Network Manager Training Course Descriptions NM6

Catalogue

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General
This document is a general course catalogue which presents all the different Network Manager courses and workshops that we can perform for all the different personnel categories for all our customers.
1. Training Programs

1.1 System Overview

In cooperation with the Customer’s project group, ABB will provide a seminar called Project Specific Introduction. The objective is to inform all employees about the background of the project, the system that is to be installed, system functions, opportunities and advantages for the users.

1.1.1 Training Objectives

Upon completion of the seminar the students should have a general understanding of:

- The scope of the procured Network Manager system
- The system, the tool for process control
- An overview of ABB and its organization
- The project and its phases
- How to work together in a project
- The Network Manager control system in forms of functionality and principles of design

1.1.2 Prerequisites

The participants should have basic knowledge of computer systems and of the process, i.e. the power network.

1.1.3 Available System Overview Courses

NM001, Project Specific Seminar
NM100, Network Manager Overview

1.1.4 Proposed training

The proposed set of training is defined in Proposal section "Scope of Supply"; subsection "Scope of Services".
1.2 Database Administrator Training

Database Administrator training is a part of the System Engineers training. The objectives for the training is to provide knowledge on how to initiate the database and how to carry out amendments and additions to the database information when there are changes and extensions to the power network.

Database Administrator training will be accomplished in two major steps:

- The students will attend some formal courses and a workshop in which they will acquire the basic skills and knowledge required to carry out amendments and additions to the database
- The students will take part in the population (entering data into the database) and verification of the data related to the process (point-to-point test). In this way, Database Administrator personnel can gain a substantial amount of the field experience necessary to become a self-sufficient administrator team

ABB recommends its Customers to put this training at the beginning of the project plan just before using the Data Engineering Tool and the Picture Design Tool.

1.2.1 Tasks
- Handles maintenance and amendments of the process and control database.

1.2.2 Training Objectives
- Be able to carry out amendments and additions to the database information when there are changes and extensions to the power network.

1.2.3 Prerequisites
- Technical vocational training
- Experience of power system and power system control
- Basic knowledge of database systems
- Basic knowledge of computer systems
- Basic knowledge of LINUX operating system
- Read and understand English well

1.2.4 Available Database Administrator Courses
- NM001, Project Specific Seminar
- NM100, Network Manager Overview
- NM200, Database Editing
- NM210, Picture Editor
- NM220, Data Engineering for SCADA
- NM231, Data Requirements for GMS
- NM232, Data Requirements for EMS
- NM233, Data Requirements for OTS
- NM234, Data Requirements for Nostradamus
- NM250, Database Maintenance
- NM270, NMTab Displays
- NM330, EMS Application Design
- NM340, EMS Application Tuning
- NM350, EMS Instructor Simulator
- NM370, DMS System Administration
1.2.5 Proposed training

The proposed set of training is defined in Proposal section "Scope of Supply"; subsection "Scope of Services".
1.3 Software System Engineers Training

ABB will provide courses covering all parts of the system software package. These courses are designed to provide a system engineer with the ability to expand and update the system software as the system expands.

The courses should preferably be conducted before system implementation, so that trained personnel can assist in the operation and validation of the test data.

The System Engineer's training will be accomplished in three steps according to below:

- The students will attend a series of formal courses (see Database Administrator) in which they will acquire the basic skills and knowledge required to carry out amendments and additions to the database.

- Secondly, the students will continue with a series of formal courses to be able to:
  - Understand the software structure, the database management system and the application software
  - Use routines for maintenance of the Network Manager software
  - Familiarization with batch and run-time procedures for generation, operation of peripherals, use of the documentation, use of the console, start-up, shut down and backup procedures
  - Use routines for database maintenance, e.g. expansion of the database to include new points, new system, new types of signals and new output control features

- Finally, the students will take part in the Power Application training and maintenance of the application functions (as supplied).

1.3.1 Tasks

- Has an overall responsibility for the Network Manager system
- Handles maintenance and development of the computer software
- Implements new functions

1.3.2 Training Objectives

- Be able to maintain and develop the software system.

1.3.3 Prerequisites

It is required that the student has the knowledge corresponding to the Database Administrator courses (see above) and:

- Basic knowledge of programming

1.3.4 Available System Engineer Courses

- NM001, Project Specific Seminar
- NM100, Network Manager Overview
- NM200, Database Editing
- NM210, Picture Editor
- NM220, Data Requirements for SCADA
- NM231, Data Requirements for GMS
- NM232, Data Requirements for EMS
- NM233, Data Requirements for OTS
- NM234, Data Requirements for Nostradamus
- NM250, Database Maintenance
- NM270, NMTab Displays
- NM300, Calculation
NM740, Calculation Workshop
NM310, Historical Information System Based on Oracle
NM330, EMS Applications Design
NM340, EMS Application Tuning
NM350, EMS Training Simulator for Instructors
NM370, DMS System Administration
NM500, System Security
NM510, System Diagnostics
NM520, Process Communication Unit, PCU400
NM530, RTU Protocol
NM540, Inter-Control Center Communication

1.3.5 Proposed training

The proposed set of training is defined in Proposal section "Scope of Supply"; subsection "Scope of Services".
1.4 Maintainers of Master Station

The training program is designed to teach the maintenance personnel how to operate and maintain the proposed system on a system module level.

Operation and maintenance training will be accomplished in two major steps:

- The students will attend a series of formal courses in which they will acquire the basic skills and knowledge required to maintain the equipment
- The students will take part in the installation and check out of the equipment. In this way, maintenance personnel can gain a substantial amount of the field experience necessary to become a self-sufficient maintenance team

Applicable test equipment and associated diagnostic software are thoroughly presented in each course.

