Statement of Work

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1. Training

1.1. Overview of ABB training programs

Purpose
This document is a general course catalogue which presents all the different Network Manager standard courses, customized courses and workshops that we can perform for all the different personnel categories for all our customers.

1.1.1. 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.

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

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

Available system overview courses
NM001, Project Specific Seminar – Hardware and Network
NM100, Network Manager Overview

Proposed training
The proposed set of training is defined in Proposal section “Scope of Supply”; subsection “Scope of Services”.

Standard course – definition
Standard courses means that the training system is a restricted standard configured system with a reference system database. Optional is to have the training at the site of the customer.

Customized course – definition
Customized course means that the customer functionality is in focus, but the training system is a restricted standard configured system with a reference system database. It is possible to offer this kind of training at customer sites. Optional is to have the training at the site of the customer.

Workshop – definition
Workshop means that the training system is the specific customer configured system with the specific customer database. Workshops are usually at the customer site.

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

### 1.1.2. Definition of different staff categories

<table>
<thead>
<tr>
<th>System 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 preventive and basic corrective maintenance by replacing failing logic modules.</td>
</tr>
</tbody>
</table>
1.1.3. Standard/customized courses: SCADA / ADMS / EMS / GMS / OTS

Key:
- Customized course
- Standard course

Operators *:
- NM600, SCADA operation 2-3 d
- NM611, GMS Appl. Operation 2-5 d
- NM612, EMS Appl. Operation 2-5 d
- NM630, ADMS Operation 2 d

Database Administrators *:
- NM200, Database Editing 2 d
- NM210, Picture Editor 2 d
- NM270, NMTab Displays 2 d
- NM220, Data Req. for SCADA 2 d
- NM300, Calculation 2 d
- NM310, Historian-UDW 3 d

Software System Engineers *:
- NM500, System Security 2 d
- NM510, System Diagnostics 2 d
- NM540, ICCP Communication 3 d

Maintainers of Master Station *:
- NM380, Power System Explorer Configuration 4 d

Network Manager Overview 2 days:
- NM370, ADMS System Adm. 4-5 d

Database Editing:
- NM250, Database Maintenance 3 d

System Security:
- NM520, PCU400 2 d

Data Requirements:
- NM232, Data Requirements 2-4 d
- NM332, EMS Appl. Design 2-5 d
- NM342, EMS Appl. Tuning 2-5 d
- NM233, Data Requirements OTS 3 d
- NM350, EMS Instruct. Simulator 2 d

Data Req. for SCADA:
- NM231, Data Req. GMS 1-3 d
- NM331, GMS Appl. Design 2-5 d
- NM234, Data Req. Nostradamus 1 d
- NM341, GMS Appl. Tuning 2-5 d

Data Req. Nostradamus:
- NM240, Data Requirements, N2A 2 d
- NM360, DMS Appl. Design, N2A 2-5 d
- NM370, ADMS System Adm. 4-5 d

Power System Explorer Configuration:
- NM380, Power System Explorer Configuration 4 d

SCADA / ADMS / EMS / GMS / OTS
1.1.4. Additional training and workshops

- **Additional training on request for: System Operators**
  - NM650, OMS Appl. Operation 2 d

- **Additional training on request for: Database Administrators**
  - NM400, Programming ODBC & DBS API 2 d
  - NM410, Programming DAIS 2 d

- **Additional training on request for: Software System Engineers**

**Workshops for:**
- **Database Administrators & Software System Engineers**
  - NM700, SCADA and Ergonomics 2-5 d
  - NM710, Data Engineering 2-5 d
  - NM711, GMS Data Engineering 2 d
  - NM712, EMS Data Engineering 2 d
  - NM713, OTS Data Engineering 2 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 Displays 2-5 d

**Workshops for:**
- **Maintainers of Master**
  - NM701, Project Specific Seminar - Hardware and Network 2 d
  - NM702, Active Directory 1 d
  - NM703, Data Protector 2 d
  - NM725, IEC101 / IEC104 Protocol 1 d
  - NM735, Alarms Configuration, 3 d
  - NM770, OMS Configuration, 2 d
  - NM780, ADMS Configuration, 3 d
  - NM790, GIS to DMS Extraction, 3 d

**Key:**
- **Standard course**
- **Workshop**
- **Customized Course**
1.1.5. 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.

