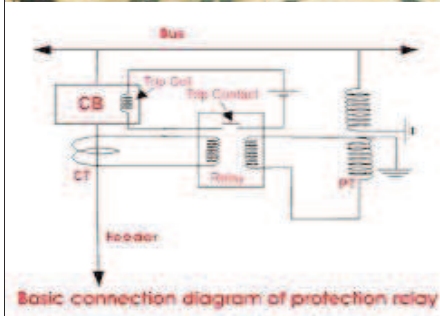

POWER SYSTEM PROTECTION FOR ENGINEERS AND TECHNICIANS



YOU WILL LEARN HOW TO:

- Describe the fundamentals of electrical power protection
- Identify and rectify the different fault types
- Perform simple fault and design calculations
- Work with protection system components (including fuses/transformers/circuit breakers)
- Complete relay settings and check a current transformer
- Demonstrate a fundamental knowledge of applications in protection

WHO SHOULD ATTEND:

- Electrical engineers
- Project engineers
- Design engineers
- Instrumentation engineers
- Electrical technicians
- Field technicians
- Electricians
- Plant operators

The Workshop

This workshop has been designed to give plant operators, electricians, field technicians and engineers a better appreciation of the role played by power system protection systems. An understanding of power systems along with correct management will increase your plant efficiency and performance as well as increasing safety for all concerned.

The workshop is designed to provide excellent understanding on both a theoretical and practical level. Starting at a basic level and then moving onto more detailed applications, it features an introduction covering the need for protection, fault types and their effects, simple calculations of short circuit currents and system earthing. This workshop includes some practical work, simple fault calculations, relay settings and the checking of a current transformer magnetisation curve.

Objectives

This is an intermediate level workshop, by the end of which you will have an excellent knowledge of the principles of protection. You will also have a better understanding of the possible problems likely to arise and know where to look for answers. In addition you are introduced to the most interesting and "fun" part of electrical engineering to make your job more rewarding. Even those who claim to be protection experts have admitted to improving their knowledge after attending this workshop.

The Program

NEED FOR PROTECTION

- Selectivity, stability, sensitivity, speed
- Reliability, dependability, security

FAULT TYPES AND THEIR EFFECTS

- Active, incipient, passive, transient, asymmetrical etc
- Phase and earth faults

SIMPLE CALCULATION OF SHORT CIRCUIT CURRENTS

- Revision of simple formulae
- Calculation of short circuit MVA and fault currents
- Worked examples

SYSTEM EARTHING

- Solid, impedance, touch potentials etc
- Effect of electric shock on human beings
- Earth leakage protection

PROTECTION SYSTEM COMPONENTS INCLUDING FUSES

- History, construction, characteristics
- Energy, let-through, application

INSTRUMENT TRANSFORMERS

- Current transformers: construction, performance, specification, magnetisation, curves etc
- Voltage transformers: types, accuracy, connections

CIRCUIT BREAKERS

- Purpose and duty, clearance times, types etc

TRIPPING BATTERIES

- Battery types, chargers, maintenance, D.C. circuitry

RELAYS

- Inverse Definite Minimum Time (IDMT) relay – construction principles and setting
- Calculation of settings – practical examples
- New era – modern numerical relays and future trends

PRACTICAL DEMONSTRATION SESSION

- Including simple fault calculations, relay settings and checking a current transformer, magnetising curve etc

APPLICATIONS CO-ORDINATED BY TIME GRADING

- Problems in applying IDMT relays

UNDERGROUND MINE DISTRIBUTION PROTECTION

- Earth leakage protection, pilot wire monitor, earth fault lockout, neutral earth resistor monitor

PRINCIPLES OF UNIT PROTECTION

- Differential protection – basic principles

FEEDER PROTECTION

- Cables
- Pilot wire differential
- Overhead lines
- Distance protection (basic principles, characteristics, various schemes)

TRANSFORMER PROTECTION

- Phase shift, magnetising in-rush, inter-turn, core and tank faults
- Differential and restricted earth fault schemes
- Buchholz relay, oil and winding temperature
- Oil testing and gas analysis

SWITCHGEAR (BUSBAR) PROTECTION

- Requirements, zones, types
- Frame leakage, high, medium and low impedance schemes, reverse blocking

MOTOR PROTECTION

- Thermal overload, time constants, early relays
- Starting and stalling conditions
- Unbalanced supply voltages, negative sequence currents, de-rating factors
- Phase-phase faults
- Earth faults – core balance, residual stabilising resistors

GENERATOR PROTECTION

- Stator and rotor faults
- Overload and over-voltage
- Reverse power/unbalanced loading
- Loss of excitation and synchronism
- Typical protection scheme for industrial generators

OVERHEAD LINE PROTECTION

- Basic principles of the distance relay
- Tripping characteristics
- Application onto power lines
- Effect of load current and arc resistance
- Various schemes using power line carrier

MANAGEMENT OF PROTECTION

- Routine testing, annual testing, investigation and performance assessment, up-grading
- Organisation, training, records, access planning

SUMMARY, OPEN FORUM AND CLOSING