The maintenance courses also provide daily equipment “hands-on” experience to reinforce the classroom lectures and exercises.

1.4.1 Tasks

- Handles maintenance of Master Station computer system and Human System Interface equipment.

1.4.2 Training Objectives

- Be able to describe the functions, design, and configurations of the computer system and control room equipment
- Perform preventive and basic corrective maintenance by replacing failing logic modules

1.4.3 Prerequisites

- Technical vocational training
- Experience of power system and power system control
- Experience of computer systems maintenance
- Basic knowledge of electronics, PC, computers, and computer systems
- Basic knowledge of LINUX operating system
- Read and understand English well

1.4.4 Available Hardware Engineer Courses

- NM001, Project Specific Seminar
- NM100, Network Manager Overview
- NM500, System Security
- NM510, System Diagnostics
- NM520, Process Communication Unit PCU400
- NM530, RTU Protocols
- NM540, Inter-Control Center Communication

1.4.5 Proposed training

The proposed set of training is defined in Proposal section "Scope of Supply"; subsection "Scope of Services".
1.5 System Operators Training

The aim of the System Operation training course is to give the operating personnel extensive knowledge of the use of the system for power system control in both normal and abnormal situations.

The Operator’s training comprises:
- SCADA system operation
- Application operation
- Optional courses

The courses are often conducted at the Customer's site and the Customer's own system is then used for the practical exercises to facilitate learning and improve realism. The theoretical parts of the training are considered as complementary to the practical exercises.

1.5.1 Tasks
- Uses the control system as a tool for power system- and process supervision
- Uses the system for process supervision, control, and regulation of process units and reporting
- Handles the system for disturbance analysis of process malfunction and the network restoration
- Supervises the control system to know when the maintenance personnel has to be notified
- Handles switching and security aspects of work in progress in power and control systems

1.5.2 Training Objectives
- Be able to use the functions of the Network Manager system for optimal power system control, planning and disturbance analysis.

1.5.3 Prerequisites
- Technical vocational training
- Experience of power system operation and PC-computers
- Read and understand English well

1.5.4 Available System Operation Courses
- NM100, Network Manager Overview (optional)
- NM600, SCADA Operation
- NM610, EMS Applications Operation
- NM630, DMS Operation
- NM640, DMS Advanced Applications Operation

1.5.5 Proposed training

The proposed set of training is defined in Proposal section "Scope of Supply"; subsection "Scope of Services".
2. Special Arrangements on Request

ABB’s experience in the field of professional training has shown that our customers often have a variety of specific needs concerning training.

In addition to the standard Curriculum ABB is prepared to arrange special courses on request. The following items are examples of areas where additional special training may be advantageous:

- Language (e.g. Spanish, Swedish, German, French)
- Hands-on training
- Enhanced Operator training
- Experience exchange

and also to work as a training consultant to make:

- Training analyses
- Training programs and plans
Course Structure Network Manager 6
SCADA / EMS / DMS / GMS

Additional training on request for:
- Database Administrators
- Software System Engineers

NM400, Programming ODBC & DBS API 2d
NM410, Programming DAIS 3d

Workshops for:
- Software System Engineers
- Maintainers of Master Station

NM700, SCADA and Ergonomics 2-5 d
NM710, Data Engineering 2-5 d
NM720, Picture Building and Maintenance 2-5 d
NM730, Database and System Maintenance 2-5 d
NM740, Calculation 2-5 d
NM750, Historical Information System 2-5 d
NM760, NMTab Display 2-5 d
NM001, System Hardware and Network 2 d
NM002, Active Directory 1 d
NM003, Data Protector 1 d
NM530, IEC101 / IEC104 Protocol 1 d

<table>
<thead>
<tr>
<th>Operators</th>
<th>Database Administrators</th>
<th>Software System Engineers</th>
<th>Maintainers of Master Station</th>
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<tbody>
<tr>
<td>Operators</td>
<td>Be able to use the functions of the Network Manager system for optimal power system control, planning, and disturbance analysis.</td>
<td>Handles maintenance and amendments of the process and control database.</td>
<td>Be able to describe the functions, design, and configurations of the computer- and network systems as well as control- and server room equipment. Perform preventive and basic corrective maintenance by replacing failing logic modules.</td>
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3 Network Manager Courses

3.1 Network Manager Overview

3.1.1 NM100, Network Manager Overview, 2 days

Standard course

The course goal is to give the participants a basic knowledge and understanding of the Network Manager system together with the Energy Management Systems (EMS).

Topics

- Network Manager introduction
  - Remote control and system hierarchy
- Network Manager system design
  - Hardware configuration and software overview
- Human-Machine Interface
  - Formats, functions, pictures and reports
- SCADA functions
  - Power system data and control, historical information
- Control system operation
  - Start-up, operation and device supervision
- Introduction to EMS
- Why use EMS?
- Brief theory and operation of EMS functions

Objectives

Upon completion of the course, the participants should:

- Have a general understanding of the Network Manager system
- Have a basic knowledge of the Network Manager system functions
- Be able to use the Human Machine interface to perform basic operations
- Have knowledge of the basics of different EMS functions
- Have knowledge of the benefits of EMS

Student Profile

Database Administrators, Software Engineers, Maintenance Personnel, or any personnel who need a general understanding of the Network Manager system

Maximum 2 participants / workstation

Prerequisites

- Technical vocational training
- Basic knowledge of computer systems
- Handling of multiple windows like MS Windows
- General understanding of the power system operation or the corresponding knowledge

Course type

Theoretical course (hands-on exercises optional)
3.2 Network Manager Database and Display Engineering

3.2.1 NM200, Database Editing, 3 days

Standard course

The course goal is to teach participants how to apply the Data Engineering tool to enter and maintain the process system description and to create displays for the Network Manager runtime system.