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

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

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

Available database administrator courses

NM100, Network Manager Overview
NM200, Database Editing
NM210, Picture Editor
NM220, Data Requirements for SCADA
NM250, Database Maintenance
NM270, NMTab Displays
NM300, Calculation
NM310, Historian - UDW
NM500, System Security
NM510, System Diagnostics
NM520, Process Communication Unit, PCU400
NM540, Inter-Control Center Communication
NM370, DMS System Administration
NM380, Power System Explorer Configuration
NM232, Data Requirements for EMS
NM332, EMS Applications Design
NM342, EMS Application Tuning
NM233, Data Requirements for OTS
NM350, EMS Training Simulator for Instructors
NM231, Data Requirements for GMS
NM331, GMS Applications Design
NM234, Data Requirements for Nostradamus
NM341, GMS Application Tuning
NM240, Data Requirements, N2A
NM360, DMS Application Design, N2A.
NM400, Programming in Windows environment - ODBC & DBS API
NM410, DAIS API Programming - Basic
NM700, SCADA and Ergonomics
NM710, Data Engineering
NM711, GMS Data Engineering
NM712, EMS Data Engineering
NM713, OTS Data Engineering
NM720, Picture Building and Maintenance
NM730, Database and System Maintenance
NM740, Calculation Workshop
NM750, Historical Information System
NM760, NMTab Displays

**Proposed training**

The proposed set of training is defined in Proposal section “Scope of Supply”; subsection “Scope of Services”.

**1.1.6. Software system 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).

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

**Training objectives**
- Be able to maintain and develop the software system.

**Prerequisites**
It is required that the student has the knowledge corresponding to the Database Administrator courses (see above) and:
- Basic knowledge of programming

**Available system engineer courses (standard, customized or workshops)**

- NM100, Network Manager Overview
- NM200, Database Editing
- NM210, Picture Editor
- NM220, Data Requirements for SCADA
- NM250, Database Maintenance
- NM270, NMTab Displays
- NM300, Calculation
- NM310, Historian - UDW
- NM500, System Security
- NM510, System Diagnostics
- NM520, Process Communication Unit, PCU400
- NM540, Inter-Control Center Communication
- NM370, DMS System Administration
- NM380, Power System Explorer Configuration
- NM232, Data Requirements for EMS
- NM332, EMS Applications Design
- NM342, EMS Application Tuning
- NM233, Data Requirements for OTS
- NM350, EMS Training Simulator for Instructors
- NM231, Data Requirements for GMS
- NM331, GMS Applications Design
- NM234, Data Requirements for Nostradamus
Proposed training

The proposed set of training is defined in Proposal section “Scope of Supply”; subsection “Scope of Services”.

1.1.7. 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.

Tasks

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

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

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

Available hardware engineer courses
NM001, Project Specific Seminar – Hardware and Network
NM100, Network Manager Overview
NM500, System Security
NM510, System Diagnostics
NM520, Process Communication Unit PCU400
NM540, Inter-Control Center Communication
NM702, Active Directory
NM703, Data Protector
NM725, IEC101 / IEC104 Protocol

Proposed training
The proposed set of training is defined in Proposal section “Scope of Supply”; subsection “Scope of Services”.

### 1.1.8. **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.

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
• Training Objectives
• Be able to use the functions of the Network Manager system for optimal power system control, planning and disturbance analysis.
Prerequisites
- Technical vocational training
- Experience of power system operation and PC-computers
- Read and understand English well

Available system operation courses
- NM100, Network Manager Overview (Optional)
- NM600, SCADA Operation
- NM611, GMS Applications Operation
- NM612, EMS Applications Operation
- NM630, ADMS Operation
- NM640, ADMS Advanced Applications Operation
- NM650, OMS Applications Operation

Proposed training
The proposed set of training is defined in Proposal section “Scope of Supply”; subsection “Scope of Services”.

