
- IED670 Hardware and Design
- IED670 Common Functions
- Configuration, Operation and Maintenance with PCM600 Tool Box

### INPS-SA302: REL670 for Transmission Protection Solutions - Configuration & Engineering

#### Contents

- Application
- Functions & Features
- Configuration & Setting example
- Testing of product

### INPS-SA303: RET670 for Transformer Protection Solutions - Configuration & Engineering

#### Contents

- Application
- Functions & Features
- Configuration & Setting example
- Testing of product

### INPS-SA304: RED670 for Line Differential Protection Solutions - Configuration & Engineering

#### Contents

- Application
- Functions & Features
- Configuration & Setting example
- Testing of product

### INPS-SA305: REG670 for Generator Protection Solutions- Configuration & Engineering

#### Contents

- Application
- Functions & Features
- Configuration & Setting example
- Testing of product

### INPS-SA306: REC670 for Control Solutions- Configuration & Engineering

#### Contents

- Application
- Functions & Features
- Configuration & Setting example
- Testing of product

### INPS-SA307: REB500 for Busbar and Station Protection System - Operation & Maintenance

#### Contents

- Introduction
- Hardware and Software concept
- HMI program (human machine interface) & LDU
- Operation and Maintenance

### INPS-SA308: REB500 for Bus bar & Station Protection Solutions - Configuration & Engineering

#### Contents

- Product/System Architecture
- Operating program overview and concepts
- An applied example
- Testing of products or system



## **INPS-SA309: REG216/316\*4 Generator Protection IED - Operation & Maintenance**

### **Contents**

- Introduction
- Hardware and Software concept
- HMI program (human machine interface) & LDU
- Operation and Maintenance

## **INPS-SA310: REG216/316\*4 for Generator Protection Solutions - Configuration & Engineering**

### **Contents**

- Product/System Architecture
- Operating program overview and concepts
- An applied example
- Testing of products or system

## **INPS-SA311: CAP316 the Function Plan Programming Tool (FUPLA) - Operation & Maintenance**

### **Contents**

- Tool CAP316 overview and concepts
- An applied example
- Operation and testing

## **INPS-SA312: REF54X Feeder Protection & Control IED - Operation & Maintenance**

### **Contents**

- Introduction
- Hardware and Software concept
- HMI program (human machine interface) & LDU
- Operation and Maintenance

## **IINPS-SA313: REF54x for Control and Protection Solutions - Configuration & Engineering**

### **Contents**

- Product/System Architecture
- Operating program overview and concepts
- An applied example
- Testing of products or system

## **INPS-SA314: REX521 Protection Relay - Operation & Maintenance**

### **Contents**

- Introduction
- Hardware and Software concept
- Operation and Maintenance
- HMI program (human machine interface) and LDU (local display unit) or LCP (local control panel)

## **INPS-SA315: COM581 for Communication Solutions in Utilities - Configuration & Engineering**

### **Contents**

- Product/System Architecture
- Operating program overview and concepts
- An applied example
- Testing of products or system

## Modules on Products for Control and Monitoring

### INPS-SA401: MicroSCADA Pro for Substation Automation - Operation & Maintenance

#### Contents

- Introduction to Substation Automation
- Functions on the station and bay level
- Communication in substations
- MicroSCADA System architecture
- MicroSCADA Picture editor (principles)
- MicroSCADA Human Machine Interface

### INPS-SA402: Substation Automation System Maintenance - Operation & Maintenance

#### Contents

- Communication in substations
- MicroSCADA System architecture
- MicroSCADA Human Machine Interface
- Supervision of the units
- Communication Parameters of IED's
- MicroSCADA Trouble- shooting

### INPS-SA403: MicroSCADA Pro for Substation Automation Solutions - Configuration & Engineering

#### Contents

- Introduction to Substation Automation
- Communication in substations
- MicroSCADA Database handling
- MicroSCADA Picture editor (principals)

### INPS-SA404: Configuration for Substation Automation Systems - System Integration

#### Contents

- Understanding of IEC 61850 protocol
- Introduction to integration tools
- Interfaces - Import / Export functions, load files for Micro SCADA database, configuration load files for Rugged COM switch, various SCL files
- Using integration tools (IET/CCT)
- The signal engineering process with CCT Tool
- Implementation into System - Set up of communication, Rugged COM switch, Download of load files, testing of the Demo-System



# Modules on Request

## **INPS-SA501: REX 500 Protection and Control IED with CAP540 Toolbox - Operation & Maintenance**

### **Contents**

- Introduction to CAP540
- REx500 Hardware and Design
- Configuration, Operation and Maintenance with CAP540 Tool Box

## **INPS-SA502: REL511 and 521 Transmission Protection Solutions - Configuration & Engineering**

### **Contents**

- Application
- Functions & Features
- Configuration & Setting example
- Testing of product

## **INPS-SA503: RET521 Transformer Protection Solutions - Configuration & Engineering**

### **Contents**

- Application
- Functions & Features
- Configuration & Setting example
- Testing of product

## **INPS-SA504: REB 670 Busbar Protection Solutions - Configuration & Engineering**

### **Contents**

- Application
- Functions & Features
- Configuration & Setting example
- Testing of product

## **INPS-SA505: REL316\*4 for Transmission Protection Solutions - Configuration & Engineering**

### **Contents**

- Application
- Functions & Features
- Configuration & Setting example
- Testing of product

## **INPS-SA506: RET316\*4 for Transformer Protection Solutions - Configuration & Engineering**

### **Contents**

- Application
- Functions & Features
- Configuration & Setting example
- Testing of product

## **INPS-SA507: RAZOA Transmission Protection**

### **Contents**

- Application
- Design & Features
- Setting example
- Testing of product

## **INPS-SA508: COMBIFLEX Transformer protection**

### **Contents**

- Products & Application
- Design & Features
- Setting example
- Testing of products

## **INPS-SA509: RADSS Bus bar protection**

### **Contents**

- Application
- Design & Features
- Testing of product

## **INPS-SA510: COMBIFLEX Generator protection**

### **Contents**

- Products & Application
- Design & Features
- Setting example
- Testing of products

## **INPS-SA511: RAICA Breaker failure protection**

### **Contents**

- Application
- Design & Features
- Testing of products



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