Topics

• Data Engineering (DE) Tool Overview and Details
• Data Processing
• Display generation
• Network Manager data model

Objectives

Upon completion of this course, the participants should be able to:

• Be able to apply the DE-tool to enter and maintain the process system description of the Network Manager runtime system
• Maintain displays created in the DE400 Graphical Editor
• Have a general knowledge of the Network Manger data model
• Backup and restore the DE400 maintenance environment

Student Profile

Database Administrators and Software Engineers

Maximum 2 participants / workstation

Prerequisites

The participants must have experience of power network design, basic knowledge of database systems, and have taken course NM100 or have the corresponding knowledge

Course Type

Training Course with hands-on exercises
3.2.2 NM210, Picture Editor, 3 days

Standard course

The course goal is to teach participants how to apply the Picture Editor Design tool to create pictures of the Network Manager runtime system. A basic knowledge should be achieved of the pictures layout and design rules together with increased knowledge of computer system ergonomics.

Topics
- Functions in the Picture Editor Design (PED)
- Create and link pictures into the database
- Test the pictures in the on-line system
- Network Manager pictures design and layout - overview
- Picture element size rules
- Colors (Static element colors, dynamic element colors and background colors)
- Picture Layout (texts, numerical presentation)
- Window handling (selection of other pictures, picture hierarchies)

Objectives
Upon completion of this course, the participants should be able to:
- Manage the PED-tool, to create Network Manager pictures, and link them into the on-line system
- Have a general understanding of the Network Manager system design
- Have a basic knowledge of the Ergonomic aspects concerning the Network Manager system pictures and picture hierarchies
- Be able to plan the ergonomic Picture building

Student Profile
Database Administrators and Software Engineers
Maximum 2 participants / workstation

Prerequisites
The participants must have experience of power network design, basic knowledge of database systems, and have taken course NM100 or have the corresponding knowledge

Course Type
Training Course with hands-on exercises and discussions
3.2.3 NM220, Data Requirements for SCADA, 3 days

Standard course

The course goal is to teach participants how to carry out additions and changes to the offline SCADA data specification information with the DE400 tool.

Topics
Add a new station into an existing system

- Specify SCADA common data
- Specify RTU relevant data
- DE400 - Data Entry and Data Populate
- Avanti Database Tool

Objectives
Upon completion of this course, the participants should be able to:

- Carry out additions and changes to the offline SCADA data specification information
- Access the runtime database system Avanti with the tool AQL in Network Manager

Student Profile
Database Administrators and Software Engineers

Maximum 2 participants / workstation

Prerequisites
The participants must have experience of power network design, basic knowledge of database systems, and have taken the courses NM100 and NM200 or have the corresponding knowledge

Course Type
Training Course with hands-on exercises
3.2.4 NM231, Data Requirements for GMS, 3 days

*Customized course/workshop*

The course goal is to teach the participants how to build Power system model and other data in Data Engineering as required for proper operation of GMS Applications.

**Topics**

- GMS data models
- Power system modelling for GMS Applications in Network Manager such as AGC, Economic Dispatch *(Optional)*, Interchange Transaction Scheduling *(Optional)*
- GMS specific forms in Data Engineering Objectives
- Hydro calculation *(Optional)*

**Objectives**

Upon completion of the course, the participants should be able to:

- Maintain, update and expand the power system models for GMS applications in the NM system.

**Student Profile**

System Engineer who can build GMS data in Data Engineering

**Prerequisites**

- Experience of power network design
- Basic knowledge of database systems
- NM220 course or have the corresponding knowledge

**Course Type**

Theoretical course (hands-on exercises optional)

3.2.5 NM232, Data requirements for EMS, 4 days

*Customized course/workshop*

The course goal is to teach the participants how to build Power system model and other data in Data Engineering as required for proper operation of EMS Applications.

**Topics**

- How to model the EMS power system network
- Data interfacing SCADA and Network applications
- EMS data models
- EMS specific forms in Data Engineering Objectives

**Objectives**

Upon completion of the course, the participants should:

- Model an EMS power system network as per the requirement.
- Enter the electrical and other parameters needed by the EMS applications.
Student Profile

System Engineer who can build EMS data in Data Engineering

Prerequisites

- Experience of power network design
- Basic knowledge of database systems
- NM220 course or have the corresponding knowledge

Course Type

Theoretical course (hands-on exercises optional)

3.2.6 NM233, Data Requirements for OTS, 4 days

Customized course/workshop

The course goal is to teach the participants how to build Power system model and other data in Data Engineering as required for proper operation of OTS Applications.

Topics

- How to model the EMS power system network
- Data interfacing SCADA and Network applications
- OTS data models
- OTS specific forms in Data Engineering

Objectives

Upon completion of the course, the participants should:

- Model an EMS power system network as needed for GMS (optional), EMS and OTS
- Enter the electrical and other parameters needed by the GMS (optional), EMS and OTS applications

Student Profile

System Engineer who can build GMS (optional), EMS and OTS data in Data Engineering

Prerequisites

- Experience of power network design
- Basic knowledge of database systems
- NM220 course or have the corresponding knowledge
- Knowledge of EMS and GMS (optional) model

Course Type

Theoretical course (hands-on exercises optional)

3.2.7 NM234, Data requirements for Nostradamus, 1 day

Customized course/workshop

The course goal is to teach the participants how to build interface between Network Manager (NM) and Nostradamus in Data Engineering as required for proper operation of Nostradamus Applications.
Topics
- Interface between Network Manager and Nostradamus
- Data transfer from NM to Nostradamus
- Data transfer from Nostradamus to NM

Objectives
Upon completion of the course, the participants should:
- Configure DE400 to build interface between Network Manager (NM) and Nostradamus.