1.1.9. 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
- Customized courses for customer that have upgraded their system to a new release. The training is focusing on the delta between the old and the new release

1.2. Network Manager Overview
1.2.1. 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 SCADA system together with the EMS (Energy Management System), GMS (Generation Management System) and DMS (Distribution Management System)
Topics

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

Objectives

Upon completion of the course, the participants should:

- Have a general understanding of the Network Manager system sign
- 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/GMS/DMS/OTS functions
- Have knowledge of the benefits of EMS/GMS/DMS

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

Theoretical course with some hands-on exercises

1.3. Network Manager Database and Display Engineering

1.3.1. NM200, Database Editing, 2 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 run-time system
- Maintain displays created in the DE400 Graphical Editor
- Have a general knowledge of the Network Manager 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, Network Manager Overview or have the corresponding knowledge

Course Type
Training Course with hands-on exercises

1.3.2. NM210, Picture Editor, 2 days

Standard course
The course goal is to teach participants how create pictures of the Network Manager run-time 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
- Create and link pictures into the Avanti 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 Picture Editor Tool (PED), to create Network Manager pictures, and link them into 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 display 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, Network Manager Overview or have the corresponding knowledge.

Course Type
Training Course with hands-on exercises and discussions

1.3.3. NM220, Data Requirements for SCADA, 2 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, Network Manager Overview and NM200, Database Editing or have the corresponding knowledge.

Course Type
Training Course with hands-on exercises

1.3.4. NM231, Data Requirements for GMS, 1 - 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
• Experience of power network design
• Basic knowledge of database systems
• NM220, Data Requirements for SCADA course or have the corresponding knowledge

Course Type
Theoretical course with hands-on exercises

1.3.5. NM232, Data Requirements for EMS, 2 - 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
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, Data Requirements for SCADA, 2 days course or have the corresponding knowledge

Course Type
Theoretical course with hands-on exercises

1.3.6. NM233, Data Requirements for OTS, 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 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
• NM232 Data Requirements for EMS course (2 – 5 days) or have the corresponding knowledge
• Knowledge of EMS and GMS (optional) model

**Course Type**

Theoretical course with hands-on exercises

1.3.7. **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

**Prerequisites**

• Experience of power network design
• Basic knowledge of database systems
• NM220, Data Requirements for SCADA, 2 days course or have the corresponding knowledge

**Course Type**

Theoretical course (hands-on exercises optional)

1.3.8. **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 Type
Workshop with hands-on exercises

1.3.9. NM250, Database Maintenance, 3 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 and maintenance in a redundant system
• Tools:
  - ADL/ADF (Avanti Definition Language Function)
  - AQL (Avanti Query Language)
  - RM (Record Manipulate)
  - QM (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, Network Manager Overview and NM200, Database Editing
• 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

1.3.10. NM270, NMTab Displays, 2 days

Standard course
NM270 for introduction to NMTab Displays how they are designed and how to maintain and build new displays

**Topics**
- NMTab runtime environment
- Configuration tool
- Constants and enumerations
- Expressions and Dependencies
- References, Poke Points, Display Links and Dynamic Function Keys
- Hints and Templates

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

**Student Profile**
Database Administrators and Software Engineers should have this knowledge.

Maximum 2 participants / workstation.

**Prerequisites**
- NM100, Network Manager Overview

**Course Type**
Power Point Slides and hands on exercises

**Reference Material**
None specific

### 1.4. Network Manager Software Design

#### 1.4.1. NM300, 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, Network Manager Overview, NM200, Database Editing and NM220, Data Requirements for SCADA or have the corresponding knowledge. They should also have some experience in computer programming

Course Type
Training Course with hands-on exercises

1.4.2. 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, Network Manager Overview, NM200, Database Editing and NM220, Data Requirements for SCADA or have the corresponding knowledge

Course Type
Training Course with hands-on exercises
1.4.3. NM320, Historical Information System based on PI, 3 days

Standard course

The course goal is to teach participants how to specify and implement OSIsoft PI data, and to present them in various standard ways

Topics

- General description
- Data Engineering
- Data presentation
- Archive backup
- PI server synchronization
- PI server supervision
- PI Security

