

CONTENTS

From the Directors Desk	2
Introduction	4
Pneumatics	8
Electropneumatics	10
PLC (Programmable Logic Controllers)	11
SIMATICS	12
SCADA	14
Hydraulics	18
Electro Hydraulics	20
Mobile hydraulics	21
Mechatronics	22
Instrumentation and Calibration	24
Electronic Trouble Shooting	26
Condition Monitoring	27
Power Protection and Protection Relays	28
Industrial Data Networks	29
Introduction to Lean Production & Value Stream Mapping	30
Maintenance Strategies and Total Productive Maintenance	31
Variable Speed Drives & Servo Motors	33

From the Director's Desk

Centurion Systems has been delivering Industrial solutions to our customers for over 20 years. Over time, we have acknowledged the fact that the industry needs a holistic solution to address its challenges and needs. Today, Centurion Systems provides solutions in 4 key business line: ***Training (Corporate & TOT), Repairs & Maintenance, Research & Development (Projects) and Part Acquisition***

Leveraging on immense experience and knowledge base in the Engineering field, our Training department, established in the year 2000; was developed, with the objective of turning ordinary training into great ***Hands On and Practical Learning Experiences***. The courses are structured to enhance the engineer's expertise, which is a value addition to his/her professional growth. The multi-dimensional experiences from our training experts in the related fields aim at increasing the engineer's awareness, facilitating organizations to be more effective & achieve improved services at their industrial set ups.

To re-define the organizations business through specialized training; **Centurion Systems** has carefully structured all the programs to ensure that attendees gain maximum benefits. A combination of carefully designed training software, hardware, written documentation, together with multimedia presentations, ensures that the courses combine theory & practical's in the ration of 25-75 percent respectively.

Centurion Systems' training courses are designed for:

- Professionals in the engineering industries; this will serve as a refresher course & will improve their job oriented skill sets. Our training will help improve productivity, reduce implementation risk and reduce cost.
- Fresh recruits and budding engineers; as these courses will make them productive early in their career.

The growth of the global economy and continuous advancements in technology is new challenges — and the requirements — of our industry. In response, **Centurion Systems** is constantly redefining our business to focus on developing, integrating, and managing our resources so that we can satisfy the ever new requirements and solving our clients' emerging challenges/problems and needs/gaps. Defining our business in this manner has allowed us to expand our technical and managerial capabilities and apply them in new, cutting-edge engineering sectors. **Centurion Systems** continuously improves the learning environment by investing in the latest technology of systems, kits and equipment at our training labs.

Just as important as the “what” and “whom” of **Centurion Systems’** business, is the “how” - as expressed in our statement of values:

- **Integrity:** Honest, timely, and direct interactions with customers, contractors, and employees.
- **Innovation:** Cost-effective, creative solutions to our customers’ needs.
- **Respect:** An environment of dignity and consideration.
- **Diversity:** A workforce and management team reflecting our nation’s gender and population.
- **Competence:** Satisfying customer requirements through our technical and managerial strengths.

Herein, we illustrate how **Centurion Systems’** strategic evolution, employee expertise, and inherent training values are joined together to deliver an environment that ensures that we are ***“training today for tomorrow’s technology”***

Dr. Kevit Desai, PhD, MBS
Managing Director

Introduction

Training Division

Centurion Systems is a premier Engineering firm established in 1989. We have acquired legendary status in Repairs and Maintenance of companies in all major sectors including Medical, Aviation, Construction & Manufacturing Industries.

Centurion Systems has pioneered in the innovation of the capability of extending the useful life of technology by our ability to repair up to component level. Our Research and Development department that offers local solutions for the upgrade of existing technology enhances this further.

The internal technical know-how of maintenance over a wide spectrum of the industry sector for the past 20 years led to the development of the engineering training department.

Centurion Systems provides the integrated support by empowering organizations' through its personnel. We are the engineering training center of choice due to our positioning in this field. We ensure that organizations benefit from their engagement with us by answering the question,

Why train with us?

The trainings are divided into three qualification levels, which each correspond to specific "job profiles". The job profiles clearly define the certified qualification and skills of trainee. With our defined, industry-focused job profiles, Centurion Systems certifications helps you transition into a variety of production, technician, and engineering jobs in high-tech and advanced manufacturing industries. The three levels are:

Level 1: Systems Assistant

Emphasis is placed on efficiently operating complex mechatronic systems, troubleshooting and foreseeing problems.

Level 2: Systems Associate

The focus in this is on systems management, investigation, repair and troubleshooting.

Level 3: Systems Professional

Customized Automation Solutions. In this level, emphasis is placed on systems design and process optimization.

1. Partnerships

Centurion Systems has forged strategic partnerships with key industry players on the higher education sector. Some of our partners are Siemens SITRAIN, Ministry of Higher Education, National Council of Science & Technology, Linkage of Industry with Academia (LIWA), FESTO, Allen Bradley, Telemecanique, KRONES, Mitsubishi, ABB.

We have also linked with the leading manufacturers of automation equipment being used in the industry currently. This enables us gain access to the actual manuals of the equipment and certified trainers.

2. Subsidized Fees

Centurion Systems Limited is DIT registered (**DIT/TRN/543**) and hence this qualifies organizations to get up to 70% reimbursement on the amount spent on the training. This makes training with Centurion Systems highly cost effective compared with the benefits that will accrue from training with us.

3. Practical Training

75% of the trainings that we carry out at our premises are practical based.

This is because we have developed through our research and development team and the partners that we have, training kits that are highly relevant as they mimic the actual workplace. The kits enable actual troubleshooting, Maintenance, Programming and other procedures to be carried out in a safe environment and this greatly boosts the confidence levels of personnel in contact with equipment in the work place.

4. Tailor Made Courses

The trainings we offer are based on fulfilling the actual determined needs in an organization. We come in at a partnership level where we identify with the help of your relevant personnel the gaps that are there between you personnel and the equipment that we have through the audits that carry out. We therefore develop courses geared towards eliminating this gaps that are there to ensure optimization of resources.

5. Access to expertise

We do connect our training partners with the network of partners that we have and hence there is a pool of professional experts that compliment our expertise and professional advise and updates that are relevant are accessible when and if need arises.

6. Accreditation

We are a great way to adding value to your trainings and capacity development through our recognized accreditations. The Ministry of science and technology and higher education, IEEE and various equipment manufactures has recognized Centurion Systems. The benefits accruing from this accreditation to various organizations are that:

- The certification we give is a guarantee of quality in capacity development even to the internal training programs that organizations' may offer.
- The trainings are based on the latest technology in the industry and the relevant information.
- There is a demonstration of direct value.