Student Profile
System Engineer who can configure DCI export and import data in Data Engineering

Prerequisites
- Experience of power network design
- Basic knowledge of database systems
- NM220 course or have the corresponding knowledge

Course Type
Theoretical course (hands-on exercises optional)

NM240, Data Requirements for DMS-N2A, 2 days

Customized course/workshop
The course goal is to teach the participants how to build DMS data in Data Engineering.

Topics
- Dynamic Network Coloring (DNC)
- How to model the DMS network
- DMS data models
- Data Engineering DMS specific forms

Objectives
Upon completion of the course, the participants should be able to:
- Model a DMS network
- Enter the electrical parameters needed by the DMS system

Student Profile
Database Administrators and Software Engineers who will build DMS data in Data Engineering

Maximum 2 participants / workstation

Prerequisites
- Technical vocational training
- General understanding of the power system operation
- Course NM220, Data Requirements for SCADA
- Course NM360, DMS-N2A Applications Design or have the corresponding knowledge
Course Type
Workshop with hands-on exercises
3.2.9 NM250, Database and System Maintenance, 2 days

Standard course

The course goal is to teach the participants how to carry out additions and changes to the database information in the Network Manager system.

Topics

- Database System:
  overview, structure and data catalog
- Database Population:
  principles, methods, tools and population handling
- Database Integrity:
  population in a redundant system and backup
- Message Handling:
  message passing, queue manager

Objectives

Upon completion of the course, the participants should be able to carry out additions and changes to the database in the Network Manager system.

Student Profile

Database Administrators, Software Engineers and Maintainers of Master Station

Maximum 2 participants / workstation

Prerequisites

- Technical vocational training
- Basic knowledge of database systems
- Have taken the courses NM100 and NM200
- Basic knowledge of operating system, e.g. LINUX
- General understanding of the power system operation or have the corresponding knowledge

Course Type

Training Course with hands-on exercises
3.2.10 NM270, NM Tab Displays, 2 days

Standard course

NM270 for introduction to NM Tab Display how they are designed and how to maintain and build new displays

Topics
- NM Tab runtime environment
- Configuration tool
- Constants and enumerations
- Expressions and Dependencies
- References, Pagination and Dynamic Function Keys
- Hints and Templates

Objectives
Upon completion of the course, the participants should be able to:
- Use and navigate NM Tab Displays
- Manage the configuration tool in the WS500 to create and maintain NM Tab displays

Student Profile
Database Admintrators and Software Engineers shuld have this knowledge.
Maximum 2 participants / workstation.

Prerequisites
- None

Course Type
Power Point Slides and hands on exercises

Reference Material
None specific
3.3 Network Manager Software Design

3.3.1 NM300, Programming Language for Calculation, 2 days

*Standard course*

*The course goal is to teach participants how to use, specify and implement user-defined calculations in a Network Manager system.*

**Topics**

- Calculations overview:
  - Tools, Status and Numeric calculations
- SCADA Power Calculations:
  - Apparent power, current and power factor calculation
- SCADA Advanced Real-time Calculations
  - Advanced calculations on measured values using Matlab™
- The System Programming Language (SPL):
  - Overview, SPL Operation, Language and compilation, Specification of data

**Objectives**

Upon completion of this course, participants should be able to use, specify and implement user defined calculations such as:

- SCADA Power calculations
- SCADA Advanced Real-time calculations
- SPL programming for Sequential Control, Interlocking and Calculation

**Student Profile**

Database Administrators and Software Engineers with the task of using and specifying user defined calculations and functions

Maximum 2 participants / workstation

**Prerequisites**

The participants should have passed courses NM100, NM200 and NM220 or have the corresponding knowledge. They should also have some experience in computer programming

**Course Type**

Training Course with hands-on exercises
3.3.2 NM310, Historical Information System based on Oracle, 3 days

Standard course

The course goal is to teach participants how to specify and implement Utility Data Warehouse (UDW) data, and to present them in various standard ways

Topics

Utility Data Warehouse (UDW):
- General description
- Data Engineering
- Storing arrangements
- Quality flags
- Archiving
- UDW Calculations
- PDR - Post Disturbance Review

Presentation:
- Trend tool
- Reports tool
- Correction of values
- Quality state presentation

Objectives

Upon completion of the course, the participants should be able to specify and implement Utility Data Warehouse (UDW) data, and to present them in various standard ways

Student Profile

Database Administrators and Software Engineers

Maximum 2 participants / workstation

Prerequisites

The participants must have basic knowledge of database systems, and have taken the courses NM100, NM200 and NM220 or have the corresponding knowledge

Course Type

Training Course with hands-on exercises
3.3.4 NM330, EMS Applications Design, 5 days

Customized course

The course goal is to teach the participants the functionality and software design of the EMS power system application subsystems. The course also describes the solution techniques employed as well as data and control interfaces within each application and among the various applications. The course is customized to correspond to the functions used by the customer.

The following information is covered for each power system application:

- Overall design
- Design breakdown into tasks and their interdependencies
- Solution techniques and algorithms
- Interfaces with other subsystems
- Execution control
- Data flow and database organization to support each function

Objectives

Upon completion of the course, Participants will be able to:

- Briefly, describe the functionality of each application subsystem
- Identify the inputs and outputs of each application
- Describe the solution techniques and algorithms used by the applications
- Discuss the interface of each application with the database, including those portions of the database used by the application with regard to content, structure, meaning, origin, and usage

Student Profile

Database Administrators, Software Engineers and Maintainers of Master Station

Maximum 2 participants / workstation

Prerequisites

- Technical vocational training
- General understanding of the power system operation
- Course NM100, Network Manager Overview
- Course NM250, Database and System Maintenance
- Course NM610, EMS Applications Operation or have the corresponding knowledge

Course Type

Class room Training Course with presentations
The course goal is to teach the participants how to maintain the EMS applications and how to tune the static and dynamic characteristics of the applications. For each of the relevant applications, participants will learn the significance of the tuning parameters and their interdependencies and how to tune the solution and performance of each function.