Objectives

Upon completion of the course, the participants should be able to specify and implement PI 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, Network Manager Overview, NM200, Database Editing and NM220, Data Requirements for SCADA or have the corresponding knowledge

Course Type

Training Course with hands-on exercises

1.4.4. NM331, GMS Applications Design, 2 - 5 days

Customized course

The course goal is to teach the participants the functionality and software design of the GMS 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 Maintenance
- Course NM611, GMS Applications Operation or have the corresponding knowledge

**Course Type**

Class room Training Course with presentations

**1.4.5. NM332, EMS Applications Design, 2 - 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 NM612, EMS Applications Operation or have the corresponding knowledge
Course Type
Class room Training Course with presentations

1.4.6. NM341, GMS Applications Tuning, 2-5 days

Customized course

The course goal is to teach the participants how to maintain the GMS 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 GMS Applications
- How to model the GMS system
- Understand GMS log files
- Meaning of execution flags
- Data flows within GMS Applications
- Theory of the relevant GMS functions
  - Automatic Generation Control
  - Economic Dispatch
  - Production Costing
  - Reserve Calculation
  - Interchange Transaction Scheduler
  - Prod-plan Application
- Tuning of the GMS Applications

Objectives
- Upon completion of the course the participants should be able to:
  - For GMS Applications
    - Verify that changes done in Data Engineering will work in the GMS Applications
    - Find errors in the GMS model
  - 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 GMS Applications

Maximum 2 participants / workstation

Prerequisites
- Technical vocational training
- General understanding of the power system operation
- Course NM100, Network Manager Overview, SCADA/EMS Overview
- Course NM250, Database Maintenance
- Course NM611, GMS Applications Operation or have the corresponding knowledge

Course Type
Training Course with hands-on exercises

1.4.7. NM342, EMS Applications Tuning, 2 - 5 days

Customized course
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.

**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
  - 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

Maximum 2 participants / workstation

**Prerequisites**
- Technical vocational training
- General understanding of the power system operation
- Course NM100, Network Manager Overview
- Course NM250, Database Maintenance
- Course NM612, EMS Applications Operation or have the corresponding knowledge
Course Type
Training Course with hands-on exercises

1.4.8. **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 Maintenance
- Course NM342, EMS Application Tuning or have the corresponding knowledge

Course Type
Training Course with hands-on exercises

1.4.9. **NM360, DMS Applications Design–N2A, 2 days**

Standard course
The course goal is to give the participants a basic knowledge and understanding of the DMS Network Application of the Network Manager system.

Topics
- DMS Network Applications introduction
- DMS Network Applications design:
  - General concepts and software overview
- DMS Network Topology Engine:
  - Visualization of the Network State, interface to SCADA, Interlock conditions, tracing modes
- Relevant DMS Network Calculation Functions:
  - Load Calibration and State Estimation
  - Load Flow Calculation
Fault Localization, Isolation and System Restoration
Short Circuit Calculation
Contingency Analysis
Loss Minimization
Training Simulator
Unbalanced Load Flow
Dynamic Network Coloring

Objectives
Upon completion of the course, the participants should be able to:
- have a general understanding of the DMS Network application system design
- have a basic knowledge of the Network Manager DMS Network functions
- be able to use the Human Machine interface to perform basic operations within the DMS Network applications

Student Profile
System Engineers, Maintenance Personnel, or any personnel who need a general understanding of the Network Manager DMS application functions.
Maximum 2 participants / workstation.

Prerequisites
- Technical vocational training
- Basic knowledge of computer systems
- Handling of multiple windows like MS Windows
- General understanding of the distribution system operation or the corresponding knowledge
- The Tool for Process Control

Course Type
Training Course with hands-on exercises

1.4.10. NM370, ADMS System Administration, 4 - 5 days

Customized course
Administrator training for personnel assigned to support ADMS deployments.
Network Manager ADMS data model training for personnel assigned to support, develop, and modify the application data.