Today's Kenyan market has potential to counter the competition offered by South East Asia, South Africa and emerging markets whose competitive advantage is felt in our business environment. Majority of the manufacturing and service organizations in Kenya deal with challenges posed by Globalization, Energy, Environment and Safety, which cut back on profit margins.

- Globalization demands higher automation levels for improved and quality production systems without the need to downsize.
- Majority of organizations embrace energy efficiency models in all aspects of their businesses, including product design and production in order to cut production costs.
- In addition, environmental management is a challenge that is beyond Corporate Social Responsibility; current changes in global environment standards influence sub-standard products and production processes and systems.
- Safety in the work environment is taking center stage in people welfare and sustaining quality and consistent production.
- Trends such as these need turn key solutions. At Centurion, we collaborate with your organization to create smart business solutions. For example, through the training programs at Centurion Systems we share knowledge, from operator level up to senior management of organizations. Our R&D support introduces more advanced systems for production and maintenance. Our training is organized year round, comprehensive programs, tailored to all levels of staff and people systems.

This is the single most important component for competitive advantage in the highly competitive industry. Empowering personnel enhances their capability of all the organization' processes leading to optimum levels of productivity.

With the change and development in technology, it is paramount for organizations to enhance their sustainability by ensuring that they tackle: Increasing costs of energy, Increasing cost of labor and the changing capability of technology.

ACCREDITATION



Ministry of Higher
Education, Science
and Technology



Inspiring global competitiveness
**KENYA ASSOCIATION
OF MANUFACTURERS**



**NATIONAL INDUSTRIAL
TRAINING AUTHORITY**

FESTO

SIEMENS



National Commission for Science,
Technology and Innovation

PARTNERSHIPS



NATIONAL INDUSTRIAL
TRAINING AUTHORITY



Pneumatics

The course deals in detail with the most up-to-date products, current tools and methods used in industry. Our principle is learning from the real world for the real world!

TARGET GROUP

Everyone who has to deal with pneumatic systems in their working environment

COURSE OUTLINE

- Objectives of low cost automation
- Basic principles of compressed air supply, production, preparation and distribution
- Power section devices (Linear and rotary actuators)
- Use of directional control valve, flow control, pressure and time control valves and sensors
- Structure and function of pneumatic devices and valves
- Basic logic functions and their application
- Symbolic representation of devices and standards (ISO 1219)
- Systematic design of circuit diagrams
- Reading pneumatic circuit diagrams
- Operating modes in pneumatic control systems
- Safety regulations and valid industrial standards
- Typical industrial circuits
- Identifying and eliminating faults
- Practical exercises for all circuits “hands on”

Outcomes

The Participant:

- can design, assemble and test basic pneumatic circuits
- can identify and describe the design, features and operation of pneumatic components
- can identify and explain symbols for pneumatic components
- can read and interpret pneumatic circuit diagrams
- can interpret technical specifications and data relating to pneumatic components
- knows the fundamentals of compressed air generation and preparation

Duration: 5 Days

Level: 1,2,3



Pneumatics Maintenance

Extend your specialist knowledge of pneumatic control systems and improve your methodical skills. Practical exercises on training equipment for setting up, commissioning, troubleshooting and fault elimination make it easier to transfer knowledge to your day-to-day work.

TARGET GROUP

Design Engineers, Plant Engineers, Maintenance staff and instructors

COURSE OUTLINE

- Pneumatic Symbols and Standards (Revision)
- Pneumatic power generation, preparation and distribution
- Design, function and identification of pneumatic components
- Construction and reading analysis of pneumatic circuits
- Reviewing, completing and using machine documentation
- Developing and applying troubleshooting strategies
- Optimizing systems using fault documentation
- Learning and applying safety regulations and valid standards
- Practical exercise and systematic “hands-on” troubleshooting

Outcomes

The Participant:

- knows and can identify the problems associated with poor compressed air preparation
- can set up and commission pneumatic systems
- can maintain and systematically troubleshoot pneumatic control systems
- can understand the causes of downtime and failures
- can interpret latest standards and regulations

Duration: 5 Days

Level: 1,2,3



Electro – Pneumatics

After the course, you will be technically and didactically able to successfully design the electro-pneumatics Systems in your company.

You will be familiarized with different technologies, identify differences and similarities and be given an opportunity for an in-depth discussion.

TARGET GROUP

Design Engineers, Plant Engineers, Maintenance staff and instructors

COURSE OUTLINE

- Electrical principles
- Electrical and pneumatic symbols and standards
- Interaction of electrical control section and pneumatic power section
- Function of signal generators (push buttons, switches and relays)
- Components of power section and control section
- Electronic proximity sensors (inductive, capacitive and infrared)
- Systematic production and reading of electrical circuit diagrams
- Operating modes of electro - pneumatic control systems
- Coordinated sequence controls
- Fault finding procedures and systematic troubleshooting
- Safety regulations and valid standards for electrical engineering and pneumatics
- Practical exercises for all circuits “hands-on”
- Typical Industrial circuits

Outcomes

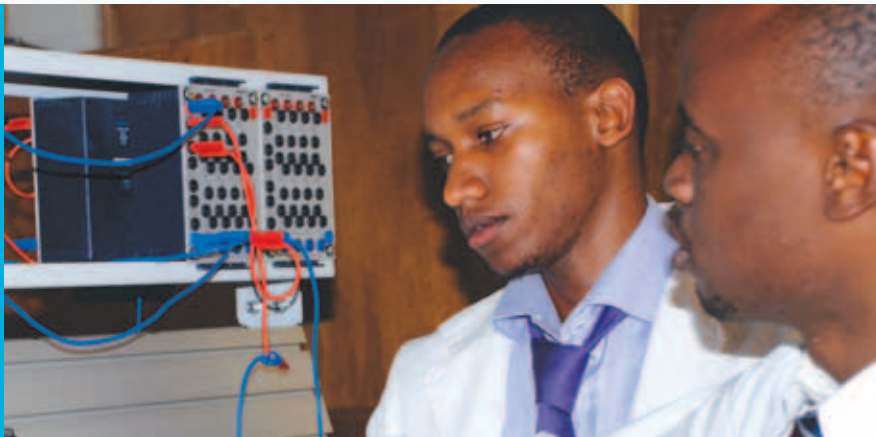
The Participant:

- can describe the functional relationship between pneumatic and electrical components
- can identify and describe the design, features and operation of electro – pneumatic and electrical components
- can identify and explain symbols for electro – pneumatic and electrical components
- can design, assemble and test an electro – pneumatic circuit
- can read and interpret electro – pneumatic circuit diagrams
- knows the role of a eletropneumatics in automation

Duration

5 Days

Level: 1,2,3



P.L.C. (Programmable Logic Controllers)

This training course focuses on the concept of hardware and software together with a practical hands-on introduction to uses, hardware configuration, uploading /down loading program and fault finding.

