Pearson BTEC Level 4 Higher Nationals in Engineering (RQF)

Unit 6: Mechatronics

Unit Workbook 4

in a series of 4 for this unit

Learning Outcome 4

Faults in a Mechatronic System

Contents

Fault finding techniques and test equipment

Input/Output

This technique involves applying a suitable input voltage and testing the output, discovering a fault, then systematically measuring again by working back stage-by-stage towards the input until the faulty stage, cable or component is identified.

Half Split

This method involves considering the whole distribution system as a series of blocks. A block could be considered to be either a transformer, cable, connector, fuse, sub-station, MCB etc. It is then required to test at the midway point of the blocks (roughly halfway through the system. If the measurement is healthy then the fault lies to the right of the system, so the blocks to the right are then tested at their midway point, etc. until the faulty block is identified.

Meters

A clamp meter is used to measure the current flowing in a cable. A typical clamp meter is shown in figure 1.

Figure 1 *A clamp meter used for measuring current in a cable*

An analogue test meter will display current, voltage or resistance on an analogue display, as shown in figure 2.

Figure 2 *An analogue test meter*

A digital multimeter (DMM) will perform the same basic tasks as an analogue meter, but with higher accuracy and a digital display. Such a DMM is shown in figure 3.

Figure 3 *A digital multimeter (DMM)*

Insulation Testers

An insulation tester, also known as a 'megohmmeter', or just 'megger' is used to determine the quality of insulation in equipment, wires, windings etc. A megger will introduce a high DC voltage, ranging from 50 to 15,000 volts to the item under test.

Insulation testers measure the leakage current caused by the applied DC voltage, and then determine the insulation resistance (since both voltage and current are known, Ohm's Law is used to determine the resistance). Since insulation testers produce high voltages, it is imperative that they are only used by qualified personnel. A typical insulation tester is shown in figure 4.

Figure 4 *A modern insulation tester*

Typical Faults

The most common types of fault which occur in electrical distribution systems are known as 'unsymmetrical' faults. These cause inequalities in both phase current and phase shift in a three-phase system. These faults are typically caused either by an open-circuit or short-circuit in a phase or phases.

Natural disturbances, such as lightning strike, high wind speed, ice accumulation on lines, falling trees etc. are the common causes of unsymmetrical faults. These faults are classified as;

- Single line to ground faults (LG fault)
- Double line fault (LL fault)
- Double line to ground fault (LLG fault)

An LG fault is by far the most common type and is usually caused by the line being in contact with the ground. An LL fault occurs when two lines are short-circuited. An LLG fault occurs when two lines are both short-circuited and in contact with the ground.

Component types available and applications:

Distribution boards

A distribution board connects to the electricity supply to a residential of commercial property. Its purpose is to divide the electricity feed from the utility company into subsidiary circuits, each protected by a fuse/circuit breaker. A common distribution board is shown in figure 5.

Figure 5 A *distribution board*