Topics
- Network Manager ADMS Architecture
- System Configuration
- User Authority
- AOR
- SCADA-ADMS Integration
- System Supervision
- Symbols
- Outage Administration
- Configuring Crews
- Configuring Switch Orders and Jobs
- Referrals
- Power Application Administration
- Manual Processes
- Network Model Overview
- Network Model Build
- Incremental Update
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. Upon completion of the course, the participants should also have acquired an understanding of the necessary database requirements to satisfy configuration of the ADMS Network Model.

Student Profile
Database Administrators and Software Engineers of the Network Manager DMS system
Maximum 2 participants / workstation.

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

Course Type
Power Point Slides

Reference Material
Network Manager DMS OMI Operator Guide
Network Manager PSE Operator Guide
Network Manager DMS System Administration Guide

1.4.11. NM380, Power System Explorer Configuration, 4 days

Standard course
Network Manager Power System Explorer configuration training for administrators.

Topics
- Workplace Configuration
- User Accounts
- User Options
- Thumbnails and Properties
- Display Structure
- External Data Objects
- Import and Export Tools

Objectives
The System Administrator Course will be a “train-the-trainer” course that will teach the fundamentals of Power System Explorer configuration and environment maintenance.
Reference Material
Network Manager PSE Configuration Guide
Network Manager PSE Installation Guide

1.5. Network Manager Software Programming

1.5.1. 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
- 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, Network Manager Overview, NM200 Database Editing, and NM220 Data Requirements for SCADA 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

1.5.2. NM410, DAIS API Programming - Basic, 2 days

Customized course
The course goal is to teach the participants how to write applications using DAIS by programming in C#.

Topics
- CORBA and SIDL Overview
- DAIS Introduction, DAIS in Network Manager
- Data Structures
- Error Handling
- DAIS Browser
- DAIS Data Access Simple IO, DAIS Data Access IO
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#.

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 courses NM100, Network Manager Overview, NM200 Database Editing, and NM220 Data Requirements for SCADA 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

1.6. Network Manager Hardware, System Configuration and Integration

1.6.1. 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

1.6.2. **NM510, System Diagnostics, 2 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 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

1.6.3. **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
- Usage of:
• Front-end (FE)
• Gateway (GW)
• RCS Application
• Engineering:
  • Configuration of NM
  • Configuration of PCU
• Communication
  • Protocols
  • Architecture (TCP/IP, Serial- and Multidrop, etc)
• PCU400 and its hardware solution and RCM
• 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, Network Manager Overview or have the corresponding knowledge

**Course Type**

Training Course with hands-on exercises

1.6.4. **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
• Manufacturer Messaging Specification (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, Network Manager Overview, NM200, Database Editing, NM220, Data Requirements for SCADA or have the corresponding knowledge

Course Type
Training Course with hands-on exercises

1.7. Network Manager Operators

1.7.1. 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 or at ABB in a customer configured system

1.7.2. NM611, GMS Applications Operation, 2 - 5 days

Customized course
The course goal is to teach the participants how to operate the GMS Applications. The course is customized to correspond to the functions used by the customer.

**Topics**
- GMS Applications
- 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:
  - Automatic Generation Control
  - Economic Dispatch
  - Production Costing
  - Reserve Calculation
  - 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 GMS Applications
- How to control the GMS Applications

**Student Profile**
People who will operate the GMS Applications
Maximum 2 participants / workstation

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

**Course Type**
Training Course with hands-on exercises

**1.7.3. NM612, EMS Applications Operation, 2 - 5 days**

*Customized course*

The course goal is to teach the participants how to operate the Network 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

**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

**Student Profile**

People who will operate the Network Applications and set up/perform EMS network studies

Maximum 2 participants / workstation

**Prerequisites**

- Technical vocational training
- General understanding of the power system operation
- Course NM100, Network Manager Overview or have the corresponding knowledge

**Course Type**

Training Course with hands-on exercises

**1.7.4. NM630, ADMS Operation, 2 days**

**Standard course**

This course trains operators to use the Network Manager ADMS 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
- Practical exercises

**Objectives**

After completion of this course students should be able to:

- Navigate around the network.
- Perform trace and feeder focus operations
- Use simulation mode
- Perform network device operations and tagging
- Work with object lists and search for objects within the network model
Locate trouble calls
Locate required objects with respect to outages
Locate and view outages
Locate and view crew assignment