**Topics in Network Applications**

- How to model an EMS network
- EMS network data concepts
- Understand EMS log files
- Meaning of execution flags
- Data flows within Network Applications
- Theory of the relevant functions:
  - Network Application Control
  - Telemetry Snapshot
  - Status and Analog Retrieval
  - Study Schedule Retrieval
  - Network Model Builder
  - Bus Scheduler
  - State Estimator
  - Network Parameter Update
  - Dispatcher Power Flow
  - Network Sensitivity
  - Security Analysis
  - Security Constrained Dispatch
  - Optimal Power Flow
  - Short Circuit Analysis
  - PAS Interlock
  - Network Application Save Cases
  - Equipment Outage Scheduler
- Tuning of Network Applications.

**Topics in Production Control & Planning**

- How to model the Production Control & Planning system
- Understand EMS log files
- Meaning of execution flags
- Data flows within Production Control & Planning Applications
- Theory of the relevant functions:
  - Load Frequency Control
  - Static Economic Dispatch
  - Dynamic Economic Dispatch
  - Load Predictor
  - Production Costing
  - Reserve Calculation
  - Study Economic Dispatch
  - Short Term Load Forecast
  - Unit Commitment
  - Transaction Evaluation
  - Interchange Transaction Scheduler
  - Prod-plan Application
- How to use the Short Term Load Forecast maintenance tool, if applicable
- Tuning of the Production Control & Production Applications
Objectives
Upon completion of the course the participants should be able to:

For Network Applications
- Verify that changes done in Data Engineering will work in Network Applications
- Find errors in EMS network model
- Create contingencies for Security Analysis, if applicable

For Product Control & Planning
- Verify that changes done in Data Engineering will work in the Production Control Applications and in the Unit Commitment, if applicable
- Find errors in the Production Control model
- Find errors in historical data for Short Term Load Forecast, if applicable

Additionally, for relevant applications:
- Identify the parameters that can be used to tune the static and dynamic characteristics
- Locate and use the appropriate displays to tune the application
- Identify the interdependencies of the various parameters and how they affect the convergence and performance of each application

Student Profile
Database Administrators and Software Engineer who will maintain the functions for the Network Applications and the Production Control & Planning Applications

Maximum 2 participants / workstation

Prerequisites
- Technical vocational training
- General understanding of the power system operation
- Course NM100, SCADA/EMS Overview
- Course NM250, Database and System Maintenance
- Course NM610, EMS Applications Operation or have the corresponding knowledge

Course Type
Training Course with hands-on exercises
3.3.6 NM350, EMS Training Simulator for Instructors, 2 days

*Customized course*

The course goal is to teach the participants how to maintain the Training Simulator.

**Topics**
- How to model the network for the Training Simulator system
- Understand log files from the Training Simulator
- Design and functional overview of the Training Simulator
- How to set up the Training Simulator environment
- Tuning of the Training Simulator
- Training Simulator specific models and Data Engineering

**Objectives**
Upon completion of the course, the participants should be able to:
- Set up the Training Simulator environment
- Create base cases
- Tune the Training Simulator network model

**Student Profile**
Database Administrators and Software Engineer who will maintain the Training Simulator

Maximum 2 participants / workstation

**Prerequisites**
- Technical vocational training
- General understanding of the power system operation
- Course NM250, Database and System Maintenance
- Course NM340 or have the corresponding knowledge

**Course Type**
Training Course with hands-on exercises
NM370, DMS System Administration, 4,5 days

Standard course

System Programmer and Administrator training for personnel assigned to support, develop, and modify system software, including training on the devices data model, design and use of all vendor supplied API, SPC, and EAI adapters.

Topics
- Database concepts
- NM DMS Architecture
- Network Model Overview
- Symbol Configuration
- EMS-DMS integration, where appropriate
- Network Incremental Update
- System Supervision
- Outage Engine Administration
- Configuring Crews and Crew Management
- Configuring Switch Orders and Jobs

Objectives
The System Administrator Course will be a “train-the-trainer” course tailored to specific types of individuals, including LINUX/UNIX System Administrators and Oracle Database Administrators.

Student Profile
Database Administrators and Software Engineers of the Network Manager DMS system

Maximum 2 participants / workstation.

Prerequisites
- Course NM630, DMS Operation
- Working knowledge of UNIX and Oracle

Course Type
Power Point Slides

Reference Material
Network Manager DMS Operator Training Manual
Network Manager DMS System Administration Guide
3.4 Network Manager Software Programming

3.4.1 NM400, Programming in Windows environment - ODBC & DBS API, 2 days

Customized course

The course goal is to teach the participants how to write applications using the NM DB Server API and the Avanti ODBC driver by programming in C#.