All topics are illustrated through practical exercises on training simulator using the Siemens PLC S7 300 series, Allen Bradley, Telemecanique, ABB, Omron, B&R and Mitsubishi.

TARGET GROUP

Personnel in Maintenance, Process-Engineering, Trainers.

COURSE OUTLINE

- Introduction to PLC architecture
- Differences between relay based system and PLC based systems
- Differences between PC based and PLC based systems
- Advantages of PLCs
- Logical flow concept
- Scan time information
- PLC addressing concept
- Creating new projects in various PLC software
- Symbol table
- Force table (for forcing output various variables)
- Developing the ladder diagram in various PLC software
- Information oriented with MPI cable adapter communication cable
- Purpose of MPI and rs232 programming cable
- Maintenance practices
- Troubleshooting actual problems
- Advanced diagnostics
- Documentation and backup of PLC programs

Outcomes

The Participant:

- Understand and create complex program structures
- Make changes and additions to programs developed by others.
- Implement modes such as automatic, manual and emergency stop.
- Combine various modules of structured programs.
- Create, read out and change hardware configurations.
- Find errors in complex programs quickly and efficiently
- Establish reasons for machine stoppages with the aid of the PLC program.
- Create and commission PLC programs with logic associations and sequences.

Duration: 5 Days

Level: 1,2,3

SIMATIC S7 Service & Maintenance Course Part 1

ST-7SERV1

AIMS AND OBJECTIVES

This course is directed at users & maintenance personnel of SIMATIC S7 programmable controllers.

PREREQUISITES

Involvement in PLC maintenance.

COURSE OUTLINE

- The SIMATIC STEP 7 System Family
- STEP 7 installation techniques & components
- PLC installation & wiring techniques
- Hardware handling
- From process to project - The SIMATIC Manager
- Hardware configuration and addressing of Signal Modules
- CPU Properties
- Symbolic notations & symbols table handling
- LAD / FBD / STL Editor
- Commissioning and Monitoring / Modifying Variables
- Linear / Structured Programming Techniques
- Debugging a program
- Binary operations & gates
- Flip flops
- Edge Detection
- Number formats / Load and Transfer operations
- Counters / Timers
- Rewiring of programs
- Documentation functions, saving and archiving
- Copying a program to a memory card

Duration: 5 Days

Level: 1,2,3



SIMATIC S7 Service & Maintenance Course Part 2

ST-7SERV2

AIMS AND OBJECTIVES

This course provides the fault finding techniques required for maintenance and in depth exercises with standard libraries. For those wanting to handle OB's and Data handling. Documentation, networking & analogues as well as sequence control.

PREREQUISITES

Successful completion of the ST-7SERV1 Course.

COURSE OUTLINE

- Hardware commissioning
- Memory reset. Variable tables
- Modifying outputs in STOP state
- STEP7 project structure
- Cyclic program execution
- Data storage in Data Blocks
- Complex Data types
- Functions & Function Blocks
- Multiple instance Model
- Trouble shooting
- B, I, L stackk handling
- Cross reference
- Break points in a program
- Organization blocks
- Analog processing
- Documentation & printing
- Archiving a project
- Communication via MPI with GD table and NETPRO
- Totally Integrated Automation, Discussion & examples of programming methods.

Duration: 5 Days

Level: 1,2,3

SCADA

(Supervisory Control and Data Acquisition)

SCADA training is an advancement of PLC training where the student is trained on how to incorporate his knowledge of PLC's and basic automation to **build, maintain** and **troubleshoot** large scale computer systems for monitoring conditions in a plant, factory or process.

FEATURES

- Practical Hands on experience with design of SCADA systems
- Learners build and maintain systems unique to their own experiences and workplaces
- Highly qualified technical team of trainers with widespread industrial experience
- Advanced training kits incorporating the latest software, design tools, sensors and instruments

a) SCADA Level 1

TARGET GROUP

Those with basic knowledge of SCADA Systems

Duration: 5 Days

COURSE OUTLINE

i. Introduction to SCADA

- History of SCADA
- Operational Philosophy
- Open- and Closed-Loop Control Concepts
- Real-Time Monitoring and Control Principles
- Overview of Industrial Control Systems (ICS)
- Overview of SCADA, DCS (Distributed Control System)
- Programmable Control Components
- Network Components
- What can SCADA do?
- How SCADA Systems Work
- Where is SCADA used?
- What's the Value of SCADA?
- An Example of a SCADA System
- Data Acquisition
- Data Communication
- Data Presentation
- Control
- Introduction SCADA Systems Engineering
- Best Practices for SCADA Security
- Next Generation SCADA Systems
- SCADA System Challenges



ii. SCADA System Overview

- SCADA Architecture
- Hardware Architecture
- Software Architecture
- Real-time database (RTDB)
- Communications
- Interfaces
- System components
- Remote Terminal Unit (RTU)
- Programmable Logic Controller (PLC)
- Master Station
- Human Machine Interface (HMI)
- Data Representation Formats
- Real Time Operations
- Features and types of the RTU

iii. SCADA Systems Operations and Integration

- Application Development
- SCADA System Requirements and Analysis
- SCADA Master-Slave Architecture
- Types of SCADA Networks
- SCADA Configuration
- SCADA Network Protocols
- Planning and Managing SCADA Projects
- Specifications; Alternative Strategies
- SCADA Procurement
- Implementation and Commissioning
- Five phases to creating a functional SCADA system
- The Design of the system architecture
- The supply and programming of the communication equipment
- The HMI graphic and alarm software programs
- The Installation of the communication equipment and the system
- The Commissioning of the system;
- Systems Integration and Testing SCADA

iv. Systems Evaluation

- How to Evaluate SCADA Systems and Hardware
- Most Important Components of the SCADA System
- Sensors and Networks
- SCADA RTU
- SCADA Master
- LAN in the Master Station
- Overview of TCP/IP and the Ethernet

SCADA

- Ethernet Networks applied to the Master Station and the Field
- LAN Connectivity; Bridges, Routers and Switches
- Communications Media and Signals
- Wireless Systems

v. SCADA Operation and Maintenance

- Component module maintenance
- Central site maintenance
- Operator room and software maintenance
- Maintenance tasks

b) SCADA Level 2 (Advanced SCADA)

