CHAPTER 3
Interlocking

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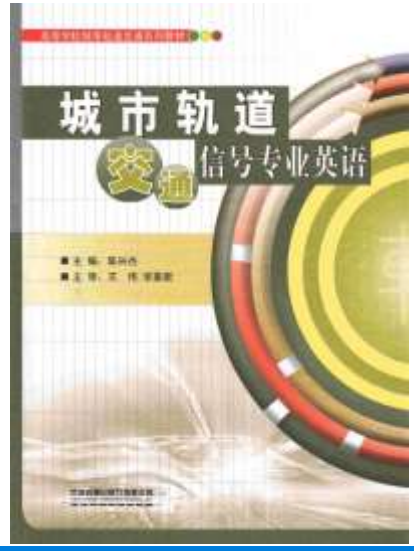

Unit 12 Relay Interlocking

- Introduction
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Introduction

- In relay interlocking the full function is realized by relay circuitry without any mechanical elements.
  - Points and signals are no longer operated by lever but by simple push buttons usually located in an illuminated track diagram.
  - The development of all relay interlocking started in the 1920s.
- Most recent relay interlocking are equipped with entrance-exit operation (NX operation) technology.
  - To set up a route in a system with NX operation technology the operator operates a push button at the entrance and the exit of the route.
  - After initiating the route in that way *the operation of points* and *the clearing of the signal* is done automatically.
  - Relay interlocking are always equipped with *continuous track clear detection devices* on all main tracks.
  - The occupation of tracks is also indicated in the illuminated track diagram.

Introduction

- The circuitry of relay interlocking is based on special safety relay. There are two classes of safety relay:
  - Class N (not controlled). Class C (controlled).
- A class N safety relay works with a very high level of confidence.
  - When the current is interrupted it is basically impossible not to reach the dropped position.
  - So no special circuits to check the proper work of the relays are required.
- Class C relays rarely remain in a "picked up" position when the current is interrupted *but it is possible*.
  - The design of the relay contacts enables them to check the relay position with the help of special circuits.
  - Because of these circuits *checking the proper work of the relays* interlocking with class C relays are more complicated.
  - However, the relays are cheaper and smaller than class N relay.

Introduction

- Older relay interlocking *work with* a free-wired logic and following the cascade or route-related locking principle.
- Later installations use geographical logic.
  - In those interlocking every track element is represented by a prefabricate relay set *performing predetermined functions*.
  - The relay sets are interconnected by special cables in an arrangement that *directly correspond to the track layout*.
- There are two mechanical types of relays in a circuit, namely regular relays and steel core relays.
- The functionality of a regular relay will be explained and thereafter the distinctive functionality of the steel core relay will be examined.

12.1 Regular relays

- A regular relay consists of a coil, an electromagnet, an armature, a pole with horizontal conductive bars and a number of contacts, 6, 10 or 20 typically.
- The electromagnet is placed inside the coil *and* each end of the coiling is connected to a pin.
  - When no current is applied to these pins, the electromagnet is demagnetized and the armature is dropped.
- Each contact consists of two pins, to which wires can be connected.
  - The lower contacts are said to be closed, since current can pass from *one pin on the contact* to *the other pin on the contact*, via the horizontal bar.
  - The upper contacts of the relay are said to be open, since the horizontal bar through which the current can pass, is not in contact with the pins.

12.1 Regular relays

- When current is applied to the coil pins, the electromagnet will carry current and magnetize.
  - The magnetized electromagnet draws the armature *which in turn pushes the pole upwards*.
  - This will invert the state of the contacts so that the upper contacts are closed and the lower contacts are open.
  - When no more current is applied, the electromagnet will demagnetize, making the armature, and thus the pole, drop.
- The pins are *the only externally accessible parts on the relay* since the other components are protected from dust and wear by a black box.
  - The pins on a relay can be numbered in one of two ways. The coil pins are the uppermost pins.

12.2 Steel Core Relays

- Steel core relays mechanically differ from regular relays in that there instead of *an electromagnetic core* is a core of heat-treated steel.
  - The heat-treated steel core causes the core to remain magnetized, even when the supply of current is stopped.
  - The coil, in which the steel core is placed, has two coilings: a magnetizing coiling and a demagnetizing coiling.
  - Initially the steel core relay is magnetized.
  - When current is applied to the demagnetizing coiling, the steel core will demagnetize and remain demagnetized until current is applied to the magnetizing coiling.
  - When the steel core is magnetized, it will remain magnetized until current is applied to the demagnetizing coiling.

12.2 Steel Core Relays

- The difference *from the regular relay to the steel core relay* is thus that the state of the regular relay depends on whether current is applied or not and the state of the steel core relay depends on, to which coiling current was last applied.

12.3 Track Sections

- A track has the ability to carry current.
- A track section is a piece of a track that is isolated, so that the current does not spread from one track section to another.
  - This means that track sections can carry current independently of each other.
- Each track section is connected to a relay.
- The wheels and the axles of the train are conductive.
  - This means that when the wheels of the train come in contact with the track section, the circuit shorts out.
- The only external influences on the track section *that will affect the state of the relay* is a train or other conductive components.

Homework

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