Topics
- NM DB Server API overview and features
- Structure of the API SDK, resource files
- API SDK data structures and error handling
- ODBC installation and configuration
- Extensive programming exercises

Objectives
Upon completion of the course, the participants should understand the basic mechanisms and structures in the APIs, to be able to write their own applications in C#, and to install and configure the ODBC driver

Student Profile
Database Administrators and Software Engineers

Maximum 2 participants / workstation

Prerequisites
- The participants must have experience of power network design, basic knowledge of database systems, and have taken courses NM100, NM200 and NM220 or have the corresponding knowledge
- Good knowledge and experience of programming in C#
- Basic knowledge of programming in Microsoft Visual Studio development environment

Course Type
Training Course with hands-on exercises
3.5 Network Manager Hardware, System Configuration and Integration

3.5.1 NM500, System Security, 2 days

Standard course

The course goal is to give the participants a basic knowledge and understanding of the Network Manager system from a security perspective.

Topics

- Introduction to Cyber Security
  Threats, Risks, Policies, Standards
  (NERC-CIP, ISO 17799, IEC 62351)
- Network Manager security overview
  Mitigation mechanisms and strategies
- System Configuration
  NM Configuration, Hardening and Intrusion Detection
- Security Management
  Auditing, monitoring and response
- Security Verification
  Vulnerability scanning, patch management

Objectives

Upon completion of the course, the participants should:

- Have a good understanding of what Cyber Security is about
- Have a basic knowledge of threats and risk assessment of a Network Manager system
- Be able to secure a Network Manager system at 'best-effort'
- Be able to scan a Network Manager system for vulnerabilities

Student Profile

Database Administrators and Software Engineers

Maximum 2 participants / workstation

Prerequisites

- Technical vocational training
- Good knowledge of computer systems and networks
- General understanding of the power system operation or the corresponding knowledge

Course Type

Training Course with hands-on exercises
3.5.2 NM510, System Diagnostics, 3 days

**Standard course**

*In the Network Manager System Diagnostics course the participants will learn techniques for troubleshooting a Network Manager system and will learn to use a variety of troubleshooting and diagnostic tools available in the Network Manager system. The course is a hands-on class and participants will, using a live system and real life examples, debug various error situations using their troubleshooting skills.*

**Topics**

- Interpretation and error mitigation of different logs and maintenance lists, for example:
  - Network Manager system logs
  - Network Manager control system event/alarm list
  - Network Manager trap list
  - Network Manager diagnostics tools
  - Troubleshooting Network Manager applications (SCADA, UDW, communications and applications)

**Objectives**

Upon completion of the course, the participants should:

- Have a good understanding of the different Network Manager logs and diagnostics tools
- Be able to locate and mitigate an error situation in a Network Manager system
- Be able to use Network Manager logs for preventive maintenance

**Student Profile**

Database Administrators and Software Engineers

Maximum 2 participants / workstation

**Prerequisites**

- Technical vocational training
- Good knowledge of the Network Manager system
- Basic knowledge of Linux Operating System

**Course Type**

Training Course with hands-on exercises
3.5.3 NM520, Process Communication Unit, PCU 400, 2 days

*Standard course*

The course goal is to teach the participants functions, design, operation, commission and maintenance of PCU400.

**Topics**

- The network control system
- Functions in PCU400
- RCS Application
- Database system
- Communication
- Hardware in PCU400
- Fault tracing and maintenance
- Documentation

**Objectives**

Upon completion of the course, the students should have acquired an understanding of the design, functions, and operation of PCU400 and the skills needed to commission and to maintain it.

**Maintenance Student Profile**

Maintainers of Master Station and other personnel interested in the subject

Maximum 3 participants / workstation

**Prerequisites**

- Technical vocational training
- Basic knowledge of electronics and PC computers
- Course NM100 or have the corresponding knowledge

**Course Type**

Training Course with hands-on exercises
3.5.4 NM530, IEC101 / 104 Protocol, 1 day

Standard course
The course goal is to give background and knowledge about IEC 60870-5-104 including Data Engineering and Fault tracing.

Topics
- Background
- IEC 60870-5-101 / 104 implementation
- RCS Application
- Data Engineering
- Fault tracing

Objectives
Upon completion of the course, the students should have acquired an understanding of the IEC 60870-5-104 protocol as well as the design and operation in Network Manager including Data Engineering and maintenance

Student Profile
Communication experts
Maximum 12 participants

Prerequisites
- Basic knowledge of RTU protocols

Course Type
Theoretical course
3.5.5 NM540, Inter-Control Center Communication, 3 days

*Standard course*

*The course goal is to teach the participants background, functions, operation, commission and maintenance of ICCP.*

**Topics**

- Introduction to Inter-Control Center Communication
- Protocol & Architecture
- ICCP Conformance Blocks
- Data Transfer & Objects
- ICCP in Network Manager
- Configuration in Network Manager
- MMS
- MMS Configuration
- Bandwidth Calculation

**Objectives**

Upon completion of the course, the participants should have acquired an understanding of the background, design, functions, and operation of ICCP and the skills needed to commission and to maintain it.

**Student Profile**

Database Administrators and Software Engineers

Maximum 2 participants / workstation

**Prerequisites**

- Technical vocational training
- Basic knowledge of computer systems
- Courses NM100, NM200, NM220 or have the corresponding knowledge

**Course Type**

Training Course with hands-on exercises
3.6 Network Manager Operators

3.6.1 NM600, SCADA Operation, 2-3 days

*Standard course*

The course goal is to teach participants how to handle the Network Manager system for basic process functions.

**Topics**

- Control room layout and operator work stations
- Introduction of Network Manager as a tool for process communication
- Information acquisition, picture design and selection
- Dialogues and reports
- Function overview:
  SCADA, EMS (if applicable), DMS (if applicable)
- Control system operation:
  System data, messages, design and device handling

**Objectives**

Upon completion of the course, the participants should be able to:

- Handle the Network Manager system for basic process functions
- Give outline of the Network Manager system design and operation

**Student Profile**

Operators
2–3 participants / workstation

**Prerequisites**

The participants should have experience of:

- Power system operation
- PC computers

**Course Type**

Training Course with hands-on exercises

The course is conducted in the control room on site
3.6.2 NM610, EMS Applications Operation, 5 days

Customized course

The course goal is to teach the participants how to operate the Network Applications and the Production Control & Planning Applications. The course is customized to correspond to the functions used by the customer.

