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Level 3 Module

Signalling Installation – Points: Electric Point Machines

Endorsement and Authorisation

For endorsement and authorisation, please refer to NR/L3/SIG/11303.

This module is a reformatted version of the previous Signalling Installation Handbook with no change to the content other than correction of terminology.
It represents historic best practice which may no longer be relevant.

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Issue record

Issue	Date	Comments
2	September 2010	Reformatted version of previous document incorporating the text of the installation handbook.
1	August 2000	First issue.

Compliance

This Network Rail standard is mandatory and shall be complied with by Network Rail and its contractors if applicable from 4 December 2010.

When this standard is implemented, it is permissible for all projects that have formally completed GRIP Stage 4 to continue to comply with the Issue of any relevant Network Rail Standards current when GRIP Stage 4 was reached and not to comply with requirements contained herein, unless the designated Standard Owner has stipulated otherwise in the accompanying Briefing Note.

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1 Introduction

The electric point machine is basically an electric motor connected to a gear chain and mechanical linkages so that the final output is the linear movement of a rod or bar which can be coupled up to the points. The whole mechanism is enclosed in a tough weatherproof case that can be fixed down to the track.

The motor can be designed to work on any suitable voltage. The most commonly used on Network Rail infrastructure is 110 volts d.c. This is usually supplied from a trickle charged secondary battery, but sometimes the machine is fed directly from a transformer/rectifier unit.

Although point machines exist that run off a.c., low voltage d.c., or a hand generator, these machines are comparatively rare and this module will concentrate on the high voltage d.c. machine.

2 The D.C. Electric Motor

The electric motor consists basically of two parts (See Figure 1):

- The Armature

The part that rotates. It consists of coils of wire slotted into a steel cylinder mounted on a shaft. The wires are connected to a circle of copper segments known as the commutator.

- The Field

This surrounds the armature and produces a magnetic field across the armature coils. It consists of either coils of wire round a steel core (an electromagnet) or a permanent magnet.

To make the armature rotate, a current needs to be passed through the armature coils at the same time as the magnetic field is present. To get current into a rotating armature, it is fed in through carbon brushes that rub against the commutator segments.

When the field is an electromagnet, the supply current to drive the motor passes through the armature and field in series. Figure 2 shows simple motor wiring, without any control circuits.

Motors with a permanent magnet field do not run if fed with a.c. This immunity makes them highly suitable for use in a.c. electrified areas.

3 The Drive Mechanism

The motor drives various gears and cams to produce movement on a drive slide within the point machine. Sometimes rubber belts on pulleys are used as part of the drive mechanism. The drive slide in turn drives a throwbar, the end of which protrudes from the machine and is coupled to the points.

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A clutch is usually included on the motor spindle. It is set to slip at a pre-determined torque, so that if the point movement is obstructed the motor can still run for a short while until an overload detector turns off the current. If a clutch was not fitted, the motor would overheat if held stationary while energised.

If a facing point lock mechanism is included, the blades for this are cam driven off the drive slide.

The point machine includes a circuit controller containing contacts which open and close according to the position of the drive slide and lock blades. Detector blades are usually included within the machine, and these operate detector contacts within the circuit controller.

4 Cut Off Contact

Within the circuit controller are contacts which open when the drive mechanism is at the end of its travel. These contacts are wired in series with the motor so that current is cut off at the completion of the points movement.

5 Reversing The Motor

The point machine needs to be able to drive the points in either direction, and the easiest way to do this is to make the motor reversible. To reverse a motor, either the current through the armature or the magnetic field produced by the field needs to be reversed.

If the field consists of a coil, the magnetic field can be reversed by reversing the direction of the electric current through it. Another method is to split the field into two separate field coils wound in opposite directions, and one or the other is used according to the direction of movement required.

If the motor has a field produced by a permanent magnet, the magnetic field cannot be reversed and so reversal of direction can only be done by changing the direction of the current through the armature.

The armature and field (if an electro magnet) therefore need to have the connections to them capable of being switched around to allow reversing. Moreover, this reversal of direction needs to be possible at any position of the points, as the signaller might require to reverse the points in mid stroke or a blockage in the points may prevent them from completing their full movement.

This switching around can be either:

- internal to the machine using “pole changing” contacts.
- external to the machine using relay or other circuitry.