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 PSE Operator Guide
Network Manager DMS OMI Operator Guide
netCADOPS Operator Guide

1.7.5. **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
- Unbalanced Load Flow
- Fault Location
- Restoration Switching Analysis
- Line Unloading
- Voltage VAr Optimization

Objectives
After completion of this course students should be able to:

- Run unbalanced load flow and interpret results
- Run fault location and interpret results
- Run Restoration Switching Analysis and interpret results
- Perform studies in simulation mode
- Run Line Unloading
- Run Voltage VAr Optimization

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 PSE Operator Guide
Network Manager DMS OMI Operator Guide

1.7.6. NM650, OMS Applications Operation, 2 days

Standard course
This course trains operators to use the ADMS outage management 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:
- Call Management
- Outage Management
- Crew Management
- Jobs
- Referrals
- Switching Plans
- Common Tagging and Switching interface between DMS and SCADA

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
- Understand how to perform switching within the DMS
- Work with Tags and Referrals

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 PSE Operator Guide
1.8. Network Manager Workshops

1.8.1. NM700, Workshop SCADA and Ergonomics, up to 5 days

**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, Network Manager Overview, NM200, Database Editing, NM210, Picture Editor and NM220, Database Requirements for SCADA or have the corresponding knowledge

**Course Type**

Workshop with hands on exercises

1.8.2. NM701, Hardware and Network, 2 days

**Workshop**

The course goal is to give the participants a basic knowledge and understanding of the Network Manager System Hardware and Network.

**Topics**

- General description
- Layout, installation, and design of the Master Station
• Preventive and corrective maintenance
• The interaction between Network Manager software and hardware
• ESD (Electrostatic discharge)
• Documentation system architecture, installed systems, security, authority, remote control, system hierarchy, open architecture, and hardware-/network configuration

Objectives
Upon completion of the course, the participants should:
• Have a general understanding of the Network Manager system Hardware and Network
• Be able to describe the design, function, and system configuration
• Be able to perform preventive and basic corrective maintenance to replace failing logic modules
• Be able to use the User Interface (e.g. ASDM, Telnet, Putty) to perform hardware-/network configuration

Student Profile
• Maintainers of Master Station or any personnel who need a general understanding of the Network Manager system.

Prerequisites
• Technical vocational training
• Basic knowledge of computer and network systems

Course Type
Training course with hand-on exercise

1.8.3. NM702, Active Directory, 1 day

Work shop
The course goal is to give the participants a basic knowledge and understanding of the Active Directory (AD) in the Network Manager System.

Topics
• Create new user accounts or manage existing user accounts
• Create new organization units (OU) and manage existing OUs
• Maintain existing Group Policy’s (GPO) or create new GPOs
• Connect to one or several domains or domain controllers in the same instance of Active Directory Administrative Center

Objectives
Upon completion of the course, the participants should:
• Have a general understanding of the Active Directory (AD)
• Understand the use of encrypted traffic in the computer network and to control administrative credentials and other security settings
• Be able to use Windows 20xx User Interface to perform basic operations

Student Profile
• Maintainers of Master Station and personnel from the customer’s local IS/IT department or any personnel who need a general understanding of the Network Manager system

Prerequisites
• Technical vocational training
• Basic knowledge of computer and network systems

Course Type
Training course with hand-on exercise
1.8.4. **NM703, Data Protector, 2 days**

**Workshop**

The course goal is to give the participants a basic knowledge and understanding of the Data Protector backup system used in the Network Manager System.

**Topics**

- Have a general understanding of the Data Protector system and the importance of backups
- Have an understanding of schedule philosophy, and how to maintain the system
- Be able to fault tracing on a high level to solve general problems
- Be able to do a restore

**Objectives**

Upon completion of the course, the participants should:

- Have a general understanding Data Protector and functionality in the SCADA-system
- Have understanding of how to perform a restore
- Be able to use Data Protector User Interface to perform basic operations

**Student Profile**

- System Engineers and/or Maintenance Personnel

**Prerequisites**

- Technical vocational training
- Basic knowledge of computer and network systems
- Basic knowledge of Linux and MS Windows operating system
- General understanding of the power system operation or the corresponding knowledge

**Course Type**

Training course with hand-on exercise

1.8.5. **NM710, Workshop Data Engineering, up to 5 days**

**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

1.8.6.  **NM711, GMS Data Engineering Workshop, up to 2 days**

Workshop

The workshop goal is to explain the data files in csv format required by the GMS functions.