TARGET GROUP

Those who have successfully completed SCADA Level 1

Duration: 5 Days

COURSE OUTLINE

i. SCADA Security and Vulnerability

- Security applied to SCADA
- Encryption
- Firewalls and Perimeter Security
- Creating and Populating a SCADA DMZ
- Field-Level Firewalls in the SCADA Network
- Access Control and Authorization: Managing Users
- Wireless Security Issues
- SCADA Security Incidents
- Overview of Encryption and Firewalls
- SCADA Security Challenges and Solutions
- SCADA Access Control and Intrusion Detection
- Challenges of Wireless in SCADA
- Points of Vulnerability for SCADA
- The IT Infrastructure
- Leased Infrastructure; Frame Relay and Other Services
- The Sensor/Field bus Networks
- Wireless LAN Systems

ii. Advanced Analysis and Implementation

iii. Wireless Sensor Technology

iv. Industrial Communication protocols

v. Relay technology

vi. PLC connection to SCADA

vii. Control room design

c) SCADA Level 3 (HMI and WinCC)

TARGET GROUP

Those who have successfully completed gone through SCADA Level 2

Duration: 5 Days

COURSE OUTLINE

- Introduction
- How a HMI works
- Importance of HMI in a automation systems
- Benefits of HMI
- System Overview
- How to establish connection with PLCs
- Integrating HMI to PLCs
- Integrating to S7- Manager
- The Project
- How to create a project.
- How to upgrade or make changes to an existing project.
- Basics of Graphic Design
- Extended Graphics Design
- The Message System
- User Management
- Process Value Archiving
- Recipe Management
- Runtime-Scripting
- Migration from Protool/Pro to WinCC Flexible V1.0
- Totally Integrated Environment.
- How to integrate peripherals e.g. HMI, speed drives, pneumatic blocks into a control systems.



Hydraulics

This course provides you with an insight into hydraulic components and their functions. You will create and read circuit diagrams, set the pressure and position the hydraulic drives. You will also learn the basics of electrical drives, enabling you to commission electro hydraulic systems. As in all Centurion Systems trainings, there is an emphasis on practical exercises.

TARGET GROUP

FA: Operators, Maintenance, Engineering, Trainer

PA: Operators Field-Process-Laboratory, Maintenance Process-Engineering, Design/Engineering, Trainer/Consultant

COURSE OUTLINE

- Equipment and circuit diagram symbols, reading and interpreting basic hydraulic circuit diagrams
- Physical principles
- Structure and mode of operation of basic components
- Measuring volumetric flow and pressure
- Technology and characteristic data of valves and drive elements
- Intensive training for industrial practice: setting up systems in accordance with circuit diagrams, commissioning
- Fundamentals of proportional hydraulics
- Structure of simple relay controls

Outcomes

The participant will be able to:

- design, assemble and test basic hydraulic circuits
- maintain and troubleshoot basic hydraulic control systems
- identify and describe the construction, design features and operation of hydraulic components
- interpret technical specifications and data relating to hydraulic components and systems
- identify and explain graphical symbols for hydraulic components
- describe fundamentals of oil flow

Duration: 5 Days

Level: 1,2,3



Hydraulics Maintenance Training

Most of the defects in plants and machinery that lead to a large percentage of purchase of spares and tools are largely due to improper operation and maintenance. This course teaches your staff how to avoid this situation and how to reduce operation cost by increasing the uptime of hydraulic equipment.

TARGET GROUP

Everyone who has to deal with hydraulics systems in the work place.

COURSE OUTLINE

- Hydraulic equipment maintenance – why its so important
- Maintaining fluid cleanliness
- Maintaining fluid temperature and viscosity within optimum limits
- Maintaining hydraulic system settings to manufactures' specification
- Scheduling component change-outs before they fail
- Following the correct commissioning procedures
- Conducting failure analysis
- The true cost of hydraulic fluid leaks.
- Fluid contamination and dealing with water in hydraulic fluid
- Troubleshooting basics and how to avoid costly mistakes
- Symptoms of common hydraulic problems and their causes
- Locating internal leakage
- Fundamentals of hydraulic component and cylinder repair



Outcomes

The Participant:

- Can describe how fluid contamination destroys hydraulic components
- Can determine an appropriate fluid cleanliness for different types of hydraulic systems
- Can achieve and maintain an appropriate fluid cleanliness on a continuous basis
- Can identify and rectify abnormal contamination load.
- Can name the one proactive maintenance routine that will save large sums of money
- Will know how to prevent damage in hydraulic systems caused by low fluid viscosity
- Can define operating temperature limits based on fluid viscosity values which will maximize component life
- Can identify and rectify abnormal heat load
- Can identify faulty circuit protection devices before they cause component failure
- Will know when to schedule hydraulic component change
- Can identify the common causes of hydraulic failure and know how to locate them
- Can apply special troubleshooting techniques for simple hydraulic systems
- Can carry out correct diagnosis
- Can carry out effective repairs on hydraulic cylinders and components.

Duration: 5 Days

Level: 1,2,3

Electro - Hydraulics

The in-depth hydraulics training combines hydraulics and electro-hydraulics in order for maintenance staff to extend their technical and methodical knowledge. This enables specific issues relating to maintenance to be dealt with in more detail.

TARGET GROUP

Design Engineers, Plant Engineers, Maintenance staff and instructors

COURSE OUTLINE

- Standards and safety regulations
- Design and function of hydraulic power supply systems
- Design and function of hydraulic valves for controlling direction, speed, position and force
- Hydraulic drives for linear and rotary movements
- Electric signal control for hydraulic power section with switching solenoid and proportional solenoid interfaces
- Synchronized controls, valve fittings, hydraulic reservoir circuits
- Systematic troubleshooting, damage analysis and weakness elimination
- Intensive practical training involving design of control systems based on circuit diagrams, commissioning and testing

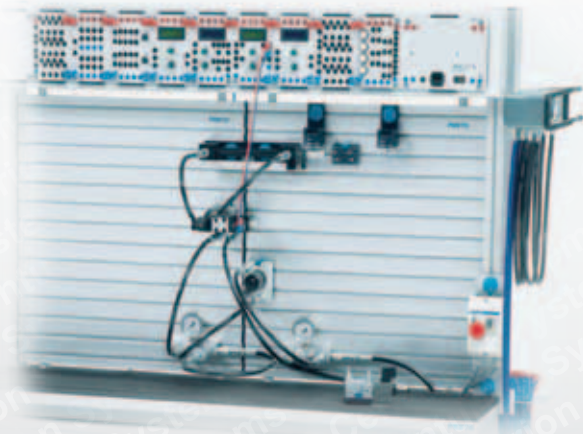
Outcomes

The Participant:

- can identify and describe the design, features and operation of electro - hydraulic and electrical components
- can identify and explain symbols for hydraulic, electro - hydraulic and electrical components
- knows the features of special application and piloted valves, special cylinders and hydraulic motors
- can design, assemble and test electro - hydraulic circuits
- can read and interpret hydraulic and electro - hydraulic circuit diagrams
- can apply the principles of systematic troubleshooting to real applications

Duration: 5 Days

Level: 1,2,3



The know-how needed to design, maintain and operate the mobile hydraulics system is becoming more important each day. Due to the complexity of the systems compared to industrial hydraulics, the skill needed to maintain and design require strong mobile hydraulics fundamentals, and due to many interesting mobile solutions and circuits, this course also enlarges your perspective of industrial hydraulics.

TARGET GROUP

maintenance, engineer, trainer

COURSE OUTLINE

- Hydro static transmission and related components.
- Steering units.
- Working hydraulics.
- Load holding.
- Load sensing in constant and variable displacement pumps.
- Pressure and flow control.
- Fundamentals of proportional control.
- Commissioning and maintaining mobile systems.

Outcomes

The Participant:

- Identify the components and explain their functions in a given mobile hydraulic circuit.
- Build and test hydrostatic transmissions, working hydraulics and steering circuits.
- Explain load sensing functions and other efficiency components.
- Make adjustments for the required control parameters of mobile hydraulics.
- Measure the required parameters in am mobile hydraulic circuit.
- Systematically troubleshoot and explain maintenance procedures.
- Explain the safety measures in mobile equipments.

PREREQUISITES

hydraulics (1) basic

Duration: 5 Days

Level: 1,2,3

Mechatronics

This training is aimed at planning, assembling, programming, commissioning operation, maintenance and troubleshooting of production systems. It comes at various levels of complexity:

- With innovative technology
- With systematic use of industrial components
- In close cooperation with industry leader in automation

TARGET GROUP

Design engineers, Plant engineers, Programmers, Maintenance staff and instructors

COURSE OUTLINE

- Basic design of FEC control system, including pneumatics, mechanics and electrics
- Input and output module tasks
- The three programming languages: FCH, LDR and STL
- Basic command set for FEC
- Creating, loading and testing simple programs
- Using the status display
- Signal storage
- PLC timer
- Archiving and dearchiving PLC programs.

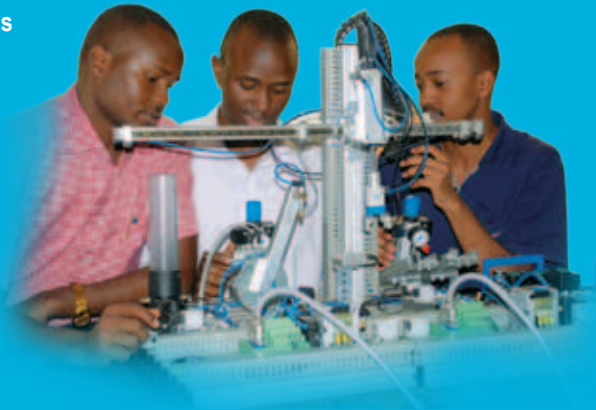
Outcomes

The Participant:

- Can identify and describe the operation of pneumatic, electro-pneumatic, electrical and PLC components and sensors.
- Can assemble and test basic mechatronics circuits (pneumatics, electrical and software)
- Recognizes and can differentiate between the different types of programming used in industry.
- Can download a program and commission a PLC control system.
- Can systematically troubleshoot mechatronics systems.

Duration: 5 Days

Level: 1,2,3



REQUIREMENTS

Mechatronics (Level 3)

TARGET GROUP

Design engineers, Plant engineers, Programmers, Maintenance staff and instructors

COURSE OUTLINE

- Extension of basic knowledge in FEC, including pneumatics, mechanics and electrics.
- Structured programming
- Sequence chain programming in STL
- Reading and standardizing analogue values
- Using different organizational modules
- Creating and using data modules
- Variable declaration in function modules and functions
- Use of standard and system function modules
- Use of IEC modules from the library

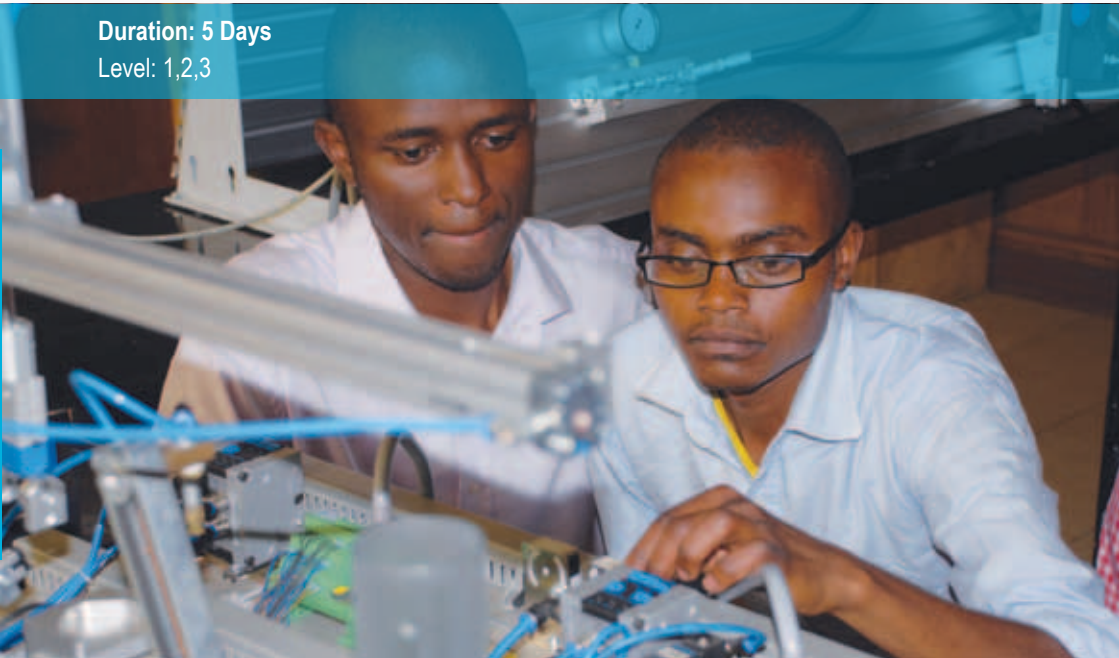
Outcomes

The Participant:

- Can install or replace and commissioning pneumatic , electro-pneumatic, electrical and PLC hardware components and sensors.
- Can interpret technical specifications and data relating to pneumatic, electro-pneumatic, electrical and PLC components and systems.
- Can perform software downloads and commission a complex PLC control system.
- Can use diagnostic software to assist in troubleshooting.