Topics

Network Applications
- Overview of the functionality
- How to find and read the results
- How to use the Network Application Control
- Meaning of execution flags
- Basic theory of the relevant functions:
  - Network Application Control
  - Telemetry Snapshot
  - Status and Analog Retrieval
  - Study Schedule Retrieval
  - Network Model Builder
  - Bus Scheduler
  - State Estimator
  - Network Parameter Update
  - Dispatcher Power Flow
  - Network Sensitivity
  - Security Analysis
  - Security Constrained Dispatch
  - Optimal Power Flow
  - Short Circuit Analysis
  - PAS Interlock
  - Network Application Save Cases
  - Equipment Outage Scheduler
- When to use the different functions

Product Control & Planning
- Overview of the functionality
- How to find and read the results
- How to use the different sub-functions of AGC
- Meaning of execution flags
- Basic theory of the relevant functions:
  - Load Frequency Control
  - Static Economic Dispatch
  - Production Costing
  - Reserve Calculation
  - Study Economic Dispatch
  - Short Term Load Forecast
  - Unit Commitment
  - Transaction Evaluation
  - Interchange Transaction Scheduler
- Input data
- When to use the different functions

Objectives

Upon completion of the course, the participants should know:
- How to operate the different Network Applications
- How to control the different Network Applications
- How to set up an EMS network study
- How to operate the Production Control & Planning Applications
- How to control the Production Control & Planning Applications

**Student Profile**
People who will operate the Network Applications and set up/perform EMS network studies and/or people who will operate the Production Control & Planning Applications

Maximum 2 participants / workstation

**Prerequisites**
- Technical vocational training
- General understanding of the power system operation
- Course NM100 or have the corresponding knowledge

**Course Type**
Training Course with hands-on exercises
3.6.4 NM630, DMS Operation, 4 days

*Standard course*

*This course trains operators to use the Network Manager DMS system.*

**Topics**

This is a “train-the-trainer” course to be conducted in a lab environment. Each student is to be provided a workstation with a minimum of two monitors. Breakdown of class schedule is as follows:

- Brief explanation of the entire system
- Graphical User Interface
- Usage of Status windows
- Locating Objects, Calls, and Outages
- Crew assignments
- Restoring outages
- Practical exercises

**Objectives**

After completion of this course students should be able to:

- Navigate around the network.
- Locate trouble calls
- Locate required objects with respect to outages
- Verify outages
- Restore outages
- Complete crew assignments
- Enter Non-Customer calls using netCADOPS
- Retrieve customer information using netCADOPS CSR forms

**Student Profile**

This course is intended for distribution system operations personnel including: operators, dispatchers, operations supervisors and responsible line managers.

Maximum 2 participants / workstation.

**Prerequisites**

- The attendees should be experienced with their distribution operating and safety procedures and be familiar with desktop computer operations.

**Course Type**

Power Point Slides

**Reference Material**

Network Manager DMS Operator’s Training Manual
3.6.5 NM640, DMS Advanced Applications Operation, 2 days

**Standard course**

This course trains advanced operators to use the Network Manager DMS advanced power systems applications.

**Topics**

This is a “train-the-trainer” course to be conducted in a lab environment. Each student is to be provided a workstation with a minimum of two monitors. Breakdown of class schedule is as follows:

- Load Allocation
- Load Flow
- Fault Location
- RSA
- Line Unloading
- Practical exercises

**Objectives**

After completion of this course students should be able to:

- Run either balanced or unbalanced load flow and interpret results
- Run fault location and interpret results
- Enter simulation mode and run simulated switching and switch orders
- Run Restoration Switching Analysis and interpret results
- Run Restoration Switching Analysis in simulation mode
- Run the Line Unloading utility

**Student Profile**

This course is intended for senior distribution system operations personnel including: senior operators and operations supervisors.

Maximum 2 participants / workstation.

**Prerequisites**

- Course NM630, DMS Operation

**Course Type**

Power Point Slides

**Reference Material**

Network Manager DMS Operator’s Training Manual
3 Network Manager Workshops

The workshops are mainly performed when a customer have some earlier experience of a Network Manager System and only need to refresh the skills. It can also be a good idea to perform a workshop when the customer wishes the training to take place on site, with their own system.

It is possible to order a workshops on any subjects, below are a few examples.

Course Structure Network Manager 6

SCADA / EMS / DMS / GMS

Workshops for:
- Software System Engineers
- Maintainers of Master Station

<table>
<thead>
<tr>
<th>Operators</th>
<th>Database Administrators</th>
<th>Software System Engineers</th>
<th>Maintainers of Master Station</th>
</tr>
</thead>
<tbody>
<tr>
<td>Be able to use the functions of the Network Manager system for optimal power system control, planning, and disturbance analysis.</td>
<td>Handles maintenance and amendments of the process and control database.</td>
<td>Be able to maintain the NM-system.</td>
<td>Be able to describe the functions, design, and configurations of the computer- and network systems as well as control- and server room equipment. Perform preventative and basic corrective maintenance by replacing failing logic modules.</td>
</tr>
</tbody>
</table>
3.1 NM700, Workshop SCADA and Ergonomics, up to 5 days

Customized workshop

The workshop goal is to teach out the proper methods and procedures for data management in the Network Manager/SCADA system, and to enhance and expand the knowledge about it.