Topics

- Introduction
- DE400
  - The use of the templates in relationship with DE400
  - The data base import process.
- Working methods:
  - Explain the GMS related data templates.
- Exercises

Objectives

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

- The explanation of the data fields required by GMS functions.

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 NM710 (SCADA Data Engineering Workshop). Preferably the participant should have knowledge about the the generator characteristics related to AGC function and their association with the SCADA data base.

Course Type

Workshop with hands on exercises

1.8.7.  **NM712, EMS Data Engineering Workshop, up to 2 days**

Workshop

The workshop goal is to explain the data files in csv format required by the EMS functions.
Topics
- Introduction
- DE400
  - The use of the templates in relationship with DE400
  - The data base import process.
- Working methods:
  - Explain the EMS related data templates.
- Exercises

Objectives
Upon completion of this workshop participants should have further knowledge and training in how to create the EMS related data in csv format in a consistent and efficient way with emphasis on:
- The explanation of the data fields required by EMS functions.

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 NM710 (SCADA Workshop Data Engineering). Preferably the participant should have knowledge about the the power flow concept, the power system equipment characteristics related to power flow concept and their association with the SCADA data base.

Course Type
Workshop with hands on exercises

1.8.8. NM713, OTS Data Engineering Workshop, up to 2 days

Workshop
The workshop goal is to explain the data files in csv format required by the OTS functions.

Topics
- Introduction
- DE400
  - The use of the templates in relationship with DE400
  - The data base import process.
- Working methods:
  - Explain the OTS related data templates.
- Exercises

Objectives
Upon completion of this workshop participants should have further knowledge and training in how to create the OTS related data in csv format in a consistent and efficient way with emphasis on:
- The explanation of the data fields required by OTS functions.

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 NM710 (SCADA Workshop Data Engineering). Preferably the participant should have knowledge about the the relay model data, EMS Power Equipment related characteristics, generator model characteristics and their association with the SCADA data base.

Course Type
Workshop with hands on exercises

1.8.9. NM720, Workshop Picture Building and Maintenance, up to 5 days

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

1.8.10. NM725, IEC101 / 104 Protocol, 1 day

Workshop
The course goal is to give background and knowledge about IEC 60870-5-101 and IEC 60870-5-104 including Data Engineering and Fault tracing.

Topics
- Have a general understanding of protocols between the Front-end and RTU
- Background
- IEC 60870-5-101 and IEC 60870-5-104 implementation
• Be able to fault tracing on a high level to solve general problems

Objectives
Upon completion of the course, the participants should:
• Have acquired an understanding of IEC 60870-5-101 and IEC 60870-5-104 protocols as well as the design and operation in Network Manager including Data Engineering and maintenance
• Be able to use logging facilities in the PCU

Student Profile
System Engineers and/or Maintenance Personnel
Communication experts

Prerequisites
• Technical vocational training
• Basic knowledge of computer and network systems
• Basic knowledge of RTU protocols

Course Type
Training course with hand-on exercise

1.8.11. NM730, Workshop Database & System Maintenance, up to 5 days

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 Maintenance
Course Type
Workshop with hands on exercises

1.8.12.  **NM735, Alarms Configuration, up to 3 days**

**Workshop**
The workshop goal is to present an overview of alarms configuration and presentation in the Network Manager/SCADA system, and to enhance and expand the knowledge about it.

**Topics**
- **Introduction:**
  - Configuration, Presentation and User Interface
- **Alarm Configuration:**
  - Configuration files – System Options
  - Data Engineering – SCADA and EMS Applications Alarms
- **Alarm Presentation:**
  - Message Coloring, Audible and Messaging
  - User Authority
- **User Interface:**
  - Related Displays
  - Alarms handlings, functions, Navigation and Filtering
- **NMR and NM conversion overview** (For existing NMR customer only)

**Objectives**
Upon completion of this workshop the participants should have further knowledge and training in how to configure, present and setup alarms interfaces for operations in an efficient way in a Network Manager/SCADA system.