Duration: 5 Days

Level: 1,2,3



Instrumentation and Calibration

COURSE OBJECTIVE

This course empowers participants with modern and cost effective skills on how to carry out an effective instrumentation processes.

TARGET GROUP

COURSE OUTLINE

1. Measurement Systems Units and Standards

- Metric units System
- Natural Units System
- Non-standard unit systems
- Process and instrument diagrams
- System functions & Specification
- Traceability of Measurement standards

2. Instrument and Process Calibration

- Basics of calibration process
- ISO-17025 general requirements for calibration laboratories
- ISO-9000 quality system management
- Calibration set up and techniques for:
- Calibration results analysis

3. Data Acquisition and Signal Conditioning

- System Components and Principles
- Data Acquisition board and Component of A/O Board
- Chassis- to-digital and digital-analog conversion
Voltage to Voltage and Current to Current
- Resistance to Voltage and Capacitance to Voltage
- Comparator
- Parts of the typical control loop

4. Sensors and Transducers

- Terminology and classification
- Relays and action valves
- Power Supply regulation
- Pneumatic and hydraulic pressure concepts
- Temperature sensors and applications



5. Signal integrity and Quality

- Signal Accuracy, Span and Linearity
- Digital signal filters
- Loops and analog signals
- Signal quality terminology
- Sources of error
- Design example

6. Hazardous Area Instrumentation

- Typical Faults in instrumentation Systems
- Troubleshooting and corrective measures
- Classification of hazardous locations
- Principles and Practices of reduction of hazards, sealing.
- Non intrinsic and intrinsically safe systems, design and evaluation
- Degree of protection

Duration: 5 Days

Level: 1,2,3



Electronic Troubleshooting

COURSE OBJECTIVES

- Electronic components and circuits review
- Troubleshooting theory and techniques for signal tracing, isolation and repair of circuit faults
- Use DMM, oscilloscopes and common test equipment in lab to locate and repair digital logic and solid-state circuits

TARGET GROUP

Those with background knowledge in Electronics and wish to enhance hands on troubleshooting and repair techniques.

COURSE OUTLINE

- Level One
 1. Using basic electronic test equipment
 2. EPROM testing
 3. Shorts location on PCB boards
 4. Linear IC Testing
 5. Digital IC testing
 6. Using current clamp meters
- Level Two
 1. Linear PCB IC testing in circuit
 2. PCB reworking
 3. Emulation PCB IC testing in circuits
 4. Back driving PCB IC testing in circuit
 5. Use of infrared thermometers, portable scope meters, signal generators, frequency counter, merge meters etc.



OUTCOMES

- Personnel will be able to quickly and systematically diagnose problems occurring within the organization's equipment.
- There will be reduced downtime on organization's equipment.
- 80% of equipment fault will be dealt with in-house
- There will be tremendous reduction in costs related to repairs

Duration: 5 Days

Level: 1,2,3

TARGET GROUP

COURSES

1. Predictive Maintenance and Implementation Considerations

- Yesterday's and today's maintenance culture and philosophies
- Asset optimization (cost- benefit)
- Predictive Maintenance Program (PMP) Implementation: Justification, level, team, hardware/software, selecting PMP machinery, collecting PMP machinery information, establishing alarms, set up PMP database, collect data, store data, compile PMP reports, fixed intervals surveys, perform analysis, correct fault and document, training, monitoring PMP effectiveness.

2. Introduction to Vibration Analysis

- What is vibration? Amplitude, motions, frequency, vibration signal processing steps, Fourier transforms, time waveform and its frequency spectrum, breakdown of the frequency domain, sub synchronous components, synchronous components, non-synchronous components, phase, overall measurement vs frequency band, lines of resolutions
- Data collection: overview, machinery monitoring, measurement sensor position, naming and position identification convention, optimum measurement conditions, vibration measurement, vibration transducers
- Spectrum Analysis Techniques: overview, collect useful information, analyze, misalignment, imbalance, looseness, bent shaft, bearing cocked on a shaft, bearing defects

3. Introduction to Infrared Analysis

- Thermography, Infrared Radiation, visible and IR spectrum, properties of IR, spot radiometer versus thermal imager, see the heat see the problem, examples electrical/mechanical, reporting

4. Introduction to Oil Analysis

- Basic Lubrication Introduction
- Wear Rates Impact Maintenance Priorities
- Industrial Oil Analysis (Chemistry, Wear and Contamination)
- Where to use Oil Analysis
- Sampling Considerations and hints
- Examples