Topics
- Introduction
  - Network Manager concept and definitions
- Theory repetition
  - Data Engineering
  - Picture Editor Design
- Working methods
  - Data Engineering
  - Ergonomics
  - Picture Editor Design
- Exercises

Objectives
Upon completion of this workshop the participants should have further knowledge and training in how to maintain the data in an efficient way in a Network Manager/SCADA system with emphasis on:
- Data Engineering
- Ergonomics
- Picture Editor Design

Student Profile
Software Engineers
Maximum 2 participants / workstation

Prerequisites
The participants must have experience of power network design, basic knowledge of database systems, and have taken the courses NM100, NM200, NM210 and NM220 or have the corresponding knowledge

Course Type
Workshop with hands on exercises
3.2 NM710, Workshop Data Engineering, up to 5 days

Customized workshop

The workshop goal is to teach out the proper methods and procedures for using the Data Engineering Tool, and to enhance and expand the knowledge and experience about it.

Topics

- Introduction
- DE400 tool repetition
  - Concept of change set
  - Build DE400 users
  - Sequence of process data maintenance
  - Export pictures from DE400 to PED500
- Working methods:
  - Follow the traditional data maintenance cycle
  - Follow the on-line maintenance method
- Exercises

Objectives

Upon completion of this workshop participants should have further knowledge and training in how to maintain the data in a consistent and efficient way with emphasis on:

- Data creation and modification
- Data population of process data

Student Profile

Database Administrators and Software Engineers, with the task of maintaining the system database

Maximum 2 participants / workstation

Prerequisites

The participants should have passed the courses NM100 (Network Manager Overview) and NM200 (Database Editing)

Course Type

Workshop with hands on exercises
3.3 NM720, Workshop Picture Building and Maintenance, up to 5 days

*Customized workshop*

The workshop goal is to teach out the proper methods and procedures for picture building and picture maintenance, and to enhance and expand the knowledge about it.

**Topics**

- Introduction
- PED500 tool repetition:
  - Rules for Picture Building
  - Data Engineering dependencies
  - Picture maintenance in multi computer systems
- Working methods:
  - Picture creation - different methods
  - Database Maintenance including the Symbol Library, Type Definitions and the PED resource file
  - Use of the PED500 help.
  - Master pictures ABB/Customer, and backup methods
- Exercises

**Objectives**

Upon completion of this workshop participants should have further knowledge and training in how to build new pictures and maintain pictures

**Student Profile**

Software Engineers, with the task of build new pictures and maintain pictures

Maximum 2 participants / workstation

**Prerequisites**

The participants should have passed the courses NM200, Database Editing and NM210, Picture Editor

**Course Type**

Workshop with hands on exercises
3.4 NM730, Workshop Database & System Maintenance, up to 5 days

Customized workshop

The workshop goal is to teach out the proper methods and procedures for database maintenance, and to enhance and expand the knowledge about it.

Topics

- Introduction
- Theory repetition:
  - Data Catalog Concepts
  - Utilities
  - Data Engineering
  - Database maintenance in multi computer systems
- Working methods:
  - Database creation – size parameterization
  - Database population – the distinction between process data and system data.
  - Use of Data Engineering.
  - Database Backup and Restore
- Exercises

Objectives

Upon completion of this workshop participants should have further knowledge and training in how to maintain the database in a consistent and efficient way with emphasis on

- Database structure creation and modification
- Database population of both process and system data

Student Profile

Software Engineers, with the task of maintaining the system database

Maximum 2 participants / workstation

Prerequisites

The participants should have passed course NM250, Database and System Maintenance

Course Type

Workshop with hands on exercises
3.5 NM740, Workshop Calculation, up to 2 days

Customized workshop

The workshop goal is to practice how to use, specify and implement user defined calculations in a Network Manager system.

Topics
- Introduction
- Theory repetition
- Working methods
- Exercises

Objectives
Upon completion of this workshop participants should have further knowledge and training in how to use, specify and implement user defined calculations such as:
- SCADA Value calculations
- SCADA Power calculations
- SPL programming for Sequential Control, Interlocking and Calculation

Student Profile
Software Engineers with the task of using and specifying user defined calculations and functions

Maximum 2 participants / workstation

Prerequisites
The participants should have passed course NM300, Calculations

Course Type
Workshop with hands-on exercises
3.6 NM750, Workshop Historical Information System, up to 5 days

*Customized workshop*

The workshop goal is to teach the participants the proper methods and procedures for using Utility Data Warehouse (UDW), and to enhance and expand the knowledge about it.

**Topics**
- Introduction
- Theory repetition
- Working methods
- Exercises

**Objectives**
Upon completion of this workshop participants should have further knowledge and training in how to use, specify and implement a Utility Data Warehouse.

**Student Profile**
Software Engineers
Maximum 2 participants / workstation

**Prerequisites**
The participants should have passed course NM310, Historical Information System based on Oracle

**Course Type**
Workshop with hands on exercises
Customized workshop

The workshop goal is to teach the participants the proper methods and procedures for using Utility Data Warehouse (UDW), and to enhance and expand the knowledge about it.

Topics
- NMTab Runtime Environment
- Configuration Tool
- Constraints and Enumerations
- Expressions and Dependent Grids
- References, Poke Points and Display Links
- Relations, Pagination and Dynamic Function Keys
- Hints and Templates
  Exercises

Objectives
Upon completion of this workshop participants should have further knowledge and training in how to use and navigate NMTab displays
Manage the configuration tool in WS500 to create and maintain NMTab displays

Student Profile
Software Engineers
Maximum 2 participants / workstation

Prerequisites
The participants should have passed course NM270, NMtab

Course Type
Workshop with hands on exercises