**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, Network Manager Overview, NM200, Database Editing, NM210, Picture Editor and NM220, Data requirements for SCADA or have the corresponding knowledge

**Course Type**
Workshop with hands on exercise

1.8.13.  **NM740, Workshop Calculation, 2 – 5 days**

**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 Power calculations
- SCADA Real Time 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

1.8.14. NM750, Workshop Historical Information System, up to 5 days

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

1.8.15. NM760, Nmtab, up to 5 days

Workshop
The workshop goal is to teach the participants how to create nmtab displays, and maintain them.

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 Displays

Course Type
Workshop with hands on exercises

1.8.16. NM770, Workshop OMS Configuration, up to 2 days

Workshop
The workshop goal is to teach the configuration in the Network Manager OMS system, and to enhance and expand the knowledge about it.

Topics
The following configurations will be covered if selected:
OMS Basic
Restoration Estimation Engine
Derived Priority Management
Outage Validation Logic
Referral Management
Notification Management
Crew Management
Web Trouble Call Entry
AMI Interface
ICCP Two way ( no SCADA )
SOI Mobile Adaptor

Objectives
Upon completion of this workshop the participants should have further knowledge and training in how to maintain the OMS configuration in an efficient way in a Network Manager/OMS system.

Student Profile
This course is intended for distribution system operations personnel including: distribution system engineer, operators, dispatchers, operations supervisors and responsible line managers.
Maximum 2 participants / workstation.
Prerequisites
The participants must have experience of power network design, basic knowledge of database systems, and have taken the courses NM630, DMS Advanced Application Operation and NM650, OMS Applications Operation.

Course Type
Workshop with hands on exercises

1.8.17. NM780, Workshop DMS Configuration, up to 3 days

Workshop
The workshop goal is to teach the configuration in the Network Manager DMS system, and to enhance and expand the knowledge about it.

Topics
The following configurations will be covered if selected:
- DMS Basic
- Fault Location
- Restoration Switching Analysis (RSA)
- ARSA (FLISR)
- Volt/Var Optimization
- DMS Network Modelling Support

Objectives
Upon completion of this workshop the participants should have further knowledge and training in how to maintain the DMS configuration in an efficient way in a Network Manager/DMS system.

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

Maximum 2 participants / workstation

Prerequisites
The participants must have experience of power network design, basic knowledge of database systems, and have taken the courses NM370, DMS System Administration, NM630, ADMS Operation and NM640, DMS Advanced Applications Operation.

Course Type
Workshop with hands on exercises

1.8.18. NM790, GIS to DMS Extraction Workshop, 3 days

Workshop
The GIS Extractor is a software program that converts network model data from the customer geographic information system (GIS) to NM ADMS database (or to a suitable format that can be interpreted by DMS).

ABB conducts a three to five days database mapping workshop to establish a design and mapping for the conversion of the customer GIS data into the format required by ABB ADMS. The GIS Extractor will be developed by ABB to work with the customer GIS. The GIS Extractors will extract data into csv files. The csv file data is imported into the ADMS database.

Topics
The following topics will be converted:
• ABB ADMS data model
• Mapping between GIS to ADMS
• There are two major tasks of the workshop. 1) ABB providing a training on essential knowledge on ADMS/OMS network model data requirement and GIS – ADMS data conversion. 2) ABB and the customer working together to come up with a GIS-ADMS mapping design used for the GIS Extractor development.
• After the workshop, ABB (or the Customer with some ABB support) will develop the GIS Extractor software program to according to the GIS – ADMS Mapping spreadsheet.

Objectives
Upon completion of the course, the participants should be able to provide the data mapping between the GIS and ADMS data model.

Student Profile
• Operators (or an operation representative who knows the information needed by an operator)
• GIS personnel
• 2–3 participants / workstation

Prerequisites
• Customer GIS knowledge
• Customer data model
• ADMS/OMS Operation needs.

Course Type
Design workshop