Duration: 5 Days each

Power Protection and Protection Relays

TARGET GROUP

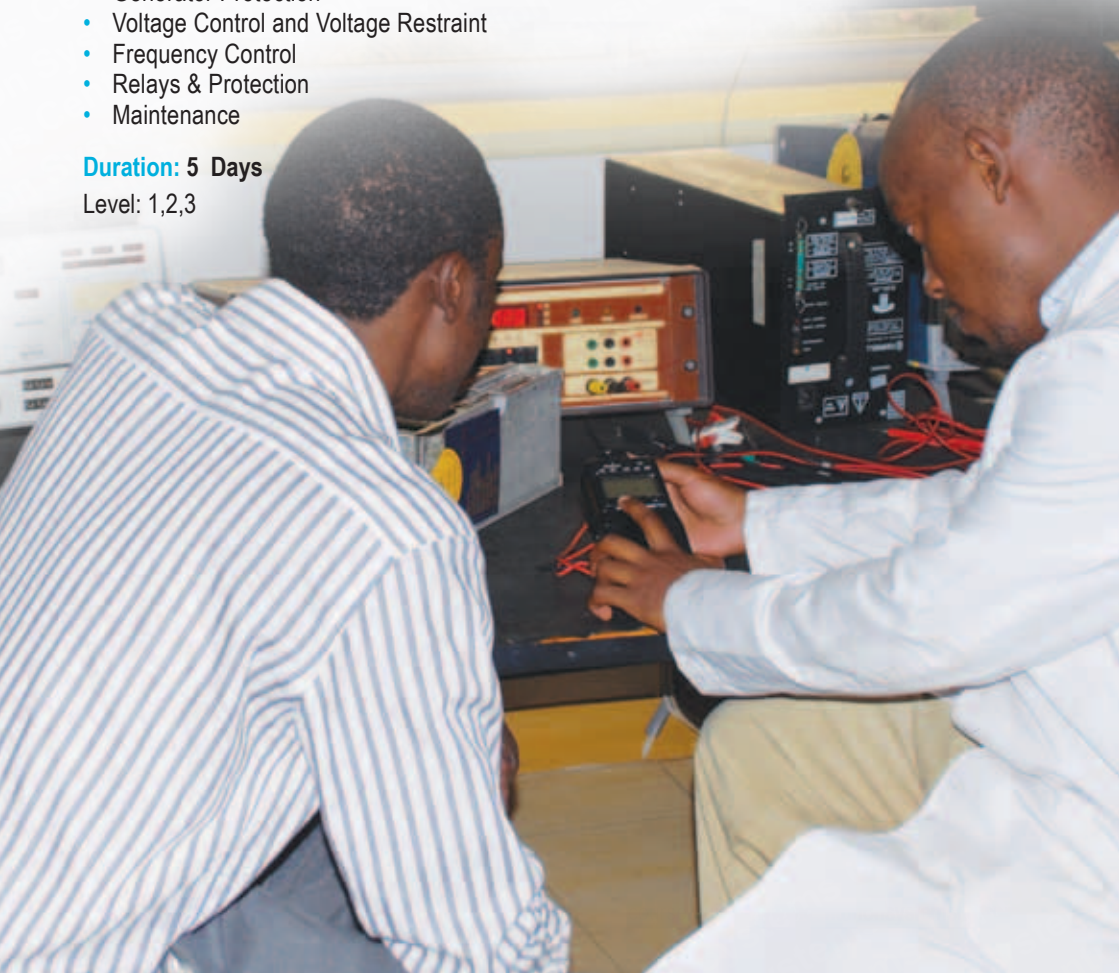
Those with background knowledge in Electronics and wish to enhance hands on troubleshooting and repair techniques.

COURSE OUTLINE

- Power System Faults
- Short Circuit Theory
- Fault Studies
- Components of Power System Protection Schemes
- Current Transformers (CTs) & Voltage Transformers (VTs)
- Co-ordination of Electrical Protection Systems
- Feeder Overcurrent Protection
- Motor Protection
- Transformer Protection
- Generator Protection
- Voltage Control and Voltage Restraint
- Frequency Control
- Relays & Protection
- Maintenance

Duration: 5 Days

Level: 1,2,3



INTRODUCTION

This course provides an insight in the variety of networks that can be applied in an industrial automation system, modification methods to optimize production, network specifications and how to react appropriately to errors and alarms. The course discusses possible causes for a network not functioning properly, such as poor design or poor installation. Industrial data networks are crucial for a total automation solution; it is in fact the backbone of production continuity.

The complexity of data communication, but also the user demands, has lead to a wide variety of industrial networks. Many companies have chosen for different network systems throughout different hierarchical layers within the organisation. This course covers the most common networks that can be found per layer, such as sensors/actuators, buses, fieldbuses and local networks (LAN), PLC

TARGET GROUP

This course has been designed for people who need to design, install, control (fault finding, security, configuration and performance) and modify industrial data networks. This training is the bases for becoming a good designer (further training is required to achieve this) and covers installation, control and modification techniques.

(Pre) Knowledge

In addition to general experience with industrial automation systems, participants should have basic electro technical skills as well as MS Windows, PLC and Sensorics

Specific Contents

- Introduction industrial data networks
- Serial connections: RS232/RS422/RS485
- Profibus / AS-I bus
- Devicenet / ControlNet
- Modbus and ModbusTCP
- Fieldbus
- Industrial Ethernet TCIP
- Interbus
- Fibre optics
- Wireless

Remarks

You can accentuate your personal preference by indicating the networks you are using in your applications prior to the course. The course can then be modified to suit your needs.

Duration: 5 Days

Level: 1,2,3

Introduction to Lean Production and Value Stream Mapping

A Business Simulation Game

Taking the form of a strategy game, this training gives you a holistic view of material and information flows within a company and sensitizes you to different type of waste in processes. You learn to analyze the causes of delivery problems and low productivity and to develop and implement ideas for meeting customer needs and improving processes. The main goal is to instill lean thinking in your company. The strategy game provides practical experience for all employees involved in lean production projects.

TARGET GROUP

Maintenance, Design/Engineering, Trainer, Management

COURSE OUTLINE

Inventory minimization as an important basis for increased productivity

- The principle of pull production control
- Advantages compared to conventional production control methods
- Types and function of different pull production control methods
- Application of methods
- Kanban – the classic pull principle
- SMED – Optimization of setup processes with Single Minute Exchange of Die
- CIP processes as part of the business game
- Introduction to Value Stream Mapping (VSM)

OUTCOMES

The participant:

- Can only analyze the causes of delivery problems and low productivity
- Can develop and implement ideas for meeting customer requirements and process improvements.

REQUIREMENTS

Some experience in production control

Duration: 5 days

Maintenance Strategies and Total Productive Maintenance

This course provides service technician with an overview of commonly used maintenance strategies, compares these based on different requirements and thus provides you with a basis for making maintenance decisions to maximize availability in your own company.

TARGET GROUP

Maintenance, Design/Engineering, Trainer, Management

COURSE OUTLINE

Production systems and their influence on maintenance

- Six typical types of machine and system loss
- Roles and self-image in maintenance
- Organizational structures for maintenance
- Comparison of maintenance strategies:
 - Event-oriented maintenance
 - Routine maintenance
 - Total Productive Maintenance (TPM)
 - Reliability-Centered Maintenance (RBM)
 - Risk-Based Maintenance (RBM)
- Data for recording maintenance performance
- Examples and practical's exercises

OUTCOMES

The participant:

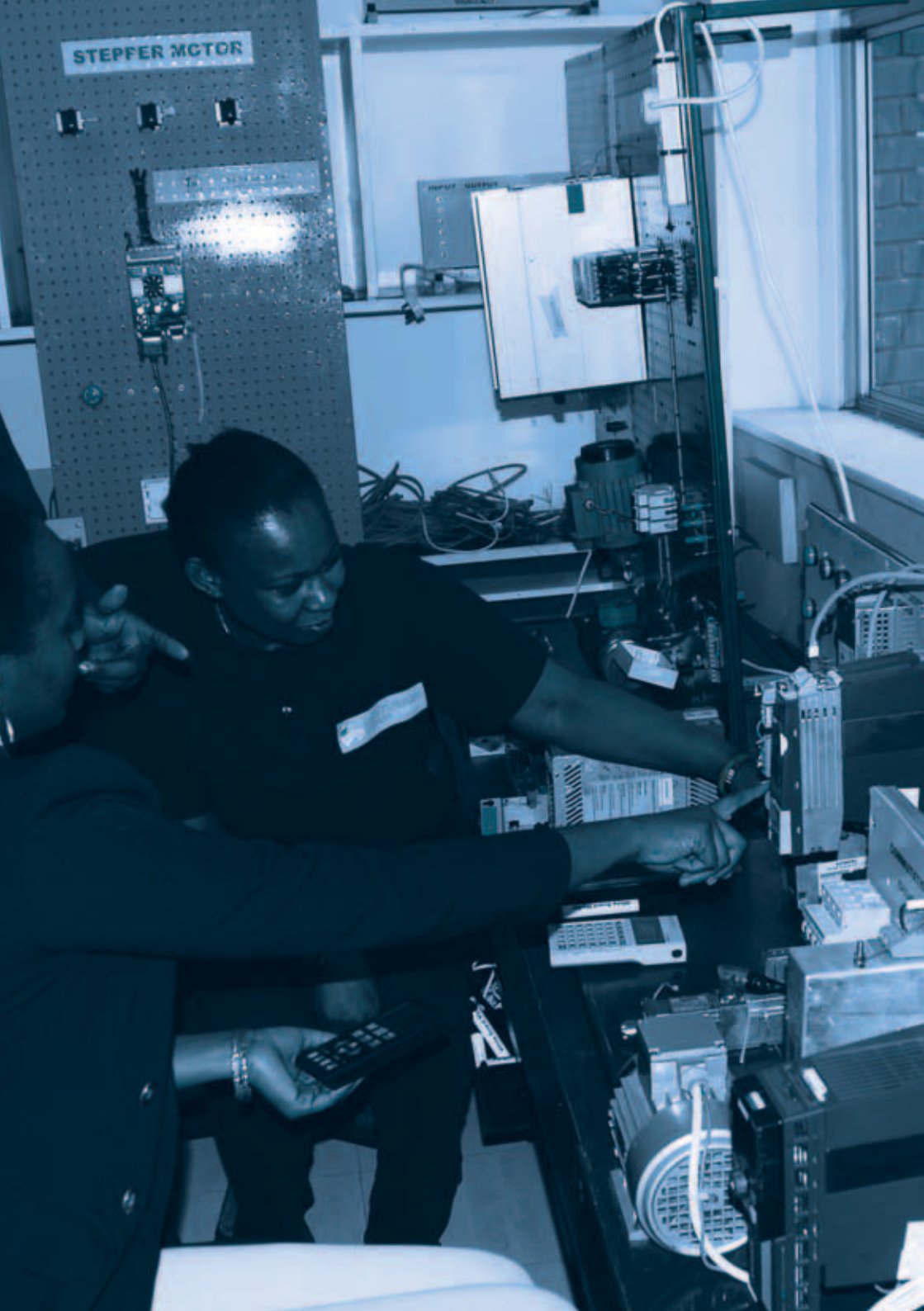
- Can establish source of loss on machines and systems
- Sees maintenance as a service provider for production
- Can evaluate various maintenance strategies and select the appropriate one for the company or various machine
- Can implement the company's maintenance strategies
- Can select and collect data for recording maintenance performance

REQUIREMENTS

Experience in maintenance

Duration: 5 days

STEPPER MOTOR



Variable Speed Drives & Servo Motors

OVERVIEW

A comprehensive hands-on introduction to installation, programming, maintenance, and troubleshooting techniques of variable speed drives. SINAMICS, S-120, G-120, and Servo motors.

TARGET GROUP

Design engineers, plant engineers, programmers, maintenance staff

a) VARIABLE SPEED DRIVES AND SERVO MOTORS - LEVEL 1

Duration: 5 Days

COURSE OUTLINE

- Motion control systems; their design, components and technological capabilities.
- Asynchronous motor principles and how they fit into drive systems.
- Affinity laws, General terms, relationships and formulas.
- Servo motion control systems; their design, components, parameters and their software control.
- Servo control Feedback; Encoder technologies, their selection and integration.
- Variable frequency drives electronic building blocks and circuit architecture.
- Voltage/frequency control mode, field weakening, Carrier and fundamental frequencies.
- Software-based, stand-alone drive system parameterization and commissioning.
- Implementing drive functions for processes (open-loop, closed-loop control,)
- Integrating safety and technology functions in software.
- Flexible signal switching and controls technology
- Hardware and software diagnostics. Using the scopemeter.
- Drive maintenance.

Practicals are carried out on our training modules.

Expected Outcome

The trainee gains hands-on skills and knowledge of motion control and is able to;

- Commission and maintain drive systems
- Employ energy efficient schemes and methods for reliable processes
- Troubleshoot and handle faults fast and appropriately.

Variable Speed Drives & Servo Motors

b) ADVANCED DRIVES AND SERVO SYSTEMS - LEVEL 2

INTRODUCTION

This course covers a wider and deeper concept of industrial motion control. Emphasis is in drive linking, drive control and drive process monitoring. This equips one with knowledge on hardware functionality, and programming for complex processes and applications.

The scope from the application, to motor, from motor to drive, from drive to the controllers and interfacing units is covered.



TARGET GROUP

Trainees with drives knowledge or those who have undergone level variable speed drives and servo motors training.

Duration: 5 Days

COURSE OUTLINE

- Concept to application; drive systems study as implemented in processes and applications.
- Synchronous Motors, PMAC, BLDC, EC; their design and applications.
- Drive sizing and selection.
- Installation procedures, legislation and standards.
- Modulation principles.
- Industrial Communication protocols.
- PLC master; controlling motors with PLC based controllers.
- HMI Monitoring and control of drive-controlled motors.
- Braking methods and implementation of braking functions.
- Drive control circuit and methods (simple, scalar, vector modes)
- Ingress-Protection ratings, EMI and EMC in frequency converters.
- Data maintenance and Documentation.
- M- Code and LV Servo system programming.
- G- Code and introduction to CNC.
- General Service and maintenance of a drive system.

Expected Outcome

The trainee:

- Gains an in-depth knowledge of motion control systems,
- Understands motion control BM NH system design and integration, fault finding and maintenance of complex drive systems,
- Will have capacity to enable interoperability between and among different motion control systems and devices

